European Space Agency

Research and Science Support Department

Planetary Missions Division

ROSETTA

Consolidated Rosetta payload report for the MCRR

RO-EST-RP-3293

Issue 1, Rev. a

17 Nov 2004

CHANGE RECORD SHEET

Date	Iss.	Rev.	pp .	Description/Authority	CR No.
11 Nov 2004	1	-	All		
17 Nov 2004	1	A		Added the following reports: ALICE CONSERT PHILAE GIADA RPC	

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MCRR review team			

1. INTRODUCTION

This report is a summary of all available Rosetta payload commissioning reports for the MCRR as available on 17 Nov 2004, after the deadline for inputs for the reports.

Instrument	Report number or name	Date	Comment
ALICE	ALICE_prelim_MCRR.pdf ALICE_final_MCRR_report.ppt	21 Jun 2004 15 Nov 2004	Copy from prelim. MCRR report Pointing and Interference Scenario
CONCERT	CONSERT_final_MCRR_report.ppt	15 Nov 2004	
COSIMA	COSIMA_final_MCRR_report.pdf	11 Nov 2004	
GIADA	RO-GIA-OACUPA-RP-075/1-	11 Nov 2004	
MIDAS	MID-IWF-TN-0088/2.1	20 Sep 2004	
MIRO	MIRO_final_MCRR_report.ppt	11 Nov 2004	
OSIRIS	OSIRIS_final_MCRR_report.pdf OSIRIS_Commissioning_Slot1.pdf OSIRIS_Commissioning_Slot2.pdf OSIRIS_Commissioning_Slot2B.pdf OSIRIS_Commissioning_Slot3.pdf OSIRIS_Commissioning_Slot-Pre3_Software_Verification.pdf	11 Nov 2004	
PHILAE	RO-LAN-PR-30400/1.0	15 Nov 2004	
ROSINA	RO-ROS-TR-1115/2.0	08 Nov 2004	
RPC	Zip file with 44 individual files, RPC_MCRR_report.zip	17 Nov 2004	The order of some of the appendices may not be correct.
RSI	RO-RSI_IGM-TP3117/I2	11 Nov 2004	
SREM	SREM_final_MCRR_report.pdf	11 Nov 2004	
VIRTIS	VIR-IAS-TR-001/2-	11 Nov 2004	

2. ALICE

Rosetta-Alice Commissioning Report

2004 March 22-24

Joel Parker, Maarten Versteeg

Summary

Because of Rosetta commissioning schedule changes, the Alice team was offered a slot of two nights (March 22 and 23) for early commissioning. Each night the time available for commanding was about 9 hours. We used about 8 hours on the first night, and 3 hours on the second. Test covered much of our Phase I (Basic Safing) procedures and included: Verification of the prime and redundant power and C&DH interfaces, memory integrity, heater operations, aperture door unlatching and "flapping", context save and restore, OBCP power up command, testing detector electronics, and thermostatic heater cycling.

***All procedures completed successfully*. The Alice instrument is behaving nominally. The spacecraft systems affecting Alice, the TC/TM, and the Rosetta data distribution system (DDS) also performed smoothly. Thanks to the effort of the to the Rosetta RMOC/RSOC teams, this was an exceptionally successful process.**

List of Procedures Executed

AL-FCP-001	Turn on to Safe Mode, Collect Housekeeping T/M
AL-FCP-002	Primary and Redundant operation
AL-FCP-003	Memory Checks
AL-FCP-004	Heaters Turn on Test
AL-FCP-005	Mode Commanding
AL-FCP-006	Parameter/Safety Mask Upload Test
AL-FCP-007	Aperture Door Unlatch and Open
AL-FCP-008	Aperture Door Cycling Tests (~12)
AL-FCP-009	Context Save and Restore Test (Update 1)
AL-FCP-012	Power up/down OBCP verification
AL-FCP-016	STIM Pulse Test, Checkout mode
AL-FCP-013	HTR Control verification
AALS703A	Full memory check

Notes, Questions, and Lessons Learned

- We need to fix the "one day off" problem in the AGS retrieval function for the DDS data. Easy workaround was used to set AGS system clock ahead one day.
- We didn't do the pressure test (AL-FCP-010) because we don't have ROSINA, so we need to remember to do that test in our April timeslot.
- The different arrival times of the VC1 and VC0 data can be quite confusing sometimes. At the beginning of a pass, old data are downloaded on VC1, but depending on the setup (filters used) on the PISA workstation ("SCO"), they can appear intermixed with real-time VC0 data. If the data are not time-synchronized, they will appear twice in the real-time display on the PISA workstation as well as in the DDS data. Supposedly, the DDS will filter out duplicate data packages that have *synchronized* times.
- Use of the PISA workstations is somewhat complicated by these VC0/VC1 issues. Making plots of data is a cumbersome process, and works best in replay mode.
- We need to formalize exchange of data with remote team members (e.g., naming convention of directories, on the Boulder rosetta website, automating the process more, etc.)
- We may need to request more internet data ports in the PISA if the Alice team needs more than two laptops plugged in at the PISA. Since it is now ESOC security policy to "lock" the PISA ports to the MAC address of the laptop that is first plugged into a given port, we cannot use other unused ports in the PISA or swap laptops on the Alice ports without interaction with ESA computer support. At the moment, only Joel and Maarten's laptops can use the Ted and Carol ports, respectively.
- Make sure we have the most recent paper version of the Alice User Manual in the PISA. In general, that should apply to other documentation as well.
- The light time delay for the April commissioning will be about 2-minute round-trip.
- The monitor in the PISA mirroring the commanding monitor from the RMOC made following, adjusting, and confirming the commanding process very easy.
- We need to remember to remind the RMOC to enable the spacecraft internal data path for specific data types (e.g., memory dump packets). Is this manual enabling always necessary? Can it be "automated" somehow?

Pre-pass Briefing Notes

Pre-pass meeting (2004 March 22, 20:45 UTC)

- Pass will be 22:00 until 8:36 UTC.
- Commanding will be around 22:15 to 8:00 UTC (allow for 15-30 minutes of s/c commanding at beginning and end of pass).
- TM will be on VC1, visible on SCO (workstation) in PISA.
- Will get science, TC, and event packets on VC1 (delayed - buffered in SSMM).
- HK on VC0 and VC1, so we will see all packets twice.
- At beginning of pass, they will be dumping TM from previous pass on VC1, so we will see our HK "live" on VC0, then eventually we will see the second set of repeat packets on VC1 as it catches up to "real time".
- Note that the first FCP's (001-011) don't have any time synchronization (until we first use the OBCP on AL-FCP-012), so this may cause confusion. Perhaps to fix this, we can manually put in a time sync command at the beginning of each FCP.
- Can't do pressure test (AL-FCP-010) because we don't have ROSINA.
- We will put "LCL off" command on another stack as an "emergency stop". (They have 3 commanding stacks, 2 really available for use, which we can use like this).
- Update LIMA and AGS to accept VC0, VC1, or both?
- Use PS loop for operations

Pre-pass briefing (2004 March 23, 20:45 UTC)

- AOS 21:12
- Commanding available 22:00-8:30 UTC
- Planned order of procedures for this pass:
    - AL-FCP-016 (STIM Pulse Test)
    - AL-FCP-013 (Heater Control Verification)
    - AALS703A (Full memory check) does checksum on full memory.
        - RMOC needs to check that the sequence is on the system.
        - RMOC needs to add OBCP On and Off around it on the command stack.
- We discussed the "funny" TRP temperatures last night that were low (5-6 C) and never changed no matter what Alice was doing or what our instrument temperature readings were. However, today we re-ran the data on the PISA workstations (using both data streams) and the values for the TRPs were different: they started at ~15 C, and tracked Alice temperature changes reasonably well. The explanation may be that the cold and static values we saw last night were old data; TRPs come on VC1, but Alice HK on VC0. If we were monitoring only VC0 (we aren't sure), then the TRPs would just be the old, last seen values.

Commissioning Log

from Rosetta Logbook at: http://www.rssd.esa.int/index.php?project=ROSETTA&page=ros_log

UTC	Description
22 Mar 2004 - 22:44	Starting Alice commanding with AL-FCP-001 Doing one command at a time (manually executing each command on the stack). First two commands are enable TC sending to Alice and TM polling from Alice, so we won't see any Alice TM reflected from those commands. TRPP=5.42 TRPR=6.25
22 Mar 2004 - 22:49	Sending LCL-11A ON...
22 Mar 2004 - 22:53	We have housekeeping. current = 0.11 mirror temperature = 13 deg grating temperature = 17 deg
22 Mar 2004 - 22:59	We confirm that Alice has increased the housekeeping rate to 5 sec
22 Mar 2004 - 23:07	We are not getting any data from the DDS, but otherwise, all seems to be nominal. We will proceed to finish FCP-001.
22 Mar 2004 - 23:12	Starting AL-FCP-002 (primary and redundant operation)
22 Mar 2004 - 23:27	Proceeding with AL-FCP-002
22 Mar 2004 - 23:47	Finished first part of AL-FCP-002, switching off LCL 11A Temperatures: Mirror=15 C Grating=18.1 C Detector electronics=19.4 C&DH=21.7 Detector Housing=16.4 Instrument Housing=17.5 TRPP=5.4 TRPR=6.3 *[N.B. later determined these are bogus]*
22 Mar 2004 - 23:50	Turned on LCL 11B (redundant power) current = 0.112
22 Mar 2004 - 23:54	Manually added a time synchronization command so as to solve some possible confusion issues with timestamps on events, and to preserve the sanity of the operators in the RMOC, who have to listen to a beeping alarm whenever Alice is operating in unsynchronized mode...
23 Mar 2004 - 0:07	Completed AL-FCP-002 successfully
23 Mar 2004 - 0:23	Beginning AL-FCP-003 (Memory Checks) As a matter of course, for these first FCP's that don't use the OBCP to turn on, the RMOC is manually inserting a time synchronization command.
23 Mar 2004 - 0:24	Time synchronization is working well. We are getting duplicate packets (from VC0 and VC1) as expected.
23 Mar 2004 - 0:26	The "DDS problem" has been resolved. It was really a problem with the AGS (possibly due to a leap year related problem). We advanced the date of the AGS by one day and it is now receiving data from the DDS.

23 Mar 2004 - 1:20	Completed AL-FCP-003 All memory dumps and memory checks passed. Note on memory dump: one byte near the beginning of each page was different from the originally expected value (the 18th byte had a value of “ff” rather than “00”), but this may be due to how the memory is filled and how unused portions are overwritten (or not). Since the PROM and two EEPROM dumps all agree (they all differ in exactly the same way), and the checksums are correct, we believe this is not a problem with Alice, but perhaps in how we originally extracted the map of the dump values.
23 Mar 2004 - 1:25	Starting AL-FCP-004 (Heater turn on test)
23 Mar 2004 - 1:33	Started mirror heater, and current increased from 0.110A to 0.153A. Started grating heater, and current further increased to 0.190A. Temperatures started around 19.5 C
23 Mar 2004 - 1:43	Mirror and grating temperatures are around 26.5 C, sufficient for us to see the rate. Now commanding the heaters off.
23 Mar 2004 - 1:54	Completed AL-FCP-004
23 Mar 2004 - 1:59	Started AL-FCP-005
23 Mar 2004 - 2:10	Increased HK rate. Enabled diagnostics. Entered checkout state.
23 Mar 2004 - 2:18	Completed AL-FCP-005
23 Mar 2004 - 2:30	Note: we did see a short increase in current when we entered safe mode. This was expected, since entering safe mode triggers a close aperture door command (regardless of door status), and saw a HV event because entering safe mode also switches off HVPS (regardless of HVPS status).
23 Mar 2004 - 2:31	Started AL-FCP-006
23 Mar 2004 - 2:50	Successfully updated parameter (HtrSenseMirror) and mask (HVPS safety mask).
23 Mar 2004 - 3:00	Completed Al-FCP-006
23 Mar 2004 - 3:06	Started AL-FCP-007 (Aperture Door Unlatch and Open)
23 Mar 2004 - 3:14	Enabled diagnostics and increased HK rate to 5 sec. Now sending commands to turn on grating and mirror heaters to a set point of 40 C.
23 Mar 2004 - 3:17	The DDS is responding very well. We have the GSE in the PISA making data requests every 2 minutes, and a laptop making web requests for larger blocks of time (at the end of each FCP), and data retrieval is only a few seconds.
23 Mar 2004 - 3:19	Heaters are activated and just starting to rise.

23 Mar 2004 - 3:47	Team discussion about the plan for the rest of the night. We decided that after the successful completion of the door unlatch and open parts of FCP-007, we will NOT turn off the heaters, but instead, proceed to FCP-008 (aperture door cycling). We will skip the first part of FCP-008 that includes: • turning on the heaters and waiting to reach the set point (since the heaters will already be on and the temperature will be at that set point) • entering checkout mode (since we will already be in that mode) We will complete the remainder of FCP-008 (flapping the door). Then, we will skip ahead to FCP-012 (Power up/down OBCP verification), since that is the next most critical step. This would skip FCP-009 (context save and restore test, to be performed later tonight or tomorrow) and FCP-010 (pressure alert test, which we cannot perform at this time anyway because ROSINA is not available).
23 Mar 2004 - 4:23	Temperatures around 34 C. Now entered checkout state. Preparing to fire pyro to unlatch door.
23 Mar 2004 - 4:50	The aperture door is open!!!
23 Mar 2004 - 4:59	Regarding the firing of the pyros to unlatch the aperture door, we asked RMOC to first fire the primary pyro (pyro A) but *not* fire the redundant pyro (pyro B) until we try to open the door first. This way, if the open fails, we have time to evaluate the situation, decide if we need to change the environment (e.g., solar angle, etc.), before firing the backup pyro. Since the first pyro firing was successful, we will close the door (which we just did, and it worked), and then open the door again, and fire the backup pyro with the door in the open position (so the pyro firing won't accidentally produce a failure with the door closed that could keep the door closed, e.g., somehow flipping the latch back over the door).
23 Mar 2004 - 5:02	Aperture door is open again. Will now fire remaining backup pyro...
23 Mar 2004 - 5:39	I got a bit behind on the log... We completed FCP-007 (except for the turning heaters off) and skipped to FCP-008 (the part after the turning heaters on). We are now on the 9th cycle of flapping (opening and closing) the aperture door.
23 Mar 2004 - 6:01	Completed AL-FCP-008
23 Mar 2004 - 6:02	Starting AL-FCP-009 (context Save and Restore) We decided we needed to do this step before the OBCP procedure to verify the state of the s/c before the OBCP is executed.
23 Mar 2004 - 6:39	Confirmed that the context was correctly saved to and restored from the spacecraft (the spacecraft now has a valid context for Alice, and is in an appropriate state from which to run the power on OBCP).
23 Mar 2004 - 6:40	Completed AL-FCP-009
23 Mar 2004 - 6:42	Starting AL-FCP-012 (Power up/down OBCP verification)
23 Mar 2004 - 6:53	OBCP startup worked correctly. Time synch confirmed on AGS.
23 Mar 2004 - 6:55	Parameter dump showed correct values. OBCP off successful.

<table>
<tr><td>23 Mar 2004 - 6:56</td><td>Completed AL-FCP-012 We are done for tonight!!! An EXCELLENT first commissioning exercise and conversation with Alice.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>23 Mar 2004 - 21:27</td><td>COMMISSIONING NIGHT #2</td></tr>
<tr><td>23 Mar 2004 - 22:37</td><td>Starting AL-FCP-016</td></tr>
<tr><td>23 Mar 2004 - 22:44</td><td>Sending the turn on stim pulse command (ZAL19220)</td></tr>
<tr><td>23 Mar 2004 - 22:46</td><td>TRPs around 13.5 C</td></tr>
<tr><td>23 Mar 2004 - 22:52</td><td>We see the stim count rates as expected (16-17 Hz) MAD command sent</td></tr>
<tr><td>23 Mar 2004 - 22:54</td><td>Note that this procedure also uses the OBCP starting in EEPROM as a test to confirm this functionality.</td></tr>
<tr><td>23 Mar 2004 - 22:56</td><td>As MAD is running, count rates are at 34 Hz</td></tr>
<tr><td>23 Mar 2004 - 23:03</td><td>We have stims!</td></tr>
<tr><td>23 Mar 2004 - 23:15</td><td>Completed AL-FCP-016</td></tr>
<tr><td>23 Mar 2004 - 23:19</td><td>Starting AL-FCP-013</td></tr>
<tr><td>23 Mar 2004 - 23:26</td><td>Using set points: Grating=27.5, Mirror=23.4 (10 C above the current temperature). Door is open again!</td></tr>
<tr><td>23 Mar 2004 - 23:46</td><td>Mirror and grating have now both hit their setpoints. We will watch the controlling work for a while...</td></tr>
<tr><td>24 Mar 2004 - 0:18</td><td>The heaters have cycled a few times, so we have turned them off and are now in a cool-down phase for about an hour. While this is going on, we will execute the memory check procedure AALS703A.</td></tr>
<tr><td>24 Mar 2004 - 0:38</td><td>The memory checks all pass.
Checksums (decimal values):

Prom Total: 11275

<table>
<tr><td></td><td>Block1</td><td>Block2</td><td>Block3</td><td>Block4</td></tr>
<tr><td>PROM</td><td>2138</td><td>28400</td><td>1102</td><td>47087</td></tr>
<tr><td>EEPROM Page1</td><td>2138</td><td>28400</td><td>1102</td><td>47087</td></tr>
<tr><td>EEPROM Page2</td><td>2138</td><td>28400</td><td>1102</td><td>47087</td></tr>
<tr><td>EEPROM Page3</td><td>2138</td><td>28400</td><td>1102</td><td>45199*</td></tr>
<tr><td>EEPROM Page4</td><td>2138</td><td>28400</td><td>1102</td><td>47087</td></tr>
</table>

* This value of the last block of Page 3 is discrepant because in a previous test (one of the pre-launch full-functional tests) Alice writes to this area like a “scratch pad” as a test to verify capability of writing to EEPROM.</td></tr>
<tr><td>24 Mar 2004 - 1:20</td><td>Competed AL-FCP-013</td></tr>
<tr><td>24 Mar 2004 - 1:20</td><td>Door is closed.
Alice is off.
Everything went GREAT.
See ya in April!!!!!</td></tr>
</table>

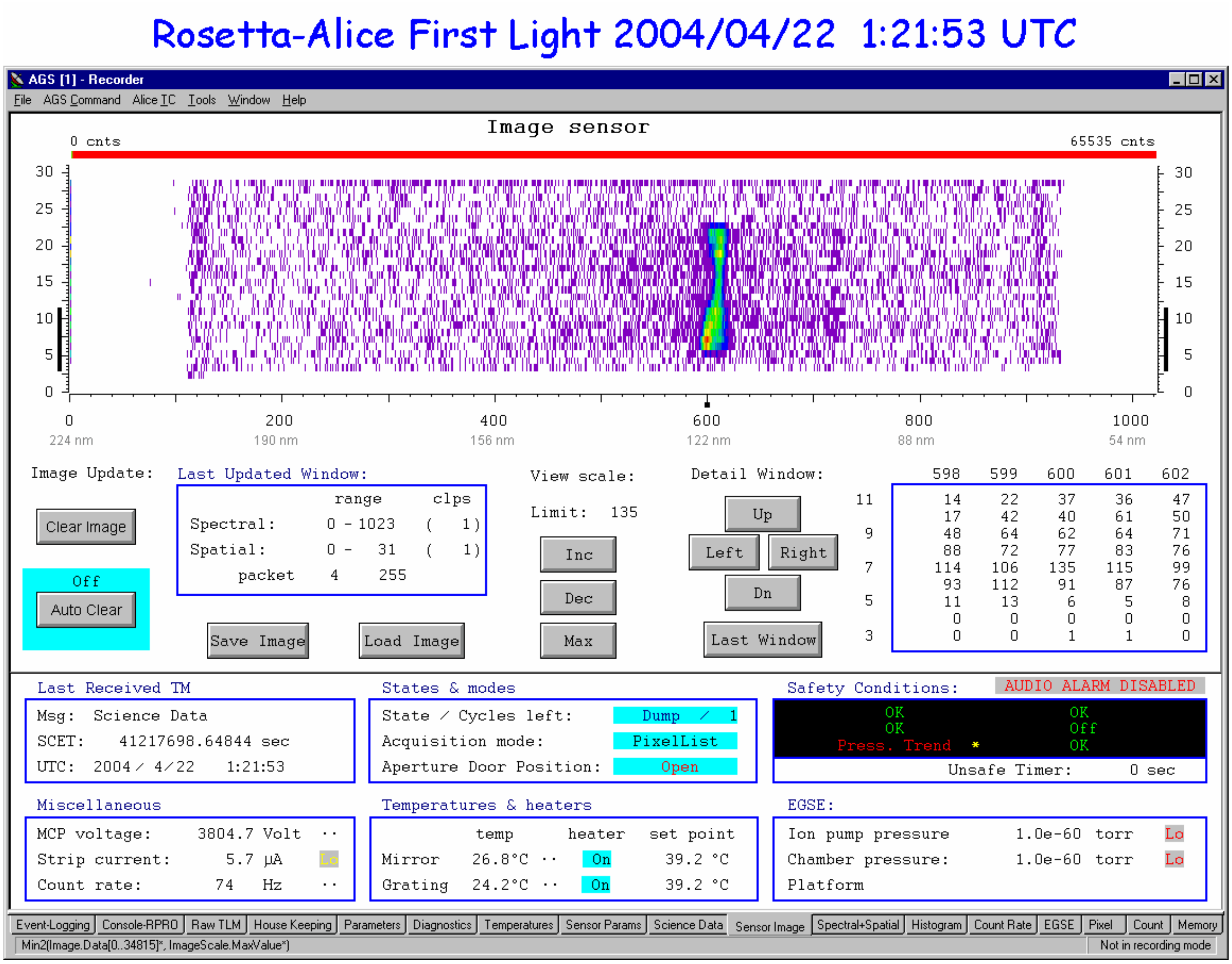
Rosetta-Alice Commissioning Report

2004 April 15-24

Joel Parker

Summary

During this commissioning slot we opened the Alice detector door (using the redundant side circuit after failure of the primary side), performed HVPS rampup tests, detector performance tests (dark count and response), software performance tests, and obtained our first light image (Hydrogen background emission; see below). The only procedure we planned and needed to execute but did not was the Performance Aliveness Test (PAT), which was initially delayed a couple days because of plan slippage (due to detector door issue), then cancelled on the last day due to spacecraft thruster thermal problems that occurred before our operations. The thruster thermal problems required an emergency slew and deletion of all subsequent timelined activities for the rest of that day, including the Alice PAT. We will need to reschedule the PAT observations sometime before the next (October) commissioning timeslot so we will have the necessary sensitivity and alignment information needed for October's operations.



Alice Personnel Present at ESOC During This Slot

2004 April 15—25: Joel Parker, Maarten Versteeg
2004 April 17—23: Alan Stern
2004 April 18—23: Dave Slater

Procedures Executed During This Slot

FCP ID	Name
AL-FCP-014	24 hr HTR Decontamination
AL-FCP-015	Detector Door Open *[modified]*
AL-FCP-017	HV Rampup 1 Testing (~2.0 kV)
AL-FCP-019	HV Rampup 2 Testing (~4.0 kV) *[modified]*
AL-FCP-020	Dark Count Check (~4.0 kV) *[modified]*
AL-FCP-021	Detector Response Test *[modified]*
AL-FCP-022	MAD TC Functional Tests *[modified]*
n/a	Deep Sky & Dark Exposures *[Added tests (2004 April 21)]*

Procedures Not Executed During This Slot

FCP ID	Name	Reason
AL-FCP-016	STIM Pulse Test, Checkout Mode	executed during previous (March) slot; also obtained several histogram images with additional STIM data.
AL-FCP-018	Noise Immunity Check	functionality was verified with other procedures
AL-FCP-023	Performance Aliveness Test	cancelled due to spacecraft problems, though most functionality was verified with other procedure and a "PAT Startup Test" procedure designed and executed during commissioning (2004 April 21).
AL-FCP-024	Optional Parameters Update	not needed
AL-FCP-025	6-month Status Check	functionality was verified with other procedures
AL-FCP-026	Hibernation Preparation	functionality was verified with other procedures
AL-FCP-017	16 hr HTR Decontamination	not needed (ran heaters continuously)

Notes, Questions, and Lessons Learned

Operations:

- The Alice ops, RSOC, and RMOC teams and remote supporting people did excellent jobs in working out the problems that came up (detector door, trips to safe due to anode voltage and ROSINA, operations replanning).
- Having team members remote (at home) to contact other support people when needed was very useful.
- We were able to quickly change TC sequence plans and edit them on the MTL interactively with RMOC. This flexibility was *extremely* valuable for the success of this commissioning.
- Replanning that involves attitude modifications require minimally 2-3 days (*weekday* days) turn-around time. Will be even more difficult when other instruments are running.
- Don't count on ops the last day or two of a slot. Make sure the instrument is in a safe state at the end of each day to cruise indefinitely in case ground contact is lost or s/c emergency.
- Having the ECAP at 10:00 when the pass activities are during the night is very hard on our ops team and their sleep schedule. We need to better plan to support that or ask if there is another option. Possible options: have a third person work a shift that overlaps part of ops and the ECAP or have a remote person call in to ECAP.
- When there are multiple teams in the PISA during pointing/interference, we all will be fighting over use of the central workstation to see the real-time data, and it seems everyone will have their speaker phones on talking to remote team members. Crowded and noisy.
- The logbook was very beneficial real time and will be a great searchable repository of information. However, when things get very busy or while working a problem, it is sometimes difficult to keep the log current. Perhaps we should keep a “private” log alongside the public log and then copy and paste into the public log when time permits. Doing this will prevent the loss of information.
- It would be nice of the logbook had a spellchecker, since entries are not editable.
- The Alice team paper sims were very useful and should be continued for future activities.
- We need to get all our standard sequences into the FOP. Talk to RSOC about this.
- Our modular scripts worked well and in fact, we should strive for even more modularity. This will provide more control even with the many changes that occur in commissioning.
- We need to do a better job of defining and communicating our hard and soft requirements (what we *need* and what we *want*). It appears to RSOC that we are shifting our requirements, e.g., pointing to blank sky, how we are to protect against hot stars, use of ROSINA, etc. We need to explain our ops philosophy better, that we are just learning our instrument, so we have certain ops limits and requirements that are strictly “safe”, but as we learn more about the instrument’s status in flight and how the ops interaction works between us, RSOC, and RMOC, we can revise those requirements as we better define the “safety envelope” for Alice. We expected that commissioning would start with the most conservative, strictest safety requirements.
- Be sure RSOC knows how to contact us at all times, even out of pass. It would have been helpful to be notified earlier of the spacecraft temperature problems so we could discuss options such as going to the PAT stars directly rather than a different slew and canceling the PAT. As it turns out, RMOC did discuss those options, but FD determined it would be too complicated on such short notice.

Data Distribution and Access:

- We need to have ROSINA off (or no Service 19 distribution to Alice) until we are sure the pressure trend problem is fixed. ROSINA is not needed during cruise; perhaps periodic "external" checks (i.e., not by Alice software) would be sufficient?
- Having the two data channels (VC0 and VC1) makes it a little difficult to monitor the data on the AGS during the period when they are dumping data from the previous out-of-pass (at that time, both channels appear in the TM on the AGS). This happens because we select the packets based on DDS *received* time. If we selected on packet *generation* time, this VC0/VC1 issue would not be a problem, but the AGS could possibly still receive packets out of order if they have generation times that are beyond the 5-minute request window (e.g., because of either a long observation, or a delay in sending some TM).
- It is very useful to have the ability to modify our GSE data access/display code as well as our pipeline code while we are in the PISA. We can address problems/issues immediately rather than put them off for when we return home.

Instrument:

- In bringing up high voltage, we were only looking at count rate and strip current. We should also make histogram acquisitions at each step so that we could get pulse height distribution data while we were bringing up the voltage.
- Should we relax the HVPS checks right at start-up to allow for temperature effects?
- The optimal HV set point will be a function of temperature (and device age). How can we best implement that?
- Some aperture door considerations in light of the detector door primary side firing failure:
    - Quantitatively review the likelihood and consequence of the aperture door getting stuck shut and the failsafe door not working vs. the potential for OAP damage or thermal damage. Should we leave the aperture door open (at least until we get to the comet) because of the potential consequence of it getting stuck?
    - A corollary to this is we should determine what the other instruments that are boresighted to Alice are doing with respect to sun avoidance and dust protection.
    - We should also finalize and implement the aperture door monitoring script.
- We should re-examine what we want to do for the 6-month check. Exercise the aperture door? Ramp HVPS? Do background/sky and dark exposures? Would it be better to have one extensive 6-month check sequences or two different (short, long) sequences?
- Remember that the heaters provide a $\Delta T \sim 17°$, so depending on initial spacecraft temperature, Alice may not reach a particular set point.

139	23 Apr 2004 - 1:51	We started the PAT test sequence: * Turn on Alice * Mask pressure trend But before the Mask Pressure Trend command was executed, Alice was safed due to a pressure trend value. SO, they have turned off ROSINA and Service 19 reporting to Alice, and deleted the set pressure trend mask command from the stack. We will run: * set HK rate to 5 sec * Turn on diagnostics * Set discriminator to 10 * Set anode voltage to low * HV step 2500, 3000 * Set anode voltage to normal * HV step 3500, 3700, 3800 in 30 second steps * Alice OFF OBCP			Joel Parker
140	23 Apr 2004 - 2:12	The PAT test ran wonderfully nominally. It was like your child learing to ride a bike, and you let go for the first time and watch her ride away...			Joel Parker
141	24 Apr 2004 - 22:44	The Alice performance aliveness test (PAT) has been cancelled due to spacecraft problems. About 6 hours before the PAT was to start, two of the Rosetta thrusters were reporting temperatures of 80 degrees. This is their upper safety limit; it is the highte			Joel Parker
142	28 May 2004 - 19:44	Tonight we will run the Alice Performance Aliveness test. The stars are HD 203245 (star 1") and alpha Peg ("star 2"). For each star we will do a pair of 1000 sec countrate scans going +/-2.5 deg across the star and a pair of 200 sec pixel list scans going +/-0.5 deg across the star. Additionally for star 2 we will do five 1080 sec "jailbar" histogram exposures at -0.05, -0.025, 0, 0.025, +0.05 deg from the star. Those will be followed by a single 1080 sec dark then shut everything down. Also note that Alice is turned off during the slew between star 1 and star 2."			Joel Parker
143	28 May 2004 - 19:45	We have AOS. Temperatures: Alice TRP = -1 C			Joel Parker
144	28 May 2004 - 19:47	Current one way light delay 136 seconds Rosetta distance from earth 40828928 kn			Maarten Versteeg
145	28 May 2004 - 20:04	Alice is ON!			Joel Parker

146	28 May 2004 - 20:11	Temperatures: Mirror = -0.55, -1 Grating = -2.5, -3.1 Detector Electronics = -0.6 C&DH = 2.4 Detector Housing = -1 Instrument Housing = -2.1			Joel Parker
147	28 May 2004 - 20:11	HV rampup proceeding nominally (voltages, currents, and countrates)			Joel Parker
148	28 May 2004 - 20:37	Done with the first countrate scan on Star 1. The HK data didn't show an unambiguous signal of the star against the background, but that may not be surprising considering the HK sampling of 30 seconds doesn't show a lot of resolution. We would expect to see the peak countrate (somewhere between 650 and 900 counts/sec) in one HK packet.			Joel Parker
149	28 May 2004 - 20:54	Second countrate scan on Star 1 is completed			Joel Parker
150	28 May 2004 - 21:08	Second pixlel list scan is done. This completes the scans on Star 1.			Joel Parker
151	28 May 2004 - 21:12	Door is not closed. HV is off.			Joel Parker
152	28 May 2004 - 21:12	CORRECTION: The above entry should read The door is NOW closed""			Joel Parker
153	28 May 2004 - 21:15	Alice is now off. Now there is APM cooldown and slew to Star 2. Alice turns back on in about 1hr 20min (22:35 UT)			Joel Parker
154	28 May 2004 - 22:43	Alice is back on.			Joel Parker
155	28 May 2004 - 22:54	We have started the first countrate scan on Star 2			Joel Parker
156	28 May 2004 - 23:06	Very nice, unambiguous detection of Star 2!			Joel Parker
157	28 May 2004 - 23:48	We have completed the 4 scans on star 2, and it looks excellent. A nice detection, indeed.			Joel Parker
158	29 May 2004 - 1:58	The jailbar pointing is complete. The aperture door is closed. We are now in the middle of a dark exposure.			Joel Parker
159	29 May 2004 - 2:11	HV is off. Dump of dark is complete. As expected, we didn't see the final HK packets showing that Alice turned off. We will confirm that by looking at the dumped data tomorrow. Temperatures: Mirror = 3.3, 2.8 Grating = 0.6, -1 Detector Electronics = 8.5 C&DH = 12.8 Detector Housing = 1.9 Instrument Housing = 1.1 An excellent PAT. Thanks to everyone. See you in the Fall...			Joel Parker

Alice Commissioning Report: Performance Aliveness Test 2004 May 28-29

Maarten Versteeg, Joel Parker

Summary

The earlier postponed R-Alice PAT was performed as the last step of the phase II commissioning activities. The complete PAT operation was executed from the s/c timeline and completed successfully. The selected target stars were HD203245 and HD218045 (alp Peg). On both stars both countrate and pixellist scanned acquisitions were performed. All eight acquisitions (a forward and reverse scan in each mode on each star) were successfully performed and resulted in corresponding science data files. Initial look at the data indicates that the R-Alice bore sight alignment is about 0.1 degree off the +Z spacecraft axis towards the –Y axis. In addition to the scans also a five-step jailbar pattern was scanned on the second star using histogram acquisitions around the nominal alignment to get measurements with a much higher signal to noise rate. The steps selected for this jailbar pattern were very small (only half a slit width), and only the last histogram barely touched the central star due to the 0.1 degree misalignment. As the last acquisition a dark histogram was acquired to be used for reference. The last acquisition was completed and dumped just before the pass ended and TM contact was lost before the instrument was switched of, although the TM already indicated that aperture door were closed and HV was switched off.

ECAP 2004/05/28

The ECAP was attended although the complete PAT operations were already uploaded to the spacecraft. This meant that no modifications were possible anymore and that the sequence would complete without any ground intervention. The only possibility was to cancel the acquisition sequence if any problems were observed in the ‘real-time’ received housekeeping telemetry. For this eventuality an OBCP off would be kept available on the ground command ‘stack’. The complete pass was filled with the PAT operation and the switch-off was planned in the last minute of the pass so no TM confirmation was expected. The science data would be received later as the dump of the previous out of pass spacecraft data had received priority (expected to be completed in less than 2 hours of the pass). As became clear during the pass, this precaution was not really necessary as Alice produces only a limited amount of science and housekeeping data (total less than 1 Mbyte expected). The current spacecraft distance is 40828928 km resulting in a one-way light delay of 136 seconds.

Rosina will not be active during the PAT, this is not considered necessary as the most recent $2.837 * 10^{-10}$ mbar and no sudden changes are expected.

In one of the PAT planning files all the countrate acquisitions AALS521A are shown with a remark: histogram acquisition for the actual commands in the sequence command the correct countrate acquisitions. This should be corrected in the database but it is not urgent.

Rosetta is currently moving towards a weekly upload and contact pattern of once per week (planned transition period of 2 months, slowly decreasing spacecraft contacts). This means that all planning (including spacecraft dynamics (FD)) has to extend over this longer period.

Other issues discussed with ESA:

Red Alarms - Christoph will retrieve the current limit settings from the ground system. These will be reviewed by SwRI and modified to attempt to remove all the 'red' alarms that occur during normal operations. Currently the alarms are distracting operations and may prevent ground command from catching a 'real' alarm. These updates will result in appropriate database update requests.

Instrument time drift – Both on the FM and the STB Alice instrument a time drift of about –45 seconds per day has been observed. Nominally this wouldn't be a problem as the time is resynchronized every 30 minutes, but Alice doesn't process the time updates during an acquisition making the effective update interval much larger. This makes out of pass operations hard as matching of telecommands and the corresponding acks is based on a limited time window (of +/– 2.5 sec). Once this time window is exceeded the received acknowledgements are tagged with ground receive time which for out of pass operations may be hours later making any tracing nearly impossible. The simple solution of increasing the time update frequency is not feasible, as this operation requires extensive spacecraft resources. SwRI will continue the investigation into this problem to determine the root cause and study possible solutions. Changing Alice to accept and use time updates also during acquisitions would result in small jumps of the instrument time of about a second each 30 minutes when a new time update is received.

Pointing information – Quaternions are still the only standard product (of FD/ESOC) that are guaranteed to be generated during the whole mission and available though the DDS. Spice kernels are currently produced weekly basis by ESTEC, but this is limited by available manpower. The supplied RA/Dec file for the PAT is even more temporary.

Knowledge video – Received the SwRI copy of the knowledgement DVD and a copy of the knowledgement software. Installation requires installing 'dot net'. Still missing is the index that will make the video really useful, now the video can only be played without any indexing capabilities, the index file will be distributed via LiveLink.

Observation plan:

Star 1: HD203245 has an expected countrate of 900 counts per second, including the background and STIM, this star was selected as the sun angle is >90 degrees making any false light due to glints nearly impossible.

Star 2: HD218045 (alp Peg) has an expected countrate of 1500 counts per second again including the background and STIM, it has a sun angle of less than 90 degrees, but the contrast is better and sky area is quieter.

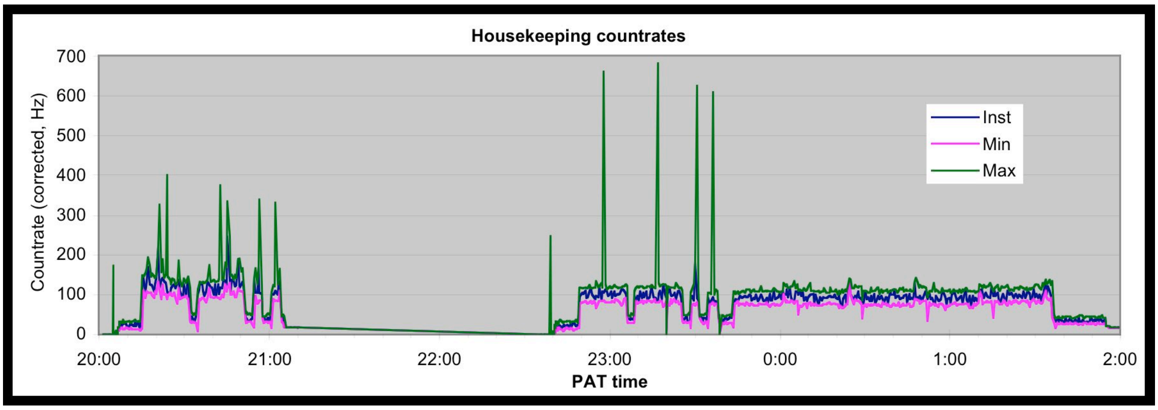
The following observations were planned

- two 5 degree scans on star 1, forward and reverse, acquisition in countrate mode
- two 1 degree scans on star 1, forward and reverse, acquisition in pixellist mode
- slew from star 1 to start 2, Alice off during scan
- two 5 degree scans on star 2, forward and reverse, acquisition in countrate mode
- two 1 degree scans on star 2, forward and reverse, acquisition in pixellist mode
- five histogram acquisitions in a 0.025 step jailbar pattern on star 2
- one histogram dark acquisition.

PAT execution:

AOS was expected and occurred at 18:49 UTC (20:49 local), with an expected 10 degree attitude at 19:35 UTC. The first Alice command is planned for 20:01 UTC.

Satellite signal was acquired as planned reporting the TRP temperatures for the Alice instrument of –1.1 degree C. At 20:01 the PAT execution started and after correct start of the instrument the HV was ramped up to the operational value. Ramp up used a quick ramp up with steps of 30 seconds. During the operations Alice housekeeping was used to verify the correct operation. To limit produced data volume the PAT sequence did not change the housekeeping rate from the nominal 30 seconds rate. It would have been easier to have a higher HK rate (e.g. 5 seconds), as this would also have resulted in a higher resolution of the received countrate data. The countrate data as retrieved during the pass is shown in the figure below. Note that during the pixellist and histogram acquisitions the reported countrate value approximately doubles (due to a known detector 'feature'), the graph has been corrected for this doubling and also for the spurious high countrate that occurred during the startup of the instrument when the discriminator value has not been set yet.



In the above graph the separate acquisitions can easily be distinguished as the aperture door was closed between all the scanning acquisitions. During the jailbar histogram acquisitions the aperture door remained open. Already in the housekeeping countrate values the peaks in the scan could be observed indicating that the stars were covered during the scans. The maximum countrate are about a factor of two smaller that the values suggested by the model. Also visible is that the scans of star 1 cover a field of view with other stars resulting in additional maxima in the countrate value.

Just before the repositioning slew, the dump of the spacecraft housekeeping was stopped and immediately the first four Alice science dumps (42 packets in total) were transmitted by the spacecraft. The Alice science data has such a small volume that the precaution taken to lower the Alice science TM was not needed. It could have been left at nominal priority meaning that it would have become available earlier during the pass.

After spacecraft repositioning the signal was acquired again and after waiting for the High Gain antenna-pointing motor to cool down the PAT was continued. Scans of the second star showed an expected higher countrate and showed also that the star 2 environment is very clean.
At the start of the dark acquisition the commanded aperture door closing was reported in the housekeeping data. After the dark acquisition the result form the HV being commanded to zero

showed in the housekeeping. As expected the result of the power down of the instrument was not observed in the telemetry any more as the signal was lost before the effect of this command had time to reach earth. During the next pass the remaining telemetry was received consisting of the final science acquisition data and the last view instrument housekeeping telemetry packets showing a proper shutdown.

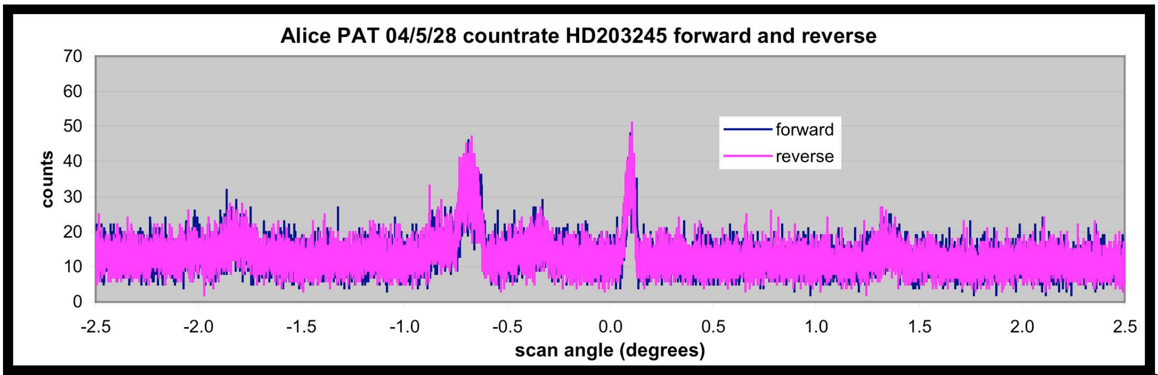
The following 14 science data sets were retrieved by Lima from the received science telemetry packets, all datasets were received completely.

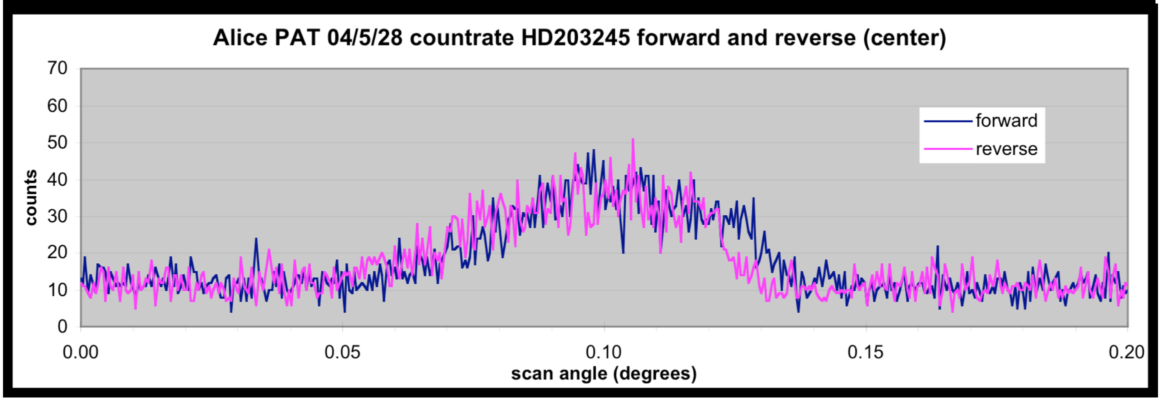
Acquired science data			
file	**scan**	**packets**	**notes**
first star (HD 203245) scans			
ra_040528203137_cnt0_eng.fit	forward 5 deg	6	
ra_040528205118_cnt0_eng.fit	reverse 5 deg	6	
ra_040528205737_pix0_eng.fit	forward 1 deg	15	26114 events
ra_040528210357_pix0_eng.fit	reverse 1 deg	15	25953 events
second star (HD 218045, alp Peg) scans			
ra_040528230537_cnt0_eng.fit	forward 5 deg	6	
ra_040528232517_cnt0_eng.fit	reverse 5 deg	6	
ra_040528233137_pix0_eng.fit	forward 1 deg	14	25102 events
ra_040528233757_pix0_eng.fit	reverse 1 deg	14	25554 events
second star (HD 218045, alp Peg) jail bars			
ra_040529000107_his0_eng.fit	-0.050 deg	19	104297 events
ra_040529002409_his0_eng.fit	-0.025 deg	19	104100 events
ra_040529004708_his0_eng.fit	0.0 deg	19	104217 events
ra_040529011008_his0_eng.fit	+0.025 deg	19	104996 events
ra_040529013307_his0_eng.fit	+0.050 deg	19	113702 events
dark acquisition			
ra_040529015448_his0_eng.fit	N/A	19	38703 events

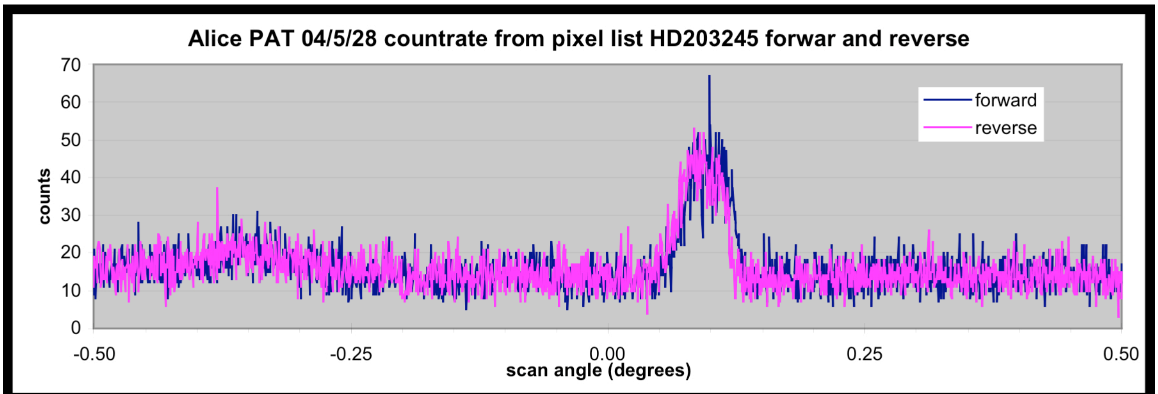
First star scans

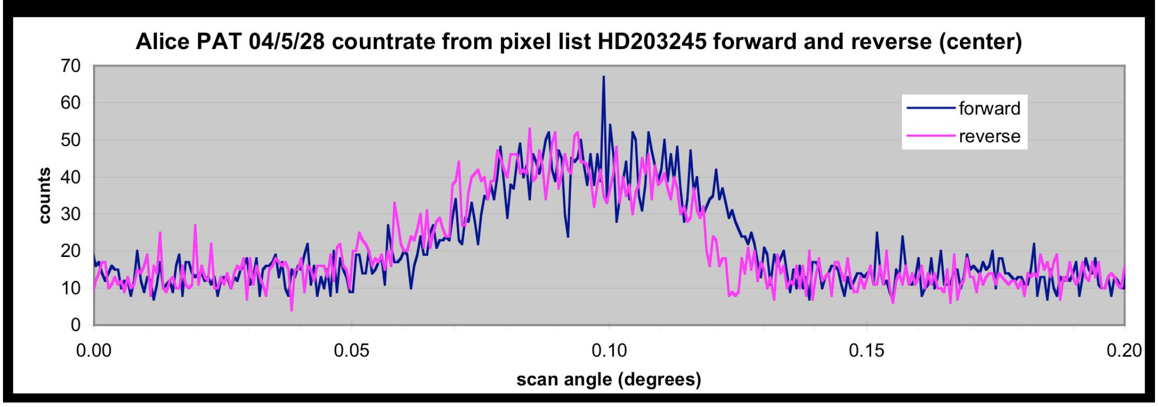
From the received science data the following graphs were derived showing the registered countrate values. Note that the angular resolution of both the countrate acquisition with 96 ms bins and a 5 degree scan and the pixellist acquisition with 125 ms time hacks and a 1 degree scan is very similar. The countrate scan has a 0.0005 degree resolution and the pixellist scan a 0.006 degree resolution.

The first graph shows both the measured countrate of the forward and reverse scans, at this scale both scans match. The next (second) graph shows the center section of this graph, were it can be seen that the bore sight offset is about 0.1 degrees. The last two graphs show the same information extracted from the pixellist acquisition scans on the same star. This shows the same bore sight alignment value as the countrate observations.


Alice PAT 04/5/28 countrate HD203245 forward and reverse
counts
scan angle (degrees)
forward
reverse

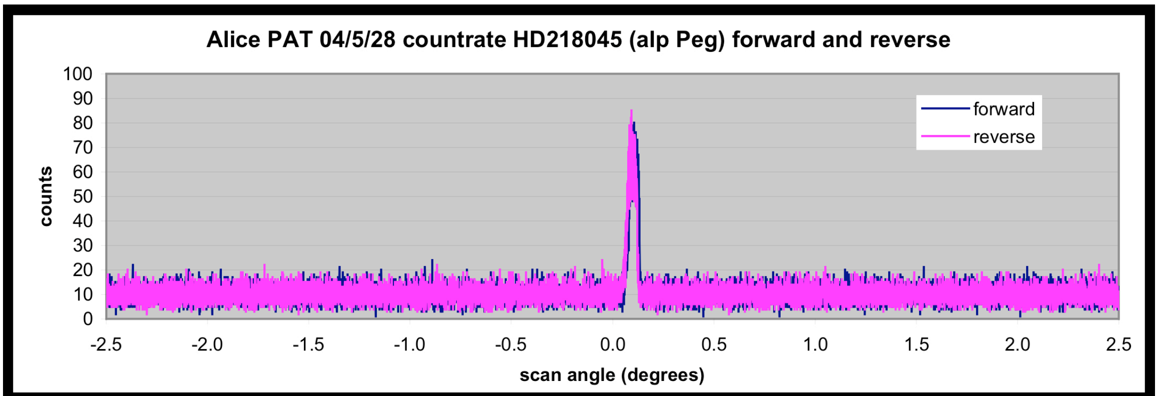

Alice PAT 04/5/28 countrate HD203245 forward and reverse (center)
counts
scan angle (degrees)
forward
reverse

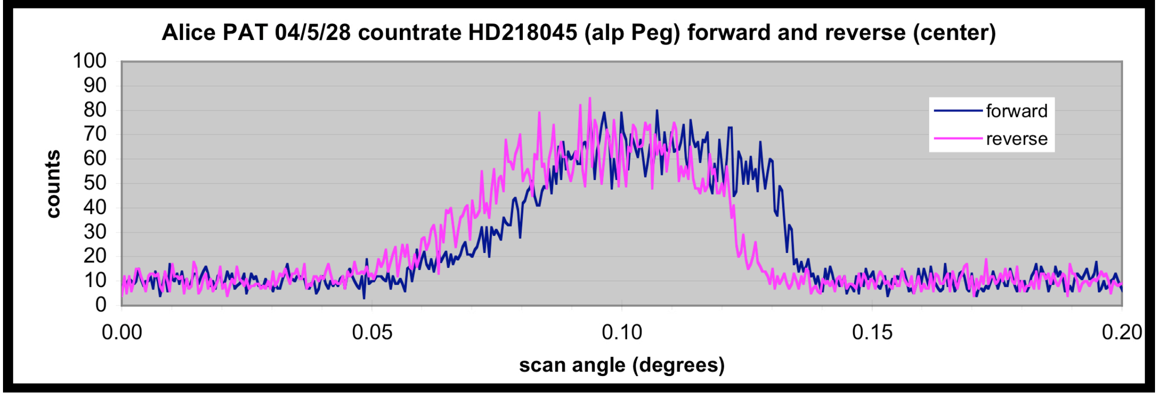

Alice PAT 04/5/28 countrate from pixel list HD203245 forwar and reverse
counts
scan angle (degrees)
forward
reverse

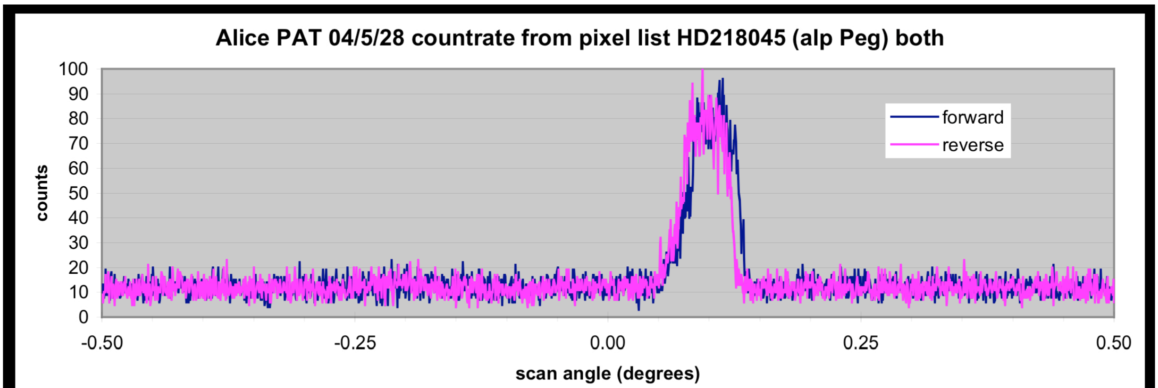

Alice PAT 04/5/28 countrate from pixel list HD203245 forward and reverse (center)
counts
scan angle (degrees)
forward
reverse

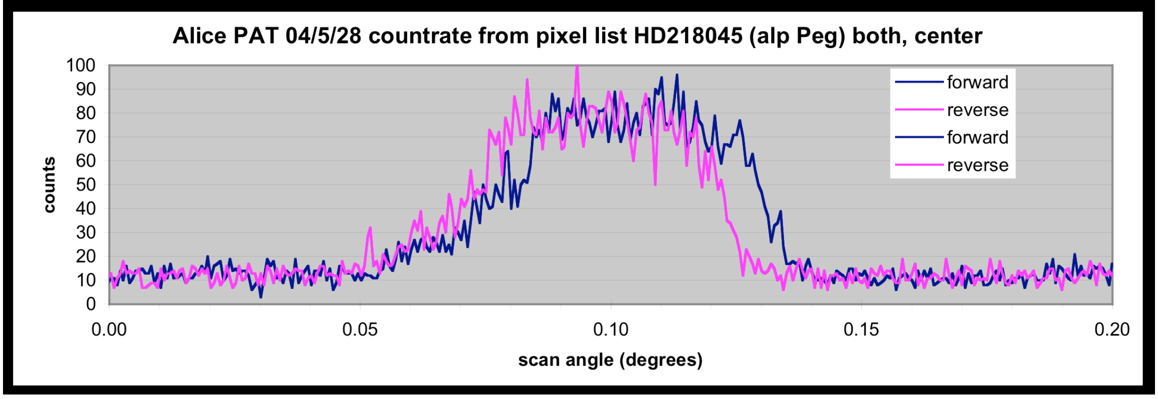
Second star scans

For the second star the same scans were performed, these scans show a quieter background and a much better signal to noise ratio. For the results see the four corresponding graphs:







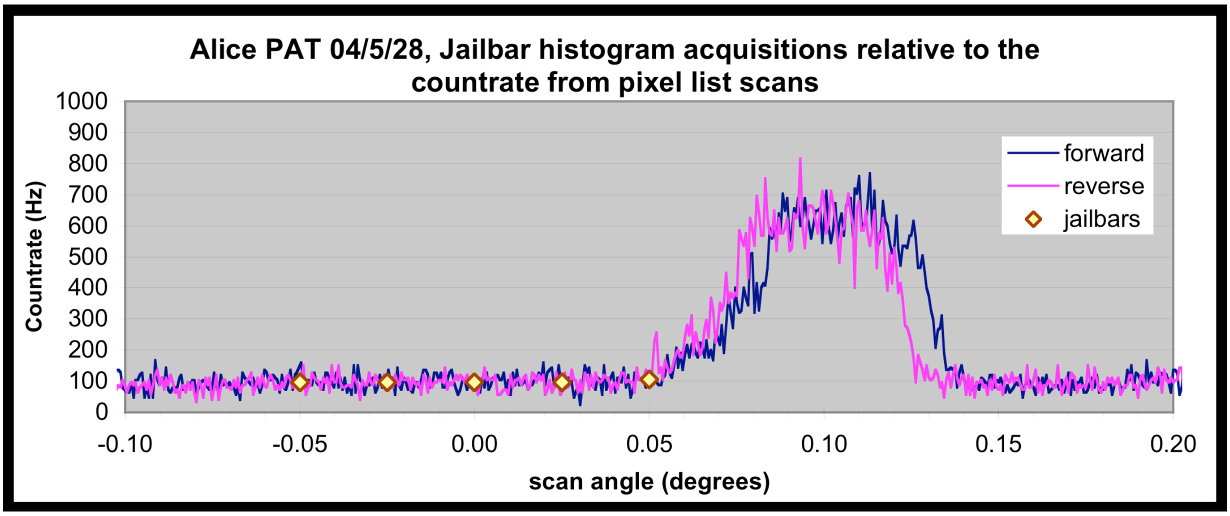


. The same alignment value is again visible in all four graphs, more clearly visible in these graphs, but also already visible in the scan results of the first star is that there is a reproducible difference between the forward and back ward scan. This difference is larger than the acquisition resolution for the scans so it doesn't seen to be related to the acquisition operation, unless there is an overall inherent time shift in the acquisition operation of the Alice instrument. This difference in forward and backward scan is about 0.01 degree, but further analysis of the figures is needed.

Second star Jailbars and dark acquisition

The planned jailbar acquisitions were added to get a limited number of observations with a much higher signal to noise ratio, both for alignment and intensity calibration purposes. The planned 5 jailbar acquisitions covered an area centered on the middle of the ideal pointing, shifting twice a half-slit width to the right and twice a half slit width to the left. As was clear from the initial checking of the first scans this would not cover the actual bore sight alignment and maybe just touch on the edges of the psf wings. But as the scanning and the whole PAT could not be modified the planned operation was continued.

The following graph shows the scan angle at which the histogram acquisition were made and the resulting countrate in reference to the countrate information that was retrieved from the pixellist scan of star 2.



Rosetta-Alice Commissioning Report
Interference and Pointing Scenario

2004 September 2 – October 4

Joel Parker

Summary

During this commissioning slot we performed several pointing operations to determine the Alice boresight relative to the space craft +Z axis (preliminary values: $\Delta X=0°$, $\Delta Y=-0.098°$) and analyze stray light as a function of solar elongation. Interference tests were done, and the analysis to date shows that no interference was seen by the Alice instrument due to other instruments or the spacecraft. Pointing/alignment observations were made on a UV calibration stars to also allow for flux calibrations at $\lambda > 950$Å. At the beginning of the commissioning slot, we uploaded a software patch to fix one problem (clock drift) and provide enhanced capabilities (door performance monitoring).

Software Patch Uploading and Testing

On September 2nd the Alice team monitored, managed, and analyzed the upload and testing of the Alice flight software patch. Maarten Versteeg traveled to ESOC in Darmstadt to support these activities. The following is from the Rosetta Weekly Operations Report #24:

> On DOY 246 the ALICE on-board software was successfully uploaded and verified via a sequence of in-flight tests. ALICE SW 2.04 was patched into EEPROM bank 4. Checksums on the EEPROM bank patched as well as a dump of this memory were requested and an online comparison of the checksums calculated on-board against the expected ones confirmed successful installation of the software. The memory dump will be analyzed offline by the ALICE team. Execution was then transferred to the new SW and a number of confidence tests were carried out with the instrument:
>
> - Aperture door cycling test
> - Door life test
> - HV ramp 1 to 2KV
> - MAD TC functional tests
>
> All tests were successfully executed, with only a minor problem with the HV ramp test when a temperature-related safety triggered and the sequence had to be restarted with a slightly modified anode voltage threshold value.
>
> ALICE was then kept active in safe state over the non-coverage period to measure the clock drift which should have been reduced significantly with the new software. It was confirmed by ESOC that the ALICE clock drift was less than 5 seconds over 15 hours.
>
> The ALICE software maintenance activities were very successful and ALICE stated that the new software is GO for use in CVP part 2.

Below is the text from the online log:

- 2 Sep 2004, 14:32... Test un deux.
- 19:01... Test in preparation for first Alice software upload during tonight's pass
- 19:31... Alice powered up after a long sleep for the first software update, instrument seems to be all fine.
- 19:39... Instrument temperatures at startup in the range -1 to 0 degC, current measurement 0.111 A, count rate noise results in reported count rates in the range 10-250.
- 19:41... First series of 85 memory patch commands uploaded, will be executed at a rate of one command per 3 seconds
- 19:42... Acknowledgements of first memory patch commands start coming in
- 19:46... Acknowledgements of the first batch of memory patch commands continue, sending the second back of again 85 memory patch commands
- 19:59... Steady stream of acks continue, send third and last batch of 86 memory patch commands.
- 20:25... All four reported checksums over the uploaded code are as expected, indicating that the whole memory patch was completed successfully.

- 20:42... The new version of the instrument software is started and comes alive for the first time on the spacecraft. All seems fine, the correct version number is reported and the count rate noise goes away.
- 21:01... Power cycle and startup of new software by OBCP directly also functions as expected, two startup packages are generated and the first housekeeping data reports again version 2.04.
- 21:09... Upload A slightly patched version of the door cycle test AL-FCP-008, the power on and off were removed, the number of cycles reduced to 6 and the initial 1 hour delay shortened to 5 minutes.
- 21:18... Uploaded new door life test sequence for execution at 21:36 (UTC).
- 21:44... Door cycling test completed successfully
- 21:55... Door life test completed successfully and reported door timing measurements in the memory dump (0x220, 0x801, 0x200, 0x8fe, 0x21e, 0x7ff, 0x20b, 0x914).
- Uploaded the HV rampup to 2 kV for execution at 22:10
- 23:14... Safety triggered during execution of rampup to 2 kV, the anode voltage did not reach the expected value. This also happened during commissioning and was caused by the low instrument temperature, during commissioning the low anodevoltage limit was lowered to 55 (~150V)
- 23:16... Additional set parameter command added (to lower min anode voltage limit) and sequence uploaded, execution starts now.
- 23:45... Rampup to 2kVolt now completed successfully and pixel list acquisition done. Now upload the MAD TC functional test sequence (AL-FCP-022) for execution at 00:15 UTC
- 3 Sep 2004, 0:35... The rampup of HV to the operational level of 4 kV was completed in the MAD TC functional test and acquisitions in various modes are performed. Initial inspection shows acquisition of the expected Ly-a background in the histogram images and the expected dog bone shape of the projected slit.
- 2:14... MAD TC functional test was completed successfully. Alice was commanded to the safe state with the aperture door closed.
- 2:41... As a final test the time drift test was started, Alice will remain on in SAFE state, the time synchronization service for Alice has been witched off and the spacecraft will periodically send connection test commands (PING) to the instrument. The responses from Alice to these commands will be time tagged by the Alice clock allowing for an easy determination of the Alice clock drift. The first two connection test commands were observed before the TM from the spacecraft was lost.
- 2:43... Also uploaded to the spacecraft were commands to switch Alice off just before the beginning of the next pass.

The patch update was completed with the submission of DCR's based on successful testing and verification of the newly installed patch. These consisted of modifying all the Alice startup sequences so that the Alice “ON” OBCP would start Alice in EEPROM that contains the patched code (however, one startup sequence used during the interference scenario was missed, causing a non-critical problem; the clock drifted as before during that test).

Planning and Execution of Commissioning Activities

The Alice team participated in all aspects of planning for the next set of commissioning activities, which primarily included the development of ITLs and SPLs, with extensive iteration with ESA via e-mail and telecoms.

The plan for Alice activities were as follows:

Sep 20-21 : Interference tests
Sep 24 : OBS07 - Stray Light Test I
Sep 24 : OBS08 - Stray Light Test II
Sep 26 : OBS20 - Alice Jailbar
Sep 26 : OBS27 - Alice Decontamination I
Sep 27 : OBS30 - Alice Raster Scan
Sep 28 : OBS28 - Alice Decontamination II
Sep 28 : AL_AD - Door performance test
Sep 30 : OBS10 - Stray Light Test III
Oct 4: Repeat of OBS20 - Alice Jailbar with corrected boresight data

During execution of these activities, the Alice team monitored the progress, downloaded data from the DDS (the response time of the DDS was very good), and analyzed the data. All these activities were done remotely from SwRI. Quick turnaround was requested by ESA for analysis of the interference and first two straylight tests to make a Go/NoGo decision on participation in subsequent interference and third straylight tests.

Stray Light Tests

In the analysis of the data from the first two stray light tests (from 140° down to 45° from the Sun) some scattered light was seen to begin appearing on the Alice detector at an angle around 60°, and slowly increased in intensity as the solar angle decreased to 45°. However, the count rate in that region was still relatively low, and the temperatures (Alice internal and external TRPs) were not too high. Based on that analysis, the Alice team agreed to participate in the Stray Light Test III down to 35°.

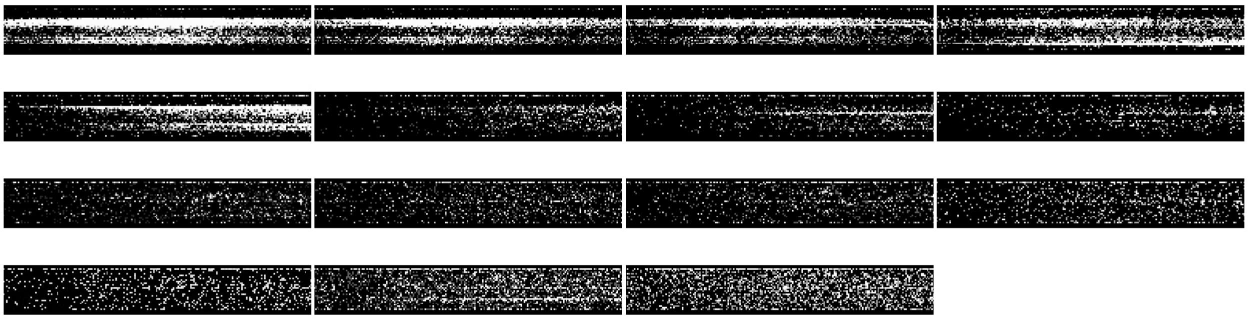


Figure 1 This is a section at the red end of the Alice detector where the solar stray light was seen. The images from upper left to lower right are: 45°, 50°, 55°, 60°, 65°, 70°, 75°, 80°, 85°, 90°, 100°, 110°, 120°, 130°, and 140°.

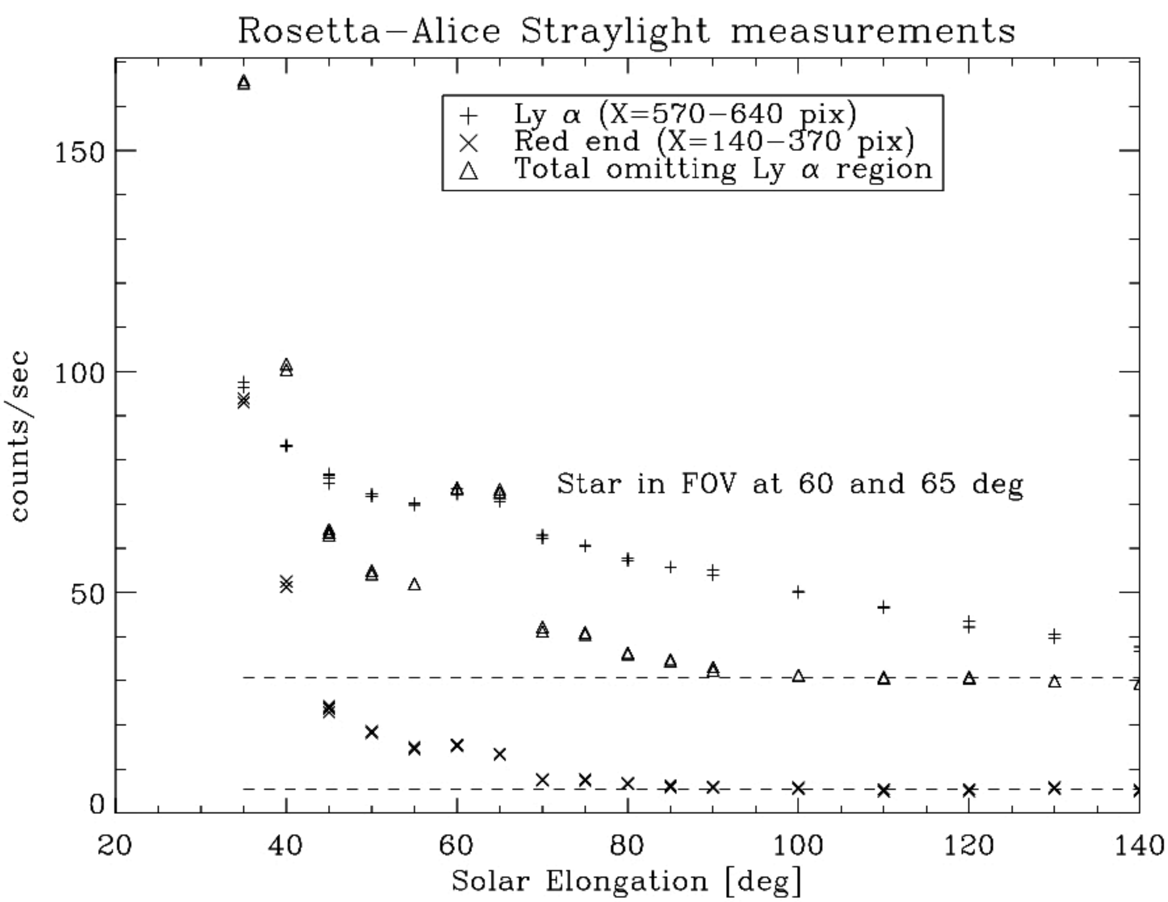


Figure 2: A plot of the count rate as a function of solar elongation.

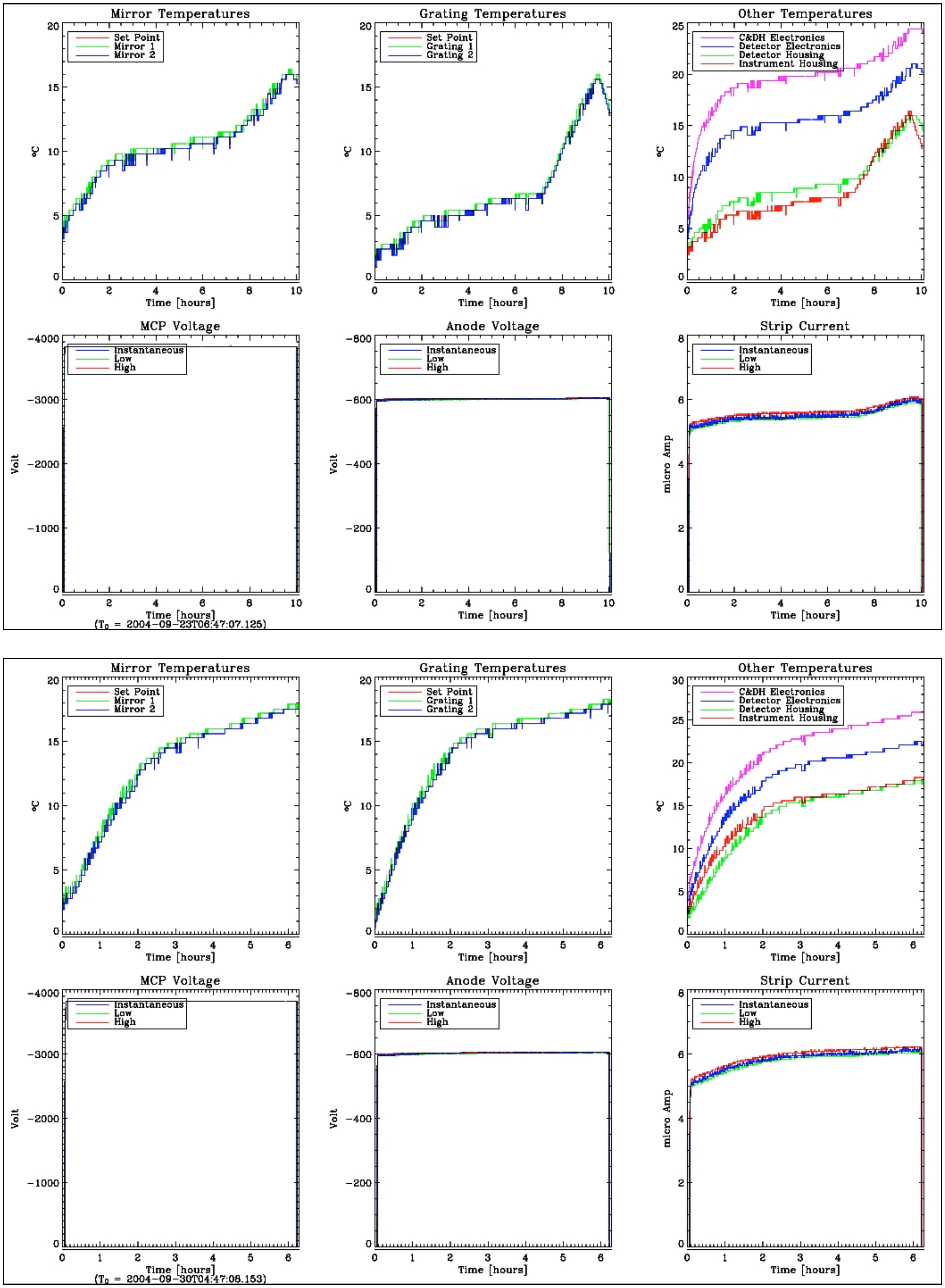


Figure 3: Alice housekeeping data from Stray Light Tests 1 and 2 (top) and 3 (bottom).

Interference Tests

The basic Alice Interference test consists of these scripted sequences:

- AALS014A Switch on
- AALS014B Start Sensitive mode - runs for 4 hours
- AALS014C End Sensitive mode - terminates sensitive mode
- AALS014D Emissive mode - 8 minutes
- AALS014E Switch off

The general concept for the test is that each Rosetta instrument will be powered on one-at-a-time and commanded into the most sensitive mode. All instruments will then be commanded into the most emissive mode and the effects will be observed with each instrument.

The Alice sensitive mode consists of a continuous series of pixel list acquisitions, after starting the sequence it will continue acquisitions for 10 hours, at this point acquisitions can be restarted to continue the test is needed. At any point the acquisitions can be stopped when the measurements are completed.

The emissive mode consists of a limited number of door operations ("flaps") and heaters activations and deactivations. A limited duration script that will execute for a few minutes controls this sequence. This is considered a most emissive mode although is not typical for nominal Alice operations. Nominally the aperture door is only operated once at the start of an observation sequence and the heaters will only be activated during a decontamination sequence, which will normally be performed while no data acquisitions are performed by the instrument.

It was not until after the interference scenario was executing that two issues/problems were recognized:

- The OBCP ON used for the interference tests called the old flight software in the PROM. Although this does not affect us or endanger Alice, the clock drift will occur, since that problem was fixed in the patch that resides in the EEPROM. This was not a "critical" issue, but was noted to ESOC in case the clock drifted far enough out of synch with the spacecraft clock that is could raise warning messages.
- The Alice "emissive" mode sequence used in this test flaps the aperture door *a lot*. Each call to the sequence flaps the door 24 times, and the sequence was called 13 times during the full run of the test, so the door flapped 312 times! Door cycles are considered to be a limited consumable (roughly 10,000 flaps for the full mission).

Results: No interference was seen from other instruments affecting Alice during the interference test. All pixel list data were exactly zero counts, showing no noise from any sources. So, the Alice team informed ESA that that we did not need to participate in any further interference tests. In fact, we explicitly stated that do not *want* to participate in any more tests with the current format of the test since it cycles the aperture door frequently, and we want to minimize door flaps.

Pointing Observations: Alignment and Flux Calibrations

Alice observations for the Pointing Scenario consisted of two types of observations: raster scans and "jailbar" observations.

Raster Scans

Alice used a bright and isolated star as the target to perform a raster of 7 sets of back-and-forth scans, where each set consists of 4 scans (2 in count rate mode followed by 2 in pixel list mode). Each scan was 1° wide (±0.5° centered on the Alice slit center boresight as determined during the PAT) at a rate of 0.01°/sec. Each raster point was stepped along the length of the Alice slit, starting at +2.1° from the slit center to -2.1° in steps of 0.7° along the slit length. This was to provide sampling of the slit position across three parts of the narrow part of the slit (+0.7, 0.0, and -0.7° from center) and across two parts of each wide part (±1.4 and ±2.1° from center). This will allow for definitive determination of the slit position (offset) and orientation (skew) relative to the spacecraft axii.

The target star was:

- Name: HD 207971 (gamma Grus)
  RA (J2000.0) = 21h 53m 55.7245s
  Dec (J2000.0) = -37d 21' 53.468"
  Spectral Type: B8 III
  V = 3.0 mag
  Teff ~ 11500 K
  E(B-V) ~ 0.00
  The estimated count rate for Alice was ~ 1300 Hz

With a slew rate of 0.01°/sec, as it passes through the narrow central part of the Alice slit (0.05° wide) it should produce ~ 6500 counts in the spectrum. In the wide top and bottom parts of the slit (0.1° wide) it should produce 13000 counts in the spectrum.

Note that each scan exposure took 100 seconds (1° scan at a rate of 0.01°/sec), and with an estimated background rates (Ly alpha, dark counts, and ions) of ~ 100 Hz, we expected about 10,000 background counts in each exposure. Added to the stellar spectrum and pixel list time hacks, we expected the observations to have totals of ~ 17500 and 24000 counts in the narrow and wide slit scans, respectively. That is sufficiently below our limit of 32768 counts in pixel list mode.

Jailbars

The objectives of these observations were to obtain pointing/alignment and slit throughput measurements for the Alice instrument. Alice was pointed to a known target star and at 31 slewing steps spaced by 0.01° between points, covering a swath of 0.31° by 6° centered on the target star. Stepping was performed perpendicular to the Alice slit (in the 0.31° direction; the Alice slit is parallel to the spacecraft X axis. At each point Alice will acquire one 145 sec histogram image.

The first set of jailbar observations performed on 20004 Sep 26 "missed" the star.

because the Alice boresight offset had an incorrect sign calculated by the Alice team. It was determined that the source of the problem was a sign error in the initial estimate of the Alice boresight from the PAT data (it was given as ΔY=+0.098° from the spacecraft +Z axis, but should have been ΔY=-0.098°). So, the observation was repeated on 2004 Oct 4. Those repeat observations were identical except they used the correct sign for the boresight offset and used 43 steps rather than 31 to increase the width of the swath and provide additional assurance that the target star would be observed.

The target star was:

- Name: HD 209952 (alpha Grus)
  RA (J2000.0) = 22h 08m 13.9855s
  Dec (J2000.0) = -46d 57' 39.512"
  Spectral Type: B7 IV
  V = 1.7
  Teff ~ 12700
  E(B-V) ~ 0.00
  The estimated count rate for Alice is ~ 7 kHz
  For exposure times of 150 sec, we predicted ~ 1e6 counts in the spectrum

Results

The raster scan and the repeated jailbar observations were successful. Both stars were observed, and the count rates were in reasonable agreement with the estimates made on the sensitivity calculations from the PAT data. These new data will allow a much more accurate calculations of the Alice instrument sensitivity (the effective area). However, note that the data from these stars are good for wavelengths longward of the Lyman-alpha cutoff (really, for good signal-to-noise, for wavelengths longer than about 950Å (see following figure). Flux calibration for shorter wavelengths will require observations of solar flux reflected from the moon during a flyby.

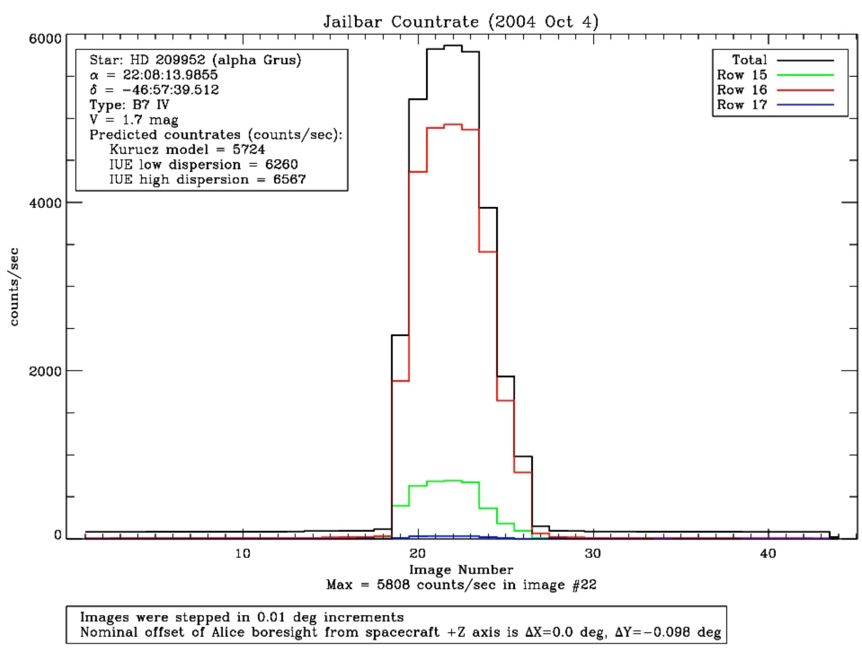


Figure 4: The profile of the stellar flux for the jailbar observations. This shows that the star was reasonably well centered in the middle of the jailbar sequence, and so was close to the offset of ΔY=-0.098°. Exact measurements are still pending analysis.

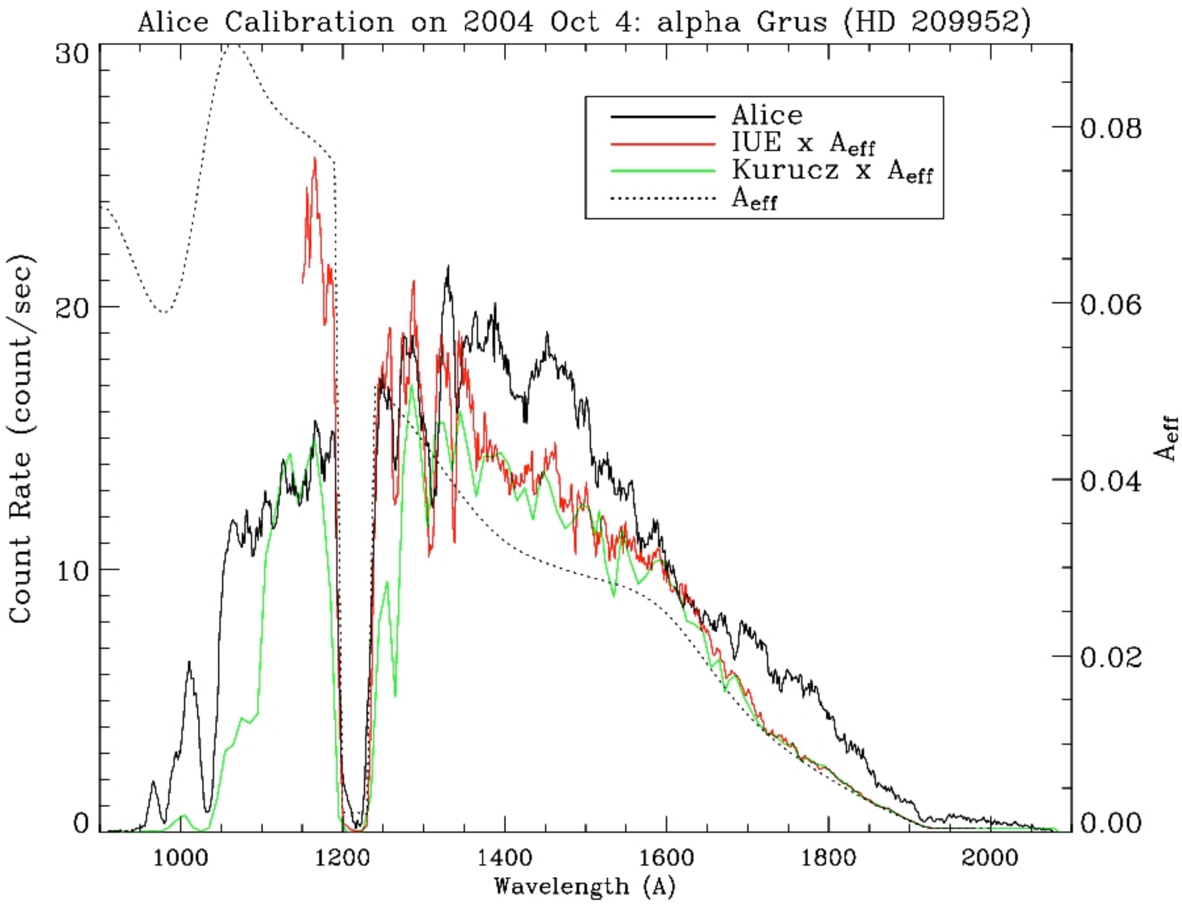
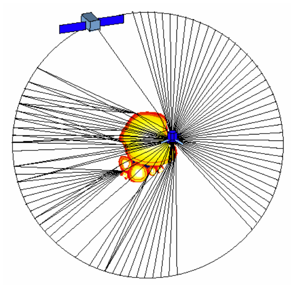


Figure 5: Comparison of the predicted (red and green lines) and observed (black line) flux of the star observed during the jailbar sequence. These data will be used to refine the Alice sensitivity (the effective area curve) over the wavelength range of good S/N.

3. CONSERT



CONSERT report MCRR

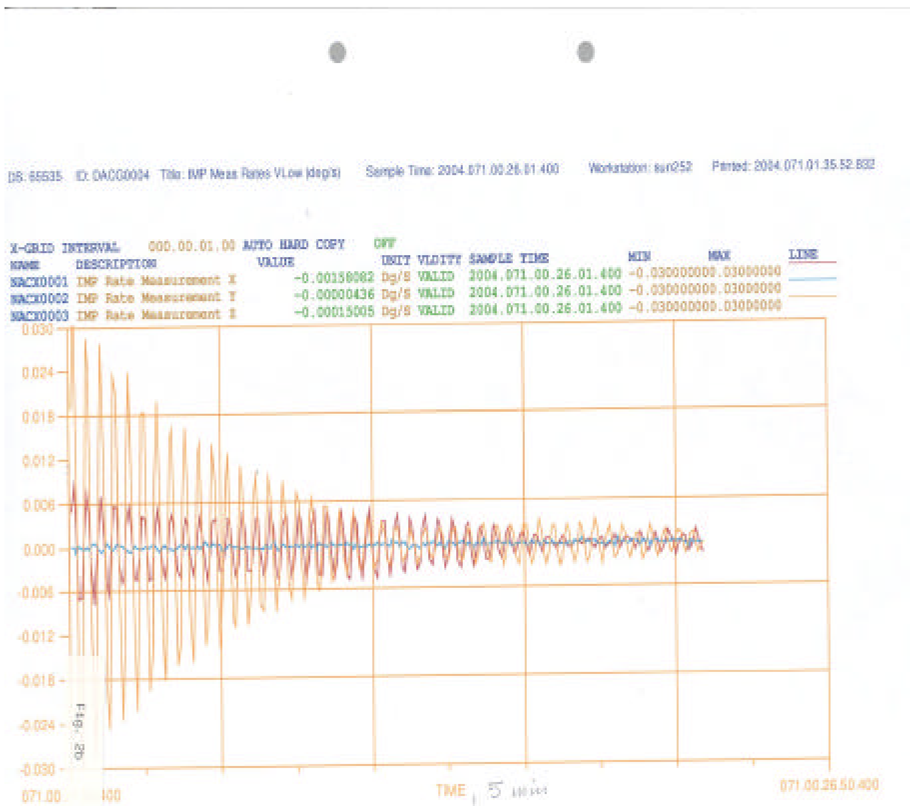
Objectives of Commissioning

- To check all functionalities.
- To evaluate the performances of the instrument. The precise evaluation is not possible due to the fact that Lander is attached to Orbiter.
- To evaluate interferences with other instruments.

Consert Orbiter.

- deployment of the antenna
- very successful and was registered on various sensors.

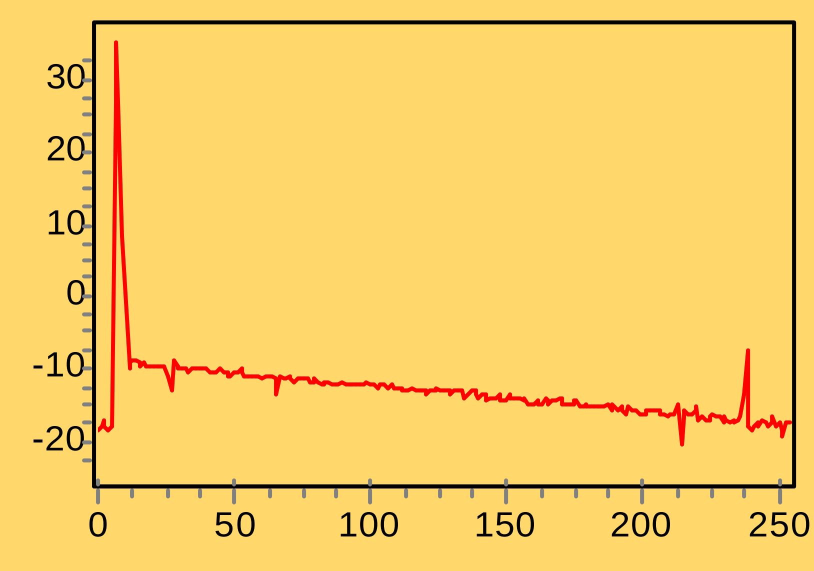
attitude oscillation after the antenna deployment.

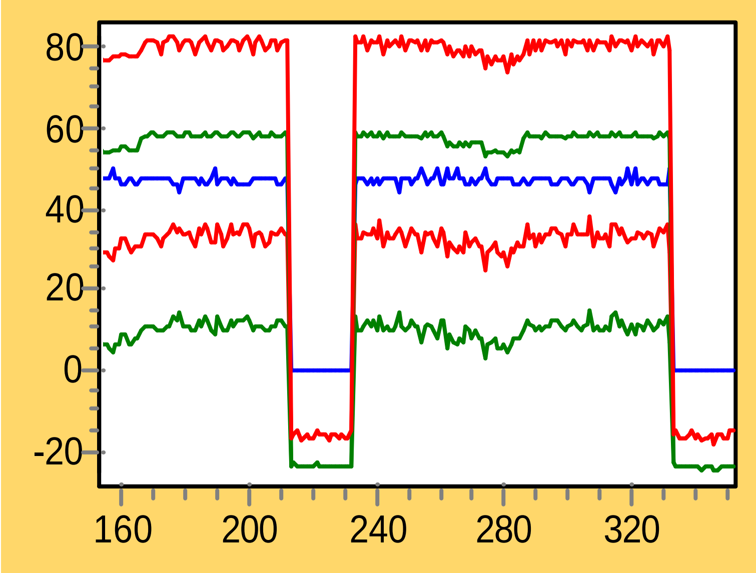


- The main observation is the increase of the noise level after the antenna deployment. This increase is equal to 1 dB and could correspond to the increase of the galactic noise level in the receiver after the deployment due to the change of the antenna gain.

Ping-Pong tests.

- This test which control the overall functioning of the experiment needs a sharp synchronization between two parts of Consert experiment.
- **The experiment works perfectly well**.



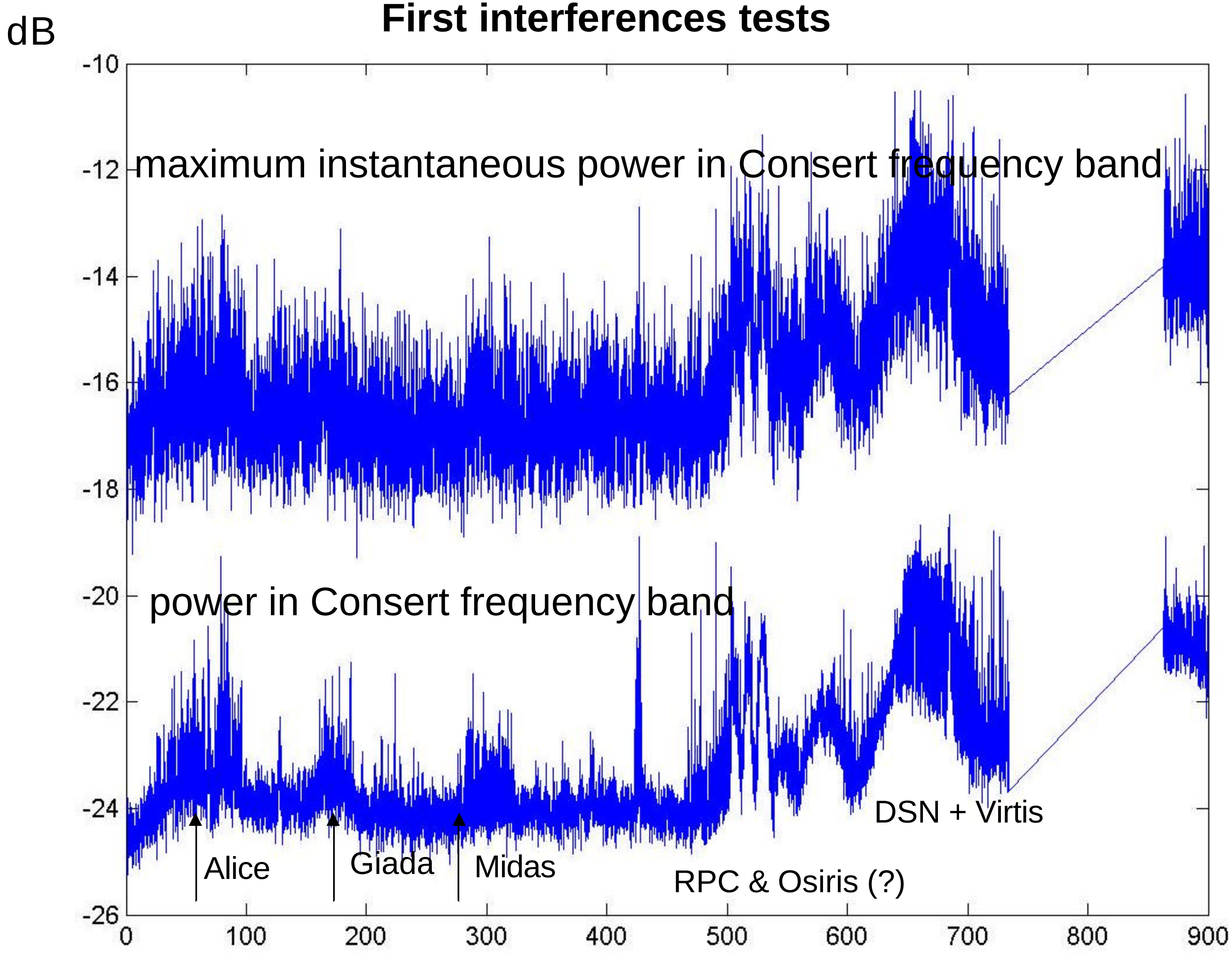


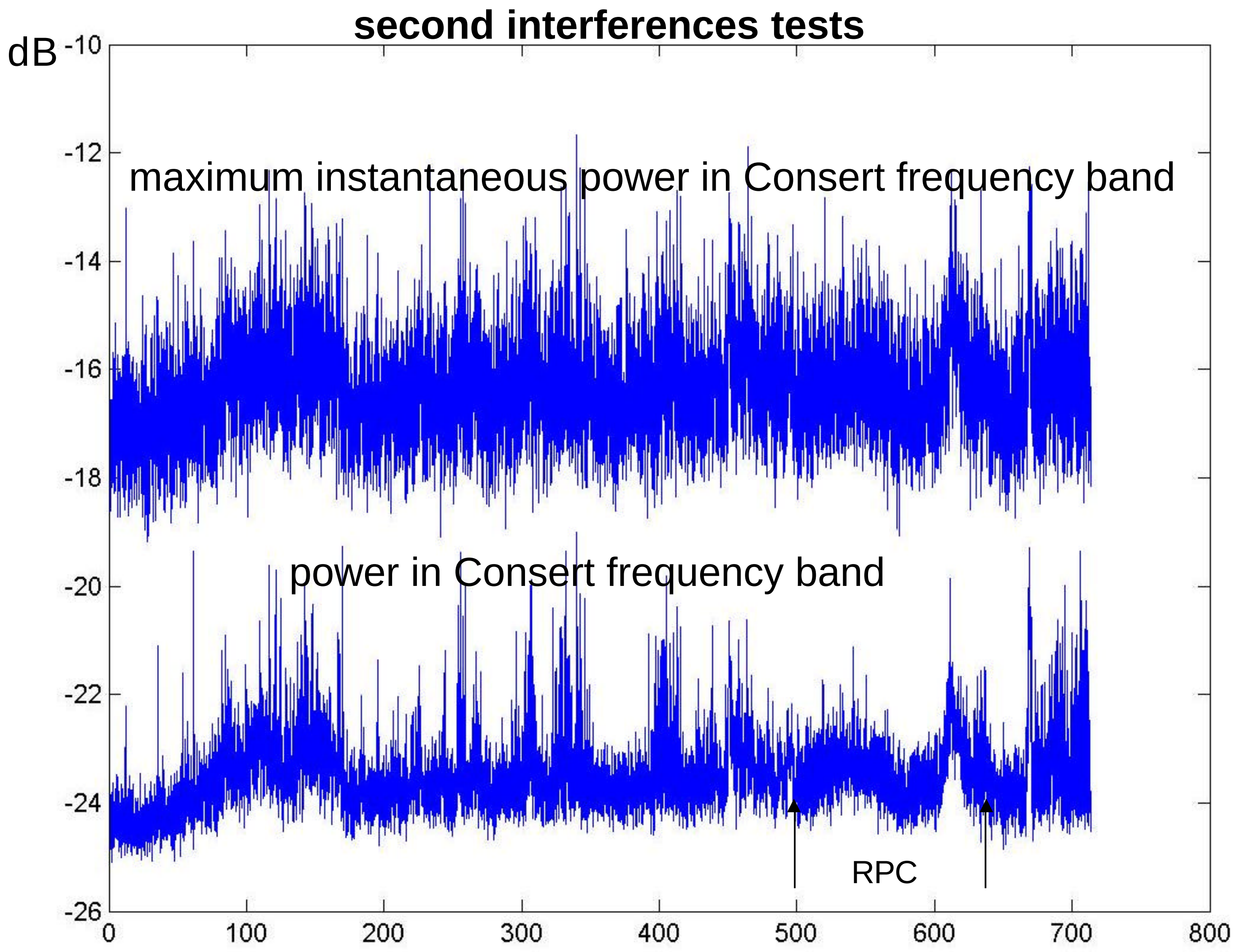
- Consert signal during Ping-Pong test.
- Power of the signal, on the red and green curves one can see the signal to noise ratio (about 100 dB, signal at about 80 dB and noise -20 dB). This is not the evaluation of performances in the comet situation. Lander antenna is not deployed and no line of sight visibility.

Interferences tests

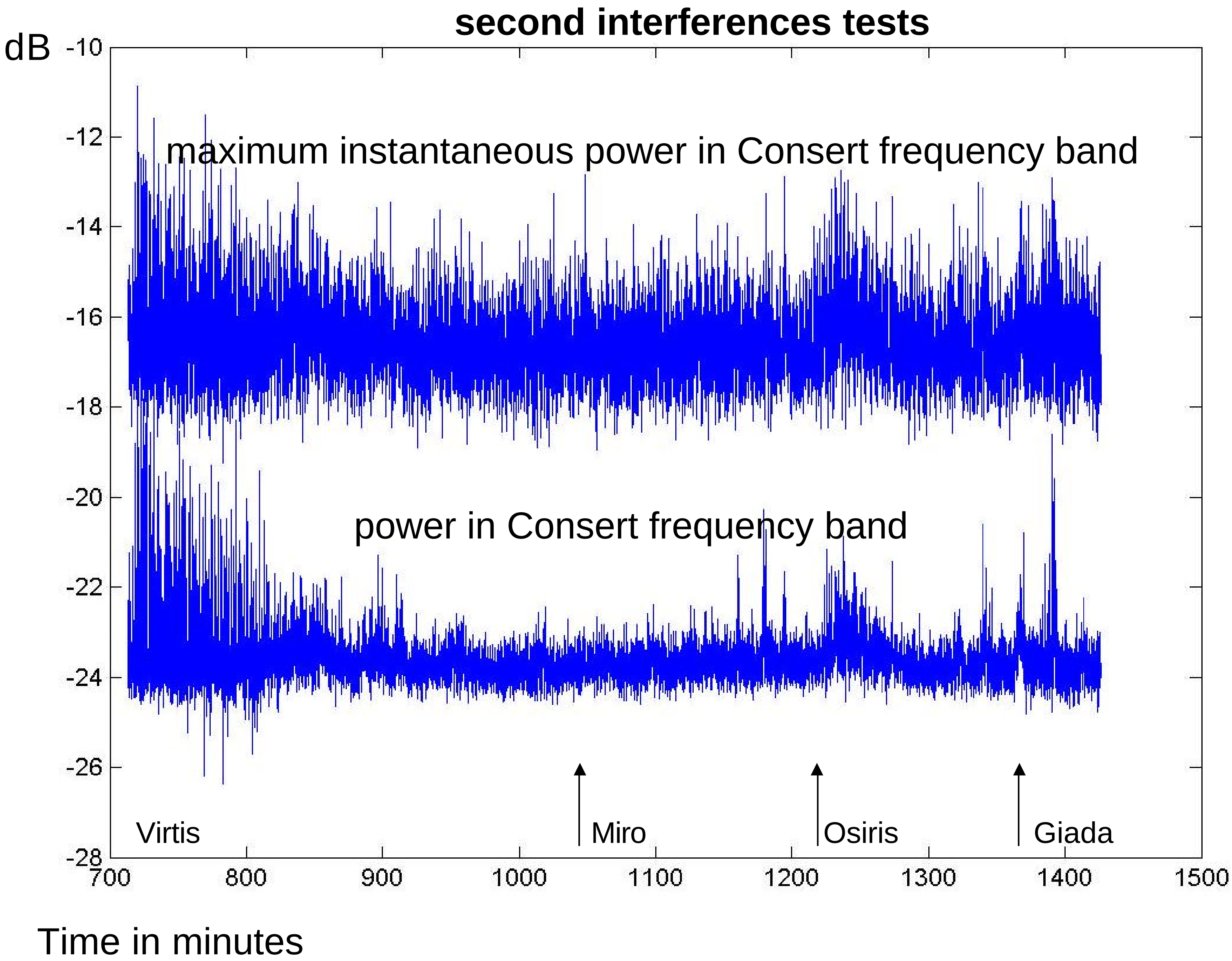
- Objectives; to see the influences of other Orbiter instruments on Consert operations and vice versa.
- To quantify this influences to decide which instruments should be OFF when Consert operates due to high level of perturbation.

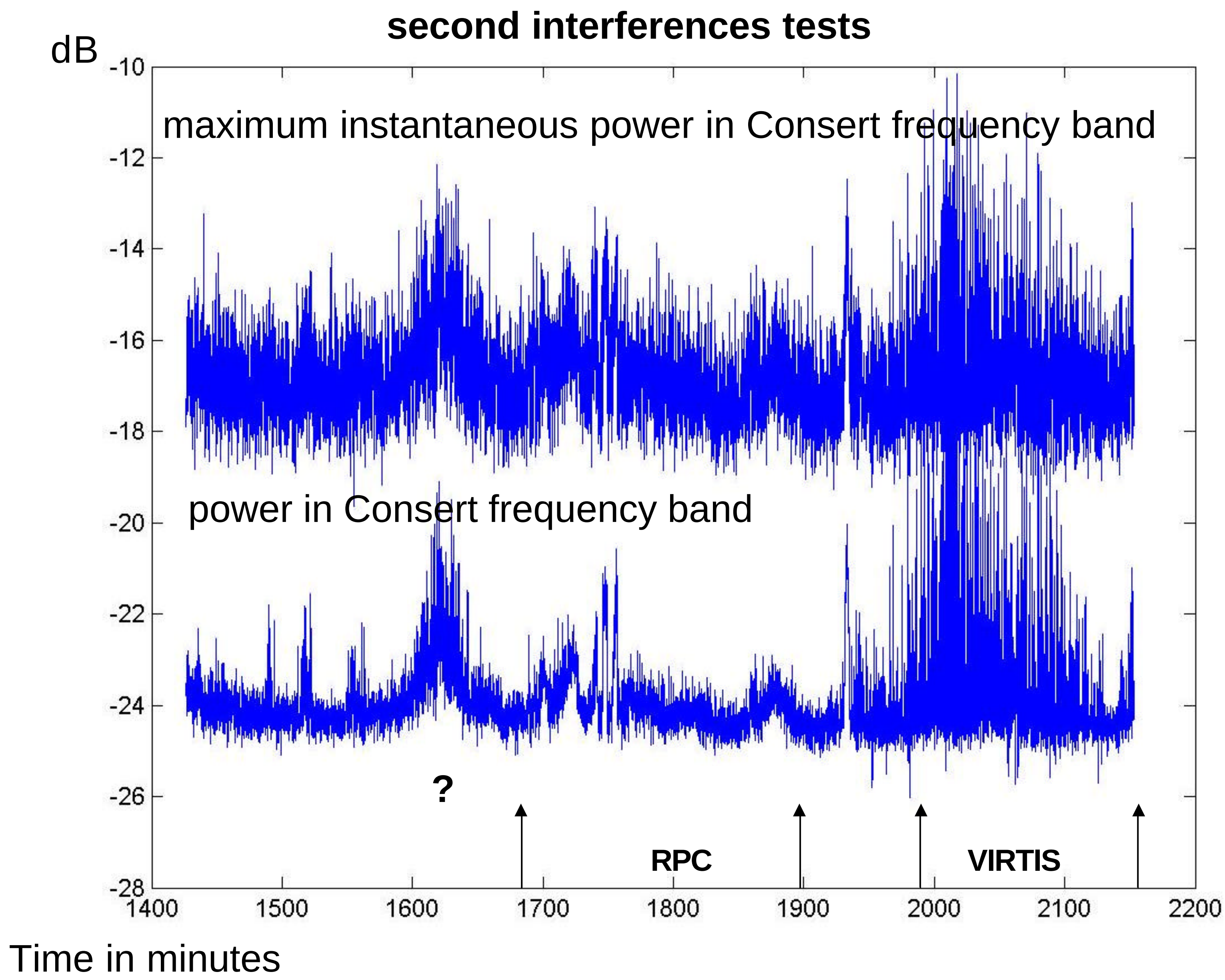
First interferences tests





Time in minutes from the beginning of experiment


second interferences tests
dB
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
700
800
900
1000
1100
1200
1300
1400
1500
maximum instantaneous power in Consert frequency band
power in Consert frequency band
Virtis
Miro
Osiris
Giada
Time in minutes

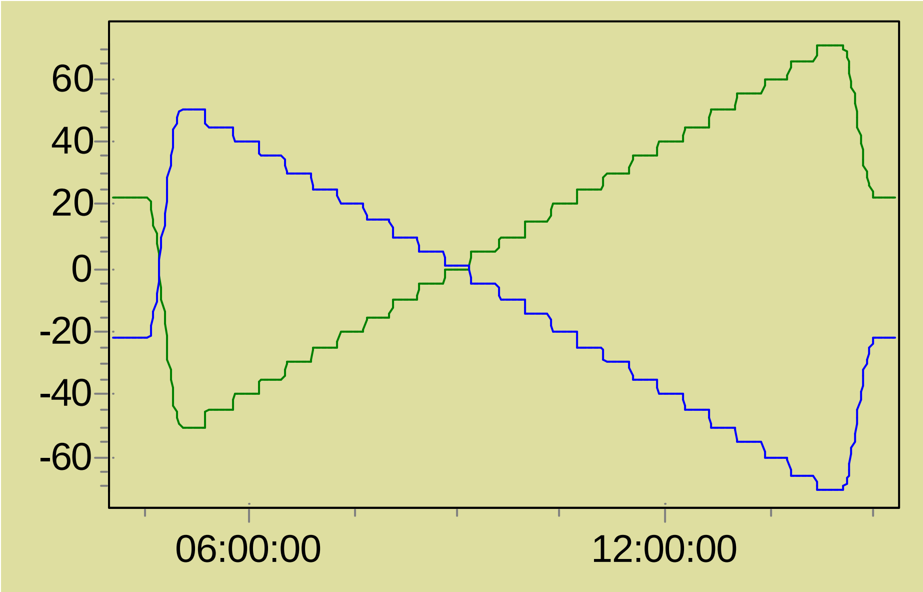

second interferences tests
dB
maximum instantaneous power in Consert frequency band
power in Consert frequency band
?
RPC
VIRTIS
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
1400
1500
1600
1700
1800
1900
2000
2100
2200
Time in minutes

Interferences preliminary conclusions

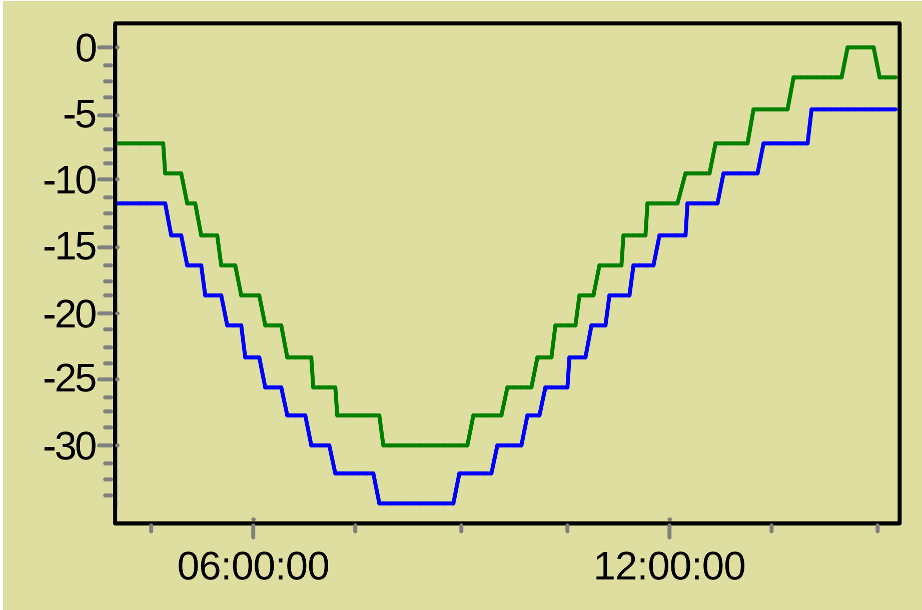
- VIRTIS and RPC perturbed strongly CONSERT
- Influence of other instruments needs still quantified evaluation

Objectives of « pointing scenario»

- The ping-pong test - signal transmitted in the space between CONSERT Lander and CONSERT Orbiter- was executed for different positions of the solar panels. The purpose was to calibrate its influence. This is important for the future tests of aging of the instrument which we will run during the journey.

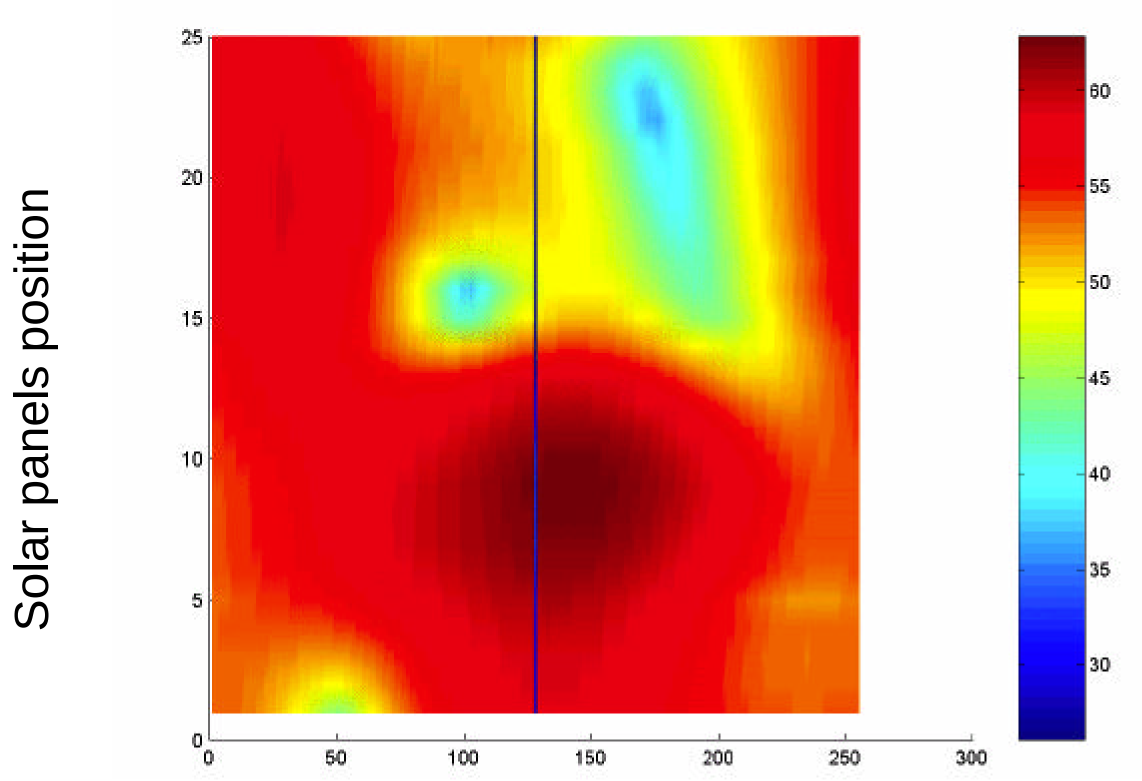


Panels positions -45°/45 à 65/-65°



Antenna temperature

Signal spectra for each solar panels position



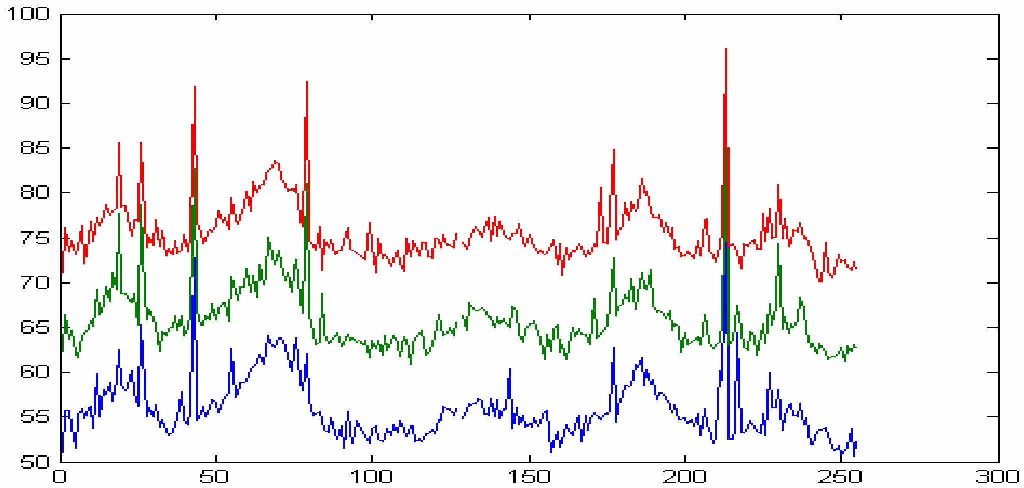
Frequency 85 -95 MHz

Concern

- The CONSERT switch on OBCP is not reliable with respect to Time Synchronisation.
- The OBCP Time update is under investigation. The FSO model was delivered to ESOC to replace the EQM. The FSO model has the same behaviour as FMO
- The problem is still under investigation

Consert Lander

- Consert test was successful. The test was conducted from SONC. Data delivery at Sonc level works without problems. There is some lost of data at the end of the cycle. This problem occurred previously with CDMS.

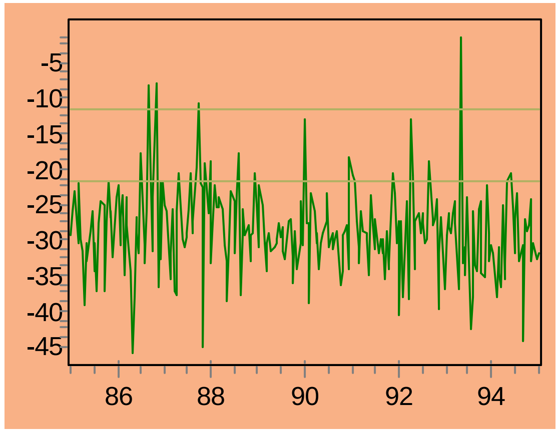


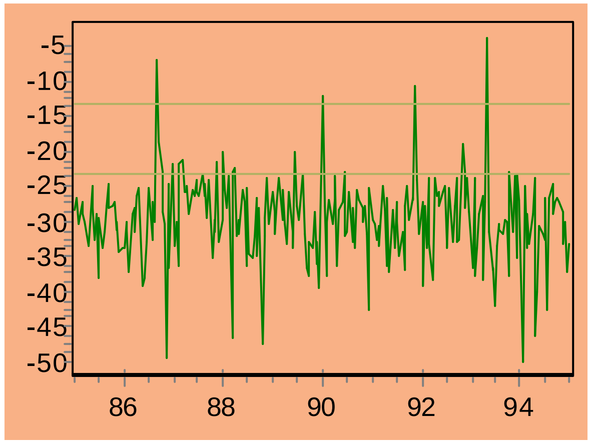
- Mean spectrum (RMS) for each slot in dB from 85 to 95 MHz 10 dB Shift between each graph.
- The following signal shows a signal shape with oscillation larger than the orbiter ones (10 dB versus 2 dB).
- The measured noise level is a few dB larger on the Lander than on the Orbiter.
- The Lander antenna is folded and this can be the reason of these larger oscillations.

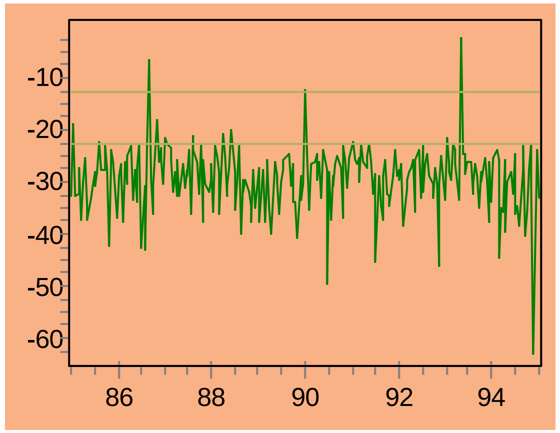
Interference and Quiet mode Tests on the Consert Lander

- Objectives; to see the influences of other Lander instruments on Consert operations and vice versa. And to test the Quiet mode of CDMS to evaluate the influence of CDMS on the noise level.
- The analysis in not yet terminated however it is clear from the present data that Sesame disturbed strongly Consert , Mopus perhaps a little, Romap and APX not. However, this results corresponds to particular set of conditions (temperatures, instruments ageing, ..) which means that during the journeys we will need additional interference tests.

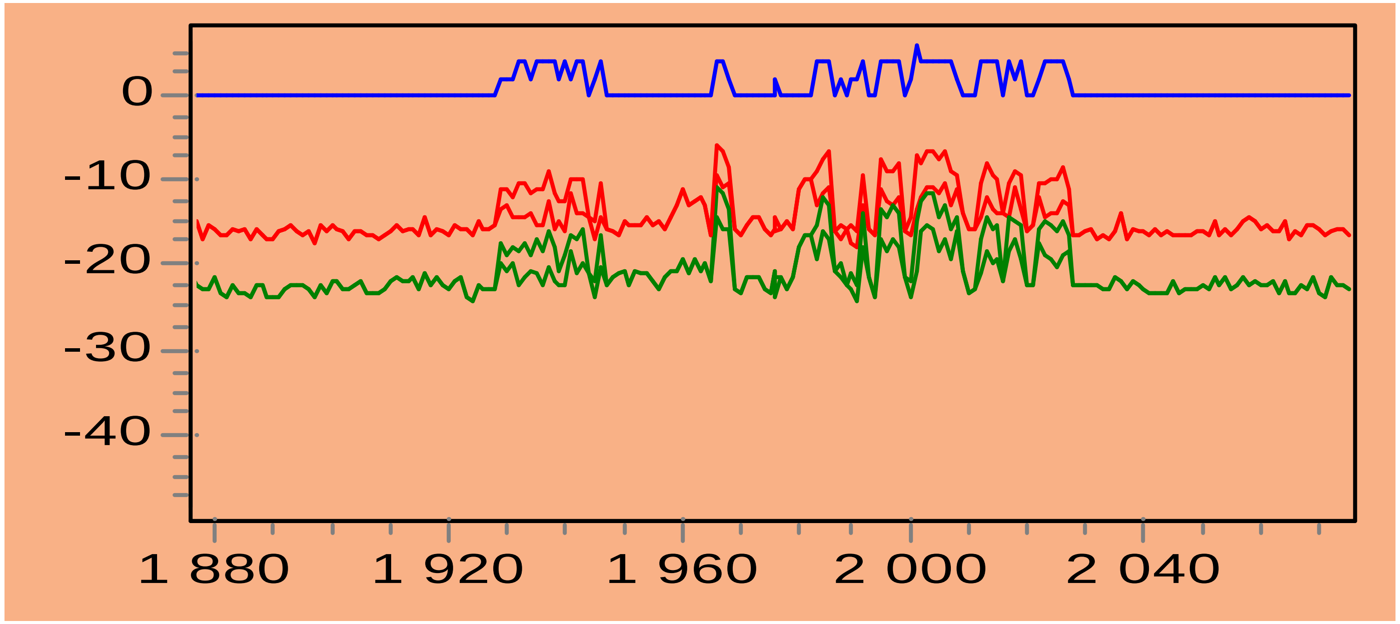
- Lander Interferences: 14-16 Mai 04
  - Quiet Mode test
    - With CDMS and Without PSS : noise decreases
    - Without CDMS : idem
    - CDMS wakeup : noise increases







- The Quiet mode tests are not yet completely conclusive due to short duration of the experiment. It seems that the CDMS working in the normal mode increases a little (1-2 dB) a noise level comparatively to the quiet mode. However, it is possible that it is only the influence of PSS of Lander. This needs more investigations.



- Sesame disturbing the Consert measurements.

Conclusions

- **Consert functional tests were successful. The OBCP problem needs more investigations.**
- **Consert experiment performances are fulfilled.**
- **We need to continue with precise analysis of interferences tests to quantify results.**
- **The pointing test shows clearly the influence of solar panels. Results will be used in the interpretation of future aging measurements.**

Conclusions

- All Ping-pong, pointing tests were done using umbilical connection between Lander and Orbiter. The procedure of Consert operations on the comet (Lander command mode, Orbiter and ground segment) is not yet established. We are working on and the first tests will be done during next period of active operations (2006)

4. COSIMA

COSIMA Commissioning Report
Issue XM1

Jochen Kissel
COSIMA P.I.

COSIMA is a time-of-flight Secondary Ion Mass Spectrometer (TOF SIMS) for the in situ analysis of cometary dust collected on one of its many substrates. As such it can only be fully tested when it is outgassed and in a good vacuum. Due to operational constraints the instrument was tested in three time blocks. During the first block (covered by the report part 1 below) the target manipulator unit was heated and both of its solid-state ion emitters were heated to degas them. All of these actions were successful.

During the second part of the commissioning (covered by the report part 2 below) ion emission was obtained from both emitters and several mass spectra were received on ground and showed the good performance of the instrument as expected from the last laboratory measurements before delivery.

However, a word of caution is needed: Both emitters show features, which are common to the on/off operation of these types of ion sources, which include higher than normal voltages needed to get them started, as well as unexpected return to normal conditions without obvious reasons.

At the end of the commissioning the emitter 'C', which previously was hard to turn ON worked flawlessly, while the emitter 'A' which previously worked excellently caused problems. This problem will need special attention in the future maintenance operations, which are planned roughly every 9 months into the mission.

All in All, COSIMA is expected fit and performing to specification and therefore ready for the comet.

The COSIMA team is having a post-commissioning workshop 22. – 25. November 2004. New findings from this workshop can obviously not be presented here.

A powerpoint file with 4-6 slides will be prepared for the review after the COSIMA workshop

COSIMA commissioning report
Part 1

Maria Genzer
Finnish Meteorological Institute

1 COSIMA commissioning objectives

The objectives of the 1st part of COSIMA commissioning in March 2004 were:

- Self-check of all hardware sub-systems with low voltage levels
- Science simulation to check the telemetry delivery path
- Unlocking the grip of the Target Manipulator Unit (TMU)
- Removing the cover from the dust outlet and moving it into storage
- Heating both emitters (A and C) for 2 hours each to help the outgassing

The commissioning steps involving high voltages (like starting the ion beam and making a test measurement) will be carried out in September during the Commissioning slot 3, after sufficient outgassing time has passed.

2 Commissioning steps

All times in UTC.

7.3.2004 23:58 COSIMA switch-on.

Switch on procedure successful. Several out-of-limits received. All values acceptable, the reason for the OOLs is that some of the limits are set wrong in the RSDB. The RSDB is to be updated.

At first, COSIMA internal temperature reading was much lower than the S/C reading. It was later discovered that the COSIMA team had wrong S/C HK values on the display. The correct temperatures matched the internal readings of COSIMA.

8.3.2004 00:04 Command to start task 16, Self-diagnosis with low voltages.

It was reported by the Spacecraft Analyst that the reading of TM parameter NCSA0043 (DOSE) went very high for a moment, and then returned to normal value.

The explanation for this is, that DOSE value is measured only once every 20 minutes. The high value is the real measurement, and the others are false readings. The limits for this parameter in the RSDB are to be updated.

00:41 Task 16 stopped as expected. All diagnosis passed. Most of the results are within 3% of the expected values, which is very good.

00:51 Command to start task 6, science simulation.

Instead of expected 8 minutes, the science simulation took much longer. The reason for the wrong expectation was, that the science simulation task was always tested on ground with much higher telemetry rate than that available onboard the spacecraft. At 01:35 it was decided to abort the task, because sufficient amount of data had already been produced by the instrument.

01:48 Attempt to abort the task with low-level abortion command.

Because the aborted task would not result in 'Task stop' event, it was decided to test whether the abortion had succeeded, by sending another command that goes to the same execution stack.

01:57 Request for TMU state event.

The 'TMU state' event should have been received immediately, but it wasn't.
01:58:45 'Task stop' event received, and the 'TMU state' event immediately after that.

This proved that the abortion of the Science simulation task did not work, but the task finished later by itself.

Later analysis of the instrument's software showed that the abortion of the task was attempted with a wrong parameter. This was due to an error in the COSIMA Commands Reference Document. The document was updated immediately.

02:03 Command to unlock the TMU grip.

The unlocking procedure was successful, resulting in the initial position for the TMU (TMU relay reading 0x3209).

02:24 Command to grasp target 0xD8 (cover).

Grasping successful, operation ended at 02:37.

02:39 Command to move the grasped target to the storage.

Operation successful, ended at 02:50.

02:52 Command to move the TMU to the initial position.

Operation successful, ended at 03:06. TMU relay reading is 0x3209.

All TMU operations went smoothly. The context file was updated after this.

At this point the PI decided that it would be enough to heat each ion source emitter for 40 minutes instead of 2 hours.

03:14 Commands to heat PIS Emitter A.

Emitter heated at 03:28, maintaining temperature until heater shutdown.

03:33 TMU state event requested, because the last TMU operation (TMU to the initial position) is considered to be a high-level task, and those do not produce TMU state events automatically.

03:57 Command to shut down the emitter heater.

04:00 Commands to heat PIS Emitter C.

At this point it was decided to make an extra test with the Cosiscope camera, while waiting for the emitter heating. The Cosiscope testing was originally left out of the commissioning plan, but since we had some time to spare, the Cosiscope was tested anyway.

04:17 Command to get image from Cosiscope (ZCS21602). No target in front of the camera.

Received 5 Cosiscope error warnings, which is a known feature of the Cosima – Cosiscope interface.

Download of the Cosiscope image began.

Emitter heater current showed an unexpected drop to ≈ 8.8 V (for emitter A it was ≈ 12V). This was interpreted to be due to a good connection between the heater and the structure.

Heating of the emitter C was continued until all Cosiscope data was down.

05:05 Cosiscope image down.

05:10 Command to shut down the heater.

Ground analysis of the Cosiscope image. The analysis shows that parts of the image are missing (black).

05:26 Another command to get Cosiscope image.

10 Cosiscope error warnings received, this is within nominal limits.

06:05 Cosiscope image down.

The image is complete.

06:13 COSIMA shutdown.

The first Cosiscope image was analyzed again and found also complete. The missing parts found before were due to the EGSE software, which is currently not designed for off-line data analysis.

3 Summary of anomalies

Anomaly	Reason	Action
OOLs for several TM parameters.	Wrong limits in the RSDB.	RSDB to be updated.
Very high reading of TM parameter NCSA0043.	The high value is the actual measured value, the others are false values.	RSDB to be updated.
Science simulation task lasted much longer than expected.	The task was always tested on ground with a higher TM rate than available onboard the S/C.	No action. It is not planned to use this task in the future.
Abortion of the science simulation task failed.	Wrong parameter used due to an error in COSIMA Commands Reference Document.	The document was updated immediately.
Emitter heater current drop when heating emitter C.	A good connection between the heater and the structure.	No action.
Parts of the first Cosiscope image missing.	EGSE software problem, the image was actually OK.	EGSE software will be updated to better support off-line analysis.

4 Commissioning results

The commissioning of COSIMA was successful. All sub-systems were proven to function well with low voltages. The Cosiscope was also tested, although this was not part of the original commissioning plan. The instrument is now switched off for the outgassing period. The commissioning will be resumed in September with the steps involving high voltages.

5 Appendices: Screenshots from Cosima EGSE software

All screenshots are taken off-line after commissioning.

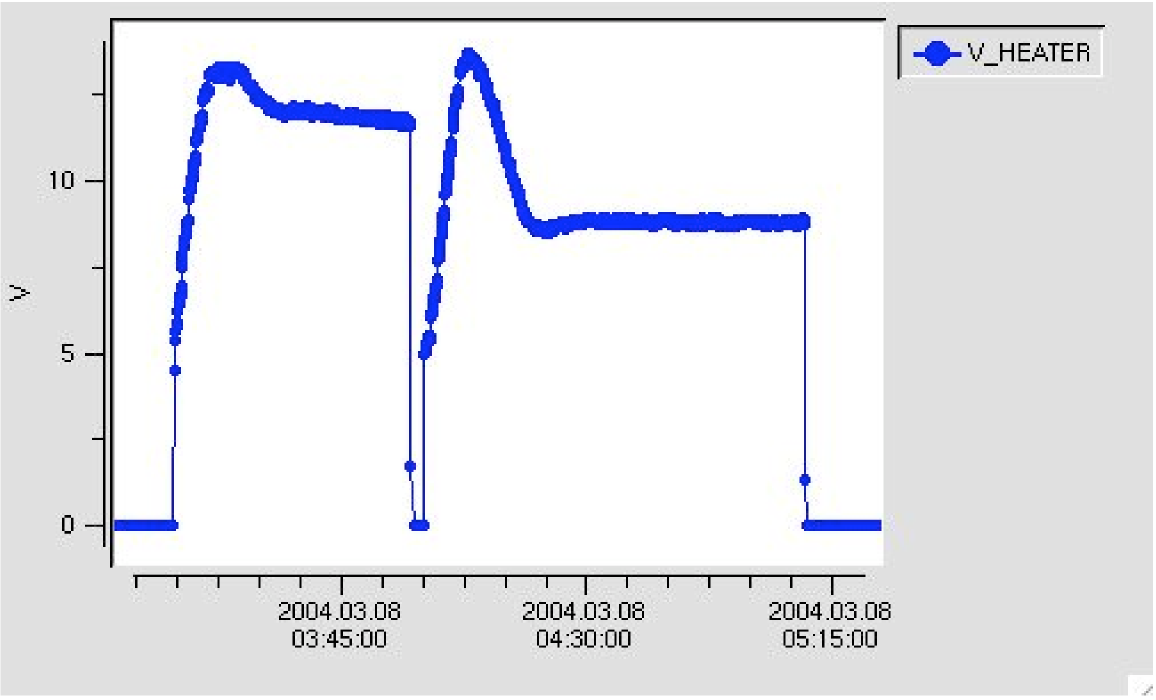


Figure 1. Heater voltage during heating emitters A and C.

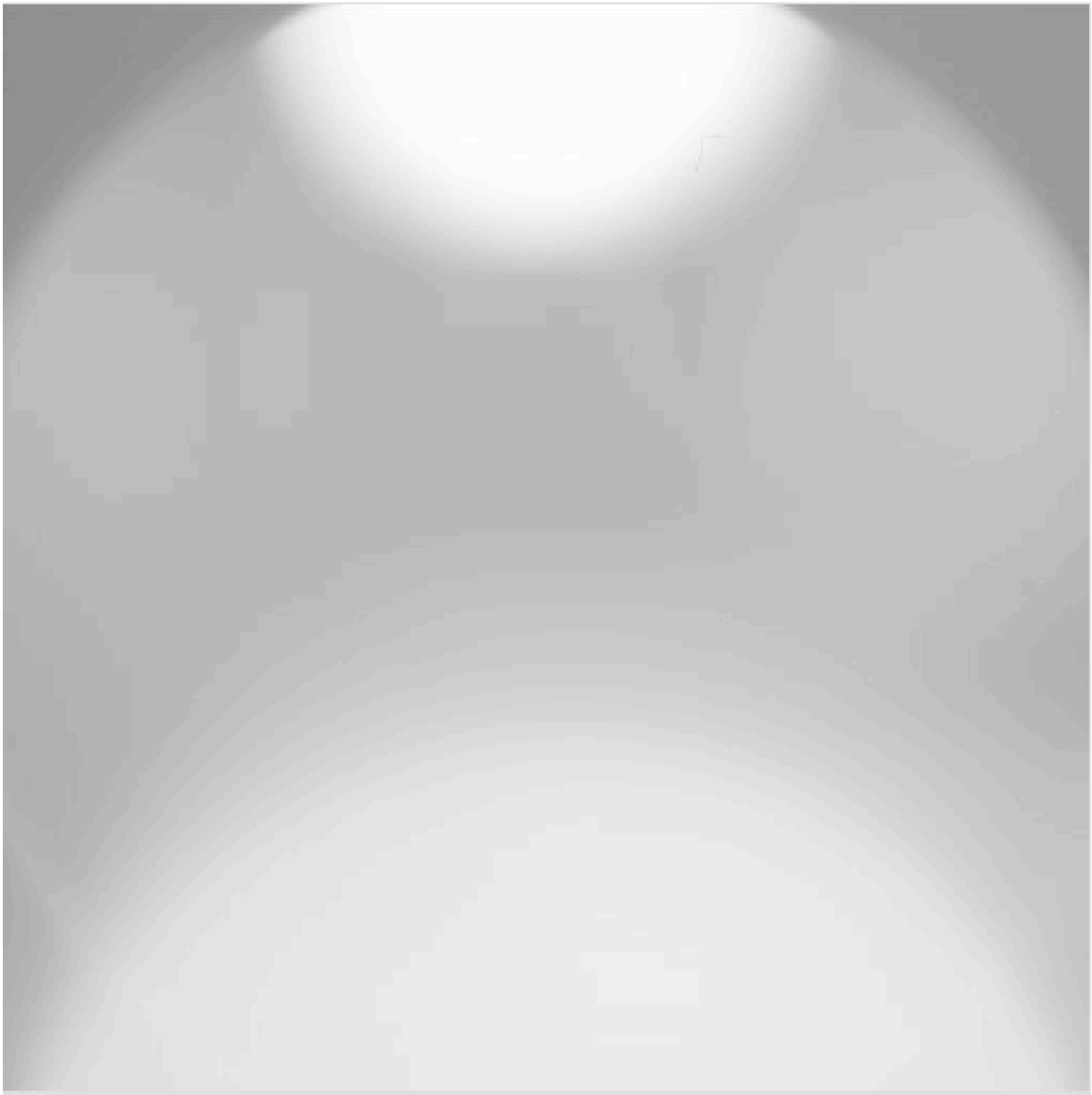


Figure 2. The first image taken by Cosiscope.

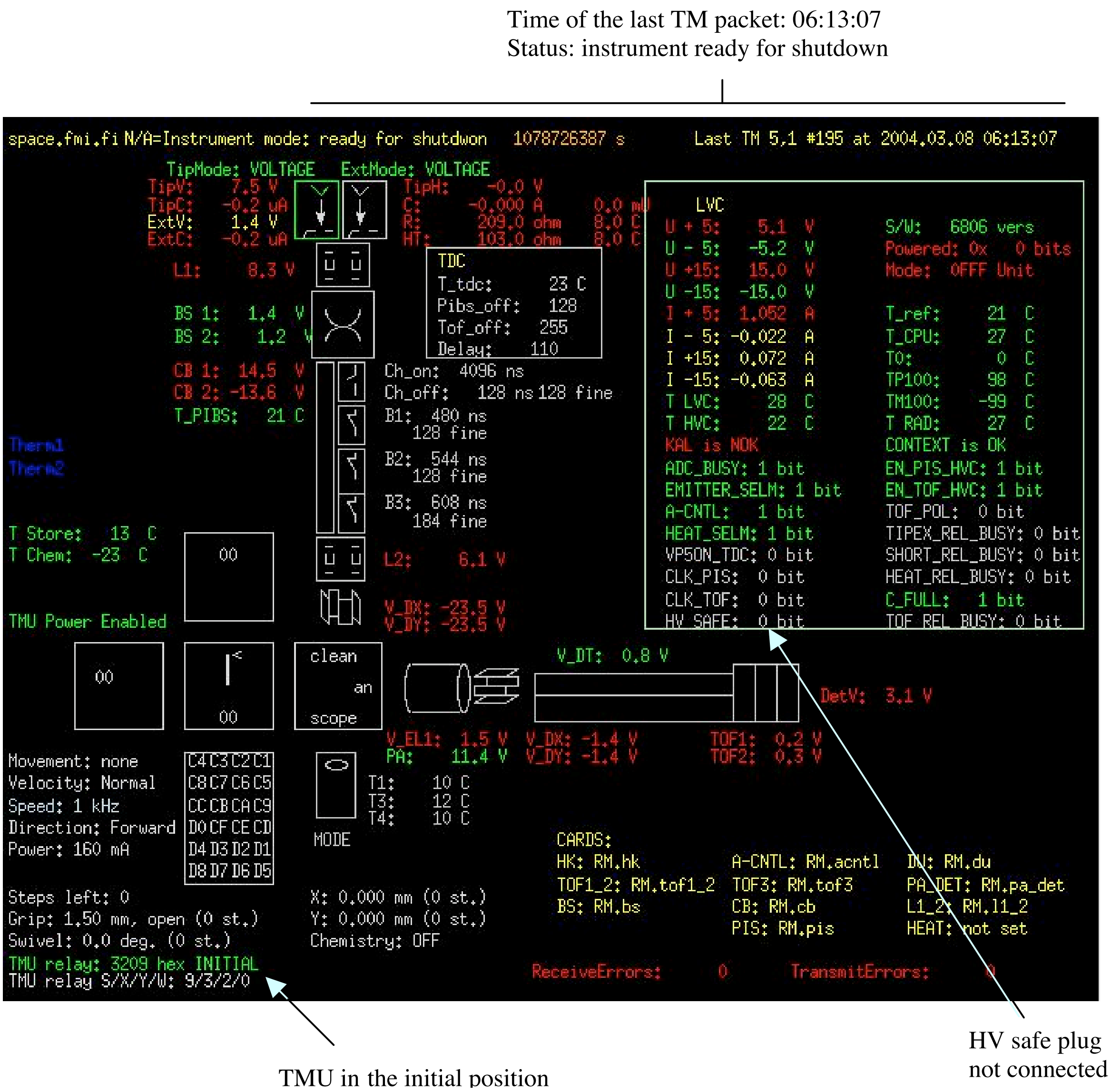


Figure 3. Cosima status just before shutdown.

COSIMA Commissioning Report, Part 2

Maria Genzer
Finnish Meteorological Institute

1 COSIMA commissioning objectives

The objectives of the 2nd part of COSIMA commissioning in September 2004 were:

- Updating COSIMA software to version 8-0-0
- Checkout of high-voltage subsystems
- Testing Cosiscope with –X led
- Activation and stabilization of both ion emitters (A and C)
- Making test measurements (spectra) with emitter A
- Optimisation of instrument performance (deflector optimization scan)

2 Steps of Commissioning part 2

All times are command execution/telemetry generation times in UTC. (One-way travel time for the signal was at that time ≈ 4 min.)

3.9.2004 19:09 COSIMA switch-on with SW patch OBCP

Several out-of-limits received. All values acceptable, the reason for the OOLs is that some of the limits are still set wrong in the RSDB. The RSDB is to be updated.

19:30 Start SW upload from the spacecraft.

20:18 Booting procedure completed. SW version 8-0-0 running in RAM.

20:31 SW version 8-0-0 burned to COSIMA EEPROM.

20:44 Cosima switch-off to test the EEPROM.

20:48 Cosima switch-on. SW version 8-0-0 loaded from the EEPROM. Everything OK.

20:50 Start task 8, self-diagnosis with high voltages.

21:27 Task 8 stopped as expected. All tests passed.

21:38 Commands to heat PIS emitter A. Heater HK (SID 2) enabled.

22:02 HK1 rate reduced to 10 minutes.

22:13 Emitter HK packet (SID 2) disabled. Emitter heating left on for the weekend.

6.9.2004 All HK values from the weekend OK.

19:12 PIS setup: change U_tip_set to 2925 raw ≈ 9.8 kV. This is now the maximum voltage the tip can reach with extractor shorted.

19:30 Set HK1 interval to 2 s.

19:31 Commands to start and immediately shut down emitter A in nominal mode (the first ignition). Ignition successful.

The HK rate did not change until 10 min after the last HK packet was received (nominal behavior of the software), so no detailed HK data was available during the ignition. The events confirm, however, that the ignition was successful.

19:40 HK1 interval set to 60 s.

19:59 Stop heater. Select emitter C and start heating it.

20:14 Start task 4, Picture with Cosiscope, target 0x2D8 (dust cover).

All TMU movements successful. Received 8 Cosiscope error warning events, which is nominal.

20:40 Task 4 completed.

20:51 Cosiscope setup for taking images with –X led (for SW testing purposes).

Start task 4, Picture with Cosiscope, target 0x2D8.

Received 4 Cosiscope error warning events, which is nominal.

20:59 Task 4 completed.

21:09 TMU state event request.

21:35 The first Cosiscope image on ground. Image OK.

21:44 Return Cosiscope parameters to default values (image with +X led).

21:48 Start task 4, image with Cosiscope, target 0x1C2 (silver target with a hole in the middle).

21:52 Reduce HK1 rate to 10 min.

Second image on ground. Image OK.

22:31 Task 4 completed. All TMU movements successful.

23:13 Image of target 0x1C2 on ground. Image OK.

Emitter C left heated until the next pass.

7.9.2004 All HK produced between the passes OK.

20:02 HK1 rate to 1 min.

20:12 HK1 rate to 2 s.
Enable Emitter HK (SID 3).

20:13 Start task 20, stabilize emitter A, with parameters x = 0, y = 300

20:30 Emitter A heated, PIS ignition successful, immediate shutdown as expected ("the first puff").

Wait 300 s.

20:38 PIS ignition.
OOL for NCSA0047 (the limit is not correct in the RSDB).
Emitter current stable.

20:43 PIS shutdown. End task. Emitter A stabilized.

20:57 Setup slot 0 for test spectrum:
Positive spectrum, Scalar measurement, 300 000 shots, IRQ measurements, FIFO + peak list returned.

Start task 19, Test measurement: target 0x1C2, x = 8000, y = 5000.

21:00 PIS test ignition successful. Cosiscope grain information taken. All TMU movements OK.

21:26 PIS ignition successful. Spectrum measured.

21:34 Automatic soft cleaning of the tip after the measurement is completed.

21:36 Task 19 completed.

The resulted spectrum was fine.

21:49 HK1 rate reduced to 1 min.

22:31 Setup slot 102 for deflector optimization scan in y direction.

Start task 3942, Measurement with slot 102: target 0x1C2, x = 8000, y = 5000.

22:34 PIS ignition successful.

22:41 Task 3942 completed. Deflector setup optimized.

23:03 Start heating emitter C.

23:20 Increase heater max. temperature (R_oper = 225 raw).
This was done because previous experience has shown that emitter C needs higher temperature than emitter A.

23:26 Attempt to start emitter C in nominal mode (the first ignition).
No ignition.

COSIMA produced an error event that was not recognized by the system. This was because the subtype for this event was set wrong in the database.

23:45 Attempt to start emitter C in tip startup mode (extractor shorted).
No ignition. The same error event not recognized by the system was produced again.

Starting emitter C failed.

23:55 Decrease heater max. temperature back to nominal (R_oper = 215 raw).

Set HK1 rate to 10 min.

Emitter C left heated until the next pass.

8.9.2004

19:30 HK1 rate set to 1 min.
TMU state event request.

TDC parameters set to the ones used during Cosima XM testing in 2002.
[0x0080, 0x0458, 0x0F9C, 0x11DB, 0x1418, 64, 255]
The default parameters in the software are incorrect. The new parameters are now in the keepalive as long as the keepalive power is on (just as the other parameters saved in the keepalive).

Setup slot 110 for relative TMU scan, x ± 1 mm
Setup slot 111 for relative TMU scan, y ± 1 mm
Setup slot 115 for Positive spectrum, scalar, 90000 shots
Setup slot 116 for Negative spectrum, scalar, 90000 shots

All task commands for measurements sent at once.

19:40 Enable emitter HK (SID 3).

Start task 3950 (measurement with slot 110): target 0x1C2, x = 3375, y = 5200

20:08 PIS ignition. Emitter current not stable, continuously dropping.

20:10 Automatic hard clean procedure of the tip.

Several automatic attempts to start the beam. Always resulting in hard clean.

20:22 HK1 rate increased to 2 s.

Several automatic attempts to start the beam. Always resulting in hard clean.

20:29 Emitter temperature increased (R_oper = 218 raw).

Several automatic attempts to start the beam. Always resulting in hard clean.

20:48 New PIS clean setup:
Extractor threshold for soft cleaning = 2.1 kV
Extractor threshold for hard cleaning = 1.75 kV
Extractor threshold for measurement abort = 1.5 kV
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s (previously 30 s, default)
Hard cleaning length = 20 s (previously 5 s, default)

20:51 Automatic hard clean with the new settings. Doesn't help.

21:02 Another automatic hard clean. Doesn't help.

21:13 Aborting all operations on-board with low-level commands.

21:15 Hard clean length increased to 60 s.

21:18 Emitter temperature increased (R_oper = 220 raw).

21:22 Start task 20: Stabilize emitter A, x = 60, y = 2

The first ignition with extractor shorted, V_tip > 10 kV (too high…)

Nominal startup => soft clean => hard clean => nominal startup => soft clean

21:41 Task 20 ended. Stabilisation of emitter A was not achieved.

21:55 Cleaning thresholds decreased in order to try to obtain a negative spectrum. PIS clean setup:
Extractor threshold for soft cleaning = 1.2 kV
Extractor threshold for hard cleaning = 1 kV
Extractor threshold for measurement abort = 850 V
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

Start task 3956 (measurement with slot 116): target 0x1C2, x = 8000, y = 5000

22:01 PIS ignition.
Automatic hard clean.
New ignition.
Extractor voltage drops under measurement abort threshold.
Task aborted automatically.

22:13 Task stop.
The resulting spectrum contained only a little of noise because of the bad beam.

22:24 Start heating emitter C.
Move TMU to initial position.

22:40 Emitter C heated.
Emitter temperature increased still (R_oper = 230 raw).

22:48 TMU in initial position (relay = 0x3209). TMU state event.

23:02 New PIS setup: U_tip_set increased to 3200 raw ≈ 10.6 kV. This is now the maximum voltage the tip can reach with extractor shorted. Extractor voltage threshold for soft clean and the current for the hard clean simultaneously returned to default values.

23:02 Attempt to start emitter C. => Ignition successful!

23:22 Emitter temperature decreased back to nominal (R_oper = 215 raw).

HK1 rate to 10 min.

Emitter C left heated until the next pass.

The nominal commissioning slot reserved for COSIMA ended. The operations of the next pass were carried out by MissionTimeLine and analyzed off-line. Also an extra commissioning slot was requested from the project to investigate emitter A behavior.

9.9.2004 Operations by Mission Time Line.

21:00 HK 1 rate to 1 min.

Emitter temperature increased (R_oper = 230 raw).

22:00 New PIS clean setup:
Extractor threshold for soft cleaning = 2.0 kV
Extractor threshold for hard cleaning = 1.5 kV
Extractor threshold for measurement abort = 1.0 kV
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

22:01 Start task 21, Stabilize emitter C, x = 0, y = 300

The first ignition successful ("the first puff").
Wait 300 s.
Ignition in nominal mode successful.
Emitter C stabilized.

22:16 Task 21 ended.
HK1 rate to 1 min.
Instrument setup dumped.

22:17 COSIMA shutdown.
COSIMA team was given an extra commissioning slot on 11/12 October for investigating problems with the emitter A.

8.10.2004 Operations by Mission Time Line

19:00 Cosima switch on

Start task 22, TMU maintenance. Successful.

Start heating emitter A.
Emitter was heated to a higher temperature (R_oper = 230 raw) than intended by the operators (nominal = 215 raw), because R_oper parameter had not been changed since using emitter C.

HK1 rate changed to 10 min.

Emitter left heated for the weekend.

11.10.2004 "On-line" operations.

8:14 HK1 rate to 1 min.

8:23 HK1 rate to 2 s.

8:24 Start task 20, Stabilize emitter A, x = 0, y = 300.

Emitter current is not stable. Hard cleaning cycles again and again.

Periodic OOLs for NCSA0047 (extractor current), because the database is not yet updated.

09:11 Task 20 finished. Stabilization did not succeed.

09:33 Start task 3, Grains with Cosiscope, target 0x1C2

Task successful.

10:15 Setup slot 115 for positive spectrum, scalar, 450.000 shots (≈ 5 min of measurement).

PIS clean setup with really low threshold values for cleaning:

Extractor threshold for soft cleaning = 200 V
Extractor threshold for hard cleaning = 150 V
Extractor threshold for measurement abort = 88 V
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

Start task 3965 (slot 115): target 0x1C2, x = 8000, y = 5000.

Ignition successful. Emitter current not stable. No cleaning cycles because of the very low thresholds.

10:57 Task finished.

11:55 Emitter temperature decreased back to nominal (=215 raw).

Start task 3965 (slot 115): target 0x1C2, x = 8000, y = 5000.

Ignition successful. Emitter current not stable. No cleaning cycles because of the very low thresholds.

12:12 Task finished.

Setup slot 116 for negative spectrum, scalar, 450.000 shots (≈ 5 min of measurement).

12:22 Start task 3966 (slot 116): target 0x1C2, x = 8000, y = 5000.

Ignition successful. Emitter current not stable. No cleaning cycles because of the very low thresholds.

12:38 Task finished.

13:10 PIS setup changed for special test with tip current:
Threshold for soft cleaning = 200 V
Extractor current for hard cleaning = 5 microA

13:13 Low-level test commands enabled for tip current test

Beam started in cleaning (tip) mode with medium level command.

13:16 Ignition successful. HK1 rate to 2 s.

13:20 Tip current levels changed every 15 seconds with low-level test command. The levels used are: 10 microA, 15 microA, 20 microA, 25 microA, 20 microA, 15 microA, 10 microA, 5 microA

13:22 PIS beam shutdown. Low-level test commands disabled.
14:09 HK1 rate to 60 s.

New PIS setup for testing emitter C:
Extractor voltage threshold for soft cleaning = 2 kV
Extractor current for hard cleaning = 80 microA
Max. extractor voltage = 10.6 kV

PIS clean setup - same values as during previous emitter C stabilization:
Extractor threshold for soft cleaning = 2 kV
Extractor threshold for hard cleaning = 1.5 kV
Extractor threshold for measurement abort = 1 kV
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

Select emitter C.

Start PIS heater.

14:29 HK1 rate to 10 min.

Emitter C left heated for the night.

12.10.2004 08:12 HK1 rate to 1 min.
Heater temperature increased (R_oper = 230 raw).

08:22 HK1 rate to 2 s.

08:42 Start task 21: Stabilize emitter C, x = 0, y = 300

08:43 Ignition in tip mode ("the first puff"). Shutdown as expected.

Wait 300 s.

08:52 Ignition in nominal mode. Current stable.

08:57 Task ended. Emitter C stabilized.

09:19 PIS clean setup with really low threshold values for cleaning:
Extractor threshold for soft cleaning = 200 V
Extractor threshold for hard cleaning = 150 V
Extractor threshold for measurement abort = 88 V
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

Setup slot 117: backup (emitter C) positive spectrum, scalar measurement, 450.000 shots (≈5min of measurement)

Setup slot 118: backup (emitter C) negative spectrum, scalar measurement, 450.000 shots (≈5min of measurement)

Start task 3957 (slot 117), target 0x1C2, x = 8000, y = 5000.

Ignition successful. Emitter current stable.

09:35 Task finished. Produced good spectrum.

Start task 3958 (slot 118), target 0x1C2, x = 8000, y = 5000.

Ignition successful. Emitter current stable.

09:46 Task finished. Produced good spectrum.

11:21 PIS heater shutdown.

TMU state request.

TMU moved back to initial position.

11:29 TMU in initial (relay 0x3209).

TMU state request.

PIS heater temperature set back to nominal (R_oper = 215 raw).

PIS clean setup:

Extractor threshold for soft cleaning = 2 kV
Extractor threshold for hard cleaning = 1.5 kV
Extractor threshold for measurement abort = 1 kV
Extractor current for soft cleaning = 30 microA
Extractor current for hard cleaning = 60 microA
Soft cleaning length = 20 s
Hard cleaning length = 60 s

Dump instrument setup.
Dump slots 115, 116, 117, 118.
Dump context file.

11:53 Cosima Power off OBCP.
COSIMA OFF.

3 Summary of anomalies

Anomaly	**Reason**	**Action**
OOLs for several TM parameters.	Wrong limits in the RSDB.	Update RSDB.
Some events were not recognized by the ground system.	Wrong event types in the RSDB.	Update RSDB.
Emitter C did not ignite the first time tried. Stabilization failed.	Probably emitter temperature was not sufficient. Stabilization worked next time with higher temperature.	Heater temperature for emitter C operation should be set to 230 raw.
Emitter A very unstable since 8.9.2004. Difficult to produce spectra with emitter A.	Unknown.	Emitter C can be used for science measurements. Tests with emitter A will continue in the future.

4 Commissioning results

Commissioning of COSIMA was successful with the exception of unstable behavior of emitter A. All other sub-systems performed well.
The automatic maintenance procedure for the emitters has to be modified based on results of the commissioning phase. New procedures will be delivered to RSOC well before the first automatic maintenance slot.
COSIMA scientific objectives can still be achieved using emitter C also for scientific measurements (backup mode).

5 Appendices: Screenshots from Cosima EGSE software

All screenshots are taken off-line after commissioning.

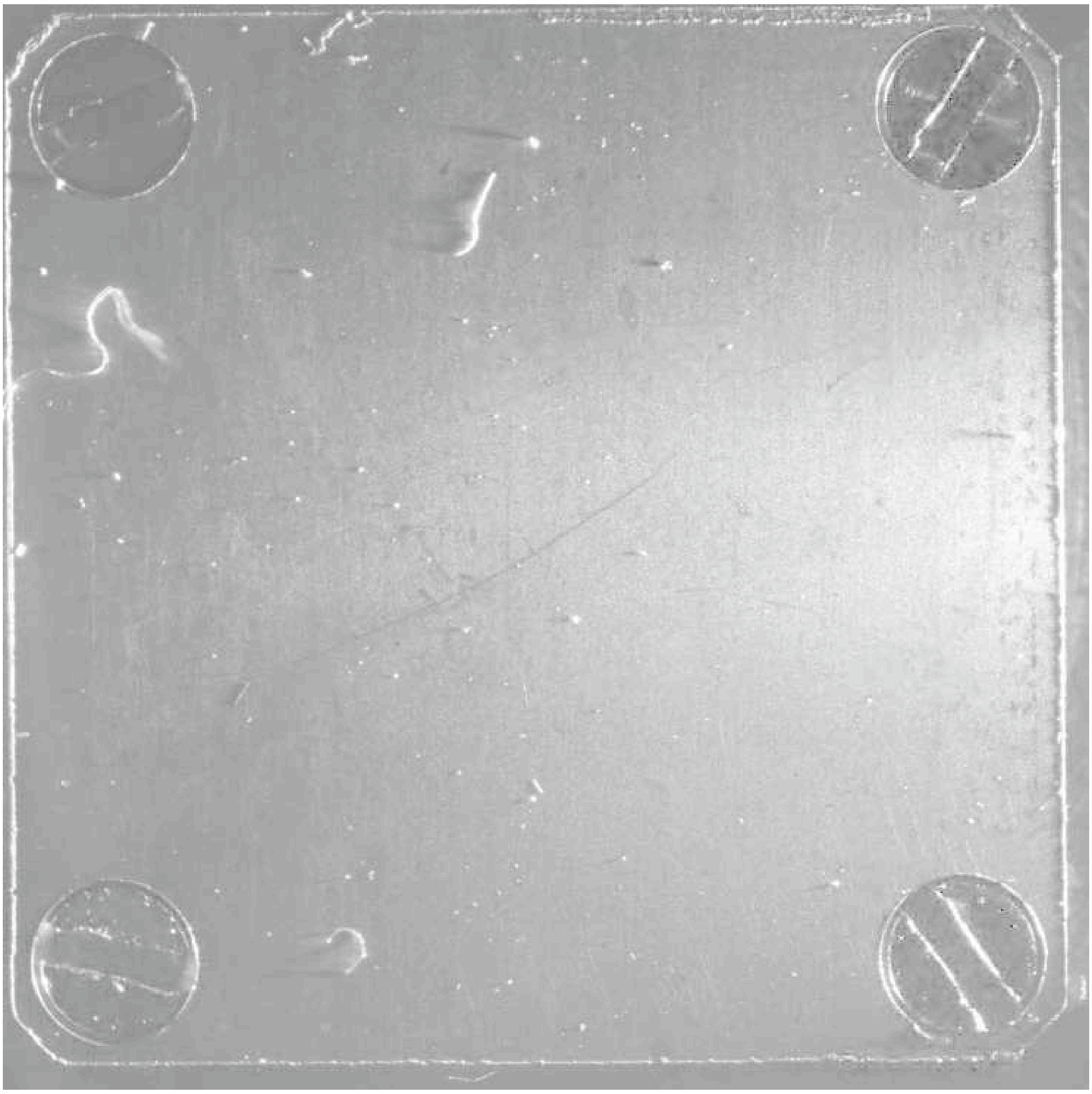


Figure 4. Cosiscope picture of target 2D8 (dust outlet cover).

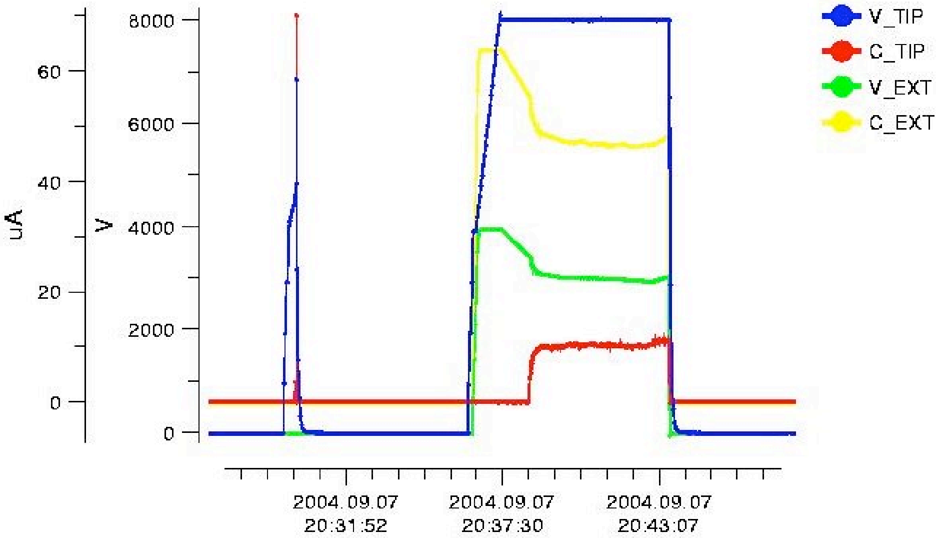


Figure 5. Tip and extractor currents and voltages during the first (successful) stabilization of Emitter A.

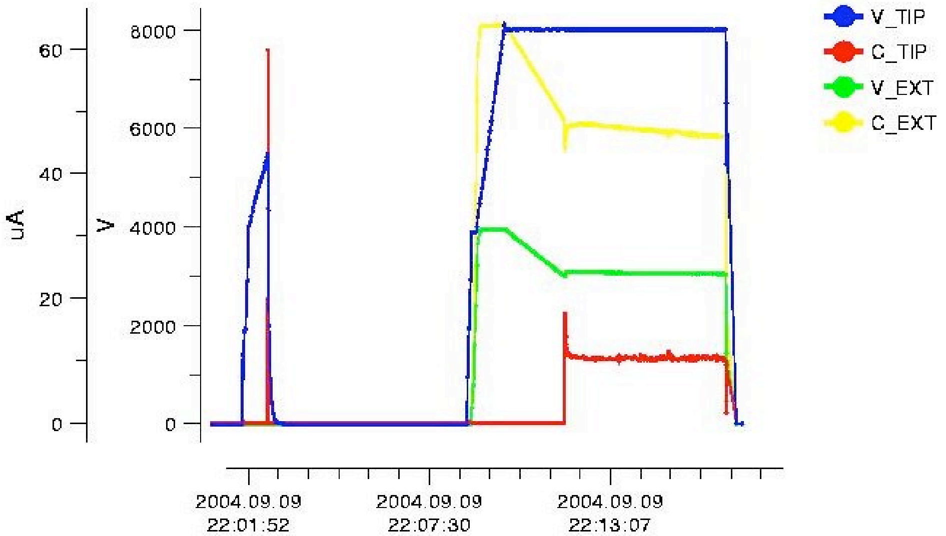


Figure 6. Tip and extractor currents and voltages during the second (successful) stabilization of Emitter C.

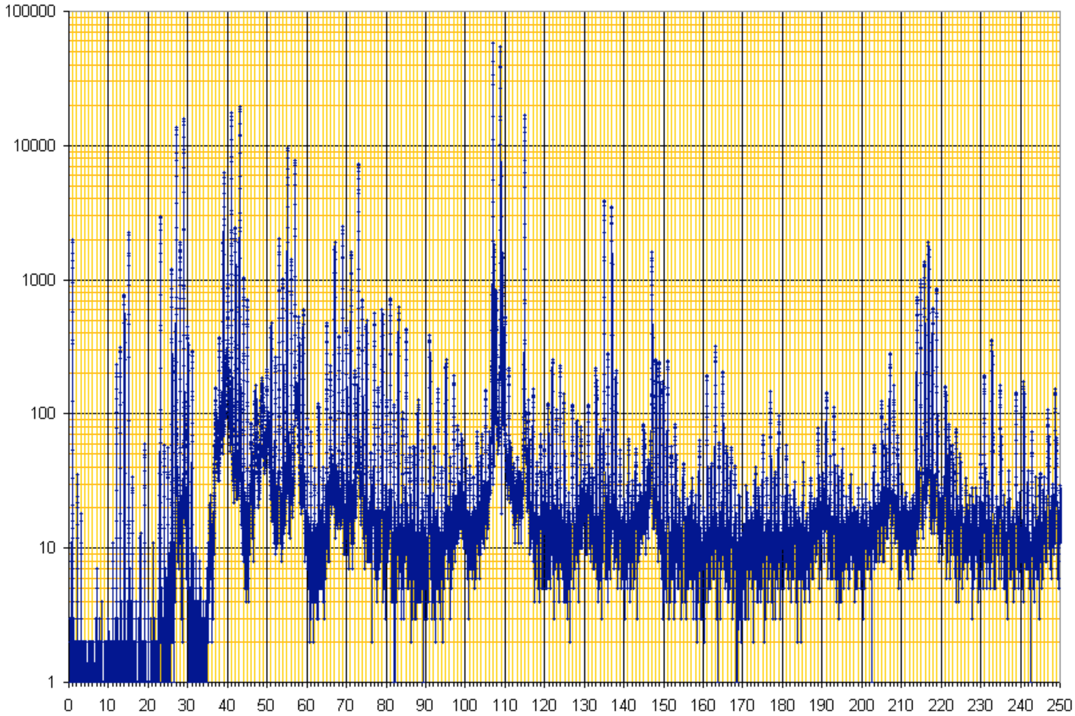


Figure 7. The first spectrum produced by COSIMA in space (Emitter A, when it was still working fine).

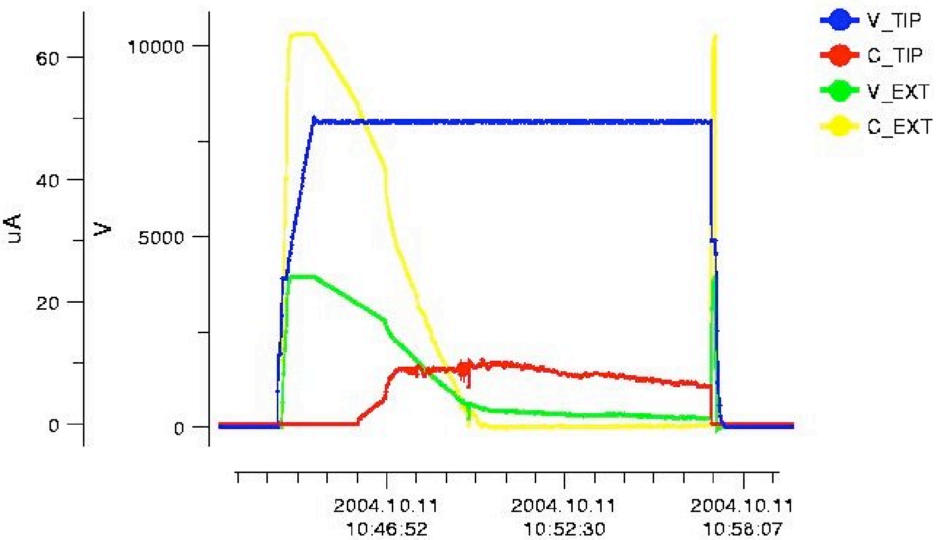


Figure 8. Tip and extractor currents and voltages during unstable behavior of Emitter A.

Draft Summary Report of the COSIMA Interference Test 1

Jouni Rynö
Finnish Meteorological Institute

COSIMA interference 1 report from 20.-21.9.2004

Summary:

Only the Target Manipulator Unit (TMU) generated possible interference.

A software bug prevented COSIMA to operate the Time To Digital Card. The same bug prevented COSIMA to measure any possible noise from other instruments.

Note:
If the interference test is to be repeated, an additional calibration command needs to be inserted before the TDC measurement command as the time to measure must be shorted in order to avoid the auto-calibration of the TDC which happens due to temperature change in the TDC boards and as a side effect zeroes the measurement timer.

Detailed operations:

A bug in the COSIMA operational code 8.0 prevented TDC measurement to continue the requested time. Instead it was stopped almost immediately after a calibration cycle.

Each TMU operation generates from the the time stamp:
- 2 s pause
- 5 s motor operation
- 1 s pause
- 5 s motor operation

For the X motor, the motor operates at 8 kHz, for the S motor 4 kHz.

2004-09-20T10:12:24	operational HV levels
2004-09-20T10:12:25	TDC on
	science packets lost
2004-09-20T10:40:02	TDC and HVs off
2004-09-20T21:31:02	TMU X-motor operation
2004-09-20T21:31:19	TMU S-motor operation
2004-09-20T21:32:02	TMU X-motor operation
2004-09-20T21:32:19	TMU S-motor operation
2004-09-20T21:33:02	TMU X-motor operation
2004-09-20T21:33:19	TMU S-motor operation
2004-09-20T21:34:02	TMU X-motor operation
2004-09-20T21:34:19	TMU S-motor operation
2004-09-20T21:35:02	TMU X-motor operation
2004-09-20T21:35:19	TMU S-motor operation
2004-09-20T21:36:02	TMU X-motor operation
2004-09-20T21:36:19	TMU S-motor operation
2004-09-20T21:37:01	TMU X-motor operation
2004-09-20T21:37:18	TMU S-motor operation
2004-09-20T21:38:02	TMU X-motor operation
2004-09-20T21:38:19	TMU S-motor operation

2004-09-20T21:41:14	operational HV levels
2004-09-20T21:42:03	TDC on
	science packets lost
2004-09-20T22:31:14	TDC and HVs off
2004-09-20T22:32:02	operational HVs and TDC on
2004-09-21T01:20:02	TDC and HVs off
2004-09-21T01:21:00	TMU X-motor operation
2004-09-21T01:21:17	TMU S-motor operation
2004-09-21T01:21:34	TMU X-motor operation
2004-09-21T01:21:51	TMU S-motor operation
2004-09-21T01:22:09	TMU X-motor operation
2004-09-21T01:22:26	TMU S-motor operation
2004-09-21T01:22:45	TMU X-motor operation
2004-09-21T01:23:02	TMU S-motor operation
2004-09-21T01:23:19	TMU X-motor operation
2004-09-21T01:23:37	TMU S-motor operation
2004-09-21T01:23:53	TMU X-motor operation
2004-09-21T01:24:10	TMU S-motor operation
2004-09-21T02:00:03	COSIMA shutdown
2004-09-21T17:01:00	COSIMA power on
2004-09-21T17:32:24	Operational HV levels
2004-09-21T17:32:25	TDC on
	science data unsable for analysis
2004-09-22T02:00:01	TDC off
2004-09-22T02:00:17	COSIMA off

As of 09. November 2004, there was no attempt for a interference Test 2 which includes COSIMA.
In case of a future test, the ACSS001C would need the command ZCS21401 \# tdc/calibrate added before the ZCS21406 tdc/measure -command.

5. GIADA

REPORT ON

GIADA BEHAVIOUR

DURING

ROSETTA COMMISSIONING

April - October 2004

Prepared by:	L. Colangeli	INAF - OAC
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CONTENTS

1. Scope and Applicability

Aim of the present document is to summarise the results and extract information about the behaviour of GIADA through all the COMMISSIONING tests performed in flight in the period from April to October 2004.

In the present issue of the report the results of preliminary data analyses are considered. The analysis shall be completed and will be matter of a new document issue.

This report is applicable to GIADA FS model on board the Rosetta S/C launched from Kourou on 02 March 2004 and presently in flight towards comet 67P/Churyumov-Gerasimenko.

All data have been retrieved from the Rosetta DDS through the PI workstations located @ PISA - ESOC or @ INAF - Osservatorio Astronomico di Capodimonte, during different tests.

The GIADA IWS (Instrument Work Station) configuration is GEWS 4.2.1 plus the RSOC Converter v 1.1.1. GIADA in flight software configuration is 2.3 plus four additional patches (3 for software and 1 for context file update).

2. Abbreviations and acronyms

ACK	Acknowledge
ADC	Analogue To Digital converter
ADP	Acceptance Data Package
AFT	Abbreviated Functional Tests
AIV	Assembly, Integration and Verification
ALS	Alenia Spazio
BT	Bench Test
CCS	Central Checkout Equipment
DDS	Data Disposition System
EGSE	Electrical Ground Support Equipment
EMC	Electromagnetic Compatibility
ESA	European Space Agency
ESOC	European Spacecraft Operation Centre
FB	GIADA Frangibolt
FCP	Flight Control Procedure
FFT	Full Functional Tests
FS	Flight Spare
GA	Galileo Avionica
GDS	Grain Detection System
GIADA	Grain Impact Analyser and Dust Accumulator
GSE	Ground Support Equipment
H/W	Hardware
HK	House Keeping
I/F	InterFace
IAA	Istituto de Astrofisica de Andalucia – Granada (E)

INAF-OAC	INAF - Osservatorio Astronomico di Capodimonte – Napoli (I)
IS	Impact Sensor
IST	Integrated System Test
IWS	Instrument Workstation
KAL	Keep Alive Line
LCL	Latch Current Limiter
LFT	Limited Functional Tests
MBS	Micro Balance Sensor
MTL	Mission TimeLine
NA	Not Applicable
OBCP	On-Board Control Procedure
PI	Principal Investigator
PM	Progress Meeting
PS	GIADA Power Supply
PZT	(IS) Piezo Sensor
QM	Qualification Model
RMOC	Rosetta Mission Operation Centre
RSOC	Rosetta Science Operation Centre
RW	Reed Switch
S/C	Rosetta Spacecraft
S/S	GIADA Sub-system (e.g. IS or GDS or MBS)
S/W	Software
SIS	Spacecraft Interface Simulator
SPT	Specific Performance test
SSMM	Solid State Mass Memory on-board of Rosetta Spacecraft
STD	Standard
TBC	To Be Confirmed
TBD	To Be Defined
TC	Telecommand
TM	Telemetry
UPA	Università Parthenope – Napoli (I)
UTC	Universal Time Code

3. Performed activities and relevant documentation

Six different test sessions of GIADA have been performed during the Rosetta Commissioning, using Main and Redundant interfaces as summarised in Table 1. In the same table, reference is given to reports and technical notes where details about GIADA results and behaviour are reported and discussed. As reference, it is also considered the activity performed on GIADA FS at the tests performed in Kourou on August and November 2003, when all GIADA sub-systems where switched on and tested (in the frame of final GIADA cleaning).

3.1 Applicable documents

AD1	RO-EST-RS-3001/EID A	ROSETTA Experiment Interface Document - Part A
AD2	RO-EST-RS-3009/EIDB	ROSETTA GIADA Experiment Interface Document – Part B
AD3	RO-ESC-PL-5000 Issue 4.7 09/08/2004	Flight Control Procedure
AD4	GIA-GAL-MA-007 Issue 2	GIADA Flight Spare User Manual

See also Table 1.

Test	**Period**	**GIADA I/F**	**Ref. documents**
Cleaning in Kourou	04-05 August 2003	Main	GIA-GAL-RP-513 RO-GIA-OACUPA-TN-125 RO-GIA-OACUPA-TN-124
Closeout in Kourou	25 November 2003	Main Redundant	GIA-GAL-RP-516 RO-GIA-OACUPA-TN-134 RO-GIA-OACUPA-TN-124
1st Commissioning	03-04 April 2004	Main Redundant	GIA-GAL-RP-517 RO-GIA-OACUPA-TN-126 RO-GIA-OACUPA-TN-124
Interference 1A	20-21 September 2004	Main	GIA-GAL-RP-518 RO-GIA-OACUPA-TN-127 RO-GIA-OACUPA-TN-124 RO-GIA-OACUPA-TN-130
Interference 1B	21-22 September 2004	Main	GIA-GAL-RP-519 RO-GIA-OACUPA-TN-128 RO-GIA-OACUPA-TN-124 RO-GIA-OACUPA-TN-130
Pointing 1	23 September 2004	Main	GIA-GAL-RP-520 RO-GIA-OACUPA-TN-131 RO-GIA-OACUPA-TN-124
Pointing 2	30 September 2004	Main	GIA-GAL-RP-520 RO-GIA-OACUPA-TN-132 RO-GIA-OACUPA-TN-124
Interference 2	12-14 October 2004	Main Redundant	GIA-GAL-RP-521 RO-GIA-OACUPA-TN-129 RO-GIA-OACUPA-TN-124 RO-GIA-OACUPA-TN-130

Table 1. GIADA Commissioning phases

4. First commissioning

4.1 Purpose

The main purposes of this test were:

- to switch GIADA on for the first time on the Main I/F
- to perform functional test in Normal mode on the Main I/F
- to switch GIADA on for the first time on the Redundant I/F
- to activate and remove the launch-lock (frangibolt)
- to open the cover
- to perform functional test in Normal mode on the Redundant I/F
- to perform a self-interference test in Normal mode on the Redundant I/F
- to perform micro-balance heating
- to close the cover
- to switch off

In addition, another switch on has been done to test the upload of the on-board SW patches according to a different packing requested by ESOC.

4.2 Operations

- The first commissioning of the Main interface (with protective cover closed) proceeded with no anomalies
- During the commissioning of the Redundant interface the Frangibolt was correctly unlocked (see Figure 1)
- During the commissioning of the Redundant interface the cover was open for the first time.
  During this operation the reed switch associated to the "open cover position" signaled that the cover did not reach the complete opening position (Figure 2). Therefore it was decided to repeat the cover open OBCP, that was successful (Figure 3).
- The commissioning of the Redundant interface was correctly executed
- The tests on all sub-systems gave results as expected
- The micro-balances were heated correctly
- The cover was closed correctly
- The SW patches upload was successfully validated

4.3 Main observations

- The **UTC time of synchronised packets** is about 14 s greater than the packet SCET time
  This effect has been clarified with ESOC people and it is due to the imprecise setting of the zero reference time at launch by about 13 s, with respect to the nominal 1 Jan 2003 00:00:00. According to ESOC communication, the UTC timestamp is accurate at few millisecond level.

- The **UTC time of unsynchronised packets** (reconstructed and assigned on ground) is about 2.8 s delayed wrt that of synchronised packets
  In this case, according to ESOC explanation, unsynchronised packets are time stamped according to the time the packet has left the S/C; this time does not account for the on board

"wait time". In the case of this commissioning ESOC has estimated a wait time of some seconds, compatible with the time found by GIADA

- The **GDS stray-light** is confirmed at a level similar to that measured during final on-ground tests (cleaning and closeout in Kourou):

Mean Left	= 0.68 V	Standard deviation Left	= 0.05 V
Mean Right	= 0.22 V	Standard deviation Right	= 0.04 V

  These values require an **increase in the Threshold setting for the GDS Left channel** to avoid flood of stray-light spurious detections

- The **IS** calibration gives values that are consistent with on-ground results

- The **MBS** reading in normal operation and during heating are compatible with expected nominal behaviour

- For the **cover open operation**, it was decided not to take any action for the following tests, but to monitor carefully the cover behaviour at the next operations

- **Already at this stage it was evident the need to increase the SSMM allocated to GIADA (1 Mbyte) in order to avoid data loss in case of several events**

- Finally, some differences were noted in the HK data once the engineering calibration was applied, between Main and Redundant values. This may require an **updating of some engineering calibration factors for laser monitoring and temperature parameters**.

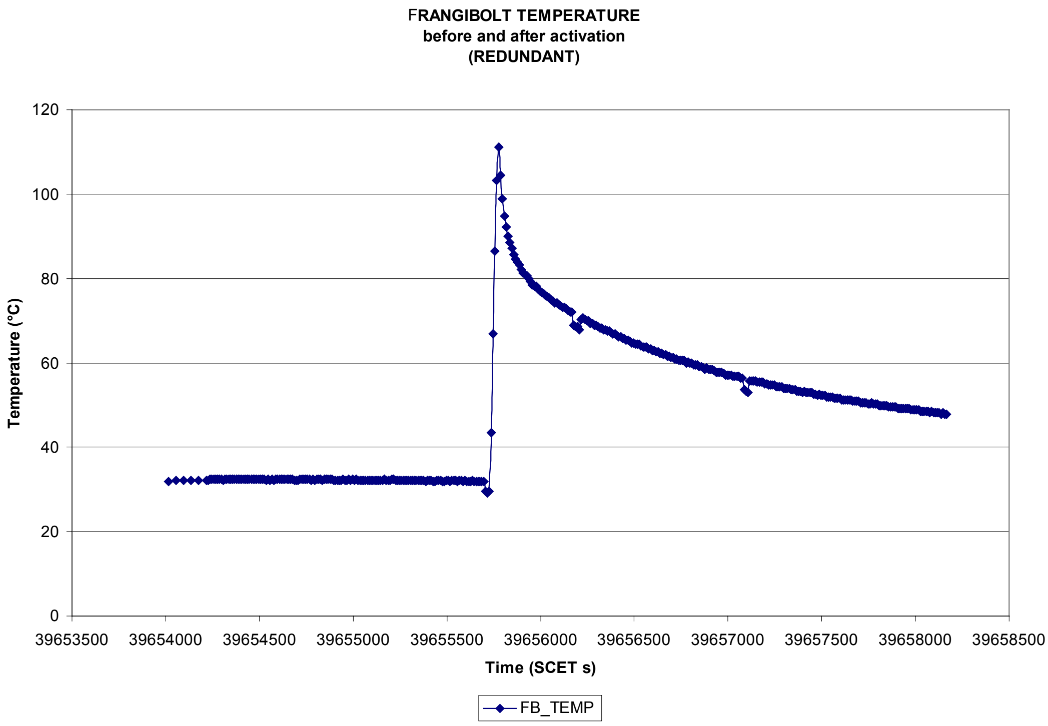

Figure 1. Commissioning 1 - Frangibolt temperature during activation (REDUNDANT)

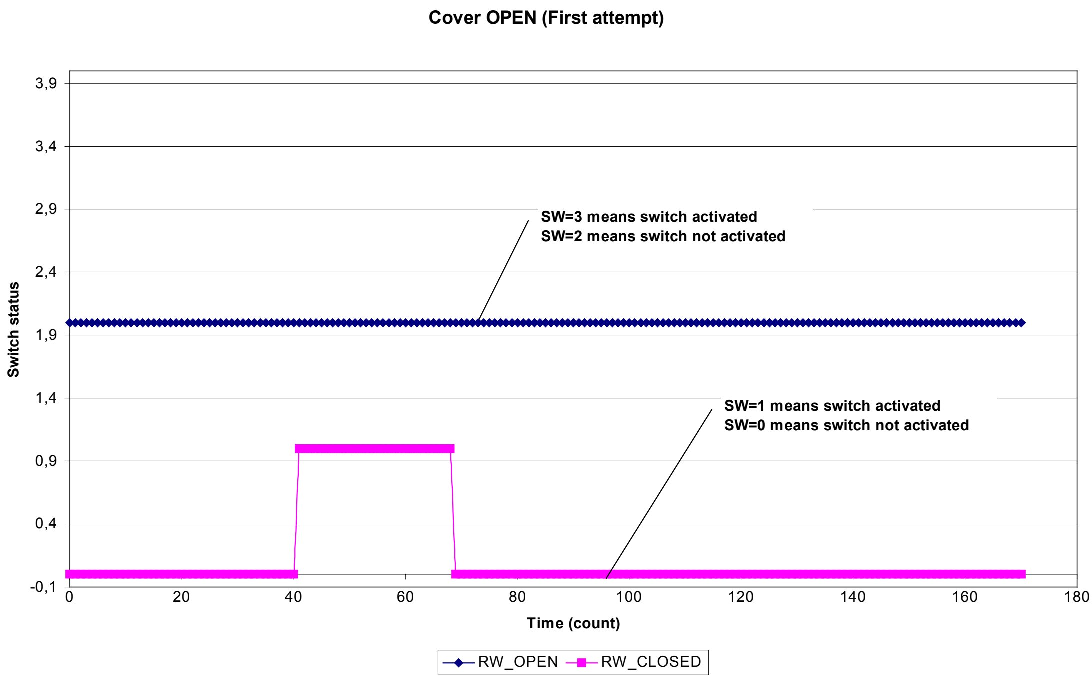

Figure 2. Commissioning 1 - Reed switches status during 1st Cover Open operation (REDUNDANT)

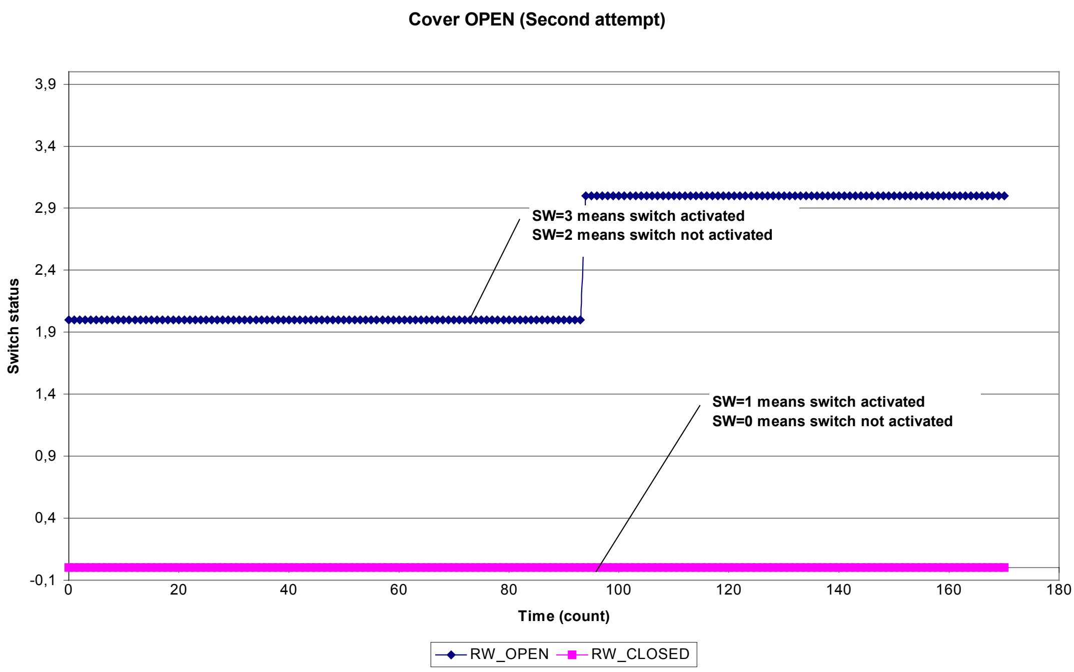

Figure 3. Commissioning 1 - Reed switches status during the 2nd Cover Open operation (REDUNDANT)

5. Interference 1A

5.1 Purpose

The main purpose of this test was to place GIADA in emissive and sensitive modes to check possible interference with operation of other payload.

The switch on allowed us also to check the behaviour of the instrument with respect to the data collected during the 1st commissioning.

5.2 Operations

- The sequence of GIADA switch on, cover open, go to normal mode and cover close was repeated various times and everything worked nominally all the times

- In order to analyse the susceptibility of GIADA to other P/L, the calibration of the sub-systems (GDS, IS, MBS) was repeated at a high rate (once every 6 min) to check the behaviour of the instrument

- The **first 210 science packets were lost** because their download occurred during the New Norcia station stop of tracking (@ 22:09 of 20 Sep., for about 25 minutes). Other **145 HK reports and some ACK reports were lost** for the same reason, as their on real-time download occurred during that loss of communication

5.3 Main observations

- The **Housekeeping** data show a correct behaviour of GIADA in terms of temperatures and voltages (Figure 4). In particular, current consumption in Normal mode is nominal: 450 mA (+15 V) and 295 mA (-15 V), as during on-ground TV tests.

- Two types of **GDS stray-light** "ghost detections" are observed on the **Left channel**:

  - detections of amplitude of the order or little above the threshold (0.8 V);
    they are attributed to the high level of stray-light, now in combination with possible electronic noise (Figure 5).
    At the beginning of the test, the "ghost detections" level is of the same order than that found during the 1st Commissioning in April '04:
    Mean Left = 0.69 V Standard deviation Left = 0.06 V
    As the test develops, the "ghost detections" level tends to increase up to a value
    Mean Left = 0.77 V Standard deviation Left = 0.08 V

    This effect could be due to interference with other P/L (see Section 8) or to internal GIADA effects, as - for example - temperature effects (see behaviour in Figure 5).

    As consequence of the high GDS event generation the SSMM memory allocated to GIADA could have been saturated. However, since the downloading rate was sufficiently high, the memory was not saturated during the test.

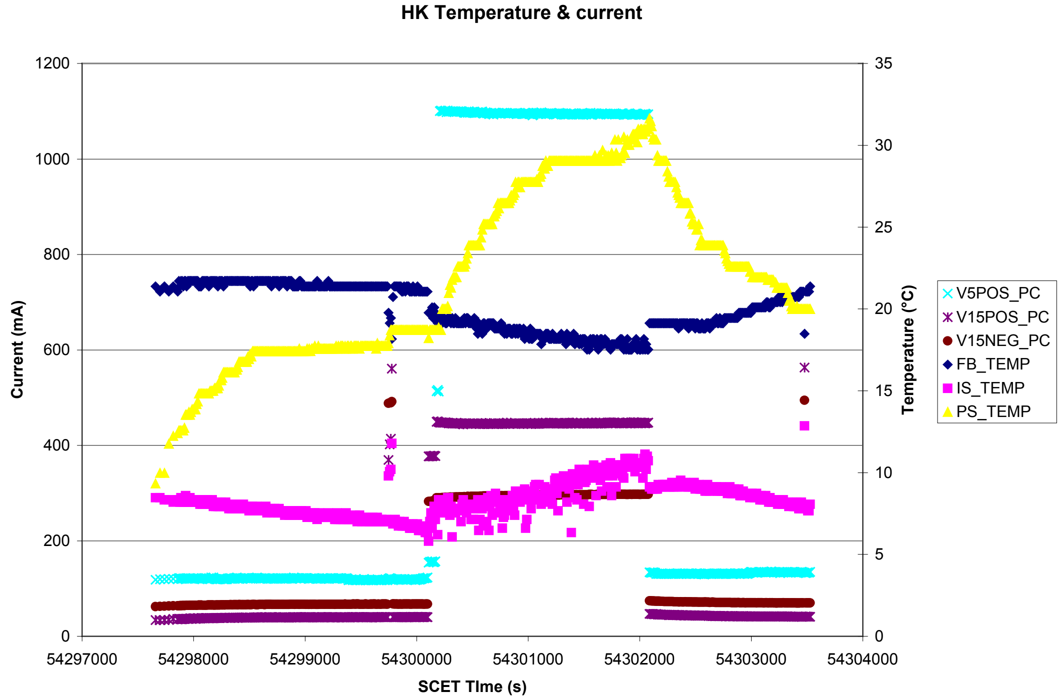

Figure 4. Interference 1A - Frangibolt, IS and Power Supply temperatures and +5V, ±15V currents (MAIN)

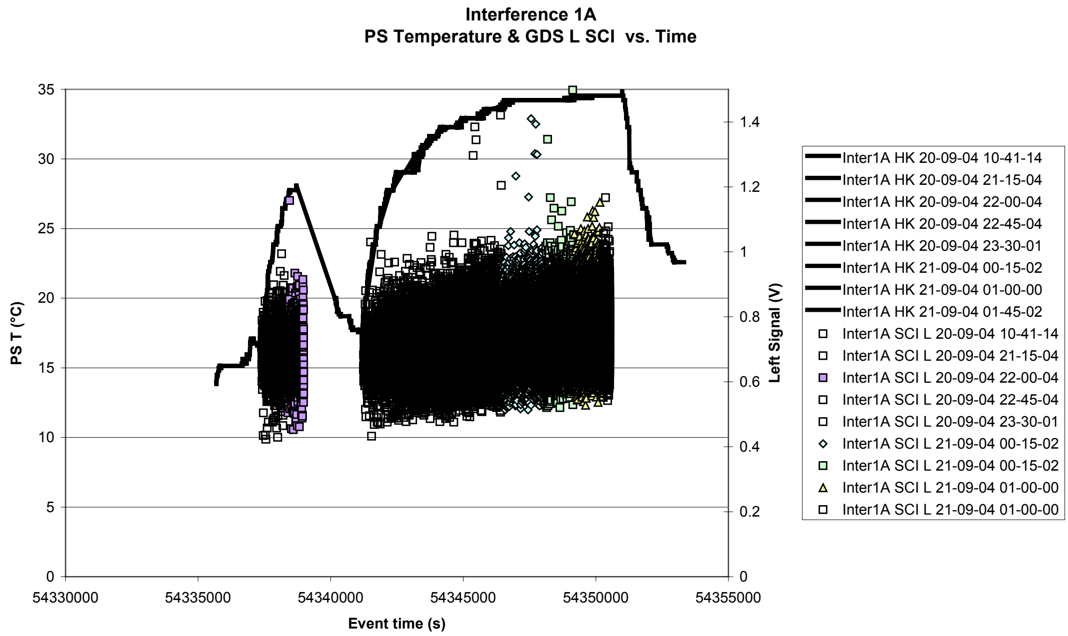

Figure 5. Interference 1A - GDS Left "ghost events" and Main Electronics temperature vs. time

- detections of amplitude well above the detection threshold or in saturation (about 6.9 V) these events happen more often than in 1st Commissioning and seem not correlated to any specific GIADA internal event (such as calibration or relay on-off switching - see Figure 6). The could be due to **interference** (conducted on the power line) **with other experiments** (see Section 8).

  In any case, in order to minimise the number of detections (and thus the GDS data rate and production), **the detection threshold of the Left channel must be increased up to 1.2V**. The modification shall be implemented as soon as possible for the next tests.

➢ The **GDS Right channel** presents only a few (7) saturated events

➢ The **GDS calibration** data present the following behaviour

- the GDS calibration of the **Left channel** follows a trend similar to that of the "ghost events"

at the beginning:	Mean Left = 0.69 V	Standard deviation Left	= 0.04 V
rising in time up to	Mean Left = 0.86 V	Standard deviation Left	= 0.03 V

  It is interesting to note that the standard deviation does not change in time on the calibration values (fast acquisition of several values), while <u>it increases in time on the GDS events</u>. This could mean an increasing noise on the signal, due to either interference with other P/L or to internal causes (e.g., thermal effects, as mentioned above)

- the GDS calibration of the **Right channel** is stable and similar to previous tests

  Mean Right = 0.22 V   Standard deviation Right = 0.04 V

➢ The **IS** output presents no "ghost detection"

➢ The **IS calibration** presents the following results:
- Channels A, B and D: nominal behaviour in terms of amplitude and detection time delay
- Channel E: no output as its Gain is set to Low
- Channel C presents some instability in amplitude and detection time delay (similar to what was observed on ground)

For next tests it is useful to put Channel E Gain to High to monitor its behaviour and to increase Channel C Threshold to (possibly) obtain higher stability

➢ The **MBS** reading shows some important difference with respect to previous Commissioning 1 results
- MBS 1 (+X), 3 (-X) and 5 (+Z) present a significant increase in frequency
- MBS 2 (+Y) and 4 (-Y) present a slight increase in frequency

These effect must be checked in following tests and may indicate some contamination of MBS exposed sensor crystal. An MBS heating is recommended at next opportunity to check if accumulated material can be removed, if sufficiently volatile.

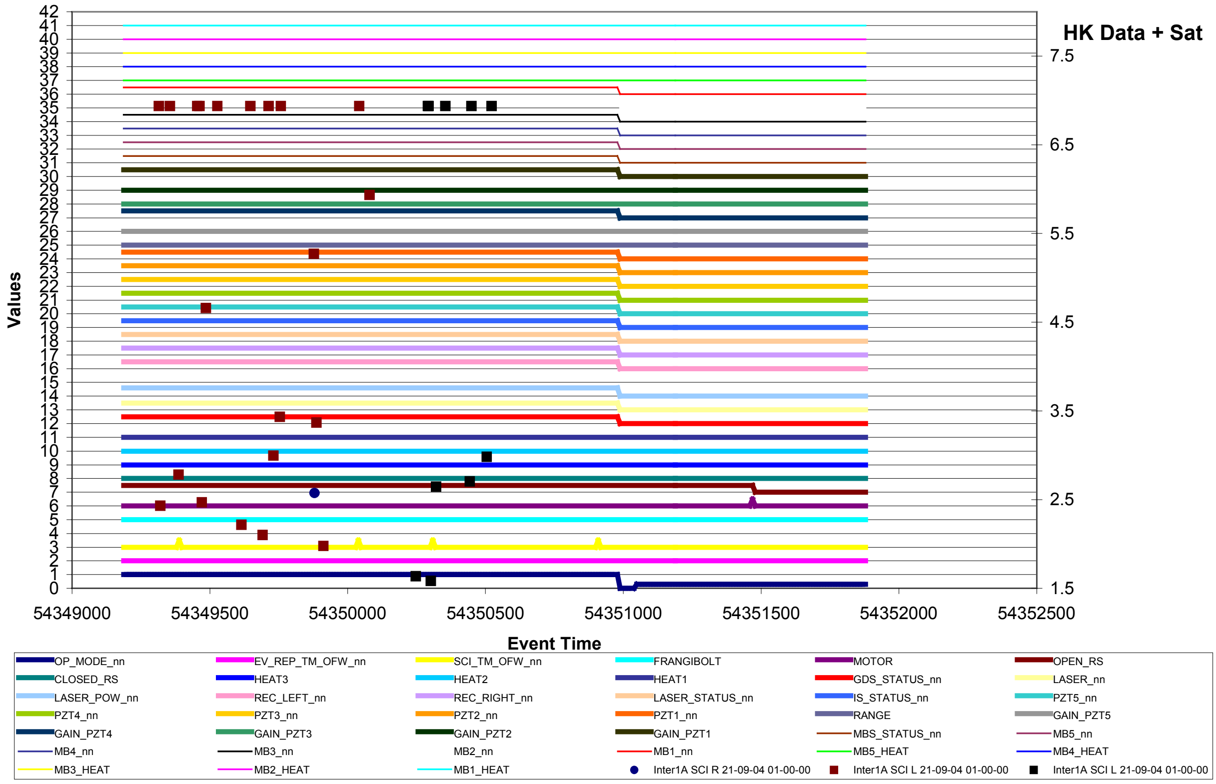

Figure 6. Interference 1A - Ghost saturated events on GDS Left channel vs. GIADA status: no correlation with GIADA events is observed

6. Interference 1B

6.1 Purpose

The main purpose of this test was to place GIADA in emissive and sensitive modes to check possible interference with operation of other payload.

The switch on allowed us also to check the behaviour of the instrument with respect to the data collected during the 1st commissioning and Interference 1A.

6.2 Operations

- The sequence of GIADA switch on, cover open, go to normal mode and cover close was repeated various times and everything worked nominally all the times
- In order to analyse the susceptibility of GIADA to other P/L the calibration of the sub-systems (GDS, IS, MBS) was repeated at a high rate (once every 6 min) to check the behaviour of the instrument

- The **first 924 science packets and other 708 sporadic TM packets were lost** as, due to the production of "ghost detections" by the GDS Left channel, the **SSMM memory (1 Mbyte) allocated to GIADA was saturated** before the download allowed to empty the memory

- The cover operated correctly. However, in order to avoid useless bouncing of the cover in the closed position, **it is suggested to skip the cover close command before the switch-off OBCP** execution, that anyway includes the cover close OBCP, during following tests.

6.3 Main observations

- The GIADA behaviour was very similar to that observed in Interference 1A

- The **Housekeeping** data show a correct behaviour of GIADA in terms of temperatures and voltages.

- Due to the loss of TM packets many information about the potential interference with other P/L switch ON could not be evaluated

  It is confirmed the need to:
  - **increase the detection threshold of the Left channel up to 1.2V**
  - **enlarge the SSMM allocation for GIADA**

- The types of **GDS stray-light** "ghost detections" on the **Left channel** are as illustrated in Section 5.3 for the Interference 1A test.
  The detections close to the threshold level present values of:
  Mean Left = 0.69 V   Standard deviation Left = 0.07 V

  Detections of amplitude well above the detection threshold or in saturation (about 6.9 V) are also observed. Again these events could be due to **interference** (conducted on the power line) **with other experiments** (see Section 8).

- The **GDS Right channel** presents only a few saturated events

- The **GDS calibration** data present the following behaviour:

  - the GDS calibration of the **Left channel** shows:
    at the beginning: Mean Left = 0.77 V   Standard deviation Left = 0.04 V
    rising in time up to Mean Left = 0.82 V   Standard deviation Left = 0.03 V

    It is interesting to note that at the last switch-on after sometime of GIADA off and with most Rosetta P/L off it results:
    Mean Left = 0.64 V   Standard deviation Left = 0.05 V

  - the GDS calibration of the **Right channel** is stable and similar to previous tests
    Mean Right = 0.20 V   Standard deviation Right = 0.04 V

- The **IS** output presents no "ghost detection"

- The **IS calibration** presents the same behaviour as during Interference 1A

- The **MBS** readings obtained during Interference 1A are confirmed

  The confirmation of MBS contamination requires investigation in conjunction with other Rosetta P/L to check for similar behaviours

7. Interference 2

7.1 Purpose

The main purpose of this test was to place GIADA in emissive and sensitive modes to check possible interference with operation of other payload. In this case, GIADA was already on when other P/L were progressively switched on. This allowed us to check better for possible interference effects.

The switch on allowed us also to check the behaviour of the instrument with respect to the data collected during the previous tests.

7.2 Operations

- The sequence of GIADA switch on, cover open, go to normal mode and cover close was repeated various times and everything worked nominally all the times

- In this test both the Main and the Redundant lines were used

- In order to analyse the susceptibility of GIADA to other P/L the calibration of the sub-systems (GDS, IS, MBS) was repeated at a high rate (once every 5 min) to check the behaviour of the instrument

- Based on results of previous tests, the following parameter settings were changed:
  - GDS Left Threshold at about 1.2 V (to reduce "ghost detections" production)
  - IS Channel E Gain was set to High and Threshold to 100 mV (to allow detections from this channel)

- All the times GIADA was switched on during this test, the **memory dumps were not retrieved.**

- **The first TM report received from GIADA (connection report 17,2) is not synchronised in time and has a wrong UTC: it results delayed of some hours wrt. UTC time @ GIADA switch-on. This effect has been confirmed as nominal by the RMOC team.**

- The cover operated correctly. During this test, in order to avoid useless bouncing of the cover in the closed position, the cover close command before the switch-off OBCP execution (that anyway includes the cover close OBCP) was skipped.

7.3 Main observations

- The **Housekeeping** data show a correct behaviour of GIADA in terms of temperatures and voltages.

- **The HK signals seem less noisy when the Redundant interface is used. A similar effect on science data is presently under investigation**

- Due to the higher GDS Left channel Threshold setting, the **GDS stray-light** "ghost detections" on the **Left channel** were much less than in previous Interference 1A-B tests. However, some detections close to the threshold level were observed with values of:

  Mean Left = 0.70 V   Standard deviation Left = 0.05 V

  Some detections of amplitude well above the detection threshold or in saturation (about 6.9 V) were also observed. Again these events could be due to **interference** (conducted on the power line) **with other experiments** (see Section 8).

- The **GDS Right channel** presents only a few saturated events

- The **GDS calibration** data present the following behaviour:

  - the GDS calibration of the **Left channel** shows (Figure 7):

    from   Mean Left = 0.69 V   Standard deviation Left = 0.04 V
    to   Mean Left = 0.82 V   Standard deviation Left = 0.02 V

  - the GDS calibration of the **Right channel** is:

    Mean Right = 0.2 V   Standard deviation Right = 0.03 V

- The **IS** output presents some "ghost detection", which are mainly due to Channel E. These detections have caused the "Dust Flux" monitor to be NOT zero along the test.

  To reduce/eliminate IS "Ghost detections" it is required to increase Channel E detection Threshold up to about 120 mV, when the Gain is set to High.

- The **IS calibration** presents the following behaviour

  - Channel-A response (amplitude and delay time) is quite stable. A slight dependence of amplitude on temperature is observed (Figure 8)
  - Channel-B response (amplitude and delay time) is quite stable. A slight dependence of amplitude on temperature is observed
  - Channel-C voltage and delay time are confirmed not stable in time
    It is suggested to increase channel C detection threshold (e.g., 100 - 150 mV) to keep the channel detection less susceptible to noise
  - Channel-D response (amplitude and delay time) is quite stable. A slight dependence of amplitude on temperature is observed
  - Channel-E response (amplitude and delay time) is quite stable. The measured amplitude decreases rapidly and reaches a minimum and then increases and becomes almost stable

when the temperature is stable (the amplitude variation is < 80 mV within 10 °C of temperature change).

- The **MBS** have been heated to check if the frequency change, observed already during Interference 1A-B, was due to contamination of volatile material. Unfortunately, the contamination is not changed with heating (Figure 9). Actually, this result was expected as during Pointing tests (see Section 9) MBS were already exposed to high temperature and no frequency change (beside the normal temperature dependence) was observed.
  It is concluded that the contamination of micro-balances reported in Table 2 is maintained.

MBS nominal sensitivity = 2.00E-10 g Hz^{-1}
MBS sensor surface = 1.00E-05 m^2
(Assumed) deposit density = 1.00E+06 g m^{-3}

	Comm 1 f (Hz)	Point 2 f (Hz)	Delta (Hz)	Delta m (g)	Thickness (m)
MB1	2700	5250	2550	5.10E-07	5.10E-08
MB2	2512	2578	66	1.32E-08	1.32E-09
MB3	2391	4093	1702	3.40E-07	3.40E-08
MB4	2503	2588	85	1.70E-08	1.70E-09
MB5	2620	3671	1051	2.10E-07	2.10E-08

Table 2. MBS frequency variation from Commissioning 1 to Pointing 2 tests and estimated total mass deposit.

This effect seems to have happened **between 1st commissioning and Interference tests and has remained stable afterwards. The deposited material seems not volatile, as heating has not produced its release. The confirmation of MBS contamination requires investigation in conjunction with other Rosetta P/L to check for similar behaviours.**

On the other hand, the frequency - temperature behaviour of all MBS has not changed, despite the frequency level changes.

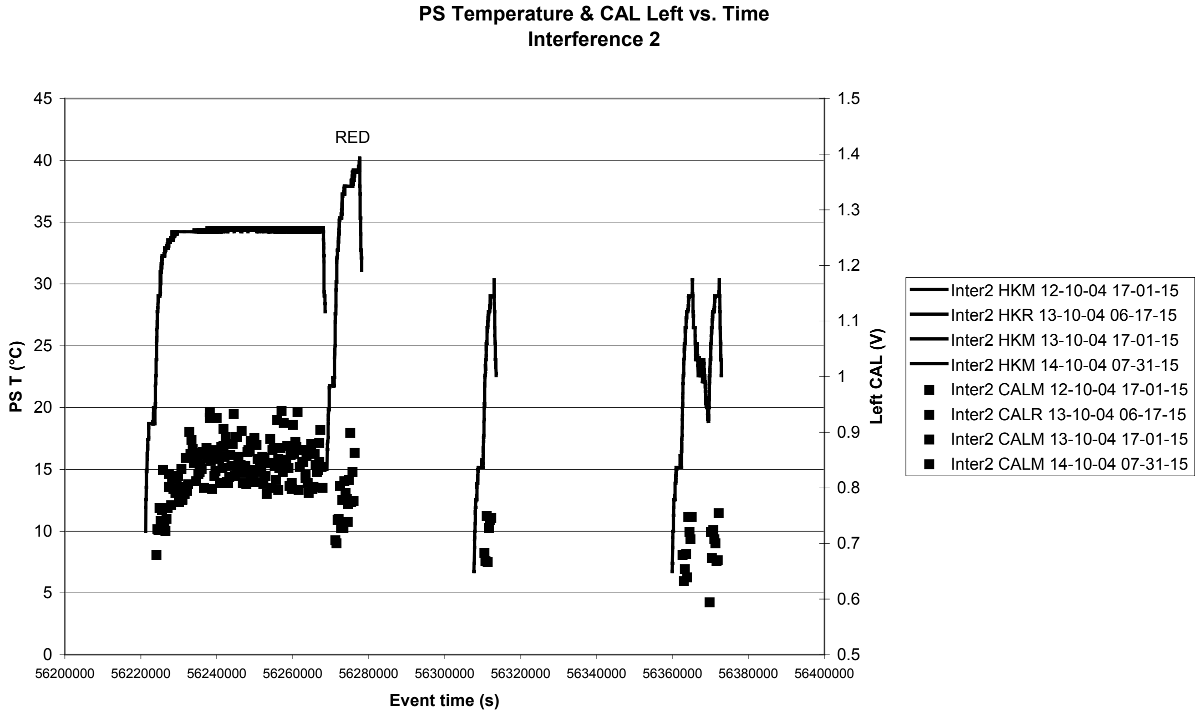

Figure 7. Interference 2 - GDS Left Calibration data (mean values) and Main Electronics temperature vs. time and used interface (RED = Redundant)

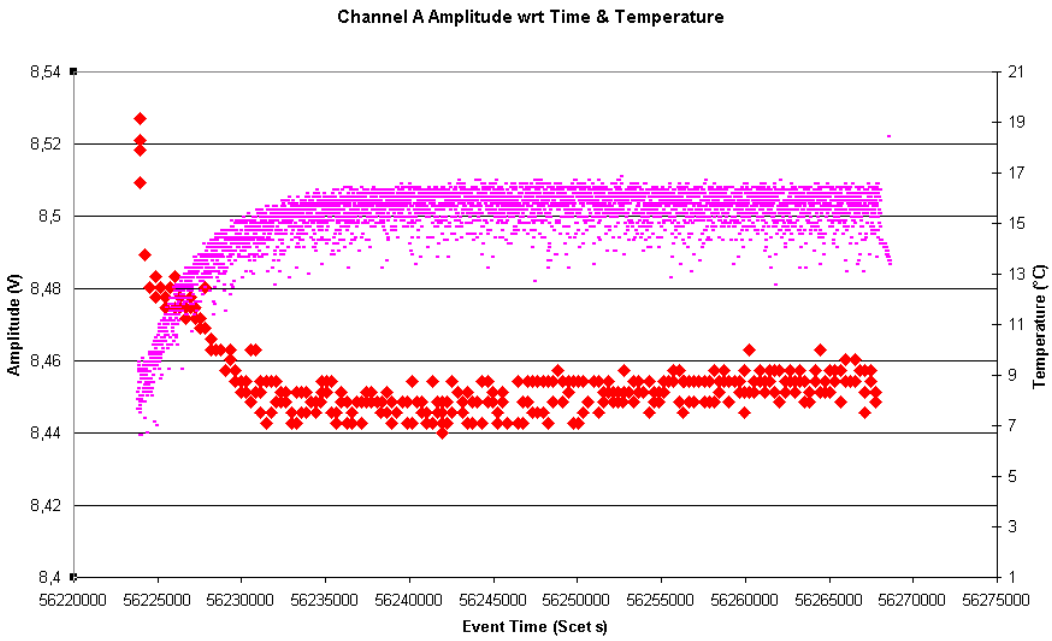

Figure 8. Interference 2 - IS Channel A calibration behaviour and IS temperature

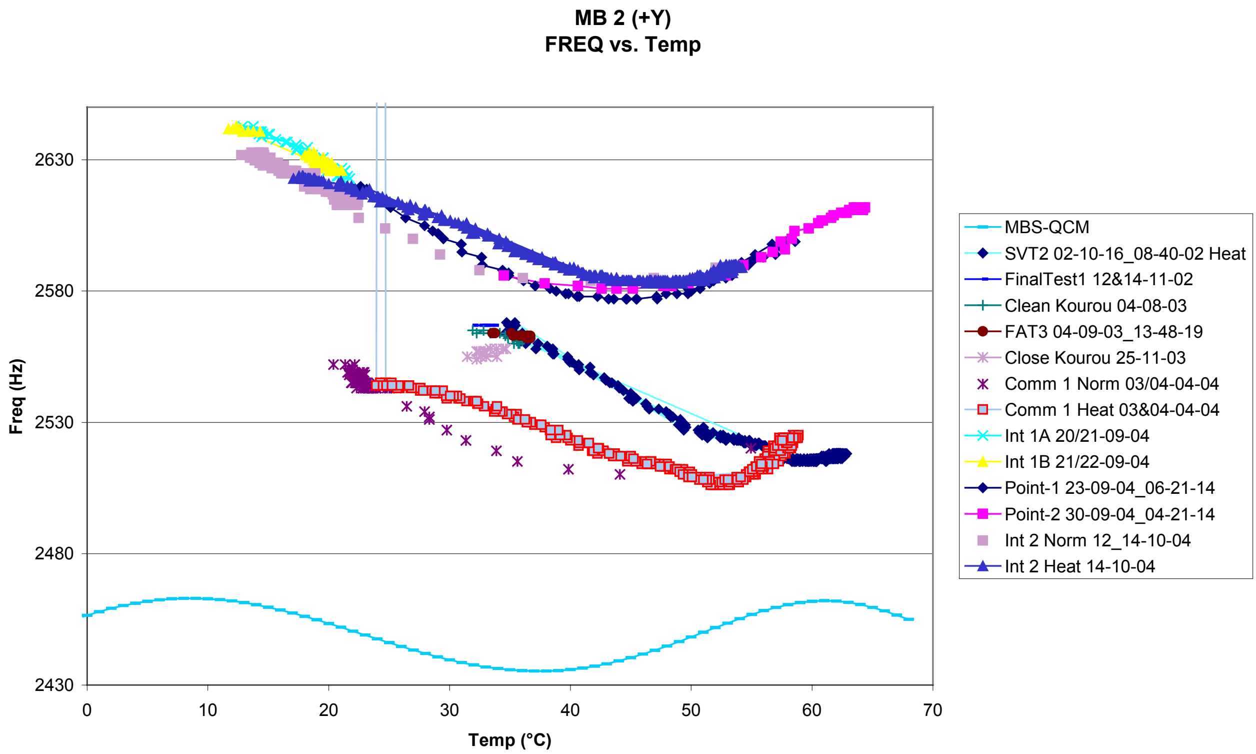

Figure 9. Comparison of the frequency behaviour for MBS-2 during different tests

8. Interference with other Rosetta payload

A first check has been done to try to identify correlations between GIADA behaviour, in particular GDS Calibration and Left "ghost event" production, and status of other Rosetta P/L according to the available information. The results are summarised in Table 3. Examples of the analysis are shown in Figure 10 and Figure 11.

Experiment	Interf.1A	Interf.1B	Interf.2-A	Interf.2-B	Interf.2-C	Interf.2-D	Result
Alice	Possible	Possible	OFF	OFF	OFF	OFF	NO
Consert	Possible	Possible	Possible	Possible	ON	OFF	Possible (^)
Cosima	Possible	Possible	OFF	OFF	OFF	OFF	NO
Giada	Noisy	Noisy	Noisy	Noisy	Quiet	Quiet	--
Midas	Possible	Possible	Possible	Possible	ON	OFF	Possible (^)
Miro	OFF earlier	Possible	OFF earlier	OFF	OFF	OFF	NO
Osiris	OFF earlier	OFF	Possible	Possible	OFF	OFF	NO
Rosina	OFF	OFF	OFF	OFF	OFF	OFF	NO
RPC	Possible	Possible	ON later	OFF	OFF	OFF	NO
Virtis	OFF earlier	OFF	ON later	Possible	OFF	OFF	NO

Table 3. GIADA GDS Left "ghost events" and other P/L behaviour

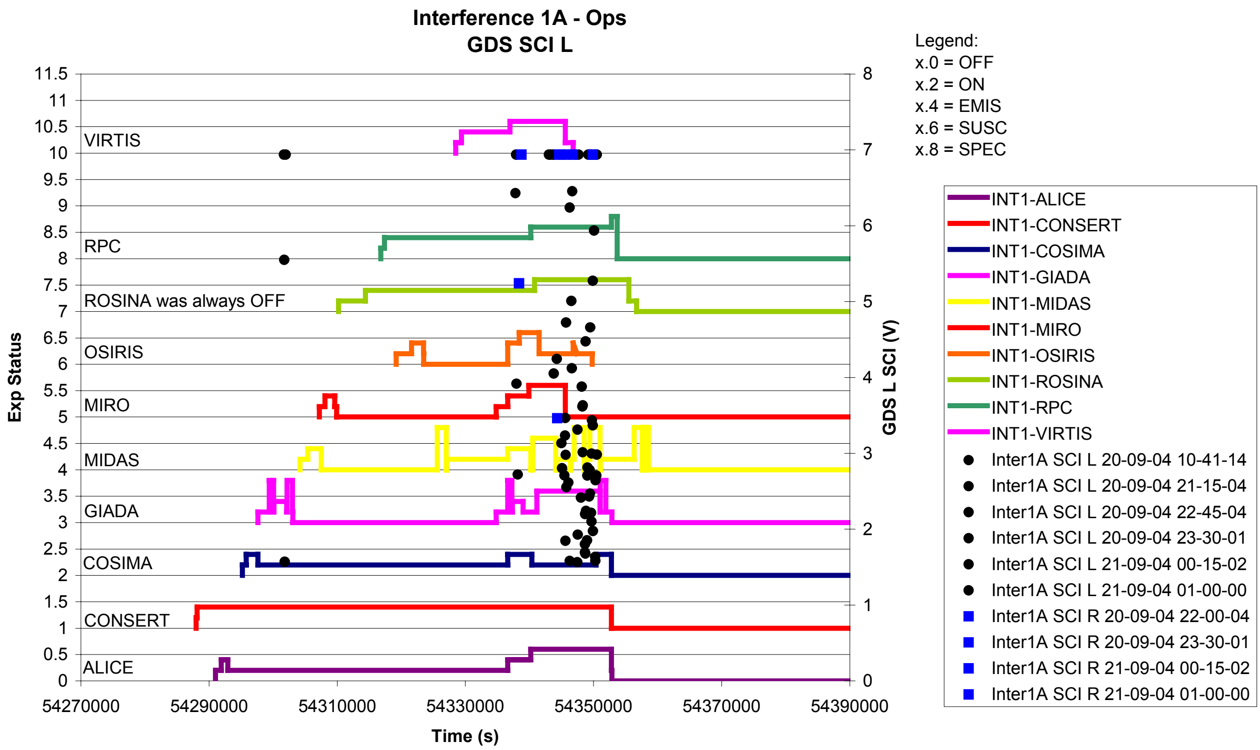

Figure 10. GDS Left "ghost events" generation vs. Rosetta P/L status during Interference 1A

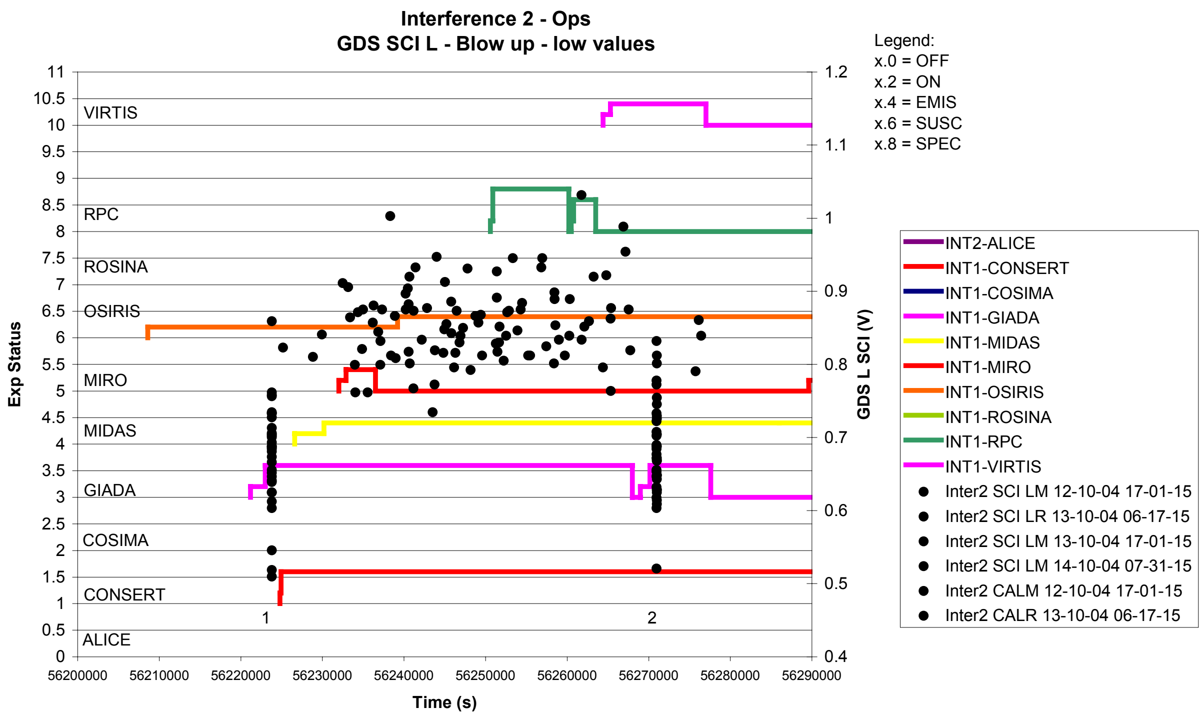

Figure 11. GDS Left "ghost events" generation vs. Rosetta P/L status during Interference 2

No clear relation between GIADA noise (GDS Left "ghost events") generation and Rosetta P/L status can be identified at the present time. In fact, Consert and Midas are the only experiments that are not switched ON/OFF during periods in which GIADA presented GDS Left " Ghost events". However, these experiments were ON during Interference 2C phase, when GIADA was quiet. **It must be checked if Consert and Midas performed the same operation during Interference 1 and Interference 2C phases. If this is the case it might be concluded that GIADA is susceptible to some Rosetta status when all P/L is ON.** On this matter, also the comparison when GIADA Main or Redundant interface are used must be considered carefully.

9. Pointing

9.1 Purpose

For GIADA, the main purpose of this test was to analyse the output of the GDS optical system (stray-light) wrt. the Sun angle position. Moreover, due to the exposure of GIADA body and entrance to different Sun angle positions, the test was aimed at analysing the evolution of thermal conditions.

The overall functioning of GIADA was also analysed.

9.2 Operations

- GIADA has participated to the following Pointing operations
  23 Sep. 2004
  OBS7 Sun moving in the X-Z plane, wrt. S/C Z axis from 140 to 90 deg, in steps of 10 deg
  OBS8 Sun moving in the X-Z plane, wrt. S/C Z axis from 85 to 45 deg, in steps of 5 deg
  30 Sep. 2004
  OBS10 Sun moving in the X-Z plane, wrt. S/C Z axis from 20 to 45 deg, in steps of 5 deg

- Unfortunately, due to the GDS Left channel data flood generated during operation, SSMM allocated to GIADA became full and data were partially overwritten. Thus, **8436 scientific TM data acquired during OBS7 were lost**

- A problem was faced at the end of OBS7-8 test, as the **GIADA cover unexpectedly moved to the open position at the final switch OFF**.
  This anomaly was detected in near real time (the operations were running during the pass) and, thanks to the collaboration of RMOC people, GIADA was switched ON again and the cover close operation repeated. **The operation was successful.**
  The reason of the inconvenience is presently under investigation. The analysis of the Telemetry performed so far confirms that all the GIADA commands and operations were submitted and run nominally. Present studies are towards in depth analysis of motor behaviour.
  It must be noted that the used commanding sequence at GIADA switch OFF foresees a first *Close cover OBCP*, followed by the *Power off OBCP*. The latter includes again the *Close cover OBCP*, that is, then, executed with the cover already in the closed position. This sequence produces the bouncing of the cover over the closed position and was used several times in the

past with no problem. It looks that this time the bouncing provoked an actuation of the motor movement towards the open position.
As a countermeasure, for all the following tests the ***Close cover OBCP* before the *Power off OBCP* has been skipped**, to avoid further problems. In fact, at the next Pointing (OBS10) and Interference 2 tests the problem did NOT show up again.

- In order to analyse the GIADA behaviour wrt to different Sun angle positions several calibrations of the sub-systems (GDS, IS, MBS) were repeated at a high rate (once every 5 min)

9.3 Main observations

- The GIADA GDS Left and Right outputs are reported in Figure 12, vs. Sun angle position wrt. S/C Z axis
We notice that the signal drops to very low values, indicating an external stray-light saturation due to Sun light entering (directly or reflected on the external parts of GIADA) the cavity where the GDS is positioned. The GDS output behaviour is also synthesised in Table 4.
We notice that the **Left channel is saturated between 30 and 75 deg**, probably because in this range of angles the Sun light is reflected towards the detectors, so saturating the detector acquisition chain, while below 20 deg, the direct light does not strikes the Left detectors
We notice that the **Right channel is saturated up to 75 deg**, probably because in this range the Sun light is either reflected or directly strikes the Right detectors
This interpretation is compatible with the internal geometry of GIADA and the light Sun incoming direction.

Point 1	Left Right	Sat starts at ≤ 75 deg Sat starts at ≤ 75 deg
Point 2	Left	Sat starts at ≥ 30 deg
	Right	Sat starts at ≥ 20 deg (always sat.)

Table 4. Saturation of GDS output during Pointing test

- **MBS** have been heated up to about 60 °C, due to their exposure to Sun.
These temperatures are comparable / higher than those applied in heating mode. Thus, it was possible to analyse the evolution of the MBS frequency vs. temperature.
The data are comparable to those obtained during Interference tests and **confirm the increase of frequency due to not volatile contaminants** (see Section 7.3).

- Other Pointing data analysis is currently ongoing to compare the results with other behaviours of sub-systems wrt. Interference test. No major difference has been identified so far.

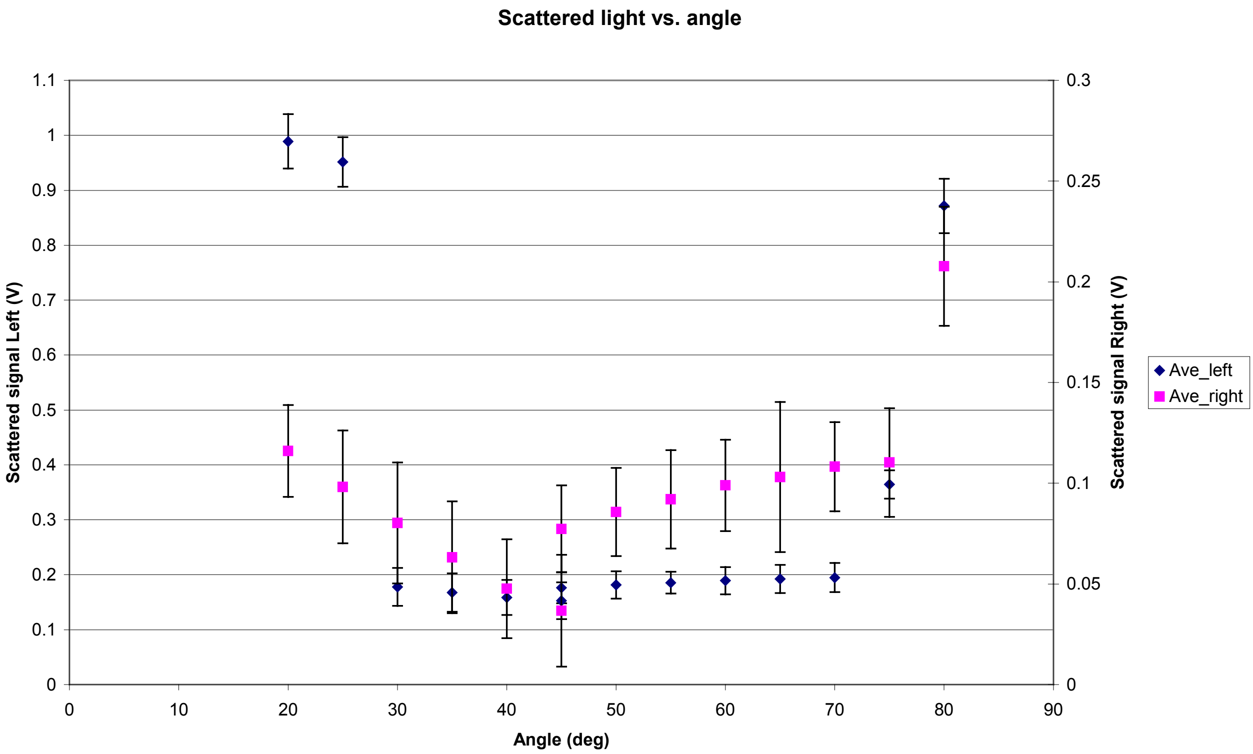

Figure 12. Pointing Test - GDS output vs. Sun angle wrt. S/C Z axis in the XZ plane

10. Comparative analyses

Some overall comparative analyses of GIADA behaviour have also been started.

As an example, the behaviour of laser light output monitoring vs. laser temperature is shown in Figure 13 and Figure 14 for Laser 1 and 4, respectively. Laser 1 shows a well defined trend, but for data acquired with the Redundant interface. This difference is attributed to the engineering calibration factors, that must be properly updated. For Laser 4, instead, a sort of hysteresys is observed, possibly related to the heating. In fact the two trends refer to a "heating" and "cooling" process induced during Pointing 1 and Pointing 2, respectively, due to the Sun - S/C configuration during these tests.

Several other potential correlations are under analysis. As another example, the behaviour of the GDS Left channel calibration output vs. Laser 1 temperature is shown in Figure 15. Excluding the data in the box, referring to the GDS saturated output during Pointing, the other points seem to follow a rising trend, at least up to about 15 °C. This is compatible with laser emission properties. It must be noted that data referring to on-ground tests (clean and close operations in Kourou) are not in line with this trend, showing a lower signal with respect to the in-flight conditions. This behaviour, as others, is matter of deeper analysis.

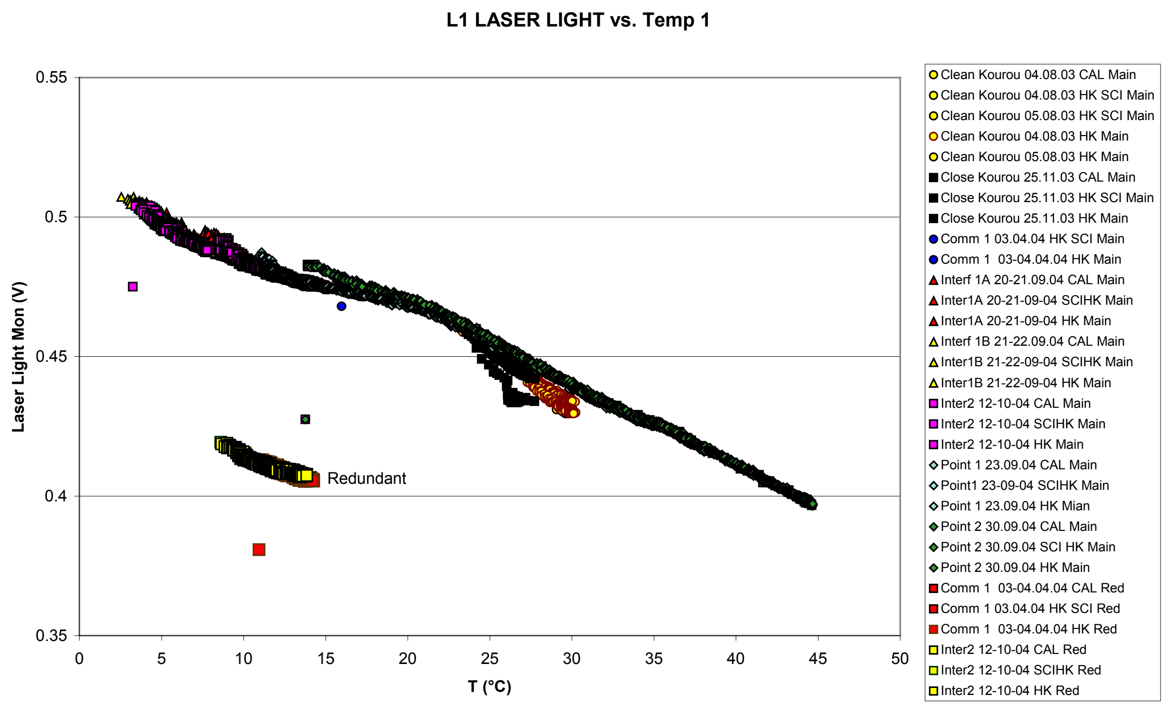

Figure 13. Comparison of different test results on Laser 1 light monitoring vs. temperature

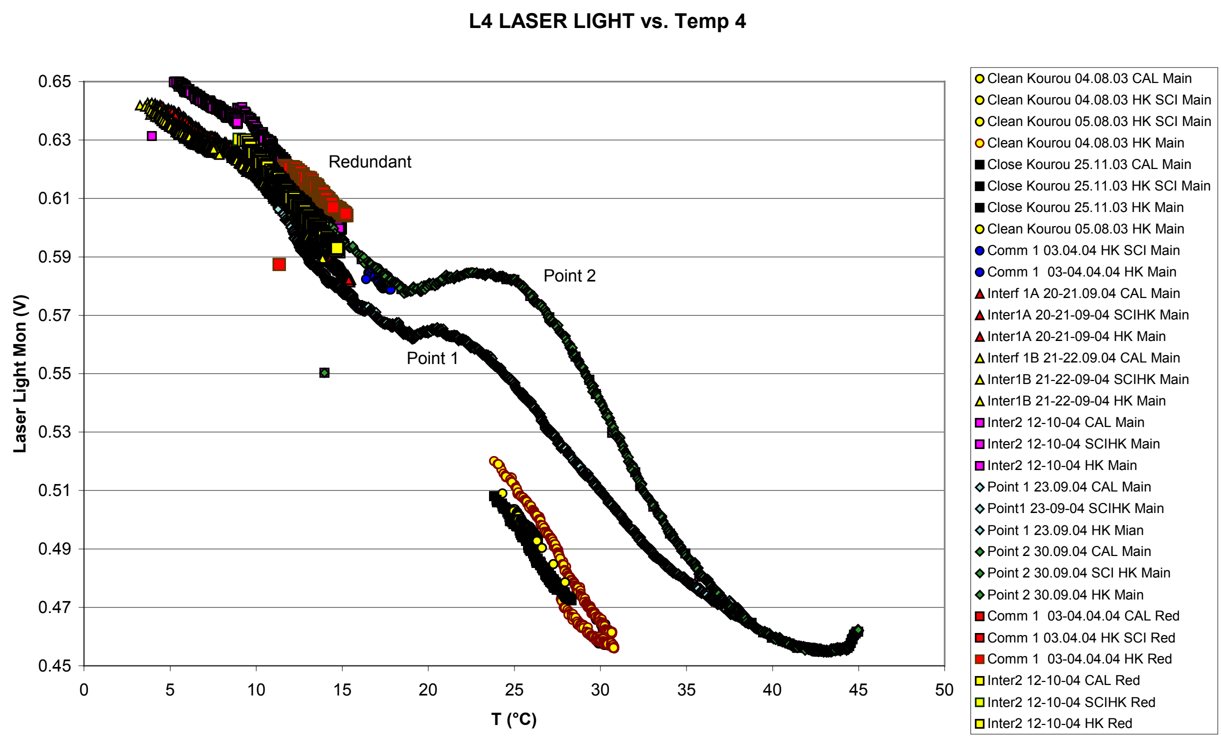

Figure 14. Comparison of different test results on Laser 4 light monitoring vs. temperature

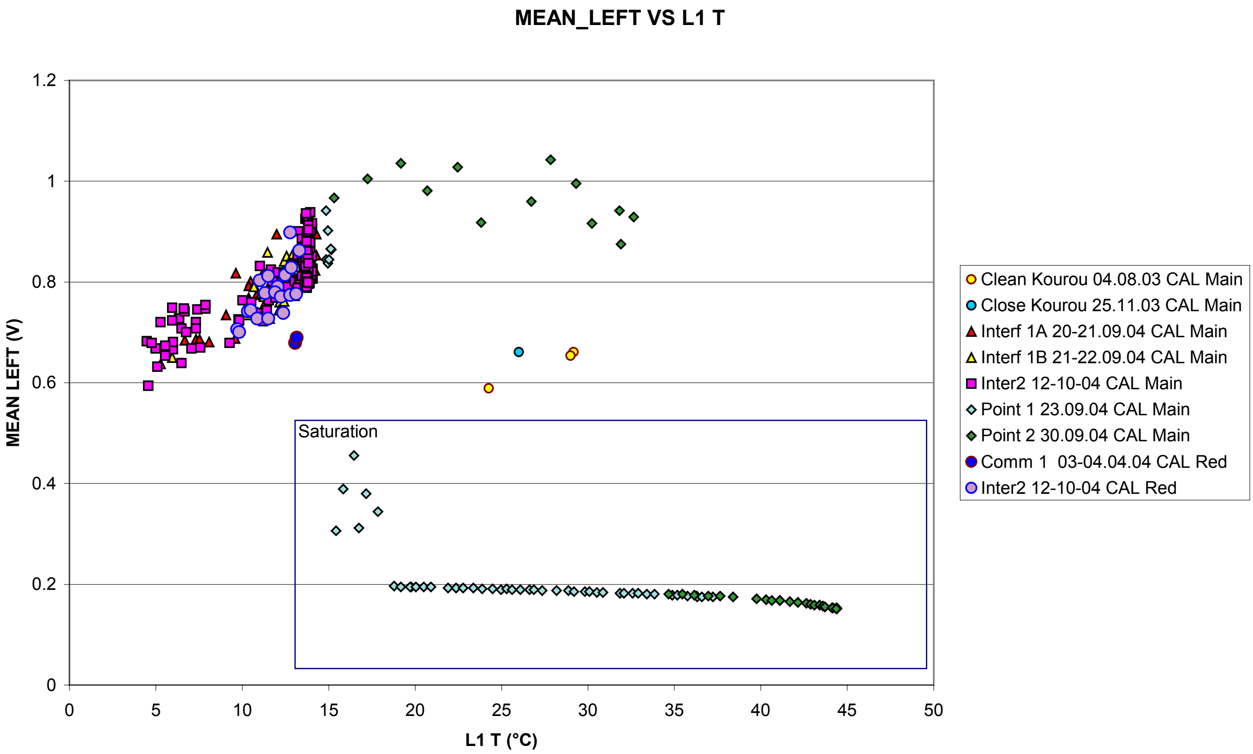

Figure 15. GDS Left channel calibration output vs. Laser 1 temperature

11. Conclusions

- **The overall GIADA results during all commissioning tests are compatible with expectations based on ground test activities. All HK parameters in different thermal conditions are within expected ranges**

- Some **tuning of Thresholds and Gains** for GDS and IS sensors is required (and has been partially implemented during tests) to avoid "ghost detections", partially due to stray-light noise (GDS) and electronic noise (GDS and IS)

- As foreseen, the SSMM size initially allocated to GIADA (1 Mbyte) seems incompatible with data generation rate, related to "ghost events" in these commissioning tests, but well representing "real events" generation expected during nominal operation at the comet. Due to the limited size of SSMM allocated to GIADA, **some sets of data have been lost** due to memory full and, then, overwritten. **It is requested to increase the SSMM allocation for GIADA to at least 70 Mbytes**

- During the several open-close cover operations, only once a **problem has been faced, as the cover moved to the open position, when it was already in the closed position and was commanded to close.** The problem is presently under investigation; it is not due to command sequences (that were nominal) and could be due to an anomalous motor behaviour, when cover bounces in the closed position. As a countermeasure, the close cover command with cover already in closed position was eliminated in the procedures. With this precaution, the **problem was NOT faced again** during several open-close operations.

- During Pointing test, **GDS saturated for some Sun incidence angles** (to be confirmed at higher sun distance). This behaviour must be accounted for in the planning of future GIADA operations.

- A **partial contamination of 3 micro-balances is definitely observed.** The contamination seems to have occurred between 1st Commissioning (3-4 April 2004) and Interference (20-21 September 2004). The contamination seems **NOT** to be **increased afterwards**. **This behaviour should be compared with results obtained by other P/L.** It looks the contaminants **are not volatile**, as MBS heating up to about 60 °C and exposure to Sun (during Pointing tests) have not produced significant release of material (frequency decrease). For the rest, the MBSs behaviour is nominal.

- Some **increase of noise** seems to be present in GIADA data (e.g., GDS and IS "ghost events") **when all P/L in ON.** However, the analysis of Interference data performed so far **has not allowed us to identify any clear relation with a specific instrument of Rosetta.** Further investigation of available data and/or other interference tests could be required. An investigation about noise level change when powering GIADA with the Main or the Redundant interface is also ongoing.

6. MIDAS

MIDAS

Commissioning Report

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1 Introduction

On top of electronics and software in MIDAS, the major mechanical elements of the instrument are summarised in Table 1.

Table 1: Mechanisms, Actuators and Sensors of MIDAS

Mechanism	**Actuator**	**Sensor**
Cover release	Pyro	Microswitch
Shutter	Piezomotor	Microswitches at end stops
Target wheel rotation	Piezomotor	Angular encoder
Lateral translation mechanism	Piezomotor	Linear Variable Differential Transducer
Coarse approach mechanism (with special launch lock position)	DC motor	Linear Variable Differential Transducer, and microswitch to sense locked position
XY scanner	Piezos (2)	Capacitive sensors (2), and voltage monitors
Z scanner	Piezo	Strain gauge, and voltage monitor
Clamping mechanisms for X and Y scanner axis	SMA	Clamp sensors (2)
16 AFM tips (4 of them magnetic)	Excitation piezo	Piezoelectric sensor integrated in each cantilever
Baseplate clamping mechanism	Paraffin actuators (2)	Microswitches (2)

2 Commissioning Objectives and Plan

2.1 Overall Schedule

Commissioning activities for MIDAS took place in three time slots:

- 4-9 April 2004
- 12 May 2004
- 12-14 September 2004

2.2 Overview of Slots 1 and 2

The overall commissioning objectives for MIDAS in the first slot of 4-9 April 2004 were:

- Open cover and release all clamps
- Verify function of each mechanism
- Verify function of each electronics module
- Characterise each AFM sensor in flight environment
- Perform line scans for exploration of target
- Perform image scans
- Characterise the microvibration environment (single point measurement)
- Verify overall instrument performance

In order to achieve these objectives, the operations were divided into the following steps:

- Basic electronics checkout
- Cover opening (pyro)
- Shutter test
- Wheel test
- Frequency scans (resonance search for each of the 16 sensors)
- Unlock XYZ scanner
- Unlock baseplate clamping
- Release approach mechanism
- Exercise approach mechanism
- Linear translation stage test
- Verification of XYZ scanner

After these steps for initialisation of the instrument, the second part of the commissioning activities on 4-9 April 2004 was dedicated to perform a variety of scans, both line scans and image scans, and single-point-measurements. These scans should demonstrate the main functionality of MIDAS, namely to provide microscopic images, and serve to establish the operating parameters for the instrument in orbit.

Each scan involved several steps:

- positioning of wheel
- positioning of linear stage
- selection of sensor
- resonance search (frequency scan) of selected sensor
- coarse approach to target
- fine approach to target
- scan (line or image)
- retraction of sensor
- data transfer

The second slot on 12 May 2004 had the objective to examine calibration facet 1 in more detail.

2.3 Planned Operations for Slots 1 and 2

The planned sequence of operations in slots 1 and 2 is given in Table 2.

Table 2: Planned sequence of operations in slot 1

Procedure	Name	Dura-tion	Night of	Sequence	Exec-ution	# of TC's
MD-FCP-001	Power ON Midas	0.25	Sun 04/04/04	AMDF001A	MTL	5
MD-FCP-002	Switch to Main Program Mode	0.25	Sun 04/04/04	AMDF002A	MTL	4
				AMDF002B	MTL	2
PW-FCP-320	Pyro Firing for MIDAS Cover Pyros	1.00	Sun 04/04/04	APWF320A	MTL	19
				APWF320B	MTL	19
MD-FCP-010	MIDAS Shutter test	0.25	Sun 04/04/04	AMDF010A	Ground	2
MD-FCP-020	MIDAS Wheel movement	0.50	Sun 04/04/04	AMDF020A	Ground	1
MD-FCP-026	MIDAS Frequency Scan	2.00	Sun 04/04/04	AMDF026A	Ground	1
MD-FCP-006	MIDAS Switch ON/OFF Subsystems	0.25	Sun 04/04/04	AMDF006C	Ground	1
CV-FCP-082	MIDAS Unlock XY Stage	1.00	Mon 05/04/04	ACVF082A	Ground	2
				ACVF082B	Ground	2
CV-FCP-083	MIDAS Unlock Baseplate	1.00	Mon 05/04/04	ACVF083A	Ground	2
				ACVF083B	Ground	2
CV-FCP-084	MIDAS Release Approach	0.50	Mon 05/04/04	ACVF084A	Ground	1
MD-FCP-021	MIDAS Approach to maximum position	0.50	Mon 05/04/04	AMDF021A	Ground	1
MD-FCP-022	MIDAS Approach to minimum position	0.50	Mon 05/04/04	AMDF022A	Ground	1
MD-FCP-012	MIDAS linear stage test	0.50	Mon 05/04/04	AMDF012A	Ground	2
MD-FCP-013	MIDAS verification of XYZ Stage	0.50	Mon 05/04/04	AMDF013A	MTL	7
				AMDF013B	Ground	1
MD-FCP-020	MIDAS Wheel movement	0.25	Tue 06/04/04	AMDF020A	Ground	1
MD-FCP-025	MIDAS linear stage to absolute position	0.25	Tue 06/04/04	AMDF025A	Ground	1
MD-FCP-026	MIDAS Frequency Scan	0.25	Tue 06/04/04	AMDF026A	Ground	1
MD-FCP-024	MIDAS fine approach	0.75	Tue 06/04/04	AMDF024A	Ground	1
MD-FCP-023	MIDAS Approach to absolute position		Tue 06/04/04	AMDF023A	Ground	1
MD-FCP-026	MIDAS Frequency Scan		Tue 06/04/04	AMDF026A	Ground	1
MD-FCP-024	MIDAS fine approach		Tue 06/04/04	AMDF024A	Ground	1

Procedure	Name	Dura-tion	Night of	Sequence	Exec-ution	# of TC's
MD-FCP-035	MIDAS Scan set-up and retract		Tue 06/04/04	AMDF035A	Ground	1
MD-FCP-029	MIDAS Line Scan	2.50	Tue 06/04/04	AMDF029A	Ground	1
MD-FCP-022	MIDAS Approach to minimum position	0.25	Tue 06/04/04	AMDF022A	Ground	1
MD-FCP-006	MIDAS Switch ON/OFF Subsystems	0.25	Tue 06/04/04	AMDF006C	Ground	1
MD-FCP-026	MIDAS Frequency Scan	0.25	Wed 07/04/04	AMDF026A	Ground	1
MD-FCP-023	MIDAS Approach to absolute position	0.25	Wed 07/04/04	AMDF023A	Ground	1
MD-FCP-024	MIDAS fine approach	0.50	Wed 07/04/04	AMDF024A	Ground	1
MD-FCP-023	MIDAS Approach to absolute position		Wed 07/04/04	AMDF023A	Ground	1
MD-FCP-026	MIDAS Frequency Scan		Wed 07/04/04	AMDF026A	Ground	1
MD-FCP-024	MIDAS fine approach		Wed 07/04/04	AMDF024A	Ground	1
MD-FCP-035	MIDAS Scan set-up and retract		Wed 07/04/04	AMDF035A	Ground	1
MD-FCP-029	MIDAS Line Scan	1.25	Wed 07/04/04	AMDF029A	Ground	1
MD-FCP-035	MIDAS Scan set-up and retract		Wed 07/04/04	AMDF035A	Ground	1
MD-FCP-028	MIDAS Full Scan	1.75	Wed 07/04/04	AMDF028A	Ground	1
MD-FCP-022	MIDAS Approach to minimum position	0.25	Wed 07/04/04	AMDF022A	Ground	1
MD-FCP-006	MIDAS Switch ON/OFF Subsystems	0.25	Wed 07/04/04	AMDF006C	Ground	1
MD-FCP-026	MIDAS Frequency Scan	0.25	Thu 08/04/04	AMDF026A	Ground	1
MD-FCP-023	MIDAS Approach to absolute position	0.25	Thu 08/04/04	AMDF023A	Ground	1
MD-FCP-024	MIDAS fine approach	0.50	Thu 08/04/04	AMDF024A	Ground	1
MD-FCP-035	MIDAS Scan set-up and retract	0.25	Thu 08/04/04	AMDF035A	Ground	1
MD-FCP-030	MIDAS Cantilever high-resolution scan	2.50	Thu 08/04/04	AMDF030A	Ground	1
				AMDF030B	Ground	1
MD-FCP-035	MIDAS Scan set-up and retract		Thu 08/04/04	AMDF035B	Ground	1
MD-FCP-022	MIDAS Approach to minimum position	0.25	Thu 08/04/04	AMDF022A	Ground	1
MD-FCP-025	MIDAS linear stage to absolute position	0.25	Thu 08/04/04	AMDF025A	Ground	1
MD-FCP-003	MIDAS Switch OFF	0.25	Thu 08/04/04	AMDF003A	MTL	8

2.4 Overview of Slot 3

The overall commissioning objectives for MIDAS in the third slot of 12-14 September 2004 were:

- To use another tip than in slots 1 and 2 (a) in order to verify that the procedure to select different tips is fully understood, (b) to check whether the performance obtained in slots 1 and 2 is repeatable, and (c) to investigate whether the failure to identify a structure on facet number 1 in slots 1 and 2 is related to needle selection.
- To perform a further search for the calibration structure on facet 1.
- To carry out an image scan on a standard target
- To return the instrument into the correct status for the following pointing and interference campaign steps.

3 Achievements

3.1 Schedule and Personnel

Commissioning was performed during 5 passes in the nights of 4-9 April 2004, one pass on 12 May 2004, and two passes from 12-14 September 2004.

The MIDAS Team representatives at ESOC were:

In slot 1:
Klaus Torkar, IWF (days 1-3)
Harald Jeszenszky, IWF
Jens Romstedt, ESTEC
John van der Biezen, ESTEC

In slot 2:
Harald Jeszenszky, IWF

In slot 3:
Harald Jeszenszky, IWF
Klaus Torkar, IWF
Jens Romstedt, ESTEC

3.2 Commissioning Log

The log of the commissioning activities in slots 1 and 2 is given in Table 3 (no entries were made in slot 3).

Table 3: Commissioning Log of Slots 1 and 2

UTC	Description
4 Apr 2004 - 21:01	Getting ready for first pass
4 Apr 2004 - 21:02	TRP of MIDAS: 35 C
4 Apr 2004 - 21:57	starting MD-FCP-001 (power on MIDAS)
4 Apr 2004 - 22:01	LCL ON command has been sent
4 Apr 2004 - 22:03	Kernel hello event
4 Apr 2004 - 22:03	294 mA primary current = nominal
4 Apr 2004 - 22:05	Internal temperatures: baseplate 28C, preamplifier 28C, power converter 32C
4 Apr 2004 - 22:05	procedure MD-FCP-001 successfully completed
4 Apr 2004 - 22:06	DDS data reception started
4 Apr 2004 - 22:11	Temperature housekeeping from powered-off subsystems is not valid. Should be filtered out in display
4 Apr 2004 - 22:17	start procedure MD-FCP-002 (switch to main program mode)
4 Apr 2004 - 22:20	main program hello event received
4 Apr 2004 - 22:27	procedure successfully completed
4 Apr 2004 - 22:29	proc. PW-FCP-320 (pyro firing) start
4 Apr 2004 - 22:38	ready to fire the first pyro
4 Apr 2004 - 22:42	Protection cap has opened!
4 Apr 2004 - 22:57	pyro sequence successfully completed
4 Apr 2004 - 22:57	MD-FCP-010 shutter test procedure start
4 Apr 2004 - 22:59	shutter has opened successfully
4 Apr 2004 - 23:05	shutter successfully closed
4 Apr 2004 - 23:05	Procedure successfully completed
4 Apr 2004 - 23:08	Procedure MD-FCP-020 wheel movement start
4 Apr 2004 - 23:09	first part: move from position 0 to 512
4 Apr 2004 - 23:11	First wheel movement was successful
4 Apr 2004 - 23:19	Duration of first movement: 32 seconds (for 1.5 turns) Second wheel movement (back to position 0) successful (duration 12 seconds for 0.5 turns)
4 Apr 2004 - 23:19	Procedure successfully completed
4 Apr 2004 - 23:26	Preparing frequency scanning tests (Procedure MD-FCP-026) for each of the 16 sensors
4 Apr 2004 - 23:30	test cantilever 1 using excitation 2, gain 2, start frequency 82674 Hz, Fstep 1Hz, FstepHi 0.1Hz
4 Apr 2004 - 23:33	Frequency of maximum = 83706.36Hz amplitude = 4.72V
4 Apr 2004 - 23:36	result for cantilever 1 is consistent with ground calibration
4 Apr 2004 - 23:49	test cantilever 2 using excitation 2, gain 2, start frequency 83253 Hz, Fstep 1Hz, FstepHi 0.1Hz
4 Apr 2004 - 23:50	Frequency of maximum = 84362Hz amplitude = 9.68V
4 Apr 2004 - 23:52	result for cantilever 2 is consistent with ground calibration
4 Apr 2004 - 23:54	tests for cantilever 3-16 will be commanded via MTL
5 Apr 2004 - 0:16	test cantilever 2 using excitation 2, gain 2, start frequency 84139 Hz, Fstep 1Hz, FstepHi 0.1Hz

UTC	Description
5 Apr 2004 - 0:16	Frequency of maximum = 84203Hz amplitude = 5.27V
5 Apr 2004 - 0:18	correction: previous values were for cantilever 3 and excitation 1, gain 1 Test cantilever 4 using excitation 3, gain 4, start frequency 89464 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 0:39	Cantilever 4: Frequency of maximum = 89739Hz amplitude = 9.45V
5 Apr 2004 - 0:42	Test cantilever 5 using excitation 3, gain 4, start frequency 80669 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 0:48	Cantilever 5: Frequency of maximum near 81724 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 0:48	Test cantilever 6 using excitation 3, gain 4, start frequency 81929 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 0:49	Cantilever 6: Frequency of maximum = 83111Hz amplitude = 7.95V
5 Apr 2004 - 0:53	Test cantilever 7 using excitation 5, gain 4, start frequency 83039 Hz, Fstep 4Hz, FstepHi 0.4Hz
5 Apr 2004 - 0:54	Cantilever 7: Frequency of maximum near 88083 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 0:55	Test cantilever 8 using excitation 7, gain 4, start frequency 87757 Hz, Fstep 4Hz, FstepHi 0.4Hz
5 Apr 2004 - 0:58	Cantilever 8: Frequency of maximum near 92949 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 1:01	Test cantilever 9 using excitation 4, gain 4, start frequency 106093 Hz, Fstep 2Hz, FstepHi 0.5Hz
5 Apr 2004 - 1:05	Cantilever 9: Frequency of maximum = 108594Hz amplitude = 4.76V
5 Apr 2004 - 1:07	Test cantilever 10 using excitation 3, gain 3, start frequency 84434 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:13	Cantilever 10: Frequency of maximum near 85458 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 1:13	Test cantilever 11 using excitation 3, gain 3, start frequency 85489 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:14	Cantilever 11: Frequency of maximum near 86515 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 1:15	Test cantilever 12 using excitation 5, gain 4, start frequency 92439 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:18	Cantilever 12: Frequency of maximum = 95128Hz amplitude = 3.56V
5 Apr 2004 - 1:19	Test cantilever 13 using excitation 2, gain 2, start frequency 83663 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:24	Cantilever 13: Frequency of maximum = 84652Hz amplitude = 7.30V
5 Apr 2004 - 1:24	Test cantilever 14 using excitation 2, gain 2, start frequency 83079 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:30	Cantilever 14: Frequency of maximum = 84078Hz amplitude = 6.81V
5 Apr 2004 - 1:30	Test cantilever 15 using excitation 2, gain 1, start frequency 82609 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:33	Cantilever 15: Frequency of maximum = 83595Hz amplitude = 6.83V
5 Apr 2004 - 1:34	Test cantilever 16 using excitation 2, gain 2, start frequency 88304 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 1:38	Cantilever 16: Frequency of maximum = 89308Hz amplitude = 9.42V
5 Apr 2004 - 1:39	This completes the first run through all 16 cantilevers. The frequency scans where amplitude overflows occurred will be repeated with reduced excitation level
5 Apr 2004 - 2:01	Test cantilever 5 using excitation 3, gain 3, start frequency 80669 Hz, Fstep 1Hz, FstepHi 0.1Hz

UTC	Description
5 Apr 2004 - 2:02	Cantilever 5: Frequency of maximum = 81722Hz amplitude = 8.27V
5 Apr 2004 - 2:04	Test cantilever 7 using excitation 5, gain 3, start frequency 83039 Hz, Fstep 4Hz, FstepHi 1Hz
5 Apr 2004 - 2:18	Cantilever 7: Frequency of maximum = 88059 Hz amplitude = 5.06V
5 Apr 2004 - 2:18	Test cantilever 8 using excitation 7, gain 3, start frequency 87757 Hz, Fstep 4Hz, FstepHi 1Hz
5 Apr 2004 - 2:19	Cantilever 8: Frequency of maximum = 93061 Hz amplitude = 7.18V
5 Apr 2004 - 2:19	Test cantilever 10 using excitation 3, gain 2, start frequency 84434 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 2:20	Cantilever 10: Frequency of maximum near 85463 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 2:21	Test cantilever 11 using excitation 3, gain 2, start frequency 85489 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 2:25	Cantilever 11: Frequency of maximum near 86521 Hz amplitude = 10.00V (overflow), needs less excitation
5 Apr 2004 - 2:26	Test cantilever 10 using excitation 2, gain 2, start frequency 84434 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 2:33	Cantilever 10: Frequency of maximum = 85469 Hz amplitude = 7.58V
5 Apr 2004 - 2:33	Test cantilever 11 using excitation 2, gain 2, start frequency 85489 Hz, Fstep 1Hz, FstepHi 0.1Hz
5 Apr 2004 - 2:38	Cantilever 11: Frequency of maximum = 86527 Hz amplitude = 7.06V
5 Apr 2004 - 2:38	Frequency scan tests successfully completed
5 Apr 2004 - 2:40	Temperatures: TRP 45C, baseplate 35C, preamplifier 38C, power converter 47C
5 Apr 2004 - 2:42	Procedure MD-FCP-006 power off subsystems start
5 Apr 2004 - 2:46	Subsystem power switched off
5 Apr 2004 - 2:48	Current returned to standby value (290 mA) Procedure successfully completed
5 Apr 2004 - 2:59	Procedure CV-FCP-082 MIDAS unlock XY stage Sequence ACVF082A for X stage started
5 Apr 2004 - 3:00	Primary current 943 mA
5 Apr 2004 - 3:00	X-lock successfully released
5 Apr 2004 - 3:03	Sequence ACVF082B for Y stage started
5 Apr 2004 - 3:05	Primary current 933 mA
5 Apr 2004 - 3:06	Y-lock successfully released
5 Apr 2004 - 3:07	Unlock XY stage successfully completed
5 Apr 2004 - 3:13	Procedure CV-FCP-083 MIDAS unlock base plate started Sequence ACVF083A release 1 started
5 Apr 2004 - 3:14	Primary current 675 mA
5 Apr 2004 - 3:15	release successful after 1 min 37 sec
5 Apr 2004 - 3:16	Sequence ACVF083B release 2 started
5 Apr 2004 - 3:20	release successful after 1 min 35 sec
5 Apr 2004 - 3:36	Procedure CV-FCP-084 release approach started
5 Apr 2004 - 3:49	Event 42766 occurred. Likely reason: parameter raw value VMDD1162 was -1, correct value is 0. command repeated
5 Apr 2004 - 3:54	LVDT reading and maximum position switch are nominal
5 Apr 2004 - 3:57	"Approach mechanism successfully moved to zero position; procedure successfully completed"
5 Apr 2004 - 4:16	"Procedure MD-FCP-021 approach to maximum position started; target position VMDD1142 changed to -9.8V "

UTC	Description
5 Apr 2004 - 4:24	"Last LVDT reading before reaching maximum position = -9.1V; procedure successfully completed"
5 Apr 2004 - 4:28	Procedure MD-FCP-006, Sequence AMDF006A with parameter PMDD7022 = REL_ON (LVDT power on) started
5 Apr 2004 - 4:31	Max. LVDT position determined with -9.27V Procedure completed
5 Apr 2004 - 4:35	"Procedure MD-FCP-022 approach to minimum position started; target position VMDD1152 changed to 9.5V "
5 Apr 2004 - 4:38	speed of approach (in both directions) is 6mV/s
5 Apr 2004 - 4:42	"Last LVDT reading before reaching minimum position = 5.28V; procedure successfully completed "
5 Apr 2004 - 4:44	Procedure MD-FCP-006, Sequence AMDF006A with parameter PMDD7022 = REL_ON (LVDT power on) started
5 Apr 2004 - 4:46	Min. LVDT position determined with 5.53V Procedure completed
5 Apr 2004 - 4:56	Procedure MD-FCP-006, Sequence AMDF006C to power off all subsystems started and successfully completed
5 Apr 2004 - 4:58	Procedure MD-FCP-012 MIDAS linear stage test started using default parameter values
5 Apr 2004 - 5:06	Timeout event occurred near end of motion (6.49V) - movement needs longer timeout (300 seconds)
5 Apr 2004 - 5:07	Procedure MD-FCP-012 MIDAS linear stage test restarted using VMDD10D2 = 300 sec
5 Apr 2004 - 5:09	Movement successfully completed after 240 sec + 52 sec at LVDT position 9.05V
5 Apr 2004 - 5:17	"MIDAS linear stage commanded to minimum position; movement successfully completed after 295 sec at LVDT position 8.96V "
5 Apr 2004 - 5:18	Linear stage test successfully completed
5 Apr 2004 - 5:19	Procedure MD-FCP-013 MIDAS verification of XYZ stage, sequence AMDF013A started using default parameter values
5 Apr 2004 - 5:54	Amplitude in X lower than expected, amplitude in Y nominal but slightly shifted, amplitude in Z nominal
5 Apr 2004 - 5:57	Procedure MD-FCP-002 started to set housekeeping rates HK1 and HK2 to 120 and 1800 sec, respectively
5 Apr 2004 - 5:58	"End of MIDAS activities for this pass; MIDAS left powered on"
5 Apr 2004 - 22:10	Sequence AMDF002B to increase housekeeping data rates executed
5 Apr 2004 - 22:12	Procedure MD-FCP-006 executed to power 3 subunits
5 Apr 2004 - 22:17	Procedure MD-FCP-004 executed, with parameters to select the 4 reference capacitors of the CSSC stage
5 Apr 2004 - 22:31	Procedure MD-FCP-035 sequence AMDF035B executed to move scanner in X direction
5 Apr 2004 - 22:34	Procedure MD-FCP-006 executed to power off subsystems
5 Apr 2004 - 22:55	Starting preparations for scanning, by: Procedure MD-FCP-020, wheel movement to facet 1 executed
5 Apr 2004 - 22:58	Procedure MD-FCP-025 to move linear stage for scanning with cantilever 12 executed
5 Apr 2004 - 23:10	Procedure MD-FCP-026 frequency scan with cantilever 12 executed
5 Apr 2004 - 23:17	Procedure MD-FCP-024 MIDAS fine approach started
5 Apr 2004 - 23:45	Contact event received
5 Apr 2004 - 23:46	Procedure MD-FCP-023 MIDAS approach to absolute position started
6 Apr 2004 - 0:07	Procedure MD-FCP-006 executed to leave 2 subsystems on (VMDD7062 and VMDD70A2 stay REL_ON)

UTC	Description
6 Apr 2004 - 0:59	Resume preparation of scan activities using sequences modified with respect of handling open/closed loop of scanner
6 Apr 2004 - 1:00	Procedure MD-FCP-026 frequency scan with cantilever 12 started
6 Apr 2004 - 1:06	Frequency scan finished
6 Apr 2004 - 1:14	Procedure for approach in open loop started (MD-FCP-004, AMDF004A, containing 2 TCs ZMD25401)
6 Apr 2004 - 1:44	Surface successfully detected
6 Apr 2004 - 1:47	Approach was successful
6 Apr 2004 - 1:49	MIDAS put into safe position until next pass by procedure MD-FCP-022 approach to minimum position
6 Apr 2004 - 1:53	Procedure MD-FCP-006 started to power off all subsystems
6 Apr 2004 - 1:57	Procedure MD-FCP-002 started to set housekeeping rates HK1 and HK2 to 120 and 1800 sec, respectively
6 Apr 2004 - 2:12	Summary of MIDAS activities on days 1 and 2 The test time available on day 1 was almost twice the planned time so most of the activities planned for days 1 and 2 could be completed on day 1. The tests covered all releases of launch locks and all major subsystems and went very smoothly until the verification of the verification of the XYZ stage (MD-FCP-013). In this test the monitor signal for the X direction of the scanner stage showed an anomaly (signal amplitude too low, some drift). After the pass the data were analysed in detail, and activities on day 2 focused on the verification of the status. The most probable failure case was suspected to be a failure of the harness to the capacitive sensor for the X channel. The tests carried out on day 2 confirmed this assumption. For future operation of the scanner it will be operated in open loop for the X stage. The approach and scan procedures have to be adapted. At the end of day 2 the modified approach procedure was successfully tested (implemented as technical command), and a modification of the database initiated.
6 Apr 2004 - 21:48	Sequence AMDF002B to increase housekeeping data rates executed
6 Apr 2004 - 21:50	Procedure MD-FCP-026 frequency scan with cantilever 12 started
6 Apr 2004 - 21:58	"Preparing several single point measurements in contact mode; Procedure move approach to absolute position"" started"""
6 Apr 2004 - 22:00	Prepare for scanning
6 Apr 2004 - 22:12	MD-FCP-035 is sent a second time
6 Apr 2004 - 22:13	Procedure MD-FCP-024 MIDAS fine approach started
6 Apr 2004 - 22:40	Surface detected at -0.15V (approach LVDT)
6 Apr 2004 - 22:44	Procedure MD-FCP-023, sequence AMDF023A started to retract a short distance
6 Apr 2004 - 22:46	Frequency scan procedure started (frequency scans generally need to be repeated when close to the surface)
6 Apr 2004 - 22:51	Procedure MD-FCP-024 MIDAS fine approach started
6 Apr 2004 - 23:03	Surface detected at same position as earlier
6 Apr 2004 - 23:04	"Procedure MD-FCP-030 single point measurement"" started"""
6 Apr 2004 - 23:10	MD-FCP-035 started, to retract from surface
7 Apr 2004 - 2:25	Starting to repeat single point measurements at different X positions
7 Apr 2004 - 2:29	In the following a high resolution single point measurement in contact mode has been performed and a line scan of a facet was taken
7 Apr 2004 - 2:29	Instrument put in safe mode until the next pass
7 Apr 2004 - 21:33	Hi Klaus! Pass 4 has started with a reset of the housekeeping rate to an increased value
7 Apr 2004 - 21:37	The XY calibration facet on position 2 has been selected

UTC	Description
7 Apr 2004 - 21:47	A frequency scan of the selected cantilever/sensor has been performed
7 Apr 2004 - 22:30	"A switch test"" between open and closed loop operations has been performed successfully"""
7 Apr 2004 - 23:52	Successful approach to the surface in order to prepare a scan in Y direction
8 Apr 2004 - 0:09	Line scan in Y direction in extremely high quality achieved
8 Apr 2004 - 0:13	prepare line scan in Y direction in open loop operation
8 Apr 2004 - 0:43	Line scan in Y direction in open loop operation successfully achieved
8 Apr 2004 - 1:25	Line scan in X direction in open loop operation successfully performed. X piezo shows nominal behaviour
8 Apr 2004 - 2:02	various line scans in X direction performed
8 Apr 2004 - 3:41	in the last 1.5 hours two full scan images with a scan size ~4.5 um successfully performed. Quality is highly satisfying
8 Apr 2004 - 3:42	Instrument put into safe mode for the last pass
8 Apr 2004 - 21:31	Pass 5 starts with the reset of the housekeeping rate
8 Apr 2004 - 21:37	collector wheel moved to calibration facet on position 1
8 Apr 2004 - 21:41	all procedures in preparation in order to perform line scans on facet 1
8 Apr 2004 - 23:41	two line scans on facet 1 has been performed
9 Apr 2004 - 0:35	MIDAS did two line scans in x-direction and a 32x32 point full scan. They found a dirt particle about 3 um wide and 1 um high. However, the facet did not show any structure, which is consistent with pass 3.
9 Apr 2004 - 1:20	KW: Pass debriefing for MIDAS 5th pass (8/9 Apr). RMOC: A. Accomazzo, P. Steele; MIDAS: H. Jeszenszky, J. Romstedt, J. van der Biezen; Project: W. Pinter-Krainer; RSOC: K. Wirth. MIDAS first was surprised by some events, but checking showed that they are nominal. Power converter temperature was at 52 degC, other internal temperatures around 40 degC, both external temperatures around 50 degC, MIDAS needs to define limits. DDS was o.k. Support by RMOC was very good.
12 May 2004 - 12:54	EGSE has been set up. Part one of MIDAS operations is already executing since 11:00z. Waiting for start of pass to get MIDAS TM
12 May 2004 - 13:08	Receiving live data from MIDAS. Part one operations have completed with approach movement to minimum position.
12 May 2004 - 14:12	The line scans taken during part one of the MIDAS operations do not show the expected structure. Continuing with part two.
12 May 2004 - 14:48	Part two has started with an absolute approach movement and a frequency scan. Everything nominal so far.
12 May 2004 - 17:21	Part two completed with the switch-off of MIDAS. All line scans have been performed successfully. Some TM packets are missing due to TM/TC link loss. Expected structure has not been found so far. Further investigation required.

Activities in slot 3, first pass starting at 19:00 on 12 September 2004 were as follows:

- Select tip number 6 (had been tip 12 in slots 1 and 2)
- Select facet 2 (calibration target 2, TGX01, 3 µm pitch squares, 1.1 µm wide)
- Perform 2 line scans with 7.5 µm length, 256 points, step size 8 starting at position (40000,40000)

- Select facet 1 (1-dimensional height standard TGZ02 with stripes, 106 nm high)
- Perform 3 line scans with 112 µm length, 512 points, step size 60 starting at position (30000,30000); the wheel segment positions were 16, 18, 14.

Activities in slot 3, 2nd pass starting at 19:00 on 13 September 2004 were as follows:

- Select facet 32 (wheel segment 512)
- Perform an image scan with 512x128 pixels (7.5 µm x 1.875 µm), step size 4 starting at position (40000,40000). The scan had to be aborted due to time reasons after line 116. The remaining time in the slot was used to:
- Prepare MIDAS for the interference campaign:
- Select facet 1, segment 16
- Select tip 12

The command histories of the activities in slot 3 are given in Tables 4 and 5.

Table 4: Command History from Slot 3, first pass starting 12 September 2004

Name	Description	Sequence	Release Time	Execution Time
ZMD19204	SET_HK1_PERIOD	AMDF002B	04.253.19.11.58	04.256.19.01.46.000
ZMD19205	SET_HK2_PERIOD	AMDF002B	04.253.19.11.58	04.256.19.01.56.000
ZMD240S5	AppToMinPos	AMDF022A	04.253.19.11.58	04.256.19.02.01.000
ZMD211S5	LinToAbsPos	AMDF025A	04.253.19.12.00	04.256.19.04.01.000
ZMD20901	MoveToSegment	AMDF020A	04.253.19.12.00	04.256.19.06.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.00	04.256.19.08.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.02	04.256.19.10.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.02	04.256.19.12.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.03	04.256.19.15.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.04	04.256.19.40.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.05	04.256.19.42.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.05	04.256.19.45.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.07	04.256.20.10.01.000
ZMD21401	Linescan	AMDF029A	04.253.19.12.07	04.256.20.10.11.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.08	04.256.20.35.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.09	04.256.20.37.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.10	04.256.20.40.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.10	04.256.21.05.01.000
ZMD21401	Linescan	AMDF029A	04.253.19.12.12	04.256.21.05.11.000
ZMD240S5	AppToMinPos	AMDF022A	04.253.19.12.12	04.256.21.30.01.000
ZMD20901	MoveToSegment	AMDF020A	04.253.19.12.13	04.256.21.32.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.14	04.256.21.35.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.15	04.256.21.37.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.15	04.256.21.40.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.16	04.256.22.05.01.000
ZMD21401	Linescan	AMDF029A	04.253.19.12.17	04.256.22.05.11.000
ZMD240S5	AppToMinPos	AMDF022A	04.253.19.12.17	04.256.23.00.01.000
ZMD20901	MoveToSegment	AMDF020A	04.253.19.12.19	04.256.23.02.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.19	04.256.23.05.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.20	04.256.23.07.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.21	04.256.23.10.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.21	04.256.23.35.01.000
ZMD21401	Linescan	AMDF029A	04.253.19.12.22	04.256.23.35.11.000
ZMD240S5	AppToMinPos	AMDF022A	04.253.19.12.24	04.257.00.30.01.000
ZMD20901	MoveToSegment	AMDF020A	04.253.19.12.24	04.257.00.32.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.253.19.12.24	04.257.00.35.01.000
ZMD20801	AutoFScan	AMDF026A	04.253.19.12.26	04.257.00.37.01.000
ZMD21301	DoApproach	AMDF024A	04.253.19.12.27	04.257.00.40.01.000
ZMD23002	PrepareForScan	AMDF035A	04.253.19.12.27	04.257.01.05.01.000
ZMD21401	Linescan	AMDF029A	04.253.19.12.29	04.257.01.05.11.000
ZMD20604	RESET_CMD	AMDC002B	04.253.19.12.29	04.257.02.00.01.000
ZMD207S5	ABORT_FUNCTION	AMDC004A	04.253.19.12.30	04.257.02.01.01.000
ZMD240S5	AppToMinPos	AMDF022A	04.253.19.12.30	04.257.02.02.01.000
ZMD21701	PowerOff	AMDF006C	04.253.19.12.31	04.257.02.06.01.000
ZMD19204	SET_HK1_PERIOD	AMDF002B	04.253.19.12.31	04.257.02.07.01.000
ZMD19205	SET_HK2_PERIOD	AMDF002B	04.253.19.12.32	04.257.02.07.11.000

Table 5: Command History from Slot 3, 2nd pass starting 13 September 2004

Name	Description	Sequence	Release Time	Execution Time
ZMD19204	SET_HK1_PERIOD	AMDF002B	04.257.00.55.17	04.257.19.01.46.000
ZMD19205	SET_HK2_PERIOD	AMDF002B	04.257.00.55.18	04.257.19.01.56.000
ZMD240S5	AppToMinPos	AMDF022A	04.257.00.55.19	04.257.19.02.01.000
ZMD211S5	LinToAbsPos	AMDF025A	04.257.00.55.20	04.257.19.04.01.000
ZMD20901	MoveToSegment	AMDF020A	04.257.00.55.20	04.257.19.06.01.000
ZMD23002	PrepareForScan	AMDF035A	04.257.00.55.21	04.257.19.08.01.000
ZMD21304	AppToAbsPos	AMDF023A	04.257.00.55.23	04.257.19.10.01.000
ZMD20801	AutoFScan	AMDF026A	04.257.00.55.23	04.257.19.12.01.000
ZMD21301	DoApproach	AMDF024A	04.257.00.55.23	04.257.19.15.01.000
ZMD207S5	ABORT_FUNCTION		04.257.19.16.25	04.257.19.20.38.260
ZMD240S5	AppToMinPos		04.257.19.28.50	04.257.19.33.02.255
ZMD20901	MoveToSegment		04.257.19.28.50	04.257.19.33.03.255
ZMD21304	AppToAbsPos		04.257.19.28.51	04.257.19.33.03.255
ZMD21301	DoApproach		04.257.19.28.52	04.257.19.33.04.255
ZMD21304	AppToAbsPos	AMDF023A	04.257.00.55.25	04.257.19.40.01.000
ZMD20801	AutoFScan	AMDF026A	04.257.00.55.25	04.257.19.42.01.000
ZMD21301	DoApproach	AMDF024A	04.257.00.55.26	04.257.19.45.01.000
ZMD214S5	FullScan	AMDF028A	04.257.00.55.27	04.257.20.10.01.000
ZMD207S5	ABORT_FUNCTION		04.258.01.45.05	04.258.01.49.17.123
ZMD21701	PowerOff		04.258.01.45.05	04.258.01.49.17.123
ZMD240S5	AppToMinPos		04.258.01.45.06	04.258.01.49.18.123
ZMD211S5	LinToAbsPos		04.258.01.45.07	04.258.01.49.20.123
ZMD20901	MoveToSegment		04.258.01.45.07	04.258.01.49.20.123
ZMD20604	RESET_CMD	AMDC002B	04.257.00.55.28	04.258.02.00.01.000
ZMD207S5	ABORT_FUNCTION	AMDC004A	04.257.00.55.28	04.258.02.01.01.000
ZMD240S5	AppToMinPos	AMDF022A	04.257.00.55.29	04.258.02.02.01.000
ZMD20604	RESET_CMD	AMDF003A	04.257.00.55.30	04.258.02.06.01.000
ZMD207S5	ABORT_FUNCTION	AMDF003A	04.257.00.55.31	04.258.02.06.11.000
ZMD21701	PowerOff	AMDF003A	04.257.00.55.32	04.258.02.06.21.000
ZMD20610	TC_ECHO_DISABLE	AMDF003A	04.257.00.55.32	04.258.02.06.26.000
ZPWMA020	MIDAS PS 1, PL-LCL 06A OFF-A	AMDF003A	04.257.00.55.32	04.258.02.06.36.000
ZDMX0054	Enable/Disable TM polling from MIDAS	AMDF003A	04.257.00.55.34	04.258.02.06.41.000
ZDMX0230	Stop Time Update to MIDAS	AMDF003A	04.257.00.55.35	04.258.02.06.46.000
ZDMX0065	Enable/Disable TC sending to MIDAS	AMDF003A	04.257.00.55.35	04.258.02.06.51.000

3.3 Mechanisms

The summary results of the commissioning of all mechanisms is given in Table 6.

Table 6: Summary results of mechanism commissioning

Mechanism	**Actuator**	**Result**
Cover release	Pyro	Microswitch acted nominally after first pyro firing
Shutter	Piezomotor	Microswitches at end stops acted; events were generated correctly
Target wheel rotation	Piezomotor	Angular encoder showed correct results; events were generated correctly
Frequency scan of 16 AFM tips	Excitation piezo	Resonance curves of each cantilever were taken and showed very minor deviations from the ground calibration. As the resonance curves are very sharp, the amplitude is extremely sensitive on the excitation level, which had to be adjusted occasionally in order to achieve amplitudes within the measurement range of the electronics.
Clamping mechanisms for X and Y scanner axis	SMA	Clamp sensor triggered nominally
Baseplate clamping mechanism	Paraffin actuators (2)	Microswitches triggered nominally after 1'37" and 1'35", respectively
Coarse approach mechanism (with special launch lock position)	DC motor	LVDT reading and maximum position switch were nominal
Lateral translation mechanism	Piezomotor	Linear Variable Differential Transducer reading was nominal; translation time was close to 300 s (nominal);
XY scanner	Piezos (2)	Capacitive sensor for X direction showed strange values (see problems), Y sensor was nominal, X and Y voltage monitors were nominal
Z scanner	Piezo	Both strain gauge and voltage

		monitor showed nominal readings

3.4 Electronics

Housekeeping values (voltages, internal temperatures, switch positions, software flags) were all nominal

Telecommands were received and executed correctly, telemetry was generated correctly.

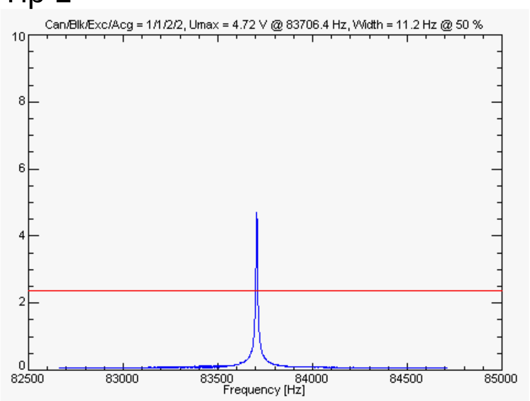
Two events generated routinely by MIDAS could not be handled by the ground data system due to minor errors in the RSDB (subtype mismatch).

There was an incorrect signal received in the channel of the X capacitive sensor of the scanner stage (see problems).

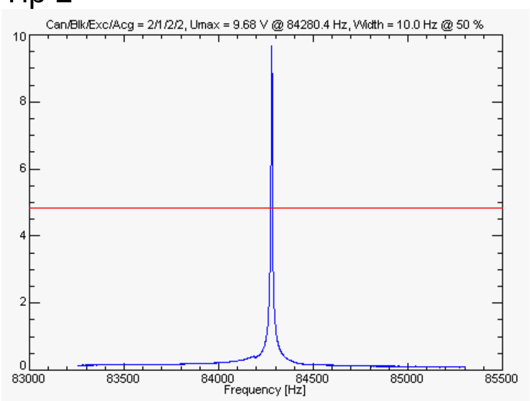
3.5 Frequency Scans

The resonance curves obtained for each of the 16 cantilever showed no deviation from the calibration measurements made in vacuum chamber apart from minor and expected shifts of the resonance frequency due to temperature.

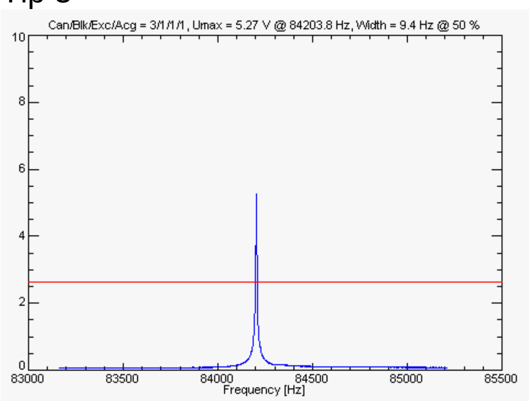
Tip 1



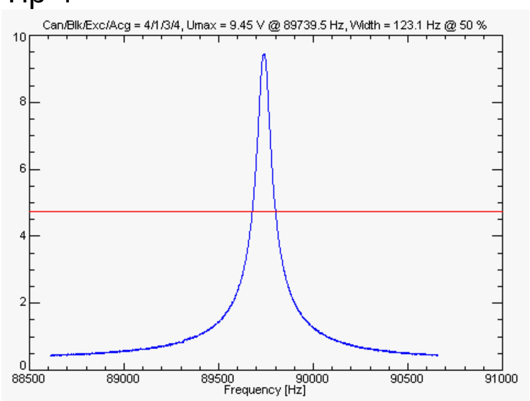
Tip 2



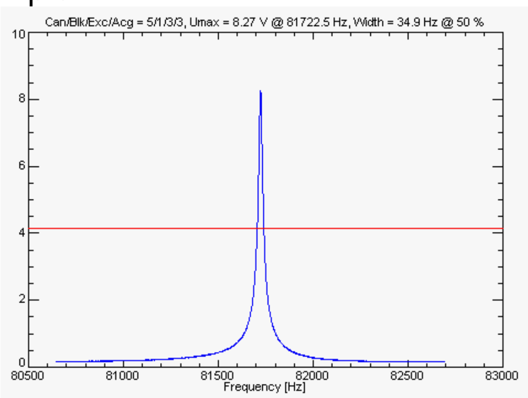
Tip 3



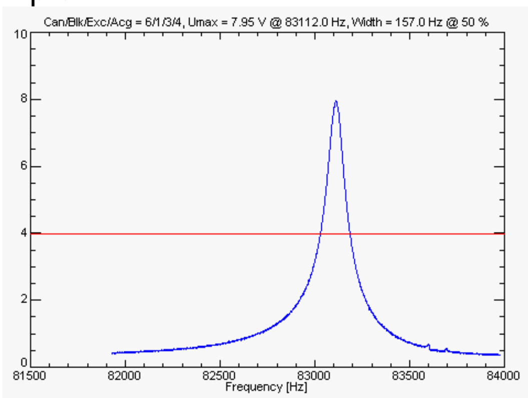
Tip 4



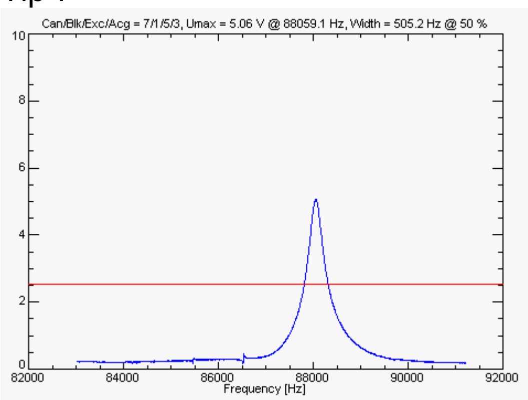
Tip 5



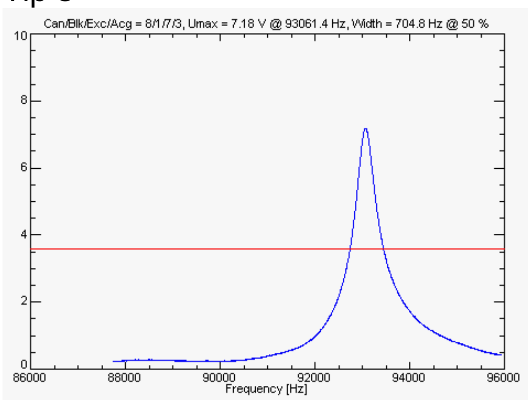
Tip 6



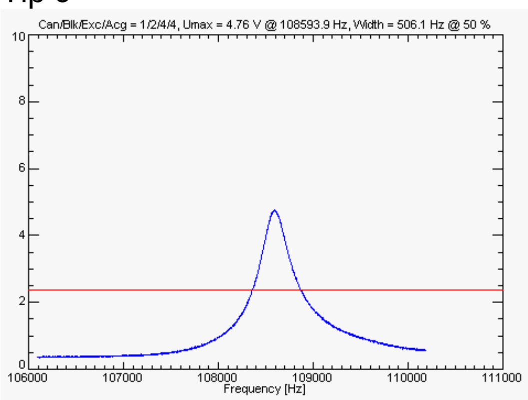
Tip 7



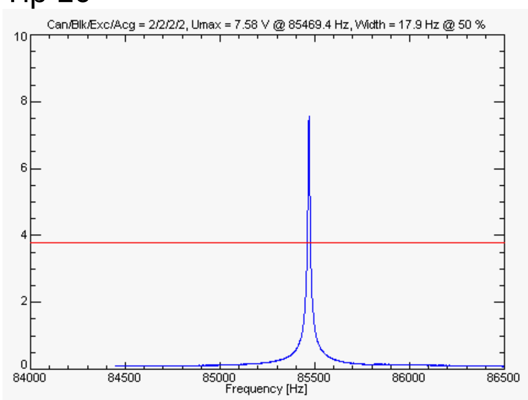
Tip 8



Tip 9



Tip 10



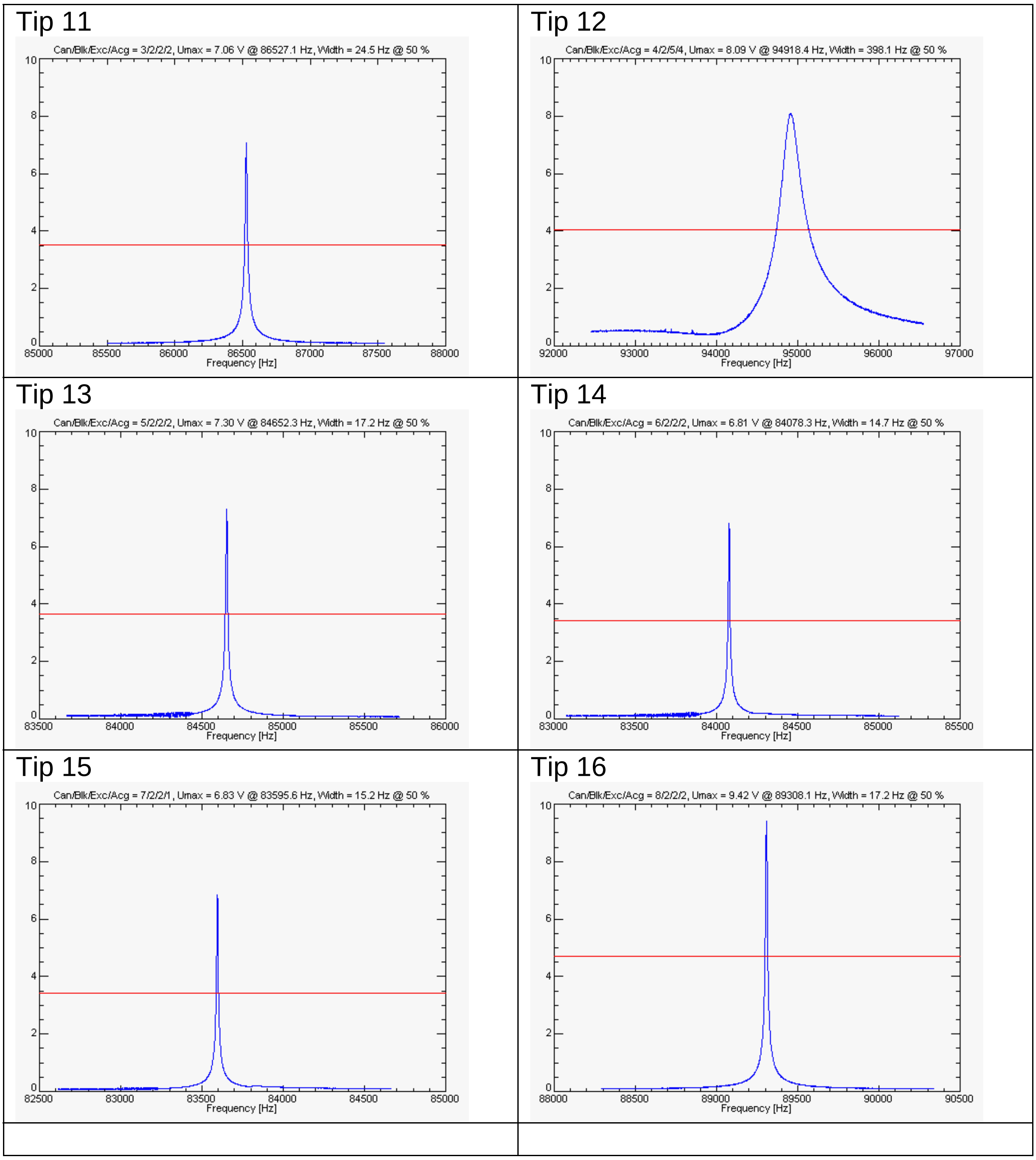


Figure 1: Frequency scan results

3.6 Line Scans

Line scans of calibration targets were performed.

The first line scan on calibration facet number 1, the 1-dimensional height standard TGZ02, did not show the expected pattern of the target (stripes, 106 nm high), but rather a flat surface. This anomaly was investigated further in slots 2 and 3.

Line scans of calibration target 2, TGX01, 3 µm pitch squares, 1.1 µm wide; serving as XY - standard correctly showed the cross-section of the 1.1 µm-size cubes in 3 µm-spacing. Figure 2 shows one typical example of the data obtained.

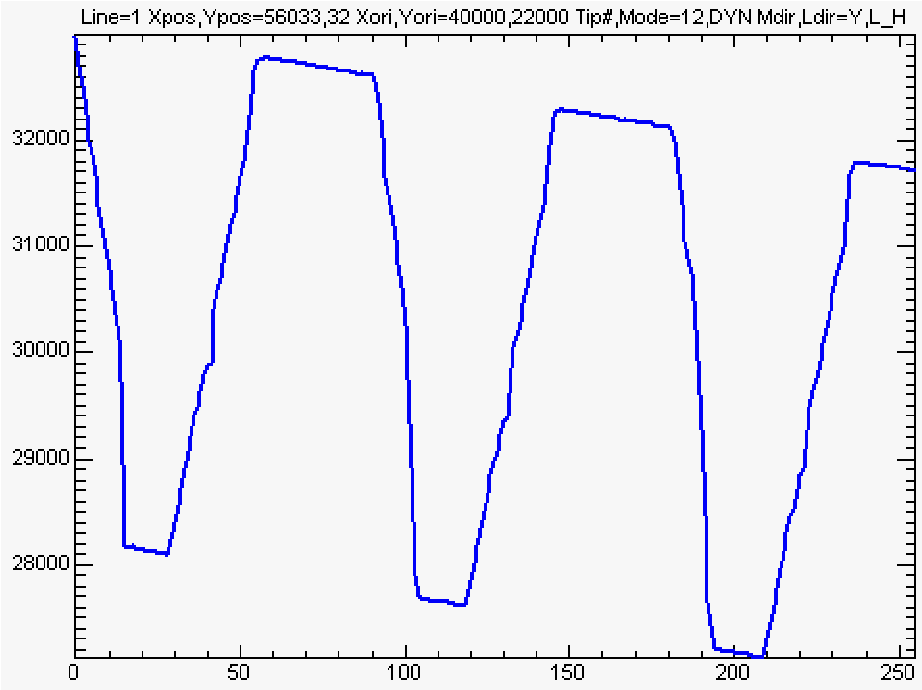


Fig. 2. Line scan of calibration surface TGX01 (raw data); parameters: open loop mode, wheel position 32, origin coordinates (40000,22000), tip 12, dynamic mode, main scan direction in Y.

3.7 Single Point Measurements

Single point measurements served to characterise the noise environment. The tip was brought into contact with the surface for about 1 minute without horizontal scanning. The displacement is registered at ~700 Hz resolution.

Figure 3 shows the Frequency spectra of the DC signal derived from the cantilever bridge at equidistant times during the one-minute single point measurements. It is worth noting that the highest amplitudes occur in the 0.4 nm range at a resonance near 200 Hz.

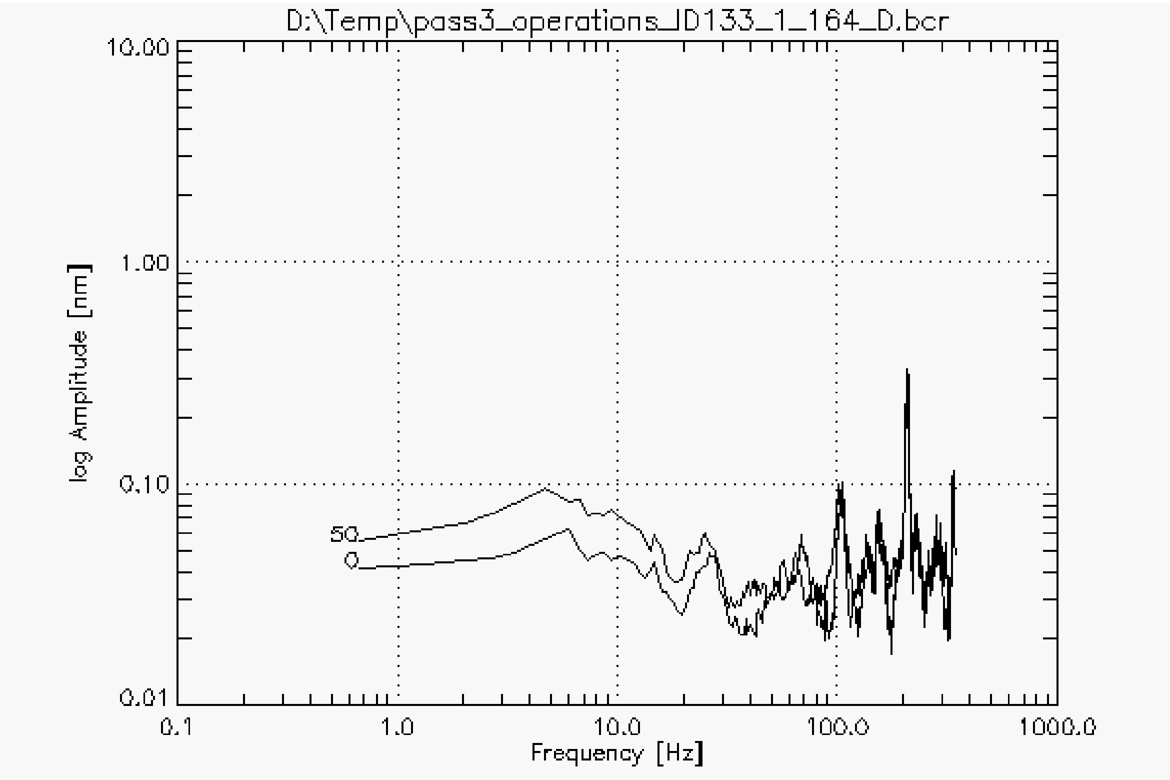


Fig. 3. Frequency spectra of the DC signal derived from the cantilever bridge at equidistant times during the one-minute single point measurements.

3.8 Image Scans

Several image scans at 32x32 pixel resolution were made in slot 1. The restriction to 32x32 pixels was due to the time limitation during commissioning. Scans were performed with X or Y as main scan direction, using the "open loop" mode for scanning in X and Y, and "closed loop" mode for Z.

Result is highly satisfying. The reproducibility of the dimensions is better than a few nm for a total feature size of ~900 nm. The ground calibration of the XYZ scanner was confirmed by the measurement of the in-flight calibration target (facet 2).

There was no visible noise in the images (neither mechanical noise due to microvibrations nor noise from sensor electronics), indicating the absence of measurable microvibrations.

Figure 4 shows an example of the raw data obtained, while Figures 5 and 6 show perspective views of data obtained with the main scanning direction in X and Y, respectively.

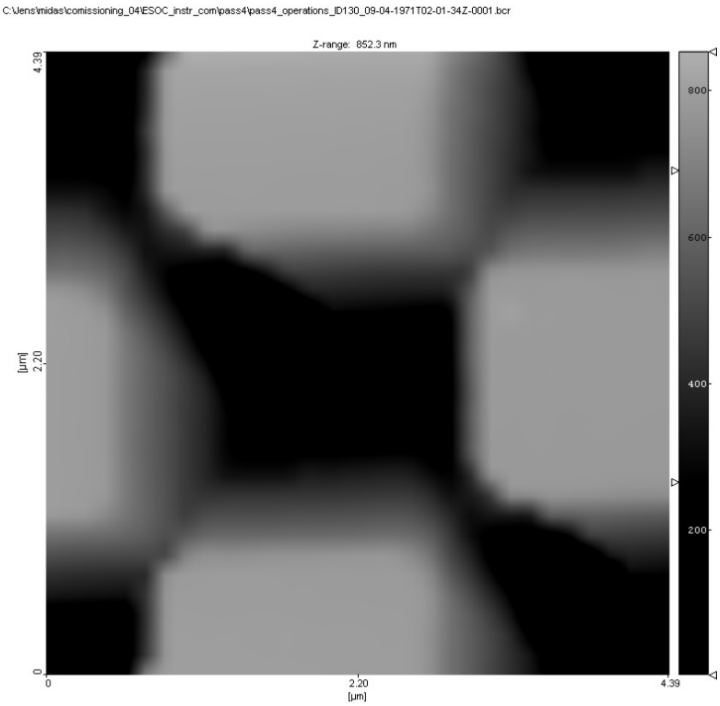


Fig. 4. Raw data image of calibration target with main scanning direction in X.

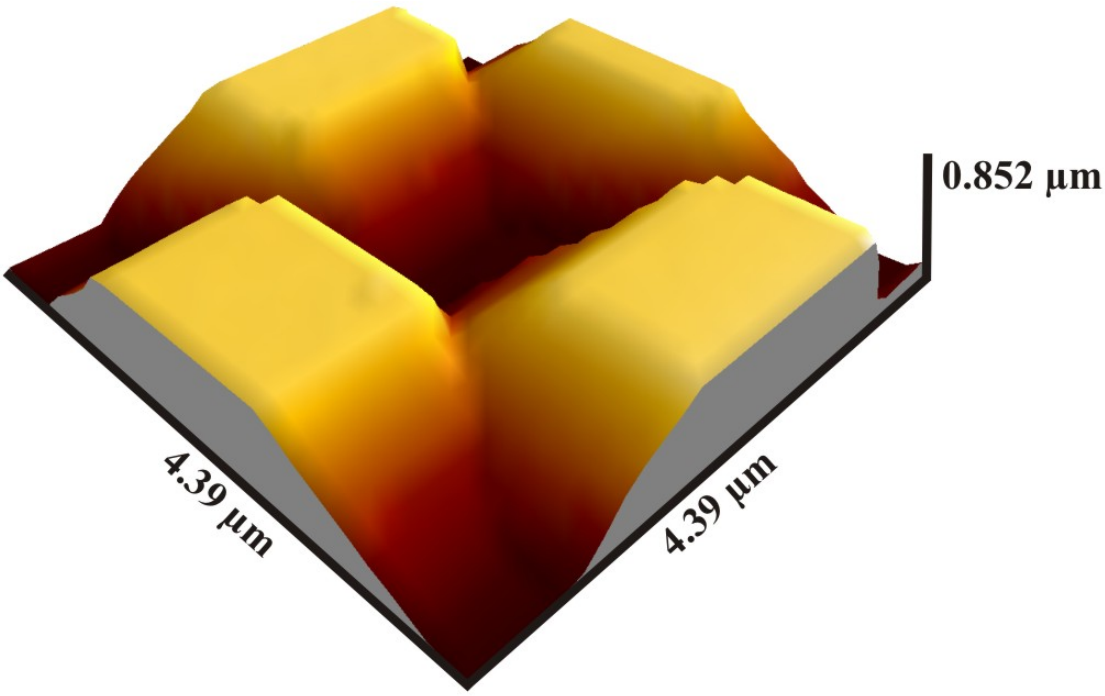


Fig. 5. Image of calibration target with main scanning direction in X.

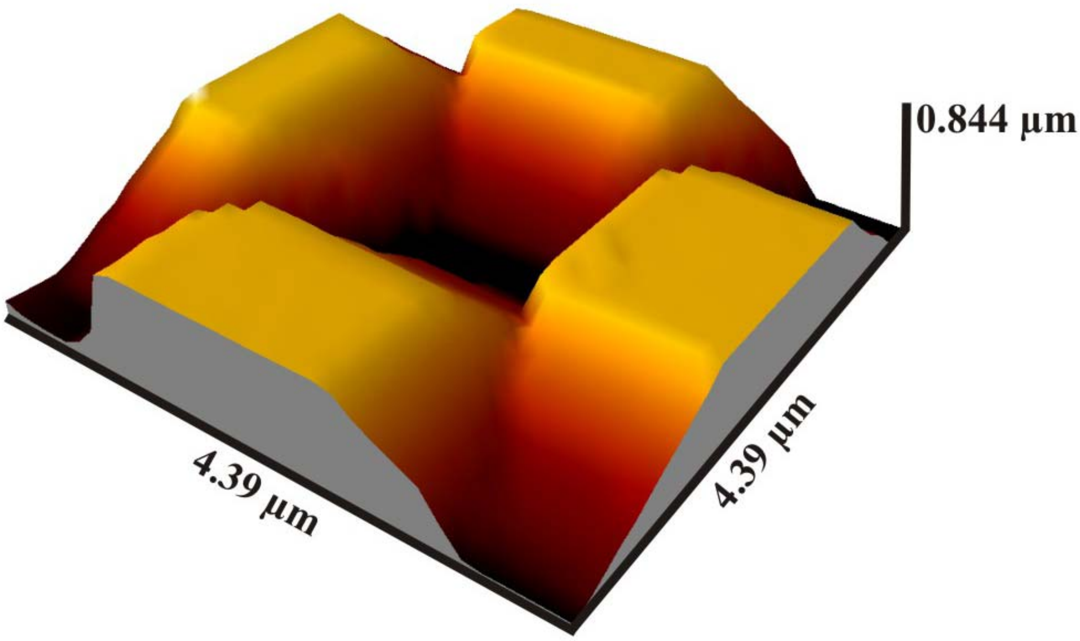


Fig. 6. Image of calibration target with main scanning direction in Y.

In slot 3, an image scan with 512 x 116 pixels was made on facet 32 (Fig. 7). The result was highly satisfying: Some smooth structures of about 8 nm height were seen. They clearly show some features of the coating material of the target. At the same time, it demonstrates that MIDAS is capable to resolve such small structures at very high quality.

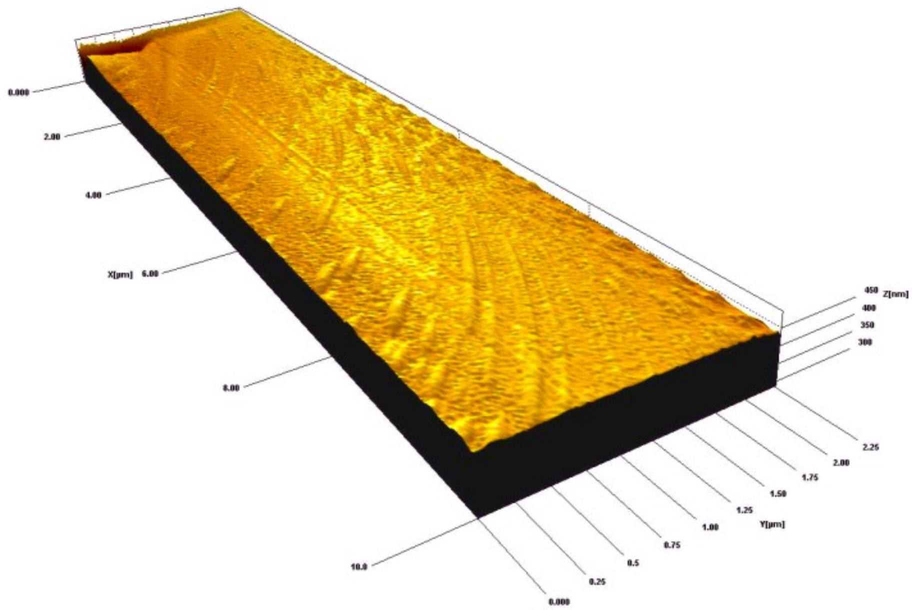


Fig. 7. Image of facet 32, 512 x 116 pixels (7.5 µm x 1.7 µm), step size 4 starting at position (40000,40000). tip 6, dynamic mode.

3.9 Further Line Scans on Calibration Facet 1 in Slot 2

The absence of the expected calibration grid structure in the line scans of facet 1 in slot 1 has been investigated further on 12 May 2004 in a delta commissioning activity (slot 2) when other positions of this facet have been scanned with 256 pixels per line, 30 nm per pixel.

Y-position = 15, X-position = 40000
Y-position = 16, X-position = 34000, 36000, ... 54000 (11 scans)

The data showed no consistent picture. No structure can be identified in some line scans, whereas some scans show an irregular structure.

3.10 Further Line Scans on Calibration Facet 1 in Slot 3

Three long linescans (112 µm) were performed on the calibration facet 1 in commissioning slot 3. The X-scanner range was set between 30000 and 60660 units. The goal was to find the grid structure, which was indeed finally found in the last part of the X-range (see Fig. 8).

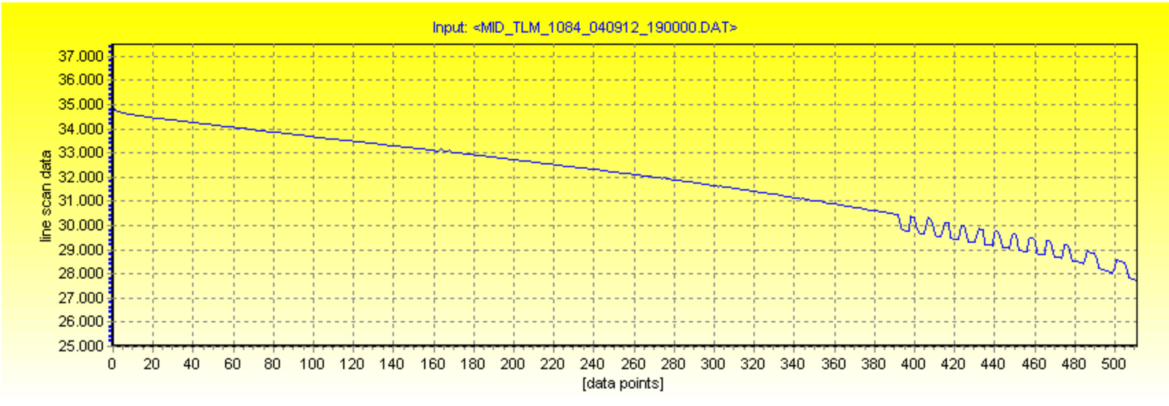


Fig. 8. Line scan of calibration surface TGZ02 (raw data); parameters: open loop mode, wheel position 32, origin coordinates (30000,30000), 512 points, step size 60, tip 6, dynamic mode.

This result proves that the scanner performs as expected. The reason for the initial failure to find the grid was obviously due to a small misalignment of the wheel position relative to the scanner unit, probably introduced during the refurbishment activities in summer 2001, when the launch-locks of several mechanisms did not allow an end-to-end verification measurement of the alignment.

This result also demonstrates that the in-flight calibration of the Z-axis is possible.

4 Problems

4.1 RSDB

A few minor errors in the RSDB were detected in the course of the commissioning, which have already been located, and a correction has been initiated.

4.2 Capacitive sensor in X direction

The displacement of the scanner in X and Y direction is known from capacitive sensors and can be inferred from the voltages applied to the piezo actuator, using the calibration to laser distance measurements obtained on the ground and in-flight calibration via the structures on the three calibration targets.

During commissioning the monitor signal for the X direction of the scanner stage showed an anomaly: The signal amplitude was significantly too low, and showed some drift.

A malfunction of the scanner can be excluded as the image and line scans could be performed successfully. The remaining failure reason is a malfunction of the capacitive sensor. The in-flight calibration routine of the capacitive sensor was executed and showed that the capacities of the reference capacitors mounted on the electronics board was measured correctly. These signatures lead to the conclusion that the most likely failure is a bad contact either in the capacitive sensor or in the harness to the electronics board of the capacitive sensor.

The work-around for this problem is to operate the scanner stage in "open loop", i.e. to set the voltages of the piezos without immediate feedback from the capacitive sensor. Knowledge of the position is nevertheless ensured by using the calibration possibilities mentioned above. The onboard software has the necessary operational modes already implemented, as the open loop mode was one of the originally foreseen modes. The operational procedures for scanning and the database had to be adapted. The successful scans during the commissioning demonstrated the correct implementation of these changes.

4.3 Calibration Facet 1 (TGZ02)

During the line scan of calibration facet 1 (height standard with 106 nm stripes) no structure could be seen. The scans were made in X direction, using the coordinates (40000,40000) as starting position (total range is from 28000 to 65535), with 256 steps of 8 units (total width ~7.5 µm).

This strange observation has been investigated further on 12 May 2004 in a delta commissioning activity when other positions of this facet have been scanned, but still without conclusion. Only in slot 3 in September 2004 it was possible to find the structure at some offset in X-direction, which is probably due to a small misalignment between the wheel and the scanner position. As a result of the measurements, the correct X-position can be calculated and taken into account in all further operations.

5 Conclusion

The commissioning of MIDAS was successful.

The instrument is fully operational.

The noise environment which is relevant for image quality is more benign than expected.

The image resolution exceeds scientific requirements to resolve microtexture of dust grains, as it matches or exceeds the requirements stated in the original proposal.

The problems encountered with the X capacitive sensor do not affect the scientific performance.

7. MIRO

FINAL MISSION COMMISSIONING REPORT FOR MIRO

SAMUEL GULKIS
JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY

NOVEMBER 11, 2004

1. Brief instrument description and summary of scientific objectives

INSTRUMENT DESCRIPTION: The MIRO instrument consists of two heterodyne radiometers, one operating at millimeter wavelengths (190 GHz, ~1.6 mm) and one operating at submillimeter wavelengths (562 GHz, ~0.5 mm). Both are fixed frequency tuned. Light enters the MIRO instrument through an offset parabolic primary mirror of 30 cm diameter and focal length of 32 cm. The accuracy of the primary surface is 10 μ RMS corresponding to less than $\lambda/50$ at 0.535 mm. The millimeter and submillimeter radiometers are both configured with broadband continuum detectors for the determination of the brightness temperature of the comet nucleus and the target asteroids. The submillimeter receiver is also configured as a very high-resolution spectrometer for observations of eight molecular transitions in the comet coma.

The MIRO instrument is comprised of four separate physical modules, interconnected with a wiring harness cable. The Sensor Unit includes the telescope, baseplate, and optical bench. The Sensor Unit is physically mounted on the spacecraft payload plane using the baseplate as the interface with the spacecraft. The MIRO telescope bore sight direction is aligned to the ROSETTA payload line of sight (+Z axis). The optical bench is mounted to the underside of the baseplate, under the telescope and inside the spacecraft. The millimeter- and submillimeter-wave receiver front ends, the calibration mechanism, and the quasi-optics for coupling the telescope to the receivers are mounted on the optical bench. A Sensor Backend Electronics Unit contains the intermediate frequency processor (IFP), the phase lock loop, and frequency sources. It is mounted next to a louvered radiator internal to the spacecraft. The Electronics Unit contains the Chirp Transform Spectrometer (CTS), the instrument computer, and the power conditioning circuits. The Ultra Stable Oscillator Unit is a self contained thermally controlled oscillator.

The flight computer for MIRO is a radiation hardened Reduced Instruction Set Computer (RISC) System/6000 (also referred to as RS/6000). The same model computer was used on the Mars Pathfinder and Mars Surveyor Projects. The design of this computer is based on the Rios Single Chip (RSC) RISC microprocessor with implementation of the VME bus and RS232 interfaces and it provides up to 128 Mbytes of local memory (RAM). The processor is a single chip implementation of the IBM Model 220 workstation and it is considered to be in the POWER PC architecture family.

Radiometric calibration of the MIRO instrument is obtained by observing two blackbody targets, each maintained at a different temperature. One target, the cold target, is exposed to space, while the other target is mounted inside the spacecraft at a nominal temperature of 300 K. The temperature difference between the targets will be maintained by a controllable heater on the warmer target large enough to permit accurate calibration of the receivers in a few minutes of integration time. Thermistor sensors provide accurate measurements of the calibration targets. A mechanical calibration switch positions the beam to observe the telescope, the cold target, or the hot target. This beam switch is the only moving mechanical part of the system. Typically, the continuum radiometer is switched to the calibration targets every 30 minutes to account for gain fluctuations.

SCIENCE OBJECTIVES SUMMARY: The science objectives of the MIRO investigation are to:

A. Characterise the abundances of major volatile species and key isotope ratios in the nucleus ices.

The MIRO instrument will measure absolute abundances of key volatile species— H_2O, CO, CH_3OH, and NH_3—and quantify fundamental isotope ratios—$^{17}O/^{16}O$ and $^{18}O/^{16}O$ —in a region within several km or less from the surface of the nucleus, nearly independent of orbiter to nucleus distance.

B. Study the processes controlling outgassing in the surface layer of the nucleus.

The MIRO experiment will measure surface outgassing rates for H^2O, CO, and other volatile species, as well as nucleus subsurface temperatures to study key processes controlling the outgassing of the comet nucleus.

C. Study the processes controlling the development of the inner coma.

MIRO will measure density, temperature, and kinematic velocity in the transition region close to the surface of the nucleus.

D. Globally characterise the nucleus subsurface to depths of a few centimeters or more.

The MIRO instrument will map the nucleus and determine the subsurface temperature distribution to depths of a centimeter or more, depending on the absorption properties of the nucleus. Morphological features on scales as small as 5 m will be identified and correlated with regions of outgassing. The asteroid surface and near surface temperatures will be measured.

E. Search for low levels of gas in the asteroid environment.

The MIRO instrument will search for low levels of gas in the vicinity of two asteroids Temperature measurements will be used to infer near surface thermal characteristics and the presence or absence of a regolith.

2. Experiment status at end of commissioning period

The MIRO instrument is fully operational at the end of the commissioning phase. A full functional test of MIRO was run twice during commissioning. The instrument responded correctly to all commands issued. The optics performance was confirmed by observing the Earth and Venus in continuum modes in both the mm and smm bands. Point source response functions were determined in both bands. Both heterodyne mixers are functioning properly. The calibration system is operating correctly. The phase lock loop and spectrometer are both functioning properly. This was checked by observing water in earth's atmosphere and water in Comet Linear.

The MIRO team has transferred data from the DDS to JPL and successfully decoded both engineering and science data.

3. Performance verification matrix (key parameters)

Parameter	Proposed	Before Launch	In-Orbit
mm beam width	25 arcmin	24.7 arcmin	23.8±1.2 arcmin
smm beam width	10 arcmin	7.6 arcmin	7.5±0.25 arcmin
Sensitivity (mm continuum)	1 K in 1 sec	≅ .1 K in 1sec	.1 K in 1 sec
Sensitivity (smm continuum)	1 K in 1 sec	≅ .2 K in 1sec	.3 K in 1 sec
Sensitivity (smm spectroscopic)	2 K in 2 min (300 KHz (dsb)	< 1.25 K in 2 min (300 KHz dsb)	< 1 K in 2 min (300 KHz dsb)
Spectral Resolution	50 kHz(.027km/s)	44 KHz(.023km/s)	Not measured

4. Problem areas and anomaly reports

A. **CTS Anomaly** - The MIRO instrument experienced two anomalies on DOY 92 - 2004. The events occurred at 15.07.21.835 and 20.20.24.481. A description of the problem is contained in the attached report to Paolo Ferri and Mark Sweeney. Briefly, the instrument detected a "busy line" signal in the CTS spectrometer indicating that an error had occurred. The MIRO software autonomously changed to [Engineering] mode after the events occurred. It was determined that the instrument could be recommended into the CTS mode.

   During the course of trouble shooting this anomaly, it was discovered that two parameters in the RSDB, both related to the CTS, were reversed. One parameter controlled the rate of heating the CTS, the second was a temperature setting. These parameters were changed in the RSDB and confirmed in the flight data.

   Following the changes in RSDB, no further anomalies were detected with the "Busy line". Unfortunately, we have not been able to confirm that a reversal of the two parameters could have caused the problem.

B. **Non-Time Sequential Data Packets** – The MIRO team received an e-mail from Paolo Ferri on 22 Sept 2004 (attached) indicating that the project had found non-time sequential data packets in the MIRO data. Non-time sequential packets create a problem when the SSMM is being searched by time interval. The MIRO team confirmed that MIRO was designed to have non-time sequential data packets. The non-time sequential packets are produced by the MIRO software as a result of the fact that the instrument produces several different kinds of data (spectroscopic and continuum) simultaneously but it is packetized separately, keeping the same type of data together in any single packet. Discussions are underway to decide what to do about this circumstance.

C. **EEPROM Memory Dump**: The original FCP 100 memory dump did not check all of the memory. A new FCP (FCP101) was written and tested. The new FCP requests each packet separately. It was cumbersome to write but it works well. Since it is only infrequently used, we think it should be kept in place.

D. **Execution failure report**: A MIRO packet was received by ESOC that could not be decoded. This problem was traced to an omission in the RSDB. A sub-type NAC 1,8 needs to be added to the RSDB. This has not been completed at this time.

E. **Interference**: MIRO observed 4 types of interference during commissioning. The interference was intermittent. At some of the interference occurred before we began the interference campaign, thereby indicating that it was not caused by other instruments. The whole study of interference is open at this time.

5. Conclusions and lessons learned

Conclusions are that MIRO is functioning well, with the exception of the intermittent interference. The interference does not jeopardize the experiment at its current level of activity. Instrument performance in flight is as good as or better than pre-ship measurements. MIRO meets or exceeds NASA Level 1.

There are several items that need follow up. These include updating the RSDB, identifying the interference and searching for cause, and agreeing on an action to close out the non-time sequential packets.

Regarding lessons learned, most of operations were smooth and communications between the project and team were very good. The one item that I could have used on a number of occasions was a good log describing exactly what was going on with the instruments and s/c and any time.

6. Recommendations for Comet Science operation (interaction with other experiments, spacecraft operation)

My (short list) recommendations for Comet Science operations:

1. Plan early and with lots of detail- then review the plans
2. Have the full Science Working Team involved in the plans and the review process
3. Make all the planning tools available to the instrument teams at their home institutions.
4. Provide nominal model trajectories and physical models to the teams
5. Assign a single point contact from the project for critical items
6. Provide an online master calendar for the science teams. This contain at minimum critical maneuvers, and deliverables.

ATTACHMENTS

ITEM 1: CTS ANOMALY REPORT

To: Paolo.Ferri@esa.int, Mark.Sweeney@esa.int
From: Samuel Gulkis <Samuel.Gulkis@jpl.nasa.gov>
Subject: MIRO failure description
Cc: Claude.Berner@esa.int, Claudia Alexander <Claudia.Alexander@jpl.nasa.gov>, Margaret Frerking <Margaret.A.Frerking@jpl.nasa.gov>, Cynthia.L.Kahn@jpl.nasa.gov, paul@chirp.mpae.gwdg.de, Timothy Koch <Timothy.C.Koch@jpl.nasa.gov>
Bcc: Samuel.Gulkis@jpl.nasa.gov
X-Attachments:

The two events occurred after a calibration sequence was just finished.
The MIRO instrument experienced two anomalies on DOY 92 -2004. The events occurred at 15.07.21.835 and 20.20.24.481. The instrument was in the [CTS/Dual Continuum] mode when the failures occurred. Both were identified with Event ID 43009 - CTS Error. The error messages indicated that the problem was related to the timing of the CTS (Chirp Transform Spectrometer). The identified event is associated with a CTS 'busy' line. A signal called 'busy' is generated by the CTS while it is performing its scan. In case of an internal error in the CTS, the 'busy' line remains high after the CTS scan is completed and is the triggering event indicating that an error has occurred. The MIRO software autonomously changed to [Engineering] mode after the events occurred. Following the first event the instrument, following a pre-loaded sequence to the spacecraft, was recommanded into [CTS /Dual Continuum] mode.

We notified Peg Frerking and Cindy Kahn at JPL, and Paul Hartogh/Christopher Jarchow at MPI. Paul, Cindy, and Peg all remembered that the problem had occurred once before when the temperature of the CTS got too high. Paul and Christopher thought that too high meant > 50C, however we think the temperature was more like 40 C when it was safe-mode switched to [Engineering] mode.

In the course of trouble shooting the problem, Cindy Kahn discovered an error in the RSDB. We also noted that the two events occurred after a calibration sequence was just finished. We don't know if either of these is related to the problem. The RSDB error should be corrected (if indeed it is in error) whether or not it is related.

The command telemetry to turn the instrument on again was already in place when we discovered the problem. This telemetry would have turned the instrument back on in its failure mode. In consultation with JPL (Cindy,Peg,Robert), we made the decision to ask ESOC to alter their telemetry in the following way. 1) Delete the four mode changes to [Dual continuum/CTS]; 2) replace the deletions with a mode change command to [Dual continuum]. This change leaves the power off on the CTS and gives us time to trouble shoot the problem. The project accepted the request.

The MIRO commissioning program does not require the CTS until April 23. The hardware teams at JPL and MPI have been alerted. I've notified Claude Berner and Claudia Alexander.

ITEM 2: COMMISSIONING REPORT FOR April 23-24, 2004

JPL

JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

11/12/2004

TO: M. Sweeney, P. Ferri, D.Kochiny,
FROM: S. Gulkis, T. Koch, M. Frerking
SUBJECT:MIRO Commissioning Report for April 23 and April 24, 2004.

In attendance at ESOC:
Nicolas Biver, Sam Gulkis, Paul Hartogh, Tim Koch
In attendance at JPL:
Charlie Backus, Peg Frerking, Mark Hofstadter, Mike Janssen, Lucas Kamp,Robert Nowicki,

Objectives of test:

1. Verify pointing using spirals on Earth
2. Verify end-to-end spectral capability by measuring Earth's water line.

Our technical objectives are:
1. Verify that CTS Warmup and Heater Control command parameters are in correct order - examine engineering data
2. Try to repeat CTS busy line high error - integrate for a long time in CTS/Dual continuum - examine error packet (5,3)
3. Try to repeat timing change - integrate for a long time in CTS/Dual Continuum - examine differences between continuum, engineering, and CTS packet time stamps
4. Verify that the timing change resets on power cycling - power on and off
5. Determine if timing change occurs in Dual continuum mode when CTS is off - go to dual continuum mode before power cycling.

Overall Description of observations:
Observations began on DOY 114 at approximately 03:30 UTC. The observations were carried out in four phases.
Phase 1 - After initialization, the instrument was commanded into CTS/Dual Continuum mode. The z axis of the spacecraft was pointing to the "blank" sky position RA= 03hrs04sec37min, Dec = -80 deg 09'29". The instrument remained in this mode until ~18:30 at which time the spacecraft was slewed into an earth stare position.

Phase 2 – This phase was an earth staring mode to measure the 556.937 GHz water line on earth as a test of the spectrometer. Observations began at 19:30 and ended at 07:09 UT on DOY 115.
Phase 3 – This phase carried out spiral scans of the earth in order to improve the knowledge of the MIRO bore sight position. This phase started near 7:09 and ended near 11:46 DOY 115. The instrument was in dual continuum for these observations.
Phase 4 – This phase was an earth staring mode. It started near 11:51 and was discontinued near 15:20 UT due to a s/c emergency.

Results:

1. Pointing was verified using the spiral scans on Earth.
2. The Earth's water line was detected.
3. The CTS warm up and Heater control was verified confirming that the RSDB database problem identified during the March observations had been corrected.
4. We were unable to produce the CTS busy line high error that we saw during the March observations.
5. We observed that the two continuum channels were much more stable during this set of observations relative to the March observations.
6. We observed sporadic and occasional down going spikes in both continuum channels. We had seen this in the ground-based measurements.
7. We observed a slight current rise in the –12 V SBEU current followed by a decay. We had seen this in the ground-based measurements.
8. We noticed that the level of interference in the S/C or instrument appeared to be lower during this run. We can't explain this.
9. We experienced about a dozen out of limit parameters on about 8 different parameters. Most of these occurred on the first day. We need to examine these data at JPL to understand if out of limit parameters are verifiable.

Overall impression: Our overall impression of the tests is that they were very successful. We confirmed the spiral scan technique for bore sighting and our water line spectroscopic channel. Although we had a weak glimpse of Venus during our previous runs, this run really served as first light for MIRO. As usual, the ESOC and ESTEC staffs were very helpful, and we would not have been able to complete our tasks without their professional support.

ITEM 3: FIRST REPORT OF NON-TIME SEQUENTIAL PACKETS

Date: Wed, 22 Sep 2004 18:11:47 +0200
From: Paolo.Ferri@esa.int
Subject: Interference Pass 2: Miro problems
To: Samuel.Gulkis@jpl.nasa.gov
Cc: Jose.Morales@esa.int, Armelle.Hubault@esa.int, Elsa.Montagnon@esa.int, rhoofs@rssd.esa.int, Detlef.Koschny@esa.int, Margaret.A.Frerking@jpl.nasa.gov, lkamp@jpl.nasa.gov
X-Lotus-FromDomain: ESA

Dear Sam,

in the second interference pass we have some problems reported in our ESOC internal daily report that I'd like you to help us investigating.

I copy below the relevant text:

At 265.23.09 several messages indicating jumps on MIRO Science SSC were received. After analysis it actually seems there are missing science packets corresponding to burst modes when several scientific packets are generated in the same second. Note that in the case of MIRO, no SSMM event indicating Margin size reached was received. A further analysis together with the PI shall be performed offline

Post-Pass Analysis

I have quickly looked at the last science TM MIRO sent, and found the reason for the symptoms described above: MIRO seems to send to the SSMM science packets in correct order of Source Sequence Count, but the OBT of those packets is not monotonically increasing. This causes a lot of problems in our control system (and it will cause problems on the SSMM if we ever try to dump by time range).

If you confirm that the above is an expected MIRO behaviour, we'll have to discuss how to modify it for the future: at the moment the control system here reacts violently to receiving packets with inconsistent order of time and SSC.

I'd be obliged if you or your people could look into the problem and let me know their opinion and interpretation of the results. I am available if you need more information on what we saw.

Thanks and kind regards
Paolo

8. OSIRIS

11 November 2004

OSIRIS Commissioning Summary

H.U. Keller, M. Küppers, H. Sierks

The objectives of the commissioning slots 1 to 3 were to test and operate all functional blocks and subsystems of OSIRIS. This was well achieved from opening the front covers down to the power-up of the CCD operational heaters.

It was decided not to switch-on and commission the redundant subunits of the DPU, motor controller and power converter. The thermal safety net to kick-in in case the main non-operational heaters or the operational structure heaters of OSIRIS fail was not tested. The CCD annealing heaters were not tested at this stage either.

The thermal concept of both cameras worked fine, all temperatures were as expected and all heaters are properly dimensioned. The CCD temperatures dropped below 170 K for the WAC and below 150 K for the NAC providing excellent CCD performance for both cameras.

A major effort went into the functional testing of the shutters. This was expected because the behaviour of the shutters is influenced by gravity. The NAC shutter was considered to be more critical and therefore received more attention. It turned out that the operational adjustments (so called shutter brake) introduced last year led to mechanical problems in zero g. It is suspected that the braked shutter blades do not travel back completely into home position due to residual mechanical friction. Without brake, the shutter blades open during back travel across the CCD resulting in additional light on the sensor. This is a performance issue for the short exposure times for the NAC and will be addressed by additional testing using the FS setup at MPAE. Functionally (locking/unlocking) the NAC shutter works well in zero-g.

The WAC shutter was addressed in the second commissioning slot as it failed in locking/ unlocking performance during comet Linear T7 observations. This led to detailed investigations and successful adjustments of mechanical parameters on the flight system.

The present status of the shutters is summarized as follows. Not a single functional (locking/ unlocking) shutter error was experienced in slot 2b and 3 neither with NAC nor WAC. The WAC shutter is performing well, while the NAC shutter shows back travel openings as was seen in ground level tests. Solution to the NAC back travel performance hit would be to enable the shutter brake circuitry again and proper adjustment of the electro-mechanical parameters.

The DPU crashed twice during operations in slot 2 and had to be power-cycled. This was a major concern and appropriate ARs were filed. Reference data stored in the OSIRIS mass memory were lost and had to be re-acquired during extra passes. The DPU failures were investigated with high priority at MPS and IDA and resulted in a series of software changes both on low level and UDP level. The software update was uploaded during the September 4/5 pass and successfully verified during the following pass.

In this software verification run, the NAC front door failed to open. This was never seen before neither during ground level operation nor in flight. Detailed investigation at MPAe identified improper timing of encoder readout with an slight mechanical oscillation of the moving door at the encoder switch position being the cause of the failure. The door handler was modified, waiting/damping times introduced, and the switch region dive-in enlarged. The UDP change was validated on the Reference OSIRIS and is ready for upload to the flight unit.

Additional to the functional tests, extensive performance tests and BOL in-flight calibrations of the OSIRIS cameras were performed during the commissioning slots as well as throughout the pointing and interference campaign. Spectrophotometric standard stars of different types were observed for the in-flight intensity calibration and for the detailed test of the point spread function of the optical systems. The Earth-Moon system, Venus, Saturn and Titan were observed to calibrate the instrument for an approximately solar type input spectrum as expected from the comet C-G. Star field observations with a high density of medium bright stars and "random" star fields (observations without a specific pointing request) were performed. Those observations are used to investigate the geometric distortion of the field of view, the linearity and limiting magnitude of the system, as well as verifying the focus and PSF of the camera systems.

The stray light behaviour of both cameras was tested between solar elongations of 20 and 140 degrees. The Orion nebula was observed for calibration and public relations. Comet Linear T7 could also be observed, however, most of the WAC observations failed due to shutter locking failures at that stage. Scattered light (elongation angle of the comet was about 45 deg) is visible to the level of the specified attenuation. All dark & bias images and reference flats (using the calibration lamps) of both cameras could be accomplished. The quantitative analyses is not yet finished. The analysis so far indicates clearly that the performance of both cameras is excellent.

In summary: The OSIRIS cameras are fully functional with outstanding optical performance. All data taking was accomplished and relayed to ground. The performance of the NAC shutter (back travel opening) still needs attention. A software update concerning the front door handler is required prior to the Earth fly-by in spring 2005.

The system was successfully operated and tested, providing confidence to fully automated operation out of pass by the mission time-line command chain as executed during the Rosetta pointing and interference campaign.

OSIRIS Commissioning Slot 1/ ESOC

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
Bern: N. Thomas; UPD: C. Barbieri, S. Debei, M. de Cecco; IAA: L. Lara; LAS: G. Rousset, L. Jorda, A. Origne; all times are ESOC local time
Project: W. Pinter-Kreiner
RMOC: D. Koschny

Times are in CET.

2004-03-11

22:30 Pre-Pass Meeting @ D217

2004-03-12

00:00 checked temperatures of s/c powered thermistors NSRAT001 to NSRAT006 at 90 deg sun incidence angle:

NAC PPE:	+17.5 deg
NAC FDM:	+17.5 deg
WAC Structure:	+12.5 deg
WAC CCD:	0 deg
NAC CCD:	-7.5 deg
NAC SiC Structure:	-10 deg

Checked all temperatures are at steady state since the s/c was turned 8 h ago. Ok for this test.

00:06 DvK identified one heater current limit out of range: LCL 22B is at nominal 6W (250mA). ESOC to verify limits set on SCOE.

00:15 start of OSIRIS commissioning: **SR-FCP-000**
run OSIRIS ON OBCP

00:23 DPU main there, PCM up and running, MCB up and running, OBCP completed successfully. Phew!

00:30 CCD Non-op heater main was switched OFF via OBCP, switched it on again.

01:12 NAC CRB switched-on and checked OK, 3 first light cmds executed and received science packets on VC1. NAC images checked and found life CCD.

01:18 Test MMB: test running thru all word groups and OK, HK status MCB, PCM, and NAC toggled to ERROR and back OK as on OSIRIS level tests. Reason: parallel transmission of stored and real-time data thru VC0 and VC1.

01:46 Start MMB: OK, start downlink manager and downlink 1 image thru MMB, image checked and OK.

01:52 WAC CRB switched-on and checked OK, first light executed and received science packets and OK. First 3 WAC images received, checked and OK.

02:12 NAC Off, WAC Off, **end of procedure SR-FCP-000** and successful. Check SCOS calibration data as OSIRIS EGSE reported good WAC CRB values while the SCOS values were off.

02:15 thermal HK: NAC 0,0; WAC 54% cycle, 43% balance. Thermal Control up and running.

Nota: check that CCD op heaters are tested elsewhere, suspect that these are not tested at all following procedure (AI: MPAe).

02:21 **start of procedure SR-FCP-015**, WAC Filter Wheel and cal lamp test

02:22 MCB Motor Power ON: Ok.

02:25 MCBInitFilterWheel: 14, 11; success, no move needed as wheels survived launch in preset launch configuration.

02:30 wheel #1 moved from 14 to 13, 13 to 14. OK

02:31 wheel #2 moved from 11 to 14, 14 to 11. OK

02:34 TestFWM WAC: OK (nota: tests main and redundant windings!)

02:37 cal lamps main 33,4 mA 15V to 374mA: OK, redundant lamps read 371mA; OK

02:41 **end of procedure SR-FCP-015** and successful. Found a moved filter wheel on NAC, checked UDP and identified bug (AI:MPAe).

02:50 **start of procedure SR-FCP-014**, NAC Filter Wheel and cal lamp test

02:51 MCB InitFilterWheel NAC Ok (14,11), but did not move as found valid encoder reading

02:52 wheel #1 moved from 14 to 13.

02:55 wheel #2 moved from 11 to 14, 14 to 11.

02:57 TestFWM NAC: OK (nota: tests main and redundant windings!)

03:00 cal lamps main: 33mA on 15V to 359mA: OK, redundant lamps read 371mA: OK

03:05 load WAC filter wheel move into its home position.

03:10 **end of procedure SR-FCP-014** and successful.

03:10 **start of procedure SR-FCP-012**, NAC and WAC Front Door release from launch lock

03:11 MCBCloseDoor NAC, checked encoder 2 in lock, moved to close (cruise) position reading 3 (rotating): success

03:14 MCBCloseDoor WAC, checked encoder 2 in lock, moved to close (cruise) position reading 3 (rotating): success

03:15 **end of procedure SR-FCP-012**

03:32 **start of procedure SR-FCP-001**, initial NAC shutter motion test

03:33 TC NAC CRB ON, SHE ON, shutter was not found in an error state. OK

03:37 NAC single image, first shutter shot. PPE and shutter mechanism is at 0deg, shutter error C found and recovered autonomously by 2nd shot of blade 2. downlinked data for check.

03:43 power down NAC CRB and SHE, **end of procedure SR-FCP-001**

check of shutter pulse data: no pulse data found in image header. Decided to rerun procedure. (suspect: shutter blades were not at zero position at start of run)

04:20 **rerun of procedure SR-FCP-001**, initial NAC shutter motion test

04:22 TC NAC CRB ON, SHE ON, shutter OK

NAC single image. shutter error C found and recovered by 2nd shot of blade 2. no shutter pulse data. Decided to continue with the WAC.

04:43 power down NAC CRB and SHE, **end of procedure SR-FCP-001**

04:46 **start of procedure SR-FCP-002**, initial WAC shutter motion test

04:47 TC WAC CRB ON, SHE ON, shutter was not found in an error state. OK

04:48 WAC single image, first shutter shot. WAC thermally stabilized at +12deg and in steady state. shutter error C found and recovered autonomously by 2nd shot of blade 2. downlinked data for check.. data checked: no pulses.

04:52 power down WAC CRB and SHE, **end of procedure SR-FCP-002** decided to rerun WAC with zero-pulse encoder disabled.

05:06 **rerun of procedure SR-FCP-002**, initial WAC shutter motion test

05:07 TC WAC CRB ON, SHE ON, OK

05:09 sent TC disable zero pulse

05:11 WAC single image. shutter error C found and recovered autonomously by 2nd shot of blade 2. downlinked data for check..

04:52 power down WAC CRB and SHE, **end of procedure SR-FCP-002**

05:30 parameter dump commanded

05:35 **start of procedure SR-FCP-028**, automatic optimization of WAC shutter

05:38 TC WAC ON. Ok.

05:47 send tablepatchvalue to set iteration limit to 1.

05:51 start auto optimize with 1 iteration. Received shutter pulses of blade 1. Cause of failure is clear now: the software upload performed in October 2003 deleted the stored profile, thus a zero profile was used here instead.

06:08 send tablepatchvalue to set iteration limit to 6.

06:09 start auto optimize with 6 iterations. Blade 1 locked in 2nd iteration, blade 2 unlocked on 1st trial. Check blade 1 and 2 encoder data and velocity profiles. Both encoder data verified, velocity profiles lock fine.

06:30 send tablepatchvalue to set iteration limit to 35. send tablepatchvalue to stop after kinematic is finished.

06:32 start auto optimize with 35 iterations running kinematic optimization. Algorithm stopped before reached kinematics success.

06:51 **end procedure SR-FCP-028**

06:53 **start of procedure SR-FCP-027**, automatic optimization of NAC shutter

06:38 TC NAC ON. Ok.

06:47 send tablepatchvalue to set iteration limit to 1.

06:56 start auto optimize with 1 iteration. Verified encoder pulses on blade 1, initial velocity is too high, thus has to be down tuned to continue.

07:12 send cmd to reduce motor power: fkineticmotor1 set to 3300 (from approx. 2700), offset 33

07:14 send tablepatchvalue to set iteration limit to 1.

07:15 start auto optimize with 1 iteration. Verified encoder pulses blade 1. did not change velocity. Checked and identified reason: WAC was modified instead of NAC.

07:44 send cmd to reduce motor power: fkineticmotor1 set to 3300 (from approx. 2700), verified that this reached NAC this time ☺

07:45 start auto optimize with 1 iteration. Verified encoder pulses blade 1.

Antenna handover from New Norcia to DSN.

08:24 back on antenna

08:25 send tablepatchvalue to set iteration limit to 6.

08:28 send cmd to reduce motor power: fkineticmotor2 set to 3300 (from approx. 2700), offset 65

08:30 start auto optimize with 6 iterations.

08:33 6 iterations run fine, check data of encoder 2.

08:35 NAC PPE is at -5 degC (S/C thermistor), NAC Thermal Control running at 54/100, WAC at 51/42, Thermal control is now stabilizing the NAC FDM and the WAC optical bench.

08:51 encoder 2 pulses verified OK.

08:52 send tablepatchvalue to set iteration limit to 35. send tablepatchvalue to stop after kinematic is finished.

08:55 start auto optimize with 35 iterations running kinematic optimization.

08:57 shutter error B received. To be checked offline! Continue test.

08:59 shutter error C received. Ok as we are in kinematics.

Decided to run full shutter optimization on the NAC. UPD checked algorithm parameters to clear procedure.

09:10 end tablepatchvalue to set iteration limit to 250 (nominal).

09:11 send TC reset tablepatchvalue to NOT stop after kinematic is finished (nominal configuration).

09:14 start auto optimize with 250 iterations max (should converge nominally at about 120)

09:43 converged after 95 iterations and finished. End of shutter commissioning in slot 1. read NAC shutter temperatures at -3.91, -4.43 degC.

09:49 **start of procedure SR-FCP-042**, OSIRIS Calibration Bias. Data is stored in SSMM by procedure (image by image). Dithering is OFF.

10:04 NAC done, continuing with the WAC.

10:15 WAC done, **end of procedure SR-FCP-042**.

10:18 print out all HK data from SCOS for comparison with EGSE.

10:20 **run SR-FCP-051**, switch-off OSIRIS via OBCP, data (in particular the NAC shutter profile) has been stored in NVRAM for future use.

10:28 ESOC confirmed non-op heaters are on (main + redundant) and CCD decon. Heaters are on.

10:29 end of shift ☺

OSIRIS Commissioning Slot #2/ ESOC

Times are in CET. H. Sierks, MPAe, 3 May 04

Shift #1 – 25/26 April 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
UPD: V. DaDeppo, S. Fornasier, M. de Cecco, M. Zaccariotto;
Project: M. Schwetterle
RMOC: E. Montagnon, RSOC: D. Koschny

2004-04-25

22:54 ready to switch-on, s/c is pointing 90deg off sun, s/c powered thermistors read

NAC FD	12.5	end of shift	+17.5	all degC
NAC STR	-17.5		-10.0	
NAC CCD	-7.5		-7.5	
NAC IFP	15.0		17.5	
WAC CCD	-2.5		0	
WAC STR	+10		12.5	

22:58 OSIRIS DPU boot event seen

23:01 procedure: **SR-FCP-050:** OSIRIS ON OBCP (main) finished successfully.
Note: CCD non-ops were switched off automatically by the OBCP

23:03 requested CCD non-op on, are on again

23:04 sent change HK request set to 15 sec (procedure **SR-FCP-052)**, ok

23:05 checked DPU main is ON, PCM up and running, MCB up and running

23:08 start Initiate thermal control **SR-FCP-020,** run Ok but switched off the CCD non-op heaters again. Switched manually the CCD non-ops ON.

23:14 released manual cmd MCB motor power main ON.

23:15 verified door encoders NAC and WAC: 3 & 3 (both in rotation, cruise closed)

23:17 LCL reading is 0.9 A on LCL 30A, 0 A on LCL 30B
29A ON, 30 A OFF, 29 B ON, 30 B ON, 22 A ON, 22 B ON

23:20 GO on open front door of NAC.

23:24 verified encoder status is 1, thus the NAC door is OPEN.

23:25 go on open front door of WAC.

23:29 verified encoder status is 1, thus the WAC door is OPEN

23:30 checked thermal control kicked in for WAC (100% duty cycle, 40 % balance), NAC is in free fall (0%, 50%) as temperatures were above thermal set points running the non-op heaters

23:32 temperature snap shot from EGSE, see summary table end of shift.

23:35 start **SR-FCP-028,** WAC CRB (and SHE) ON, finished Ok.

23:39 upload 5 modified shutter parameters (see email R. Mueller, 31 Mar 04) and number of iteration set to 5 via TablePatchCommands

23:43 checked WAC CRB is ON, HK is Ok, Shutter temp at +9 degC, ADCs at 0 degC, CRB.PCM at +10degC

23:46 cmd array dump is sent, check on EGSE ongoing.

2004-04-26

00:03 temperature snap shot from EGSE, see summary table end of shift.

00:17 all uploaded parameters are checked and Ok.

00:18 start shutter WAC auto-optimize with 35 iterations.

00:30 temperature snap shot from EGSE, see summary table end of shift.

00:35 decided to change thermal control set point of the NAC PPE from -18deg to 0.0 degC. Preparing the parameter change command.

00:40 WAC shutter optimization stopped after 34 steps, blade 1 kinematics and locking done, blade 2 kinematics done, locking not finished. Analyzing shutter data…

00:48 WAC shutter data analysis done, Ok for WAC now, coming from the good direction (as was the NAC in comm. slot #1)

00:49 sent the parameter change cmd for NAC thermal set point PPE: 0degC

00:51 switch off the CCD non-op structure heaters main and redundant (29A & 29B)

00:55 realized that the NAC thermal set point was commanded to 0K instead 0 degC.

00:58 sent the parameter change cmd for NAC thermal set point PPE: 0degC, positive.

01:08 change WAC shutter algorithm parameters to 250 iteration limit and do not stop after kinematics.

01:22 NAC PPE is reaching 0degC, verified that the thermal control kicked in.

02:00 CCD temperatures are WAC -66.0, NAC -74.0 degC

02:01 decided to start full WAC shutter optimization (may want to go for 2nd verification run tomorrow by wavy plot)

02:04 shutter test is running…

02:10 temperature snap shot from EGSE, see summary table end of shift.

02:33 WAC shutter optimization finished after 98 iterations. Analyzing results…

03:06 temperature snap shot from EGSE, see summary table end of shift.

03:17 sent parameter change of WAC shutter LockingPointAccA1 and B1 (rattle reduction) from -35 to now -5 to get inside stability region.

03:30 verified parameter changes arrived correctly onboard s/c

03:31 start procedure **SR-FCP-023,** initialized WAC filter wheels, closed WAC door (encoder reads 3), start calibrate shutter for WAC (test of optimization).

03:52 checked: -30 degC is set point of the FDM, FDM safe guard thermostat is set at -34.1 degC

03:56 procedure **SR-FCP-023** finished.

04:00 close front door NAC. Verified encoder readout 3 and UDP success.

04:03 start procedure **SR-FCP-021,** power down non-essential systems.

04:06 temperature snap shot from EGSE (all deg C):

		23:32	00:03	00:30	02:10	03:02	04:06
NAC	CCD	-12.8	-9.0	-6.8	-71.5	-88.0	-98.7
	FDM	14.3	7.7	0.4	-14.1	-20.2	-25.5
	FWM	10.5	7.7	4.4	-0.7	-1.4	-1.7
	FDIF	10.0	4.4	-2.4	-15.9	-21.2	-26.6
	PPE	10.5	7.2	3.7	0.6	0.1	0.1
	M1/M3	-18.1	-18.9	-20.5	-25.5	-28.1	-31.1
	M2	-17.4	-18.7	-20.5	-25.5	-28.1	-31.1
WAC	CCD	-12.6	-8.0	-5.5	-67.9	-82.4	-91.6
	FDM	8.5	9.8	10.0	9.8	9.8	9.8
	FWM	7.5	8.0	8.7	9.0	9.0	9.0
	STR	12.0	12.3	12.3	12.3	12.3	12.3
	T3	16.6	14.8	14.8	14.8	14.6	14.8
	T4	14.1	13.6	13.3	13.1	13.1	13.3
SHM	WAC		9.9	9.8	10.0	10.1	10.0

04:10 procedure **SR-FCP-021** finished.

04:21 sent MCB motor power ON to return the WAC filter wheel back to nominal

04:23 sent WAC filter wheel back to 1,2

04:25 MCB motor power main OFF

04:30 set HK to 120 sec
04:35 end of shift, OSIRIS stays ON out of pass with thermal control running.

Shift #2 – 26/27 April 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
UPD: V. DaDeppo, S. Fornasier, M. de Cecco, M. Zaccariotto;
LAM: G. Rousset, A.Origne; U of Bern: N. Thomas.
Project: M. Schwetterle
RMOC: E. Montagnon, RSOC: D. Koschny

2004-04-26

21:39 s/c is pointing 90deg off sun, s/c powered thermistors read (all degC)

NAC FDM	-33.3	reads at 01:03	-33.33
NAC STR	-40.0		-42.00
NAC CCD	-120.9		-122.73
NAC IFP	0		-10,0
WAC CCD	-106.4		-104.55
WAC STR	10.0		10.0

22:09 temperature snap shot from EGSE, see summary table end of shift. Note that the NAC CCD thermistor (AD590) suffered a reversal of characteristics as seen earlier in device level tests (ref. OSIRIS Technical Note by G. Tomasch). AI to follow history of CCD HK data and correct for reversal.

22:49 about to start …

22:50 sent update HK cycle from 120 sec to 15 sec

22:54 sent tablepatchvalue to change thermal set point for the NAC PPE to -10degC as heater power @ 0 degC set point was found marginal for thermal regulation

22:59 TCWACON, PowerMCBMotorsON Main

23:00 verified NAC PPE temp set point reads 263K on EGSE.

23:08 PPE is going down in temp, 0% balance (all at FDM), duty cycle 31% or 2.3 W is needed to maintain the FDM at -30degC

23:10 patched WAC shutter parameter: blade1impact velocity changed from 0.092 to 0.05 m/s and verified patch

23:11 sent realize WAC shutter profile

23:14 sent CalibrateShutter WAC: no shutter errors reported, no backtravel seen!

23:38 decided to continue WAC shutter investigation changing LockingAccPoint A1, B1 from -5,-5 to +5,+5

23:48 sent patchtablecommand. Waiting for verification. -> ok

23:51 sent realize WAC shutter profile

23:53 NAC STP is at -5.67degC DoY117 12:29

23:55 sent CalibrateShutter WAC: no shutter errors reported, single hitch at 20ms

2004-04-27

00:19 temperature snap shot from EGSE, see summary table end of shift.

00:32 decided to continue shutter investigation changing WAC LockingAccPoint A1, B1 from +5,+5 to +10,+10. Decision tree is: if 10,10 is ok, then final set shall be 5,5, if 10,10 fails, then 0,0 will be the selection point. Final verification run shall be 20 to 300ms.

00:35 NAC PPE at -10deg needs 5.6W (77% duty cycle, 100% balance)

00:40 verified change of WAC shutter parameters

00:43 sent realize WAC shutter profile

00:46 sent CalibrateShutter WAC: 1 shutter locking error seen, same behavior at 20ms as the 5,5 run.

00:59 decided to set WAC LockingAccPoint A1, B1 to 0,0 and prepare final run.

01:02 sent tablepatchcommand to realize 0,0

01:11 sent realize WAC shutter profile

01:14 sent CalibrateShutter WAC for 20 to 300ms, 5 shots each.

01:35 end of sequence. No WAC shutter errors seen in 140 shots, first evaluation shows no backtravel opening. Detailed offline investigation to follow (realized that the earlier series of shutter errors enabled initial back pull, AI: exact time of this event to identify and investigate potential impact in data gained).

01:40 NAC now, procedure **SR-FCP-027,** but with change of motor power due to lower temperature, motor power is higher at low temperature.

01:45 TCNACON released. Ok, CCD temp (CRB.HK) is at **-123.7degC.**

01:49 tablepatchcommand released: NAC kineticmotor1 and kineticmotor2

01:52 temperature snap shot from EGSE, see summary table end of shift.

01:59 start of NAC shutter auto-optimize

02:25 NAC shutter optimization finished after 79 iterations with an unlocking error ☹ in the last verification image acquisition

02:47 found NAC LockingAccPoint A1, B1 were at -45,-45. decided to modify to -10,-10 and run (wavy) verification sequence.

02:55 tablepatchcommand released for -10,-10

03:00 sent realize NAC shutter profile

03:03 sent CalibrateShutter NAC for 20 to 100ms, 5 shots each; experienced some shutter errors, to be investigated in detail offline.

03:23 released procedure **SR-FCP-029:** Sync Test for NAC and WAC (NAC first)

03:46 opened NAC door, then WAC door

03:49 first light both cameras 2 images (NAC: 500ms, 5sec; WAC 5sec, 30sec), filter NAC: FFP-VIS/FFP-IR, filter WAC: Empty/Red

04:26 closed both front door, turned filters back to nominal, FW NAC to default, MCB motor power main OFF, set HK to 120 sec, end of shift

		22:09	00:19	01:52
NAC	CCD	-80.6	-78.9	-75.6
	FDM	-28.1	-26.1	-29.1
	FWM	-2.2	-9.3	-11.1
	FDIF	-30.4	-28.1	-30.6
	PPE	0.1	-10.1	-10.1
	M1/M3	-40.0	-40.5	-41.3
	M2	-39.3	-39.8	-40.5
	SHM	n/a	n/a	-9.6
WAC	CCD	-101.2	-106.7	-106.3
	FDM	10.3	10.3	10.3
	FWM	8.5	8.7	8.7
	STR	12.3	12.3	12.3
	T3	14.6	14.6	14.6
	T4	13.3	13.3	13.3
SHM	WAC	n/a	10.1	10.1

Shift #3 – 27/28 April 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
UPD: V. DaDeppo, S. Fornasier, M. de Cecco, M. Zaccariotto;
LAM: G. Rousset, A.Origne;
Project: n/a
RMOC: E. Montagnon, RSOC: n/a

2004-04-27

22:35 s/c is pointing 90deg off sun, s/c powered thermistors read (all degC). OSIRIS HK snap shot see table at end of shift.

NAC FDM	-35.6
NAC STR	-44.0
NAC CCD	-124.6
NAC IFP	-10
WAC CCD	-106.4
WAC STR	10.0

22:42 execute HK to 15 sec

22:53 execute procedure **SR-FCP-027,** test optimization of NAC shutter at -10degC after long term stabilization, back pull is still on from yesterdays experience

23:01 sent CalibrateShutter NAC for 20 to 100ms, 2 shots each. See 2 type C errors which are due to a bit weak blade 2 performance, but no home position problem detected.

23:33 sent CalibrateShutter NAC for 20 to 100ms, 5 shots each. Some type C and type A errors seen. UDP bombed out with div/0 error.

2004-04-28

00:10 Decided to change temperature set point to -18 degC and continue from there with new optimization, no brake, no pull back (same configuration as the WAC). Note that the blade speed was found as 1.4 m/s, expected are 1.3 m/s, to be investigated in detail.

00:19 sent tablepatchcommand to change NAC PPE temp. set point to -18 degC

00:20 continue with the WAC with tablepatchcommand to disable pull back (use_ensure_home_position=false)

00:29 TC WACON

00:31 sent tablepatchcommand to disable pull back

00:58 sent CalibrateShutter WAC for 20 to 100ms, 2 shots each.

01:06 PCM error event, lost MCB power.

01:29 identified reason of error: NAC cal lamps were still on when switching the WAC cal lamps were on. The increase of current on the 15V rail exceeding the allowed limit at the PCM.

NCR to be raised to notify non-op heaters ON to s/c in case of MCB loss!

01:37 power down WAC CRB to stop still running UDP in DPU, this was successful.

01:39 power MCB ON to recover thermal control, Ok

01:43 power ON the WAC CRB, Ok

01:53 power ON MCB motor power main ON (running **SR-FCP-023),** Ok

01:58 re-transmission of CalibrateShutter WAC for 20 to 100ms, 2 shots each: OK

02:03 sent CalibrateShutter WAC for 20 to 100ms, 5 shots each.

02:13 sent CalibrateShutter WAC for 110 to 300ms, 5 shots each.

02:28 1 shutter error A detected at 160 ms

02:29 MMB ON

02:31 start procedure **SR-FCP-042** CalibrationBias for cold CCDs (NAC and WAC)

02:48 received multiple UDP error commands

03:20 decided to power cycle, thus start power down subsystems, power down OSIRIS via manual switch off, but leaving out the NVRAM storage as the UDP software may be corrupted.

03:34 OSIRIS is OFF, non-op heaters are ON.

03:36 start switch-on OBCP **SR-FCP-050**, executed Ok

03:46 start Initiate Thermal Control **SR-FCP-020**, Ok

03:51 MCB motor power main ON

03:53 MCBInitFilterWheel NAC and WAC

04:00 MCBMoveFilterWheel NAC to default: 2,2

04:03 MCBMoveFilterWheel WAC to default: 1,2

04:06 execute procedure **SR-FCP-021,** power down non-essential loads, end of shift

		22:35
NAC	CCD	-72.8
	FDM	-26.6
	FWM	-11.6
	FDIF	-30.4
	PPE	-9.8
	M1/M3	-44.3
	M2	-43.6
	SHM	n/a
WAC	CCD	-101.2
	FDM	10.3
	FWM	8.5
	STR	12.3
	T3	14.6
	T4	13.1
SHM	WAC	n/a

Shift #4 – 28/29 April 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
UPD: C. Barbieri, V. DaDeppo, S. Fornasier, M. de Cecco, M. Zaccariotto;
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Project: W. Pinter-Krainer
RMOC: E. Montagnon, RSOC: D. Koschny

2004-04-28

Nota: The Sync Test NAC & WAC was analyzed offline at MPAE (by R. Kramm). New (and better:-) sync values were identified reflecting the quiet s/c environment in flight. The noise level in flight is significantly lower than on ground for both cameras, the NAC lower than the WAC. The new sync value for both cameras is: 17, to be uploaded and saved today.

22:14 s/c is pointing to standard star Epsilon Aquarius, 94.5deg to sun, s/c powered thermistors read (all degC). OSIRIS HK snap shot see table at end of shift.

NAC FDM	-33.3	NAC STPP	-6.3	TC ON
NAC STR	-48.0	E-Box TRP	10.0	ON
NAC CCD	-128.2 (145.0K)	WAC STPP	-1.8	TC ON
NAC IFP	-20	NAC CRB TRP	-1.4	OFF
WAC CCD	-106.4 (166,8K)	WAC CRB TRP	-1.8	OFF
WAC STR	10.0			

22:16 thermal control parameters at stabilization are:
NAC 55% duty cycle, 100% balance (PPE only at the time being)
WAC 62% duty cycle, 50% balance

22:42 execute HK to 15 sec

23:12 first Table Patch values sent: shutter parameters WAC, change sync values NAC&WAC (17/17), adjust NAC motor power, max iterations for NAC optimization (35)

23:14 request table dump to ground for verification, verified and Ok.

23:27 sent realize WAC shutter profile (note: WAC CRB and SHE are off). Generated error message as the subsystems were expected to be ON for reset and init shutter electronics, but Ok.

23:35 TCNACON, TCWACON, Ok

23:38 CRBSetUp to acquire 1 image to verify the WAC shutter curve is correctly recovered

23:41 TCAcquireImage WAC sent with 100 ms exposure, 64 by 64 px uncompressed

23:42 No data packages on EGSE. fixed it. Shutter pulses confirmed and appear Ok.

23:53 switched cal lamps on for WAC to avoid 1st image only half exposed.

23:55 MCB motor power main on, init filter wheel, Ok

00:00 sent calibrate shutter (wavy plot) 20..100 ms/5 shots. WAC back pull automatic is disabled.

00:06 no shutter errors seen, start investigate WAC profiles.

00:07 OSIRISLibExit to safe full parameter table to NVRAM

00:10 start procedure **SR-FCP-027,** test optimization of NAC shutter at -18degC, limit set at 35 iterations. shutter brake is OFF, back pull is OFF, automatic kick-in of back pull is ON (safety feature armed), Ok

00:23 parameter change to set limit to 250 iterations (nominal)

00:26 start procedure **SR-FCP-027,** test optimization of NAC shutter at -18degC, limit set at 250 iterations (full run), same configuration as above: . shutter brake is OFF, back pull is OFF, automatic kick-in of back pull is ON (safety feature armed)

00:54 NAC shutter optimization finished after 83 iterations, start to analyze data.

01:18 found NAC LockingAccPoint A1, B1 were at -45,-45. decided to modify to -20,-20 and run (wavy) verification sequence.

01:23 tablepatchcommand released for -20,-20

01:24 sent realize NAC shutter profile

01:27 sent CalibrateShutter NAC for 20 to 100ms, 2 shots each to check NAC locking performance. Finished without locking error.

01:31 sent CalibrateShutter NAC for 20 to 100ms, 5 shots each to check NAC locking performance and backtravel opening

01:40 no shutter errors, but backtravel opening detected. Agreed to modify NAC LockingAccPoint A1, B1 to -35,-35 and retest CalibrateShutter NAC for 20 to 100ms, 2 shots

01:44 tablepatchcommand released for -35,-35

01:45 sent realize NAC shutter profile

01:49 sent CalibrateShutter NAC for 20 to 100ms, 2 shots, no shutter errors, no backtravel openings.

01:58 sent CalibrateShutter NAC for 20 to 100ms, 5 shots, no shutter errors, 2 backtravel openings found at 80ms.

02:08 tablepatchcommand released for -10,-10; enable shutter brake NAC ON

02:09 sent realize NAC shutter profile

02:27 sent CalibrateShutter NAC for 20 to 100ms, 2 shots. Various shutter errors seen with brake ON.

02:39 tablepatchcommand released for -35,-35, switch NAC brake Off and disable back pull

02:42 sent realize NAC shutter profile

02:43 power cycle shutter electronics to ensure NAC brake is switched off

02:44 sent CalibrateShutter NAC for 20 to 100ms, 2 shots with brake OFF. No shutter errors, but various shutter backtravel openings seen.

02:50 OSIRISLibExit to safe full parameter table to NVRAM

02:54 sent CalibrateShutter NAC for 110 to 200ms, 8 shots with brake OFF. No shutter errors and no backtravel opening.

03:05 sent TableSendSegment (3 segments) to verify the (reloaded) shutter current profile. Verified NAC shutter parameters and NAC LockingAccPoint A1, B1, all OK as expected.

03:07 sent CalibrateShutter NAC for 210 to 300ms, 5 shots with brake OFF. No shutter errors and no backtravel opening, thus new baseline in operating the NAC shutter is no brake, no back pull.

03:15 preparing observation sequence for stellar calibration run. Got all on the command stack.

03:19 released command MCBOpenDoor NAC

03:23 NAC Door is open (encoder reading 1)

03:24 released command MCBOpenDoor WAC

03:27 WAC Door is open (encoder reading 1)

03:28 CRBSetUp NAC and WAC

03:29 SingleImage WAC for stellar calibration, check of correct exposure time.

03:30 SingleImage NAC for stellar calibration, check of correct exposure time.

03:34 Close Door NAC: Ok

03:37 Close Door WAC: Ok

03:42 start to retrieve reference exposure times for flat fielding by starting up initial flat fields

03:44 sent calibration lamps On for the WAC, CRB SetUp 2kx2k standard configuration, Green filter, exposure time 6 sec, 6:1 compressed

03:47 sent cal lamp WAC OFF

03:52 sent calibration lamps On for the NAC, CRB SetUp 2kx2k standard configuration, FFP-IR FFP-VIS filter, exposure time 200 msec, 6:1 compressed

03:56 sent cal lamp NAC OFF

03:59 sent NAC filter wheel back to 2,2

04:02 sent WAC filter wheel back to 1,2

04:05 power down non essential subsystems, OK

04:15 change of HK rate to 120sec, end of shift

Note: received both stellar calibration images (NAC & WAC) to check exposure time, both are at about 8000 DN peak at epsilon aquarium and thus allow to calculate the good exposure times for the clean run.

The NAC and WAC initial flat fields were received for analysis.

04:30 loss of pass. S/C will slew off eps_aquarius and return to this pointing tomorrow for the next shift.

		22:16	01:26
NAC	CCD	-66.7	-68.7
	FDM	-25.5	-28.8
	FWM	-19.2	-19.1
	FDIF	-28.3	-30.9
	PPE	-18.2	-17.9
	M1/M3	-47.6	-47.6
	M2	-46.9	-46.9
	SHM	n/a	-17.7
WAC	CCD	-101.2	-100.4
	FDM	10.3	9.8
	FWM	8.5	8.7
	STR	12.3	12.3
	T3	14.6	14.8
	T4	13.6	13.3
SHM	WAC	n/a	9.6

Shift #5 – 29/30 April 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, H. Sierks, H.U. Keller;
UPD: V. DaDeppo, C. Barbieri;
Project: W. Pinter-Krainer
RMOC: E. Montagnon, RSOC: D.Koschny

2004-04-29

22:14 s/c is pointing to standard star Epsilon Aquarius, 94.5deg to sun, s/c powered thermistors read (all degC). OSIRIS HK snap shot see table at end of shift.

NAC FDM	-33.3		NAC STPP	-6.3	TC ON
NAC STR	-48.0		E-Box TRP	10.0	ON
NAC CCD	-128.2	(145.0K)	WAC STPP	-1.8	TC ON
NAC IFP	-20		NAC CRB TRP	-1.8	OFF
WAC CCD	-106.4	(166,8K)	WAC CRB TRP	-1.8	OFF
WAC STR	10.0				

22:42 execute HK to 15 sec

22:48 sent MMB switch on, checked on EGSE and verified Ok.

22:57 start procedure **SR-FCP-007,** Initiate WAC: MCB Motor Power Main On, CRB On, SHE On, init filter wheel, pre-flash the CCD, open front door; checked HK data, Ok.

23:05 start procedure **SR-FCP-037,** Initiate NAC: MCB Motor Power Main On, CRB On, SHE On, init filter wheel, pre-flash the CCD, open front door; checked HK data, Ok.

23:20 start procedure **SR-FCP-004,** stellar calibration on Eps Aquarius. A move filter wheel back to default was sent while acquiring 1st NAC images, it was executed but did not interfere (tbc). Retransmitted move to default. Continued with WAC.

00:07 end of procedure **SR-FCP-004** (first run)

00:08 restart procedure **SR-FCP-004,** stellar calibration on Eps Aquarius, 2nd run (for data consistency/integrity check)

00:46 several shutter errors type A during stellar image sequence (long exposure times)

00:52 end of procedure **SR-FCP-004** (second run)

00:53 continue with single image NAC on s/c stability test, filter 8,5 (neutral/farUV), 2min exposure time

01:02 start procedure **SR-FCP-026,** close NAC and WAC front doors, Ok

01:13 start procedure **SR-FCP-042,** calibration bias

Note: First analysis of stellar star images show evidence that the star location jitters in the NAC images depending on filter position. Potential explanation is the filter mounting with the 30 arc min wedge causing slight displacement of the image.

02:33 end of procedure **SR-FCP-042,** calibration bias

02:35 start procedure **SR-FCP-017,** flat fields WAC

02:56 noted 2 MMB single errors since the MMB was started today (cosmics, tbc)

04:05 released last WAC flat on nominal lamps, deferred the flat on the reference lamps to next shift

04:08 released WAC main calibration lamps OFF

04:11 released UDP 402, power down NAC including motor power and filter wheel reset to default.

04:15 released UDP 402, power down WAC including motor power and filter wheel reset to default.

04:16 realized that the procedure will bomb out as the first run of UDP_402 for the NAC powered down the motor power, thus the first step UDP_402 for the WAC to close the WAC door cannot be executed.

04:17 indeed, the second run of UDP_402 bombed out.

04:18 released TCWACOff to power down the WAC CRB and WAC SHE.

04:23 released change of HK rate to 120 sec, end of shift.

Shift #6 – 30 April/ 01 May 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, H. Sierks, H.U. Keller;
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RMOC: E. Montagnon, RSOC: D.Koschny

2004-04-30

21:33 s/c is pointing to 2002/T7 LINEAR with 44deg sun angle since >8h, thus OSIRIS temperatures are expected increased significantly and in steady state. s/c powered thermistors read (all degC):

NAC FDM	-10.0	NAC STPP	13.5	TC ON
NAC STR	-7.5	E-Box TRP	19.5	ON
NAC CCD	-126.4	WAC STPP	12.5	TC ON
NAC IFP	-20	NAC CRB TRP	16.1	OFF
WAC CCD	-104.6	WAC CRB TRP	16.1	OFF
WAC STR	10.0			

MMB single errors are at: 9, double errors: 0
NAC thermal control at: 11% cycle/100% balance
WAC thermal control at: 22% cycle/100% balance

21:49 Thermal control checked in life HK stream, ok and survived the slew and steep temperature increase. The slope shall be checked offline in performance of the thermal control algorithm.

21:54 temperature snap shot from OSIRIS HK:

NAC	CCD	-70.2
	FDM	-5.0
	FWM	-16.9
	FDIF	-5.7
	PPE	-17.9
	M1/M3	-8.8
	M2	-8.3
WAC	CCD	-101.0
	FDM	14.3
	FWM	9.5
	STR	12.3
	T3	12.8
	T4	13.6

Note the increase of the NAC SiC structure from -48degC sun off-pointing to -8.8degC due to 44deg sun pointing. Door is closed in both cases. Impact on NAC camera defocus to be investigated and verified.

Note the increase in s/c panel temperature is about 20degC (-6 to +13.5 for NAC STP) due to the slew to 44deg sun angle.

22:41 execute HK to 15 sec

22:48 release TCWACOn, TCNACOn, PowerMCBMotorsOn

22:54 start procedure **SR-FCP-046,** CCD Op Heaters On/Off test, level 100, thus 100/255%; note that the heater update takes over the current ADC configuration (this explains the increase of 50mA on the -5V rail), Ok

23:20 start first phase of comet observation for evaluation of exposure times (1 NAC, 2 WAC images). Experienced shutter error type A on WAC last exposure.

23:51 Command last WAC image again (60sec exposure). Success. Image is down streaming. Moved filters back to default and closed the doors, Ok.

23:55 End of phase 1 comet procedure.

23:58 start procedure **SR-FCP-046,** CCD Op Heaters duty cycle set to 254, thus 100%, Ok

00:00 start procedure **SR-FCP-017,** flat fields WAC, last image with reference lamps

00:19 procedure fails with WAC shutter error A, end of procedure **SR-FCP-017** and hand over to comet observation**.**

00:20 next procedure to come is comet observation, phase #2. adjusted the exposure times and reshuffled NAC first, then WAC

00:32 released open door NAC, Ok

00:36 released open door WAC, Ok

00:42 start comet 2002/T7 LINEAR observation, first NAC with 5 images.

01:03 NAC images acquired and stored in MMB, continue with WAC

01:04 released first WAC image, filter Empty/Red, suffered shutter error A again

01:10 reshuffled command sequence again to return NAC to safe configuration. Executed filter wheel move back to default, Ok.

01:13 released NAC door close command, Ok. NAC comets obs done.

01:14 decided to run shutter optimization WAC kinematics only, Mode 3 of eOptimizeKinematics of calibrate shutter procedure. Note that the WAC shutter will now be optimized in sunlight because the door is open.

01:17 released WAC shutter optimization command

01:27 WAC shutter optimization finished with slightly modified parameters: motor power blade 1 changed from 2488 to 2494, spring from 69,31 to 68,72, angle from 1.51 to1.50; motor power blade 2 changed from 2734 to 2725, spring from 84.2 to 76.5, angle from 0.84 to 0.87;

01:33 first WAC image, filter Empty/Red, shutter was Ok now.

01:36 DPU freezes after SR SPIHT Start after having sent the 2nd WAC image acquisition command, while image 1 was still in compression.

01:44 released ping test OSIRIS. Failed. Lost the commanding interface.

01:51 released watch-dog command OSIRIS: DPU Halt PE. No response.

02:00 decided to power cycle OSIRIS using OBCP OFF. Command released.

02:06 OSIRIS is OFF. Decided to power ON again using ON OBCP.

02:16 OBCP ON running. Completely successfully.

02:20 released thermal control command. HK is at 15 sec by default. NAC&WAC non-op heaters and CCD non-op heaters are reported OFF now. PPE is running at -14degC.

02:22 TCNACOn released. OK

02:24 TCWACOn released. OK

02:27 TC motor power on. TC InitFilterWheel NAC and WAC both, Ok.

02:30 released Open Door NAC. Prepared procedure for comet obs part #2.

02:39 CRBSetup NAC and WAC released, Ok.

02:40 first NAC comet LINEAR image again (40sec exposure time), streamed out to s/c mass memory (SSMM), ok. 2nd (64sec exposure time): Ok and streamed out, re-synced DPU clock, 3rd (62sec exposure time): Ok and streamed out, 4th (60sec exposure time): OK and streamed out, 5th (194sec exposure time): Ok and streamed out. All NAC images acquired and dumped into s/c memory.

02:56 NAC first stray light estimation is about 200 DN for a 2sec exposure with orange filter, sun angle 44 degrees, s/c @ 0.8989 AU.
WAC first stray light estimation is about 400-4500 DN wedge in 2 sec exposure with empty/Red filter.

03:06 released command WAC shutter calibration, kinematics only. Running and finished.

03:14 released command NAC filter wheel back to default, Ok

03:17 optimization finished with nearly identical parameters as about 2 hours ago: motor power blade 1 now 2493 instead 2494, spring now 68,71 instead of 68,72, angle now 151, was 1.51; motor power blade 2 now 2723, was 2725, spring now 76.8, was 76.5, angle now 0.87, was 0.87; Ok

03:17 released NAC close door command. Ok, NAC is saved and finished.

03:21 released command to acquire first WAC comet LINEAR image (20sec exposure time),. Ok, and streamed out to s/c mass memory successfully.

03:24 sent command to acquire 2nd WAC image (60sec exposure time), failed with shutter error A.

03:31 released command to acquire 2nd WAC image again, changed exposure time from 60 sec to 50 sec. failed again with shutter error A.

03:37 released command for 3rd and last WAC image (300sec exposure time), failed with shutter error type A.

03:40 s/c powered thermistors read (all degC):

NAC FDM	5.0	NAC STPP	12.0	TC ON
NAC STR	2.5	E-Box TRP	16.1	ON
NAC CCD	-119.1	WAC STPP	12.5	TC ON
NAC IFP	-17.5	NAC CRB TRP	17.2	OFF
WAC CCD	-100.9	WAC CRB TRP	17.2	OFF
WAC STR	12.5			

03:45 released WAC filter wheel back to default, Ok.

03:49 released WAC close door, Ok.

03:53 released dump table segments, done.

04:01 start OFF OBCP, end of shift, end of OSIRIS commissioning slot #2.

Known (experienced) ‚features' of OSIRIS post commissioning slot #1 and #2:

1. disable back pull automatic for WAC shutter mechanism (NCR to raise)
2. disable shutter brake NAC and back pull automatic for NAC (NCR), but back pull feature is armed in case of two consecutive shutter errors type A are seen.
3. investigate div/0 of calibrate shutter run (at LinRegFitVelocity, tbc) and how it can hang up UDP manager (tbc), raise NCR
4. correct NAC FW turn at end of test FWM WAC (shall read WAC, not NAC in procedure, NCR to raise)
5. dual cal lamps check to implement with proper error handling (NCR)
6. investigate and improve thermal control of NAC Front Door Mechanism (oscillations)
7. ensure return of FWs to default at power down
8. request non-op heaters ON after PCM error event with MCB OFF, review error handling on PCM out-of-limit events
9. NCR on MMB continuous single error count up, investigate this wrt potential side effect of UDP crash
10. NAC back pull kicked-in after 1 real shutter error type A, review double reading of failure type A and modify to 2 consecutive shutter errors
11. NCR on cal lamps on and wait tbc sec before activating shutter in calibrate shutter UDP
12. NCR on DPU time sync required every 10-30 min
13. NCR on EGSE PC time not reliable
14. EGSE does not display parameter to reset back pull
15. DDS/EGSE packets and event losses
16. MCB Phase NAC FDM is not correct on SCOS (thus RSDB fault), entry NSRDM017 floats with values above 100.
17. check and correct RSDB HK calibrations (AI IB)
18. check on: OSIRIS internal queuing of incoming UDP commands as a FWM cmd 'move to default' entered a running stellar sequence in shift #5. Baseline strategy was understood (at least by MK, HSi) that incoming UDPs are queued for execution by the UDP handler.
19. Note: MMB Fill Status (NSRAD007) is not updated by DPU HK generation, has to be checked on UDP HK Screen on EGSE. DPU HK is thus misleading, shall be modified to correct reading.
20. UDP 402: do not touch general camera parameters, run on WAC bombed out after having powered down the NAC.
21. investigate and eventually increase the thermal set point of the NAC Front Door, -30degC plus oscillations (approx. +-2deg) is too close to the trigger point of the redundant non-op heaters (-34degC)
22. bug in stellar star UDP that does not allow exposure times longer than 20sec without an event as notification back down to ground
23. procedures shall be time lined in future activities to improve efficiency
24. tests of procedures and procedure flow are mandatory to clear and approve for execution
25. DDS VC0 and VC1 merging, loss of events, heavy replay. EGSE/DDS interface has to be improved and running for the slot #3
26. RSBD: NAC and WAC CRB dosis are read active (displayed green, not grey) on SCOS-2000 while both CRBs are OFF.

27. NAC and WAC CCD Op-heaters read 20W on UDP HK screen (at setting 100/254 acc. 0.2W) , item on OSIRIS HK screen stays greyed and does not provide the heater power (0mW) unless image acquired, percentage to be taken from UDP screen. UDP screen reads -2% and 50W at setting 254/0.5W.
28. CCD op heater is not 100 at 100%, 254 is related to 100%. To be corrected.
29. shutter error A double encoded (again at next at eventually good exposure) is misleading…
30. Get start up of thermal control into the autostart UDP.
31. Analyze in detail the stray light on NAC and WAC from comet LINEAR observations.
32. Identify and investigate sources of irregular features in images, e.q. WAC upper right leak (tbc) and half moon feature (tbc).
33. Analyze transients and thermal time constants on both NAC and WAC with open/closed doors at 0.89AU and during/after slew from 90deg to 44 deg.
34. Shutter optimization process to be reviewed in view of the various WAC shutter failures.
35. Investigate the 1st and 2nd DPU crash. Investigate on onboard software and PCM HK data, as the camera op heaters were not maintained in 2nd DPU hang-up. But this task is allocate resident inside PCM on the duty cycle/balance delivered by the DPU and maintained unless overwritten by the DPU.
36. Implement thermal control of CCDs using the CCD op-heaters. Verify heater performance and max temperature increase.

Proposed supplementary activities in OSIRIS commissioning slot #2B or #3:

- Plain file transfer test with 512MB SSMM allocation and use
- Stellar calibration @ different CCD temperatures (QE verification
- Dual exposure into MMB
- Upload corrected UDPs (tbc, see above list of features)
- Trigger WD reset and verify/ensure recovery to safe mode
- Test of low power mode all subsystems (DPU, etc.)
- Test of shutter charge modes slow and fast
- Verify auto exposure, add max exposure time to routine to ensure upper limit time out
- Check and test CCDs readout via A, AB and with the gain high and low
- Implement proper command to stop execution of a running UDP. Test this command thoroughly on Reference OSIRIS is forehand.
- Verify that all ADC combinations are tested in both CRBs
- Check MMB scrubbing and adjust to proper value. Investigate need to automatically rescale scrubbing onboard
- Test service 19 and set proper thresholds
- Test automatic action on SREM threshold exceeding
- Test camera pointing vs. individual filter for both cameras, test on repeatability and hysteresis.
- Test emergency shutdown command (tbc)
- Implement dedicated Operational Modes (Idle, On, etc. acc. User Manual), leave CRBs ON out-of-pass.

Deferred Tests from Commissioning Slot #2:

- Plain File Test acc. SR-FCP-009
- Full NAC Flat Fields SR-FCP-016
- Full WAC Flat field SR-FCP-017
- Shutter runs NAC and WAC 20 to 100ms, 5 shots every 10ms
- High-Speed Imaging Test SR-FCP-043
- CCD Op heater performance (steady state) NAC & WAC
- Shutter optimization WAC
- stellar calibration, some images failed due to 20sec max exp time

Nota:

- OSIRIS Commissioning Slot #3 shall be controlled from OSIRIS EGSE **ONLY,** thus reliable data transfer must be worked out and x-checked well in time to slot #3.
- OSIRIS Commissioning Slot #3 shall be run on timing checked and controlled procedures, procedure approval by run on reference OSIRIS.

APPENDIX

1. Co-Alignment Analysis (preliminary)
2. NAC Preliminary Results
3. WAC Preliminary Results

Co-Alignment Analysis (preliminary)

Configuration:

- s/c is nominally pointing +z to Epsilon Aquarii (analysis performed on slot #4 data, 1st pointing to eps aquarii)
- error of s/c pointing is +- 10 arc sec (equivalent to NAC 2.5 px, WAC 0.5 px). This value is the requirement, which was confirmed by simulation.

Epsilon Aquarii (s/c +z centre) was found at:

- NAC px 1045, 1051 (22/48 px offset from s/c pointing) or 92,118 arc sec off-pointing on filter FFP-VIS / Orange

- WAC px 1007, 962 (-16/-61 px offset from s/c pointing) or 320, 1220 arc sec off-pointing on filter Empty / Red

Centre of WAC was found at NAC coordinates 955, 1370

equivalent

centre of WAC at NAC coordinates 1037, 954.

OSIRIS Commissioning Slot #2B/ESOC

Times are in CET.

Shift #1 – 3/4 June 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H.U. Keller;
UPD: none; LAS: none;
Project: W. Pinter-Krainer
RMOC: E. Montagnon, RSOC: -

2004-06-03

20:34 routing is: HK and events on VC1, HK and events on VC0 (the VC0 configuration is a special OSIRIS request)

20:53 s/c telemetry. SREM is confirmed ON.

21:52 ready to switch-on, s/c is pointing below 90deg off sun, s/c powered thermistors read:

NAC FD	-2.5	all degC
NAC STR	-33.3	
NAC CCD	-120.9	
NAC IFP	-2.5	
WAC CCD	-110.0	
WAC STR	-2.5	(15deg colder than last time with CCD heaters ON)

22:00 start of **SR-FCP-050:** OSIRIS ON OBCP (main)

22:05 OSIRIS DPU boot event seen, PCU on, MCU on

22:06 end of procedure: **SR-FCP-050:** OSIRIS ON OBCP (main)

22:07 sent change HK request set to 15 sec, finished procedure **SR-FCP-052** (HK rate change) successfully

22:08 released start of thermal control, **SR-FCP-020**

22:09 service 19 subtype 13, 14, 15 read: (223, B, 17B) (225,D,186) (260,B,175) (254,E,15F)

22:10 dump parametertable (full): TableSendSegment 3 times

22:11 thermal control **SR-FCP-020** running.

22:30 start of **SR-FCP-009** Plain file transfer test

23:45 recovered 3 images and streaming out. Procedure needs change to configure queue back to nominal (disable transfer from stored queue). finished **SR-FCP-009** successfully.

23:57 sent StopMMB, switched MMB Off

2004-06-04

01:12 NAC is thermally stabilized @ -18degC PPE, FWM & shutter actuators, while the WAC is not there yet @ +12degC. Decided to continue with NAC shutter tests first.

01:18 sent CalibrateShutter NAC kinematics only (mode 3); compared with run of slot 2 of end April 04.

	old run	new run	ratio	deviation
motor blade 1	2758.9	2748.9	0.996	0.4%
spring1	82,15	79.27	0.965	3.5%
angle1	1.922	1.947	1.013	1.3%
motor blade 2	2589.8	2567.5	0.991	0.9%
spring2	50.83	43.90	0.864	13.6%
angle2	2.219	2.248	1.013	1.3%

01:38 start of **SR-FCP-022,** NAC wavy plot 20 to 100ms, 5 shots each. no shutter errors detected. Backtravel openings checked and found at all exposure times except 20 ms ☹

01:55 start of **SR-FCP-016,** NAC flat fields, based on time line release.

02:47 NAC flats done and streamed out into SSMM. Decided to power cycle OSIRIS for clean DPU setup out of pass. New NAC shutter parameters will not be stored into NVRAM.

02:49 send OsirisLibInit to reload initial NAC shutter parameter set as of start of shift

02:52 sent OSIRIS Off command sequence (Off OBCP)

02:56 realized short service 19 data set at 0,0,0. to be checked off-line

02:59 OSIRIS is Off. Released sequence to switch On again.

03:06 OSIRIS is On again.

03:17 verified thermal control kick-ed in. Changed HK rate. done for today.

Shift #2 – 4/5 June 2004

2004-06-04

21:19 TM coverage, s/c powered thermistors read:

NAC FD	-35.6	all degC
NAC STR	-48.0	
NAC CCD	-128.2	
NAC IFP	-20.0	
WAC CCD	-106.4	
WAC STR	+10.0	

21:39 released change of HK rate

21:41 route TM via CC09 and stop downlink of NAC flats which are stored in CC07

21:42 use **SR-FCP-011** to run WAC CalibrateShutter kinematic only (mode 3)

	old run	new run	ratio	deviation
motor blade 1	2492.7	2492.7	1	0%
spring1	68.71	68.71	1	0%
angle1	1.506	1.506	1	0%
motor blade 2	2723.9	2720.7	0.9988	0.12%
spring2	76.8	75.93	0.989	1.1%
angle2	0.874	0.880	1.007	0.7%

22:18 changed parameter WAC CCDTravel1 to 0.2mm longer (0.0288 to 0.0290)

22:21 released WAC ShutterAutoOptimize with 2 shots max iteration

22:49 changed parameter WAC CCDTravel1 to 0.5mm longer (0.0290 to 0.0295)

22:50 released WAC ShutterAutoOptimize with 2 shots max iteration

23:15 released WAC ShutterAutoOptimize with 250 shots max iteration: full optimization.

00:01 sent WAC parameter change of LockingPointAccA1 and …B1 from -40,-40 to 0,0

00:05 sent WAC RealizeShutterProfile

00:08 WAC CalibrateShutter 100 to 150, 2 shots every 10 ms. No shutter errors, no backtravel openings.

00:28 WAC CalibrateShutter 100 to 300, 5 shots every 10 ms. No shutter errors seen, no backtravel openings.

00:42 released timelined command stack with 350ms, 400ms, 500ms, 1000ms, 5 shots each. No shutter errors seen, no backtravel openings.

00:56 released WAC CalibrateShutter 20 to 100, 5 shots every 10 ms. No shutter errors seen, no backtravel openings.

01:05 rerouting TM back to CC07 for WAC flat field image acquisition

01:09 start of **SR-FCP-017**, WAC flats part 1 on timeline basis

01:34 WAC flats part 1 done, preparing WAC flats part 2

01:40 start of **SR-FCP-017**, WAC flats part 2 on timeline basis

02:12 ESOC command server stopped releasing OSIRIS commands of timeline. Resumed and continued with last WAC flats on stack. Some command history messages were lost on SCOS2000.

02:22 WAC flats part 2 done, finished WAC flats and streamed out to SSMM. No shutter errors seen.

02:23 released TableExit to store parameter table in NVRAM

02:25 sent TCNACOn, and Initiated NAC FWM

02:27 start of **SR-FCP-043** Test of high speed imaging. Finished successfully.

02:44 start of **SR-FCP-123** Star field imaging NAC and WAC. Finished successfully.

03:00 start CalibrateShutter NAC 20 to 200, 3 shots each. Shutter data were routed thru MMB. No shutter errors, but backtravel opening seen up to 200ms.

03:12 MCBMoveFilterWheel NAC back to nominal, WAC is already at nominal and checked.

03:18 OFF OBCP and done

Nota:

Not a single functional (locking/unlocking) shutter error was experienced with neither NAC nor WAC. The WAC shutter appears performing well (tbc in slot#3 on stability), while the NAC shutter shows backtravel openings as seen in ground level tests. Solution to the NAC backtravel performance hit would be enabling the shutter brake circuitry, to be agreed on between MPAe and the LAS and UPD teams.
No DPU crash faced in this commissioning slot which could be an indicator that the shutter error handling should be analysed having caused the trouble.

OSIRIS Software Verification Slot ESOC

Present: His, MK, HUK, Operator Elsa M.
Times are in CET.

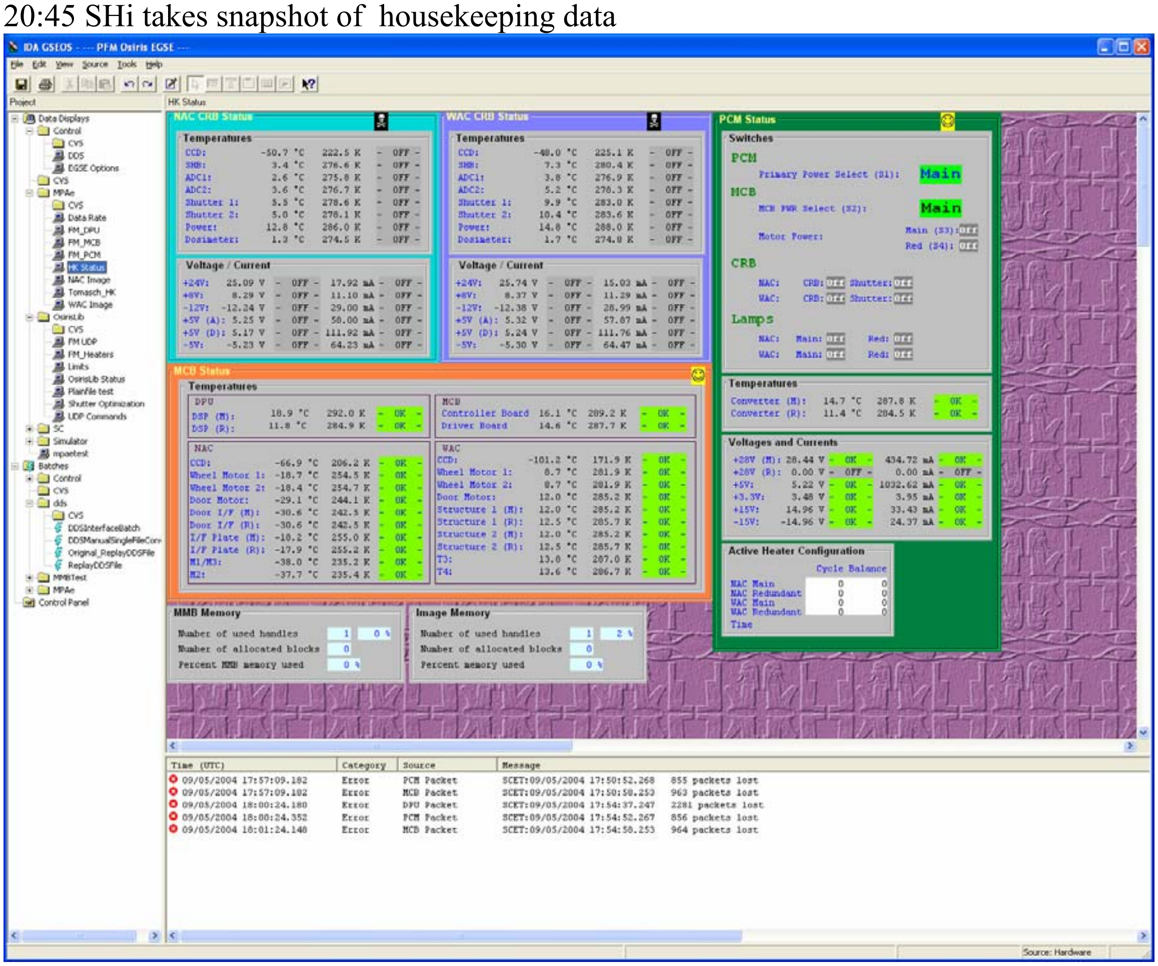
2004-09-05

20:00 Pre-Pass Meeting @ D217

20:40 checked temperatures of s/c powered thermistors NSRAT001 to NSRAT006 at 74 deg sun incidence angle:

NAC PPE: -20.0 deg (camera -17.92 deg)
NAC FDM: -33.3 deg (camera -29.6 deg)
WAC Structure: +10 deg (camera housekeeping at 12.04 both structure thermistors)
WAC CCD: -106.36 deg
NAC CCD: -128.18 deg
NAC SiC Structure: -40 deg (camera -38.2 deg primary, -38.0 deg secondary)
Checked all temperatures are at steady state since the s/c was turned 18 h ago. Ok for this test.

20:45 SHi takes snapshot of housekeeping data



20:56 NAC FW at -18.7 and -18.4 deg operational!
WAC FW at +8.74 both
21:02 Power MCB ON procedure needed before powering motors on
21:07 housekeeping rate change
21:12 MCB ON confirmed
21:13 NAC CRB power switch on TCNACON
CRB setup
Table patch value (sync)
21:22 confirm NAC CRB on etc
21:15 Inconsistancy in Image ID, 64 instead of 128 lines!
21:22 Acquire bias sent
21:31 confirmed OK
21:32 Start the other 31 images time lined
21:32 problems with SCOS2000, cmds not sent
21:36 commands now released
21:39 commando released to switch off housekeeping via VC0
21:52 some problem with the first image on the EGSE, jump in sequence ID
21:58 execution finished
22:01 delay of cmds because of restart of SCOS2000
22:07 problems with packet loss on EGSE – problems with the DDS request (?)
22:14 DDS error msg (Archive error: could not communicate with DDSSret process – could not send request to HF Archive) for 3 queries index 603 to 605. Skipped these files
22:17 EM send cmd to s/c and awaits confirmation to check on SCOS problem
22:25 NAC perform bias test (NAC_BiasTest_2096x128_bin1.itl) finally sent
22:44 finished
22:45 still problems with the SCOS2000
22:49 EM found out that she enabled housekeeping via VC0 rather than disabling it as planned. This explains the loss of packets observed on the EGSE
22:50 SR-FCP-012 (NAC/WAC front door test) step by step
22:53 open NAC cmd sent
23:00 SHv realized that he has not the latest version of the EGSE s/w here at ESOC
23:03 failure of SR MCB: FDM Goto Switch Failure and Front Door Open Failed
23:06 command TableSendSegment of segment SEG_MCB to verify table values.
23:15 table values ok
23:30 SCOS2000 is being rebooted
00:20 SCOS2000 up and running again
leave NAC front door in present state (no problem according to H Si telecon)
00:37 operate WAC FDM, open door cmd sent
T of WAC door 12 deg
00:47 door open verified on EGSE
00:48 close door cmd
00:57 confirmed
00:59 send SR-FCP-014 NAC filter wheel use seq. until the lamp is switched on

01:15 main cal lamp confirmed on
01:16 continue with rest of sequence, last 2 cmd deleted (redundant cal. Lamp)
01:18 TCWACON
01:19 CRBSetup for both cameras take 512x512 image at offset 0,0 through amp. B and tandem ADCs, binning 1
01:30 MMB on confirmed on EGSE
01:31 TCAquireImage no compression, 2 min exp. Time, acquire through MMB for NAC
01:35 dito for WAC
01:42 execution confirmed for NAC **with shutter error A**
01:45 ditto for WAC without error!
01:47 prepare for switch off: filter wheel in default position MCBMoveFilterWheel NAC 2,2, WAC 1,2
01:55 confirmed FW positions
01:59 Switch off OBCP
02:08 confirmed off
02:10 CCD decontamination heaters on

finished shift at 02:10 on 6. Sept. 04

H. U. Keller

OSIRIS Commissioning Slot #3/ESOC

Times are in CET. H Sierks, MPAe

Shift #1 – 14/15 September 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks;
UPD: G. Parzianello, V. daDeppo, S. Fornasier; LAS: by phone;
Project: M. Schwetterle; RMOC: E. Montagnon;

2004-09-14

19:00 pre-pass briefing.

20:41 s/c commanding

20:50 OSIRIS is ON and stabilized from yesterdays switch-on and thermal control init.

NAC FD	-31.1	all degC
NAC STR	-46.0	
NAC CCD	-128.2	
NAC IFP	-20.0	
WAC CCD	-106.40	
WAC STR	+10.0	

20:51 released MCBMotorPowerON, released TCNACON

21:02 released NAC calibrate shutter command, kinematics only

21:20 NAC kinematics done, not a single functional shutter failure was seen

	last run	this run
motor blade 1	2748.9	2703.3
spring1	79.27	70.45
angle1	1.947	1.977
motor blade 2	2567.5	2552.3
spring2	43.90	41.66
angle2	2.248	2.258

21:29 released star field image NAC, 2048x2048, 2min exposure, 1x1, 5:1 compression

21:45 NAC image taken successfully, no shutter error, data streaming down now

21:46 released NAC image 2048x2048 (timelined) with calibration lamps ON, 2 sec exposure, 2x2, 12:1 compressed

22:08 released TCWACOn, Calibrate WAC shutter on kinematics only

22:13 NAC images are streamed down, star field indicates open door of NAC, forwarded images to LAS for detailed check, check performed and found not a single star in image! All spots are cosmics☹

22:34 results of WAC shutter kinematics:

	old run	last run	this run
motor blade 1	2492.7	2492.7	2499.95
spring1	68.71	68.71	69.36
angle1	1.506	1.506	1.501
motor blade 2	2723.9	2720.7	2726.35
spring2	76.8	75.93	74.91
angle2	0.874	0.880	0.881

22:47 released sequence on winding test of the NAC FDM motor

22:49 stopped as enable low level cmd was missing

23:01 released sequence again with enable cmds included

23:16 checked all 4 phases and driver stages of Front Door Mechanism motor and found all OK, current increase on 28V per winding is about 200 mA @ -30degC

23:18 going for the sync test next on NAC and WAC

23: 22 FWM Init sent

23:30 FWM Init OK received (ERT 21:30)
FCP 124 (skip TCNACOn, camera already on)

23:32 (SCET 21:32) NAC sync test 1x1 started

23:40 Note: MCB Init FWM message does not indicate camera. Needs update

23:46 (SCET 21:46)NAC sync test 2x2 started

2004-09-15

00:00 (SCET 22:00) NAC sync test 4x4 started

00:13 (SCET 22:13) NAC sync test 8x8 started

FCP 125 (skip TCWACOn, camera already on)

00:27 (SCET 22:27) WAC sync test 2096/1x1 started

00:40 (SCET 22:40) WAC sync test 2048/1x1 started

00:54 (SCET 22:54) WAC sync test 128/1x1 started

01: 08 (SCET 23:08) WAC sync test 2x2 started

01:22 (SCET 23:22) WAC sync test 4x4 started

01: 35 (SCET 23:35) WAC sync test 8x8 started

01:47 All sync tests finished, going for additional NAC images for FDM investigation (longer integration times)

Note: SCET time has lapsed so we update time

01:54 set NAC filters back to default

01:55 set WAC filters back to default

ca 02:00 swap science to ex-plainfile which is now set up for telemetry packets

02:33 (SCET 0:33:36) acquire star field image NAC, 2048x2048, 5 min exposure, 1x1, 5:1 compression

02:38 (SCET 0:38) NAC image taken successfully, no shutter error, data streaming down now

02:41 (SCET 0:41:37) acquire star field image NAC, window 2048x2048, 5 min exposure, 1x1, 5:1 compression. Second image shall allow for cosmics removal and thus clarify star identification.

02:46 (SCET 0:46:44) NAC image taken successfully, no shutter error, data streaming down now

02:49 (SCET 0:49:34) open WAC door

02: 50 (SCET 0:50:46) acquire star field image WAC, 2048x2048, 0.5 min exposure, 1x1, 5:1 compression

02:51 (SCET 0:51:24)
WAC image taken successfully, no shutter error, data streaming down now

02:56 (SCET 0:56:47) close WAC door

03:10 released NAC and WAC CCD op heater ON at 255 (100%) for thermal stabilization out of pass.

03:14 Current CCD temperature reading is:

NAC CCD	-126.36 S/C	-126.39 (CRB)	-69.72 (MCB)
WAC CCD	-104.55 S/C	-105.75 (CRB)	-100.19 (MCB)

NAC +5Van: 57mA +5Vdig: 112mA -> +5Vdig: 209mA
WAC +5Van:57 mA +5Vdig: 113mA -> +5Vdig: 211mA

Note: The 2 NAC images were analysed and compared. There is evidently no star seen!

Shift #2 – 15/16 September 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, R. Mueller, H. Sierks, H. U. Keller;
UPD: G. Parzianello, V. daDeppo, S. Fornasier, M. deCecco; LAS: G. Rousset, A. Origne, S. Laurent, J.L. Boit;
Project: M. Schwetterle; RMOC: E. Montagnon;

2004-09-15

Prior to the shift, the recorder files of the September 5, 2004, door anomaly were replayed. There is evidence that the successful WAC door opening was performed with approx. 90 internal commands to the MCB, while the unsuccessful NAC opening was stopped after approx. 20 commands. Investigation of the UDP source code indicates a stop of UDP after reception of an error code returned from the MCB. This error byte was not notified to ground. Details and background of error requires further offline analysis.

19:00 pre-pass briefing.

20:43 Current CCD temperature reading is:

NAC CCD	-111.82 S/C	-112.54 (CRB)	-96.38 (MCB)
WAC CCD	-93.64 S/C	-94.57 (CRB)	-90.03 (MCB)

NAC +5Van: 57mA +5Vdig: 209mA
WAC +5Van:57 mA +5Vdig: 211mA

20:58 Released MCBMotorPowerOn

NAC image with grazing incident sun @ 90deg with 90sec, 2x2, 12:1

Move NAC door inwards by 50 steps, successfully completed.

NAC image with grazing incident sun @ 90deg with 90sec, 2x2, 12:1

s/c slew to 96 deg performed according to planning (sun under z-panel)

Two NAC images received – the straylight pattern changed indicating that the FDM moved. The second image had basically no straylight thus the door was closed down touching the NAC baffle. The mechanism definitely moved ☺

21:12 Released the MCBMoveMechanism patch

21:16 Released the ShutterEnsurehomeposition patch

21:22 Successful MCBMoveMechanism patch

21:25 Successfull ShutterEnsurehomeposition patch

21:36 Released sequence:

DPU power save mode off
PCM+MCB HK rate to 1 s
Move NAC FDM 600 steps towards open

Take NAC star reference image (2048x2048 2x2bin 12:1 90 s)
Switch Main NAC callamp ON
Take NAC callamp reference image (2048x2048 2x2bin 12:1 2 s)
Switch Main NAC callamp OFF
Change PCM+MCB HK rate to 15 s
Disable DPU power save mode

NAC FDM encoder reading changed to 3 indicating that the FDM did move and that the closed position switch was triggered.

22:00 checked NAC images and found stars and the rounded shape of the door on one side of the image. Phew☺

22:03 released 600 steps back move to NAC door

22:11 set PCM sync value of NAC to 6 via TablePatchValue

22:12 NAC door moved, but the close switch did not change to close as we are marginal in the switch hysteresis

20:23 released door to cruise via MCBCloseDoor NAC, Ok

20:35 released door to open via MCBOpenDoor NAC, Ok

20:44 released door to close via MCBCloseDoor NAC, Ok

20:57 released MMB On for geometric calibration

23:26 geometrics done.

23:30 released NAC and WAC CloseDoor cmds, done and fine.

2004-09-16

00:05 released tablepatchcmds for NAC shutter brake on and back-pull enable

nota: see details below in shift #4 concerning the shutter brake activation: the brake was **NOT** activated at this point

00:06 power cycled the NAC CRB and SHE to activate the brake (see nota)

00:06 released TCAcquireImage NAC 120ms exposure time with brake and post shot back-pull @ 1 sec exp time and 0.3 ms nominal back-pull pulse (see nota)

00:40 analysed back pull and found the blades bouncing as desired at low velocity of below 0.08 m/s

00:49 released NAC TCAcquireImage again, got shutter error type D and recommended same image

01:11 released NAC TCAcquireImage and checked again, same bouncing behavior.

01:41 released 5 NAC TCAcquireImages with same parameters on statistics

02:04 No change to patched NAC shutter parameters. Keep in mind for later!

Going for WAC geometric calibration. Modifying to save time:
Exposures 5 min. instead of 15 minutes
Switching back to other packet store (because of size)

02:13 Open WAC door released

02:15 WAC CRBSetup released; waiting for HS link

02:18 rest of WAC imaging series released

03:10 release WAC door close

03:11 sequence run successfully

03:11 released WAC FWMs back to default

03:12 released Motor Power OFF

03:12 released NAC CRBSetup

03:12 released bias/dark imaging with NAC

03:27 one before last single image released

03:37 last single image released

03:37 release: change NAC set temperature to -10 C/263.15 K + dump segment

03:40 check: both doors are closed, FWMs are in default positions, S3 is off. No more commanding required.

03:46 Current CCD temperature reading is:

NAC CCD	-111.82 S/C	-112.65 (CRB)	-96.13 (MCB)
WAC CCD	-93.64 S/C	-94.57 (CRB)	-90.03 (MCB)

03:50 verified new thermal set point and confirmed via dump.

04:00 Done for today.

Shift #3 – 16/17 September 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, H. Sierks;
UPD: G. Parzianello, V. daDeppo, S. Fornasier, M. deCecco; LAS: G. Rousset, A. Origne, S. Laurent, J.L. Boit;
Project: M. Schwetterle; RMOC: E. Montagnon;

2004-09-16

19:00 pre-pass briefing.

20:43 Current CCD temperature reading is:

NAC CCD	-110.00 S/C	-109.9 (CRB)	-100.70 (MCB)
WAC CCD	-93.64 S/C	-94.49 (CRB)	-90.03 (MCB)

21:04 released NAC shutter kinematics command @ -10˚ C (note: back-pull is always on, thus also thru kinematics)

21:20 NAC kinematics done

	old run	-18˚C run	-10˚C run
motor blade 1	2748.9	2703.3	2692.24
spring1	79.27	70.45	70.89
angle1	1.947	1.977	1.990
motor blade 2	2567.5	2552.3	2553.22
spring2	43.90	41.66	44.97
angle2	2.248	2.258	2.230

21:35 MCBMotorPowerOn released

21:41 released TCAcquireImage NAC 120ms with brake and back pull. (see nota)

21:47 received error on illegal size, realized that we did not send the CRB Setup cmd

21:48 released CRBSetup cmd

21:48 released TCAcquireImage NAC 120ms with brake and back pull. (see nota)

22:08 released 5 TCAcquireImage NAC 120ms, all shot are similar in back pull and without a hitch so far. No shutter errors seen. (see nota)

22:34 released TCAcquireImage NAC @ 50ms

22:40 released TCAcquireImage NAC @ 20ms

23:04 on proposal by Mario and in agreement with LAM we released CalibrateShutter, 20 to 70 ms, 2 shots

23:30 Calibrate shutter finished without a shutter error, analyzing data

23:58   all shutter pulse data similar

23:59   released TCAcquireImage 20 ms in test mode

00:26   released TCAcquireImage 20 ms in test mode again

00:28   released TCAcquireImage 20 ms in test mode 3 times

00:35   creating stack for WAC dark/bias 0/1/600 s exposure time

00:47   last NAC image received

00:51   switch to main storage file in SSMM, released stack

01:32   setting up stack for sync test repetition, starting with WAC reduced set. 1x1 2096x64 0x11

01:38   released sequence (WAC is already ON)

01:53   setup/release WAC 2x2/256x256/0x11 sequence

02:05   setup/release WAC 4x4/512x512/0x11 sequence

02:20   setup/release WAC 8x8/1024x1024/0x11 sequence

02:33   setting up stack for sync test repetition, starting with NAC reduced set. 1x1 2096x64 0x6

02:34   released sequence (NAC is already ON)

02:47   setup/release NAC 2x2/256x256/0x11 sequence

03:00   setup/release NAC 4x4/512x512/0x11 sequence

0314:   setup/release NAC 8x8/1024x1024/0x11 sequence

03:36 set NAC PPE temperature to -18 degrees C

03:38 Switch off CCD operational heaters

03:40 Move filter wheels to default position

03:43 PowerMCBMotorsoff

04:46   verified CCD op heaters are off, thermal control got -18degC target temperature @ PPE and temperature drifts down.

End of shift

Nota: The NAC CalibrateShutter images were analysed (20 to 70 ms, 2 shots, cal lamps ON). Backtravel opening was found in most images indicating that the shutter brake was not activated. The check of the code of the onboard software gave evidence that the low level software changes to the new kernel software as uploaded on September 4 is not compatible with the current activation of the NAC shutter brake☹
In consequence, the shutter brake was OFF all along the shutter investigation performed so far up to slot #3.
The NAC shutter brake activation command was modified in related UDP and prepared for uplink on September 17, 04.
In addition, the MCB handler was modified for uplink concerning notification of error byte in case of commanding failure and re-transmission of command as stated in related MCB interface documents.
Both modified UDPs shall be made permanent.

Shift #4 – 17/18 September 2004

MPAe: S.Hviid, M. Kueppers, I. Buettner, H. Sierks;
UPD: G. Parzianello, V. daDeppo, S. Fornasier, M. deCecco, C. Barbieri;
LAS: G. Rousset, A. Origne, S. Laurent, J.L. Boit;
Project: M. Schwetterle; RMOC: E. Montagnon;

2004-09-17

19:00 pre-pass briefing.

20:30 NAC thermal transient was analysed: PPE transition from approx. +5degC non-op to -18degC op lasts about 5 hours slope plus approx 4 hours dwell time. Thus 10h transition time should be accounted for transition from about 70deg sun angle above z panel to operation (or kinematics run).

20:40 s/c commanding

20:49 Current CCD temperature reading is:

NAC CCD	-126.4 S/C	-126.3 (CRB)	-69.97 (MCB)
WAC CCD	-104.6 S/C	-105.6 (CRB)	-99.93 (MCB)

20:55 released start of OSIRIS OFF OBCP. The actual parameter table (incl. results of NAC & WAC kinematics as well as brake configuration) is stored to NVRAM.

21:01 released OSIRIS ON OBCP for clean boot.

21:18 OSIRIS booted. Thermal control started.

21:22 uploaded patch MCBMoveMechanism (notify error byte in case of failure and retry commanding MCB once)

21:24 uploaded patch SwitchSHEBlade2BrakeOn (activate shutter brake adopted to low level software change)

21:33 first patch in onboard and checked, second in as well and checked

21:38 released SavePOPs to NVRAM to make changes permanent

21:50 released tablepatchcommands to disable NAC shutter brake and disable back pull for upcoming kinematics.

21:51 released TCNACOn, CalibrateShutter NAC on kinematics.

22:10 NAC kinematics done

	old run	-18˚C run	-10˚C run	-18˚C run
motor blade 1	2748.9	2703.3	2692.24	2706.8
spring1	79.27	70.45	70.89	71.48
angle1	1.947	1.977	1.990	1.985
motor blade 2	2567.5	2552.3	2553.22	2562.9
spring2	43.90	41.66	44.97	46.60
angle2	2.248	2.258	2.230	2.258

22:14 released TCWACOn

TCMCBMotorPowerON

MCBDoorOpen NAC

MCBDoorOpen WAC

StartMMB

Swapped SSMM to primary osiris storage (CC07)

22:26 Start Stellar Calibration NAC &WAC (FCP-004)

22:52 Type D shutter error during NAC stellar calibration

00:08 TablePatchValue patchs thermal parameter for NAC front door from 0.5 to 0.025

00:08 TableSendSegment

00:08 Start of NAC limited Focus Check (FCP-018)

00:22 Start of WAC limited Focus Check (FCP-019)

01:11 Closed NAC and WAC front doors

01:19 WAC 3min dark fullframe image

01:34 NAC 3 min dark fullframe image

01:44 released tablepatchcommands to enable NAC shutter brake and enable back pull, TableSendSegment for dump down for check

released TCNACOff
released TCNACON
CRBSetup 2x2, etc. standard for this test

01:48 released sequence of 2 images with shutter brake on, the first will start in ensured home position as left from the last non-braked shot. This first shot will see the brake on blade 2 and the home back-pull. The first 'recovered' shot is the next, the second shot, that will be analyzed on locking success and flight velocity profile.

02:14 first shot was nominal (as expected), second shot of 120ms had error type A (locking error), thus the second blade was not shot. The shutter pulse of blade 1 are not regular, could indicate start close to open position (tbc), requires further analysis.

02:17 released tablepatchcmds to disable shutter brake and back-pull and table dump, followed by power cycle of the NAC CRB to disarm the shutter brake

02:19 released TCAcquireImage 120ms to check shutter at nominal condition. No shutter error seen. Analyzing pulse data…

02:30 released CalibrateShutterNAC

02:38 set NAC FDM thermal control parameters back to nominal for storage: integral back to 0.5. followed by table dump.

02:51 release RTU Science enable (file size < 100 kByte)

Image was using size from CalibrateShutterNAC so could not be compressed. Repeating exercise with correct parameters.

03:00 In parallel: preparing stack for low power mode with filter moves (cf. SR-FCP005)

03:10 RTU science is seen on EGSE

03:13 Disable RTU Science, enable HS Science

03:16 NAC, WAC CRBs OFF, MMB OFF

03:18 Releasing stack for low power mode test

03:35 Filter wheels to default positions

03:36 Motor Power OFF

03:36 configure science HS link back to default file

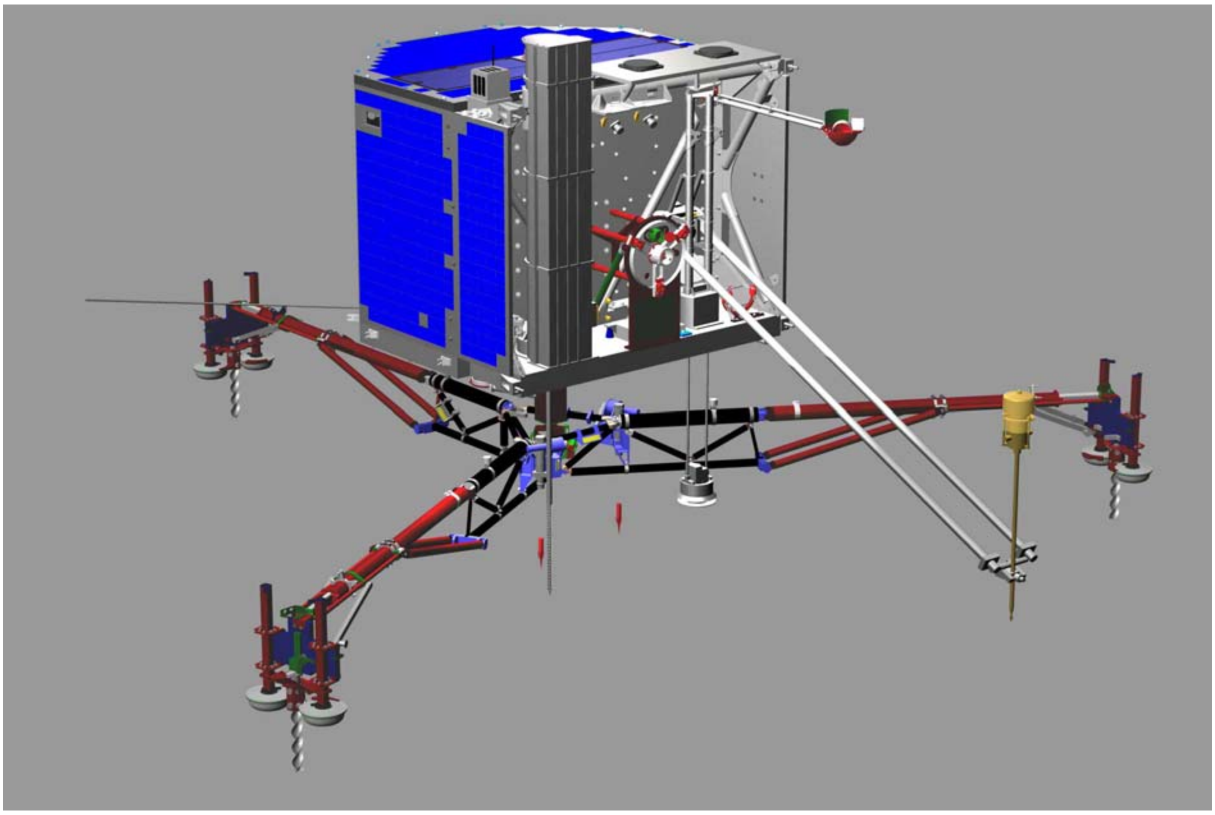
04:00 HK Rate to 120 s

end of commissioning slot #3. OSIRIS stays on for the upcoming interference campaign.

Philae

Commissioning Report

Reference:	RO-LAN-RP-30400
Issue:	1.0
Date:	11.11.2004
Prepared by:	Philae Team
Authorized by:	12. 11. 2004 .... H. Scheuerle, Philae Project Manager



DOCUMENTATION CHANGE RECORD

Issue	Rev.	Sec.	Page	Date	Changes
1	0	All	All	11.11.2004	Initial Issue

Contents

1 Commissioning Operations - Overview

Philae was switched on already 9 hours after launch for NEA release (launch locks). This was necessary to keep thermo elastic deformations within allowed limits The Lander responded as expected, giving an early indication that the vital subsystems were alive.
The NEA firing was smooth and successful (see section 2.9).

The detailed checkout has been performed in four commissioning blocks:

- Block 1: 12. – 17.03.2004
  The block was mainly devoted to the checkout of subsystems.
- Block 2: 09. – 15.04.2004
  Continuation of subsystems checkout
  Instrument checkout
- Block 3: 13. – 21.05.2004
  Continuation of instrument checkout
- Block 4: 05. – 09.10.2004
  Mainly devoted to combined operations between SD2 (drill), CIVA-M (microscopes), COSAC and PTOLEMY (mass spectrometers)

Philae participated in addition in the pointing campaign on 01.10.2004 and combined RPC/ROMAP measurements on 08./10.09.2004 during Draconide encounter.

For a detailed breakdown of activities see annex I (as-run timelines)

2 Subsystem Status

2.1 Subsystem Performance Matrix

Subsystem	Performance	Major Open Work	
		for cruise	for on-comet operations
Electrical Support System			
Command & Data Management System			Yes
Power Subsystem			Yes
Thermal Control System			
S-Band Telecom Subsystem			
Active Descent System			Yes
Flywheel			
Mechanical Support System & NEAs			Yes
Landing Gear			Yes
Anchor			

2.2 Electrical Support Subsystem

Introduction and Goals

During commissioning all Lander units (subsystems and experiments) are thoroughly tested. The ESS (Electrical Sub-System) as data interface between Philae (Lander) and Rosetta-Orbiter was tested mainly by using it in the normal operation. Using alternatively both ESS branches, the main and redundant system, was the only specific test condition.
Another goal was also to gather data under real space conditions as basis for later operation phases.

Results

In general both branches of the ESS worked fine and the commissioning can be stated as successful. The quick built up and stable link via RF was a highlight of the testing, for we have been not sure that it would work fine in this configuration – the antennas of Orbiter and Lander look in the same direction and no reflective walls help in space-. In block 1 tests ran using the main and redundant ESS nearly equally. In block 2 the redundant ESS was exclusively used, in block 3 and 4 only the main ESS was switched on.

Some minor remarks shall be noted to cover all observed incidences.

The +5V and +12V converters inside the ESS became very hot, in block 2 nearly to the upper temperature limit. It was not critical but was carefully observed for that reason. As fig. 2 and 3 show, the temperature goes up to 98°C in the redundant branch at a distance to the sun of 0.9 AU. The mean temperature of these converters shall not exceed 103 °C [see Annex 1], i.e. an upper limit for the HK warning shall be set to 107°C taken into account the variation of the measurement [Fig. 3]. Figure 1 indicates that the converter in the main branch is slightly better coupled to the box and was therefore the preferred branch in block 3 with a minimal sun distance of 0.8 AU. As fig. illuminates, at no time any critical temperature was observed.

The MSS and WAX tests in block 1 were only partially done. Main point of concern was the WAX heating, which may result in loosing the Lander in case of a regulation failure and as result the heating could not be stopped in time [see anomaly report RO-LCC-AR-0006]. The procedure update will introduce an automatic switch OFF of the LCL1&2 as additional safety step. The WAX heating test itself is postponed to a time shortly before the real separation (in 2014). These MSS tests have to be performed on both ESS branches again.

ESOC objected to the amount of events from the ESS related to start and stop the transmission of TC and TM to the Lander (see AR ROS_SC-23).

NCR's

Two NCR are still open, RO-LAN-NC-30352 and -30368.

The first one is related to a time sync lost, which was thought due to not sending the right time to the Lander after boot up or even that the ESS itself has not overtaken the OnBoard-Time. The analysis shows, however, that the ESS time was right and a command was sent to Philae and acknowledged. So this NCR has been shifted to CDMS.

NCR-30368 deals with a wrong time stamp at some event packets from the ESS. Due to the automatic time correction method at ESOC, the observed time shift is not visible any more in our data – and also not at the data pool at ESOC. We have to discuss the point with ESOC, how to store these events to be able to analyse its cause. The shift in the time stamp does not affect the operation.

Open work

The relays for the push power and the WAX heating control are part of the ESS. Nevertheless, these tests go with the MSS and are discussed and handled there.

With respect to the amount of events by the ESS, a solution by a change of the ESS-SW code is not advised: such change deeply involves the whole ESS-Orbiter protocol and has to be reloaded after each booting sequence. It is a potential source of malfunction and is opposed to the requirement of tolerance of one failure. [See also Annex 2, a comment from CAPTEC after an analysis wrt to a SW-Patch].

Two other – operational - approaches are under development by configuring the data transfer from Orbiter to ground:
- either the ESS event are directed into the science data stream
- or the ESS events are put into a separate packet store and taken from there on explicit command. Here the amount of storage (for about two days) has to be calculated.

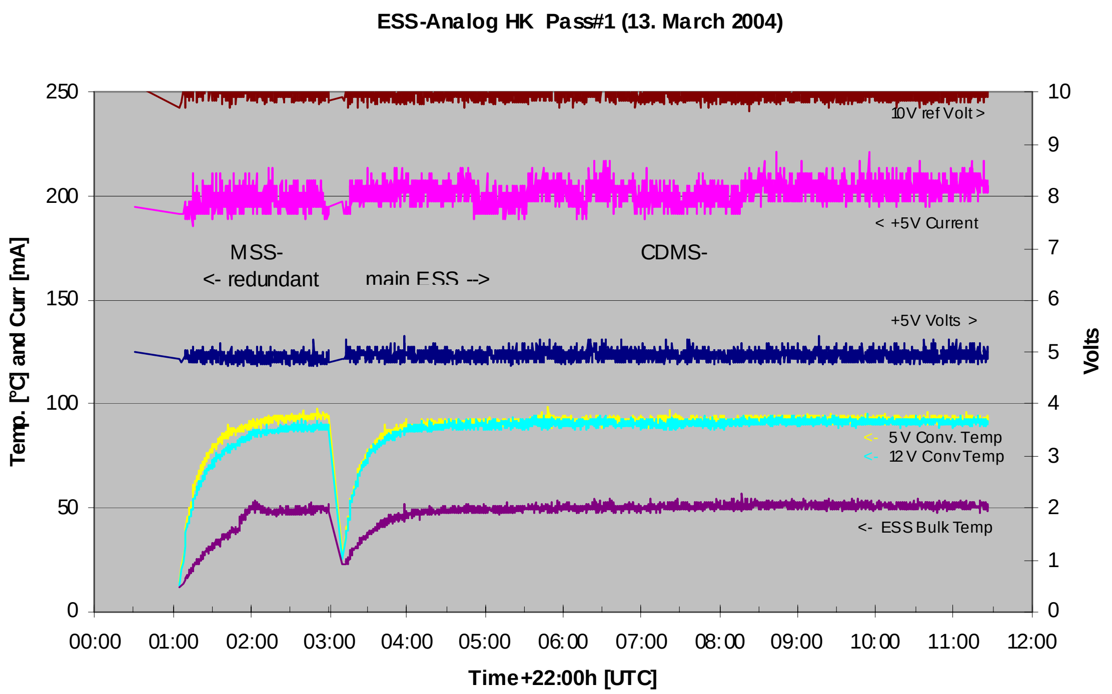


Fig. 1 ESS analogue HK of Pass#1 in Block 1

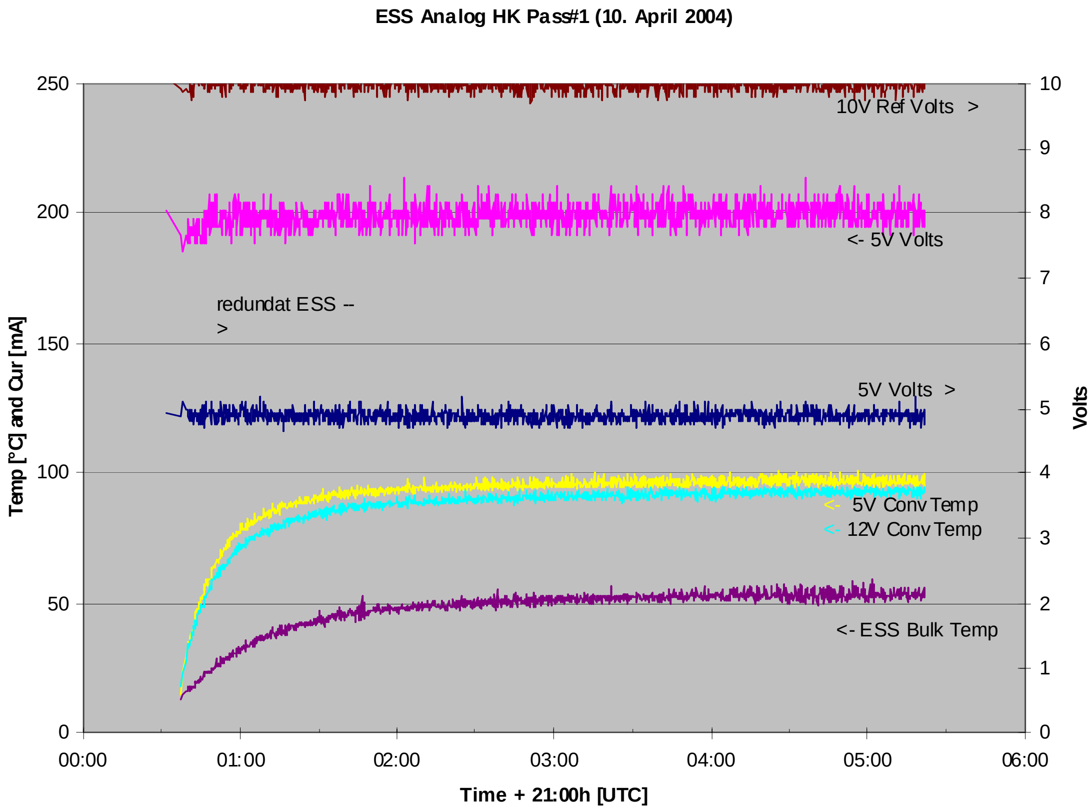


Fig. 2: ESS analogue HK of Pass#1 in Block 2

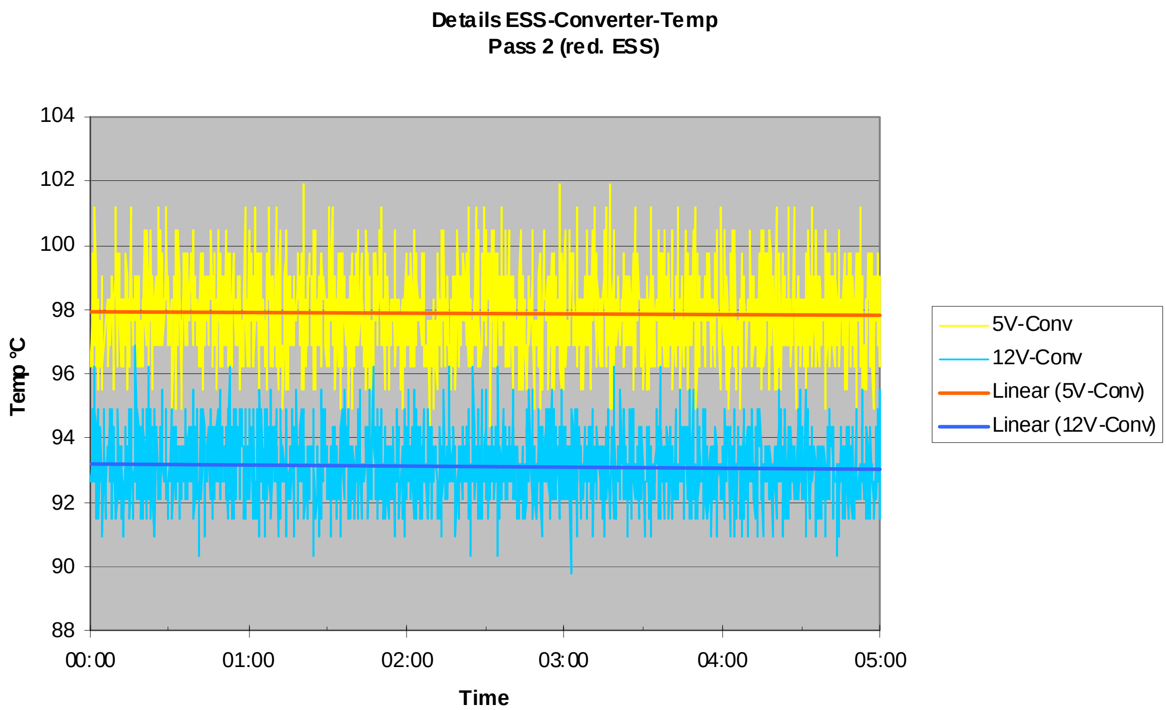


Fig. 3: Detail of Converter Temperature (Pass#2 in Block 2)

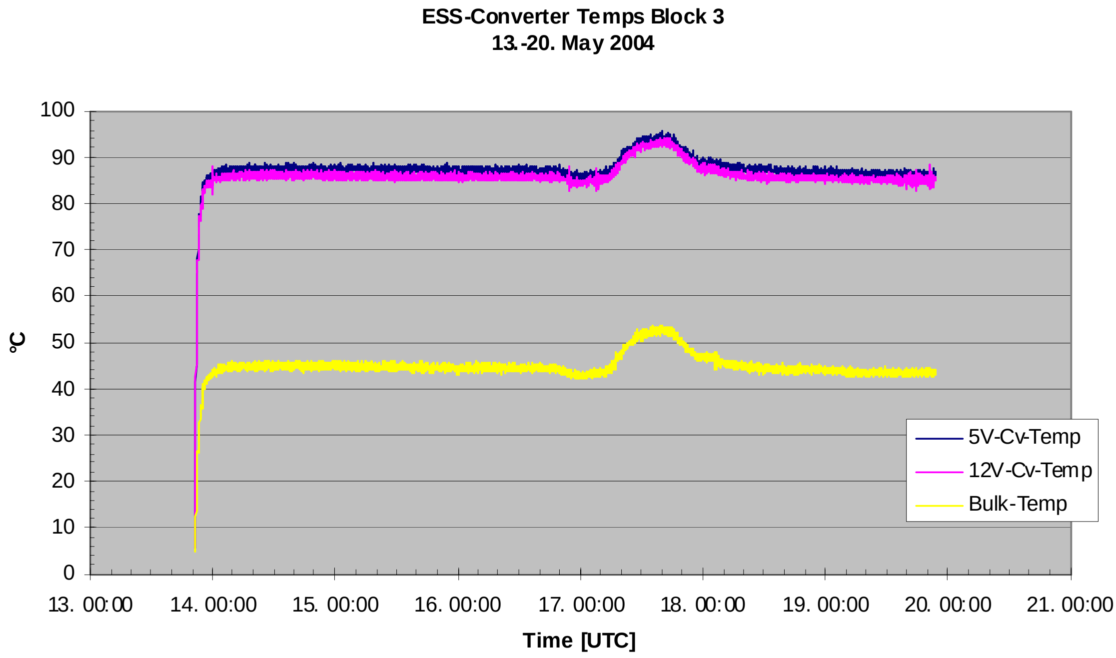


Fig. 4: ESS (main) converter temperature during some days of Block 3. Nowhere the limit of 103 °C was exceeded. The bulge at 17. May is related to the manoeuvres due to the Comet observation.

Annex 1:
Statement of F. Kennedy (CAPTEC) to the question to avoid some of the ESS-events by patching the ESS-code

About the suppression of events, we have looked at this possibility and the initial assessment is as follows:

Because the ESS software executes from ROM any new functions would have to be in RAM and this poses operational problems as well as inherent development problems.

New functions can be added in RAM; however, these can only call functions which have been declared in the original code using the "_far" keyword.

The events 48051, 48052, 48053 and 48054 are raised deep inside the code called from the Task ldrExecute, and as part of ROM resident functions (rfprCheckNominalState, rfprInitCommand) which are not available to be called from RAM.

The only possibility would be to replace the entire ldrExecute task, including any functions which it calls which have not been declared as "_far" in the original code, by RAM code. Even if only the first level of functions called by ldrExecute needed to be programmed in RAM, this would be about 2 kB. However, almost all functions called by functions called by ldrExecute will need to be patched, so that a figure of 4 kB is likely.

Because all references to data and code addresses would need to be manually patched (Ref 2, Chapter 6) this is a prohibitive effort, even without taking into account the possibility of error.

I hope this answers your questions. If you decide to go further we could estimate the effort required.

Best regards,

Fred Kennedy

2.3 Command & Data Management System (CDMS)

Goal of commissioning

- To obtain an overall status of CDMS flight HW for both main and redundant internal functional sub-units within CDMS (DPU1,2; MM1,2; CIU1,2; RTC1,2; ETCD1,2,3)
- To test Orbiter-Lander tele-communication link for both main and redundant branches of both communication media (Umbilical and RF)
- To test 'inter-lander' communication with all Lander Units (subsystems/experiments) on both main and redundant communication branches for both TC and TM direction
- To test long-term operation of CDMS in flight/space environment in terms of operations reliability, commandability and responsiveness
- To reveal eventually unnoticed deficiencies in current CDMS SW, ver 6.0

Results

- All internal functional sub-units within CDMS are intact and operational
  (Note*** For MM ref. 'NCRs' below)
- Telecommunication between Orbiter-Lander is operational
  (Note*** For RF communication ref. 'NCRs' below)
- Inter-lander communication is operational
- CDMS has been operated continuously for about 4*150 hours during the 4 commissioning blocks
- SW version 6.0 is basically operational, however some discrepancies have also been revealed
  (Note*** ref. 'NCRs' below)

NCRs

NCR	Description	Origin	Status
30344	CDMS escapes autonomous batt. handling	SW	SW bug identified, to be repaired in the next SW ver.
30346	Follow-on NCR on 'DPU-ovrsw' (RF comm.)	HW	Problem not yet fully undersood and identified Further analisis and implementation of SW work-around for the HW problem suggested, wherever is possible
30352	CDMS/ESS time sync lost	SW	Reason not yet identified
30356	LPC still ON after re-config.	Procedure	Problem identified Modify test procedure
30362	Last SESAME TC's not executed	SW	Investigation is going on

30366	Link break at the end of a full MM dump	SW	Problem identified, to be repaired in the next SW ver.
30369 30370 30373 30374 30376	„Corrupted parameters or blocks in TM packets…”	SW	Problem identified, to be solved in the next SW ver.

Open work

- NCRs to be closed through developing a new SW version
- Validation on the Ground Reference Model
- Uplink new SW version into FM and test/validate it in FM environment

2.4 Power Subsystem

Introduction

The PSS is a central part of the Lander. Basically it receives electrical energy from different sources (e.g. from Orbiter, Batteries, Solar Arrays), converts/conditions this energy to the required form (i.e. voltage/current), then distributes it within the subsystems and experiments. It works partly autonomously (e.g. short circuit handling), partly controlled by CDMS (switch on/off the different units). Through its TM channels it continuously produces and delivers 105 analogue HK data and about 200 bit digital status information.

Goal of Commissioning

The commissioning activity for PSS consisted of:

- checking of all testable (main and redundant) sub-units (i.e. converters and control units) and switches
- testing of all (main and redundant) HK channels
- checking the health of Primary and Secondary Batteries
- discharging the Secondary Battery to a level of 40%
- implementation of a new procedure for Secondary Battery monitoring

Results

The test plan covered the largest part of the PSS electronics, except for the solar array, MPPTs, shunts and primary battery switch to main bus, which would have been difficult to test in the given configuration. The tests were successful.

The HK parameters indicating the EPC1/2 converters' "input current" showed anomalous fluctuations, although the currents themselves are correct, as derived from other HK data.

The Primary and Secondary Battery's health checks gave positive results. The Secondary Battery discharge to ~40% charge level was executed in a few consecutive steps according to the plan. A new procedure for Secondary Battery charge level monitoring, permitting more accurate measurements, was uploaded during the block 4 of commissioning and applied successfully. The collected cell voltage data will be the reference for similar checks in future.

Non Conformances

Three NCRs have been generated:

RO-LAN-NC-30349 "EPC1,2 current consumption anomaly":
This is a PSS-HK data acquisition problem; the real EPC currents are stable as the "C-LCL-M/R" channels show. Further investigation is required. Status: Open.

RO-LAN-NC-30350 “Flywheel (FW) speed anomaly”:
The PSS’s HK unit only samples the FW’s speed or rpm signal. As all other PSS H/K channels are nominal the most likely cause for the observed anomaly is the generation of faulty rpm signals by the FW itself (see also section Flywheel). Status: Open.

RO-LAN-NC-30356 “LPC still ON after reconfiguration”:
The LPC remained ON as a consequence of a faulty CDMS command sequence. It was corrected. Status: Closed

Open work
Lander FM: Secondary Battery monitoring, possibly charging.
Rationale: The procedure used prior to block 4 entailed discharge/charge currents to derive the Secondary Batteries’ cell voltages. These currents caused cell voltage shifts and made the determination of the cells’ Uoc voltage more difficult (Uoc provides important information about the Secondary Batteries’ self discharge rate during cruise). The new procedure runs without charge or discharge current.
Future passive checkouts (Lander operated via MTL) will be used for monitoring the Secondary Batteries in cold condition, whereas during active checkout phases tests will be performed at both hot and cold conditions. In case of necessity a charging up to a defined level will be performed.
A modification is required in CDMS S/W: analyzing of HK data in Block 1-4 it has turned out that the MPPT output current channels produce misleading current values at high (>35 degC) temperature in non-op mode. Because the CDMS s/w uses these HK data to determine the sunset on comet, the modification of this s/w segment is necessary. There are other, useful HK channels to solve this problem.
Additional verifications which were not part of commissioning (involving for example the Solar Generator or the Primary Battery) are TBD.

Ground Reference Model: Investigation of EPC1/2 input current anomaly.
As the mentioned HK channels show similar behaviour in the GRM, it will be possible to localize or perhaps correct the failure by S/W.

2.5 Thermal Control Subsystem

Tasks of the Thermal Control System (TCS)
The tasks of the Thermal Control System of Philae are:

- Ensure Lander survival during Lander Hibernation phases
- Provide temperature environment as requested by Lander PIs during Lander operational blocks

Therefore no dedicated commissioning of the TCS has been performed, since it has to work continuously from launch until the end of the mission. Nevertheless specific functionalities are executed in parallel to Lander commissioning respectively to support S/S and P/L commissioning.

Results
During Lander hibernation phases a temperature environment inside the Lander could be established which is compliant with the specification (requirement T > -55 degC):

- the temperature of the internal compartment has been stabilized at around -26 degC
- the temperature inside the battery compartment is at -38 degC
- the main hibernation heaters work nominally.

For more information refer to the Lander Hibernation Reports RO-LAN-RP-3040x.

During Lander operational phases (CVP block 1-4, during Draconide encouter and Consert Pointing) the temperature environment inside the compartment could be well established following the PI requests in the range of -40 degC to +40 degC. All TCU sensors provide reasonable readings, showing that all temperatures inside the Lander as well as outside are in the expected ranges. All TCU operated heaters have been successfully used, either via heater control loops using various set-points as required or, partly, via the TCU heater emergency functionality to provide a special, constant temperature environment.

After Launch the failed TCU 1 was found operating again without any restrictions. Therefore throughout the Lander CVP blocks both TCUs were used, either working alone or parallel. But, since the failure at TCU 1 could not be finally identified, TCU 1 will serve as back-up and TCU 2 will be the nominally used unit.

Non Conformances
After Launch one temperature sensor (at Lander Push plate) has been found open (refer to RO-LAN-NC-30343), but without any major effect. During NEA release the sensor at the Civa-Stereo camera was used instead and NEA release could be performed successfully. For the remaining mission the Push plate temperature is only regarded as additional information and therefore can be predicted from the TMM.

Open work
The redundant hibernation heater system has to be verified.
Update of the Lander Thermal Mathematical Model (TMM) based on the InFlight temperature readings.

2.6 S-Band Telecom Subsystem

Role of the Tx/Rx subsystem
The role of the S-Band telecom subsystem is to ensure the telecommunication link between the Orbiter and the Lander from the time they are separated. It is composed of two antennas and their electronics located on the Orbiter, and of two antennas and their electronics located on the Lander. All of them are under the Lander responsibility.

Goal of Commissioning

- Verify the orbiter/lander telecom units' good health,
- Record reference performance values for monitoring the long term drift,
- Check the RF link parameters between the orbiter and the lander.

Results

- Both main and redundant telecom units on the orbiter and lander (4 combinations) have been verified: no difference of performance has been noted between the chains,
- RF links have been established in the visibility and forced modes: the establishment time varies between 1mn 30 to 3mn 30,
- Referenced values (frequency oscillators, back ground noise, RX signal input level, bit error rate, TX out power) have been recorded.

Non Conformances
The two observed anomalies can be classified as minor, as they do not prevent functioning of the sub-system.

- Important bit error rate degradation of the TM link during block 1/pass 1 and block 3/pass5 has been noted (drop around 60 dB). After the separation, this could lead to an interruption of the RF link, but the link can be re-established
- RX registers 12 abnormal value when the ESS RX are stand by mode. This anomaly could explain the establishment time variations (1 min 30 to 3 min 30)

These two anomalies should be linked to "on board interferences", but the tests performed during block 4 when the Orbiter Rx was in the listening mode did not support this explanation (different Lander and Orbiter configurations from the previous blocks). It could be linked also to the current configuration where the antennas are very close to each other: it is very likely that the Telecom system will work better when Lander and Orbiter will be separated.

Open work
New tests with the GRM in a stand-alone configuration, or better with the GRM connected to the Orbiter EQM are required to try to reproduce these anomalies.

On board the TM-backup mode of the CDMS has to be tested (feature of new CDMS-S/W to be uploaded).

2.7 Active Descent Subsystem

Goal of the Active Descent System (ADS) commissioning

ADS commissioning should prove, that ADS is still operating after launch and major features as PSS and CDMS interfaces are working as well as the gas tank is still sealed.

Results

To commission ADS, procedure CV-FCP-232 has been performed switching-on ADS and executing a Health check. All major check-outs as unit currents and tank pressure were nominal. To support PSS CVP, this procedure was executed twice: 1) powered from HPC and 2) powered from LPC. In both cases ADS behaviour and TM readings were nominal. No other ADS modes were tested.

Non Conformances

In addition ADS was operated during Lander Cruise AFT (4 times) and Extended AFT (1 time), during the later also a Health check was executed. The readings from the health check were again nominal, but at **every** switch-on, independent from the applied power converter, ADS reported problems during power-on reset. The watchdog bit was set at least once in every case, in addition during one Cruise AFT ADS was not able to operate at all (see RO-LAN-NC-30351) or another error bit was also set (refer to RO-LAN-NC-30378). This bit "CDMS communication error" indicates a bad checksum or missing bytes, consequently ADS operation is doubtful. A comparison of the reported currents during power-on indicates a weak power-I/F between ADS and the PIF board respectively the LPC and HPC. Further investigations on this topic are needed.

Open work

Investigate ADS power-on reset problems during non-exclusive switch-on. Especially a strategy for ADS application during SDL needs to be prepared.

A detailed ADP and unit status review has been performed after block 3. It revealed that the applied routines of the ADS modes "Mission set" and "Acceleration", previously dedicated for usage during descent, are only at a "preliminary" level and not in line with the actual thruster performance, referred to a qualification campaign. Therefore these modes should **not** be used until a patch is prepared and uploaded to correct these settings. It is emphasized that in the baseline scenario for descent these modes are **not required**.

In addition the readings from the ADS accelerometer are assumed to be not reliable since vibration from the Lander flywheel is expected to influence the accelerometer performance. To investigate this feature, further In-Flight-testing is requested.

2.8 Flywheel

Introduction
The flywheel of Philae (FW) is used to stabilize the Lander during separation and descent in z-axis.
Its rotation-speed can be adjusted via a control voltage by the power system. The required angular momentum for a stabilized separation and descent is about 5 Nms. To compensate for nutation effects due to possible air-drag in the comet's atmosphere it is required to change the flywheel speed during descent, causing a slow (i.e. ~ 1rpm) rotation of the Lander.

Goal of Commissioning
During commissioning the health of the FW was to be demonstrated and any possible damage during launch to be ruled out.

Results
During the Lander Commissioning block 1, passes 4 and 5 (15.-17.3.2004), the flywheel performance was verified (CV-FCP-230, V6).

The commissioning was successful, although the speed reading at high velocity (>9000 rpm) was erroneous. (see below)

Both commissioning runs showed comparable results.

Flywheel performance during Rosetta Lander commissioning:
The flywheel momentum has been calibrated with the Orbiter attitude system. It shows satisfactory results. The internal counter of the flywheel does not give correct values at high rpm rate (see NCR).

a) control voltage at 3 V (should result in 6857 rpm, corresponding to 4.46 Nms)
measured rpm: 6740 (4.38 Nms) the Orbiter data indicate 4.26 Nms

b) control voltage at 4.3V (should result in 9897 rpm, corresponding to 6.43 Nms)
measured rpm: 9094 (decreasing); the Orbiter data indicate 5.9 Nms, increasing (!) to a stable 6.2 Nms, after about 10min

spin off time from 6780 rpm to ~0 rpm: about 40 min

Nota: FW MoI in spin direction: 0.0062 kgm^2
Orbiter z-axis relevant for Lander FW (since the cosine of 2.5 can be assumed equal 1 (0.999048))

Non Conformances
During the tests one NCR has been raised: NCR: RO-LAN-NC-30350
The speed reading at high velocity (>9000 rpm) was erroneously.

This has no effect on the performance of the wheel itself since this measurement is not used for the closed loop speed control (but for information only).

Open Work
none

One more exercise over the next decade may be advantageous from a tribological point of view (tbc).

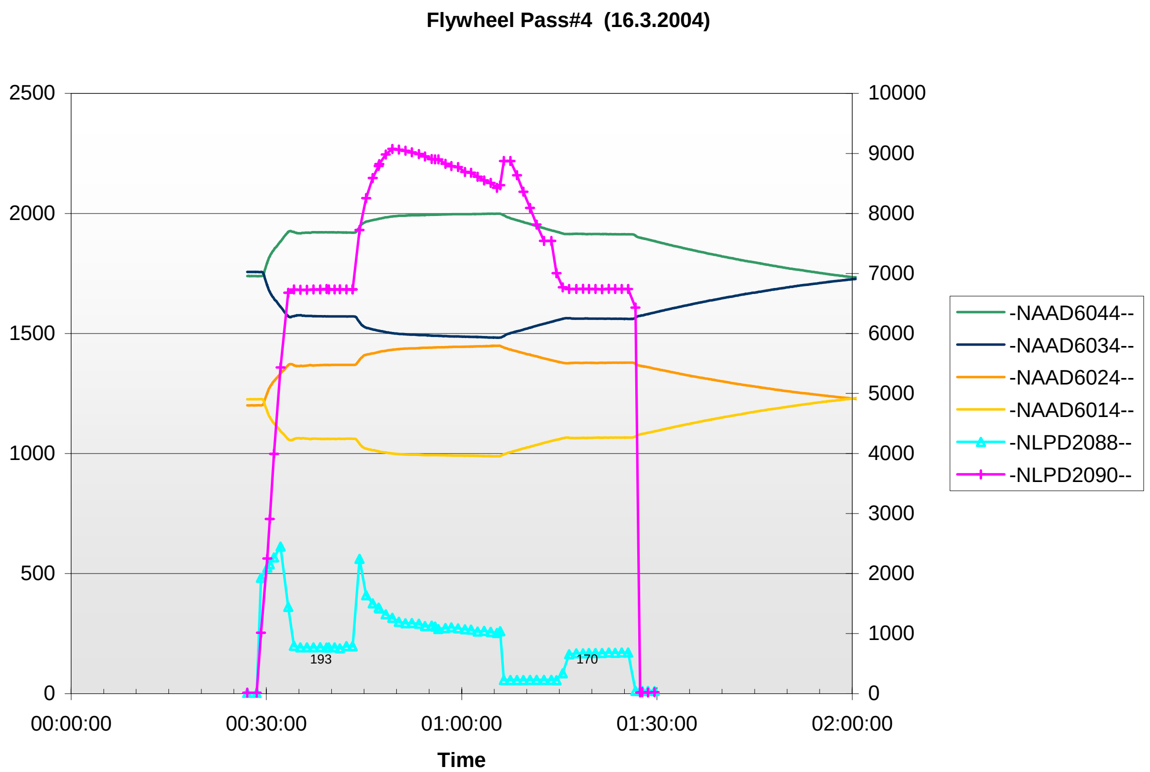


Figure 1 shows the flywheel momentum together with the momentum of the 4 Orbiter inertia wheels. The comparison allows the calculation of the actual FW speed.

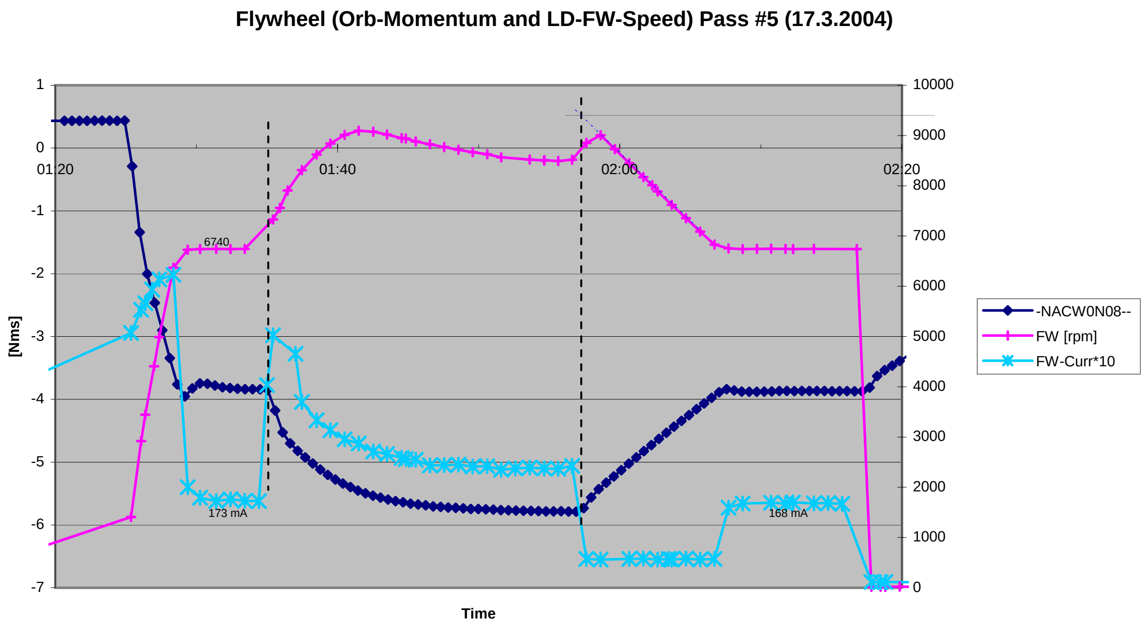


Figure 2 shows flywheel speed, implied momentum on orbiter and current, drawn by the flywheel during commissioning in pass 5.

2.9 Mechanical Support Subsystem and NEAs

Introduction
The MSS is designed to eject the Lander from the Orbiter, followed by descent and landing on the Comet surface. The MSS electronics was switched on at the launch day for firing of the NEAs. This task was performed without any problems. Therefore already before commissioning it became clear that the MSS electronics is working and that all HK values are nominal.

Goal of Commissioning
The commissioning activities for the MSS, scheduled at the beginning of Block 1, consisted of the following procedures:
- verification of the communication link between MSS and ESS
- verification of cruise latch wax actuator heating function
- verification of nominal eject sequence in dry-run mode (safe)

Results
The first activity was performed successfully (as had indeed been seen before, during MSS switch-on prior to NEA release on the launch day).
The second activity generated an error report (no thermal effect) due to the fact that a switch-on command for a S/C LCL was missing from the procedure, and thus no power was applied to the heater. The option to switch these LCLs by ground command was rejected due to safety concerns (signal turn-around times too long for intervention in case of malfunction).
This applied as well for the third aspect (dry-run) so the rest of the commissioning in Block 1 was scrapped. A careful analysis of the procedure update for Block 2 revealed an additional potential risk in the power routing and switching in the ESS: the heater power is drawn from the push power line and LCL, so activation of push power in case of an electrical or mechanical failure of the ESS wax heater relay would result in an unintended heating of the cruise latch actuator.

Non Conformances
None on MSS side

Open work
In order to keep intervals for security reasons as short as possible it is necessary to implement changes in the MSS commissioning SAT which in turn require validation with the MSS GRM at LCC and the Orbiter-ESS at ESOC. This was not possible in the limited time before end of commissioning. A proposal for further tests of the ESS / MSS is prepared. Tests in flight are open. They shall be performed after validation on the ground reference models.

2.10 Landing Gear

Introduction
The LG is designed to support the landing on the Comet surface, to damp down the impact velocity and to anchor the Lander. The LG is mounted to the Lander for flight in a folded configuration and it was hard locked to the Lander during launch.

Goal of Commissioning
The commissioning activities for the LG, scheduled for Block 1, consisted of the following procedures:
- verification of the electronics and HK status
- release of the central launch lock

Results
The landing gear was commissioned in March 2004. All housekeeping values were nominal and the last step was the successful release of the central launch lock. The so-called "hot knife" cut the string according to the procedures tested on ground, and the housekeeping value for the release of the central launch lock changed its state from the locked to the un-locked position. We expect that the release mechanism for the lower launch lock, which is also initiated through a "hot knife" release mechanism, will work as well. This lock mechanism will be released in 2014 during the descent of the Lander towards the comet.

Non Conformances
None

Open work
Presently we prepare a vacuum test chamber with the purpose of long term storage of sample flight qualified motors used within the landing gear. It is envisaged to test some of these motors for their long term behaviour. In the forthcoming mission we intend to switch the landing gear electronics box on and check again the validity of the housekeeping values. Furthermore, in line with our ground tests in the thermal vacuum chamber at the MPS, we will have to decide if operation of some landing gear motors should be commanded.
Note: There occurred an electrical failure on the LG electronics at the Lander ground reference model after LG commissioning. No further switch on of the flight electronics is planned as long as the failure analysis is not finalized.

2.11 Anchor

Introduction

The two anchors (also called harpoons) are designed to be shot at the landing on the Comet surface and to fix the Lander at the landing site by ropes. These ropes are pulled tight with help of rewind-motor systems.

Goal of Commissioning

The commissioning activities for the anchors, performed at 10.04.04, consisted of the following procedures:

- verification of the electronics and HK status
- heat up the motor housings by external heaters
- operate the rewind motors in free run direction

These tests were repeated at Block 2 at 16.05.04 with the small difference of a longer pre-heat time for the motors operations (25 min instead of 15 min before).

Results

The two electronics for the two harpoons work perfect, all HK values show the anticipated values for both tests.
Both motors could be heated and successful operated at both tests.

Non Conformances

None

Open work

The commissioning was performed successful without any problem. However, the temperature readings after heat up of the motors show lower values than anticipated at both tests for both motors. The temperature sensors are provided by the TCUs (four sensors in total for main and redundant TCU). These sensors are at different positions and not very close to the motors. Therefore a calibration of the motor temperature compared with the reading of the temperature sensors shall be performed at a thermal vacuum chamber with a flight spare harpoon and parts of the landing gear structure on ground.
During commissioning there were some systematic problems with the visualization of the commissioning results by the DAVIS display.

3 Instrument Status

3.1 Instrument Performance Matrix

Instrument	Performance	Major Open Work	
		for cruise	for on-comet operations
APXS	■		
ÇIVA/ROLIS	■		Yes
CONSERT	■		
COSAC	■		Yes
MUPUS	■		Yes
PTOLEMY	■		
ROMAP	■ *)		Yes
Sample, Drill & Distribution (SD2)	■		
SESAME	■		Yes

***) Penning sensor failed**

3.2 APXS

Introduction and Science objectives
Alpha-X ray Spectrometer, measures directly all major elements except H, He but including C, N, O, and refractories in the uppermost surface of the nucleus. The APXS is important for the Lander payload because it provides information on the elemental composition of the material underneath the Lander which cannot be derived from the results of the more sophisticated Evolved Gas Analysers (EGAs) because many elements are not represented in the volatile fraction with their true abundance. (The elemental, together with the isotopic composition must be measured because it proves or disproves the solar-system origin of the nucleus' bulk material.

Operational objectives for commissioning blocks
The aim of APXS commissioning was to test data acquisition and calibration based on 3 X-ray spectra and 3 Alpha spectra of the calibration target on the inner side of the doors. This test aims to be carried out during both commissioning and cruise. Although APXS prefers to work alone as it is very sensitive to electronic noise, it took take part in an interference test to monitor perturbations in the instrument data caused by the effects of other instruments (CONSERT and ROMAP). A further aim of APXS was to read data concerning the deployment position of the Landing Gear by way of the CDMS Backup RAM

Commissioning blocks results
Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2)
Block 2 and block 3: CV-FCP-239 was run on the main and redundant Lander configurations respectively. No PI was present at SONC, however no problems were reported.
During block 3, APXS participated (AMDT401 and AMDT301) in the CONSERT and ROMAP interference tests (CV-FCP-252 and CV-FCP-253).
Block 4: APXS extended AFT was successfully executed. (LZ-FCP-030, V1)
Cruise AFT was successfully executed (LZ-FCP-020, V2)

Non Conformance Reports
none

Open work
Remaining activities from commissioning objectives: None

Open work currently identified:
- adjust thresholds in the X-ray and the alpha-channel sometime during cruise
- perform periodic instrument checkouts (intervals of may be one to two years depending on overall cruise activities) to follow the performance of the radioactive source

3.3 ÇIVA/ROLIS

Introduction and Science Objectives

ÇIVA is an integrated set of imaging instruments, designed to characterize the landing and sampling site, the 360° panorama as seen from the Rosetta Lander, the samples collected and delivered by the Drill Sample and Distribution System, and the stratigraphy within the boreholes. It is constituted of a panoramic stereo camera (ÇIVA-P), and a microscope coupled to an IR spectrometer (ÇIVA-M(V/I)). ÇIVA interfaces the Lander CDMS via ROLIS.

ÇIVA-P will characterize the surface topography and provide an albedo mapping of the landing site, with the aim of describing the interfaces between dark mantle materials and brighter surface ices at all scales; it will identify structures (microcracks, vents, faults) and erosion features linked to cometary processes; it will reconstruct the local 3-dimensions structure of the surface, in at least one FOV including a landing leg, the penetration of which will indicate the tensile strength of the cometary material. In case the Lander would rotate, the stereoscopic reconstruction will be obtained for the full panorama. In addition, if operations of ÇIVA-P are repeated several times along the cometary activity, manifestations of cometary activity (microjets and faint dust emissions) and resulting surface changes will be detected at scales not achievable from the Orbiter.

ÇIVA-M combines an ultra-compact and miniaturized visible light microscope and coupled IR spectrometer, to characterize, by non-destructive analyses, the texture, albedo, mineralogic and molecular composition of each of the samples collected and distributed by the Drill Sample and Distribution System.

ROLIS is a miniature CCD imager located on the balcony of the Rosetta Lander and oriented in a downward-looking direction. From this position ROLIS can observe a region of about 30x30 cm of the nucleus surface located below the lander with a spatial sampling of 0.3 mm/pixel. In order to illuminate the field to be imaged, ROLIS incorporates four independent arrays of light emitting diodes (LEDs) irradiating through the visible and near IR, in spectral bands centred at about 470, 530, 640 and 870 nm, respectively, and with a FWHM of about 100 nm. ROLIS will also operate during the descent phase, acquiring images of the landing site and its vicinity shortly before touch-down.

Due to its location on the so called “instrument common working circle”, ROLIS can inspect the sampling sites of the “in situ” Lander analyzers, before and after the drilling operation. Such inspection, which is achieved through a rotation of the Lander body, can provide an important contribution to the interpretation of the sample analysis, by putting these measurements into the context of the surface colours and morphology. In addition, imaging of the bore-hole sides can possibly reveal signs of stratification, or give clues about the mechanical strength of the surface layer.
The combination of the descent imaging sequence with the close-up images, will give the opportunity to observe the surface features over a broad range of scale lengths, and to assess the diversity of the cometary surface. In this respect, ROLIS represents the ideal link between the Orbiter observations and those made by the Lander analyzers.

Operational Objectives for Commissioning
One of the main aims of the ÇIVA/ROLIS tests was to carry out a proper evaluation of the thermal behaviour of all sub-units, so as to prepare ÇIVA/ROLIS for the operational sequence during the delivery.

In particular, the **ÇIVA objectives** were to carry out
- ÇIVA P complete check out, producing 7 images
- ÇIVA M/I and M/V check out, by taking three images each (M/I and M/V)
- Data compression and transfer to the CDMS.
- Test the interface between ÇIVA M and SD2

The aim of the **ROLIS commissioning** was
- to perform a thorough health check to verify that the instrument is fully functional and
- to assess the instrument performance.

The ROLIS functional check
- collects relevant housekeeping data
- verifies the integrity of the on-board instrument software
- tests the camera functionality by acquiring images
- exercises the individual channels of the illumination device
- verifies the integrity of the telemetry data

The performance of ROLIS-D is assessed by
- evaluating the cosmetic quality of the detector
- measuring the CCD readout noise
- measuring the dark current generation

Commissioning Results
Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2)

Block 2: Procedures CV-FCP-236 and CV-FCP-237 were executed on the main configuration.
The CV-FCP-236 data have shown wrong decoding at SONC of some of the ÇIVA/ROLIS HK parameters (temperature, voltages, NCR RO-LAN-NC-30360). For ROLIS, no problems were reported, although some packets were received out of order. A modified command sequence was to be submitted from ROLIS for the block 3 procedure.
During CV-FCP-237, the command to switch on ÇIVA-M heaters was not received by ROLIS despite the existence of a TC execution report for this command (NCR RO-LAN-NC-30361). No TC error message was produced by ROLIS, it seems the command was simply not received. ÇIVA-M/I and M/V were successfully tested. The start of this procedure was re-executed the following day, and ROLIS successfully received the command. Heating was observed during one hour, and then switched off by manual command. A decrease in temperature after the heaters were switched off, confirmed that the heating effect was a result of ÇIVA -M heaters and not electronics alone.
It was noted during the contingency plan, that there was a bad ordering of some of the TSC8 to TSC11 temperature parameters; NCR RO-LAN-NC-30365.

Block 3: A change to the ÇIVA -P and ROLIS D procedure (CV-FCP-236) was prepared for this block. For ROLIS D, 4 DIT images were taken instead of 2, this time using no LED, then IR, blue and green LEDs. For ÇIVA changes were made to the exposure times of ÇIVA P cameras 2, 4 and 5, and stereo. This procedure was successfully run.
The SD2 carousel and ÇIVA-M procedure (CV-FCP-259) was also executed without any problems.

Block 4: procedures CV-FCP-260, V2 and CV-FCP-261, V2 (combined operations), Extended AFT (LZ-FCP-030, V1) and CV-FCP-262, V1 (ÇIVA -P) were executed on the main configuration.
ÇIVA-M / SD2/COSAC combined operation: CV-FCP-260, V2:
During these combined operation ÇIVA-M/I (oven 12) and ÇIVA-M/V (oven 12) were successfully tested except first (simulated) ÇIVA-M/V image in place of a real image (CDPU camera exchange) The CDPU S/W should be updated at next active cruise phase.
ÇIVA-M / SD2 / PTOLEMY Combined operation: CV-FCP-261, V2:
During these combined operation ÇIVA-M/I (oven 12) and ÇIVA-M/V were successfully tested (Oven#8). No anomaly on ÇIVA -M/V images.
ÇIVA Extended AFT (LZ-FCP-030, V1): was successfully executed and ÇIVA-P simulated images were OK. No error on telemetry: All HK parameters are OK
CV-FCP-262, V1 ÇIVA-P: Changes were made to the exposure times (256 ms, optimised exposure and 896 ms of ÇIVA P cameras 1, 3 and 5). This procedure was successfully run.
For ÇIVA-P Heater: all HK parameter were nominal.

During Commissioning Block 4 ROLIS has performed an assessment of the CCD and electronics performance by acquiring dark images. The values are consistent with the pre-launch ones, and show no signs of detector degradation.

Cruise AFT was successfully executed (LZ-FCP-020, V2)

Block4 ÇIVA conclusion: Results fully nominal except one ÇIVA-M/V simulated image during COSAC / SD2 / CIVA (anomaly on communication link between CDPU and visible camera: one corrective action opened by ÇIVA team).

Block4 ROLIS conclusion: The ROLIS results were fully nominal.

Non Conformance Reports: 30360, 30361, 30365

Remaining activities and open work
Remaining activities from commissioning objectives: none
Open work currently identified: preparation of the March 05 Earth fly-by; preparation of a new version of the ÇIVA software to be uploaded after ground validation)

3.4 CONSERT

Introduction and Science objectives

CONSERT is an experiment for investigation of the electrical characteristics of the nucleus´ bulk material and internal structure. A transmitter on the Orbiter sends wave packets through the nucleus to the Lander, which returns them back in a transponder manner. The scientific objectives are:

- to measure the mean dielectric properties and, through modelling, to set constraints on the cometary composition (material, porosity...)

- to detect large-sized embedded structures (several tens of meters), and stratifications

- to detect small scale irregularities within the comet

Operational objectives for commissioning

The CONSERT instrument needs fine synchronisation, and one of the primary aims during commissioning was to ensure that the clocks were in tune with each other. By measuring any drift throughout the course of the mission, more accurate results will be determined from the real science data from the on-comet phase. Secondary motivations of the commissioning phase included subsystem tests and Lander/Orbiter communications tests.

Other CONSERT Lander aims included a TC Verification Test, a Patch and dump test, and a solar panel interference test (with CONSERT/Orbiter). CONSERT also wished to monitor the level EM Interference from other experiments (ROMAP, APXS and MUPUS), onboard the Lander, and also the interference from the subsystems (CDMS, PSS, DPUs).

CONSERT also wanted to monitor the interference with respect to the solar panels positions.

Commissioning results

Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2)

Block2: procedures CV-FCP-238, CV-FCP-257 and CV-FCP-258 were successfully executed using the main configuration. A change to one command word “AAAA” in the patch and dump procedure was considered, although it was too late to be implemented in block 2 operations, it may be considered for future runs of this test.

Block 3: the CONSERT Lander Verification test (CV-FCP-238) was repeated numerous times, including on the redundant configuration. Between pass two and three, the verification test was run almost continuously during the LOS. An increase in noise during 2 to 3 hours of these continuous operations was observed. In addition, there was an overall noise increase of 4dB when compared with the results from block 2.

Also in block 3, the CDMS Quiet Mode test (CV-FCP-253) was successfully executed along with CONSERT Interference test (CV-FCP-253). During CV-FCP-253 specifically high levels of interference were observed from SESAME.
The CONSERT/Orbiter and CONSERT/Lander Ping-Pong test/Clock Drift Correction was successfully executed 3 times in the last pass of block 3.

Interference tests / pointing scenario orbiter
In the interference scenario, CONSERT/orbiter was shown to be disturbed by several orbiter instruments; on the other hand, some orbiter instruments were perturbed by CONSERT/orbiter. This was a purely orbiter-level activity.
The pointing scenarios were used by CONSERT to perform a signal calibration for various angles of the orbiter solar panels. Evaluation of these measurements is presently ongoing.

Block 4: CONSERT Extended AFT (LZ-FCP-030, V1): was well executed. Cruise AFT was successfully executed (LZ-FCP-020, V2).

Non Conformance Reports: 30375

Remaining activities and open work
Remaining activities from commissioning objectives: none

Open work currently identified:
Test related to noise background and synchronization

3.5 COSAC

Introduction and Science objectives

The scientific goals of COSAC are: The identification of natural and pyrolytically generated volatile compounds and their mother molecules with emphasis on organic, potentially "pre-biotic" material. A special effort is devoted to chiral compounds with the objective to look for deviations from homochirality which is characteristic of life on Earth. Method: Cometary material from both the natural surface below the Lander and the ground of drill holes is stepwise heated up to 800°C and the evolving gases are analyzed employing the GC/MS method, also commonly used in laboratories on ground.

The separation and identification, respectively, of isobaric molecules is mainly accomplished by means of a high-resolution TOF mass spectrometer ($M/\Delta M > 3000$ in a high-resolution mode, 300 in low-res mode for M up to about 7000 in theory) employing a special geometry of synchronous ion trajectories allowing for long paths despite a small instrument dimension (multiple reflections). Many isotopic ratios and their dependence of the compounds, in which they are found, can be measured.
COSAC also comprises a pressure gauge (Pirani and Penning system, interfaced to ROMAP) to measure the cometary atmosphere's pressure in the range 10-7 to 1 mbar.

Operational objectives for commissioning
The first part of commissioning was to include a mass-memory test, a test of the GC column heaters, a test of the MS in sniffing mode using every one of the three cathodes once, and an oven test where an oven was to be contacted via the tapping station, heated shortly, and the temperature monitored. The second block should include nine consecutive runs of the MS in sniffing mode. The third block comprises GC/MS coupled modes as well as MS-oven tests.
In order to operate the tapping station, COSAC requested to know the status of SD2. This was be implemented by writing and reading to the CDMS BRAM

Commissioning blocks results

Block 1
The first part started with a switch off of COSAC caused by too high current. It was restarted which led to a new generation of commands which interfered with the first set. This switch-off did not occur again although the same command sequences were repeated for more than fifteen times. In the end the following results were obtained: The mass-memory test went well. The GC heating test proved that all column heaters are ok. From the MS three spectra were retrieved, two by cathode 2, one by cathode 3. Because of the mix-up of commands cathode 1 was not used. The spectra are small in signal amplitude (i.e. the vacuum is good, as expected) and show traces of water and carbon-dioxide. This means that the COSAC MS is operating smoothly. The oven test led to a time-out for the tapping station. The house-keeping data for the position imply that it moved but did not move back to its initial position.
The second night was completely successful. Nine meaningful spectra were retrieved.

Block 2

The second part of COSAC commissioning was used to correct the behaviour of the tapping station (TS). After error analysis in Lindau and on the ground reference model (GRM) at DLR, Cologne, the TS was opened again. The procedure was as follows: Firstly the sample drilling and distribution unit (SD2) was switched on to read its angular position. It was found to be –1.06° which was perfectly in line with our expectations of a slightly off-zero position. Secondly the actual house-keeping (HK) value for the position of the COSAC TS was gathered. It was unchanged from the value it produced at the end of the commissioning block before. Then the TS was driven for five seconds in reverse. This was successful and the HK-value changed to a position almost completely open. The procedure was finished by a so-called TS correction run which automatically leaves the TS in its uppermost position. After this SD2 once again red its position which was left unchanged by the TS movement. Some of the HK values were obviously wrong. The cause was an internal software error of COSAC which required major restructuring of the software.

Block 4

During the third part several tasks were performed. Firstly new software was uploaded. Secondly the first block of commissioning was repeated. It ran smoothly. All three cathodes of the MS are operational and yield spectra. The vacuum improved since March. The tapping station moved as expected. The HK values were correct.
During the second night the combined operations were tested. They comprised:
(1) a tapping station calibration run (that is a complete turn to get the position readings for all possible positions and the contact behaviour). It went well. A complete cycle of position readings for the tapping station was obtained.
(2) an MS-oven measurement where the content of an oven containing MolSieve adsorbent was directly heated into the MS. This went almost perfectly. The only thing which did not work as expected was the oven which, as far as one can say up to now, did not heat. But the MS delivered a spectrum similar to the ones retrieved before.
(3) a GC/MS run where the content of an oven containing Tenax absorbent was heated into the GC and the GC exhaust was sent to the MS. This part worked ok. The GC carrier gas flowed as expected, the oven was heated and the MS measured 14 spectra. The GC detector went out of range. This happened because the warm compartment of the Lander was below 0°C. The operational parameters had been selected for an internal temperature of around 20°C.

Block 4 Conclusion: the COSAC hardware is alive and well, but fine tuning needs to be done.

Non Conformance Reports: 30345, 30347, 30348, 30353, 30380
NCR RO-LAN-30345 (command time-line mixed up), solved from COSAC's point of view, from CDMS point of view further solution for on-comet operations has to be developed.
NCR RO-LAN-30347 (high inrush current), solved from COSAC's point of view, officially closed.
NCR RO-LAN-30348 (wrong tapping station position): Solved from COSAC's point of view, the repetition of the original procedure was successful during the first night of the third part.
NCR RO-LAN-30353 (erroneous HK values): Solved from COSAC's point of view. The cause was found within the old software. The new software uploaded during the first night of block 4 does not produce that error any more.
NCR RO-LAN-30380 (oven not heating), still under investigation; tests with other ovens on the FM will clarify the situation eventually.

Remaining activities and open work

Further fine tuning of the instrument is necessary but will be mostly performed at MPS Lindau.

3.6 MUPUS

Introduction and Science objectives

The Multi-Purpose Sensor Experiment actually consists of three parts:

- A penetrator, approximately 40 cm long, will be hammered into the ground about 1m apart from the Lander for measuring during the penetration process the mechanical strength of the material by means of a depth sensor. The penetrator is equipped with a series of temperature sensors and heaters for determining the temperature as a function of depth and insolation. The thermal conductivity of the surrounding material can be measured using the "line" method.
- An accelerometer and a temperature sensor accommodated in the harpoon(s) will allow doing thermal and strength measurements to probably larger depths.
- A four-channel infrared radiometer measures surface temperatures in the vicinity of the Lander.

The scientific objectives of MUPUS are to characterize the thermal and mechanical properties of the nucleus material over the diurnal cycle and its variations with approach to the Sun.

Operational objectives for commissioning blocks

MUPUS aimed to carry out a primary test of Pen El by performing TPPROBE mode, performing a health check and receiving housekeeping data. MUPUS also wanted to monitor internal interference effects with ROMAP and CONSERT. (using TP Probe mode and THC Probe mode).
A new version of MUPUS SW was necessary before commencing the MUPUS commissioning.

Commissioning blocks results

Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2) Software upload and health checks were successfully performed.

Block 2: procedure CV-FCP-241 was carried out two times on the main configuration. Some anomalies occurred. During both procedures, glitches were observed in the power profile. These were attributed to bad data (caused by false timing of the h/k-readings), rather than real variations in the power. During the first run, the science data from the TPPROBE mode stopped being sent shortly before the scheduled end of this test and science data from the subsequent health check mode were not received at all. For the first run, some science data was not received in the correct order. During the repeat of the test, the health check was successful and science data was received. Some science packets were again received in the wrong order (it is assumed that this problem is ground anomaly and not an onboard anomaly). This latter problem is not critical for MUPUS.

Block 3: the length of CV-FCP-241 was extended by several minutes and run on the redundant configuration, the problem of the missing science data did not re-occur. MUPUS also participated (AMDT307 and AMDT407) in the ROMAP and CONSERT Interference tests (CV-FCP-255 and CV-FCP-252 respectively). During the execution of the CV-FCP-252, MUPUS again ceased to transmit science data. No problems occurred during CV-FCP-255.

Block 4: MUPUS Extended AFT (LZ-FCP-030, V1): was well executed. Cruise AFT was successfully executed (LZ-FCP-020, V2).

Non Conformance Reports:
30357, 30358, 30359, 30369
30376 (related to the CDMS-S/W, closed on MUPUS side)

Remaining activities and open work
The reasons for the anomalies described by the NCR's have to be identified in order to close the open NCR's. An update of the flight-software will then be necessary in the future in order to fix the associated problems. These investigations are currently in progress and most of the problems are now quite well understood. In detail:
NCR 30357: stop of sending science data. This was caused by a communication problem between MUPUS and CDMS which kept MUPUS in an infinite waiting loop. It will be solved by introducing an adequate timeout.
NCR 30358: wrong order of science packets. Caused by ground anomaly, no action needed.
NCR 30359: bad h/k-readings. This was caused by an inadequate timing in the flight-S/W and will be corrected by modification of the internal timing.
NCR 30369: 1 block shift in science data frames. This event occurred after MUPUS received the message "Illegal Request Code" from CDMS for which the reason is still unclear. Nevertheless, the problem will be solved by MUPUS keeping track of the data already transmitted, thereby avoiding sending data twice.

The flight-software will be updated accordingly and a thorough verification on the MUPUS reference system and the Lander GRM is foreseen to validate the changes.

3.7 PTOLEMY

Introduction and Science objectives

1. Evaluate the link between water ice on a comet and major bodies of water on Earth.
2. Comprehend the internal balance of volatiles on a comet and describe the cosmochemical fundamentals of cometary formation.
3. Elucidate the nature of organic components present on a comet and assess the relationship with equivalent materials known from other Solar System reservoirs (the Earth, asteroids, planets and their satellites, interplanetary dust etc.).
4. Determine the nature of low temperature mineral components present on a comet and decipher the formation history of such materials.
5. Document certain features of any high-temperature, refractory, minerals.
6. Assess the relevance of comets to the operation of widespread and important Solar System processes such as planet formation and the origin of life.

The term "MODULUS" is taken to mean Methods Of Determining and Understanding Light elements from Unequivocal Stable isotope compositions. The scientific goal of using MODULUS is to understand the geochemistry of the light elements (i.e. hydrogen, carbon, nitrogen, and oxygen) by studying their nature, distribution and stable isotopic compositions, specifically: H/D (1H/2H), 12C/13C, 14N/15N, 16O/17O and 16O/18O. The isotope ratios of interest are measured on appropriate gas species using an ion trap mass spectrometer, and expressed as differential values referenced to well established and internationally recognised standard materials.

Operational objectives for commissioning
PTOLEMY aims were to carry out a memory check of various areas of the EEPROM and run Cruise Test mode and Post Launch Mode. Cruise Test Mode aimed to assess the status of the instrument and to collect the temperatures of thermocouples, pressure from pressure sensors and baseline power levels. This test also operated a sequence of valves, and ran most science components for a few seconds whilst monitoring pressure and temperature sensors.
Post Launch mode aims to prepare PTOLEMY for the Cruise phase of the mission by opening valves to vent small amounts of trapped air and performing limited bake-outs. PTOLEMY also had the objective of testing the interface with the SD2 Carousel and calibrating the docking station.

Commissioning results

Block 1: AFT was successfully executed (LZ-FCP-020, V2)

Block 2: procedures CV-FCP-235 and CV-FCP-248 were executed on the main configuration without any major problem.
In CV-FCP-235, the PTOLEMY sample transfer pipe heated up by approximately 100 deg C during the test, and in order to avoid excessive thermal cycling, it was decided not to run this procedure in block 3 as planned.
In CV-FCP-248, a minor anomaly was observed with the operation of one valve.
Additionally, as expected, some trapped gas remained in the Ptolemy system (approx. 34 mbar).

Block 3: procedure CV-FCP-248 was run again instead of CV-FCP-235, in order to reduce the remaining trapped gas. The last science packet was not received from this operation.

Block 4: procedures S/W upload (LZ-FCP-700, V4), Verify PTOLEMY BRAM (LZ-FCP-100, V3), Cruise phase mode (CV-FCP-235, V5), Post launch mode (CV-FCP-248, V6), combined operations (CV-FCP-261, V2), Extended AFT (LZ-FCP-030, V1) and the cruise AFT (LZ-FCP-020 V2) were executed.
S/W patch (LZ-FCP-700, V4): upload and operation was as expected.
Re-run of CVP procedures CV-FCP-235 and CV-FCP-248 was carried out using patched S/W. No problems were encountered.
PTOLEMY / SD2 / ÇIVA combined operation (CV-FCP-261, V2) was executed successfully with tapping station calibration, down and up sequences, oven test and reception of science packets.
PTOLEMY Extended AFT (LZ-FCP-030, V1), using the newly loaded mode “limited cruise mode”, was well executed without problems.
The cruise AFT was also run successfully (LZ-FCP-020, V2).

Non Conformance Reports: 30373
The non-conformance is caused by the CDMS S/W and will be solved with the next version.

Remaining activities and open work
Remaining activities from commissioning objectives: none
Open work currently identified: none

3.8 ROMAP

Introduction and Science objectives
The ROSETTA Magnetic Field and Plasma Experiment resulted from the combination of the proposals ROMA (ROSETTA Magnetometer) and SPM (Simple Plasma Monitor).

The magnetometer of this experiment will operate from Lander release to touch-down in order to investigate the nucleus in search of an intrinsic magnetic field.

Later on ROMAP will, in conjunction with the Plasma Experiment Package on the Orbiter, support the studies of comet/solar-wind interaction and the formation of a magnetic cavity.

The penetration speed of the magnetic field at the occasion of the passage of a tangential discontinuity will provide information on the conductivity of the nucleus and to some extent also on its large-scale structure.

Operational objectives for commissioning
The aim of ROMAP during commissioning was to test the operational modes to check that the experiment and modes are working correctly. As well as checking the TC commands, it aimed to readout the voltages, currents, temperatures and controller statuses. A calibration sequence for the SPM had to be performed in order to check the health of the channeltrons. The test also aimed to check the functionality of the Penning and Pirani pressure measurement system. ROMAP also aimed to investigate the EM effects inflicted on ROMAP from other experiments (CONSERT, MUPUS, SESAME, APXS)

Commissioning results

Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2)

Block 2: procedure CV-FCP-240 was executed. Several anomalies were noted. A problem occurred with the high voltage, which was switched off automatically and the default values re-applied. The test was stopped and repeated, the same problem occurred again. The second time the procedure was left to run until the end. It was not possible to store the pressure sensor values to the BRAM (by using the command store-p). Some ROMAP data were lost (ground anomaly?).

Block 3: Procedure CV-FCP-240 was modified. This time the Penning-On command (which used the high voltage) was executed much later than in the original plan, in order to switch on high voltage for the first time with surface mode activation (SPM). Timing of the Store-P command was also modified slightly and the final Slow-MAG mode was allowed to run until the beginning of the following pass.
Also during block 3, ROMAP participated in the CONSERT Interference Test (CV-FCP-252), and the ROMAP Interference Test (CV-FCP-255). In former, it was found that CONSERT perturbed the ROMAP MAG data. During the latter it was found that all of the other participating instruments significantly disturbed the ROMAP MAG data.

Block 4: Procedure CV-FCP-240, V7 and LZ-FCP-030, V1 (Extended AFT) ROMAP CVP block 4 (CV-FCP-240, V7 sequence B) test was completely executed. MAG worked properly. SPM worked properly as well in measuring (surface) mode, but during calibration mode when the high voltage is increased stepwise a breakdown occurred. This problem was already observed during the previous block.
Approximately 8 hours after start of the procedure, when the Penning HV was activated (ROMAP being in *slow mode*), a breakdown and a power over consumption of 1.5 W (at ROMAP level) was observed. The problem could be localised in the Penning electronics by correlation with temperature measurements of a thermal sensor close by. The investigation is going on.
During the last pass of block 4 SPM was re-run in surface mode only and worked properly. The power consumption appeared normal; the Penning was not switched on again.
ROMAP Extended AFT (LZ-FCP-030, V1): was well executed.
Cruise AFT was successfully executed (LZ-FCP-020, V2)

Non Conformances: 30363, 30364, 30367**,** 30379 (corresponding to AR ROS_SC-66)

Remaining activities and open work

Investigation of non-conformance related to the Penning electronics is going on.

ROMAP operations can be continued *with Penning off* until investigation results are available.

3.9 Sample Drill and Distribution Device (SD2)

Introduction and Science objectives

The SD2 experiment provides samples of comet material collected at different depths to microscopes and evolved gas analysers by performing the following:
- drill the comet surface
- collect samples of material
- transport each sample to the Carousel sample feed position for delivering it to different ovens for high and medium temperatures and microscope inspection;
- rotate the Carousel and present the sample fed oven in front of the appropriate experiment station for analysis.

Operational objectives for commissioning
Purpose of SD2 commissioning was to verify that the SD2 Electronic Unit and the SD2 SW work correctly, and that the carousel correctly moves according to the needs of ÇIVA/COSAC/PTOLEMY.

Commissioning results

Block 1
Lander AFT test has been performed. The test foresees to just power on all the units and collect the housekeeping data.
Test passed, pointing out that:
- the SD2 S/W is not corrupted
- the boot works correctly
- the housekeeping data are correctly collected by CDMS
- the contents of the housekeeping data is the expected one

All test passed

Block 2
Procedure *CV-FCP-233,V7* has been performed. It foresees the power on of the carousel and drill translation resolvers.
Test results pointed out that:
- specific commands are correctly sent by CDMS to SD2 and correctly executed by SD2
- mission plan commands are correctly uploaded by SD2 from CDMS and correctly executed by SD2
- telemetry data is correctly generated by SD2 and correctly handled by CDMS
- carousel position is the expected one
- drill translation position is the expected one

- contents of the housekeeping data (16 words) is the expected one, with the exception of HK2 word (reading of current on +12Volt line). NCR RO-LAN-NC-30355 has been raised.
- contents of the scientific data (32 words) is the expected one, with the exception of SC13 word (status of Volume Checker micro-switch). NCR RO-LAN-NC-30354 has been raised.

Block 3
The following procedures have been performed:

- procedure *LD-CRP-001, V1*. The purposes are both to verify the status of upper volume checker micro-switch and the full functionality of SD2 carousel (see NCR RO-LAN-NC-30354). The results of the procedure execution are:
    - the volume checker has been successfully moved UP and Down
    - when the volume checker is up both the upper and lower micro-switches indicate "close". This is correct for the upper micro-switch but is not correct for the lower micro-switch
    - when volume checker starts its movement, the upper micro-switch changes status from closed to open and also the lower micro-switch changes its status from closed to open (so that the reading of the lower micro-switch becomes correct)
    - the status and readings of upper micro-switch is always OK
    - the reading of lower micro-switch does not reflect the status of the volume checker when volume checker is up
    - when volume checker is in between upper and lower limits, reading of lower micro-switch is correct
    - since the lower micro-switch is actually not used during volume checker measurements, the conclusion is that the volume checker can be used as it is
    - the carousel moves correctly; target position 4320 (oven 12 under CIVA-MV) has been reached with -5[arcmin] accuracy; zero position has been reached with +1[arcmin] accuracy

  All test passed, allowing to close out the NCR RO-LAN-NC-30354.

- procedure *CV-FCP-259, V1*. The purpose is to move the carousel in four positions according to ÇIVA needs, and at the end to put the carousel in its zero position. Carousel correctly performed the 5 movements; maximum stroke: 132 deg; maximum error in target positioning: 3[arcmin]. All test passed

Block 4:
The following procedures have been performed:

- procedure LD-CRP-001,V1, steps ALDC001A,D,E. Procedure LD-CRP-001,V1 was already executed during block 3 as "additional procedure" to the originally foreseen CV-FCP-259, V1. In block 4 only the "carousel warm up" steps have been executed. These steps foresee the movement of carousel to 4320 [arcmin], 600mA, 100.2 rpm, and then go to 0 [arcmin], 600 mA, 62 rpm.

Procedure has been successfully executed: Carousel correctly performed the 2 movements; maximum stroke: 72 deg; maximum error in target positioning: 2[arcmin]. All test passed

- procedure CV-FCP-260,V2 SD2/COSAC/CIVA combined test. SD2 carousel is moved according to COSAC and CIVA needs; after the proper carousel movement, COSAC moves the tapping station and then, after the proper carousel movement, CIVA takes image of ovens in front of it.
  Procedure has been successfully executed: Carousel correctly performed 4 movements; maximum stroke: 108 deg; maximum error in target positioning: 3[arcmin]. All test passed

- procedure LZ-FCP-020,V2, cruise AFT operations. All test passed

- procedure LZ-FCP-030,V2, extended cruise AFT operations. All test passed

- procedure CV-FCP-261,V2, combined operation PTOLEMY/ SD2/ Civa.
  Procedure has been successfully executed: Carousel correctly performed 6 movements; maximum stroke: 168 deg; maximum error in target positioning: 4[arcmin]. All test passed.

Non Conformance Reports: 30354, 30355, 30377

During Block 2, two NCRs have been raised.
NCR number RO-LAN-NC-30354 has been raised relevant to SC13 contents – status of Volume Checker lower micro-switch
NCR number RO-LAN-NC-30355 has been raised relevant to HK2 contents – reading of current on +12V line

During Block 4, one NCR has been raised.
NCR number RO-LAN-NC-30377: One science packet received twice.

Remaining activities and open work

1. Investigation on NCR RO-LAN-NC-30355
Ad hoc test executed on Lander GRM points out that the value read during block2 is correct, while the expected test output specified in the procedure is not correct and shall be modified. The NCR has been closed out by procedure change.

2. Investigation on NCR RO-LAN-NC-30354
Investigations have been performed by executing ad hoc tests both on LANDER GRM and on LANDER FM during block 3 (see above procedure CV-CRP-001, V1). The NCR has been closed out by clause “use as is”.

3. Investigation of NCR RO-LAN-NC-30377
Investigation is going on.

3.10 SESAME

Introduction and Science objectives

Surface and comet particle properties

The CASSE instrument is developed to study by acoustic sounding the mechanical properties of the upper surface layers of the comet.

DIM investigates the flow of small particles hitting the Piezo-sensor plates of this instrument.

PP sounds electromagnetically the permittivity properties of the surface. This is mainly aimed to study the water content and its variations.

The expected main outcomes of SESAME is a better understanding of the physical properties of cometary surfaces and are better data for modelling the surface layers and their influence on cometary outgassing. This modelling will help to separate fluxes of more „pristine“ gases from those, which are modified by earlier processing at and within the surface layer.

Operational objectives for commissioning

SESAME aimed to perform a predefined ‘SESAME functional test’, which consisted of a health check sequence for each of the three instruments (CASSE, DIM and PP) that make up the SESAME experiment. Additionally, the tests were used to verify "healthy" housekeeping data. The SESAME test sequences included various listening modes for CASSE, DIM and PP in order to characterize the electronic and vibration environment.
In addition, SESAME was part of tests to measure the interference on ROMAP and CONSERT (and also tried to monitor them).
A secondary aim was to read the parameters stored in the BRAM of other units.

Commissioning results

Block 1: Cruise AFT was successfully executed (LZ-FCP-020, V2)

Block 2: CV-FCP-234, V6 was executed twice on the main configuration.
An anomaly occurred during the second execution of the CV-FCP-234. The AMST appears to have started and finished early. As a consequence, the final COM_HK commands were not sent.

It also appeared that the last HK data from the first run and the first HK data from second run were merged in one HK packet.

During the first run, the PCB temperature was around 40°C. Some parameters were "noisy". In order to clarify the readings, a new procedure was submitted for block 3 and requested to be run on a colder Lander. The new procedure included:

– CASSE measurement at a third frequency, 1.6 kHz
– CASSE measurement at 1 kHz with gain 168 and 79.
– DIM Average_Continuous for all 3 axes to search for external vibration noise
– Repeated DIM Noise_Test (5 times) for better statistics of electronic noise on DIM PCB
– PP AMTEST to search for electronic noise

Block 3: The new sequence was executed three times during this block; twice during pass 5 and once again during pass 8. During the first test (on the main configuration), the last two commands (COM_HK) of the sequence were not sent. This problem appears to be identical to the one, which was observed during in block 2. The sequence was repeated on the redundant configuration and once again (during pass 8) on the main configuration. No problems occurred in either of the two repetitions.

Block 4: Extended AFT (LZ-FCP-030, V1; SESAME part) was well executed.
Cruise AFT was successfully executed (LZ-FCP-020, V2). CASSE measured external vibrations (from Orbiter?) in the frequency range from 150 to 250 Hz.

Non Conformance Reports: 30362 (caused by CDMS)

Remaining activities and open work
No remaining activities from commissioning objectives.
Open work currently identified:
The flight software has to be upgraded to version FM 2.0 in order to solve problems with the CDMS and to implement missing S/W modules. Special tasks are:

- Time information into housekeeping data for identification purposes
- Implementation of CASSE Triggered Mode for noise and impact detection
- Implementation of PP Passive Mode measurements
- Implementation of digital filter routines into SESAME software.

The interference tests at least with ROMAP should be repeated using only Lander battery power. In addition, the SESAME instruments should also operate in listening modes (especially CASSE and PP) to detect any interference from the other experiments.

4 Non Conformance Reports / Anomaly Reports

During the four Philae Commissioning blocks 38 Non-conformance Reports (NCR) have been generated:

- 11 classified as “major”, 1 closed
- 27 classified as “minor”, 8 closed

In addition, ESOC has generated two Anomaly Reports (AR 23 on ESS events) and AR 66 on ROMAP excessive current consumption). The latter one corresponds to the Philae NCR 30379 and will be traced there.

The pending actions for the open NCRs can be categorized as:

- **Failure investigation** ongoing
  NC 30349, 30351 (Empty ADS packet), 30352 (CDMS/ESS time sync lost), 30363 (ROMAP high voltage problem), 30368 (ESS, time stamp inconsistency), 30371 (Tx/Rx) drop in link quality), 30375 (CONSERT increased noise problem), 30377 (SD2), 30378 (ADS events), 30379 (ROMAP increased power consumption), 30380 (COSAC oven did not heat as expected)
- **Software correction** necessary: definition, (GRM) validation and implementation are pending:
  NC 30344, 30345, 30346 (DPU over-switch), 30357 (MUPUS, Anomaly in MUPUS h/k and s/c data transmission), 30359 (MUPUS, Anomalous MUPUS h/k data), 30361 (CDMS), 30362 (CDMS), 30366 (CDMS), 30369 (MUPUS), 30370 (CDMS), 30372 (CDMS), 30373 (CDMS), 30374 (CDMS), 30376 (CDMS)
- **Operational work-around** has to be defined:
  NC 30351 (empty ADS packet),
- **Documentation update** pending:
  NC 30343, 30350, 30360 (RSDB update), 30365

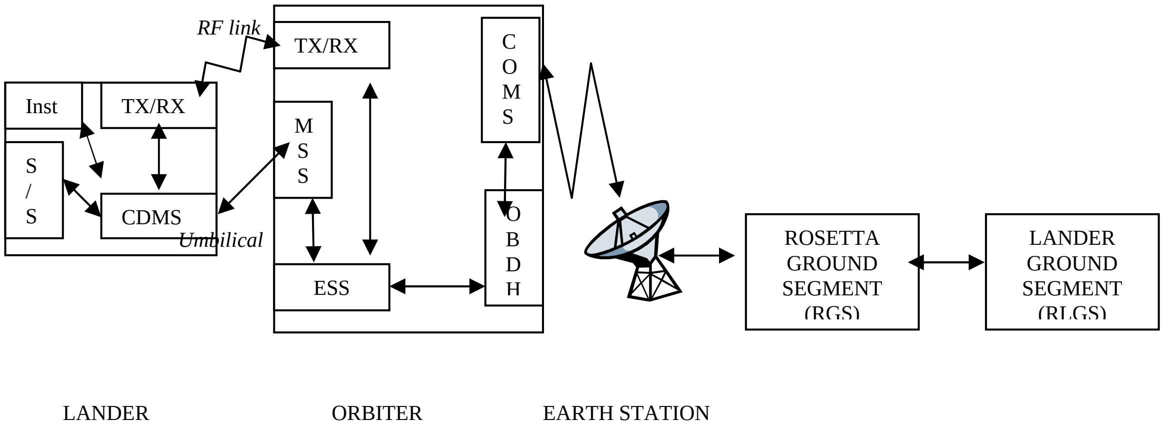
The failure investigation of the CDMS team has shown that the NCRs 30361, 30370, 30373, 30374 and 30376 can be traced back to the same root cause, simplifying the S/W modification to some extent.

No NCR has been dispositioned as “use-as-is” with the acceptance of a reduced functionality. It is expected that all NCRs can be closed without compromising the full operational capability of Philae.

5 Ground Segment

Scope

Mission Operations of the Rosetta Lander are far more complex than for a typical orbiter experiment, as they couple the operations of 10 instruments, as well as the Lander with all its subsystems, constituting a spacecraft in itself. For this reason, the Lander Project has defined and implemented specific and necessary means and tools for operating the Lander within the overall operations strategy of ESA for the ROSETTA mission.
A Rosetta Lander Ground Segment (RLGS) has thus been implemented with interfaces to the ESA's ROSETTA Ground Segment (RGS) on one hand and to the Instrument and Sub-System providers on the other hand.
In addition, during the critical mission a Philae representative is located at the Rosetta Mission Operation Center (RMOC) located at ESOC.
The RLGS consists of the Lander Control Center (LCC) at DLR Cologne and the Science Operations and Navigation Center (SONC) at CNES Toulouse and concentrates the expertise for subsystems and instruments towards a single interface to RGS. All Lander operations from the post-launch phase, commissioning, over the cruise phase, to near-comet, descent & landing and finally to on-comet phases are conducted through the RLGS.



Inst: instruments	MSS: Mechanical Support System
S/S: Sub-Systems	ESS: Electrical Support System
CDMS: Command & Data Management System	COMS: Orbiter Communication S/S
TX/RX: RF Transmitter & Receiver	OBDH: Orbiter Data Management S/S

Main Tasks of the RLGS

- Issue the planning for Philae operations
- Verification at Ground Reference Model (GRM)
- Create commands and flight control procedures (FCPs) through RGS
- Receive Lander related data and data products through DDS
- Analyze Lander telemetry in near real-time and off-line
- Distribute and archive all Lander related data

RLGS status after Commissioning

RLGS Operations
All required Operation requests for experiments and subsystems are transmitted via RLGS external and internal interfaces, such as Lander Instrument Operation Request (LIOR, by PI) and Subsystem Operation Requests (SOR – by Subsystem provider). The inputs are compiled at RLGS, procedures are established and checked by means of the Lander Planning Tool (MOST) and the GRM. After final validation of the test, the required inputs (LOR; CS_P etc.) are created and sent out by means of an Operation Request Manager (ORM) Tool.

This work flow allowed the relevant preparation and validation of all Lander TCs and FCPs for commissioning. Also the Lander Operations timelines for the various blocks were derived from the GRM output by providing realistic test duration, power profiles and data rates.

Thus the execution of all scheduled Lander activities could be managed within the given time frames by RMOC.

Open work
None

Lander Operation Requests and Flight Procedures Summary
To achieve the goals for commissioning and future Lander Operations including SW Uploads to the experiments
- 30 Commissioning procedures and
- 64 Flight Control Procedures (including Contingency Recovery Procedures)

were established with RMOC for the Rosetta FOP.
It was taken care, that most of the procedures are designed in such a way, that they can be executed manually from ground or via Mission Timeline (MTL)
For the Lander activities so far, RLGS has transferred successfully:
- 15 LORs, mainly to update the Lander Stored Telecommand Buffer and execute SW Uploads
- 6 CS_Ps with SW Upload TCs for MUPUS, COSAC and PTOLEMY.

Open Work

Update of Lander RSDB parameters and settings based on CVP results

RLGS interface to RGS
The RLGS uses two interfaces to provide all necessary inputs to and retrieve Lander data from RGS. Both interfaces with dedicated protocols were already validated well in advance before launch with RGS.

- LCC <->RSOC
  to provide SW Upload files (CS_P, C S_D) and Lander Operation Requests (LOR, LOP) to RGS

- LCC <-> DDS
  to retrieve final PORs, Lander data, AUX data and LTVF files
- SONC <-> DDS
  to retrieve Lander Science data and AUX data

The interface to the DDS worked excellent via internet as well as via ISDN connection. SONC and LCC were able to retrieve the data in near real-time and thus could perform on-line operations through RMOC. Any additional information (TC settings) needed in the course of operations were provided in LOR format whenever possible. All updated manual stacks were approved by Philae Representative at PISA or Lander Authority.

Open work
None

Data Distribution and archiving
All retrieved Lander data could be processed and stored inside RLGS. On-line monitoring of the procedure execution could be performed at SONC- and LCC- operation centers during near real-time operations.
The data are accessible via dedicated ftp- or web-accounts at RLGS servers for experimenters and subsystem providers.

Open work
None

Anomaly Reports

AR ROS_SC-66	Excessive current consumption for ROMAP after Penning activation AR is covered by Lander NCR RO-LAN-NC-30379 Ok of PI to operate ROMAP as planned during earth-swing-by
AR ROS_SC-23	ESS events flood ON Board Event Log and RMCS AR is covered by ESS ‘open work’, detailed analysis of RAM patch capability required Intermediate workaround of packet store and handling at RMCS was applied by RMOC for Lander CVP Block4.

Conclusions

The Lander commissioning was extremely successful from RLGS point of view with smooth interfaces to RGS.
Beside the maintenance of Lander RSDB entries there is no open work left as a direct result of commissioning and RLGS is ready to support cruise operations until the beginning of Observation Phase.

Future activities are mainly related to improvements of internal RLGS internal tools and facilities, the preparation of the comet activities and knowledge preservation.

In addition to these RLGS internal tasks LCC has to adapt to a modification on RGS side. The SCOS 3.1 system, to be installed beginning of 2005, withdraws the possibility to request TM data by SCOS arrival time. Since this key is used by the LCC system, it will cause a complete change of data request strategy, including a change of LCC SW in this respect.

To prepare RLGS interfaces for further external changes it is requested to

- involve RLGS in discussions of technical interfaces with impact on the Lander Ground Segment interface
  (e.g. CRID-, DDID-updates)
- inform the Rosetta Instrument providers on the long-term maintenance plan of the ESOC systems with respect to the evolution of the Rosetta Ground Segment Interfaces

6 Conclusions and Recommendations

- **Commissioning was performed smoothly throughout all blocks. The cooperation between ESA's ROSETTA Ground Segment and the Lander Ground Segment was excellent.**

- **All functions vital for cruise and potential science operations during cruise have been verified.**

- **Most of the functions essential for landing and on–comet science operations have been successfully tested to the envisaged level, but further tests on ground and with the Flight Model as well as S/W improvements are required.**

- **The penning sensor, part of the ROMAP instrument, failed during block 4 of commissioning. The other ROMAP sensors are not affected, i.e. the magnetic field and plasma measurements can be performed without degradation. A permanent loss of the penning sensor, if confirmed, would be unpleasant but not constitute a substantial degradation of the Lander's scientific objectives.**

- **Commissioning has demonstrated the global good health of the Lander (systems and instruments). The level of performances achieved gives confidence that Philae will contribute at full scale to the overall ROSETTA mission success.**

7 Annex I – As-run timelines

Block 1

Pass 1	DOY 072-073

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
12.03.2004	21:50	**Start data requesting from DDS**									
	21:52	**Start of Pass**	LMP-Annex A	AOS 0deg (TM only)							
	22:38	**Start of Orbiter preparation**	LMP-Annex A	AOS10deg (TM/TC)							
	23:02	**ESS/Lander Power ON**	ES-FCP-001, V13 LMP-Annex B	via OBCP, Redundant path							
	23:13	**ESS/Lander Link Establishment**	ES-FCP-002, V4 RO-ES-FCP-001	via Umbilical EPC1,2 current consumption anomaly, NCR-30349							
	23:31	**MSS commissioning on redundant side**	CV-FCP-226, V8 RO-CV-FCP-226	→ **Aborted** Anomaly Report: RO-LCC-AR-0006							
	23:31	**ESS commissioning on redundant side**	CV-FCP-223, V5								
13.03.	00:50	**ESS/Lander Power OFF**	ES-FCP-999, V11	via OBCP							

	01:05	**ESS/Lander Power ON**	ES-FCP-001, V13	via OBCP, Main path							
	01:14	**ESS/Lander Link Establishment**	ES-FCP-002, V4 RO-ES-FCP-001	via Umbilical					S		
	01:30	**CDMS and TxRx commissioning**	CV-FCP-224, V8	Slot 1 Umbilical Link breaks at end of MM dump, NCR-30366							
	06:30	**TCU1 test**	n/a								
	07:00	**CDMS and TxRx commissioning**	CV-FCP-224, V8	Slot 2							
	08:15	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C							
	08:50	**Mupus S/W file upload into Orbiter SSMM**	n/a								
	09:12	**End of Commanding**		LOS 10deg (TM only)							
	09:37	**End of Pass**		LOS 5deg (End of TM)							
	09:40	**Stop data requesting from DDS**									

Block 1

Pass 2	DOY 073-074

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
13.03.2004	21:45	**Start data requesting from DDS**						
	21:48	**Start of Pass**		AOS 0deg (TM only)				
	22:35	**Start of Orbiter preparation**		AOS10deg (TM/TC)				
	23:02	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C				
	23:17	**CDMS and TxRx commissioning**	CV-FCP-224, V8	Slot 3 Umbilical Link breaks at end of MM dump, NCR-30366				
14.03.2004	04:52	**POR execution**	LZ-FCP-100, V3	TC Update for CONSERT and LG, MUPUS AMST207			S	
	05:30	**Mupus S/W version 46 upload into Mupus**	LZ-FCP-700, V4 RO-LM-SEQ-700	MUPUS SW 46 image part1: CS_P_PILRSO_D_0000_LZ_______00013.ROS MUPUS SW 46 image part2: CS_P_PILRSO_D_0000_LZ_______00014.ROS				
	07:55	**Cruise AFT execution**	LZ-FCP-020, V2	Platform: Standard configuration				
	08:43	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. B: SetP to +35°C/+5°C				

	09:09	**End of Commanding**	n/a	LOS 10deg (TM only)							
	09:34	**End of Pass**		LOS 5deg (End of TM)							
	09:40	**Stop data requesting from DDS**									

Block 1

Pass 3	DOY 074-075

	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CIU 1 2	Conv	TCU 1 2
14.03.2004	21:42	**Start data requesting from DDS**						
	21:44	**Start of Pass**	n/a	AOS 0deg (TM only)				
	22:31	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)			S	
	22:54	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C				
	23:02	**Lander ESS & TxRx Checkout**	ES-FCP-010, V4	Anomaly with DPU redundancy received, NCR-30346				
	23:45	**ESS/Lander Power OFF**	ES-FCP-999, V11	via OBCP				
	23:52	**ESS/Lander Power ON**	ES-FCP-001, V13	via OBCP, Main path				
	23:58	**ESS/Lander Link Establishment**	ES-FCP-002, V4	via Umbilical				
15.03.	01:38	**Lander ESS & TxRx Checkout**	ES-FCP-010, V4	Re-run				

	03:20	**PSS Secondary Battery Check-out**	LP-FCP-019, V5 RO-LP-FCP-019						S		
	08:00	**PSS Primary Battery Check-out**	LP-FCP-018, V5 RO-LP-FCP-018								
	09:05	**End of Commanding**	n/a	LOS 10deg (TM only)							
	09:30	**End of Pass**	n/a	LOS 5deg (End of TM)							
	09:32	**Stop data requesting from DDS**									

Block 1

Pass 4	DOY 075-076

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
15.03.2004	21:40	**Start data requesting from DDS**						
	21:41	**Start of Pass**	n/a	AOS 0deg (TM only)			S	
	22:27	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)				
	23:05	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. B: Forced HPC, CIU2, TCU1				
	23:28	**Flywheel commissioning**	CV-FCP-230, V6	Flywheel speed anomaly, NCR-30350				
16.03.2004	01:06	**Landing Gear commissioning**	CV-FCP-229, V6	Executed steps: 1,2,13,14,17,1,2,17				
	02:20	**Cosac commissioning (Part 1)**	CV-FCP-241, V5	Cosac excessive inrush current, NCR-30347 Wrong overload handling at CDMS, NCR-30345 Tapping station in wrong position, NCR-30348			H	
	03:54	**ADS commissioning**	CV-FCP-232, V6					
	04:50	**Cruise AFT execution**	LZ-FCP-020, V2	Empty ADS packet, NCR-30351 (refer also to RO-LAN-NC-30313)				

	05:38	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard Configuration					S		
	05:51	**ESS/Lander Power OFF**	ES-FCP-999, V11	via OBCP							
	06:05	**ESS/Lander Power ON**	ES-FCP-001, V13	via OBCP, Redundant path							
	06:12	**ESS/Lander Link Establishment**	ES-FCP-002, V4 RO-ES-FCP-001	via Umbilical					S		
	06:20	**End of Lander activities**	n/a								
		Handover to Mars Express									
	07:00	**Stop data requesting from DDS**									

Block 1

Pass 5	DOY 076-077

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
16.03.2004	21:35	**Start data requesting from DDS**						
	21:37	**Start of Pass**	n/a	AOS 0deg (TM only)			S	
	22:23	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)				
	22:55	**Time synchronisation ESS-Lander**		ESS/CDMS TimeSyncronisation lost, NCR-30352 Lander TM pakets: SCET = REVT at SCOS				
	22:57	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. C: Forced LPC, CIU1, TCU2				
	23:23	**Flywheel commissioning**	CV-FCP-230, V6	Flywheel speed anomaly, NCR-30350				
17.03.2004	00:45	**Cosac commissioning (Part 2)**	CV-FCP-246, V5				L	
	01:40	**Lander ESS & TxRx Checkout**	ES-FCP-010, V4					
	02:55	**ADS commissioning**	CV-FCP-232, V6					
	04:03	**Lander ESS & TxRx Checkout**	ES-FCP-010, V4	Re-run of Rx2 measurements				

	04:45	**Cruise AFT execution**	LZ-FCP-020, V2								
	05:31	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard Configuration							
	05:57	**PSS Secondary Battery Check-out**	LP-FCP-019, V5 RO-LP-FCP-019	Battery handling aborted by CDMS, NCR-30344					S		
	06:51	**ESS/Lander Power OFF and hibernation setting**	ES-FCP-999, V11								
	08:58	**End of Commanding**	n/a	LOS 10deg (TM only)							
	09:23	**End of Pass**	n/a	LOS 5deg (End of TM)							
	09:40	**Stop data requesting from DDS**									

Block 2

Pass 1	DOY 100-101

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 12	Conv	TCU 12
09.04.2004	20:10	**Start data requesting from DDS**						
	20:16	**Start of Pass**	LMP-Annex A	AOS 0deg (TM only)				
	21:03	**Start of Orbiter preparation**	LMP-Annex A	AOS10deg (TM/TC)				
	21:31	**ESS/Lander Power ON**	ES-FCP-001, V13	via OBCP, Redundant path				
	21:42	**ESS/Lander Link Establishment**	ES-FCP-002, V4 RO-ES-FCP-001	via Umbilical				
	22:30	**TC parameter update**	LZ-FCP-100, V3	MDAF_SCHRMA_D__040407141419_00026.ROS				
	22:58	**Carousel verification**	CV-FCP-233, V7 RO-CV-FCP-233	Executed to verify carousel status prior to Cosac TS recovery Anomaly on SC13 SD2 parameter, NCR: RO-LAN-NC-30354 Anomaly on HK2 SD2 parameter, NCR: RO-LAN-NC-30355			S	

	23:24	**Cosac Tapping Station Recovery**	LE-CRP-001, V0	Refer to NCR: RO-LAN-NC-30348 Erroneous Cosac HK parameters, NCR: RO-LAN-NC-30353							
10.04.2004	01:42	**Carousel verification**	CV-FCP-233, V7 RO-CV-FCP-233	Executed to verify carousel status after to Cosac TS recovery --> No carousel movement observed							
	02:07	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C							
	02:30	**Orbiter preparation**	n/a								
	02:37	**End of Pass**		Groundstation hand-over							
	03:11	**Stop data requesting from DDS**									

Block 2

	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 1 2	Conv	TCU 1 2
	Pass 2			DOY 101-102				
10.04.2004	20:05	**Start data requesting from DDS**						
	20:13	**Start of Pass**		AOS 0deg (TM only)			S	
	21:00	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)				
	21:29	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C				
	21:45	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. C: Forced LPC, CIU1, TCU2				
	22:08	**Anchor commissioning (Part 2)**	CV-FCP-231, V6 RO-CV-FCP-231	Predefined duration of Anchor motor heating was rather short, Anchor re-run (CVP part 1) was shifted to LDR CVP block 3			L	
11.04.2004	00:04	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. C: Forced LPC, CIU1, TCU2				
	00:20	**SD2 commissioning (Part 2)**	CV-FCP-233, V7 RO-CV-FCP-233	see also NCR: RO-LAN-NC-30354, -30355				

	00:56	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. B: Forced HPC, CIU2, TCU1 LPC still ON after re-configuration, NCR: RO-LAN-NC-30356							
	01:11	**SD2 commissioning (Part 1)**	CV-FCP-233, V7 RO-CV-FCP-233						L H		
	02:00	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C							
	02:15	**Orbiter preparation**	n/a								
	02:36	**End of Pass**		Groundstation hand-over							
	03:05	**Stop data requesting from DDS**									

Block 2

Pass 3	DOY 102-103

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
	20:15 MTL	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C					L H		
11.04.2004	20:00	**Start data requesting from DDS**									
11.04.2004	20:10	**Start of Pass**		AOS 0deg (TM only)					L H		
11.04.2004	20:57	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)							
11.04.2004	21:34	**Lander platform re-configuration**	LZ-FCP-200, V4 LZ-FCP-900, V4 LZ-FCP-200, V4	Seq. A: Standard Configuration Platform reset (AMST00) Seq. B: Forced HPC, CIU2, TCU1					S		
11.04.2004	22:15	**Mupus commissioning (Part 1)**	CV-FCP-242, V6 RO-CV-FCP-242	Anomaly in Mupus HK and SC data transmission, NCR: RO-LAN-NC-30357 Mupus SC frames not delivered in order, NCR: RO-LAN-NC-30358 Anomalous Mupus HK data, NCR: RO-LAN-NC-30359							

	23:59	**Consert Lander Verification (Part 1)**	CV-FCP-238, V5 RO-CV-FCP-238						H		
12.04.2004	00:33	**Consert TC Verification**	CV-FCP-257, V6 RO-CV-FCP-257								
	01:05	**Consert Patch & Dump**	CV-FCP-258, V7 RO-CV-FCP-258								
	01:49	**Mupus Health Check Re-run**		see also NCR: RO-LAN-NC-30357							
	02:04	**LG BRAM setting**		Required preparation for APXS CVP							
	02:20	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C							
	02:30	**Orbiter preparation**	n/a								
	02:35	**End of Pass**		Groundstation hand-over							
	03:13	**Stop data requesting from DDS**									

Block 2

Pass 4	DOY 103-104

	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 12	Conv	TCU 12
12.04.2004	20:03	**Start data requesting from DDS**						
	20:08	**Start of Pass**		AOS 0deg (TM only)				
	20:54	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)				
	21:32	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C				
	21:42	**APXS commissioning (Part 1)**	CV-FCP-239, V5 RO-CV-FCP-239					
	23:45	**Rolis/Civa-P commissioning (Part 1)**	CV-FCP-236, V5 RO-CV-FCP-236	Procedure started via MTL (due to ground station handover) Wrong CIVA temperature H/K, NCR: RO-LAN-NC-30360 ESS events flodd OnBoard Event Log and RMCS, AR: ROS_SC-23			H	

13.04.2004	03:32	**Sesame commissioning (Part 1)**	CV-FCP-234, V6 RO-CV-FCP-234							
	04:04	**Ptolemy commissioning (Part 1)**	CV-FCP-235, V7 RO-CV-FCP-235							
	05:33	**Mupus commissioning (Part 1) Re-run**	CV-FCP-242, V6 RO-CV-FCP-242	see also NCR: RO-LAN-NC-30357						
	07:12	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C						
	08:00	**Orbiter preparation**	n/a							
	08:15	**End of Pass**		Groundstation hand-over						
	08:28	**Stop data requesting from DDS**								

A ground station handover (NewNorcia to Canberra) was performed from 24:00 (UTC) (End of NNO) to 02:15 (UTC) (Start of CAN), where neither TC nor TM was available

A ground station handover (Canberra to Madrid) was performed from 05:00 (UTC) (Start of MAD) to 05:20 (UTC) (End of CAN), where no TC was available and TM was reduced

Block 2

Pass 5	DOY 104-105

Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
22:15 MTL	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C					H		
22:30 MTL	**Civa-M commissioning (Part 1)**	CV-FCP-237, V6								

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
14.04.2004	00:08	**Start data requesting from DDS**									
	01:00	**Start of Pass/ Orbiter preparation**	n/a								
	------	**Civa-M commissioning (Part 1)**	CV-FCP-237, V6 RO-CV-FCP-237	Continuation see also NCR: RO-LAN-NC-30360 Civa-M/P heating not received by CIVA/ROLIS IME, NCR: RO-LAN-NC-30361							
	02:58	**Sesame commissioning (Part 1) Re-run**	CV-FCP-234, V6 RO-CV-FCP-234	Last Sesame TCs not executed, NCR: RO-LAN-NC-30362					H		

	03:32	**Romap commissioning (Part 1)**	CV-FCP-240, V7 RO-CV-FCP-240	Romap high voltage problem, NCR: RO-LAN-NC-30363							
	04:14	**Lander to Stand-by**	LZ-FCP-900, V4								
	04:20	**Romap commissioning (Part 1) Re-start**	CV-FCP-240, V7 RO-CV-FCP-240	Lost SC data frames on Romap, NCR: RO-LAN-NC-30364							
	06:20	**Orbiter preparation**	n/a								
	06:30	**End of Pass**		Groundstation hand-over							
	07:13	**Stop data requesting from DDS**									

-----	**Romap commissioning (Part 1)**	CV-FCP-240, V7	Continuation					H		
11:30 MTL	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. A: Wcomp to +35°C							

A ground station handover (Canberra to Madrid) was performed from 05:00 (UTC) (Start of MAD) to 05:20 (UTC) (End of CAN), where no TC was available and TM was reduced

Block 2

Pass 6	DOY 105-106

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
15.04.2004	00:05	**Start data requesting from DDS**						
	01:15	**Start of Pass/ Orbiter preparation**	n/a					
	01:28	**Lander Temperature Configuration**	LZ-FCP-300, V4	Seq. C: Both SetP to -40°C			H	
	01:41	**Ptolemy commissioning (Part 2)**	CV-FCP-248, V6 RO-CV-FCP-248					
	03:10	**Additional Civa-M heater test**	CV-FCP-237, V6 LZ-FCP-900, V4	see also NCR: RO-LAN-NC-30360 refer to NCR: RO-LAN-NC-30361 Possible inversion of 2 parameters, NCR: RO-LAN-NC-30365				
	04:35	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard Configuration				
	04:48	**PSS Secondary Battery Check-out**	LP-FCP-019, V5 RO-LP-FCP-019	90+30 min discharge performed, achieved final charge level = 45%			S	

	07:26	**ESS/Lander Power OFF and hibernation setting**	ES-FCP-999, V11	via OBCP								
	07:50	**Orbiter preparation**	n/a									
	08:15	**End of Pass**		Groundstation hand-over								
	08:26	**Stop data requesting from DDS**										

A ground station handover (Canberra to Madrid) was performed from 04:50 (UTC) (Start of MAD) to 05:10 (UTC) (End of CAN), where no TC was available and TM was reduced

Block 3

Pass 1	DOY 134-135

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
13.05.2004	19:00	**Start data requesting from DDS**						
	19:06	**Start of Pass**	LMP-Annex A	AOS 0deg (TM only)				
	19:52	**Start of Orbiter preparation**	LMP-Annex A	AOS10deg (TM/TC)				
	20:34	**ESS/Lander Power ON**	ES-FCP-001, V14 LMP-Annex B	via OBCP, Main path				
	20:48	**Main Hibernation heater switch-off**	n/a					
	20:51	**ESS/Lander Link Establishment**	ES-FCP-002, V4 RO-ES-FCP-001	via Umbilical				

	21:30	**TC parameter update**	LZ-FCP-100, V3	Already uploaded (at DOY133) PORs are started via MTL: 21:30 (UTC) POR #28: Upload of Carousel CVP TCs 22:15 (UTC) POR #29: Delete obsolete TCs 23:00 (UTC) POR #30: Upload updated TCs / new TCs for Sesame CVP 23:45 (UTC) POR #31: Upload add. TCs for Romap CVP					S		
14.05.2004	00:10	**TCU heater setting**	n/a	see note							
	00:18	**Romap commissioning (Part 2)**	CV-FCP-240, V5 RO-CV-FCP-240								
	01:07	**Lander to Stand-by**	LZ-FCP-900, V4								
	01:13	**Romap commissioning (Part 2) Re-start**	CV-FCP-240, V5 RO-CV-FCP-240								
	02:00	**End of Pass**		Groundstation hand-over							
	02:30	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 2	DOY 135-136

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CIU 1 2	Conv	TCU 1 2
14.05.2004	19:00	**Start data requesting from DDS**						
	19:05	**Start of Pass**		AOS 0deg (TM only)				
	19:51	**Start of Orbiter preparation**		AOS10deg (TM/TC)				
	20:34	**Lander to Stand-by**	LZ-FCP-900, V4	Romap switch-off				
	20:45	**Consert Lander Verification**	CV-FCP-238, V5 RO-CV-FCP-238	Noise 4dB higher than previously measured in block 2 NCR: RO-LAN-NC-30375			S	
	21:32	**Consert Interference Test**	CV-FCP-252, V6 RO-CV-FCP-252	(with experiments: APXS, Mupus, Romap, Sesame)				
		ESS packet time stamp inconsistency		NCR: RO-LAN-NC-30368				
15.05.2004	01:30	**Consert Lander Verification**	CV-FCP-238, V5 RO-CV-FCP-238	Start of 34 repetitons, executed during the following LOS phase				

	02:00	**End of Pass**		Groundstation hand-over								
	02:10	**Stop data requesting from DDS**										

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 3	DOY 136-137

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 12	Conv	TCU 12
15.05.2004	19:00	**Start data requesting from DDS**						
	19:04	**Start of Pass**	n/a	AOS 0deg (TM only)				
	19:50	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)			S	
	20:44	**Consert Interference Test**	CV-FCP-253, V5	(with PSS and CDMS)				
	23:41	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. C: Forced LPC, CIU1, TCU2				
	23:52	**Mupus commissioning (Part 2)**	CV-FCP-242, V6 RO-CV-FCP-242	Block shift within MUPUS Science Packet NCR: RO-LAN-NC-30369 Illegal Request Message received by MUPUS from CDMS NCR: RO-LAN-NC-30376				
16.05.2004	01:44	**Consert Lander Verification**	CV-FCP-238, V5 RO-CV-FCP-238				L	

	02:11	**APXS commissioning (Part 2)**	CV-FCP-239, V5 RO-CV-FCP-239								
	03:30	**End of Pass**		Groundstation hand-over							
	04:05	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 4	DOY 137-138

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CIU 1 2	Conv	TCU 1 2
16.05.2004	19:02	**Start of Pass**	n/a	AOS 0deg (TM only)				
	19:48	**Start of Orbiter activity**	n/a	AOS10deg (TM/TC)			L	
		Orbiter Trim manoeuvre						
	21:35	**Start data requesting from DDS**						
	22:50	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard configuration			S	
	23:04	**Lander to Stand-by**	LZ-FCP-900, V4					
	23:17	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. B: Forced HPC, CIU2, TCU1				
	23:33	**Anchor commissioning (Part 2)**	CV-FCP-231, V6 RO-CV-FCP-231				H	
17.05.200	01:34	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. B: Forced HPC, CIU2, TCU1				
	02:00	**End of Pass**		Groundstation hand-over				

	02:25	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 5	DOY 138-139

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m r	CI U 1 2	Co nv	TC U 1 2
17.05.2004	18:55	**Start data requesting from DDS**						
	19:01	**Start of Pass**	n/a	AOS 0deg (TM only)				
	19:47	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)			H	
	20:24	**Sesame commissioning**	CV-FCP-234, V7 RO-CV-FCP-234	New sequence B has been exceuted				
	21:10	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard configuration				
	21:20	**Lander to Stand-by**	LZ-FCP-900, V4					
	21:22	**DPU2 status investigation**		Dips in CDMS DPU2 current NCR: RO-LAN-NC-30370 Executed Sequence: DPU1 - DPU2 - DPU1			S	
	22:29	**Lander ESS and TxRx Checkout**	ES-FCP-010, V4	Drop in Tx/Rx link quality NCR: RO-LAN-NC-30371				
18.05.	01:10	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. C: Forced LPC, CIU1, TCU2				

	01:28	**Sesame commissioning (Part 2)**	CV-FCP-234, V7 RO-CV-FCP-234	Sequence B					L		
	02:10	**End of Pass**		Groundstation hand-over							
	02:25	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 6	DOY 139-140

Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 12	Conv	TCU 12
17:30 MTL	**Rolis/Civa-P commissioning (Part 2)**	CV-FCP-236, V5				L	

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS mr	CIU 12	Conv	TCU 12
18.05.2004	18:55	**Start data requesting from DDS**						
	19:00	**Start of Pass**	n/a	AOS 0deg (TM only)				
	19:46	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)			L	
	-----	**Rolis/Civa-P commissioning (Part 2)**	CV-FCP-236, V5 RO-CV-FCP-236	Continuation				
	21:07	**Ptolemy commissioning (Part 3)**	CV-FCP-248 V6 RO-CV-FCP-248	Ptolemy SC packet lost NCR: RO-LAN-NC-30373				
	22:44	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard configuration				
	22:58	**Lander to Stand-by**	LZ-FCP-900, V4					

	23:14	**SD2 Volume Checker movement**	LD-CRP-001, V1	CDMS-SD2 I/F problem NCR: RO-LAN-NC-30372							
19.05.2004	01:15	**End of Pass**		Groundstation hand-over					S		
	02:20	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 7	DOY 140-141

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
	17:14 MTL	**Carousel commissioning**	CV-FCP-259, V1						S		
19.05.2004	18:57	**Start data requesting from DDS**									
19.05.2004	18:59	**Start of Pass**	n/a	AOS 0deg (TM only)							
19.05.2004	19:44	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)							
19.05.2004	-----	**Carousel commissioning (SD2 plus Civa-M)**	CV-FCP-259, V1 RO-CV-FCP-259	Continuation CDMS-SD2 HK problem NCR: RO-LAN-NC-30374					S		
19.05.2004	22:34	**Romap Interference Test**	CV-FCP-255, V4 RO-CV-FCP-255	(with experiments: APXS, Mupus, Sesame)							
20.05.2004	01:43	**DPU2 status investigation**		DPU toggled to DPU2, continous operation during next LOS							
20.05.2004	02:00	**End of Pass**		Groundstation hand-over							
20.05.2004	02:47	**Stop data requesting from DDS**									

Note: TCU heater setting: Cosac-GC, Topplate, PrimaryBattery and SecondaryBattery heater in Emergency mode; Flywheel heater disabled; ZEbox heater to control loop,

Lander stand-by current is 652 mA (resp. 672 mA).

Block 3

Pass 8	DOY 141-142

Date	Start time (UTC)	Activity	Procedures	Remarks Off-nominals	ESS m	ESS r	CIU 1	CIU 2	Conv	TCU 1	TCU 2
20.05.2004	18:55	**Start data requesting from DDS**									
	18:58	**Start of Pass**	n/a	AOS 0deg (TM only)							
	19:43	**Start of Orbiter preparation**	n/a	AOS10deg (TM/TC)					S		
	20:15	**TCU heater setting reset**		All heaters set to Control loop							
	20:35	**DPU2 status investigation**		DPU toggled back to DPU1							
	20:50	**Consert Instrument Clock Drift Correction**	CN-FCP-004, V11	Executed 3 times: with different parameters between run 1 and 2, run3 is a repetition of run 2							
	22:43	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. B: Forced HPC, CIU2, TCU1							
	23:00	**Sesame commissioning Re-run**	CV-FCP-234, V7 RO-CV-FCP-234	Re-run of Sequence B					H		
	23:51	**Lander Interface Configuration**	LZ-FCP-200, V4	Seq. A: Standard configuration					S		

21.05.2004	00:05	**Lander to Stand-by**	LZ-FCP-900, V4								
	00:15	**ESS/Lander Power OFF and hibernation setting**	ES-FCP-999, V11	via OBCP							
	02:00	**End of Pass**		Groundstation hand-over							
	02:05	**Stop data requesting from DDS**									

CVP block 4 is based on the following Lander operational requests:

LOR	Description	LOR / LOP number	Corresp. POR	Delayed TC file	FT transfer filename
#1	ESS/LDR Switch on and Lander configuration	00043	00058		
#2	Lander Stored TC Buffer (STCB)	00044	00059		
#3	COSAC SW Upload	00046	00062	ALES700A	3000 (3100)
#4	PTOLEMY SW Patch	00047	00063	ALYS700A ALYS700B ALYS700C	3001 (3101) 3002 (3102) 3003 (3103)
#5	PTOLEMY CVPs re-run with updated SW and Secondary Battery Monitoring	00048	00064		
#6	COSAC combined operations, Cruise AFT, Extended AFT, ROMAP CVP Seq3 and Start of PTOLEMY combined operations	00049	00065		
#7	CIVA_P Tests and ROLIS_D full dark image	00050	00066		

Note:
LOR 00045 (=POR 00060) has been replaced by LOR 00046

Lander configuration during block 4:

ESS usage: Main branch
CDMS setting: Standard configuration, Both CIUs
Converter setting: AMDT controlled
TCU usage: TCU-2 (TCU-1 only the first 10 min after switch-on)

Block 4

		Start	Activity	Procedure	Sequence	Remarks, Off-nominals	
		17:15	**Start data requesting from DDS**				
Pass 1		**17:18**	**Start of Pass**			NNO_AOS_0 (TM only)	
Pass 1		**18:12**	**Start of Orbiter Preparation**			NNO_AOS_10 (TM/TC)	
Pass 1	MTL	**18:45**	**Switch-ON ESS (main) and Lander**	ES-FCP-001,V14 RO-ES-FCP-001	AESF001C, E		LOR #1
Pass 1	MTL	**18:52**	**Establish link via umbilical and verify Lander status**	ES-FCP-002,V5 RO-ES-FCP-002	AESF002A		LOR #1
Pass 1	MTL	**18:55**	**Lander configuration**	LZ-FCP-100,V3	ALZF100A	Set CDMS to enhanced mode Change TCU application (TCU-1 → TCU-2)	LOR #1
Pass 1	MTL	**19:10**	**TC Parameter Update (General)**	LZ-FCP-100,V3	ALZF100A	Upload of Romap CVP-B4, Civa-P CVP-B4 Upload of Combined-Operation Upload of updated Cruise AFT, Extended AFT Upload of Battery Monitoring TCs	LOR #2
Pass 1	Manual	**19:47**	**ESS RxTxPower ON**	Fixed TC:	ZESF0054	Environmental noise measurement; NO link establishment!	
Pass 1	Manual	**20:09**	**Verify position of carousel**	LD-CRP-001,V1	ALDC001A,D,E		
Pass 1	Manual	**21:23**	**Upload of new Cosac S/W (V120704)**	LZ-FCP-700,V4	ALES700A	Upload S/W patch data / CS_P_..........00015.ROS Execute Cosac LFT Execute Cosac EEPROM Init	LOR #3
Pass 1	Manual		**TC Parameter Update (Cosac)**	LZ-FCP-100,V3	ALZF100A	Upload of updated AMST (FCP-241)	LOR #3
Pass 1	Manual	**23:37**	**Re-run of Cosac CVP**	CV-FCP-241,V5	ACVF241A	(refer to RO-LAN-NC-30348)	LOR #3
Pass 1	Manual		**Verify Cosac and SD2 BRAM**	LZ-FCP-100,V3	ALZF100A		LOR #3

Start	Wednesday, 06.10.2004 (DOY 280)	Procedure	Sequence	Remarks, Off-nominals

Block 4

Pass	Mode	Start	Activity	Procedure	Sequence	Remarks	LOR
Pass 1	Manual	**00:16**	**Upload of Ptolemy S/W patch**	LZ-FCP-700,V4	ALYS700A ALYS700B ALYS700C	CS_P_...........00019.ROS CS_P_...........00020.ROS CS_P_...........00021.ROS	LOR #4
		00:48	**Verify Ptolemy BRAM**	LZ-FCP-100,V3	ALZF100A		
	MTL	**00:55**	**Execute Ptolemy Cruise Phase Mode**	CV-FCP-235,V5 RO-CV-FCP-235	ACVF235A		LOR #5
		02:05	**Start Ptolemy Post Launch Mode**	CV-FCP-248,V6 RO-CV-FCP-248	ACVF248A		
		02:33	**End of Online Commanding**			NNO_LOS_10	
		02:55	**Stop data requesting from DDS**				
			Continue Ptolemy Post Launch Mode				
		03:25	**Secondary Battery Monitoring**	LP-FCP-020,V2 RO-LP-FCP-020	ALPF020A	(at T = -34degC)	
		04:00	**Secondary Battery Heating**		ALPF020B		
		15:00	**Temperature Configuration Setting**	LZ-FCP-300,V4	ALZF300C	(Reset TCU settings)	
		15:05	**Secondary Battery Monitoring**	LP-FCP-020,V2 RO-LP-FCP-020	ALPF020A	(at T = 0 degC)	
		15:35	Lander in Stand-by Mode				
		15:45	**Combined Operation (Part 1: Cosac / SD2 / Civa-M)**	CV-FCP-260,V2 RO-CV-FCP-260	ACVF260B	Start heating of Civa-M	LOR #6
		17:17	**Start data requesting from DDS**				
Pass 2		**17:17**	**Start of Pass**			NNO_AOS_0 (TM only)	
		18:11	**Start of Orbiter Preparation**			NNO_AOS_10 (TM/TC) Upload of LOR #7	
		18:45	Continue CombOps (Part 1: Cosac / SD2 / Civa-M)	CV-FCP-260,V2 RO-CV-FCP-260	ACVF260B	Execute Combined operation Anomaly at SD2-CDMS I/F, RO-LAN-NC-30377	
		21:15	**Disable 28V to Landing Gear**	LZ-FCP-100,V3	ALZF100A	Requested by SSA to disable LG operation	
		21.16	**Cruise AFT**	LZ-FCP-020,V2 RO-LZ-FCP-020	ALZF020A	ADS events reported, RO-LAN-NC-30378	
		22:00	**Extended AFT**	LZ-FCP-030,V1 RO-LZ-FCP-030	ALZF030A	ADS events reported, RO-LAN-NC-30378	

Block 4

Pass	Mode	Start	Thursday, 07.10.2004 (DOY 281)	Procedure	Sequence	Remarks, Off-nominals	LOR
Pass 2	MTL	**00:00**	**Start Romap CVP block 4**	CV-FCP-240,V7 RO-CV-FCP-240	ACVF240B	Wrong TC setting prevents start of AMST	LOR #6
		00:38	**Re-start of Romap CVP block 4**	CV-FCP-240,V7 RO-CV-FCP-240	ACVF240B	Re-start after TC update successful Romap increased power consumption, RO-LAN-NC-30379	
		02:22	**Stop data requesting from DDS**				
		02:33	**End of Online Commanding**			NNO_LOS_10	
			Continue Romap CVP block 4				
		17:10	**Start data requesting from DDS**				
Pass 3		**17:16**	**Start of Pass**			NNO_AOS_0 (TM only)	
		17:23	Lander in Stand-by Mode				
		17:45	**Combined Operation (Part 2: Ptolemy / SD2 / Civa-M)**	CV-FCP-261,V2 RO-CV-FCP-261	ACVF261B	Start heating of Civa-M	
	Manual	**18:09**	**Start of Orbiter Preparation**			NNO_AOS_10 (TM/TC)	
		18:45	Continue CombOps (Part 2: Ptolemy / SD2 / Civa-M)	CV-FCP-261,V2 RO-CV-FCP-261	ACVF261B-L	Execute Combined operation	

Start	Friday, 08.10.2004 (DOY 282) Saturday, 09.10.2004 (DOY 283)	Procedure	Sequence	Remarks, Off-nominals

Block 4

Pass 3	Manual	**00:45**	**ESS RxTxPower OFF**	Fixed TC: ZESF0072			
		00:55	Lander in Stand-by Mode				
		01:30	**Stop data requesting from DDS**				
		02:32	**End of Online Commanding**			NNO_LOS_10	
			Lander in Stand-by Mode				
	MTL	**03:00**	**Secondary Battery Heating**		ALPF020B		
		11:00	**Temperature Configuration Setting**	LZ-FCP-300,V4	ALZF300C	(Reset TCU settings)	
		11:05	**Secondary Battery Monitoring**	LP-FCP-020,V2 RO-LP-FCP-020	ALPF020A	(at T = 0 degC)	
		11:35	Lander in Stand-by Mode				
		16:30	**Start Civa-P CVP block 4**	CV-FCP-262,V1 RO-CV-FCP-262	ACVF262A	Start heating of Civa-P	LOR #7
		17:10	**Start data requesting from DDS**				
Pass 4		**17:14**	**Start of Pass**			NNO_AOS_0 (TM only)	
		18:08	**Start of Orbiter Preparation**			NNO_AOS_10 (TM/TC)	
		18:30	Continue Civa-P CVP block 4	CV-FCP-262,V1 RO-CV-FCP-262	ACVF262C-F	Execute Civa-P CVP block 4	
		21:45	**Civa-P heater test**	CV-FCP-262,V1 RO-CV-FCP-262 LZ-FCP-900,V4	ACVF262A+F ALZF900A		
		23:00	**Rolis-D darkfull frame test**	LZ-FCP-100,V3	ALZF100A		
		23:23	**Romap/Penning failure investigation**	CV-FCP-240,V7 RO-CV-FCP-240	ACVF240B	Re-run (partly) of Romap CVP block 4	

Pass 4		**01:15**	**Switch-OFF ESS/Lander and activate hibernation setting**	ES-FCP-999,V11	AESF999A, B	
		02:15	**Stop data requesting from DDS**			
		02:31	**End of Online Commanding**			NNO_LOS_10

8 Annex II – Pass reports

Lander status prior to operation:
- Lander set to hibernation mode
- hibernation heater operating nominally
- all temperatures are within switch-on range (ESS = +12degC, Lander YEbox = -22degC)

Lander operation was performed from 23:02 to 09:05 (UTC)

Executed operations during pass 1:

1.) 23:02 UTC ESS/Lander Switch-on (Red. Side, via OBCP) ES-FCP-001, V13
ESS/Lander current consumption nominal (379 mA)

2.) Link establishment via umbilical ES-FCP-002, V4 was nominal

3.) MSS-CVP CV-FCP-226, V8 started on the Redundant side at 23:31 UTC

3.1) MSS Coms test was performed successfully.

3.2) During Wax heater test SAT was loaded and started at 23:48 (SAT Enable)
WAX test on both sides (WAX-A and WAX-B) failed, WAX test Fail event received

Identified reason:
The required WAX power was not available since LCL1A/B and LCL2A/B are not switched on. Due to a error in the procedure this was not executed.

A Re-Run in orbit was rejected, since heating longer than foreseen (20 sec) will cause the Cruise Latch to become open, which will enable Lander separation.

It was decided to prepare an updated procedure including the commands for LCL switch-on/off and timing related to the SAT execution to minimize any risk of an unforeseen Lander separation.

The updated procedure should be tested on ground before execution in orbit, rescheduling is necessary, earliest in block 2.

MSS-Commissioning was aborted.

4.) ESS/Lander Switch-off (via OBCP) ES-FCP-999, V11 was nominal

5.) 01:05 UTC ESS/Lander Switch-on (Main Side, via OBCP) ES-FCP-001, V13 was nominal
ESS/Lander current consumption as expected (352-372 mA)

6.) Link establishment via umbilical ES-FCP-002, V4 was nominal

7.) CDMS-CVP CV-FCP-224, V8 was started at 01:30 UTC

7.1) Initial context test was nominal

7.2) Test with DPU1 as prime was nominal,

TxRx link establishment was successful both with TxRx1 and TxRx2 within 4 minutes.

MM1 was filled completely and dumped, link breaks were received at the end of the dump. MM1 was reset via command.

MM2 was filled partly, but dumped the whole MM content with old packets (from LDR E2E test TBC).

8.) A TCU1 test was executed at 06:30 UTC using TC ZLC80036 (TCU1 as Default) to force CDMS to switch-on TCU1.

It was found, that TCU1 is working again. All sensors are showing similar values then TCU2.

TCU2 was defined as default again, in order to continue with CDMS-CVP.

9.) CDMS-CVP continued at 07:00 UTC

Test with DPU2 as prime were executed up to CIU testing (step 3.2). As results are nominal.

CDMS-CVP will be continued at step 3.3 at the next pass.

10.) Temperature configuration Setting LZ-FCP-300, V4 was performed at 08:15 UTC

- Both TCUs are switched-on
- all Warm compartment heaters are on by setting the set-point to +35°C
- heater current is nominal.

11.) Mupus S/W files upload into Orbiter SSMM was performed successfully at 08:50 UTC, name of files are 2000 and 2001, and were also copied as 3000 + 3001 as back-up.

Lander status at end of Lander operation (09:05 UTC):

- Lander is switch-on
- Platform units (ESS, CDMS, PSS) and both TCUs and all compartment heaters are operating

Additional notes:

a) Mupus LTVF files were fetched from DDS and checked against Mupus S/W image, files are identical. Go for upload of Mupus S/W files upload was given.

   General GO from Mupus PI for S/W upload was given.

b) Travel light time for this pass was 22 sec (roundtrip)

c) Data retrieval from DDS was nominal.

SUMMARY:

CDMS-CVP completed successfully
Mupus S/W V46 upload successfully performed
Cruise AFT successfully executed

BLOCK1 PASS2 PERFORMANCE REPORT:

Lander status prior to operation:

- Platform units (ESS, CDMS, PSS) and both TCUs and all compartment heaters are operating
- In total 31.2W (12W hibernation heater, 6W platform, 2*6.6W) were dissipated during LOS inside the Lander, temperature at YEboxes increased up to +14degC
- Temperature of ESS internal DC/DC converter increased up to 92degC after 23 hrs of operation.

Lander operation was performed from 23:02 to 08:52 (UTC)

Executed operations during pass 2:

1.) Temperature configuration Setting LZ-FCP-300, V4 was performed at 23:02 UTC
All heaters and TCU1 were switched-off, set points reset to –40degC,
operation continues with TCU2

2.) CDMS-CVP CV-FCP-224, V8 continued at 23:17 UTC at step 3.3

MM1 was filled partly and dumped. No link break event was received, dump ended nominal

MM2 was filled completely and dumped, link breaks were received at the end of the dump. MM2 was reset via command.

TxRx link establishment was successful both with TxRx1 and TxRx2 within 4 minutes.
DPU pages were dumped successfully via RF link.

The tests with H/W decoded TCs were also executed successfully.

CDMS-CVP was successfully performed.

3.) POR (Consert Mission Table update, TC for Mupus Health Check, LG and Cosac TCs) was uplinked and transferred to Lander, follow by a dump of the DPU pages C and D.
LZ-FCP-100, V3

Execution time was 04:52:53 (UTC)

4.) 05:34 UTC Mupus S/W upload was successfully executed, requiring just one attempt, verified by check sum and a health check. CDMS pages $0C and $0D were dumped.

5.) The Cruise AFT LZ-FCP-020, V2 was successfully executed from 07:58 to 08:28 (UTC)

6.) Temperature configuration Setting LZ-FCP-300, V4 was performed at 08:43 UTC
All heaters and TCU1 are switched-on, set points set to +35/+5degC

Lander status at end of operation (UTC):

- Lander is switched-on

- Platform units (ESS, CDMS, PSS) and both TCUs and all heaters are operating
- New Mupus S/W version 46 uploaded

Additional notes:
Data retrieval from DDS was nominal, just one short FTP error (around 1 min)

SUMMARY:

ESS TxRx Check-out on main branch completed successfully
Anomaly with CDMS redundancy was observed
Secondary Battery Check-out successfully performed
Primary Battery Check-out successfully performed

BLOCK1 PASS3 PERFORMANCE REPORT:

Lander status prior to operation:

- Platform units (ESS, CDMS, PSS), both TCUs and all heaters are operating
- Temperature at battery has increased to +7degC, at YEboxes up to +27degC

Lander operation was performed from 22:54 to 08:24 (UTC)

Executed operations during pass 3:

1.) Temperature configuration Setting LZ-FCP-300, V4 was performed at 22:54 UTC
All heaters and TCU1 were switched-off, set points reset to –40degC,
operation continues with TCU2

2.) ESS TxRx Check-out LZ-FCP-010, V4 has been started at 23:02 UTC

About 3 min after RF link establishment a series of event packets (Anomaly with CDMS redundancy) were received, indicating that the redundant DPU was reset several times. The link could not be re-established via umbilical. Since a recovery procedure has not been prepared yet, a power cycling of the ESS/Lander has been performed. Lander status in general and DPU2 status were nominal again.

3.) ESS TxRx Check-out LZ-FCP-010, V4 has been re-started at 01:38 UTC and ended at 03:10 UTC.
Measurements showed a low noise environment.

4.) PSS Secondary Battery Check-out started at 03:20 UTC.
Two long discharge sequences (90min duration) and one short discharge sequence (30min duration) have been executed, Secondary battery has been discharged down to 26.6V.

Temperatures at end of discharge were +37degC at the top plate heater and +15degC inside the secondary battery.

5.) PSS Primary Battery Check-out has been successfully executed at 08:00 UTC

Lander status at end of operation:

- Lander is in stand-by mode, all heaters are off.

Additional notes:

a) Data retrieval from DDS was nominal

b) Travel light time for this pass was 27 sec (roundtrip)

SUMMARY:

Flywheel commissioning (part 1) was performed successfully.
Landing Gear CVP (Release of Central Launch Lock) was executed successfully.
Cosac CVP (part 1) was partly successfully and needs to be rerun.
ADS commissioning (part 1) was performed successfully.

BLOCK1 PASS4 PERFORMANCE REPORT:

Lander status prior to operation:
- Lander is in stand-by mode, all TCU heaters are off.

Lander operation was performed from 23:05 to 06:20 (UTC)

Executed operations during pass 4:

1.) Interface configuration Setting LZ-FCP-200, V4 was performed at 23:05 UTC
Platform is set to use only HPC, CIU2 and TCU1

2.) Flywheel CVP CV-FCP-230, V6 has been started at 23:28 UTC

The expected speed level (level 0 = 6850 rpm) after switch-on was reached,
speed level 2 (= 9897 rpm) was just 9404 rpm as maximum. Impact on Orbiter was acceptable.

3.) Landing Gear CVP CV-FCP-229, V6 has been executed at 01:06 UTC.
The Central Launch Lock was successfully released and LG-CVP is finalised.

4.) Cosac CVP CV-FCP-241 was started at 02:20 UTC.

During operation an CDMS anomaly with Power Control was received and Cosac was power-cycled. The second run was executed without problems, but an unexpected tapping station reading was detected at the end. Procedure needs to be executed again in block 2.

Cosac-MS, GC and MM were tested successfully.

5.) ADS-CVP CV-FCP-232, V6 was executed successfully at 03:54 UTC
Tank pressure was around 63 bar, pipe pressure was 0 bar.

6.) The Cruise AFT LZ-FCP-020, V2 was executed from 04:51 to 05:23 (UTC). Due to the platform I/F configuration setting (only one CIU) a non-critical limit error was received for Anchor, since it needs both CIUs.

7.) Interface configuration Setting LZ-FCP-200, V4 was performed at 05:38 UTC
Platform is set to standard configuration (autonomous selection, both CIUs)

8.) Lander ESS power off (via OBCP) ES-FCP-999, V11 was performed at 05:51 UTC.

9.) Lander ESS power on (Redundant side, via OBCP) ES-FCP-001, V13 was performed at 06:05 UTC.

10.) Establish ESS-Lander-Link via umbilical ES-FCP-002, V4 was executed at 06:12 UTC

Lander operations were stopped, since Mars Express requires the TC/TM link.

Lander status at end of operation:
- Lander is in stand-by mode powered via Orbiter-LCL/ESS redundant side
- all TCU heaters are off.

SUMMARY:

**Flywheel commissioning (part 2), Cosac commissioning (part 2), ESS TxRx Check-out and ADS commissioning were performed successfully as well as the Cruise AFT.
The platform configuration settings worked nominally.**

The Lander is set to hibernation mode and waiting for the next Commissioning Block.

BLOCK 1 PASS 5 PERFORMANCE REPORT:

Lander status prior to operation:

- ESS/Lander are powered from redundant side
- Lander is in stand-by mode, all TCU heaters are off.

Lander operation was performed from 22:55 to 07:05 (UTC)

Executed operations during pass 5:

1.) Since time synchronisation after power on at end of pass4 failed, a TC (Dump 1 CDMS HK) was

sent, which synchronizes ESS and Lander.

2.) Interface configuration Setting LZ-FCP-200, V4 was performed at 22:57 UTC
Platform is set to use only LPC, CIU1 and TCU2

3.) Flywheel CVP CV-FCP-230, V6 has been started at 23:23 UTC
All values seen during the run in pass4 were again achieved. Flywheel is working nominal.

4.) Cosac CVP (part 2) CV-FCP-246, V5 was started at 00:49 UTC and executed successfully.

5.) ESS TxRx Checkout ES-FCP-010 was performed at 01:40 UTC
Measurements from Rx2 have to be repeated

6.) ADS-CVP CV-FCP-232, V6 was executed successfully at 02:55 UTC
Tank pressure was again around 63 bar, pipe pressure was 0 bar.

7.) Part TxRx2 of ESS TxRx Checkout ES-FCP-010 was successfully re-run at 04:03 UTC
Measurements from Rx2 were now as expected.

8.) The Cruise AFT LZ-FCP-020, V2 was executed successfully from 04:51 to 05:20 (UTC). Due to the platform I/F configuration setting (only one CIU) again a few limit errors in the first words of certain unit TM packets were received.

9.) Interface configuration Setting LZ-FCP-200, V4 was performed at 05:31 UTC
Platform is set to standard configuration (autonomous selection, both CIUs).

10.) PSS Secondary Battery Check-out was started at 05:57 UTC.
Since the secondary battery temperature was slightly below the actual threshold, it was decided to use the S/W temperature control loop inside the autonomous battery handling procedure instead of
pre-heating. Due to an interpretation failure in the waiting loop the software entered AMST00 instead of continuing on with the commanded sequence. This aborted the additional run of the secondary battery check-out. Since battery heating went on, the execution of battery discharge became possible later, but was not executed anymore due to the coming end of the pass.

11.) Lander ESS power off (via OBCP) ES-FCP-999, V11 was performed at 06:51 UTC.

Lander status at end of operation:

- Lander is in hibernation mode
- Primary Battery temperature is 3.8 degC
- YEbox temperature is 23 degC

Additional notes:

a) Travel light time for this pass was 31 sec (roundtrip)

b) Data retrieval from DDS was working nominal.

SUMMARY:

ESS and Lander were successfully switched-on for CVP block 2
Cosac Tapping Station Recovery was successfully executed, Tapping Station is back to a defined "Open" position.
SD2 CVP procedure to verify carousel position has been successfully executed.

BLOCK 2 PASS 1 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS was switched-off
- Lander is in hibernation mode
- Switch-on temperature levels at ESS and Lander YEbox were given

Lander operation was performed from 21:31 to 02:20 (UTC)

Executed operations during pass 1:

1.) 21:31(UTC) ESS/Lander Power ON ES-FCP-001, V13, was started using the redundant side

via OBCP, ESS performance and LCL15B current consumption are nominal.

2.) 21:42 (UTC) ESS/Lander Link Establishment ES-FCP-002, V4 was executed,
Lander packets show nominal Lander performance

3.) 22:30 (UTC) MDAF_SCHRMA_D__040407141419_00026.ROS to correct Sesame STCB and AMST items was successfully executed.

4.) 22:58 (UTC) SD2 CVP CV-FCP-233, V7 was started to verify the carousel position prior to Cosac Tapping station recovery. Carousel position reading shows –1.07 deg.

5.) 23:24 (UTC) Cosac Tapping Station Recovery LE-CRP-001, V0 was performed. After a successful test run the final position could be reached. Cosac is prepared now for Re-run of CV-FCP-241.

6.) 01:42 (UTC) SD2 CVP CV-FCP-233, V7 was started to verify the carousel position after Cosac Tapping station recovery. Carousel position reading still shows –1.07 deg.

7.) 02:07 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
Both TCUs are switched on and all warm compartment heaters. Current consumption is nominal. (LCL15B = 898 mA)

Lander status at end of operation:
- Lander is switched-on
- Both TCUs and all Warm Compartment heaters are switched-on
- YEbox temperature at end of AOS was –11 degC

Additional notes:

a) Data retrieval from DDS to LCC was working nominal.
b) Data transfer from LCC to SONC reported some outages, needs further investigations

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 9 to 10/04/2004
Author : M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°:2 Day n°: 1	AOS time (UTC): 20h16 (AOS 0 deg) LOS time (UTC): 2h37 (End of Pass)
Experiments involved: SD2, COSAC	

SLOT PROGRESS

Start time of Lander operations: 21h30

End time of Lander operations: 2h30

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
LZ-FCP-100	22:30	22:41	-	-
CV-FCP-233	23:00	23:16	2	7
LE-CRP-001	23:24	01:30	25	11
CV-FCP-233	01:41	01:58	2	7

Ground anomalies description:

- SONC-CVP-1 : Important delay of data reception between LCC and SONC : 14mn delay observed from request to DDS up to arrival of data on trait-op3CI (DDS status indicates 10s from request arrival to data sending)

- SONC-CVP-2 : PIs Internet PC : Access to proxy failure observed from 10/04 0h00 (local time)

On-Board Anomalies description:

2 SD2 anomalies:
- HK3 Current +12V line : lower than expected
– SC13 Volume Checker status (FFFC instead of FFFD)

1 COSAC anomaly : HK sampling problem

SLOT DEBRIEFING

SD2 Carrousel in correct position (-1.06 deg for +/- 7 deg requirement) Next block to be performed as previously planned. SD2 FCP to be removed from Pass3.		
Actions:	Resp.:	Due date:
SONC to investigate on ground anomalies. Technical support to be activated during this week-end	PhG	10/04
LCC team to write a NCR for SD2 anomaly	LCC	
SONC to open a NCR for COSAC anomaly	SONC	

SUMMARY:

Anchor commissioning was successfully executed, but initial heating phase needs to be extended before re-running.
SD2 CVP procedure has been successfully executed on Forced LPC as well as on Forced HPC configuration.

BLOCK 2 PASS 2 PERFORMANCE REPORT:

Lander status prior to operation:
- Lander is switched-on
- Both TCUs and all Warm Compartment heaters are switched-on
- YEbox temperature at end of LOS was +17 degC

Lander operation was performed from 21:29 to 02:20 (UTC)

Executed operations during pass 2:

1.) 21:29 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
TCU set points were reset to –40 degC, all heaters are switched-off

2.) 21:45 (UTC) Interface configuration setting LZ-FCP-200, V4 was executed,
Lander was set to “Forced LPC, CIU1, TCU2” configuration

3.) 22:08 (UTC) Anchor commissioning CV-FCP-231, V 6 was started
Initial temperatures at Anchors were –146 degC and heating was executed,followed by a rewind motor operation. Since temperatures at end of heating reach only the very lowest level of motor switch-on temperature, the re-run in pass 3 was skipt and an update of the heating time needs to be introduced prior to the re-run in Lander CVP block 3. All other Anchor parameters were found nominally.

4.) 00:04 (UTC) Interface configuration setting LZ-FCP-200, V4 was executed,
Lander was set to “Forced LPC, CIU1, TCU2” configuration again

5.) 00:20 (UTC) SD2 CVP CV-FCP-233, V7 was performed, results were similar to pass 1 results

6.) 00:56 (UTC) Interface configuration setting LZ-FCP-200, V4 was executed,
Lander was set to “Forced HPC, CIU2, TCU1” configuration

7.) 01:11 (UTC) SD2 CVP CV-FCP-233, V7 was performed
Results were similar to previous results

After the end of SD2 CVP, the LCL15B current was found higher then expected (10-20 mA).
A first investigation indicates that the LPC is still switched-on. Further investigation is needed.

8.) 02:00 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
Both TCUs are switched on and all warm compartment heaters. Current consumption as expected due to LPC opeartion. (LCL15B = 918 to 938 mA)

Lander status at end of operation:
- Lander is switched-on
- Both TCUs and all Warm Compartment heaters are switched-on

Additional notes:

Data retrieval from DDS to LCC was working nominal.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 10 to 11/04/2004
Author : Ph. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°:2 Day n°: 2	AOS time (UTC): 20h13 (AOS 0 deg) LOS time (UTC): 2h36 (End of Pass before MEX)
Experiments involved: SD2 (Part 2)	

SLOT PROGRESS

Start time of Lander operations: 21h30

End time of Lander operations: 2h15

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
On LPC:				
CV-FCP-233	00:22	01:11	2	7
On HPC:				
CV-FCP-233	00:42	01:30	3	7

Ground anomalies description:

A Davis disconnection was observed at 23h UTC (observed also yesterday). This problem is not critical as the system can be rebooted easily. It will be kept under observation in the future passes.

On-Board Anomalies description:

The 2 anomalies noticed yesterday remain:
- HK3 Current +12V line : higher than yesterday (yesterday (100 mA instead of 80, for 3° instead of –30°), but lower than expected
- SC13 Volume Checker status (FFFC instead of FFFD)

SLOT DEBRIEFING

Change to pass 3: Mupus will replace the second part of Anchor commissioning

Change to pass 4: Ptolemy and TxRx will replace Mupus commissioning

Actions:	Resp.:	Due date:
SD2 will investigate the 2 NCRs and will propose new procedures for Block 3 operations	SD2 team	30/04/04

SUMMARY:

Lander platform was reconfigured to Forced HPC configuration.
Mupus commissioning was performed.
Consert CVP procedures for “Lander verification”, “TC verification” and “Patch & Dump” were executed.

BLOCK 2 PASS 3 PERFORMANCE REPORT:

Lander status prior to operation:
- Lander is switched-on
- During LOS heating phase TCU set points (+35 degC) were reached at the Cosac-GC and the Topplate
- 20:15 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed via MTL
- TCU set points were reset to –40 degC, all heaters are switched-off
- HPC and LPC are still switched-on

Lander operation was performed from 21:34 to 02:30 (UTC)

Executed operations during pass 3:

1.) 21:34 (UTC) Lander platform recovery was performed
Lander was switched to standard configuration, reset and switched back to “Forced HPC”

configuration, LPC is now off, Lander was set to “Forced LPC, CIU1, TCU2” configuration

2.) 22:15 (UTC) Mupus commissioning CV-FCP-242, V 6 was executed
Some anomalies during Mupus Health Check at the end of the CVP were observed, no science packets were received anymore.

3.) 23:59 (UTC) Consert Lander Verification CV-FCP-238, V5 was executed

4.) 00:33 (UTC) Consert TC Verification CV-FCP-257, V6 was executed

5.) 01:05 (UTC) Consert Patch & Dump CV-FCP-258, V7 was executed

6.) 01:49 (UTC) Mupus Health Check was re-run

7.) 02:04 (UTC) The LG BRAM (HK word 17) was set to 2100hex to prepare APXS CVP in pass 4

8.) 02:20 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
Both TCUs are switched on and all warm compartment heaters. Current consumption is nominal. (LCL15B = 898 mA)

Lander status at end of operation:
- Lander is switched-on
- Both TCUs and all Warm Compartment heaters are switched-on

Additional notes:

Data retrieval from DDS to LCC was working nominal.

cnes	**SONC–ROSETTA**	**COMMISIONING OPERATION REPORT**	Date : 11 to 12/04/2004
Author : M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°:2 Day n°: 3	AOS time (UTC): 20h10 (AOS 0 deg) LOS time (UTC): 2h35 (End of Pass)
Experiments involved: MUPUS, CONSERT	

SLOT PROGRESS				
Start time of Lander operations: 22h15				
End time of Lander operations: 2h15				
FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-242	22:14	00:00	22	64
CV-FCP-238	00:06	00:28	-	134
CV-FCP-257	00:34	00:55	-	134
CV-FCP-258	01:00	01:25	-	135
MUPUS Health check (AMST 207)	01:50	02:00	3	5

Ground anomalies description:

None

On-Board Anomalies description:

MUPUS_1 : SC frames delivered in bad order
MUPUS_2 : Missing SC packets
MUPUS_3 : Jumps on voltage values

SLOT DEBRIEFING		
Because of anomaly on MUPUS (missing SC packets), a health check has been carried out at the end of the pass. Mr Klingelhöfer will represent APXS PI during CVP operations.		
Actions :	Resp.:	Due date:
SONC to check what could happen if we don't acquire communication with New Norcia during Pass4, especially concerning Civa/Rolis heating	JF	

SUMMARY:

The commissioning of APXS (Part 1), Rolis/Civa-P (Part 1), Sesame (Part 1) and Ptolemy (Part 1) was executed.
A Re-run of Mupus CVP was performed.

BLOCK 2 PASS 4 PERFORMANCE REPORT:

Lander status prior to operation:
- Lander is switched-on
- During LOS heating phase TCU set points (+35 degC) were reached at the ZEbox, Cosac-GC and the Topplate
- Lander I/F configuration is still set to “Forced HPC”

Lander operation was performed from 21:32 to 07:25 (UTC)

Executed operations during pass 3:

1.) 21:32 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
TCU set points were reset to –40 degC, all heaters are switched-off, TCU 2 is switched-off

4.) 21:42 (UTC) APXS commissioning (Part 1) CV-FCP-239, V5 was executed

3.) 23:45 (UTC) Rolis/Civa-P commissioning (Part 1) CV-FCP-236, V5 was started via MTL

4.) A ground station handover (NewNorcia to Canberra) was performed from 24:00 (UTC) (End of NNO) to 02:15 (UTC) (Start of CAN), where neither TC nor TM was available

5.) 03:32 (UTC) Sesame commissioning (Part 1) CV-FCP-234, V6 was executed

6.) 04:04 (UTC) Ptolemy commissioning (Part 1) CV-FCP-235, V7 was executed

7.) A ground station handover (Canberra to Madrid) was performed from 05:00 (UTC) (Start of MAD) to 05:20 (UTC) (End of CAN), where no TC was available and TM was reduced

8.) 05:33 (UTC) Mupus commissioning CV-FCP-242, V6 was executed again to support failure investigation related to the off-nominals seen during the first run in pass 3

9.) 07:12 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
Both TCUs are switched on and all warm compartment heaters. Current consumption is nominal. (LCL15B = 898 mA)

Lander status at end of operation:
- Lander is switched-on
- Both TCUs and all Warm Compartment heaters are switched-on

Additional notes:

Data retrieval from DDS to LCC was interrupted three times due to autom. TM requester hang-up. Data transfer from LCC to SONC was interrupted for about 20 min, expected to be caused by telephone line hick-ups.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 12 to 13/04/2004
Author : Ph GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°: 2 Day n°: 4	AOS time (UTC): 20h08 (AOS 0 deg New Norcia) LOS time (UTC): 8h15 (End of Pass on Madrid)
Experiments involved: APXS, Rolis/Civa, Sesame, Ptolemy, MUPUS	

SLOT PROGRESS				
Start time of Lander operations: 21h30				
End time of Lander operations: 08h00				
FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-239	21:45	23:00	14	72
CV-FCP-236	23:45	03:00	47	14+1282(Rol);1837(Civ)
CV-FCP-234	03:30	03:40	1	33
CV-FCP-235	04:10	05:20	12	8
CV-FCP-242	05:30	07:05	18	79
Ground anomalies description: One of the 7 CIVA images is not completely processed				
On-Board Anomalies description:				

SLOT DEBRIEFING		
APXS: Mr Klingelhöfer has remotely represented APXS PI during CVP operations. Analysis was not got at the end of APXS operations. ROLIS: all voltages and currents are nominal. 2 images were taken that show regions of spacecraft MLI with saturated spot in the middle of the field. No transmission errors have been detected, some out-of-order packets have been noted. CIVA-P: Heating was nominal, HK temperatures show nominal levels. 7 images have been received, 2 of them showing the solar panels of the Orbiter. Their quality is very good, the resolution being nominal with views of details of the solar panel.		

SLOT DEBRIEFING (Continued)		
SESAME: as the team was present in SONC, it has been asked and agreed that operations can be run in place of TxRx operations. All the results are very satisfactory and very similar to those acquired previously on the GRM. The only normal exception is the temperature of the PCB around 40°. The team requires to re-run the same procedure in other conditions, that is other PCB temperature or LPC converter instead of HPC.		
PTOLEMY: This procedure is an electrical checkout of the experiment. All proceed nominally. The memory check is successful. Ptolemy is now in the position to run the FCP-248 on Wednesday.		
MUPUS: Request of the team for rerunning a test was accepted and performed. The test is this time successful. However some packets remain in a wrong order.		
<u>Actions :</u>	<u>Resp.:</u>	<u>Due date:</u>
APXS to provide analysis of results.	APXS	
SONC to check if the out-of-order ROLIS packets is due to SONC processing	JD	
SONC to check why CIVA image in not complete	JD	
SONC to check the temperature of CIVA camera 6 (seems to be 10° higher than the other ones)	VL	
SONC to check if MUPUS packets disordering is due to SONC processing	JD	

SUMMARY:

The commissioning of Civa-M (Part 1) was executed.
Sesame (Part 1) was re-run on request by the PI.
Romap commissioning (Part 1) was started.

BLOCK 2 PASS 5 PERFORMANCE REPORT:

Lander status prior to operation:

- Lander is switched-on, I/F configuration is still set to "Forced HPC"
- At 22:15 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed via MTL TCU set points were reset to –40 degC, all heaters are switched-off, TCU 2 is switched-off
- At 22:30 (UTC) Civa-M commissioning (Part 1) CV-FCP-237, V6 was started via MTL

Lander operation was performed from 01:00 to 06:30 (UTC)

Executed operations during pass 5:

1.) Civa-M commissioning (Part 1) CV-FCP-237 was continued until 02:45 (UTC)
Although the camera heater failed to operate, images were taken (temperature recorded by the TCU 1 was around –78degC).

5.) On request from PI 02:58 (UTC) Sesame commissioning (Part 1) CV-FCP-234, V6 was again executed to evaluate noisy readings. Unexpectedly the last two TCs of AMST 110 were not executed.

6.) 03:32 (UTC) Romap commissioning (Part 1) CV-FCP-240, V5 was started.
Since the SPM high voltage could not be switched on, Romap CVP was stopped on request of the PI.

7.) 04:14 (UTC) Lander to Stand-by LZ-FCP-900 was executed to stop Romap CVP.

8.) 04:20 (UTC) Romap commissioning (Part 1) CV-FCP-240, V5 was re-started.
SPM HV still could not be switched-on. Nevertheless Romap PI requests to continue CVP until its defined end.

Lander status at end of operation:

- Lander is switched-on
- Romap commissioning (Part 1) CV-FCP-240, V5 is still ongoing
- Temperature configuration Setting LZ-FCP-300, V4 is scheduled to be executed via MTL at 11:30 (UTC)

Additional notes:

Data retrieval from DDS to LCC was nominal.
Data transfer of online data to SONC shows some outages during CIVA activities due to high data rates.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 13 to 14/04/2004
Author : M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°: 2 Day n°: 5	Start of Pass (UTC): 01h00 (Canberra) End of Pass (UTC): 8h15 (Madrid)
Experiments involved: Civa-M, Sesame, Romap	

SLOT PROGRESS

Start time of Lander operations: 01h30

End time of Lander operations: 08h20

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-237	01:30	02:55	57	11602
CV-FCP-234	03:00	03:15	2	32
CV-FCP-240	03:25	06:20	54	1529

Ground anomalies description:

The computer centre network was not working at the beginning of the preparation of SONC facilities
DAVIS stopped about 10 mn between 1h 47 and 1h 57

On-Board Anomalies description:

- CIVA-M TC of pre-heating not received by ROLIS_IME
- SESAME AMST not completely executed
- ROMAP voltage peaks

SLOT DEBRIEFING

CIVA-M: The heating was not performed because of the non execution of the TC that requests heating. However the 3 images of CIVA-MV and the total amount of CIVA_MI data have been received and show the same features than those observed on the FM on ground before launch. CIVA requests to redo the pre-heating activities of CIVA-MV, this is accepted for Pass 6.

SESAME: The AMST finished earlier than expected, and so all TCs were not executed and finally one packet of SC data is missing.

SLOT DEBRIEFING (Continued)		
ROMAP: After a normal beginning, the ROMAP CVP is stopped at 4h12. For low voltages the features obtained showed very good results; for high voltages, the activities failed but the software switched the 2 instruments in the right default mode. Decision was taken to restart the same procedure at 4h20.		
Actions :	Resp.:	Due date:
SONC to check if the total amount of CIVA packets was received	JD	

SUMMARY:

The commissioning of Ptolemy (Part 2) was executed.
A Civa-M heater test was performed on request by the PI.
The Secondary Battery was discharged down to 45% charge level.

BLOCK 2 PASS 6 PERFORMANCE REPORT:

Lander status prior to operation:
- Lander is switched-on, I/F configuration is still set to “Forced HPC”
- At 10:30 (UTC) Romap commissioning (Part 1) CV-FCP-240, V5 ended as expected
- At 11:30 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed via MTL
  Both TCUs are switched on, WComp heater set points were set to +35 degC and reached during the remaining LOS duration

Lander operation was performed from 01:28 to 07:50 (UTC)

Executed operations during pass 6:

1.) 01:28 (UTC) Temperature configuration Setting LZ-FCP-300, V4 was executed
TCU set points were reset to –40 degC, all heaters are switched-off, TCU 2 is switched-off

2.) 01:41 (UTC) Ptolemy commissioning (Part 2) CV-FCP-248. V6 was started

3.) 03:10 (UTC) An additional Civa-M heater test was performed, applying parts of the Civa-M CVP and a manual commanded unit switch-off (via LZ-FCP-900, Lander to normal mode).
A temperature increase was observed.

4.) 04:35 (UTC) Lander Interface Configuration Setting LZ-FCP-200, V4 Sequence A was performed. Lander is switched to standard configuration.

5.) 04:48 (UTC) PSS Secondary Battery Checkout LP-FCP-019, V5 was executed
using sequence C (90 min Secondary battery discharge) followed by sequence D (30 min discharge). A charge level of 45% has been achieved.

6.) 07:26 (UTC) ESS/Lander Power OFF ES-FCP-999, V11 was executed

Lander status at end of operation:
- ESS is switched-off
- Lander is in Hibernation mode
- Main Hibernation heaters are powered via LCL 5A
  current consumption is nominal (=462 mA)

Additional notes:

Data retrieval from DDS to LCC was nominal.

cnes	**SONC–ROSETTA**	**COMMISIONING OPERATION REPORT**	Date : 14 to 15/04/2004
Author : Ph. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°: 2 Day n°: 6	Start of Pass (UTC): 01h15 (Canberra) End of Pass (UTC): 8h15 (Madrid)
Experiments involved: Ptolemy, Civa-M	

SLOT PROGRESS				
Start time of Lander operations: 01h45				
End time of Lander operations: 08h00				
FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-248	01:39	03:00	16	7
CV-FCP-237 (+switch off heater by direct command then abort procedure LZ-FCP-900)	03:15	04:25	18	7

Ground anomalies description:

DAVIS displays seemed not to have been updated in real-time (particularly embarrassing during Ptolemy Commissioning that would have like to take into account the displayed values)

On-Board Anomalies description:

Possible inversion of CIVA-M TSC11 (structure temperature) and TCS8 (CCD temperature); data show an evolution on TSC11 only

SLOT DEBRIEFING		
PTOLEMY: Functioning of Ptolemy has been assessed as completely successful. CIVA-MV: The TC that was not implemented yesterday was this time received and effective. This is demonstrated by the temperature measurements. But the temperatures are not identical between those measured on the structure and on the CCD (possible inversion between the 2 parameters). Actions :	Resp.:	Due date:

SUMMARY:

ESS and Lander were successfully switched-on for CVP block 3
TC parameter upload was successfully executed, all activities as planned for block 3 are now prepared.
Romap CVP (part 2) has been started.

BLOCK 3 PASS 1 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS was switched-off
- Lander is in hibernation mode
- Switch-on temperature levels at ESS and Lander YEbox were given

Lander operation was performed from 20:34 to 02:00 (UTC)

Executed operations during pass 1:

1.) 20:34(UTC) ESS/Lander Power ON ES-FCP-001, V14, was started using the main side via OBCP, ESS performance and LCL15A current consumption are nominal.

2.) 20:48 (UTC) To prepare the Lander internal compartment on PI request for a lower temperature level then achieved during block 1 and 2, the main hibernation heater LCL5A was switched off.

3.) 20:51 (UTC) ESS/Lander Link Establishment ES-FCP-002, V5 was executed.
Lander packets show nominal Lander performance, TCU1 is operating

4.) 21:30 (UTC) The execution of the previously uploaded PORs was started via MTL

21:30 (UTC) POR #28: Upload of Carousel CVP TCs
22:15 (UTC) POR #29: Delete obsolete TCs
21:30 (UTC) POR #30: Upload updated TCs / new TCs for Sesame CVP
21:30 (UTC) POR #31: Upload additional TCs for Romap CVP
All uploads were executed successfully.

5.) 00:10 (UTC) To prevent continuous TCU heater switching due to the low temperatures inside the compartment and provide a clean power environment for experiment operations TCU heaters are switched-on via the “TCU Heater Emergency Mode”.
Lander stand-by current is now 650 mA.

6.) 00:18 (UTC) Romap CVP (Part 2) CV-FCP-240, V5 was started.
The high voltage could now be switched-on. Although the TC for surface mode was sent by CDMS and received by Romap the TM indicate the unit operating in the slow mode.
On PI request Romap should be restarted.

7.) 01:07 (UTC) Romap is switched-off using AMST00 from LZ-FCP-900, V4

8.) 01:13 (UTC) Romap CVP (Part 2) CV-FCP-240, V5 was restarted.

Lander status at end of operation:
- Lander is switched-on, and TCU1 is operating with Cosac-GC, Topplate, PrimBattery and SecBattery heater in the Emergency mode and Flywheel heater disabled. ZEbox heater is still in a control loop setting.
- Romap is switched-on and is expected to operate until start of the next pass

Additional notes:
c) Data retrieval from DDS to LCC and SONC was working nominal.
d) Communication loop setup at start of pass was disturbed, but finally could be established

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 13 to 14/05/2004
Author :P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 1	AOS time (UTC): 19h06 (AOS 0 deg) LOS time (UTC): 2h00 (End of Pass)
Experiments involved: ROMAP	

SLOT PROGRESS

Start time of Lander operations: 20h30

End time of Lander operations: 2h00

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-240	00:19	01:06	12	723
LZ-FCP-900	01:08	01:13	-	-
CV-FCP-240	01:14	01:55	9	717

Ground anomalies description:

No anomaly

On-Board Anomalies description:

No anomaly

SLOT DEBRIEFING

The different Romap modes were activated consecutively as initially planned: Romap high voltage was switched on successfully. But the controller was partly reseted. Therefore the HK values could not reflect an active surface mode although the high voltage was still on.

So it was decided to re-launch the Romap procedure. On the second attempt the surface mode could be switched on without any problems, 6 frames of SPM have been received. During SPM calibration mode, which means increasing the high voltage in 5 steps, the instrument was reseted by sparkling, switching into the highest step. The instrument went automatically into the Slow mode. Romap was still on after the LOS.

SUMMARY:

Romap CVP (part 2) has been finalized.
Consert Lander Verification was successfully executed
Consert Interference Test (with other Lander experiments) was successfully executed

BLOCK 3 PASS 2 PERFORMANCE REPORT:

Lander status prior to operation:

- ESS and Lander are switched-on
- TCU heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating
- Romap CVP is still ongoing

Lander operation was performed from 20:34 to 02:00 (UTC)

Executed operations during the pass:

1.) 20:34(UTC) Romap was switched-off by executing LZ-FCP-900, V4, Lander to Stand-by

2.) 20:45 (UTC) Consert Lander Verification, CV-FCP-238, V5 was successfully executed

3.) 21:32 (UTC) Consert Interference Test (with other experiments) CV-FCP-252, V6 was successfully performed

4.) On Request of the Consert PI the Consert Lander Verification CV-FCP-238, V5 will be executed over the following LOS phase. Due to the procedure duration of about 18 min, the activity will be repeated 34 times, starting every 30 minutes via the MTL. Only the first command of the procedure to start the Consert AMST will be executed, the remaining commands (CDMS and PSS HK dumps) are not uploaded, since these HK packets will be generated automatically.

Lander status at end of operation:

- ESS main and Lander are switched-on
- TCU1 is operating with Cosac-GC, Topplate, PrimBattery and SecBattery heater in the Emergency mode and Flywheel heater disabled. Zebox heater is still in a control loop setting
- The first repetition of Consert Lander Verification has started

Additional notes:

Data retrieval from DDS to LCC was working nominal.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 14 to 15/05/2004
Author :P. GAUDON	Signature :		

PRELIMINARY CONTEXT

Block n°:3 Day n°: 2	AOS time (UTC): 19h05 (AOS 0 deg) LOS time (UTC): 1h30 (End of Pass)
Experiments involved: ROMAP, CONSERT, APXS, MUPUS, SESAME	

SLOT PROGRESS

Start time of Lander operations: 20h30

End time of Lander operations: 1h30

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
LZ-FCP-900	Pass 2	20:30	1	3676 (Romap inc. Pass 1)
CV-FCP-238	20:45	21:10	-	134 (Consert)
CV-FCP-252	21:47			
APXS	22:00	22:20	4	12
MUPUS	22:30	23:54	19	53
ROMAP	23:58	00:30	9	56
SESAME	00:33	01:05	5	99
CONSERT	21:47	01:12	-	2634
		01:12		

Ground anomalies description:

Failure in the Voice loop: when RMOC and SONC are alone, reception is 5/5; when LCC enters in the loop, RMOC hears SONC only 4/4, LCC hears SONC 3/3 and SONC hears RMOC and LCC 5/5
TCU files stored in the SEF (computer centre) but not distributed in the SONC

On-Board Anomalies description:

Mupus abnormal end of TM transmission (NCR already identified during block 2)

NCR Consert: 4dB bigger noise than in Block 2

NCR Romap: working of the penning sensor to be investigated

SLOT DEBRIEFING		
Romap has worked continuously between pass 1 and pass 2 and was stopped at the beginning of the pass 2 AOS. Now the instrument can write correctly in the Backup Ram. There is still an incertitude in the working of the penning sensor. They do not see any parameter of the high voltages. The reason could be the same as initially for SPM (outgassing outside very small boxes). The Consert FCP-238 has been rerun before the interference tests. An excess of 4 db in the noise were noticed, when this is compared to the result obtained during the block 2. The reason of this behaviour has to be investigated further. Consert interference tests: - Apxs working: TBD - Mupus working: The SC TM was blocked before the end of the procedure (at generation or storing or transmission). This problem was observed during Block 2 operations, but has never happened on the GRM. It could be relative to the Flight temperature and needs careful investigation. - Romap working: The Consert influence is really visible and modifies the Romap measurements of around 100 nTeslas every 5 seconds. That means that it could be preferable that Consert cannot be switched on when Romap is working. - Sesame working: Sesame sees very good results (only 1 error in the EGSE) and is not perturbated by Consert. Consert interference tests are successful. Consert has to evaluate the influence of the other instruments. However it is clear that Sesame perturbates Consert very strongly. Consert perturbates Romap. However it exists perhaps the possibility to work in the same time but it needs to be explored. Consert asks for a functioning outside visibility during 2 passes, if possible during the pass 2 and pass 3 to evaluate exactly the perturbation from the Lander. It has been agreed by RMOC to run again the procedure FCP-232 2 times every hour just after the current LOS (02:00) until the next AOS (the last run will be at 18:30 pass 3).		

SUMMARY:

Consert Lander Verification was successfully executed during the LOS time between pass 2 and pass 3 and during the Forced LPC configuration
Consert Interference Test (with CDMS and PSS) was successfully executed
Mupus commissioning (Part 2) was successfully performed
APXS commissioning (Part 2) was successfully executed

BLOCK 3 PASS 3 PERFORMANCE REPORT:

Lander status prior to operation:

- ESS and Lander are switched-on
- TCU1 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating
- Additional Consert Lander Verifications tests have ended

Lander operation was performed from 20:44 to 03:30 (UTC)

Executed operations during the pass:

1.) 20:44 (UTC) Consert Interference Test (with CDMS and PSS) CV-FCP-253, V5
was successfully executed

2.) 23:41 (UTC) Sequence C of Lander Interface Configuration, LZ-FCP-200, V4 was executed
Lander platform is set to Forced LPC, CIU1 and TCU2

TCU2 is operating with Cosac-GC, Topplate, PrimBattery and SecBattery heater in the Emergency mode and Flywheel heater disabled. ZEbox heater is still in a control loop configuration.

3.) 23:52 (UTC) Mupus commissioning (Part 2) CV-FCP-242, V6 was successfully performed

4.) 01:44 (UTC) Consert Lander Verification CV-FCP-238, V5 was executed again to conclude the PSS CVP in this respect

5.) 02:11 (UTC) APXS commissioning (Part 2) CV-FCP-239, V5 was successfully executed

Lander status at end of operation:

- ESS main and Lander are switched-on
- TCU2 is operating with the heaters switched-on as described above.

Additional notes:

Data retrieval from DDS to LCC was working nominal.
Voice loop between RMOC, LCC and SONC could be established without problems

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 15 to 16/05/2004
Author :M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 3	AOS time (UTC): 19h04 (AOS 0 deg) LOS time (UTC): 3h30 (End of Pass)
Experiments involved: CONSERT, MUPUS, APXS	

SLOT PROGRESS

Start time of Lander operations: 20h30

End time of Lander operations: 3h30

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-253	20:30	23:35	-	366
CV-FCP-242	23:54	01:36	21	81
CV-FCP-238	01:45	02:04	-	134
CV-FCP-239	02:15	03:25	14	72

Ground anomalies description:

SONC NCR: Presence of duplicated CDMS data (APID 1748 and 1751) in SONC DPS.
Cut of France Telecom link between 3:00 and 3:30.

On-Board Anomalies description:

MUPUS NCR: “Illegal Request” Message received from CDMS

SLOT DEBRIEFING

	Resp.	Due date

SUMMARY:

Anchor commissioning (Part 2) was executed

BLOCK 3 PASS 4 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS and Lander are switched-on
- TCU2 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating

Lander operation was performed from 22:50 to 01:50 (UTC)

Executed operations during the pass:

1.) 22:50 (UTC) Sequence A of Lander Interface Configuration, LZ-FCP-200, V4 was executed

Lander platform is set to Standard

2.) 23:04 (UTC) Lander to Normal Mode LZ-FCP-900,V4 was executed

3.) 23:17 (UTC) Sequence B of Lander Interface Configuration, LZ-FCP-200, V4 was executed

Lander platform is set to Forced HPC, CIU2 and TCU1

TCU1 is operating with Cosac-GC, Topplate, PrimBattery and SecBattery heater in the Emergency mode and Flywheel heater disabled. ZEbox heater is still in a control loop configuration.

4.) 23:33 (UTC) Anchor commissioning (Part 2) CV-FCP-231, V6 was performed
Both motors were observed to operate, but TCU temperature readings were only in the order of –138 degC: probable reason could be, that TCU1 is now used instead of TCU2 and TCU1 sensors are at a slightly different position; further investigations are needed

5.) 01:34 (UTC) Sequence B of Lander Interface Configuration, LZ-FCP-200, V4 was executed

Lander platform is set to Forced HPC, CIU2 and TCU1

This additional activity is required, since during Anchor CVP both CIUs will be used and Lander platform needs to be reconfigured for the activities of the next pass

Lander status at end of operation:
- ESS main and Lander are switched-on
- TCU1 is operating with the heaters switched-on as described above.

Additional notes:
Data retrieval from DDS to LCC was working nominal.

SUMMARY:

Sesame commissioning (New sequence B) was executed on HPC and LPC configuration
DPU2 status investigation has been performed
ESS TxRx Checkout was successfully executed

BLOCK 3 PASS 5 PERFORMANCE REPORT:

Lander status prior to operation:

- ESS main and Lander are switched-on
- TCU1 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating

Lander operation was performed from 20:24 to 02:10 (UTC)

Executed operations during the pass:

1.) 20:24 (UTC) Sesame commissioning CV-FCP-234, V7 sequence B was executed
It was observed again, that the last two commands to Sesame were not executed; additional investigation is necessary

2.) 21:10 (UTC) Sequence A of Lander Interface Configuration, LZ-FCP-200, V4 was executed

Lander platform is set to Standard

3.) 21:20 (UTC) Lander to Normal Mode LZ-FCP-900,V4 was executed

4.) 21:22 (UTC) To investigate the Lander CDMS DPU2 status, a Toggle DPU was executed.
After a few HK packets were received, the DPU was toggled again, DPU1 is now prime again

5.) 22:29 (UTC) ESS TxRx Checkout ES-FCP-010, V4 was performed
including additional TCs to investigate the Lander RX behaviour, when neither the Lander TX nor the ESS TxRx unit are switched-on

6.) 01:10 (UTC) Sequence C of Lander Interface Configuration, LZ-FCP-200, V4 was executed

Lander platform is set to Forced LPC, CIU1 and TCU2

TCU2 is operating with Cosac-GC, Topplate, PrimBattery and SecBattery heater in the Emergency mode and Flywheel heater disabled. ZEbox heater is still in a control loop configuration.

7.) 01:28 (UTC) Second run of Sesame commissioning CV-FCP-234, V7 sequence B was performed and all commands have been executed

Lander status at end of operation:

- ESS main and Lander are switched-on
- TCU2 is operating with the heaters switched-on as described above.
- The MTL has been prepared to start Rolis/Civa-P CVP at DOY139 17:30 UTC

Additional notes:

Data retrieval from DDS to LCC was working nominal

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 17 to 18/05/2004
Author : P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 5	AOS time (UTC): 19h01 (AOS 0 deg) LOS time (UTC): 1h15 (End of Pass)
Experiments involved: SESAME	

SLOT PROGRESS

Start time of Lander operations: 20h15

End time of Lander operations: 1h15

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-234	20:15	20:50	6	144
CV-FCP-234	01:30	02:05	7	145

Ground anomalies description:

On-Board Anomalies description:

NCR CDMS/SESAME: the 2 last TCs of the SESAME AMST were not executed. This was already observed during the block 2 (see NCR 30362)

SLOT DEBRIEFING

The first test was run at 20h15 with the HPC converter.

The SESAME procedure ends before its normal waited end as it was already observed during Block 2, although a correction was tested successfully in the GRM.

Parameters of PP, CASSE and DIM were all located in their nominal ranges.

The second test was run from 01:30 to 2:05 with the LPC converter.

This time all the TCs were executed and results are completely consistent with those obtained on the GRM.

SUMMARY:

Rolis/Civa-P commissioning was successfully executed
Ptolemy commissioning (Part 3) was performed
SD2 Volume Checker movement was successfully executed

BLOCK 3 PASS 6 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS main and Lander are switched-on
- TCU2 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating
- Rolis/Civa-P commissioning has been started via MTL at 17:30 UTC

Lander operation was performed from 20:15 to 01:15 (UTC)

Executed operations during the pass:

2.) 20:15 (UTC) Continuation of Rolis/Civa-P commissioning CV-FCP-236, V5
Activity was successfully executed, pictures from Rolis and Civa-P have been received

2.) 21:07 (UTC) Ptolemy commissioning (Part 3) CV-FCP-248, V6 was performed

3.) 22:44 (UTC) Sequence A of Lander Interface Configuration, LZ-FCP-200, V4 was executed
Lander platform is set to Standard

4.) 22:58 (UTC) Lander to Normal Mode LZ-FCP-900,V4 was executed

5.) 23:14 (UTC) SD2 Volume Checker movement LD-CRP-001, V1 was successfully performed
The carousel could be rotated successfully, which is the prerequisite for the following carousel commissioning.

Lander status at end of operation:
- ESS main and Lander are switched-on
- TCU2 is operating with the heaters switched-on as described above.
- The MTL has been prepared to start Carousel CVP at DOY140-17:14:30 UTC

Additional notes:
Data retrieval from DDS to LCC was working nominal

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 18 to 19/05/2004
Author :M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 6	AOS time (UTC): 19h00 (AOS 0 deg) LOS time (UTC): 2h15 (End of Pass)
Experiments involved: Rolis/Civa-P, Ptolemy, SD2	

SLOT PROGRESS

Start time of Lander operations: 22h45

End time of Lander operations: 1h15

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-236	17:30 (commanded during previous pass)	20:50	44	3444
CV-FCP-248	21:07	22:15	15	6
LD-CRP-001	23:15	01:00	19	257

Ground anomalies description:

None

On-Board Anomalies description:

Ptolemy : 6 science packets received at SONC, instead of 7 expected
CDMS: Unexpected Memory full error generated by CDMS

SLOT DEBRIEFING

	Resp.	Due date
Rolis/Civa-P : 4 pictures received as expected, no missing data Ptolemy : NCR for missing science packet, time line correct SD2: -Translation of volume checker, micro switch in correct position -Carrousel turned with 70°		

SUMMARY:

Carousel commissioning was successfully executed
Romap Interference test was successfully performed

BLOCK 3 PASS 7 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS main and Lander are switched-on
- TCU2 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating
- Carousel CVP has been started via MTL

Lander operation was performed from 20:15 to 02:00 (UTC)

Executed operations during the pass:

1. 20:15 (UTC) Continuation of Carousel commissioning CV-FCP-259, V1
Activity was successfully executed, pictures from Civa-M/I and M/V have been received

2.) 22:34 (UTC) Romap Interference test, CV-FCP-255, V4 was executed

3.) 01:43 (UTC) To investigate the Lander CDMS DPU2 status, a Toggle DPU was again executed. DPU2 will be prime during the following LOS phase.

Lander status at end of operation:
- ESS main and Lander are switched-on
- TCU2 is still operating with the heaters switched-on as described above.

Additional notes:

Data retrieval from DDS to LCC was working nominal

Data transfer between LCC and SONC was disturbed during the whole pass, but the link from LCC to PISA and LCC to the Web-server worked nominal. Since no failure could be identified, investigation needs to be continued during the coming LOS phase.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 19 to 20/05/2004
Author :M. JEANNOT	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 7	AOS time (UTC): 18h59 (AOS 0 deg) LOS time (UTC): 2h00 (End of Pass)
Experiments involved:SD2/Civa-M, Romap/APXS/Mupus/Sesame	

SLOT PROGRESS				
Start time of Lander operations: 20:15				
End time of Lander operations: 1h15				
FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-259	17:15 (commanded during previous pass)	22:15	SD2:22, CIVA:39	SD2:321, CIVA:7477
CV-FCP-255	22:15	01:40	APXS:4, MUPUS:19, SESAME:5, ROMAP:37	APXS:12, MUPUS:72, SESAME:99, ROMAP:331
Ground anomalies description: DAVIS failure during pass (only a few data were received during the pass)				
On-Board Anomalies description: CDMS : Problems with CDMS during pass 7 SD2 commissioning				

SLOT DEBRIEFING		
CIVA : Very positive results : good angles, ovens in the exact good position, results similar to those got on ground.	Resp.	Due date
Action : To provide current values on 28V bus during CIVA-M lamp switch-on, and corresponding values during CIVA-M operations in block2.	LCC	ASAP
SD2 : Good results: the ovens has been correctly positioned by SD2 rotating the Carousel. NCR have been written related to the interface between SD2 and CDMS (see NCR added).ROMAP : Interferences observed as expected. Power consumption of other experiments can be monitored through ROMAP SESAME : Everything is good, all data received within the healthy range. MUPUS : Data received are correct.		

SUMMARY:

Consert Instrument Clock Drift Correction was successfully executed
Re-run of Sesame commissioning was successfully performed
ESS is switched-off and Lander is set to hibernation mode

BLOCK 3 PASS 8 PERFORMANCE REPORT:

Lander status prior to operation:

- ESS main and Lander are switched-on
- TCU2 heaters at Cosac-GC, Topplate, Primary battery and Secondary battery are operating

Lander operation was performed from 20:15 to 02:00 (UTC)

Executed operations during the pass:

1.) 20:15 (UTC) TCU setting has been reset (valid for both TCUs)
Emergency heater setting is disabled, set points are set to –40degC, heater control is enabled

2.) 20:35 (UTC) DPU of CDMS is toggled back to DPU1

3.) 20:50 (UTC) Consert Instrument Clock Drift Correction, CN-FCP-004, V11 was executed successfully. Sequence has been performed three times with slightly changed parameter values between run1 and run2.

4.) 22:43 (UTC) Sequence B of Lander Interface Configuration, LZ-FCP-200, V4 was executed
Lander platform is set to Forced HPC, CIU2 and TCU1

5.) 23:00 (UTC) Sesame commissioning CV-FCP-234, V7 sequence B was executed
All commands have been sent, all telemetry has been received as expected

6.) 23:51 (UTC) Sequence A of Lander Interface Configuration, LZ-FCP-200, V4 was executed
Lander platform is set to Standard, TCU1 is operating

7.) 00:05 (UTC) Lander to Normal Mode LZ-FCP-900,V4 was executed

8.) 00:15 (UTC) Lander ESS Power OFF ES-FCP-999, V11 has been executed via OBCP
Main hibernation heaters are switched-on.

Lander status at end of operation:

- ESS is switched-off
- Lander is set to hibernation mode

Additional notes:

Data retrieval from DDS to LCC was working nominal

Data transfer between LCC and SONC had still a few outages at the beginning of the pass, but could be stabilized during the remaining pass.

	SONC–ROSETTA	**COMMISIONING OPERATION REPORT**	Date : 20 to 21/05/2004
Author : P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°:3 Day n°: 8	AOS time (UTC): 18h58 (AOS 0 deg) LOS time (UTC): 1h15 (End of Pass)
Experiments involved: CONSERT, SESAME	

SLOT PROGRESS

Start time of Lander operations: 20:15

End time of Lander operations: 1h15

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CN-FCP-004	21:00	22:33	O: 980 L: -	O: 113+120+119 L: 131+141+127
CV-FCP-234 (Seq B)	23:03	23:33	7	145

Ground anomalies description:

Start of the activities with the redundant DAVIS link

On-Board Anomalies description:

SLOT DEBRIEFING

	Resp.	Due date
CONSERT Ping-Pong : The procedure was run 3 times: all foreseen data were collected with different duration (FIOW=5). SESAME commissioning on HPC: According to SONC and LCC teams the procedure was executed until the end, as for the second run of pass 5 on LPC. The performing of the timeline is validated and the amount of data is as expected. Science and HK parameters have to be checked by the SESAME team.		

SUMMARY:

ESS and Lander are switched-on, all parameters are nominal
TC parameter upload was executed, Lander is prepared for block 4 activities
S/W upload for Cosac and Ptolemy was performed and verified
Both units are prepared for combined operation

During the actual LOS phase the following activities will be performed via MTL:
Ptolemy Post Launch Mode will be finalized
Secondary Battery will be monitored at two different temperatures
Cosac-SD2-Civa Combined Operation will be started with heating of Civa-M

BLOCK 4 PASS 1 PERFORMANCE REPORT:

Lander status prior to operation:
- ESS was switched-off
- Lander is in hibernation mode
- Switch-on temperature levels at ESS and Lander YEbox were given

Lander operation was performed from 18:45 to 02:33 (UTC)

Executed operations during pass 1:

The following activities were performed via MTL:

1.) 18:45 (UTC) ESS main side and Lander are powered on via OBCP,
ESS performance and LCL15A current consumption are nominal.

2.) 18:52 (UTC) ESS/Lander Link Establishment was executed.
Lander packets show nominal Lander performance, TCU1 is operating

3.) 18:55 (UTC) Lander has been configured to apply CDMS enhanced mode and use TCU2,
TCU1 is switched off.

4.) 19:10 (UTC) A TC parameter upload to prepare Lander for CVP block 4 was executed

Between 19:30 and 20:05 (UTC) the return time of LCC requests from DDS shows a delay, probably caused by a large amount of dumped data (from Orbiter dump as well as from Lander dump related to the TC parameter update). Investigation is ongoing.

All uploads were executed successfully.

The following activities were performed manually:

5.) 19:47 (UTC) ESS TxRx 1 was switched-on to perform a noise measurement.

6.) 20:09 (UTC) LD-CRP-001, V1 was started to verify the carousel position
BRAM contents was received as expected as well as carousel movement and final position.

7.) 21:23 (UTC) Cosac S/W upload was successfully executed including Cosac LFT

At 23:30 again a delay in return of LCC requests from DDS was observed during a higher Lander TM rate (due to dump of CDMS pages).

8.) 23:37 (UTC) The Re-run of Cosac CV-FCP-241 was executed and successfully performed

9.) Cosac and SD2 BackupRam content was checked and verified,
i.e. Cosac-SD2-Civa Combined Operation can be executed as scheduled.

10.) 00:16 (UTC) Ptolemy S/W patch was uploaded

11.) 00:48 (UTC) Ptolemy BackupRam was checked and found OK
i.e. Ptolemy-SD2-Civa Combined Operation can be executed as scheduled.

The following activities were performed via MTL:

12.) 00:55 (UTC) Ptolemy Cruise Phase Mode CV-FCP-235 was executed

13.) 02:05 (UTC) Ptolemy Post launch Mode CV-FCP-248 was started

Lander status at end of operation:

- ESS and Lander are switched-on
- ESS TxRx is switched-on for continuous noise measurements
- Lander is prepared for CVP block 4
- New S/W for Cosac and Ptolemy has been successfully uploaded and both units are prepared for combined operation
- Ptolemy Post Launch Mode test was started

Additional notes:

e) Whenever Lander dumps data, DDS performance decreases and return on LCC requests were delayed, which will affect and delay Lander operation when manually commanded

f) Voice loop connection to SONC is very weak and needs to be improved.

cnes	**SONC–ROSETTA**	**COMMISIONING OPERATION REPORT**	Date : 5 to 6/10/2004
Author : P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°: 4 Day n°: 1	AOS time (UTC): 17h18 (AOS 0 deg) LOS time (UTC): 3h27 (End of Pass)
Experiments involved: SD2, COSAC, PTOLEMY	

SLOT PROGRESS

Start time of Lander operations: 18h45

End time of Lander operations:

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
LZ-FCP-100	20:38			
LD-CRP-001		21:13	9	128
LZ-FCP-700	21:17			
LZ-FCP-100				
CV-FCP-241		00:02	22	445
LZ-FCP-700	00:24	00:46	19	
CV-FCP-235	01:02	01:13		8
CV-FCP-248	02:15	continuing		

Ground anomalies description:

SONC: 1 packet lost for Ptolemy at 1h 41 53. At the same time LCC received this packet twice.

On-Board Anomalies description:

SD2 – CDMS: NCR 30355 - items 1 and 2, as noted during block 3

SLOT DEBRIEFING

	Resp.	Due date
SD2 : - Carrousel turned from 0 position to 4320 (72°), and back to 0 position - Drill position correct The Block 3 anomalies that indicate “Science data ready – timeout” and “memory full” were still observed. This anomaly concerns the CDMS software and is considered as minor. For completeness, see the SD2 report.		

SLOT DEBRIEFING		
COSAC: - checksum of COSAC EEPROM before upload OK - software upload successful - EEPROM init executed (checked by LCC) - COSAC Limited Functional Test successful - TC parameter update executed (checked by LCC) - Running of the COSAC CVP procedure complete: 3 mass spectrometers obtained - COSAC and SD2 BackUp_RAM (checked by LCC) The COSAC combined operations (that were optional) were skipped. **PTOLEMY:** - the Cruise mode was nominal. The only difference with the blocks 2 and 3 is the temperature of the Ptolemy compartment that was less by 15°. It leads to a higher power consumption of the instrument - the Post launch mode was also nominal before the end of the procedure. It will end around the time of LOS 0		

SUMMARY:

All activities executed via MTL during LOS between pass 1 and 2 were successfully executed.
Cosac-SD2-Civa Combined Operation was performed as expected.
Cruise and Extended AFT were successfully performed.
Romap was started.

During the actual LOS phase Romap CVP block 4 will be finalized.

BLOCK 4 PASS 2 PERFORMANCE REPORT:

Lander activities executed from MTL during LOS:
Ptolemy Post Launch Mode test was finalized
First Secondary Battery Monitoring (with SecBatt at –34 degC)
Secondary battery was heated via TCU-2 heater
Second Secondary Battery Monitoring (with SecBatt at 0 degC)

Lander status prior to operation:
Cosac-SD2-Civa Combined operation has been started via MTL, heating of Civa-M was ongoing

Lander AOS operation was performed from 17:17 to 02:33 (UTC)

Executed operations during pass 2 (all activities were performed via MTL):

1.) 18:45 (UTC) Cosac-SD2-Civa Combined operation continued with the next item and ended successfully.

2.) 21:15 (UTC) 28V to Landing gear electronics was disabled to keep LG off during the following AFTs (as requested by SSA).

3.) 21:16 (UTC) Cruise AFT LZ-FCP-020, V2 has been executed.

4.) 22:00 (UTC) Extended AFT LZ-FCP-030, V1 was performed.

5.) 00:38 (UTC) Romap CVP block 4 was started
(first attempt from MTL failed due to wrong setting in the fixed RSDB command, Romap was started via adapted manual command)

Lander status at end of operation:
Romap is switched-on.

Additional notes:

- Access from LCC to DDS was lost from 19:07 to 19:22 (UTC). Neither data requests via FTP nor Request Log view via http was possible during that period.
- The rest of the pass DDS performance was nominal.

cnes	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 6 to 7/10/2004
Author : P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°: 4 Day n°: 2	AOS time (UTC): 17h17 (AOS 0 deg) LOS time (UTC): 3h27 (LOS 0 deg)
Experiments involved: PTOLEMY , SD2, COSAC, CIVA, ROMAP	

SLOT PROGRESS

Start time of Lander operations: out of visibility

End time of Lander operations: out of visibility

FCP number:	Start time:	End time:	HK packets number:	SC packets number:
CV-FCP-248	02:16	03:11	9 PTOLEMY	PTOLEMY
LZ-FCP-260	18:45	20:36	26 SD2	264 SD2
	18:55	20:32	23 COSAC	1096 COSAC
	15:45	20:18	CIVA	4000 CIVA
LZ-FCP-020	21:40	22:44	2 APXS	APXS
	22:51	23:13	CIVA	3 CIVA
	21:36	21:45	CONSERT	39 CONSERT
	21:22	21:31	3 COSAC	2 COSAC
	21:37	21:45	2 MUPUS	1 MUPUS
	21:25	21:29	2 PTOLEMY	PTOLEMY
			ROLIS	ROLIS
	21:36	21:45	2 ROMAP	19 ROMAP
	21:39	21:44	2 SD2	SD2
	21:37	21:45	2 SESAME	1 SESAME
LZ-FCP-030	22:33	22:37	2 APXS	APXS
	22:54	23:13	CIVA	5826 CIVA
	22:30	22:39	CONSERT	39 CONSERT
	22:31	22:38	2 COSAC	7 COSAC
	22:31	22:37	2 MUPUS	1 MUPUS
	22:07	22:20	4 PTOLEMY	8 PTOLEMY
	22:37	22:49	ROLIS	304 ROLIS
	22:01	23:28	20 ROMAP	177 ROMAP
	22:32	22:37	2 SD2	7 SD2
	22:06	22:13	4 SESAME	408 SESAME
CV-FCP-240	00:39	02:27	25 ROMAP	206 ROMAP

<u>Ground anomalies description:</u>

SONC: 90 packets in excess in the database for CIVA-MV (FCP 260 combined operations)

SONC: too long SFDU decom processing for CIVA (1h 30 for 4000 packets)

<u>On-Board Anomalies description:</u>

SD2: SC packets contain twice the same 32 words

SLOT DEBRIEFING		
SD2: During the combined test the carousel achieved different positions with a maximum uncertainty of 3 arcmin. It came back successfully at the 0 position. The NCR noted yesterday was still observed today (the 2 first items of NCR 30355). Wrong CDMS behaviour was observed in the content of science data as previously noted during the Block 3 for HK packets. The results obtained during Cruise AFT and Extended AFT are completely satisfying (see SD2 report below). **COSAC:** - Tapping station test: successful 1 complete cycle was performed, the potentiometer readings received - Combined operations: successful a) one oven tested for the Mass Spectrometer: The measurement was correct, 1 MS spectrum was retrieved But the oven was probably not heated b) an other oven was tested with the Gas Chromatograph and the Mass Spectrometer The measurement was correct, GC and MS worked nominally 14 MS spectra and 1 GC spectrum were retrieved - Cruise AFT test: successful - Extended AFT test: successful **CIVA:** SONC processing was very slow, but all processing were performed - CIVA_MV during combined operations: Some holes observed in the first image (possible pb of decompression) The second and third image were better focalized than in block 3 (lower temperature) - CIVA_MI during combined operations: Nominal functioning - CIVA (CIVA_P, CIVA_MI and CIVA_MV) during Cruise AFT and Extended AFT: nominal functioning **ROMAP:** Results are only partial today. First SPM data show a nominal working of the instrument for the first time (no reset of the high voltage due to too high pressure). The spectrometer works for the first levels of energy.	<u>Resp.</u>	<u>Due date</u>

SUMMARY:

Romap CVP block 4 test was finalized, but an extensive power consumption was found. Investigation is ongoing.
Ptolemy-SD2-Civa Combined Operation was performed successfully.
ESS TxRx noise measurement session ended.

During the actual LOS phase a repetition of Secondary Battery monitoring will be executed.

BLOCK 4 PASS 3 PERFORMANCE REPORT:

Lander activities executed from MTL during LOS:
Romap CVP block 4 test was finalized.
Ptolemy-SD2-Civa Combined operation has been started

Lander status prior to operation:
Ptolemy-SD2-Civa Combined operation has been started with heating of Civa-M.

Lander AOS operation was performed from 17:16 to 01:00 (UTC)

Executed operations during pass 3:

1.) 18:45 (UTC) Ptolemy-SD2-Civa Combined operation continued with the next item and ended successfully.

2.) 00:45 (UTC) ESS TxRx was switched-off.

Lander status at end of operation:
Lander is in stand-by mode.
MTL is prepared to start a repetition of Secondary Battery monitoring at 03:00 (UTC), (Battery heating to 0degC, followed by a monitoring cycle).

Additional notes:

- Throughout the pass LCC requested data from DDS via ISDN lines.
- DDS performance was nominal.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 7 to 8/10/2004
Author : P. GAUDON		Signature :	

PRELIMINARY CONTEXT	
Block n°: 4 Day n°: 3	AOS time (UTC): 17h16 (AOS 0 deg) LOS time (UTC): 3h25 (End of Pass)
Experiments involved: ROMAP, SD2, PTOLEMY, CIVA	

SLOT PROGRESS

Start time of Lander operations: out of visibility

End time of Lander operations: 00:32 UTC (stand-by mode)

FCP number:	Start time:	End time:	HK packets number:		SC packets number:	
CV-FCP-240	02:27	17:18	202	ROMAP	1782	ROMAP
CV-FCP-261	17:45	17:46		CIVA_M Heating	7	CIVA_M Heating
	18:59	19:01		SD2	65	SD2
	19:01	20:42		PTOLEMY	5	PTOLEMY
	21:33	21:36		SD2	64	SD2
	21:37	21:44		CIVA_MI	2066	CIVA_MI
	21:57	22:00		SD2	64	SD2
	22:01	22:07		CIVA_MV	1695	CIVA_MV
	22:21	22:24		SD2	64	SD2
	23:21	23:48	74	PTOLEMY	5	PTOLEMY
	00:05	00:07		SD2	64	SD2
	00:09	00:14	93	CIVA_MV	1694	CIVA_MV
	00:30	00:32	79	SD2	64	SD2

Ground anomalies description:

On-Board Anomalies description:

SD2 – CDMS: the 2 anomalies seen Day 1 and Day 2 are still true

SLOT DEBRIEFING

ROMAP:	Resp.	Due date
The Penning hardware is no more operational. It looks like if a short-circuit occurs in the electronics during its functioning out of visibility. The power consumption of the other modes (SPM, MAG) is increased by 1.5 W, but this raising will not jeopardise their functioning. The new behaviour of the electronics has to be characterised. This is why a new test is planned at the end of the day 4 of the block 4 (tomorrow night).		

SLOT DEBRIEFING		
SD2 : - 6 movements of the carrousel (0 -> 11520 -> 9360 -> 7200 -> 5040 -> 7200 -> 0 positions) were executed successfully - the maximal gap with the desired positions is 4 arcmin for the third movement The 3 Block 3 anomalies were still observed. These minor anomalies concern the CDMS software. For completeness, see the SD2 report. **PTOLEMY:** - the software patch loaded on Day 1 operated as expected - first tapping station calibration as well as the different tapping station up and down sequences were successful. - The docking positions were located at 8.58 mm and 3.15 mm for the first up and down positions, at 8.63 mm and 3.05 mm for the first up and down positions. The oven were in the first case at –100°C, and at +10°C in the second case. For completeness, see the PTOLEMY report. **CIVA:** CIVA_MI and CIVA_MV worked absolutely nominally. There was no noticeable difference between the 2 sets of CIVA_MV images, before and after PTOLEMY use of the tapping station.		

SUMMARY:

An additional Secondary Battery monitoring was executed.
Civa-P CVP block 4 Operation was successfully performed.
Civa-P heater operation (heating w/o IME operation) were executed as expected.
Rolis-D darkfull frame test has been successfully performed.

A re-run of Romap CVP block 4 sequence was executed to gain data for failure investigation.

BLOCK 4 PASS 4 PERFORMANCE REPORT:

Lander activities executed from MTL during LOS:

Secondary Battery was again heated up to 0degC, followed by another SecBattery monitoring.
Civa-P CVP block 4 operation has been started.

Lander status prior to operation:

Civa-P heaters are operating.

Lander AOS operation was performed from 17:14 to 01:32 (UTC)

Executed operations during pass 4:

1.) 18:30 (UTC) Civa-P CVP block 4 operation continued with the next item and ended as scheduled.

2.) 21:45 (UTC) Civa-P heater test was executed successfully.

3.) 23:00 (UTC) Rolis-D darkfull frame test has been performed.

4.) 23:23 (UTC) A Re-run of Romap CVP block 4, Seq. ACVF240B, has been started to perform a failure investigation.
A first re-run showed Romap within nominal parameters, but the surface mode could not be started. The second re-run was successful. Further investigation of the Penning malfunction is required.

5.) 01:15 (UTC) ESS/Lander switch-off was executed.

Lander status at end of operation:

Lander is in hibernation mode, ESS is switched-off.

Additional notes:

- Throughout the pass LCC requested data from DDS via ISDN lines.
- DDS performance was nominal.

	SONC–ROSETTA	COMMISIONING OPERATION REPORT	Date : 8 to 9/10/2004
Author : P. GAUDON	Signature :		

PRELIMINARY CONTEXT	
Block n°: 4 Day n°: 4	AOS time (UTC): 17h14 (AOS 0 deg) LOS time (UTC): 3h24 (End of Pass)
Experiments involved: CIVA, ROMAP	

SLOT PROGRESS

Start time of Lander operations: out of visibility

End time of Lander operations: 00:15 UTC (Philae switch-off)

FCP number:	Start time:	End time:	HK packets number:		SC packets number:	
CV-FCP-262	16:30	21:02	63	CIVA_P Heating	6	CIVA_P Heating
	18:33	18:36		CIVA_P I1	1140	CIVA_P I1
	19:23	19:28		CIVA_P I2	1513	CIVA_P I2
	20:13	20:17		CIVA_P I3	1301	CIVA_P I3
	21:45	22:36	10	CIVA_P Heating	7	CIVA_P Heating
LZ-FCP-100	23:01	23:12	3	ROLIS	298	ROLIS
CV-FCP-240	23:29	00:49	15	ROMAP	203	ROMAP

Ground anomalies description:

On-Board Anomalies description:

SLOT DEBRIEFING

	Resp.	Due date
CIVA: - 3 CIVA_P cameras (the 2 that have the Orbiter panels in their view field, the one that has a Landing Gear foot in its view field) were tested with 3 different exposure times: 2 exposure times were fixed, 1 was automatically optimised. The results show a very good quality in each image and prove that the optimisation works correctly. - The CIVA heaters were tested successfully through the 28V line while the ROLIS/CIVA IME was off. This means that it is possible to heat CIVA independently and more economically (wrt power consumption).		

SLOT DEBRIEFING		
ROLIS: SONC retrieved one image that seems to be complete. It has to be confirmed by ROLIS team. **ROMAP:** - In a first attempt MAG was switched on and worked nominally, but SPM high voltage did not work. However contrarily to the results of yesterday, the power consumption profile appeared perfectly normal. - The second attempt showed this time that SPM worked. This behaviour is not understood but was already observed in the previous block.		

9 Annex III – Non conformance Reports

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30343

Title

Lander Push Plate sensor telemetry off-nominal after launch

Subsystem 1	Model	Classification	Date	Originator
Lander, TCS, Orbiter	FM	Major	09.03.2004	Maibaum

Description

After launch the mentioned telemetry values show +359degC, which is 255hex raw and far away from the expected values (-170degC to +120degC).

Orbiter measured sensor at Lander PushPlate "Pay439-SSPLander Temp4, PushPlate"
Parameter name: NLTAT015 at RSDB, ORB20_PushPlate_Tem, ORB_PushPlate_Temp at LCCS

Failure investigation

The raw value indicates an open circuit of this sensor.

Corrective actions, definition

1. During NEA release this sensor has been replaced by the Civa_P_stereo sensor NTAT014 to predict the NEA release start time.
2. Note failure / action in NEA release report (AI: M.Maibaum)
3. Note failure / status in the Lander User Manual (AI: M. Maibaum)
4. Further investigation by TBD (deleted by MRB 22.04.04)

MRB participants, date

Corrective actions, status	Overall status
1. closed, 2. and 3. open 4. Closed	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_343_MRB.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30342.pdf		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30344

Title

CDMS escapes Autonomous Battery Handling and enters AMST00

Subsystem 1	Model	Classification	Date	Originator
Lander, CDMS	FM	Minor	19.03.2004	Pätz, Bossler

Description

As long as the temperature of the secondary battery compartment is below the commanded threshold for charging CDMS enters AMST00, instead of waiting for reaching the temperature threshold and then continuing on with the commanded operation

Failure investigation

SW bug identified, to be repaired in the next SW ver.

Corrective actions, definition

1. Fix in next CDMS s/w version.
2. Implementation after GRM verification in LDR commissioning block tbd.

MRB participants, date

Corrective actions, status	Overall status
1. and 2. open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_344_MRB.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30345

Title

Resuming AMST and TC sequences in case of short circuit with a Lander Unit

Subsystem 1	Model	Classification	Date	Originator
Lander, CDMS, COSAC	FM	Minor	19.03.2004	Balazs

Description

Due to a short (over-current, see NCR RO-LAN-NC-30347)) on turning on COSAC in frame of the COSAC commissioning procedure (COSAC FM model) CDMS resumed AMST sequencing with starting the same AMST item again along with generating the same TCs to COSAC again. Thus, the same TC(s) were issued to COSAC twice, with some time delay between them

Failure investigation

Comments by CDMS team, A. Balazs
1. Note that CDMS reaction to this non-nominal event was according to the agreed baseline, ref. DDD
2. Curent baseline in this respect needs to be considered

Corrective actions, definition

1. For commissioning: CDMS item change: go to AMST00 in case of further current overload.

2. For on-comet operations further solution has to be developed.

MRB participants, date

Corrective actions, status	Overall status
1. Closed 2. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30345_MRB.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30346

Title

Follow-on NCR on 'DPU-overswitch'

Subsystem 1	Model	Classification	Date	Originator
Lander, CDMS, Tx/Rx	FM	Major	19.03.2004	Balazs

Description

During RX/TX/ESS commissioning (following a successful RF communication test within CDMS commissioning) CDMS unexpectedly issued 'Anomaly with CDMS redundancy' event packets, repeatedly with about 4 sec between them over about 4-5 min. The CDMS HK packet, which was generated during this time period, indicated a nominal voltage but about 80% of the nominal current in the secondary (redundant) DPU. Afterwards the telecommunication link to CDMS went lost. Since the link to CDMS could not be established within ca. 5-10 min and no recovery procedure (HW decoded TCs to CDMS in TC-backup mode of ESS) was at place, operation team decided to power cycle the Lander/CDMS. Following this the link could be established again and both DPUs proved to be intact and operational.

Failure investigation

Problem not yet fully undersood and identified
Further analisis and implementation of SW work-around for the HW problem suggested, wherever is possible

Corrective actions, definition

1. Continue failure investigation. A. Balazs
2. Develop s/w work-around solution: A. Balazs
3. Implement in further CDMS s/w version after GRM validation

MRB participants, date

Corrective actions, status	Overall status
1. - 3. open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30347				
Title				
COSAC excessive inrush current				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
COSAC	FM	Minor	16.03.2004	Pätz, Bossler

Description

During COSAC activation (Mass spectrometer) a CDMS anomaly with Power Control was received and Cosac was power-cycled. The second run was executed without problems, but an unexpected tapping station reading (NCR RO-LAN-NC-30348) was detected at the end.

Affected procedure and time: Cosac CVP CV-FCP-241 was started at 02:20 UTC.

Failure investigation

Done by R. Roll, e-mail, 6.4.04. Cause can only be identified tentatively. Most probable cause is an excess in the inrush current especially involving the HV unit. Residual contamination might have led to discharges, which have not been observed thereafter again.

Corrective actions, definition

1. Use-as is and power-on COSAC again

MRB participants, date

Corrective actions, status	Overall status
1. Done w/o problems (12 times after incident) - closed	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30347.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30348

Title

COSAC tapping station in wrong position

Subsystem 1	Model	Classification	Date	Originator
COSAC	FM	Minor	16.03.2004	Roll, Bossler

Description

COSAC Tapping Station stalled in intermediate position during Lander commissioning procedure Cosac CVP CV-FCP-241, started at 02:20 UTC

Related NCR RO-LAN-NC-30345

Failure investigation

Failure analysis by MPAe, R. Roll
Stalling due to misalignment of COSAC tapping station wrt SD2 carossel. Assumed cause for that being small movement of the carossel due to launch loads.

Corrective actions, definition

1. Verify above assumption on GRM
2. Establish recovery procedure and verify on GRM
3. Perform recovery procedure on FM during block 2.
4. Repeat procedure during commissioning block 4.

MRB participants, date

Corrective actions, status	Overall status
1. Closed, 25.3.04, assumption and recovery procedure verified on GRM 2. Closed, recovery procedure according to outline, COSAC_TPST_correction_input(hyperlink 2) 3. Closed 4. Closed	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30348\NC_30348_MRB.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30348\COSAC_TPST_correction_input.doc		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30349

Title

EPC1,2 current consumption anomaly

Subsystem 1	Model	Classification	Date	Originator
PSS	FM	Minor	13.03.2004	Abt, Bossler

Description

EPC1 and EPC2 In-Current is ranging between 10.5 and 20.5 mA even though during the whole period of observation no load was connected to the EPCs. Without any load change the nominal input current should be around 16 mA and stabile.

Block 1, pass 2 - observed also later on and also before launch, see NCR RO-LAN-NC-30342

Failure investigation

Status per 12.09.04: (I. Szemerey: Possibly, data acquisition problem, to be investigated further at GRM together with TU Budapest
11.11.04: It is PSS-HK data acquisition problem, the real EPC currents are stable as the "C-LCL-M/R" channels show. Further investigation is required

Corrective actions, definition

1. Failure investigation by PSS team
2. Follow-on NRB after availability of failure analysis results

MRB participants, date

Corrective actions, status	Overall status
1., 2. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30349.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30350

Title

Flywheel speed anomaly

Subsystem 1	Model	Classification	Date	Originator
Flywheel, PSS	FM	Minor	15.03.2004	Ulamec

Description

During the commissioning of the FW (14./15.3.2004) at high speed (i.e. 9890rpm) the speed counter signal was wrong (too low and not at stable level).

Failure investigation

Comment: Data from the Orbiter inertia wheels, however, indicate that the actual performance was as expected. The wrong data may be due to some EMC disturbance on the signal line at high counting rate. The FW rpm counter has only informative importance, thus the failure has no impact on the mission.
Nota: at 6850 rpm the signal was correct. It is proposed to stabilize the speed at 8390 rpm (and check, whether the disturbance occurrs also at this value) in one of the future FW activations
Attachment: curve with FW power, FW rpm signal (pink) and Orbiter inertia wheel data (z-axis)
Assessment by I. Szemerey, 11.11.04: The PSS's HK unit only samples the FW's speed or rpm signal.
Because all other PSS channels look correct, possibly the FW produces faulty rpm signal.

Corrective actions, definition

1. Use as is
2. Entry into User Manual

MRB participants, date

Corrective actions, status	Overall status
1. Closed 2. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30350\NC_30350.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30350\flywhe_pass4_040316.xls	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30350\flywhe_pass5_040317.xls	

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30351				
Title				
Empty ADS packet				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
ADS	FM	Minor	21.04.2004	Fantinati, Bossler

Description

During Lander commissioning, block 1, pass 5 17.03.04, ADS generated off-nominal h/k data (packet containing "0000", see attachment 3).

Procedure: ADS CVP CV-FCP-230, v6

Similar behaviour observed already during FM integration/test, see NCR RO-LAN-NC-30313

Failure investigation

moM, 13.-14-09-04: Investigation by ADS team could not identify a reason for this behaviour. It is expected, that during power-on the system reset might fail causing an ADS hang-up. A technical solution can not be given.

Corrective actions, definition

1. ADS team for investigation
2. Since the behaviour has only been observed during power-on, an operational solution (e.g. update of SDL timeline) needs to be evaluated. AI.: M. Maibaum Due date: 31.12.2004

MRB participants, date

Corrective actions, status	**Overall status**
1. Closed 2. Open	**Open**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30351.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30352

Title

CDMS/ESS time sync lost

Subsystem 1	Model	Classification	Date	Originator
CDMS, ESS	FM	Minor	14.03.2004	Balazs

Description

During Lander commissioning, on 14.03.2004, prior to concluding with pass 3 of block 1 as last activity to be prepared for the upcoming LOS period the telecommunication link between Lander and CDMS was established. All this happened after power cycling of ESS/Lander, in particular after changing from the one ESS electronics to the other (main vs. redundant) one. No configuration change has been taken/commanded with CDMS in the described time interval. After establishing the telecommunication link CDMS delivered TM packets with non-synchronised time-stamps and this sustained during the whole LOS period. Upon uplinking a TC to the Lander/CDMS at the beginning of the following AOS time synchronism between ESS/Lander/CDMS was restored again.

Failure investigation

Pending, task assigned to K. Pelka/C. Fantinati; reason not yet identified.
11.11.04: NCR related to a time sync lost, which was thought due to not sending the right time to the Lander after boot up or even that the ESS itself has not overtaken the OnBoard-Time. The analysis shows, however, that the ESS time was right and a command was sent to Philae and acknowledged. So this NCR has been shifted to CDMS.

Corrective actions, definition

1. No reason could still be identified for not getting time-synchronised upon establishing the telecommunication link. No such a phenomena has been experienced with the ESS/Lander up to now.
2. For the time being, use as is...
3. K. Pelka for failure investigation
4. CDMS for further analysis

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. - 2. - 3. Closed	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30352.doc			

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30353				
Title				
Erroneous COSAC HK parameters				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
COSAC	FM	Minor	10.04.2004	Bossler

Description

Erroneous HK readings on parameter "PIPE A,B" observed during CVP operations (Block2 Day 1, procedure LE-CRP-001, version 0).
This is suspected to occur on any other parameter intermittently

Failure investigation

Preliminary results per e-mail Fred Goesmann, 28.04.04: In the mean time our investigations about house-keeping errors led us to the conclusion that a new software version is mandatory. The phenomenon seems not to have caused real trouble as yet but it surely is worrying. Most of the errors seem to be caused by a timing problem, but not all of them. We are proceeding but not yet finished.

Final investigation results: The cause was found within the old software. The new software uploaded during the first night of part three does not produce that error any more.

Corrective actions, definition

1. Continue commissioning as is.
2. Detailed failure investigation by COSAC team to propose s/w work around tbc
3. Verification on GRM
4. Upload to FM

MRB participants, date

Corrective actions, status	Overall status
1. - 2. Closed, see above 3. Closed 4. Closed: The new software uploaded during the first night of block three does not produce that error any more.	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30353.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30354

Title

Anomaly on SC13 SD2 parameter

Subsystem 1	Model	Classification	Date	Originator
SD2	FM	Major	10.04.2004	Jeannot (SONC)

Description

Bad value on SC13 (Volume checker) observed during CVP operations (Block2 Day 1) : FFFC instead of FFFD.

Failure investigation

E-mail, E. Re, 28.10.04: Investigated by SD 2 team, including tests during Commissioning Block 3, on 18-19 May 2004. The results of the investigation was that the volume checker can be used with no problem (even if SC13 gives a partially wrong indication -i.e. the bit relevant to the lower microswitch status- when the volume checker is in the upper position)

Corrective actions, definition

Failure investigation by SD2 team: may be traced back to residual movement due to launch load

1.SD2 team to investigate problem and develop work-around procedure incl. verification on GRM

2. During next commissioning block: move by direct command volume checker to upper position

MRB participants, date

LCC, PISA, SONC
Follow-on MRB: Fantinati, Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs; 22.04.04

Corrective actions, status	Overall status
1., 2. Closed	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30354.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30355

Title

Anomaly on HK2 SD2 parameter

Subsystem 1	Model	Classification	Date	Originator
SD2	FM	Minor	10.04.2004	Bologna/SD2 team

Description

Bad value on HK2 (current on 12V line- resolver on) observed during CVP operations (Block2 Day 1) : 95.2 mA observed instead of 120+/- 10 mA.

Failure investigation

E-mail, E. Re, 28.10.04: Investigated by SD 2 team, including tests on the Lander GRM, on 19-04-04. The conclusion was that there was no technical problem; only an expected value in a procedure was wrong.

Corrective actions, definition

1. Execute procedure CV-FCP-233, v7 as planned for block 2 pass 2 and compare current/temperature data with data from block 2 pass 1.

MRB participants, date

Corrective actions, status	Overall status
1. Closed with the results of the a.m. failure investigation.	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30355.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30356

Title

LPC still ON after re-configuration

Subsystem 1	Model	Classification	Date	Originator
CDMS, PSS	FM	Minor	11.04.2004	

Description

After performing Lander re-configuration, procedure LZ-FCP-200, v4 during block 2, pass 2 of Lander commissioning, it was observed that the LCL15B current was 20 mA larger than expected.

Failure investigation

Problem identified; modify test procedure

Corrective actions, definition

LPC still ON, the difference in current is the idle current of LPC, failure investigation tbc.

1. Proceed with this configuration (both LPC and HPC ON)
2. In a further step, set Lander back to standard configuration, see attached procedure
3. Perform failure investigation, A.I. assigned to A. Balazs

MRB participants, date

Corrective actions, status	Overall status
1., 2., 3. Closed	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30356\NC_30356.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30356\Recovery procedure.pdf		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30357

Title

Anomaly in MUPUS h/k and s/c data transmission

Subsystem 1	Model	Classification	Date	Originator
MUPUS	FM	Major	12.04.2004	Hlond, Bossler

Description

a)As observed by LCC: At the end of the MUPUS commissioning block 2, pass 3, 23:30:27 (immediately before going to health mode), procedure CV-FCP-242, v6 MUPUS h/k data were received, but without any changes in values except on-board time and t/c echo
b)As observed by MUPUS team: During the last few minutes of TPPROBE mode measurement, we did not obtain SC frames (HK frames are OK), and also after HEALTH command, not any SC frames were received.

Comment to point b) by LCC: LCC analysis of available data showed a continuous sequence counter and no error message by CDMS, indicating that no science data have been generated by MUPUS.

Failure investigation

The attached graphs show that the heating has not been resumed at the time of failure occurrence.
Pending. LOWG #7: investigation is going on. Flight software review is probably necessary. NCR is due to software-related issues.
11.11.04: This was caused by a communication problem between MUPUS and CDMS which kept MUPUS in an infinite waiting loop. It will be solved by introducing an adequate timeout.

Corrective actions, definition

1. Finalise this MUPUS commissioning as of block 2, pass 3.
2. Perform failure investigation (A.I. MUPUS team).
3. Follow-on MRB after availability of the failure investigation results 13.04.04, 1:00UTC:
a. MUPUS commissioning test shall be repeated in order to provide more data to the MUPUS team for further failure investigation. b.Test with continuous temperature monitoring; c. SONC to define temperature criteria
4. S/W modification; validation on GRM; Upload to FM (as consequence of failure investigation, 11.11.04)

MRB participants, date

LCC, PISA, SONC; 13.04.04. Follow.on MRB: Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs; 22.04.04

Corrective actions, status	Overall status
1. Closed 2. Closed, see results 11.11.04 3. a) Done, block 2, pass 4; 3.b) done, as above; 3.c) see attachment 2 4. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30357\Attachment NC_30357.pdf	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30357\NC_30357 attachment 2.pdf	

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30358

Title

MUPUS s/c frames not delivered in order

Subsystem 1	Model	Classification	Date	Originator
MUPUS	FM	Minor	12.04.2004	M. Hlond, MUPUS

Description

MUPUS SC frames were not delivered to and received by SONC in correct order (TPPROBE mode frames 17-1A(hex) were delivered after SC frame 21(hex), between two HK frames we have not any MUPUS SC frames (usually should be 4 frames))

Failure investigation

LCC failure analysis: TM requester problem, packets received twice, see attached print-out. SONC not on live stream (but on live and dump)

Corrective actions, definition

1. SONC to check: data processing problem at SONC (corrected)

MRB participants, date

LCC, SONC, PISA, 13.04.04, 1:00 UTC

Corrective actions, status	Overall status
1. Closed by SONC	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30358\NC_30358.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30358\NC_30358 attachment.pdf		

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30359				
Title				
Anomalous MUPUS h/k data				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
MUPUS	FM	Major	13.04.2004	Hlond

Description

Anomaly on MUPUS h/k (e.g. 12 V reading jumping to 140 V) during execution of MUPUS commissioning, block 2, pass 3

Failure investigation

See attached graphs prepared by LCC.
Preliminary failure analysis by MUPUS team indicates a s/w and/or h/w problem on MUPUS side. Affected h/k data are not critical to MUPUS.
LOWG 7: minor, can be corrected; it will probably be corrected together with 30357.
11.11.04: This was caused by an inadequate timing in the flight-s/w and will be corrected by modification of the internal timing

Corrective actions, definition

1.MUPUS team for further failure investigation
2.MUPUS to propose work-around solution (as feasible) to be verified on GRM

MRB participants, date

Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs; 22.04.04

Corrective actions, status	**Overall status**
1. Closed 2. Open	**Open**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30359\NC_30359 V April 13.pdf			

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30360				
Title				
Wrong CIVA temperature h/k				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
CIVA	FM	Major	13.04.2004	Bossler, Pätz

Description

CIVA h/k parameter read-out wrong (at LCC and SONC).

Affected parameter:
CRH_VOLT_m5VD
CRH_VOLT_p15VD
CRH_VOLT_p5VD

CRH_TEMP_CIVA_P6.

Procedure: CV-FCP-236, CV-FCP-237

SCET: 031251

Block 2, pass 4

Failure investigation

LOWG 7: Close after correction of the SONC tools (validated during B3)

Corrective actions, definition

1. CIVA PI to investigate
2. Follow-on MRB after availability of results:
3. Update CIVA documentation (e.g. User Manual)
4. Update SONC database
5. Update RSDB

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	**Overall status**
1. Closed, see above LOWG 7 statement 2. Closed 3. CIVA action open 4. Closed. LCC/SONC data base updated resulting in corect read-out 5. LCC action open	**Open**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**

PHILAE Non-conformance Report

Identifier
RO-LAN-NC-30361

Title
CIVA-M/P heating not received by CIVA/ROLIS IME

Subsystem 1	Model	Classification	Date	Originator
CIVA-M	FM	Minor	14.04.2004	Bossler, Pätz, Soufflot

Description

During execution of procedure CV-FCP-237, V5 it was observed that the CIVA-M heaters were OFF.

Time-tagged TC to switch on heater was sent to ROLIS; checked via 'Visible TC execution Report EVT of CDMS, ID= 50000. CIVA-M/V heating commands not received by CIVA/ROLIS IME (5004 0010 AFEC)

Note: CIVA-M commissioning was started via MTL

Block 2, pass 5

Failure investigation

Pending; possibly execution time too short

LOWG 7: Close for the ÇIVA/ROLIS team since the non reception of the command has been demonstrated according to the internal ÇIVA/ROLIS H/K data

Further investigation on CDMS side, possibly subsystem interface problem

Corrective actions, definition

1. CIVA PI to investigate
2. Repeat test on block 2, pass 6 to re-verify heater activation
3. CDMS for further investigation, s/w modification and validation on GM; implementation on FM thereafter

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. Closed 2. Closed, by retest 15.04.04 3. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30361\NC_30361.doc	..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30361\Temperature diagram Re-test		

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30362				
Title				
Last SESAME TC´s not executed				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
CDMS, SESAME	FM	Minor	14.04.2004	Bossler, Pätz, Seidensticker, Thiel

Description

During (re-)execution of the repetition of the Sesame commissioning procedure CV-FCP-234, the last 2 commands of the AMST have not been executed, since AMSTstopped about 15 secs earlier than expected.

The telemetry packet with sequence count 0033h is missing, causing the non-availability of science data: 2 SESAME health-checks. Affected telemetry packet: telemetry packet, seq ct 0033h.

Block 2, pass 5

Reobserved block 3, pass 5, 17.05.04:
"During the first part of the SESAME commissioning in the Block3 Pass 5 the 2 last commands of the FCP CV-FCP-234 were not executed. It was already observed during the Block 2 in the NCR referenced under the NCR RO-LAN-NC-30362"

Failure investigation

Investigation is going on (11.11.04)

Corrective actions, definition

1. CDMS team to investigate
2. Correct within next CDMS s/w version

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	**Overall status**
1. Closed 2. Open, CDMS action	**Open**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30362.doc	\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30363\SONC Input.doc		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30363

Title

ROMAP high voltage problem

Subsystem 1	Model	Classification	Date	Originator
ROMAP	FM	Minor	14.04.2004	Auster, Bossler

Description

Both high voltages (SPM and Penning) could not be powered on. The repetition shows the same results. ROMAP went back after internal reset into default mode (slow mode).

Block 2, pass 5, 03:15 UTC

Added on 15.05.04 (Block 3, pass 1):
There is still an incertitude in the working of the penning sensor. Parameters of the high voltages were not observed. The reason could be the same as initially for SPM (outgassing outside very small boxes).

Failure investigation

Failure investigation (preliminary, by U. Auster): Problem may be due to too high pressure within a.m. units which are inside the Lander internal compartment. Needed pressure < 10exp-5mbar.

Corrective actions, definition

1. Re-start procedure
2. ROMAP PI to investigate
3. Repetition of the test in commissioning block 3 with some modifications

MRB participants, date

Follow-on MRB: Fantinati, Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs, 22.04.04

Corrective actions, status	Overall status
1. Done w/o h/v activation 2. Closed 3. Open, successful for units other than Penning and SPM in highest voltage level - see remark under description	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30363.doc	\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30363\SONC Input.doc		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30364

Title

Lost SC data frames on ROMAP

Subsystem 1	Model	Classification	Date	Originator
ROMAP	FM	Minor	14.04.2004	G. Berghofer

Description

During COM. Test frames with seq. Count 1415-1459 (OBT:40539556-40540954) are not appearing in the SONC Database.

Failure investigation

Failure investigation by LCC: all packets are available at LCC

Corrective actions, definition

1. SONC to investigate: Data processing problem (corrected)

MRB participants, date

Fantinati, Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs

Corrective actions, status	Overall status
1. Closed	**Closed**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30365

Title

Possible inversion of 2 parameters

Subsystem 1	Model	Classification	Date	Originator
CIVA	FM	Minor	15.04.2004	Soufflot

Description

CIVA-M TSC11 (structure temperature) and TSC8 (CCD temperature) seem to be reversed

Note: data show an evolution on TSC11 only

Failure investigation

LOWG 7: Close: the reordered H/K list has been transmitted to SONC by the ÇIVA Team and is being included in the updated documentation set.

Corrective actions, definition

1. Failure investigation by PI
2. Update CIVA documentation (e.g. User Manual)
3. Update SONC database
4. Update RSDB

MRB participants, date

Corrective actions, status	Overall status
1. Closed, see "Failure investigation" 2. CIVA action open 3. SONC action open 4. LCC action open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
..\ADP_FM, Lander Level\NCR\NCR_Single\NC_30365.doc			

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30366				
Title				
Umbilical link break at the end of a full MM 2				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
CDMS, Mass memory	FM	Major	22.04.2004	Bossler

Description

(Umbilical) link breaks were received at the end of the (full) MM2 dump.

Note: MM2 was reset via command.

Refer also to NCR - 327

Failure investigation

-

Corrective actions, definition

1. CDMS: to be corrected in next s/w version

MRB participants, date

Fantinati, Jansen, Maibaum, Nietner, Bossler, Scheuerle, Ulamec, Pätz, Abt, Warmbold, Balazs; 22.04.04

Corrective actions, status	**Overall status**
1. Open	**Open**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**
K:\ADP_FM, Lander Level\NCR\NCR_Single\NC_30366.doc			

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30367				
Title				
ROMAP not possible to write into back-up RAM				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
ROMAP	FM	Minor	29.04.2004	Berghofer, Bossler

Description

tbd. by ROMAP team

Failure investigation

Pending

Corrective actions, definition

1. Since setting of STCB ok, HV pirani/penning shall not be enabled after a reset of the system
2. LCC to monitor if BRAM write is successful during GRM verification (CDMS EGSE)
3. ROMAP Team to analyze the data of the GRM test, sent out yesterday by Sven Jansen 'Romap GRM test (02.04.2004)'
4. If BRAM error is reproducible, remove the TC from the list to avoid system reset (tbc after GRM test)
5. Replace the command GetMagPar by PenSen command at 05:00:10
6. Keep StorePresVal (BRAM write) command at 05:50:10, if still applicable (s. above)

MRB participants, date

Via e-mail communication, 29.04.04

Corrective actions, status	**Overall status**
1. to 6. Closed: Instrument can write to B/U RAM verified by execution of CV-FCP-240, block 3, pass 2.	**Closed**

Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**
K:\ADP_FM, Lander Level\NCR\NCR_Single\NC_30367.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30368

Title

Time stamp inconsistency

Subsystem 1	Model	Classification	Date	Originator
ESS	FM	Minor	14.05.2004	Bossler

Description

For some ESS packets it has been observed that the earth reception time was earlier than the time stamp included in the packet (non-systematic behaviour, example: 22:38:44 UTC ERT vs. 22:38:48 time stamp).

Block 3, pass 2, 22:45 but observed also for some other times

Failure investigation

11.11.04, K. Pelka: Due to the automatic time correction method at ESOC, the observed time shift is not visible any more in our data – and also not at the data pool at ESOC. We have to discuss the point with ESOC, how to store these events to be able to analyse its cause. The shift in the time stamp does not affect the operation.

Corrective actions, definition

1. Continue operations
2. Failure investigation assigned K. Pelka

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. - 2. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30369

Title

Block shift within MUPUS Science Packet

Subsystem 1	Model	Classification	Date	Originator
MUPUS	FM	Minor	16.05.2004	Bossler

Description

A shift of one block has been observed within MUPUS science packets. See attached print-out.

01:01:31 UTC

Failure investigation

Final analysis pending; preliminary data evaluation at LCC reveals that the problem can be correlated to a hk error flag "CDMS illegal request code"
LOWG 7: the instrument reacted correctly to an illegal code coming from CDMS.
CDMS team 25.06.04: CDMS/experiment interface problem on CDMS side. More specifically, the CIU internal managment of h/k data of units interfacing with the CIU is concerned.
11.11.04: This event occurred after MUPUS received the message “Illegal Request Code” from CDMS for which the reason is still unclear. Nevertheless, the problem will be solved by MUPUS keeping track of the data already transmitted, thereby avoiding to send data twice.

Corrective actions, definition

1. MUPUS operation continued
2. MUPUS team for failure investigation
3. MUPUS s/W change and validation on GM before implementation into FM
Per follow-on MRB, 25.06.04:
3. Change within next CDMS software version. In the same way affected: NCR - 370, 373, 374 and 376

MRB participants, date

Pätz, Bossler. Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. - 2. Closed, see above 3. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
to come			

PHILAE Non-conformance Report

Identifier
RO-LAN-NC-30370

Title
Dips in CDMS DPU2 current

Subsystem 1	Model	Classification	Date	Originator
CDMS	FM	Minor	17.05.2004	Bossler

Description

During block 3, pass 4 sporadic dips in the DMS DPU2 current were observed, ref. attached print-out

Failure investigation

Similar to NCR -369, the cause is on CDMS (CIU) side. The dips are not real ones.

Corrective actions, definition

1. Continue with commisssioning
2. To assess the health status of DPU2 at the beginning of pass 5, a short term status check incl. toggling to DPU2 shall be performed
3. Long time test done during block 3

Per follow-on MRB, 25.06.04:

4. Change within next CDMS software version

MRB participants, date

Pätz, Nietner, Scheuerle, Balazs, Bossler 17.05.04. Follow-on MRB: Scheuerle, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. - 2. Closed 3. Closed 4. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30370\Current DPU2.pdf			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30371

Title

Drop in Tx/Rx link quality

Subsystem 1	Model	Classification	Date	Originator
Tx/Rx	FM	Major	18.05.2004	Peragin, Bossler

Description

After the link has been established, the link quality dropped for an unknown reason - observed on in ESS Tx/Rx telemetry and then increased again and remains stable. The same behaviour has been observed during block 1, pass 1. See attached (1,2) spreadsheets (row 1 indicating the link quality).

Observed: 23:11:11 to 23.14:41 UTC, DOY 138.

Failure investigation

Pending. In response to the corrective action definition 2. below the MRB, 24.06.04, has devised to ask ESOC to analyse potential TCs, events, changes in Orbiter attitude, changes in current levels on Orbiter side. Per e-mail, dated 25.06.04 (attached) no such events have been identified.

Corrective actions, definition

1. Continue operation
2. Contact ESOC if any activities had been started that could have increased the noise level

MRB participants, date

Peragin, Bossler 18.05.04. Follow-on MRB 24.06.04: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Maibaum, Ulamec

Corrective actions, status	Overall status
1. -; 2. open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30371\Bloc 1	\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30371\Bloc 3 pass 5		

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30372

Title

Problems with CDMS during block 3 pass 6 SD2 commissioning (issue 2)

Subsystem 1	Model	Classification	Date	Originator
CDMS, Sd2	FM	Minor	19.05.2004	SONC

Description

1) Unexpected Memory full error generated by CDMS
2) SD2 tries to send scientific data to CDMS but timeout occurs so that data were lost
Added on 20.05.04:
3) Science packet number 11 contains as last frames an unexpected frame, whose first word does not belong to SD2 science data.

Failure investigation

In addition to problem on CDMS side (CIU interface problem), SD2 is too sensitive, therefore t/c is generated before each sequence to disable reaction to a grpoup of error messages. Similar behaviour on GRM (description by C. Fantinati pending).

Corrective actions, definition

1. To be corrected in next CDMS s/w version.

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30372\NCR_30372 SONC			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30373

Title

Ptolemy science packet lost during Block 3 Commissioning

Subsystem 1	Model	Classification	Date	Originator
PTOLEMY, CDMS	FM	Minor	18.05.2004	Ptolemy team

Description

From the Post Launch Mode 7 science auxiliary packets were expected, however only the first 6 were received. Ptolemy housekeeping indicates Post Launch Mode operated successfully, therefore it would seem that this last packet was sent by Ptolemy but not received at SONC.

Failure investigation

Confirm (if possible) with CDMS whether packet was received from Ptolemy, and whether or not the packet was sent from CDMS to SONC.

Corrective actions, definition

Per follow-on MRB, 25.06.04:
1. Change within next CDMS software version. In the same way affected: NCR - 370, 373, 374 and 376

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\Roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30373\NCR 30373			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30374

Title

Problems with CDMS during block 3 pass 7 SD2 commissioning (Issue 1)

Subsystem 1	Model	Classification	Date	Originator
CDMS, SD2	FM	Minor	20.05.2004	SONC

Description

Unexpected HK values: it seems that CDMS asks twice the same HK word. This happens in sequence counter 22, 7th sub-packet where word 13 has the same value of word 12; in sequence counter 39, 1st sub-packet where CDMS asks twice contents of word 4 and stores in word 4 and word 5.

Failure investigation

Due to CDMS/CIU internal handling of h/k data.

Corrective actions, definition

Per follow-on MRB, 25.06.04:
1. Change within next CDMS software version. In the same way affected: NCR - 370, 373, 374 and 376

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30374\NCR CDMS 3.doc			

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30375				
Title				
Noise 4dB higher than previously measured in block 2				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
CONSERT	FM	Minor	15.05.2004	Kofman
Description				
The noise measured during Block 3 is 4dB higher than during Block 2				
Failure investigation				
Pending. LOWG 7: this needs more investigation				
Corrective actions, definition				
Pending				
MRB participants, date				
Corrective actions, status				**Overall status**
Open				**Open**
Doc_Link	**Doc_Link 2**	**Doc_Link 3**	**Doc_Link 4**	
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30375\SONC Input.doc				

PHILAE Non-conformance Report

Identifier				
RO-LAN-NC-30376				
Title				
Illegal Request Message received by MUPUS from CDMS				
Subsystem 1	**Model**	**Classification**	**Date**	**Originator**
MUPUS	FM	Minor	16.05.2004	Jeannot

Description

In the middle of the test (Block3 Day 3), MUPUS has received the CDMS message "Illegal Request" when sending message data ready. (Frame 64)

Failure investigation

Is it really a Mupus error or a not correctly recognised (by CDMS) Mupus Request?

LOWG 7: still under investigation.

Failure investigation by CDMS team: Due to CDMS/CIU internal handling of h/k data.

Corrective actions, definition

Per follow-on MRB, 25.06.04:
1. Change within next CDMS software version. In the same way affected: NCR - 370, 373, 374 and 376

MRB participants, date

Follow-on MRB: Scheuerle, Pätz, Balazs, Bossler, Fantinati, Jansen, Ulamec 25.06.04

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30376\SONC Input.doc			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30377

Title

Problems with CDMS during block 4 pass 2, SD2 commissioning

Subsystem 1	Model	Classification	Date	Originator
SD2, CDMS	FM	Major	06.10.2004	SONC/SD2 team

Description

During execution of procedure CV-FCP-260,V2, item 2, scientific data of SD2 are not fully the expected ones.
In fact:
- the first SC packet contains twice the same 32 words;
- 65 SC are received even if as a maximum 64 SC are generated by SD2;
- 65th SC contains the first 32 words correct and the other one are zero.

A similar problem relevant to HK has been traced in NCR_CDMS_3 raised during block 3

Failure investigation

Preliminary comments by B. Pätz, 7.10.04:
- Did some of you ever observe (not planned) identical science blocks?
- Does SD2 SW use the 'flush science data' service request?(would be the explanation for the structure of SC packet # 193!?)
- Are we sure that this is another effect of NCR-30355?

Please find attached SONC NCR and printout of the 2 SD2 packets

Corrective actions, definition

1. Failure investigation by SD2 team

MRB participants, date

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30378

Title

ADS events "watch-dog enabled" and "CDMS communication error"

Subsystem 1	Model	Classification	Date	Originator
ADS	FM	Major	07.10.2004	Maibaum

Description

During block 4, pass 2, starting at 21:16 UTC while the Landerwas performing the cruise AFT (LZ-FCP-020, V2) within the ADS h/k data the events "watch-dog enabled" (once) and CDMS communication error(in all repetitions) have been observed. These messages did not re-appear duringthe following extended AFT (see attached print-outs

Failure investigation

Pending

Corrective actions, definition

1. ADS team/P. Schmid for failure investigation

MRB participants, date

Maibaum, Bossler 7.10.04

Corrective actions, status	Overall status
1. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30379

Title

ROMAP increased power consumption

Subsystem 1	Model	Classification	Date	Originator
ROMAP	FM	Major	08.10.2004	Auster, Bossler

Description

In CV-FCP-240 (Seq.B) an over consumption of 1,5 watts was observed at Romap level after Penning activation in ROMAP slow mode (appr. 8hrs after start of procedure) The over consumption was constant until the end of procedure (appr. 8:45 hrs after activation of Penning)

Failure investigation

Preliminary failure investigation by U. Auster/I.Szemerey, identifying a wrong relais status or a defect within the P/P electronics box as probable causes for the overcurrent: doc_link 1.

Corrective actions, definition

1. A re-start of the FCP (pass #4) showed nominal power values of the ROMAP experiment for slow mode and SPM operation during 30 minutes; after that ROMAP was switched off by LZ-FCP-900. Penning was not activated.
2. Further failure investigation by ROMAP team
3. Health status check of the Penning instrument
4. ROMAP operations can be continued - with Penning off until investigation results of 3. are available.

MRB participants, date

Corrective actions, status	Overall status
1. Closed 2. Open 3. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4
\\Ntfs01rskp\roland\ADP_FM, Lander Level\NCR\NCR_Single\NC_30379\Preliminary failure			

PHILAE Non-conformance Report

Identifier

RO-LAN-NC-30380

Title

Oven did not heat has expected during MS measurement

Subsystem 1	Model	Classification	Date	Originator
COSAC	FM	Minor	14.10.2004	SONC on behalf of COSAC B4 report

Description

The only thing which did not work as expected was the oven which, as far as we can say up to now, did not heat. But the MS behaved itself and delivered a spectrum similar to the ones retrieved the night before.

Failure investigation

11.11.04: under investigation; tests with other ovens on the FM will clarify the situation eventually.

Corrective actions, definition

1. Failure investigation
2. Corrective/preventive actions after availability of failure analysis results

MRB participants, date

Corrective actions, status	Overall status
1. Open 2. Open	**Open**

Doc_Link	Doc_Link 2	Doc_Link 3	Doc_Link 4

9. PHILAE

10. ROSINA

ROSINA Commissioning Report

Table of Content

Change Record

Issue	Date	Change	Responsible
Issue 1	6. June 2004		Altwegg
Issue 2	8. Nov. 2004	Include commissioning period 3, Sept. 2004	Altwegg

1. Scientific Goals

As part of the core payload of the Rosetta mission, the Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) will answer outstanding questions concerning the main objectives of the mission. The primary measurement objective of the spectrometer is:

- To determine the elemental, isotopic and molecular composition of the atmospheres and ionospheres of comets as well as the temperature and bulk velocity of the gas and the homogenous and inhomogeneous reactions of gas and ions in the dusty cometary atmosphere and ionosphere.

In determining the composition of the atmospheres and ionospheres of comets, the following prime scientific objectives, also defined by the Rosetta Science Definition Team will be achieved:

- Determination of the global molecular, elemental, and isotopic composition and the physical, chemical and morphological character of the cometary nucleus.
- Determination of the processes by which the dusty cometary atmosphere and ionosphere are formed and to characterize their dynamics as a function of time, heliocentric and cometocentric position.
- Investigation of the origin of comets, the relationship between cometary and interstellar material and the implications for the origin of the solar system.
- Investigation of possible asteroid outgassing and establish what relationships exist between comets and asteroids.

To accomplish these very demanding objectives, ROSINA must have unprecedented capabilities, including:
1) Very wide mass range from 1 amu (Hydrogen) to >300 amu (organic molecules).
2) Very high mass resolution (ability to resolve CO from N_2 and ^{13}C from ^{12}CH).
3) Very wide dynamic range and high sensitivity to accommodate very large differences in ion and neutral gas concentrations and large changes in the ion and gas flux as the comet changes activity between aphelion and perihelion.
4) The ability to determine the outflowing cometary gas flow velocities.
The necessity for the unusual high capabilities of this experiment stems from the fact that it is one of the key instruments which is able to give meaningful data during the whole mission and thus by monitoring and characterizing the different phases of comet activity from apogee through perigee will lead to a full understanding of cometary behavior. Correlated studies with optical

observations, with, for example, the dust instruments, the magnetometer and the surface science package further augment the scientific return of the ROSINA instrument.

INSTRUMENT REQUIREMENTS
Table 1 lists the science objectives and the instrument requirements necessary to achieve them. The necessary performance of ROSINA is summarized in table 2 and the comparison of operating ranges of the two mass analyzers is given in fig. 1.1. The requirements listed in Table 1 are unprecedented in space mass spectrometry. So far, no single instrument is able to fulfill all of these requirements. We have therefore adopted a three-sensor approach: each sensor is optimized for part of the scientific objectives while at the same time complementing the other sensors. In view of the very long mission duration they also provide the necessary redundancy.
Sensor I (DFMS) is a double focusing magnetic mass spectrometer with a mass range 1- 100 amu and a mass resolution of 3000 at 1 % peak height. Th sensor is optimized for very high mass resolution and large dynamic range.
Sensor II (RTOF) is a reflectron type time of flight mass spectrometer with a mass range 1->300 amu and a high sensitivity. The mass resolution is better than 500 at 1 % peak height. This sensor is optimized for high sensitivity over a very broad mass range.
Sensor III (COPS) consists of two pressure gauges providing density and velocity measurements of the cometary gas.

Table 2.1 Science objectives and measurement requirements for ROSINA

Scientific Objectives	**Associated critical measurements**	**Measurement requirements**
Determine elemental abundances in the gas	Separate CO from N_2	Mass resolution >2500 at 1 % of peak height at mass 28 amu
Determine molecular composition of volatiles	Measure and separate heavy hydrocarbons (neutrals and ions) up to mass 300 amu	Mass range 1-300 amu with a resolution of >300 at 1 %; Sensitivity >10^{-3} A/Torr
Determine isotopic composition of volatiles	Separate ^{12}CH and ^{13}C. Measure HDO, DCN and other deuterated neutrals and ions	Mass resolution >3000 at 1 % peak height, relative accuracy 1 %, absolute accuracy 10 %
Study the development of the	Measure the composition (water and minor	Mass range 1-300 amu,

cometary activity	constituents) between 3.5 AU (gas production rate 10^{24} s^{-1}) and perihelion (10^{29} s^{-1})	dynamic range 10^8
Study the coma chemistry and test existing models	Measure ions and molecules in the mass range 1-300 amu and their velocity and temperature	Mass range for ions and neutrals 1- >300 amu, dynamic range 10^8 sensitivity $>10^{-3}$ A/Torr
Study the gas dynamics and the interaction with the dust	Measurement of the bulk velocity and temperature of the gas	Bulk velocity corresponding to E=0.02 eV ±10 %, temperature = 0.01 eV ± 20%
Characterization of the nucleus	Characterization of outbursts and jets of limited angular extent	2^o Narrow field of view, time resolution =1 minute
Characterization of asteroids	Detect asteroid exosphere or determine upper limit	Extreme sensitivity for H_2O, CO, and CO_2

2. Commissioning of COPS and DPU

2.1. Timeline

	Procedure	Title	UTC
1	RN-FCP-001	Manual switch on	19 Mar 2004 - 22:50
2	RN-FCP-051	Switch off by OBCP	19 Mar 2004 - 23:17
3	RN-FCP-050	Switch on by OBCP	19 Mar 2004 - 23:25
4	RN-CVP-141	First switch on of COPS	19 Mar 2004 - 23:49
5	RN-FCP-051	Switch off by OBCP	20 Mar 2004 - 7:59
6	RN-FCP-050	Switch on by OBCP	20 Mar 2004 - 22:35
7	RN-CVP-141 (cont)	First switch on of COPS	20 Mar 2004 - 22:39
8	RN-FCP-012	COPS pressure monitoring	
9	RN-FCP-051	Switch off by OBCP	

2.2. Events

2.2.1. Manual Switch on

No anomalies were observed during this procedure. LCL current varied between 0.146 and 0.43 A, depending on the load of the DPU.

2.2.2. Switch off by OBCP

No anomalies detected during the switch off. Context file was sent.

2.2.3. Switch on by OBCP

No anomalies detected during switch on. Context file was correctly received.

2.2.4. First switch on of COPS

No anomalies were detected during switch-on of COPS into standby mode. During measurement of the filament offset a sensor error report was received. This error was due to a higher than expected offset value in the emission current (0.21 μA (raw value 32 instead of <10)). This required a change in the table settings of COPS. The value was set to raw value 50 which fixed the problem. The cause of this problem is most probably photoemission of the COPS outer grid increasing the emission current. This effect is of no consequences neither to the health of the instrument nor to its scientific performance.

It was also recognized that the limit in the COPS table is set to a value which is too low to allow operation of the filament on 200 μA. This value is only used during commissioning to speed up the outgasing. This step was omitted from the procedure. Both values will be updated during the next S/W upload foreseen during the second part of the ROSINA commissioning. The final pressure value reported by COPS and sent as pressure report to the other instruments was 2 x 10-9 mbar.

No anomalies occurred during the commissioning neither of the second filament nor of the first two microtip arrays. It became obvious that the microtip conditioning will take more time than available during this commissioning period. The pressure reading never reached a plateau and was always a factor of 3 higher than for the filament. However, this was expected. As the microtips will not be used probably until we reach the comet (monitoring is done with the filament) this activity can as well be postponed by a few years.

Activities were stopped after the conditioning of the second microtip because we were near the end of the pass.

Activities were resumed during the next pass. All microtips were switched on one after the other. No anomalies were detected.

During the high emission mode of the first three microtip arrays a sensor error occurred. The cause of this error was a wrong parameter. There is a difference in the electronics of the FS and the FM model. For the FM the lowest emission value which is regulated by the electronics is 5 μA whereas for the FS the regulation starts only at 80 μA. The parameter sent (25 μA) was correctly not accepted for the FS. For safety reasons (and because there was no need) we decided not to go to such a high value before the microtips had more time to outgas.
On both days it was seen that the DPU sometimes has a problem with the time stamp given to the HK packets. The time of the DPU runs faster by 4 ms per minute (which is within the limits). However from time to time it jumps by 10 or more seconds into the future. It is always resynchronized by the S/C later on. The cause of this jumps which happened quite often during the first pass and much less so during the second is unknown and needs analysis.

2.2.5. COPS to monitoring mode

No anomalies occurred during this step. The pressure reading was only slightly lower than on the previous day. Due to the time jumps of the DPU it was decided to eliminate also the slightest risk and to switch off ROSINA at the end. COPS will be left on for an extended period of time during the next commissioning slot of ROSINA.

2.3. Problems encountered

DPU: The timestamps of the HK packets were partly wrong (time in the future) which led to the **Anomaly Report Number : ROS_SC-17**
COPS: The offset value for the filament emission current was lower than expected due to high temperatures. This is only an effect of the housekeeping reading and has no influence on the scientific performance. However, this led to error reports from the DPU and to the **Anomaly Report Number : ROS_SC-26**
When COPS was monitoring the pressure for ALICE it was recognized that the pressure gradient which is delivered by service 19 was out of range due to a S/W error which led to the **Anomaly Report Number : ROS_SC-25**

3. Rosina Cover Open and S/W upload

3.1. DFMS

Unit temperatures:

RTOF: 50°C, 50°C, 27.1°C (TRP)
DFMS: 25°C, 20.7°C, 20.7°C (TRP)
COPS: 23.5°C (TRP)
DPU: 12°C (TRP)

One way delay: 80s

21:03:40 Switch on Rosina
21:35:00 Switch on COPS, current 51.8mA
21:43:00 COPS to monitoring mode, electronic 16.8°C, sensor 29.4°C
22:10:00 First pressure value high Immission
22:45:00 Fire first DFMS pyro
22:53:00 Fire second DFMS pyro
23:17:00 Switch on DFMS, current MEP 0.32A, Float 0.24A, temp. 20..26°C
Cover close and open switches both OFF
23:44:50 Open cover, motor temp 43°C
Sensor error report
Motor and hall counter with large offset, close switch now ON
01:03:00 Move cover relative 50 steps to open
DPU error report, wrong parameter in database
01.14:00 Move cover relative 50 steps to open with corrected parameter
DPU error report, action before not completed
01:30:00 Init DFMS, Move cover relative 50 steps to open
Success
01:36:00 Move cover relative 50 steps to open (altogether 100 steps now)
01:46:00 Move cover relative 57 steps to open (altogether 157 steps now)
Cover open switch ON
01:53:00 Start OBCP Off
01:57:00 Rosina OFF

3.2. RTOF cover opening

Procedures used:

CV-FCP-143.xls (ID 277) ROSINA Fire RTOF Pyros
O.K.
RN-FCP-004.xls (ID 281) ROSINA Switch RTOF to standby Mode
O.K.
RN-FCP-006.xls (ID 282) ROSINA – Open RTOF Cover
O.K.

3.2.1. ID 277 ROSINA Fire RTOF Cover Pyro CV-FCP-143

Remark: No values (HK currents or voltages) to be checked on RTOF side.

3.2.2. ID 281 ROSINA Switch RTOF to Standby Mode RN-FCP-004

1st temperatures after 1st Switch ON RTOF to standby mode (pyros are already fired)

T_BP_OS	75.35 °C
T_BP_SS	72.20 °C
T_MCP_OS	49.89 °C
T_MCP_SS	8192 (hex) not connected
T_HV1	24.38 °C
T_LVPS	25.20 °C
T_MC_MOT	57.85 (real time)

Cover relative position = 0
Cover absolute position = 21
Close switch OFF

3.2.3. ID 282 ROSINA Open RTOF cover RN-FCP-006

05 May 2004

Time (UTC)	T_BP_OS [°C]	T_BP_SS [°C]	T_MCP_OS [°C]	cover abs. Pos
23:14	89.51	75.05		19
23:18	95.36	79.10	52.7	10
23:23	101.08	84.49	52.6	5
23:27	106.94	88.92	51.9	2
23:32	111.61	93.21	53.4	1
23:37	115.75	97.20	53.7	0
23:52	130.48	112.03	54.6	0

Time [UTC]	Activity	
22:45	TMP_All.dat	
23:14	Cover is at abs. Pos. = 19	T_BP_OS = 89.51°C T_BP_SS = 75.05°C
23:18	Cover is at abs. Pos. = 10	T_BP_OS = 95.36°C T_BP_SS = 79.10°C T_MCP_OS = 52.70
23:23	Cover is at abs. Pos. = 5	T_BP_OS = 101.08°C T_BP_SS = 83.49°C T_MCP_OS = 52.6
23:27	Cover is at abs. Pos. = 2	T_BP_OS = 106.94°C T_BP_SS = 88.92°C T_MCP_OS = 51.9
23:32	Cover is at abs. Pos. = 1	T_BP_OS = 111.61°C T_BP_SS = 93.21°C T_MCP_OS = 53.4
23:37	Cover is at abs. Pos. = 0	T_BP_OS = 115.75°C T_BP_SS = 97.20°C T_MCP_OS = 53.7
23:52	Cover is at abs. Pos. = 0	T_BP_OS = 130.48°C T_BP_SS = 112.03°C T_MCP_OS = 54.6
00:00 until 01:00	S/W Patch loaded	
01:29	COPS_HK_+12V_I = 51.86mA	Electron Temp. = 18.9°C Sensor Temp. = 29.8°C
01:35	DFMS_MEP_G_Temp = 94°C	
01:43	Cover is at abs. Pos. = 0	*+5V:* 5.11V; 63.31mA

	T_BP_OS = 157.67°C T_BP_SS = 142.18°C T_MCP_OS = 60.40 T_HV1 = 25.43 T_LVPS = 25.54	*-5V:* -4.86V; 196.53mA *+15V:* 14.78V; 113.79mA *-15V:* -14.64V; 45.74mA *+5VAdd:* 5.00V; 59.57mA *+24V:* 24.28V; 14.80mA *+8V:* 7.94V; 2.26mA
01:46	Cover is at abs. Pos. = 0 T_BP_OS = 157.96°C T_BP_SS = 142.53°C T_MCP_OS = 60.83 T_HV1 = 26.31 T_LVPS = 26.35	*+5V:* 98mA *-5V:* 200mA *+15V:* 127mA *-15V:* 51mA *+5VAdd:* 54.77mA *+24V: 28*.16mA *+8V:* 4.7mA

3.3. Problems encountered

The procedure to open the DFMS cover failed because it was not foreseen that by firing the cover pyros the end switch of the motor position would also change. The S/W did not anticipate this and assumed that the “cover closed switch” would be on. This is of no consequence as this procedure is used only once. No problems were encountered with RTOF because the procedure had meanwhile been adapted to this situation.
Subsequent closing and opening of both covers due to the deep space maneuver went very smoothly.
No problems encountered with the S/W upload. However the S/W upload was done only for the main part of the DPU. The redundant part should be done after the interference scenario.

4. Commissioning of DFMS

4.1. Sequence of events

Procedure	**Time**	**Command**	**Remarks**
CV-FCP-144	20:12:51	P4_MODE	OK
21.05.2004	20:23:08	Enable High Voltages	OK
	20:28:17	Fil 1 @ SUB	OK
	20:44:01	Fil 1 @ 2uA	OK
	20:59:43	Fil 1 @ OFF	OK
	21:00:43	Fil 2 @ SUB	OK
	21:15:39	Fil 2 @ 2uA	OK
	21:29:58	Fil 2 @ OFF	OK

CV-FCP-145	21:30:55	Init HV and set HVS Flag	OK
	21:31:33	Enable High Voltages	OK
	21:32:34	Enable SLx	OK
	21:32:44	Set SLL to -140 V	OK
	21:37:45	Set SLL to -280 V	OK
	21:42:45	Set SLL to -400 V	OK
	21:47:46	Enable SLx	OK
	21:47:56	Set SLR to -140 V	OK
	21:52:57	Set SLR to -280 V	OK
	21:57:57	Set SLR to -400 V	OK
	21:59:28	Enable SEx	OK
	21:59:39	Set SES to -1050 V	OK
	22:06:28	Set SES to -2100 V	OK
	22:11:23	Set SES to -2990 V	OK
	22:20:26	Enable TLx	OK
	22:20:37	Set TLL to -665 V	OK
	22:25:22	**Set TLL to -1330 V**	**All ISC TLx, HVx, SEx, SLx seemed to be OFF. All voltages are gone. This happened before the execution of this command (TLL to -1330 V). Time of collapse seems to be near 22:26.**
	22:54:37	Init HV and set HVS	OK
	23:16:13	Enable Direct Commands	OK
	23:16:21	Direct Command: Set TLL to -665 V	OK
	~23:18:56	**Ext HK TLL RMON reports:**	**-97.14 V**
	23:23:56	**Ext HK TLL RMON reports:**	**-98.62 V**
	23:33:20	Init HV and set HVS	OK
	23:32:17	Enable High Voltages	OK
	23:33:17	Enable Direct Commands	OK
	23:33:27	Direct Command: Set TLL to -665 V	OK
	23:38:56	**Ext HK TLL RMON reports:**	**-96.40 V**
	23:50:46	Enable Direct Commands	OK
	23:50:51	Direct Command: Set TLR to -665 V	OK
	23:53:56	**Ext HK TLR RMON reports:**	**-122.58 V**
22.05.2004	00:05:39	P4_MODE	OK

00:10:29	P4_MODE	OK
00:16:52	Init HV and set HVS	OK
00:16:59	Enable High Voltages	OK
00:17:07	Enable Direct Commands	OK
00:17:15	Direct Command: Set TLL to -665 V	
	Ext HK TLL RMON reports:	**-89.73 V**
00:30:17	Enable Direct Commands	OK
00:30:23	Direct Command: Set SLL to -280 V	OK
00:49:00	Problem is not solved, we leave it for the moment. We skip to step 290	
00:50:11	Enable Vaccl	OK
00.50:21	Set Vaccl to -2030 V	OK
00:56:55	Set Vaccl to -4060 V	OK
01:02:32	Set Vaccl to -5800 V	OK
01:08:40	Set Vaccl to -2200 V	OK
01:24:47	P4_MODE	OK
01:25:08	4 times heater off	OK
	Next pass	
20:17:10	P4_MODE	OK
20:17:31	4 times heater on	OK
20:26:44	Init HV and set HVS	OK
20:26:49	Enable High Voltages	OK
20:28:15	Enable Vaccl	OK
20:28:54	Set Vaccl to -2200 V	OK
20:35:11	Enable HVBias	OK
20:35:22	Set HVBias to -1050 V	OK
20:40:53	Set HVBias to -2100 V	OK
20:45:47	Set HVBias to -3000 V	OK
20:50:43	Enable ASP E	OK
20:50:54	Set HVFDP to -1050 V	OK
20:56:44	Set HVFDP to -2100 V	OK
21:01:52	Set HVFDP to -2900 V	OK
21:07:04	Set HVFDP to 0 V	OK

21:08:04	Enable ASP D	OK
21:08:15	Set ZQ2 to 700 V	OK
21:13:44	Set ZQ2 to 1400 V	OK
21:18:45	Set ZQ2 to 2000 V	OK
21:25:13	Set ESS1 to 210 V	OK
21:27:14	Set ESS1 to 420 V	OK
21:29:14	Set ESS1 to 600 V	OK
21:31:25	Set ESS2 to 175 V	OK
21:33:25	Set ESS2 to 350 V	OK
21:35:25	Set ESS2 to 500 V	OK
21:36:56	Reset ZQ2	OK
21:38:07	Reset ESS1	OK
21:39:18	Reset ESS2	OK
21:40:18	Enable ASP C	OK
21:40:28	Set ZQ1 to 140 V	OK
21:45:43	Set ZQ1 to 280 V	OK
21:47:43	Set ZQ1 to 400 V	OK
21:48:54	Set ESAC to 1h	OK
21:52:05	Set ESAO to 50 V	OK
21:55:15	Set ESAI to -60 V	OK
21:58:26	Set ESAC to 3000h	OK
22:00:59	Set ESAO to 150 V	OK
22:04:09	Set ESAI to -160 V	OK
22:07:20	Set ESAC to 6000h	OK
22:10:30	Set ESAO to 250 V	OK
22:13:40	Set ESAI to -260 V	OK
22:15:46	Set ESAC to 9800h	OK
22:18:56	Set ESAO to 350 V	OK
22:22:06	Set ESAI to -360 V	OK
22:25:17	Set ESAC to cd00h	OK
22:28:28	Set ESAO to 450 V	OK
22:31:39	Set ESAI to -460 V	OK
22:34:41	Reset ZQ1	OK
22:35:52	Reset ESAC	OK
22:37:02	Reset ESAO	OK
22:38:13	Reset ESAI	OK
22:39:23	Set CEM REP to -100 V(Ena ASP A...)	OK
22:42:34	Set MP to -100 V	OK
22:45:34	Set MP to 100 V	OK
22:48:45	Set RQ to -50 V	OK
22:51:45	Set RQ to 50 V	OK
22:57:01	Set HP to -100 V	OK
23:00:01	Set HP to 100 V	OK
23:01:07	Reset CEM Rep	OK
23:02:17	Reset MP	OK
23:03:28	Reset RQ	OK
23:04:38	Reset HP	OK
23:05:39	Reset HVs to 0	OK

	23:09:40	Init HV and set HVS	OK	
CV-FCP-146	23:09:40	Condition MCP/LEDA	OK	
	To 01.35:35	P4_MODE	OK	

CV-FCP-146 410 ff /Pressure: 3e-10mbar

23.05.2004	From 20:17:19	Condition CEM	OK	
	To 22:38:47	Reset CEMHV	OK	
	22:55:49	Set SLL to -140V	OK	
	23:00:44	Set SLL to -280V	OK	
	23:10:29	Set SLR to -280V	OK	
	23:17:10	Set SES to -1050V	OK	
	23:22:40	Set SES to -2100V	OK	
	23:27:52	Set TLL to -665V	OK	
	23:39:26	Set TLL to -1330V	OK	
	23:44:53	Set TLR to -490V	OK	
	23:50:50	Set TLR to -1400V	OK	
24.05.2005	**00:00:05**	**Set SES to -2990V**	**All ISC TLx, HVx, SEx, SLx turned OFF again!**	
CV-FCP-144	00:44:33	Reset All DFMS Enable High Voltages		
	00:49:51	Fil 1 subemission	OK	
	00:56:18	Fil 1 2uA emission	OK	
	01:02:14	Fil 1 off	OK	
	01:08:24	P4 Mode DFMS OFF	OK	
26.05.2004	23:48:10	P4_MODE	OK, DFMS on	
	23:48:16	Heater off	OK	
	23:48:21	Heater off	OK	
	23:48:26	Heater off	OK	
	23:48:31	Heater off	OK	
27.05.2004	00.05.01	Get table entries	OK	
	00.05.12	Get table entries	OK	
	00.05.20	Get table entries	OK	
	00:13:17	Enable direct command	OK	
	00:13:22	DFMS load table	OK	Set SES to 1000 V Tll and TLR according to Bern results
	00:13:28	Enable direct command	OK	
	00:13:33	DFMS load table	OK	
	00:13:44	Enable direct command	OK	
	00:13:52	DFMS load table	OK	

00:14:42	Get table entries	OK	
00:14:48	Get table entries	OK	
00:14:55	Get table entries	OK	
00:29.52	Set Mode 5	OK	science data are coming (7 spectra as expected),, good spectrum for mass 28, spectrum for mass 45 and 44 and 16
00:55:05	P4_MODE	OK, DFMS standby	**HURRAAA**
01:05:32	ROSINA off OBCP	OK	

4.2. Problems encoountered

During the conditioning of the HVs in the source and transfer region of DFMS we experienced a sudden loss of the high voltages SEx, SLx and TLx. At that time SES was on its maximum voltage of -3000V and we were in the process of stepping up TLL. For the detailed commanding sequence see above! When we tried to set the reference value of TLL again without enabling the HV the reference value showed ca. -100V instead of the expected -665 V. This problem was analyzed by repeating the same sequence of commands on the FM in Bern. The FM showed exactly the same response and the conclusion was, that this is not an anomalous behaviour of the FS sensor, but rather due to the unusual combination of setting a high voltage without enabling it. Two nights later TLL was again switched on with the SES at -2100V. No problems occurred. SLL, SLR, TLL and TLR were put to their maximum value. Everything remained stable. However when finally SES was commanded to -3000V another reset of the HV's occurred.

4.3. Analysis of failure

By analyzing the HK value it was recognized that already a few minutes before the first breakdown the SES voltage showed an unstable behavior. The DMON of SES, which represents an error voltage was enhanced. No such effects were seen on the other voltages. The conclusion is that a high voltage discharge occurred. However, no clues were found where this discharge occurs (sensor or electronics). It is however improbable that the cabling is broken which was suspected at the beginning. This would not give an advanced signal before the breakdown.
The SES voltage of -2100V applied during the second test period is a stable situation. Absolutely no traces of discharge could be found during the 40 minutes DFMS was operated with SES on -2100 V. For safety reasons no other tests were performed near the breakdown voltage.

4.4. Course of action

The SES voltage (source exit slit) was always operated at its upper limit. However, from the physics of the sensor it is clear that it can also be operated at lower levels without loosing too much intensity. On the FM in Bern we tried to find voltage combinations of TLx, SES and SLx with a lower SES voltage. This can easily be found. For water we find for an SES voltage of -1000V a combination of the other voltages which still yields 100 % of the sensitivity. This sensitivity drops to 85 % for a SES voltage of -750V. This part of the DFMS analyzer is almost equal between FM and FS. An optimization of the voltages always gives the same results on the FM and the FS. Results gained from the FM can therefore easily be transferred to the FS.
This was successfully tried during the last commissioning slot in the night 26/27 May. A constant voltage of -1000V was applied on the SES. For the TLL the formula used to calculate TLL is given by:

$$V(TLL) = -825.56492 + 0.14228*vaccl + 1.23052e-5*vaccl^2 + 3.63869e-9*vacc^3;$$

For TLR:

$$V(TLR) = -612.6+5.900e-2*vaccl-1.368e-6*vaccl^2+2.084e-9*vaccl^3;$$

The spectra obtained suggest a relatively good optimization for low masses (<30), but maybe not for the higher masses. This can easily be understood because the measurements on the FM were mainly done with mass 18. The anisotropy observed between row A and B on the LEDA also suggest that the beta deflector may have to be reoptimized as may be the case with the voltages on the entrance slit switch ESS1 and ESS2.
This will be further refined and we will use the lowest possible SES voltage still giving a strong signal. As the problem is not present anymore at SES =-2100V, any voltage less than -1500 V will most probably be on the safe side also for extended operations. The best set of voltages will be determined using the FM in the lab and the tables in the FS DPU will be updated with the next S/W update probably in fall 2004.
The fact that we got good spectra shows that no parts of the sensor are floating, that is the discharge was not due to broken cables but rather to a resistance which broke down. This may improve with time (outgassing).

5. RTOF commissioning

Procedures:
RN-FCP-004.xls (ID) ROSINA Switch RTOF to Standby
O.K.

RN-FCP-148.xls (ID 303) ROSINA Condition RTOF Filaments
O.K.

RN-FCP-149.xls (ID 304) ROSINA Condition RTOF HV
O.K.

RN-FCP-151.xls (ID 306) ROSINA Check-out RTOF Measurement Modes (5 modes, Internal Calibrator ETS and ETSL)
O.K.

5.1. Sequence of events

Procedure	Time (Release Time)	Command	Remarks
CV-FCP-148			
24.05.2004	22:09:45	P4_MODE	OK, RTOF on
	22:22:21	Fil SS 1 standby	OK
	22:32:07	Fil SS 1 20 µA	OK
	22:51:54	Fil SS 1 off	OK
	22:53:55	Fil SS 2 standby	Fil SS 2 stays @ off, Filheat SS 1 goes up to 145.54 mA again (interval was too short, extended to 4 min)
	23:07:24	Repeat Fil SS 1 off	OK
	23:11:25	Repeat Fil SS 2 standby	OK
	23:20:24	Fil SS 2 off	OK
	23:24:24	Fil OS 1 standby	OK
	23:33:12	Fil OS 1 20 µA	OK
	~ 23:50		serious problems with the S/C (Helium pressure falls dowm), interruption of the RTOF Commissioning
25.05.2004	01:36:09	Fil OS 1 off	OK
	01:40:09	Fil OS 2 standby	OK
	01:48:08	Fil OS 2 off	OK
CV-FCP-149			
25.05.2004	01:54:27	Switch ETS on	OK
	02:03:38	Set ETS to Mode 1 10kH	OK
	02:04:39	Set ETS to SS Mode	OK

	02:05:39	Enable ETS ExDel	OK
	02:06:39	Set ETS ExDel	OK
	02:07:40	SS Pulser on	OK
	02:08:40	Read out ETS	OK, 140 science data are coming
	02:22:24	SS Pulser off	OK
	02:23:24	Switch ETSL on	OK
	02:29:47	Set ETSL to Mode 1 10kH	OK
	02:30:48	Set ETSL to OS Mode	OK
	02:31:48	Enable ETSL ExDel	OK
	02:32:48	Set ETSL ExDel	OK
	02:33:48	OS Pulser on	OK
	02:34:49	Read out ETSL	OK, 229 science data are coming (not complete)
	02:40:29	OS Pulser off	OK
	02:41:30	Switch ETSL off	OK
	02:41:40	Switch ETS off	OK
	02:43:18	P4_MODE	OK, RTOF off
25.05.2004	20:36:48	P4_MODE	OK, RTOF on, currents of +8 V, +15 V, -15 V, +5 V Add, -5 V Add, +5 V show all a decay during about the first two hours after switching RTOF on
	20:46:46	Enable Drift	OK
	20:46:56	Set Drift to -1000 V	OK
	20:53:46	Enable A1 SS	OK
	20:53:56	Set A1 SS to -750 V	OK
	20:56:57	Set A1 SS to -1250 V	OK
	21:01:52	Enable A2 SS	OK
	21:02:02	Set A2 SS to -1200 V	OK
	21:05:02	Set A2 SS to -2500 V	OK
	21:10:26	Enable SL SS	OK
	21:10:37	Set SL SS to -1000 V	OK
	21:13:37	Set SL SS to -2000 V	OK
	21:16:37	Set SL SS to -2400 V	OK
	21:19:38	Set SL SS to -2800 V	OK
	21:22:38	Set SL SS to -3200 V	OK

21:25:38	Set SL SS to -3600 V	OK
21:30:47	Set SL SS to -4000 V	OK
21:35:35	Set SL SS to -4500 V	OK, at about 21:39:00 (Reception Time): Hk-value of SL SS shows only about -3358 V, next Hk-value is again about -4600 V
21:40:47	Enable R1	OK
21:40:57	Set R1 to -300 V	OK
21:41:57	Set R1 to +500 V	OK
21:44:58	Set R1 to 0 V	OK
21:47:58	Enable R2	OK
21:48:08	Set R2 to -500 V	OK
21:51:08	Set R2 to -1500 V	OK
21:54:09	Enable RL	OK
21:54:19	Set RL to -1300 V	OK
21:57:19	Set RL to -2600 V	OK
22:00:19	Set RL to -3100 V	OK
22:03:20	Set RL to -3600 V	OK
22:06:20	Set RL to -4100 V	OK
22:09:20	Set RL to -4600 V	OK
22:14:39	Set RL to -5000 V	OK
22:19:49	Enable HM1	OK
22:19:59	Set HM1 to -200 V	OK, at 22:20:21 (Reception Time): Progress Report, Drift went up to about -1100 V, next Hk-value is ok again
22:22:00	Set HM1 to -1000 V	OK
22:27:51	Enable HML	OK
22:28:01	Set HML to -1100 V	OK
22:31:02	Set HML to -2200 V	OK
22:34:02	Set HML to -2600 V	OK
22:37:02	Set HML to -3000 V	OK
22:42:51	Set HML to -3400 V	OK
22:48:40	Set HML to -3800 V	OK
22:53:33	Set HML to -4200 V	OK

	22:58:52	Set HML to -4500 V	OK
	23:04:47	Enable Drift	OK
	23:04:57	Set Drift to -1500 V	OK
	23:07:58	Set Drift to -1800 V	OK
	23.10:58	Set Drift to -2100 V	OK
	23:16:48	Set Drift to -2400 V	OK, at 23:21:20 (Generation Time): Progress Reports on A1, A2, SL SS, D, RL, HML, HM1 (all but R2 which were on); Error Report on HM1; **RTOF off**
	23:21:43	Set Drift to -2700 V	OK, command received by DPU, but RTOF is already off at that time. **Assumption: Discharge in the electronics, therefore 'disturbing' of the Hk values**
26:05:2004	00:07:49	P4_MODE	OK
	00:24:39	Enable Drift	OK
	00:24:50	Set Drift to -1500 V	OK
	00:31:42	Set Drift to -1800 V	OK
	00:37:10	Set Drift to -2100 V	OK
		interruption, continuing with COPS	
	00:56:23	Switch on COPS	OK
	01:06:49	Set COPS to Science Mode	OK
		back to RTOF	
	01:27:58	P4_MODE	**Execution Error! Drift has to be switched off first.**
	01:37:32	Switch off HV	OK
	01:42:54	P4_MODE	OK, RTOF off
		COPS	
26.05.2004	20:27:03	Switch off COPS Science Data	OK
		RTOF	

	20:32:27	P4_MODE	OK, RTOF on, currents of +8 V, +15 V, -15 V, +5 V Add, -5 V Add, +5 V show all a decay during about the first two hours after switching RTOF on, comparing to 25.05.2004
	20:43:35	Enable Drift	OK
	20:43:45	Set Drift to -1500 V	OK
	20:50:11	Set Drift to -1800 V	OK
	20:56:25	Set Drift to -2100 V	OK
	21:03:55	Set Drift to -2400 V	OK
	21:21.25	Set Drift to -2700 V	OK
	21:41:25	Set Drift to -3000 V	OK
	21:59:46	Set Drift to -1000 V	OK
	22.05:15	Enable A1 OS	OK
	22:05:26	Set A1 OS to -650 V	OK
	22:08:26	Enable A2 OS	OK
	22:08:36	Set A2 OS to -1200 V	OK
	22:10.59	Set A2 OS to -2500 V	OK
	22:16.25	Enable SL OS	OK
	22:16:36	Set SL OS to -1100 V	OK
	22:19:36	Set SL OS to -2200 V	OK
	22:22:36	Set SL OS to -2600 V	OK
	22:27:46	Set SL OS to -3000 V	OK
	22:32:37	Set SL OS to -3400 V	OK
	22:37:44	Set SL OS to -3800 V	OK
	22:43:09	Set SL OS to -4200 V	OK
	22:51:25	Set SL OS to -4500 V	OK
	22:56:58	Step down RTOF HV	OK

CV-FCP-151

26.05.2004	23:03:39	Set Mode 211	OK, cover moves to absolute position 19 (was before at absolute position 0), science data are coming

	23:15:40	Set Mode 221	OK, science data are coming
	23:20:41	Set Mode 231	OK, science data are coming
	23:25:41	Set Mode 213	OK, science data are coming
	23:30:41	Set Mode 223	OK, science data are coming
	23:33:44	P4_MODE	OK, RTOF to standby
Signed command stack	23:40:01	Enable RTOF Cover Operations	OK
	23:40:06	RTOF Cover Operation	OK, cover moves to absolute **position 1**, cover is now at the right position for the measurements in fall
	23:46:46	P4_MODE	OK, RTOF off

5.2. Problems encountered

During the HV stepping of the drift voltage (Vdrift at 2400 V) RTOF was switched off by the DPU due to corrupted HK values. The cause of this could not be evaluated. One possible explanation is that the load on the power supplies was too small because only one voltage was switched on therefore making the power supply (+ / - 5V) unstable. The next night the drift voltage was increased to the nominal voltage of 3000 V without any problems. Such switch-offs were encountered previously in the lab and cause no damage to the instrument.

6. Commissioning of RTOF and DFMS measurement modes

6.1. Timeline

DOY	Date	Time (UTC)	Proc Ref.	Activity	Dur.	Comments
247	3-Sep-04	17:52		Telemetry acquisition (AOS TM)		
		18:46		Start of commanding (AOS TC)		
		19:46	RN-FCP-050	ROSINA switch-on via OBCP	0.5h	main LCL
		20:15	RN-FCP-030	ROSINA On-board Software Maintenance	1h	main DPU - patch SW65 Instantiated SW Maintenance procedure ROS-TUB-CR-65/1.0
			RN-FCP-051	ROSINA Switch-off	0.5h	Cover OPEN
			RN-FCP-050	ROSINA switch-on via OBCP	0.5h	main LCL
				Verify new SW version active and dump DFMS parameter table		
			RN-FCP-	ROSINA Switch-off	0.5h	Cover OPEN

			051			
		2:59		End of commanding (LOS TC)		
262	18-Sep-04	17:30	RN-FCP-050	ROSINA switch-on via OBCP		main LCL - via MTL
		17:35	RN-FCP-002	DPU to **Instrument** Mode		MTL
		17:37	RN-FCP-012	COPS Monitoring Mode		MTL
		17:38		Telemetry acquisition (AOS TM)		
		18:32		Start of commanding (AOS TC)		
		19:30	RN-FCP-004	RTOF to Standby		
		20:00	CV-FCP-150	RTOF Condition Detectors	5h	auto-release of commands
		1:00	CV-FCP-151	RTOF Measurement Modes	1h	auto-release of commands
		2:00	RN-FCP-004	RTOF Standby		
			RN-FCP-014A	RTOF Off		TBD
			RN-FCP-019 (312)	COPS to mode 312		medium emission, medium ion range
			RN-FCP-016 (8)	COPS enable science mode		for thruster firing
		2:30		End of commanding (LOS TC)		
263	19-Sep-04	17:37		Telemetry acquisition (AOS TM)		
		18:31		Start of commanding (AOS TC)		
		19:30	RN-FCP-016 (9)	disable COPS science		
			RN-FCP-019 (322)	COPS to mode 322, monitoring		
			RN-FCP-004	RTOF Standby		TBD
			CV-FCP-151	RTOF Measurement Modes (cont.)	4h	auto-release of commands
			RN-FCP-004	RTOF Standby		Order TBC First switch on of all three sensors together
			RN-FCP-003	DFMS to stby		
			RN-FCP-014A	RTOF Switch-off, only first part of procedure, leaves cover open and COPS on		TBC depending on where we are in the measurement mode procedure. If possible, start DFMS first (M5), before switch-off of RTOF. Not possible if the last mode of RTOF has for the

						last digit a 5 (both RTOF channels)
		23:30	CV-FCP-147	DFMS Measurement Modes	3h	auto-release of commands
			RN-FCP-003	DFMS to stby		
			RN-FCP-014B	DFMS Switch-off, second part of procedure only, leaves cover open		
		2:00	RN-FCP-051	ROSINA switch-off		Cover status OPEN (TBC)
		2:30		End of commanding (LOS TC)		
			RN-FCP-030	ROSINA On-board Software Maintenance	1h	redundant DPU - patch SW6-4 Instantiated SW Maintenance procedure ROS-TUB-CR-64/1.2
			RN-FCP-030	ROSINA On-board Software Maintenance	1h	redundant DPU - patch SW6-5 Instantiated SW Maintenance procedure ROS-TUB-CR-65/1.0
				Verify new SW version active and dump DFMS parameter table		
			RN-FCP-051	ROSINA Switch-off		Cover CLOSED (TBC)
				Select ROSINA main data channel		
		15:05		End of DSN Track		
285	11-Oct-04	17:10		Telemetry acquisition (AOS TM)		
		18:03		Start of commanding (AOS TC)		
				ROSINA Activities during this pass depending on previous progress		
		21:24		End of commanding (LOS TC)		

6.1.1. Command history

Procedure	Time (Execution or Generation)	Command	Remarks
18.09. 2004			
ROSINA	17:50:00	Switch on	

COPS	18:01:00	Switch on			
	18:15:39 (Reception)		Filament Current 0.43 A		
	18:35:30 (Reception)		Pressure 9 e-10 mbar		
			12V I = 93.7 mA		
			Ion I = 0.4 pA		
			p = 6 e-10 mbar		
RTOF stby	18:49:00	cmd released			
	18:57:50 received		T_MCP=41 °C		
			T_BP_OS=101 °C		
			T_BP_SS=97 °C		
			T_HV1=21 °C		
			T_LVPS=22.7 °C		
			p=2.3 e-10 mbar		
			5V		5.27
			5V curr		109
			5V neg		-4.82
			5V neg curr		184.76
			15V		15.41
			15V curr		131.24
			15V neg		-13.95
			15V neg curr		51.43
			24V		25.15
			24V curr		26.6
			8V		8.06
			8V curr		4.19
			5V add		5.13
			5V add curr		54.2
			Primary	0.651/0.678	
	19:10:00	first stack of cmds released	p=2.1 e-10 mbar		
	19:13:59	enable rtof drift voltage	ok		
	19:15:00	set drift voltage to -1000V	-960V		
	19:20:00	enable mcp_ss	ok		
	19:20:11	mcp_ss to 200V	220V		
	19:25:11	mcp_ss to 1000V	1031V		
	19:30:12	mcp_ss to 1250V	1252V		
	19:35:12	mcp_ss to	1505V		

	1500V		
19:40:12	mcp_ss to 1700V	1740V	
19:45:13	mcp_ss to 1800V	1839V	
19:50:13	mcp_ss to 1900V	1938V	
20:00:14	mcp_ss to 2000V	2041V	p=1.6 e-10 mbar
20:08:26	mcp_ss to 2100V	2120V	
20:18:27	mcp_ss to 2200V	2241V	
20:28:27	mcp_ss to 2300V	2344V	
20:38:48	mcp_ss to 2400V	2442V	
20:43:49	mcp_ss to 2450V	2496V	
20:48:49	mcp_ss to 2500V	2539V	
20:53:50	mcp_ss to 2550V	2594V	
20:58:50	mcp_ss to 2600V	2641V	
21:03:50	mcp_ss to 2650V	2694V	
21:08:51	mcp_ss to 2700V	2741V	
21:13:51	mcp_ss to 2750V	2791V	
21:18:51	mcp_ss to 2800V	2836V	
21:23:52	mcp_ss to 2850V	2892V	T_MCP=43.2°C, Drift=-983V
21:28:52	mcp_ss to 2900V	2948V	
21:38:53	mcp_ss switch off	ok	51V (at 21:49:49)
21:49:53	enable mcp_os	ok	
21:50:54	mcp_os to 200V	214V	
21:55:54	mcp_os to 1000V	1022V	
22:00:55	mcp_os to 1250V	1274V	p=1.4e-10
22:05:55	mcp_os to 1500V	1527V	
22:10:55	mcp_os to 1600V	1627V	
22:15:55	mcp_os to 1700V	1727V	
22:20:55	mcp_os to 1800V	1832V	

	22:25:56	mcp_os to 1900V	1930V	
	22:30:57	mcp_os to 2000V	2029V	
	22:39:51	mcp_os to 2100V	2135V	
	22:49:52	mcp_os to 2200V	2231V	
	22:59:52	mcp_os to 2300V	2334V	
	23:09:52	mcp_os to 2400V	2434V	Drift=-991V, I prim=0.678A, TRPP=16.11°C, Temp B=48.33°C, Temp A=46.67°C
	23:19:26	mcp_os to 2450V	2484V	
	23:24:26	mcp_os to 2500V	2532V	
	23:29:26	mcp_os to 2550V	2590V	
	23:34:27	mcp_os to 2600V	2637V	
	23:39:27	mcp_os to 2650V	2684V	
	23:44:27	mcp_os to 2700V	2739V	
	23:49:28	mcp_os to 2750V	2790V	
	23:54:28	mcp_os to 2800V	2834V	T_MCP = 44.07°C
	23:59:29	mcp_os to 2850V	2883V	
	00:04:29	mcp_os to 2900V	2944V	
	00:14:29	mcp_os switch off	ok	
	00:19:30	enable drift	ok	
	00:20:30	switch off drift	ok	
	00:31:06	MODE_1G	Set to Gas Mode, ok	
	00:33:03	MODE_11	HV up, ok	
	00:44:12	MODE_191	**Sensor Error Report at 00:49:55, RTOF off (MC Reset?)**	
	01:08:40	RTOF to standby	ok	
	01:22:49	MODE_191	Receiving Science Data	
	01:47:05	RTOF to standby	ok	
COPS	01:54:56	MODE_312	ok	
	01:58:54	Enable Science Data	ok	

RTOF	02:04:04	RTOF off	ok	
RTOF	18:55:29	stby	ok	
COPS	18:58:41	Disable Science Mode	ok	
RTOF	19:08:04	MODE_511	ok	
			FEC went on before Cover opening (perhaps should be changed)	
			5V	5.15 V
			5V curr	85.23 mA
			5V neg	-5.05 V
			5V neg curr	109.82 mA
			15V	15.05 V
			15V curr	
			15V neg	-14.47 V
			15V neg curr	54.09 mA
			24V	24.67 V
			24V curr	24.05 mA
			8V	8.05 V
			8V curr	3.12 mA
			5V add	5.09 V
			5V add curr	51.68 mA
			Primary	0.687 A
			T_BP_OS 35.24 °C	
			T_BP_SS 31.49 °C	
			T_MCP 23.7°C	
			T_HV1 20.6°C	
			T_LVPS 21.7°C	
			Motor Position = 12	
	19:18:30		**Receiving Error Reports (Filament), went on with Progress Reports without any problems**	
COPS	19:21:56	MODE_322 (normal measure mode)	ok	
RTOF	19:38:34		**Sensor Error Report, RTOF off (MC Reset?)**	
	19:40:57	MODE_171	?	
	19:40:59		**Progress Reports**	
	19:58:15	standby	ok	
	20:07:21	MODE_171	ok (Filament on, Pulser on, HV on, Detector on, GCU 2 on, GCU_IN_PRES = 1,11V)	
	20:32:01	MODE_516	**? (Drift only -797V)**	

	20:44:07	standby	**ok (Drift goes up to -1136V, then falls down)**
	20:58:46	MODE_60	ok (Drift normal)
	21:25:17	MODE_513	**Monitoring and Filament Problems**
	21:41:10	standby	ok
DFMS	21:44:29	standby	ok
	22:01:03	RTOF off	
	22:01:21	MODE_2	
	22:03:16	MODE_5	MEP A_T= 7°C MEP G_T=14°C MEP H_T= 7,5C° MEP N_T= 8,8°C REF_T= 43 4°C IS_T= 30,5°C Magnet_T=-2.2°C LEDA_T=-1.05°C RDP_T=-1.17°C
	22:19:14	MODE_210	
	22:33:17	Sensor Error HVFDP	Instead of -3000V (postaccel) only -2700 was reached (SW update needed)
	22:37:32	M_209	o.k.
	22:50:32	M_150	
	23:02:10	Sensor Error HVFDP	Instead of -3000V (postaccel) only -2700 was reached (SW update needed) while trying to measure Xenon
	23:06:17	M_152	ZQ2 was commanded to 2018V, limit is 2000 V, only 6 spectra recorded
	23:26:51	M_212	
	23:30:07	Sensor Error HVFDP	
	23:37:10	M_219	CEM Mode
	23:41:33	M_160	ok, but not on the peak
20.09. 2004	00:00:28	M_162	
	00:14:29	M_229	
	00:19:06	M_170	
	00:31:47	M_172	
	01:07:38	dfms stby	
	01:22:06	DFMS off	
	01:24:19	ROSINA off	

6.2. Events

6.2.1. SW update (3. Sept. 04), version 6.5

No anomalies were observed during this procedure.

6.2.2. ROSINA switch on (18. 9. 04)

No anomalies detected during the switch on.

6.2.3. COPS into monitoring mode

No anomalies, COPS pressure was around 1 e-10 mbar.

6.2.4. RTOF detector conditioning

No anomalies were detected during detector conditioning. The detector temperature was initially at 41 °C rising to 44 °C at the end of the procedure.

6.2.5. RTOF measurement modes

Mode 11, standby mode, storage source
RTOF was successfully switched on with all HV's and the filament

Mode 191, noise spectrum
During the switch-off of the filament a monitoring error of the main controller status occurred switching RTOF off immediately (MC error). The mode 191 was repeated without problems.

6.2.6. COPS mode 312 and science data enabled

o.k
During the thruster firing COPS registered a pressure of 2 e-6 mbar which is clearly above the safety limit of 1 e-6 mbar of the two other sensors (see attached plot). This triggered a pressure alert event.

6.2.7. COPS mode 322 and science data disabled (19.09.04)

o.k

6.2.8. RTOF measurement modes (cont.)

Mode 511
RTOF was switched on. After successful switch-on the filament switched itself off, but was forced back to operation by the DPU. A background spectrum was taken (see attached plot). At the end of the mode, another monitoring error occurred (MC error) which switched RTOF off.

M171 (Gas calibration mode)
RTOF was switched on. However, the pulser switched itself to a lower than normal voltage after a short time without being forced back by the DPU

(pulser error). At that time the monitoring function of the DPU did not work any more (monitoring error).
Later the pulser switched itself again at the nominal voltage for a short time.
At the end of the mode the drift voltage switched itself from 3000 V to 800 V (drift voltage error).

Mode 513
A spectrum was taken but with the wrong drift voltage and the wrong pulser voltage set by the previous mode. Otherwise no problems were encountered.

RTOF was switched to standby mode. At that time the drift voltage reacted as expected.

Mode 516

RTOF was switched on with the Ortho source active. Again the filament (this time the ortho-filament) switched itself off after a short time and was not forced back on (filament error, monitoring error). The drift stayed constant at 3000 V, the pulser remained at the nominal voltage. However, during the mode the storage source pulser, which was not used in this mode, switched itself on to 300V (pulser error)!

RTOF was then switched off.
Cover is open.

6.2.9. DFMS measurement modes

DFMS was successfully switched on to stby. Spectra were taken. After that a low resolution spectrum over the full mass range was taken. It was repeated with high resolution. Gas calibration spectra were also taken.
However there were several problems:

1. No peaks were observed during gas calibration mode
2. The gain adjust algorithm was not correctly executed
3. Masses >50 amu are postaccelarated with -3000V. The monitoring of the DPU however would not accept such a command as the limit is -2900 V for the FS (-3000V for the FM)
4. Mass 12 (high resolution) needs a quadrupol voltage > 2000 V at low temperatures which also is not accepted by the DPU
5. The scans with the channeltron show that the peaks are shifted compared to the last spectra taken a year ago in Kourou (due to the temperature and the ion source voltages which had to be changed).

6.3. Analysis of failures

Analysis of all unexpected features is ongoing, both at the PI institution and at our Co-I institutions, mainly Braunschweig. A preliminary report is attached to this report. Both sensors work as they should from a scientific performance point of view. Spectra can be taken and show the mass peaks expected. The scientific performance is excellent. As long as only single commands are sent like it was done during the first commissioning phase in May and also during detector conditioning, everything works nominally. As soon as measurement modes are commanded which result in multiple commands from the DPU to the sensors, problems are encountered. The faulty gain adjust algorithm of DFMS, the unexpected behavior of different voltages in RTOF, the monitoring function of the DPU which stopped working, all point to problems with the S/W. Some of the problems encountered like the drift voltage which drops to lower voltage values or the problems with the gain adjust algorithms with DFMS have also been seen on the FM model in Bern, however much less frequently.

Meanwhile the causes of most of the failures have been found.

1. Drift error: Drift voltage dropping to lower than normal values:
   Conflict in the DPU, dead time of the processor during data readout, corrected and verified on the FM in Bern
2. Monitoring error: SW error, corrected and verified on the simulator in Braunschweig
3. Limit of the postacceleration of DFMS / upper limit of the quadrupol zoom lense
   Difference between FS and FM model. The postacceleration will be set to -2900 V for both sensors (no performance loss). The zoom factor will be set to 6.2 instead of 6.4 for both sensors. Only very minor impact.
4. Gain algorithm for DFMS, probably due to a wrong calculation of the offset (being investigated on the FM in Bern)
5. MC error: Settling of HV leads to instability (maybe very small discharges in the electronics due to outgassing when heating up)., disappeared after 30 minutes of operation
6. Filament error /pulser error
   For the voltage changes (filament voltages, pulser voltage) we have different possibilities:
   a) DPU HK readout commands are sometimes wrong
   b) Communication problem between DPU and RTOF in command channel
   c) Voltages are set by RTOF itself

   c) could be caused by a pressure increase when switching on the filament after a long non-operating time. However, once the monitoring problem is solved the changes in the voltages would not lead to incorrect measurements as the voltages would be forced back to their correct values by the DPU as it was efficiently done before the monitoring stopped.

The problem that we didn't see peaks in the DFMS spectra in the GCU mode is due to the faulty gain algorithm and not enough wait time. This has to be investigated by correcting the gain algorithm, using longer integration times and then optimize the voltage settings which were deduced from the FM for the FS.

6.4. Course of action

The above requires a SW update which will be prepared by Braunschweig. We need other opportunities to test the SW and retest the measurement modes of both RTOF and DFMS. For DFMS we may need a period where we can optimize the voltage settings.

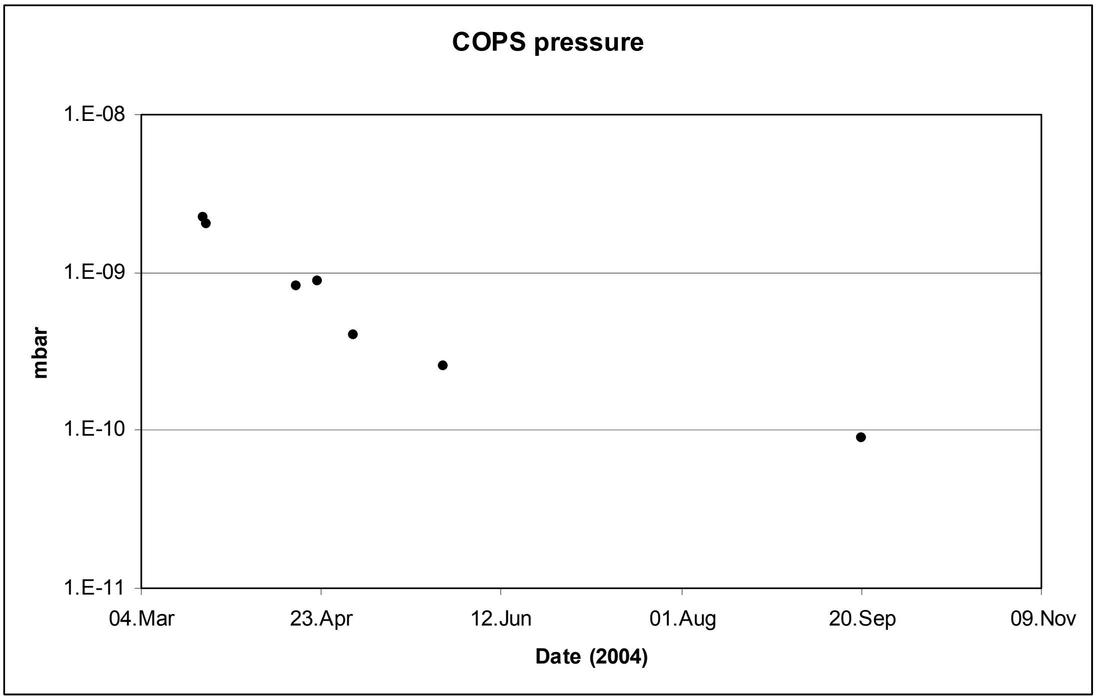
7. Interference scenario

Due to the very late commissioning slot (immediately before the interference scenario started) and to the encountered problems ROSINA activity during the interference scenario was cancelled. It was absolutely impossible to change the mode of operation or to upload SW patches between the commissioning slot of ROSINA and the interference scenario.

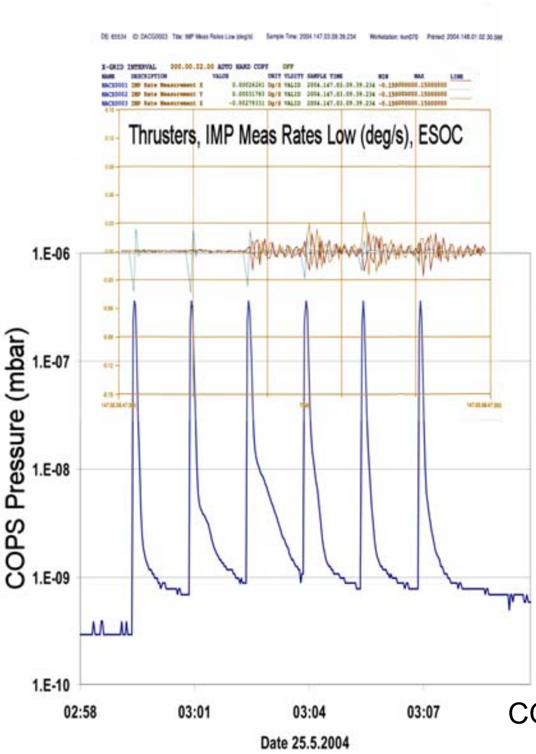
8. Scientific performance

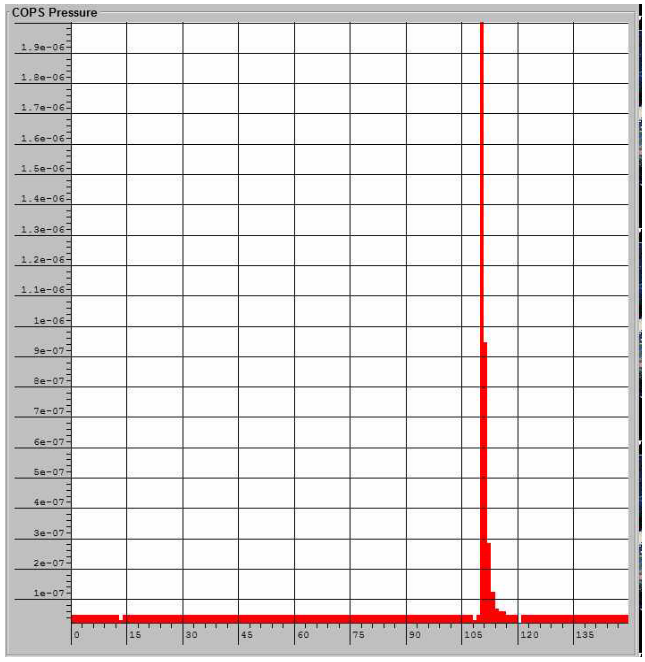
8.1. COPS

COPS is very stable. The first pressure measurement on March 19 gave a pressure of 2×10^{-9} mbar. Each time COPS is switched on it needs appr. 20 minutes to reach the final value due to its own outgassing. The final pressure due to the outgassing of the S/C has been decreasing steadily over the last 8 months except during thruster firing (see below).



COPS was put in the science mode (low sensitivity) which allows generating science pressure data every 2 s during wheel offloadings in May. The pressure increase observed was instantaneous and in the order of three to four orders of magnitude. The COPS pressure reached the limit of the pressure range COPS was operated with. It takes about two hours before it reaches again the original pressure value. A second measurement on Sept. 20 with a higher pressure range setting revealed that the pressure increase reached an even higher value of 2 e-6 mbar. As this is the mean value of the pressure over 10 s the real peak value is estimated to be in the low 10^{-5} mbar range. This was unexpected. The predictions were that we would not see any hydrazine molecules at the aperture of our sensors. At least for RTOF which is relatively close to thrusters it may pose a risk because of a pressure rise above the safe limit of 1 x 10^{-6} mbar. Other instruments may also be affected. The mass spectrum with RTOF revealed that no remnants of the methyl-hydrazine can be detected outside of thruster firings. That means that the hydrazine is not deposited in the ion source of RTOF. However, the ion source was always at elevated temperatures exceeding 100 °C. It therefore does not imply that no methyl-hydrazine is deposited on Rosetta, especially on cold surfaces.





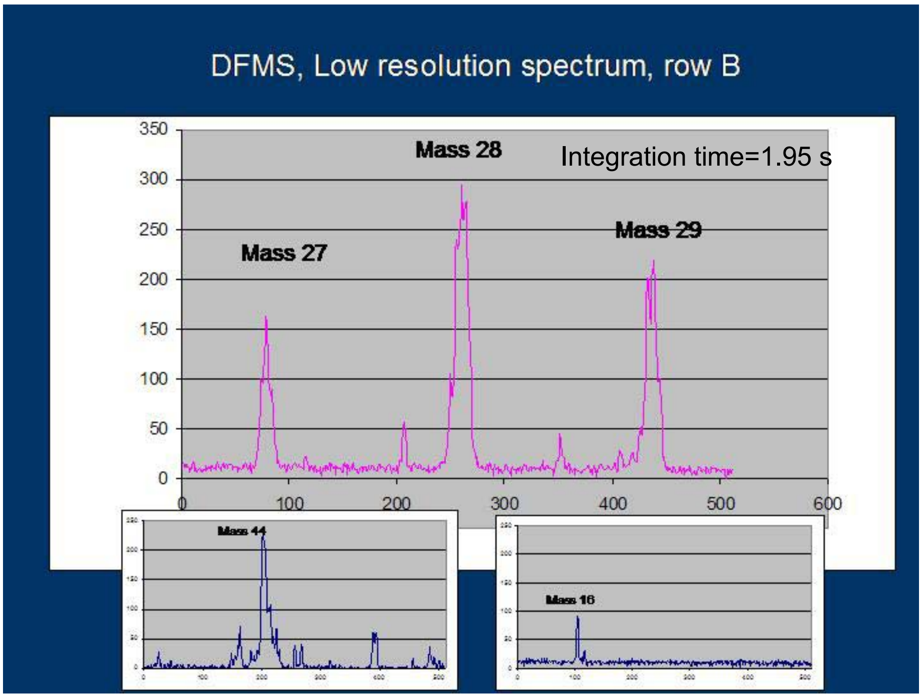
COPS pressure peak during thruster firing, 19. 9. 04

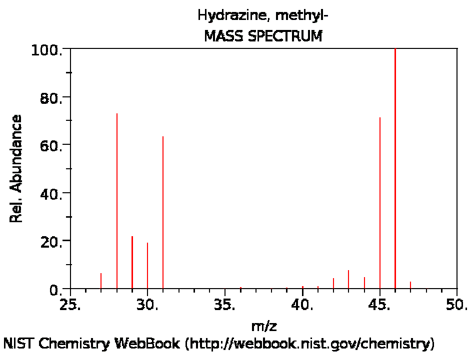
Overall performance

	Sensitivity
Proposal	10^{-2} A/Torr
FM/FS	~2 10^{-1} A/Torr
FS in flight	N/A*

* The sensitivity in flight cannot be determined as there is no other means than COPS to measure the pressure to calibrate it against. However, the sensitivity of COPS is given solely by geometric factors, which do not change from ground to space.

8.2. DFMS



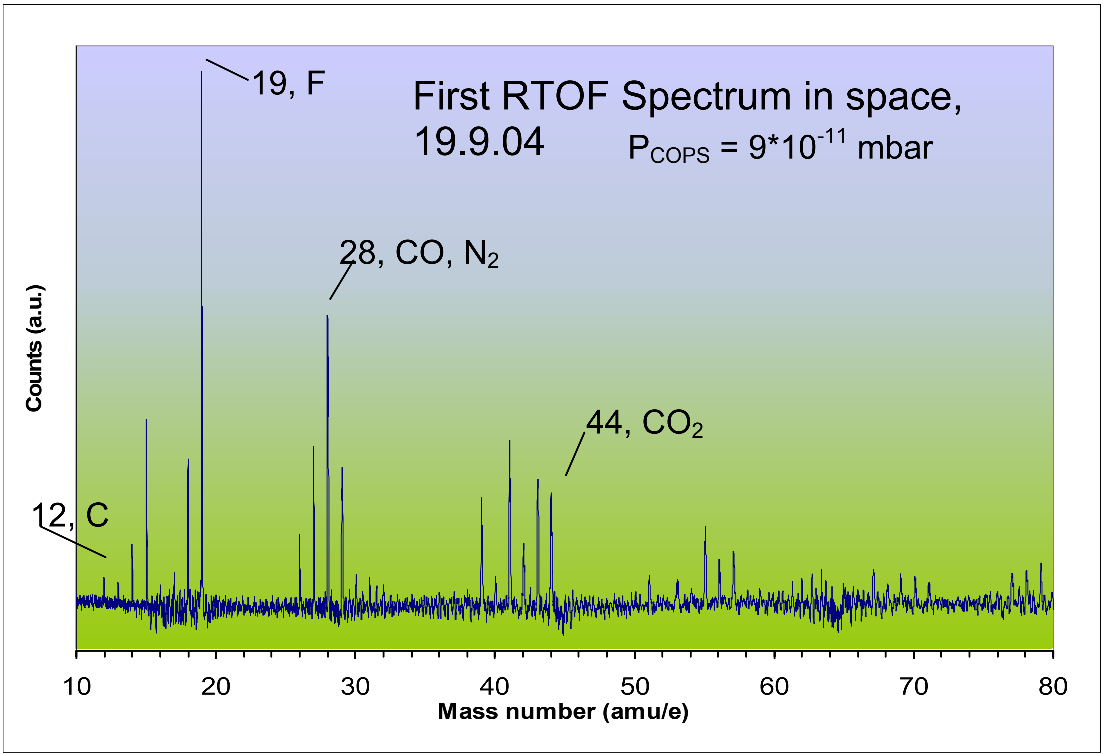


The above mass spectra were obtained at a total pressure of 2 x 10^{-10} mbar (measured by COPS) and with an integration time of 1.95 s. The voltages of the ion source were not optimized and therefore the three spectra not completely comparable. The ratio of m29/m28/m27 suggests an organic molecule as parent (glue from the sealing tapes of the MLI?). However, the above spectra would probably also be compatible with methyl-hydrazine as a parent (see sample mass spectrum). More measurement over the full mass range and at high resolution) are needed.

	Mass range	Mass resolution	Sensitivity
Proposal	12-100	3000 at 1%	10^{-5} A/Torr
FM/FS	12->130	1200-3650 at 1% depending on detector and mode	~5 10^{-6} A/Torr (TBC)
FS in flight	12->130	TBD, needs GCU	TBD, needs GCU

8.3. RTOF

A mass spectrum from RTOF was recorded in September (see fig.). This showed a nominal performance of RTOF. At a pressure of 9 e-11 mbar as measured by COPS this demonstrates the excellent sensitivity of RTOF. The Fluorine peak is intrinsic to the RTOFstorage source, the other peaks represent the residual gas. There is no peak at mass 46 which would represent the parent molecule of Methyl-hydrazine.



	Mass range	Mass resolution	Sensitivity
Proposal	1-300	500 at 1%	10^{-4} A/Torr
FM/FS	1->300	500-1500 at 1% depending on mode	~10^{-4} A/Torr
FS in flight	1->300	500-1500 at 1% depending on mode	~10^{-4} A/Torr (TBC)

9. Anomaly reports

- **Anomaly Report Number : ROS_SC-17**
  Anomaly Report Title : ROSINA TM Packets Time Stamping Drifts and Jumps
  New Status of AR : CLOSED
  Resolution Status & Details : The ROSINA DPU was patched on 4th May to the new software Version 6.4. This patch contained a fix to resolve this timing problem. ROSINA DPU was in continuous use from 2004.142.19.06 to 2004.148.01.05. No re-occurrance of this error took place confirming the successful resolution of this problem. The Anomaly Report can be closed.

- **Anomaly Report Number : ROS_SC-25**
  Anomaly Report Title : ROSINA Pressure Gradient values delivered by Service 19 are Out of Range
  New Status of AR : CLOSED
  Resolution Status & Details : The ROSINA DPU was patched on 4th May to the new software Version 6.4. This patch contained a fix to change the pressure gradient value provision strategy such that a new pressure gradient value being issued from ROSINA would only be sent if it is above 1e-16 mbar. Otherwise ROSINA's output will be 0xFF. It is confirmed from ROSINA that this patch does fix the large pressure gradient value problem which was observed by ALICE as part of the Service 19 test. This Anomaly Report can be considered closed. Note that we have contacted ALICE and TM from the DPU is being made available to them to allow them to verify this.

- **Anomaly Report Number : ROS_SC-26**
  Anomaly Report Title : ROSINA Error Reports generated on DOY 111 which resulted in COPS switch-off
  New Status of AR : CLOSED
  Resolution Status & Details : The ROSINA DPU was patched on 4th May to the new software Version 6.4. This patch contained a fix to change the offset value of the filament emission current to a value of 0.5 uA (previously 0.35 uA) and the regulation value for the filament emission current to 70 uA (previously 80 uA) for the high emission mode. Upon starting the new software, these new values came into effect. ROSINA COPS was in continuous use from 2004.142.19.06 to 2004.148.01.05. No re-occurrance of this error took place confirming the successful resolution of this problem. The Anomaly Report is closed.

- **Anomaly Report Number : ROS_SC-60**

Anomaly Report Title : ROSINA - sensor errors during RTOF operations, 19.Sep.04
During commissioning of RTOF modes, several occurrences of TM(5,2) EID 44104 Sensor error report were received: at 263.00:45, 263.19:14:18, 263.19:14:21, 263.19:14:25, 263.19:15:25, 263.19:15:29, 263.19:16:33, 263.19:16:37, 263.19:38:34. In two cases, the ROSINA DPU also switched autonomously RTOF OFF. The detector had to be reactivated by command.
These errors prevent off-line operations of the RTOF detector and their cause was not understood by the ROSINA
Meanwhile most causes are understood. After a SW update this has to be verified by retesting.

- **Anomaly Report Number : ROS_SC-61**
  Anomaly Report Title : ROSINA Measures Unexpectedly High Pressure During Thruster Firing 19.Sep.04
  Measurements conducted with the Rosina COPS instrument during Reaction Wheel Offloading (i.e. thruster firing activity) revealed environmental pressure peaks up to >10 e-6 bar. This generated a ROSINA Pressure Alert.
  Assuming that Rosina HV instruments (RTOF and DFMS) are exposed to such pressure levels, this would cause severe permanent damage to the instrument.
  Before any thruster firings ROSINA has to be switched off (can be done by cutting the LCL if not enough time available to switch it off by OBCP which would be preferable.

10. Open tasks

The following tasks have not yet been completed:

	Procedure	Task	Reason	Duration
1	N/A	Upload S/W	Problems encountered during commissioning period in Sept.	2-3 h
2	N/A	RTOF into operating mode by manual commanding, stability test	By using manual commanding HW and SW problems can be distinguished. RTOF needs time to settle	1 pass
3	N/A	Retest of DFMS Gain algorithm and probably	It is not yet clear if the parameters uploaded after the failure of the SES	1 pass

		reoptimization	voltage are fully compatible with the FS, reoptimization is probably needed	
4*	CV-FCP-007	DFMS measurement modes	Complete commissioning	1 pass
5	CV-FCP-011	RTOF measurement modes	Complete commissioning	1 pass
6		Contingency		1 pass
7	N/A	S/W upload to redundant part	Has to follow task #4	2-3 h

*Between pass 3 and 4 we need at least one week to solve any anomalies which might occur in pass 2 or 3.

11. Conclusions

11.1. COPS and DPU

The overall performance of ROSINA DPU and COPS is excellent. No major anomalies occurred. The pressure onboard Rosetta during the commissioning of COPS was 2 x 10^{-9} mbar in March and dropped to 9 x 10^{-11} mbar till September. It is to be hoped that this pressure decreases even more during the following months and years in order to get sensitive measurements with ROSINA near the comet. The amount of hydrazine seen with COPS during thruster firing is astonishing, clearly contradicting the models presented by industry previously. At least for RTOF such a pressure increase could cause damage if RTOF is operating if the thrusters close to RTOF behave the same way as the thrusters closest to COPS. **It has to be ensured that RTOF is switched off prior to any thruster firing.** The modeling of the thrusters has to be re-evaluated.

11.2. DFMS

The mass spectra received from DFMS are astonishing in view of the low pressure and the short integration time revealing the good sensitivity of this instrument. The molecules responsible for the mass spectra are located either in the organic material used on the S/C (glue?) or remnants of the hydrazine. The overall performance of DFMS is excellent. Some SW problems have to be solved by SW upload and need a retest.

11.3. RTOF

The RTOF commissioning was very promising as long as the commanding happened from ground. No major problems were observed. High voltages, ion sources, filaments and data acquisition systems all perform nominally. The spectrum of the residual gas looks excellent. However there are several SW problems, mostly due to timing which prevented a successful commissioning of the automated measurement modes. These problems have mostly been understood. A SW upload is in preparation. A retest is necessary.

Hans Balsiger
ROSINA PI

Kathrin Altwegg
ROSINA TM

11. RPC

ICA Commissioning Part 1.

The ICA commissioning part 1 only consisted in Low Voltage (LV) commissioning, i.e. no High Voltages (HV’s) were operated. Even if part one was not fully completed, the ICA LV commissioning was almost completed. In fact, the only remaining LV testings is the memory management, “Load ,Dump and Check”. Required to check out ESOC compatibility and capability. The ICA part in the PIU redundant testing is not included in this report.

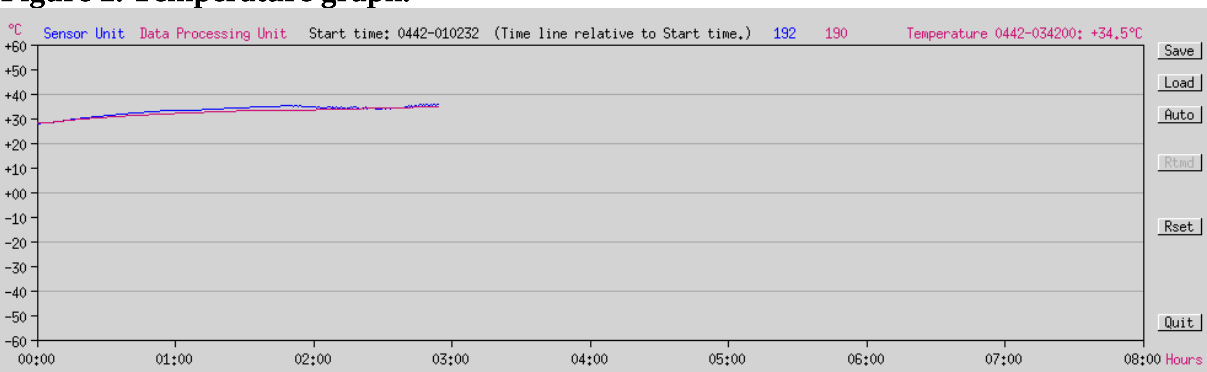
For the tests carried out, ICA behaved in all respects as expected. All data were received complete and correct (see fig 1). The temperature characteristics seem fine (see fig 2).

Figure 1. Packets statistic.

ICA Edf: 9 Lost Edf:
Sct: 0442-035448 Fmt: 0442-035417.062 ReStart
Hkt: 0442-035552 Dif: 000104 Max dif: 001600

	Counts	Seq.Cnt	Lost	Packet time	Total in bytes
HK packets:	341	340	0	0442-035552	14322
Science packets:	241	240	0	0442-035448	211582
Ack/Nak packets:	123	122	0	0442-035620	2464
Event packets:	17	16	0	0442-023027	374
Memo. packets:	0	0	0	0000-000000	0
				Total Sum	228742

Figure 2. Temperature graph.



For ICA: Hans Borg,
Hans Nilsson.

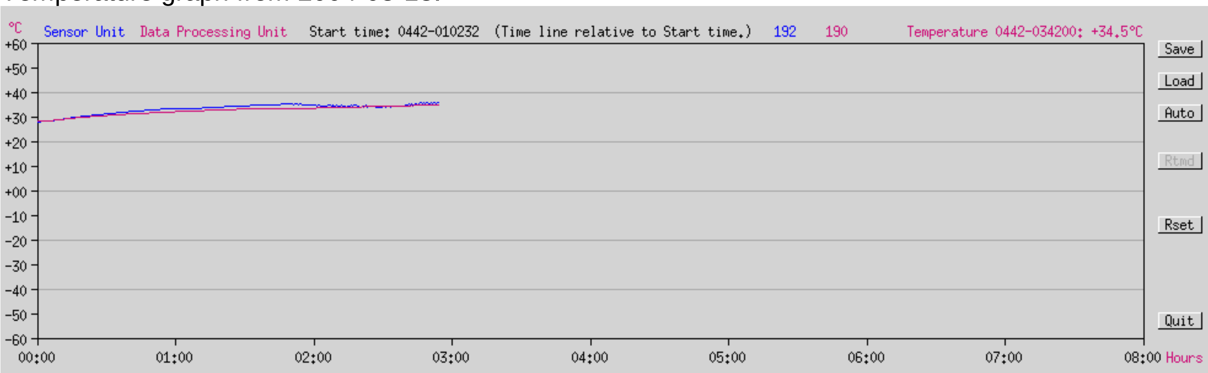
ICA Low Voltage Commissioning report.

2004-05-26

Note that this report only concerns the ICA Low Voltage Commissioning. The High Voltage Commissioning will be performed later. That implies that ICA can not measure any particles yet.

The Low Voltage Commissioning was carried out in two steps (mid Mars, beginning April). Apart from some minor RSDB changes, the ICA performed as expected. The temperature characteristic of the experiment is so far good.

Temperature graph from 2004-03-18.



For ICA
Hans Borg.

ICA High Voltage Commissioning

R. Lundin, H. Nilsson, H. Borg and K. Lundin
Swedish Institute or Space Physics, IRF, Kiruna, Sweden

The ICA High Voltage Commissioning took place September 06-08 2004.
ICA contains two main high voltage supplies. The so called OPTO-supply and the MCP-supply. The OPTO-supply generates the positive and negative “main” high voltages for the different deflection and analysing voltages. The MCP-supply generates the bias high voltage for the MCP. The high voltages on both supplies can be controlled by reference voltages 0-5 V. The OPTO-supply is controlled with a 3-bit D/A converter and the MCP–supply with a 4-bit D/A converter.

The HV commissioning started with the OPTO-supply. The high voltage switch on procedure for the OPTO-supply was done by commanding the main high voltage on and the OPTO-supply switch on. The high voltage was raised to the default voltage step by step by commanding. The high voltage for each corresponding reference voltage, starting from reference 0, was analysed by means of the high voltage monitoring. Correct monitor value was the criteria for sending the command for the next higher high voltage value. The procedure was repeated until the OPTO-supply was operating at the default value with correct monitor reading. The OPTO-supply was then switched off and the MCP-supply was switched on.

The MCP-supply was tested in the same way as the OPTO-supply. The MCP was tested up to reference level 12 which corresponds to the nominal operational high voltage value for the MCP. When operating the MCP with the nominal bias voltage (level 12) the background counts were detected as expected in the imager data.

The ICA was after the verification of the OPTO and MCP HV-supplies operated in a normal mode with all the different deflection and analysing high voltages running.

Solar wind ions measured by ICA in the solar direction indicated that the analyzer and imaging detection systems performed as expected.

OPTO-supply

Reference level	Monitor (kV)
0	0,1
1	0,7
2	1,3
3	1,9
4	2,5
5	3,1
6	3,7
7	4,3

MCP-supply

Reference level	Monitor (kV)
0	0,2
1	0,5
2	0,8
3	1,1
4	1,4
5	1,7
6	2,0
7	2,3
8	2,6
90	2.9
10	3,2
11	3,5
12	3,8

Pointing and interference scenario

During the interference scenario no clear signatures of interference could be found. The solar wind was in the instrument field-of-view during part of the pointing scenario, and the sun illumination also gave a good variation of the heating of the instrument.

Status after commissioning

ICA is working well and is as well tested as can be done in the solar wind. Some more data with some further variation of the instrument parameters, such as setting of post-acceleration and use of the high mass resolution mode would be useful. Most useful for in-flight verification of the instrument performance is to perform measurements during the Earth flyby in March 2005. This will enable us to verify in-flight the mass-resolution as well as test the low-energy detection limit of ICA (was ≈25 eV during calibration).

The instrument display three anomalies. The first is that when the instrument gets warm, above about +35° C, certain mass rings start to give dark counts. This will be handled by on-board software, requiring a patch that has already been developed. Second, during certain conditions the instrument generates increased dark counts in some sectors. These two anomalies are benign, not expected to pose any major problems and will be handled by data analysis software on ground. The third anomaly is a fast temperature rise that has happened twice in the high temperature regime (≈+40°C). Since ICA is automatically switched off at +50°C it does not lead to any immediate harm for ICA. After switch on some hour later, ICA behaves quite normally again. The effect is under investigation.

Performance verification matrix

The expected performance of the instrument is summarized in table 1, taken from the EID-B. The time resolution is given both for the solar wind energy step mode (maximum time resolution) and the full energy range which is used most of the time. The EID-B do not specify the mass resolution. Scientifically, the ion composition analyzer must be able to separate light solar wind ions from heavier ions of cometary origin. Furthermore we expect to be able to detect and analyse very heavy ions, ion clusters and charged dust particles. The latter could neither be tested with a calibration facility at the teams disposal, nor during the initial solar wind commissioning phase.

Property	Expected performance	Achieved performance
Angular resolution	22.5° x 4.5 °	As expected performance (1)
Mass resolution	Resolve ions of cometary origin	As expected performance
Energy range	1 eV – 40 keV	25 eV – 40 keV (result from calibration, not commissioning)
Energy resolution	Resolve cold beams	Can clearly resolve solar wind (1)

(1) The solar wind is clearly seen in one sector as can be expected (figure 1).

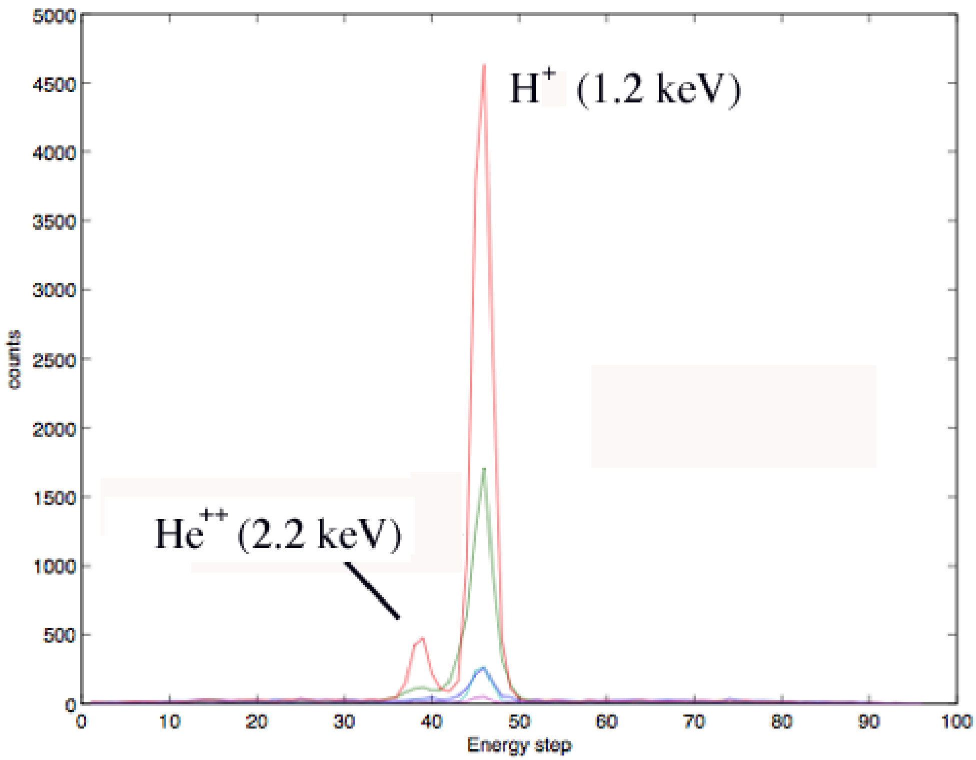


Figure 1 Solar wind energy spectra for H+ and He++ taken during ICA HV-commissioning. Each line denotes the energy spectra from the sector with highest count rates and the surrounding sectors (2 on each side). Counts are summed over all Polar angles and all mass channels.

Brief instrument description

The Ion Composition Analyzer (ICA) is an ion spectrometer designed to study ion dynamics with mass resolution. Particles enter the analyser through an outer grounded grid. Behind the grid is a deflection system whose purpose is to deflect particles coming from angles between 45° and 135° with respect to the vertical axis (spacecraft y-axis), into the electrostatic analyser. Ions within a swept energy pass band will pass the electrostatic analyser. The ions are then deflected in a cylindrical magnetic field set up by permanent magnets; the field deflects lighter ions more than heavy ions into the centre of the analyser. The ions finally hit an MCP and are detected by an anode system. Ions are analysed in both direction and mass per charge simultaneously. The magnet assembly can be biased with respect to the electrostatic analyser to postaccelerate ions; this postacceleration enables a selection of both mass range and mass resolution. The nominal energy range of the instrument is 1 eV/e to 40 keV/e, covered in 96 steps. The full mass matrix has 32 channels, grouped according to calibration data. Resolution and mass coverage will depend on ion energy and post acceleration setting.

The spatial resolution of the instrument is 22.5° x 4.5°. The 16 anode sectors of the MCP constitutes a 360° field-of-view in the x-z plane of the spacecraft with 22.5° resolution. A field-of-view of 45° to 135° with respect to the spacecraft y-axis is achieved through the deflection system, with an angular resolution of 4.5°. The spatial resolution transmitted to ground is dependent on available telemetry, as is the mass resolution. Therefore the data files from ICA will contain a variable amount of mass channels, deflection angles and sectors. Data is further compressed using lossless compression.

Scientific Objective

The basic objective of the ICA instrument is to perform in-situ measurements of ions in order to study the interaction between the solar wind and a comet. The mass per charge and energy per charge, as well as the direction of travel of individual positive ions, will be measured in almost 2π. ICA will contribute to many of the common scientific objectives of RPC. In order to meet these objectives the ICA instrument is designed to meet the following requirements:

1. ICA will determine ion distribution functions for the major solar wind and cometary ion species.
2. ICA will have a mass-resolution sufficient to enable the distinction between major ion constituents (e.g. H^+, He^{++}, He^+, O^{++}, O^+) within an energy range from about 25 eV/e – 40 keV/e.
3. ICA will resolve ionised atomic and molecular species from the cometary ionosphere (e.g. O^+, N^+, N_2^+, O_2^+, CO_2^+), picked-up by the solar-wind flow or streaming out by mass-loaded acceleration processes.
4. ICA will measure "dusty" plasma components.and low-energy ionized heavy molecules (e.g. organic molecules) from the cometary nulclei, as first measured in-situ by the Giotto spacecraft, (Korth et al, 1987).

Report on IES Low Voltage Commissioning – Phase 1

Summary Report

IES performed nominally throughout this commissioning phase.

Phase 1 of RPC LV Commissioning exercise was conducted during real time passes on the nights of March 17/18 and March 18/19, 2004. An IES instrument team composed of Raymond Goldstein, Craig Pollock, and John Hanley was on site at ESOC from March 15 through March 19 to set up for the tests, approve and monitor their execution, and participate with the rest of the RPC team present in evaluation and planning. All aspects of the IES commissioning were completely successful. Certain previously planned operations of the commissioning were deferred to later dates. The IES Safe mode verification was deferred until the time of high voltage commissioning (planned for September 2004) for instrument safety reasons. This was documented in RPC Procedure Variation Request, RO-RPC-VAR-02. Verification of On Board Control Procedures and embedding of science data in HK Event Messages were both deferred to a subsequent LV Commissioning sequence likely to take place in late April or May 2004.

A total of 33 commands were issued to IES, including commands required to activate and de-activate test pulsers, and to perform a warm re-boot of the instrument processor over a span of approximately 3-1/2 hours of actual run time. One command was appropriately rejected by the instrument processor, owing to the fact that the instrument was in the wrong mode to properly execute the command at the time it was issued (IES was already in LVSCI mode when a command to change to LVSCI mode was received) - this is correct behavior for this condition. The science data reported while the test pulsers were active looked as expected.

The IES team had a concern regarding the temperature reported by the sensor PAY429, located on the outboard portion of the IES double tophat assembly. This point was reading in excess of +48° C prior to applying power to IES and rose to 51.7 C by the end of the first night's testing. The Experiment Interface Data Base (EIDB) calls for maximum operating temperature at the TRP of +50° C but does not specify the PAY429 maximum temperature. The IES team agreed, however, to allow temperatures at these two points to get as high as +55° C before shutting off (this value was never achieved). The justification for this allowance is that the IES was tested to +60° C during Thermal vacuum and that consultation with engineers in San Antonio yielded the conclusion that the components involved could survive substantially higher temperatures.

One IES thermistor gave values that were excessively large (~ +92° C) at the PISA console, though the temperatures were within reason at the IES EGSE. The tentative conclusion is that this was due to a GSE calibration bug, which will require confirmation.

Detailed Report

Steps Performed

17/18 March 2004. On this night, Flight Control Procedures (FCP) 011, 109, 010, 019, 103, and 010 (IES off) were executed in the order cited here.

Note that on 17/18 March 2004, two RPC Procedure Variation Requests were submitted:

- RO-RPC-VAR-02, Skip IES safe mode during initial turn on (RP-FCP-100) during PIU Redundant Commissioning, step 190
- RO-RPC-VAR-05(?), Insert IES-INSTR-PROG-MODE RESUME command after PIU Main Commissioning and EXP HW Verification Step 190, since the IES TM/TC check leaves IES in PROM mode after an internally induced watchdog reset.

18/19 March 2004. On this night, FCP 011, 130, and 010 were executed in the order cited here.

Telemetry

Correct TLM was received showing nominal IES operation.

LVPS monitors (observed on both PIU Main and Redundant):

- +5V => +5.05 V
- -5V => -5.03 V
- +12V => +12.32 V
- -12V => -12.26 V

Internal Temperature monitors T1 and T2:

- 17/18 March 2004 Temperatures => +37 to +47 deg C
- 18/19 March 2004 Temperatures => +37 to +40 deg C (about 12 minutes of run time)

Commanding

IES responded correctly to all commands sent.

QL Science Data

IES science data was nominal in response to STIM pulses.

Anomalies

Pending review by our thermal engineers, we have some concern about the operating temperatures possibly getting too high, especially since the S/C will be slightly closer to the Sun during operation in May.

Report on Second Round of IES Low Voltage Commissioning Activities

1) Objectives

   This round of commissioning had two primary objectives:

   a. Verify Memory Service operations: Patch, verify, dump
   b. Verify functionality of HV Events approach to prompt viewing of IES science data (ion and electron counts)

2) Sequence and Results

2.1) Memory Service Test Sequence

IES was first turned on at 2052 UTC in maintenance mode (RPC-FCP-012), executed Memory Service Test (RPC-FCP-108), and then turned off (RPC-FCP-010), concluding achievement of first objective. IES was on for 35 minutes (from 2052 UTC to 2127 UTC. During that time the temperature according to PAY429 increased from 50.0 degC to 51.67 degC (1 lsb change). During the Memory Service Test, the Memory Load was transmitted and acknowledged.

2.2) Memory Service Test Results

From point of view of IES personnel at ESOC and at SwRI, this portion of the test was completely successful. Acknowledges were received as appropriate. Critical sequences of words specified by John Hanley were observed.

2.3) High Voltage Events Test Sequence

The High Voltage Events test involved no high voltage commanding or high voltage operations. This was a test to demonstrate that we could deliver instrument count rate data as Event Messages within the Housekeeping telemetry stream. This capability will be utilized in September 2004, during IES HV commissioning.

IES was turned on again at 2337 UTC, using RPC-FCP-011. The HV Events test was then run by executing RPC-FCP-114, which in turn calls RPC-FCP-115 (enable HV Event Messages), RPC-FCP-130 (enable and disable electron and ion stim pulsers), and RPC-FCP-116 (disable HV Event Messages).

2.3) High Voltage Event Test Results

We were able to confirm two memory loads performed early in FCP-114 by virtue of command history. FCP-115 then enabled HV Events reporting and FCP-130 turned on electron and ion stim pulsers.

We were able to see the effects of the STIM pulsers in the HV Event data reported in HK. Both Ion and Electron counters states (NRPA1541 and NRPA1542) made transition from raw value 0 to raw value 1 when pulsers were turned on near

131.00.07 and from 1 back to 0 when pulsers were turned off near 131.00.28. Both Ion and Electron counts (displayed in an Exp Man format) were observed to make transitions from –1.00 to 4.71 when pulsers were turned on and back from 4.71 to –1.00 when pulsers were turned off. In this sense this test was successful. The HV Events test was basically successful. However, there were lessons learned and bugs uncovered that are described below.

1) The plots on the ESOC GSE needed improvement in details, quantitative verification, and calibration. Axis labels and associated tick marks were missing (grid lines appeared on the ESOC monitor screen, but they were drawn in white and did not appear on print-outs). They also did not correspond to locations of tick marks (even demarcations of the entire plotted range), which did not appear on screen or on the prints.

2) The IES GSE in ESOC and that in San Antonio were not both able to receive telemetry. Either one was able to connect and receive telemetry as long as the other was not connected, but both were not able to at the same time. The GSE in San Antonio had “tunneled” into network sites behind the ESOC firewall (specifically Chris Lee’s laptop). In the future it will be helpful to be able to view IES science and engineering telemetry streams from both ESOC and SwRI.

3) There was a difference noted between the IES internal temperatures reported on the SCOTTS 2000 GSE and the IES GSE in San Antonio. Details to be provided.

4) No Science data stream when HV events messages were enabled. The primary purpose of the HV Events test was to place detected event rates in “Event Messages”, which are telemetered along with HK data and therefore become available to IES experimenters many minutes earlier than the otherwise would be, as reported in the science data stream. However, it was not anticipated and is not acceptable that the enabling of these HV Event Messages appears to disable or otherwise interrupt the normal delivery of science data to the IES GSE. This requires investigation and solution.

REPORT ON RESULTS OF RPC-IES OPERATIONS DURING MISSION COMMISSIONING
16 November 2004

1. Introduction

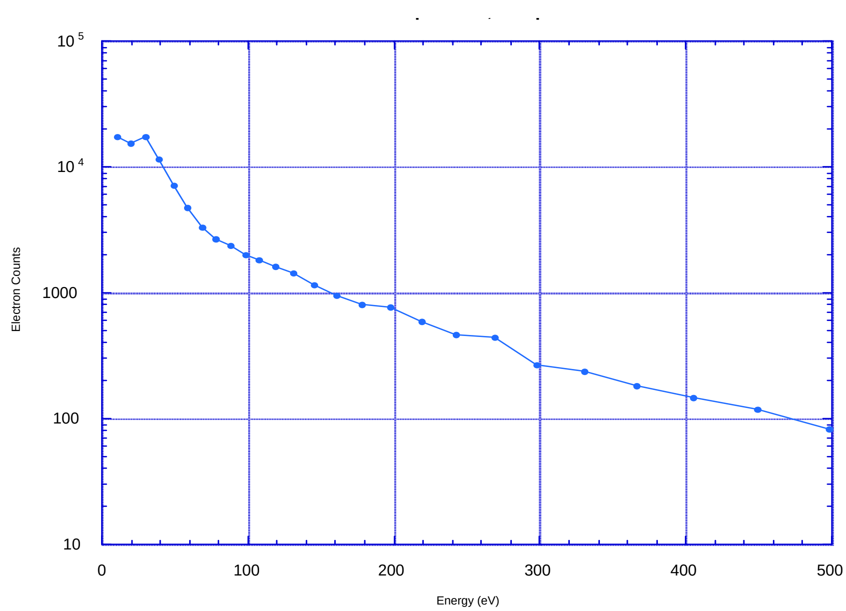
The Ion and Electron Sensor (IES) participated in four phases of the Rosetta Mission Commissioning activities. Operation appears nominal although the data are still being analyzed. (See item 6, below.)

2. Low Voltage Commissioning

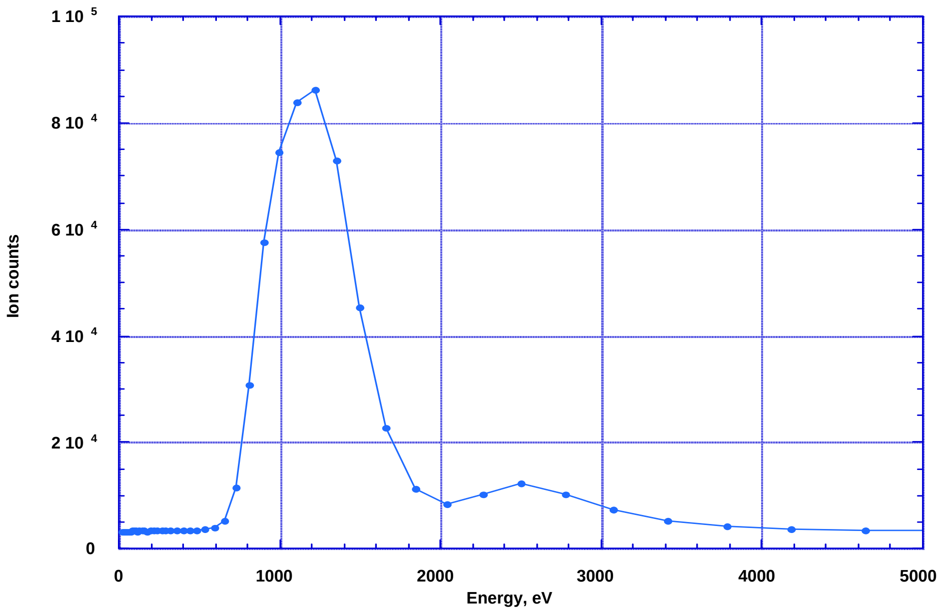
IES was first turned on in space on 18 and 19 March 2004, in low voltage mode only. The plan was to wait as long as possible for high voltage operation in order to outgas the instrument as long as possible. Low voltage operation, including internal "stim" pulsers showed nominal operation and that IES survived launch in working order. Additional low voltage operations were performed on 9 and 10 May 2004.

3. High Voltage Commissioning

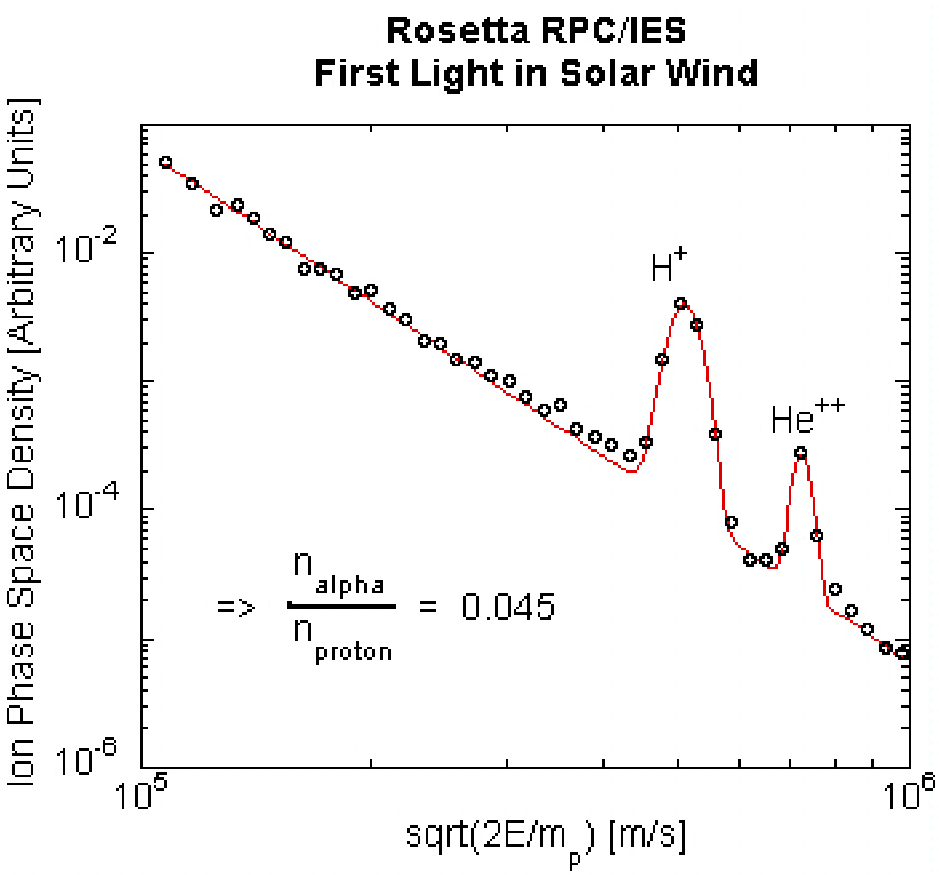
High voltage (HV) operation in space was initiated during the period between 6 and 10 September 2004. All HV supplies operated nominally and we were able to detect the solar wind ions (protons and alphas) and electrons. See the Figures following. The first two show energy spectra of solar wind electrons and ions. The third shows a simplified analysis of the ion data that gives a reasonable proton/alpha ratio. These show the full functionality of IES and that it was operational.



IES solar wind electron energy spectrum, 9/10 September 2004



IES solar wind ion energy spectrum, 9/10 September 2004



4. Interference Scenarios

IES participated in the Interference Scenarios performed on 20 and 21 September and 13 and 14 October 2004. No obvious interference was observed from other payload elements, nor did we receive any reports of interference caused by IES.

5. Pointing Scenarios

IES participated in the Pointing Scenarios performed on 23 and 30 September 2004. We were able to see changes in the apparent direction of the solar wind beam, as expected, indicating nominal function of the deflector system.

6. Anomaly

Subsequent to the above operations, we began detailed analysis of the data and discovered what appears to be spurious spikes in the electron data. We suspect that this may be a result of an error in the flight software and are carefully reviewing that code as well as all flight and pre-launch ground test data. Note that IES produces data at a higher rate than our telemetry rate allows so the data are compressed on board. The spikes may be a result of improperly combining the counts belonging to the multi-dimensional (energy, azimuth, and elevation) data. We also plan tests using our IES electrical simulator in the laboratory. We will provide a report on the results of these studies.

RPC-LAP
INTERFERENCE SCENARIO REPORT

Operations:
September 20 - 22, 2004
October 13 – 14, 2004

IRFU-ROS-CVPIF
Version 1.0
11 Nov 2004

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Contents

Document history

Revision	**Date**	**Comment**
0.1	2004-09-22	Initial revision (RG)
0.2	2004-10-14	Added part 2 (RG)
0.3	2004-11-09	Corrected times for Tx (RG)
1.0	2004-11-11	Editorial (AIE)

1 Interference Scenario, Part 1, Run 1 (2004-09-20 -- 21)

A late replanning exercise resulted in a missing command "start sampling", which caused problems for the LAP operations after the initial step (see below). This means that the LAP "noisy" modes were only partially run, though sufficiently to be seen in MIP data, and that the quiet listening mode were only run for a short time at start.

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
0030	040920 16:20		804		OBCP Starts LAP in quiet mode, no science passes the PIU.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Temperature: (After –6 deg C correction) 20.9 deg C
0040	040920 16:30		362		Runs LAP active interference mode. LAP transmits As follows: Probe 1 1 KHz, Macro 0x106 Probe 2 1 KHz, Macro 0x107 Probe 1 5 KHz, Macro 0x100 Probe 2 5 KHz, Macro 0x101 Probe 1 6.7 KHz, Macro 0x102 Probe 2 6.7 KHz, Macro 0x103	Procedure FCP-362 had a missing command “StartSampling”. This caused the instrument to hang up the whole first day of interference. FCP-362 has been run successfully before. However the “StartSampling” command has then been executed by some other procedure prior to FCP-362 and thus the missing command has not been detected. We do however suspect that the first step started to transmit at 1KHz. We belive this since MIP can see overtones from our square wave being produced at exactly that time, and they also see the same thing during the successful interference day 2.
0050	040920 16:57		804	3	OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	Default Burst never starts due to hang up in step 0040. Though we can see in HK that it did try.
0070	040920 22:32		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP sensitive mode never starts due to to hang up in step 0040. Though we can see in HK that it did try.
0090	040921 02:00		804		OBCP LAP OFF	LAP Turns off (Since day 2 recovers from hang up above we now for certain it did, thus problem at step 290 day 2 do not exist here)

2 Interference Scenario, Part 1, Run 2 (2004-09-21 -- 22)

Operations were fully succesful, both "noisy" and "listening" modes. No obvious signature of any interference could be been seen in the data.

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
0130	040921 17:30		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 17:33 as it should. Temperature: (After –6 deg C correction) 19.1 deg C
	040921 18:05				ROSINA Emissive mode on	Nothing detected in E-field or Density spectra.
	040921 19:10				ROSINA Emissive mode off	Nothing detected in E-field or Density spectra.
0150	040921 19:50		804		OBCP LAP OFF	LAP was turned off.
0190	040921 20:15		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 20:18 as it should. Temperature: (After –6 deg C correction) 25.4 deg C
0200	040921 20:35		805	2	MIP-LAP Into LDL normal mode LAP should execute macro 0x206 or macro 0x906.	LAP executes macro 0x306. OBCP 805 error. LDL normal failed! We got some fine sweep data though!
0220	040921 21:00		804	0	OBCP LAP Quiet Stops LAP science in PIU.	.
0230	040921 21:05		362	0	Runs LAP active interference mode. LAP transmits As follows: Probe 1 1 KHz, Macro 0x106, at 21:05:46 Probe 2 1 KHz, Macro 0x107, at 21:10:02 Probe 1 5 KHz, Macro 0x100, at 21:13:46 Probe 2 5 KHz, Macro 0x101, at 21:16:58 Probe 1 6.7 KHz, Macro 0x102 Probe 2 6.7 KHz, Macro 0x103	Though LAP science is stopped in the PIU we got one frame with transmitter data from 21:16:26 and it looks right. Note that the fact that LAP science is stopped in the PIU does not make us less noisy. However it reduces the telemetry volume. The two last steps macro 0x102 and 0x103 seems to be cut short by the next step 0240.
0240	040921 21:15		804	3	OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	Default burst is ok.
	040921 21:20			2	LAP goes into default normal mode macro 0x212 (replaced old macro 0x202)	The command to do this cant be found in the procedures. Data looks fine though.
0260	040921 21:35		804	3	OBCP Starts LAP sensitive mode macro 0x302.	Macro 0x302 started 21:48 and data looks fine.

					Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	
0290	040921 22:25		804		LAP OFF	LAP was not turned off as indicated by the procedure!!
0300	040921 22:35		804		RPC OFF	LAP was powered down.
0340	040921 22:45		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 23:03 as it should. Temperature: (After –6 deg C correction) 27.5 deg C
	040921 23:30				MIRO Emissive mode on	Nothing detected in E-field or Density spectra.
	040922 00:00				MIRO Emissive mode off	Nothing detected in E-field or Density spectra.
	040922 00:20				GIADA Emissive mode on	Nothing detected in E-field or Density spectra.
	040922 00:50				GIADA Emissive mode	Nothing detected in E-field or Density spectra.
	040922 01:20				ALICE Emissive mode	Nothing detected in E-field or Density spectra.
	040922 01:40				ALICE Emissive mode	Nothing detected in E-field or Density spectra.
0360	040922 02:00		804		LAP OFF	LAP was powered down.

3 Interference Scenario Part 2, Run 1 (2004-10-13)

Interference scenario part two was a rerun for observing RPC effects on other instruments, not for us observing others. Therefore no other instruments are changing to or from emissive mode during the periods there RPC is on.

We exclude the RPC step number in this table. Since we work directly with a modified ITL file, basically it consists of the second part of the original interference ITL that was used in part one, only modified to use procedures to start the LDL mode that failed in step 200 above.

Start UTC	End UTC	RP FCP	SID	Description	Notes
041013 01:15		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 01:18 as it should. Temperature: (After –6 deg C correction) 20.9 deg C
041013 01:30		399		LAP EndMacro	Macro execution stopped
041013 01:37		901	2	MIP-LAP Into normal LDL mode Using procedure and not OBCP 805 that previously failed.	LAP executes generic macro 0x200 and goes into LDL mode ok.
041013 01:55		903	2	Turn off normal LDL.	Turned off normal LDL.
041013 02:00		804	0	OBCP LAP Quiet Stops LAP science in PIU.	LAP Science will not be seen but we will still be noisy.
041013 02:05		362	0	Runs LAP active interference mode. LAP transmits As follows: Probe 1 1 KHz, Macro 0x106, at 02:05:46 Probe 2 1 KHz, Macro 0x107, at 02:09:30 Probe 1 5 KHz, Macro 0x100, at 02:14:18 Probe 2 5 KHz, Macro 0x101, at 02:17:30 Probe 1 6.7 KHz, Macro 0x102, at 02:20:42 Probe 2 6.7 KHz, Macro 0x103, at 02:25:30	Though LAP science is stopped in the PIU we got two frames with transmitter data from 02:23:22, 02:27:06 and they look alright. Reason this is possible is that the data is transmitted after 02:25 then science is again permitted by the next step. The macro in the next step is then put on hold until the transmitter data has been sent approximately 2 min. Note that the fact that LAP science is stopped in the PIU does not make us less noisy. However it reduces the telemetry volume.
041013 02:27		804	3	OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	Default burst is ok.
041013 02:45		804	3	OBCP Starts LAP sensitive mode macro 0x302.	Macro 0x302 started 02:47 and first science 02:47:54.

				Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	
041013 03:35		804		LAP OFF	LAP was turned off.
041013 04:00		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 04:03 as it should. Temperature: (After –6 deg C correction) 25.4 deg C
041013 04:45		804		LAP OFF	LAP was powered down.

4 Interference Scenario Part 2, Run 2 (2004-10-13 -- 14)

From LAP's point of view the second run in part 2 is identical to first run above.

Start UTC	End UTC	RP FCP	SID	Description	Notes
041013 22:15		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 22:18 as it should. Temperature: (After –6 deg C correction) 20.4 deg C
041013 22:31		399		LAP EndMacro	Macro execution stopped
041013 22:37		901	2	MIP-LAP Into normal LDL mode Using procedure and not OBCP 805 that previously failed.	LAP executes generic macro 0x200 and goes into LDL mode ok.
041013 22:55		903	2	Turn off normal LDL.	Turned off normal LDL.
041013 23:00		804	0	OBCP LAP Quiet Stops LAP science in PIU.	LAP Science will not be seen but we will still be noisy.
041013 23:05		362	0	Runs LAP active interference mode. LAP transmits As follows: Probe 1 1 KHz, Macro 0x106, at 23:05:46 Probe 2 1 KHz, Macro 0x107, at 23:09:30 Probe 1 5 KHz, Macro 0x100, at 23:14:18 Probe 2 5 KHz, Macro 0x101, at 23:17:30 Probe 1 6.7 KHz, Macro 0x102, at 23:20:42 Probe 2 6.7 KHz, Macro 0x103, at 23:25:30	Though LAP science is stopped in the PIU we got two frames with transmitter data from 23:23:22, 23:27:06 and they look alright. Reason this is possible is that the data is transmitted after 02:25 then science is again permitted by the next step. The macro in the next step is then put on hold until the transmitter data has been sent approximately 2 min. Note that the fact that LAP science is stopped in the PIU does not make us less noisy. However it reduces the telemetry volume.
041013 23:27		804	3	OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters (not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up & down. 27.3 ms each plateau keeping 4 samples each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up & down 27.3 ms each plateau keeping 8 samples each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	Default burst is ok.
041013 23:45		804	3	OBCP Starts LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	Macro 0x302 started 23:47 and first science 23:47:54.
041014		804		LAP OFF	LAP was turned off.

00:35					
041014 01:00		804	3	OBCP LAP ON and start LAP sensitive mode macro 0x302. Density probe 1 Fix bias 10 V. E-Field probe 2 Fix bias 0 A.	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Macro 0x302 started 01:03 as it should. Temperature: (After –6 deg C correction) 25.0 deg C
041014 01:45		804		LAP OFF	LAP was powered down.

5 Results

Spectrograms providing overview of LAP observations during the interference scenario are provided in an Appendix (because they are very voluminous, in print as well as on disk). A general conclusion from these, and from the data presented below, is that the operations of the other instruments did not have any major impact on LAP data.

Representative spectra, processed at the LAP GSE, for each period in the interference scenario are found in Figures 1 -- 4, covering transitions from passive to active mode of ROSINA, MIRO, GIADA and ALICE. The spectra are not normalized to physical units. In no case can we see any obvious interference signatures.

A known interference is the MIP-LAP LDL mode operations, where MIP uses LAP probe 2 for transmission. This signal can of course be seen in LAP, as is illustrated in Figure 5. Operational modes for avoiding this kind of interference are either existing since long time (the so called mixed LDL mode, in which MIP an uses the probe every second AQP) or are supported in flight software but not yet implemented in macros (delaying LAP operations within an AQP, which will enable us to get better time resolution than allowed by the mixed LDL mode while still avoiding MIP interference in LDL).

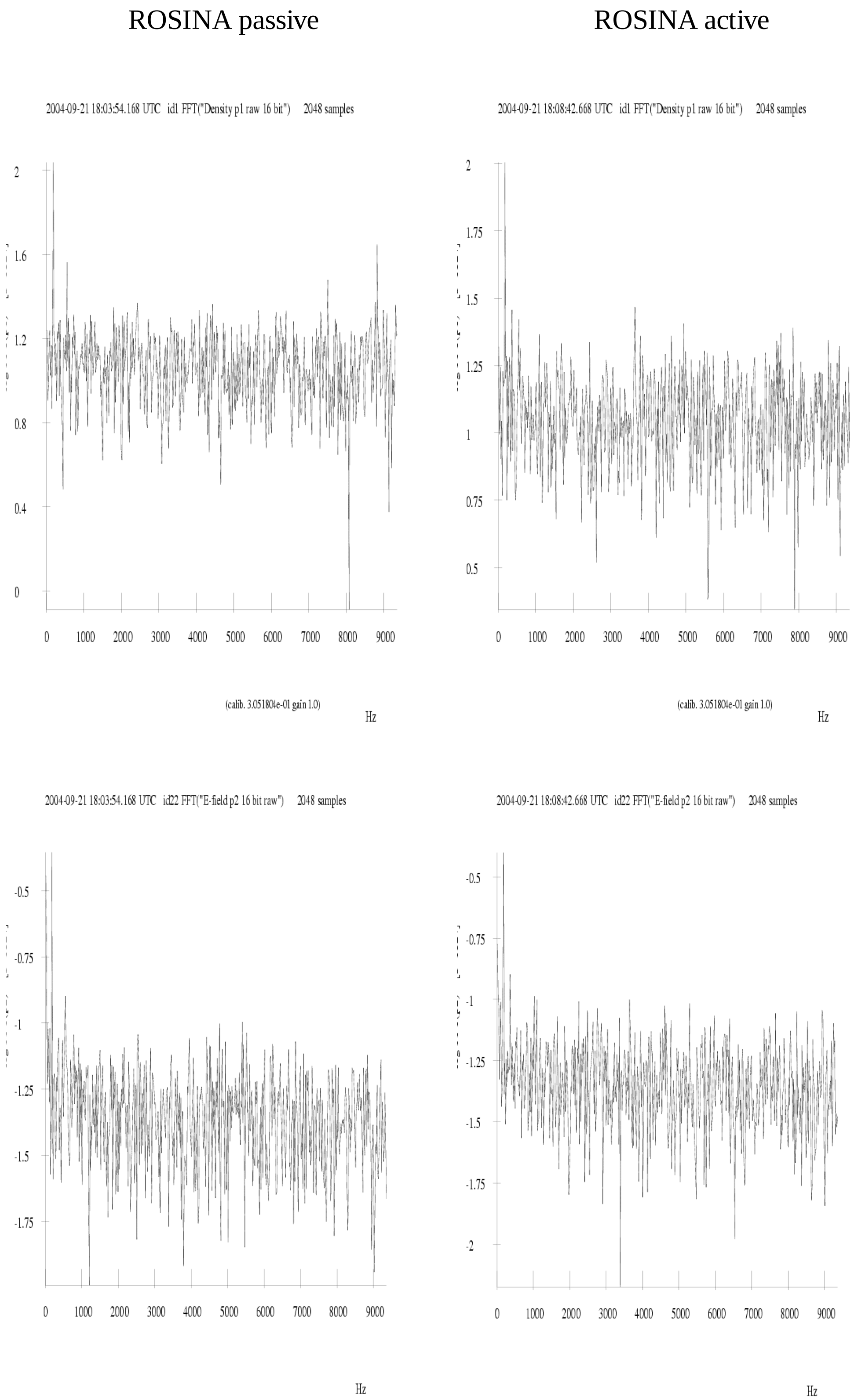

Figure 1. LAP response to ROSINA operations (P1 in density mode at top, P2 in E-field mode below). No signature is found.

MIRO passive MIRO active

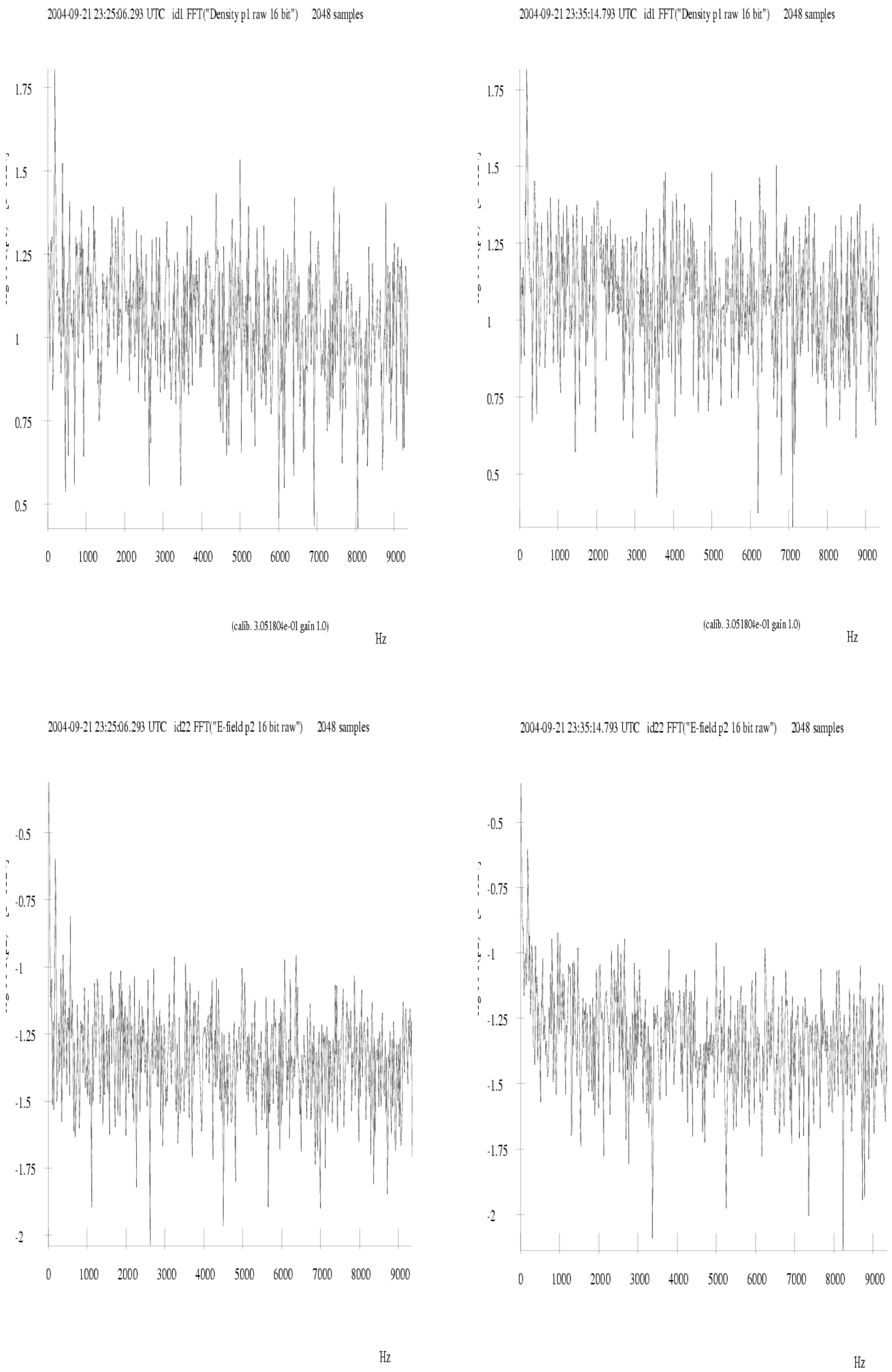

Figure 2. LAP response to MIRO operations (P1 in density mode at top, P2 in E-field mode below). No signature is found.

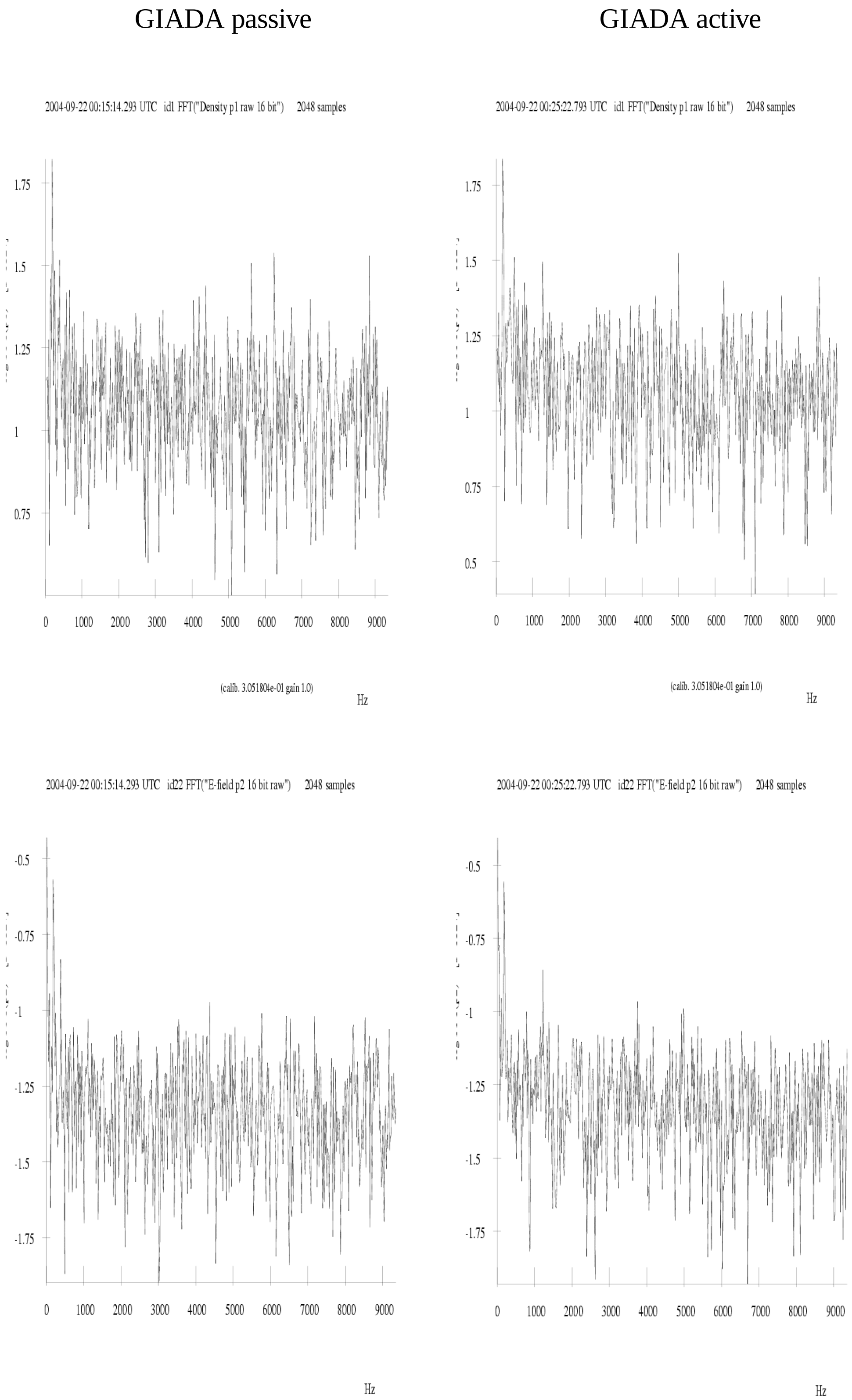

Figure 3. LAP response to GIADA operations (P1 in density mode at top, P2 in E-field mode below). No signature is found.

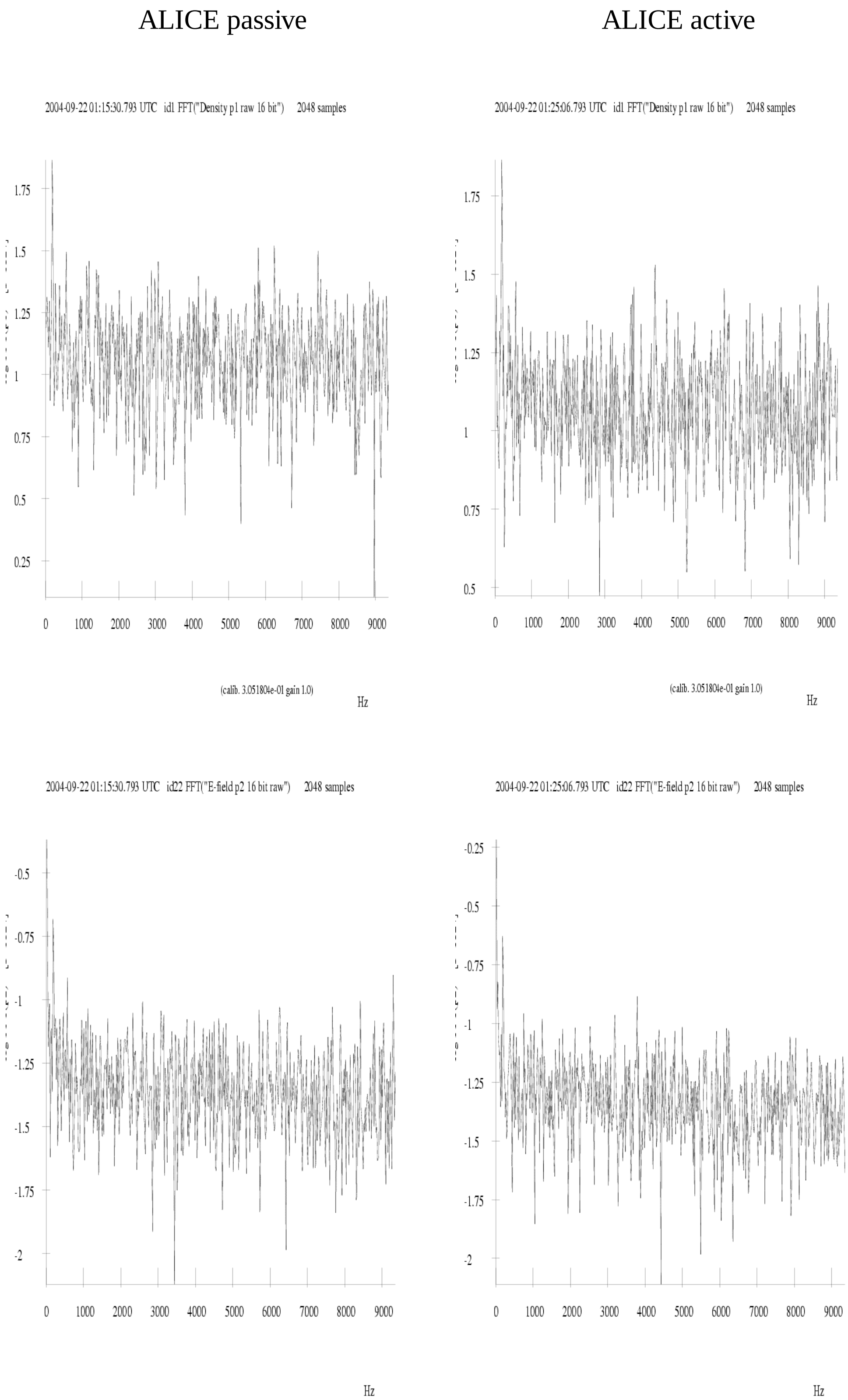

Figure 4. LAP response to ALICE operations (P1 in density mode at top, P2 in E-field mode below). No signature is found.

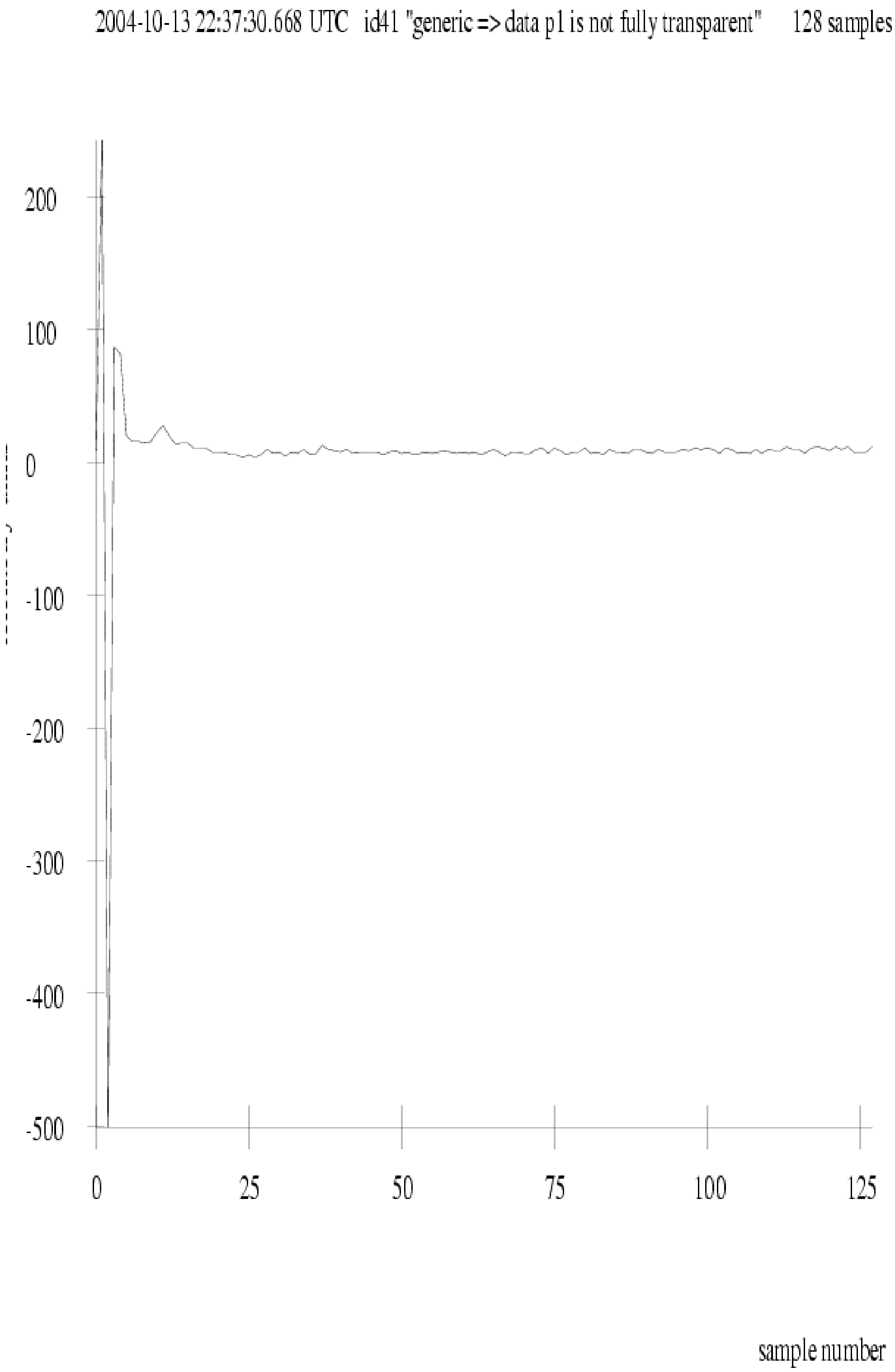

Figure 5. MIP signature in LAP data in LDL mode. Time series from probe 1 sampled at 18750 Hz.

6 Conclusion

Spectrograms of LAP data are provided as an appendix to this report. No obvious signature of any interference from instruments outside RPC has been seen in the data. We have not yet been able to fully analyze all data, and it is possible that the continued analysis may still show some interference. However, we can conclude that we see no problems seriously affecting the planning of upcoming operations.

Regarding interference and noise in general, LAP of course get interference from MIP when using the LDL mode, but this has always been expected and operations are tailored to avoid problems with this.

In the signals from both LAP probes, there is also a signal at approximately 190 Hz and its first harmonics. This is a common mode signal, almost vanishing when looking at the differential signal (P1-P2). This is described in the LAP report from the third RPC CVP slot (IRFU-ROS-CVPREP3).

Appendix: Spectrograms from the interference scenario operations

Note: As the spectrograms are numerous and large, not all versions of this report will include them.

RPC-LAP
POINTING SCENARIO REPORT

("LAP dance")

Operations on October 10, 2004

IRFU-ROS-CVPPNT
Version 1.0
10 Nov 2004

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Uppsala, Sweden

Contents

Document history

Revision	Date	Comment
0.1	2004-09-22	Ops log (RG)
0.2	2004-10-11	Editorial (AIE)
0.3	2004-11-10	Results (AIE)

1 Background

This is the report from the "LAP dance", i.e. the pointing operations bringing the LAP probes into shadow and sunlight alternatingly.

Goals of the LAP dance activity:

- Verify operations of both probes in sunlight and shadow
- Establish photelectron saturation current of the individual probes
- Get background data for estimating wake effects

Originally, the LAP dance was scheduled for September 29. However, the ITL for the operations did not include a command to turn LAP on. Consequently we were off during this operation, and no data were gathered. Thanks to good cooperation with ESOC, RSOC and the PIU team, a rerun was scheduled and exectuted on October 9, this time with a LAP on command added. This operations was fully succesful. Solar wind density at ACE position was around 3 - 5 cm^{-3} during the time of LAP operations (05:47 - 13:51), as can be seen in Figure 1.

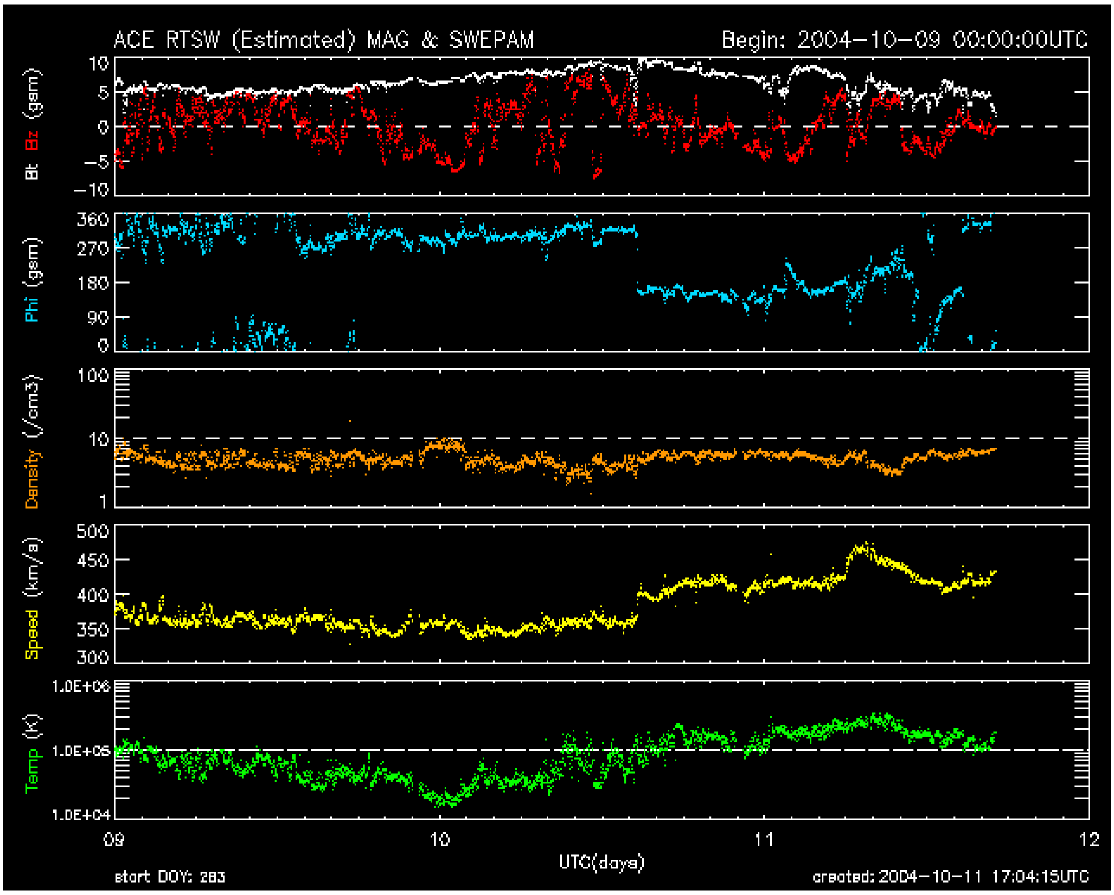

Figure 1. ACE data covering the day 2004-10-10 when the "LAP dance" was run.

2 Operations log

Information on RPC step numbers is not included since we used the ITL file directly.

Example probe sweeps are displayed in Figures 2 - 4.

Start UTC	End UTC	RP FCP	SID	Description	Notes	Pointing
041010 05:00	041010 06:02	804		OBCP Starts LAP in Default Burst Mode, Macro 0x204. Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	LAP started and booted software version 14, HK parameters ok. Macro checksum 0x5CA8 indicates intact flash memory. Temperature: (After –6 deg C correction) 20.1 deg C Macro 0x204 starts at: 05:03:06 Default burst mode sweeps starts at: 05:07:54	Start: P1 and P2 sunlit, though P2 is in wake. If0(P2) ≈ -70 nA Starts at default –30 degrees around –Y axis.
041010 06:02		399		LAP EndMacro	LAP ends execution of default burst mode sweeps	
041010 06:08		353		LAP Procedure starts Macro 0x204 same as above for LAP SL Mode.	Macro 0x204 starts at again at 06:08	Slew starts to +50 degrees around –Y axis at average rate 0.033 deg/sec. This gives (50-(-30))/0.033/60=40.4 min.
06:33						Data shows increase of P2 photoemission current and collected current starting about here. If0(P2) ≈ -75 nA
041010 06:48					Slew end	Data shows P1 completely in shadow at 06:48:42. Preceeding P1 sweep at 06:47:38 showed full photoemission current but much reduced electron collection, i.e. sunlight but wake. P2 in sunlight.
06:57						P2 current stabilizes after some time of increase.
041010 08:16					Slew start	Slew to +30 deg at average rate 0.033 deg/sec. This gives |30-50|/0.033/60=10.1 min
08:28:58						P1 comes into sunlight during this sweep. Photoemission current changes from -10 to -20 nA during downsweep, but stays constant at -20 nA during upsweep -- strange. In next sweep, it is stable around -80 nA as usual. Collected current not fully developed.
041010 08:32					Slew end ?	P1 and P2 both sunlit.
041010		399		LAP EndMacro	Macro 0x204 ends	

Start UTC	End UTC	RP FCP	SID	Description	Notes	Pointing
08:45						
041010 08:55	041010 09:50	351		LAP Procedure starts Macro 0x204 same as above for LAP LL Mode.		
041010 09:50		399		LAP EndMacro	Macro 0x204 ends	
041010 09:55		352		LAP Procedure starts Macro 0x204 same as above for LAP LS Mode.		
041010 09:55					Slew start	Slew to –30 deg at average rate 0.033 deg/sec. This gives |-30-30|/0.033/60=30.3 min
041010 10:22:34					Slew end	P2 into eclipse, P1 still in sunlight. P2 current has gone down smoothly from max 100 nA to max 35 nA before entering eclipse: clear wake signature.
041010 11:55:00					Slew start	Slew to 0 deg. At average rate 0.033 deg/sec. This gives 30/0.033/60=15.2 min
12:22:02						P2 into sunlight, P1 still sunlit.
041010 12:28:00					Slew end ? later than expected ?	P1 and P2 both sunlit.
041010 12:40		399		LAP EndMacro	Macro 0x204 ends	
041010 12:44:58		302		LAP Default normal mode	Normal mode is started to ensure that we do not overfill the S/C memory. Some gaps in data 22.4 min from 12:49:14 to 13:11:38	
041010 13:54:50				Last science data		
041010 14:00:00		806		OBCP RPC OFF (Last HK)	RPC off	

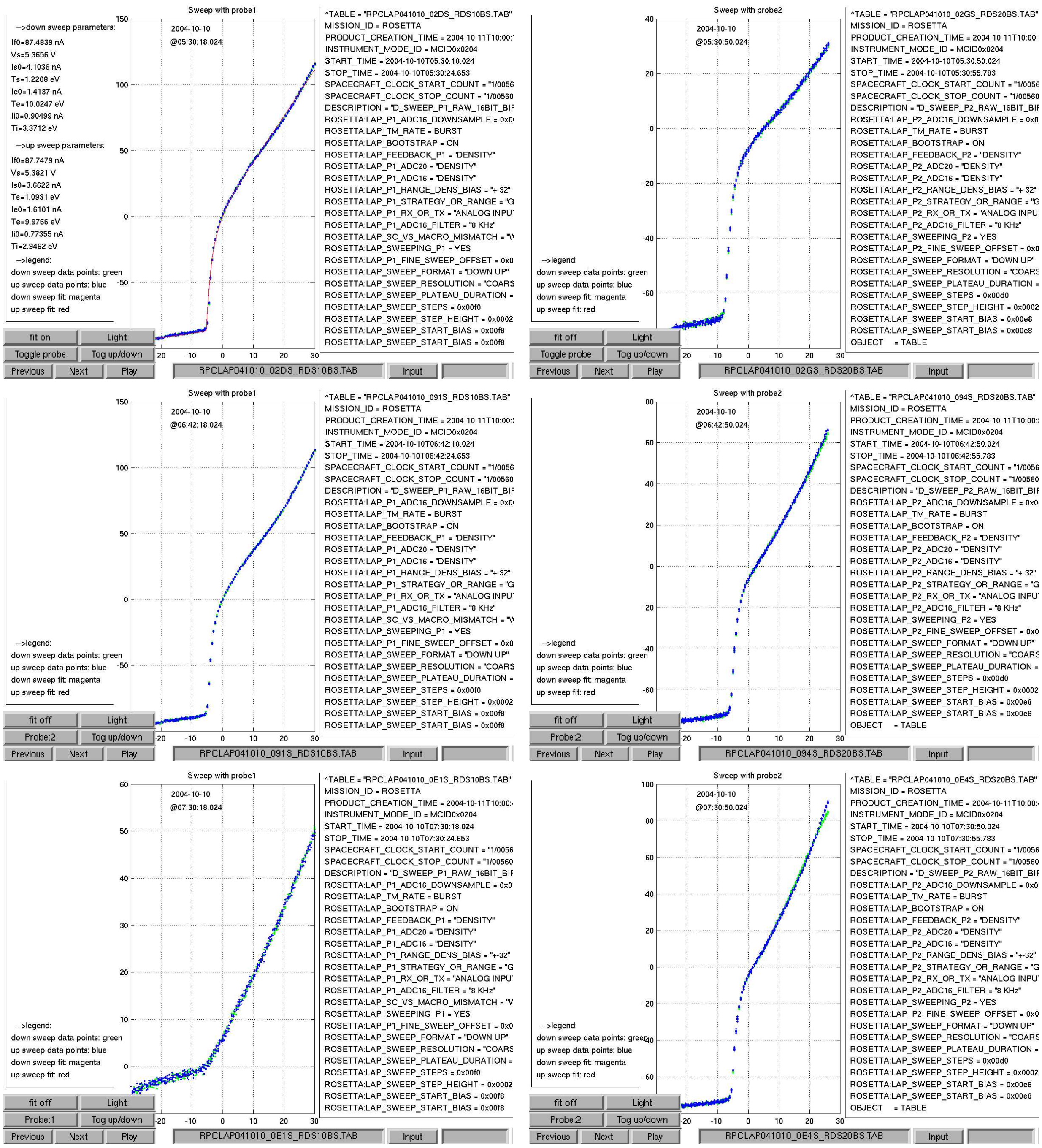

Figure 2. Sweeps on P1 (left column) and P1 (right) at three times during the LAP dance. *Top*: P1 and P2 both sunlit. *Middle:* A few minutes before P1 enters eclipse. *Bottom:* P1 in shadow, P2 still in sunlight. Continued in Figure 3, details on P1 eclipse entry in Figure 4.

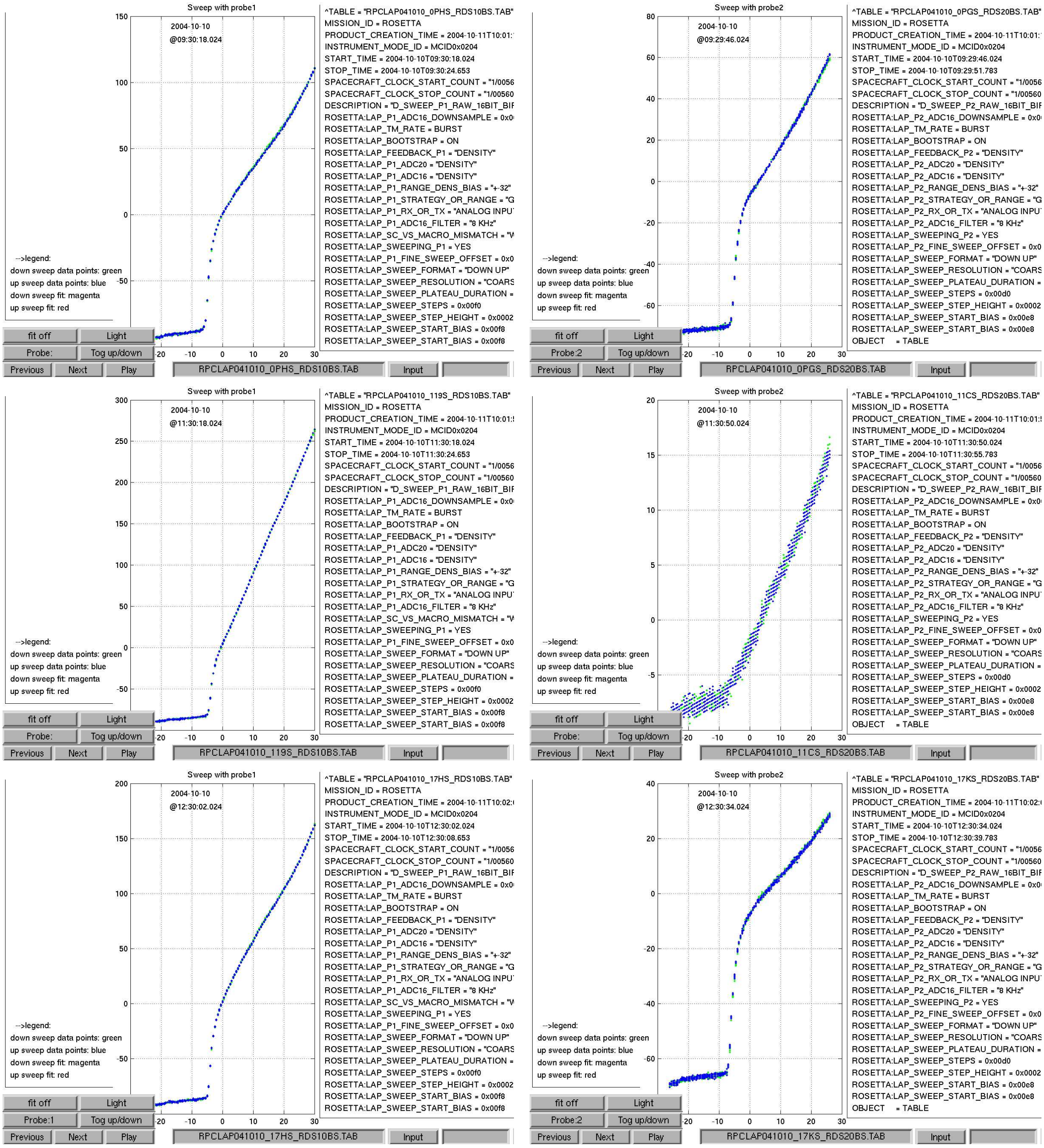

Figure 3. Sweeps on P1 (left column) and P1 (right) at three times during the LAP dance. *Top:* P1 and P2 both sunlit. *Middle:* P1 in sun, P2 in shadow. *Bottom:* Both probes sunlit.

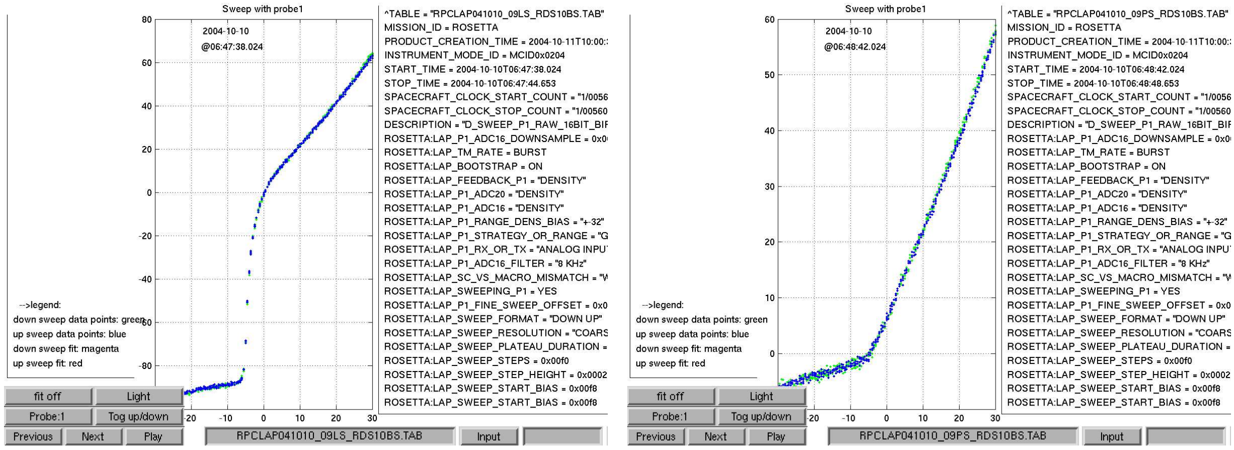

Figure 4. Sweeps from probe 1 just before and after entering eclipse.

3 Results

During this activity, each probe were at some time in sun and in shadow. This revealed several interesting phenomena, some of which are readily understood and some of which requires further investigation.

Some basic features can be seen directly in the subset of probe sweeps displayed in Figures 2 through 4. The photoemission behaves as expected when entering eclipse, i.e. disappears. It is also possible to trace a decrease of the electron collection current just before entering shadow. This is what we should expect from a wake around the spacecraft, which should have a certain opening angle. We could also expect a phenomenon of this kind for the spacecraft photoelectron cloud, which certainly should be denser on the sunlit side. Further investigation is needed to properly model the observed data.

Figure 5 shows the photoemission current estimated from the probe bias sweeps for the two LAP probes as a function of time during the LAP dance. Some basic features are readily observed. First, we can clearly see when probe 1 (blue-green curve) and probe 2 (red-black curve) goes into eclipse as a sudden drop in photoemission current. The different residual values of electron emission or ion collection for the two probes when in shadow could possibly be due to calibration issues. The strength of the increase in photoemission from P2 when and just before P1 goes into shadow at 6:50 is to some extent an artifact of the analysis routine and of changing ion current, and the dip seen in the P1 curve just before UT 13:00 is clearly spurious. However, that P2 is lower in photosaturation current than P1 is obvious directly from the sweeps. This could possibly be due to negative charging of spacecraft or lander structures in the vicinity of P2, but more likely also be due to contamination on the probe, perhaps from thruster firings. One should note that P2 has spent much less time in sunlight than has P1. It will be very interesting to see if this difference persists, though it has little or no impact on the scientific performance of the instrument.

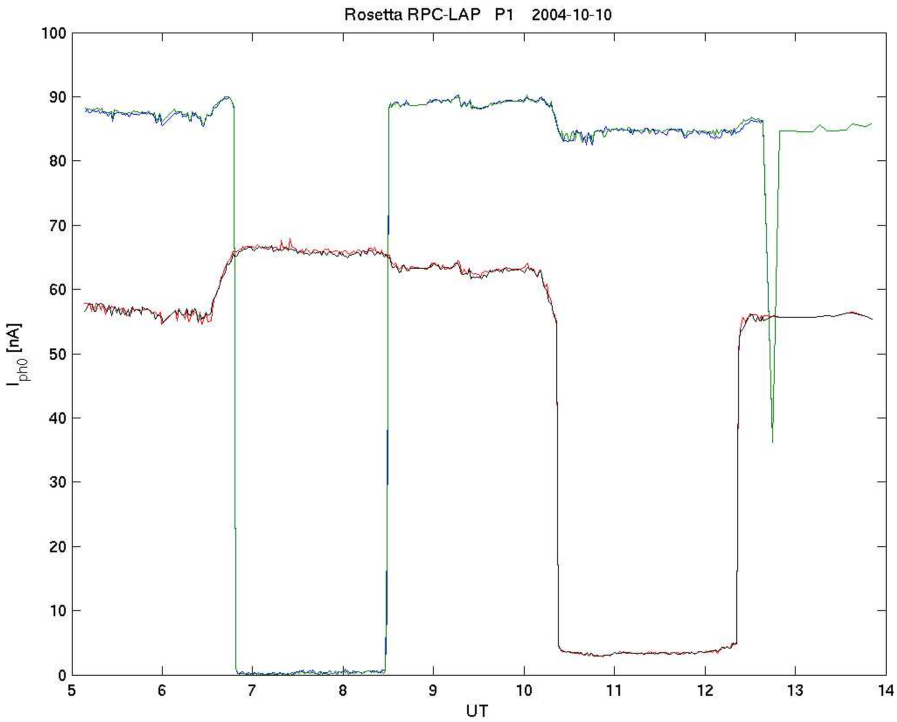

Figure 5. Photoemission saturation current (with a contribution from collected ions) derived from probe bias sweeps during the LAP dance. Some features in the curves are spurious, but the drastic drops in current when the probe goes into eclipse are clear, and also that P2 (red-black) has less photoemission than P1 (blue-green).

4 Conclusion

The LAP dance has provided a very good data set for investigation of the spacecraft environment. This set of probe bias sweeps at different rotations of the spacecraft will be valuable for example for separating out the real solar wind plasma signature from the collection of spacecraft photoelectrons. The integrity of the LAP instrument has also been verified in the sense that the broad features of the data are as expected, including the signatures of the probes operating in sunlight and shadow. All objectives of the exercise have been met.

RPC-LAP COMMISSIONING: FIRST ACTIVITIES

IRFU-ROS-CVPREP1
Version 1.0
2 April 2004

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Summary

RPC-LAP was succesfully started on the night March 17-18, 2004. This report summarizes the activities and anomalies observed during that night and the following, when we performed boom deployment. All LAP activities were succesful, though as we had to cut short the activities for investigation of the problem on the RPC redundant power supply, we have no measurements in any useful science mode. We have thus only verified the main hardware as yet, and can therefore only say very little about the scientific capacity of LAP.

LAP Commissioning Night One (March 17-18, 2004)

Activities

The tests this first night mainly considered the main commissioning of the PIU, verification of the data links and all internal functions of LAP and other subunits. All commands were sent and accepted, LDL normal and mixed mode was tested and LAP default burst science mode. During these tests LAP functioned nominally. A few observations were made during the night:

1. Science data gathered included voltage bias sweeps on both (undeployed) probes. Probe 1 (on the upper or MIP boom) showed very high current values, outside the ±10 uA measurement range of the instrument (Figure 1). The data look very similar to the data from 21 August 2003, when P1 was observed to be in contact with the MLI (Figure 2). At that time, a resistance from probe to ground through the MLI of around 400 kohms was observed. Tonight we found around 75 -- 150 kohm. We interpret the data as contact between probe and MLI.
2. Probe 2 (on the lower or MAG boom) showed nominal data (Figure 3).
3. We also did measurements at constant bias (zero volts). On P1 (the probe touching MLI), a strong signal close to 150 Hz is clearly visible in these data (Figure 4). Possible causes include mechanical vibration modulating the probe-MLI contact and a direct electrical signal (amplitude of a few mV, assuming 100 kohm resistance to ground through MLI). No signal is visible on P2.
4. Operations were halted following the redundant PIU power supply anomaly.

Anomalies

PIU Main side Commissioning

- In LAP Tm/Tc Check procedure RP_FCP_309 there are two verification errors, that has to be changed in future versions:

    1) Procedure expects software version 7, but real version is 11. After reset, the instrument indeed returns software version 11.
    2) As reading from flash memory will be done, the procedure turns off watchdog but verification is done for watchdog to be on. Again instrument returns correct value watchdog off.

- During LDL mode the LAP GSE lost synchronization, this was due to a decoding problem in the GSE software this has been corrected and verified.
- Sensor 1 (upper boom) touched MLI before deployment.

PIU Redundant Side Commissioning

- No LAP anomalies could be observed during redundant commissioning, instrument worked perfect for about 10 min.
- A procedure was added between step 0180 and 190 in the redundant commissioning plan, to put LAP into safe mode(Maintenance mode) RP_FCP_300 before memory services tests, but we never got that far before the redundant side crashed.

LAP Commissioning night two (March 18-19, 2004)

Activities

Due to the observed anomaly on the PIU redundant power supply during night one, the planned RPC activities were cut down to only include verification of all instruments and boom deployments. The LAP data from the boom deployment are summarized in Figure 5. A few observations were made during the night:

5. LAP was at first started without any science mode running. All seemed to work well.
6. For the boom deployment, LAP was run in a mode intended to provide close-to-continuous data at 60 S/s on both probes. Bias voltage was zero, in order to minimize currents in case of MLI contact (which indeed was observed, see notes from night one). However, we only got data from every second AQP, due to a bug in the macro. This means that truly continuous coverage of the boom deployment was not achieved.
7. Current change on P2 was very small during deployment. As P2 is in shadow and wake after as well as before deployment, this is quite reasonable, particularly given the zero bias level.
8. Before deployment, probe P1 was in contact with the MLI, drawing a small and varying current. This current changed from about -40 nA to -150 nA at the firing of the pyro for the other boom, but again decreased to a few tens of nA during the deployment of the other boom (Figure 5). This can be interpreted as the contact with the MLI being very sensitive to vibrations.
9. At the firing of the pyro for P1, the current to this probe was suddenly stabilized at around +10 nA (Figure 5). This is interpreted as due to MLI contact lost.
10. During P1 deployment, the current increased to +30 nA. Probe P2 drew a slightly higher current. As the bias is zero, no useful conclusions can be drawn from this, particularly as we have not calibrated for the offsets. Such calibrations have to wait for next commissioning slot (see below).
11. Due to the conservative RPC operations philosophy adopted for the time, no mode providing useful science data was run following the boom deployment: no sweeps, no non-zero constant-bias, no E-field mode, no internal offset calibrations. Neither have the LAP internal verification activities been completed. LAP is thus not yet commissioned: only the most basic hardware and software verifications have been done, and its scientific capabilities are not verified.

The LAP observations during boom deployment are summarized in Figure 6.

Anomalies

- RP-FCP-312 should have produced nearly continuous data thus 30s from each sensor every AQP using slow 20 bit ADC:s (60Hz). However due to an addition to the data format in the latest software version 11 we only got data every other AQP. This slipped through the analysis of ground test data. The solution to the problem is to reduce the number of samples acquired in each AQP by one in LAP Macro 0x205 (The LAP macro used in RP-FCP-312). The macro will then sample data every AQP as originally intended. To do this, we need to do a macro upload.

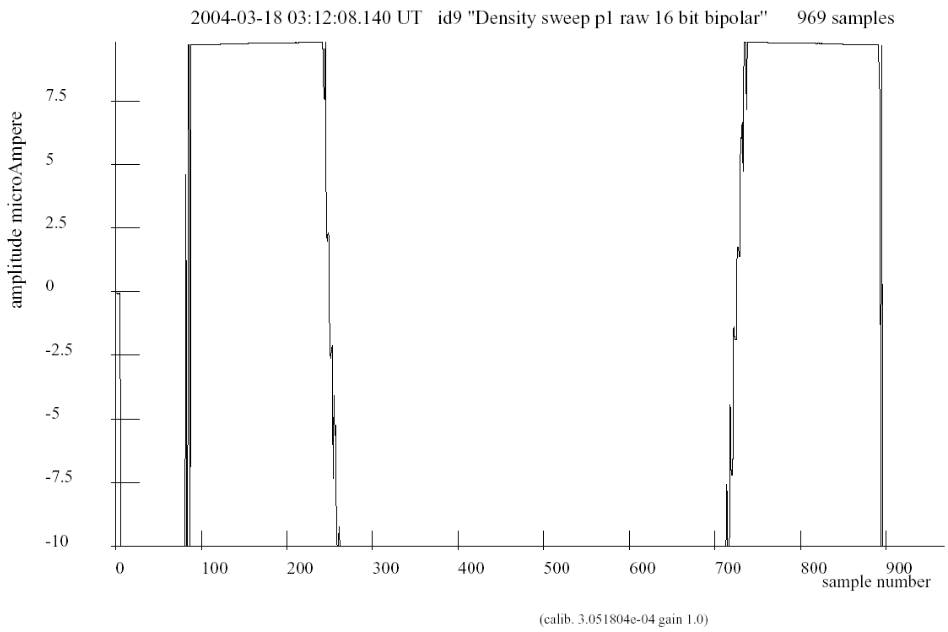

Figure 1. LAP probe bias sweep on probe 1 during night one (before deployment), showing rapidly changing current going out of the LAP 10 uA measurement range, attributed to the probe being in contact with MLI. The bias voltage steps are 0.5 V, so we see an effective resistance through the MLI of 2.5 V over 20 uA in this case, i.e. 125 kohm.

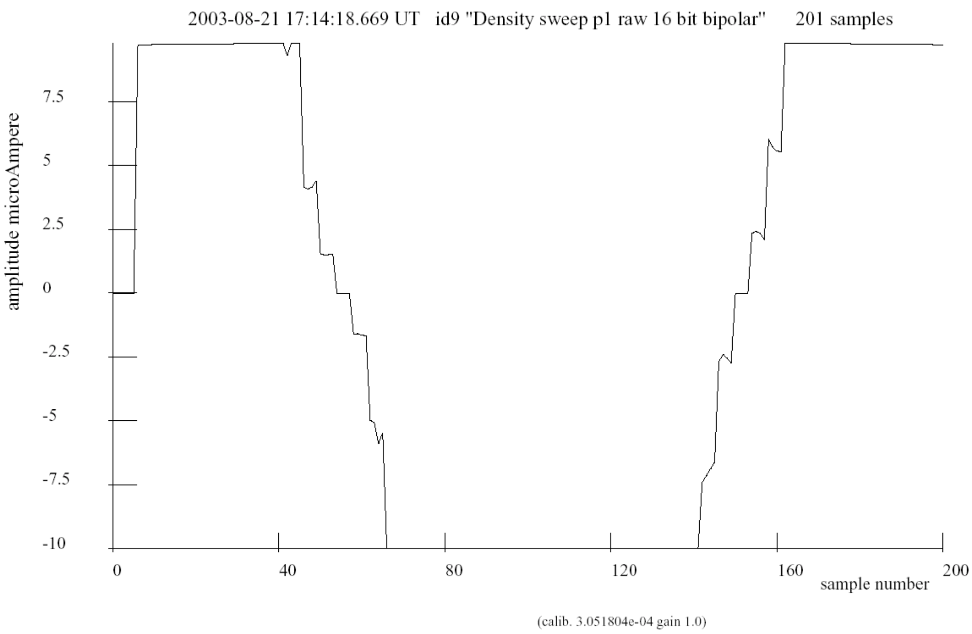

Figure 2. LAP probe bias sweep from 2003-08-21, when the MLI was observed to be in contact with the probe.

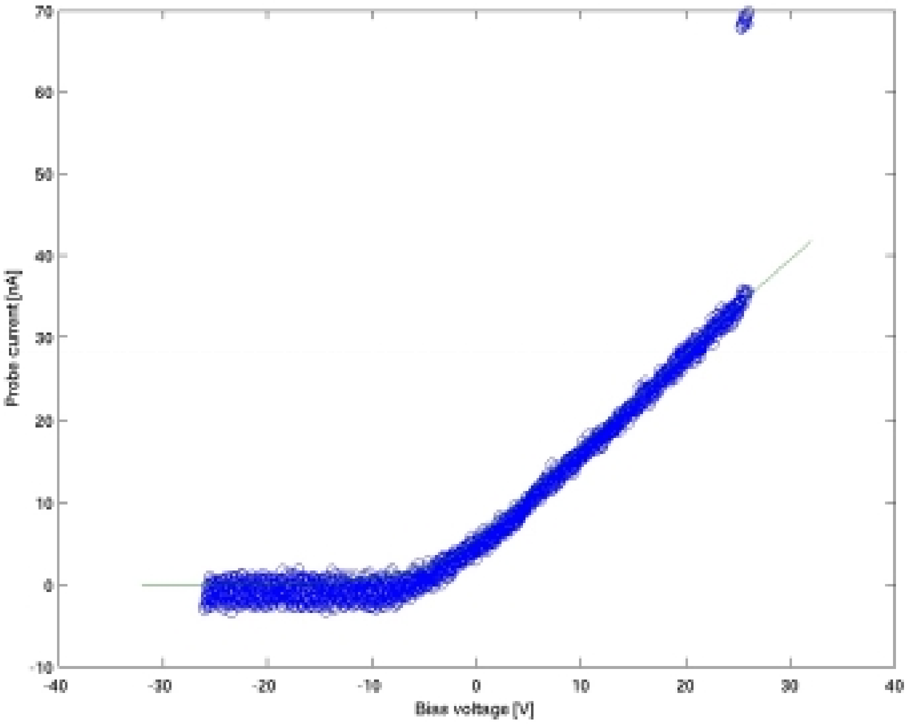

Figure 3. LAP probe bias sweep on probe 2, 2004-03-17 23:59:36.640. Data reduced using a preliminary correction algorithm. Solid line is theoretical probe curve for plasma density 0.12 cm^{-3} and electron temperature 5 eV, but as the boom is not deployed, this is certainly not a measure of the ambient plasma.

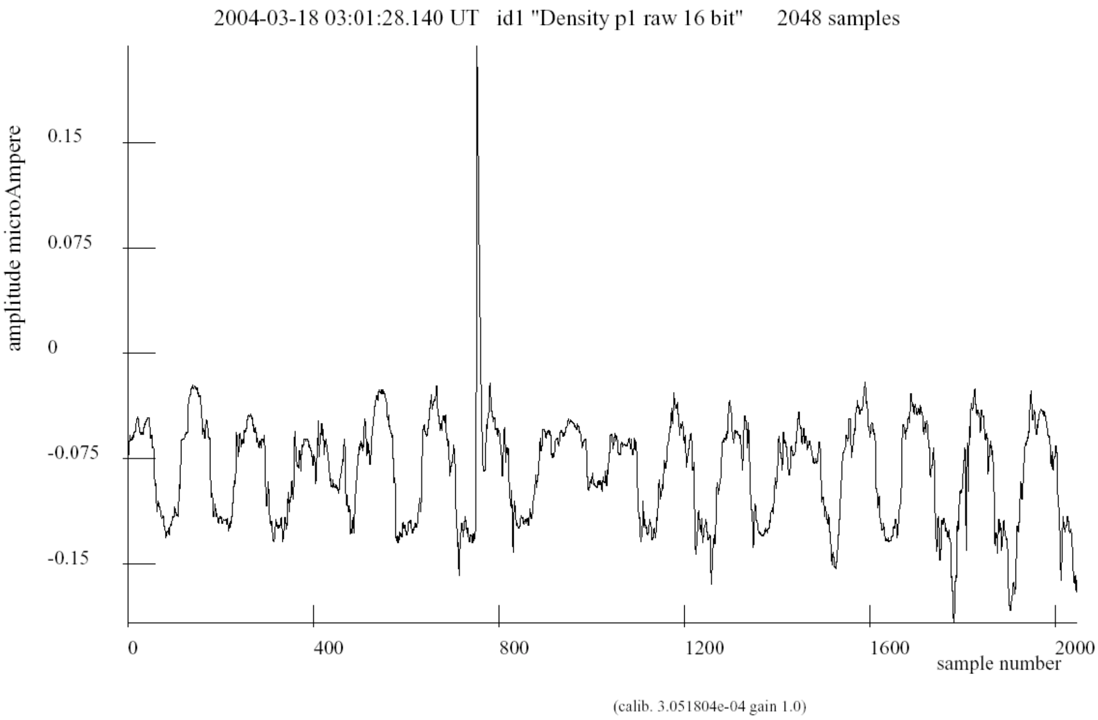

Figure 4. LAP constant bias data from P1 showing a strong signal at 150 Hz. The bias voltage is 0.0 V. Sampling frequency is 18750 Hz, so the plot covers 110 ms. The peak just before sample 800 is expected (due to a step in a bias voltage sweep).

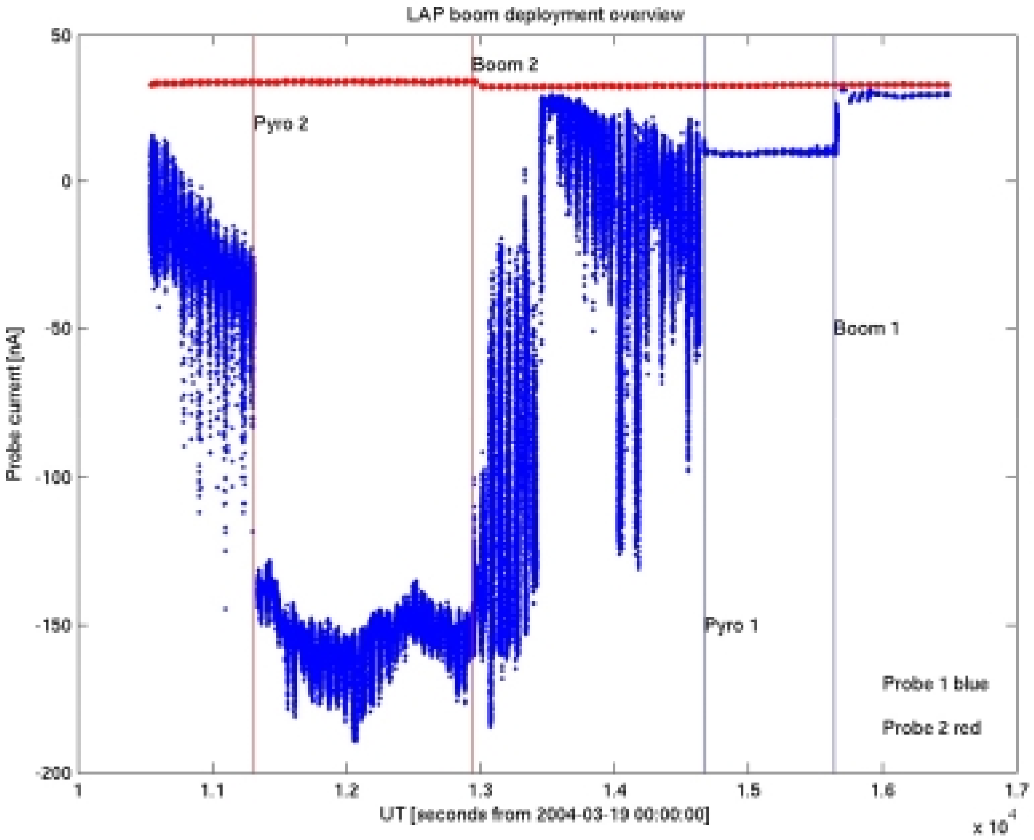

Figure 5. LAP boom deployment overview. Plotted quantity is current observed by the LAP probes (P1 blue, P2 red): positive currents means electrons attracted to the probe. The bias voltage was 0.00 V. The times for pyro firings and boom deployments are indicated by vertical lines. A commented version of thisplot is shown as Figure 6.

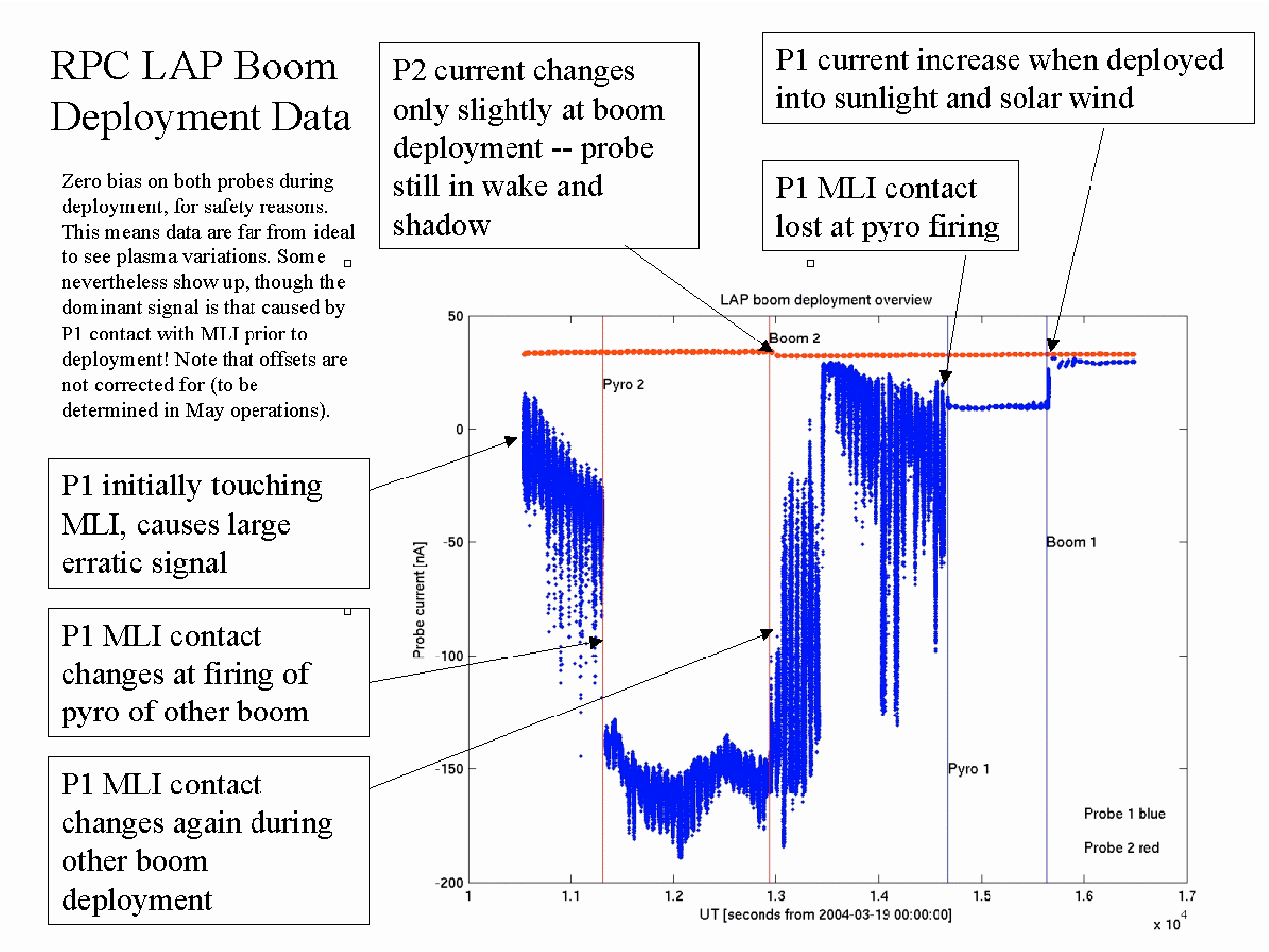

Figure 6. LAP boom deployment data summary.

RPC-LAP COMMISSIONING

PART 2

May 7 - 10, 2004

IRFU-ROS-CVPREP2
Version 1.0
10 June 2004

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1. Summary

In the second RPC commissioning slot, March 7-11, 2004, LAP made its first measurments in scientifically useful modes. All major operational modes were tested. The tests were succesful, verifying that the LAP measuremnts work as expected. In particular, the Langmuir probe bias sweeps are very clean. A few minor bugs in flight and ground software were discovered and need to be fixed, and some further testing is needed in other environments and with special pointing modes to further characterize the instrument, but in general the first results are fully satisfying. LAP has thus been verified to be a working instrument, and can be considered ready for use for scientific operations.

2. General

The first RPC commissioning slot, CVP-1, ended directly after boom deployment, in order to investigate the failure of the redundant power supply thoroughly before containing. For LAP, the first really useful measurements therefore was left for the second commissioning slot in May 2004, CVP-2, which is the subject of this report. The "LAP dance", i.e. the pointing to get all illumination combinations on the probes, is deferred to the commissioning slot in September-October (CVP-3).

The solar wind conditions, shown in Figure 1 as observed by the Advanced Composition Explorer spacecraft, were unfavorable to LAP during all CVP-2, with plasma density below 3 cm^{-3} most of the time. This means that the possibilities to observe the natural plasma in the LAP probe sweeps were limited.

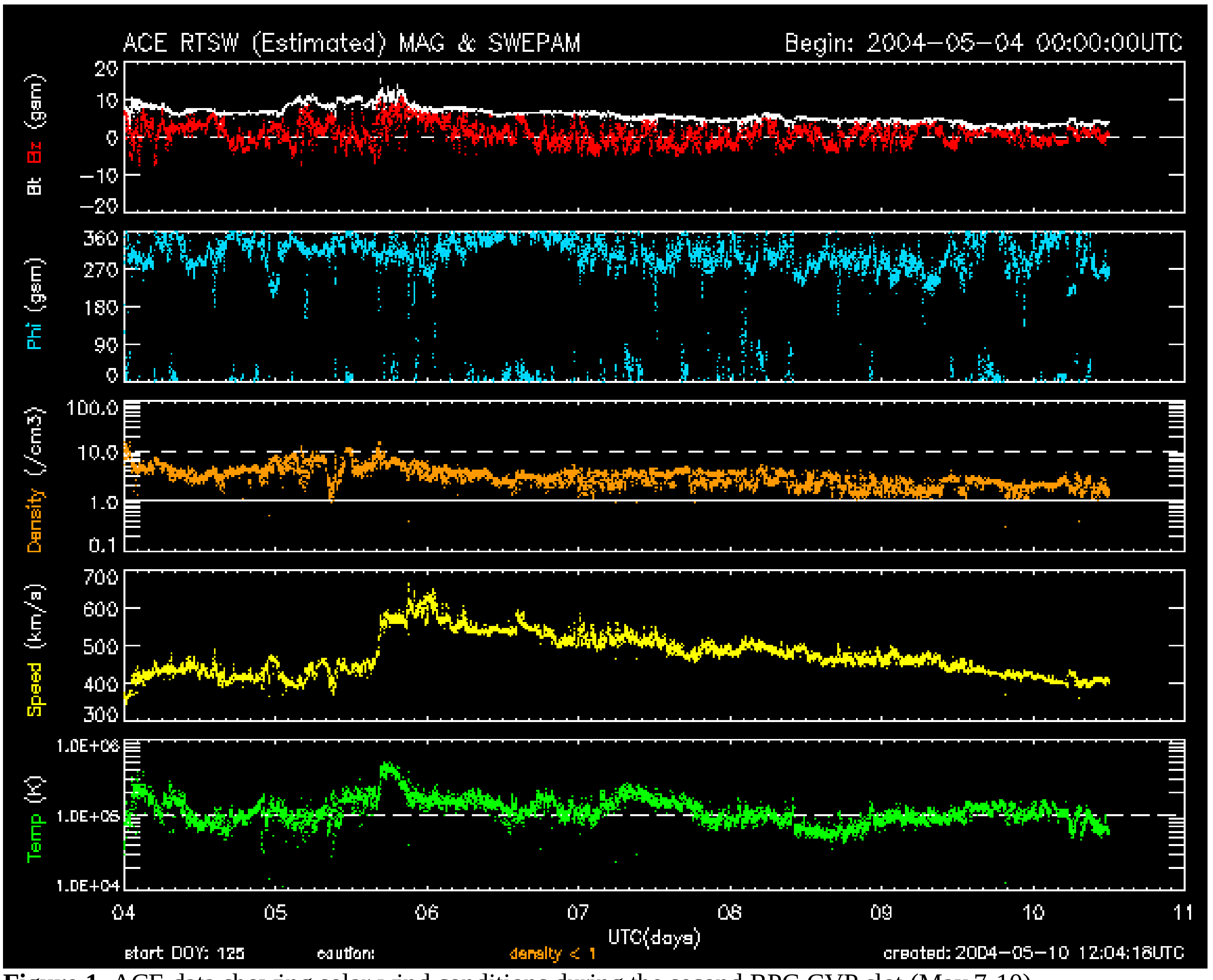

Figure 1. ACE data showing solar wind conditions during the second RPC CVP slot (May 7-10).

3. Data examples

Sweeping the bias voltage and measuring the resulting probe current is one of the major operational modes of LAP. In the operations in this commissioning slot, more 400 such probe sweeps were acquired on both probes. An example, fully typical, is shown in Figure 2. The probe bias voltage was varied from +30 V to -30 V in steps of 0.5 V, and then back to + 30 V again. Green and blue dots mark the measurement during the downward and upward parts of the sweep, respectively, and red and magenta curves are results of an automatic model fit routine, working on ground. Things to note:

- The blue and green points coincide almost exactly: there is very little noise in the data.
- The automatic analysis routine (working on ground) achieves a very good fit.
- For negative bias, the current is dominated by photoemission, as is to be expected.
- For positive bias, the collected current is dominated by photoelectrons from the spacecraft. This is also expected for the low density solar wind.
- The position of the knee in the curve is very clear, enabling unambiguous determination of the spacecraft potential (7.6 V here).
- The fit routine distinguishes a small contribution from actual plasma electrons, with a random current of 0.5 to 0.7 nA and a temperature of 5 to 6 eV. These are very reasonable values, and values of the same order are indeed derived from all probe sweeps. It is possible that these values actually reflects the real plasma even in this very tenuous solar wind, though this must be further modelled and compared to measurements in denser plasmas.
- The origin of the slope of the curve on the negative bias side is not yet clear.

All P1 sweeps look similar to this one. Another sweep example, only spanning ±12 V, can be seen in Figure 5. The bias voltage from all sweeps needs to be corrected for internal offsets, determined by onboard calibration (Figure 4). The bias sweeps from P2, which is in shadow and wake (Figure 6) have not yet been analysed in detail, but show very small currents (few nA). Full comparisons of the two probes can be done in the autumn CVP slot, when both probes will experience sun and shadow during some part of the time.

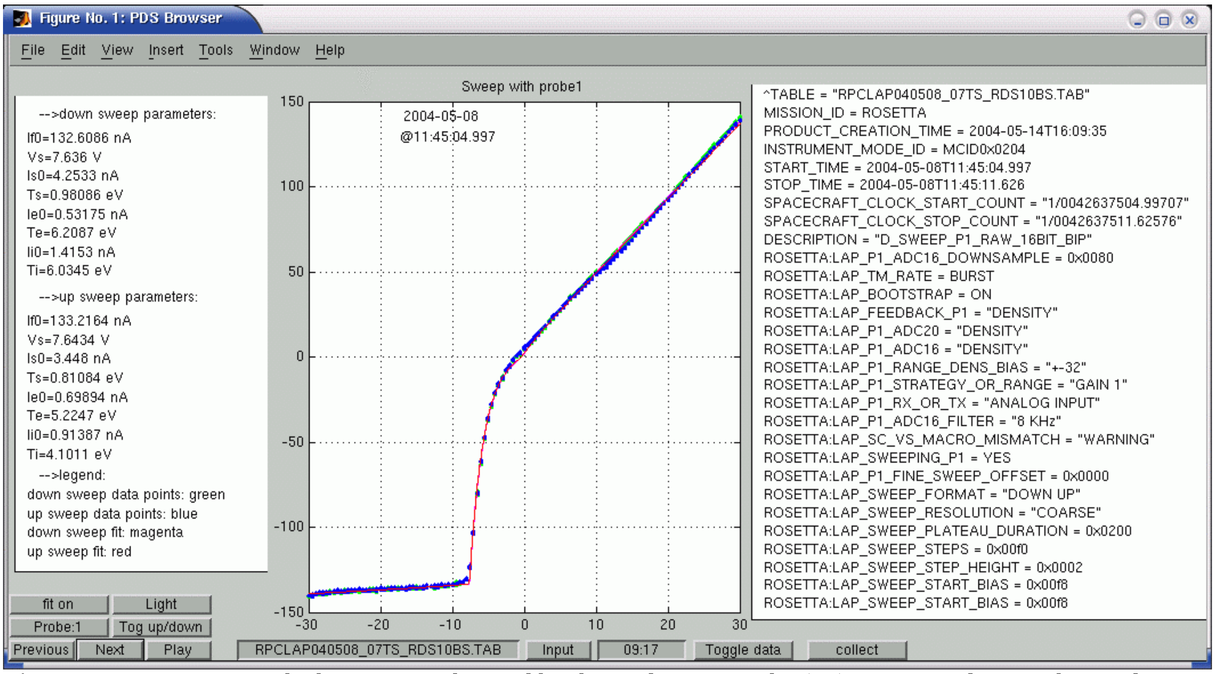

Figure 2. A Langmuir probe bias sweep obtained by the sunlit LAP probe (P1). Horizontal axis is bias voltage in volts, vertical axis is probe current in nA. Points are measured data, curves are model fit results, with colour coding and fit parameters given in the text panel at left. The text panel at right gives information from the PDS file header for the sweep, describing instrument settings and other relevant information.

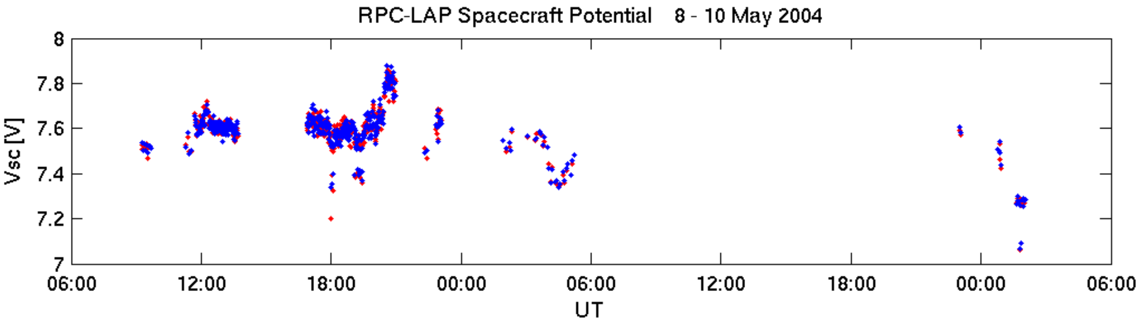

Figure 3. Spacecraft potential derived from probe 1 bias voltage sweeps. This potential is expected to contravary with the plasma density, i.e. higher V_{sc} means lower plasma density.

One of the parameters derived from the sweeps is clearly physically meaningful even in this tenuous solar wind. In Figure 3, we have plotted the spacecraft potential as a function of time for all the probe 1 bias voltage sweeps in this CVP slot. Though there is no independent density measurement to compare to, the variations seen are very likely to reflect real density variations in the plasma. This will need to be verified by operations in denser plasmas during e.g. the Earth flybys.

It is clear that the bias voltage sweep mode works very well, producing extremely clean data. This mode can be considered fully verified.

In addition to bias sweeps, LAP was also operated in fixed-bias modes, both in voltage bias mode (density flucutation measurement) and current bias mode (electric field and s/c potential measurment). Data examples are found in Figure 7. These data also look fine, with noise limited to discretization noise and a few very weak peaks showing up in the spectra, though detailed analysis remains to be done. The transmitter of the LAP propagation experiment was also turned on for some time, and also worked well.

4. Activities

4.1 First pass (May 7-8, 2004)

RPC step	Start UTC	End UTC	FCP	Macro	Description	Notes
0050	040507 21:15		031		LAP on, boots s/w version 4 from EEPROM	RPC current increase 51 mA (seems to be the resolution). S/w version 4 verified. Op amp temp 32 C (PIU had 26 C at turnon).
0080	21:22		300		LAP into safe mode. Needed for memory services testing.	Cannot be verified in TM.
0110	22:40	23:35	308		LAP memory service test. Dumps macro 0x101 to TM and loads a dummy patch (actually a list of numbers 1, 2, 3, 4, …) to test that memory dumping and patching both works.	Memory services did not work with this version of PIU FSW. Rerun using PIU PROM FSW (as opposed to EEPROM) in third pass.
0210	01:12	01:50	310	0x105 0x104	LAP calibration. First 12 mins of sweeping over internal resistor (±12 V over 5.1 Mohm), then open sweeps. Reprogrammed from SVT-3, where a bug was discovered.	OK. Open probe sweeps (0x104) determined the offsets (Figure 4). At first glance, P1 and P2 sweeps over 5.1 Mohm (0x105) also look nice. The succesful execution verifies the reprogramming after SVT-3.
0230	01:50	02:15	334	0x404	Digital filter tests (ADC20). EE, bias 0. Simple MA downsampling 30x.	Data make sense, but the GSE cannot unpack it correctly: P1 and P2 data are interleaved, and the four LS bits are left at the end. Wrong data ID code (bug in macro). In addition, about a third of the TM is filled with zeroes.
0260			335		Digital filter tests (ADC16). EE, bias 0. Downsampling 2, 4, 8 & 16 times using our real 32 coefficient FIR filters.	These procedures was defered to out of pass. However, none of these data ended up on the s/c SSM, because of a limit of 10 MB for RPC being passed, apparently causing overwriting of old data. However we seem to have all HK from this period. Both procedures rerun in second out-of-pass.
0290			316		LAP NN test. NN, ADC20. Stepping bias on both probes simultaneously: -32, -24. -16, -8, +8, 16, 24, 32 V. The macro bug discovered in CVP-1 will mean every 2nd AQP will be missing.	

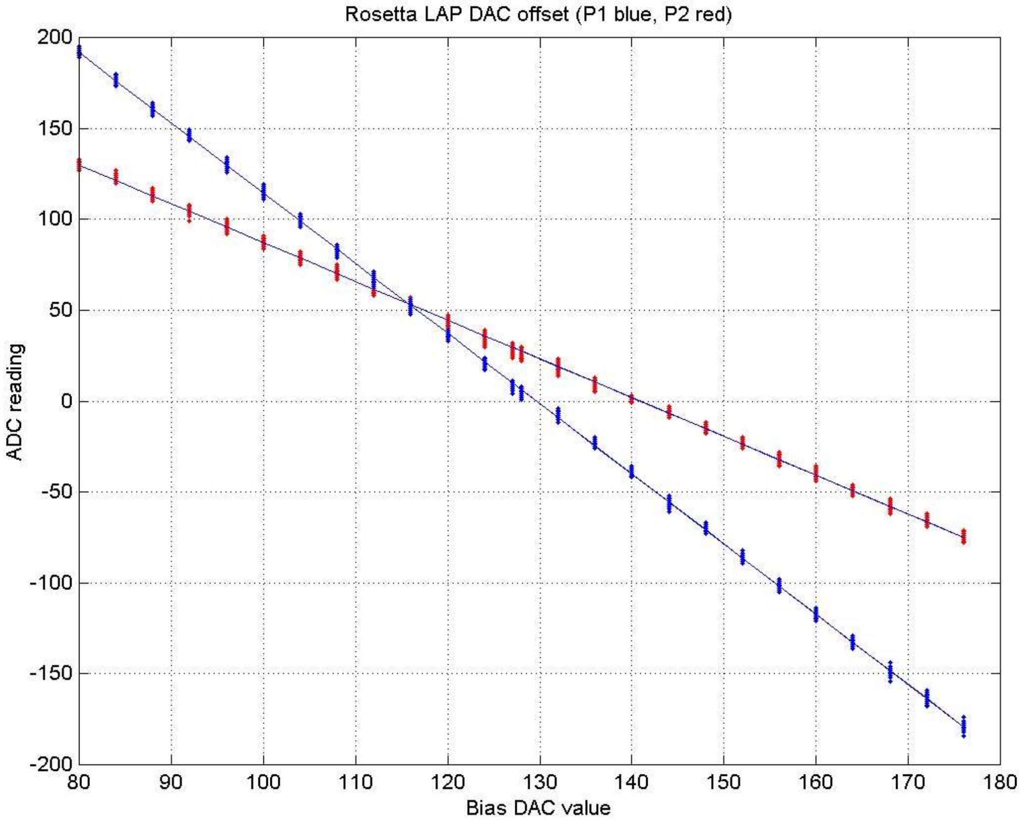

Figure 4. LAP internal offsets determined by doing open sweeps, i.e. sweeps connected neither to the probes nor to the internal 5.1 Mohm resistor, in step 0210 during the first pass. Linear fits: P1 y = -500.52 - 3.86 x, P2 y = 300.46 -2.133 x.

4.2 First out of pass (May 8, 2004)

RPC step	Start UT	End UT	FCP	Macro	Description	Notes
0020	09:07:44		317	0x300	LAP EE test. BM, ADC 20. Bias steps: +44, +33, +22, +11, -11, -22, -33, -44 nA.	Partly lost due to the loss of out-of-pass data by the 10 MB limit. Rerun in second out-of-pass. P2 saturates at -40 V for the most negative biases.
0040	09:15:12	09:39:44	318	0x203	LAP NE test. Vb sweeps on P1, E bias 0 on P2.	OK. Preliminary analysis of a probe sweep (Figure 5) shows very clean data. Clear spikes in E2 when N1 start sweeping. Instrumental or physical?
0060	09:46:08	10:10:40	319	0x301	LAP EN test. As the NE test but P1-P2 reversed.	OK.
0080	10:17:36	10:34:40	330	0x501	Log compression. NN, sweeps alternatively on P1/P2, fix bias 0 on the other.	OK. Data looks reasonable, though unpacking not implemented in EGSE or PDS.
0110	10:42:08 10:50:08 10:58:08 11:06:08 11:18:24	10:46:24 10:54:24 11:02:24	321	0x304 0x305 0x306 0x307 0x202	Fine/coarse NN sweeps (alternatingly sweeping P1/P2, fix bias 0 on the other) followed by default normal (0x202, NN, always sweeping). The fine sweep macros 0x304 - 0x307 do down/up sweeps as follows: 0x304: -1.77 - -2.46 V 0x305: 0.519 - -0.171 V 0x306: 2.8 - 2.11 V 0x307: 5.07 - 4.38 V	OK. The fine sweeps look quite useless, as they should in a warm and tenuous plasma, but all seems to have worked. Coarse sweeps also look fine.

0130	11:42:56	13:41:20	351	0x204	LAP LL mode (constructed for the LAP dance, where LL means both probes in light -- they are not so here). BM, alternating sweeps on P1/P2, fix bias +20 V on the other.	OK. Noise level at low frequency same on P1 & P2, but P1 rolls of faster, giving lower noise at higher frequencies. Noise is around 10 TM (2 nA) units peak-to-peak. Peaks: 180 Hz, some 6 dB in P2 and lower in P1. 8.775 kHz, persistent for a long time. Sweeps look fine. When replaying the data in 040511, the GSE showed very strange data and crashed at 12:11:44. However when replaying the data from the DDS the problem disappeared. So this problem is GSE related, probably the data was streamed to fast. The noise reached the full range, ±32768. Probably a GSE problem.
0180	13:47:12	15:17:20	360	0x302	LAP in passive mode. NE, 10 V and 0 nA bias, BM. ADC16, 2048 samples. MIP Tx should start around 14:47.	OK. When all passive, the noise level is the same as in step 0130. The 180 Hz peak is still there. Signal at very low frequency, say a few Hz, so that only a part of the wave is seen in the records. When browsing the spectra, we can find no change in noise level or any spectral peaks when MIP are transmitting, presumably after 14:47. It thus seems we have no interference from MIP when not in LDL. HK is missing due to the 10 MB SSM limit problem.
0240	 15:24:16 15:28:00 15:32:48 15:36:00 15:39:12 15:44:00	 15:27:28 15:31:12 15:34:24 15:37:36 15:42:24	362	 0x106 0x107 0x100 0x101 0x102 0x103	LAP in active mode (NN). Tx1 1 kHz, Rx2 Tx2 1 kHz, Rx1 Tx1 5 kHz, Rx 2 Tx2 5 kHz, Rx 1 Tx1 6.7 kHz, Rx 2 Tx2 6.7 kHz, Rx 1	Test OK, bug at end. Received signal are pulses rather than square wave, i.e. derivative of square wave. Transmission was not turned off at end of test. LAP was left transmitting at 6.7 kHz. This is pure miscommanding, not an instrument problem. All subsequent data are therefore contaminated.

0260	16:52:48		361	0x204	LAP sweep i/f. This is just default burst science mode, i.e. NN in BM, sweeps alternatingly on P1/P2, bias 20 V on the other.	Worked OK, but data contaminated by continued Tx.
0290			303	0x204	LAP default burst. NN in BM, sweeps alternatingly on P1/P2, bias 0 V on the other.	Worked OK, but data contaminated by continued Tx.

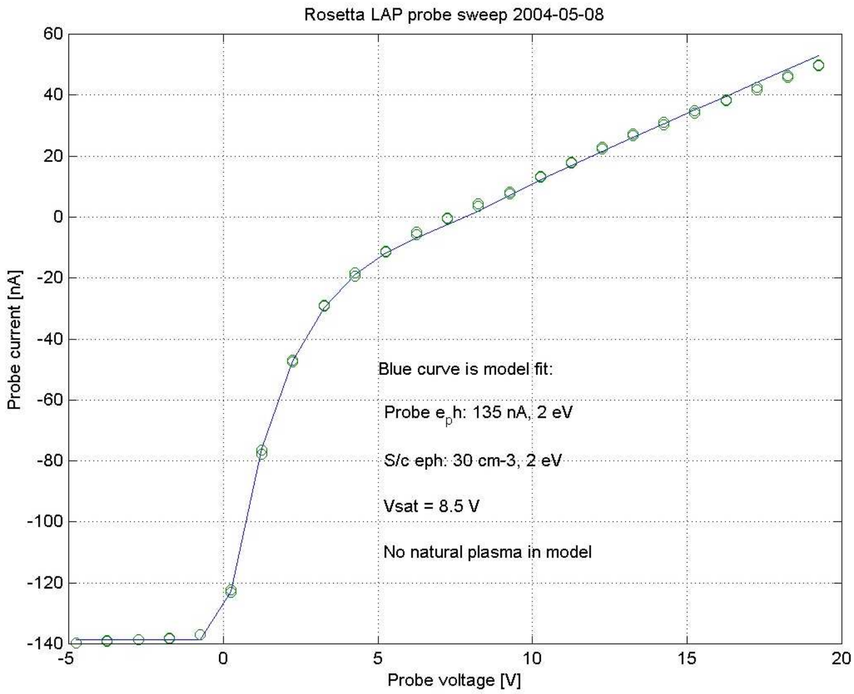

Figure 5. A LAP P1 (sunlight) probe bias voltage sweep obtained during the out-of pass NE test (step 0040 in the first out-of-pass). The data are extremely clean, with no detectable hysteresis despite small currents. In this analysis, no natural plasma has been assumed, which should be a good approximation considering the very tenuous solar wind conditions (1 - 4 cm-3 according to ACE). Internal offsets, obtained from the in-flight calibration data in Figure 4, have been removed. More detailed analysis of a probe sweep is shown in Figure 2.

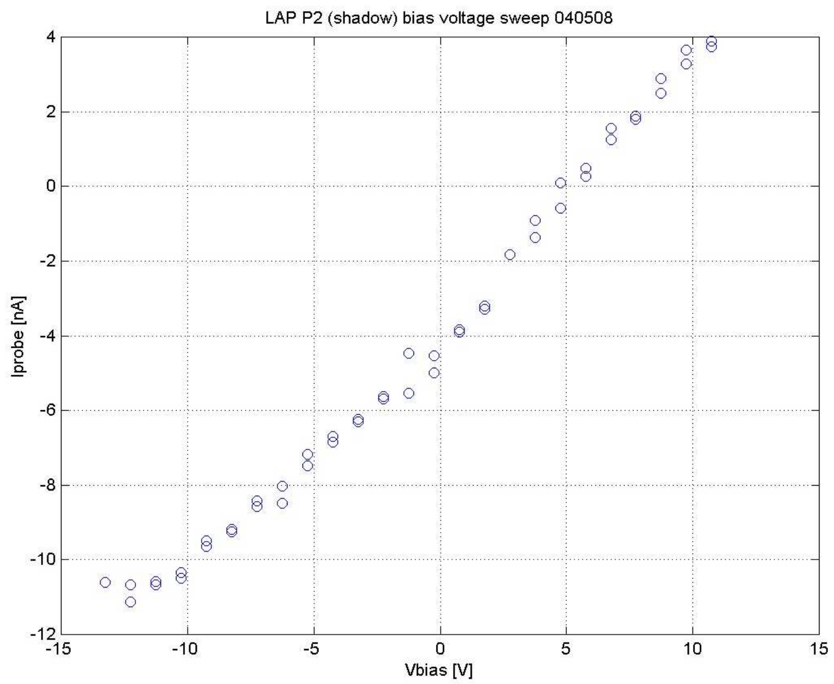

Figure 6. A LAP P2 (shadow) probe bias voltage sweep ontained during the out-of-pass EN test (step 0050 in the first out of pass). The linear behaviour through I = 0 indicates that the offsets determined from the calibration in the first pass, which have been corrected for in this plot, do not apply or are imperfectly handled.

4.3 Second pass (May 8-9, 2004)

RPC step	Start UT	End UT	FCP	Macro	Description	Notes
	20.59:12					Missing science only HK, this continues until 21:40:00
0000	21:06:08		891	0x200 ?	Mixed LDL, BM?	Only HK received..
0100 0110 0120 0130 0140	21:33:20 21:49:20 22:19:12		804	0x202 0x201 0x201 0x202	OBCP tests. 0x202 = default normal mode (alternating sweeps/fix bias NN), 0x201 = default minimum mode	LAP still transmitting at 6.7 kHz, contaminating all data. 21:40:00 Science data reappears. The time intervals for 0x201 were too short for any minimum mode science data to arrive. This is because the test mainly was to see that the OBCPs worked. Step 140 also known as 2nd step 130 due to a typo in the RPC plan. LAP quiet in step 140, i.e. no data.
	22:51:12 22:58:00			0x204	Tx stopped by command.	This stopped the 6.7 kHz transmission. We went to default burst science mode a few minutes before. HK says first 0x204 is 22:51:44, but science data shows this is not true.
0210	23:25:52		901	0x200	Normal LDL. N bias 0 on P1, MIP using P2.	Muddled commanding. At first, we did not get any data as we were by mistake put into "quiet mode", which means PIU stopped our data. This was fixed by a PIU command, but no EndMacro was sent to LAP before starting LDL mode. Hence, BM data were transmitted in NM, putting LDL on hold, which it would have been until all data had been emptied in NM. To fix this, LAP was put to BM.
0220		00:43:12	904	0x200	LDL normal Tx test. We stay as in step 0210: FCP 904 only concerns MIP.	OK. Disturbance from MIP clear.

0240	00:54:24		902	0x200	Mixed LDL. N bias 0 on P1, MIP using P2.	OK. Clear disturbances from MIP, looking like in normal LDL. Varying disturbance levels seen until 01:05:04, where it disappears. This test was done with the generic macro 0x202. Ops like this should use the fixed macros in banks 567, but this means OBCPs should be upgraded. The generic macros are not transparent to PDS s/w and should be avoided.
0250			905	0x200	Mixed LDL Tx level test. N bias 0 on P1, MIP using P2. We run as in 0240	OK. Varying disturbance levels seen until 01:05:04, where it disappears.
0260	01:24:48		903		LDL off.	
	01:26:56	01:45:36		0x200		We in LDL again, but no MIP signals seen?
	01:55:44	02:08:32		0x202	Default normal.	OK. When EndMacro is sent, this is not reflected in HK. It should be seen that execution stop. Last HK 02:17:36.

4.4 Second out-of-pass (May 9, 2004)

The timeline for this was revised. See RPC_CVP_Plan_2_5.xls09/05/2004 by Chris Lee. Everything run about 5 minutes earlier than said in that xls.

RPC step	Start UT	End UT	FCP	Macro	Description	Notes
0000		02:21:20	901	0x202	Default normal.	OK. Noise levels as before, sweeps look fine.
0040	02:29:20		335	0x400 0x401 0x402 0x403	LAP digital filter tests A16.	OK. Downsampling seems to work fine. 180 Hz peak remains clearly.
0070	02:53:52	03:02:56	316	0x205	LAP NN test. 20 bit data, only every second AQP filled due to bug in macro. Bias voltage steps: 0, -32, -24, -16, -8, 8, 16, 24,32.	OK. First bias step captured in data 02:54:24. Data looks OK but offsets must be corrected for.
	03:04:00	05:12:32		0x202	Default NM. Started at end of NN test.	OK.
0100	05:19:28	07:18:24	317	0x300	LAP EE test.	OK. P2 (shadowed) saturates at +44 nA and all negative Ib values. Otherwise, P1 and P2 data look very similar, except that P2 levels are a factor around 6 higher.
0150	09:01:52	13:04:00	901	0x200	Normal LDL.	OK. High MIP disturbance level, as expected.
0190	13:05:04	17:00:48	902	0x200	Mixed LDL	OK. Data checked until 15:47:12. During this period, there is no visible disturbance from MIP, in contrast to the normal LDL data above, and in contrast to the mixed LDL in third pass. Can it be that mixed LDL only works well when commanded from OBCP, or even generic macro in OBCP? Did MIP actually work?
0210	17:44:00	18:19:12		0x303	EE, 18 kS/s on both.	OK. 18:05:52 strange discontinuity on P2, from -6 V to 0 V. Also seen in P1 data, looks like GSE is mixing P1 and P2 data. Data examples in Figure 7. Above problem is not present in the replay of DDS data. It is therefore related to the GSE and it is probably caused by to high streaming rates.
0220	18:24:00	18:53:52		0x405	NN, 18 kS/s on both.	OK. Only noise in data. Data examples in Figure 7.

0230				0x201	Default MM. Downsampled 20 bit data.	No data? Apparently, this was not run as intended. This should have been the only minimum mode data we took in CVP-2.

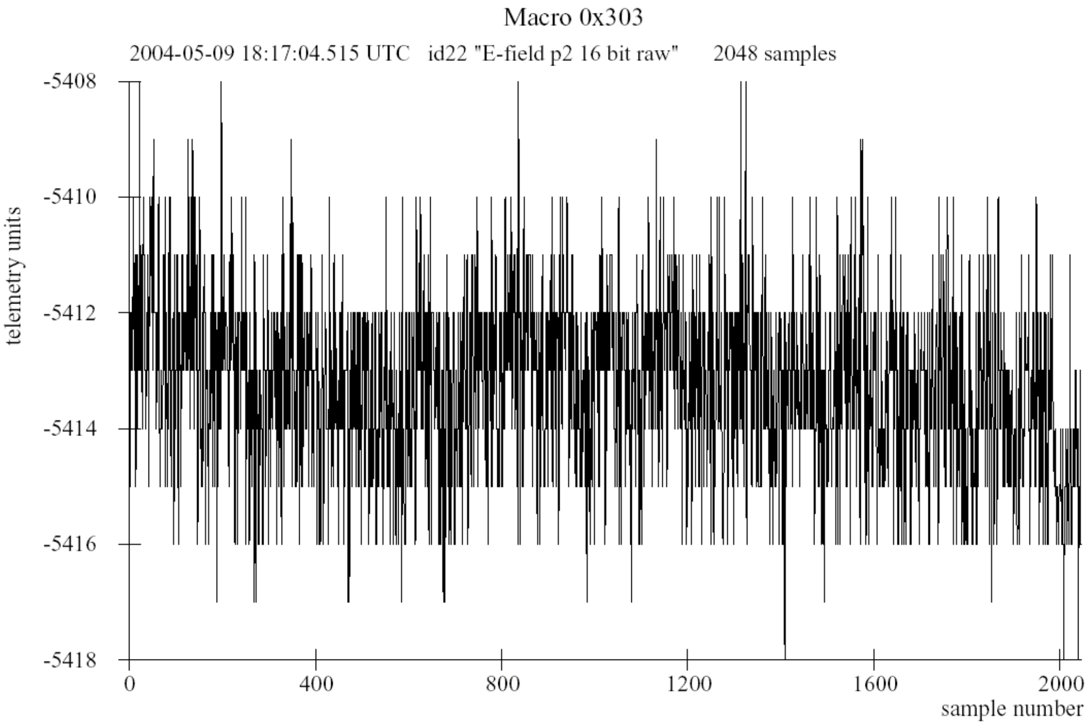

Figure 7a. The noise level in the voltage measured on probe 1. Only bit level noise is seen. Calibration factor is 1.22 mV/TM unit. A weak low-frequency signal can be seen. Sampling frequency is 18750 Hz, low-pass filtered at 8 kHz. CHECK!

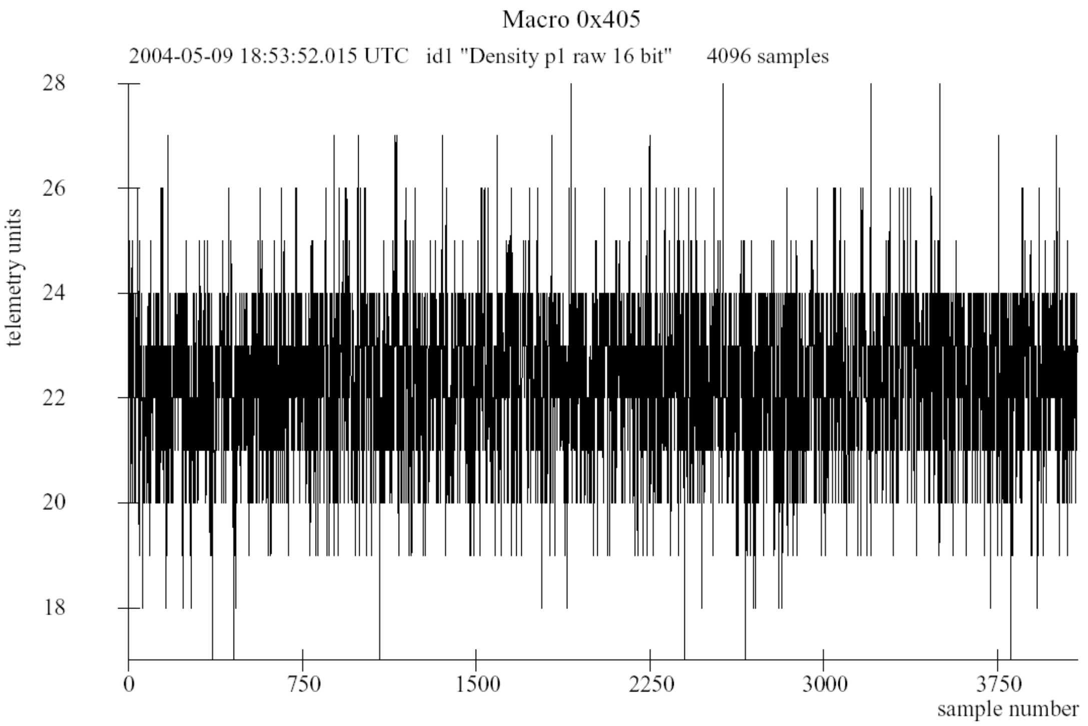

Figure 7b. The noise level in the current measured on probe 1. Only bit level noise is seen. Calibration factor is 0.305 nA/TM unit. Sampling frequency is 18750 Hz, low-pass filtered at 8 kHz. CHECK!

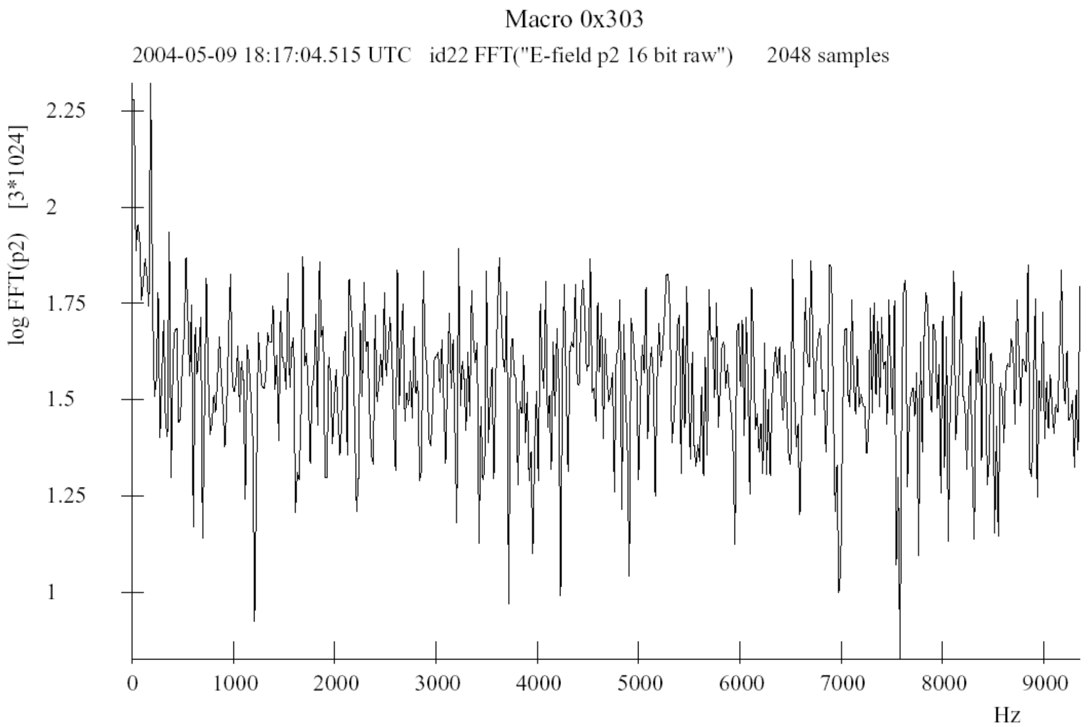

Figure 7c. Spectrum of the signal in Figure 7a. The peak at 180 Hz is the only persistent feature rising above the white noise.

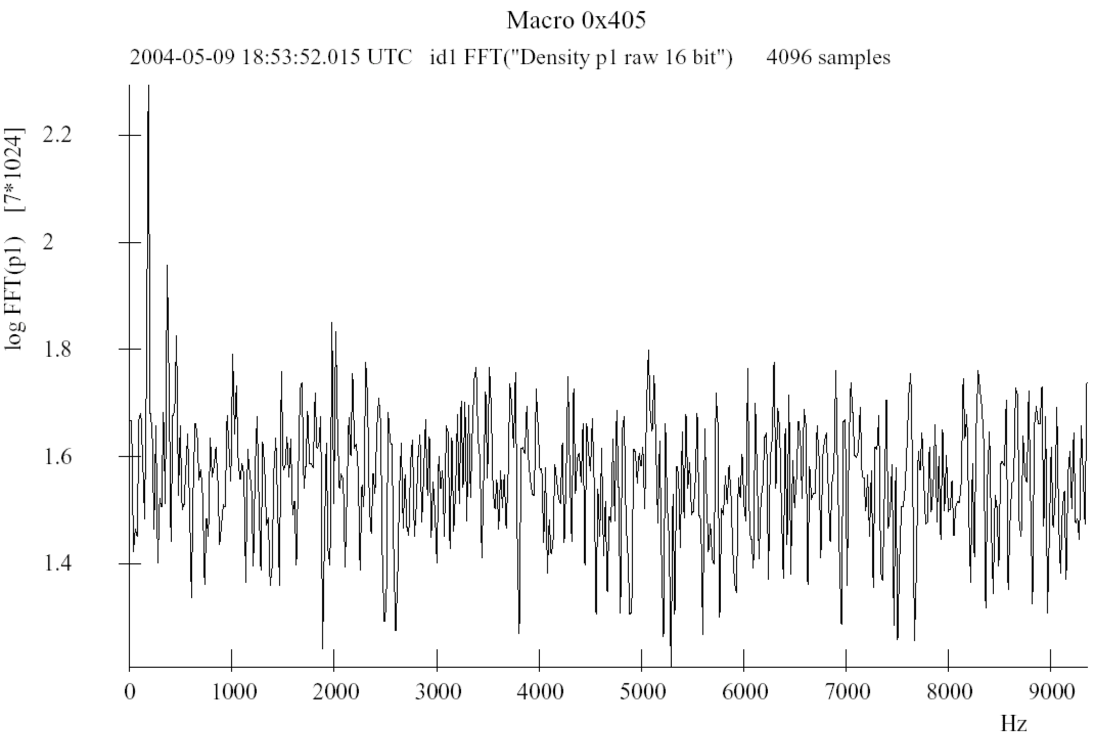

Figure 7d. Spectrum of the signal in Figure 7b. The peak at 180 Hz is the only persistent feature rising above the white noise

4.5 Third pass (May 9-10, 2004)

RPC step	Start UT	End UT	FCP	Macro	Description	Notes
0110			032		LAP on maintenance mode.	
0130	22:01	Before 23:00	308		LAP memory service test. Dumps macro 0x101 to TM and loads a dummy patch (actually a list of numbers 1, 2, 3, 4, …) to test that memory dumping and patching both works.	OK! Memory dump:Starts at 22:01:59. Contents compared to expected, fully OK. Note that the LAP GSE prints the dump with last line on top, i.e. upside down in the GSE this is now corrected. Patching: Worked OK, but the event packets from LAP verifying the correct checksum were not defined in the RSDB, so it took some time to find them. All the memory services tonight were performed using PIU PROM FSW this time (c.f. first pass), as the otherwise used PIU FSW seems to have a bug concerning memory services. Previous LAP patching (Sep 2002) also used PIU PROM FSW.
0180	23:01	23:05	804	0x203	NE in NM. Sweep on P1, E bias 0 on P2.	OK.
0190	23:07	23:27	902		Mixed LDL.	There was a problem on MIP. Chris therefore let MIP wait for a while while finishing som IES stuff. In the meantime, LAP was hacking along in mixed LDL, but then turned off. The problem was later traced to forgetting turning on MIP.
0200			905		LDL level test (mixed LDL).	Postponed because of trouble with step 0190.
0270	 23:59 00:09	 00:09 00:35	114 031 310 030	 0x105 0x104	LAP calibration. FCP 310 (LAP calibration) was ran inside FCP 114 (IES HV event tests) to save time (a procedure variation request, Appendix A). FCPs 031 and 030 are for turning on and off LAP, respectively, while 310 runs macros 0x105 (sweeps over internal resistor) and 0x104 (sweeps over open probes, to get internal offsets).	OK. Quick look at open P2 sweeps indicates no significant drift since two nights ago: still varies between 131 and -76 TM units.
	00:56		902		Mixed LDL (rerun of 0190).	OK. Disturbances from MIP seen, in contrast to step 0190 in the 2nd out-of-pass run. Going in and out of LDL several times.
0310	01:38		804	0x203	NE in NM. Vb1 0 V, Ib2 0 nA.	OK.

0320	01:41		390	0x203	NE in NM. Vb1 +32 V, Ib2 +20 nA	OK. Offsets must be corrected for: otherwise mask the first points at fixed bias.
0330	01:46		390	0x203	NE in NM. Vb1 -32 V, Ib2 +20 nA	OK. See 0320.
0340	01:51		390	0x203	NE in NM. Vb1 +32 V, Ib2 +20 nA	OK. See 0320.
0350	01:56	02:02	390	0x203	NE in NM. Vb1 -32 V, Ib2 +20 nA	OK. See 0320.
0370			310		LAP calibration.	Run as step 0270 (see above).

5. Anomalies

1. Is the calibration of the internal LAP temperature sensor, mounted on an op amp, really correct? It always indicates 32 deg C at turnon, which seems too high. PIU suggests 26 deg C in the same situation.
2. The memory services test was not successful in the first attempt, due to problems outside LAP (PIU, s/c or ESOC). However we test was successfully redone running the PIU using older prom code. Though LAP needs to update the RSDB with event packets for memory patching.
3. The downsampled 20 bit data (macro 0x404) are not correctly unpacked by the GSE. This is due to a bug in the macro, not producing a correct data identifier.
4. The downsampled 20 bit data (macro 0x404) had about one third of the data volume filled by zeroes.
5. Out of pass data on May 8 until around 09:00 are missing. This is presumably not a LAP issue (MAG and MIP equally affected).
6. Second pass science data from May 8 20:59 to 21:40 are missing. Reason for this is unknown.
7. Transmission not turned off at end of active mode test. This is completely understandable: the EndMacro does not contain anything to turn off the transmitter. The reason for this bug creeping into the procedures is as follows: originally, the StopSampling command was used instead of EndMacro, and the StopSampling does turn off the Tx. For other reasons, we went to using EndMacro instead, which works better in other situations, but not here. This is corrected in LAP Flight software version 12 which we hope to patch in the future.

8. Event IDs not in RSDB. Meant that our event packets verifying the checksum from the patching were not recognized at ESOC.
9. Disturbances in mixed LDL seems smaller (nondetectable) when run from OBCPs. Why?

6. Improvements to do

1. Calibration mode. Needs only to run the two steps (open probe and internal resistor) a few times each, say two times. No need to run both up and down: better use the data points for getting more individual steps than to see every step twice. Even calibration in NM should span ±32 V.
2. Normal mode sweeps. Better run only one direction from -16 V to + 32 V than to run up and down ±12 V as now.
3. Bias levels. Useful bias levels in solar wind are:
   a. Sunlight/solar wind: Vb = +32 V, Ib = -44 nA.
   b. Shadow/wake: Vb = +32 V, Ib = +20 nA, though Vb isn't very useful at all here.
4. One may consider implementing macros for all combinations of light/shadow: LL, LS, SL, SS.
5. Check all macros. Are they useful and to things we want?

Appendix A

RPC PROCEDURE VARIATION REQUEST

Number:	1	**Revision:**	1	**Date Raised:**	9/5/04
Title:	Start LAP Calibration at end of maintenance				
Pass Date:	9/10th March 2004	**Approx Time:**	Midnight		
RPC CVP Stage Name:	**Part2 IP Day 3**	**Involving Steps:**	0100-0140		

Involving:	**PIU**	**X**	**IES**		**ICA**		**LAP**	**X**	**MIP**		**MAG**	

Change Reason

Run LAP calibration inside RP-FCP-114 procedure in out of pass sequence part 2 day 3 ("Part 2 IP day 3") as this has higher priority than other LAP operations.

Full Description of Variation

The following procedures will be run:

RP-FCP-031 LAP On
RP-FCP-310 LAP Calibration

RP-FCP-030 LAP off

LAP off procedure shall be sent as requested by RPC team.

Effects:

Puts the execution of LAP Calibration earlier to save time.

Authorisation

RPC Ops:	Chris Lee	***IES:***	
ICA:		**LAP:**	
MIP:		**MAG:**	

RPC-LAP COMMISSIONING
PART 3

September 6 - 10, 2004

IRFU-ROS-CVPREP3
Version 1.0
11 Nov 2004

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Table of contents

Document history

Revision	**Date**	**Comment**
0.1	2004-09-07	Initialized (RG)
0.2	2004-09-10	Ops log
1.0	2004-11-11	Editorial (AIE)

1 Introduction

The LAP activities in the third CVP slot had multiple objectives:

- Patch flight software for minor problem discovered previously (macro ID not included in TM following a macro upload)
- Upload new macros
- Get more solar wind data, hopefully in denser conditions than what we saw in May
- Investigate if the offsets had drifted since May

All the goals were succesfully pursued. The solar wind as seen on the ACE s/c, not very close to Rosetta (Figure 1), was denser than during the RPC CVP slot in May at the start of this CVP slot, but declined to lower densities again at the end.

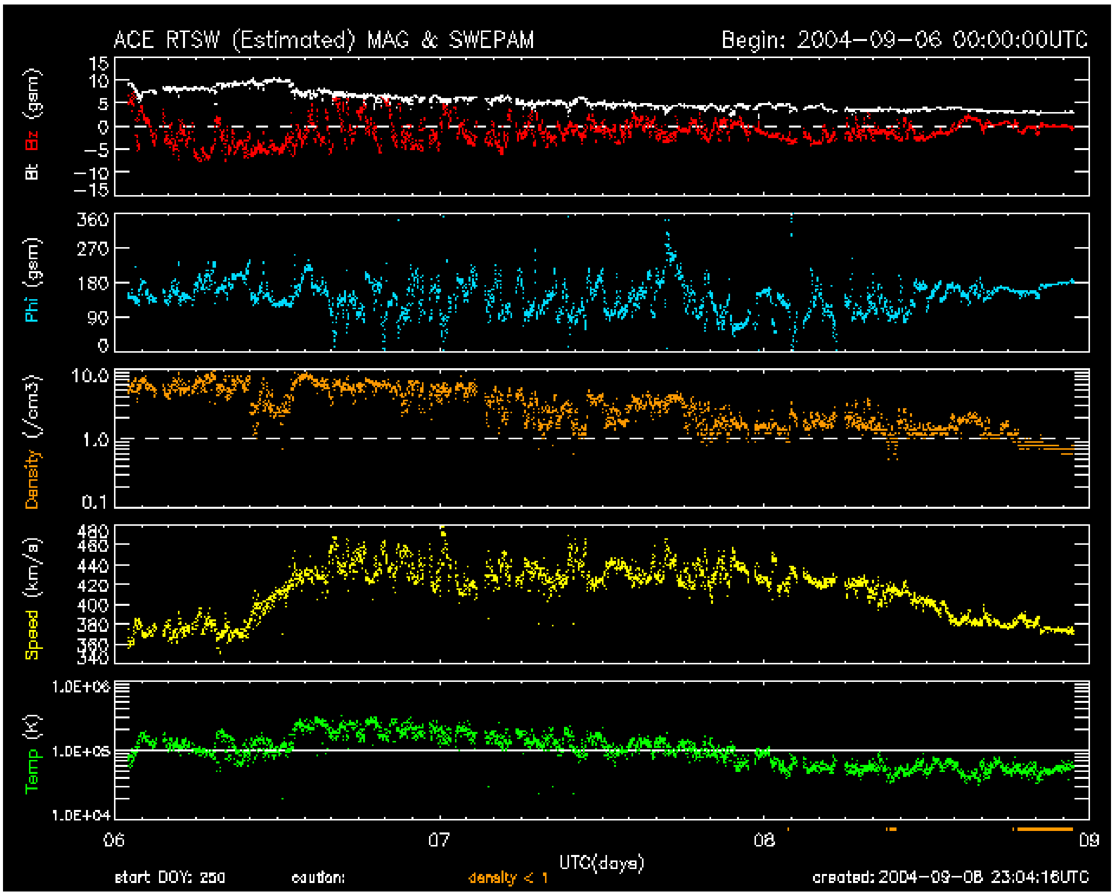

Figure 1. ACE data showing solar wind conditions at ACE during CVP-3.

2 Pass 1 (2004-09-06 -- 2004-09-07)

The primary RPC aims this night were the high voltage commissioning of ICA and IES, the patching of PIU and LAP flight software, and the upload of new LAP macros. For LAP, the rest of this week (CVP3 in our terminology) mainly is verification of the new s/w and macros, and getting data for performance evaluation.

Other operations did not go as smooth as planned, meaning that we were much delayed and had to cut parts of our ops from the timeline. This in turn resulted in no reboot of LAP, meaning that the objective of testing the new flight s/w was not reached, though the new macros were run.

The pass started around 19:30 UT, with PIU patching at about 19:45 -- 19:50 UT (times TBC).

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
090	20:20:34		032		Powers on LAP and boots SW version 11 (slot 4), and sets telemetry to none.	As no science TM were enabled because of subsequent patching and macro uploads, we got internal temperature readings for quite a long time. Temperature (after -6 deg C correction): 21.4 deg C at start 20:20 22.6 deg C at 20:28 (0.15 K/min) 23.5 deg C at 20:34 (0.15 K/min) 24.4 deg C at 20:44 (0.09 K/min) 25.0 deg C at 20:54 (0.06 K/min) 25.4 deg C at 21:04 (0.04 K/min) 25.9 deg C at 21:19 (0.03 K/min) 26.2 deg C at 21:31 (0.025 K/min) 26.5 deg C at 21:46 (0.02 K/min) 26.7 deg C at 22:02 (0.0125 K/min) 27.0 deg C at 22:27:30 (0.02 K/min) 27.3 deg C at 22:44 (0.02 K/min) For comparison, PIU temp 26.9 deg C and rising when LAP had 25.9 deg C, from initial 19.6 deg C. PIU temp increase steepens when LAP is turned on.
100	20:56:04	21:07:34	060		Sends LAP SW patch file. Current patch v14. Should return event 0x20 and checksum 0x2ace. Patch is stored into flash memory slot 3.	Event packet with ID 0x20 and checksum 0x2ace at 21:07:34, signalling succesful patching. It should be noted that the checksum is calculated before burning into flash, not on the actual flash content after burn. The checksum of the actual flash content will be calculated at boot time.
140	22:22:05	22:34:22	320		Upload new lap macros 0x104, 0x105, 0x212, 0x205, 0x300, 0x404. Should be 143 totally commands. At next boot store macro crc value from HK Calibration parameters.	The procedure was delayed because of delays due to ESOC handling of IES HV sequence upload.
190					ESOC changes OBCP to be able to boot new LAP software.	Postponed because of delay.
200	-	-	804		Turn LAP off	Postponed because of delay. That means that we will run the new macros on the old (unpatched) s/w.
210	-	-	804		Turn LAP on, boot slot 3.	
215	23:05:14		315		Verifies uploaded macros. Empty macros is 0x406, 0x407, 0x503, 0x504, 0x505, 0x506, 0x507.	No verification. As step 210 was not performed, the flash was not on when step 215 was executed (the flash is on at turn on, but is turned off as soon as any macro or other activity is started). The data received thus is garbage. Hence, we get no verification of the macros before they are run. We decided this is OK: even with a buggy macro, there is no danger to the instrument.
217	23:20		310	2	Calibration mode. Macro 0x105 Calibration 4 KHz filters, Density mode, Gain 1.0. Fix bias 0 V. Density mode down sweep over internal resistor 5.1 Mohm. Macro 0x104 Open Sweep test calibration Down sweeping P1 & P2. 4KHz filters.	No data because LAP science were by mistake disabled in the PIU until 23:45.
225			399		End Macro	

RPC Step	Start UTC	End UTC	RP FCP	S I D	Description	Notes
230	23:40 (23:46)		316	3	LAP NN Test Macro 0x205 1789 samples on P1 & P2 20 Bit ADC:s Full 20 bit data, Density mode,Gain 1.0 Fix bias is then changed: +00:01:04 Density Fix Bias 0x0000 -32 V p1 & p2 +00:01:04 Density Fix Bias 0x2020 -24 V p1 & p2 +00:01:04 Density Fix Bias 0x4040 -16 V p1 & p2+00:01:04 Density Fix Bias 0x6060 - 8 V p1 & p2 +00:01:04 Density Fix Bias 0xa0a0 8 V p1 & p2 +00:01:04 Density Fix Bias 0xc0c0 16 V p1 & p2 +00:01:04 Density Fix Bias 0xe0e0 24 V p1 & p2 +00:01:04 Density Fix Bias 0xffff 31.8 V p1 & p2 +00:01:04 Execute Macro 0x212 (default normal) Alternating down sweeps density mode +16 V to -32 V, 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	First data at 23:46:10, when LAP science was enabled in PIU. As LAP had not been rebooted, a bug in the old s/w causing the macro ID not to be put into TM following a macro upload means that macro ID in TM is 0x00.
255			334	2	LAP Digital Filter test A20 Macro 0x404 E-Field mode. E-fix bias 0 A. Full 20 Bit ADC:s P1 & P2 Down sampling 30 times thus ~2Hz. 1286 smpls p1+p2 21.4 s.	Postponed (duplicated in out of pass)

3 Out of Pass 1 (2004-09-07)

The data from the first 12 hours of out-of-pass operations were lost because of a miscalculation of data volumes. The total data volume available to RPC on the s/c solid state mass memory (SSMM) is 10 MB: if we produce more, we start overwriting the oldest data. RPC had estimated that the total data volume gathered out of pass would not exceed 10 MB, so that we should not lose any data. The calculation was correct, but the conclusion was not: real time telemetry were not available directly at AOS, but had to wait for approximately one hour of s/c activities and then some data dumping. As LAP and MAG both were in burst mode (SID3) at the end of out-of-pass and during the pass, storing a few extra hours of data (at burst mode rate) caused overwriting of the first 12 hours of normal mode (SID2) data.

In consequence, the only data gathered during this out-of-pass were in default normal (0x212) and default burst (0x204) mode. An example probe sweep is shown in Figure 2.

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
020			399		End macro	Verified in HK. No science data (see comments above this table)
030	 01:16:34 01:27:46		310	2	Calibration mode Macro 0x105 Calibration 4 KHz filters, Density mode, Gain 1.0. Fix bias 0 V. Density mode down sweep over internal resistor 5.1M ohm. Macro 0x104 Open Sweep test calibration Down sweeping P1 & P2. 4KHz filters.	Verified in HK. No science data (see comments above this table)
040			399		End macro	
050	 01:43:46 01:53:22		316	3	LAP NN Test Macro 0x205 1789 samples on P1 & P2 20 Bit ADC:s Full 20 bit data, Density mode,Gain 1.0 Fix bias is then changed: +00:01:04 Density Fix Bias 0x0000 -32 V p1 & p2 +00:01:04 Density Fix Bias 0x2020 -24 V p1 & p2 +00:01:04 Density Fix Bias 0x4040 -16 V p1 & p2 +00:01:04 Density Fix Bias 0x6060 - 8 V p1 & p2 +00:01:04 Density Fix Bias 0xa0a0 8 V p1 & p2 +00:01:04 Density Fix Bias 0xc0c0 16 V p1 & p2 +00:01:04 Density Fix Bias 0xe0e0 24 V p1 & p2 +00:01:04 Density Fix Bias 0xffff 31.8 V p1 & p2 +00:01:04 Execute Macro 0x202 Alternating down sweeps density mode +-12V 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	Verified in HK. No science data (see comments above this table)
060			399		End macro	
070	02:09:22		317	3	LAP EE Test Macro 0x300 EE Mode, 20 bit ADC:s Full 20bit E-Field, 1789 smpls, E-Strategy bias. P1 nA +00:01:04 E-Fix Bias 0x0000 +00:01:04 E-Fix Bias 0x2020 +00:01:04 E-Fix Bias 0x4040 +00:01:04 E-Fix Bias 0x6060 +00:01:04 E-Fix Bias 0xa0a0 +00:01:04 E-Fix Bias 0xc0c0 +00:01:04 E-Fix Bias 0xe0e0 +00:01:04 E-Fix Bias 0xffff	Verified in HK. No science data (see comments above this table)
080			399		End macro	

090	02:23:46		334	2	LAP Digital Filter test A20 Macro 0x404 E-Field mode, E-fix bias 0 A. Full 20 Bit ADC:s P1 & P2 Down sampling 30 times thus ~2Hz. 1286 smpls p1+p2 21.4 s.	Verified in HK. No science data (see comments above this table)
110	02:55:46		804	2	OBCP starts Macro 0x212. Default normal mode Alternating down sweeps density mode +26 to -32 V 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	No science data available until (see comments above this table)
125	14:18:58		804	3	OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	At 19:20 and onwards, P2 is in darkness.

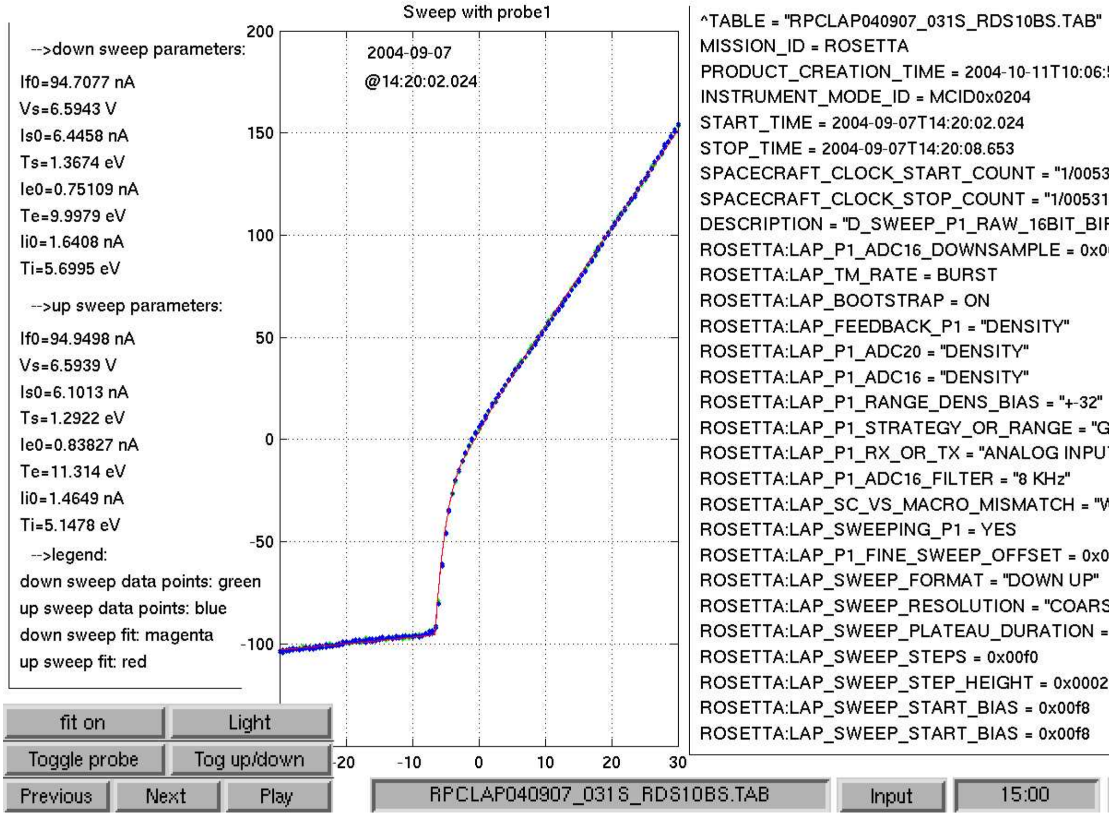

Figure 2. Probe sweep on P1 with analytical fit. Based on LAP PDS archive data. The analysis s/w displays some of the PDS headers at right.

4 Pass 2 (2004-09-07 -- 2004-09-08)

The original timeline was completely revised (Appendix A), as our objective of testing the new flight s/w had not been met yesterday. LAP operations were loaded to the mission timeline and run in parallel to the real-time IES and ICA activities.

Events and HK from OP were dumped until around 20:20, when science TM dump started. Real time HK of course were present all the time. Real time science TM from 21:43.

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
000		19:43:14			Previous mode from out of pass is running. Check TM to see everything is all right.	P1 sun, P2 darkness
005	19:45		804		LAP off.	
010	19:55		804		LAP on, no sci TM enabled.	HK reports s/w version 14, as it should (the new version). Macro checksum 0x5CA8 (sent by version 14 at boot, should stay the same at every boot until we change the macros again). The checksum just comes in one KH packet, as the OBCP performs an EndMacro prohibiting further transmission of the checksum. Temperature 25.2 deg C (after -6 deg correction) after reboots. The parameters for boot was: VRPD1262=Quiet VRPD1267=0xFF The "VRPD1262=Quiet" means that LAP science TM was disabled by PIU. This was OK for step 020, but it also disabled science TM in steps 030 - 070. Steps 080 - 110 were run from OBCP and included SID settings, so here data are OK. Correct parameter settings would have been VRPD1262=SID3, telling PIU to allow LAP science data transmission, while keeping VRPD1267=0xFF, which tells LAP not to produce any science (as was correct for step 020).
020	19:59:44		315		Verify uploaded macros. No science data produced. Empty macros are 0x406, 0x407, 0x503, 0x504, 0x505, 0x506, 0x507.	All macros but two (0x906, 0xA06) verified. Reason for missing macros to be investigated later (do not affect any CVP activities). **Investigate**. 43 commands acknowledged in HK, giving 43 events.
030	 20:05:38 20:17:22		310		Calibration. Includes to steps: Macro 0x105 Calibration 4 KHz filters, Density mode, Gain 1.0. Fix bias 0 V. Density mode down sweep over internal resistor 5.1M ohm. Macro 0x104 Open Sweep test calibration Down sweeping P1 & P2. 4KHz filters.	Did we have sufficient time to send down all the data from 0x104? It may be that we allocated too little time for this. However, the EndMacro will not cut the transmission, so data should come down before the NN test. No science data received -- see comments to step 010.
040	20:21:38		399		End macro	Dump of 0x104 should probably still have been ongoing if we had got science data, but as we did not (see comments to step 010) we do not know.
050	 20:25:54		316		NN test followed by Default normal Macro 0x205 1789 samples on P1 & P2 20 Bit ADC:s Full 20 bit data, Density mode,Gain 1.0	Check: did we get continuous data (i.e., every AQP) as we should? No science data received -- see comments to step 010.

	20:35:30				Fix bias is then changed: +00:01:04 Density Fix Bias 0x0000 -32 V p1 & p2 +00:01:04 Density Fix Bias 0x2020 -24 V p1 & p2 +00:01:04 Density Fix Bias 0x4040 -16 V p1 & p2 +00:01:04 Density Fix Bias 0x6060 - 8 V p1 & p2 +00:01:04 Density Fix Bias 0xa0a0 8 V p1 & p2 +00:01:04 Density Fix Bias 0xc0c0 16 V p1 & p2 +00:01:04 Density Fix Bias 0xe0e0 24 V p1 & p2 +00:01:04 Density Fix Bias 0xffff 31.8 V p1 & p2 +00:01:04 Execute Macro 212 Alternating down sweeps density mode -32 V to +16 V, 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	
060	20:45:38		399		End macro	
070	20:49:54		334		Digital filter test A20 Macro 0x404 E-Field mode. E-fix bias 0 A. Full 20 Bit ADC:s P1 & P2 Down sampling 30 times thus ~2Hz. 1286 smpls p1+p2 21.4 s.	No science data received -- see comments to step 010.
080	21:01:38		804		Default burst VRPD1262=SID3 VRPD1267=0x14 OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	Science data looks fine in the EGSE. P1 in sunlight and solar wind, P2 in shadow and wake.
090	21:01:47		390		Fixed bias P1 & P2 to +25 V. Default burst keeps running. VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	The bias FCP may be updated: need not be so complicated with the s/w version 14. Science data looks fine in the EGSE. P1 in sunlight and solar wind, P2 in shadow and wake.
100	00:02:58		804		Default normal (set up for out-of pass) VRPD1262=SID2 VRPD1267=0x12 OBCP starts Macro 0x212. Default normal mode Alternating down sweeps density mode +26 to -32 V 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	
110		00:36:02	390		Fixed bias P1 & P2 to +25 V. Default normal keeps running into out of pass.	Science data looks fine in the EGSE. P1 in sunlight and solar wind, P2 in shadow and

					VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	wake. Science data ends at 00:36:02 as the first out-of-pass data were overwritten due to a similar miscalculation of data volumes as occurred in the first out-of-pass.

5 Out of Pass 2 (2004-09-08)

There are no science data 00:44:50 - 03:58:04: they were overwritten due to a similar miscalculation of data volumes as during the first out-of-pass. However, thanks to the prompt commanding to normal mode (SID2) of LAP and MAG at AOS (see next section), we lost no more than 3 hours this time.

RPC Step	Start UTC	End UTC	RP FCP	SID	Description	Notes
	03:58:04			2	Default normal mode, macro 0x212	TM OK.
125			804	3	Default burst mode, bias zero	

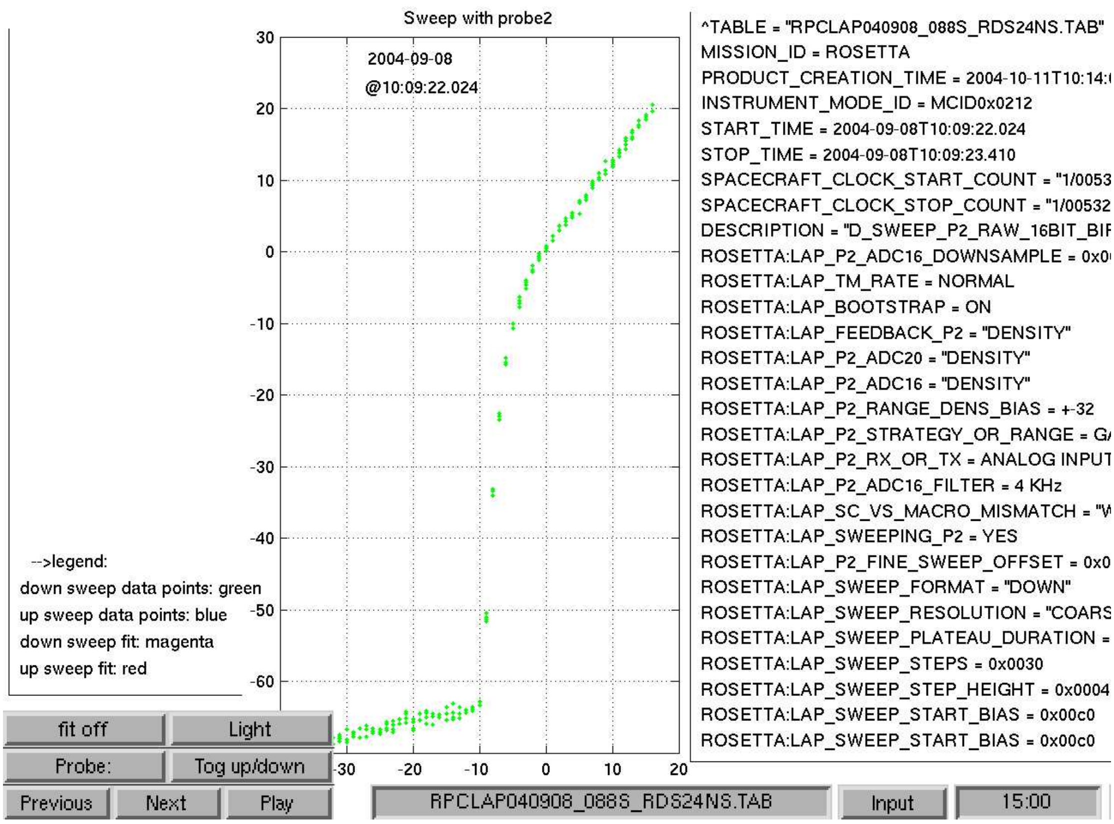

Figure 3. In normal mode telemetry, we do not take bias sweeps at such detail and as frequently as in burst mode, but the data are still very useful. This shows a sweep with probe 2 in sunlight.

6 Pass 3 (2004-09-08 -- 2004-09-09)

<table>
<tr><th>RPC Step</th><th>Start UTC</th><th>End UTC</th><th>RP FC P</th><th>SI D</th><th>Description</th><th>Notes</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Previous mode from out of pass is running (default burst, 0x204, with fixed bias P1P2 set to +25 V)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>804</td><td>2</td><td>Default normal
VRPD1262=SID2
VRPD1267=0x12

OBCP starts
Macro 0x212.
Default normal mode
Alternating down sweeps density mode
+26 to -32 V
4khZ analog filters.
Duration 1.4 s gain 1.0.
Fixed bias 0 V P1&P2
see IRFU-ROS-LAPMPF for details.</td><td>Commands to put LAP and MAG into normal TM (SID2) were manually inserted at AOS in order to avoid yesterday's overwriting of out-of-pass data.

Macro 0x212 verified in HK.</td></tr>
<tr><td></td><td>22:02:26</td><td></td><td>804</td><td>3</td><td>Default burst
VRPD1262=SID3
VRPD1267=0x14

OBCP Starts
Macro 0x204, Default Burst Mode
Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF)

Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample.
Total 972 samples. (2 initial plateaus before sweep included)

Fix duration P2 4096 Density bias 0V
Fix duration P1 2048 Density bias 0V

Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample.
Total 1688 samples. (2 initial plateaus before sweep included)</td><td>OK.</td></tr>
<tr><td>030</td><td>
22:05:06</td><td></td><td>310</td><td>3</td><td>Calibration. Includes to steps:

Macro 0x105
Calibration 4 KHz filters, Density mode, Gain 1.0. Fix bias 0 V. Density mode down sweep over internal resistor 5.1M ohm.

Macro 0x104
Open Sweep test calibration
Down sweeping P1 & P2. 4KHz filters.</td><td>As .there was no EndMacro and we went from a burst macro to a normal mode macro, we lost essentially all data. One of the buffers was filled with data from the preceeding step, which took almost all the AQP to dump. Hence, we only got one single internal resistor sweep from each probe (macro 0x105), while the open sweep data (0x104) were lost completely.

It is absolutely essential to insert an EndMacro if going between macros producing different TM rates. The exception is if an OBCP is used, in which case there is an EndMacro at start. In the case we had here, the first mode (default burst, 0x204) was commanded by OBCP, but that does not help as the calibration was commanded by ordinary FCP.</td></tr>
<tr><td>040</td><td></td><td></td><td>399</td><td></td><td>End macro</td><td></td></tr>
<tr><td>050</td><td>

22:25:54</td><td></td><td>316</td><td>3</td><td>NN test followed by Default normal

Macro 0x205 (NN)
1789 samples on P1 & P2 20 Bit ADC:s</td><td>Check: did we get continuous data (i.e., every AQP) as we should? Yes, we did! The bug fix in FSW 14 is thus verified.</td></tr>
</table>

	22:34:58				Full 20 bit data, Density mode, Gain 1.0 Fix bias is then changed: +00:01:04 Density Fix Bias 0x0000 -32 V p1 & p2 +00:01:04 Density Fix Bias 0x2020 -24 V p1 & p2 +00:01:04 Density Fix Bias 0x4040 -16 V p1 & p2 +00:01:04 Density Fix Bias 0x6060 - 8 V p1 & p2 +00:01:04 Density Fix Bias 0xa0a0 8 V p1 & p2 +00:01:04 Density Fix Bias 0xc0c0 16 V p1 & p2 +00:01:04 Density Fix Bias 0xe0e0 24 V p1 & p2 +00:01:04 Density Fix Bias 0xffff 31.8 V p1 & p2 +00:01:04 Execute Macro 212 (default normal) Alternating down sweeps density mode -32 V to +16 V, 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	
060			399		End macro	
070	22:58:58		334	2	Digital filter test A20 Macro 0x404 E-Field mode, 4kHz analog filter. E-fix bias 0 A. Full 20 Bit ADC:s P1 & P2 Down sampling 30 times thus ~2Hz. 1286 smpls p1+p2 21.4 s.	OK
080	23:11:14		804	3	Default burst VRPD1262=SID3 VRPD1267=0x14 OBCP Starts Macro 0x204, Default Burst Mode Alternating bias sweeps on p1 & p2. 8KHz Analog filters(not 4Khz as in IRFU-ROS-LAPMPF) Sweep P1 +-30 V duration 6.6s 0.5V Step size 240 steps up&down. 27.3 ms each plateau keeping 4 smpls each plateau every 128:th sample. Total 972 samples. (2 initial plateaus before sweep included) Fix duration P2 4096 Density bias 0V Fix duration P1 2048 Density bias 0V Sweep P2 +-26 V duration 5.8s 0.5V Step size 208 steps up&down 27.3 ms each plateau keeping 8 smpls each plateau every 64:th sample. Total 1688 samples. (2 initial plateaus before sweep included)	OK
090			390		Fixed bias P1 & P2 to +25 V. Default burst keeps running. VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	
060 (not on MTL)	23:57:06		804	2	Default normal (set up for out-of pass) VRPD1262=SID2 VRPD1267=0x12 OBCP starts Macro 0x212. Default normal mode Alternating down sweeps density mode +16 to -32 V 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	TM OK. Initial TM problem observed in real time: we got science TM as we should, but the GSE refused to unpack any of them until 00:25. A hickup in the GSE system, or actually scrambled TM content? **Investigate.**

7 Out of Pass 3 (2004-09-09)

An extra DSN coverage during daytime made it possible to view data up to 12:XX in real time.

The calibration sequence, which had been planned to be run four times before this week and actually ran three times before but whose data had always been lost, was executed and its data finally transmitted as planned. The result from the offset determination (macro 0x104) are displayed in Figure 4. Included is also a best-fit line to offset determination in May. For probe 1, the May and September offsets differ slightly, while probe 2 shows constant offsets.

The offset stability appears to be very good. Taking the observed spread of the data around the fitted lines as an uncertainty measure, we can determine the current to within 5 TM units, corresponding to 1.5 nA (high gain, 16 bit ADCs). The observed spread in data agrees well with the general noise level (see Section 8).

The difference between the P1 offset curves determined in May and September is mainly due to a change of slope of the curve. This can be a temperature effect, though we are more inclined to believe that we here see the real drift we had anticipated, and for which we have included the possibility of onboard calibrations. The difference in the slopes determined in May and September is small, only corresponding to 0.17 nA/V.

RPC Step	Start UTC	End UTC	RPFCP	SID	Description	Notes
000				2	Running default normal mode from last pass	TM OK.
005			399		EndMacro	
007			310	2	Calibration	
	01:04:50				0x105 (sweeps over 5.1 Mohm)	TM OK. (Macro editor displayed only one decimal point, so that sweeps looked like 0.2 V/step rather than 0.25 V/step. Fixed.)
	01:16:54				0x104 (open sweeps)	TM OK.
008	01:36:50		804	2	Default normal VRPD1262=SID2 VRPD1267=0x12 OBCP starts Macro 0x212. Default normal mode Alternating down sweeps density mode +16 to -32 V 4khZ analog filters. Duration 1.4 s gain 1.0. see IRFU-ROS-LAPMPF for details.	TM OK. Data dumped via DSN up to 12:XX, with the rest arriving at next AOS via the ordinary ESA link (New Norcia).

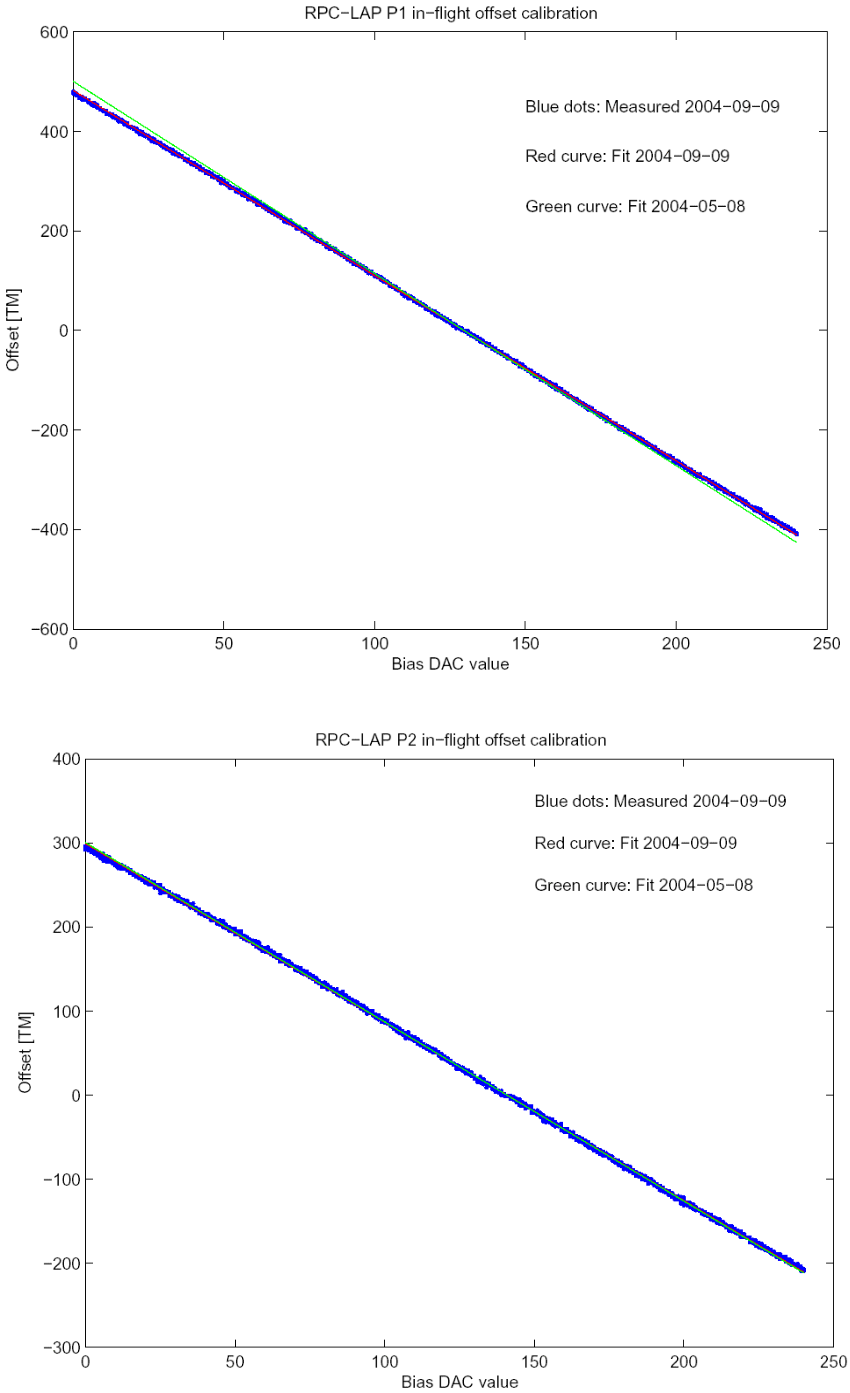

Figure 4. Offset determinations on September 9, 2004, for P1 (top) and P2 (bottom). Blue dots are data, red line a linear fit. The green line is a linear fit to offset determination from May 8, 2004. Each bias DAC step is 0.25 V, and each TM unit on the vertical axis corresponds to a current of 0.305 nA. A drift in the slope of the P1 offset curve from May to September is clearly seen. The possibility to do onboard calibration was implemented precisely because of such long-term drifts are expected.

8 Pass 4 (2004-09-09 -- 2004-09-10)

As all basic verification of the operation of the instrument running flight software v14 had now been completed, we used this last night of operations for running some previously unused macros, with the objectives of:

A. Verifying these macros for operational use.

B. Gather data for observation of Vsc variation during sweeps (macro 0x203).

C. Gather data for verification of wave data in NN and EE mode (0x405, 0x303).

D. Get more runtime on default burst mode (0x204) in (hopefully) varying solar wind conditions. Solar wind conditions were still very low (< 1 cm-3 according to ACE) at the time of issuing the commands (p.m.), so we put the default burst at end. Unfortunately, the density stayed low all night.

Results from the wave observations are shown in Figures 5 and 6. Figure 5 shows observed time series and their calculated difference, from RPC step 030 (macro0x303). Variations on the order of a few bits are clearly seen. Assuming this is typical for the noise level on LAP, we estimate an RMS value of around 2.7 TM units, or 3.4 mV, for the noise. Figure 6, showing averages of power spectra, reveals that the noise has two components. First, there is some signal at around 180 Hz and its first few harmonics. Note that this signal essentially disappears in the differential signal, and hence is a common mode interference. Apart from this, the noise is approximately white with a level of 0.001 mV^2/Hz ($4 \cdot 10^{-5}$ $(mV/m)^2/Hz$ for 5.01 m probe separation), corresponding to an RMS value of around 3 mV or 2-3 TM units over the full frequency range, consistent with the time series data in Figure 5.

RPC Step	Start UTC	End UTC	RPC FCP	SID	Description	Notes
000				2	Default normal running from out of pass.	HK OK.
010	20:02:58	21:00:02	804	2	Normal SE (voltage sweeps on P1, 20 bit E data on P2, Ibias 0 nA)	TM OK.
020	21:02:42		804	3	Burst NN (interferometry), 16 bit, full resolution (macro 0x405)	TM OK.
030			804	3	Burst EE, 16 bit, full resolution (macro 0x303)	TM OK. ESOC reported a rejected command when the OBCP was executed. However, our TM showed we had succesfully entered 0x303. At closer investigation, it was found that ESOC had sent two almost identical versions of the OBCP command at the same time. One of these had been executed succesfully, the other was rejected by the s/c (as it of course should be). Very nice data, establishing the 190 Hz peak and its harmonics as common mode noise (Figures 2 and 3).
040	23:02:42	01:20:50	804	3	Default burst (macro 0x204)	TM OK.
050	01:20:50				LAP off. End of CVP3 RPC operations.	

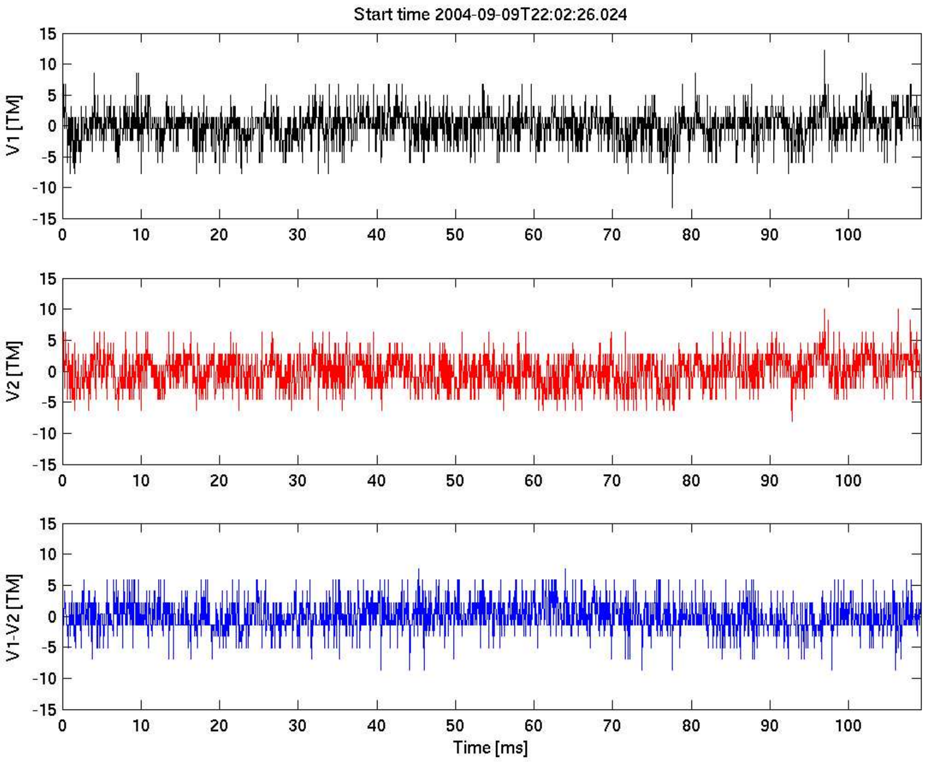

Figure 5. Time series from probes 1 (black) and 2 (red) at full time resolution and zero bias current. The blue curve is the difference between the two signals. One TM unit is 1.22 mV in physical units.

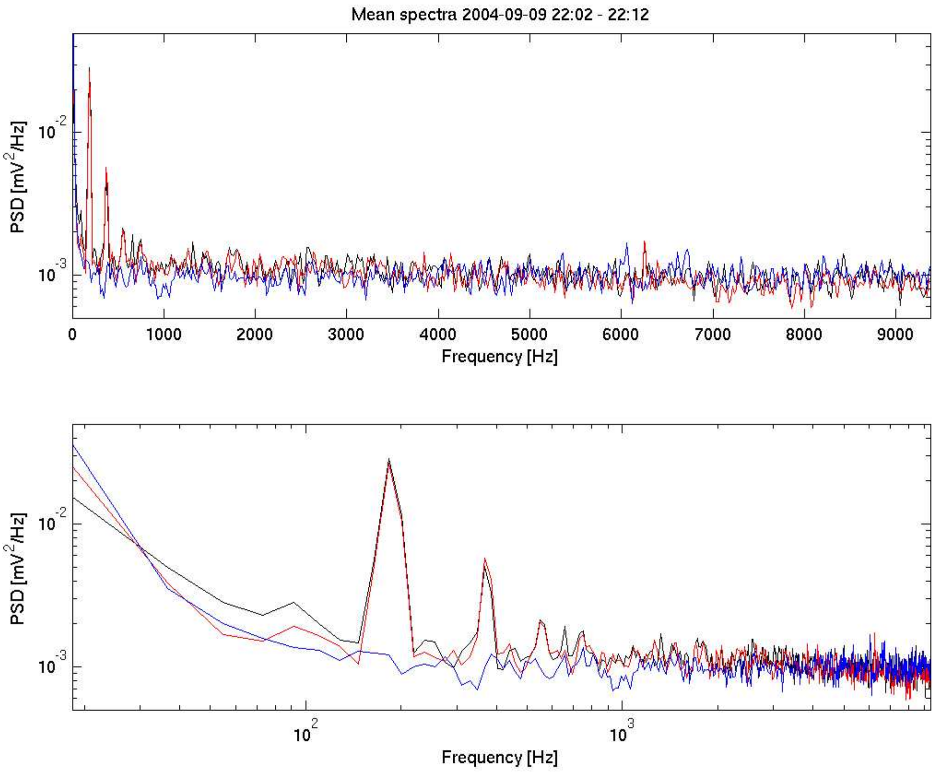

Figure 6. Mean of spectra calculated from 16 snapshots similar to those in Figure 3, with 32 second delay between each. Colour codes as in Figure 3. Based on 1024 point FFTs and Hann window. Normalization is such that the RMS value of the time series is the square root of the integrated power spectrum.

9 Anomalies

One possible instrument (software) problem remains to be investigated:

1. Two macros, 0x906 and 0xA06, not verified in LAP MTL step 020 in second pass. To be investigated.

10 Conclusion

The LAP activities during RPC CVP slot 3 were very succesful, achieving the objectives for the activity as well as providing very useful experience on handling the complex RPC-LAP system in space.

Appendix A

RPC-LAP Operations Request for 2004-09-07 (in pass)
Anders.Eriksson@irfu.se

Rationale: Test central LAP functionality following s/w upgrade 2004-09-06.

Time from start (suggested)	**Duration (delay until next)**	**Activity**	**FCP**
00:00:00	00:03:00	LAP off	804 VRPD1262=OFF VRPD1267=0xFF
00:03:00	00:03:00	LAP on	804 VRPD1262=Quiet (*) VRPD1267=0xFF
00:06:00	00:03:00	Verify uploaded macros	315
00:09:00	00:16:00	Calibration	310
00:25:00	00:01:00	End macro	399
00:26:00	00:20:00	NN test	316
00:46:00	00:01:00	End macro	399
00:47:00	00:10:00	Digital filter test A20	334
00:57:00	00:03:00	Default burst	804 VRPD1262=SID3 VRPD1267=0x14
01:00:00	Leave running until some time before end of pass (as long as possible, but at least 30 mins before end of commanding)	Bias +25 V P1P2	390 PARAM1=0xE4E4 PARAM2=0xE4 PARAM3=0x0000
hh:mm:00	00:02:00	Default normal (for out-of pass)	804 VRPD1262=SID2 VRPD1267=0x12
hh:(mm+2):00	Leave running for out of pass (SID2) measurements	Bias +25 V P1P2	390 PARAM1=0xE4E4 PARAM2=0xE4 PARAM3=0x0000

(*) Note added post-run: This was wrong, as it tells PIU to disable LAP science packet transmission. Should have been SID3. See log for details.

RPC-LAP
COMMISSIONING REPORT

IRFU-ROS-CVPREP-MAIN
Version 1.0
11 Nov 2004

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Table of contents

Document history

Revision	Date	Comment
1.0	2004-11-11	Initial revision (AIE)

1 Introduction

This report summarizes the LAP operations and results from the RPC CVP (commisioning and verification phase). The intention is to provide a high-level summary of operations and illustrate the operational capbilities of the instruments, as well as what remains to be done. For details on each CVP phase, please see the documents listed in Table 1 and attached to this report. Other relevant documents are the reports from the PIU team and the weekly reports from ESOC.

Doc ID	Title	Date	Rev	Note
IRFU-ROS-CVPREP1	RPC-LAP Commissioning: First Activities	2004-04-02	1.0	Covers 1st RPC CVP slot, March 17-19, 2004
IRFU-ROS-CVPREP2	RPC-LAP Commissioning Part 2	2004-06-10	1.0	Covers 2nd RPC CVP slot, May 7-10, 2004
IRFU-ROS-CVPREP3	RPC-LAP Commissioning Part 3	2004-11-11	1.0	Covers 3rd RPC CVP slot, September 7-11, 2004
IRFU-ROS-CVPIF	RPC-LAP Interference Scenario Report	2004-11-11	1.0	Covers the CVP interference scenario, Sep 20-22 and Oct 13-14, 2004.
IRFU-ROS-CVPPNT	RPC-LAP Pointing Scenario Report	2004-11-11	1.0	Covers the "LAP dance", Oct 10, 2004

Table 1. LAP CVP reports, treating LAP commissioning operations in detail.

2 Technical performance

2.1 Hardware verification

All hardware features have been tested in flight, including:

- Fixed bias voltage operations on one and two probes
- Fixed bias current operations on one and two probes
- Bias voltage sweeps
- MIP-LAP long Debye length mode (LDL)
- LAP transmitter
- All analog filters: 20 Hz, 4 kHz, 8 kHz on each probe
- The 16-bit and 20-bit ADCs on each probe
- High and low measurement range switch (gain 1 and 0.05)
- Calibration sweeps over internal resistor
- Offset determination, sweeping over open probes

All hardware modes have worked without any problems. The post-launch integrity of the LAP hardware is fully established.

2.2 Flight software

All major modes have been tested in flight, including:

- Commanding of all hardware modes
- High-frequency sampling and data transmission
- Digital filtering and downsampling of 16-bit and 20-bit data
- Differential measurements
- Probe bias sweeps at various range, step and speed settings
- Log compression of sweep data
- Sampling of internal temperature sensor
- LDL operations in "mixed" and "normal" mode
- Flight software patching
- Macro uploads
- Commanding by OBCPs (on-board control procedures)

A few problems relating to the flight software have been discovered and corrected. A bug in a macro intended for quasi-continuous sampling of the 20 bit ADCs caused 50% data loss in this mode. This was discovered in March and corrected in a macro upload in September. We also changed the macros for bias sweeps in normal mode to only sweep in one direction, as no hint of any hysteresis effects can be found in the sweeps. A software patch at the same time cured a minor bug causing the macro ID (an identifier of the instrument settings) not to be included in the telemetry in the operations immediately following a macro upload, and also added support for delaying LAP sampling for arbitrarily long time after an AQP pulse, though this is not yet implemented in any macro. In addition, macro chaecksum and macro ID are put in HK data in this new version, and an instruction to stop any ongoing transmitter operations is now included in the EndMacro command.

Other operational problems have been due to improper commanding rather than to technical problems with the flight software. Overall, the LAP flight software has proved to be stable and well functioning, fully supporting upcoming LAP operations.

2.3 Operations

During CVP, operations have mainly been conducted with a direct interface RPC-ESOC, though the RSOC interface have been used in e.g. the pointing scenario. The very flexible and service minded attitude from ESOC and RSOC as well as the solid support from the PIU team at Imperial College have made the initial operations a pleasant experience, and we have been able to run all intended operations. This does not mean that everything have worked flawlessly. In general, the miscommanding incidents we have had can be attributed to our need to learn to handle the complex LAP-RPC-ESOC-spacecraft system. Commissioning has been a very useful learning experience.

2.4 Ground support equipment and data archiving

The LAP GSE software has been continuously updated during the CVP. In parallel, the software for production of data for the PDS (planetary data system) style archive have been developed. All LAP CVP data are now converted to PDS, albeit only as edited raw data. During the initial phase, data calibration have been done in analysis software, but we are now preparing calibrated data for PDS. Though software for data reduction also have been developed, routine production of derived data like plasma density and electron temperature will have to wait until after the Earth flyby, as this will provide the first opportunity to verify models for derivation of physical parameters from the data.

Figure 1. PISA room, ESOC. *Left:* The two engineers carrying the main weight of LAP commissioning, Bjørn Lybekk (Oslo University) and Reine Gill (Swedish Institute of Space Physics, Uppsala), at the LAP GSE. *Right:* RPC team and ESA staff at the screens. The cooperation within RPC and with ESOC/RSOC have been excellent.

3 Scientific performance

3.1 Noise level

Figure 2 shows a snapshot of time series data sampled at full time resolution in the E-field mode, providing 18750 samples/s. Variations on the order of a few bits are clearly seen. Assuming this is typical for the noise level on LAP, we estimate an RMS value of around 2.7 TM units, or 3.4 mV, for the noise.

Figure 3, showing averages of power spectra, reveals that the noise has two components. First, there is some signal at around 190 Hz and its first few harmonics. Note that this signal essentially disappears in the differential signal, and hence is a common mode interference. Apart from this, the noise is approximately white with a level of 0.001 mV^2/Hz, corresponding to an RMS value of around 3 mV or 2-3 TM units over the full frequency range, consistent with the time series data in Figure 2.

The LAP probe-to-probe distance is 5.01 m, so the noise level estimated above translates to a threshold for wave measurements of around $4 \cdot 10^{-5}$ $(mV/m)^2/Hz$.

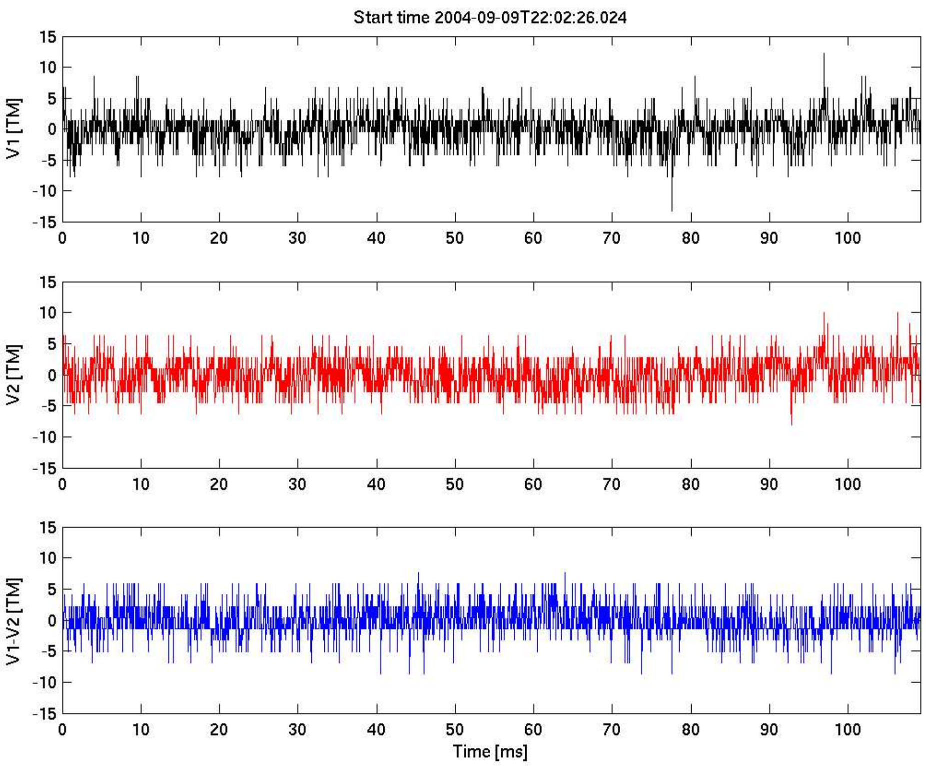

Figure 2. Time series from probes 1 (black) and 2 (red) at full time resolution and zero bias current. The blue curve is the difference between the two signals. One TM unit is 1.22 mV in physical units.

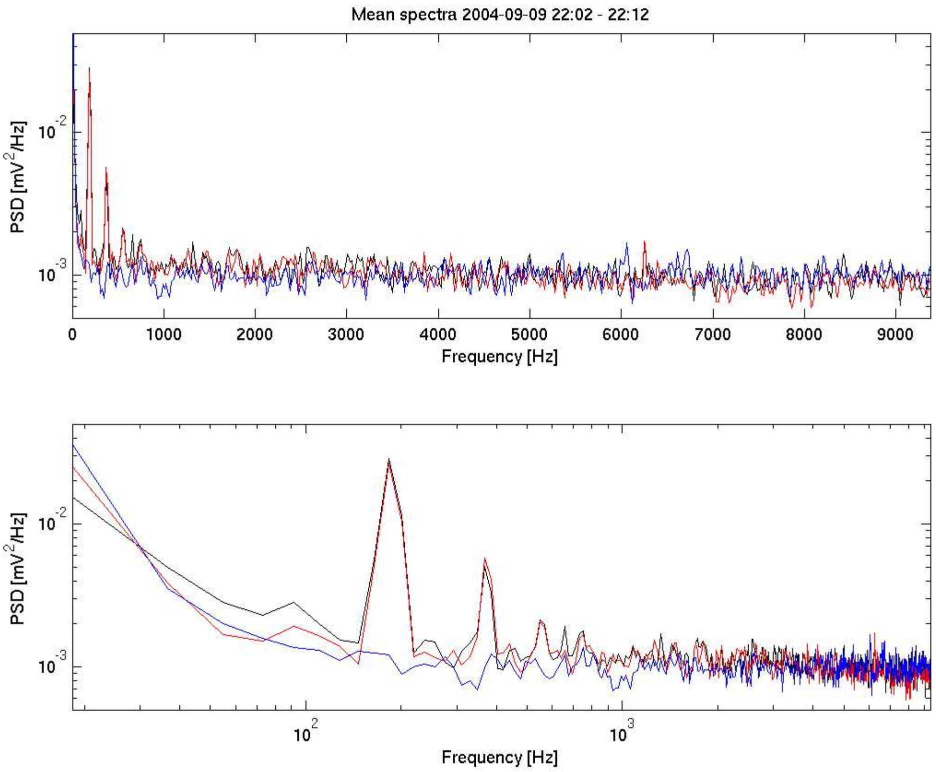

Figure 3. Mean of spectra calculated from 16 snapshots similar to those in Figure 2, with 32 second delay between each. Colour codes as in Figure X. Based on 1024 point FFTs and Hann window. Normalization is such that the RMS value of the time series is the square root of the integrated power spectrum.

3.2 Interference

3.2.1 General

Figure 3 shows typical spectra of LAP data obtained at full sampling frequency (18750 Hz, filtered at 8 kHz). The only persistent features are the lines around 190 Hz and its first few harmonics, as discussed in Section 3.1 above. The origin of these lines is not known. However, it should be noted that the blue curve in Figure 3, based on the differential signal between the two probes, these lines are absent. It is thus a common mode signal which will not influence wave measurements.

3.2.2 LDL mode

Interference from MIP when that instrument uses LAP probe 2 for transmission in the long Debye length mode is expected and well known from ground tests. This has also been verified in space (an example plot is included in the LAP interference scenario report, IRFU-ROS-CVPIF). There are two ways to avoid such interference: the so called mixed LDL mode, in which MIP uses the probe in one AQP (acquisition period pf 32 s) and LAP the next, or by delaying LAP sampling within the AQP. The first method is implemented in RPC, and following the LAP flight software patch in September 2004, the second method is also available (though not yet implemented in standard operational modes).

3.2.3 Interference scenario results

As detailed in the report from the interference scenario (IRFU-ROS-CVPIF), no interferences from instruments outside RPC were detected. It is possible that continued analysis can yield some interferences, but it is clear that there were no major effects, affecting upcoming operations. An example plot is included here as Figure 4.

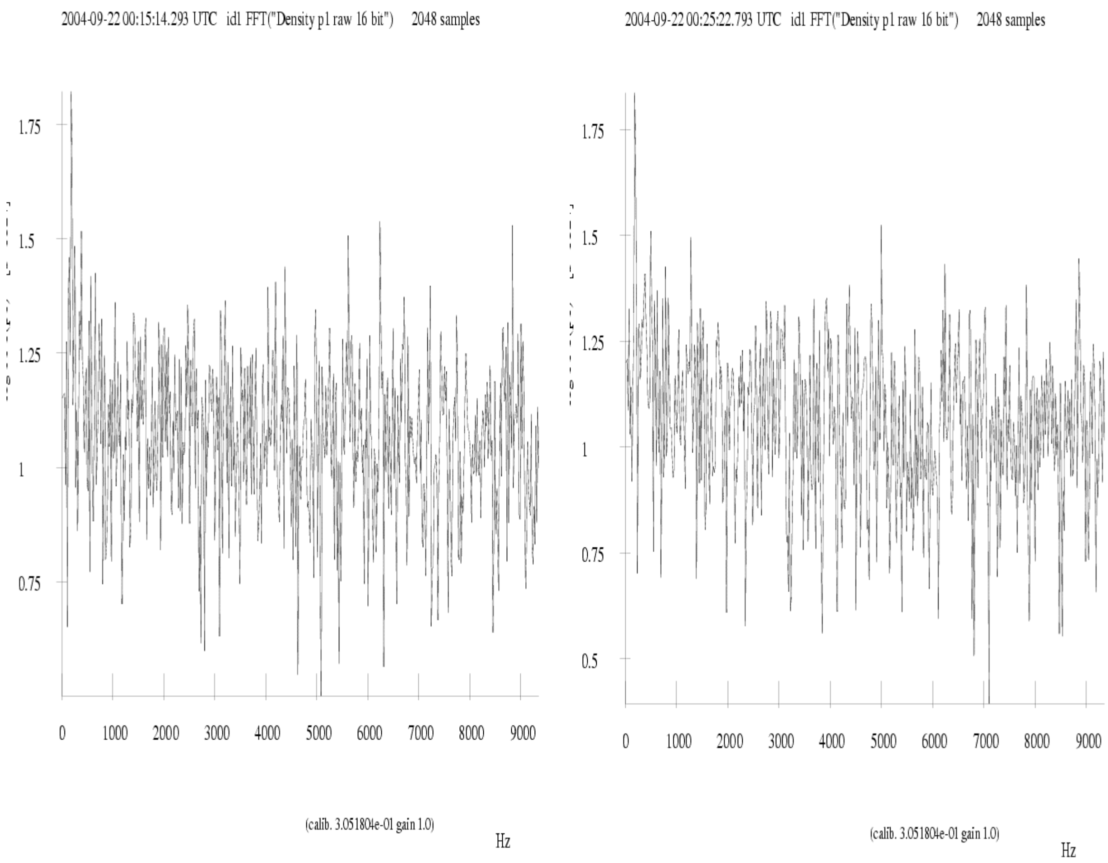

Figure 4. Example plot from the LAP interference scenario report, showing LAP P1 spectra before and after GIADA going into active mode. No obvious signature van be detected.

3.3 Calibration and offsets

LAP has the capability to determine instrument offsets and calibration factors onboard. Figures 5 shows the offset determinations in September 2004. Included is also a best-fit line to offset determination in May. For probe 1, the May and September offsets differ slightly, while probe 2 shows constant offsets.

The offset stability appears to be very good. Taking the observed spread of the data around the fitted lines as an uncertainty measure, we can determine the current to within 5 TM units, corresponding to 1.5 nA (high gain, 16 bit ADCs). The observed spread in data agrees well with the noise level at fixed bias established in Section 3.1.

The difference between the P1 offset curves determined in May and September is mainly due to a change of slope of the curve. This can be a temperature effect, though we are more inclined to believe that we here see the real drift in instument electronics that we had anticipated, and for which we have included the possibility of onboard calibrations. The difference in the slopes determined in May and September correspond to 0.17 nA/V, which we for the moment can use as a worst-case uncertainty measure for slope determinations. Even this is an excellent value, corresponding to little more than 10 nA over the full LAP bias range, and we should note that this certainly is an upper value with a good margin.

Monitoring these small offset changes is of some interest at this stage in the project, with only tenuous solar wind plasmas as yet observed. However, when in the dense plasma at the comet, with currents up to tens of microamps expected, these considerations will be completely irrelevant.

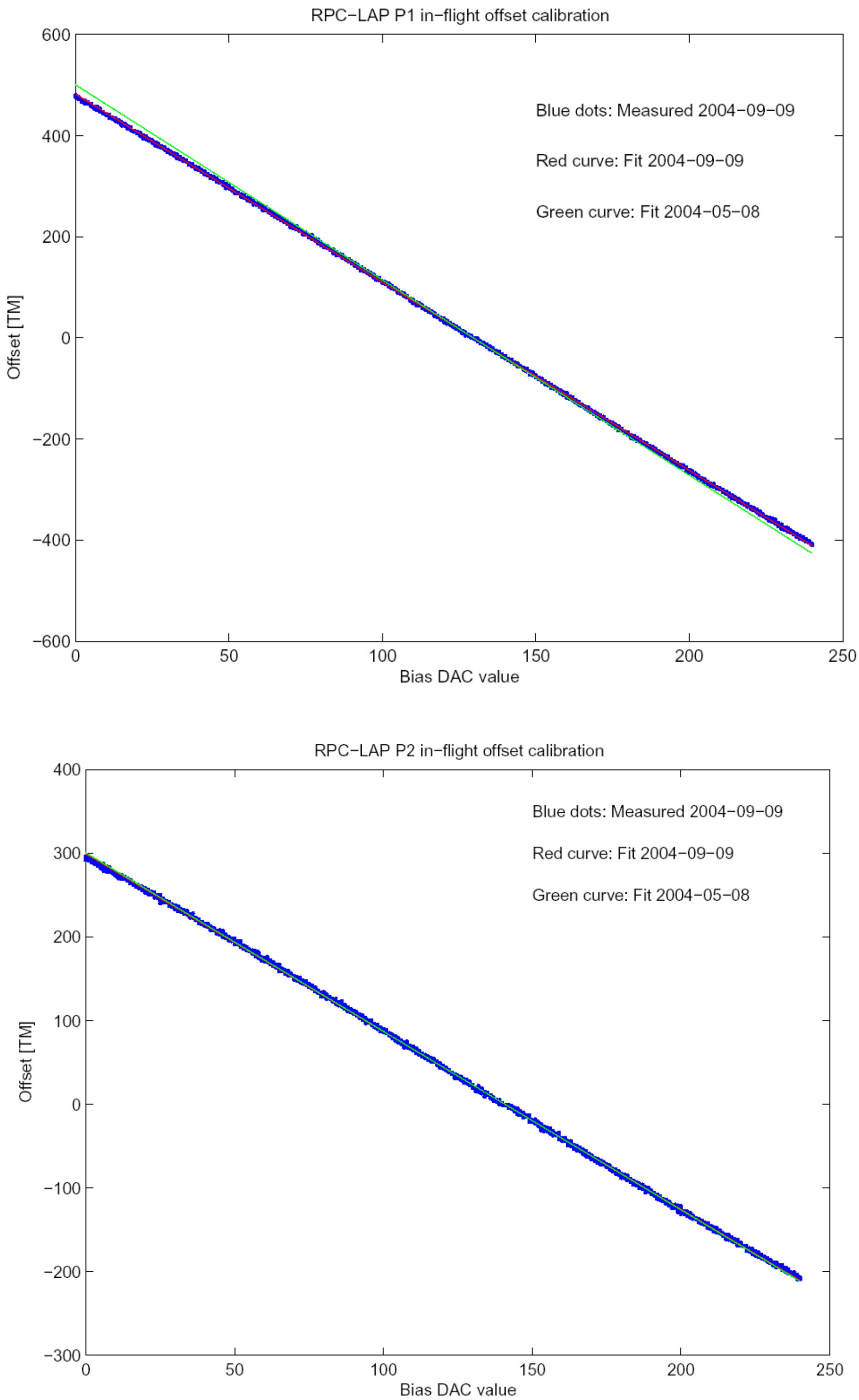

Figure 5. Offset determinations on September 9, 2004, for P1 (top) and P2 (bottom). Blue dots are data, red line a linear fit. The green line is a linear fit to offset determination from May 8, 2004. Each bias DAC step is 0.25 V, and each TM unit on the vertical axis corresponds to a current of 0.305 nA.

3.4 Probe bias sweeps

After compensation for on-board determined offsets, LAP produces very clean Langmuir probe bias sweeps. An example is seen in Figure 6. In the tenuous solar wind plasma, the probe current is dominated by probe photoelectron emission at negative voltages, and by collection of photoelectrons emitted by the spacecraft on the positive side. While any interpretation of fitted parameters in terms of physical quantities like plasma density and electron temperature thus is uncertain in the solar wind, other parameters are quite clear. The photoemission saturation current is around 80 nA, as expected from our Cassini probe. It is also possible to estimate the spacecraft potential from the probe sweeps with good accuracy. This quantity should contravary with the plasma density, and is therefore very useful. However, the detailed relation between density and potential is quite individual between spacecraft, and we cannot produce any good estimates until we have some other density data to compare to. The Earth flyby will produce such data.

There is no sign of any hysteresis effects in the LAP probe bias sweeps, i.e. any consistent difference between sweeps where the voltage is increased (upsweeps) or decreased (downsweeps). This is as expected, as no hysteresis could be found on our Langmuir probe on Cassini either, which uses the same titanium nitride surface coating. This means that we do not have to sweep in both directions, and hence can save some telemetry. Sweep operations in normal TM mode have been adjusted accordingly.

A notable and stable feature of the LAP bias sweeps in the solar wind is the slope of the curve on the negative side, amounting to around 0.5 nA/V in Figure 6. The worst-case uncertainty on the slope of 0.17 nA/V discussed in Section 3.3 is not sufficient to explain the observed slope, which can be seen in both probes. While some unknown instrumental effect may be hypothesized, we are more inclined to suspect either a leakage current over the insulator between probe and stub, or a real plasma population. The solar wind plasma is not expected to include ions below some 1 keV, but it could be due to for example photoelectrons emitted by a very negative area on the spacecraft (below -30 V) or possibly ions from still ongoing outgassing from the spacecraft.

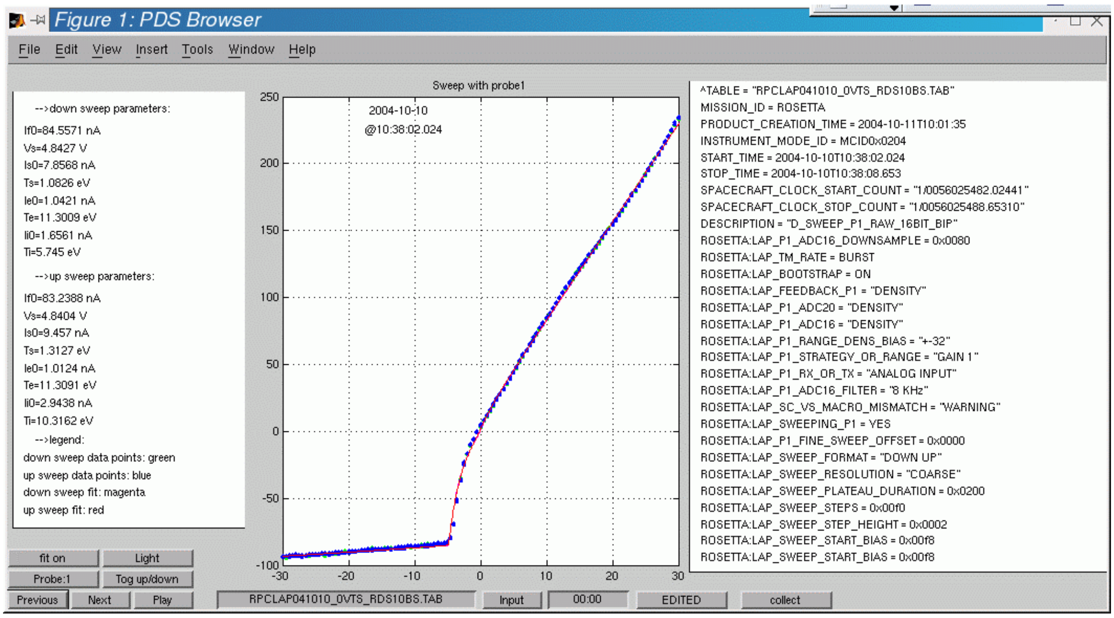

Figure 6. A Langmuir probe bias sweep obtained by LAP during the pointing scenario ("LAP dance"). In the tenuous solar wind plasma, the sweeps are dominated by emission and collection of photoelectrons. Though one can make a good fit to the measured data, most of the derived parameters cannot be considered reliable here.

3.5 Probe photoemission

For investigation of the photoemission characteristics of both probes, the pointing scenario included some special maneouvres known as the LAP dance. During this activity, each probe were at some time in sun and in shadow. This is described in more detail in in the report from the LAP dance (IRFU-ROS-CVPPNT).

Figure 7 shows the photoemission current estimated for the two LAP probes as a function of time during the LAP dance. Some basic features are readily observed. First, we can clearly see when probe 1 (blue-green curve) and probe 2 (red-black curve) goes into eclipse as a sudden drop in photoemission current. The different residual values of electron emission or ion collection for the two probes when in shadow could possibly be due to calibration issues. The strength of the increase in photoemission from P2 when and just before P1 goes into shadow at 6:50 is to some extent an artifact of the analysis routine and of changing ion current, and the dip seen in the P1 curve just before UT 13:00 is clearly spurious. However, that P2 is lower in photosaturation current than P1 is obvious directly from the sweeps. This could possibly be due to negative charging of spacecraft or lander structures in the vicinity of P2, but more likely also be due to contamination on the probe, perhaps from thruster firings. One should note that P2 has spent much less time in sunlight than has P1. It will be very interesting to see if this difference persists. It has little or no impact on the scientific performance of the instrument.

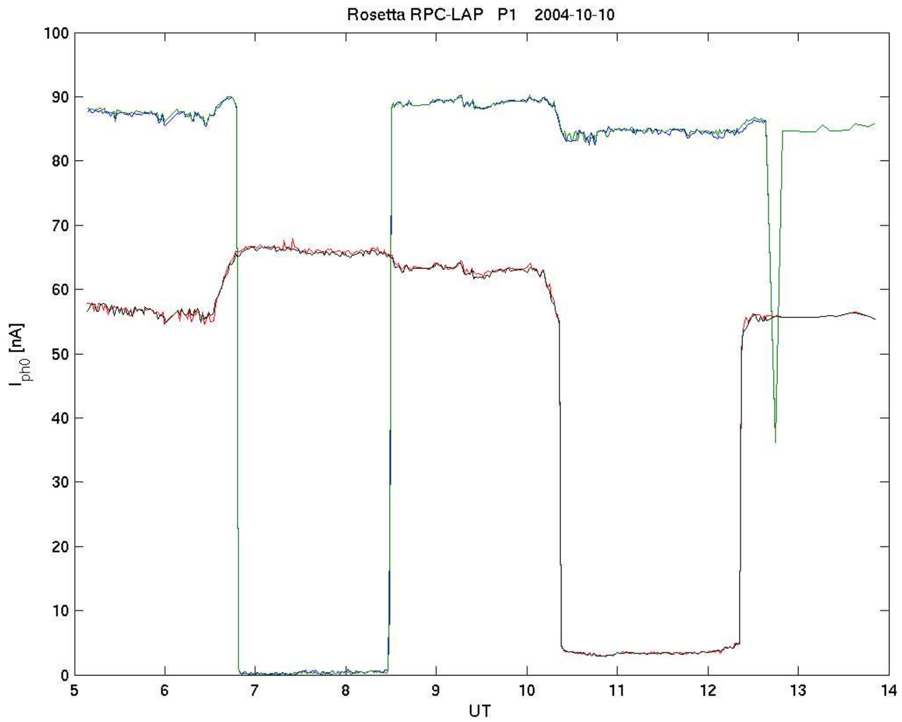

Figure 7. Photoemission saturation current derived from probe bias sweeps (Figure 6 is an example) during the LAP dance. Some features in the curve are spurious, but the drastic drops in current when the probe goes into eclipse are clear, and also that P2 (red-black) has less photoemission than P1 (blue-green).

4 Conclusion

The CVP has fully verified the post-launch integrity of the LAP instrument and verified basic scientific capabilities.

In lack of independent data for comparison, all scientific aspects of LAP cannot yet be considered verified. The Earth flyby will provide such comparison data, from other spacecraft as well as from plasma models. From what can be judged from the data we have seen so far, LAP will meet its design goals. The status of the LAP science capacity is elaborated in Table 1 below.

In conclusion, LAP works as intended and is fully ready for scientific operations. The instrument appears to meet all its design goals, though actual verification of some of the capabilities have not yet been possible.

Parameter	**EID-B**	**In-flight verification**
Plasma density	$1 - 10^6$ cm^{-3}	Measurement technique verified. Earth flyby should verify actual determination up to 10^3 cm^{-3}.
Electron temperature	10 meV - 10 eV	Measurement technique verified. Comparison values needed. Earth flyby should verify actual determination in 0.1 - 10 eV range.
Flow velocity	0 - 10 km/s	Measurement technique verified. Earth flyby may possibly verify actual determination.
Plasma waves	0 - 8 kHz	Verified. Threshold value around $4 \cdot 10^{-5}$ (mV/m)^2/Hz established.
Spacecraft potential	±32 V	Verified.

Table 1. LAP science capabilities and verification status.

R O S E T T A

FLIGHT REPORTS
of RPC–MAG

RO–IGM–TR–0006

Issue: 1 Revision: 1

April 6, 2004

Report of the

COMMISSIONING PART 1A

Time period: March 17. - 19., 2004

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Contents

1 Summary

The first commissioning phase for RPC–MAG was executed in the time period March 17. – 19, 2004. All the performed steps were successful. MAG worked as expected. All modes were checked, both the OB and the IB sensor were checked as sensor. All voltages were stable and in the expected range. The sensor temperatures varied in a wide low range ($-100°$C – $-85°$C) , because the sensors were obviously in the shadow. During the MAG boom deployment MAG was set to BURST mode. The boom rotation could be identified in the data. After the boom deployment the offset remained higher as expected. Most likely a source on the s/c (compensation magnet ?, Lander ?) is responsible for this behavior. It is obvious that the source of this high residual field is located the s/c, because there is no smooth transition in the magnetic field values during the last phase of the boom rotation. The changes in the magnetic field end abruptly and do not follow a smooth curve. Therefore, the influence of the s/c can be seen (especially with the IB sensor) even in the deployed boom position. A detailed investigation will be performed in the next weeks to create a model that can eliminate the disturbing residual field at the locations of the sensors.

In summary MAG is operating well and we are looking forward for the first scientific relevant measurements.

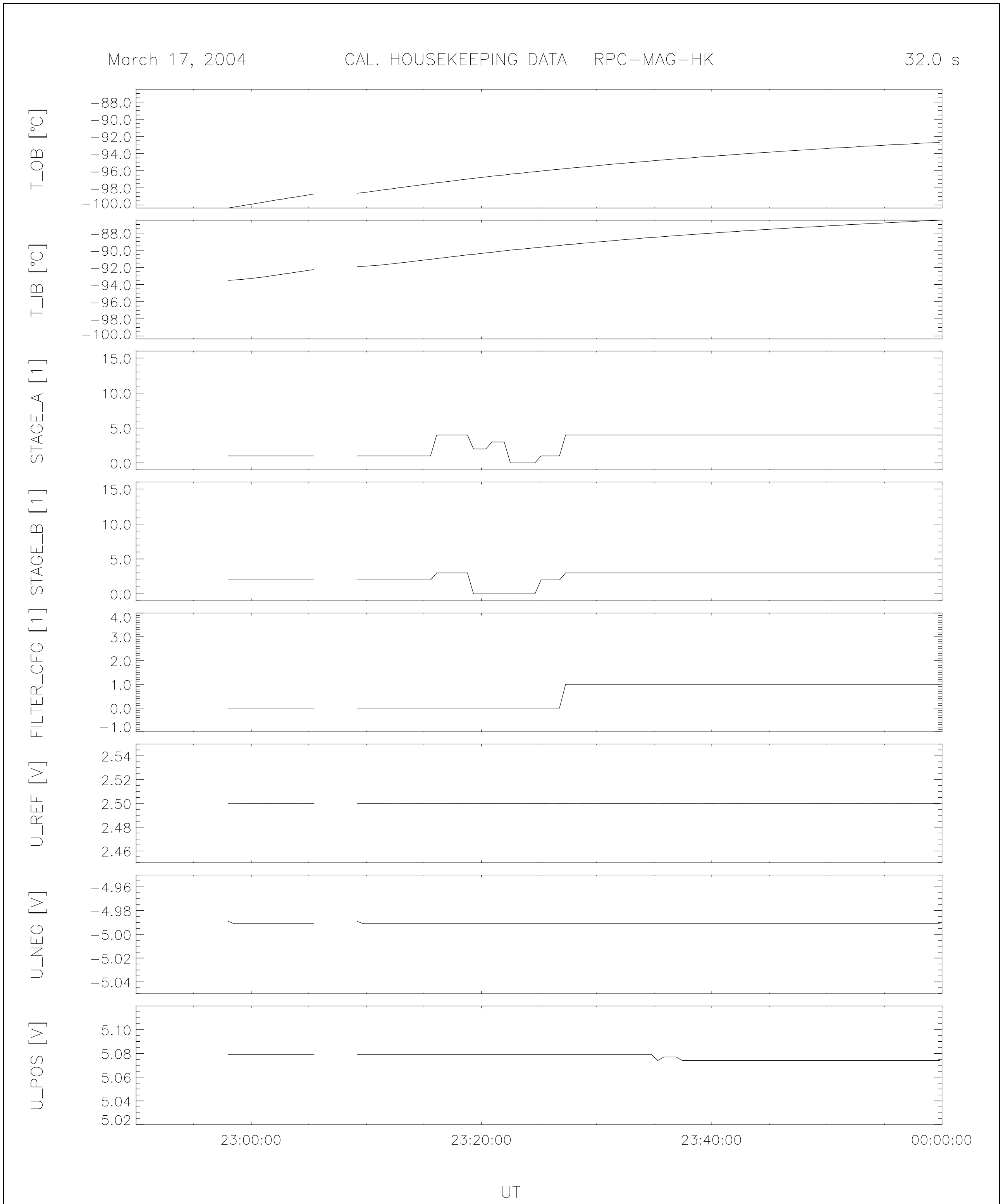
The next sections give a brief description of the executed activities and show the obtained data. Housekeeping data (Temperature of the OB & IB sensor, Filter Stages A & B, Filter configuration register, Reference voltage, negative and positive 5V supply voltage, and the coarse HK sampled magnetic field data of the OB sensor) are presented as well as magnetic field science data of the OB and IB sensor in the activated modes.Magnetic field data are plotted in instrument coordinates if not otherwise stated. They are calibrated according to the results of the ground calibration. Sensitivity, Misalignment, and Temperature effects are taken into account. The s/c residual field is not subtracted.

2 March1 17, 2004:

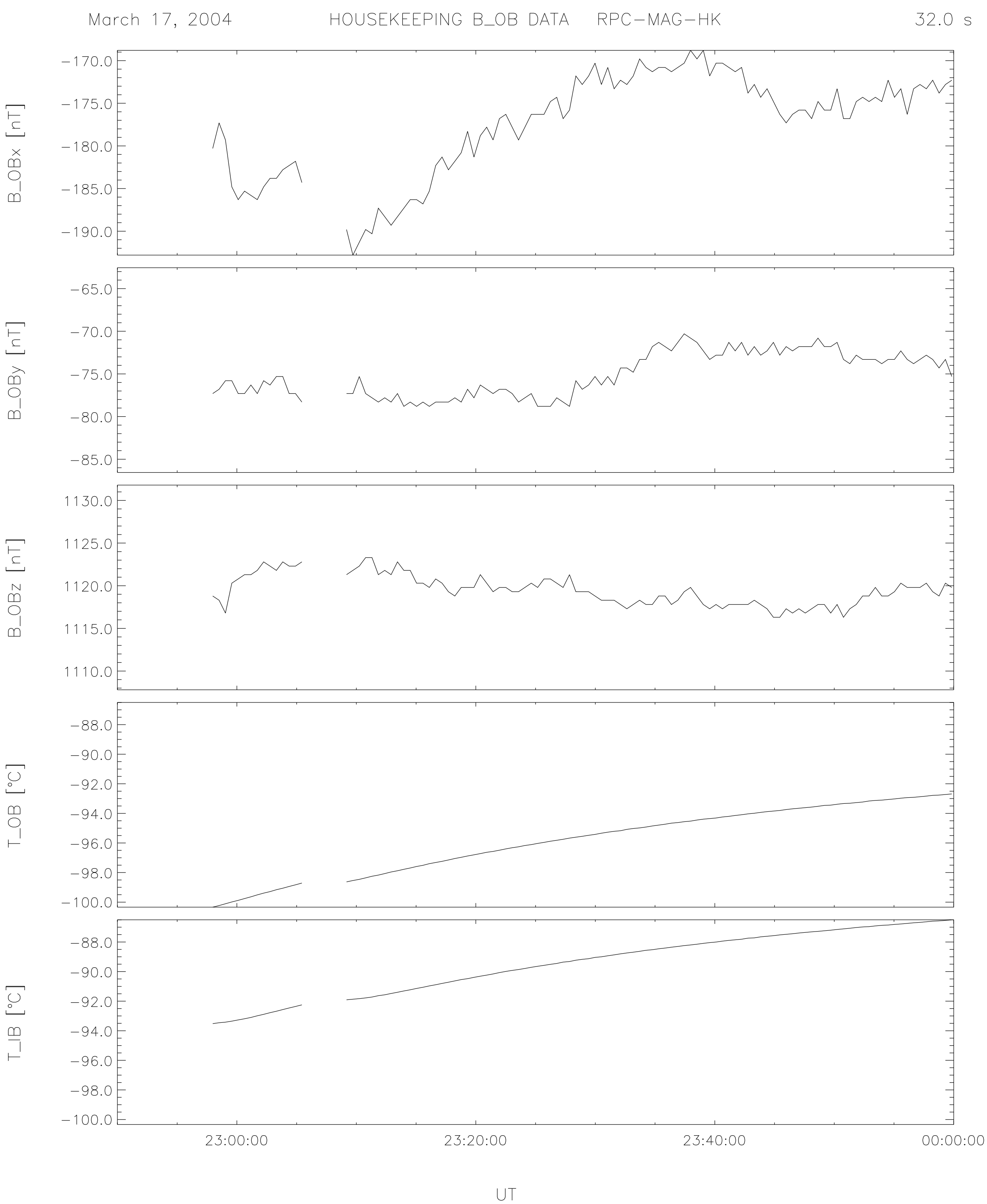
2.1 Actions

MAG was switched on immediately after PIU. At the beginning of the RPC commissioning the MAG TM/TC check was carried out according to FCP_509 (start at 23:12). All commands passed smoothly and the instrument followed in the expected way. All modes were tested. IB and OB were switched to be primary sensors. The result can be seen in the following plots.

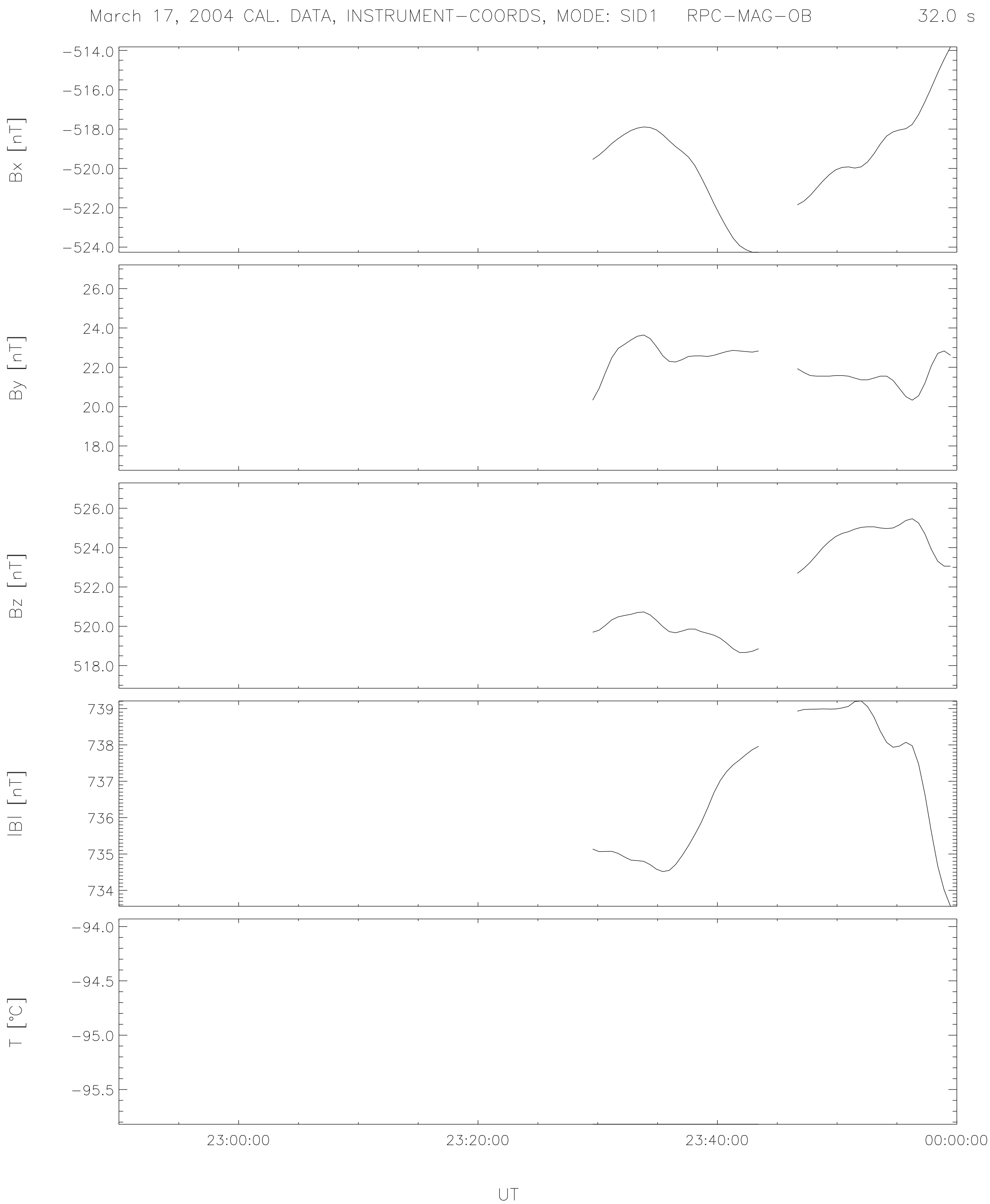
2.2 Plots



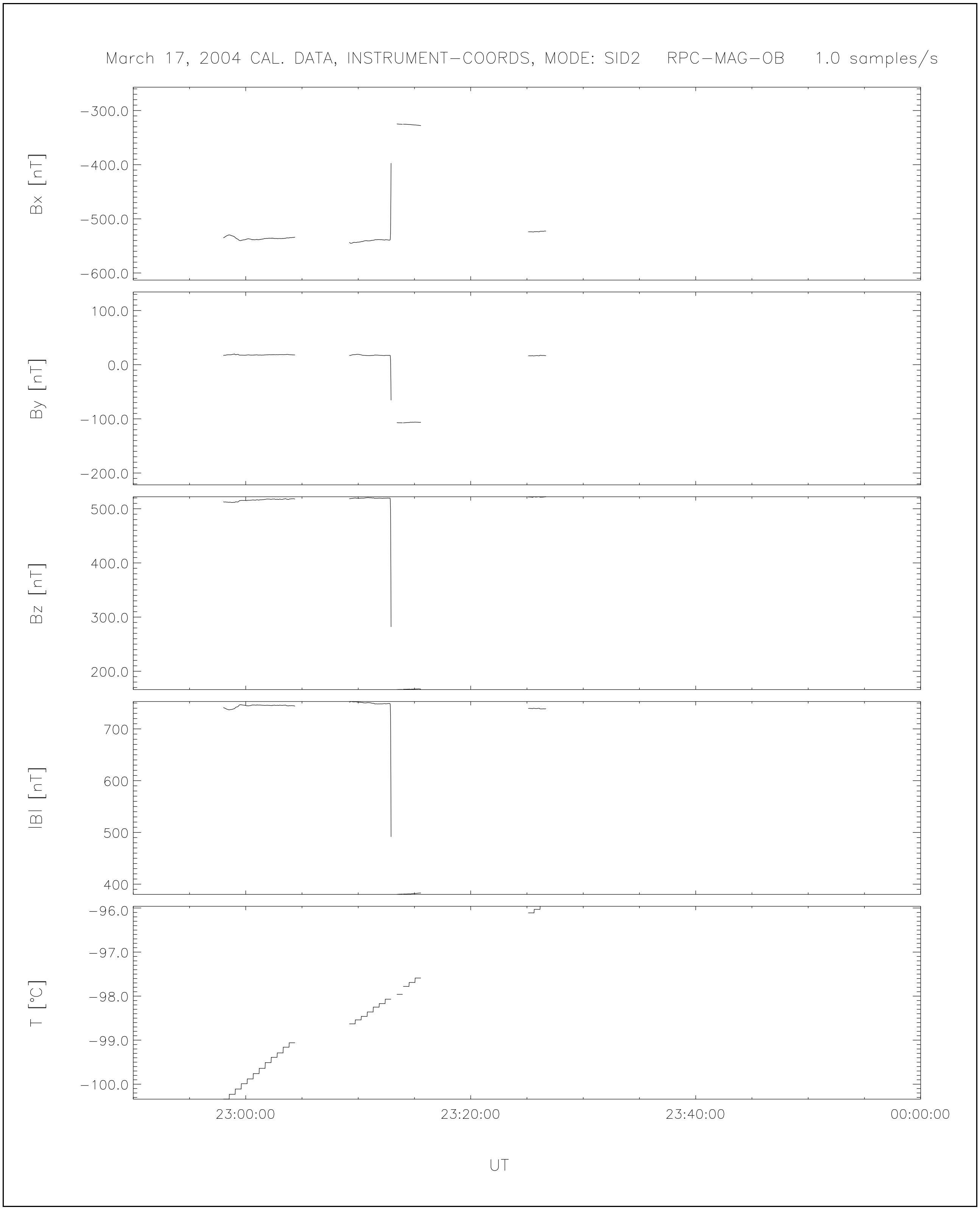
March 17, 2004
CAL. HOUSEKEEPING DATA RPC−MAG−HK
32.0 s
T_OB [°C]
−88.0
−90.0
−92.0
−94.0
−96.0
−98.0
−100.0
T_IB [°C]
STAGE_A [1]
15.0
10.0
5.0
0.0
STAGE_B [1]
FILTER_CFG [1]
4.0
3.0
2.0
1.0
0.0
−1.0
U_REF [V]
2.54
2.52
2.50
2.48
2.46
U_NEG [V]
−4.96
−4.98
−5.00
−5.02
−5.04
U_POS [V]
5.10
5.08
5.06
5.04
5.02
23:00:00
23:20:00
23:40:00
00:00:00
UT



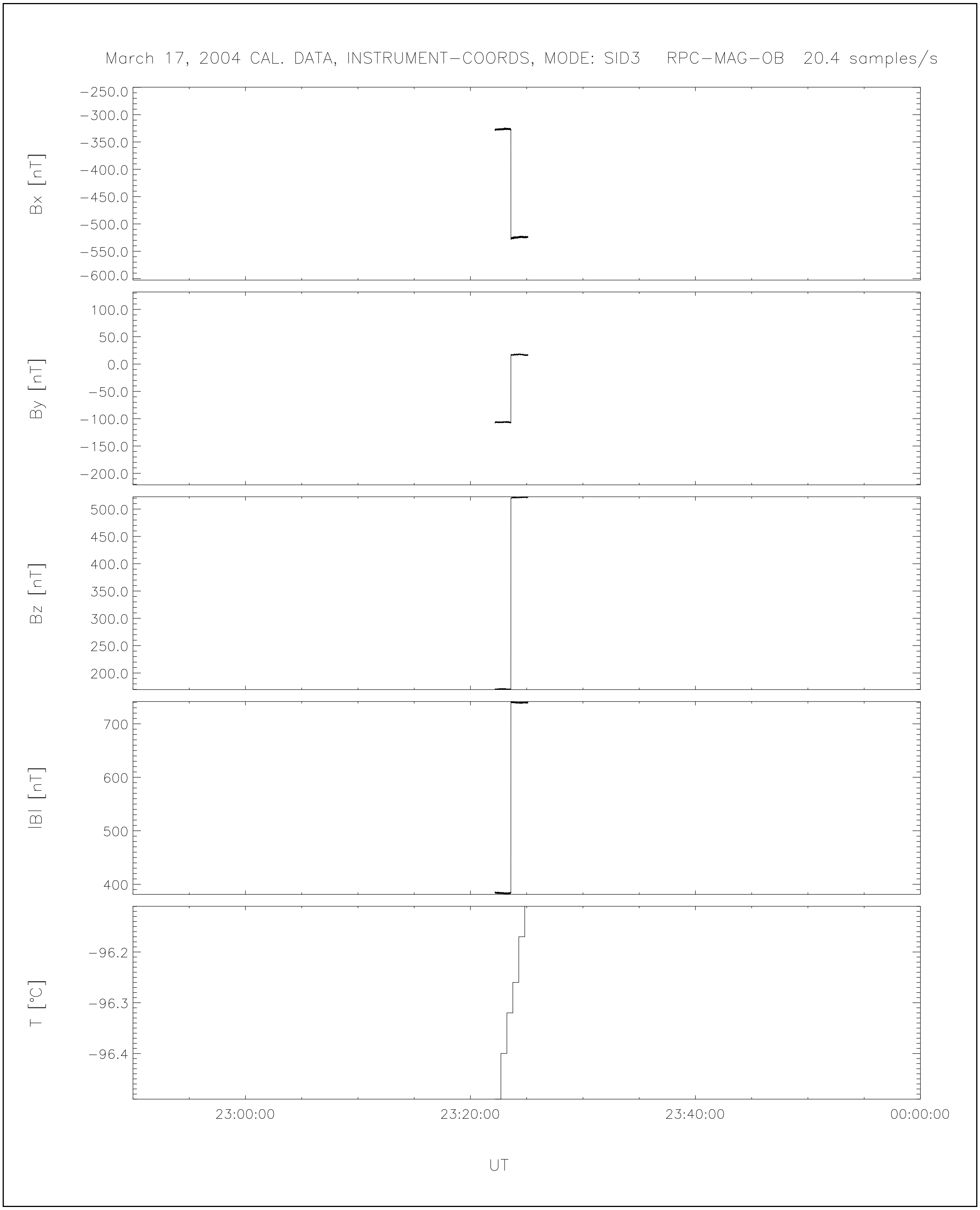
March 17, 2004
HOUSEKEEPING B_OB DATA RPC–MAG–HK
32.0 s
B_OBx [nT]
B_OBy [nT]
B_OBz [nT]
T_OB [°C]
T_IB [°C]
23:00:00
23:20:00
23:40:00
00:00:00
UT



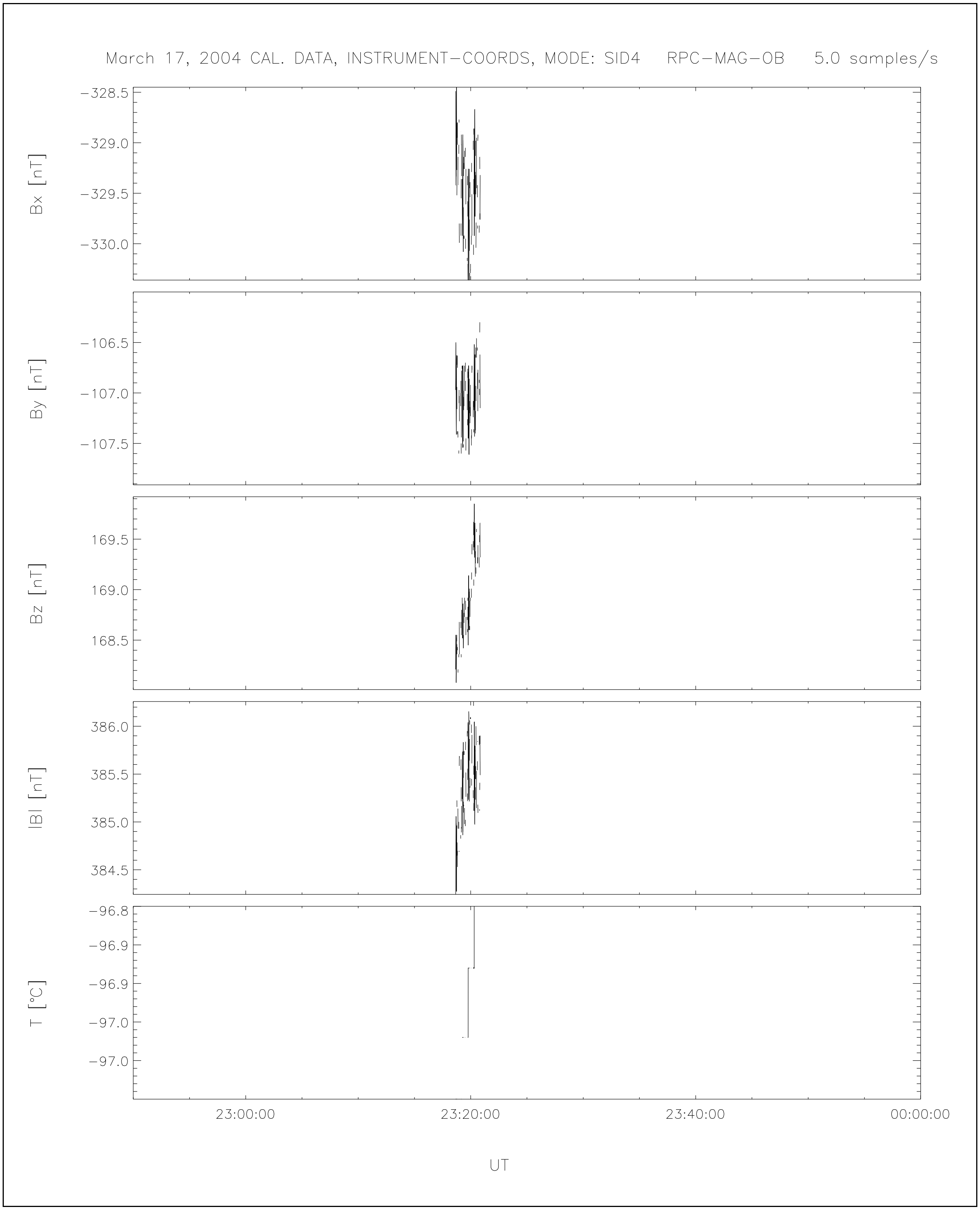
March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID1 RPC–MAG–OB 32.0 s
Bx [nT]
−514.0
−516.0
−518.0
−520.0
−522.0
−524.0
By [nT]
26.0
24.0
22.0
20.0
18.0
Bz [nT]
526.0
524.0
522.0
520.0
518.0
|B| [nT]
739
738
737
736
735
734
T [°C]
−94.0
−94.5
−95.0
−95.5
23:00:00
23:20:00
23:40:00
00:00:00
UT

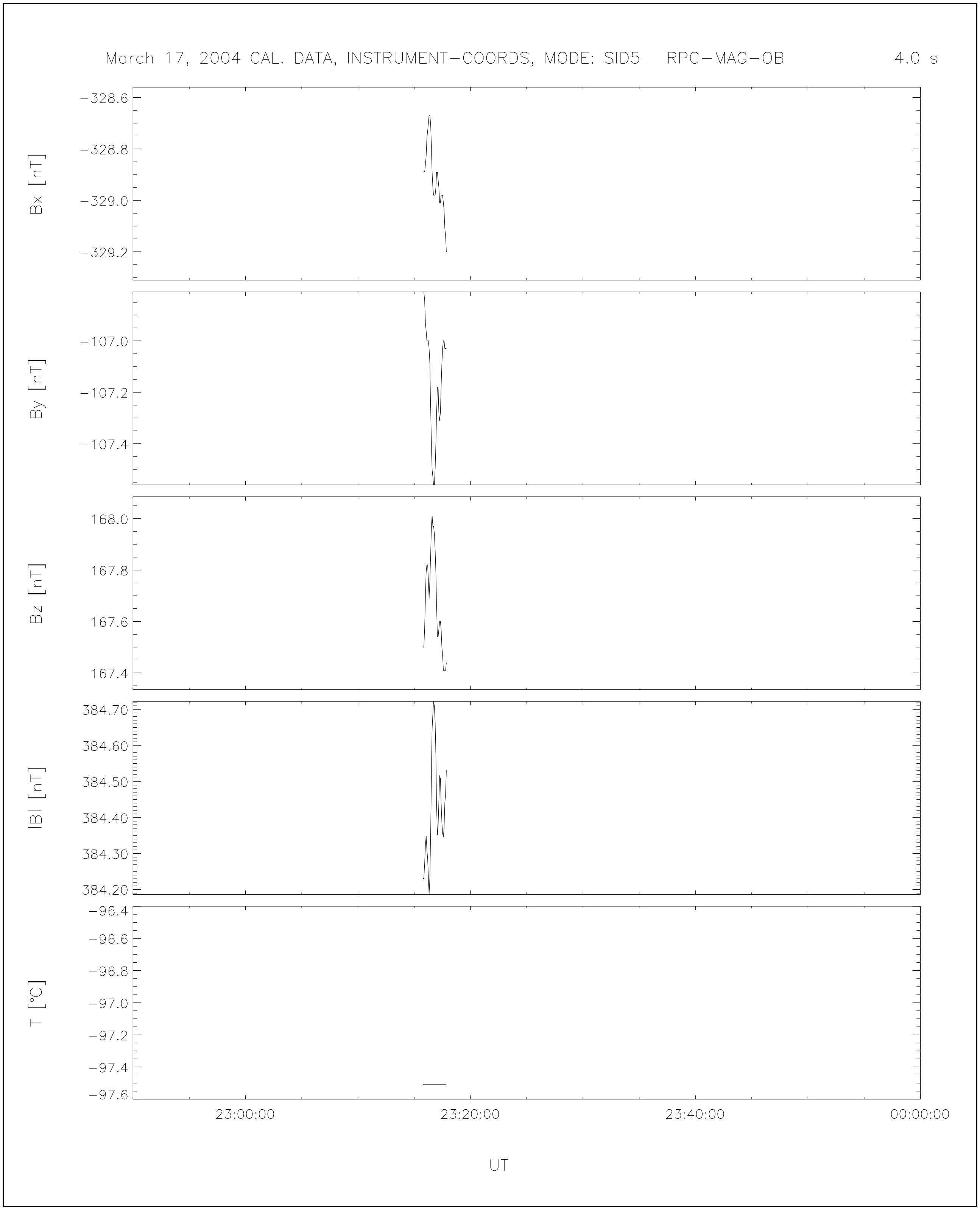


March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID2 RPC–MAG–OB 1.0 samples/s
Bx [nT]
−300.0
−400.0
−500.0
−600.0
By [nT]
100.0
0.0
−100.0
−200.0
Bz [nT]
500.0
400.0
300.0
200.0
lBl [nT]
700
600
500
400
T [°C]
−96.0
−97.0
−98.0
−99.0
−100.0
23:00:00
23:20:00
23:40:00
00:00:00
UT

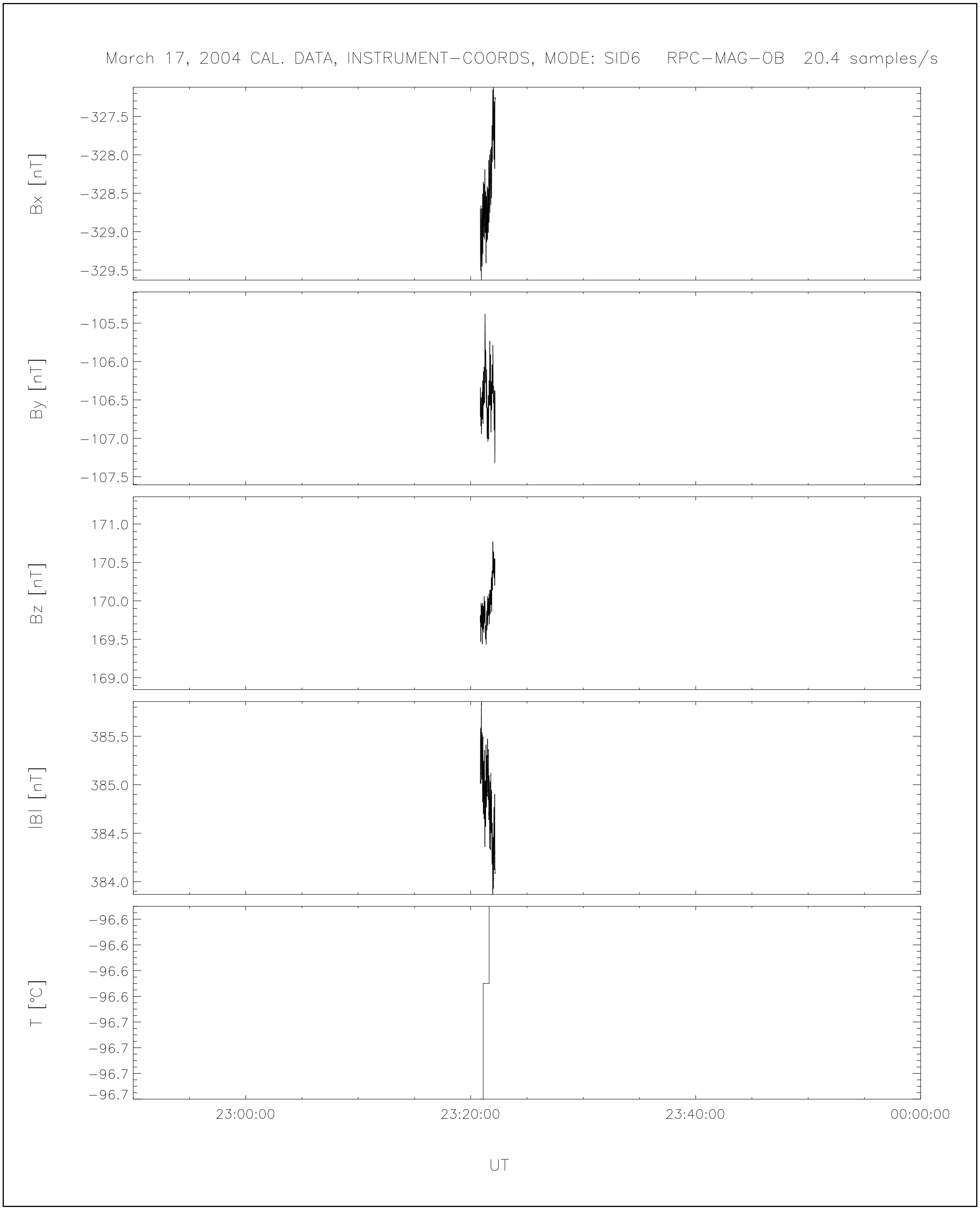


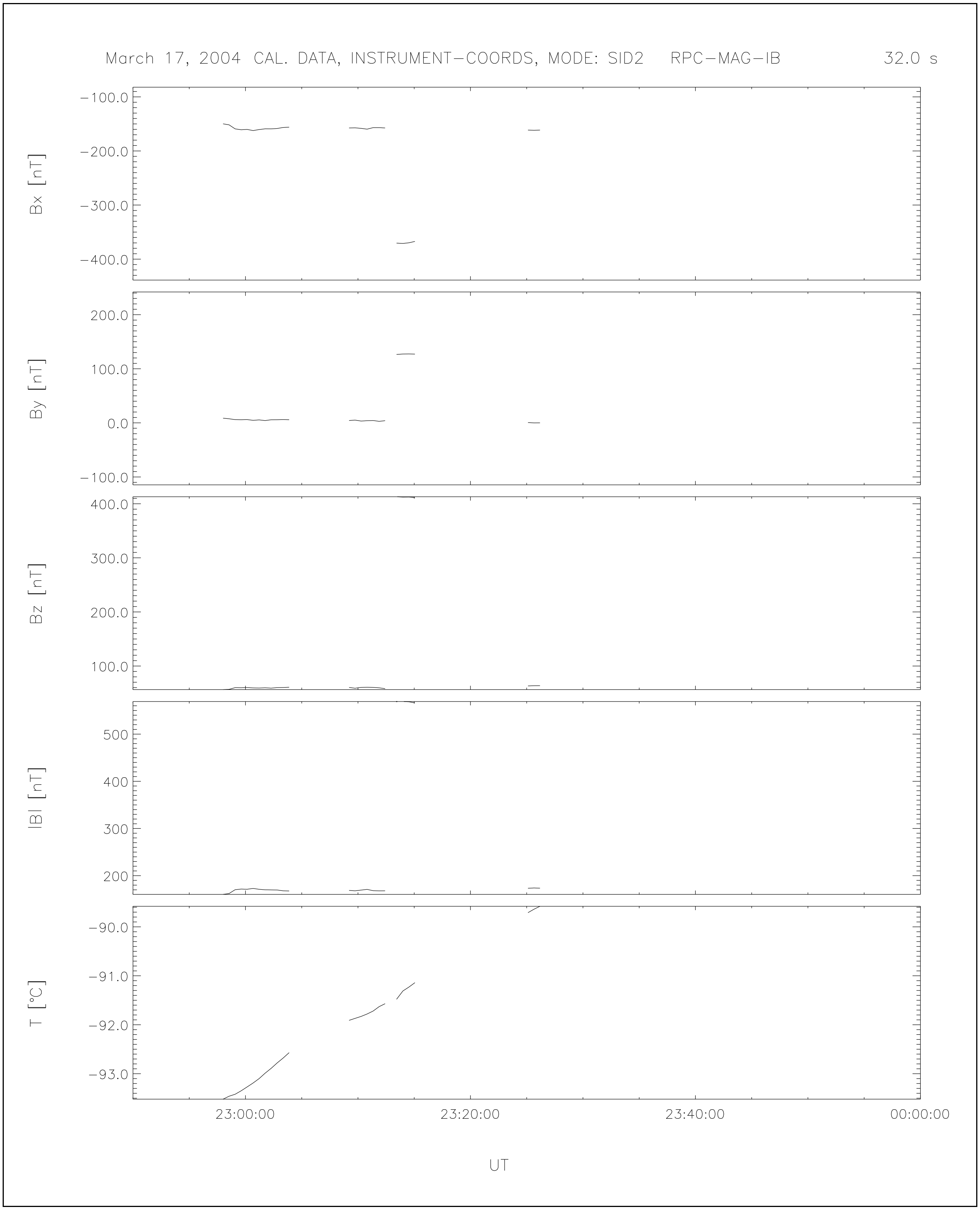
March 17, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID3 RPC−MAG−OB 20.4 samples/s
Bx [nT]
−250.0
−300.0
−350.0
−400.0
−450.0
−500.0
−550.0
−600.0
By [nT]
100.0
50.0
0.0
−50.0
−100.0
−150.0
−200.0
Bz [nT]
500.0
450.0
400.0
350.0
300.0
250.0
200.0
|B| [nT]
700
600
500
400
T [°C]
−96.2
−96.3
−96.4
23:00:00
23:20:00
23:40:00
00:00:00
UT


March 17, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID4 RPC−MAG−OB 5.0 samples/s
Bx [nT]
−328.5
−329.0
−329.5
−330.0
By [nT]
−106.5
−107.0
−107.5
Bz [nT]
169.5
169.0
168.5
|B| [nT]
386.0
385.5
385.0
384.5
T [°C]
−96.8
−96.9
−96.9
−97.0
−97.0
23:00:00
23:20:00
23:40:00
00:00:00
UT

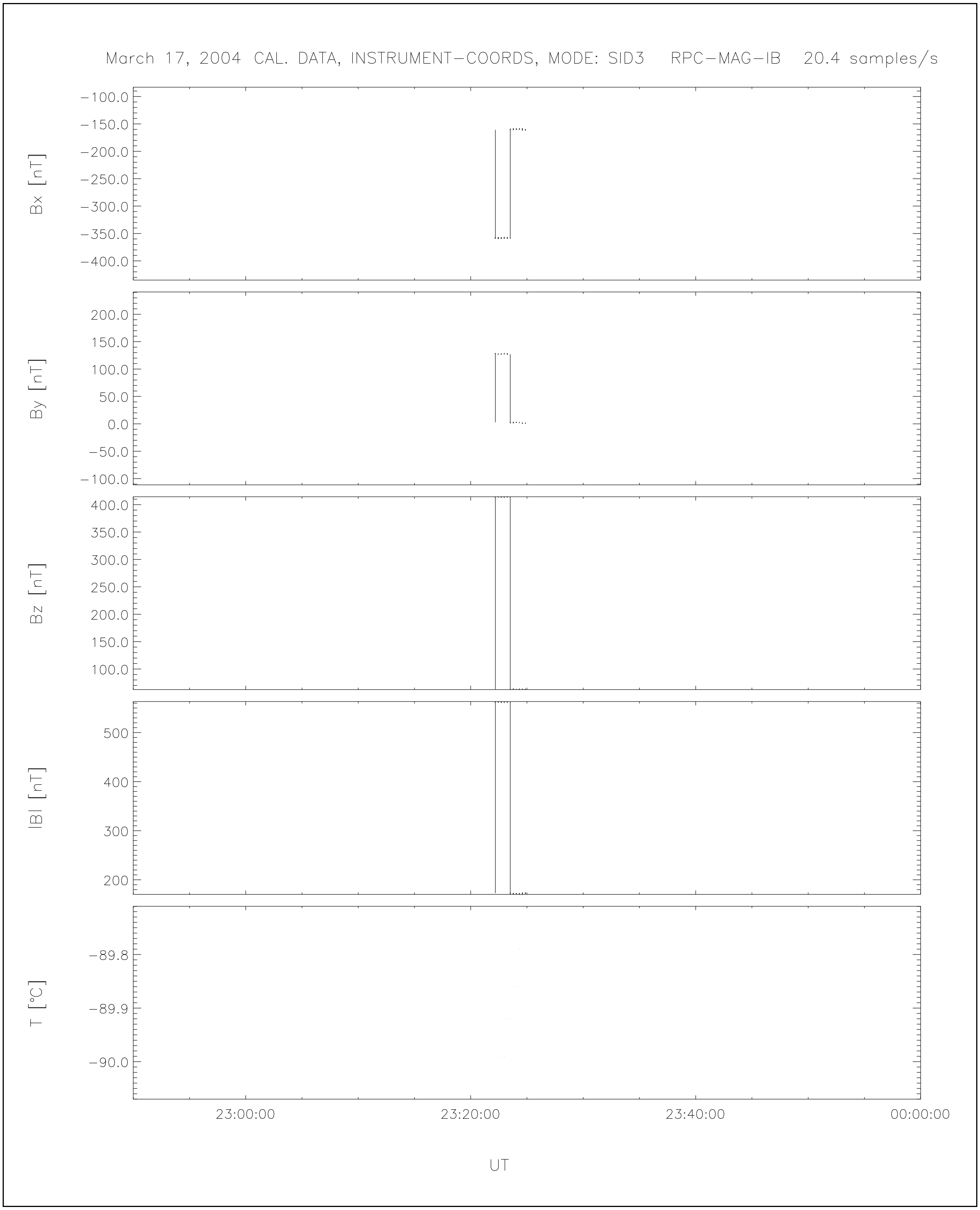


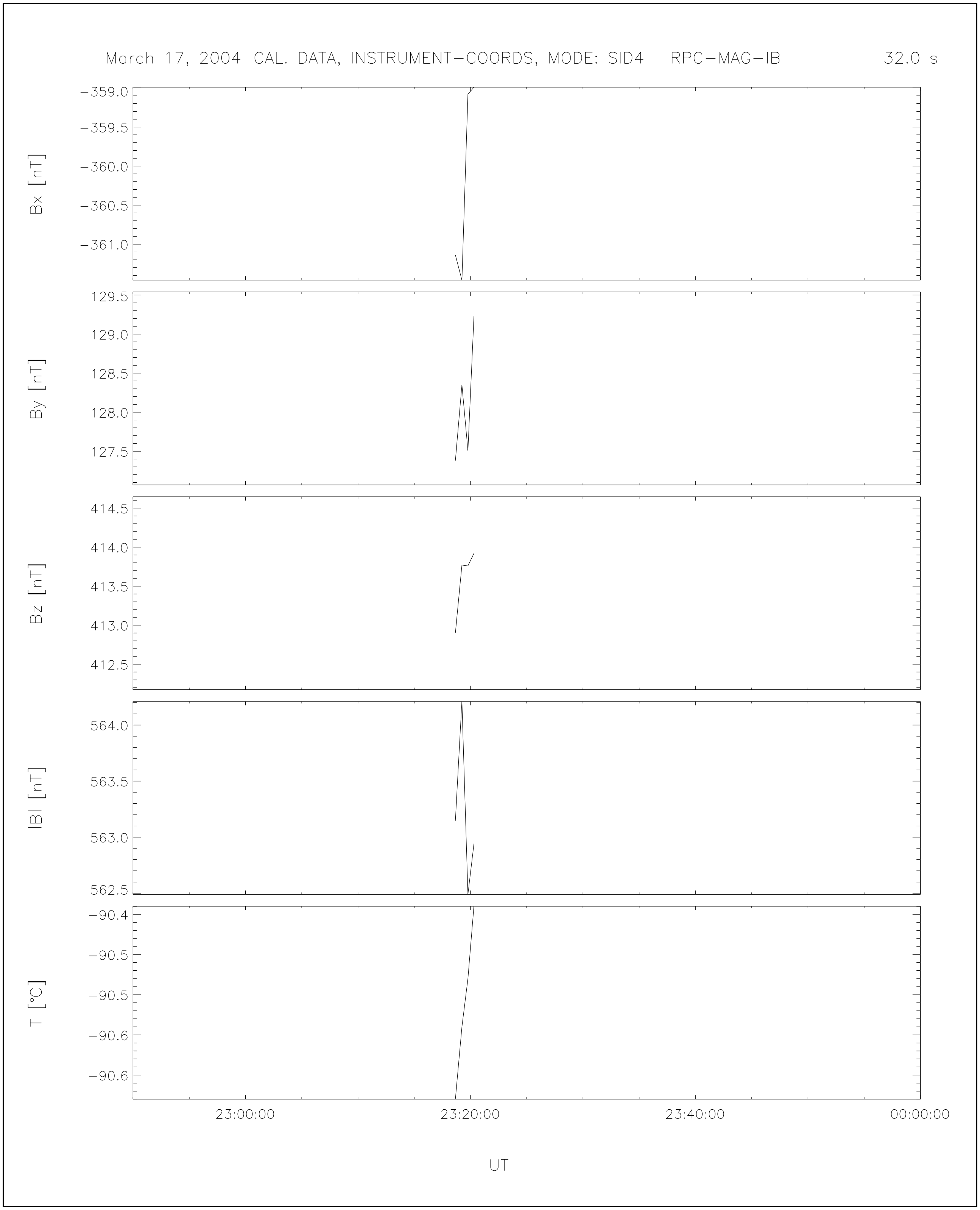
March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID5 RPC–MAG–OB 4.0 s
Bx [nT]
−328.6
−328.8
−329.0
−329.2
By [nT]
−107.0
−107.2
−107.4
Bz [nT]
168.0
167.8
167.6
167.4
|B| [nT]
384.70
384.60
384.50
384.40
384.30
384.20
T [°C]
−96.4
−96.6
−96.8
−97.0
−97.2
−97.4
−97.6
23:00:00
23:20:00
23:40:00
00:00:00
UT


March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID6 RPC–MAG–OB 20.4 samples/s
Bx [nT]
−327.5
−328.0
−328.5
−329.0
−329.5
By [nT]
−105.5
−106.0
−106.5
−107.0
−107.5
Bz [nT]
171.0
170.5
170.0
169.5
169.0
IBI [nT]
385.5
385.0
384.5
384.0
T [°C]
−96.6
−96.6
−96.6
−96.6
−96.7
−96.7
−96.7
−96.7
23:00:00
23:20:00
23:40:00
00:00:00
UT

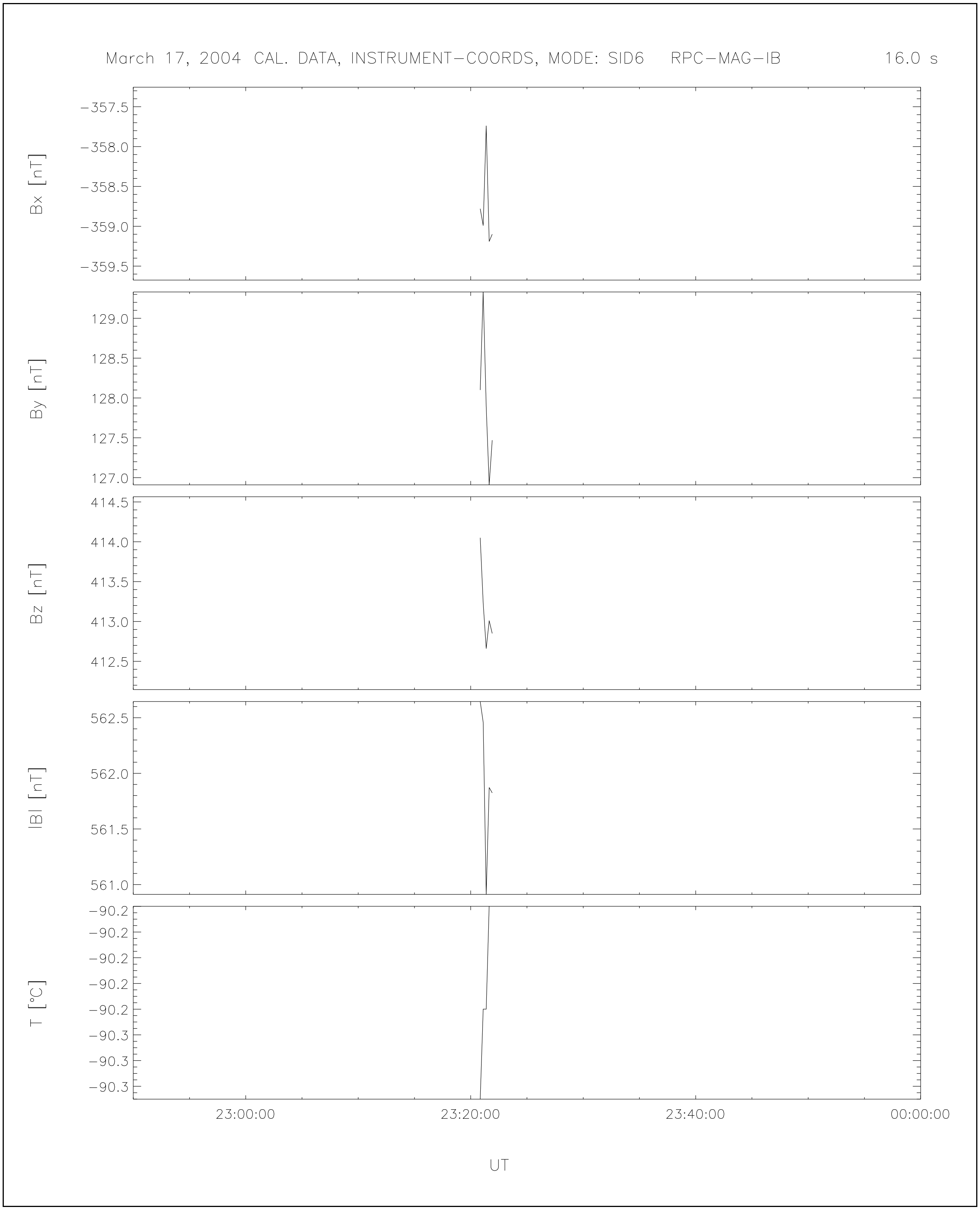


March 17, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID2 RPC−MAG−IB 32.0 s
Bx [nT]
−100.0
−200.0
−300.0
−400.0
By [nT]
200.0
100.0
0.0
−100.0
Bz [nT]
400.0
300.0
200.0
100.0
IBI [nT]
500
400
300
200
T [°C]
−90.0
−91.0
−92.0
−93.0
23:00:00
23:20:00
23:40:00
00:00:00
UT


March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID3 RPC–MAG–IB 20.4 samples/s
Bx [nT]
−100.0
−150.0
−200.0
−250.0
−300.0
−350.0
−400.0
By [nT]
200.0
150.0
100.0
50.0
0.0
−50.0
−100.0
Bz [nT]
400.0
350.0
300.0
250.0
200.0
150.0
100.0
IBI [nT]
500
400
300
200
T [°C]
−89.8
−89.9
−90.0
23:00:00
23:20:00
23:40:00
00:00:00
UT



March 17, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID4 RPC−MAG−IB 32.0 s
Bx [nT]
−359.0
−359.5
−360.0
−360.5
−361.0
By [nT]
129.5
129.0
128.5
128.0
127.5
Bz [nT]
414.5
414.0
413.5
413.0
412.5
IBI [nT]
564.0
563.5
563.0
562.5
T [°C]
−90.4
−90.5
−90.5
−90.6
−90.6
23:00:00
23:20:00
23:40:00
00:00:00
UT



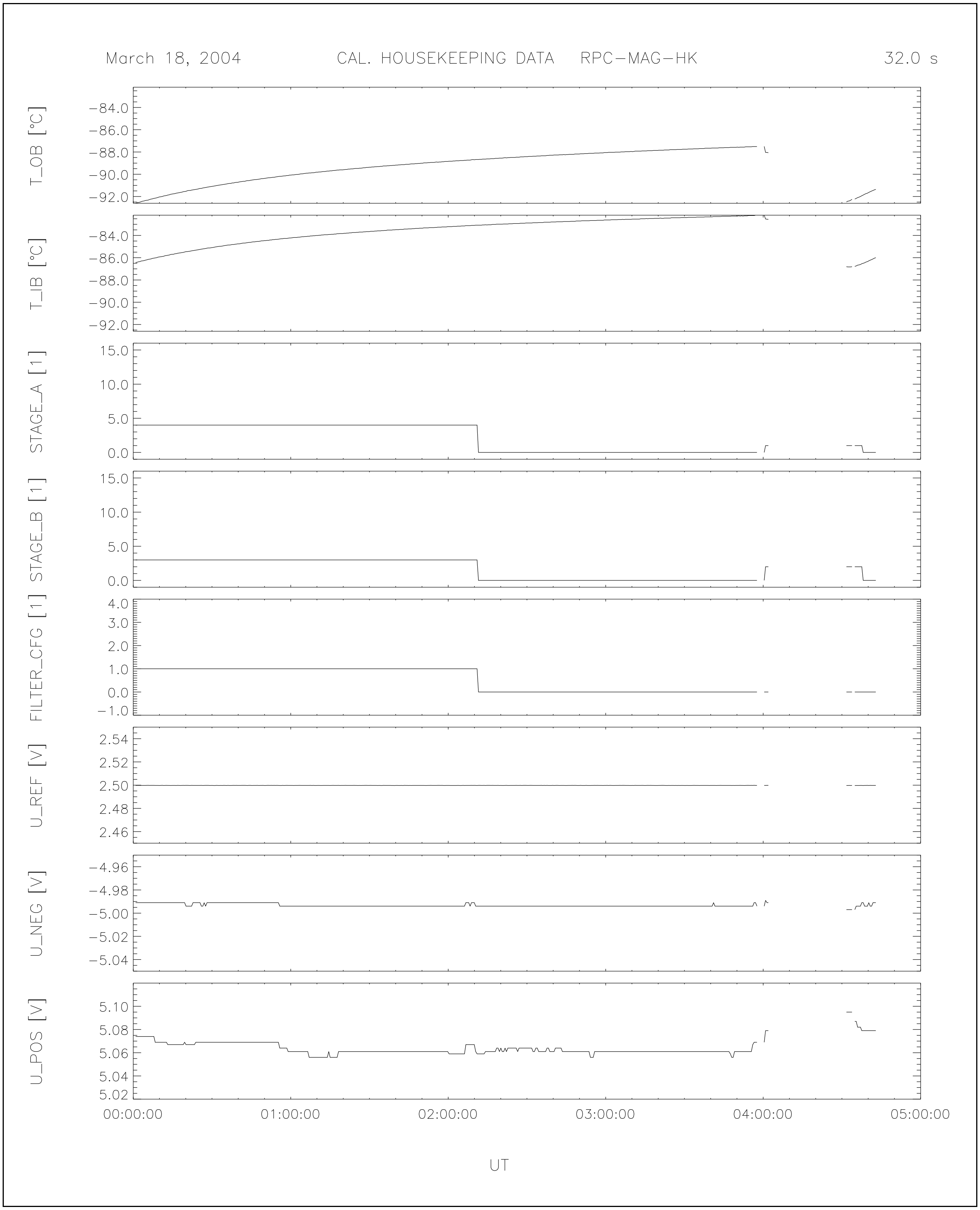
March 17, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID6 RPC–MAG–IB 16.0 s
Bx [nT]
−357.5
−358.0
−358.5
−359.0
−359.5
By [nT]
129.0
128.5
128.0
127.5
127.0
Bz [nT]
414.5
414.0
413.5
413.0
412.5
|B| [nT]
562.5
562.0
561.5
561.0
T [°C]
−90.2
−90.2
−90.2
−90.2
−90.2
−90.3
−90.3
−90.3
23:00:00
23:20:00
23:40:00
00:00:00
UT

3 March1 18, 2004:

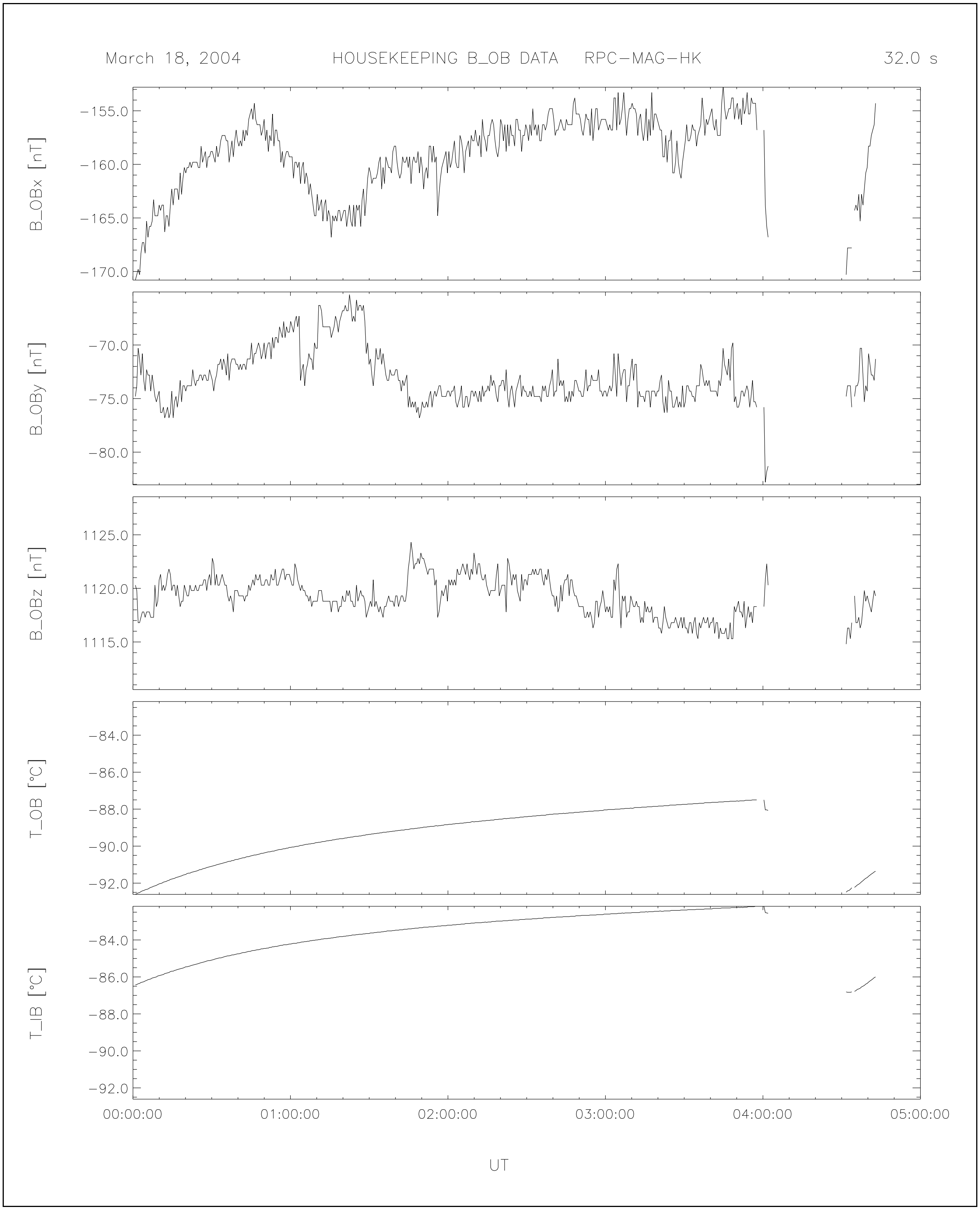
3.1 Actions

The tests carried on. MAG was setto BURST mode during the commissioning of the other RPC instruments. At 04:32 the redundant DPIU was activated. MAG sent data until 04:42 when the PIU failure occured. MAG worked properly all the time.

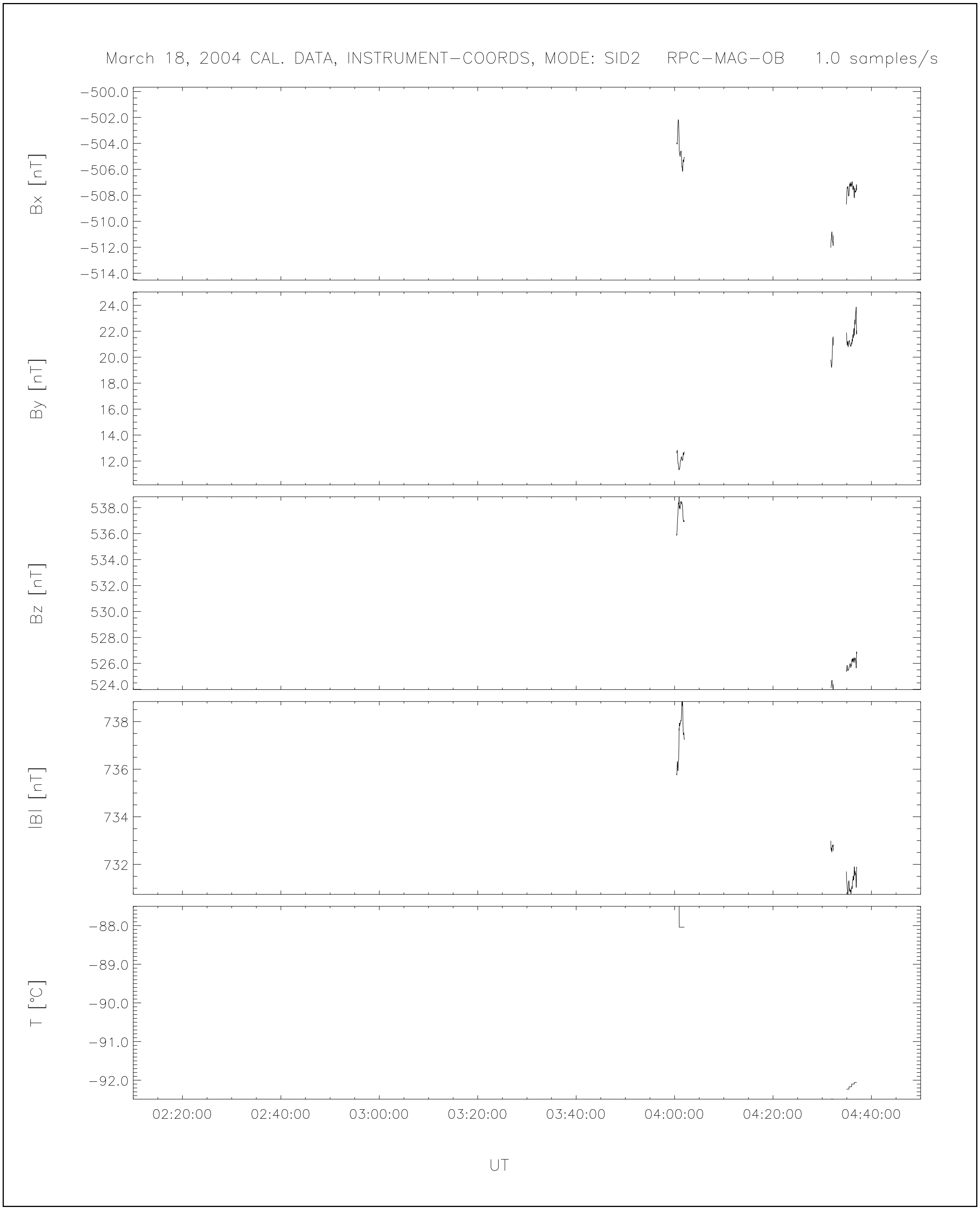
3.2 Plots



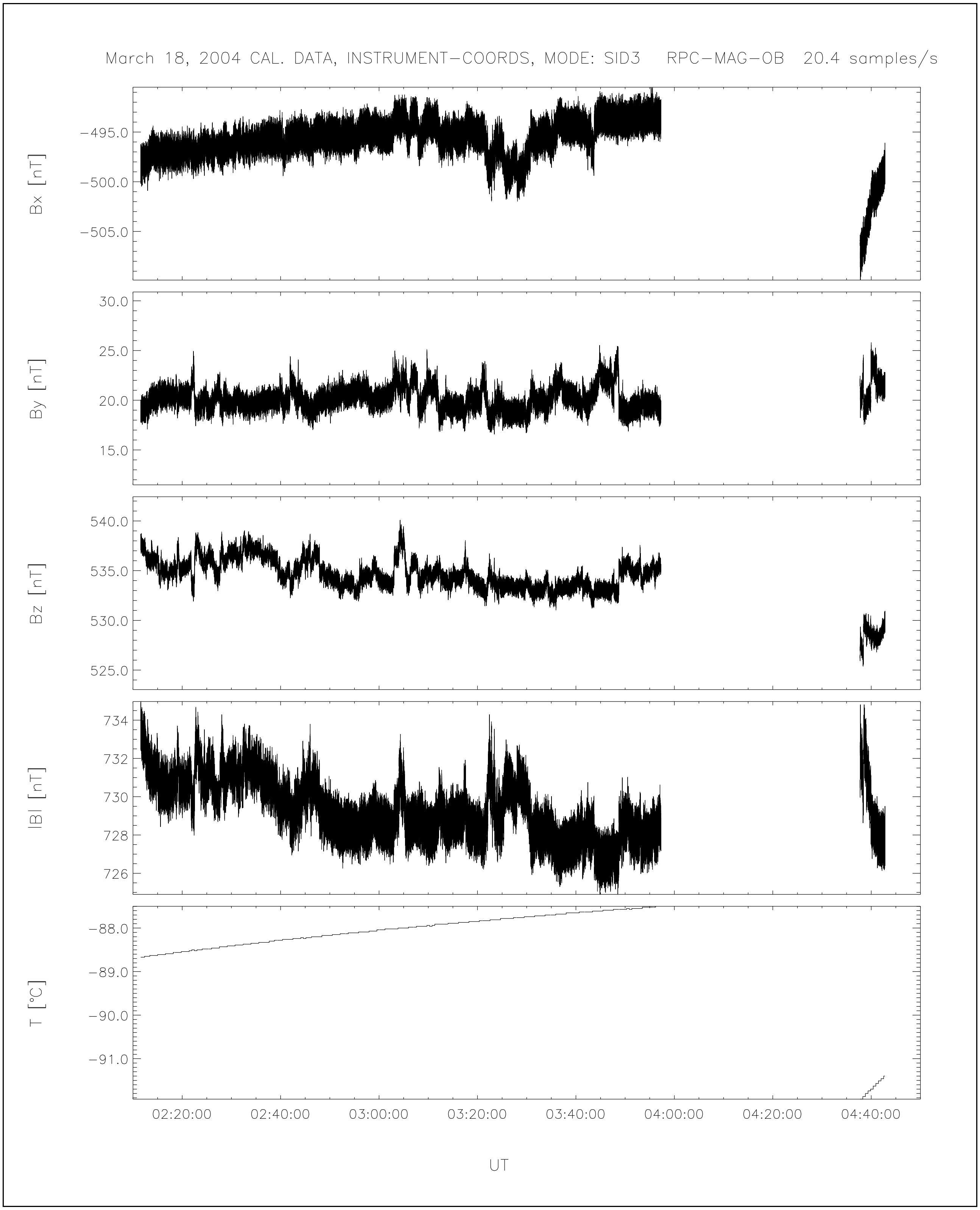
March 18, 2004
CAL. HOUSEKEEPING DATA RPC−MAG−HK
32.0 s
T_OB [°C]
T_IB [°C]
STAGE_A [1]
STAGE_B [1]
FILTER_CFG [1]
U_REF [V]
U_NEG [V]
U_POS [V]
00:00:00
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT



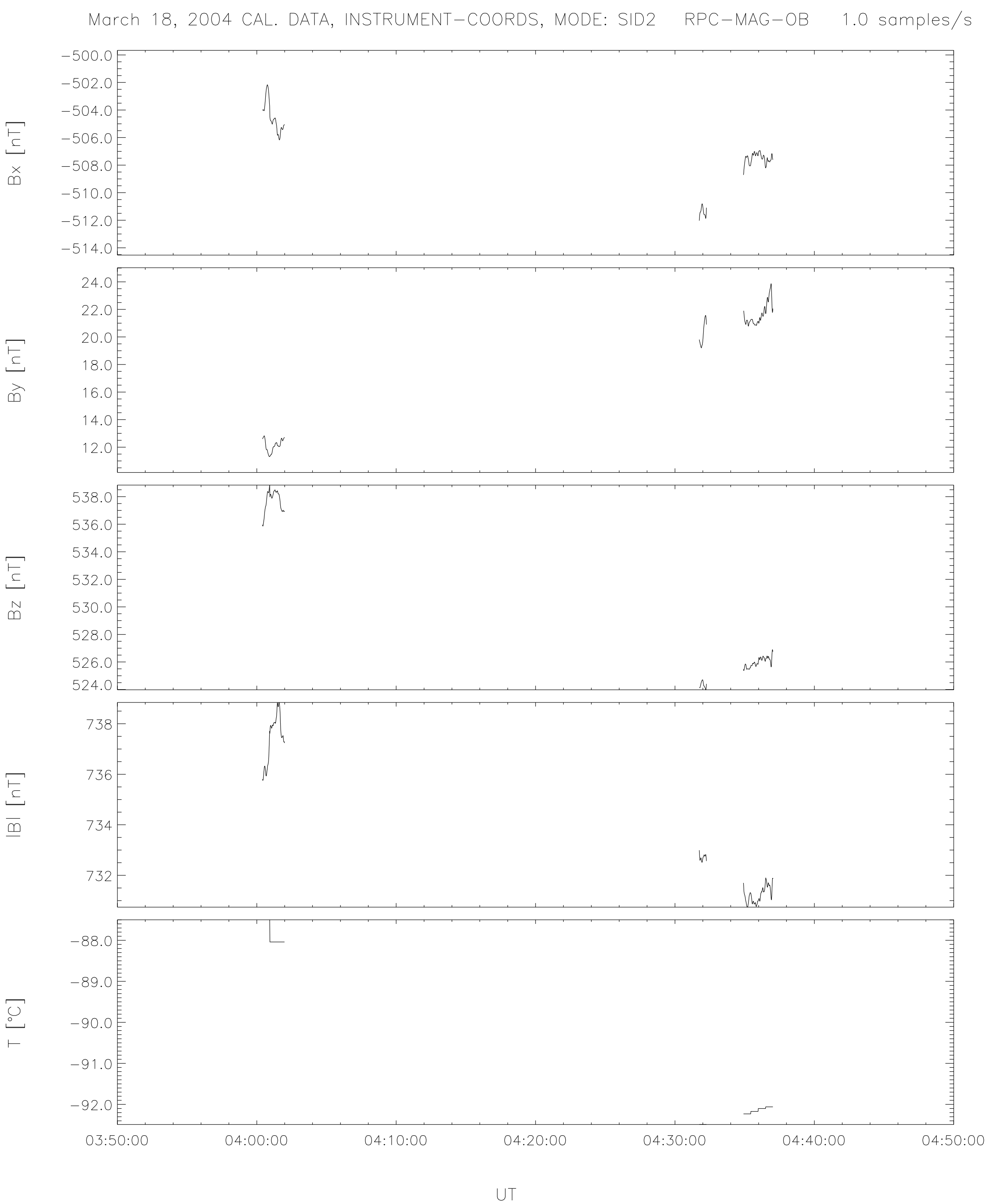
March 18, 2004
HOUSEKEEPING B_OB DATA RPC−MAG−HK
32.0 s
B_OBx [nT]
−155.0
−160.0
−165.0
−170.0
B_OBy [nT]
−70.0
−75.0
−80.0
B_OBz [nT]
1125.0
1120.0
1115.0
T_OB [°C]
−84.0
−86.0
−88.0
−90.0
−92.0
T_IB [°C]
−84.0
−86.0
−88.0
−90.0
−92.0
00:00:00
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT



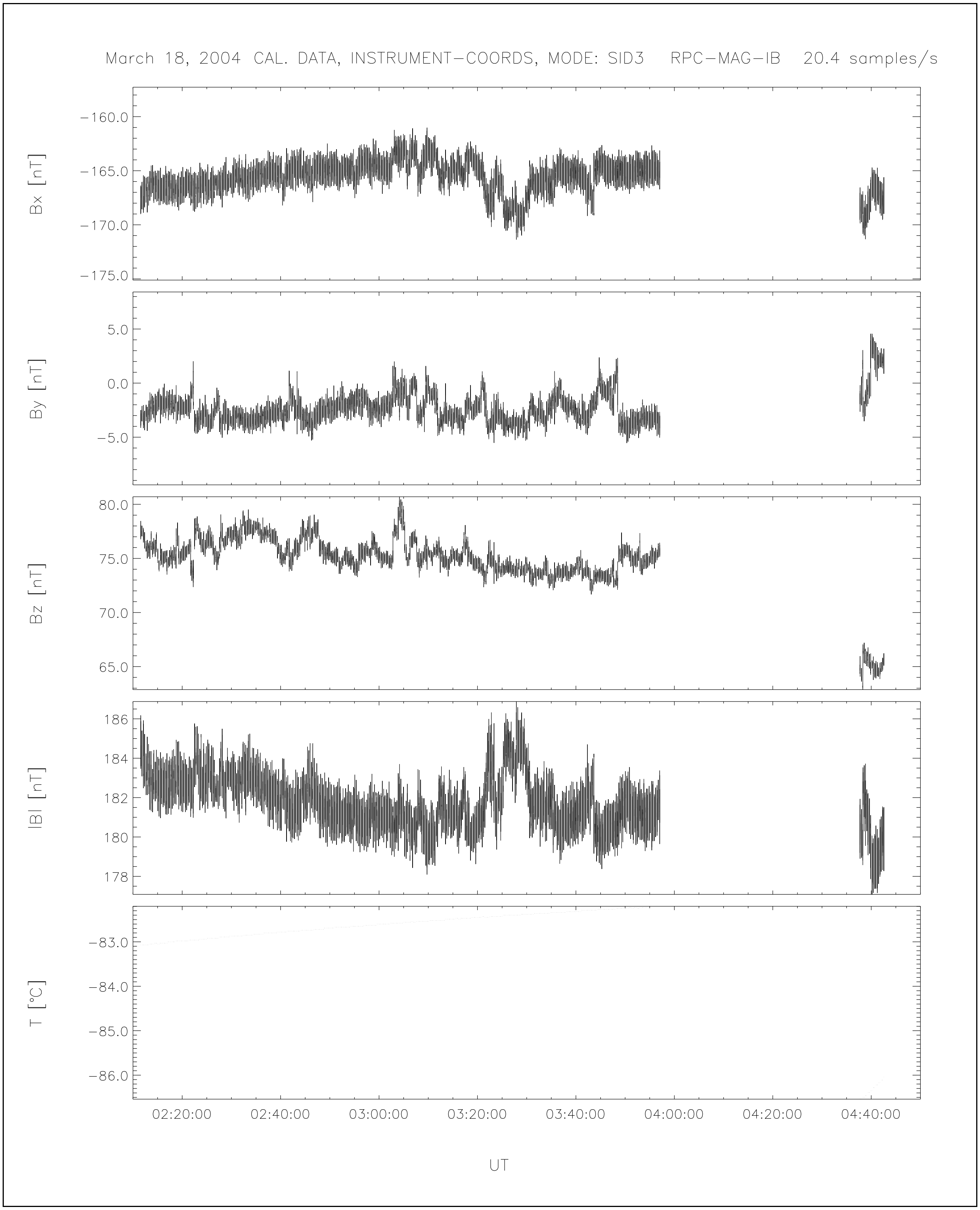
March 18, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID2 RPC−MAG−OB 1.0 samples/s
Bx [nT]
By [nT]
Bz [nT]
|B| [nT]
T [°C]
02:20:00
02:40:00
03:00:00
03:20:00
03:40:00
04:00:00
04:20:00
04:40:00
UT

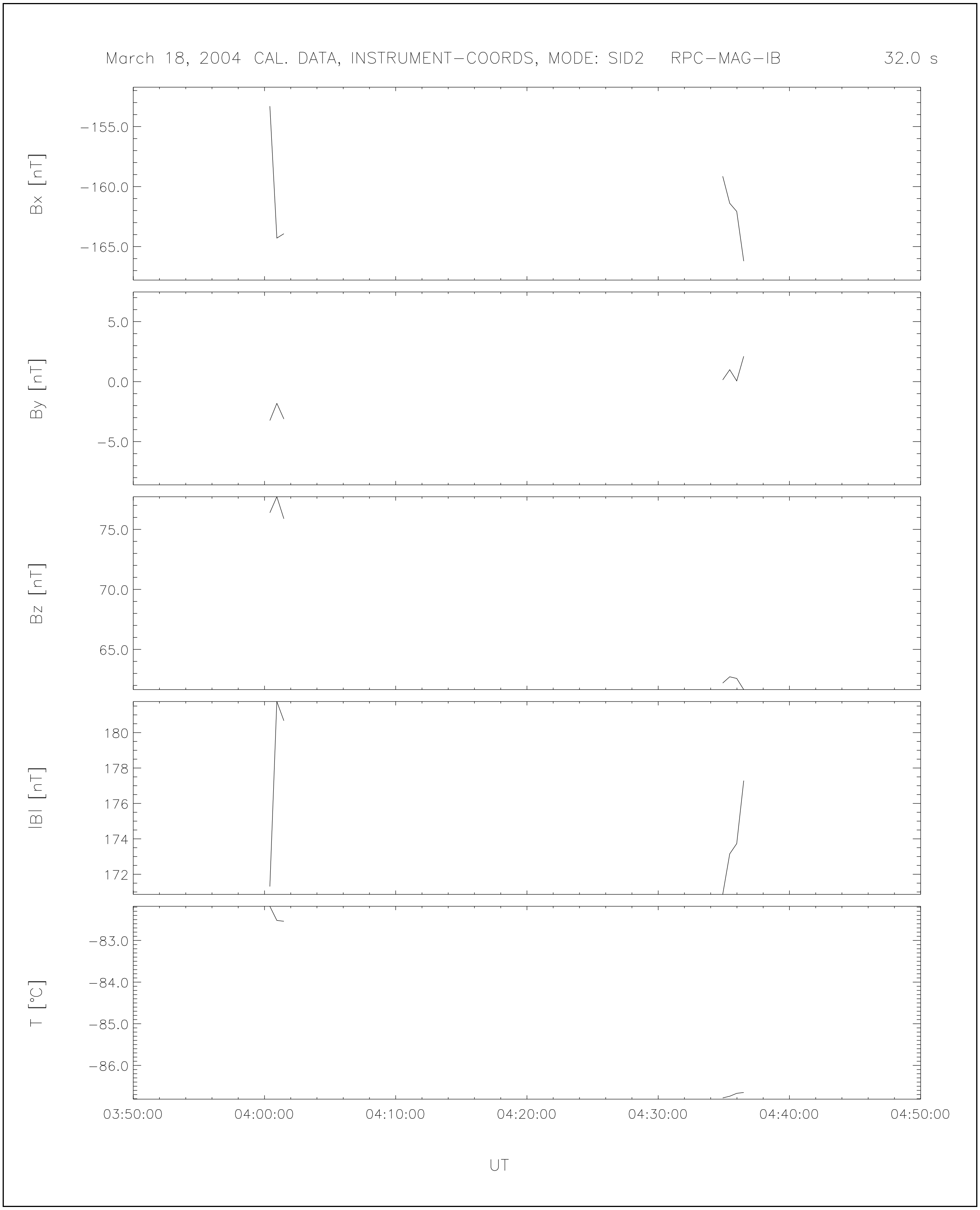


March 18, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID3 RPC–MAG–OB 20.4 samples/s
Bx [nT]
−495.0
−500.0
−505.0
By [nT]
30.0
25.0
20.0
15.0
Bz [nT]
540.0
535.0
530.0
525.0
|B| [nT]
734
732
730
728
726
T [°C]
−88.0
−89.0
−90.0
−91.0
02:20:00
02:40:00
03:00:00
03:20:00
03:40:00
04:00:00
04:20:00
04:40:00
UT



March 18, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID2 RPC–MAG–OB 1.0 samples/s
Bx [nT]
−500.0
−502.0
−504.0
−506.0
−508.0
−510.0
−512.0
−514.0
By [nT]
24.0
22.0
20.0
18.0
16.0
14.0
12.0
Bz [nT]
538.0
536.0
534.0
532.0
530.0
528.0
526.0
524.0
|B| [nT]
738
736
734
732
T [°C]
−88.0
−89.0
−90.0
−91.0
−92.0
03:50:00
04:00:00
04:10:00
04:20:00
04:30:00
04:40:00
04:50:00
UT


March 18, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID3 RPC−MAG−IB 20.4 samples/s
Bx [nT]
−160.0
−165.0
−170.0
−175.0
By [nT]
5.0
0.0
−5.0
Bz [nT]
80.0
75.0
70.0
65.0
|B| [nT]
186
184
182
180
178
T [°C]
−83.0
−84.0
−85.0
−86.0
02:20:00
02:40:00
03:00:00
03:20:00
03:40:00
04:00:00
04:20:00
04:40:00
UT



March 18, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID2 RPC–MAG–IB 32.0 s
Bx [nT]
−155.0
−160.0
−165.0
By [nT]
5.0
0.0
−5.0
Bz [nT]
75.0
70.0
65.0
|B| [nT]
180
178
176
174
172
T [°C]
−83.0
−84.0
−85.0
−86.0
03:50:00
04:00:00
04:10:00
04:20:00
04:30:00
04:40:00
04:50:00
UT

4 March1 19, 2004:

4.1 Actions

MAG was switched on immediately after PIU. MAG was set to BURST mode at 01:02. Today the Booms were deployed. The deployment of the MAG boom can be seen in the magnetic field data. At about 03:08 the answer of the pyro firing can be seen as a spike in the magnetic field data. The real MAG boom deployment can be seen between 03:35 – 04:42. A detailed analysis of the MAG OB data(in s/c coordinates) shows:

Component	Level in STOWED position [nT]	Level in DEPLOYED position[nT]
B_x	518	-77
B_y	31	-13
B_z	-529	101
B	740	128

Component	Noise width in STOWED position [nT]	Noise width in DEPLOYED position[nT]
B_x	4	1.3
B_y	2	1.2
B_z	1.5	0.8

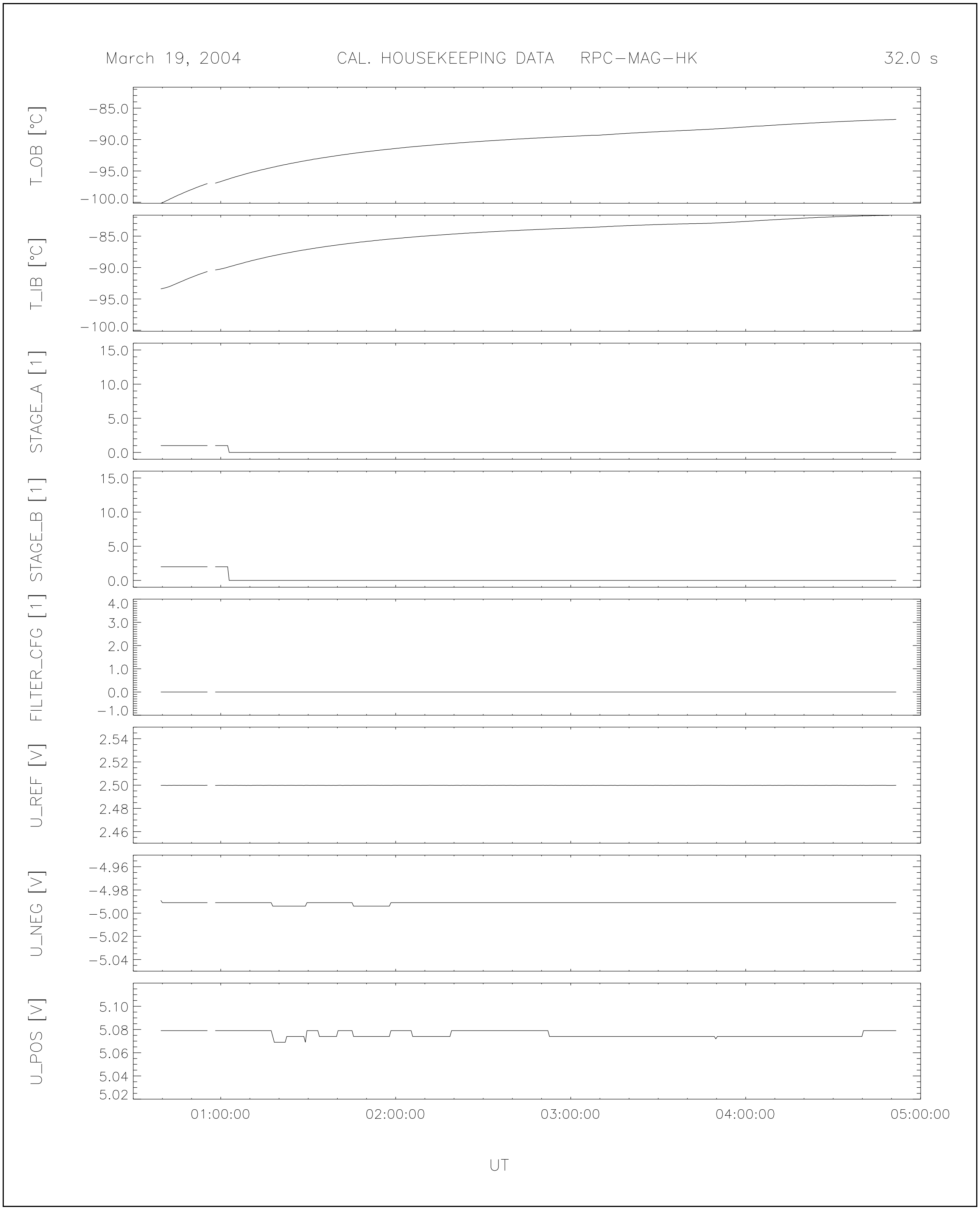
Results of the boom deployment:

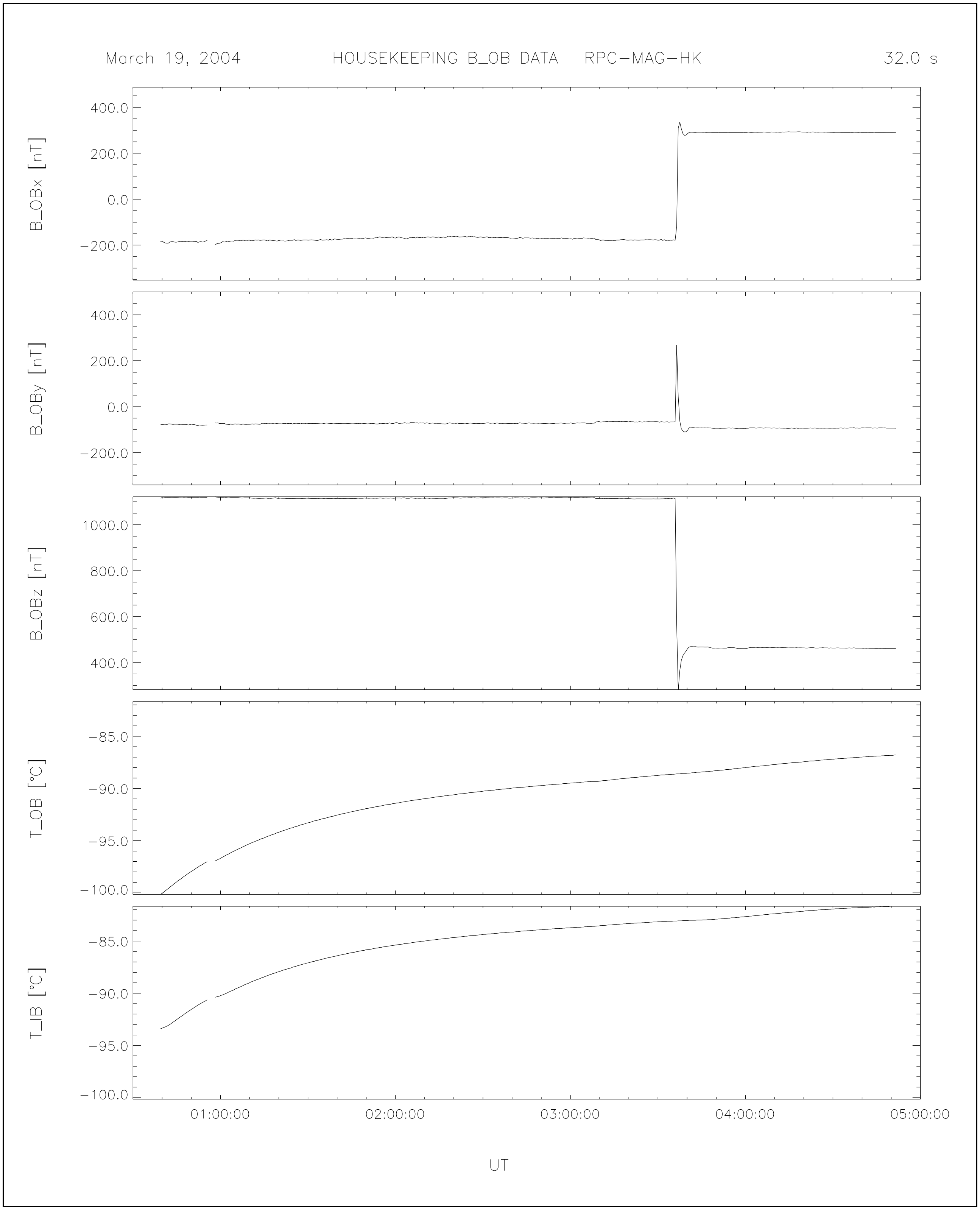
- The measured residual field is, as expected, significantly lower in the deployed position. The field modulus decreases from 740 nT to 128 nT.
- The noise width decreases as well, as expected. The noise width is reduced by more than a factor of two in the deployed position.

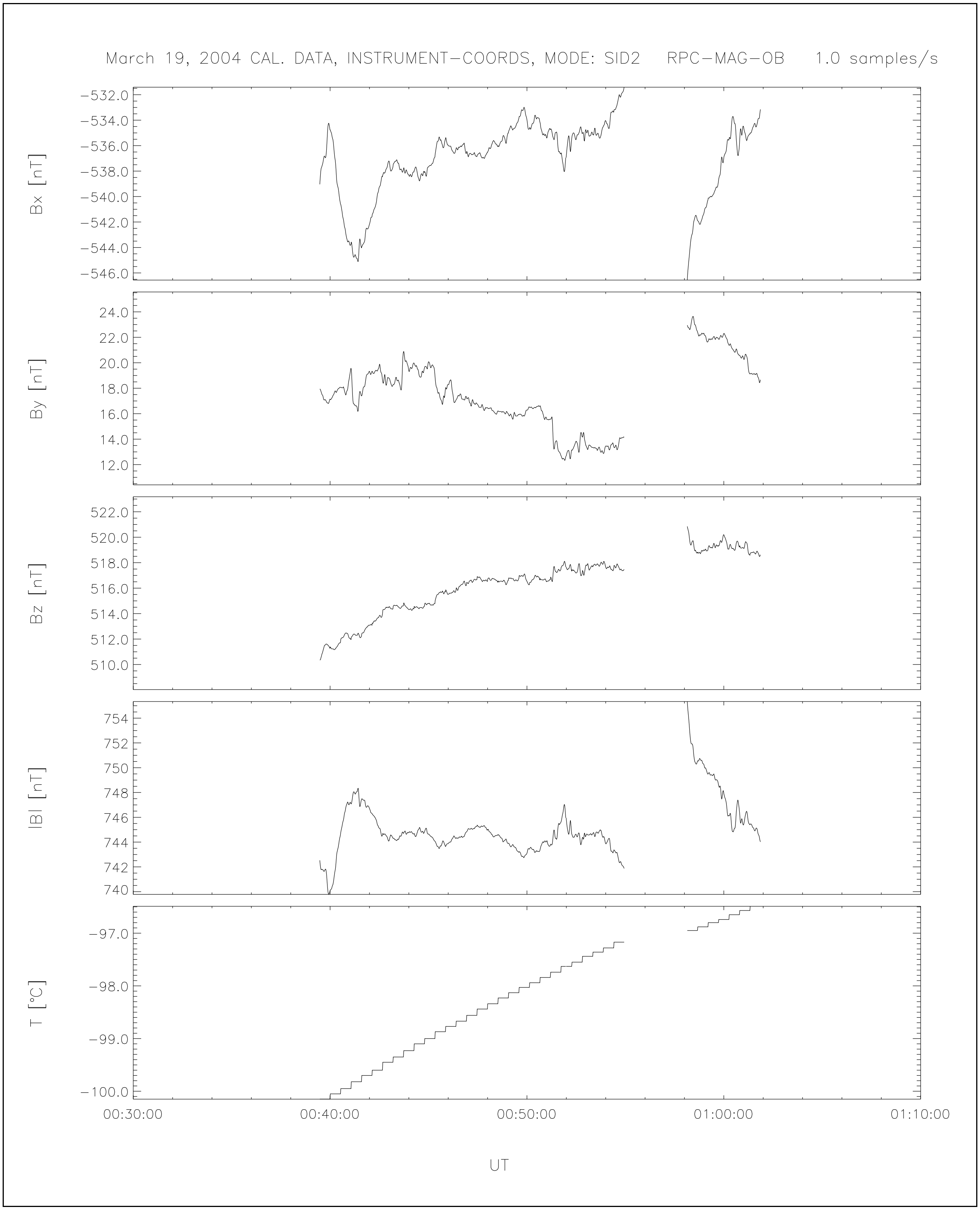
As already mentioned in the summary, the field changes end abruptly and not smoothly at the end of the boom deployment. This is a clear indication for a remaining residual field caused by the s/c.

The deployment of the LAP boom can not be seen in the magnetic field data.

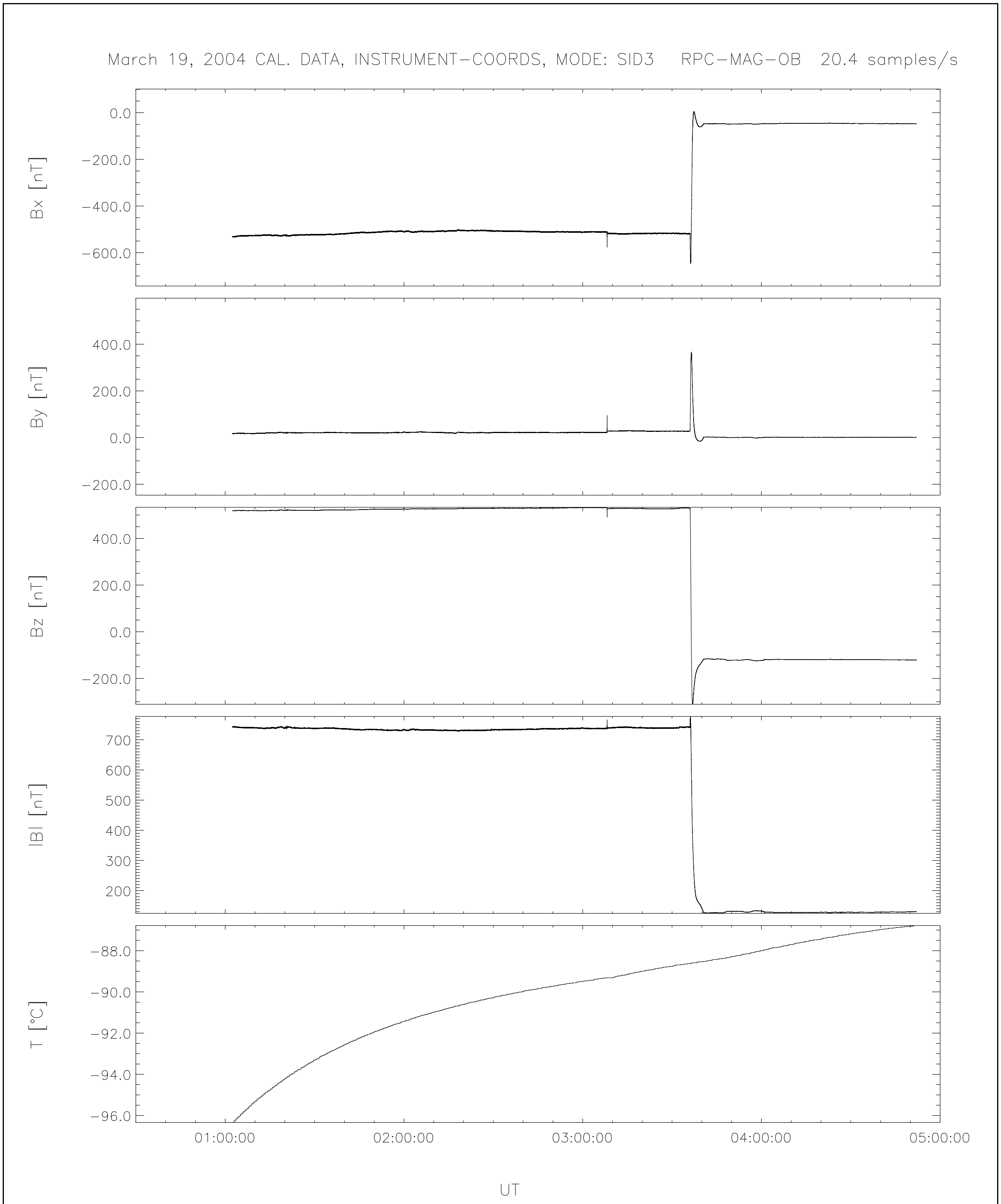
4.2 Plots


March 19, 2004
CAL. HOUSEKEEPING DATA RPC−MAG−HK
32.0 s
T_OB [°C]
T_IB [°C]
STAGE_A [1]
STAGE_B [1]
FILTER_CFG [1]
U_REF [V]
U_NEG [V]
U_POS [V]
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT

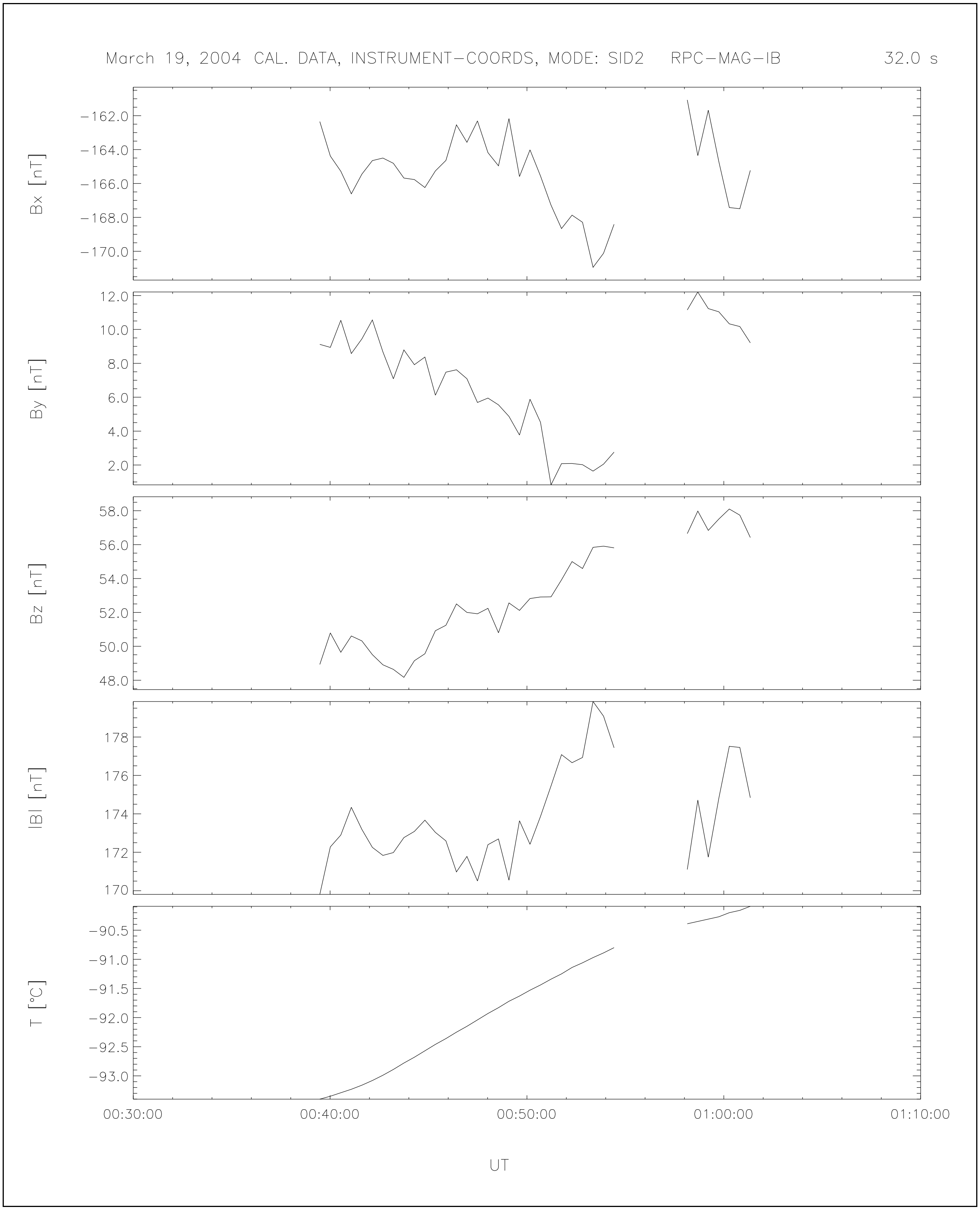

March 19, 2004
HOUSEKEEPING B_OB DATA RPC−MAG−HK
32.0 s
B_OBx [nT]
B_OBy [nT]
B_OBz [nT]
T_OB [°C]
T_IB [°C]
400.0
200.0
0.0
−200.0
1000.0
800.0
600.0
−85.0
−90.0
−95.0
−100.0
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT



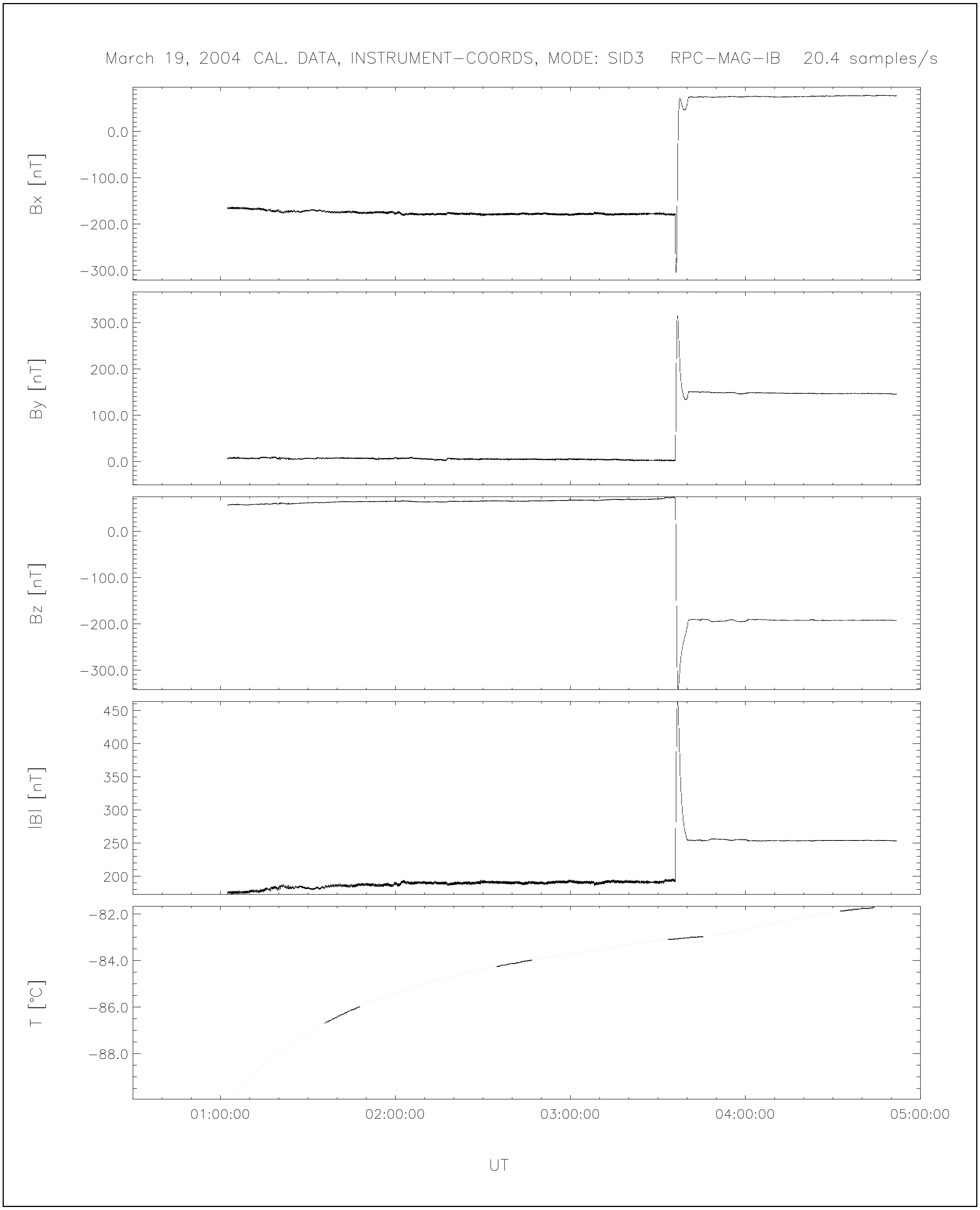
March 19, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID2 RPC–MAG–OB 1.0 samples/s
Bx [nT]
By [nT]
Bz [nT]
IBI [nT]
T [°C]
00:30:00
00:40:00
00:50:00
01:00:00
01:10:00
UT



March 19, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID3 RPC–MAG–OB 20.4 samples/s
Bx [nT]
0.0
−200.0
−400.0
−600.0
By [nT]
400.0
200.0
0.0
−200.0
Bz [nT]
400.0
200.0
0.0
−200.0
|B| [nT]
700
600
500
400
300
200
T [°C]
−88.0
−90.0
−92.0
−94.0
−96.0
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT



March 19, 2004 CAL. DATA, INSTRUMENT–COORDS, MODE: SID2 RPC–MAG–IB 32.0 s
Bx [nT]
−162.0
−164.0
−166.0
−168.0
−170.0
By [nT]
12.0
10.0
8.0
6.0
4.0
2.0
Bz [nT]
58.0
56.0
54.0
52.0
50.0
48.0
IBI [nT]
178
176
174
172
170
T [°C]
−90.5
−91.0
−91.5
−92.0
−92.5
−93.0
00:30:00
00:40:00
00:50:00
01:00:00
01:10:00
UT


March 19, 2004 CAL. DATA, INSTRUMENT−COORDS, MODE: SID3 RPC−MAG−IB 20.4 samples/s
Bx [nT]
0.0
−100.0
−200.0
−300.0
By [nT]
300.0
200.0
100.0
0.0
Bz [nT]
0.0
−100.0
−200.0
−300.0
|B| [nT]
450
400
350
300
250
200
T [°C]
−82.0
−84.0
−86.0
−88.0
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
UT

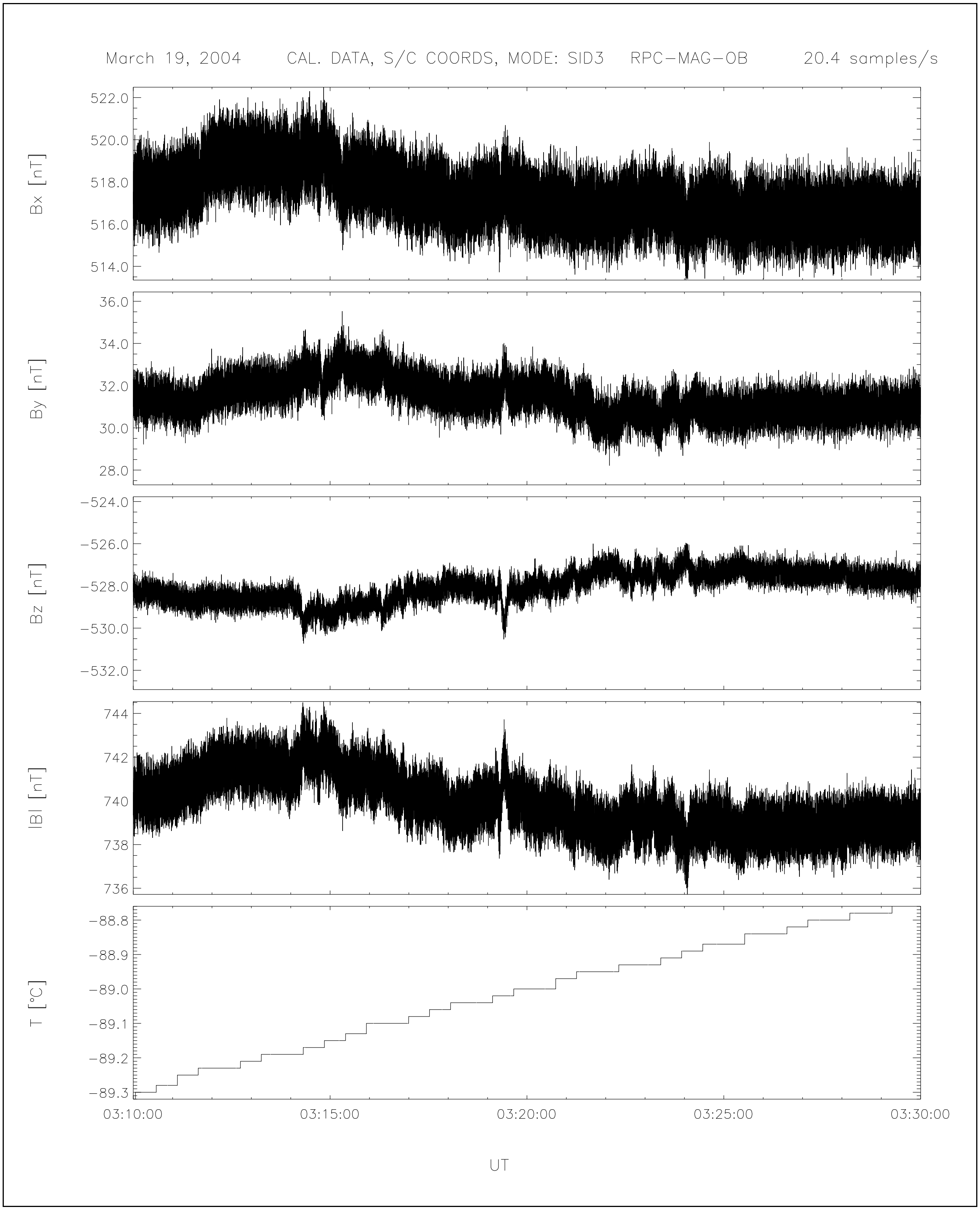


Figure 1: OB Data before boom Deployment

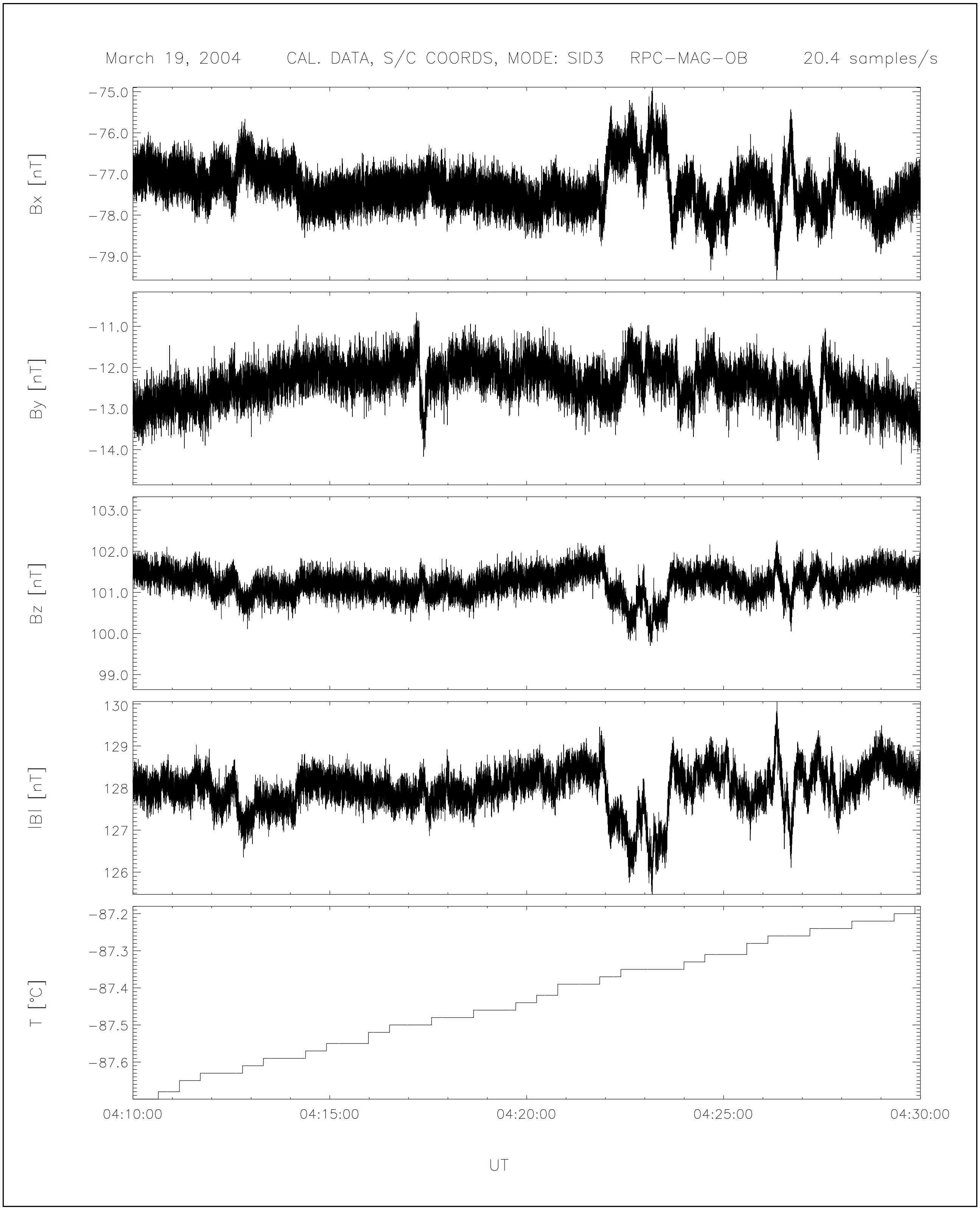


Figure 2: OB Data after boom Deployment

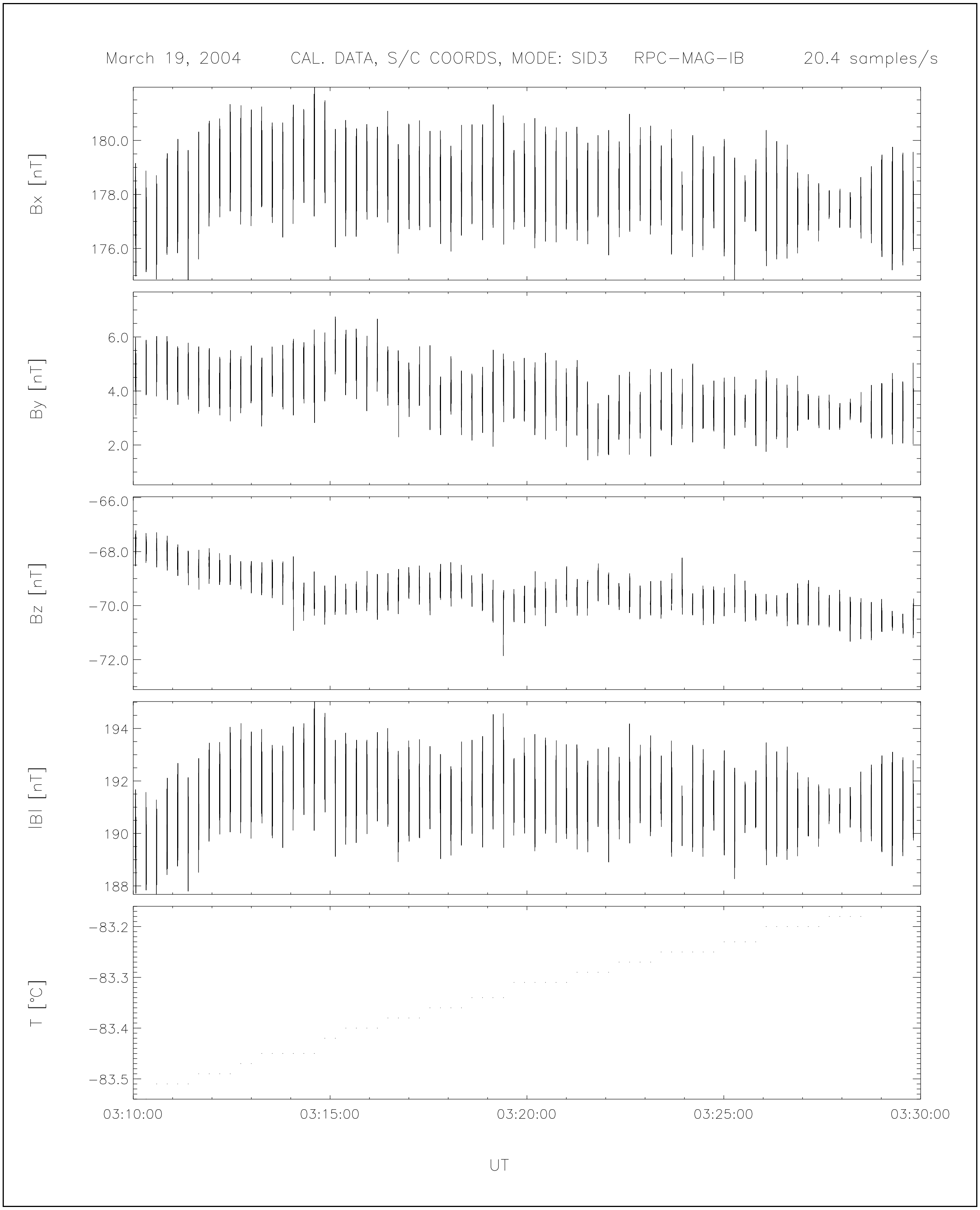


Figure 3: IB Data before boom Deployment

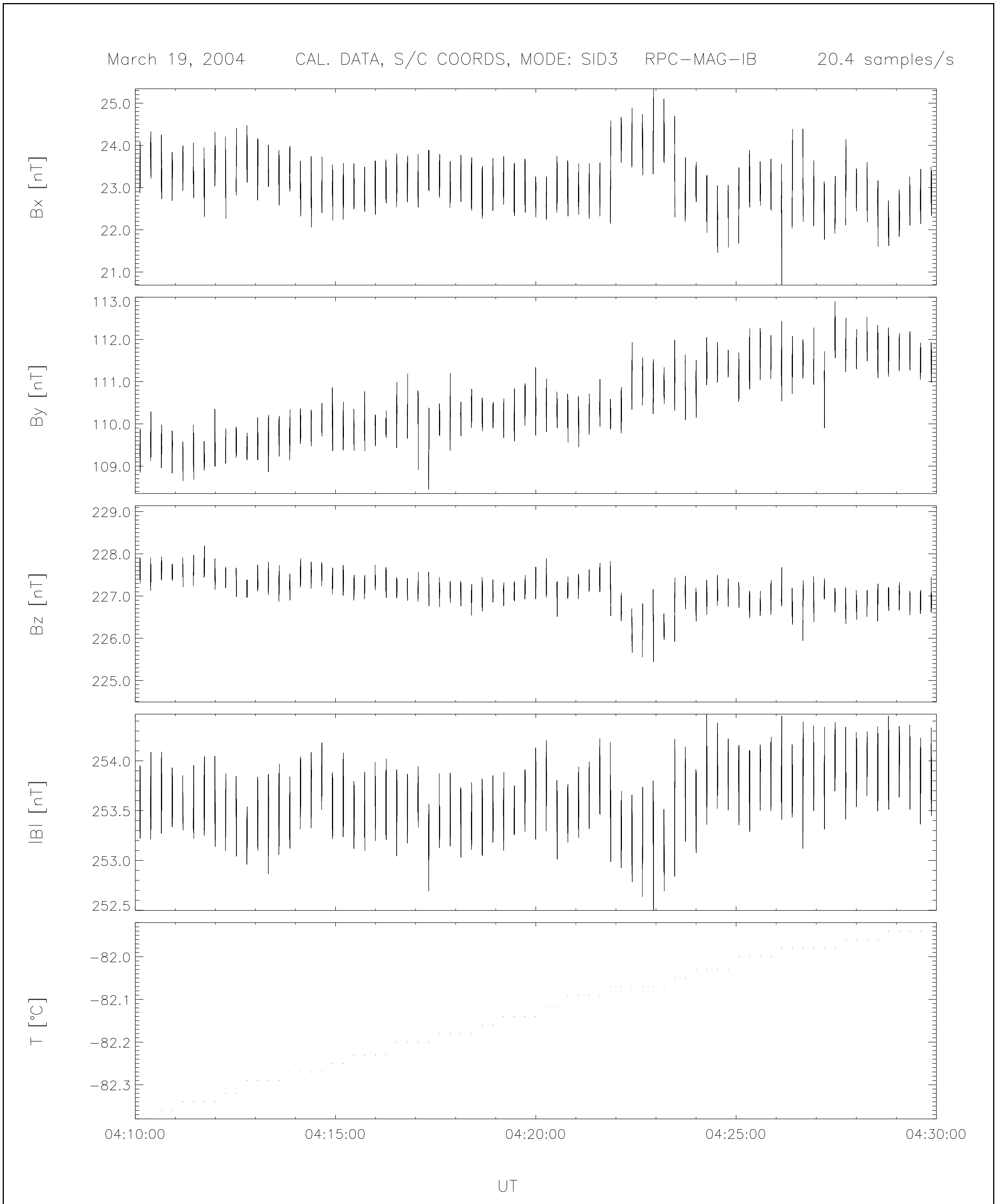


Figure 4: IB Data after boom Deployment

R O S E T T A

FLIGHT REPORTS
of RPC–MAG

RO–IGM–TR–0008

Issue: Preliminary Revision: 0.9

May 11, 2004

Report of the

COMMISSIONING PART 2

Time period: May 05. - 10., 2004

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Contents

1 Summary

The second commissioning phase for RPC–MAG was executed in the time period May 05. – 10., 2004. All the performed steps were successful. MAG worked as expected.

Both, the OB and the IB sensor were checked as primary sensor. All voltages were stable and in the expected range. The sensor temperatures varied in a range of (−115°C – −80°C), because the sensors were obviously in the shadow.

In summary MAG is operating well and we are looking forward for the first scientific relevant measurements.

The next sections give a brief description of the executed activities and show the obtained data. Housekeeping data (Temperature of the OB & IB sensor, Filter Stages A & B, Filter configuration register, Reference voltage, negative and positive 5V supply voltage, and the coarse HK sampled magnetic field data of the OB sensor) are presented as well as magnetic field science data of the OB and IB sensor in the activated modes. Magnetic field data are plotted in instrument coordinates if not otherwise stated. They are calibrated according to the results of the ground calibration. Sensitivity, Misalignment, and Temperature effects are taken into account. The s/c residual field is not subtracted.

2 May 07, 2004:

2.1 Actions

MAG was switched on immediately after PIU via OBCP and set to HK mode and later to SID 5. All commands passed smoothly and the instrument followed in the expected way.

2.2 Plots

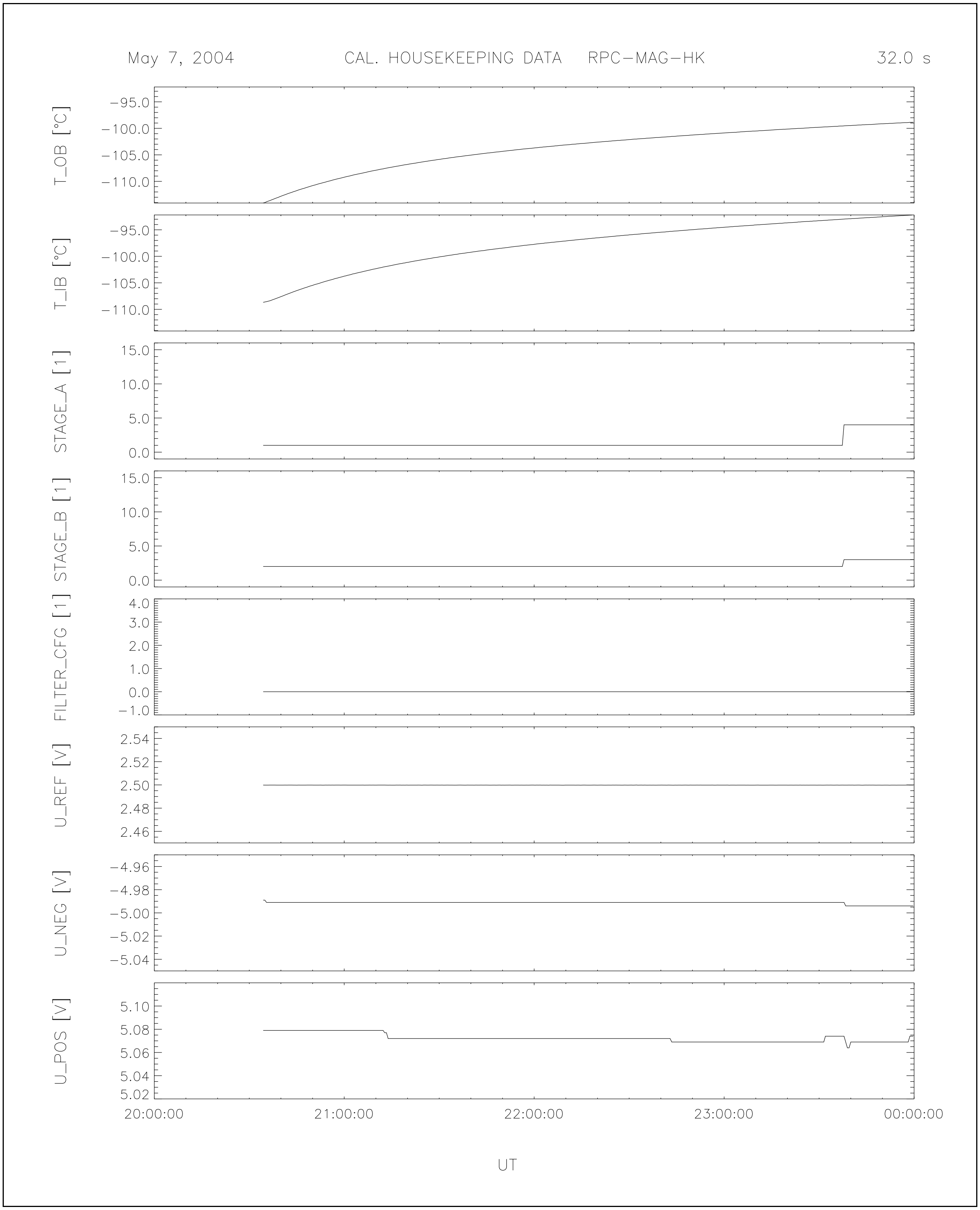

Figure 1: File: RPCMAG040507T2033_CLA_HK_P2000_2400

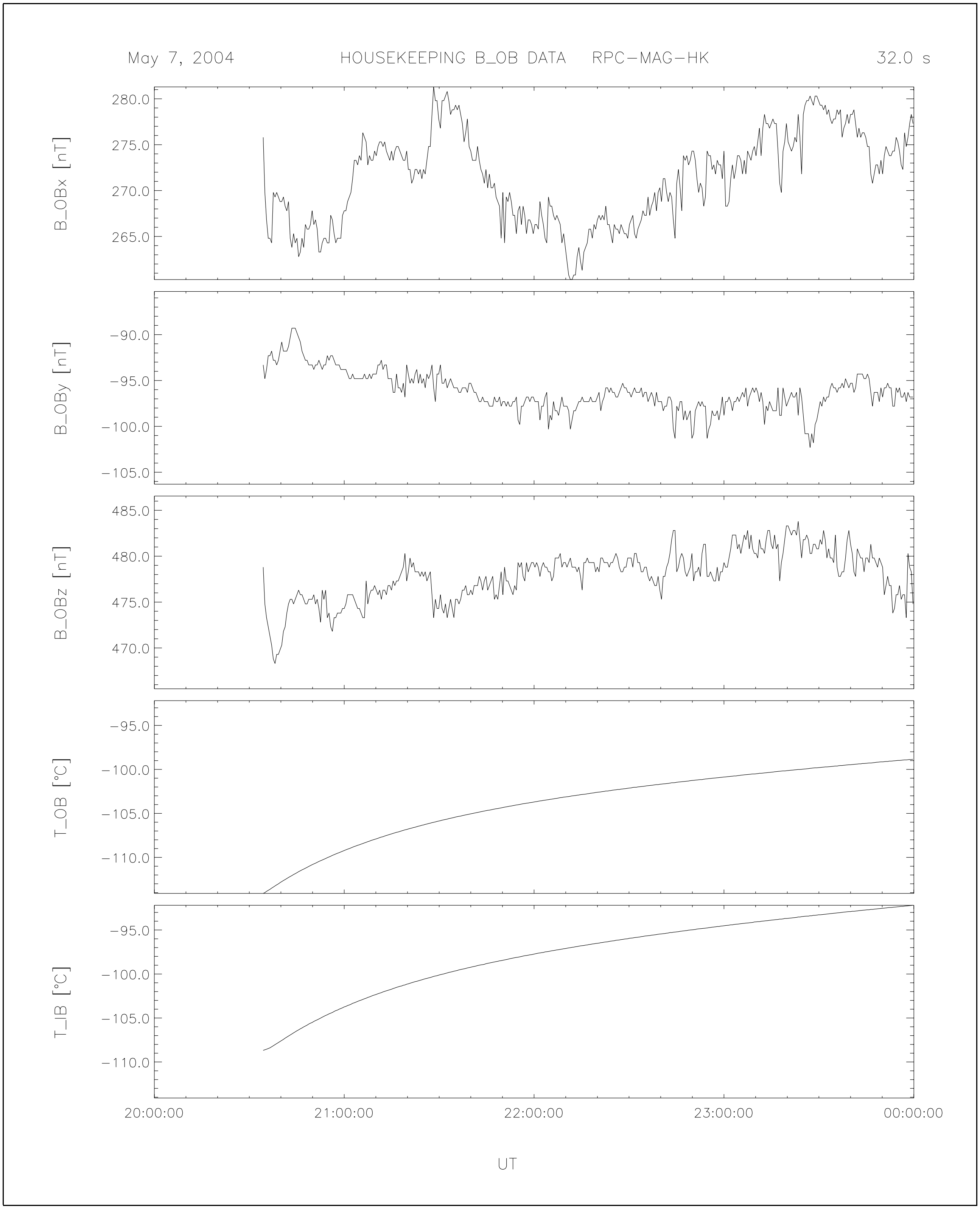

Figure 2: File: RPCMAG040507T2033_CLA_HK_B_P2000_2400

3 May 08, 2004:

3.1 Actions

MAG was successfully set to SID4 at 01:50. Data were sent until 02:15 (LOS). The data show variations of maximum 4 nT in the modulus. The temperature was stable at 95◦ C.

All the day the instrument gathered data during the Out of path period. Unfortunately the HK data were lost until 16:00 due to on override of the SSMM. During the day the Instrument was switched successfully to to all SIDs.

Various steps of a few 10 nT occurred in the B-Field data.
Details:

Time	coordinates	Sensor	Amplitude of step (x,y,z) nT	Temperature
2004-05-08 10:12:28	s/c	OB	(40,-50,10)	T = const
2004-05-08 10:12:28	s/c	IB	(-40,50,-10)	T = const
2004-05-08 12:22:43	s/c	OB	(-40,50,-10)	T = const
2004-05-08 12:22:43	s/c	IB	(40,-50,10)	T = const
2004-05-08 15:25	s/c	OB	(15,5,-25)	$\Delta T = +8^{\circ}$ C
2004-05-08 15:25	s/c	IB	(10,0,-25)	$\Delta T = +8^{\circ}$ C
2004-05-08 16:40	s/c/	OB	(40,-50,15)	T = const
2004-05-08 16:40	s/c/	IB	(-40,50,-10)	T = const
2004-05-08 18:23:35	s/c	IB	(+42,-52,+13)	T = const
2004-05-08 18:23:35	s/c	OB	(-42,50,-12)	T = const

Until now the origin of these steps is unkown.
Attitude Change ?
Thruster firing ?
Shadow changing ?

3.2 Plots

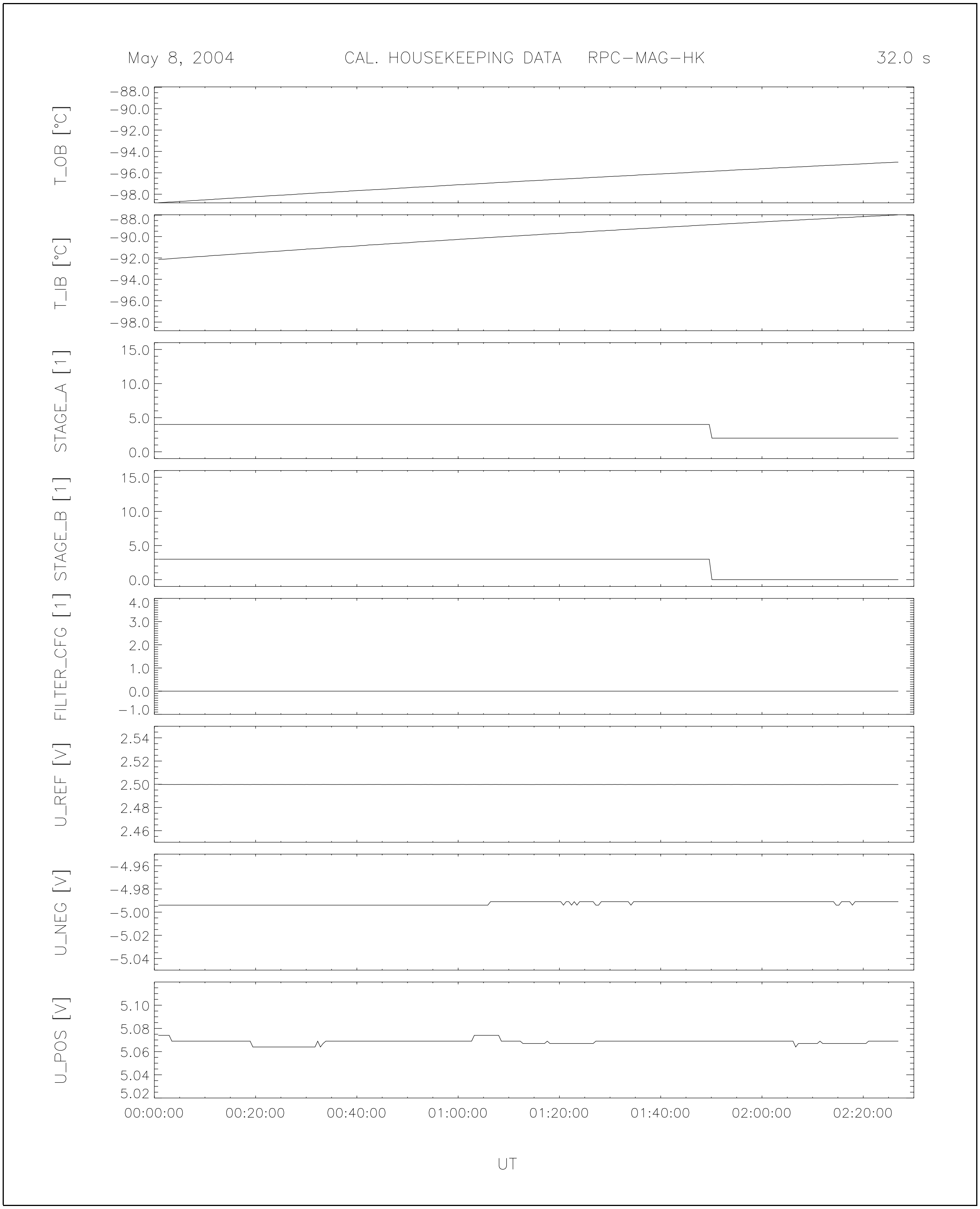

Figure 3: File: RPCMAG040508T0000_CLA_HK_P0000_0230

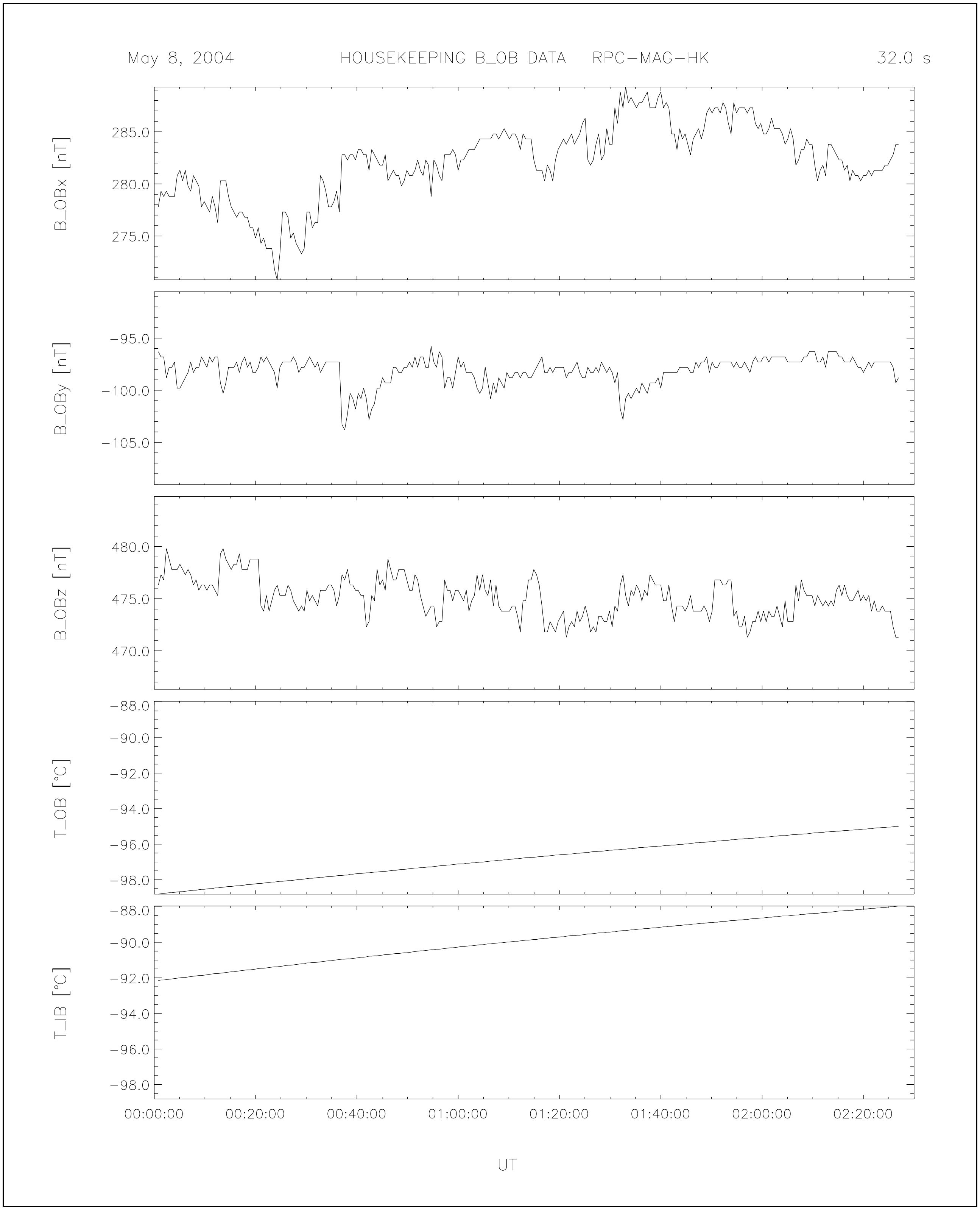

Figure 4: File: RPCMAG040508T0000_CLA_HK_B_P0000_0230

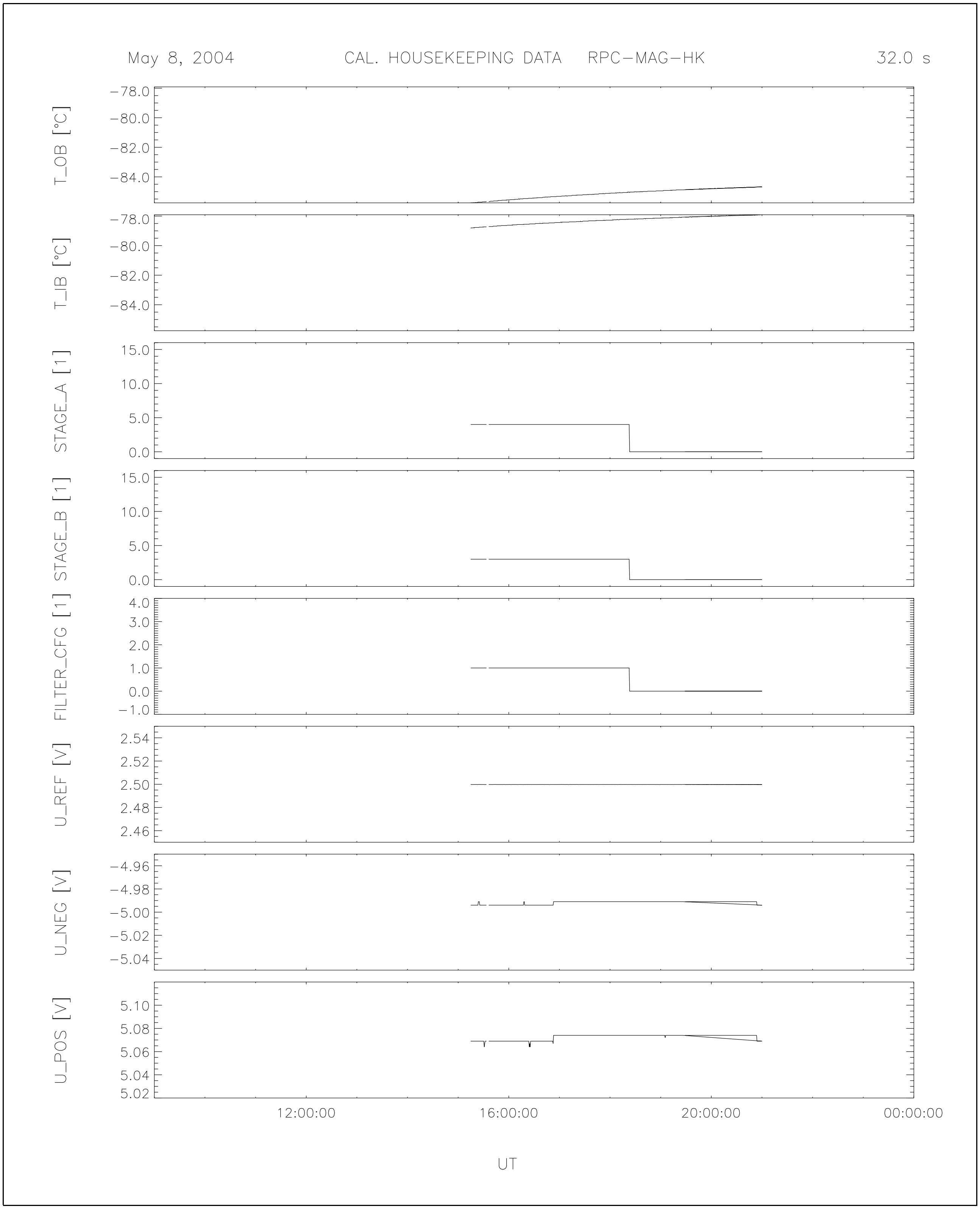

Figure 5: File: RPCMAG040508T0900_CLA_HK_P0900_2400

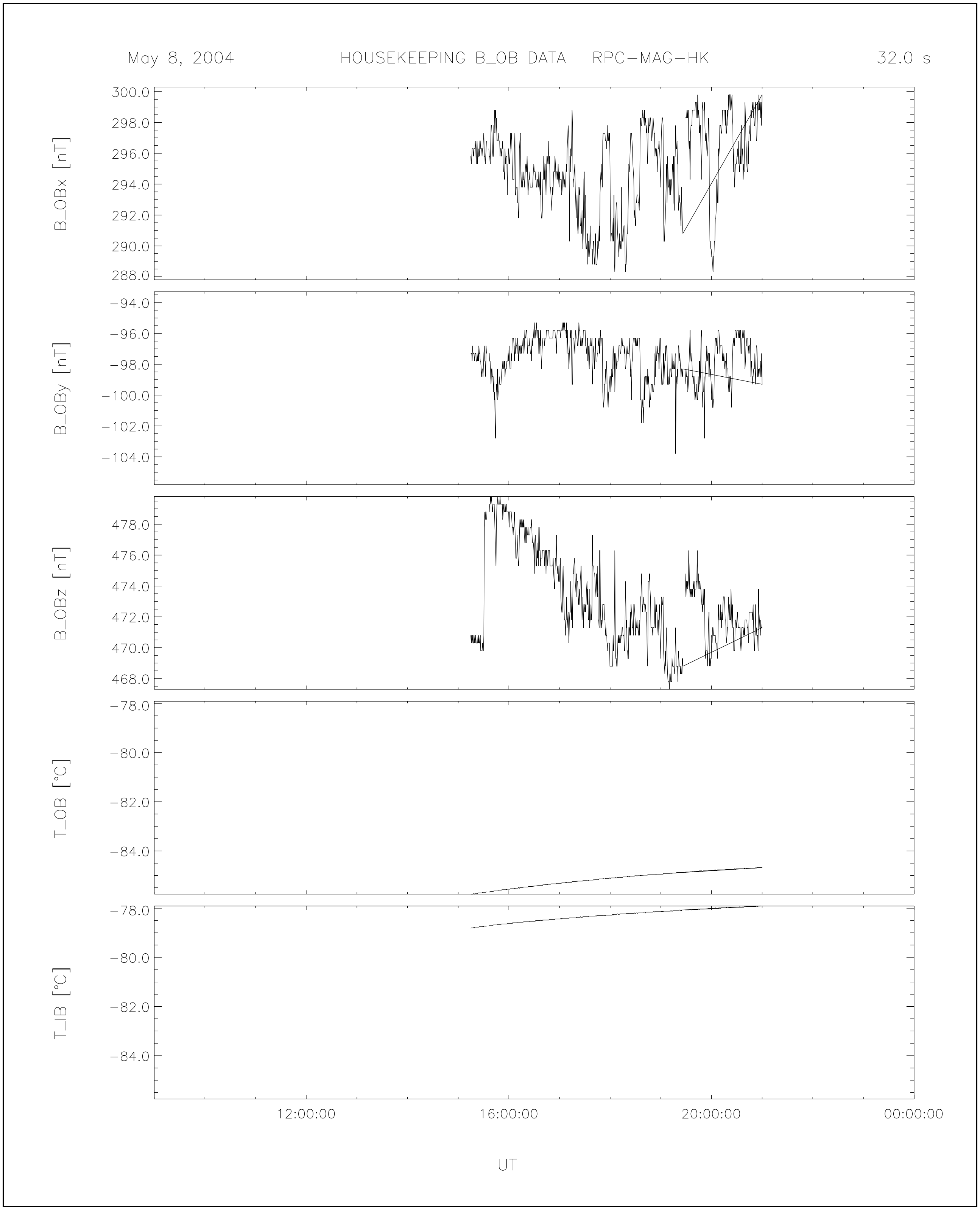

Figure 6: File: RPCMAG040508T0900_CLA_HK_B_P0900_2400

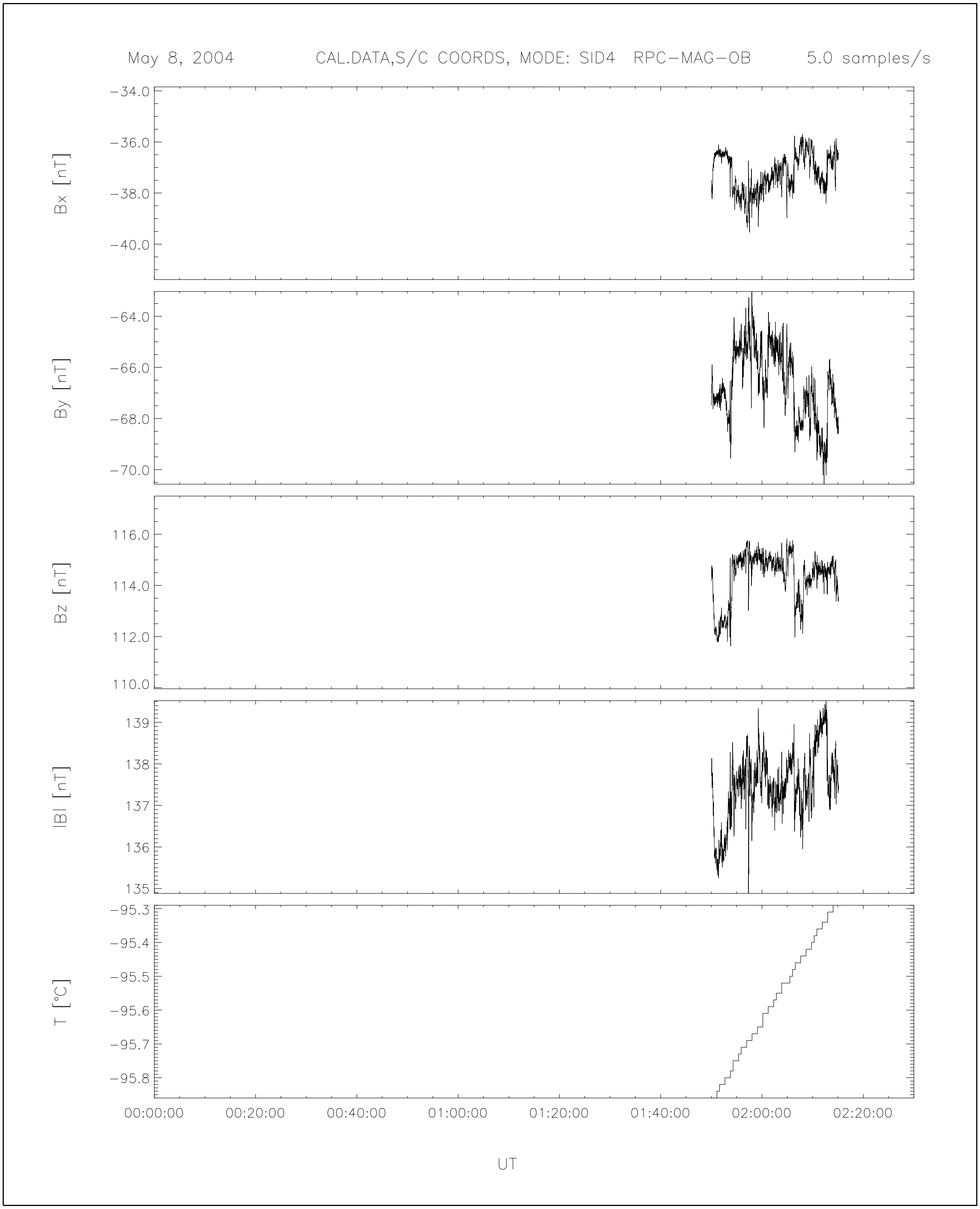

Figure 7: File: RPCMAG040508T0150_CLB_OB_M4_T0000_0230

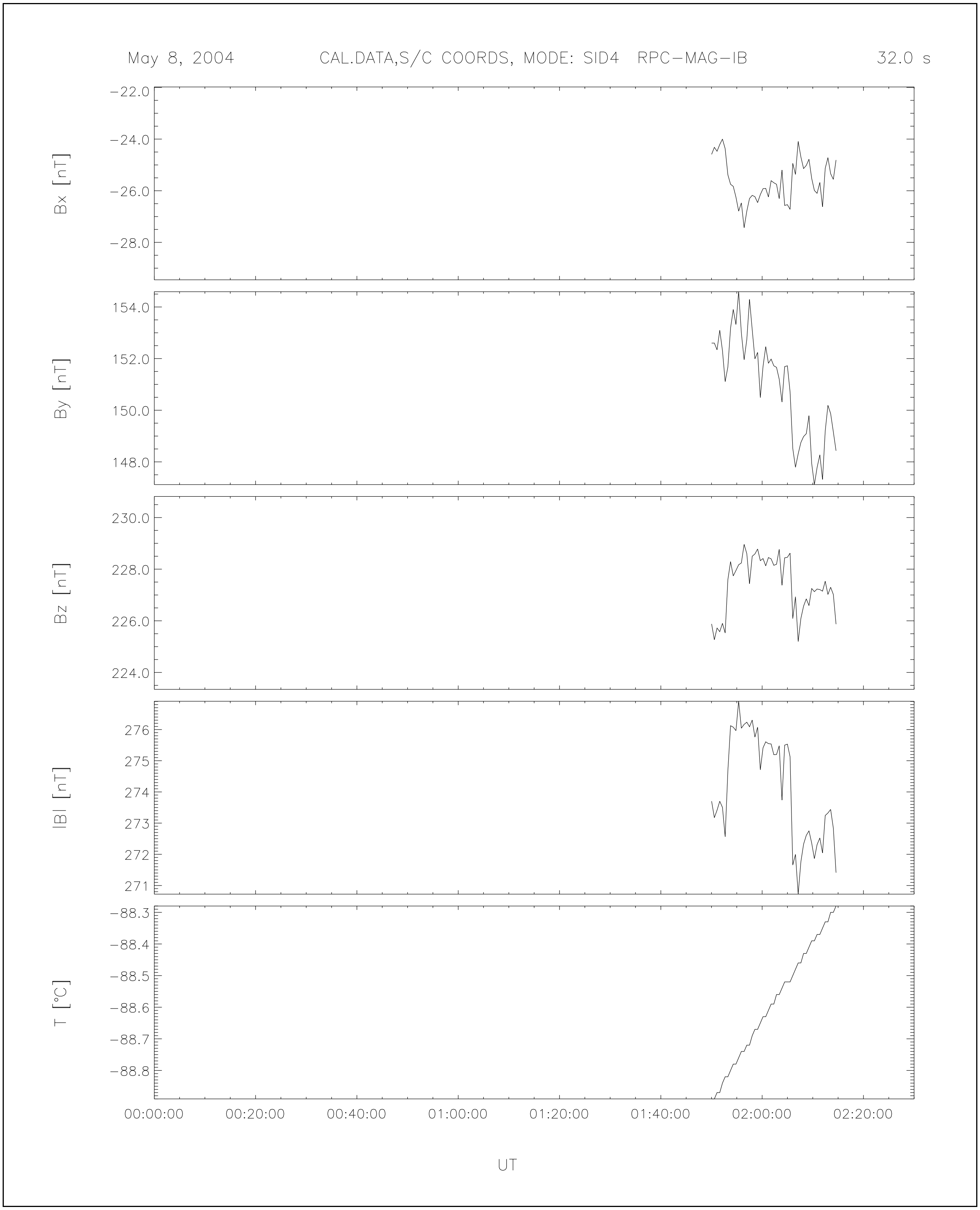

Figure 8: File: RPCMAG040508T0150_CLB_IB_M4_T0000_0230

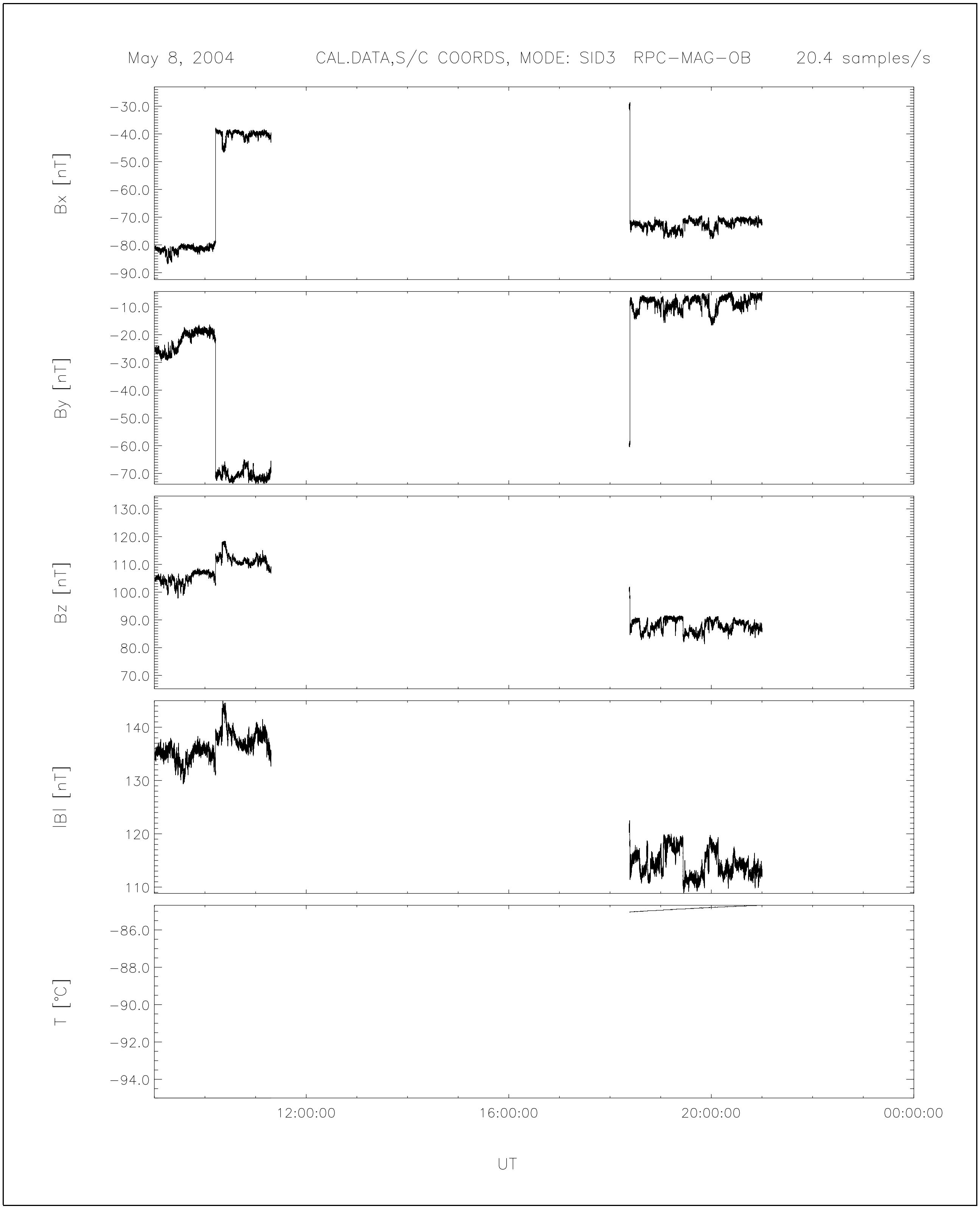

Figure 9: File: RPCMAG040508T0900_CLB_OB_M3_T0900_2400

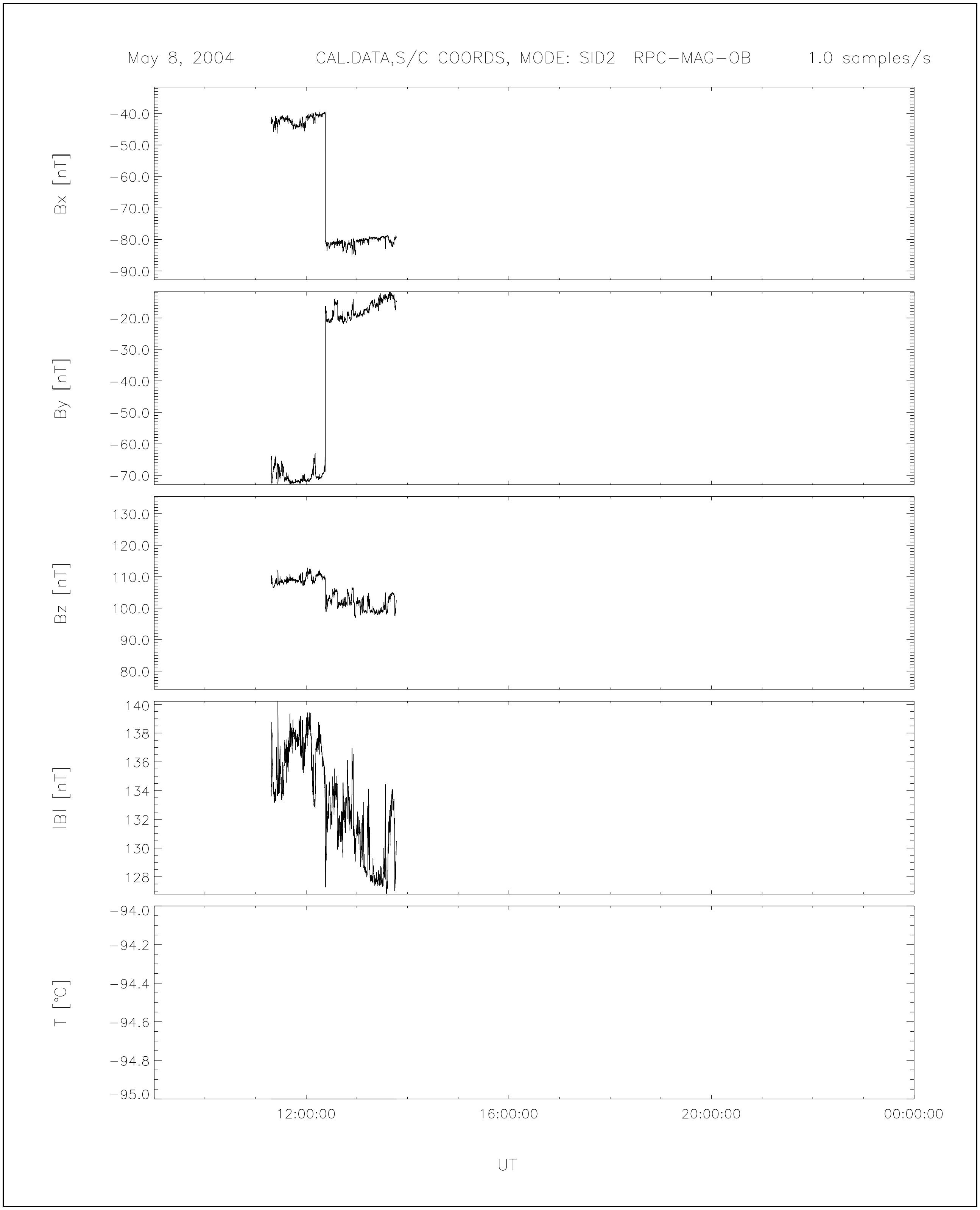

Figure 10: File: RPCMAG040508T0900_CLB_OB_M2_T0900_2400

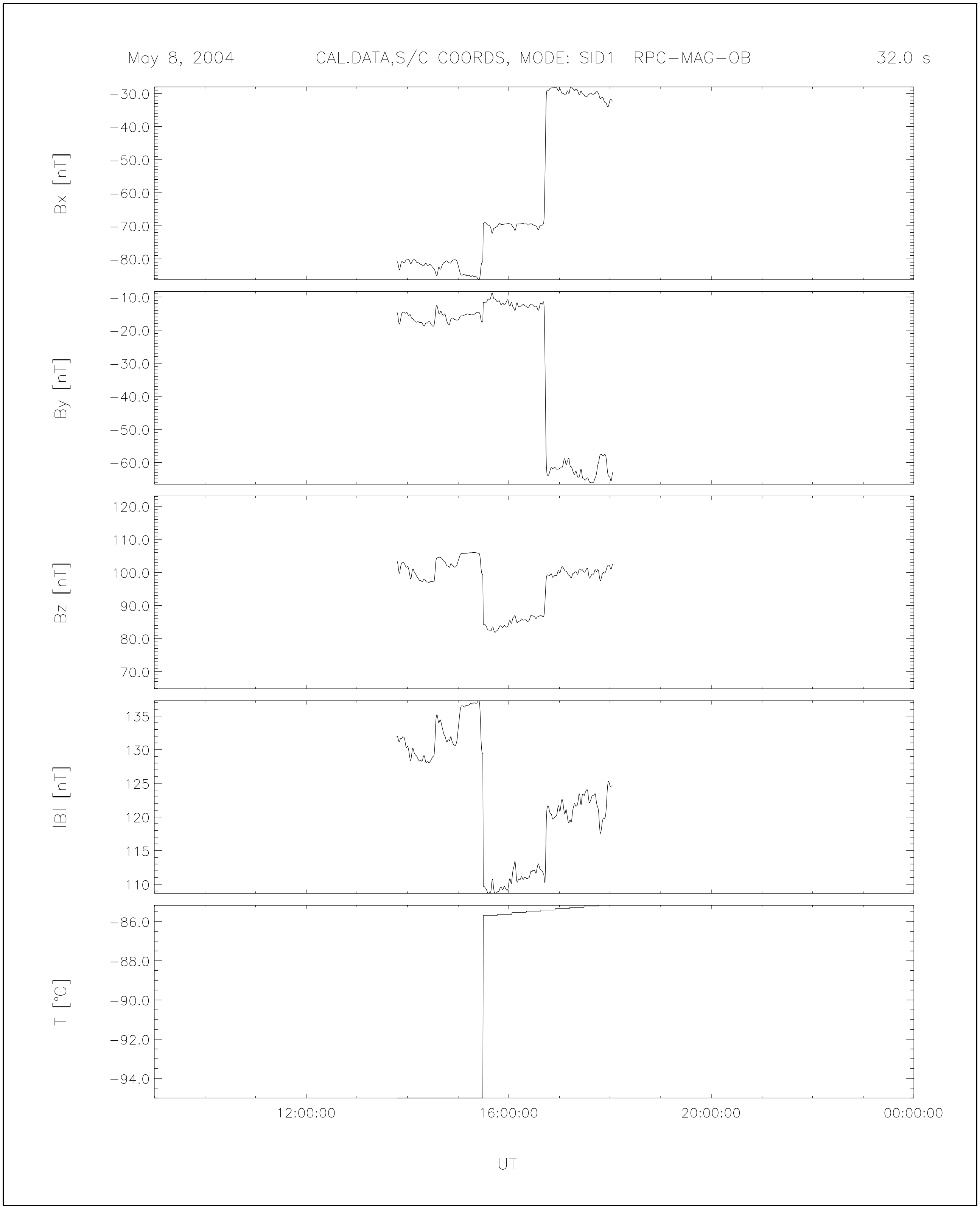

Figure 11: File: RPCMAG040508T0900_CLB_OB_M1_T0900_2400

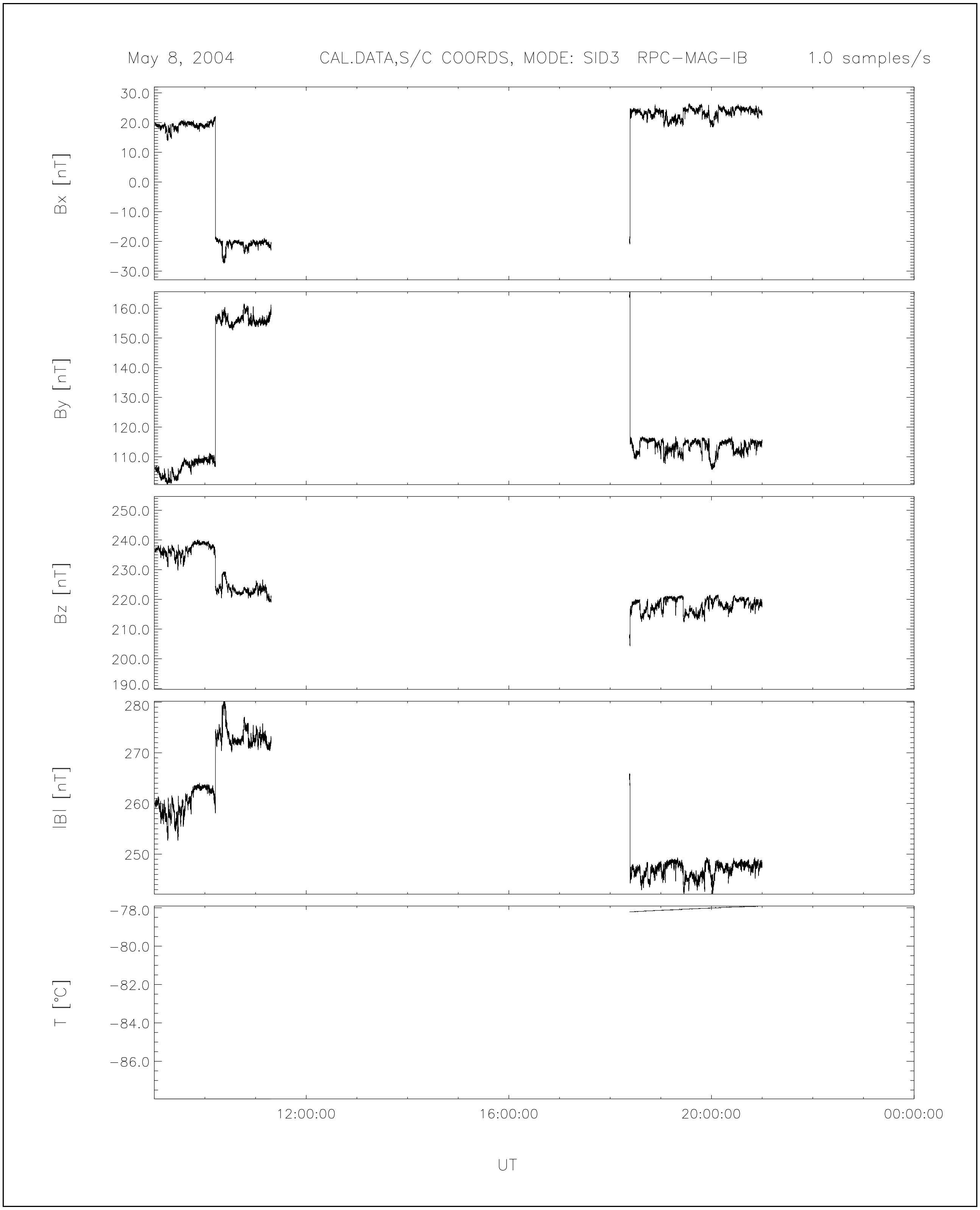

Figure 12: File: RPCMAG040508T0900_CLB_IB_M3_T0900_2400

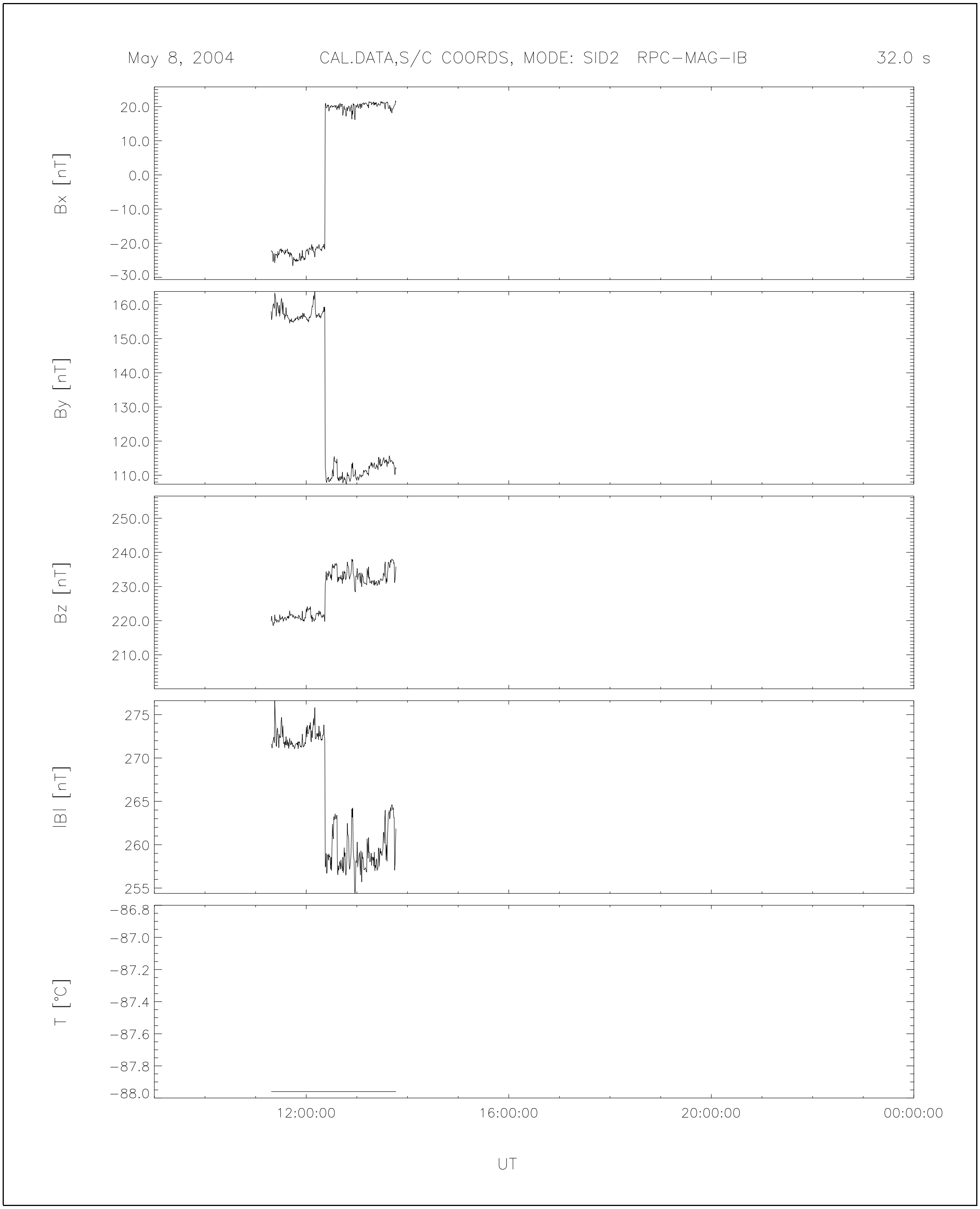

Figure 13: File: RPCMAG040508T0900_CLB_IB_M2_T0900_2400

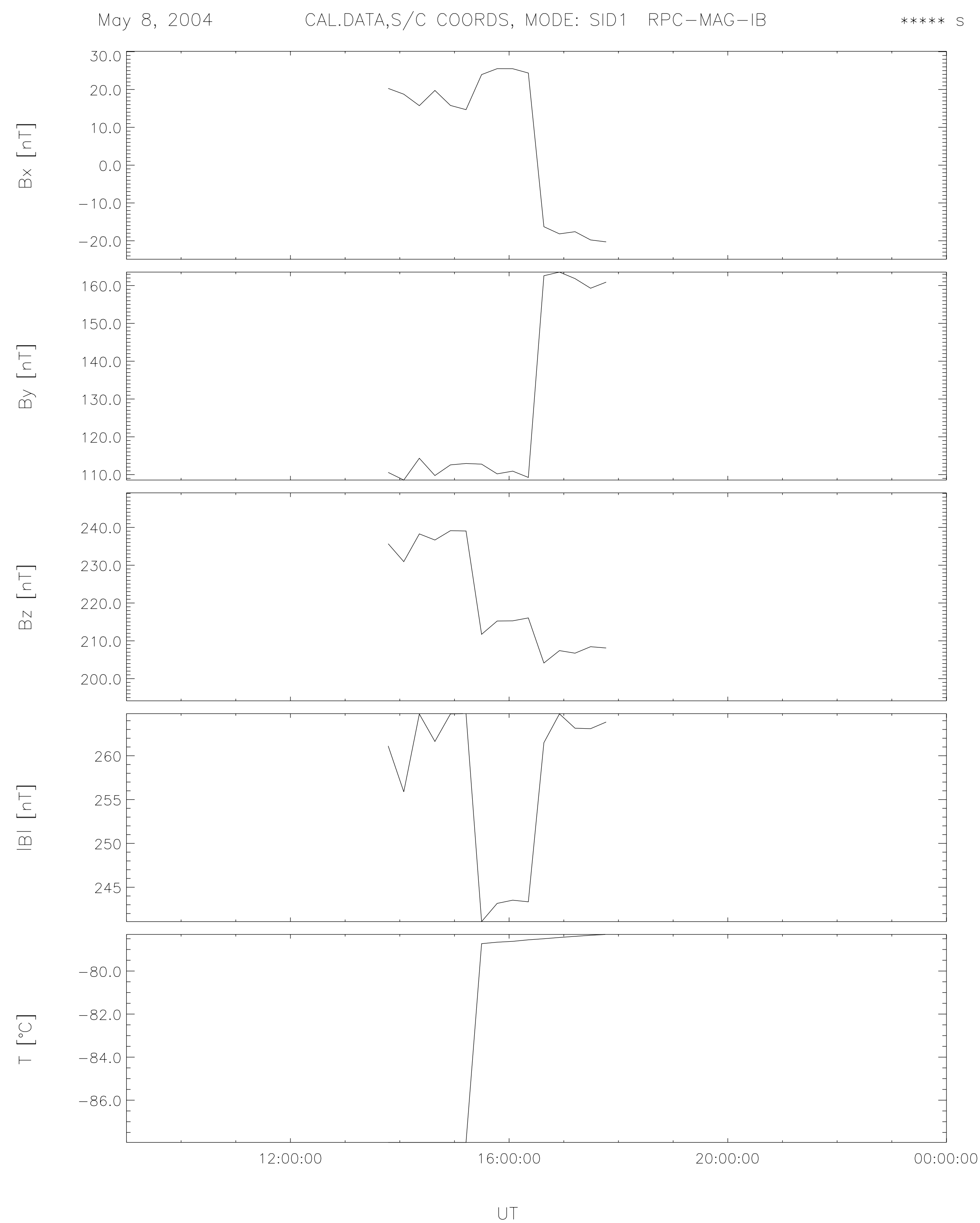

Figure 14: File: RPCMAG040508T0900_CLB_IB_M1_T0900_2400

4 May 09, 2004:

4.1 Actions

Today we got data from 00:00 until 12:00 and from 1600 until midnight. The instrument was operated in modes SID3, SID4, and HK. The instrument worked fine.
It is,however, remarkable that the very low frequent noise level is in the order of 8 nT_pp.
This seems to be caused by various spikes.

Origin ?
LDL mode ?
S/c ops ?

4.2 Plots

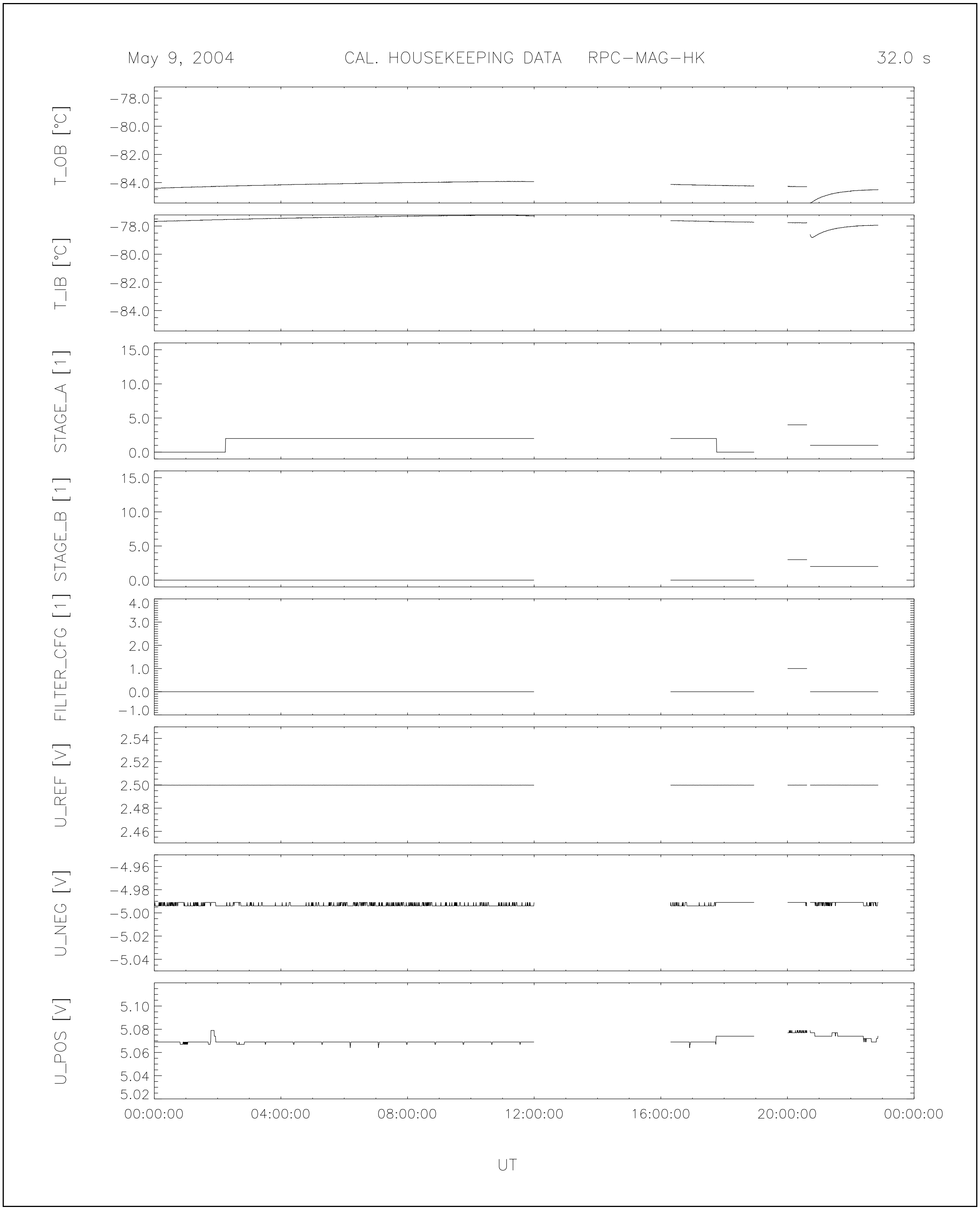

Figure 15: File: RPCMAG040509T0000_CLA_HK_P0000_2400

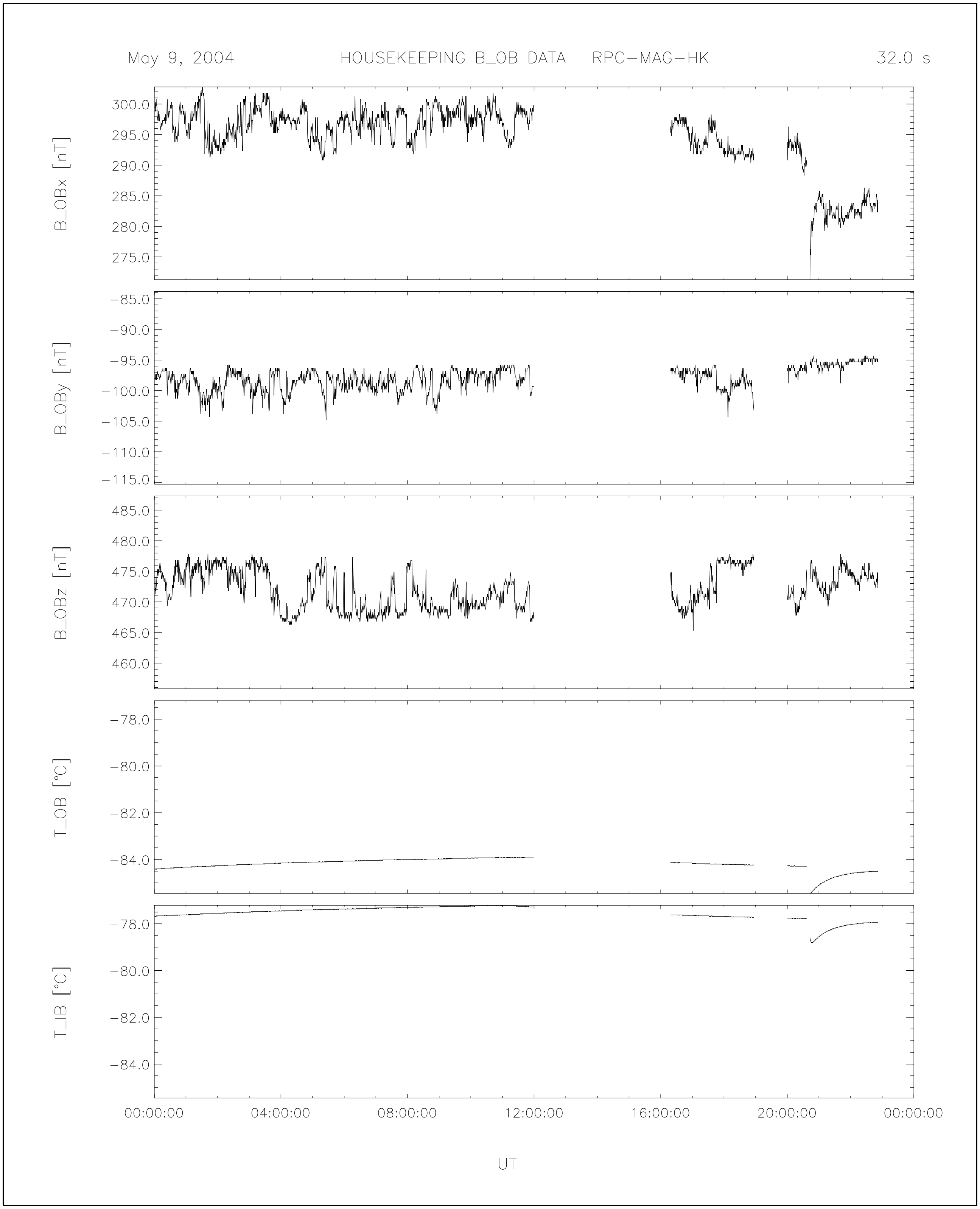

Figure 16: File: RPCMAG040509T0000_CLA_HK_B_P0000_2400

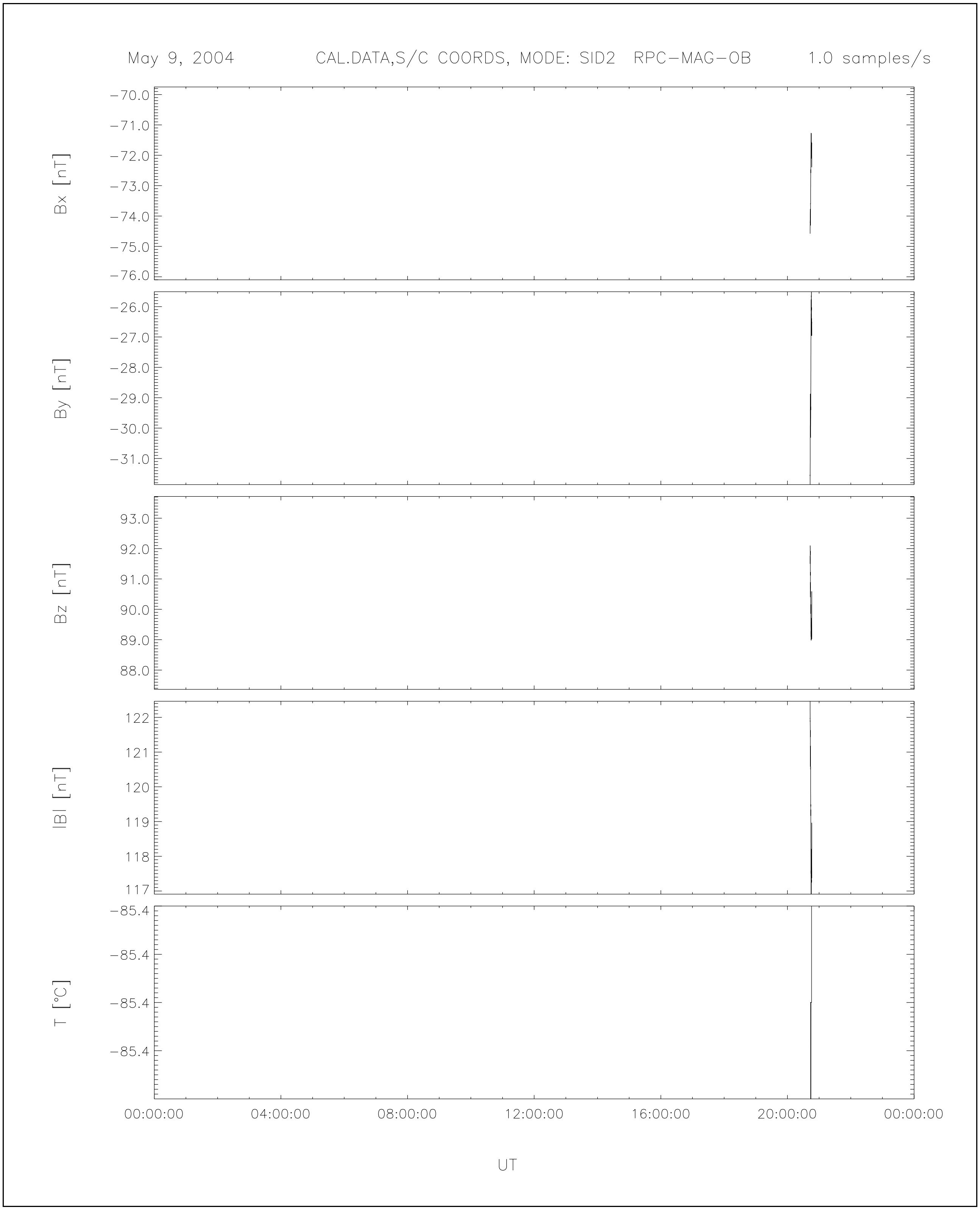

Figure 17: File: RPCMAG040509T2042_CLB_OB_M2_T0000_2400

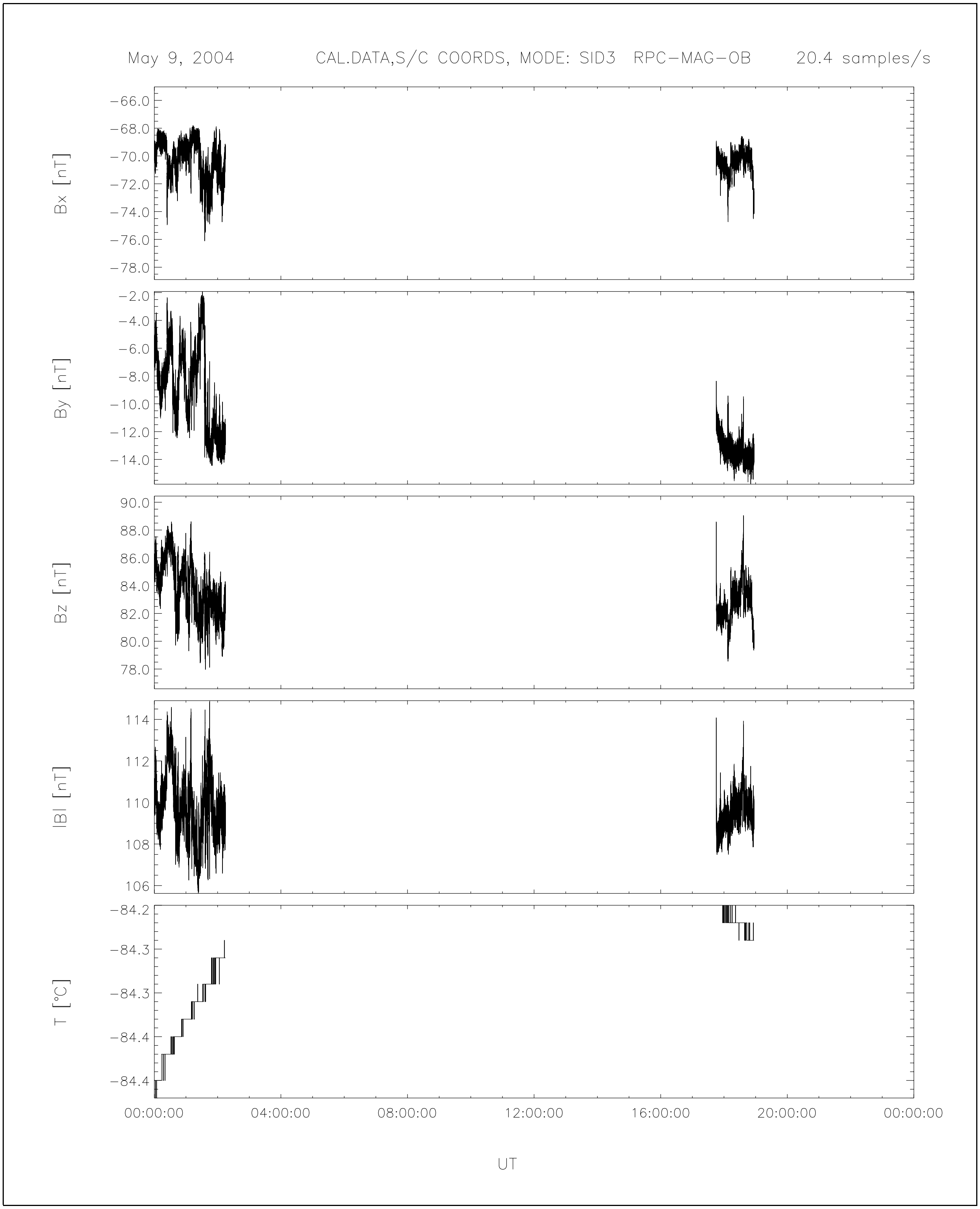

Figure 18: File: RPCMAG040509T0000_CLB_OB_M3_T0000_2400

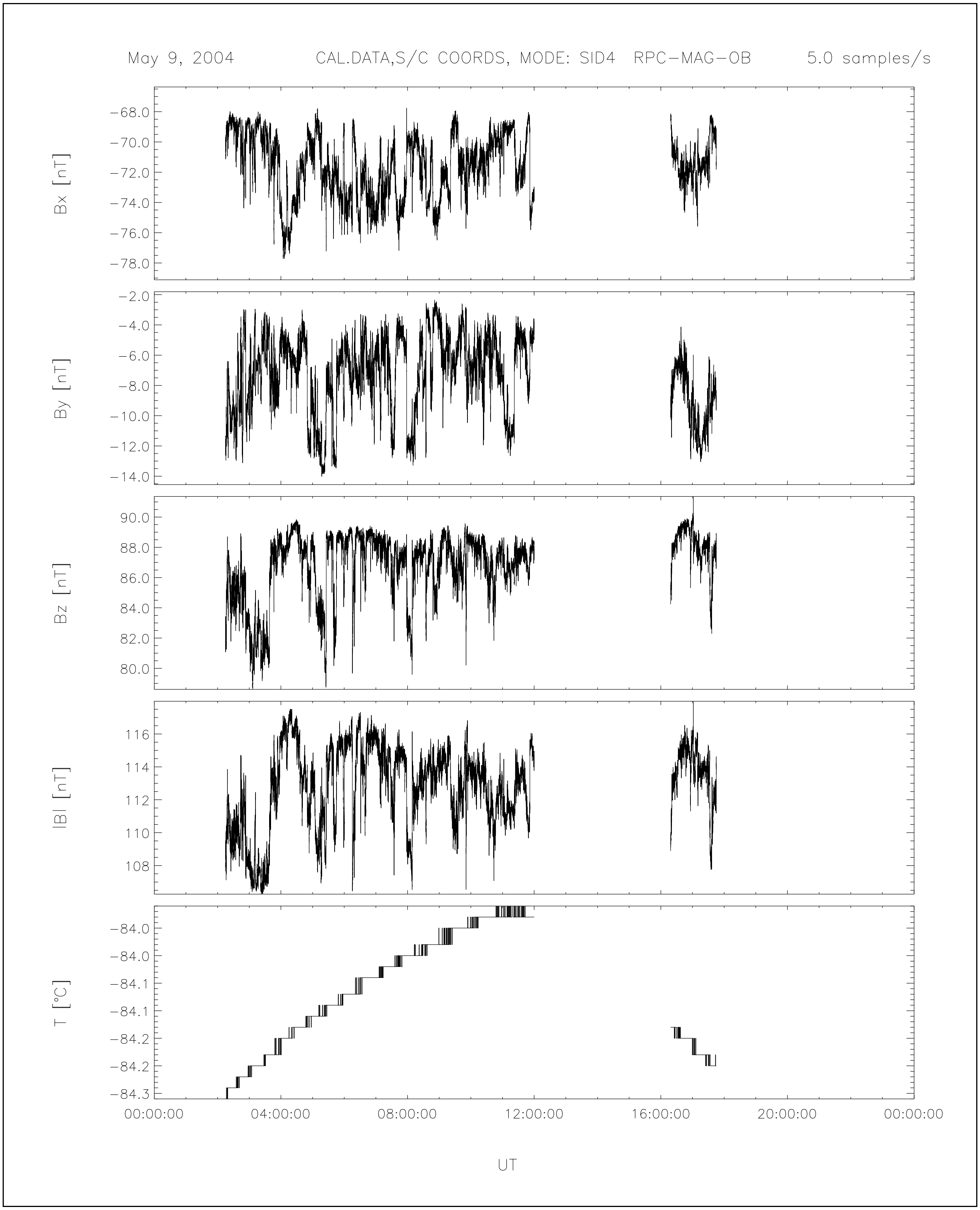

Figure 19: File: RPCMAG040509T0215_CLB_OB_M4_T0000_2400

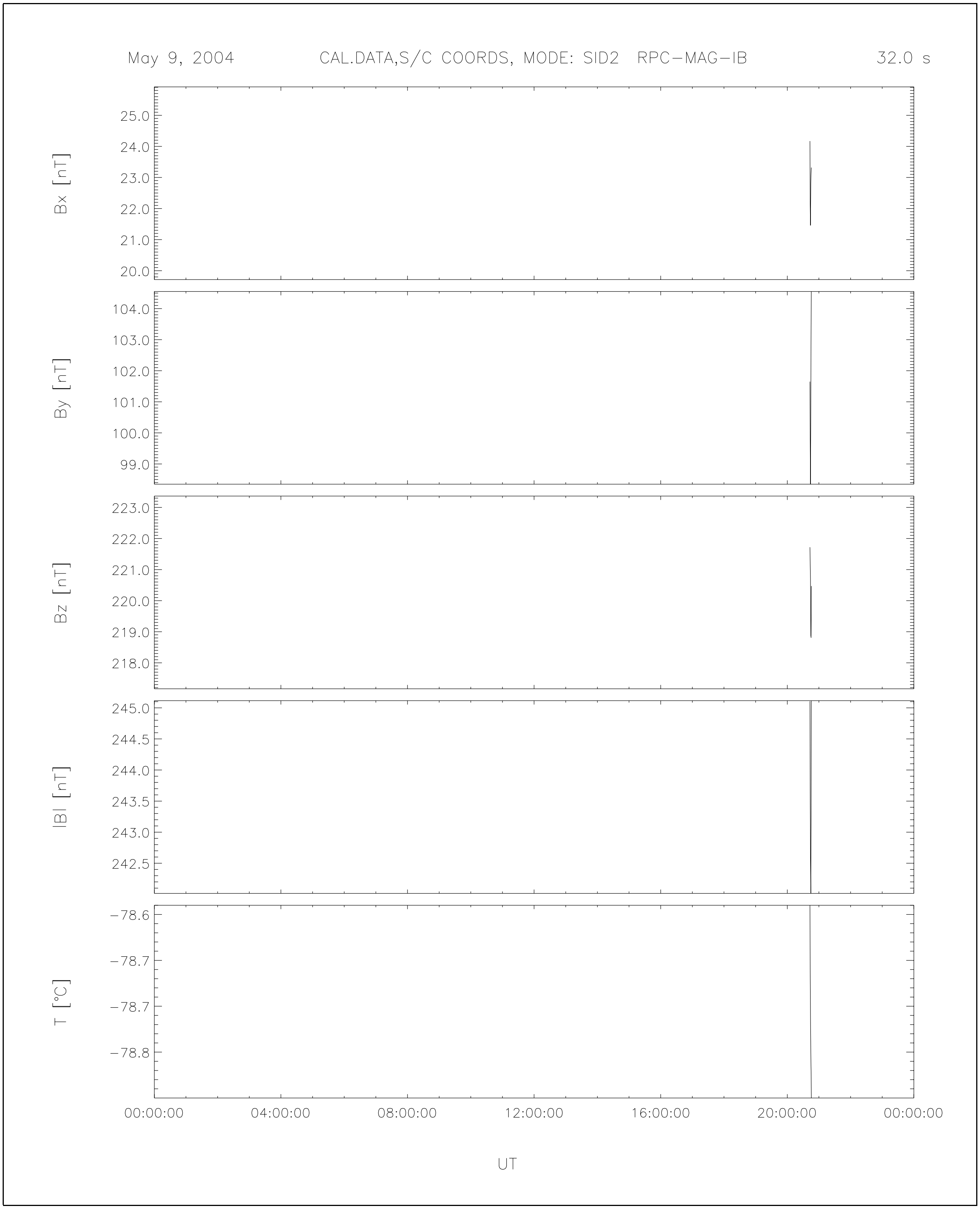

Figure 20: File: RPCMAG040509T2042_CLB_IB_M2_T0000_2400

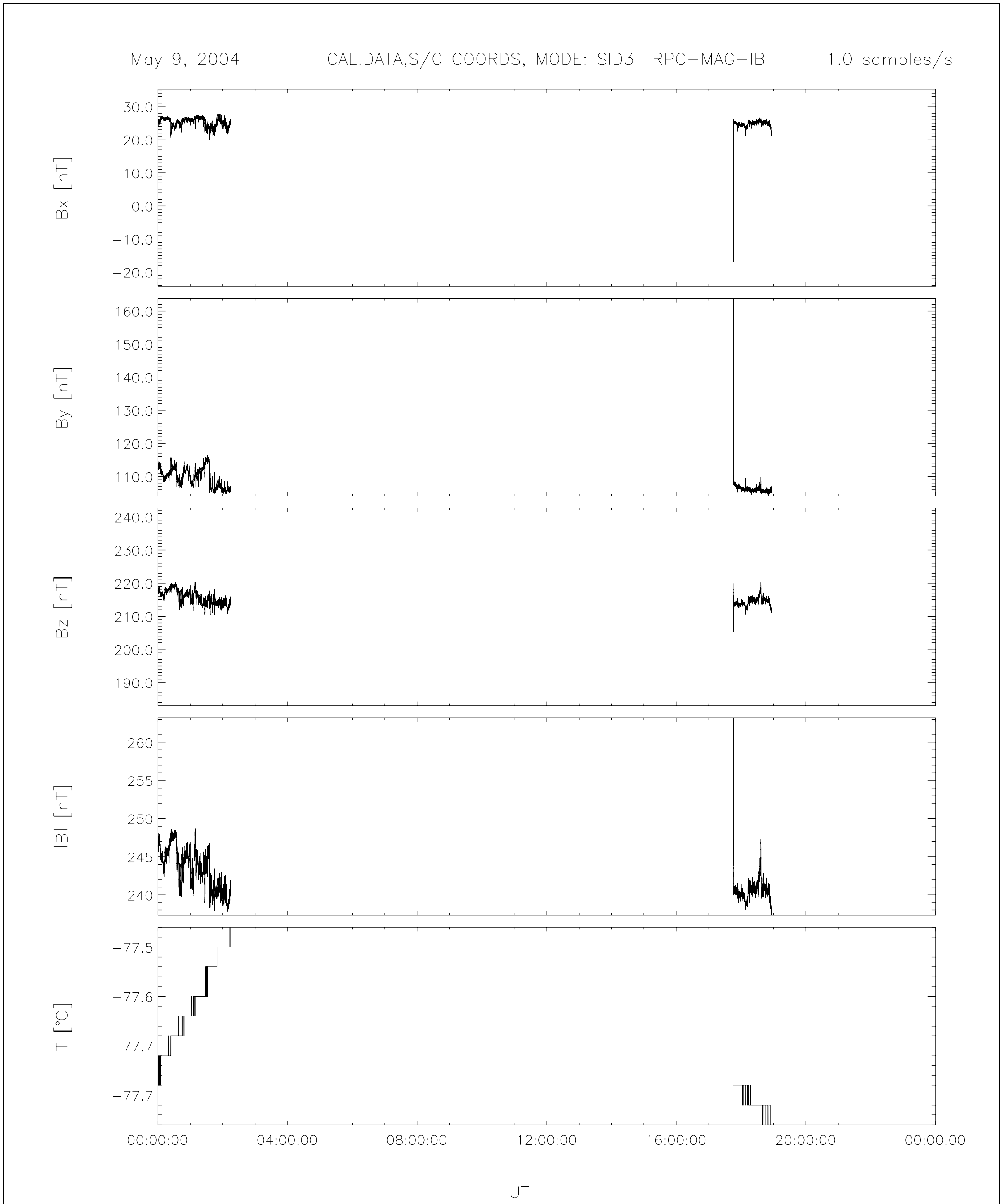

Figure 21: File: RPCMAG040509T0000_CLB_IB_M3_T0000_2400

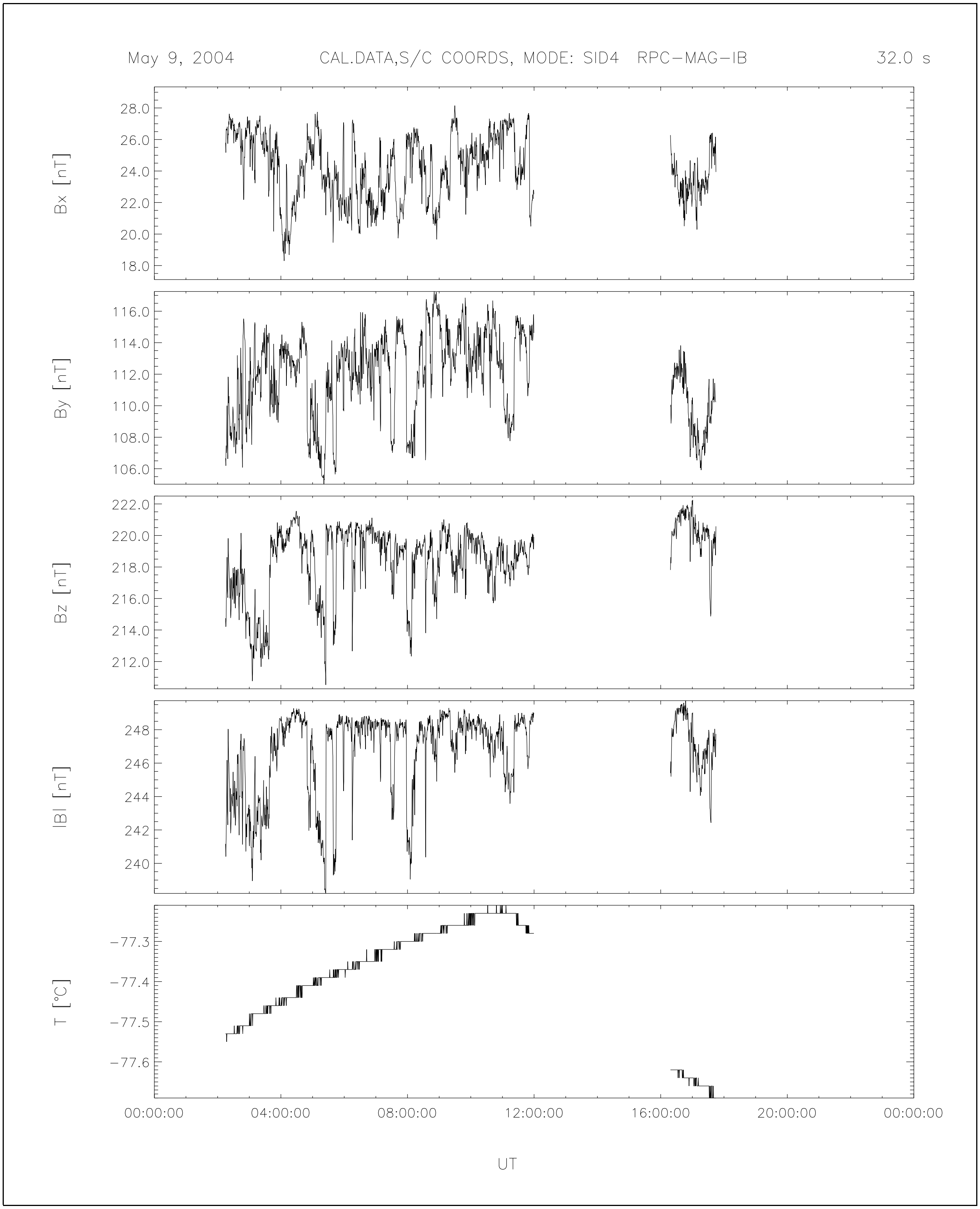

Figure 22: File: RPCMAG040509T0215_CLB_IB_M4_T0000_2400

5 May 10, 2004:

5.1 Actions

TBW

5.2 Plots

TBW

ROSETTA

FLIGHT REPORTS
of RPC-MAG

RO-IGEP-TR0013

Issue:1   Revision:0

November 10, 2004

Mission Commissioning Results Review
MCRR

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1. Introduction

This document describes the results of the commissioning and interference campaign concerning the RPC MAG experiment. The tests were executed from March 17. - October 14, 2004.
Details and an overview of the measured data can be found in:

RO--IGEP--TR0006: Report of the Commissioning PART 1, March 17. -- March 19, 2004

RO--IGEP--TR0008: Report of the Commissioning PART 2, May 05. -- May 10, 2004

RO--IGEP--TR0010: Report of the Commissioning PART 3, September 6. -- September 10, 2004

RO--IGEP--TR0011: Report of the Interference Campaign, September 20. -- October 14, 2004

RO--IGEP--TR0012: Investigation of the impact of ROSETTA's Reaction wheels on the Magnetic Field measurements.

These documents can be found on :

ftp-server: ***ftp.geophys.nat.tu-bs.de***
user: ***anonymous***
directory: ***/pub/rosetta/docs***

A copy is also available on the RPC server at the Imperial College.

2. Activities during CVP

2.1 Functional Tests

- RPCMAG could be switched on successfully every time and worked as expected.
- RPCMAG was tested in all modes successfully.
- Both RPCMAG sensors are working nominally.
- Sensor temperatures: - 120°C ... -45°C

2.2 Boom Deployment

The MAG Boom deployment was successfully performed on March 19th, 2004.

- The s/c generated Residual field before Deployment was
  ~200 nT at the IB sensor
  ~740 nT at the OB sensor

- The s/c generated Residual field after Deployment was
  ~ 250 nT at the IB sensor
  ~100 nT at the OB sensor

- The noise level after the boom deployment was about a factor of ten lower than before the deployment.

All measurements were taken at a sensor temperature of about T = -88°C.

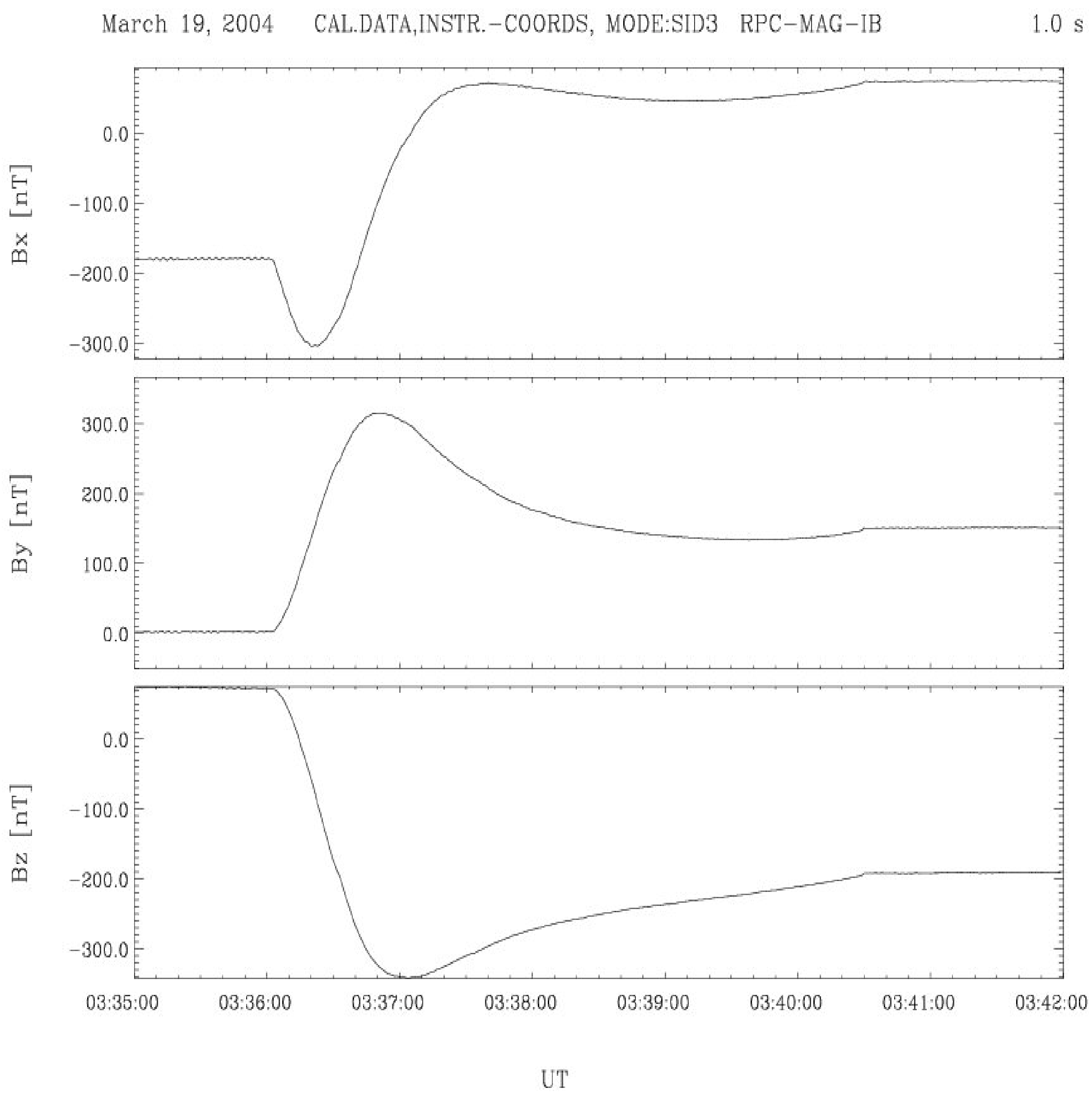


Figure 1:The magnetic Field at the IB sensor during the boom deployment

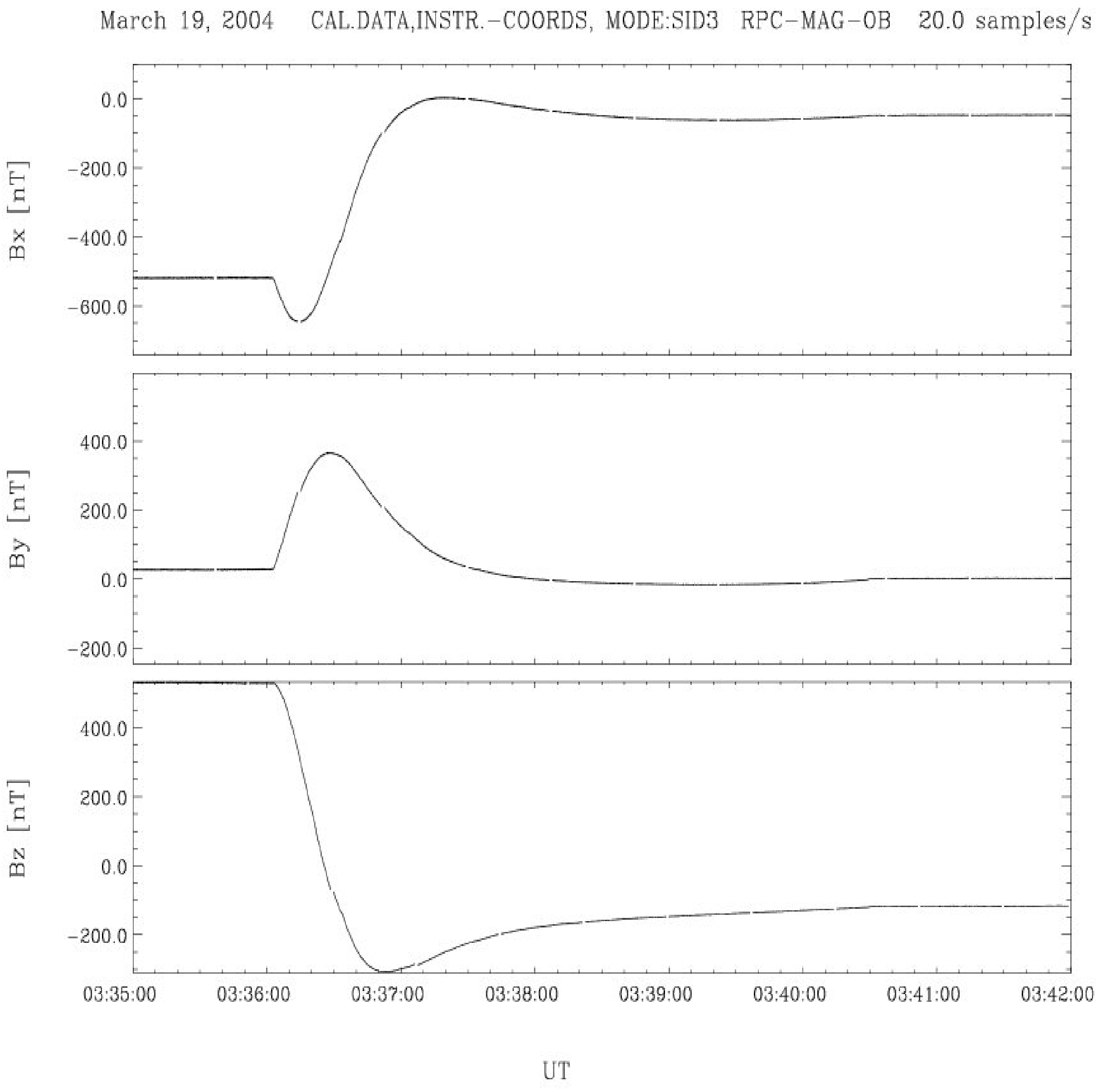


Figure 2: The magnetic Field at the IB sensor during the boom deployment

3. Cognitions from CVP

3.1 DC Analysis - Temperature Behaviour

- S/C generated Residual field after Deployment
  ~ 250 nT @ IB ~100 nT @ OB

- RPCMAG readings vary with temperature

- Temperature dependence of RPCMAG offset deviates from GND CAL results.
  The most likely reason for this is that the ground calibration was only be performed down to –60°C, the observed temperatures in space, however, are going down to –125 °C.

➔ A New temperature model has to be applied

3.1.1 The old Temperature Model

The quality of the ground calibration based temperature model of the sensors was checked using the following Procedure:

- Long term investigation: May – September 2004
  All available commissioning data were taken
- Averages were built on a 10 minute base

Result:

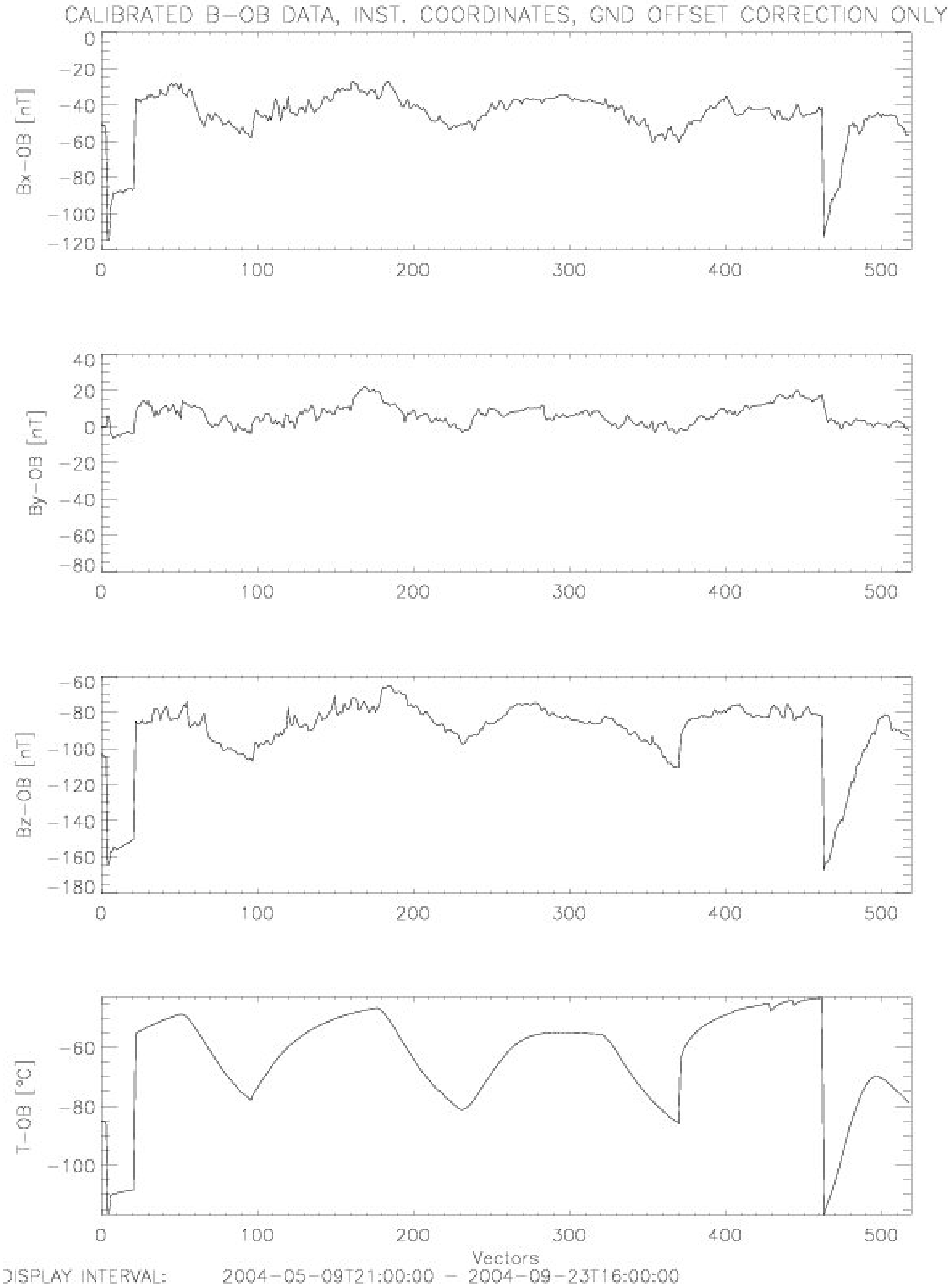


Figure 3: 600s average OB Magnetometer readings, calibrated with ground calibration results, versus sensor temperature.

It is obvious that a strong correlation between the sensor temperature and the MAG sensor readings occurs. Therefore, a better temperature model has to be developed.

3.1.2 The new Temperature Model

To get an idea of the real dependence between the MAG sensor readings and the sensor temperature the 10 minute averaged MAG data were plotted versus the temperature. Refer to Figure 4. As a result it turned out, that a cubic Temperature model (solid line) like

$$B_i^*(t) = B_i(t) - P3_i(T(t))$$

Describes the sensor behaviour in a convenient was. The original ground based model was just a pure linear model.

The successful application of the new model to the data can be seen in Figure 5.

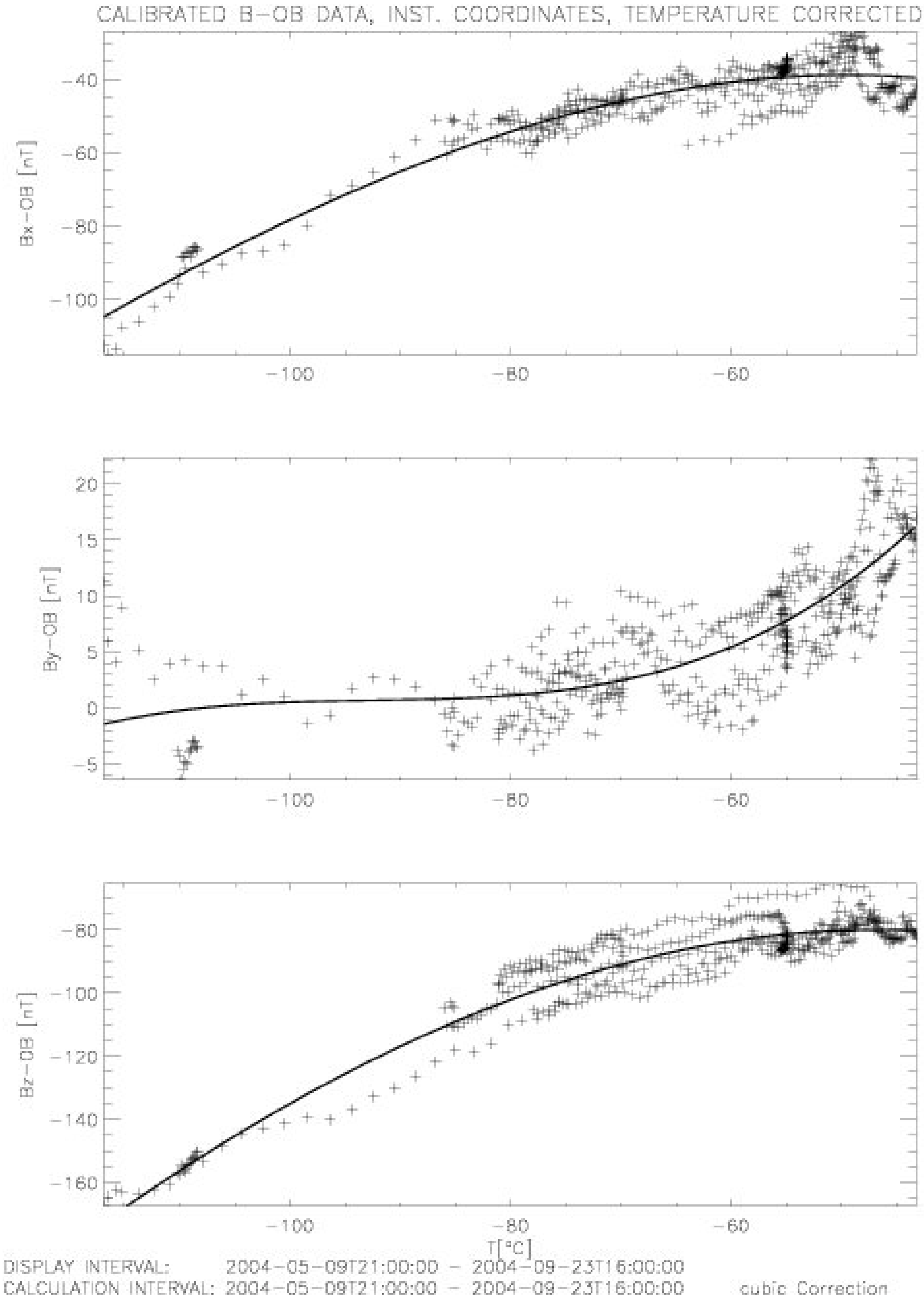


Figure 4: 600s average OB Magnetometer readings versus sensor temperature.

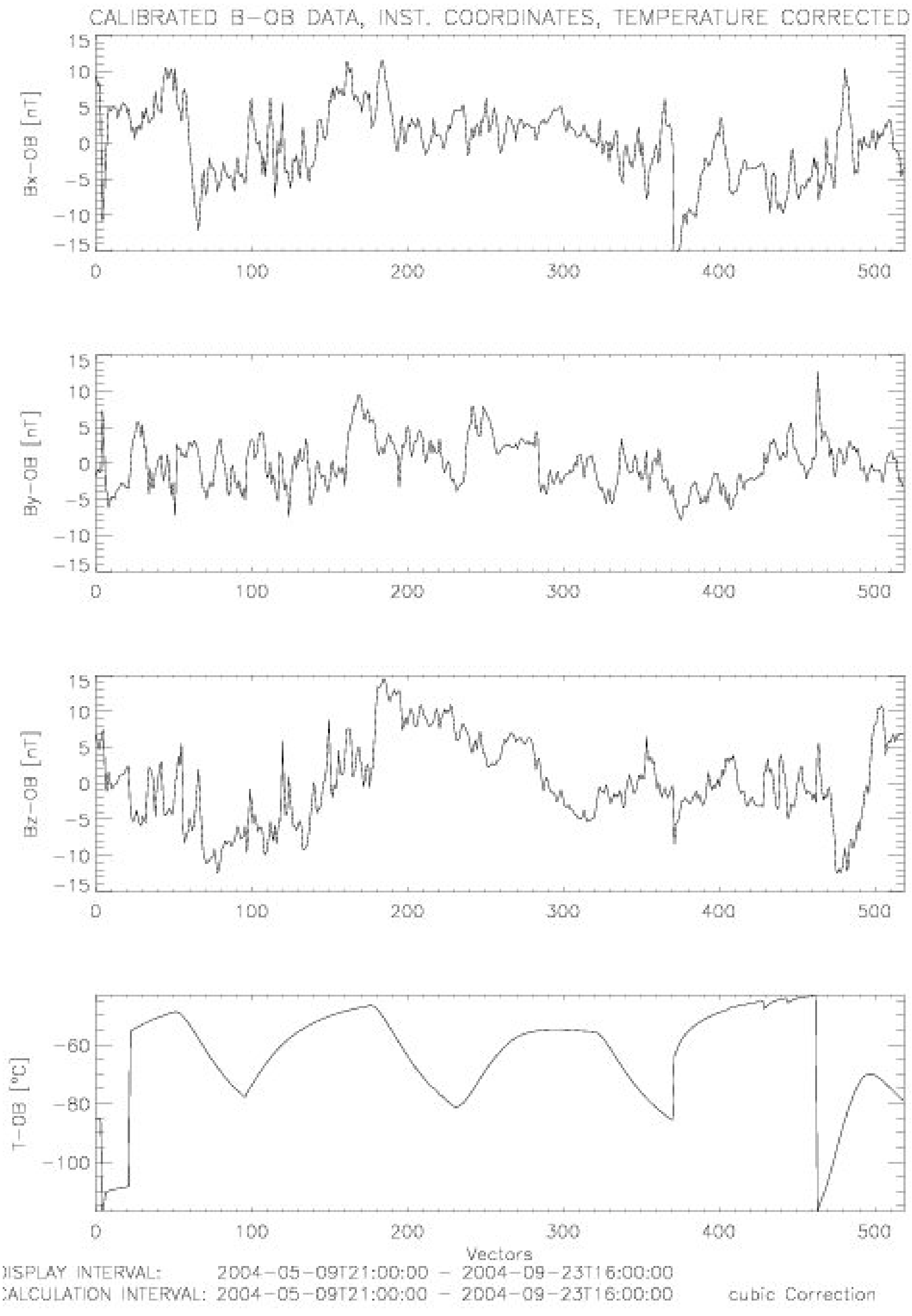


Figure 5: 600s average OB Magnetometer readings, calibrated with the new temperature model, versus sensor temperature.

3.2 AC-Analysis: Impact of the Reaction wheels

The signal analysis revealed that

- there is always a sinusoidal disturbance in the order of 1nT$_{PP}$ with slow varying frequencies.
- The observed frequencies of the disturbers are different for different modes. ➔ Aliasing effect
- Disturbance can be seen on OB, IB & ROMAP

This behaviour is displayed on the following diagrams.

3.2.1 Typical Timeseries

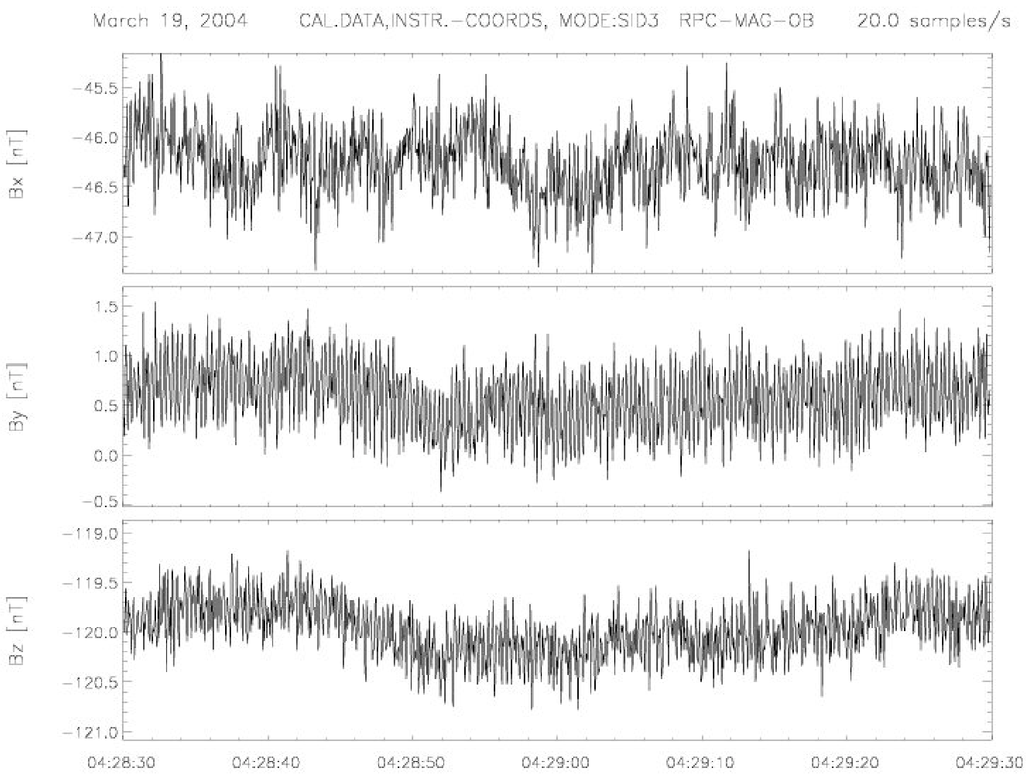


Figure 6: Typical timeseries of OB burst mode data.

Data were zoomed in a 1 minute interval. The DC level is quite stable, the noise is in the order of 0.7 nTpp.

3.2.2 Typical Powerspectra

The power spectra reveal discrete, monofrequent signals in the order of a few Hertz if the MAG signal is sampled with 20 Hz.

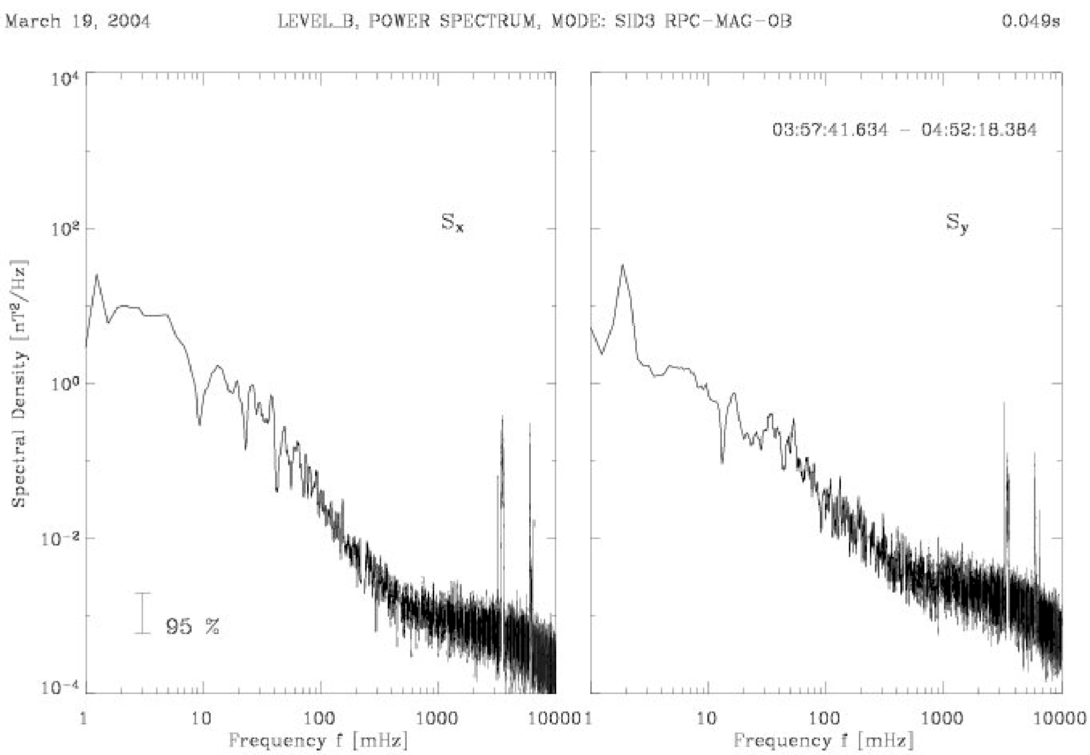


Figure 7: Typical Power spectra. Data of the OB sensor in Burst mode. X and Y component in s/c coordinates is plotted.

3.2.3 Typical Dynamical Spectra

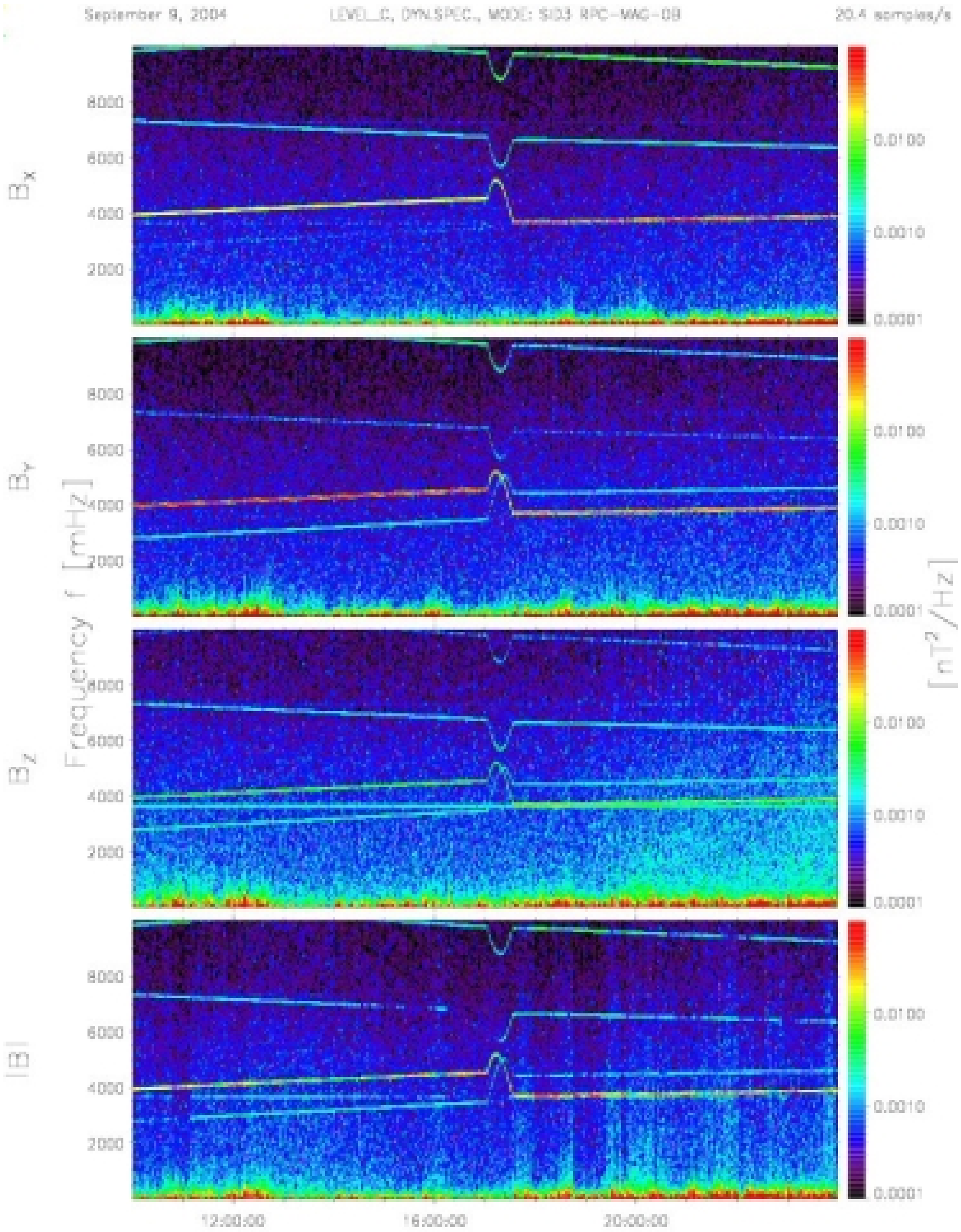


Figure 8: Typical Dynamic spectra. Data of the OB sensor in Burst mode (20 Hz sampling) in s/c coordinates is plotted.

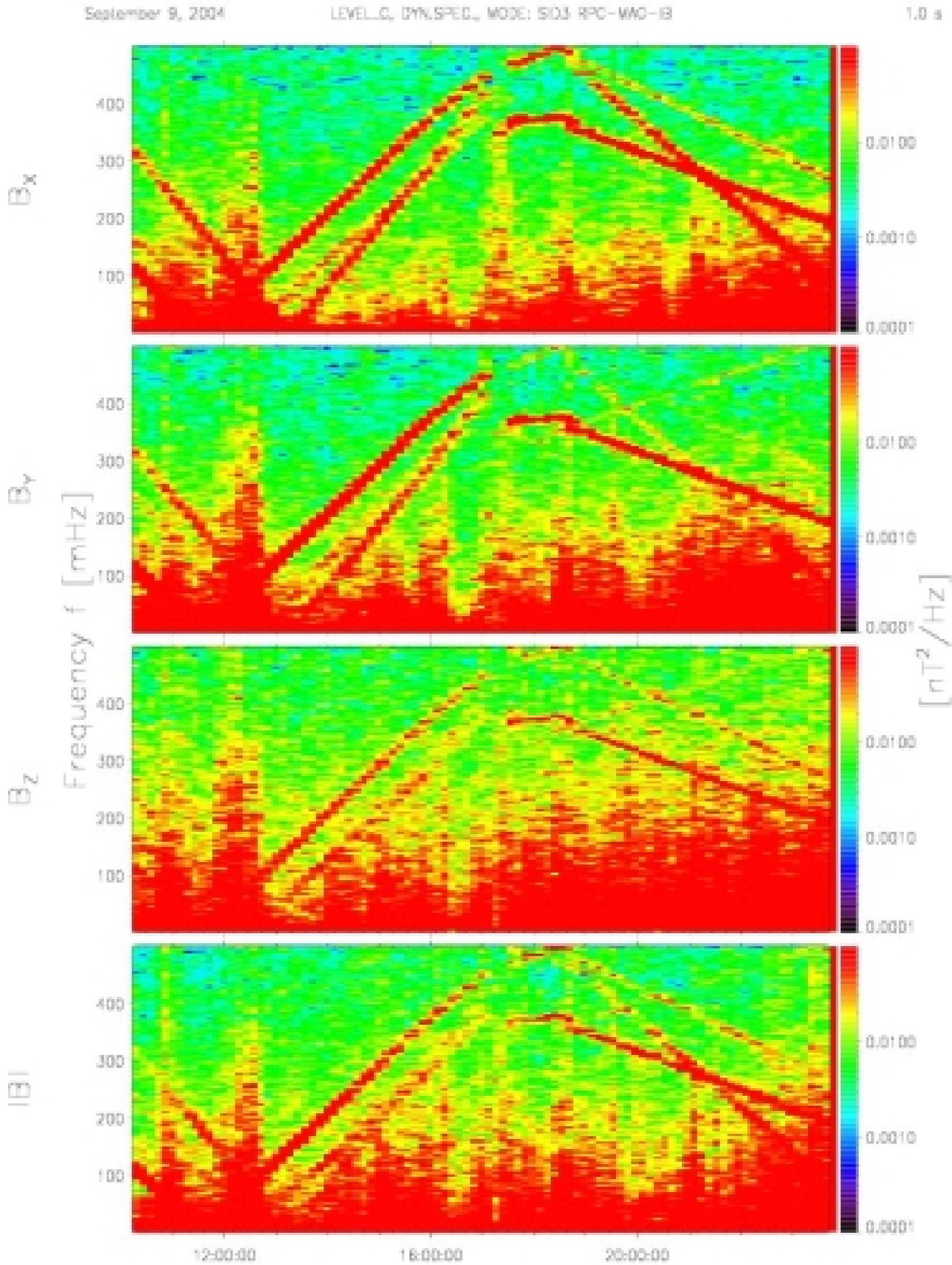


Figure 9: Typical Dynamic spectra. Data of the IB sensor in Burst mode (1Hz sampling) in s/c coordinates is plotted.

The dynamic spectra show various spectral lines beside the "real magnetic field data". These line vary slowly with the time and show specific structures. The shape of these disturbance lines is specific to the sampling frequency of the MAG sensosrs. All these criteria lead to the guess, that the disturbance might be an Aliasing effect and might be dependent of ROSETTAs four reaction wheels.

3.2.4 The Reaction Wheels

The next figure show the speeds of the reaction wheels in rpm. The data are taken from the DDS. The panels show the timeseries of the parameters

- NAAD60014
- NAAD6024
- NAAD6034
- NAAD6044

The parameters have been calibrated using the DDS calibration value 0.50813.
Figure 12 shows the same data but in the unit of Hertz rather than Rpm.

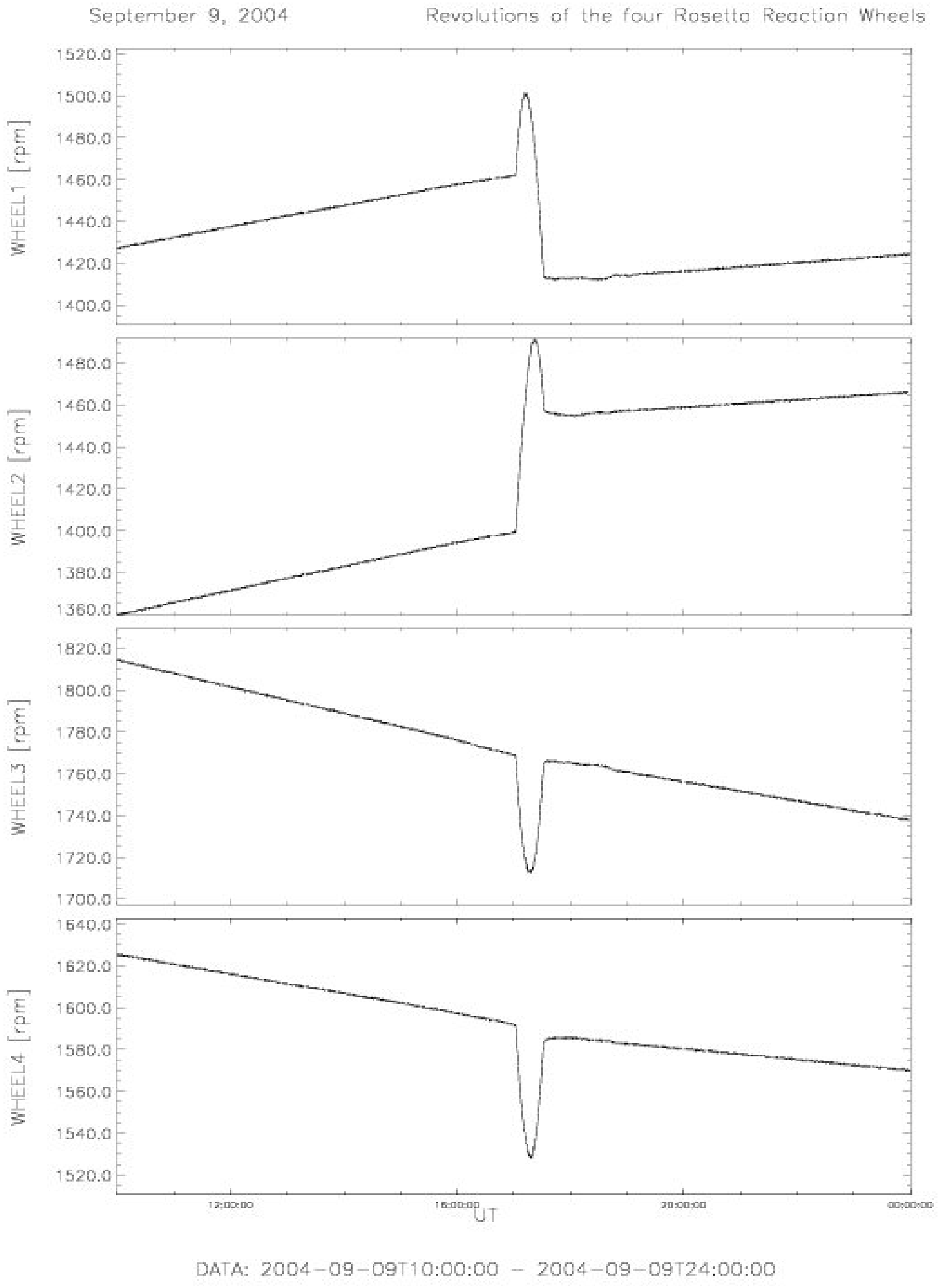


Figure 10: Revolutions of all 4 Rosetta Reaction wheels in rpm.

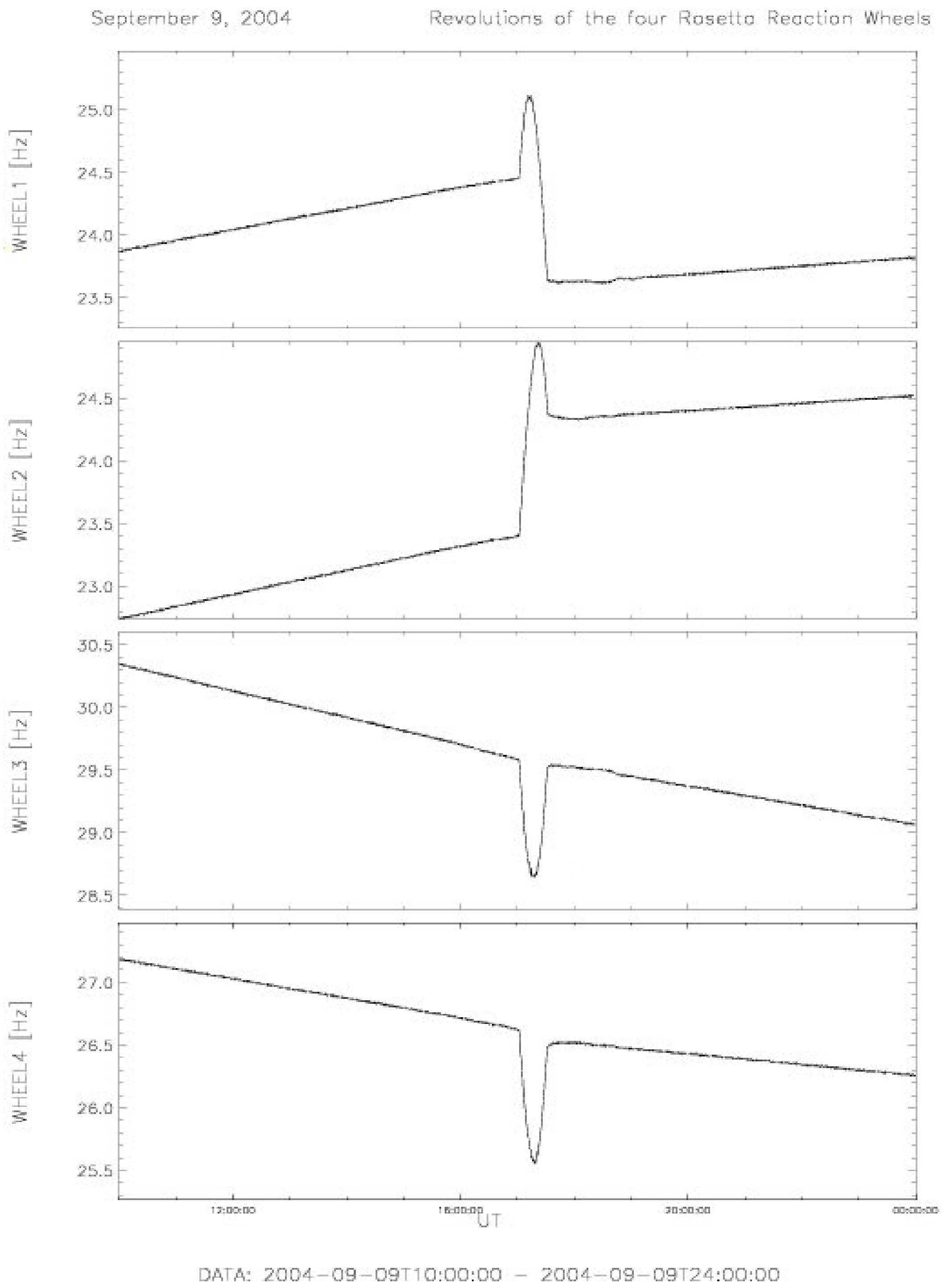


Figure 11: Revolutions of all 4 Rosetta Reaction wheels in Hertz.

3.2.5 Reaction Wheels - Seen from the MAG sensors

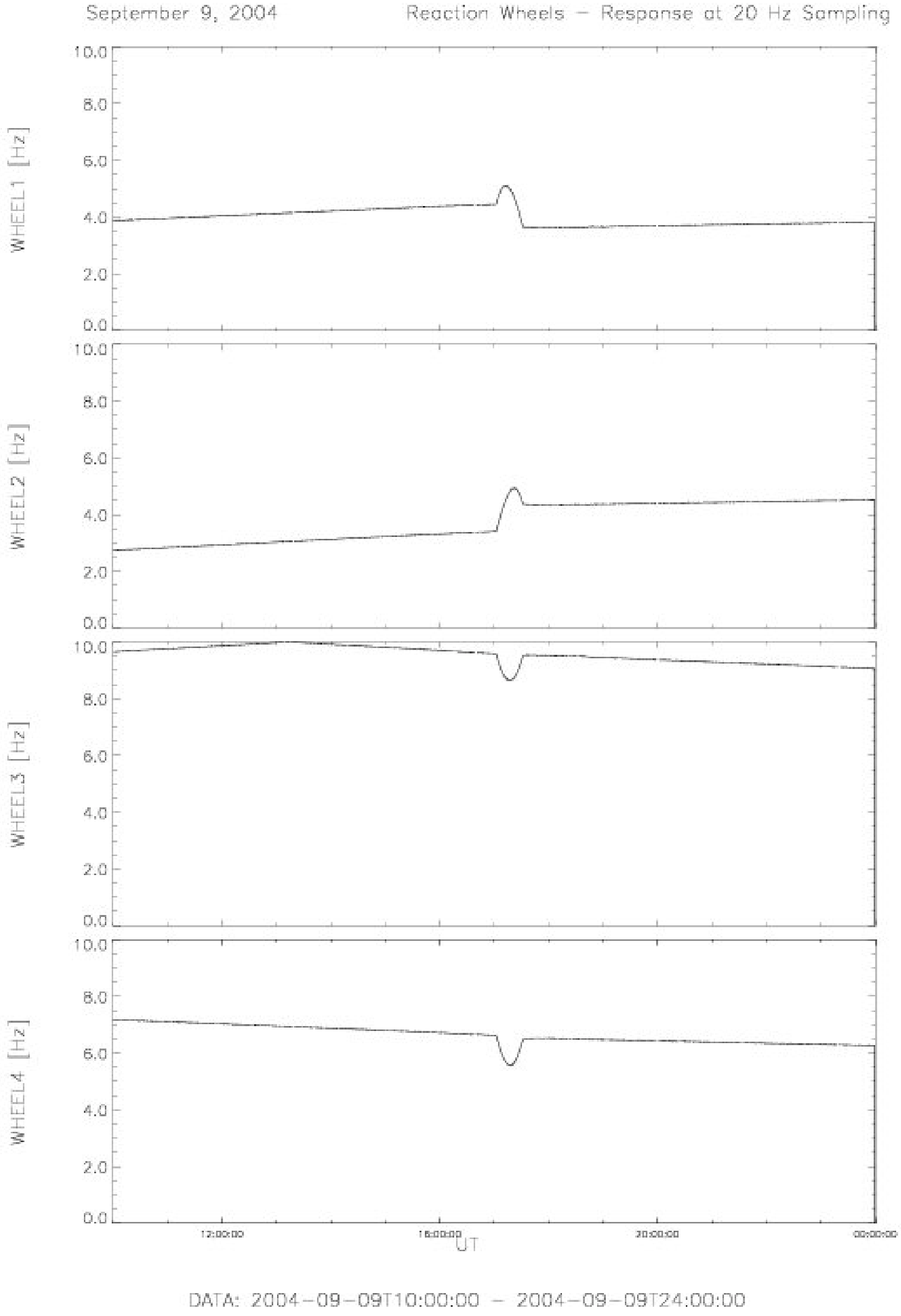


Figure 12: Magnetic signature of the 4 Reaction wheels seen by a sensor which is sampled with 20 Hertz.

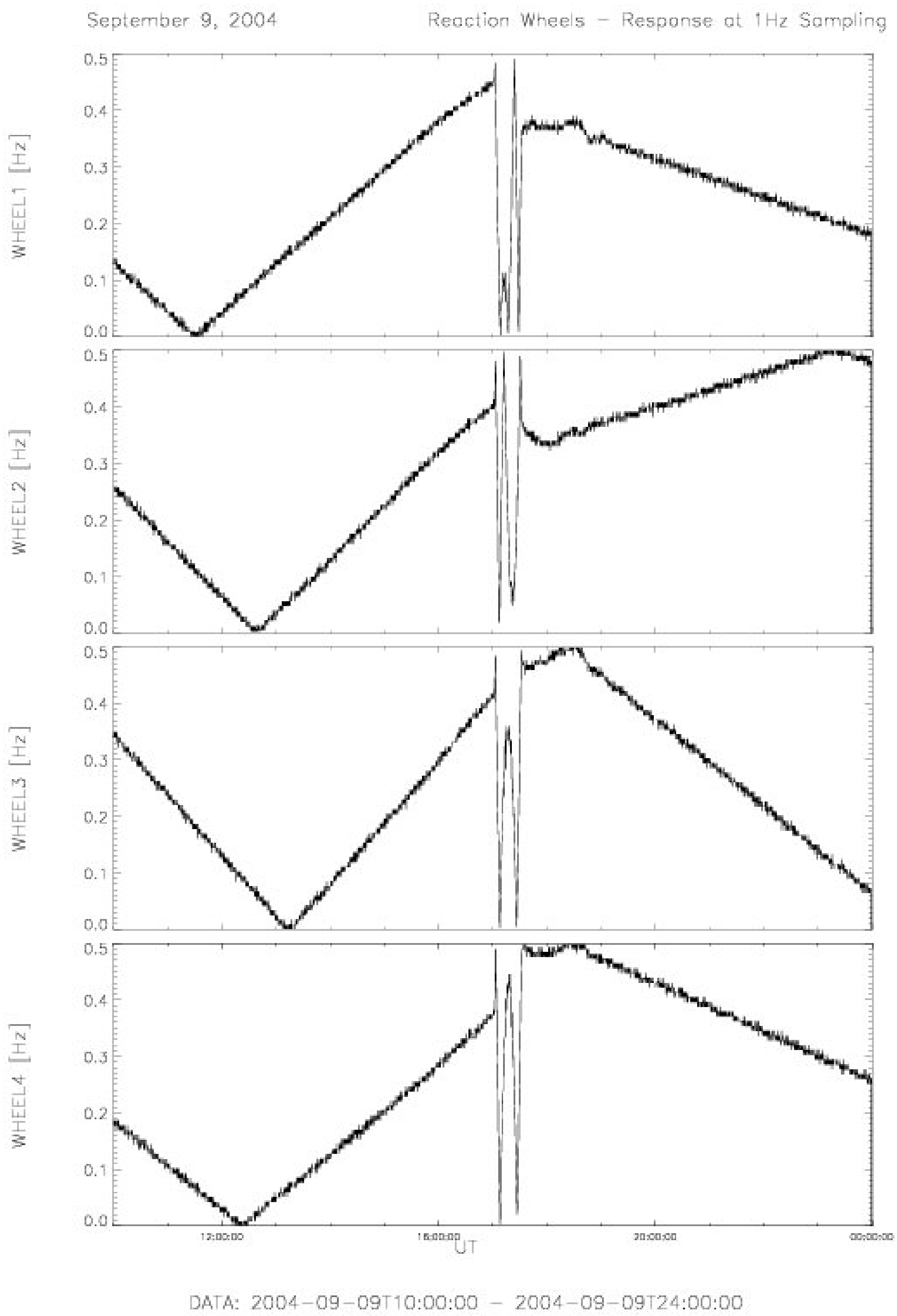


Figure 13: Magnetic signature of the 4 Reaction wheels seen by a sensor which is sampled with 1 Hertz.

To get an idea how the "high frequent" reation wheel speeds would appear on sensor which is only sampled with 20 Hz or 1Hz the wheel data have been shifted and folded down to the Nyquist frequency interval according the sampling theorem. The result can be seen in Figures 13 and 14.

3.2.6 AC-ANALYSIS : Results

- RPCMAG clearly identifies the signatures of the 4 Reaction wheels
  The comparison of the dynamic spectra of the magnetic field data and the reaction wheel frequencies from the DDS parameters reveals a nearly perfect accordance.

➔ Dynamic frequency reduction model to be developed to get rid of the reaction wheel impact

- Spin –Off:
  Analysis of OB, IB and - independently - ROMAP revealed a slightly wrong reaction wheel calibration factor (1.00335 ~ 4 rpm)

➔ DDS HK Calibration Parameters to be updated.

3.3 Comparison with ROMAP

3.3.1 Power Spectra

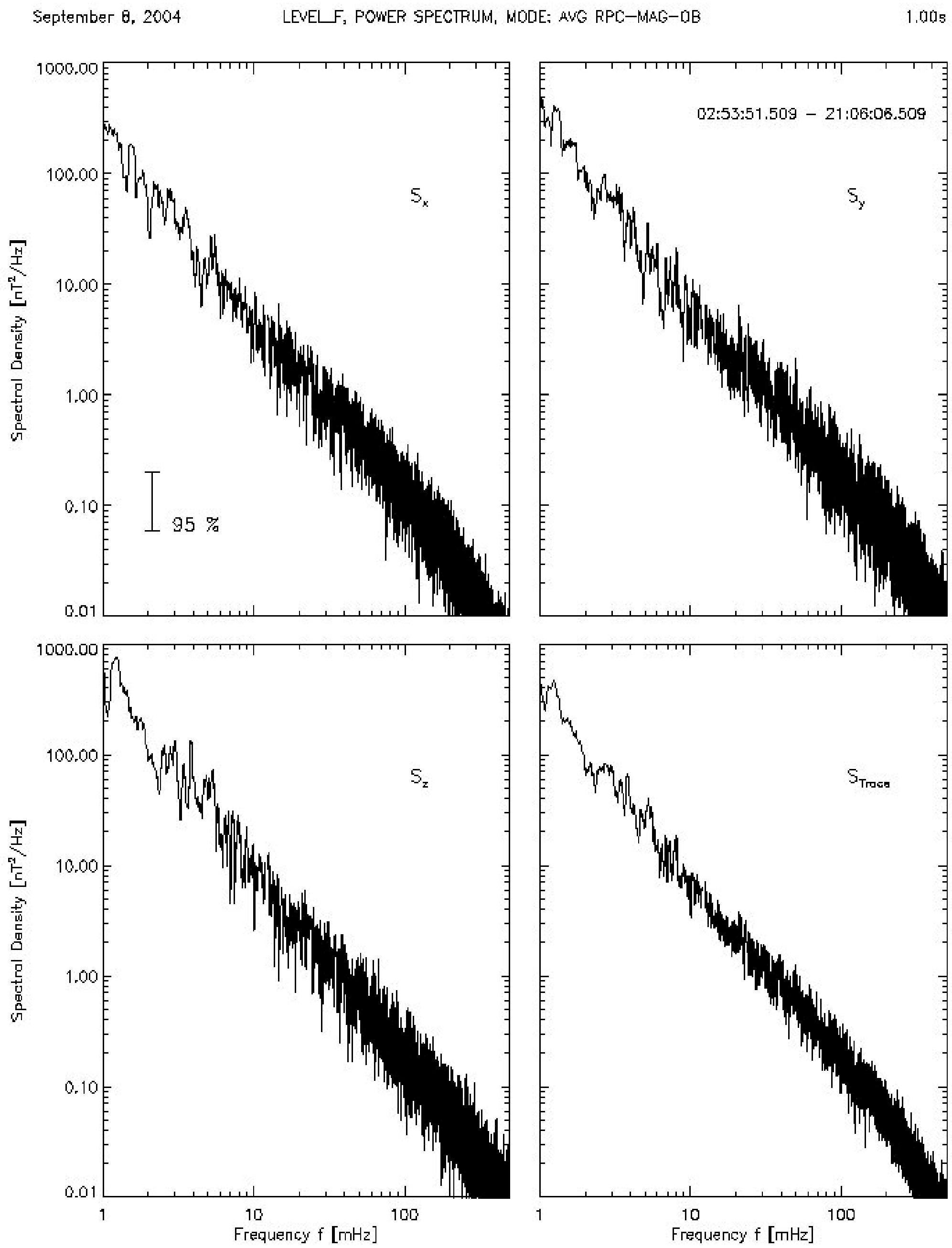


Figure 14: Power Spectra of the RPC_MAG OB sensor.
1 s average data in s/c coordinates.

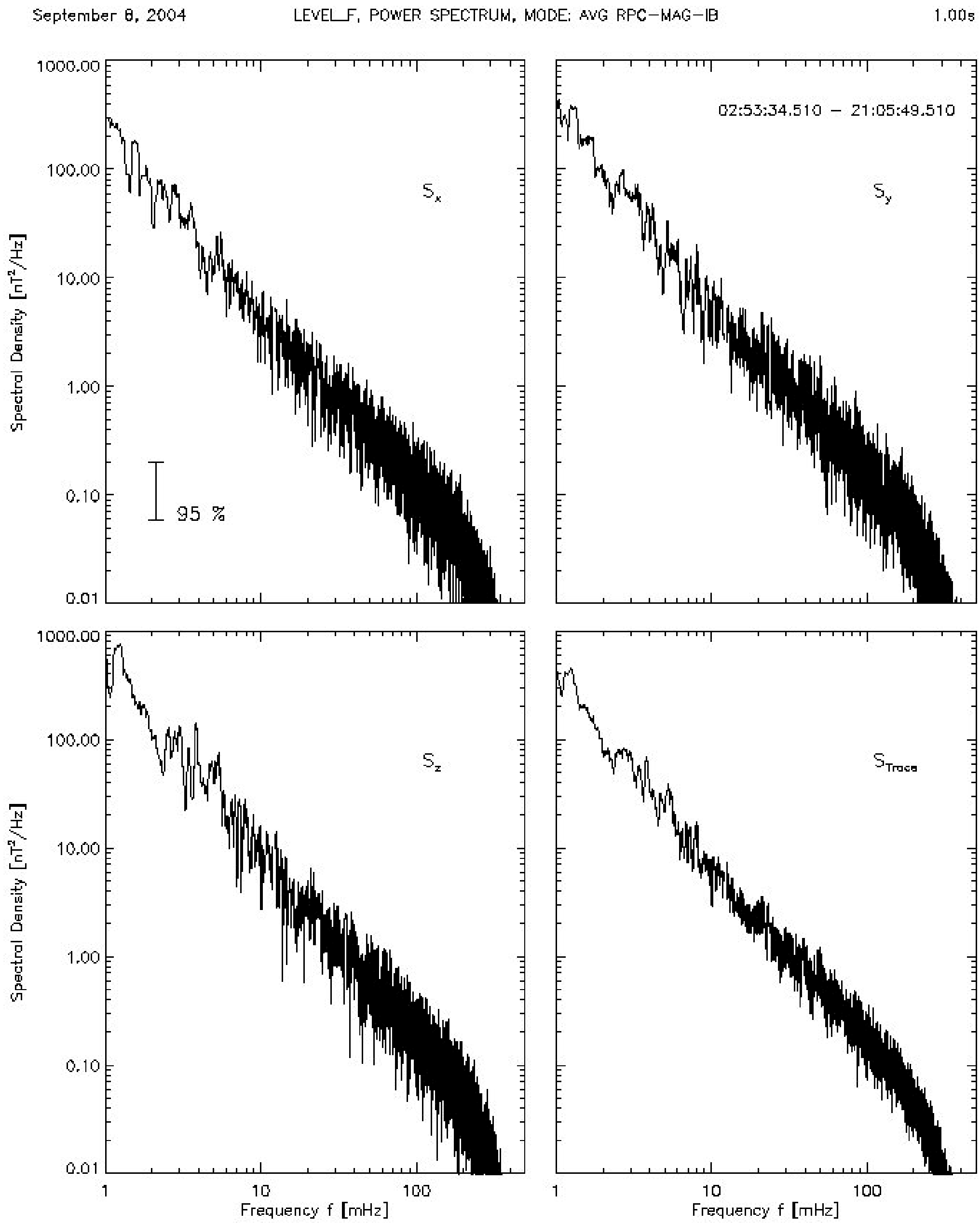


Figure 15: Power Spectra of the RPC_MAG IB sensor.
1 s average data in s/c coordinates.

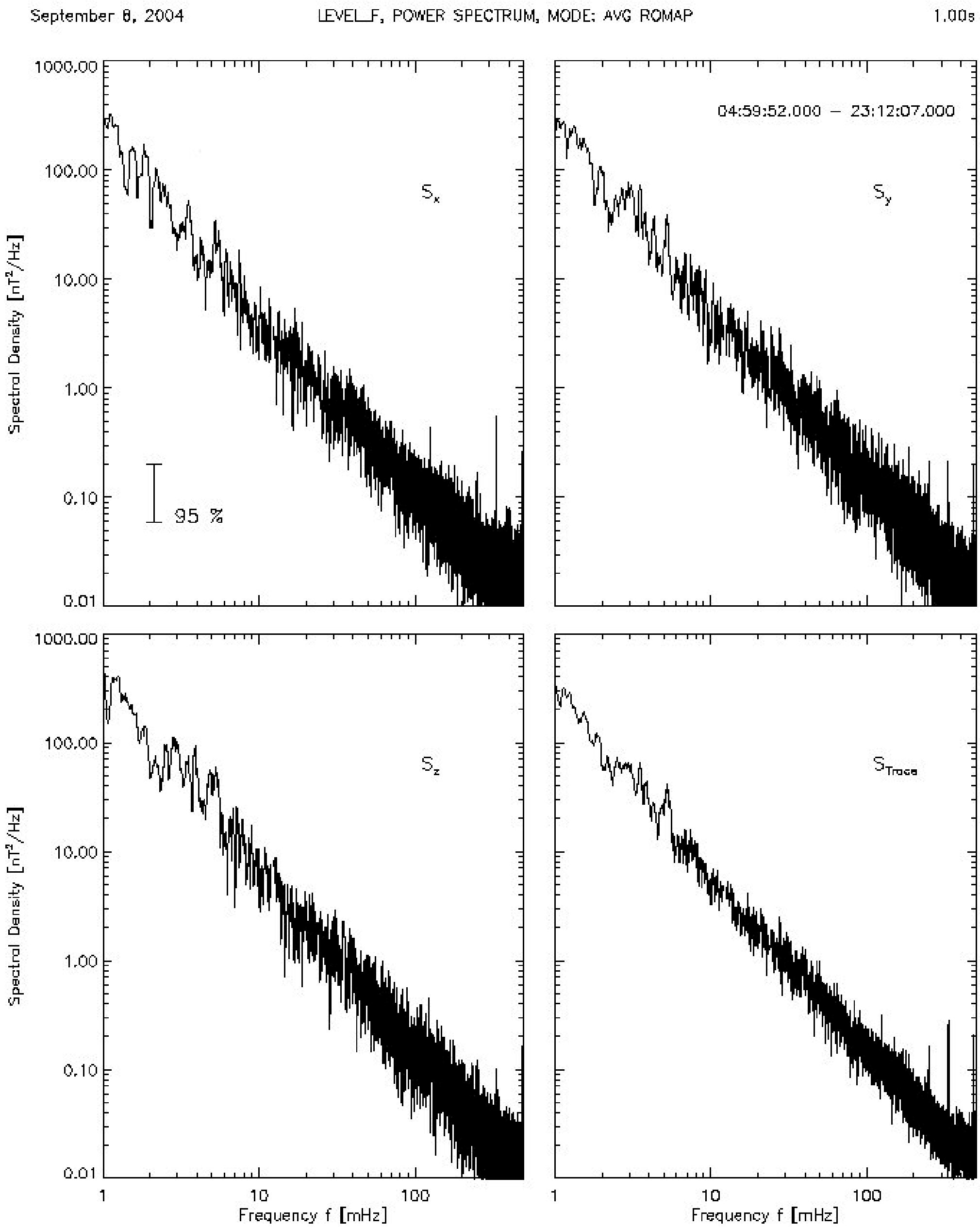


Figure 16: Power Spectra of the ROMAP sensor.
1 s average data in s/c coordinates.

The Figures 15 – 17 show the Power spectra for of the RPCMAG OB, RPCMAG IB, and the Lander Magnetometer ROMAP. Data were taken in a 1 Hz mode.
As result it can be stated, that all three sensors have quasi the same dynamic properties. The noise level of the RPCMAG sensors seem to be slightly better in the higher freuquent part of the spectrum.

3.3.2 Dynamic Spectra

As a last point of the investigation also the dynamic spectra for RPCMAG and ROMAP are shown in Figures 18 – 20. All there sensor sho the impact ot the reaction wheels. The slightly different pictures are caused by different sampling modes.

- RPCMAG OB was sampled with 20 Hz. The data were averaged later to 1s mean values.
- RPCMAG IB was sampled with 1Hz. No additional averaging was done. The “low activity” areas in the spectrum are caused by a mode switching to a low smapling mode on the IB sensor.
- ROMAP was sampled with 1Hz. No additional averaging was done.

Therefore, these data show different behaviour concerning the response of the reaction wheel speeds.

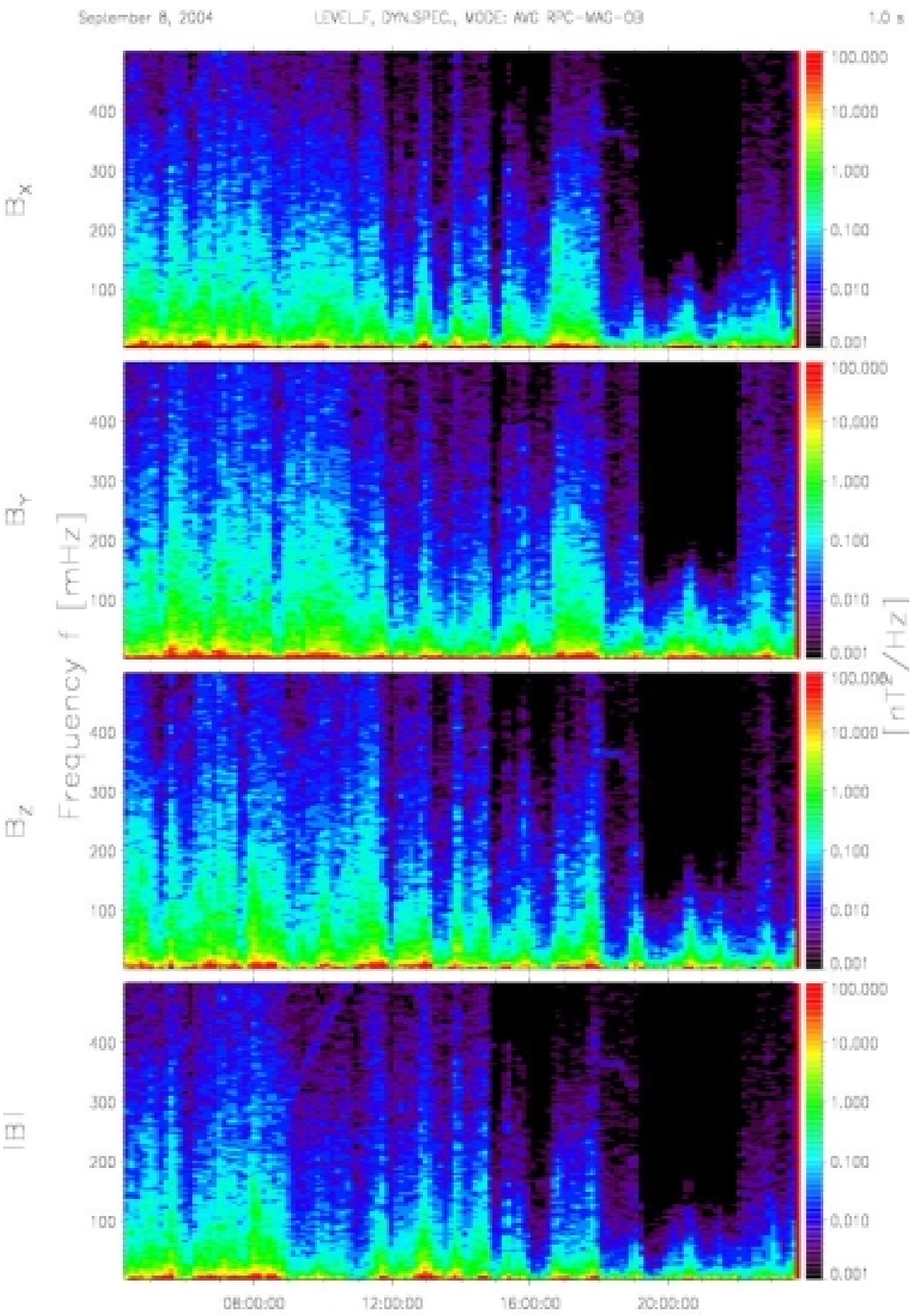


Figure 17: Dynamic Spectra of the RPC-MAG OB sensor. 1 s average data in s/c coordinates.

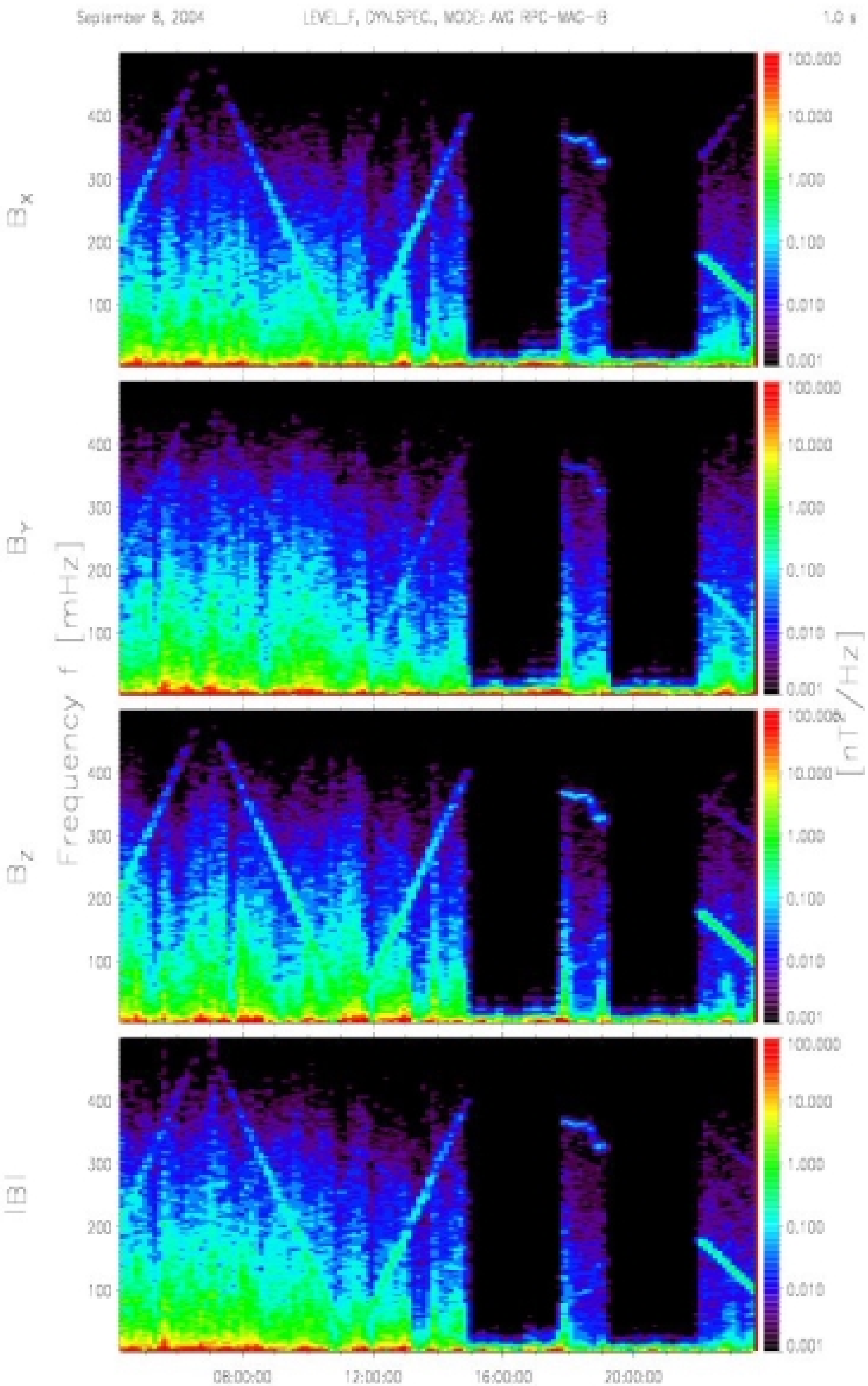


Figure 18: Dynamic Spectra of the RPC-MAG IB sensor. 1 s average data in s/c coordinates.

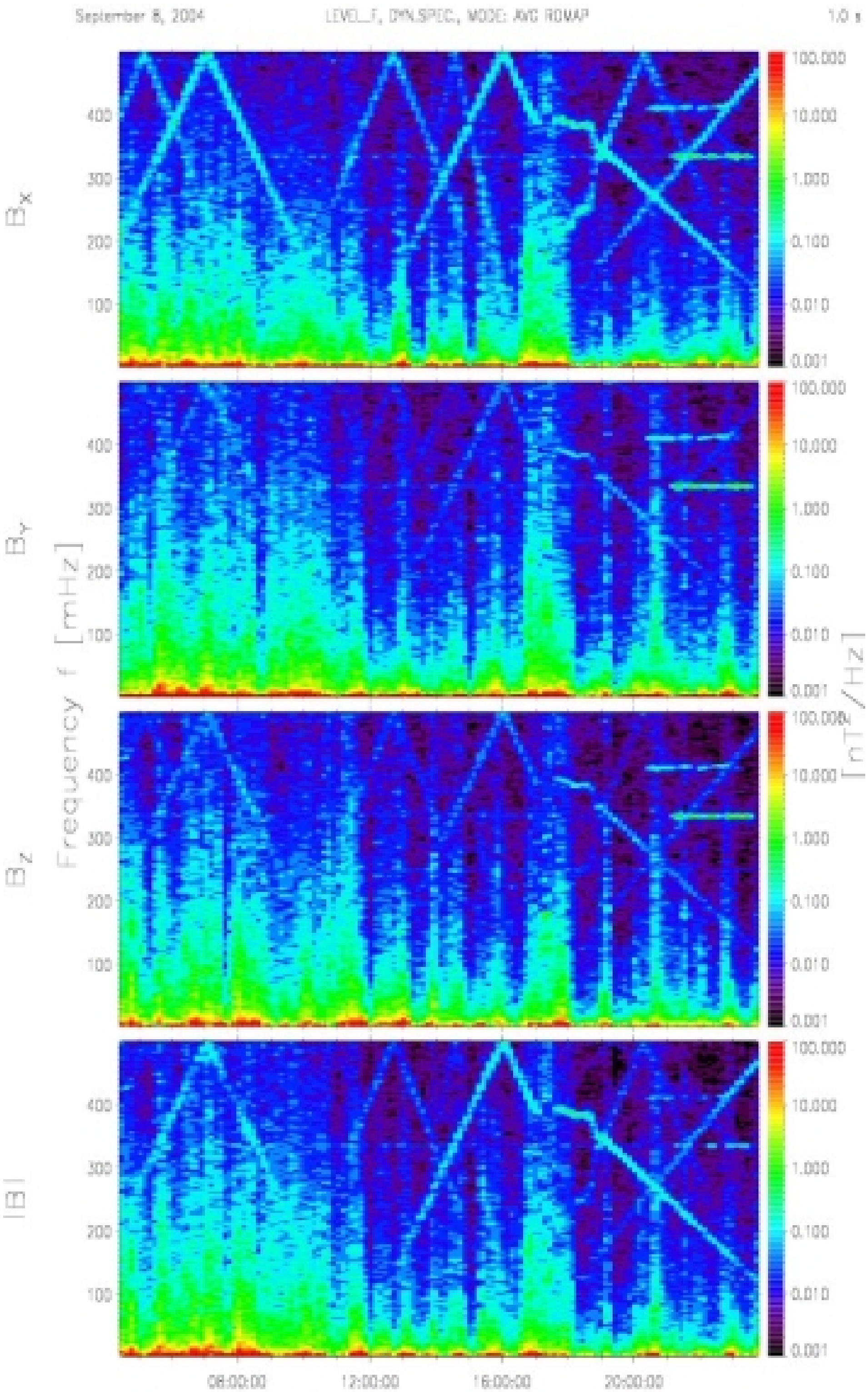


Figure 19: Dynamic Spectra of the ROMAP sensor.
1 s average data in s/c coordinates.

4. Interference Campaign

The analysis of the interference campaign did not show remarkable interference effects rather than the reaction wheels. A detailed analysis could be performed if a detailed list of activities on the s/c (Time, event) would be available. A coarse overall first view analysis, however, did not show any further problems.

5. Instrument Status

RPCMAG is fully operable!

6. Archiving S/W Status

For the archiving of the data an IDL s/w package called *DDS2PDS* has been developed. This is a day based Data processing tool which

- gets data from the ftp sever
- converts binary to ASCII data
- calibrates the data
- generates plots and PDS compliant files

This s/w is working but always under improvement.

Improvements:

- New Temperature model already implemented
- Dynamic frequency elimination to be implemented

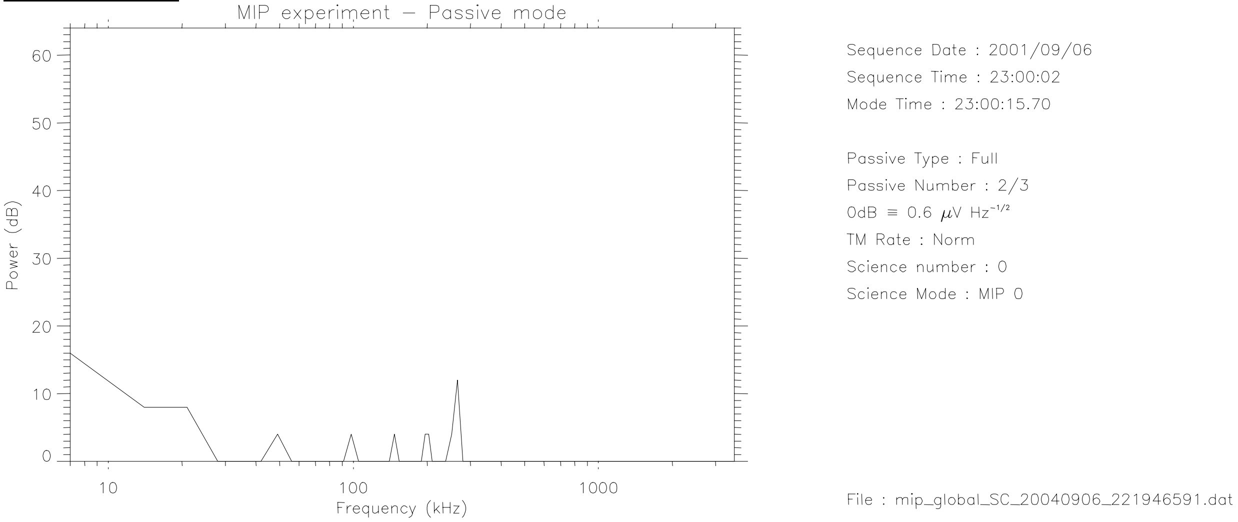
According to this, the RPCMAG EAICD is kept up to date.

MIP/RPC H.V. Commissioning

6-7/9/04

22:18:58 MIP on File : mip_global_sc_20040906_221946591.dat
TC : 0 0 0 45 02 01 MIP R2 sensor temperature : 18.17 °C

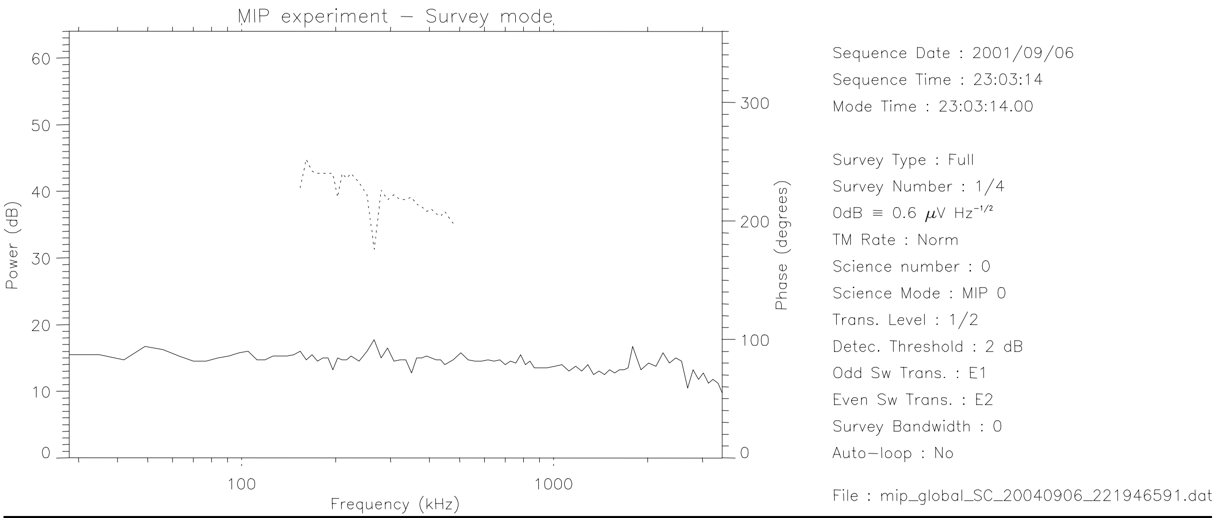
<u>Passive mode</u>



These permanent frequency peaks :
- 49 kHz (4 dB)
- 98 kHz (4 dB),
- 147 kHz (4 dB),
- 196-203 kHz (4 dB),
- 266 kHz (12 dB),

were already observed during Commissioning Part 2. Every one, except 266 kHz, could be considered as harmonics of 49 kHz. They are probably generated by RPC.

<u>Active mode</u>



The mean level is at 14 dB about with some permanent frequency peaks at 280 kHz and 1792 kHz.

00:44:02	last MIP science packet	
01:00:34	MIP off	MIP R2 sensor temperature : 25.02 °C

Conclusion

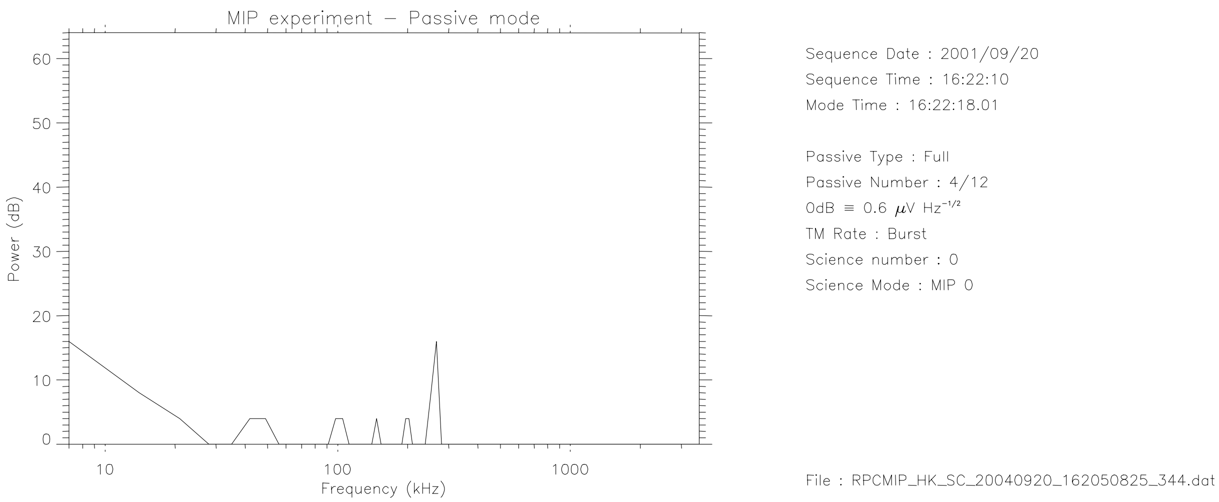
MIP is working correctly.

MIP/RPC Interference Scenario (day 1)

20-21/9/04

16:20:02 MIP on file : RPCMIP_HK_SC_20040920_162050825_344.dat
TC : 0 0 0 45 2 3 MIP R2 sensor temperature : -13.14 °C

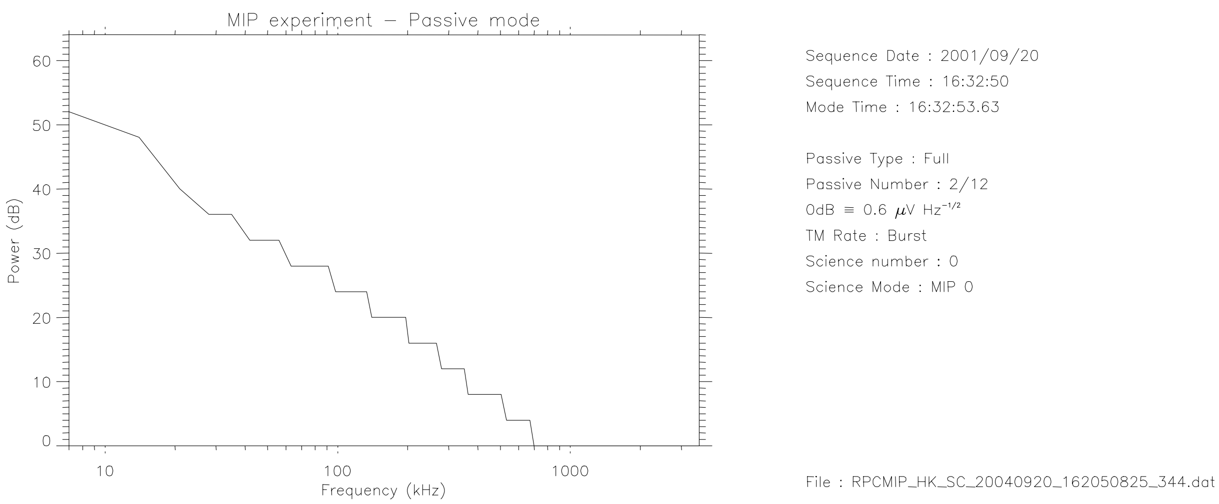
<u>Passive mode</u>



As during HV Commissioning, we observe the same permanent frequency peaks :

- 42-49 kHz (4 dB)
- 98-105 kHz (4 dB),
- 147 kHz (4 dB),
- 193-203 kHz (4 dB),
- 266 kHz (16 dB), which is 4 dB higher refer to HV Commissioning.

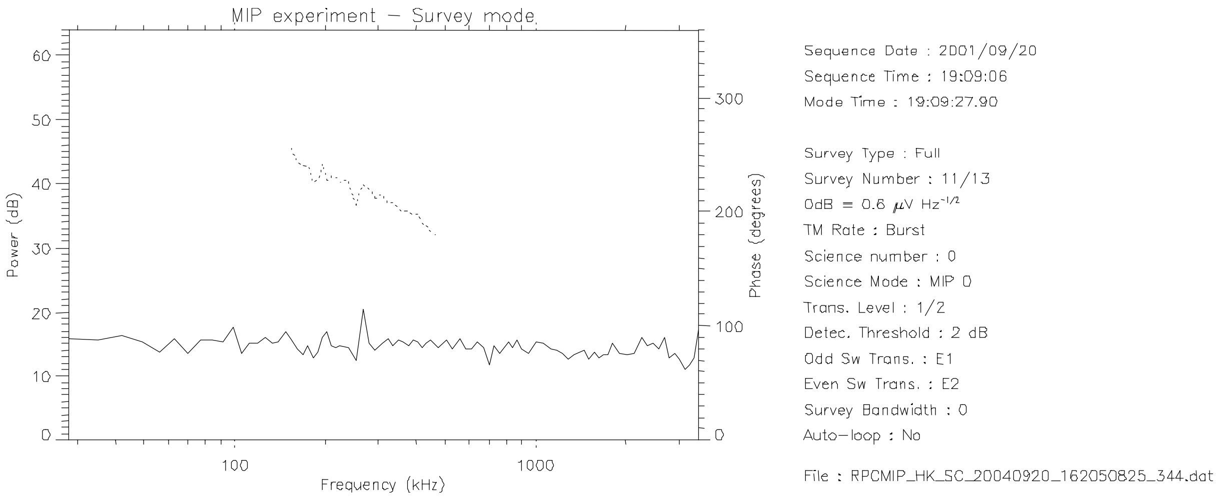
16:29:38 to 16:33:22 LAP active interference



It appears that during this time LAP1 is transmitting square wave frequencies between 1 and 6.7 kHz, but MIP sees strong harmonics up to 700 kHz.

22:04:34 to 22:29:06 Gap of data (no Science, no HK).

Active mode



We observe the same results as compared to HV Commissioning, except for 266 kHz peak which is 2 dB higher.

22:32:50 TC : 0 0 0 45 2 73

MIP works only in passive mode. We observe the same results as compared to the previous TC.

02:00:50 MIP off MIP R2 sensor temperature : -5.65 °C

Conclusion

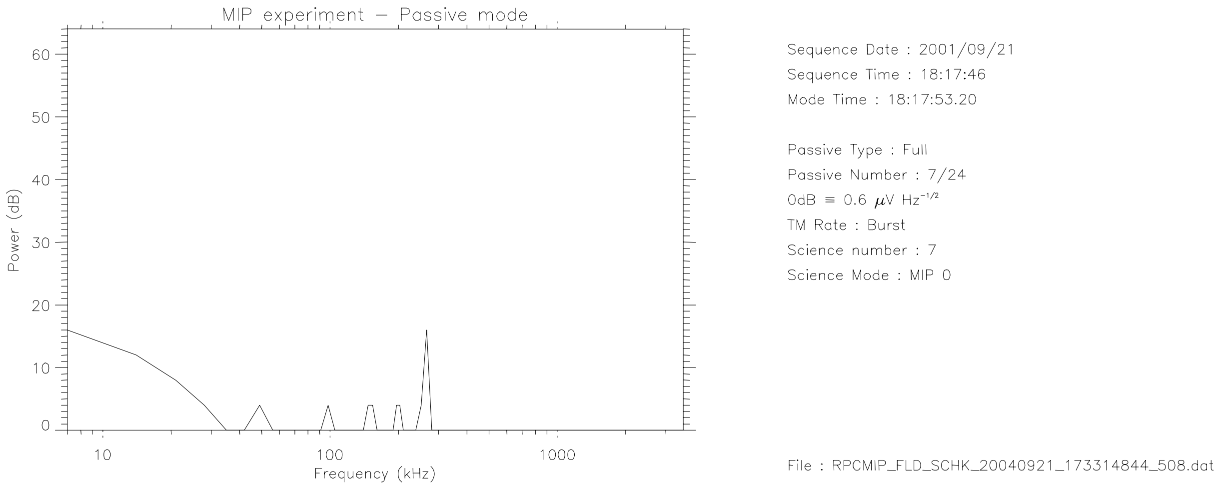
MIP is working correctly, and we do not see, in these results, any new strong interferences coming from other experiments, except when LAP is active.

MIP/RPC Interference Scenario (day 2)

21-22/9/04

17:32:26 MIP on file : RPCMIP_FLD_SCHK_20040921_173314844_508.dat
TC : 0 0 0 45 2 73 MIP R2 sensor temperature : -13.49 °C

Passive mode



As during HV Commissioning, we observe the same permanent frequency peaks :

- 49 kHz (4 dB)
- 98 kHz (4 dB),
- 147-154 kHz (4 dB),
- 196-203 kHz (4 dB),
- 266 kHz (16 dB), which is 4 dB higher refer to HV Commissioning.

19:50:34 MIP off MIP R2 sensor temperature : -5.91 °C

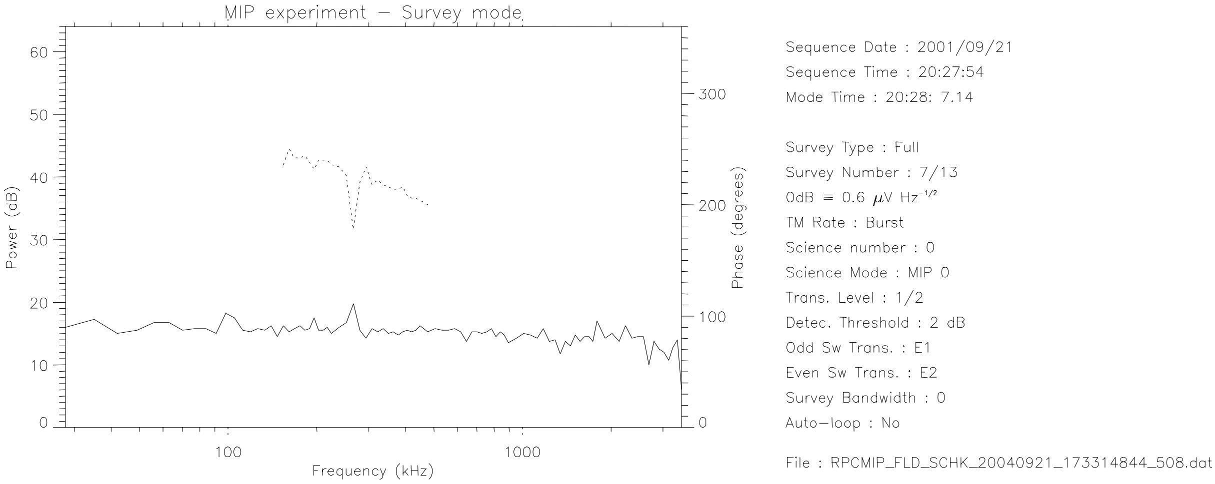
20:17:14 MIP on file : RPCMIP_FLD_SCHK_20040921_173314844_508.da
TC : 0 0 0 45 2 3 Survey mode MIP R2 sensor temperature : -12.25 °C

Passive mode

Quasi identical to the previous sequence.

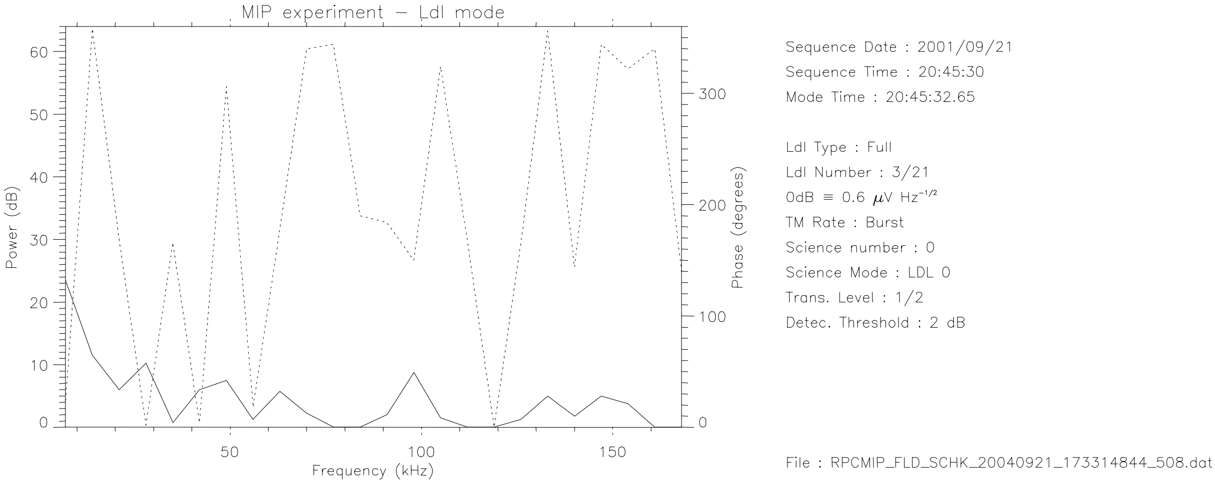
Active mode

We observe the same results as compared to HV Commissioning, except for 266 kHz peak which is 2 dB higher.



20:35:54 TC: 0 0 0 45 2 7

LDL mode



Compared with the results obtained during Commissioning Part 2 (9/5/04 IP Day 2), it is clear that we see only noise. **We conclude that LAP2 is not transmitting the MIP signal. Something could be wrong in the OBCP ARPS805A as LAP is not set in LDL mode**.

20:55:38 TC : 0 0 0 45 2 3 Survey mode

Same results as obtained at 20:17:14

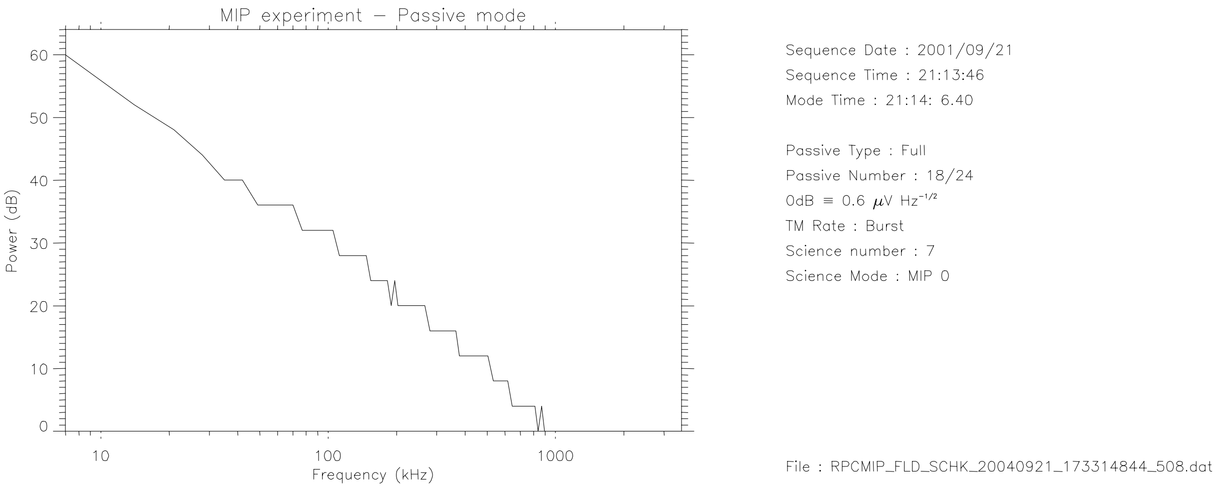
21:00:26 TC : 0 0 0 45 2 73

Passive mode

Same results as obtained at 17:32:26, except during LAP active interferences between

- 21:04:42 and 21:07:54 (20 dB at 150 kHz),

- 21:07:54 and 21:08:26 (20 dB at 63 kHz),
- 21:13:14 and 21:14:50 (20 dB at 200 kHz).



21:17:30 same TC : 0 0 0 45 2 73

22:35:22 MIP off MIP R2 sensor temperature : -5.91 °C

23:02:42 MIP on file : RPCMIP_FLD_SCHK_20040921_173314844_508.dat
TC : 0 0 0 45 2 73 MIP R2 sensor temperature : -12;23 °C

Same results as obtained at 17:32:26

02:00:50 MIP off MIP R2 sensor temperature : -5.92 °C

<u>Conclusion</u>

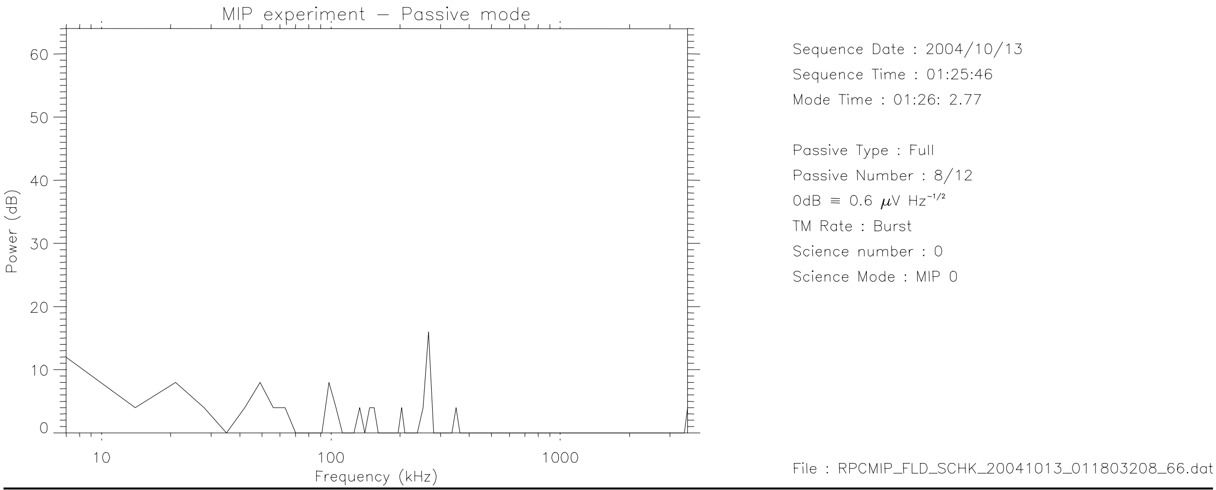
MIP is working correctly, and we do not see, in these results, any new strong interferences coming from other experiments, except when LAP is active. We notice that the 266 kHz frequency peak is stronger than in Commissioning part 2.
Therefore this interference campaign is not valuable regarding disturbances generated by RPC. Thus the noisiest mode (LDL mode) was not transmitting probably due to OBCP fault.

MIP/RPC Interference Scenario Part 2

13/10/04

01:17:46 MIP on file : RPCMIP_FLD_SCHK_20041013_011803208_66.dat
TC : 0 0 0 45 2 3 Survey mode MIP R2 sensor temperature : -16.19 °C

<u>Passive mode</u>

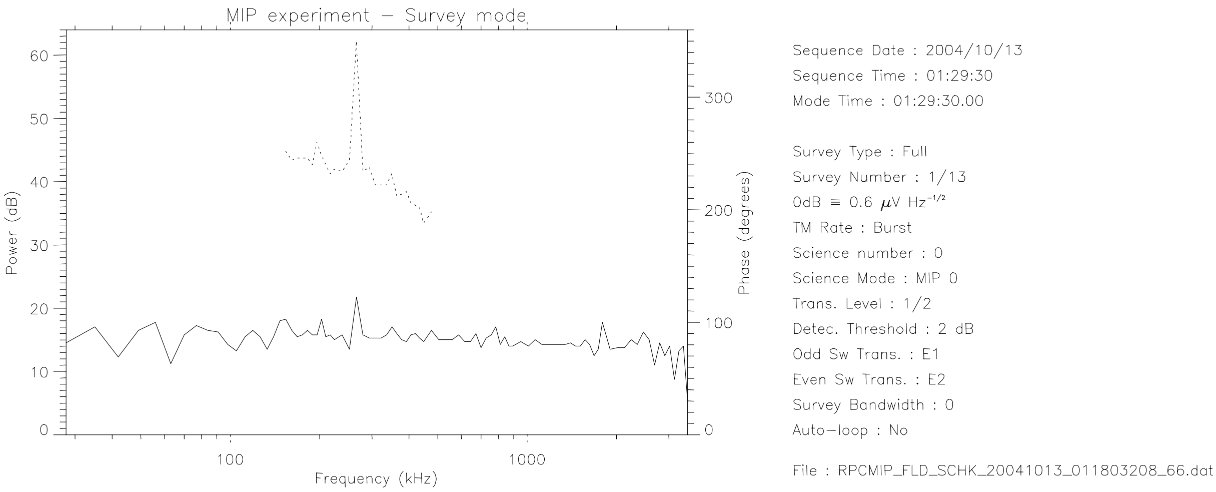


Compared to the Interference Scenario Part 1 we observe the same frequency peaks :
- 49 kHz (8 dB)
- 98 kHz (8 dB)
- 147-154 kHz (4 dB)
- 203 kHz (4 dB)
- 266 kHz (16 dB)

and some additional non permanent peaks :
- 133 kHz (4 dB)
- 350 kHz (4 dB)

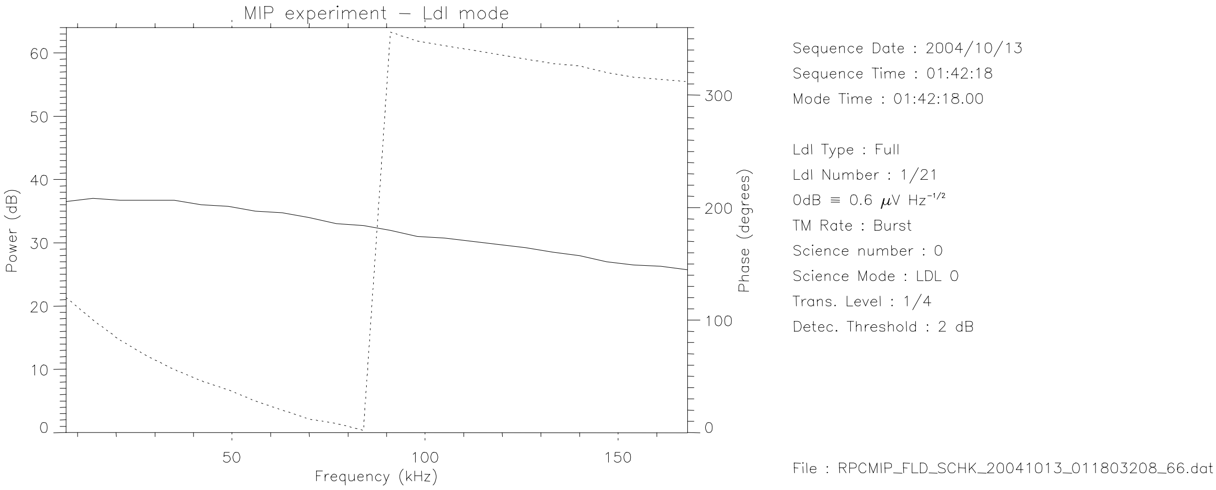
The electrical environment seems a little bit noisier.

<u>Active mode</u>



Same results as Interference Scenario Part 1. The medium level is at 15 dB.

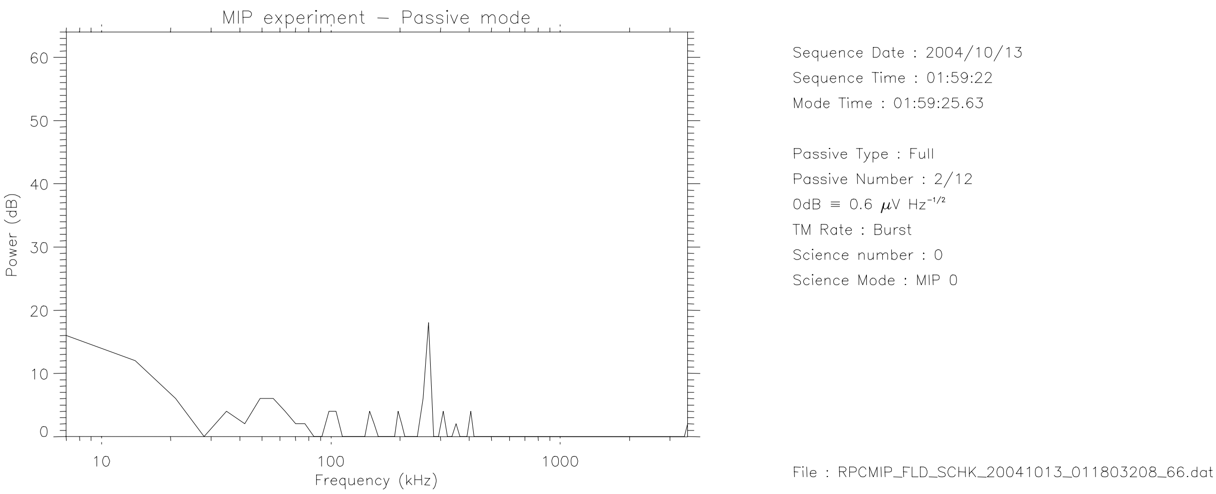
01:36:58 TC : 0 0 0 85 0 7 LDL mode



Performed with the level 1/4, this mode is working perfectly and the level is conform to a vacuum environment (too weak plasma).

01:55:38 TC : 0 0 0 85 0 3 Survey mode (level 1/4)

<u>Passive mode</u>



In this mode we have a better accuracy concerning the peak levels (2 dB resolution instead of 4 dB in the most configurations). The noise spectrum is practically the same:

- 49-56 kHz (6 dB)
- 98-105 kHz (4 dB)
- 147 kHz (4 dB)
- 196 kHz (4 dB)
- 266 kHz (18 dB)
- 308 kHz (4 dB)
- 350 kHz (2 dB)
- 406 kHz (4 dB)

- 3584 kHz (2dB)

Active mode

The level 1/4 is too weak and lost in noise : the medium level is at 11 dB.

02:00:26 TC : 0 0 0 45 2 73 Passive sequence

We can observe the same noise spectrum, except during two time intervals where we observe a strong LAP active interference : from 02:04:54 to 02:08:36 and from 02:12:22 to 02:14:18.

02:14:18 to 02:23:54 Only HK are received

Final MIP R2 sensor temperature : -9.06 °C

MIP off

13-14/10/04

22:17:46 MIP on File : RPCMIP_FLD_SCHK_20041013_221803211_208.dat

TC : 0 0 0 45 2 3 Survey mode MIP R2 sensor temperature : -16.39 °C

Passive mode

Same noise spectrum as early in the morning.

Active mode

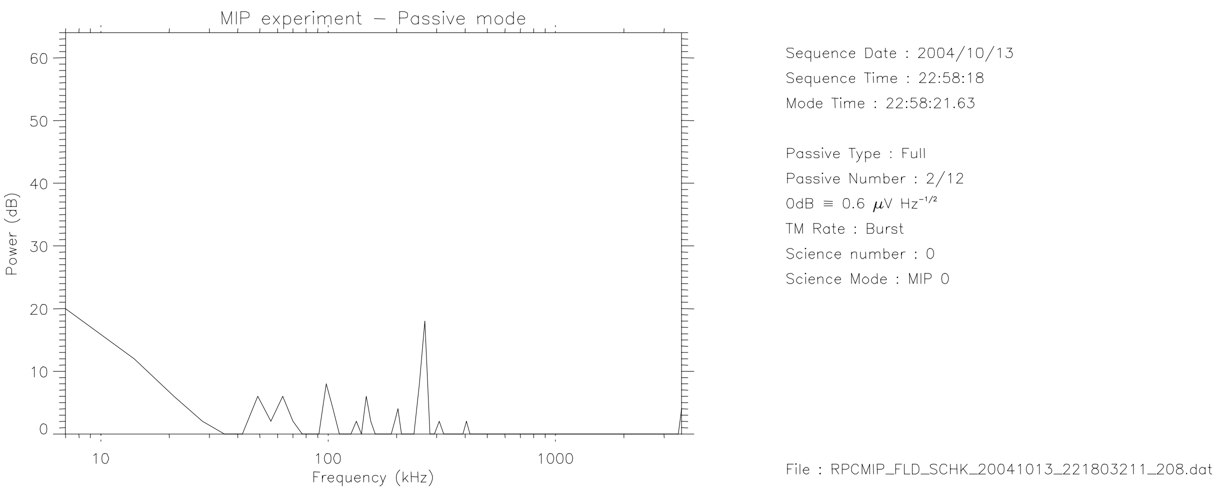
Same result as early in the morning. The medium level is at 15 dB.

22:36:58 TC : 0 0 0 85 0 7 LDL mode

The LDL mode works perfectly, in the same conditions as early in the morning.

22:55:38 TC : 0 0 0 85 0 3 Survey mode (level 1/4)

Passive mode



This spectrum is a little bit noisier than the corresponding one performed early in the morning.

Active mode

The level 1/4 is too weak and lost in noise : the medium level is at 11 dB.

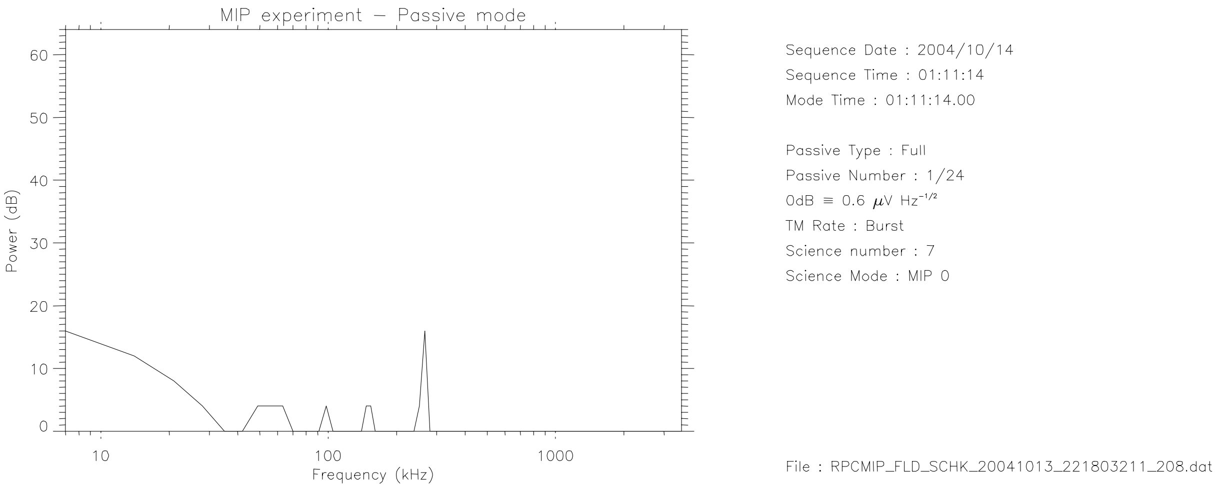
23:00:26 TC : 0 0 0 45 2 73 Passive sequence
We can observe the same noise spectrum as early in the morning, except during three time intervals where we observe a strong LAP active interference : from 23:04:54 to 23:08:36 and from 23:12:22 to 23:16:04 and from 23:19:50 to 23:23:32.

23:27:38 TC : 0 0 0 45 2 73 Passive sequence
Same noise spectrum as early in the morning.

00:35:22 MIP off Final MIP R2 sensor temperature : -9.13 °C

14/10/04

01:02:42 MIP on File : RPCMIP_FLD_SCHK_20041013_221803211_208.dat
TC : 0 0 0 45 2 73 Passive sequence MIP R2 sensor temperature : -15.21 °C



This spectrum looks a little bit less noisy than the previous ones.

01:45:22 MIP off Final MIP R2 sensor temperature : -9.52 °C

Conclusion

MIP is working correctly, even in LDL mode. This campaign does not show off clear interferences coming from other Rosetta instruments. We have to add that RPC was on during a very short time, outside many other experiments. It is a pity because MIP is sensitive to electrical interferences between 7 and 3584 kHz.
Thus it seems that the most part of the frequency peaks come from RPC. It is the case for the 49 kHz and harmonics (98, 147, 196, 252, 308, 350, 406 kHz, taking into account that the

frequency resolution is 7 kHz below 224 kHz and 14 kHz upper), which were already observed during RPC EMC tests at Östersund in June 2001. The important 266 kHz peak was observed during TBTV tests at ESTEC in February 2002 and during most AIV tests. Remember that the EMC tests at ESTEC in June 2002 cannot be taken into account due to a bad connection problem !

MIP/RPC Commissioning Part 1

18/3/04 Experiment H/W verification – PIU main commissioning

MIP on TC : 0 0 0 45 2 1 File : 01_15_29.dat

Temperature given by MIP/MAG : -150°C !!!
Temperature given by the S/C : -70°C
Boom temperature : -66°C

1) FCP 409 TM/TC check manual procedure

All commands are correctly executed. At the end of this FCP two identical LDL mode has been run which give two different levels.

2) FCP 900 LDL test slot

We notice the sending of 2 consecutive table sequences to set MIP in science MIP and again to set MIP in LDL mode
Noise level at 7 kHz : 10 dB
LDL level at 7 kHz : 25 dB, decreasing faster
Noise level at 7 kHz : 12 dB
LDL level at 7 kHz : 35 dB, decreasing slowly

File : 02_56_53.dat

TC : 0 0 0 45 0 1

3) FCP 049 MIP link reset test

MIP link did not recover from the link reset, only HK are transmitted. Finally Rx timeout event occurs.

MIP is switched off.

MIP on TC : 0 0 0 45 2 1 File : 03_17_40.dat

4) FCP 403 Default burst science mode

TC : 0 0 0 45 2 3

Level of the survey mode : 14 to17 dB

File : 04_58_53.dat

TC : 0 0 0 45 2 3

MIP off.

PIU redundant commissioning

MIP on TC : 0 0 0 45 2 1

1) FCP 403 Default burst science mode

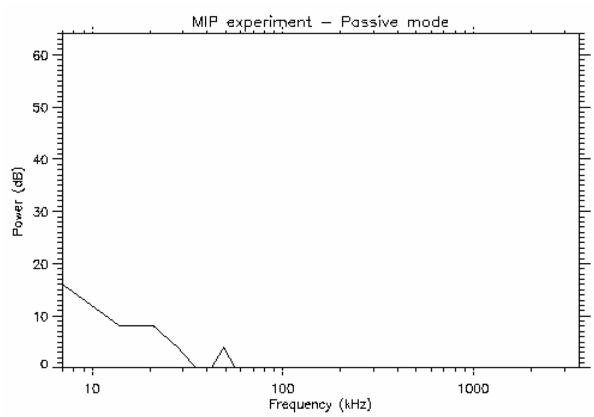
TC : 0 0 0 45 2 3

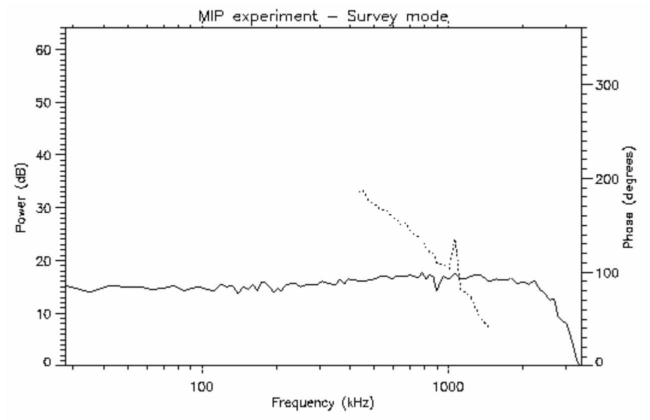
Same observations.
TM is suddenly interrupted after IES powered on, with increasing of the primary current. +5 V PIU redundant power supply is out of order.

19/4/04 Special timeline for RPC debug

1) FCP 041 MIP on with default table
MIP on TC : 0 0 0 45 2 1 File : 02_25_18.dat

MIP works correctly
Temperature measured via MAG : -150°C !!!
Temperature measured by the S/C : -21.13°C
Temperature of the boom (TRP) : -70°C





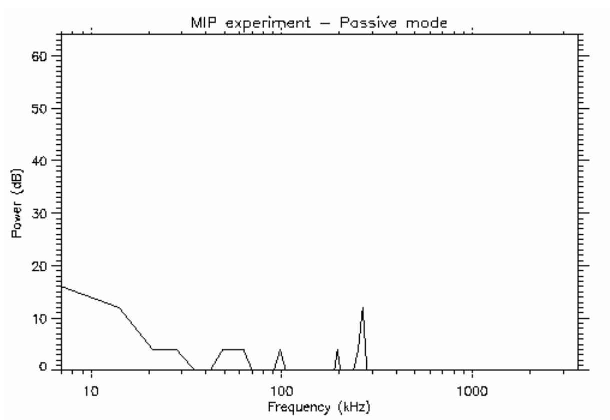
2) Lower boom deployment (MAG)
MIP off

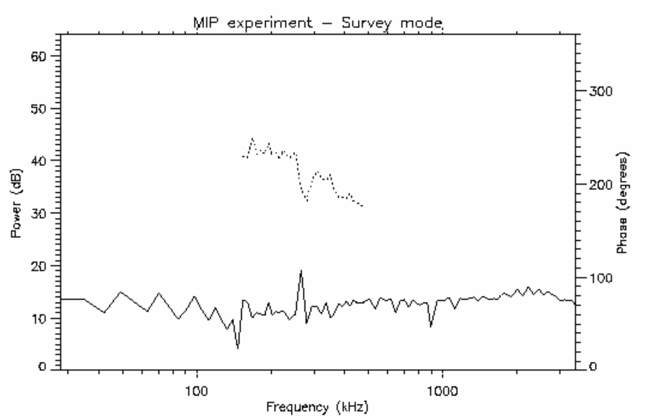
3) Upper boom deployment (MIP)
MIP off

Temperature measured by the S/C increases from -70°C to +47°C
Temperature of the boom (TRP) increases from -70°C to -53°C

MIP on TC : 0 0 0 45 2 1 File : 06_33_56.dat
4) FCP 450 MIP active boom mode

Temperature measured via MAG : +53.00°C at the beginning
Temperature measured by the S/C : +50°C
TC : 0 0 0 45 2 3





Temperature measured via MAG : +66.7°C at the end
Temperature measured by the S/C : +55°C
260 kHz ray in passive mode
Low level in survey mode : 12 dB at low frequencies, 15 dB at high frequencies, with a maximum at 2.3 MHz.

Conclusion

MIP is working correctly with three remarks :

1) the temperature measured by the MIP sensor is no significant when lower than -70°C
2) The behaviour of the LDL mode has to be carefully analysed with the LAP team to explain the two different levels observed. Notice that we have not already performed this mode with the booms deployed.
3) The survey mode is 2 or 3 dB lower than expected when the booms are deployed. If confirmed with the further tests, we can increase the transmitting level to compensate.

MIP/RPC Commissioning Part 2

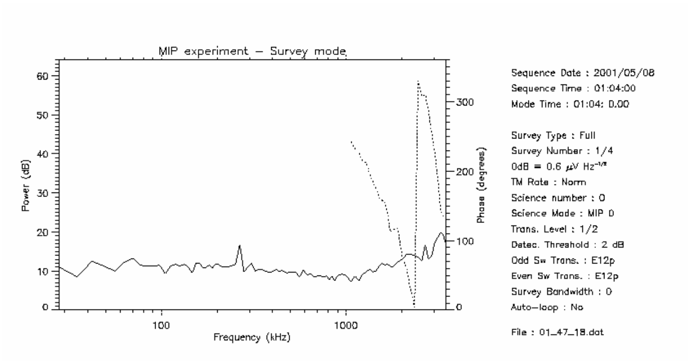
7/5/04 IP Day 1

MIP on TC : 0 0 0 45 2 1 File : 01_47_18.dat

1) <u>FCP 481 MIP E1 transmitter level check</u>

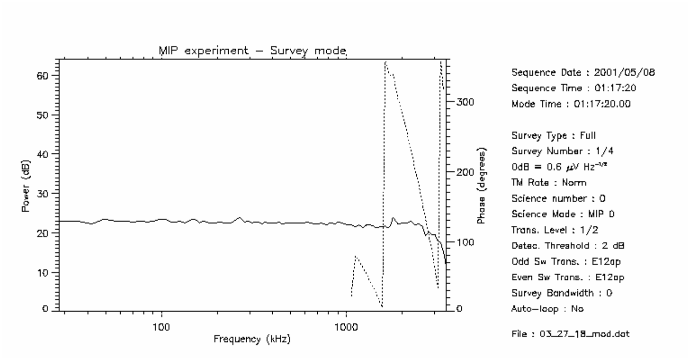
In MIP science mode the transmitted levels 1/2, 1, 1/4, 1/8 are successfully tested. The vacuum levels are respectively : 15 dB, 20 dB, 10 dB, 5 dB.

2) <u>FCP 482 MIP both transmitters check</u>



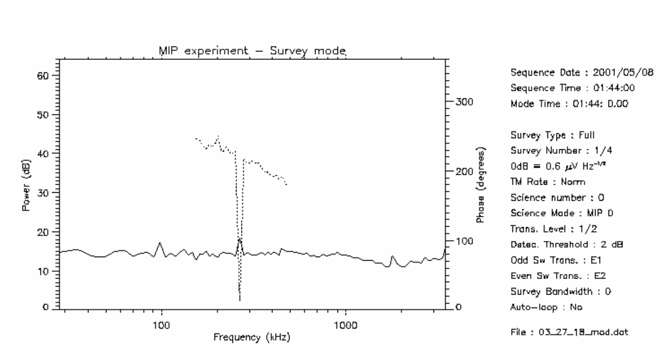
E1 and E2 in phase gives a non flat response near 10 dB

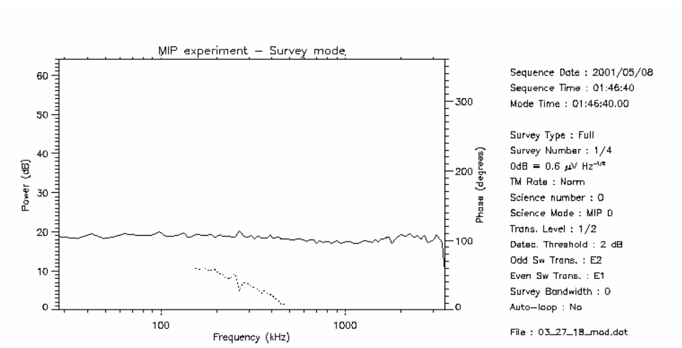
File : 03_27_18.dat



E1 and E2 in opposite phase gives a flat response near 23 dB

3) <u>FCP 486 MIP E1 and E2 transmitters level check</u>





With E2 the signal is 3 to 4 dB higher than with E1. Presently we have no explanation for this dissymmetry.
Since 02:14:56 only HK are received

8/5/04 IP Day 2

1) FCP 486 MIP E1 and E2 transmitters level check

Following of previous data since 02:00:00 to 02:26:08. File : 22_21_52.dat
MIP sensor temperature monitored by the S/C : Th1 = 8.84 °C
MIP sensor temperature monitored by RPC : Th2 = 9.94 °C
STP upper boom : 27.14 °C

Then new data without HK packets

09:00:48	MIP in min rate, no HK
09:06:40	TC 0 0 0 45 06 10, no HK
09:21:36	TC 0 0 0 45 06 20, no HK
09:36:32	TC 0 0 0 45 06 70, no HK
10:18:08	TC 0 0 0 45 06 03, no HK
10:33:04	TC 0 0 0 45 06 13, no HK
10:48:00	TC 0 0 0 45 06 23, no HK
11:02:56	TC 0 0 0 45 06 73, no HK
11:43:28	TC 0 0 0 45 06 01, no HK
11:58:24	TC 0 0 0 45 06 11, no HK
12:13:20	TC 0 0 0 45 26 11, no HK
12:28:16	TC 0 0 0 45 06 21, no HK
12:43:12	TC 0 0 0 45 06 31, no HK
12:58:40	TC 0 0 0 45 06 41, no HK
13:13:36	TC 0 0 0 45 06 51, no HK
13:28:32	TC 0 0 0 45 06 71, no HK
13:48:48	TC 0 0 0 45 02 71, no HK
14:48:32	TC 0 0 0 45 02 01, no HK
15:13:36	TC 0 0 0 45 02 01, with HK packets
15:22:40	TC 0 0 0 45 02 71

During this last configuration we can see LAP1 square wave transmitting at 6.7 kHz at 3 times between 15:23:44 to 15:43:02

16:52:38 end of sequence

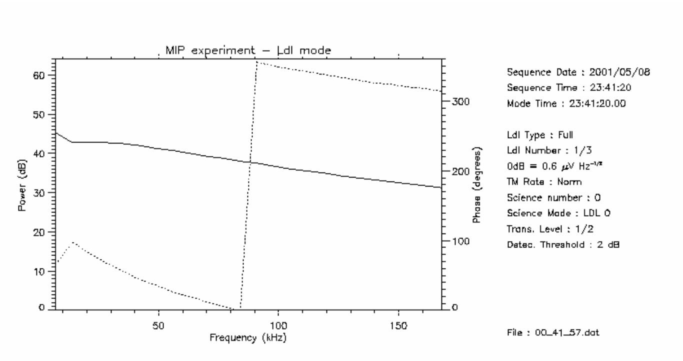
MIP on TC : 0 0 0 45 2 1 File : 00_22_28.dat

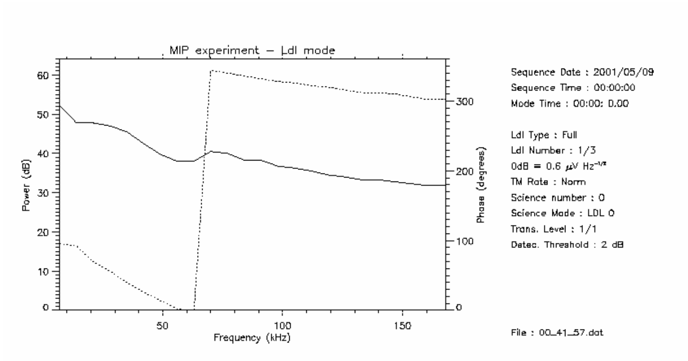
2) FCP_804 OBCP check

During this FCP a dissynchronisation is performed between MIP and LAP in LDL mixed mode. An alarm signal is generated and MIP is forced in MIP science mode. This test is successful.

3) FCP_904 LDL normal transmitter level check

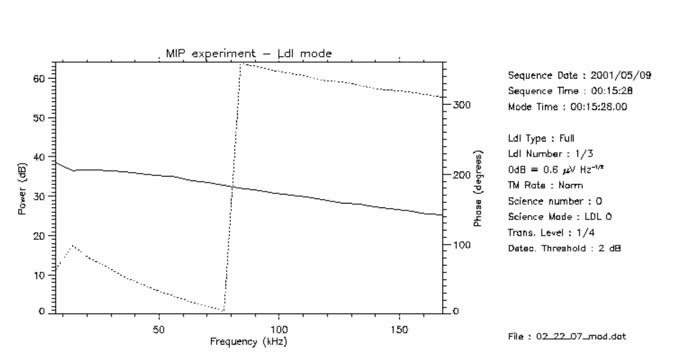
MIP on TC : 0 0 0 45 2 1 File : 00_41_57.dat

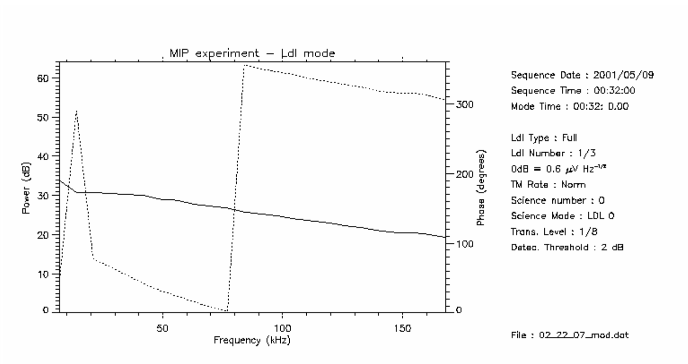




2 transmitting levels are checked : levels 1/2, 1. We can notice a strong distortion with the full level transmission.

File : 02_22_07.dat





2 other transmitting levels are checked : levels 1/4, 1/8
The end of this file was corrupted due to a wrong command (?)

4) FCP_905 LDL mixed transmitter level check
TC : 0 0 0 45 0 D File : 03_11_49.dat
MIP sensor temperature monitored by the S/C : Th1 = 8.84°C
MIP sensor temperature monitored by RPC : Th2 = 9.92 °C
STP upper boom : 27.14°C
3 transmitting levels are checked : levels 1/8, 1, 1/8, ¼
The procedure was interrupted. It has to be replay.

5) FCP_420 MIP in active mode
MIP on TC : 0 0 0 45 2 1 File : 04_06_21.dat

9/5/04 IP Day 2

16 h 35 File : 16_44_11.dat
Following of previous data since 02:20:16
02:20:16 TC : 0 0 0 45 2 1
02:54:56 TC : 0 0 0 45 2 0

03:09:52 TC : 0 0 0 45 2 3
09:01:52 TC : 0 0 0 45 0 7
LDL normal in burst mode : phase change at 14 kHz
11:55:12 End of file

18 h 25 Following of the previous sequence File : 18_24_12.dat
11:55:12 TC : 0 0 0 45 0 7
13:00:48 TC : 0 0 0 45 0 3
13:03:28 TC : 0 0 0 45 0 F
LDL mixed in burst mode : phase change at 14 kHz
16:45:20 End of file

20 h 35 Following of the previous sequence File : 20_36_36.dat
16:44:48 TC : 0 0 0 45 0 F
17:02:24 TC : 0 0 0 45 0 3
17:43:28 End of session
Old data are sent at the end of this file.

1) FCP_905 LDL mixed transmitter level check
MIP on TC . 0 0 0 45 2 1 File : 03_06_16.dat
4 transmitting levels are checked : levels 1/2, 1, 1/4, 1/8. The results are the same as compared with FCP 904.

Conclusion

During this Part 2 Commissioning we have tested the sensitivity of the MIP experiment with different levels, either in MIP Science mode, and in LDL mode.

In MIP Science mode the results are in agreement with the theory : the vacuum level is at 17 dB. But we observe a dissymmetry between E1 and E2 transmission which could be due to the location of the sensor on the S/C : R1 is only 0.6 m distant from the S/C structure (0.5 m from the closest instrument) when the requirement was 1 m (EID B 2.2.2.2). This may affect the measurement of the plasma drift velocity.

In LDL mode the sensitivity is largely better than we expected after the test campaign in the ASTRIUM anechoid chamber at Portsmouth. So we can use for the LDL mode the transmitting level 1/4 or even 1/8 which is at least 20 dB above the noise. On the other hand the full level 1 must be proscribed.

At last the OBCP relative to a dissynchronization between LAP and MIP in LDL mixed mode has been successfully tested.

The MIP instrument is in good health and the sensitivity is correct particularly in LDL mode.

RPC-PIU Redundant Power Supply Failure Investigation - Summary Report

Chris Carr & Emanuele Cupido
Imperial College London
15th November 2004

Contents

Introduction

- Scope
  - The purpose of this report is to summarise the investigations performed into the failure of the RPC-PIU redundant power supply.
  - Detailed reports are annexed.

- Summary
  - The RPC-PIU unit contains the low-voltage primary to secondary voltage converters for all RPC units. This power supply contains a total of four voltage converters, two of which serve as 'main' and two of which are a fully independent redundant chain. During testing of the redundant side of RPC, one of the converters on the redundant power supply chain suffered a sudden and catastrophic failure, consistent with a short circuit on the secondary-side voltage output.
  - There are a number of failure mechanisms which could cause this, so it is impossible to determine exactly what happened. However, we suspect that an output smoothing capacitor failed short circuit.
  - Investigations by parts experts have not shown any specific concerns against the parts used, so we conclude that this is a case of random component failure.
  - The failure is isolated to the redundant side of the RPC.
  - Since the main-side power supply is working well, RPC retains full operating functionality.

Summary of the observed failure

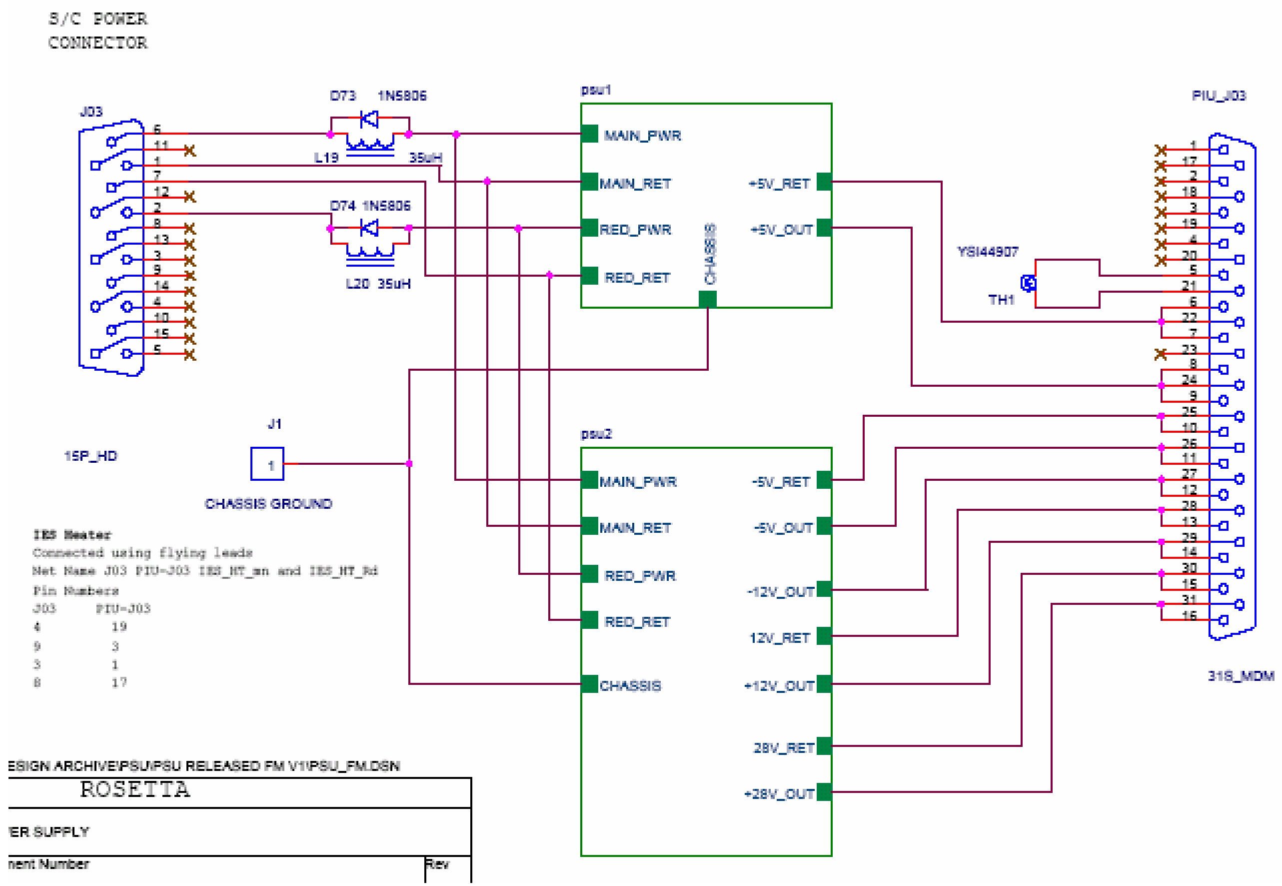
- Observation
  - The failure occurred during the first night of RPC commissioning, while testing the redundant side power-supply (PSU) and Data Processing Unit (DPIU)
  - On initial power-up and for the first 20 minutes of operation, everything was nominal
    - All Voltages correct were stable and at the correct levels
    - The nominal current of 340mA was drawn from spacecraft LCL
  - The failure occurred suddenly and without warning after 20 minutes
    - All RPC experiment/sensors were switched OFF
    - Constant (abnormal) current of 240mA drawn from spacecraft LCL
    - LCL powered OFF immediately by ground command
  - After meeting with ESOC to discuss the situation (attachment 1) an initial investigation was performed:
    - Power ON redundant supply
    - Same abnormal current of 240mA
    - Repeated - same
- Initial diagnosis
  - Sudden catastrophic failure
  - No further attempt has been made to power on the redundant supply during any subsequent commissioning slots
- These observations have been documented as follows:
  - Attachment 1 – PIU Commissioning report
    - This document describes in detail the observed failure and includes the minutes of meetings held between RPC and ESOC

Analysis

- Refer to the top-level schematic of the redundant power supply on the following slide
  - Note that the redundant supply consists of two separate converters
    - PSU1 provides conversion from +28V primary to +5V secondary (regulated)
    - PSU2 provides conversion from +28V primary to
      - -5V secondary (regulated)
      - +12V, -12V & +28V secondary (un-regulated)
- The observed failure mode is consistent with a short circuit of the PSU1 +5V secondary to ground
  - Confirmed by bench test on breadboard model of the power supply
    - The observed failure mode is constant current of 240mA
    - When the lab model +5V supply is shorted to ground, then 240mA is drawn
    - This is a combination of the limiting short-circuit current drawn by PSU1 plus the normal (quiescent) current drawn by PSU2
    - PSU2 thus apparently operates normally
  - Other failure modes are possible, but do not show the same current draw.

PIU Power Supply top-level schematic (identical, main or redundant)

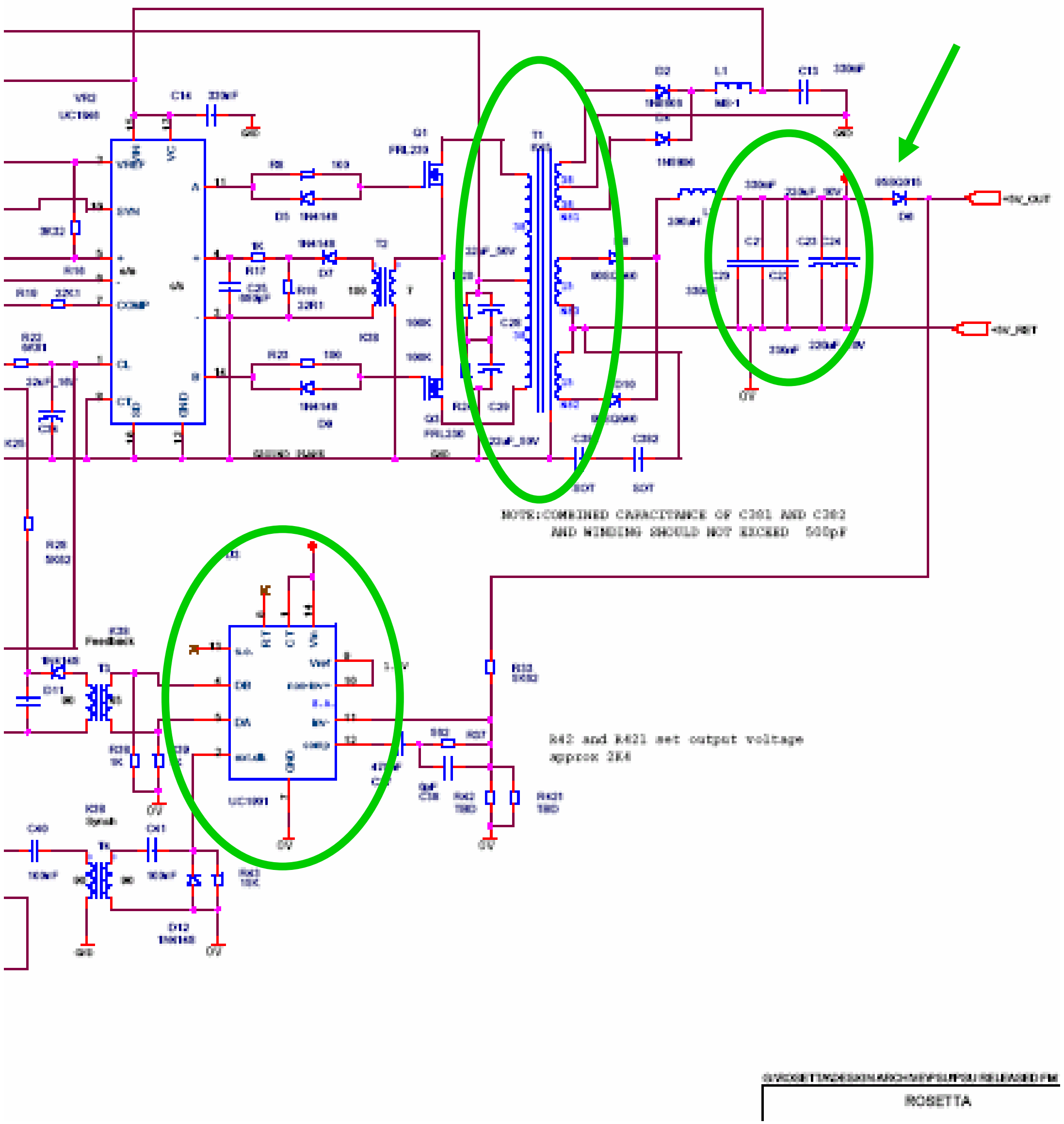
Spacecraft
LCL
+28V primary
power in



Secondary
Voltages
+5V
-5V
+12V
-12V
+28V
out (to
power
switches)

Failure Mechanisms

- Refer to the schematic of the secondary side of PSU1 on the following slide
- Four failure mechanisms are considered:
  - Short circuit of transformer (circled)
  - Failure-to-short of Feedback generator Integrated Circuit (circled)
  - Short circuit of Capacitor (circled)
  - Other unspecified short-to-ground such as
    - PCB failure
    - Short due to debris inside box
    - Loose or broken component or mechanical part
- Note that the short circuit is prevented from propagating outside the PSU1 unit by the use of an isolating diode on the output (arrowed)


NOTE:COMBINED CAPACITANCE OF C301 AND C302
AND WINDING SHOULD NOT EXCEED 500pF
R42 and R421 set output voltage
approx 2K4
ROSETTA

Discussion of Failure Mechanisms

- Short circuit of transformer
  - Manufactured in-house at Imperial College by experienced technician
  - 15+ similar currently flying (Ulysses, Cassini, Cluster, Double Star…)
  - Plus many more on past missions
  - All manufactured by the same technician
  - Manufacturing and assembly records (inc. photos) give no abnormal indications
- Failure-to-short of Feedback generator IC
  - Qualified part, used elsewhere on Rosetta
  - No known alerts or reliability indications
  - Short circuit is not a typical failure mode for IC's
- Short circuit of Capacitor
  - Two types, both Hi-rel ESA SCC Level C
    - Ceramic type CKRO6 330nF
    - Wet Tantalum type CLR79 220uF
  - Capacitors are known to fail short circuit
  - 5 parts versus 1 each of the above
- Other unspecified short
  - No known indications for this

- On balance of probability, we consider that capacitor short-circuit is the likely failure mechanism
  - Other failure mechanisms can not be ruled-out

Capacitors

- With regard to the capacitors, we reviewed:
  - The parts procured
    - Sample parts from same lot submitted to ESTEC for DPA
    - No manufacturing defects found
    - See ESTEC DPA reports (attachments 2 and 3)
  - The Manufacturers Documentation
    - For the Ceramic capacitors, two specific areas of concern were raised by ESTEC
      - Maximum failures allowed during lot-testing
        - » Lot qualified, but obviously marginal
      - Use of pure-tin for internal soldering of lead to ceramic body
        - » Possible tin-whisker short mechanism
    - Nevertheless, parts considered acceptable by ESTEC
    - See certificate of conformance (attachment 4)
  - The assembly process applied by Imperial College
    - Parts were soldered at higher than recommended temperature
    - However, a study performed some years ago by ESA concludes high temperature soldering has no reliability impact (attachment 5)
    - Nevertheless, in order to verify this a set of capacitors from the same lot were soldered to a sample PCB using the same procedure and temperatures (indeed by the same technician). This PCB was sent to ESTEC for analysis. The capacitors were subject to DPA. No adverse effect was found (attachment 6)

Conclusion

- No specific indication of a design, manufacturing or handling problem with the subject unit before launch
- Supply was burnt-in and had accumulated a significant number (>>50) of operating hours at unit and system level
- A capacitor short-circuit is considered to be the most likely failure mechanism
  - Some QA concerns exist for the ceramic CKR06 type
    - High manufacturer lot-test failure rate
    - Use of pure-tin for internal soldering of lead to ceramic body
  - However, no specific indication from DPA
  - Other failure mechanisms can not be excluded

- Failure is isolated to the PSU1 of the redundant side power supply
- Failure can not propagate to the main side supply

- We conclude that the failure is due to a random individual component problem
- There is therefore no indication of any reliability or lifetime issue affecting the main-side supply
- We do not see the need for any operational restriction on use of the main-side supply

	A	B	C	D	E	F	G	H	I
1	**Title**	**4.1 & 4.2 HV Commissioning (Day 1)**				**6-7th Sept**			
2	**Prt3D1_IP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	00:00:00	RP-FCP-801	Power Main LCL Main DPIU	n/a	00:03:10	03:01:32	HV Orientation
6	0010	00:03:10	ExeTime	RP-FCP-069	Maintenance mode	n/a	00:00:40	n/a	HV Orientation
7	0020	00:03:50	ExeTime	RP-FCP-060	Upload PIU Patch	n/a	00:30:00	n/a	HV Orientation
8	0030	00:33:50	ExeTime	RP-FCP-066	Switch to PROM	n/a	00:00:56	n/a	HV Orientation
9	0040	00:36:20	0:02:30	RP-FCP-068	E2Prom Patch & Reboot in Ram (if required)	n/a	00:02:00	n/a	HV Orientation
10	0050	00:38:20	ExeTime	RP-FCP-051	MAG On	n/a	00:01:15	n/a	HV Orientation
11	0060	00:39:35	ExeTime	RP-FCP-500	MAG No data	n/a	00:00:32	00:46:46	HV Orientation
12	0070	00:40:07	ExeTime	RP-FCP-011	Power on IES in LVSCI	n/a	00:01:15	n/a	HV Orientation
13	0080	00:41:22	ExeTime	RP-FCP-069	Maintenance mode	n/a	00:00:40	n/a	HV Orientation
14	0090	00:42:02	ExeTime	RP-FCP-032	Power on LAP for maintenance	n/a	00:01:58	n/a	HV Orientation
15	0100	00:44:00	ExeTime	RP-FCP-060	Patch LAP (also verification of PIU patch)	n/a	00:30:00	n/a	HV Orientation
16	0110	01:14:00	ExeTime	RP-FCP-114	Upload IES HV Events code & test (PIU switch to normal mode within proceedure)	n/a	00:11:06	00:16:04	HV Orientation
17	0120	01:25:06	ExeTime	RP-FCP-041	MIP On (aliveness test)	n/a	00:01:15	n/a	HV Orientation
18	0130	01:26:21	ExeTime	RP-FCP-503	MAG SID 3	n/a	00:00:42	Unknown	HV Orientation
19	0140	01:27:03	ExeTime	RP-FCP-XXX	Load on to MTL FCP 320	TBD	00:00:01	00:04:05	HV Orientation
20	0150	01:27:04	ExeTime	RP-FCP-021	Power ICA	n/a	00:02:00	n/a	HV Orientation
21	0160	01:29:04	ExeTime	RP-FCP-206	Switch to test science	n/a	00:01:00	00:02:18	HV Orientation
22	0170	01:30:04	ExeTime	RP-FCP-115	Enable HV Events	n/a	00:01:04	Unknown	HV Orientation
23	0190	01:31:08	ExeTime	RP-FCP-XXX	ESOC Change OBCP	TBD	00:00:01	00:00:01	HV Orientation
24	0215	01:31:09	ExeTime	RP-FCP-XXX	Load RP-FCP-315 on MTL	TBD	00:00:01	00:00:01	HV Orientation
25	0217	01:31:10	ExeTime	RP-FCP-XXX	Load RP-FCP-310 Calibration mode to run after FCP315	TBD	00:00:01	00:00:11	HV Orientation
26	0225	01:31:11	ExeTime	RP-FCP-399	End Macro	00:04:16	00:00:10	01:00:11	HV Orientation
27	0230	01:31:21	ExeTime	RP-FCP-XXX	MTL Load LAP NN Test RP-FCP-316	TBD	00:00:01	01:31:11	HV Orientation
28	0240	01:31:22	ExeTime	RP-FCP-221	ICA HV Commisioning. Executed up to "step2"	n/a	01:00:00	01:00:10	HV Orientation
29	0245	02:31:22	ExeTime	RP-FCP-399	End Macro	00:04:16	00:00:10	Unknown	HV Orientation
30	0247	02:31:32	ExeTime	RP-FCP-204	ICA Default Calibration Science (for atleast 1hr)	n/a	00:01:00	Unknown	HV Orientation
31	0260	03:01:32	0:30:00	RP-FCP-803	Test Mode change OBCP HV OFF PARAM: VRPD1260=Quiet, VRPD1265=0xFF, VRPD1261=HV_OFF, VRPD1266=0xFF	00:20:00	00:01:00	Unknown	HV Orientation
32	0280	03:02:32	ExeTime	RP-FCP-XXX	Switch to X sun pointing	TBD	00:00:01	Unknown	X-sun pointing
33		3:02:32							
34									
35		6 hour pass							

	A	B	C	D	E	F	G	H	I
1	**Title**	**Part 3 OP Day 1**			**7th Sept**				
2	**Prt3D1_OP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-803	IES ICA Mode Change: IES quiet PARAM: VRPD1260=QUIET, VRPD1265=0xFF, VRPD1261=OFF, VRPD1266=0xFF	00:20:00	00:01:00	01:52:56	+XSunPointing
6	0010	00:01:00	ExeTime	RP-FCP-040	MIP Off	n/a	00:00:43	n/a	+XSunPointing
7	0020	00:11:00	0:10:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
8	0030	00:15:16	ReqTime	RP-FCP-310	Calibration Mode	00:23:40	00:11:56	00:23:40	+XSunPointing
9	0040	00:38:56	ReqTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
10	0050	00:43:12	ReqTime	RP-FCP-316	LAP NN Test	00:21:28	00:09:44	00:21:28	+XSunPointing
11	0060	01:04:40	ReqTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
12	0070	01:08:56	ReqTime	RP-FCP-317	LAP EE Test	00:09:44	00:08:40	00:09:44	+XSunPointing
13	0080	01:18:40	ReqTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
14	0090	01:22:56	ReqTime	RP-FCP-334	LAP Digital Filter Test A20	00:28:56	00:00:08	Unknown	+XSunPointing
15	0110	01:52:56	0:30:00	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID2, VRPD1267=0x12, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID4	00:10:00	00:01:00	12:36:04	+XSunPointing
16	0125	14:29:00	12:36:04	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x14, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	03:30:00	+XSunPointing
17	0130	17:59:00	3:30:00	RP-FCP-803	IES ICA Mode Change: IES ICA on in LV PARAM: VRPD1260=SID3, VRPD1265=0xFF, VRPD1261=SID4, VRPD1266=0x21	00:20:00	00:01:00	Unknown	+XSunPointing
18	0150	18:00:00	ExeTime	RP-FCP-XXX	Day End - turn spacecraft to HV pointing	TBD	00:00:01	Unknown	HV Orientation
19		18:00:00							

	A	B	C	D	E	F	G	H	I
1	**Title**	**4.1 & 4.2 HV Commissioning (Day 2)**				**7-8th Sept**			
2	**Prt3D2_IP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Check state of MAG LAP & IES ICA to see if ready to load LAP MTL and if start initial cofig commands for ICA and IES (steps upto 0020)	TBD	00:00:01	00:03:12	HV Orientation
6	0002	00:00:01	ExeTime	RP-FCP-115	Start IES events (initial config)	n/a	00:01:04	00:02:04	HV Orientation
7	0005	00:01:05	ExeTime	RP-FCP-205	Switch ICA to test science ready for calibration	n/a	00:01:00	Unknown	HV Orientation
8	0010	00:02:05	ExeTime	RP-FCP-130	Turn on IES Stim	n/a	00:01:07	00:21:07	HV Orientation
9	0020	00:03:12	ExeTime	RP-FCP-XXX	RP-FCP-221 ICA Hv comisiioning - initial configuration (Partial execution to a point where we left of last night t)	TBD	00:00:01	02:06:51	HV Orientation
10	0030	00:23:12	0:20:00	RP-FCP-110	Turn off Stims (2 extra cmds) IES MCP comissioning	03:00:51	01:46:51	01:46:52	HV Orientation
11	0040	02:10:03	ExeTime	RP-FCP-XXX	RP-FCP-221 ICA Hv commissioning. Complete what's left from day 1 . Run final steps in parrellel with IES (c. 4 hours)	TBD	00:00:01	03:13:20	HV Orientation
12	0050	02:10:04	ExeTime	RP-FCP-111	IES Initial HV turn on of ESA's (ESA left at 25V which will reject partical entry onto the MCP's)	03:15:15	03:10:15	03:11:15	HV Orientation
13	0080	05:20:19	ExeTime	RP-FCP-803	OBCP Mode Change: test HV off procedure IES ICA PARAM: VRPD1260=HV_OFF, VRPD1265=0xFF, VRPD1261=HV_OFF, VRPD1266=0xFF	00:20:00	00:01:00	00:02:04	HV Orientation
14	0085	05:21:19	ExeTime	RP-FCP-116	Stop IES HV Events	n/a	00:01:04	Unknown	HV Orientation
15	0090	05:22:23	ExeTime	RP-FCP-803	OBCP Mode Change: turn off ICA completely IES ICA PARAM: VRPD1260=NoChange, VRPD1265=0xFF, VRPD1261=OFF, VRPD1266=0xFF	00:20:00	00:01:00	Unknown	HV Orientation
16	0100	05:23:23	ExeTime	RP-FCP-XXX	Turn space craft to X-sun pointing	TBD	00:00:01	Unknown	X-Sun pointing
17		5:23:23	ınd we will not be able to accomplish all that is planned here						
18									
19		6 hour pass							

	A	B	C	D	E	F	G	H	I
10	**Title**	**4.1 & 4.2 HV Commissioning (Day 2 - LAP MTL time line)**						**7-8th Sept**	
2	**Prt3D2_IP_MTL_LAP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Start of OPS	TBD	00:00:01	Unknown	HV Orientation
6	0005	00:20:00	0:20:00	RP-FCP-804	Turn LAP off OBCP Mode Change PARAM: VRPD1262=OFF, VRPD1267=0xFF, VRPD1263=NoChange,, VRPD1268=0xFF, VRPD1264=NoChange	00:10:00	00:01:00	00:10:00	HV Orientation
7	0010	00:30:00	0:10:00	RP-FCP-804	Turn LAP on with updated OBCP PARAM: VRPD1262=Quiet, VRPD1267=0xFF, VRPD1263=NoChange, VRPD1268=0xFF, VRPD1264=NoChange	00:10:00	00:01:00	01:04:00	HV Orientation
8	0020	00:35:00	0:05:00	RP-FCP-315	Macro validation	n/a	00:02:10	00:05:00	HV Orientation
9	0030	00:40:00	0:05:00	RP-FCP-310	Calibration mode	00:23:40	00:11:56	00:16:00	HV Orientation
10	0040	00:56:00	0:16:00	RP-FCP-399	End Macro	00:04:16	00:00:10	00:04:00	HV Orientation
11	0050	01:00:00	0:04:00	RP-FCP-316	NN Test	00:21:28	00:09:44	00:20:00	HV Orientation
12	0060	01:20:00	0:20:00	RP-FCP-399	End macro	00:04:16	00:00:10	00:04:00	HV Orientation
13	0070	01:24:00	0:04:00	RP-FCP-334	Digital filter test	00:28:56	00:00:08	00:13:00	HV Orientation
14	0080	01:34:00	0:10:00	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3, VRPD1267=0x14, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=NoChange	00:10:00	00:01:00	03:03:00	HV Orientation
15	0090	01:37:00	0:03:00	RP-FCP-390	Change LAP Bias: PARAM: VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	n/a	00:00:03	03:03:00	HV Orientation
16	0100	04:37:00	3:00:00	RP-FCP-804	(To be performed just be fore end of pass) Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID2, VRPD1267=0x12, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	Unknown	HV Orientation
17	0110	04:40:00	0:03:00	RP-FCP-390	Change LAP Bias: PARAM: VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	n/a	00:00:03	Unknown	HV Orientation
18		4:40:00							

	A	B	C	D	E	F	G	H	I
10	**Title**	**Part 3 OP Day 2**			**8th Sept**				
2	**Prt3D2_OP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Ops Start - turn to xsun pointing	TBD	00:00:01	18:00:00	+XSunPointing
6	0010	00:00:01	0:00:01	RP-FCP-803	IES ICA Mode Change: IES quiet PARAM: VRPD1260=QUIET, VRPD1265=0xFF, VRPD1261=OFF, VRPD1266=0xFF	00:20:00	00:01:00	17:57:59	+XSunPointing
7	0030	13:54:50	13:54:49	RP-FCP-504	MAG: Switch toSID4	n/a	00:00:42	Unknown	+XSunPointing
8	0125	17:58:00	04:03:10	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x14, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	00:01:00	+XSunPointing
9	0130	17:59:00	ExeTime	RP-FCP-803	IES ICA Mode Change: IES ICA on in LV PARAM: VRPD1260=SID3, VRPD1265=0xFF, VRPD1261=SID3, VRPD1266=0x1B	00:20:00	00:01:00	Unknown	+XSunPointing
10	0150	18:00:00	ExeTime	RP-FCP-XXX	Day End - turn spacecraft to HV pointing	TBD	00:00:01	Unknown	HV Orientation
11		18:00:00							

	A	B	C	D	E	F	G	H	I
01	**Title**	**4.1 & 4.2 HV Commissioning (Day 3)**				**8-9th Sept**			
2	**Prt3D3_IP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-804	to be run as soon as possible after AOS (switch LAP and MAG to SID2 to allow real time science to catch upo as soon as possible) Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID2, VRPD1267=0x12, VRPD1263=OFF,	00:10:00	00:01:00	00:01:00	HV Orientation
6	0002	00:01:00	ExeTime	RP-FCP-803	actual CVP starts here. -- IES ICA Mode Change: ICA HV ON PARAM: VRPD1260=NoChange, VRPD1265=0xFF VRPD1261=SID4_HV_ON VRPD1266=dec33	00:20:00	00:01:00	06:37:05	HV Orientation
7	0005	00:02:00	ExeTime	RP-FCP-115	Start IES events	n/a	00:01:04	00:01:04	HV Orientation
8	0010	00:03:04	ExeTime	RP-FCP-130	Turn on IES Stim	n/a	00:01:07	01:00:01	
9	0020	01:03:04	1:00:00	RP-FCP-XXX	RP-FCP-110 Turn off stim (2 extra commands) Reinitialise MCP's	TBD	00:00:01	05:43:05	HV Orientation
10	0030	01:03:05	ExeTime	RP-FCP-112	(1 extra command) Initial HV turn on of DEF side 1 (finish what wasn't doen previous day)	02:55:00	02:50:00	02:50:00	HV Orientation
11	0040	03:53:05	ExeTime	RP-FCP-113	Initial HV turn on of DEF side 2 (proceed until 45 mins before LOS then perform last comand in sequence)	02:50:00	02:45:00	02:51:00	HV Orientation
12	0045	06:38:05	ExeTime	RP-FCP-803	OBCP Mode Change IES ICA PARAM: VRPD1260=SID3_HV_ON VRPD1265=0xFF VRPD1261=No_Change VRPD1266=0xFF (run for as long as possible)	00:20:00	00:01:00	00:01:00	HV Orientation
13	0050	06:39:05	ExeTime	RP-FCP-803	OBCP Mode Change IES ICA PARAM: VRPD1260=HV_OFF, VRPD1265=0xFF, VRPD1261=OFF, VRPD1266=0xFF	00:20:00	00:01:00	00:06:04	HV Orientation
14	0055	06:44:05	0:05:00	RP-FCP-116	Disable IES HV Events	n/a	00:01:04	Unknown	HV Orientation
15	0060	06:45:09	ExeTime	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID2, VRPD1267=0x12, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID4	00:10:00	00:01:00	Unknown	HV Orientation
16	0070	06:46:09	ExeTime	RP-FCP-XXX	Turn space craft to X-sun pointing	TBD	00:00:01	Unknown	X-Sun pointing
17		6:46:09							

	A	B	C	D	E	F	G	H	I
1	**Title**	**4.1 & 4.2 HV Commissioning (Day 3 - LAP MTL time line)**						**8-9th Sept**	
2	**Prt3D3_IP_MTL_LAP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Start of OPS	TBD	00:00:01	Unknown	HV Orientation
6	0020	00:00:01	ExeTime	RP-FCP-804	to be run when IES science is REAL TIME . Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3, VRPD1267=0x14, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	00:59:00	
7	0030	00:05:01	0:05:00	RP-FCP-310	Calibration mode	00:23:40	00:11:56	00:16:00	HV Orientation
8	0040	00:21:01	0:16:00	RP-FCP-399	End Macro	00:04:16	00:00:10	00:04:00	HV Orientation
9	0050	00:25:01	0:04:00	RP-FCP-316	NN Test	00:21:28	00:09:44	00:20:00	HV Orientation
10	0060	00:45:01	0:20:00	RP-FCP-399	End macro	00:04:16	00:00:10	00:04:00	HV Orientation
11	0070	00:49:01	0:04:00	RP-FCP-334	Digital filter test	00:28:56	00:00:08	00:13:00	HV Orientation
12	0080	00:59:01	0:10:00	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3 VRPD1267=0x14 VRPD1263=OFF VRPD1268=0xFF VRPD1264=NoChange	00:10:00	00:01:00	Unknown	HV Orientation
13	0090	01:02:01	0:03:00	RP-FCP-390	Change LAP Bias: PARAM: VRPD3046=0xE4E4 VRPD3055=0xE4 VRPD3050=0x0000	n/a	00:00:03	Unknown	HV Orientation
14		1:02:01							

	A	B	C	D	E	F	G	H	I
1	**Title**	**Part 3 OP Day3**			**9th Sept**				
2	**Prt3D3_OP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Ops Start - turn to xsun pointing	TBD	00:00:01	18:06:17	+XSunPointing
6	0005	00:00:01	ExeTime	RP-FCP-399	End Macro	00:04:16	00:00:10	00:04:16	+XSunPointing
7	0007	00:04:17	0:04:16	RP-FCP-310	Calibration mode	00:23:40	00:11:56	Unknown	+XSunPointing
8	0008	00:34:17	0:30:00	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID2 VRPD1267=0x12 VRPD1263=OFF VRPD1268=0xFF VRPD1264=No_Change	00:10:00	00:01:00	00:01:00	+XSunPointing
9	0010	00:35:17	ExeTime	RP-FCP-803	IES ICA Mode Change: IES quiet PARAM: VRPD1260=QUIET VRPD1265=0xFF VRPD1261=OFF VRPD1266=0xFF	00:20:00	00:01:00	08:00:00	+XSunPointing
10	0030	08:35:17	08:00:00	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID2 VRPD1267=0x12 VRPD1263=OFF VRPD1268=0xFF VRPD1264=SID3	00:10:00	00:01:00	09:30:00	+XSunPointing
11	0040	18:05:17	9:30:00	RP-FCP-803	IES ICA Mode Change: IES ICA ON in LV PARAM: VRPD1260=SID3 VRPD1265=0xFF VRPD1261=SID3 VRPD1266=0x1B	00:20:00	00:01:00	Unknown	+XSunPointing
12	0050	18:06:17	ExeTime	RP-FCP-XXX	Day End - turn spacecraft to HV pointing	TBD	00:00:01	Unknown	HV Orientation
13		18:06:17							

	A	B	C	D	E	F	G	H	I
1	**Title**	**4.1 & 4.2 HV Commissioning (Day 4)**				**9-10th Sept**			
2	**Prt3D4_IP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-803	IES ICA Mode Change: ICA HV ON & IES Off. PARAM: VRPD1260=OFF VRPD1265=0xFF VRPD1261=HV_ON VRPD1266=0xFF	00:20:00	00:01:00	00:10:00	HV Orientation
6	0010	00:10:00	0:10:00	RP-FCP-803	IES ICA Mode Change: ICA Off. PARAM: VRPD1260=No_Change VRPD1265=0xFF VRPD1261=OFF VRPD1266=0xFF	00:20:00	00:01:00	00:10:00	HV Orientation
7	0020	00:20:00	0:10:00	RP-FCP-803	when in Real Time Science: IES ICA Mode Change: Test HV ON part of OBCP. PARAM: VRPD1260=SID3_HV_ON, VRPD1265=0xFF, VRPD1261=SID3_HV_ON, VRPD1266=0x1B	00:20:00	00:01:00	05:20:00	HV Orientation
8	0030	05:40:00	5:20:00	RP-FCP-803	to be run 20 min before end of pass: OBCP Mode Change. IES ICA OFF. PARAMS: VRPD1260=OFF VRPD1265=0xFF VRPD1261=OFF VRPD1266=0xFF	00:20:00	00:01:00	00:10:00	HV Orientation
9	0040	05:50:00	0:10:00	RP-FCP-804	check LAP MTL is running step 40 before executing this step! VRPD1262=OFF VRPD1267=0xff VRPD1263=OFF VRPD1268=0xff VRPD1264=SID2	00:10:00	00:01:00	00:10:00	HV Orientation
10	0050	06:00:00	0:10:00	RP-FCP-800	RPC OFF	n/a	00:03:10	Unknown	HV Orientation
11		06:00:00							

	A	B	C	D	E	F	G	H	I
1	**Title**	**4.1 & 4.2 HV Commissioning (Day 4 - LAP MTL time line)**						**9-10th Sept**	
2	**Prt3D4_IP_MTL_LAP**								
3		**Time**				**Procedure Duration**			
4	**Step**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
5	0000	00:00:00	0:00:00	RP-FCP-XXX	Start of OPS	TBD	00:00:01	Unknown	HV Orientation
6	0010	00:00:01	ExeTime	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID2 VRPD1267=0x13 VRPD1263=No_Change VRPD1268=0xFF VRPD1264=NoChange	00:10:00	00:01:00	01:00:00	HV Orientation
7	0020	01:00:01	1:00:00	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3 VRPD1267=0x35 VRPD1263=No_Change VRPD1268=0xFF VRPD1264=NoChange	00:10:00	00:01:00	01:00:00	HV Orientation
8	0030	02:00:01	1:00:00	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3 VRPD1267=0x23 VRPD1263=OFF VRPD1268=0xFF VRPD1264=NoChange	00:10:00	00:01:00	01:00:00	HV Orientation
9	0040	03:00:01	1:00:00	RP-FCP-804	Configure MAG LAP OBCP Mode Change PARAM: VRPD1262=SID3 VRPD1267=0x14 VRPD1263=No_Change VRPD1268=0xFF VRPD1264=NoChange	00:10:00	00:01:00	Unknown	HV Orientation
10	0050	06:00:01	3:00:00		duration of previous step is an estimate (assumes we start MTL at 19:30 UTC and we and Ops at 01:30 UTC)only estimated end of Ops	*TBD*	*TBD*	*Unknown*	
11		6:00:01							

RPC Commissioning Part 3
Pass-1 activities Log

rpclap_bjorn (19:44:28): Test from Bjoern
chris_carr2000 (19:44:34): Hi Bjoern
rpclap_bjorn (19:46:35): Second test from Bjoern
chris_carr2000 (19:59:22): Welcome to RPC Commissioning Part 3
chris_carr2000 (19:59:31): Phone Numbers:
chris_carr2000 (19:59:55): RPC EGSE Station: 63374
chris_carr2000 (20:00:15): Rosetta Control Room: 63523
rpclap_reine (20:01:16): RPCLAP Telephone: 63373
rpcmag_khg (20:03:35): Hi there! Here is KHG without micro.
chris_carr2000 (20:03:53): No problem, nobody has a microphone!
chris_carr2000 (20:04:05): ...we just use text
rpcmag_ingo (20:04:30): Hi Karl-Heinz, everything fine, pass starts at ~21:30
chris_carr2000 (20:04:51): All: we will start actually in about 10 minutes
rpcmag_khg (20:05:49): I am getting old; forgot on how it works
rpclap_anders (20:08:24): Hi Hans! We seem to have a nice weather this time: ACE reports a comfortable 7 cm-3.
chris_carr2000 (20:12:34): First Sequence started
chris_carr2000 (20:23:57): Wrong PIU patch address in PIU due to OBCP having been updated for the patch which we are about to send
chris_carr2000 (20:24:43): Therefore running from RAM but with PROM code
chris_carr2000 (20:25:06): This is unexpected but OK; will continue and put the patch into PIU EEPROM
rpcica_hansb (20:25:32): RP-FCP-200 is the correct ICA Safe Mode (i.e HV off)
chris_carr2000 (20:25:42): PIU Voltages
chris_carr2000 (20:25:51): 92mA LCL
chris_carr2000 (20:26:25): 5.13V, -5.05V, 12.55V, -12.92V, +28.96V
chris_carr2000 (20:26:40): PSU 19.6 deg. C
chris_carr2000 (20:26:58): MAG ON - HK received
chris_carr2000 (19:30:55): I have now set the clock on this computer back one hour so it is showing UTC times, for clarity
chris_carr2000 (19:32:16): So, subtract 1 hour from the lines above...
rpcmag_ingo (19:33:07): HK received on MAG-GSE
rpcmag_ingo (19:34:12): Mag OB sensor shows -121 degrees. Cold but ok
chris_carr2000 (19:42:56): Start of PIU Memory Load Sequence
rpclap_bjorn (19:49:09): Delay on telemetry data is now 8 min
rpclap_bjorn (19:50:37): Testing time stamps
chris_carr2000 (19:51:49): PIU Patch accepted and burnt into EEPROM
chris_carr2000 (19:55:57): (Note: the PIU patch had been previously uploaded as a file onboard, and was executed from the DMS)
chris_carr2000 (19:58:55): MAG OFF, Reboot PIU to new code version
chris_carr2000 (20:00:02): MAG on 20:01:54
chris_carr2000 (20:03:15): There will now be a 15 minute intermission whilst ESOC restarts the commanding system
chris_carr2000 (20:03:35): ..."should have used Linux", says Reine
chris_carr2000 (20:11:41): PIU Reboot now seen at EGSE
chris_carr2000 (20:12:19): Voltages 5.1, -5.7, +12.6, -12.9, +28.9
chris_carr2000 (20:12:30): Temperature 23.0 deg
chris_carr2000 (20:12:55): correction: -5.07V
rpcmag_ingo (20:13:40): HK + SID2 received on MAG-GSE
chris_carr2000 (20:19:06): Sequences up to step 90 sent

rpclap_reine (20:30:57): LAP HK at 20:20:34, looks ok, shall I come up for LAP patching?
chris_carr2000 (20:53:55): LAP patching started
rpclap_reine (21:18:18): LAP event: ID 0x20, checksum 0x2ace, as expected. Interpretation: patching successful.
chris_carr2000 (21:22:24): LAP patching finished successfully
chris_carr2000 (21:22:46): Starting FCP 110 for IES events upload
chris_carr2000 (21:23:35): correction: step 110, FCP 114
rpclap_anders (21:31:44): LAP DPU board temp now 25.9 deg C, rising at 0.03 deg/min. At startup, we had 21.4 deg C rising at 0.15 deg/min.
chris_carr2000 (21:32:20): PIU power supply temperature is now 26.9 deg.C
rpcies_rayg (21:34:21): IES temp. started at 35 deg, now 36.7.
rpcica_hansb (22:29:04): ICA HK received.
rpclap_bjorn (22:30:58): MIP SCI wrong source sequence count, corrupted TM package
rpcica_hansb (22:36:53): ICA EEPROM reboot OK. Science data received
rpclap_bjorn (22:37:07): IES SCi corrupted TM package
rpcmag_ingo (22:37:24): MAG receives Burst Data !
rpclap_reine (22:46:41): LAP Received All143 Acknowledgements for Macro Upload step 140
chris_carr2000 (23:03:51): FCP310 set to run on MTL at 23:20
chris_carr2000 (23:06:38): FCP316 @ 2340
chris_carr2000 (23:06:47): FCP399 @ 2335
chris_carr2000 (23:09:36): FCP399 (again) @ 2359
chris_carr2000 (23:14:13): 2305 ran FCP 315
rpclap_reine (23:20:25): FCP315 was bodged because we didn't power cycle as planned. But it will not matter since macros will be verified one by one through execution anyway.
chris_carr2000 (23:20:35): ICA HV commanding starts
rpclap_anders (23:35:01): Steps 200 and 210 postponed. LAP will thus continue running the old software during out of pass, but use new macros. This is OK -- it only means we do not test the patched s/w tonight.
chris_carr2000 (23:58:26): ICA proceeding to opto HV step 2
rpclap_anders (23:59:55): LAP now receives science data, somewhere into step 230. For step 217 we have no science data. However, the same ops will be duplicated out of pass during daytime.
rpclap_anders (00:07:46): LAP now receives nice probe sweeps. Because of not rebooting LAP and thus running the new macros on old s/w we do not get the macro IDs in the TM, so Reine can look forward to some manual intervention when preparing the PDS data.
chris_carr2000 (00:12:38): ending ICA at level 2 and switching off HV
chris_carr2000 (00:12:47): disabling IES HV events
rpclap_reine (00:14:41): Comment to anders above. not because running on old sw just a that a reboot is needed after macro upload on old sw.
rpclap_anders (00:15:12): Oh well, you know
rpcies_craigp (00:21:02): Am I on?
chris_carr2000 (00:21:06): yes
rpcies_craigp (00:21:10): Thanks

RPC Commissioning Part 3
Pass-2 activities Log

chris_carr2000 (18:35:20): Signal acquired
rpcica_hansb (18:38:48): ICA receives HK
chris_carr2000 (18:39:43): LCL 275mA
chris_carr2000 (18:40:10): 5.13V, -5.07, 12.30, -12.33, +27.97
chris_carr2000 (18:40:18): Temp 30.46 degC.
rpclap_bjorn (18:42:01): 18:30UT the real time data from DDS is coming
rpcies_rayg (18:46:06): IES sees data.
chris_carr2000 (18:53:00): LAP timeline set to start 19:45 (step 5 MTL)
rpclap_bjorn (19:04:01): The science is now stored on the satellite
chris_carr2000 (19:37:21): SSMM download started at 1910
rpclap_reine (19:54:45): Last LAP HK 19:45:22 LAP is Off.
rpclap_anders (19:54:52): LAP off seen in HK
rpclap_anders (20:01:07): Chris L tells LAP is rebooted. No HK on DDS yet.
rpclap_anders (20:03:28): LAP booted s/w version 14
chris_carr2000 (20:04:17): started first interactive command 2000
rpclap_reine (20:04:22): LAP ON at 19:55:30 Software version 14
rpclap_reine (20:11:54): LAP Macro verification done.
chris_carr2000 (20:13:17): MAG missed sample and counter unsync events at 20.01.54
chris_carr2000 (20:13:41): IES command rejected event at 20.3.55
rpclap_anders (20:18:18): LAP MTL step 20 completed, now running step 30.
chris_carr2000 (20:24:32): OP HK download complete; science starting
chris_carr2000 (20:29:19): IES HV Step 30 started
rpclap_anders (20:30:18): LAP MTL step 30 (calibration) completed.
rpclap_anders (20:35:25): Now in LAP MTL step 50 (NN test, i.e. bias level stepping) according to HK.
rpclap_anders (20:53:58): LAP MTL step 50 (NN test) completed.
rpclap_bjorn (21:00:07): We should expect real time science in about 20 minutes
rpclap_anders (21:01:08): LAP now in MTL step 70 (digital filter test)
rpclap_anders (21:11:05): LAP MTL step 80 (default burst mode) verified in HK
rpclap_reine (21:12:26): LAP HV Commissioning sequence day 2 entered default normal.
rpclap_reine (21:15:05): That was default burst..
rpcmag_ingo (21:43:15): mag gets burst data
rpclap_anders (21:43:31): LAP gets burst data, looking good!
rpclap_bjorn (21:44:10): 21:34:00 UT first real time SCI appears
rpclap_anders (21:51:53): All LAP commanding except out-of-pass preparations completed. Present operation (default burst) verified in science, the rest in TM. All looks OK, so we leave the rest to you and the MTL. Good night!
rpcica_hansb (00:16:12): ICA HV commissioning completed OK.

RPC Commissioning Part 3
Pass-3 activities Log

rpclap_anders (19:35:09): The spirit is willing but the network is rotten.
chris_carr2000 (19:43:32): RPC Commissioning Part 3 Day 3
chris_carr2000 (19:48:41): LAP and MAG commanded into SID2 on first contact with s/c to avoid overwriting SSMM
rpclap_anders (19:49:21): LAP HK shows macro 0x212 running, verifying the SID2 commanding.
rpcica_hansb (20:00:00): ICA modechange OK. HV monitors Ok
rpclap_bjorn (20:00:50): External network is up again, but the local DNS server is down.
chris_carr2000 (20:32:48): PIU Voltage Check:
chris_carr2000 (20:33:29): 5.13, -5.07, 12.3, -12.3, 27.8
chris_carr2000 (20:34:35): LCL 316mA
chris_carr2000 (20:34:57): PSU Temp 29.6
chris_carr2000 (21:10:39): LAP MTL Upload Started
chris_carr2000 (21:10:51): Execution scheduled for 21.45
rpcmag_khg (21:15:33): Just returned from DFG in Bonn. Still enough sweets over there?
rpcmag_ingo (21:16:13): MAG gets HK data, waiting for Science, sweets are available
rpcmag_khg (21:17:06): Germany played Brazil 1:1, I just learned
rpcmag_ingo (21:18:15): thanks for filling the log file
rpcmag_ingo (21:40:53): MAG receives SID2 data
chris_carr2000 (21:41:06): Start of real-time science generation
rpclap_bjorn (21:41:16): 21:32:18 UT SCI appears, 2 minutes earlier than yesterday
rpclap_anders (21:47:06): LAP normal mode (SID2) science data looks fine.
rpclap_anders (21:47:26): "Look fine", that is.
chris_carr2000 (21:55:11): Correction: LAP MTL will execute starting 22.00
chris_carr2000 (22:03:09): Loaded IES HV steps 30 & 40 together on the timeline
chris_carr2000 (22:03:29): MAG switched back to SID 3
rpcmag_ingo (22:11:09): MAG receives BURST data
rpclap_reine (22:11:22): LAP Gets SID 3
rpclap_anders (22:11:40): LAP sees nice SID3 sci data (default burst mode)
rpclap_reine (22:14:26): LAP Executes FCP-310 Calibration
rpclap_reine (22:36:16): LAP NN Test FCP 316 Running
rpclap_anders (22:42:28): LAP now in NN test, working fine. The proceeding calibration step executed as it should, but we got no data because of a data rate mismatch.
rpclap_anders (22:55:56): LAP digital filter test completed
rpclap_reine (23:01:44): Correction LAP Still doing NN test.
rpclap_reine (23:13:37): LAP Running FCP-334
rpclap_reine (23:22:04): LAP Running SID 3 Default burst
chris_carr2000 (23:50:53): Switching IES HV Off and ICA Off and preparing for out of pass
rpclap_reine (00:05:21): LAP is in SID2
rpcmag_ingo (00:05:37): MAG in SID4 now
chris_carr2000 (00:12:39): end of activities for in-pass

RPC Commissioning Part 3
Pass-4 activities Log

rpcmag_ingo (18:43:18): MAG gets HK
chris_carr2000 (18:44:45): RPC COMMISSIONING PART 3 DAY 4
chris_carr2000 (18:44:59): 9th September 2004
chris_carr2000 (18:45:20): Start of pass: Receiving real time housekeeping data
chris_carr2000 (19:10:23): LCL Current 214mA
chris_carr2000 (19:10:30): PIU Voltages:
chris_carr2000 (19:11:27): 5.14, -5.07, 12.3, -12.3, 27.8
chris_carr2000 (19:11:35): 28 deg. C
rpclap_anders (19:17:34): LAP HK coming in, looks as expected.
chris_carr2000 (19:26:27): ICA Powered ON at 19.05
rpclap_anders (19:37:46): LAP OBCP for NE mode (macro 0x203) set for 20:00
rpcica_hansb (20:09:06): ICA HK with HV-on received.
chris_carr2000 (20:09:06): IES Powered OFF
rpclap_anders (20:15:40): LAP in MTL step 10, running macro 0x203 (sweeping P1, E-field mode on P2)
rpclap_reine (20:19:28): Thus LAP NE-Mode.
rpcmag_ingo (20:19:58): MAG gets burst mode data
rpclap_bjorn (20:20:33): SCI appears 20:10UT
rpclap_anders (20:22:01): LAP gets normal mode (SID2) data from macro 0x203, looking as expected.
chris_carr2000 (20:44:25): IES ON at 20.25
rpcica_hansb (20:52:24): ICA on as expected
rpclap_reine (21:11:48): 21:02:42 LAP starts macro 0x405 NN-Interferometry
rpclap_reine (22:25:42): 22:02:58 LAP Starts macro 0x303 EE-Mode
rpclap_reine (22:27:58): Two OBCPs for LAP mode change was loaded on the MTL to execute at the same time, one was rejected by s/c.
rpclap_reine (23:11:31): 23:02:42 LAP Starts macro 0x204 Default Burst mode
chris_carr2000 (01:25:38): IES and ICA powered OFF
chris_carr2000 (01:29:08): LAP is powered OFF
rpcmag_ingo (01:30:31): MAG is in SID2
chris_carr2000 (01:42:29): 01.33 RPC is OFF
rpclap_anders (01:42:34): That calls upon us, by the grace of Grace / We will perform in measure, time and place: /So thanks to all at once and to each one / who now have rolled to space Rosetta's stone!

PIU Commissioning Report

Summary

Commissioning of the PIU was performed during real-time passes on the nights of 17/18 and 18/19 March 2004. the PIU team at ESOC comprised Chris Lee (responsible for RPC overall) and Chris Carr (responsible for PIU).

During the first pass the PIU 'Main' side was successfully commissioned. Towards the end of the first pass the 'redundant' PIU was tested and an anomaly with the power supply was detected.

The second pass was used to test again the 'main' side and to execute the boom deployment sequences.

Pass 1 PIU 'Main' Commissioning

PIU and RPC sequences were executed according to the detailed sequence given in the Annex 1 'Step 1.1 As-Run'. The detailed timeline may be seen in the log-file (Annex 4).

Operation of the PIU was nominal.
On initial power-up of the PIU and MAG switch-on, the following parameters were noted:
LCL 'A' current 102mA
PIU HK: 23.8 deg. C, +5.1V, -5.1V, 12.5V, -12.9V, 28.9V

After power on of all instruments these parameters changed to
LCL 'A' current 347mA
PIU HK: 31 deg. C, 5.1V, -5.7V, +12.4V, -12.4V, +28.1V

With all experiments on, the PIU PSU temperature levelled out at 34 deg. C. compared to the s/c monitored TRP temperature of 22 deg. C.
This is as expected.

All commanding to PIU and through to experiments was successful.
No telemetry anomalies were observed.

Pass 1 PIU 'Redundant' Commissioning

PIU and RPC sequences were executed according to the detailed sequence given in the Annex 2 'Step 1.2 As-Run'. The detailed timeline may be seen in the log-file (Annex 4).

On initial power-up of the PIU and MAG switch-on, the following parameters were noted:
LCL 'A' current 103mA
PIU HK: 31.6 deg. C., +5.15V, -5.4V, +12.5V, -12.8V, +29.2V

After power on of all instruments these parameters changed to

LCL ‘A’ current 339mA
PIU HK: Not Recorded

All commanding to PIU and through to experiments was successful.
No telemetry anomalies were observed.

Operation of the PIU was nominal up to the point at which all experiments were powered on. After 22 minutes of operation, the LCL current was seen to go down to 240mA with a simultaneous loss of telemetry. RPC was powered off.

On powering DPIU redundant again the same anomalous current of 240mA was observed. The LCL was switched off.

A third attempt was made to power just the PIU redundant power supply by switching just the LCL and not the HPC for the DPIU redundant. The same behaviour was seen which implied a fault in the redundant PSU unit.

At this point testing was abandoned for the rest of the pass.

Pass 1 Summary of Observed Anomaly

RPC held a meeting with ESOC to discuss the situation. These notes are attached (Annex 7). These notes provide a full description of the observed anomaly and suggested course of action.

Subsequent commissioning activities for the following pass (pass 2) were modified accordingly (see top-level RPC report).

Pass 2 Special Timeline for Debug and Boom Deployment

Two further attempts were made to power on the redundant power supply of the PIU. In both cases, the LCL current immediately showed the same anomalous behaviour seen on the previous pass.

Subsequently, the PIU ‘main’ side was operated successfully with the MAG experiment always on and additionally each other experiment in turn. The detailed sequence is given in Annex 3. The detailed timeline may be seen in the log-file (Annex 5).

On initial power-up of the PIU and MAG switch-on, the following parameters were noted:
LCL current 102mA
PIU Voltage +5.13V, -5.05V, +12.5V, -12.9V, +28.9V
Temp 23.8 deg C

According to the revised plan the booms were deployed and the LAP, MIP and MAG experiments monitored this. At the end of the test the PIU PSU temperature had levelled out at 28 deg. C.

The performance of the PIU was nominal. All commanding to PIU and through to experiments was successful. No telemetry anomalies were observed.

The PIU ‘main’ was powered off after just over 5 hours of operation.

Summary of Pass 2 Operations

The ‘main’ side PIU was seen to operate nominally throughout the pass. A meeting was held after the pass 2 operations. The notes of this meeting are attached (Annex 8).

Conclusions

Based on the observations of the pass 1 and pass 2 testing carried out, the ‘main’ side PIU can be considered to be fully commissioned and operational. The redundant side appears to have a failure which is limited to the power supply. However, this is TBD by further investigations which will be performed on development models of the PIU by Imperial College, according to the notes of the meeting on 19th March (Annex 8)

Chris Carr
31st March 2004

RPC–PIU Commissioning

Part 2

7-10/05/2004

Summary

Commissioning Part 2 of the PIU was performed on 7-10/05/2004.
Operations were executed during ground station pass phases and out-of-pass phases as shown in the timeline.

The PIU team members present at ESOC were Chris Carr, Chris Lee, Emanuele Cupido.

PIU was powered during the first pass phase and kept in operating condition until the last pass phase when it was switched off. Only PIU Main PSU was operated. No anomalies were reported.
OBCP 8091 was executed successfully.
PIU Memory Service Test procedure was executed successfully.

Introductory note

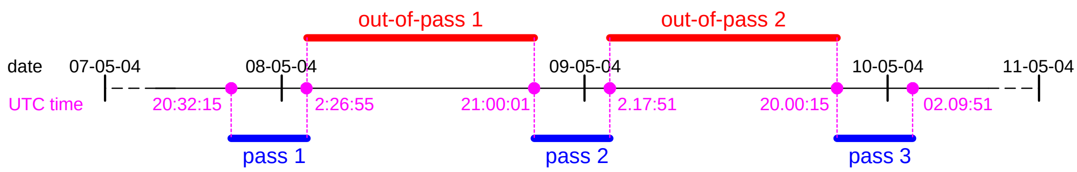
Commissioning operations were planned taking into account the outcome of the MRB meeting held at ESOC on 6/05/2004 (ref. ROS-ESOC-OPS-MIN-1009-OPS-CQ) during which the potential occurrence of PIU Redundant PSU failure in PIU Main PSU was discussed with ESOC and ESTEC.
The strategy adopted for PIU operations during Commissioning Part 2 was:

? Minimize the number of PIU power cycles in favour of prolonged operational time (given PIU team's knowledge of the subject at the present time, power cycles are considered to be potentially more deleterious for the PSU than prolonged operational time).

? Limit the number of experiments powered simultaneously in order to limit the load on the PIU PSU.

Timeline

The timeline is based on TM packets timestamps as retrieved from RDDS.



Pass 1

PIU and RPC sequences were executed according to detailed sequence given in Annex 1 (Annex1_RPC_CVP_Plan_as_run_1_0.pdf).

Sequences executed during pass 1 (Prt2D1_IP) and out-of-pass 1 (Prt2D1_OP) are reported. The detailed timeline is reported in Annex 2 (Annex2_Log_Pass_1.pdf)

PIU and MAG were switched on successfully using OBCP8091. OBCP8091 starting event returned at 20:33:30UTC.

“PIU Alive” event received at 20:34:11UTC.

First PIU HK data received at 20:36UTC.

First PIU HK parameters values recorded during pass 1 (PIU and MAG were powered):
LCL current: 102mA
Voltages: 5.14V, -5.07V, 12.57V, -12.92V, 28.93V
Temperature: 25.94°C

PIU HK parameters values when PIU, MAG, ICA, and LAP were powered:
LCL current: 214mA
Voltages: 5.14V, -5.07V, 12.33V, -12.37V, 27.83V
Temperature: 30.2°C

Operation of PIU was nominal during pass 1.

Anomalies reported:

1. Memory Service Packets for ICA, LAP, IES not accepted by PIU.
   The problem is related to subunits and it only occurs when using the latest SW version. PROM SW works correctly; therefore the problem is confined in SW PATCH. New patch is necessary to solve the problem.

Out-of-pass 1 & Pass 2

PIU and RPC sequences were executed according to detailed sequence given in Annex1 (Annex1_RPC_CVP_Plan_as_run_1_0.pdf). Sequences executed during pass 2 (Prt2D2_IP) and out-of-pass2 (Prt2D2_OP) are reported. The detailed timeline is reported in Annex 3 (Annex3_Log_Pass_2.pdf)

No anomalies were found present in out-of-pass 1 PIU HK data.

PIU, MAG, LAP, MIP, operated successfully overnight.

First PIU HK parameters values recorded during pass 2 (PIU, MAG and LAP were powered):
LCL current: 153mA
Voltages: 5.14V, -5.07V, 12.32V, -12.40V, 27.69V
Temperature: 32.27°C

Operation of PIU was nominal during pass 2.
No anomalies were observed during pass 2 operations.

Out-of-pass 2 & Pass 3

PIU and RPC sequences were executed according to detailed sequence given in Annex1 (Annex1_RPC_CVP_Plan_as_run_1_0.pdf). Sequences executed during pass

3 (Prt2D3_IP) are reported. The detailed timeline is reported in Annex 4 (Annex4_Log_Pass_3.pdf)

No anomalies were found present in out-of-pass 2 PIU HK data.

First PIU HK parameters values recorded during pass 3 (PIU and MAG powered):
LCL current: 102mA
Voltages: 5.14V, -5.07V, 12.55V, -12.88V, 28.83V
Temperature: 31.97°C

Operation of PIU was nominal during pass 3.
No anomalies were observed during pass 3 operations.

PIU Service Memory sequence (FCP091) was started at 20:13UTC and executed successfully.

Last PIU HK parameters values recorded (PIU, MAG, IEC, ICA and LAP powered):
LCL current: 275mA
Voltages: 5.13V, -5.07V, 12.30V, -12.33V, 27.93V
Temperature: 32.57°C

RPC LCL OFF received from S/C at 2:20UTC.

Conclusions

All objectives of PIU Commissioning Part 2 t has been accomplished successfully.

RPC–PIU Commissioning

Part 3

6-10/09/2004

Summary

Commissioning Part 3 of the PIU was performed on 6-10/09/2004.
Operations were executed during ground station pass phases and out-of-pass phases as shown in the timeline.

The PIU team members present at ESOC were Chris Carr, Chris Lee (for the first two days), Emanuele Cupido.

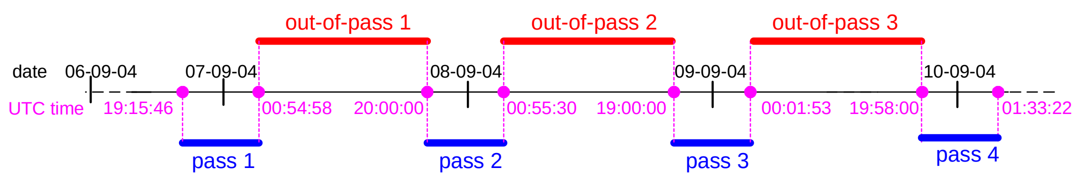
Main objective of the activity was the commissioning of the high voltage (HV) subsystems of the ICA and IES instruments and the OBCPs for HV subsystems commanding.
LAP calibration procedures were executed.
Memory maintenance activity was also performed on PIU and LAP.

Science data packets were lost during Out-of-pass-1 and Out-of-pass-2 due to insufficient SSMM allocation.

PIU was powered on during the first pass phase and kept in operating condition until the last pass phase when it was switched off. Only PIU Main PSU was operated. No anomalies were reported.

Timeline

The timeline is based on TM packets timestamps as retrieved from RDDS.



Sequences executed

PIU and RPC sequences were executed according to detailed sequence given in Annex 1 (Annex1_RPC_CVP_Plan_as_run_2_0.pdf), where:

Prt3D1_IP reports the sequences executed during pass 1;
Prt3D1_IP_MTL_LAP reports the sequences executed during pass1 via MTL;
Prt2D1_OP reports the sequences executed during out-of-pass 1.
Prt3D2_IP reports the sequences executed during pass 2;
Prt3D2_IP_MTL_LAP reports the sequences executed during pass2 via MTL;
Prt2D2_OP reports the sequences executed during out-of-pass 2.
Prt3D3_IP reports the sequences executed during pass 3;
Prt3D3_IP_MTL_LAP reports the sequences executed during pass3 via MTL;
Prt2D3_OP reports the sequences executed during out-of-pass 3.
Prt3D4_IP reports the sequences executed during pass 4;
Prt3D4_IP_MTL_LAP reports the sequences executed during pass4 via MTL;.

Pass-1

The timeline of the operation performed during Pass-1 is reported in Annex 2 (Annex2_Log_Pass_1.pdf)

PIU and MAG were switched on successfully using OBCP8091.
"PIU Alive" event received at 19:15:46 UTC.

First valid PIU HK data, received at 19:17:54 UTC, reported:

- Voltages: 5.13V, -5.49V, 12.55V, -12.92V, 28.99V
- Temperature: 19.24°C
- LCL current: 92mA

PIU sw patch (patch name: thePiuExeFsMn520E2prm.pch) was uploaded and successfully applied, bringing PIU sw version to 5.10 build 520.
LAP sw patch (patch name: f14_b3) was uploaded and successfully applied.

Operation of PIU was nominal during Pass-1. No anomalies where reported.

Graphs of the main PIU Housekeeping parameters during Pass-1 are reported in figure 1.

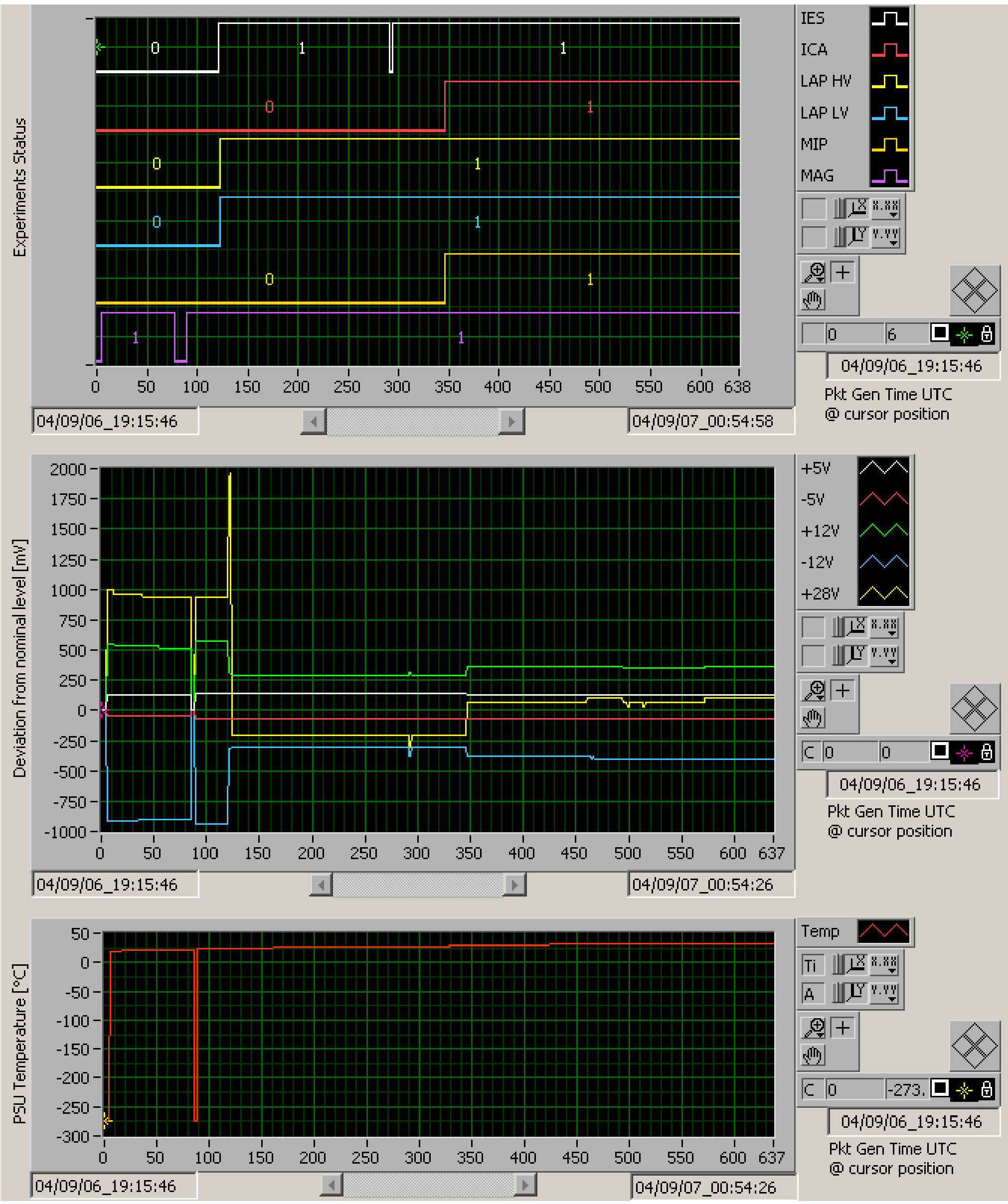


Figure 1: RPC experiments status, PIU PSU voltages and PIU PSU temperature during Pass-1.

Out-of-pass-1 & Pass-2

The timeline of the operation performed during Pass-2 is reported in Annex 3 (Annex3_Log_Pass_2.pdf)

RPC-LAP, MAG and ICA reported a loss of science data acquired during Out-of-pass 1 due to insufficient SSMM allocation.
1302 LAP science data packets, 1559 MAG science data packets and 28 ICA science data packets were lost.
Data loss corresponds to approximately 12 hours of operation (last packet's timestamp before data loss: 07/09/04_00:03:43; first packet's timestamp after data loss: 07/09/04_12:26:36).

No anomalies were found present in Out-of-pass-1 and Pass-2 PIU HK data.

Graphs of the main PIU Housekeeping parameters during Out-of-pass-1 and Pass-2 are reported in figure 2.

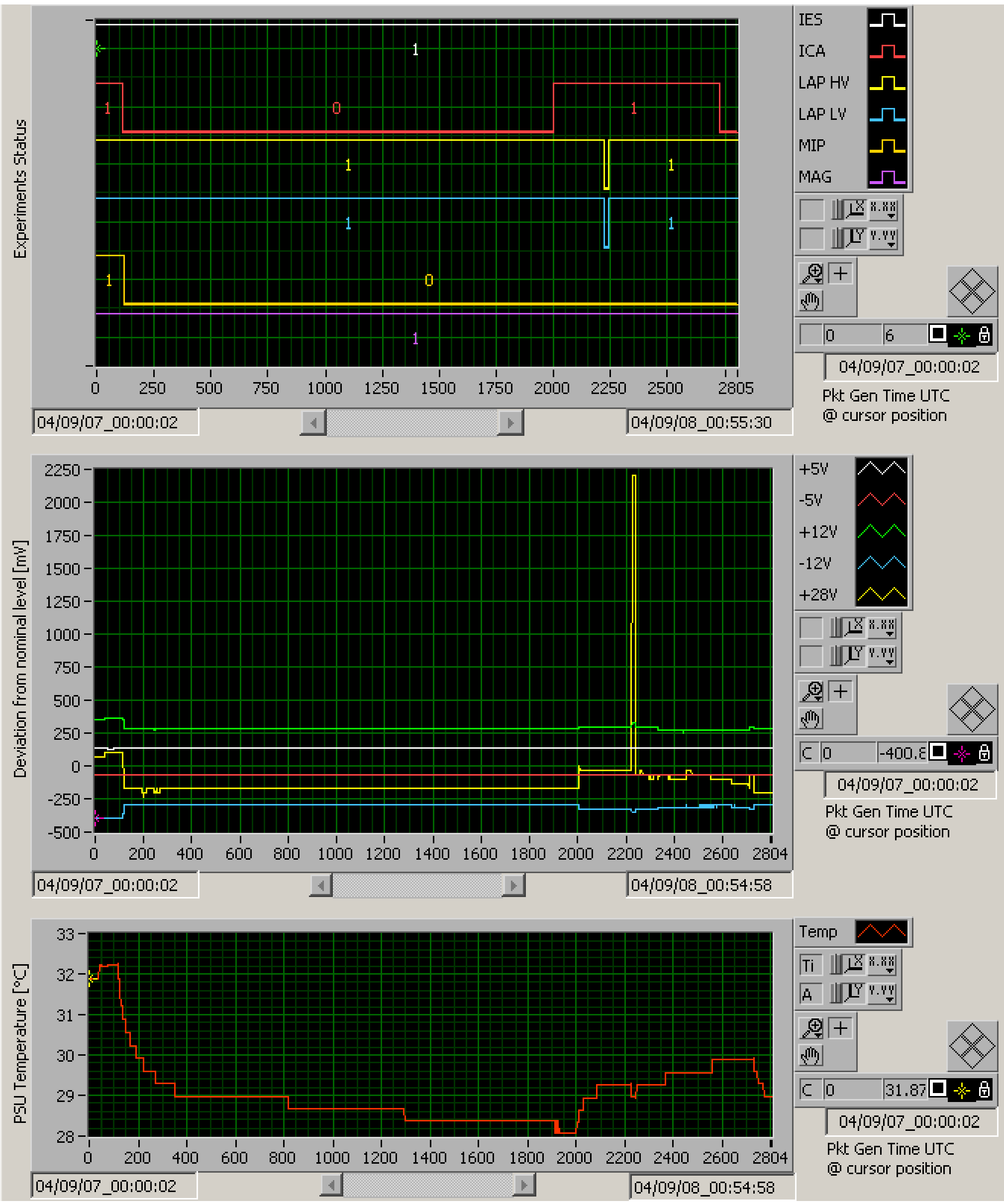


Figure 2: RPC experiments status, PIU PSU voltages and PIU PSU temperature during Out-of-pass-1 & Pass-2.

Out-of-pass-2 & Pass-3

The timeline of the operation performed during Pass-3 is reported in Annex 4 (Annex4_Log_Pass_3.pdf)

RPC LAP, MAG and IES reported a loss of science data acquired during Out-of-pass 2 due to SSMM overwriting.
362 LAP science data packets, 724 MAG science data packets and 28 IES science data packets were lost.
Data loss corresponds to approximately 3 hours of operation (last packet's timestamp before data loss: 08/09/04_00:44:50; first packet's timestamp after data loss: 08/09/04_03:58:04).

No anomalies were found present in Out-of-pass-2 and Pass-3 PIU HK data.

Graphs of the main PIU Housekeeping parameters during Out-of-pass-2 and Pass-3 are reported in figure 3.

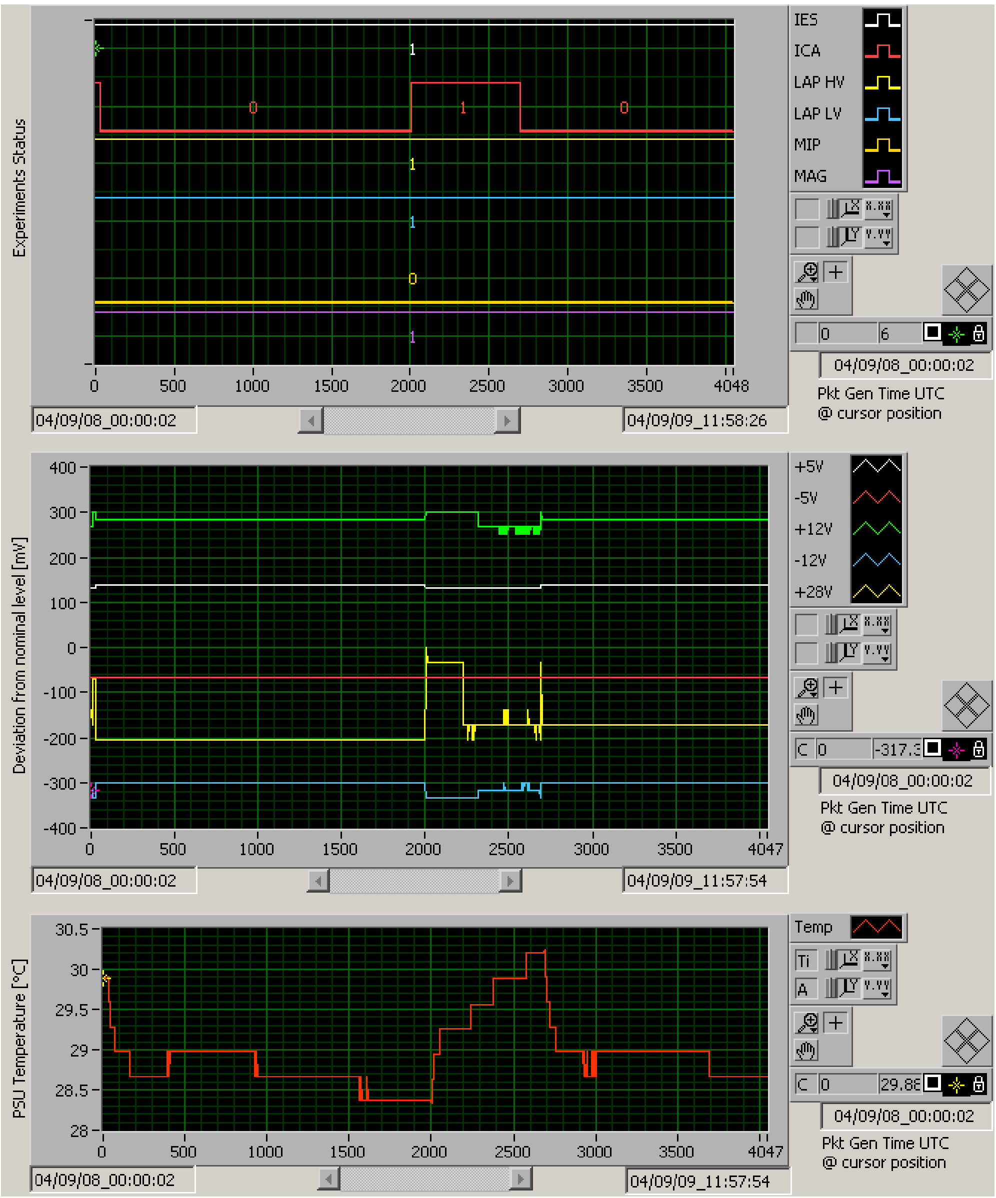


Figure 3: RPC experiments status, PIU PSU voltages and PIU PSU temperature during Out-of-pass-2 & Pass-3.

Out-of-pass-3 & Pass-4

The timeline of the operation performed during Pass-4 is reported in Annex 5 (Annex5_Log_Pass_4.pdf)

No anomalies were found present in Out-of-pass-3 and Pass-4 PIU HK data.

RPC LCL OFF received from S/C at 2:20UTC.

Graphs of the main PIU Housekeeping parameters during Out-of-pass-3 and Pass-4 are reported in figure 4.

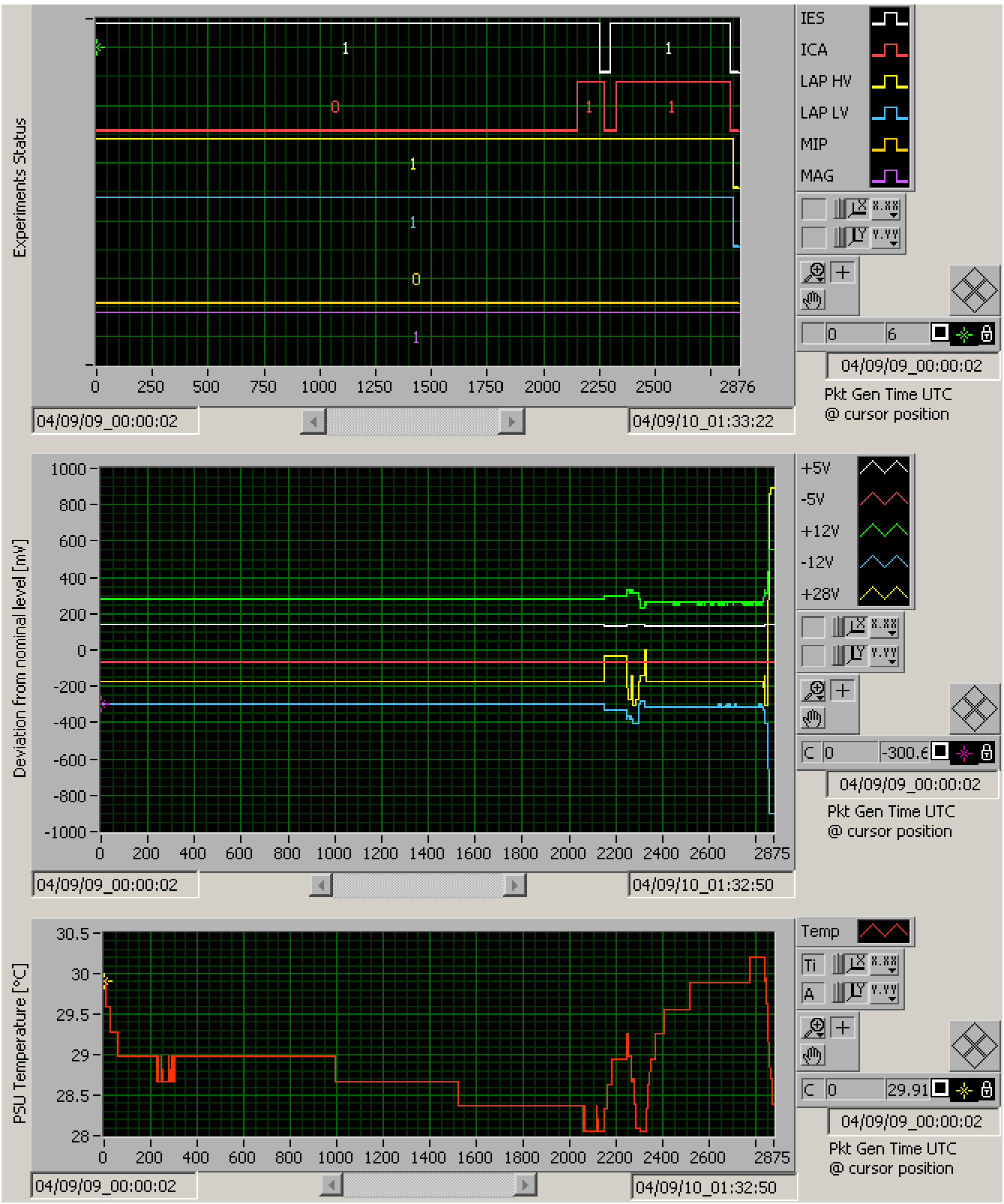


Figure 4: RPC experiments status, PIU PSU voltages and PIU PSU temperature during Out-of-pass-3 & Pass-4.

Conclusions

All objectives of PIU Commissioning Part 3 has been accomplished successfully.

RPC Commissioning Part 1 Report

Summary

The first part of the RPC Commissioning was performed during real-time passes on the nights of 17/18 and 18/19 March 2004.

During the first pass the PIU ‘Main’ side was successfully commissioned. All experiments were powered on and basic low-Voltage functionality was tested. Towards the end of the first pass the ‘redundant’ PIU was tested and an anomaly with the power supply was detected.

The second pass was used to test again the ‘main’ side PIU and all experiments, and to execute the boom deployment sequences.

Attendance

Chris Lee, Karl-Heinz Glassmeier, Andrea Diedrich, Ingo Richter, Ray Goldstein, John Hanley, Craig Pollock, Hans Borg, Hans Nilsson, Anders Eriksson, Reine Gill, Jean-Gabriel Trotignon, Jean-Louis Michau, Oezer Aydogar, Bjorn Lybekk, Chris Carr

Pass 1

Step 1.1

Sequences were executed according to the detailed sequence given in the Annex 1 ‘Step 1.1 As-Run’. The detailed timeline may be seen in the log-file (Annex 4).
The following anomalies and deviations were noted:

Step	Anomaly
0060	LAP Verification error – wrong verification parameter
0100	MIP Did not recover normal mode on link reset test (MIP to check TM)
0140	Command ZRP22135 should have EXE ACK removed (database change)
0255	Command inserted (ref to RO-RPC-VAR-005)

These anomalies are minor and the test was considered successful.

Step 1.2

Sequences were executed according to the detailed sequence given in the Annex 2 ‘Step 1.2 As-Run’. The detailed timeline may be seen in the log-file (Annex 4).

Operation of the PIU was nominal up to the point at which all experiments were powered on. After 22 minutes of operation, the current drawn from the LCL by RPC was seen to go down, with a simultaneous loss of telemetry. RPC was powered off.

After a short debug session, testing was abandoned for the rest of the pass.
Further details of this anomaly are given in the PIU report (attached, Annex 14).

Pass 1 Summary

RPC held a meeting with ESOC to discuss the situation. These notes are attached (Annex 7). These notes provide a full description of the observed anomaly and suggested course of action.

Pass 2 Special Timeline for Debug and Boom Deployment

During the second pass, the PIU 'main' side was operated successfully with the MAG experiment always on and additionally each other experiment in turn. The detailed sequence is given in Annex 3. The detailed timeline may be seen in the log-file (Annex 5).

Pass 2 Summary

The 'main' side PIU was seen to operate nominally throughout the pass. The PIU 'redundant' side was tested again. The same anomalous behaviour was observed.
A meeting was held after the pass 2 operations. The notes of this meeting are attached (Annex 8).

Conclusions

Based on the observations of the pass 1 and pass 2 testing carried out, the 'main' side PIU can be considered to be commissioned and operational. The redundant side PIU appears to have a failure which is isolated to the power supply. However, this is TBD by further investigations by Imperial College, according to the notes of the meeting on 19th March (Annex 8). All experiments have been powered on and basic post-launch integrity and functionality has been verified. High voltages have not been enabled. Further low-voltage commissioning activities for all experiments will be performed in May.

Chris Carr & Chris Lee
1st April 2004

Title **1.1 PIU Main Commissioning & EXP HW Verification**

Step	FCP Number	Description	Runtime Notes
0000	RP_FCP_001	Power Main LCL Main DPIU	
0010	RP_FCP_051	MAG on (asap to see condition of PSU)	
0015	RP_FCP_067	E2Prom Patch & Reboot in Ram (MAG auto shutdown)	
0020	RP_FCP_051	MAG on	
0030	RP_FCP_509	MAG Tm/Tc Check	
0040	RP_FCP_059	MAG Link Reset Test	
0050	RP_FCP_031	LAP on	
0060	RP_FCP_309	LAP Tm/Tc Check	Verification error - verifies for NRPD3358 to be 7 actual value should be 11.
0070	RP_FCP_041	MIP on	
0080	RP_FCP_409	MIP Tm/Tc Check	
0090	RP_FCP_900	LDL Test Slot	
0100	RP_FCP_049	MIP Link Reset Test	MIP did not recover Normal Comms Mode
0110	RP_FCP_040	MIP off	
0120	RP_FCP_039	LAP Link Reset Test	
0130	RP_FCP_021	ICA on	
0140	RP_FCP_209	ICA Tm/Tc Check	Command ZRP22135 should have EXE ACK
0150	RP_FCP_029	ICA Link Reset Test	
0160	RP_FCP_020	ICA off	
0170	RP_FCP_011	IES on	
0180	RP_FCP_109	IES Tm/Tc Check	Done in parrallel with ICA
0190	RP_FCP_019	IES Link Reset Test	
0200	RP_FCP_021	ICA on (For PSU load test)	
0210	RP_FCP_041	MIP on	
0220	RP_FCP_503	MAG Default Burst Science Mode	
0230	RP_FCP_403	MIP Default Burst Science Mode	
0240	RP_FCP_303	LAP Default Burst Science Mode	
0250	RP_FCP_203	ICA Default Burst Science Mode (use fake m	Running 203 with Mode command parameter set to 35 which starts fake mode
0255	Extra Command	ZRP21467	Command inserted (RO-RPC-VAR-005)
0260	RP_FCP_103	IES Default Burst Science Mode	
0270	RP_FCP_010	IES off	
0280	RP_FCP_020	ICA off	
0290	RP_FCP_030	LAP off	
0300	RP_FCP_050	MAG off	
0310	RP_FCP_040	MIP off	
0320	RP_FCP_051	MAG off	
0330	RP_FCP_090	PIU Tm/Tc Checks	
0340	RP_FCP_000	Power RPC off	

Title 1.2 PIU Redundant Commissioning

Step	FCP Number	Description	Runtime Notes
0000	RP-FCP-002	Power Red LCL Red DPIU	
0010	RP-FCP-051	MAG on (asap to see condition of PSU)	
0020	RP-FCP-067	E2Prom Patch & Reboot in Ram (MAG auto shutdown)	
0030	RP-FCP-051	MAG on	
0040	RP-FCP-041	MIP on	
0050	RP-FCP-031	LAP on	
0060	RP-FCP-021	ICA on	
0070	RP-FCP-011	IES on	
0080	RP-FCP-503	MAG Default Burst Science Mode	
0090	RP-FCP-403	MIP Default Burst Science Mode	
0100	RP-FCP-303	LAP Default Burst Science Mode	
0110	RP-FCP-203	ICA Default Burst Science Mode (use fake mode)	
0120	RP-FCP-103	IES Default Burst Science Mode	
0130	RP-FCP-019	IES Link Reset Test	No Telemetry - step not run
0140	RP-FCP-029	ICA Link Reset Test	No Telemetry - step not run
0150	RP-FCP-039	LAP Link Reset Test	No Telemetry - step not run
0160	RP-FCP-049	MIP Link Reset Test	No Telemetry - step not run
0170	RP-FCP-059	MAG Link Reset Test	No Telemetry - step not run
0180	RP-FCP-200	ICA Safe Mode	No Telemetry - step not run
0190	RP-FCP-100	IES Safe Mode	Deleted (RO-RPC-VAR-02)
0195	RP-FCP-300	LAP Safe Mode	No Telemetry - step not run
0200	RP-FCP-010	IES off	No Telemetry - step not run
0210	RP-FCP-040	MIP off	No Telemetry - step not run
0220	RP-FCP-069	Set to maintenance mode	No Telemetry - step not run
0230	RP-FCP-091	PIU Memory Service Test	No Telemetry - step not run
0240	RP-FCP-012	IES on in maintenance mode	No Telemetry - step not run
0250	RP-FCP-108	IES Memory Service Test	No Telemetry - step not run
0260	RP-FCP-208	ICA Memory Service Test	No Telemetry - step not run
0270	RP-FCP-308	LAP Memory Service Test	No Telemetry - step not run
0280	RP-FCP-010	IES off	No Telemetry - step not run
0290	RP-FCP-020	ICA off	No Telemetry - step not run

Title Special time line for RPC Debug

Step	FCP Number	Description	Runtime Notes
0000	RP-FCP-XXX	High rate SC LCL Hk Enable	
0010	RP-FCP-XXX	RPC LCL B On	
0020	RP-FCP-XXX	RPC LCL B Off	
0022	RP-FCP-XXX	Extreme Rate LCL sample	
0023	RP-FCP-XXX	RPC LCL B On	
0024	RP-FCP-XXX	RPC LCL B Off	
0030	RP-FCP-001	Power Main LCL Main DPIU	
0040	RP-FCP-051	MAG on	
0050	RP-FCP-XXX	Wait for temp to stabilise	
0060	RP-FCP-067	E2PROM Patch & reboot	
0070	RP-FCP-051	MAG on	
0080	RP-FCP-503	MAG Burst	
0090	RP-FCP-XXX	Wait to breath !	
0100	RP-FCP-041	MIP On	
0110	RP-FCP-XXX	Wait	
0120	RP-FCP-040	MIP Off	
0130	RP-FCP-031	LAP on	
0140	RP-FCP-XXX	Wait	
0150	RP-FCP-030	LAP off	
0160	RP-FCP-021	ICA On	
0170	RP-FCP-206	Test Mode	
0180	RP-FCP-XXX	Wait	
0190	RP-FCP-020	ICA Off	
0200	RP-FCP-011	IES On	
0210	RP-FCP-130	IES Stim mode	
0220	RP-FCP-XXX	Wait	
0230	RP-FCP-010	IES Off	
0240	RP-FCP-XXX	Boom Deployment decision	
0242	RP-FCP-031	LAP on	Inserted
0245	RP-FCP-312	LAP Deployment mode	Inserted
0250	RP-FCP-XXX	Deploy MAG boom	
0260	RP-FCP-031	LAP on	Deleted
0270	RP-FCP-312	LAP Deployment mode	Deleted
0280	RP-FCP-XXX	Deploy MIP (Upper boom) boom	
0290	RP-FCP-350	LAP End Macro	FCP number corrected to 399
0300	RP-FCP-030	LAP off	
0310	RP-FCP-041	MIP On	
0320	RP-FCP-450	MIP Active boom mode	
0330	RP-FCP-040	MIP Off	

0300	RP-FCP-030	LAP off	No Telemetry - step not run
0310	RP-FCP-050	MAG off	No Telemetry - step not run
0320	RP-FCP-090	PIU Tm/Tc Checks	No Telemetry - step not run
0330	RP-FCP-000	Power RPC off	
0340	RP-FCP-000	Power Red LCL Red DPIU	Debug step added
0350	RP-FCP-000	Power RPC off	Debug step added

chris_carr2000 (8:30:11 PM): That's great, Oezer.
rpcpiu_chrisl (9:39:20 PM): Hello all
rpcpiu_chrisl (9:39:37 PM): SC Temperatures are now available
rpcpiu_chrisl (9:39:56 PM): RPC IES SC Temp (PAY429) 48.33
rpcpiu_chrisl (9:40:14 PM): RPC IES TRPP #053 35 C
rpcpiu_chrisl (9:40:43 PM): ICA SC Temp (PAY430) 25.71 C
rpcpiu_chrisl (9:41:01 PM): ICA TRPP #056 25.7
rpcpiu_chrisl (9:41:42 PM): MAG IB STP -65.78 C
rpcpiu_chrisl (9:42:01 PM): PAY 431 MIP Probe -70 C
chris_carr2000 (9:42:06 PM): Start of playback data for EGSE connectivity test
rpcpiu_chrisl (9:42:33 PM): MIP STP #059 -66.65
rpcpiu_chrisl (9:42:49 PM): LAP2 STP -66.65 C
rpcpiu_chrisl (9:43:08 PM): LAP1 STP not showing any data
chris_carr2000 (9:43:58 PM): All exps confirm receipt of SVT playback data
rpcica_hansb (9:44:34 PM): Ica receives playback.
rpcies_johnh (9:44:56 PM): IES received playback
rpcmag_oezer (9:45:42 PM): MAG received playback
rpclap_reine (9:49:31 PM): LAP received playback data
rpcpiu_chrisl (9:52:35 PM): So is every body ready ?
chris_carr2000 (9:52:55 PM): PIU Ready
rpcmag_ingo (9:53:37 PM): MAG ready
rpcica_hansb (9:56:25 PM): ICA ready
rpcies_rayg (9:58:04 PM): IES is ready.
jeanlouis_michau (10:02:08 PM): MIP ready
rpclap_reine (10:03:00 PM): LAP Ready
rpcpiu_chrisl (10:05:19 PM): Procedure variation. The extra MAG off step spotted at step 320 should actually be MAG on in the description and RP-FCP-051 is correct. We will run this step
rpcpiu_chrisl (10:12:07 PM): Message from Mike Ludlam after I invited him to join us on line.
rpcpiu_chrisl (10:12:09 PM): ah, would love to, but have my driving test then! typical. hope all goes well. send me an email when with an update when you have time. I won't ring as it maybe distracting... m

rpcpiu_chrisl (10:12:54 PM): IES - what is the situation with your SC Thermistor ?
rpcies_johnh (10:15:55 PM): We are talking to our engineers back home. Hang on.
rpcpiu_chrisl (10:16:47 PM): PIU SC Thermistor #051 & #052 at a cosy 22.14 C
rpcpiu_chrisl (10:17:19 PM): Should actually say RPC-0 Thermistor is sitting on the top of the box
rpcpiu_chrisl (10:23:40 PM): Correction - Chris says it is actually by our reference point by our foot
rpcpiu_chrisl (10:27:34 PM): Query RMOC about high IES temp. SC Attitude not nomial with sun shinning on Experiemnt panel. RMOC will check thermal model and report
rpcpiu_chrisl (10:29:36 PM): Current IES temp is 48.3 (PAY429) and TRPP is 35 C (Redundant thermistor agree with values)
rpcies_rayg (10:32:51 PM): Re IES temperatures: Or engineers point out that the EIDB calls out 50 C

as a max operating temperature, which presumably becomes a flight rule. Can we waiver this to extend the max temp to say 55 C? What is the process to do this?
rpcpiu_chrisl (10:36:37 PM): In fact the time lines for the LAP dance are being sent up !
rpcies_johnh (10:41:47 PM): rpcies_rayg: Re IES temperatures: Or engineers point out that the EIDB calls out 50 C as a max operating temperature, which presumably becomes a flight rule. Can we waiver this to extend the max temp to say 55 C? What is the process to do this?
rpcpiu_chrisl (10:47:58 PM): RMOC Reports will start in a few minutes
rpcpiu_chrisl (10:52:53 PM): RP_FCP001 started manually
rpcpiu_chrisl (10:54:04 PM): LCL being turned on at 31 ma (nominal)
rpcpiu_chrisl (10:55:34 PM): Tm TC Enabled ; time update sent
rpcpiu_chrisl (10:55:40 PM): LCL now 61 mA
rpcpiu_chrisl (10:57:00 PM): PIU Alive event receveived
rpcpiu_chrisl (10:57:15 PM): HK Being received starting FCP051 turn on MAG
rpcpiu_chrisl (10:57:50 PM): MAG on sent as sequence
rpcpiu_chrisl (10:58:34 PM): acks comes
rpcpiu_chrisl (10:59:07 PM): Normal mode is on for MAG
rpcpiu_chrisl (10:59:27 PM): LCL is now 102 mA
rpcpiu_chrisl (11:00:27 PM): PIU HK is 23.83 C, 5.13,-5.05 12.52, -12.88, 28.93
rpcpiu_chrisl (11:00:40 PM): Further PIU Hk monitoring to be done by Chris
rpcpiu_chrisl (11:00:50 PM): First sceince packet (MAG)
rpcmag_ingo (11:02:15 PM): MAG received HK and normal mode data
rpcmag_ingo (11:02:28 PM): It looks good!
chris_carr2000 (11:03:17 PM): Receiving HK Packets on PIU EGSE
rpcpiu_chrisl (11:03:23 PM): MAG temperatures are very low but SC thermistor reports -65
rpcpiu_chrisl (11:03:59 PM): MAG data is -102.51C OB -94.56
chris_carr2000 (11:03:59 PM): PIU s/w v5.5 Build 498
rpcpiu_chrisl (11:04:37 PM): MAG team what do want to do - power off or carry on ? If we power off I would probably have to turn PIU off
rpcmag_ingo (11:04:49 PM): Carry on!
rpcpiu_chrisl (11:06:18 PM): Starting FCP062 as sequence to patch and reboot PIU (MAG will be shut down automatically)
rpcpiu_chrisl (11:06:29 PM): PIU voltages look stabke
chris_carr2000 (11:06:58 PM): PIU EGSE runtime error. Restarting
rpclap_reine (11:07:57 PM): Just commenting list says FCP067..?
rpcpiu_chrisl (11:08:19 PM): MwaN 67
rpcpiu_chrisl (11:08:26 PM): nEXT piu aLIVE EVENT RECEIVED
rpcpiu_chrisl (11:09:15 PM): Ptach address used for PIU 0xB000
rpcpiu_chrisl (11:09:31 PM): Turn MAG back on 051
rpcpiu_chrisl (11:12:34 PM): Starting 509 MAG Tm TC Check - Ingo in control !!
rpcmag_ingo (11:12:48 PM): I am checking, Oezer
rpcpiu_chrisl (11:13:03 PM): Good !
rpcmag_ingo (11:13:50 PM): We received HK packet
rpcmag_ingo (11:14:06 PM): And Normal Mode data

rpcpiu_chrisl (11:16:13 PM): Good - MAG verifications okay
chris_carr2000 (11:16:34 PM): PIU: 24.5 deg. +5.14V, -5.7, +12.6, -12.9, +28.9V
rpcmag_oezer (11:17:12 PM): MAG data is normal
chris_carr2000 (11:17:40 PM): What magnetic field do you see?
rpcpiu_chrisl (11:18:17 PM): Change to SID 5 okay and validated in HK
rpcmag_oezer (11:18:17 PM): -188 nt -78 nT 1120 nT
rpcmag_oezer (11:18:43 PM): Inboard-Outboard change!
rpcpiu_chrisl (11:18:54 PM): Okay doesnt seem to agree with the calibration in the RSDB needs to be looked at
rpcpiu_chrisl (11:19:21 PM): Change to SID4 - tell us when you see it Oezer
rpcmag_oezer (11:19:34 PM): okay
rpcmag_oezer (11:20:17 PM): IB X=22 nT Y=-200nT Z=768nT
rpcpiu_chrisl (11:20:17 PM): Clarification the RSDB MAG vector calibration seems to be wrong
rpcpiu_chrisl (11:21:21 PM): Starting to change to SID6
rpcpiu_chrisl (11:22:36 PM): Oezer could you tell me the raw Vector values in the HK packet ?
rpcpiu_chrisl (11:22:52 PM): Starting with SID3
rpcmag_oezer (11:23:07 PM): -183 nT -78 nT 1119nT
rpcpiu_chrisl (11:23:30 PM): How about the uncalibrated values ?
rpcmag_oezer (11:23:38 PM): sid 4
rpcmag_oezer (11:24:13 PM): Chris they are raw values!
rpcmag_oezer (11:24:27 PM): HK and science packet the same!
rpcpiu_chrisl (11:24:31 PM): Okay
rpcmag_oezer (11:25:52 PM): Test Mode
rpcpiu_chrisl (11:26:04 PM): Waiting to switch to Outboard
rpcpiu_chrisl (11:26:45 PM): Discussion between KHG and CC seems to indicate the MAG sensor temperatures may be real (boom stowed in shadow & difference seem as exepected)
rpcpiu_chrisl (11:27:01 PM): Okay
rpcmag_oezer (11:27:47 PM): burst mode
rpcmag_oezer (11:28:22 PM): inboard outboard change!
rpcpiu_chrisl (11:29:24 PM): MAG FCP finished
rpcpiu_chrisl (11:29:39 PM): Getting ready to do MAG link reset FCP 059
rpcmag_oezer (11:30:15 PM): normal mode
chris_carr2000 (11:31:48 PM): MAG HK B raw values:
chris_carr2000 (11:31:52 PM): FE9F
chris_carr2000 (11:31:56 PM): FE62
rpcpiu_chrisl (11:32:00 PM): Link Rest test - spuurious MAG data event receives
chris_carr2000 (11:32:01 PM): 08C1
rpcpiu_chrisl (11:32:18 PM): Reine Anders do you want to come here to do your Tm Tc check ?
rpclap_reine (11:32:34 PM): Ok
chris_carr2000 (11:32:59 PM): Note: MAG raw values as decoded by RPC EGSE
rpcmag_oezer (11:33:48 PM): IB again X=20 nT Y=-200nT Z=770 nT
rpcmag_oezer (11:34:29 PM): OB X=-174 nT Y=-77 nT Z=1119 nT
rpcpiu_chrisl (11:35:11 PM): RP-FCP-031 LAP on started

rpcmag_oezer (11:35:27 PM): OB Temp=-94°C
rpcmag_oezer (11:35:43 PM): IB Temp=-88°C
rpcpiu_chrisl (11:36:20 PM): LAP Normal Mode reached
rpcpiu_chrisl (11:37:18 PM): LAP HK looks good
chris_carr2000 (11:37:53 PM): Just been talking via the messenger to Bodo, in Beijing. He sends regards.
rpcpiu_chrisl (11:38:03 PM): FCP 309 started LAP Tm Tc check
rpcpiu_chrisl (11:38:10 PM): Bodo can watch if he wants !
chris_carr2000 (11:38:25 PM): he is going for breakfast now
chris_carr2000 (11:40:07 PM): LAP ON
chris_carr2000 (11:41:00 PM): PIU: 26.1 deg, +5.1, -5.7, +12.3, -12.4, +28.3
rpcpiu_chrisl (11:41:18 PM): Verfication for Watchd fails as predicted NRPD3306 is Disabled in the first set of verfications
rpcpiu_chrisl (11:41:36 PM): PIU Voltages looks as we expect doesnt it
chris_carr2000 (11:44:41 PM): Checking. First impression that Voltages slightly lower than we have seen before
rpcmag_ingo (11:45:51 PM): MAG voltages are okay!
rpcpiu_chrisl (11:47:04 PM): NRPD3314 shows OOL but this turns out to be an .EM parameter which should be deleted
rpcpiu_chrisl (11:51:40 PM): Verification error - verifies for NRPD3358 to be 7 actual value should be 11.
rpcpiu_chrisl (11:52:14 PM): MAG have we seen a minimum mode science packet yet ?
rpcpiu_chrisl (11:54:52 PM): Sending up LAP Macro commands stopping at ZRP23009
rpcmag_oezer (11:55:01 PM): I didn't see minumum mode!
rpcpiu_chrisl (11:55:37 PM): LCL with MAG & LAP on is 153 mA
rpcpiu_chrisl (12:00:52 AM): LAP Burst mode packets (x3) received
rpclap_anders (12:05:04 AM): First LAP sci TM: P1 apparently touches MLI, lloks like in August test
rpcpiu_chrisl (12:08:13 AM): Turn LAP to minimum mode.
rpcpiu_chrisl (12:08:34 AM): Waiting to send the last 2 LAP commands when mimnimum mode data received. LAp please inform
rpclap_anders (12:08:46 AM): LAP sci data:
rpcpiu_chrisl (12:08:54 AM): Turning on MIP FCP-041
rpcpiu_chrisl (12:10:03 AM): MIP is ion MIP HK received
rpcmag_ingo (12:11:32 AM): The packet period for the Minimum Mode MAG-SID1 is 1024s. As we switched to another mode before this period was over, there was no chance to see science data on our GSE. The commnanding ,however, was ok and verified.
chris_carr2000 (12:13:53 AM): PIU HK sees Voltages, Temperature go to zero for one packet
rpclap_anders (12:14:31 AM): P2 sweeps nominal. P1 sweeps show MLI contact. Constant bias data nominal. P1 was probe that had MLI contact in August 2003. At that time, resistance was around 400 kohm, today we see around 75 kohm.
chris_carr2000 (12:14:50 AM): PIU: 28.4 deg, 5.1, -5.7, +12.4, -12.5, +28.1
rpcpiu_chrisl (12:16:03 AM): MIP in bit of confusion over HK contents. To OOL on NRPD4358 & NRPD435E burt No OOL should be defined

rpcpiu_chrisl (12:20:25 AM): Started FCP 408
rpclap_anders (12:20:49 AM): Low TM sci packet received, looks OK
rpcpiu_chrisl (12:23:55 AM): Last 2 LAP commands sent a bit of time ago
rpcpiu_chrisl (12:28:31 AM): There is a discrepency in the RPC thermistors for MIP - reports -162C SC Thermistor reports -65 Degs C
rpcpiu_chrisl (12:55:40 AM): FCP 021 011 to be sent as sequences. IES ICA Tm Tc test will now be done in parrallell
rpcpiu_chrisl (12:56:09 AM): 021 011 have now been sent
rpcpiu_chrisl (12:56:17 AM): LCL with MIP LAP MAG 224 mA
rpcpiu_chrisl (12:57:19 AM): ICA now on
rpcpiu_chrisl (12:58:54 AM): Current with ICA 286mA
rpcpiu_chrisl (12:59:02 AM): Send IES 011 as sequence now
rpcpiu_chrisl (1:00:18 AM): IES On
rpcpiu_chrisl (1:00:32 AM): LCL Current 347mA
rpcica_hansb (1:00:43 AM): ICA Pwr ON status Ok.
rpcpiu_chrisl (1:01:49 AM): IES - power on warning events I beleive are normal - I am correct ?
rpcica_hansb (1:02:06 AM): ICA ready for FCP-209
rpclap_anders (1:02:41 AM): First paper-and-pencil calibration of LAP P2 probe sweeps give a s/c potential of 7.5 V, which is very reasonable and probably close to true. Assuming Te = 10 eV (consistent with real time ACE data), we get a density around 6 cm-3 from the slope of the probe curve on the electron side. This almost shockingly reasonable -- ACE has 4 cm-3 right now. This is so good that it must be complete nonsense!
rpcies_johnh (1:02:45 AM): Yes, we have event messages that are issued at power on.
rpcpiu_chrisl (1:03:54 AM): ICA: sending first comand (page 3)
chris_carr2000 (1:04:55 AM): PIU: 31 deg., 5.1, -5.7, +12.4, -12.4, +28.1
rpcies_johnh (1:05:00 AM): Initial IES PROM HK observed, in RESUME-PROM mode, so we look nominal thus far, plus we're ARMED so our plug was indeed pulled!!
rpclap_reine (1:06:28 AM): Could FCP 408 actually mean 409?
rpcies_johnh (1:06:42 AM): IES now executing out of EEPROM, in version 1.5. Voltage monitors look nominal: +5.06, -5.02, +12.39, -12.38
rpcpiu_chrisl (1:06:53 AM): IES can we start 109 ?
rpcica_hansb (1:08:13 AM): Next cmd.
rpcies_johnh (1:08:42 AM): Yes, we're ready to start, the warning messages you observed were nominal
rpcpiu_chrisl (1:08:52 AM): Nect ICA command gone (end of page 3)
rpclap_reine (1:09:20 AM): We are ready to run FCP_900.
rpcpiu_chrisl (1:09:32 AM): Are initial IES verifications Okay ?
rpcies_johnh (1:09:43 AM): IES temperatures: 37.2 and 37.3 deg C from instrument monitors.
rpcpiu_chrisl (1:09:52 AM): I dont think they will run 4 commands stacks in parrallel reine
rpcies_johnh (1:10:14 AM): Yes, initial IES verifications are okay.
rpcpiu_chrisl (1:10:39 AM): First command of 109 being sent
rpclap_reine (1:11:32 AM): We are ready anyway.
rpcica_hansb (1:13:41 AM): Next cmd
rpcpiu_chrisl (1:14:17 AM): ICA command sent (top of page 4)

rpcies_johnh (1:16:58 AM): IES in LVENG mode now.
rpcpiu_chrisl (1:17:39 AM): So we can send the bnext 3 accorrding to timing in the procedure
rpcies_johnh (1:17:56 AM): Go ahead.
rpcica_hansb (1:18:25 AM): Next cmd
rpcpiu_chrisl (1:20:22 AM): Hi J
rpcica_hansb (1:21:36 AM): ICA SC. data Ok.
rpcpiu_chrisl (1:21:38 AM): John looking at old procedure. We did infact send the next 3 MEM commands of IES
rpcpiu_chrisl (1:23:06 AM): ICA command has now gone ZRP22002
rpcies_johnh (1:24:25 AM): IES Memory write received and executed.
rpcica_hansb (1:25:14 AM): Next Cmd.
rpcies_johnh (1:25:35 AM): IES Memory Go received and executed
rpcies_johnh (1:26:06 AM): ies memory copy received and executed.
rpcpiu_chrisl (1:26:32 AM): Finished MIP 409 everything okay
rpcpiu_chrisl (1:28:24 AM): MIP & LAP please keep an eye on your EGSE for the execution of FCP 900
rpcpiu_chrisl (1:28:29 AM): ICA now at console
rpclap_reine (1:28:43 AM): Ok!
rpclap_reine (1:34:06 AM): Commands recived.
rpcica_hansn (1:35:40 AM): ICA temperatures read from EGSE: 31.3 and 30.8 deg C
rpcies_johnh (1:36:04 AM): ies now changed to LVCI mode
rpclap_reine (1:36:26 AM): LAP in LDL mode
rpcies_johnh (1:38:03 AM): ies data-acq-table command received and executed
rpclap_reine (1:38:36 AM): LAP GSE Sync error.
rpcies_johnh (1:39:11 AM): ies temperature at 42.5 deg C on internal monitors
rpcpiu_chrisl (1:39:42 AM): Sending next 3 Time tag commands starting
rpcpiu_chrisl (1:39:50 AM): That last message was very late sorry
rpcies_johnh (1:40:02 AM): whose commands? ies?
rpcpiu_chrisl (1:40:41 AM): Yes the ones we have agreed on which actually went a few minutes ago you should have the effect in the Tm about now
rpcpiu_chrisl (1:41:21 AM): LDL commanding got a bit muddled and the LDL mode got non synchronised - The obcp ran but did MIP LAP reach the correct mode ?
rpcpiu_chrisl (1:42:05 AM): Next ICA comand going (top of page 7)
rpclap_reine (1:42:15 AM): LAP reached LDL mode, but we seem to have a GSE length decoding error.
rpcpiu_chrisl (1:43:26 AM): IES Can we send any more commands?
rpcpiu_chrisl (1:43:41 AM): Sending next ica COMMAND
rpcica_hansn (1:44:04 AM): The ICA commands come through nice to the EGSE and can be followed, I don't just see the last one
rpcies_johnh (1:44:09 AM): ies team sees heartbeat going up by no additional commands beyond data-acq-table, so we'd like to await their receipt.
rpcpiu_chrisl (1:44:59 AM): The next one on the stack is ZRP21116 Data ACQ En. Copy previous sentence
rpcies_johnh (1:45:18 AM): Yes, that's the one we're waiting for.
rpcpiu_chrisl (1:45:43 AM): It hasnt been sent ! Shall I send it ?

rpcies_johnh (1:45:51 AM): Yes
rpcpiu_chrisl (1:46:38 AM): MIP LAP we should be in mixed? Are we and if so can I send the next commands?
rpcpiu_chrisl (1:47:28 AM): Sending next ICA command (first command on page 8)
rpclap_reine (1:47:32 AM): LAP We are in mixed, got science go ahed!
rpcpiu_chrisl (1:48:29 AM): IES tell us when you are ready to send next command (and how many)
rpcpiu_chrisl (1:49:18 AM): Sending next ICA command
rpcies_johnh (1:50:04 AM): Alright, still awaiting data-acq-en. We'd be comfortable with executing through to ies-stim-ion-en, though for the next go around
rpcies_johnh (1:50:13 AM): ies-data-acq-en just received
rpcpiu_chrisl (1:52:14 AM): IES - next 6 commands then ?
rpcies_johnh (1:52:33 AM): Yes. ies temperature monitors at 43.5 deg C
rpcies_johnh (1:53:32 AM): What are s/c readings of ies temperatures (2 temps, pay429 and TRP's)?
rpclap_reine (1:54:00 AM): LAP science still goes out of sync..it seems to be a GSE decoding problem.
rpcpiu_chrisl (1:54:18 AM): Next IES commands being sent
rpcpiu_chrisl (1:54:33 AM): Okay LAP MIP doing your Link reset tests
rpclap_reine (1:55:39 AM): Go ahed.
rpcpiu_chrisl (1:57:15 AM): Link Reset tests 049 039 sent to MTL to be executed at 2:00am
rpcies_johnh (1:58:09 AM): ies data-generate received and executed
rpcpiu_chrisl (1:59:08 AM): Next ICA command top of page 10
rpcies_johnh (1:59:28 AM): ies comm rate mode received and executed
rpcpiu_chrisl (2:00:15 AM): SC PIU Temp TRPP 22.14 C
chris_carr2000 (2:01:01 AM): PIU Internal Temperature monitor 34 deg
jeanlouis_michau (2:01:05 AM): MIP looks OK
chris_carr2000 (2:01:16 AM): Levelled out, with all experiments powered on
rpcpiu_chrisl (2:01:50 AM): IES OAY 429 Temp is 50 Deg C
rpcpiu_chrisl (2:02:17 AM): IES TRPP #53 35 deg C
rpcpiu_chrisl (2:03:22 AM): IES Temp Monitor say NRPD1M41 M42 read 91.76 degC
rpcies_johnh (2:03:43 AM): ies stim elc adj, ies stim elc en, ies stim ion adj, ies stim ion en, received and executed
rpcpiu_chrisl (2:04:21 AM): Can we send any more yet ?
rpcies_johnh (2:04:28 AM): That NRPD1M41 number looks out of whack with our same telemetry point. I'm thinking our MUX calculation is not working well.
rpcpiu_chrisl (2:04:54 AM): MIP Link did not recover from the link reset yet - Rx timeout events occurring
rpcies_johnh (2:05:08 AM): Yes, send the ies safety commands (3 of them)
rpcies_johnh (2:06:50 AM): ies team sees stim data in its science telemetry
rpcpiu_chrisl (2:08:15 AM): IES - your next 3 commands being sent
jeanlouis_michau (2:08:32 AM): No MIP science, only HK
rpcpiu_chrisl (2:08:54 AM): Yep - it didnt recover from doing a HW reset of the link.
rpcpiu_chrisl (2:09:11 AM): Switch MIP off (as in procedure) and will repower you on again
jeanlouis_michau (2:09:28 AM): OK
rpcpiu_chrisl (2:10:37 AM): Running step 210, 220,240

rpcpiu_chrisl (2:11:29 AM): Next ICA command (top page 11)
rpcpiu_chrisl (2:13:07 AM): MIP Back on - setting to burst mode step 403
rpcies_johnh (2:14:22 AM): ies-safety-amb-set, ies-safety-thresh-elc, ies-safety-thresh-ion all received and executed.
rpcpiu_chrisl (2:14:49 AM): Can we execute last two commands ?
rpcies_johnh (2:15:16 AM): We'd like to do the watchdog command by itself first and confirm its execution before doing the last one.
rpclap_reine (2:15:22 AM): LAP is not yet in default burst.
rpcpiu_chrisl (2:15:31 AM): Okay LAP
rpcpiu_chrisl (2:15:46 AM): IES - does one of you want to come to the console
rpcies_johnh (2:15:56 AM): I'll be right there.
rpcpiu_chrisl (2:16:16 AM): Next ICA Command (top of page 12)
rpcpiu_chrisl (2:18:02 AM): Second from last IES command being sent
rpclap_reine (2:18:08 AM): LAP Burst mode
rpcpiu_chrisl (2:18:49 AM): Good
jeanlouis_michau (2:20:03 AM): MIP in burst mode
rpcpiu_chrisl (2:20:21 AM): Senidng last IES command of step 180 IES Reset
rpcpiu_chrisl (2:21:08 AM): IES PIU Link Error received - nominal
rpcpiu_chrisl (2:21:26 AM): FCP 109 completed successsfully
rpcies_johnh (2:21:37 AM): Great!
rpcpiu_chrisl (2:21:40 AM): ICA command sent (top of page 13)
rpcpiu_chrisl (2:21:59 AM): IES will do link reset test
rpcies_johnh (2:22:50 AM): ies-watchdog-ctrl confirmed here at egse
rpcies_johnh (2:24:21 AM): ies reset confirmed here at egse
rpcpiu_chrisl (2:24:34 AM): IES in the current mode can we switch you to burst mode ?
rpcpiu_chrisl (2:24:52 AM): IES generates alot of PIU link error events but TM is regained
rpcpiu_chrisl (2:25:19 AM): Next ICA command sent (top of page 14)
rpcpiu_chrisl (2:29:44 AM): ica pay430 tEMP 29.29
rpcpiu_chrisl (2:29:58 AM): ica #056 trpp 25.71
rpcpiu_chrisl (2:30:15 AM): ies pay 429 tEMP 50
rpcpiu_chrisl (2:30:59 AM): ies TRPP #53 35 deg C
rpcpiu_chrisl (2:31:29 AM): PIU TRPP 22.14
rpcpiu_chrisl (2:34:31 AM): IES your TRPP has pass the soft limit and now is above 50 deg.(51.67) Okay to carry on ?
rpclap_anders (2:35:09 AM): LAP science news: Refined analysis, using a computer instead of a ruler and some software instead of my brain, confiims the suspicion that the nice density estimate previously reported indeed was nonsense. It seems we need to deploy the booms after all!
rpcpiu_chrisl (2:35:42 AM): IES Confirm it is okay to carry on over soft limit
rpcpiu_chrisl (2:38:52 AM): ica CAOMMAND top of page 16
rpcies_johnh (2:39:46 AM): ies team says yes to carry over on soft temperature limit
rpcpiu_chrisl (2:41:00 AM): Send ing next 5 ICA commands
rpcpiu_chrisl (2:42:09 AM): IES I think the definition of NRPD1m41 &42 is wrong as it varies between sensible temperatures and something very large

rpcies_johnh (2:44:29 AM): Agreed regarding the NRPD1M41/42.
rpcpiu_chrisl (2:45:28 AM): Sending resume moide command
rpcpiu_chrisl (2:48:26 AM): IES ins now LVSCI can I send the Burst mode procedure (103)
rpcies_johnh (2:48:45 AM): Go ahead with burst mode procedure
rpcies_johnh (2:50:21 AM): Regarding the soft limit once again, you wrote that TRPP exceeded 50 deg C, yet a few lines above, the TRPP is 35 deg C. Did you mena that PAY429 was exceeding 50 deg C?
rpcies_johnh (2:58:49 AM): ies-data-acq-table, ies-data-acq-en, ies-data-generate-en, ies-comm-rate-mode received and executed
rpcpiu_chrisl (2:59:44 AM): jOHN STILL LOOK AT TEMP
rpcpiu_chrisl (2:59:54 AM): ICA command sent top of page 20
rpcies_johnh (3:00:19 AM): ies monitor temps are at 46 deg C, so still within allowable range.
rpcpiu_chrisl (3:00:44 AM): IES PAY249 Temp is 51.67
rpcpiu_chrisl (3:06:17 AM): ICA command failure ZRP22315 exe ack not received. Command reboots and thus should not produce an Exe ack)
rpcies_johnh (3:08:38 AM): ies team sees burst science data (though all null)
rpcpiu_chrisl (3:19:08 AM): ICA getting to final commands
rpcpiu_chrisl (3:37:06 AM): Previous PIU RTP Values have been wrong. The current value is now 28.57 deg C
rpcpiu_chrisl (3:40:54 AM): Last ICA command from 209 sent
rpcpiu_chrisl (3:43:04 AM): Per forming link reset on ICa step 0150
rpcpiu_chrisl (3:46:09 AM): Link Reset test succeeded missing steps 160 and 200
rpcpiu_chrisl (3:49:15 AM): ICA DPU reaches soft temp limit of 35 - should be a al imit of 50
rpcpiu_chrisl (3:49:36 AM): Running 203 with Mode command set to 35 which starts fake mode
rpcpiu_chrisl (3:52:09 AM): LCL current 337mA
rpcpiu_chrisl (3:57:16 AM): Turn all instruments off
rpcpiu_chrisl (3:58:29 AM): Ingo can you report this spurrious signal that you are seeing ?
rpcpiu_chrisl (4:01:18 AM): PAY420 IES Temp 51.676
rpcpiu_chrisl (4:01:32 AM): #053 TRRP IES Temp 39
rpcies_craigp (4:02:41 AM): Good. PAY420 IES Temp unchanged since last report.
rpcpiu_chrisl (4:03:16 AM): Start step 0330 PIU Tm Tc test
rpclap_reine (4:05:49 AM): LAP is OFF
rpcies_craigp (4:06:33 AM): IES is OFF.
rpcmag_ingo (4:06:48 AM): At the beginning of the data aquisition we see a 1.4 Hz and a 9 Hz peak in the burst data.
rpcmag_ingo (4:07:10 AM): MAG was off and is on again
chris_carr2000 (4:08:36 AM): PIU Alive v5.5 Build 498
rpcmag_ingo (4:09:52 AM): MAG seems to be off
chris_carr2000 (4:10:43 AM): MAG is off
rpcpiu_chrisl (4:21:02 AM): PIU Tm/Tc is complete turning off main side
rpcpiu_chrisl (4:21:23 AM): Next stage is redudnant side - what is the situation with LAP ?
rpcpiu_chrisl (4:21:54 AM): Stage 1.2 PIU Redundant
rpclap_reine (4:22:34 AM): We are off
rpclap_reine (4:23:03 AM): And ready for redundant

rpcpiu_chrisl (4:25:29 AM): EPROOM Patch parameter is set to 0xB000 for PIU
rpcmag_ingo (4:28:00 AM): The analysis of MAG burst data at a later time showed that there were frequency peaks at 0.8 Hz 0.9 Hz and 9.5 Hz.
rpcpiu_chrisl (4:28:28 AM): ICA Burst Mode (203) set with fake value in parameter (35)
rpcpiu_chrisl (4:29:52 AM): Starting by switching on Redundant LCL
rpcpiu_chrisl (4:31:24 AM): REdundnat LCL on at 0.035A Now at 72 mA with DPIU on
rpcpiu_chrisl (4:32:07 AM): Redundnat DPIU on
rpcpiu_chrisl (4:33:17 AM): PIU Temp shows 1180 deg C when MAG is not on
rpcpiu_chrisl (4:33:54 AM): PIU Voltages look fine - starting the main steps
rpcpiu_chrisl (4:34:22 AM): LCL draws 103mA with MAG on
rpcpiu_chrisl (4:36:57 AM): MAG showed a NO Normal Mode event initially before starting up then showed Normal Mode
rpcpiu_chrisl (4:37:09 AM): LAP ICA MIp MAG on
rpcmag_ingo (4:37:17 AM): MAG is on again. HK frames are sent
rpcpiu_chrisl (4:38:48 AM): IES on again Normal Link status acheived.
chris_carr2000 (4:38:53 AM): PIU: 31.6 deg. 5.15, -5.4, 12.5, -12.8, +29.2
rpclap_reine (4:39:52 AM): LAP HK Recived
rpcpiu_chrisl (4:40:01 AM): LCL 339mA with all instruments powered
chris_carr2000 (4:41:35 AM): Seen 2 more packets when the PIU analogue parameters go to zero
rpcica_hansb (4:41:54 AM): ICA HK received.
rpcpiu_chrisl (4:42:22 AM): Does it look like there is no data in them ?
rpcies_johnh (4:42:24 AM): 04:41 ies hk received at egse
chris_carr2000 (4:42:35 AM): yes
rpclap_reine (4:43:56 AM): LAP Default Burst Mode
rpcpiu_chrisl (4:43:59 AM): I dont see drop out on the EGSE here
rpcies_johnh (4:44:02 AM): 04:42 ies is executing from eeprom v1.5
rpcpiu_chrisl (4:45:46 AM): Adding LAP safe mode at step 175 and removing IES safe mode at step 190
rpcies_johnh (4:46:41 AM): 04:45 All ies FCP_103 commands received. ies temperatures reading 42 deg C
rpcpiu_chrisl (4:48:44 AM): Waiting to see at what level PIU PSU temperature stabilises
rpclap_bjorn (4:52:11 AM): No telemetry data
rpcies_johnh (4:53:40 AM): No ies telemetry either.
rpcpiu_chrisl (4:55:55 AM): No Tm on Scoos 2000
rpcpiu_chrisl (4:56:12 AM): Trying a ping command to see if any thiong happens
rpcpiu_chrisl (4:58:43 AM): Shut LCL with FCP 000
rpcpiu_chrisl (4:59:21 AM): RPC is off
rpcpiu_chrisl (5:47:45 AM): RPC is off
rpcpiu_chrisl (5:48:35 AM): WIll start by turning on PIU and then MAG and waiting
rpcpiu_chrisl (5:48:39 AM): Start FCP 002
rpcpiu_chrisl (5:53:16 AM): Current goes to i240mA asked for quick shut down
rpcpiu_chrisl (6:14:34 AM): Powering on LCL briefly to see if the LCL will boot up at 30mA to try and isolate the fault.
rpcpiu_chrisl (6:14:55 AM): RMOC is setting the SC HK rate to fastest rate possible (1Hz)#

rpcpiu_chrisl (6:15:23 AM): LCL on & off comands will be space at about 10 seconds appart
rpcpiu_chrisl (6:18:20 AM): LCL on at 06:20 and off 10 secs later
rpcpiu_chrisl (6:22:08 AM): LCL current increases to 240mA

rpcies_craigp (12:27:24 AM): test
rpcpiu_chrisl (12:27:31 AM): goog to be back
rpcmag_ingo (12:28:45 AM): :D
rpcpiu_chrisl (12:34:32 AM): Turning on Main LCL
rpcpiu_chrisl (12:36:02 AM): Current level nominal at 31mA (sometimes a digit higher)
rpcmag_oezer (12:36:10 AM): good
rpcpiu_chrisl (12:37:35 AM): Turning on PIU
rpcpiu_chrisl (12:38:03 AM): DPIU current nominal
rpcpiu_chrisl (12:38:08 AM): 71mA
rpcmag_oezer (12:38:09 AM): good
rpcmag_oezer (12:38:39 AM): :)
rpcpiu_chrisl (12:39:00 AM): MAG being turned on
rpcpiu_chrisl (12:40:40 AM): MAG on LCLC current 102mA (nominal)
rpcmag_oezer (12:41:13 AM): ;)
rpcpiu_chrisl (12:41:26 AM): PIU Voltage 5.13,-5.05,12.5,-12.9,28.9
rpcpiu_chrisl (12:41:40 AM): PIU Temp 23.8 deg C
rpclap_bjorn (12:41:46 AM): PIU HK arrived
chris_carr2000 (12:42:18 AM): The PIU Figures yesterday were: rpcpiu_chrisl (11:00:27 PM): PIU HK is 23.83 C, 5.13,-5.05 12.52, -12.88, 28.93
chris_carr2000 (12:42:34 AM): i.e. the same
rpcpiu_chrisl (12:42:48 AM): good
rpcmag_oezer (12:43:32 AM): yes
rpcpiu_chrisl (12:43:37 AM): How long shall we wait for the temp to stabilise
chris_carr2000 (12:44:16 AM): now receiving PIU packets from DDS
rpcmag_ingo (12:44:38 AM): MAG receives HK packets
rpcmag_oezer (12:44:45 AM): HK packet okay
rpcmag_oezer (12:46:10 AM): Normal Mode science data okay!
rpcmag_ingo (12:46:15 AM): let's wait 30 minutes for stabilizing temperatures
rpcpiu_chrisl (12:50:50 AM): MAG has the same field and same temperatures as yesterday
rpcmag_oezer (12:51:00 AM): correct
rpcmag_oezer (12:52:19 AM): revV=2.5V, OBTemp=-98'C IBTemp=-92'C 5VA=5.079V -5VA=-5.11V
rpcmag_oezer (12:52:55 AM): -5VA=-5.011V
rpcpiu_chrisl (12:53:57 AM): LCL current stilll stable
rpcpiu_chrisl (12:54:35 AM): MAG team - I need to repatch my software and reboot MAG will be breifly off for a minute - can I proceed now with this process ?
rpcmag_ingo (12:54:56 AM): yes, do so
rpcpiu_chrisl (12:56:02 AM): Starting to patch and reboot
rpcpiu_chrisl (12:57:43 AM): PIU Rebooted LCL current back to 71mA
rpcpiu_chrisl (12:57:49 AM): MAG being swithc back on
rpcmag_ingo (12:58:04 AM): MAG receives data
rpcpiu_chrisl (12:59:07 AM): MAG back on
rpcpiu_chrisl (12:59:18 AM): LCL current baqck to 102 mA

rpcmag_ingo (12:59:59 AM): Mag gets new data
rpcpiu_chrisl (1:01:08 AM): HOw are PIU voltages ?
chris_carr2000 (1:01:54 AM): waiting for data
rpcpiu_chrisl (1:01:56 AM): What Tm mode is MAG in ?
rpcmag_ingo (1:02:17 AM): 5.0794V,-5.01135V --- MAG in normal mode
rpcpiu_chrisl (1:02:44 AM): Okay I will switch you to burst - every vevtor is precious.....
rpcmag_ingo (1:02:56 AM): thank you
rpcpiu_chrisl (1:03:09 AM): My pleasure
rpcpiu_chrisl (1:03:28 AM): oops...bitte schooon
chris_carr2000 (1:03:33 AM): voltages back
chris_carr2000 (1:04:06 AM): 5.1 -5.7 12.6 -12.9 28.9
chris_carr2000 (1:04:15 AM): 25 deg.
rpcpiu_chrisl (1:05:01 AM): Voltages have changed since the reboot
chris_carr2000 (1:05:05 AM): correction: -5.1
rpcpiu_chrisl (1:05:21 AM): Phew but still slight change
rpcmag_ingo (1:05:23 AM): MAG voltages stable
rpcmag_ingo (1:05:50 AM): MAG still in normal mode
rpcmag_ingo (1:07:44 AM): MAG now in burst mode
rpcpiu_chrisl (1:09:13 AM): The MAG HK Vector field had a bit of step change before and after the patch & reboot sequence - is this normal ?
rpcpiu_chrisl (1:10:04 AM): Chris are you seing a trend in the temperature
chris_carr2000 (1:10:13 AM): yes
chris_carr2000 (1:10:16 AM): up
chris_carr2000 (1:10:19 AM): slowly
rpcpiu_chrisl (1:10:28 AM): Not getting flatter yet ?
chris_carr2000 (1:10:27 AM): going up too slow to tell really
chris_carr2000 (1:10:49 AM): looks like will level out about 27 to 28
rpcmag_ingo (1:11:33 AM): MAG shows normal behaviour.
jeanlouis_michau (1:15:24 AM): MIP ready
rpcpiu_chrisl (1:16:09 AM): MIP Power on Sequence being prepared
rpcpiu_chrisl (1:16:48 AM): MIp On sent
rpcpiu_chrisl (1:18:29 AM): MIP ON LCL current 163mA
rpcpiu_chrisl (1:19:00 AM): LCL current showing variation but this has been seen during EMC
jeanlouis_michau (1:21:13 AM): MIP receives data
rpcpiu_chrisl (1:21:41 AM): MIP LCL current varies between 184mA and 133mA
chris_carr2000 (1:21:43 AM): PIU: 26.4 deg. C.
chris_carr2000 (1:22:03 AM): that's quite a big variation...
rpcpiu_chrisl (1:22:13 AM): IES TRP at 35
rpcpiu_chrisl (1:22:24 AM): IES PAY429 48.33
rpcies_craigp (1:22:37 AM): same as yesterday
jeanlouis_michau (1:22:43 AM): MIP temp : -99.62 C !!!
rpcpiu_chrisl (1:22:46 AM): Yes but as expected
chris_carr2000 (1:23:06 AM): PIU: +5.1 -5.1 +12.8 -13.1 +29.4

jeanlouis_michau (1:25:09 AM): MIP expects to have the same temp as measured by the S/C
rpcpiu_chrisl (1:25:44 AM): Yes - perhaps your calibration is not good - it is the same as yesterday
rpcpiu_chrisl (1:26:07 AM): Or it is passed the edge of the calibration
jeanlouis_michau (1:27:29 AM): I don't think so. TBC
rpcpiu_chrisl (1:27:48 AM): Lets look at the raw values afterwards
rpcpiu_chrisl (1:28:10 AM): MIP has been on for almost 15 minutes - I will start powering it down
jeanlouis_michau (1:28:48 AM): All other param seems OK
rpcpiu_chrisl (1:29:45 AM): MIP off
rpcpiu_chrisl (1:29:57 AM): Will wait abit before starting LAP
rpclap_reine (1:30:15 AM): LAP standing by.
rpcpiu_chrisl (1:30:24 AM): LCL has returned to 102mA
rpcpiu_chrisl (1:31:25 AM): Hows PIU ?
chris_carr2000 (1:32:10 AM): Fine
rpcpiu_chrisl (1:32:20 AM): Temp levelled out ?
chris_carr2000 (1:32:21 AM): Still see MIP on here
rpcpiu_chrisl (1:32:57 AM): Turning LAP on seuence sent
chris_carr2000 (1:33:04 AM): No, was going up after MIP on
jeanlouis_michau (1:33:51 AM): End of data for MIP
rpcpiu_chrisl (1:33:59 AM): LAP on
rpcpiu_chrisl (1:34:09 AM): LCL Current 163mA
chris_carr2000 (1:34:15 AM): PIU: Voltages back to pre-MIP values
chris_carr2000 (1:34:33 AM): PIU: 27.2 deg. C.
rpcpiu_chrisl (1:36:52 AM): LAP LCL is stable
rpclap_reine (1:37:11 AM): LAP HK recived
chris_carr2000 (1:37:40 AM): PIU: 27.5 deg. C.
rpclap_reine (1:37:51 AM): LAP Temperature on top of op-amplifier 30.7 degrees
chris_carr2000 (1:38:42 AM): PIU: +5.1 -5.1 +12.3 -12.4 +27.7
rpcpiu_chrisl (1:39:09 AM): LAP off procedure sent
rpcpiu_chrisl (1:40:17 AM): LAP Off
rpcpiu_chrisl (1:40:29 AM): ICA ready - will wait 5 mins before power on
rpcpiu_chrisl (1:40:42 AM): LCL current returns to 102mA
rpclap_reine (1:43:31 AM): LAP Temperature series 30.8 30.9 31.0 31.1 31.2 31.3 31.4 31.5 31.6 31.7 31.8
chris_carr2000 (1:43:37 AM): PIU: 27.8 deg. C.
rpcpiu_chrisl (1:44:19 AM): ICA Ready ?
rpcpiu_chrisl (1:44:26 AM): ICA On sequence sent
rpcica_hansb (1:44:32 AM): Yes
chris_carr2000 (1:45:20 AM): PIU: Voltages back to pre-LAP (MAG only) values
rpcpiu_chrisl (1:45:27 AM): Good
rpcpiu_chrisl (1:45:46 AM): ICA on
rpcpiu_chrisl (1:45:58 AM): 163mA LCL currenrt
rpcmag_khg (1:46:00 AM): ChrisL, I feel that you are doing a great job !!!!
chris_carr2000 (1:46:53 AM): I agree with the new Yahoo user from the MAG experiment!

rpcica_hansb (1:47:25 AM): :) Like wise
chris_carr2000 (1:47:39 AM): =D>
rpcpiu_chrisl (1:47:57 AM): How do I blush ?
rpcmag_ingo (1:48:01 AM): :o)
chris_carr2000 (1:48:07 AM): :">
rpcpiu_chrisl (1:48:48 AM): ICA LCL current look stable , just started fake mode
rpcica_hansb (1:49:00 AM): HK seen
chris_carr2000 (1:49:51 AM): PIU: +5.1 -5.1 +12.4 -12.4 +29.5
rpcica_hansb (1:51:27 AM): Was test-mode command sent ?
rpcpiu_chrisl (1:52:20 AM): Yes but a bit late
chris_carr2000 (1:53:22 AM): PIU: 28.1 deg. C.
rpcica_hansb (1:53:31 AM): Sc. data seen
rpcpiu_chrisl (1:54:39 AM): ICAI LCL current very stable
rpcica_hansb (1:54:48 AM): ICA satisfied.
rpcpiu_chrisl (1:54:59 AM): I will turn ICA off after 10 minutes - is that okay ?
rpcica_hansb (1:55:10 AM): Yes
rpcpiu_chrisl (1:57:50 AM): Turning off ICA
rpcpiu_chrisl (1:58:28 AM): ICA Offf
rpcpiu_chrisl (1:58:48 AM): Will tunr IES on in about 5 minutes
rpcies_craigp (1:58:57 AM): ies is ready
rpcpiu_chrisl (1:59:00 AM): LCLC current returns to 102mA
chris_carr2000 (2:02:35 AM): PIU: 28.4
rpcpiu_chrisl (2:02:44 AM): Temp I take it
rpcies_johnh (2:02:48 AM): When will FCP-130 be issued relative to ies on?
chris_carr2000 (2:02:49 AM): yes
rpcpiu_chrisl (2:03:03 AM): What is your requirement?
rpcpiu_chrisl (2:03:35 AM): PIU TRPP 25 deg C
rpcies_johnh (2:03:50 AM): I think the timeline is okay, your best bet is to issue when you see ies mode as LVSCI
rpcpiu_chrisl (2:03:59 AM): Okay
rpcpiu_chrisl (2:04:29 AM): IES On being sent
rpcpiu_chrisl (2:05:00 AM): Commands sent
chris_carr2000 (2:05:05 AM): PIU Voltages back to pre-ICA values
rpcpiu_chrisl (2:05:29 AM): LCL current at usual PIU+MAG level of 102mA
rpcpiu_chrisl (2:05:55 AM): IES on
rpcpiu_chrisl (2:06:51 AM): IES LCL current starts at 153 deg C
rpcpiu_chrisl (2:07:05 AM): and then gooes to 163 deg C
rpcies_johnh (2:07:13 AM): Did you mean mA?
chris_carr2000 (2:07:14 AM): are you sure?
rpcpiu_chrisl (2:07:40 AM): yes mA - dough !
chris_carr2000 (2:08:02 AM): PIU: 28.1 deg. C. (lower)
rpcpiu_chrisl (2:08:07 AM): Starting STIm procedure
rpcies_johnh (2:08:18 AM): I take it you saw the LVSCI?

rpcpiu_chrisl (2:08:25 AM): yup
rpcies_johnh (2:09:34 AM): ies team sees HK TM on its egse
chris_carr2000 (2:12:03 AM): PIU: +5.1 -5.1 +12.3 -12.3 +29.9
rpcies_johnh (2:14:06 AM): ies monitors read: +5.08, -5.02, +12.33, -12.26, T1=37.54 deg C, T2=37.65 deg C
rpcies_johnh (2:15:16 AM): ies command rejected due to commanding it to LVSCI when it is already in this mode. This is not a problem.
rpcies_johnh (2:15:31 AM): ies science data observed with stim active - looks nominal
rpcpiu_chrisl (2:16:15 AM): IES TRRP 35
rpcpiu_chrisl (2:16:31 AM): IES PAY429 48.33
chris_carr2000 (2:17:37 AM): PIU: 28.7 deg. C. (higher)
rpcpiu_chrisl (2:18:20 AM): I think the IES power draw is slightly higher as it quantisation noise is less
rpcpiu_chrisl (2:18:28 AM): IES Off being sent
rpcica_hansb (2:18:49 AM): A @};- to everybody.
rpcies_johnh (2:18:53 AM): Don't understand your power draw statement
rpcpiu_chrisl (2:19:19 AM): IES Power off
rpcpiu_chrisl (2:19:33 AM): Current back to PIU MAG levels 102mA
rpcpiu_chrisl (2:20:28 AM): Can everybody come to the console now
rpcpiu_chrisl (2:43:19 AM): Moving the LAP on procedures to before the boom deployment
rpcpiu_chrisl (2:51:18 AM): Turn on LAP procedure being sent
rpcpiu_chrisl (2:52:54 AM): LAP on
chris_carr2000 (2:53:08 AM): PIU: 28.4 deg. C.
rpcpiu_chrisl (2:53:11 AM): Reine when can I send the mode command?
rpcpiu_chrisl (2:53:19 AM): LCL 0.163
rpcpiu_chrisl (2:53:25 AM): 163mA
rpclap_reine (2:53:58 AM): We are ready
rpcpiu_chrisl (2:57:18 AM): LAP Tell us when you are in the correct mode
rpclap_reine (2:57:30 AM): LAP HK recived
chris_carr2000 (2:58:47 AM): PIU: +5.1 -5.1 +12.3 -12.3 +27.7
chris_carr2000 (2:59:19 AM): same as before
rpclap_reine (3:01:02 AM): LAP is in Correct Mode
rpcpiu_chrisl (3:01:03 AM): Reine are you in the correct mode ?
rpcpiu_chrisl (3:01:08 AM): Okay
rpcpiu_chrisl (3:01:17 AM): Telling Mark to proceed
rpclap_reine (3:02:47 AM): We have realtime science looks as expected.
rpcpiu_chrisl (3:02:55 AM): Good
chris_carr2000 (3:03:37 AM): Chris: any change in LCL with this LAP mode?
rpcpiu_chrisl (3:04:08 AM): LAP current went down with mode change (153mA)
rpcpiu_chrisl (3:04:19 AM): Anders says this is expected for this mode
rpcpiu_chrisl (3:05:23 AM): Pyro comands being sent
rpcpiu_chrisl (3:07:53 AM): Pyro fire command sent
rpcpiu_chrisl (3:09:02 AM): Can see Pyro in the rates
rpclap_reine (3:10:16 AM): LAP Sensor 2 about 34 nA current

rpcpiu_chrisl (3:11:25 AM): Redundant Pyro fires
rpclap_reine (3:12:21 AM): Looking for pyros..
rpcpiu_chrisl (3:12:34 AM): They are on the SC
rpcmag_ingo (3:13:29 AM): MAG sees PYros
rpcpiu_chrisl (3:13:42 AM): Was it cold out at the SC ?
rpclap_anders (3:16:45 AM): No obvious pyro signature in LAP data
rpcpiu_chrisl (3:29:43 AM): Boom deployment commands being prepared
rpcpiu_chrisl (3:31:18 AM): MTL loaded for 3:35:00
rpcpiu_chrisl (3:32:22 AM): Motor start at 3:35:40
rpcpiu_chrisl (3:35:51 AM): Motoro running (we hope)
rpcmag_ingo (3:36:09 AM): we hope also
rpcpiu_chrisl (3:42:21 AM): Apparently the boom is now deployed
rpcmag_ingo (3:42:36 AM): MAG sees dramatically changing fields -as expected
rpclap_reine (3:44:22 AM): LAP current has dropped about 2 nA
rpcpiu_chrisl (3:45:26 AM): Still awaiting Power of of Boom motors
rpclap_anders (3:46:00 AM): Our probe current dropped from 34 nA to 32 nA -- not very dramatic. You can fold in the boom again!
rpcpiu_chrisl (3:49:33 AM): Motors off
rpclap_reine (3:52:49 AM): Current on sensor 1 has gone positive.
rpclap_reine (3:53:32 AM): No it hasn't plot error.
rpcpiu_chrisl (4:01:09 AM): Pyro commansd being sent
rpclap_reine (4:02:45 AM): What time did u fire pyros.
rpcpiu_chrisl (4:03:25 AM): Just arming them at the moment - firing is 8 commands away
rpcpiu_chrisl (4:04:45 AM): Pyro fired
rpclap_reine (4:08:56 AM): LAP Sees pyro signature
rpcpiu_chrisl (4:13:27 AM): Boom to be deployed at 4:20:40
rpclap_anders (4:13:34 AM): Clear signature of this pyro in LAP data. We see increased ionization from the pyro, and the observed current changes from negative to positive -- we thus appear to not longer touch the MLI.
rpclap_reine (4:13:44 AM): LAP is not touching MLI anymore
rpclap_reine (4:19:25 AM): Current on sensor 1 is about 10 nA
rpcpiu_chrisl (4:20:23 AM): Boom deployed
rpcpiu_chrisl (4:30:55 AM): LAP !
rpcpiu_chrisl (4:31:13 AM): Boom has been deployed fully now - when can we turn you off ?
rpclap_reine (4:34:56 AM): Yes
rpcpiu_chrisl (4:35:00 AM): Wrong procedure number in the script
rpcpiu_chrisl (4:35:04 AM): Should be 399
rpcpiu_chrisl (4:35:20 AM): End MAcro sent
rpclap_anders (4:35:32 AM): Very clear signature in LAP data when deplying boom, though currents are small -- as they should be at zero bias. How we long for the day when we will get some bias sweeps!
rpcpiu_chrisl (4:38:12 AM): LAP Science Data stops
rpcies_craigp (4:40:14 AM): Did micro-switch depression confirm complete boom deployment in both cases?

rpcpiu_chrisl (4:40:21 AM): Yes
rpcpiu_chrisl (4:40:39 AM): LAP Off
rpcpiu_chrisl (4:40:50 AM): LCL current back to 102 mA
rpcpiu_chrisl (4:43:04 AM): MIP Temp getting higher currently at -14.33C
rpcpiu_chrisl (4:44:46 AM): MIP now -5 Deg C
jeanlouis_michau (4:46:01 AM): Fold the boom before burning !!!!!!!
rpcpiu_chrisl (4:54:25 AM): MIP Temperature now at 21.43 C
rpcpiu_chrisl (5:11:28 AM): MIP & LAP 2 STP have now come off their limits and have started increaseing -53.33 and -58.88 respectively
rpcpiu_chrisl (5:24:57 AM): MIP Temp seems to stabilise at 46,8 deg C
rpcpiu_chrisl (5:25:17 AM): Preparing to tunr MIP on
jeanlouis_michau (5:25:48 AM): MIP is ready
rpcpiu_chrisl (5:25:56 AM): MIP Power on commands sent
rpcpiu_chrisl (5:27:24 AM): MIP On
rpcpiu_chrisl (5:27:55 AM): LCL current flutuating but avergae is 163mA
rpcpiu_chrisl (5:29:35 AM): Fluctuates between 183 and 133mA
rpcpiu_chrisl (5:30:01 AM): MIP Boom temperature is starting to increase again
rpcpiu_chrisl (5:30:07 AM): Now 51,67 C
rpcpiu_chrisl (5:32:08 AM): MIP STP now -45.62
rpcpiu_chrisl (5:32:22 AM): LAP2 STP -48.75
chris_carr2000 (5:32:48 AM): PIU: 29.6 deg. C.
chris_carr2000 (5:33:44 AM): PIU: +5.1 -5.1 +12.8 -13.1 +29.4
rpcpiu_chrisl (5:34:01 AM): MIP Internal sensor thermistor now reads more reasonable value 50 degrees
rpcpiu_chrisl (5:36:46 AM): MIP SC Sensor temp reach stability of 53.33 C
jeanlouis_michau (5:38:33 AM): There is more noise than when folded
rpcpiu_chrisl (5:40:14 AM): MIP is being powered off
rpcpiu_chrisl (5:40:34 AM): MIP Sensor temp reachesd 55 deg C
rpcpiu_chrisl (5:41:10 AM): MIP Off LCL back to 102mA
rpcpiu_chrisl (5:42:47 AM): MAG Being switched off
rpcmag_ingo (5:43:18 AM): OK - time to say good bye
rpcpiu_chrisl (5:43:35 AM): MAG OFF LCLC goes to 71mA
rpcpiu_chrisl (5:43:47 AM): PIU being shut down
rpcpiu_chrisl (5:45:12 AM): LCL off
rpcpiu_chrisl (5:45:23 AM): We can breath again (until next time)
rpcpiu_chrisl (5:45:53 AM): Chris can you capture the log file please
chris_carr2000 (5:46:11 AM): ok

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RPC-VAR-02	**Revision:**	1	**Date Raised:**	17th March 2004
Title:	Skip IES safe mode during initial turn on (RP-FCP-100)				
Pass Date:	17th/18th March 2004	**Approx Time:**	05:00 CET (45 mins in to the CVP step)		
RPC CVP Stage Name:	PIU Redundant Commissioning	**Effected Steps:**	190		

Involving:	**PIU**		**IES**	X	**ICA**		**LAP**		**MIP**		**MAG**	

Change Reason

This procedure will set IES in an intermediate mode towards enabling the HV although the HV is not enabled by the procedure. To minimise the risk of premature enabling of IES HV the IES team decided this procedure should be skipped

Full Description of Variation

Do not execute RP-FCP-100 in step 190 of plan

Effects:

Telemetry is not affected. IES remains in a suitable state for the following IES procedure (IES OFF)

This procedure should be tested at the beginning of the HV commissioning phase in Autumn 2004

Authorisation

RPC Ops:		**IES:**	
ICA:	N/A	**LAP:**	N/A
MIP:	N/A	**MAG:**	N/A

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RPC-VAR-03	**Revision:**	1	**Date Raised:**	17th March 2004
Title:	Parameter change in RP-FCP-220				
Pass Date:	19h/20 March 2004	**Approx Time:**	23:00 CET		
RPC CVP Stage Name:	Experiment Commissioning Day 1	**Effected Steps:**	150		

Involving:	**PIU**		**IES**		**ICA**	**X**	**LAP**		**MIP**		**MAG**	

Change Reason

An error has been spotted in RP-FCP-220 where a bad parameter value fails to perform the required test of exercising the Watchdog Reset.

This be can be fixed by adjusting the parameter value

Full Description of Variation

In RP-FCP-220 the command ZRP220035 Test WD reset is executed once (page 5 of the FOP procedure).

The command parameter should be as follows:

PRPPG2035=0x004A.

Effects:

The following verification of
NRPD2320=0x0000
Is corrected as the instrument performs an internal reset caused by the WD timer.

Nothing else is effected.

Authorisation

RPC Ops:		**IES:**	
ICA:	N/A	**LAP:**	N/A
MIP:	N/A	**MAG:**	N/A

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RPC-VAR-04	**Revision:**	1	**Date Raised:**	17th March 2004

Title:	Set LAP into safe mode before Memory tests

Pass Date:	17/18th March 2004	**Approx Time:**	c. 4 hours into pass
RPC CVP Stage Name:	PIU Redundant Commissioning	**Effected Steps:**	170-180

Involving:	**PIU**		**IES**		**ICA**		**LAP**	**X**	**MIP**		**MAG**	

Change Reason

Oversight means that LAP is not in correct mode to perform the Memory Service test in step 0270 (RP-FCP-308). An extra FCP must be run to set up the correct mode.

Full Description of Variation

Insert extra step 175 into RPC Timeline and run

RP-FCP-300 LAP safe Mode

Execution time is 1 min 36 seconds.

Effects:

Place LAP into a non science production mode ready for memory service operation. Thus there will be slight reduction of telemetry volume.

The duration of the whole test phase will be increased by a couple minutes but this will be comenasated by the fact we are not running the IES safe mode procedure (RO-RPC-VAR-2)

Authorisation

RPC Ops:		**IES:**	N/A
ICA:	N/A	**LAP:**	
MIP:	N/A	**MAG:**	N/A

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RPC-VAR-005	**Revision:**	0	**Date Raised:**	18/3/04
Title:	IES Command Insertion during PIU Main Commissioning				
Pass Date:	18/3/04	**Approx Time:**	02:28 UT		
RPC CVP Stage Name:	PIU Main Commissioning	**Affected Steps:**	Before 0260		

Involving:	**PIU**		**IES**	**X**	**ICA**		**LAP**	**X**	**MIP**		**MAG**	

Change Reason

End of step 190 leaves IES in wrong mode

Full Description of Variation

Send TC Packet ZRP21467 (IES-INSTR-PROG-MODE) with parameters
PRPD1430=0x43
PRPD1431=0x04 (resume)

Effects:

Correction

Authorisation

RPC Ops:		**IES:**	
ICA:		**LAP:**	
MIP:		**MAG:**	

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RP-VAR-006	**Revision:**	1	**Date Raised:**	18/3/04

Title:	RPC Aliveness Test & Boom deployment

Pass Date:	18/3/04	**Approx Time:**	Start of Pass
RPC CVP Stage Name:	MIP MAG LAP Boom Deployment	**Affected Steps:**	Before 0260

Involving:	**PIU**	X	**IES**	X	**ICA**	X	**LAP**	X	**MIP**	X	**MAG**	X

Change Reason

Failure of RPC During redundant commissioning has cause a change in timeline for the boom deployment.

Full Description of Variation

The new time line is attached. During allops RPC requests the highest rate of LCL Hk possible.

Initially RPC want to ascertain is the failure still exists on the Redundant channel. This will be performed by a quick on/off test of the LCL B using the MTL.

Then the main channel shall be powered carefully keeping RPC in a low power mode. When this has been completed a decision will be mode if RPC will be operational during the boom deployment. This second part of the procedure will be performed off the stack. RP-FCP-000 should be kept close at hand if a quick shutdown needs to be performed.

Even if RPC is not powered the boom deployment should be performed if time allows

Effects:

Increased data from the LCL HK.
Boom deployment may take place later in the pass than expected.

Authorisation

RPC Ops:		**IES:**	
ICA:		**LAP:**	
MIP:		**MAG:**	

Title Special time line for RPC Debug

Step	Time: Absolute	Time: Relative	FCP Number	Description	Procedure Duration: Required	Procedure Duration: Execution	Procedure Duration: Actual
0000	00:00:00	00:00:00	RP-FCP-XXX	High rate SC LCL Hk Enable	TBD	00:00:01	00:00:01
0010	00:00:01	ExeTime	RP-FCP-XXX	RPC LCL B On	TBD	00:00:01	00:00:10
0020	00:00:11	00:00:10	RP-FCP-XXX	RPC LCL B Off	TBD	00:00:01	00:31:25
0030	00:10:11	00:10:00	RP-FCP-001	Power Main LCL Main DPIU	n/a	00:01:25	n/a
0040	00:11:36	ExeTime	RP-FCP-051	MAG on	n/a	00:01:15	n/a
0050	00:31:36	00:20:00	RP-FCP-XXX	Wait for temp to stabilise	TBD	00:00:01	00:13:02
0060	00:31:37	ExeTime	RP-FCP-067	E2PROM Patch & reboot	n/a	00:01:46	n/a
0070	00:33:23	ExeTime	RP-FCP-051	MAG on	n/a	00:01:15	n/a
0080	00:34:38	ExeTime	RP-FCP-503	MAG Burst	n/a	00:00:42	03:22:22
0090	00:44:38	00:10:00	RP-FCP-XXX	Wait to breath !	TBD	00:00:01	00:15:01
0100	00:44:39	ExeTime	RP-FCP-041	MIP On	n/a	00:01:15	n/a
0110	00:59:39	00:15:00	RP-FCP-XXX	Wait	TBD	00:00:01	00:15:44
0120	00:59:40	ExeTime	RP-FCP-040	MIP Off	n/a	00:00:43	n/a
0130	01:00:23	ExeTime	RP-FCP-031	LAP on	n/a	00:01:41	n/a
0140	01:15:23	00:15:00	RP-FCP-XXX	Wait	TBD	00:00:01	00:17:44
0150	01:15:24	ExeTime	RP-FCP-030	LAP off	n/a	00:00:43	n/a
0160	01:16:07	ExeTime	RP-FCP-021	ICA On	n/a	00:02:00	n/a
0170	01:18:07	ExeTime	RP-FCP-206	Test Mode	n/a	00:01:00	00:15:01
0180	01:33:07	00:15:00	RP-FCP-XXX	Wait	TBD	00:00:01	00:17:00
0190	01:33:08	ExeTime	RP-FCP-020	ICA Off	n/a	00:00:44	n/a
0200	01:33:52	ExeTime	RP-FCP-011	IES On	n/a	00:01:15	n/a
0210	01:35:07	ExeTime	RP-FCP-130	IES Stim mode	n/a	00:01:07	00:15:01
0220	01:50:07	00:15:00	RP-FCP-XXX	Wait	TBD	00:00:01	00:00:45
0230	01:50:08	ExeTime	RP-FCP-010	IES Off	n/a	00:00:44	n/a
0240	01:50:52	ExeTime	RP-FCP-XXX	Boom Deployment decision	TBD	00:00:01	01:00:00
0250	02:50:52	1:00:00	RP-FCP-XXX	Deploy MAG boom	TBD	00:00:01	01:01:42

Title Special time line for RPC Debug

Step	Time: Absolute	Relative	FCP Number	Description	Procedure Duration: Required	Execution	Actual
0260	02:50:53	ExeTime	RP-FCP-031	LAP on	n/a	00:01:41	n/a
0270	02:52:34	ExeTime	RP-FCP-312	LAP Deployment mode	n/a	00:01:12	01:00:01
0280	03:52:34	1:00:00	RP-FCP-XXX	Deploy MIP (Upper boom) boom	TBD	00:00:01	Unknown
0290	03:52:35	ExeTime	RP-FCP-350	LAP End Macro	00:37:20	00:00:08	00:00:08
0300	03:52:43	ExeTime	RP-FCP-030	LAP off	n/a	00:00:43	n/a
0310	03:53:26	ExeTime	RP-FCP-041	MIP On	n/a	00:01:15	n/a
0320	03:54:41	ExeTime	RP-FCP-450	MIP Active boom mode	n/a	00:01:36	00:01:36
0330	03:56:17	ExeTime	RP-FCP-040	MIP Off	n/a	00:00:43	n/a
0340	03:57:00	ExeTime	RP-FCP-050	MAG Off	n/a	00:00:43	n/a
0350	03:57:43	ExeTime	RP-FCP-000	PIU Off	n/a	00:01:00	n/a

RPC PROCEDURE VARIATION REQUEST

Number:	RO-RPC-VAR-01	**Revision:**	1	**Date Raised:**	17th March 2004
Title:	Change Bias Levels of LAP probe				
Pass Date:	18/19th March 2004	**Approx Time:**	c. 4 hours into pass		
RPC CVP Stage Name:	RPC Boom Deployment	**Effected Steps:**	120-130		

Involving:	**PIU**		**IES**		**ICA**		**LAP**	**X**	**MIP**		**MAG**	

Change Reason

Set Bias level on LAP probe to improve measurement after the boom deployment

Full Description of Variation

Send Extra Command between steps 120 and 130. Command should be sent c. 15 minutes before step 130 (at 03:00:00 in the table time frame)

Command Details:

ZRP23013 Density Fix Bias

Parameters
PRPD3045=0x00
PRPD3046=0xd0d0
PRPD3047=0x0000

Effects:

Voltage level changes on both LAP probes to 20V

Authorisation

RPC Ops:		**IES:**	N/A
ICA:	N/A	**LAP:**	
MIP:	N/A	**MAG:**	N/A

RPC CVP meeting regarding anomaly in PIU redundant commissioning

ESOC 18 March 2004 17:00

Present:
PIU: Chris & Chris
ICA: Hans & Hans
IES: Ray, Craig, John
LAP: Reine, Bjoern, Anders (taking notes)
MAG: Karl-Heinz, Ingo, Andrea
MIP: Jean-Gabriel, Jean-Louis
Project: Marc, Viney

1. Status

Chris Lee described what happened during PIU redundant commissioning. After all instruments had been turned on, nominal LCL current of 300-400 mA was observed. After some 5 mins, the LCL current dropped first to 240 mA, then rised to about 250 mA until the LCL was turned off around 15 minutes after the failure.

After a meeting with RMOC, PIU was turned on again. LCL current was again 240 mA again, and no data arrived. PIU was then turned off. Turning on only the LCL, not the DPIU, once again gave 240 mA.

Analysis

- No communication from PIU, which only uses +5 V. Hence +5 V failure likely.
- PIU has two power supplies on both Primary & Redundant channel. One provides +5 Volts and the other provides -5/+12/-12/28 Voltages, this is referred to the Aux PSU.
- All instruments probably switched off on all voltage lines. If +5V failed then the solid state swithces will automatically close. Thus the time during which instruments were powered with -5/+12/-12/28 V but no +5 V must have been short (ms).
- A failure of a sub-instrument is unlikely to cause the observed problem, as the PIU is designed and tested to cope with all kinds of instrument failures. To cause the observed behaviour, we would thus need both a sub-instrument failure and a failure of PIU.
- If 5 V supply was completely shorted, a much higher current would be drawn (at least 450 mA). Thus a large current draw on +5V (secondary) side is unlikely and the failure is probably on the primary side.
- Possible component failure in switch component unlikely, would have PIU still working etc.
- Thermal problem unlikely. Temperatures were moderate and quite stable at time of failure, and things have been run colder and hotter in TV.
- Main side has more mileage on ground. Redundant mainly used in unit tests.
- Failure likely isolated to primary side of the 5 V.
- Passive components: No surface mounted Cs or Rs. No single short of a R seems to be able to cause 250 mA. Electrolytic Cs mounted in series.
- MOSFETs. Top quality, but may of course still possibly fail - could cause a current draw of 250mA.
- Any IC may fail, shorted in itself.
- Functional failure of PSM IC or clock generator could cause one of the Power switch MOSFET to be permanently on . Difficult to know what current it would draw without further analysis.

Further analysis requires simulations and/or tests at the FS unit, aiming at identifying failure scenarios reproducing the observed PIU behaviour.

2. General considerations

Further investigations, including in-depth analysis of available data, are needed to understand the implications of the failure to RPC operations.

While we may get a lot more understanding of the detailed failure mode from diagnostics and simulations, there is no way out of the situation that we sooner or later need to turn on the PIU and the RPC instruments. The only parameter we can control in doing so is the load on the power supply. We do not yet know if the failure scenario encountered last night in any way depend on the power consumption (which was quite high, with all instruments powered on). While we gain nothing by waiting with turning RPC, we should for the moment use a conservative approach and only run one instrument at a time, and only do this to check out that RPC is actuallyalive on the primary side.

Waiting with turning PIU on would be justified only if weconsider some external parameter to be more favourable later on. Considering the very nominal environmentalconditions, including temperature, this is very unlikely. With a conservative operational scenario as described above, doing a checkout of the PIU primary side and all the instruments today seems justified.

3. Activities tonight

For tonights pass, we will not follow the CVP plan, but aim for the following conservative plan:

A. Try starting PIU on the redundant side.
B. Start PIU, primary side.
C. Start MAG (to verify MAG and get PIU HK).
D. Start each instrument, one at a time, and turn it off before next instrument starts (to verify each instrument).
E. Boom deployment (optional)
- Keep PIU and MAG on (verify boom deployment, verify instrument integrity after deployment, and get valuable data on s/c magnetic fields)
- Keep LAP on during upper boom deployment (verify boom deployment, verify instrument integrity after deployment, and get valuable data on s/c environment)
- Turn off LAP
- Run MIP (verify instrument inegrity after deployment).

Chris Lee will prepare a list of procedures.

4. Further activities

After the activities outlined above, we postpone further commissioning activities until we have spent further effort on diagnosis of the problem. The RPC environmental monitoring is likewise postponed.

19th March 2004

RPC Meeting at ESOC

After the apparent failure of the PIU redundant-side power supply, the meeting was called to review the status of the commissioning steps performed, and to plan for another slot at ESOC to complete the remaining activities.

For context, see also the notes of the meeting on 18th (taken by Anders Eriksson). These detail the discussions in the immediate aftermath of the observed failure.

Present:
Chris Carr (taking notes), Chris Lee, Karl-Heinz Glassmeier, Andrea Diedrich, Ingo Richter, Ray Goldstein, John Hanley, Craig Pollock, Hans Borg, Hans Nilsson, Anders Eriksson, Reine Gill, Jean-Gabriel Trotignon, Jean-Louis Michau, Viney Dhiri

Agenda (ad-hoc)

1. Failure Investigation
2. Commissioning steps performed so far
3. Activities yet to be done
4. Planning

Failure Investigation

a) Imperial (Chris Carr & Trevor Beek) will try to reproduce the observed failure mode using the breadboard and/or QM power supply units.
b) Imperial will review the design and the parts procurement history.
c) In case additional support is needed then this is offered by the LAP team (have a power converter specialist).
d) Imperial will report to RPC as soon as possible, certainly within 1 month.

Commissioning Steps Performed so far

a) During the first pass the planned activities on the PIU ‘main’ side were completed. Refer to the CVP plan document (Chris Lee) for details. In summary:
    a. Switch-on and checkout of PIU main (processor and power supply)
    b. Switch-on and checkout all instruments
b) The first pass was halted early due to the observed problem with the PSU redundant. Therefore, the IES HV Events test was not done.
c) The second pass was used to check again correct functioning of PIU main-side and all experiments, plus the deployment of both booms, including
    a. monitoring (during deployment) with MAG and LAP, and
    b. monitoring (after deployment) with MIP
d) Action: each team to produce a report on the commissioning, including
    a. Steps performed
    b. Correct TM received
    c. Correct response to all commanding (Note: command history needs to be downloaded from DDS)
    d. Quick-look science data (where applicable)

    e. List anomalies, etc.
    f. Due end of next week (26th March)
e) Action: Chris Carr to build a consolidated report for RPC.

Activities Yet to be Done

a) Assuming a terminal failure of the redundant +5V supply, it is not suggested to try the redundant PIU processor in case there is any link to the failure (even though this is considered VERY unlikely). The redundant processor was in any case observed to work correctly until the PSU failure.
b) The following activities, all considered essential, remain:
    a. For ICA mainly the HV commissioning steps remain (planned for September)
    b. Ditto IES except for the HV Events test
    c. LAP science performance verification and (out of pass) pointing scenarios
    d. MIP LDL test
    e. OBCP’s (will be phased-in as normal method of operating RPC, during the above activities)
    f. IES, ICA, LAP and PIU Patching/Maintenance

Planning

a) ESOC Constraints
    a. From 2nd week April, pass durations reduce to 5 hours due to MEx sharing
    b. This Commissioning phase ends 2nd June
    c. Mid-May there will be a manoeuvre for the asteroid trajectory
b) Chris Lee estimates 3 x 5 hour passes needed for the remaining interactive procedures, plus the out of pass procedures which can be run as expected (e.g. LAP pointing)
c) New basis for planning will be ‘MAG plus one instrument at a time’ with the exception being the LDL test (which will include mixed-mode)
d) Chris Lee will draft a plan for this.
e) RPC Preference is for a new slot in May. Action Chris Lee to inform project (also that we won’t want the April Alice slot)
f) The following team is the ‘essential-minimum’ RPC team needed for the next slot:- Bjoern, Reine, Hans Borg, Chris Lee, Chris Carr, Ingo, Jean-Louis, John.
g) PI responsibility is delegated to the on-site person unless the PI is available real-time by phone.

Other Business

a) Earth fly-by is the first operational scenario to be considered
    a. Planning needs to be done
    b. Trajectory will go through radiation belts – RPC needs to balance the risks with the benefits
b) IES, ICA and MIP teams to set up their RSA keys with Tim Oddy at Imperial (needed for RSYNC)
c) DDS
    a. No requests from 2100 to 0800 UT during commissioning
    b. rodds.esa.int user ro_rpc (ask me or Chris Lee for the password)

    c. Don't over-use (there is a quota)

d) Meetings:
    a. SWT 12th May at ESTEC
    b. Commissioning Review #1 8th July at ESOC
    c. RPC will meet during the next commissioning slot (May)

Chris Carr
21st March 2004

Key:
Green = Added*
Yellow = Modified*
Red = Deleted*

* with respect to original planning.

Title **Part 2 IP Day 1**

Assume 4 hours of ops, will do ICA

Step	Time Approx UC	FCP Number	Description	Notes
0000	20:30	RP-FCP-801	OBCP Power On Main	
0030	21:09	RP-FCP-050	MAG quiet mode	RP-FCP-500 ran (typo in script)
0050		RP-FCP-031	LAP on	
0060		RP-FCP-021	ICA on	
0070	21:21	RP-FCP-200	ICA Safe Mode	
0080		RP-FCP-300	LAP Safe Mode	
0040		RP-FCP-069	Set to maintenance mode	Moved here as 031 and 032 enables science
0090	21:27	RP-FCP-091	PIU Memory Service Test	Failed - memory dump not received
0090	21:46	RP-FCP-091	PIU Memory Service Test	Rerun as memory dump category not enabl;ed on SC but Failed - memory dump not as expected
0100	22:07	RP-FCP-208	ICA Memory Service Test	Failed - Memory service packets rejected by PIU
0110	22:38	RP-FCP-308	LAP Memory Service Test	Failed - Memory service packets rejected by PIU
New	22:49	RP-FCP-003	Set to normal mode	Did NOT reach normal mode
0040		RP-FCP-069	Set to maintenance mode	
New	22:58	RP-FCP-003	Set to normal mode	Reached normal mode
0040	23:03	RP-FCP-069	Set to maintenance mode	Return succesfully to maintenance mode
0110		RP-FCP-308	LAP Memory Service Test	Failed same problem
New		RP-FCP-003	Set to normal mode	Did NOT reach normal mode again
0040	23:21	RP-FCP-069	Set to maintenance mode	
New		RP-FCP-003	Set to normal mode	Reached normal mode
0120	23:31	RP-FCP-030	LAP off	
0130	23:41	RP-FCP-041	Power on MIP	
0135		RP-FCP-505	MAG in SID 5	
0136		RP-FCP-510	MAG OB	
0150	23:55	RP-FCP-020	ICA off	
0140	0:01	RP-FCP-481 (MTL)	MTL Load: MIP: transmitter level check	
0160	0:05	RP-FCP-021	Power on ICA	
0170		RP-FCP-220	ICA LV Commisioning	
0175		RP-FCP-511	MAG IB	
0190	1:01	RP-FCP-482 (MTL)	MTL Load: MIP: Both transmitters check	
0180	1:03	RP-FCP-020	ICA: Power off	
0200	1:08	RP-FCP-031	LAP on	
0210	1:19	RP-FCP-310	LAP Calibration	
0220	1:45	RP-FCP-399 (MTL)	LAP EndMacro	
0240	1:40	RP-FCP-486 (MTL)	MTL Load: Transmitter level check	
0230	1:50	RP-FCP-334 (MTL)	LAP Digital Filter Tests A20	
0245	1:50	RP-FCP-504 (MTL)	MAG SID 4	Data lost due to SSM memory overflow
0270	2:10	RP-FCP-480 (MTL)	MTL Load: MIP Data Rate Check	Data lost due to SSM memory overflow
0250	2:30	RP-FCP-399	LAP EndMacro	Data lost due to SSM memory overflow
0260	2:35	RP-FCP-335	LAP Digital Filter Tests A16	Data lost due to SSM memory overflow
	2:20	Aprox end of pass		

Title **Part 2 OP Day 1**

Assume 4 hours of ops, will do ICA. Contains all we can do from EXP Coms day 1 and 2 plus the initial part of coordinated consortium test (not including LDL)

PL Downlink BW (kbit/s) 14000

	2:06	**Time**				**Procedure Duration**			
Step	**UTC**	**Absolute**	**Relative**	**FCP Number**	**Description**	**Required**	**Execution**	**Actual**	**Pointing Requirements**
0000	2:06	00:00:00	0:00:00	RP-FCP-XXX	Pass end LAP Mip MAG on (02:15)	TBD	00:00:01	01:54:59	+XSunPointing
0010	2:46	00:40:00	0:40:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:59	+XSunPointing
0020	2:50	00:44:59	0:04:59	RP-FCP-316 (MTL)	MTL Load: LAP NN Test	00:21:28	00:10:00	06:00:00	+XSunPointing
0030	3:00	00:54:59	ExeTime	RP-FCP-510	MAG OB	n/a	00:00:42	05:50:10	+XSunPointing
0040	4:00	01:54:59	1:00:00	RP-FCP-XXX	End of ops (04:00)	TBD	00:00:01	14:24:17	+XSunPointing
0050	8:50	06:44:59	4:50:00	RP-FCP-399	LAP EndMacro (08:50)	00:04:16	00:00:10	00:10:52	+XSunPointing
0060	8:51	06:45:09	ExeTime	RP-FCP-503	MAG SID 3 Burst	n/a	00:00:42	01:22:18	+XSunPointing
0070	8:51	06:45:51	ExeTime	RP-FCP-484 (MTL)	MTL Load: MIP: Check of seq's in min rate	01:00:00	00:10:00	01:26:42	+XSunPointing
0080	9:01	06:55:51	ExeTime	RP-FCP-317	LAP EE Test	00:09:44	00:08:40	00:09:44	+XSunPointing
0090	9:11	07:05:35	ReqTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0100	9:15	07:09:51	ReqTime	RP-FCP-318	LAP NE Test	00:26:40	00:00:08	00:26:40	+XSunPointing
0110	9:42	07:36:31	ReqTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0120	9:46	07:40:47	ReqTime	RP-FCP-319	LAP EN Test	00:26:40	00:00:08	00:27:22	+XSunPointing
0130	10:13	08:07:27	ReqTime	RP-FCP-511	MAG IB	n/a	00:00:42	01:05:58	+XSunPointing
0140	10:14	08:08:09	ExeTime	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0150	10:18	08:12:25	ReqTime	RP-FCP-330	LAP Log compression	00:18:48	00:00:08	00:20:08	+XSunPointing
0160	10:18	08:12:33	ExeTime	RP-FCP-485 (MTL)	MTL Load: MIP: Check of sequences in burst rate	01:00:00	00:10:00	01:25:19	+XSunPointing
0170	10:38	08:32:33	0:20:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0180	10:42	08:36:49	ReqTime	RP-FCP-321	LAP Coarse/Fine Sweeps	00:44:36	00:36:36	00:56:36	+XSunPointing
0190	11:19	09:13:25	ExeTime	RP-FCP-502	MAG SID 2 Normal	n/a	00:00:42	01:04:27	+XSunPointing
0200	11:39	09:33:25	0:20:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0210	11:43	09:37:41	ReqTime	RP-FCP-351	LAP LL mode	00:30:00	00:00:08	00:00:08	+XSunPointing
0220	11:43	09:37:49	ExeTime	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000	n/a	00:00:03	02:00:03	+XSunPointing
0230	11:43	09:37:52	ExeTime	RP-FCP-483 (MTL)	MTL Load: MIP: Check of sequences in normal rate	02:00:00	00:10:00	02:05:06	+XSunPointing
0240	12:23	10:17:52	0:40:00	RP-FCP-510	MAG OB	n/a	00:00:42	01:24:24	+XSunPointing
0250	13:43	11:37:52	1:20:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0260	13:48	11:42:08	ReqTime	RP-FCP-360	LAP in passive mode	01:30:40	00:00:08	01:30:50	+XSunPointing
0270	13:48	11:42:16	ExeTime	RP-FCP-501	MAG SID 1 Min	n/a	00:00:42	02:59:44	+XSunPointing
0280	13:48	11:42:58	ExeTime	RP-FCP-421	MIP in passive mode	00:30:00	00:01:36	01:00:00	+XSunPointing
0290	14:48	12:42:58	01:00:00	RP-FCP-420	MIP in active mode	00:30:00	00:01:36	00:34:16	+XSunPointing
0300	15:18	13:12:58	ReqTime	RP-FCP-399	LAP End Macro	00:04:16	00:00:10	00:05:52	+XSunPointing
0310	15:23	13:17:14	ReqTime	RP-FCP-421	MIP in passive mode	00:30:00	00:01:36	01:29:55	+XSunPointing
0320	15:24	13:18:50	ExeTime	RP-FCP-362	LAP in active mode	01:23:00	01:09:28	01:23:00	+XSunPointing
0330	16:47	14:41:50	ReqTime	RP-FCP-399	LAP End Macro	00:04:16	00:00:10	00:00:52	+XSunPointing
0340	16:48	14:42:00	ExeTime	RP-FCP-511	MAG IB	n/a	00:00:42	01:35:52	+XSunPointing
0350	16:48	14:42:42	ExeTime	RP-FCP-361	LAP Sweep IF	01:30:40	00:00:08	00:00:08	+XSunPointing
0360	16:48	14:42:50	ExeTime	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000	n/a	00:00:03	00:00:03	+XSunPointing
0370	16:48	14:42:53	ExeTime	RP-FCP-399	LAP End Macro	00:04:16	00:00:10	00:04:59	+XSunPointing
0380	16:53	14:47:09	ReqTime	RP-FCP-040	MIP Off	n/a	00:00:43	n/a	+XSunPointing
0390	16:53	14:47:52	ExeTime	RP-FCP-303	LAP Default Burst	n/a	00:00:32	Unknown	+XSunPointing
0400	18:23	16:17:52	1:30:00	RP-FCP-503	MAG Burst	n/a	00:00:42	00:00:42	+XSunPointing
0410	18:24	16:18:34	ExeTime	RP-FCP-510	MAG OB	n/a	00:00:42	Unknown	+XSunPointing
0420	18:25	16:19:16	ExeTime	RP-FCP-XXX	Start of next pass (20:00)	TBD	00:00:01	Unknown	+XSunPointing

					Data Volume	123863744.4 bits		**Peak Pwr**
Exp Modes at end of procedure						15120.1 kbytes		6160.0
IES	**ICA**	**LAP**	**MIP**	**MAG**	**DataRate (bit/s)**	**Data Vol (bits)**	**Running Totot (Mbytes)**	**Avg Pwr (mW)**
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	1141200.0	0.1	6160.0
Off	Off	Hk Only	SID 3 Brst	SID 4	663.5	198386.5	0.2	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	1749900.0	0.4	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	10499400.0	1.6	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	50747100.0	7.7	6160.0
Off	Off	Hk Only	Off	SID 4	351.5	3515.0	7.7	3993.3
Off	Off	Hk Only	Off	SID 3 Brst	1378.0	57876.0	7.7	3993.3
Off	Off	Hk Only	SID 1 Min	SID 3 Brst	1394.5	836700.0	7.8	6160.0
Off	Off	SID 3 Brst	SID 1 Min	SID 3 Brst	3647.5	2130140.0	8.0	6160.0
Off	Off	Hk Only	SID 1 Min	SID 3 Brst	1394.5	356992.0	8.1	6160.0
Off	Off	SID 2 Nrm	SID 1 Min	SID 3 Brst	1457.0	2331200.0	8.4	6160.0
Off	Off	Hk Only	SID 1 Min	SID 3 Brst	1394.5	356992.0	8.4	6160.0
Off	Off	SID 2 Nrm	SID 1 Min	SID 3 Brst	1457.0	2331200.0	8.7	6160.0
Off	Off	SID 2 Nrm	SID 1 Min	SID 3 Brst	1457.0	61194.0	8.7	6160.0
Off	Off	Hk Only	SID 1 Min	SID 3 Brst	1394.5	356992.0	8.7	6160.0
Off	Off	SID 2 Nrm	SID 1 Min	SID 3 Brst	1457.0	11656.0	8.7	6160.0
Off	Off	SID 2 Nrm	SID 3 Brst	SID 3 Brst	1752.5	2103000.0	9.0	6160.0
Off	Off	Hk Only	SID 3 Brst	SID 3 Brst	1690.0	432640.0	9.0	6160.0
Off	Off	SID 2 Nrm	SID 3 Brst	SID 3 Brst	1752.5	3848490.0	9.5	6160.0
Off	Off	SID 2 Nrm	SID 3 Brst	SID 2 Nrm	470.0	564000.0	9.6	6160.0
Off	Off	Hk Only	SID 3 Brst	SID 2 Nrm	407.5	104320.0	9.6	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 2 Nrm	2660.5	21284.0	9.6	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 2 Nrm	2660.5	7981.5	9.6	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 2 Nrm	2410.0	5784000.0	10.3	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 2 Nrm	2410.0	11568000.0	11.6	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 2 Nrm	157.0	40192.0	11.6	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 2 Nrm	2410.0	19280.0	11.6	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 1 Min	2341.7	98351.5	11.7	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 1 Min	2341.7	8430131.2	12.7	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 1 Min	2341.7	4215065.6	13.2	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 1 Min	88.7	22708.0	13.2	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 1 Min	88.7	8515.5	13.2	6160.0
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 1 Min	151.2	752991.6	13.3	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 1 Min	88.7	887.0	13.3	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 1 Min	88.7	3725.5	13.3	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 1 Min	2341.7	18733.6	13.3	6160.0
Off	Off	SID 3 Brst	SID 2 Nrm	SID 1 Min	2341.7	7025.1	13.3	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 1 Min	88.7	22708.0	13.3	6160.0
Off	Off	Hk Only	Off	SID 1 Min	27.2	1169.7	13.3	3993.3
Off	Off	SID 3 Brst	Off	SID 1 Min	2280.2	12313096.9	14.7	3993.3
Off	Off	SID 3 Brst	Off	SID 3 Brst	3631.0	152502.0	14.7	3993.3
Off	Off	SID 3 Brst	Off	SID 3 Brst	3631.0	152502.0	14.8	3993.3
Off	Off	SID 3 Brst	Off	SID 3 Brst	3631.0	0.0	14.8	3993.3

ITL Part

Time Ref	Event Type	Event ID		Delta Time	Sequence	Comment	ITL			
6:44:59	PTRS	001001	-	00:00:00	ARPF399A	# LAP EndMacro (08:50)	PTRS(COUNT=001001)	-00:00:00	RPC	RBA2
6:44:59	PTRS	001001	+	00:00:10	ARPF503A	# MAG SID 3 Burst	PTRS(COUNT=001001)	+00:00:10	RPC	RBA2
6:44:59	PTRS	001001	+	00:00:52	ARPF484A	# MTL Load: MIP: Check of seq's in min rate	PTRS(COUNT=001001)	+00:00:52	RPC	RBA2
6:44:59	PTRS	001001	+	00:10:52	ARPF317A	# LAP EE Test	PTRS(COUNT=001001)	+00:10:52	RPC	RBA2
6:44:59	PTRS	001001	+	00:20:36	ARPF399A	# LAP EndMacro	PTRS(COUNT=001001)	+00:20:36	RPC	RBA2
6:44:59	PTRS	001001	+	00:24:52	ARPF318A	# LAP NE Test	PTRS(COUNT=001001)	+00:24:52	RPC	RBA2
6:44:59	PTRS	001001	+	00:51:32	ARPF399A	# LAP EndMacro	PTRS(COUNT=001001)	+00:51:32	RPC	RBA2
6:44:59	PTRS	001001	+	00:55:48	ARPF319A	# LAP EN Test	PTRS(COUNT=001001)	+00:55:48	RPC	RBA2
6:44:59	PTRS	001001	+	01:22:28	ARPF511A	# MAG IB	PTRS(COUNT=001001)	+01:22:28	RPC	RBA2
6:44:59	PTRS	001001	+	01:23:10	ARPF399A	# LAP EndMacro	PTRS(COUNT=001001)	+01:23:10	RPC	RBA2
6:44:59	PTRS	001001	+	01:27:26	ARPF330A	# LAP Log compression	PTRS(COUNT=001001)	+01:27:26	RPC	RBA2
6:44:59	PTRS	001001	+	01:27:34	ARPF485A	# MTL Load: MIP: Check of sequences in burst rate	PTRS(COUNT=001001)	+01:27:34	RPC	RBA2
6:44:59	PTRS	001001	+	01:47:34	ARPF399A	# LAP EndMacro	PTRS(COUNT=001001)	+01:47:34	RPC	RBA2
6:44:59	PTRS	001001	+	01:51:50	ARPF321A	# LAP Coarse/Fine Sweeps	PTRS(COUNT=001001)	+01:51:50	RPC	RBA2
6:44:59	PTRS	001001	+	02:28:26	ARPF502A	# MAG SID 2 Normal	PTRS(COUNT=001001)	+02:28:26	RPC	RBA2
6:44:59	PTRS	001001	+	02:48:26	ARPF399A	Type your question here and then click Search	PTRS(COUNT=001001)	+02:48:26	RPC	RBA2
6:44:59	PTRS	001001	+	02:52:42	ARPF351A	# LAP LL mode	PTRS(COUNT=001001)	+02:52:42	RPC	RBA2
6:44:59	PTRS	001001	+	02:52:50	ARPF390A	# Change LAP probe biases PARAM: VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000	PTRS(COUNT=001001)	+02:52:50	RPC	RBA2
6:44:59	PTRS	001001	+	02:52:53	ARPF483A	# MTL Load: MIP: Check of sequences in normal rate	PTRS(COUNT=001001)	+02:52:53	RPC	RBA2
6:44:59	PTRS	001001	+	03:32:53	ARPF510A	# MAG OB	PTRS(COUNT=001001)	+03:32:53	RPC	RBA2
6:44:59	PTRS	001001	+	04:52:53	ARPF399A	# LAP EndMacro	PTRS(COUNT=001001)	+04:52:53	RPC	RBA2
6:44:59	PTRS	001001	+	04:57:09	ARPF360A	# LAP in passive mode	PTRS(COUNT=001001)	+04:57:09	RPC	RBA2
6:44:59	PTRS	001001	+	04:57:17	ARPF501A	# MAG SID 1 Min	PTRS(COUNT=001001)	+04:57:17	RPC	RBA2
6:44:59	PTRS	001001	+	04:57:59	ARPF421A	# MIP in passive mode	PTRS(COUNT=001001)	+04:57:59	RPC	RBA2
6:44:59	PTRS	001001	+	05:57:59	ARPF420A	# MIP in active mode	PTRS(COUNT=001001)	+05:57:59	RPC	RBA2
6:44:59	PTRS	001001	+	06:27:59	ARPF399A	# LAP End Macro	PTRS(COUNT=001001)	+06:27:59	RPC	RBA2
6:44:59	PTRS	001001	+	06:32:15	ARPF421A	# MIP in passive mode	PTRS(COUNT=001001)	+06:32:15	RPC	RBA2
6:44:59	PTRS	001001	+	06:33:51	ARPF362A	# LAP in active mode	PTRS(COUNT=001001)	+06:33:51	RPC	RBA2
6:44:59	PTRS	001001	+	07:56:51	ARPF399A	# LAP End Macro	PTRS(COUNT=001001)	+07:56:51	RPC	RBA2
6:44:59	PTRS	001001	+	07:57:01	ARPF511A	# MAG IB	PTRS(COUNT=001001)	+07:57:01	RPC	RBA2
6:44:59	PTRS	001001	+	07:57:43	ARPF361A	# LAP Sweep IF	PTRS(COUNT=001001)	+07:57:43	RPC	RBA2
6:44:59	PTRS	001001	+	07:57:51	ARPF390A	# Change LAP probe biases PARAM: VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000	PTRS(COUNT=001001)	+07:57:51	RPC	RBA2
6:44:59	PTRS	001001	+	07:57:54	ARPF399A	# LAP End Macro	PTRS(COUNT=001001)	+07:57:54	RPC	RBA2
6:44:59	PTRS	001001	+	08:02:10	ARPF040A	# MIP Off	PTRS(COUNT=001001)	+08:02:10	RPC	RBA2
6:44:59	PTRS	001001	+	08:02:53	ARPF303A	# LAP Default Burst	PTRS(COUNT=001001)	+08:02:53	RPC	RBA2
6:44:59	PTRS	001001	+	09:32:53	ARPF503A	# MAG Burst	PTRS(COUNT=001001)	+09:32:53	RPC	RBA2
6:44:59	PTRS	001001	+	09:33:35	ARPF510A	# MAG OB	PTRS(COUNT=001001)	+09:33:35	RPC	RBA2

Parameters

ARPF399A	
ARPF503A	
ARPF484A	
ARPF317A	
ARPF399A	
ARPF318A	
ARPF399A	
ARPF319A	
ARPF511A	
ARPF399A	
ARPF330A	
ARPF485A	
ARPF399A	
ARPF321A	
ARPF502A	
ARPF399A	
ARPF351A	
ARPF390A	VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000
ARPF483A	
ARPF510A	
ARPF399A	
ARPF360A	
ARPF501A	
ARPF421A	
ARPF420A	
ARPF399A	
ARPF421A	
ARPF362A	
ARPF399A	
ARPF511A	
ARPF361A	
ARPF390A	VRPD3046=0xd0d0, VRPD3055=0x00d0, VRPD3050=0x0000
ARPF399A	
ARPF040A	
ARPF303A	
ARPF503A	
ARPF510A	

Title **Part 2 IP Day 2** Contains OBCP check out

Step	Time Absolute	FCP Number	Description	Notes
	18:22			DSN HK Down load pass starts (mo TC)
	20:15			OP data shows missiong data between 2:20 and 09:00
	20:55	RP-FCP-041	MIP on	Added (MIP in wrong state at start of pass)
0000	20:58	RP-FCP-891	Test OBCP KRPS8094 (LDL Control)	
0100		RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 4 RB-C5 (SID2,0x12,OFF,0xFF,SID1)	
0110	21:45	RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 5 RB-C5,(SID1,0x11,OFF,0xFF,SID2)	
0120	22:00	RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 6 RB-C5, (SID1,0x11,OFF,0xFF,SID1)	
0130	22:15	RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 3 RB-B4,(SID2,0x12,SID2,0x02,SID4)	
0130	22:30	RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 3 RB-B4,(QUIET,0xFF,SID2,0x02,SID3)	Please note step number typo in sequence
	22:47	RP-FCP-804	LAP Mip MAG Mode Change: (SID3,0x13,NoChange,0xFF,NoChange)	LAP transmitter still on after OP pass active mode. Use descrete command to stop it but with burst mode to observe if it works
	23:00	Discrete	ZRP23030 sent	Turn off active transmission of LAP
	23:09	RP-FCP-804	LAP Mip MAG Mode Change: (QUIET,0xFF,NoChange,0xFF,NoChange)	Transmission stopped succesfull (plan power cycle of LAP not needed)
0205	23:25	RP-FCP-490	Set Passive spectrum coding PARAM: VRPG4011=0x00	
0210		RP-FCP-901	Normal LDL on	
0220	23:35	RP-FCP-904	LDL normal tx level test	ZRP32001 sent mid procedure to renable LAP science as the previous quiet mode disabled it
0230	0:45	RP-FCP-903	LDL off	
0235	0:47	RP-FCP-491	Set transmission level PARAM: VRPG4005=0x01	
0240	0:50	RP-FCP-902	Mixed LDL on	
0250	1:02	RP-FCP-905	LDL mixed tx level test	and and LDL becomes unsynchronised. OBCP does not recover
	1:42	RP-FCP-804	LAP Mip MAG Mode Change: (OFF,0xFF,OFF,0xFF,NoChange)	Power off to quickly recover operation (LDL test aborted)
	1:54	RP-FCP-804	LAP Mip MAG Mode Change: (ON,0x12,ON,0x02,NoChange)	Power on again
0260		RP-FCP-903 (MTL)	LDL off	Not placed on MTL and not run due to previous problems
0270		RP-FCP-420 (MTL)	MIP in active mode	
	2:20	Pass ends		

Title **Part 2 OP Day 2**

Grey area is the pre compiled ITL, other sequences added to MTL manually

Step	Time UTC	Absolute	Duration	FCP Number	Description	Procedure Duration Required	Execution	Actual	Pointing Requirements
0000	2:15	00:00:00	0:00:00	RP-FCP-504	MAG SID 4 (2:15)	n/a	00:00:42	01:00:16	+XSunPointing
0010	2:25	00:10:00	0:10:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0020	2:29	00:14:16	ReqTime	RP-FCP-335	LAP Digital Filter Tests A16	00:15:04	00:10:16	00:20:16	+XSunPointing
0030	2:39	00:24:32	ExeTime	RP-FCP-480 (MTL)	MTL Load: MIP Data Rate Check	00:45:00	00:10:00	06:20:28	+XSunPointing
0040	2:49	00:34:32	0:10:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0050	2:53	00:38:48	ReqTime	RP-FCP-316	LAP NN Test	00:21:28	00:09:44	02:21:28	+XSunPointing
0060	3:15	01:00:16	ReqTime	RP-FCP-510	MAG OB	n/a	00:00:42	Unknown	+XSunPointing
0070	5:15	03:00:16	2:00:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	00:04:16	+XSunPointing
0080	5:19	03:04:32	ReqTime	RP-FCP-317	LAP EE Test	00:09:44	00:08:40	02:00:00	+XSunPointing
0090	7:19	05:04:32	2:00:00	RP-FCP-399	LAP EndMacro	00:04:16	00:00:10	Unknown	+XSunPointing
0095	7:25	05:10:00	0:05:28	RP-FCP-XXX	End of Ops	TBD	00:00:01	12:57:46	+XSunPointing
0100	9:00	06:45:00	01:35:00	RP-FCP-490	Set Passive spectrum coding PARAM: VRPG4011=0x00 (Ops start at 09:00)	n/a	00:00:01	00:00:01	+XSunPointing
0110	9:00	06:45:01	ExeTime	RP-FCP-491	Set transmission level PARAM: VRPG4005=0x01	n/a	00:00:01	04:01:43	+XSunPointing
0120	9:00	06:45:02	ExeTime	RP-FCP-901	LDL normal on	n/a	00:02:16	04:00:00	+XSunPointing
0130	13:00	10:45:02	04:00:00	RP-FCP-903	LDL Off	n/a	00:01:42	00:01:44	+XSunPointing
0140	13:01	10:46:44	ExeTime	RP-FCP-491	Set transmission level PARAM: VRPG4005=0x01	n/a	00:00:01	00:00:01	+XSunPointing
0150	13:01	10:46:45	ExeTime	RP-FCP-490	Set Passive spectrum coding PARAM: VRPG4011=0x00	n/a	00:00:01	Unknown	+XSunPointing
0160	13:01	10:46:46	ExeTime	RP-FCP-902	LDL Mixed	n/a	00:02:16	04:00:00	+XSunPointing
0170	17:01	14:46:46	04:00:00	RP-FCP-903	LDL Off	n/a	00:01:42	Unknown	+XSunPointing
0180	17:41	15:26:46	00:40:00	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x23, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	00:40:00	+XSunPointing
0190	18:21	16:06:46	00:40:00	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x35, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	00:10:00	00:01:00	00:01:00	+XSunPointing
0200	18:22	16:07:46	ExeTime	RP-FCP-804	LAP Mip MAG Mode Change: RPC Env. Mon. 6 RB-C5, PARAM: VRPD1262=SID1, VRPD1267=0x11, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID1	00:10:00	00:01:00	Unknown	+XSunPointing
0210	20:22	18:07:46	2:00:00	rp-fcp-XXX	End of Ops	*TBD*	*TBD*	*Unknown*	+XSunPointing

				Data Volume	74487.5	kbits		Peak Pwr
Exp Modes at end of procedure						9.1 Mbytes		6160.0
IES	**ICA**	**LAP**	**MIP**	**MAG**	**DataRate (bit/s)**	**Data Vol (kbits)**	**Running total (Mbytes)**	**Avg Pwr (mW)**
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	278.6	0.03	6160.0
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	118.9	0.05	6160.0
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	286.0	0.08	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	1708.9	0.29	6160.0
Off	Off	Hk Only	SID 3 Brst	SID 4	663.5	165.9	0.31	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	3668.4	0.76	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	20506.6	3.26	6160.0
Off	Off	Hk Only	SID 3 Brst	SID 4	663.5	165.9	3.28	6160.0
Off	Off	SID 3 Brst	SID 3 Brst	SID 4	2916.5	20506.6	5.79	
Off	Off	Hk Only	SID 3 Brst	SID 4	663.5	212.5	5.81	
Off	Off	Hk Only	SID 3 Brst	SID 4	663.5	3693.3	6.26	
Off	Off	Hk Only	SID 2 Nrm	SID 4	1432.0	1.4	6.26	4513.3
Off	Off	Hk Only	SID 2 Nrm	SID 4	1432.0	1.4	6.26	4513.3
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	6686.7	7.08	6160.0
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	47.4	7.09	6160.0
Off	Off	Hk Only	SID 2 Nrm	SID 4	1432.0	1.4	7.09	4513.3
Off	Off	Hk Only	SID 2 Nrm	SID 4	1432.0	1.4	7.09	4513.3
Off	Off	SID 2 Nrm	SID 2 Nrm	SID 4	475.5	6686.7	7.90	6160.0
Off	Off	Hk Only	Off	SID 4	351.5	823.8	8.00	3993.3
Off	Off	SID 3 Brst	Off	SID 3 Brst	3631.0	8510.2	9.04	3993.3
Off	Off	SID 3 Brst	Off	SID 3 Brst	3631.0	212.8	9.07	3993.3
Off	Off	SID 1 Min	Off	SID 1 Min	28.8	202.7	9.09	3993.3
Off	Off	SID 1 Min	Off	SID 1 Min	28.8	0.0	9.09	

ITL Part

Time Ref	Event Typ	Event ID		Delta Tim	Sequence	Comment	ITL	
6:45:00	PTRS	002001	-	00:00:00	ARPF490A	# Set Passive spectrum coding PARAM: VRPG4011=0x00 (Ops start at 09:00)	PTRS(COUNT=002001)	-00:00:00
6:45:00	PTRS	002001	+	00:00:01	ARPF491A	# Set transmission level PARAM: VRPG4005=0x01	PTRS(COUNT=002001)	+00:00:01
6:45:00	PTRS	002001	+	00:00:02	ARPF901A	# LDL normal on	PTRS(COUNT=002001)	+00:00:02
6:45:00	PTRS	002001	+	04:00:02	ARPF903A	# LDL Off	PTRS(COUNT=002001)	+04:00:02
6:45:00	PTRS	002001	+	04:01:44	ARPF491A	# Set transmission level PARAM: VRPG4005=0x01	PTRS(COUNT=002001)	+04:01:44
6:45:00	PTRS	002001	+	04:01:45	ARPF490A	# Set Passive spectrum coding PARAM: VRPG4011=0x00	PTRS(COUNT=002001)	+04:01:45
6:45:00	PTRS	002001	+	04:01:46	ARPF902A	# LDL Mixed	PTRS(COUNT=002001)	+04:01:46
6:45:00	PTRS	002001	+	08:01:46	ARPF903A	# LDL Off	PTRS(COUNT=002001)	+08:01:46
6:45:00	PTRS	002001	+	08:41:46	ARPF804A	# LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x23, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	PTRS(COUNT=002001)	+08:41:46
6:45:00	PTRS	002001	+	09:21:46	ARPF804A	# LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x35, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	PTRS(COUNT=002001)	+09:21:46
6:45:00	PTRS	002001	+	09:22:46	ARPF804A	# LAP Mip MAG Mode Change: RPC Env. Mon. 6 RB-C5, PARAM: VRPD1262=SID1, VRPD1267=0x11, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID1	PTRS(COUNT=002001)	+09:22:46
6:45:00	PTRS	002001	+	11:22:46	ARPFXXXA	# End of Ops	PTRS(COUNT=002001)	+11:22:46

Parameters

RPC	RBA2	ARPF490A	VRPG4011=0x00 (Ops start at 09:00)
RPC	RBA2	ARPF491A	VRPG4005=0x01
RPC	RBA2	ARPF901A	
RPC	RBA2	ARPF903A	
RPC	RBA2	ARPF491A	VRPG4005=0x01
RPC	RBA2	ARPF490A	VRPG4011=0x00
RPC	RBA2	ARPF902A	
RPC	RBA2	ARPF903A	
RPC	RBA2	ARPF804A	VRPD1262=SID3, VRPD1267=0x23, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3
RPC	RBA2	ARPF804A	VRPD1262=SID3, VRPD1267=0x35, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3
RPC	RBA2	ARPF804A	VRPD1262=SID1, VRPD1267=0x11, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID1
RPC	RBA2	ARPFXXXA	

Title Part 2 IP Day 3

Step	UTC Time	FCP Number	Description	Notes
0000	19:10	RP-FCP-804	LAP Mip MAG Mode Change: Everything except MAG off, PARAM: VRPD1262=OFF, VRPD1267=0xFF, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=QUIET	Done via DSN
0010	19:16	RP-FCP-069	Set to maintenance mode	Done via DSN. Ack not received by DSN but via NN 30 mins later
0020	20:14	RP-FCP-091	PIU Memory test (ensure commands loaded on stack !)	
0030	20:34	RP-FCP-050	MAG OFF	
0040	20:37	RP-FCP-066	Reboot in PROM	
0050	20:45	RP-FCP-051	MAG ON	
0060		RP-FCP-069	Set to maintenance mode	
0070	20:51	RP-FCP-012	IES on in maintenance mode	
0080	20:58	RP-FCP-108	IES Memory Service Test	
0090		RP-FCP-010	IES off	
0100	21:33	RP-FCP-022	ICA on Maintenance mode	ICA Automatically shuts down: problem is the old parameter monitoring code in PROM which is not glitch protected
0110	21:33	RP-FCP-032	LAP on Maintenance mode	
0120		RP-FCP-208	ICA Memory service test	Not done due to ICA shut down
0130		RP-FCP-308	LAP Memory service test	LAP program event not seen - due to packet not defined in RSDB
			Disable ICA paramter monitoring on PIU	
	22:21	RP-FCP-022	ICA on Maintenance mode	
	22:33	RP-FCP-208	ICA Memory service test	Succesful
0140		RP-FCP-020	LAP off	
0150		RP-FCP-030	ICA off	
0160		RP-FCP-050	MAG off	
0170	22:50	RP-FCP-067	Patch and reboot in E2PROM	
0180	22:55	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x13, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	
0190	23:25	RP-FCP-902	LDL Mixed ON	Failed and LDL test aborted again. (Further analysis shows that I have not turn MIP on in previous step)
0200		RP-FCP-905	LDL Lvl Test	
0210		RP-FCP-903	LDL OFF	
0220		RP-FCP-804	LAP Mip MAG Mode Change: Everything off, PARAM: VRPD1262=OFF, VRPD1267=0xFF, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=OFF	Mistake in params (MAG was QUIET)
0230		RP-FCP-066	Reboot in PROM	
0240		RP-FCP-051	MAG ON	
0250	23:41	RP-FCP-011	IES On	
0260	23:47	RP-FCP-069	PIU Maintenance Mode	
0270		RP-FCP-114	Prepare & Test IES to generation of HV Events	PIU Goes to normal mode
	0:04	RP-FCP-031	LAP on	Perform LAP calibration in parrallele to save time
	0:08	RP-FCP-310	LAP Calibration	Perform LAP calibration in parrallele to save time
0280		RP-FCP-115	Renable HV Events	Skipped as test was performed in step 270
0290		RP-FCP-130	Run stim mode	Skipped as test was performed in step 270
	0:31	RP-FCP-030	LAP Off	
0300	0:31	RP-FCP-010	IES Off	
	0:36	RP-FCP-050	MAG off	Forgot to add steps to switch back to new SW version
	0:36	RP-FCP-067	Patch and reboot in E2PROM	Forgot to add steps to switch back to new SW version
		RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x13, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	Have another attempt at LDL mixed mode
	0:50	RP-FCP-041	Turn MIP ON	Realised my mistake in not turning MIP on
		RP-FCP-902	LDL Mixed ON	
	0:57	RP-FCP-905	LDL Lvl Test	Ran with reduce durations of each step as we were running out of time. Test was successfully excuted
	1:28	RP-FCP-903	LDL OFF	

0310	1:35	RP-FCP-804	LAP Mip MAG Mode Change: PARAM: VRPD1262=SID3, VRPD1267=0x13, VRPD1263=OFF, VRPD1268=0xFF, VRPD1264=SID3	
0320	1:40	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0xFFFF, VRPD3055=0x00FF, VRPD3050=0x4040	
0330	1:45	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0x0000, VRPD3055=0x0000, VRPD3050=0x4040	
0340	1:50	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0xFFFF, VRPD3055=0x00FF, VRPD3050=0x4040	
0380	1:55	RP-FCP-803	IES ICA Mode Change: (SID3,SID_TEST,0xff,32)	Moved to earlier point in sequence
0350	1:57	RP-FCP-390	Change LAP probe biases PARAM: VRPD3046=0x0000, VRPD3055=0x0000, VRPD3050=0x4040	
0360		RP-FCP-399	LAP End Macro	Performed earlier
0370		RP-FCP-310	LAP Calibration	Performed earlier
0380	1:55	RP-FCP-803	IES ICA Mode Change: (SID3,SID_TEST,0xff,32)	Performed already
0390	2:06	RP-FCP-806	Perform Graceful shutdown	

RPC Commissioning Part 2
Log pass 1

rpcpiu_chrisl (7:22:44 PM): Morning all
rpcpiu_chrisl (7:22:59 PM): AOS is at 19.15 UTC
rpcpiu_chrisl (7:23:15 PM): SC Commanding starts at 20:02 UTC
rpcpiu_chrisl (7:23:47 PM): We should start RPC ops at 20:45 (ish) UTC
rpcpiu_chrisl (7:29:30 PM): For the log. Just done a connection test with IES at San Antonio tunneling through the Linux machine. All works okay
rpclap_reine (7:35:24 PM): Hurray!
rpcpiu_chrisl (7:36:50 PM): Temperatures on MAG and LAP1 boom LAP1 STP -67.42 C
rpcpiu_chrisl (7:37:01 PM): MAG IB STP -67.42
rpcpiu_chrisl (7:37:40 PM): LAP MIP Boom temps MIP STP 48.33 C LAP2 STP 60.0C
rpcpiu_chrisl (7:40:06 PM): IES TRPP 38.00 DegC
rpcpiu_chrisl (7:40:17 PM): ICA TRPP 25.71
rpcpiu_chrisl (7:53:09 PM): Procedure variation request no 7 submitted. Run sequence to go from maintenance to normal mode between step 120 and 130 of tonights ops
chris_carr2000 (8:18:19 PM): Restarted RPC EGSE
chris_carr2000 (8:18:46 PM): MIP and ICA to reconnect
chris_carr2000 (8:29:08 PM): Ready to start RPC Operations Ref to 'Part 2 IP Day 1'
rpcpiu_chrisl (8:30:48 PM): Step 000 FCP801 Power main Patch address 12000
rpcpiu_chrisl (8:31:00 PM): Executed (response in 3 mins)
rpcpiu_chrisl (8:33:30 PM): OBCP Starting event returned
rpcpiu_chrisl (8:34:11 PM): PIU Alive event received
rpcpiu_chrisl (8:34:44 PM): No HK received yet
rpcpiu_chrisl (8:35:58 PM): MAG on
rpcpiu_chrisl (8:36:52 PM): PIU Voltages 5.14V -5.07V 12.57 -12.92 28.93V Temperature 25.94
chris_carr2000 (8:36:59 PM): PIU Voltage...
rpcpiu_chrisl (8:37:01 PM): No LCL current received
rpcmag_ingo (8:37:43 PM): We got our first packet!
rpcmag_ingo (8:39:16 PM): MAG OB TEMP = -113 °, MAG IB TEMP= -107°
rpcpiu_chrisl (8:39:18 PM): Does every thing look okay
rpcpiu_chrisl (8:39:36 PM): Magnetic field?
rpcmag_ingo (8:39:44 PM): Voltages look good
rpcpiu_chrisl (8:40:44 PM): Ingo are these temperature out of limit (they are red on the system)
rpcmag_ingo (8:42:16 PM): Temperatures are no problems for the sensors
rpcpiu_chrisl (8:42:46 PM): RSDB Action item: Correct limits for MAG temperatures to correct values NRPA5330 NRPA5320
rpcmag_ingo (8:54:06 PM): According to our documents the limits for the sensors are -150 °C
rpcpiu_chrisl (8:54:20 PM): LCL Current 102 mA
rpcpiu_chrisl (8:56:42 PM): Moving step 40 to after step 80 because LAP and ICA on enables the science of each instrument (which is not good)
rpclap_reine (8:58:03 PM): Ok.
rpcpiu_chrisl (8:59:39 PM): Step 30 incorrect should be FCP 500
rpcpiu_chrisl (9:09:22 PM): Starting now step 30 then step 50 and 60. LAP and ICA will now be powered
rpclap_reine (9:09:47 PM): Ok
rpcpiu_chrisl (9:10:44 PM): RSDB Action PIU Temperature. Power on value of HK (before MAG is powered) should not cause an out of limit, (Perhaps add a validity check to value)
rpcpiu_chrisl (9:13:20 PM): PIU Voltages 5.14 -5.07 12.55 -12.90 28.86 Temp 29.25 102 mA
rpcpiu_chrisl (9:14:48 PM): LAP is now on current 153 mA
rpcpiu_chrisl (9:15:42 PM): ICA is now on current 214mA
rpcica_hansb (9:16:45 PM): ICA HK received

rpclap_reine (9:16:52 PM): LAP HK
rpcpiu_chrisl (9:19:32 PM): Okay can we proceed
rpclap_reine (9:19:49 PM): Yes
chris_carr2000 (9:20:32 PM): PIU Voltages +5.14, -5.07, +12.33, -12.37, +27.83
rpclap_anders (9:20:49 PM): LAP s/w version verified. Op amp temperature C.
rpcpiu_chrisl (9:20:55 PM): Doing steps 70 80 40
rpcpiu_chrisl (9:27:35 PM): Starting FCP 091 (PIU Maintenance test)
rpcpiu_chrisl (9:36:41 PM): Setting up step 100 (ICA Memory test)
rpcpiu_chrisl (9:36:57 PM): Memory load data files are from the data filed given to ESOC.
rpcpiu_chrisl (9:37:58 PM): Activate patch has to be injected into the system manually because cannot associate Mem Id to more than one PID. Therefore data will be hard coded onto the command stack
chris_carr2000 (9:39:59 PM): PIU PSU Temperature 30.2 deg. C.
chris_carr2000 (9:42:27 PM): PIU Memory Dump Packets have not been seen
rpcpiu_chrisl (9:43:58 PM): Request further info about memory dump
rpcpiu_chrisl (9:46:33 PM): Memory dump category not enabled must re run PIU memory test Procedure (this will total 4 writes to PIU EPROM test area)
rpcpiu_chrisl (9:46:56 PM): RMOC now enabling dump categories for PIU ICA LAP
rpcpiu_chrisl (9:50:53 PM): PIU Dump packs should come down when they enable it - please standby
rpcpiu_chrisl (9:51:13 PM): If they are received no reason to rerun test - Total writes therefore is only 2
rpcpiu_chrisl (9:57:03 PM): ICA Memory test. Activate patch entered incorrectly. Re-entered and now looks correct
rpcpiu_chrisl (9:57:42 PM): still no dump packets......
rpcpiu_chrisl (10:07:07 PM): Sending ICA Memory test packets
rpcpiu_chrisl (10:07:29 PM): Memory Dump packets have been received by SCOS2000 (2x RAM 1 x EPROM)
rpclap_bjorn (10:21:33 PM): The memory dump data arrived to late on the DDS for the automatic request every second minute. We will get them later on the manual request.
rpcpiu_chrisl (10:23:45 PM): ICA Memory check is not working got an event BadTcType (why - need to check this)
rpcpiu_chrisl (10:30:36 PM): Nor are the dumps. Action: Check why ICA Memory service is not working
rpcpiu_chrisl (10:32:55 PM): Time of first memory: execution time 128.22.13.54.509
rpcpiu_chrisl (10:38:27 PM): Trying LAP Memory tests
rpcpiu_chrisl (10:40:50 PM): LAP Activate patch is okay
rpcpiu_chrisl (10:48:53 PM): LAP Memory dump also has the same problem in that it says it is BadTcType. Will try switching to normal mode then back to maintainenance to see if we can cure the problem
rpcpiu_chrisl (10:50:12 PM): We have performed Memory Patching on LAP in summer 2003
chris_carr2000 (10:55:16 PM): hello Ray
rpcies_rayg (10:55:45 PM): Hi. I'm at home now and Jane says Hi also.
chris_carr2000 (10:56:35 PM): Hi to Jane too
rpcpiu_chrisl (10:58:05 PM): Hi Ray
rpcpiu_chrisl (10:58:47 PM): PIU Maintenance to Normal transition did not seem to work. Back to maintenance command also sent. Will try to return to normal mode again
rpcmag_ingo (11:01:12 PM): ponders the meaning of life
rpcpiu_chrisl (11:01:19 PM): There has been a slight increase in LCL current to 235 mA HK still being generated
rpcpiu_chrisl (11:03:32 PM): Okay reach normal mode again. Switch back to maintenance mode.....and then try LAP commands
rpcpiu_chrisl (11:15:05 PM): Okay the PIU maintenance check didn’t work. Got the dumps correctly but the contents didn’t reflect the values expected.

rpcpiu_chrisl (11:17:52 PM): Problems solved: No load commands were inserted into the procedure therefore the PIU Memory service test will not respond corrfectly. Will repeat on day 3 IP
rpcpiu_chrisl (11:18:56 PM): Aborted LAP and ICA memory load tests. Switch back to normal mode and resumed script at step 120
rpcpiu_chrisl (11:21:42 PM): Didn’t reach normal mode again. Will switch back to maintenance mode and then again to normal mode
rpcpiu_chrisl (11:22:37 PM): Chris can we have a voltage check
chris_carr2000 (11:23:44 PM): copy that
rpcpiu_chrisl (11:23:57 PM): IES temp PAY429 IES temp 51.67 TRPP #53 35
chris_carr2000 (11:24:37 PM): PIU Voltages: +5.14, -5.07, +12.33, -12.37, +27.8
chris_carr2000 (11:24:55 PM): PSU Temp 33 deg. C.
rpcies_rayg (11:25:06 PM): That's kind of warm. Are we at +X to Sun?
rpcies_rayg (11:26:41 PM): Note that the IES operating limits are 54 C for yellow and 58 C for red. The non-op limit is 70C.
rpcpiu_chrisl (11:30:18 PM): We are plus +X to the sun, temperature is still slowly falling . It will be like this until the end of our ops
rpcpiu_chrisl (11:31:04 PM): Reach normal mode (at last) starting with step 120 switching LAP off
rpcpiu_chrisl (11:34:59 PM): LAP is off LCL 153 mA
chris_carr2000 (11:36:20 PM): PIU Voltages: +5.14, -5.07, +12.37, -12.42, +29.44
rpcpiu_chrisl (11:36:45 PM): k
chris_carr2000 (11:41:21 PM): MIP ON
rpcpiu_chrisl (11:44:08 PM): MAG and MIP science now being returned
rpcpiu_chrisl (11:44:08 PM): MIP is now on
rpcpiu_chrisl (11:44:08 PM): LCL 224
rpcpiu_chrisl (11:44:08 PM): and fluctuating
rpcpiu_chrisl (11:44:08 PM): (ie Ingo can stop pondering!!)
rpcpiu_chrisl (11:46:07 PM): Two MIP of limits: RSDB action I think as I think they are COCO types when they should not be NRPD4358 NRPD435E
chris_carr2000 (11:46:11 PM): PIU Voltages: +5.14, -5.07, +12.43, -12.48, +29.89
chris_carr2000 (11:48:17 PM): Hello Ray: can you remember the approximate date of the last time when the IES software was patched on the FM?
rpcpiu_chrisl (11:49:05 PM): I think he means the FS
rpcpiu_chrisl (11:52:20 PM): Okay Reine - I definitely have a patch file from sept 02
rpcies_rayg (11:53:19 PM): No, I don't. It may have been before launch. Could that be correct?
rpclap_reine (11:53:50 PM): Inside the patch file it says it was created June 10 2002
rpcpiu_chrisl (11:54:32 PM): MIP Procedure to start executing at 1 minute past miodnight
rpcpiu_chrisl (11:55:21 PM): MIP Procedure fcp 481
rpcpiu_chrisl (11:55:38 PM): Now turn off ICA to make go to a known state
rpcpiu_chrisl (11:56:19 PM): LCL fluctuating between 192 and 224 mA (Due to MIP). This is normal
rpcpiu_chrisl (11:59:48 PM): Last IES Patch was shortly after 31st July 2002
chris_carr2000 (12:00:06 AM): before launch then...
rpclap_reine (12:05:11 AM): LAP SW Patch was definitely after 23 of June 2002
rpcpiu_chrisl (12:05:12 AM): ICA on LCL current back to around 200 mA
rpcies_rayg (12:05:28 AM): I thought John Hanley did one while it was off the S/C back here, which would have been ~summer 2003. Nicht war?
rpcies_rayg (12:06:51 AM): I can email John to verify that.
rpclap_reine (12:08:35 AM): LAP The patch file we used was created 23 Sep 2002.
rpcpiu_chrisl (12:10:34 AM): May be but we are trying to work out when we successfully patched stuff via the PIU as PIU is not playing cricket when it comes to memory tests
rpclap_reine (12:11:39 AM): ..Yeah and the patch file we used then we did that was created 23 Sep 2002...that gives an indication of when.
rpcpiu_chrisl (12:12:56 AM): No MAG packets but they are being received by the system. Bjorn can you look why we may not be getting anything from the DDS

rpcpiu_chrisl (12:13:18 AM): Solution. Time delay for the MAG packet means they wont be picked up in Bjorns Request
rpclap_bjorn (12:14:15 AM): Yes if they do not arrive in 4 minutes they are not picked up.
rpcpiu_chrisl (12:25:46 AM): ICA gets CMD Err event - seems to be spurious and we are unshure of it source
rpcies_rayg (12:37:20 AM): I'm going off for dinner and a glass of wine. Back later.
rpcpiu_chrisl (12:38:02 AM): Please can I have a glass of wine too? And the dinner wouldnt go amiss especial from a stylish kitchen! Regards to Jane!!
rpcpiu_chrisl (12:39:15 AM): MIP procedure 482 sent to MTL to start executing at 1:01 (hour after previous procedure)
rpcpiu_chrisl (1:03:03 AM): ICA off
rpcpiu_chrisl (1:03:22 AM): MIP Procedure 486 on MTL to execute at 140
rpcpiu_chrisl (1:03:33 AM): 1:40 UTC that is
rpcpiu_chrisl (1:03:59 AM): MIP Procedure 480 on MTL to execute at 2:10 UTC
rpcpiu_chrisl (1:04:18 AM): MAG procedure 504 on MTL to execute at 1:50
rpcpiu_chrisl (1:04:41 AM): MAG procedure 510 to execute at 3:00 via MTL
rpcpiu_chrisl (1:04:55 AM): ICA off LCL 153-173 mA
rpclap_reine (1:05:03 AM): Yes
rpcpiu_chrisl (1:08:27 AM): LAP on commands sent to SC
rpcpiu_chrisl (1:09:36 AM): Lap power on has been executed
rpcpiu_chrisl (1:09:52 AM): LAP on
rpcpiu_chrisl (1:10:08 AM): LCL 224 mA
rpclap_reine (1:19:06 AM): We are getting calibration data now.
rpcpiu_chrisl (1:22:37 AM): LAP MTL Times FCP399 01:45, FCP334 01:50, FCP399 02:30, FCP335 02:35, FCP399 02:55, FCP316 03:00
rpcpiu_chrisl (1:27:23 AM): LAP commands have been up load to SC
rpcpiu_chrisl (1:31:12 AM): For the record Last patching via the PIU was shortly after the 23/9/02 when both LAP and PIU were patched. The operation was performed with PIU running the PROM code. The procedure is detailed by work sheet RO-RPC-WP-6025
rpclap_anders (1:36:02 AM): LAP calibration macros seem to work as intended (knock wood)
Yahoo! Messenger (1:38:36 AM): rpcica_hansb has left the conference.
rpcpiu_chrisl (1:46:50 AM): PIU Voltages 5.14 -5.07 12.4 -12.5 27.86 34.38degC
rpcpiu_chrisl (1:52:53 AM): MIP Parameter NRPD1435A also shows OOL - again I think this the COCOC problem
rpcpiu_chrisl (1:53:01 AM): MAG has just switch to SID4
rpcpiu_chrisl (1:53:36 AM): MAg science generated
rpcmag_ingo (1:54:31 AM): MAG receives science packets, SID4
rpcpiu_chrisl (2:15:13 AM): Debriefing meeting at 2:25am upstairs
rpcies_rayg (2:17:36 AM): In case you are still interested in the last patch for IES, John Hanley emailed me that it was done at SWRI before I took it back to Kourou. That was done using John's PIU simulator.
rpcpiu_chrisl (2:19:04 AM): PIU Voltages before LOS 5.14 -5.07 12.40 -12.48 27.86 Temp 34.38degC LCL Current 204mA
rpcpiu_chrisl (2:19:12 AM): Thanks Ray.

RPC Commissioning Part 2
Log pass 2

rpcmag_ingo (7:54:15 PM):
rpcpiu_chrisl (7:55:19 PM): Are you sleeping?
rpcmag_ingo (7:55:29 PM): No
rpcpiu_chrisl (7:57:57 PM): You icon says that I should be quite - I thought you did not want to be woken up
rpcpiu_chrisl (7:58:04 PM): Okay serious stuff now
rpcpiu_chrisl (7:58:16 PM): PIU MAG LAP MIP operated successfully overnight
rpcpiu_chrisl (7:58:31 PM): MIP is now off as per the OP sequence
rpcpiu_chrisl (7:59:57 PM): The LCL current is nominal at 153mA
rpcpiu_chrisl (8:00:31 PM): Voltages 5.14 -5.07 12.32 -12.40 27.69V Temp 32.27 degC
rpcpiu_chrisl (8:01:25 PM): Data download of out of pass data estimated to be 45 minutes starting at about 20:00 (UTC)
rpcpiu_chrisl (8:06:57 PM): Command to start download has been sent
rpclap_bjorn (8:09:37 PM): We have been getting online HK data, downloaded via DSN since 18:22:07UT
rpcpiu_chrisl (8:12:51 PM): Down load started at 20:08
rpcpiu_chrisl (8:13:22 PM): Currently at 9:16 UTC
chris_carr2000 (8:15:00 PM): Bjoern is starting a download of the overnight out of pass data starting 0200 (initial request for 2 hours of data)
chris_carr2000 (8:16:04 PM): Packets being received from 0200
chris_carr2000 (8:16:26 PM): DDS reports last packet will be 0309
rpclap_reine (8:16:26 PM): LAP receives Out of pass data
rpcpiu_chrisl (8:19:38 PM): There is no science or HK data in SSMM trying to find it
rpclap_reine (8:20:23 PM): LAP data is not out of pass yet...02:14:00
chris_carr2000 (8:25:19 PM): No data from 0309 until 0900. Reason unknown - ESOC checking
rpclap_bjorn (8:33:44 PM): requested DDS data 2004-05-08 09-11UT, (sent the first 10 min a little to fast to you)
rpcpiu_chrisl (8:38:22 PM): Two MAG events Missed Sample CounterUnsync. Ingo can you check the science data for any drop out when you receive it Time 129.20.33.52 UTC
rpcmag_ingo (8:39:59 PM): WE just get the data from the Out of pass period
rpclap_bjorn (8:46:31 PM): We only see SCI data in now, from 2004-05-08 10:17UT
rpcpiu_chrisl (8:46:44 PM): HK from 2:15 to 9:15 now being downloaded
rpcpiu_chrisl (8:46:49 PM): Will start with today procedures
rpcpiu_chrisl (8:55:25 PM): Added extra step to procedure to start MIP
rpcpiu_chrisl (8:58:01 PM): Send MIP LAP commands to configure instruments
rpcpiu_chrisl (8:58:10 PM): Chris can you do a voltage check for me
rpcpiu_chrisl (8:58:26 PM): LCL current 214
chris_carr2000 (8:58:43 PM): No, I have no data!
rpcpiu_chrisl (9:00:28 PM): Duh !
rpcpiu_chrisl (9:00:51 PM): Voltages 5.14 -5.07 12.40 -12.48 27.86
rpcpiu_chrisl (9:01:18 PM): Temp 32.57 deg
rpcpiu_chrisl (9:01:29 PM): LCL 214mA
rpcpiu_chrisl (9:02:20 PM): LAP and MIP in correct state to test LDL
rpclap_bjorn (9:02:51 PM): 2004-05-08 11-13UT data is coming via dds2rpc->RPC_EGSE only SCI and ACK
rpcpiu_chrisl (9:04:29 PM): Out of limits at 241 am. NRPD3315 NRPD3314 Data base check
rpcpiu_chrisl (9:09:51 PM): Database action MIP NRPD436C
rpcpiu_chrisl (9:11:20 PM): remove COC
rpcpiu_chrisl (9:11:28 PM): Command to unsync LDL sent
rpcpiu_chrisl (9:15:59 PM): LDL unsync event OBCP triggered to resynchronise
rpcpiu_chrisl (9:19:00 PM): Back into LDL mode (mixed successfully
Yahoo! Messenger (9:20:12 PM): rpcies_rayg has joined the conference.

rpcpiu_chrisl (9:21:17 PM): Hi Ray - how things
rpclap_bjorn (9:24:52 PM): 2004-05-08 13-15 UT coming via DDS and GSE

rpcpiu_chrisl (9:26:09 PM): Starting step 110
rpclap_bjorn (9:26:25 PM): Still only SCI data via GSE
rpclap_bjorn (9:38:57 PM): 2004-05-08 15-17 data is coming also HK after 15:14UT
rpcpiu_chrisl (9:41:56 PM): step 110 will be released at 21:45UTC
rpcpiu_chrisl (9:52:02 PM): step 120 will be released at 22:00UTC
rpclap_bjorn (9:52:48 PM): 2004-05-08 17-19UT data is coming now
rpcpiu_chrisl (9:53:03 PM): step 110 executed successfully
rpclap_reine (9:53:54 PM): LAP active mode is still in effect...thus we are still transmitting.
rpcpiu_chrisl (9:54:56 PM): PIU voltages: 5.14 -5.07 12.32 -12.40 27.69; Temp=32.87degC; current 153mA; LAP, MAG on only
rpclap_anders (10:04:16 PM): LAP out of pass science data looks good up to the point of our active mode test. LAP was still transmitting at 6.7 kHz well after this test should have ended (at least at 18:00). We may very well be doing so still. We should not. Oh dear.
rpclap_bjorn (10:05:01 PM): 2004-05-08 19-21UT data is coming
rpclap_anders (10:10:20 PM): News on LAP interference: Apparently, we only disturb ourselves: MIP data are uncontaminated after around 15:40.
rpcpiu_chrisl (10:11:15 PM): step 120 executed successfully
rpcpiu_chrisl (10:11:43 PM): step 130 to be released at 22:15UTC
rpclap_anders (10:15:08 PM): LAP 6.7 kHz transmission still going on at 20:26 UT
rpclap_bjorn (10:15:56 PM): 2004-05-08 21-22UT data is coming via RPC EGSE
rpclap_reine (10:24:16 PM): LAP End Transmission command constructed..
rpclap_bjorn (10:32:51 PM): 2004-05-08 22:00 - 21:20 data via RPC GSE
rpclap_reine (10:36:53 PM): LAP Receives default normal mode data 22:18:40 transmitter is still on..
rpclap_bjorn (10:41:00 PM): Now we have done the playback of the old data and is doing the "real time requests" every 2 minutes.
rpclap_reine (10:42:23 PM): LAP transmitter is still on real-time normal mode is affected.
rpcpiu_chrisl (10:44:47 PM): first step 130 and second step 130 (should have been step 140) has been executed successfully
rpclap_reine (10:56:28 PM): LAP received default burst, still affected by transmitter.
rpclap_reine (11:03:56 PM): LAP Transmitter disappeared!
rpcpiu_chrisl (11:09:44 PM): LAP set to produce science data again at 22:47UTC. Command executed successfully. Planned power cycle has been cancelled. LAP set in quiet mode.
rpcpiu_chrisl (11:24:57 PM): Sent step 205 and 210 sent to space craft to execute
rpcpiu_chrisl (11:25:05 PM): This starts LDL more
rpcpiu_chrisl (11:25:12 PM): LCL current 204mA
rpclap_bjorn (11:26:44 PM): Bad TM packet arrived 2004-05-08_23:19
chris_carr2000 (11:31:11 PM): Caused PIU EGSE s/w to lose sync on subsequent good packets. Restarted PIU EGSE solved problem
rpclap_reine (11:31:12 PM): LAP Received command acks.
rpclap_reine (11:32:10 PM): LAP in normal LDL
rpclap_reine (11:34:02 PM): LAP Receives no science
rpcpiu_chrisl (11:35:36 PM): FCP 904 to be executed off stack 23:35
rpcpiu_chrisl (11:45:51 PM): Sent ZRP32001 to re-enable LAP science because OBCP QUIET disabled it (error in procedure sequence)
rpcpiu_chrisl (12:12:26 AM): Sent burst rate command for LAP
rpclap_reine (12:20:16 AM): Receiving LAP LDL data
rpcpiu_chrisl (12:43:25 AM): step 230 delivered at 00:40 UTC
rpcpiu_chrisl (12:46:00 AM): step 230 executed successfully at 00:45UTC
rpclap_reine (12:46:31 AM): ok
rpcpiu_chrisl (12:47:51 AM): step 235 delivered at 00:47UTC
rpcpiu_chrisl (12:48:55 AM): step 235 executed successfully

rpclap_bjorn (12:49:15 AM): Bad MIP SCI TM packet at 2004-05-09 00:43UT
rpcpiu_chrisl (12:50:50 AM): step 240 delivered at 00:50 UTC
rpclap_reine (12:53:45 AM): LAP LDL Off
rpcpiu_chrisl (12:56:35 AM): step 240 executed successfully at 00:56UTC
rpclap_reine (12:58:32 AM): LAP in Mixed LDL 00:54:24
rpcpiu_chrisl (1:03:48 AM): step 250 released at 01:02UTC
rpcpiu_chrisl (1:10:41 AM): step 260 and 270 put in MTL. Step 260 execution time is 02:20UTC
rpcpiu_chrisl (1:41:05 AM): Step 250 LDL mode has problems MIp rejects the commands LAP ? MIP in unknown LDL state do power off then on to recover
rpcpiu_chrisl (1:41:59 AM): Run OBCP 804 with MIP LAP Off and MAG no change
rpcpiu_chrisl (1:44:54 AM): Power off LAP and MIP
rpcpiu_chrisl (1:54:04 AM): OBCP to power LAP MIP on in normal mode. Params 0x12 for LAP 0x02 for MIP
rpclap_reine (1:56:09 AM): Ok
rpclap_reine (1:56:45 AM): LAP LDL Off at 01:52:32 UTC
rpclap_reine (1:58:50 AM): LAP Off On at 01:53:04.
rpclap_reine (2:01:07 AM): LAP in default normal mode
rpcpiu_chrisl (2:02:35 AM): Probably will have to do FCP 905 again tomorrow as it did not complete
rpclap_reine (2:03:02 AM): Ok
rpcpiu_chrisl (2:17:18 AM): PIU Voltages: +5.14, -5.07, +12.14, -12.15, +27.86
rpcpiu_chrisl (2:17:27 AM): Temp 33.78 deg. C
rpcpiu_chrisl (2:17:32 AM): LCL 214mA
rpcpiu_chrisl (2:20:50 AM): Carrier gone
rpcpiu_chrisl (2:20:54 AM): End of operations

RPC Commissioning Part 2
Log pass 3

rpcpiu_chrisl (6:54:22 PM): Final step in OP ITL rerun due to typo in my script
rpcpiu_chrisl (7:13:33 PM): Step 000 sent - powering of LAP disables MAG science
rpcpiu_chrisl (7:16:24 PM): step 110 set to maintenance mode
rpcpiu_chrisl (7:17:07 PM): PIU Voltages 5.14 -5.07 12.55 -12.88 28.83 LCL 102mA Temp 31.97degC
rpcpiu_chrisl (7:20:30 PM): Maintenance mode achieved but not properly ackknowledged
rpcpiu_chrisl (7:45:20 PM): Correction: it isn’t step 110. it should be step 010
rpclap_bjorn (7:50:33 PM): Last data we got from DDS today was up to 2004-05-09T18:56:47Z
rpclap_bjorn (8:05:43 PM): 2004-05-09_20:00:15 real time data is coming from the DDS .
rpcpiu_chrisl (8:13:10 PM): Okay starting step 20 PIU Memory tests
rpcpiu_chrisl (8:14:50 PM): Switch to Maint command Ack eventually received (came via VC1)
rpcpiu_chrisl (8:15:32 PM): Dump command has been sent
rpcpiu_chrisl (8:19:02 PM): Memory load with dead beef cafe sent to PIU ram
rpcpiu_chrisl (8:22:22 PM): Memory load of the same area has been sent and then memory check a minute later
rpcpiu_chrisl (8:26:53 PM): RAM memory write successfully (check and dump confirms it)
rpcpiu_chrisl (8:29:19 PM): EPROM Memory load successful
rpcpiu_chrisl (8:31:32 PM): memory DUMP AND CHECK CONFIRMS SUCCESS
rpcpiu_chrisl (8:37:09 PM): Reboot in PROM commands be sent (MAG is now off)
rpcpiu_chrisl (8:43:14 PM): PROM code v5.5 0x1f2
rpcpiu_chrisl (8:46:07 PM): Running in Maintenance mode from prom code
rpcpiu_chrisl (8:46:38 PM): 5.13 -5.05 12.50 -12.87 28.83 current 102 mA temp 30.46 deg C MAG only on
rpcpiu_chrisl (8:47:37 PM): IES Temp
rpcpiu_chrisl (8:47:51 PM): RAY 429 is 50 degC
rpcmag_ingo (8:47:59 PM): MAG receives HK data
rpcpiu_chrisl (8:48:03 PM): TRPP #53 is 33 degC
rpcpiu_chrisl (8:51:23 PM): IES Power on sent at 20:51
rpcpiu_chrisl (8:53:53 PM): IES in normal mode
rpcpiu_chrisl (8:54:51 PM): PIU Voltages 5.13 -5.05 12.27 -12.28 29.82 LCL 163mA Temp 30.46
rpcpiu_chrisl (8:55:06 PM): IES PAY 50 TRPP 33
rpcpiu_chrisl (8:58:59 PM): Starting fcp 108 IES MEm tests. Skipping first command as we are already in Pause mode. Cleared by IES team
rpcpiu_chrisl (9:02:49 PM): IES Memory load commands being sent 3 commands inc Activate patch 1 second between each
rpcpiu_chrisl (9:06:14 PM): IES Temp 1 28.29 Temp 28.27
rpcpiu_chrisl (9:09:08 PM): PAY 429 now 51,67
chris_carr2000 (9:11:22 PM): Welcome, Jim
jlburch_swri (9:12:34 PM): Thanks, Chris. I will stand by.
rpcpiu_chrisl (9:14:28 PM): Okay memory loads are nominal and we are not expecting an event at the end of the patching
rpcpiu_chrisl (9:14:32 PM): Hello jim !
rpcpiu_chrisl (9:17:00 PM): RSDB Action: Check IES temperature calibration: disagrees with IES GSE
rpcpiu_chrisl (9:20:26 PM): Memory load packet sent to experiment without problem that occurred 2 days ago
rpcpiu_chrisl (9:21:55 PM): Memory load check and dump for IES confirmed to be correct
rpcpiu_chrisl (9:22:17 PM): PAY429 51.67
rpcpiu_chrisl (9:23:51 PM): IES Heaters -> A heater is off B heater is on but circuit is also connected to Lander elements and so it cannot be turned off

rpcpiu_chrisl (9:26:24 PM): Hans, are you ready to turn on?
Yahoo! Messenger: rpcmag_khg has declined to join and sent: Nein, danke.
rpcpiu_chrisl (9:29:26 PM): More clarification: Heater B is on but drawing no current as it is thermostatically controlled
rpcies_rayg (9:31:03 PM): Ok, but controlled by the Lander or IES or either?
rpcpiu_chrisl (9:32:48 PM): No by the ground but via a thermostat (I guess a local one for each unit)
rpcpiu_chrisl (9:33:04 PM): ICA now, LAP commands to power on also sent
rpcpiu_chrisl (9:39:25 PM): PIU Voltages 5.13 -5.05 12.50 -12.87 28.83 LCL....
rpcpiu_chrisl (9:42:03 PM): ICA automatically switched off using PIU automatic event monitoring
rpcpiu_chrisl (9:42:24 PM): LAP is on successfully LCL 163 mA
rpcpiu_chrisl (9:43:14 PM): Using PROM code which does not use the latest version of the ICA monitoring macros. Latest version has glitch protection. Probablly thisis caused by a ICA glitch
rpcpiu_chrisl (9:52:54 PM): ICA memory load aborted due to problems. Next procedure is LAP memory service test.
rpcpiu_chrisl (10:04:08 PM): execution of step 130 started at 22:02UTC
rpcpiu_chrisl (10:20:43 PM): Didn't seem to get final event for memory load. May have sent the dog prom command to early. Press ahead with ICA Power on according to variation request
rpcpiu_chrisl (10:25:49 PM): ICA Reaches normal mode
rpcpiu_chrisl (10:28:13 PM): Current 224mA
rpcpiu_chrisl (10:29:26 PM): Mode and check commands sent
rpcpiu_chrisl (10:32:09 PM): IES PAY429 still at 51.67 deg C
rpcpiu_chrisl (10:33:52 PM): ICA memory check completed successfully
rpclap_anders (10:33:53 PM): LAP memory dump OK
rpcpiu_chrisl (10:37:41 PM): ICA programming successful and dump report received
rpcpiu_chrisl (10:49:11 PM): LAP programming works fine but final event is not defined in the data base
rpcpiu_chrisl (10:49:34 PM): RSDB Update: LAP Event packets need to be added
rpcpiu_chrisl (10:49:51 PM): IES PAY 429 Temp back to 50
rpcies_rayg (10:51:14 PM): OK re PAY. I suspect the difference WRT the 51.67 is just one bit.
rpcpiu_chrisl (10:51:37 PM): Affirmative - it's obvious from the display
rpcpiu_chrisl (10:51:59 PM): Ray do you remember your APID value?
rpcies_rayg (10:52:32 PM): For what?
rpcpiu_chrisl (10:52:44 PM): Your telemetry packets (events)
rpcies_rayg (10:53:27 PM): Hang on, Charles is looking. Is it in the EIDB?
rpcpiu_chrisl (10:53:52 PM): Try EIDA section 8 I think
rpcies_rayg (10:54:41 PM): we're looking
rpcpiu_chrisl (10:57:40 PM): PIU reboot s success fully
rpcies_rayg (10:58:34 PM): Chris, why do you need to know the APID?
rpcpiu_chrisl (10:59:44 PM): We have an unknown packet from the Sc with APID 0D51 and I am trying to work out if it is one of ours
rpcies_rayg (11:03:35 PM): looking.....
rpcies_rayg (11:08:05 PM): D41 ack/nak d44 HK d47 event d49 mem serv d4c science
rpcpiu_chrisl (11:09:24 PM): okay you are innocent but next time....
rpcpiu_chrisl (11:09:37 PM): Unknown packet is actually a ICA acknowledge packet
rpcies_rayg (11:10:01 PM): thanks for all the fun.
rpcies_rayg (11:24:35 PM): sooooo?
rpcpiu_chrisl (11:25:00 PM): Okay LDL mode failed to start (MIP rejected command) will skip steps 220 and perform later (if time permits)
rpcpiu_chrisl (11:25:07 PM): IES standby for next bout of ops
rpcies_rayg (11:25:26 PM): goody
rpcpiu_chrisl (11:26:08 PM): Give us a ring
rpcmip_jlm (11:26:54 PM): MIP is always off
rpcpiu_chrisl (11:31:20 PM): We had MIP on for a bit but had problems with LDL mode. Finishing to IES ops whilst I try and work out the problem. We will turn on MIP after we have done the IES HV events

rpclap_reine (11:35:12 PM): Did you turn LAP off or did we die?
rpcpiu_chrisl (11:36:25 PM): We turn off LAP
rpcpiu_chrisl (11:37:43 PM): Turning on IES
rpcpiu_chrisl (11:41:21 PM): IES on successfully
rpcpiu_chrisl (11:47:56 PM): PIU in maintenance
rpcpiu_chrisl (11:48:04 PM): Sending two memory load commands
rpcpiu_chrisl (11:48:32 PM): IES temp up to 51.67 (23:46)
rpcpiu_chrisl (11:52:16 PM): LAp being powered on
rpclap_reine (11:57:46 PM): LAP On 23:53:37 UTC
rpcpiu_chrisl (11:58:17 PM): LAP on confirmed on Macro executed
rpcpiu_chrisl (12:04:34 AM): Okay FCP 115 and 130 being sent
rpclap_reine (12:04:40 AM): LAP Calibration mode 0x105 internal resistor sweeps started 23:59:28 UTC
rpcpiu_chrisl (12:07:12 AM): HV Events being generated
rpcpiu_chrisl (12:08:25 AM): IES in LV SCI
rpcpiu_chrisl (12:08:31 AM): LAP final command sent
rpclap_reine (12:17:03 AM): LAP Calibration mode 0x104 open sweeps started 00:09:36 UTC
rpcpiu_chrisl (12:31:06 AM): Turning IES and LAP off skipping 280 and 290 steps
rpclap_anders (12:32:35 AM): LAP cal run successful: quick analysis shows no significant offset drift since two days ago. Good, though it means I don't understand the data...
rpcpiu_chrisl (12:35:53 AM): Ingo, HGA antenna reposition coincides with your queriy to Mark. he reckons the attitude may have shifted slightly
rpcmag_ingo (12:36:35 AM): copy that
rpcpiu_chrisl (12:36:57 AM): After running step 300 have run LAP off and MAG off and then FCP fcp 067
rpcpiu_chrisl (12:38:25 AM): IES Off
rpclap_anders (12:41:03 AM): LAP off
rpcmag_ingo (12:49:12 AM): MAG gets HK again
rpcpiu_chrisl (12:49:42 AM): Problem with step 180 didn’t turn MIP on !!!
rpcpiu_chrisl (12:49:46 AM): run fcp041
rpcmag_ingo (12:50:58 AM): MAG receives NORMAL Science packets
rpclap_bjorn (12:54:22 AM): Bad ICA EVENT arrived
rpcpiu_chrisl (12:55:23 AM): Running Mixed LDL on sequence
rpcmag_ingo (12:56:59 AM): MAG gets BURST data now
rpcpiu_chrisl (12:57:00 AM): Start 905 sequence
rpclap_anders (12:58:33 AM): LAP gets science
rpclap_reine (12:59:55 AM): Looks to we are running 804?
rpclap_reine (1:02:44 AM): Mixed LDL!
rpcpiu_chrisl (1:07:47 AM): Mixed LDLD off; starting LDL mode again at the next level
rpclap_reine (1:12:56 AM): LAP is not in LDL 01:08:48 UTC
rpclap_reine (1:15:08 AM): LAP in mixed LDL 01:10:56 UTC
rpcpiu_chrisl (1:25:19 AM): IES Temp still 51.67 can we turn you on just for 5 minutes just to check that the final OBCP's work?
rpcpiu_chrisl (1:27:03 AM): Last LDL config sent
rpcpiu_chrisl (1:28:02 AM): Sequence 903 will be sent (steps 200 and 210) next steps will be 804
rpcpiu_chrisl (1:32:58 AM): Setting up step 310 and then steps 320 to 350 with 5 mins between each
rpcpiu_chrisl (1:35:43 AM): Mode control sent MIP off LAP to start bias tests
rpcpiu_chrisl (1:36:16 AM): That was step 310
rpcpiu_chrisl (1:36:57 AM): PU Voltages 5.14 -5.07 12.40 -12.48 27.86 LCL 214 Temp 32.57
rpclap_reine (1:38:39 AM): Was LDL OFF sent?
rpclap_reine (1:39:04 AM): A now it's off...
rpcmip_jlm (1:40:33 AM): Good results for MIP in LDL mixed mode
rpcpiu_chrisl (1:42:54 AM): 320 sent at 1:40:55
rpclap_reine (1:44:33 AM): Can U keep us posted on when U send the bias changes, please.

rpcpiu_chrisl (1:45:45 AM): Second Bias command sent
rpcpiu_chrisl (1:50:58 AM): Step 340 Bias command just sent
rpclap_reine (1:51:43 AM): Science is coming 01:47:12 UTC
rpcpiu_chrisl (1:51:50 AM): IES ICA due to come on in a few mins. PAY429 still at 51 deg C
rpcpiu_chrisl (1:55:39 AM): IES ICA OBCP Control Mode sent
rpcpiu_chrisl (1:57:12 AM): Last Bias command sent 3 mins ago
rpcpiu_chrisl (1:59:34 AM): IES is on according to HK
rpcies_craigp (2:01:19 AM): IES GSE sees data flow.
rpcpiu_chrisl (2:02:51 AM): ICA and IES on
rpcpiu_chrisl (2:03:24 AM): PIU Voltages 5.13 -5.07 12.30 -12.33 27.93 LCL 275 Temp 32.57 deg C
rpcies_craigp (2:04:56 AM): All IES HK nominal.
rpcica_hansb (2:05:18 AM): ICA in expected sid/mode combination
rpcpiu_chrisl (2:06:52 AM): Mode control OBCP to turn everything off sent
rpcpiu_chrisl (2:06:56 AM): IES off
rpcpiu_chrisl (2:07:03 AM): LAP off
rpcica_hansb (2:07:20 AM): ICA HK & science as expected.
rpclap_anders (2:07:25 AM): Thanks for today!
rpclap_reine (2:08:23 AM): Tack för idag, slut för idag.
rpcpiu_chrisl (2:08:31 AM): ICA off
rpcpiu_chrisl (2:08:37 AM): LCL off being sent
rpcpiu_chrisl (2:08:51 AM): Bon voyage PIU IES ICA LAP MIP MAG will meet again!

rpcica_hansb (2:10:08 AM): Thanks a lot ChrisL and all others.
rpcpiu_chrisl (2:12:20 AM): RPC LCL Off ---- Finished
rpcpiu_chrisl (2:12:57 AM): Debriefing in 10 minutes

Problems and anomalies reported during RPC Commissioning Part 2

1. **ICA switch off.**

This is not a problem and is due to using the PROM code with ICA. The monitoring in this code is not sophisticated enough and only checks one sample for an OOL. As the first ICA link data packet may contain zeros this triggers an OOL and shuts ICA down.

2. **Memory Service Packets for ICA, LAP and IES not accepted by PIU.**

The problem is related to subunits and it only occurs when using the latest SW version. PROM SW works correctly; therefore the problem is confined in SW PATCH. New patch is necessary to solve the problem.

3. **RSDB Problems**

PIU Temperature should have a validity check to prevent initial erroneous reading
MIP has probably got COCO defined erroneously in NRPD435A, NRPD4358, NRPD435E, and NRPD436C.
LAP Out of limits NRPD3315, NRPD3314.

4. **IES HV Events**

Science report stops after the application of IES HV generation patch.

5. **LAP incessant Active Mode**

Once Active mode has been started it is not stopped by the EndMacro Command which is used extensively in FCP's and OBCP's. During CVP it was stopped using a discrete command. LAP requires SW patch to fix the problem so that EndMacro works as expected.

6. **Temperature limits**

Some temperatures are erroneously reported as OOL (include MAG, LAP and IES). Temperature limits in RSDB need to be updated.

7. **ICA Erroneous Error Event**

ICA received an erroneous command event - reason TBD.

8. **Undefined packets**

LAP Memory Patch Successful event not defined in RSDB.
ICA Acknowledgement not defined in RDB.
Unknown packets must be identified and defined.

9. **Memory Allocation**

ESOC did not receive from the S/C part of the data which were supposed to have been produced by RPC's instruments during out-of-pass 1. Further investigations confirmed that part of RPC data collected during out-of-pass 1 and stored in the SSMM had been overwritten with newer RPC data with the result of a data loss. In practice the size of the SSMM allocated for RPC was sufficient for storing only about 2/3 of the data produced during out-of-pass 1.

SSMM allocation needs to be increased from 10MB (current value) to 50MB

10. IES Temperature Calibration

Temperature reading reported by SCOS2000 disagrees with IES' GSE.

Due to some of the problems and anomalies reported in this document, part of the sequences originally scheduled for RPC Commissioning Part 2 had been postponed until RPC HV Commissioning (see Annex1_RPC_CVP_Plan_as_run_1_0.htm.)

12. RSI

ROSETTA

Rosetta Radio Science Investigations

RSI

Report on NEVP Commissioning Operations March, May, September and October 2004

Issue: **2**
Revision: **0**
Date: **01.11.2004**
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Prepared by

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Martin Pätzold

Approved by

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Martin Pätzold (RSI Principal Investigator)

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Document Change Record

Issue	Rev	Sec	Date	Changes	author
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1	0	All	20.05.2004	May operations included	mpa
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ACRONYMS

A/D	Analog/Digital
AGC	Automatic Gain Control
AGVTP	Archive Generation, Validation and Transfer Plan
AOL	Amplitude Open Loop
ATDF	Archival Tracking Data Format
CD-ROM	Compact Disk - Read Only Memory
CL	Closed-Loop
DDS	Data Delivery System
DSN	Deep Space Network
DVD	Digital Versatile Disk
ESA	European Space Agency
ESOC	European Space Operation Center
ESTEC	European Space Technology Center
FOL	Frequency Open Loop
G/S	Ground Station
HGA	High Gain Antenna
IFMS	Intermediate Frequency Modulation System
JPL	Jet Propulsion Laboratory
LCP	Left Circular Polarization
LGA	Low Gain Antenna
LOS	Line Of Sight
MaRS	Mars Express Radio Science Experiment
MGA	Medium Gain Antenna
MGS	Mars Global Surveyor
NASA	National Aeronautics and Space Administration
ODR	Original Data Record
OL	Open-Loop
ONED	one-way dual-frequency mode
ONES	One-way single-frequency mode
PDS	Planetary Data System
POL	Polarization Open Loop
RCP	Right Circular Polarization
RSR	Radio Science Receiver
RX	Receiver
S/C	Spacecraft
SIS	Software Interface Specification
S-TX	S-Band Transmitter
SPICE	Space Planet Instrument C-Matrix Events
TBC	To Be Confirmed

TBD	To Be Determined
TWOD	Two-way dual-frequency mode
TWOS	Two-way single-frequency mode
USO	Ultra Stable Oszillator
X-TX	X-band Transmitter

Contents

1 INTRODUCTION

1.1 SCOPE

This document reports on the NEVP Commissioning of the Rosetta Radio Science Investigation Experiment RSI in March, May, September and October 2004 using the ESA ground station in New Norcia (NNO). The report lists the procedures, sequences used and analyses the data files for the check-out of the Ultra-stable Oscillator (USO), the two-way radio link and the Center of Mass Determination (CMD).

1.2 REFERENCED DOCUMENTS

	Reference Number	Title	Issue Number	Date

1.3 DOCUMENT OVERVIEW

2 SUMMARY OF THE MARCH COMMISSIONING (RSI PART 1)

2.1 OPERATIONS

- General: NNO observations went well from the operational point of view. The RSI FCPs have been executed without major problems.
- The IFMS dual-frequency ranging capability was not available. A precise calibration and correction of the ranging data will therefore not be feasible.
- The IFMS-RS open-loop capability was not yet available, but implementations is planned for later in 2004.

2.2 IFMS ACTIVE TABLE

The IFMS active table must represent the requested space and ground segment configuration defined in the RSI FCPs. During the two one-way passes at NNO tracks, we encountered the following inconsistency between FCP and active table:

- On DOY 187, the coherency parameter was set to "TRUE" (representing a two-way radio link) although the S/C transponder was in non-coherent mode. This resulted in false calculations in the IFMS and eventually in wrong delta delay values. Correct values can be obtained by recalculating delta delay values with correct parameters. However, a wrong configuration of the active table seriously hampers automatic data processing.

2.3 DATA QUALITY

2.3.1 Two-way data TWOD-X and TWOS-X

- In general, the two-way Doppler data are of good quality. One reason for this, however, is the high uplink SNR due to the short distance to Earth during NEVP. A more realistic scenario will be an IC Commissioning at large geocentric distances.
- On average, the X/X-band Doppler noise level is at 30 - 40 µm/s if the X-band uplink is used. This is about a factor of five to ten less than estimated previously. However, again, the commissioning at large geocentric distances suggested for September will represent a realistic scenario. The X/S-band link shows a slightly higher noise level. The differential Doppler was at 60 – 70 µm/s. The plasma propagation showed quiet and constant over all days of observation.
- The differential Doppler showed a sensitivity in the order of 10^{12} m^{-2} s^{-1} for the change of the electron content and 10^{-3} hexem for the electron content. These sensitivities may worsen at large geocentric distances.
- The noise level needs to be reassessed at much greater geocentric distances for reasons mentioned above. This will be representative for a more realistic case of noise level background with low uplink SNR and is essential for experiment calibration.

2.3.2 One-way data ONED and ONES with USO

- The two one-way tracking passes showed instant and erratic jumps at X-band frequency by up to 10 mHz. These excursions last several minutes.
- The ONED X-band frequency seem to show more noise and jumps than the ONES data.
- The ONED S-band data show a 1-sigma noise of 4.4 Hertz. At these near-Earth distances this cannot be attributed to plasma because the two-way TWOD-X data from the same pass do not confirm these plasma contributions. This amplitude was also never encountered with Ulysses (S-up/S-&X-down) during solar conjunction deep in the solar corona.
- This noise amplitude at S-band and the erratic jumps at X-band make the one-way data unuseable for scientific applications.
- The behaviour of the X-band ONED data seems to be similar to the Mars Express ONED data from the MaRS July 2003 commissioning.
- Questions and items to be checked:
  - Is the USO properly connected to TRSP-2?
  - Is the USO lock status ok?
  - Was the TCXO switched-off or muted? (Sequence says yes; HK?)
  - Could there be a cross-talking between USO and TCXO?
  - Check all USO and TRSP HK, in particular TRSP-2 RF output power to find correlations between potential HK events and the frequency jumps
  - Is probably the internal 11/3 coherency between X-band and S-band violated?
  - Check the coherency flag in the IFMS active tables. Must be "TRUE" for two-way and "FALSE" for one-way

2.3.3 Conclusions

There is a need for further check-outs of the USO. RSI proposes the following:

- Two or three of the RSI TVT commissioning passes in May will be given up and replaced by USO check-out procedures.
- In particular the inter-connection between both transponders needs to be checked
- A rough sequence shall be:
  TWOS-X -> TWOD-X -> ONED(TCXO) -> ONED(USO) -> ONES(USO) -> ONES(TCXO) -> TWOS-X ; record each separate configuration for 30 minutes, except the ONED and ONES configuration for one hour.
  TM ON continuously
  RNG ON continuously for two-way parts
  Monitor HK in real-time
- Perform this sequence for both transponders

3 SUMMARY OF THE MAY COMMISSIONING (RSI PART 2)

3.1 OPERATIONS

- General: NNO observations went well from the operational point of view.
- Three of the five tracking passes have been substituted with ad-hoc procedures for the check out of the USO in various configurations. The purpose was to verify the high noise and frequency jumps seen during the commissioning in March.
- The ad-hoc procedures were roughly a sequence of the following procedures: TWOD -> ONED-TCXO -> ONED-USO -> ONES-USO -> ONES-TCXO -> TWOS
- The IFMS dual-frequency ranging capability was not yet available.
- The IFMS-RS open-loop capability was not yet available.

3.2 IFMS ACTIVE TABLE

- It was not possible to update the coherency flag during the track when changing from coherent to non-coherent tracking.

3.3 ONE-WAY DATA ONES AND ONED

- The USO performed normally and as expected.
- The average noise level was in the order of 50µm/s and comparable to the two-way noise level.
- The Allan deviation was found to be 10^{-13} @ 1 second, $6\cdot10^{-14}$ @ 10 seconds, $4\cdot10^{-14}$ @100 seconds at X-band and better than the specifications.
- Spikes with period of 3 minutes have been observed in the X-band data. The occurrence of these spikes could not being verified during an reevaluation of the data in October 2004. This may be connected with the IFMS data provision and needs to be studied in more detail.
- The difference between TM ON and TM OFF in the X-band data is typically 30% in noise level.
- When switching TM ON at X-band, an increase in noise at S-band by a factor of 2.5 could be observed.
- There was no difference in USO behaviour and performance when the USO was connected to Transponder 1 or Transponder 2.
- The average nois elevel of the TCXO was 4 cm/s. Electron content data have been found as stable as with the two-way link due to the common noise source of both carrier frequencies.

3.4 TWO-WAY DATA TWOS AND TWOD

- When the S-band downlink was switched ON, a spike in the X-band frequency of 0.1 Hz occurred
- Spikes with period of 3 minutes have been observed in the X-band data. The occurrence of these spikes could not being verified during an reevaluation of the data in October 2004.

4 SUMMARY OF THE SEPTEMBER AND OCTOBER OPERATIONS

4.1 07.SPETEMBER, CENTER OF MASS DETERMINATION (CMD)

The purpose of the CMD procedure is the determination of the center of mass with respect to the phase center of the antenna and estimate the influence on the Doppler if the spacecraft is slewed while the HGA is kept pointing in Earth direction. This situation may occur during the flybys.
High and medium slew rates have been applied in azimuth and elevation direction. Changes of the carrier frequency by fractions of Hertz could be observed during the slews.
Mechanical oscillations have been probably induced on the HGA with sharp periods ranging from some seconds to 200 seconds. Of concern may be the induced high amplitude oscillations of the HGA (70 mHz peak-to-peak) during the high rate elevation slew of 0.1°/s.

4.2 09. OKTOBER, USO COMMISSIONING

4.3 OPERATIONS

- General: NNO observations went well from the operational point of view. The RSI ad-hoc procedure has been executed without major problems
- During the last hour of operations the IFMS could not lock on the ranging and no range data have been recorded.
- The AGC data could not be retrieved from the DDS. These data are no longer available on the IFMS (deleted after one week) and are assumed lost.

4.4 DATA QUALITY

4.4.1 Two-way data TWOD-X and TWOS-X

- In general, the two-way Doppler data are of good quality but X-band showed an oscillation of a 50 seconds period and 20 mHz peak-to-peak (700 µm/s) when TM is ON.
- The S-band did not show an apparent oscillation, but the power spectrum revealed the 50 seconds oscillations two orders of magnitude weaker.
- On average, the X/X-band Doppler noise level is at 200 µm/s for the current distance of Rosetta (0.5 AU).
- The differential Doppler showed a sensitivity in the order of 10^{12} m^{-2} s^{-1} for the change of the electron content and 10^{-2} hexem for the electron content.

4.4.2 One-way data ONED and ONES with USO

- The X-band USO data showed a noise level of 120 – 130 µm/s with TM ON and 30% less with TM OFF.
- While a 50 seconds oscillation period was always present at X-band when TM was ON, no oscillation could be observed at S-band. When TM was OFF no 50 seconds oscillation was present at X-band.

- The S-band noise level remained unchanged at 850 µm/s when X-band switched from TM ON to TM OFF and back. There was no modulation on the S-band carrier.

5 OVERVIEW

5.1 TRACKING DATES

Activity	DOY	Date	Time (UCT)	Antenna
ONES	088	28.03.2004	20 :50 – 06 :55 UT (DOY 89)	NNO
ONED	089	29.03.2004		NNO
ONED/ONES	123	02.05.2004	20 :45 – 02 :15 UT (DOY 123)	NNO
ONED/ONES	124	03.05.2004		
ONED/ONES	125	04.05.2004		
ONED/ONES	283	09.10.2004	18 :17 – 02 :11 UT (DOY 283)	NNO

5.2 RSI ACTIVITIES AND FLIGHT OPERATION PROCEDURES

The following FCPs have been used for the RSI activities:

Activity	DOY	Date	FCP	description
ONES	088	28.03.2004	RF-FCP-011	One-way X-band D/L
ONED	089	29.03.2004	RF-FCP-012	One-way X & S-band D/L
ONED/ONES	123	02.05.2004	Ad hoc	One-way X & S-band D/L TCXO and USO
ONED/ONES	124	03.05.2004	Ad hoc	One-way X & S-band D/L TCXO and USO USO was not muted after track
ONED/ONES	125	04.05.2004	Ad hoc	One-way X & S-band D/L TCXO and USO
CMD	255	07.09.2004	RF-FCP-020	Two-way X-up/X- & S-down
ONED/ONES	283	09.10.2004	Ad hoc	One-way X & S-band D/L TCXO and USO

5.3 REAL TIME SEQUENCES

The real time sequences will be presented in each section.

5.4 LATE CHANGES TO THE SEQUENCES

none

6 DOY 088, 28.03.2004 – 29.03.2004

6.1 DESCRIPTION

Tracking at NNO performing ONES with USO

6.2 CONFIGURATION

Ground station	NNO, 35-m
ESOC FOP	
RSI activity	ONES
Time	DOY 088, 28.03.2004 – 29.03.2004 20:50 – 06:55 UT
Configuration spacecraft	ONES
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: X-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

6.3 SEQUENCE

Time (UTC)	NNO
088.21:51	Start RSI activity Start TWOS-X Doppler recording TM ON
088.22:51	Stop TWOS-X Doppler recording
088.23:01	Reconfigure to ONES USO; TM ON Start ONES Doppler recording
089.01:01	Stop ONES USO
089.01:01	Start ONES USO, TM OFF
089.03:01	Stop ONES
089.03:01	Start ONES USO, TM ON
089.05:01	Stop ONES
089.05:01	Reconfigure TWOS-X TM ON
089.05:21	Start TWOS-X, TM OFF
089.06:21	Stop TWOS-X
089.06:21	Start TWOS-X, TM ON
089.06:51	Stop TWOS-X End of RSI activities

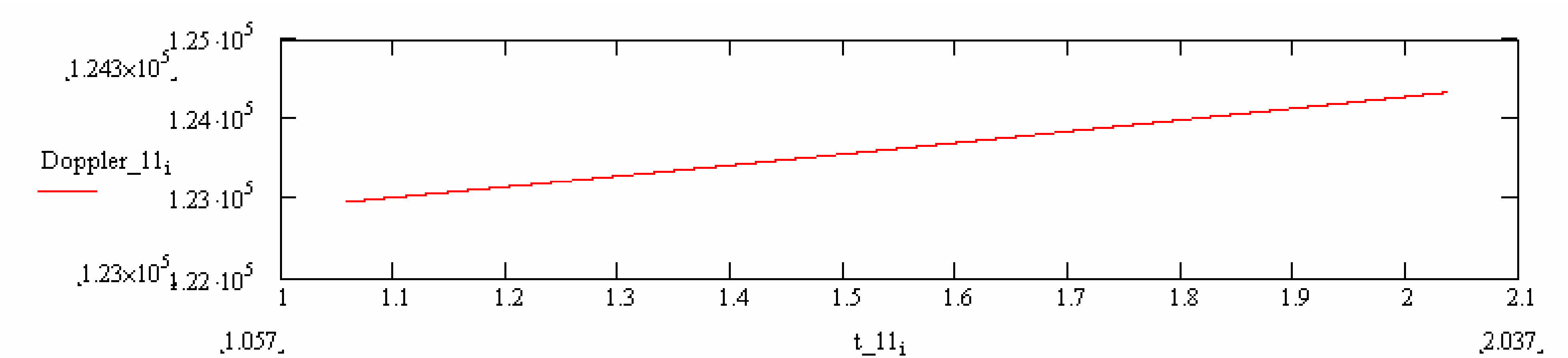
6.4 LATE CHANGES, ANOMALIES

The USO shows random jumps of 10 mHz amplitude at X-band.

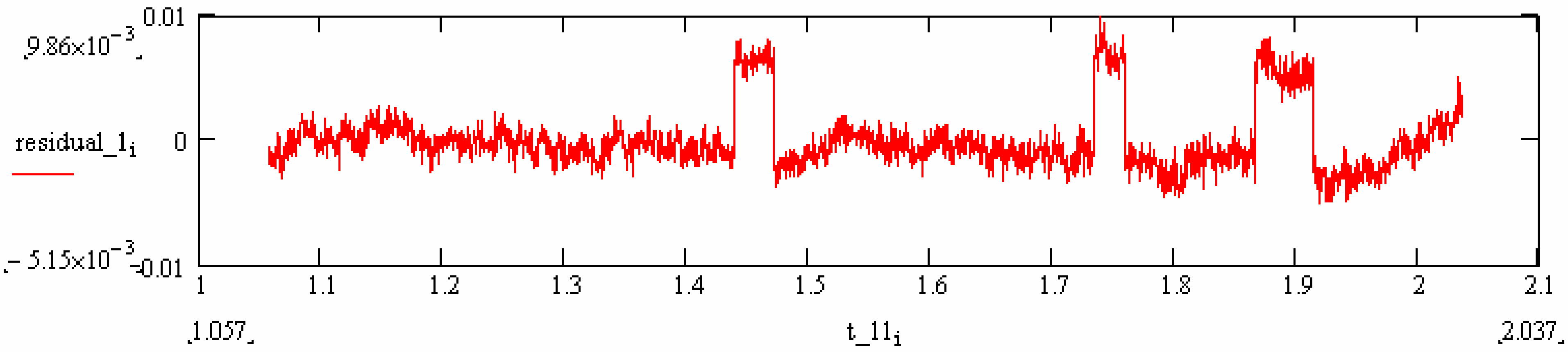
6.5 DATA ANALYSIS

6.5.1 IFMS Doppler, DOY 088.21:51 – 089.06:51 UT

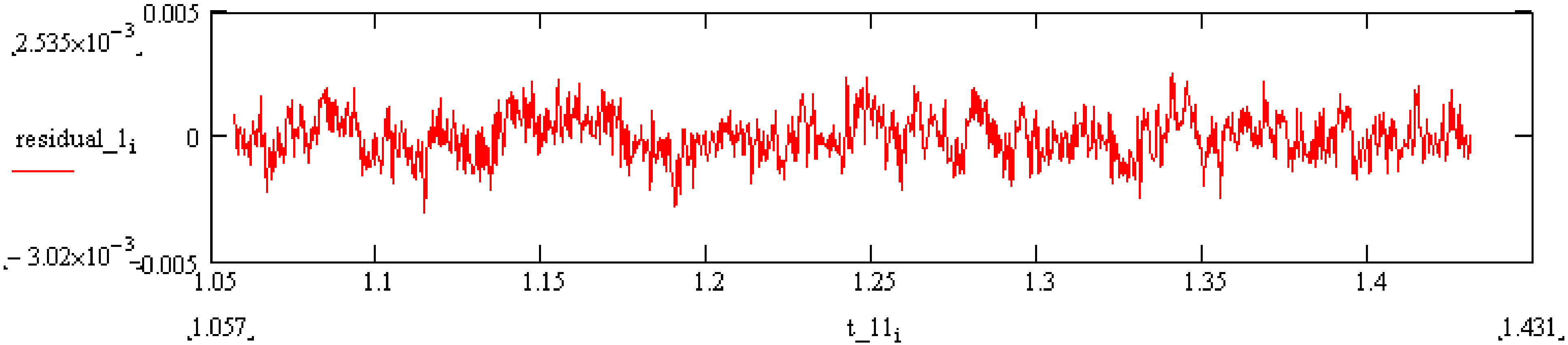
6.5.1.1 Doppler with TM and RNG OFF, one-way non-coherent USO from 089.01:01 to 089.02:01 UT (first file)



X-band between 089.01:01 and 089.02:01 UT, unit is Hertz.

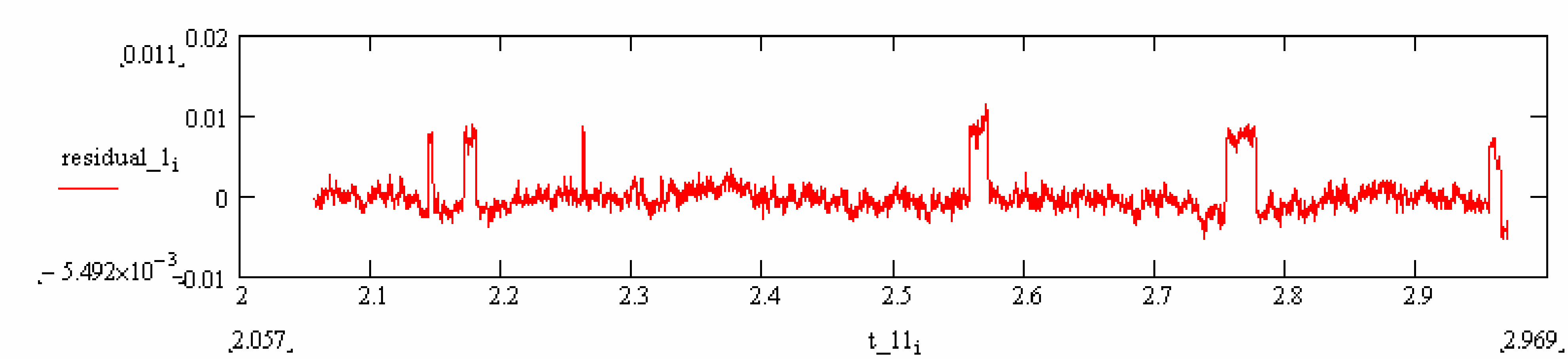


X-band residuals between 089.01:01 and 089.02:01 UT after substracting a polynominal fit. Note the 10 mHz jumps which last several minutes.



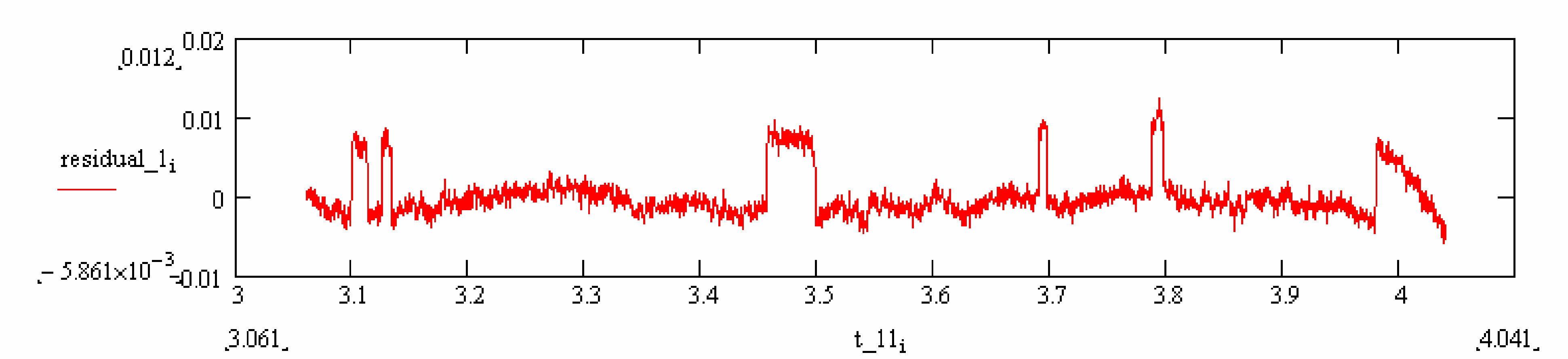
The 1-sigma X-band rms yields 31 µm/s between 089.01:01 and 089.01:25 UT (before the first frequency jump).

6.5.1.2 Doppler with TM and RNG OFF, one-way non-coherent USO from 089.02:01 to 089.03:01 UT (second file)



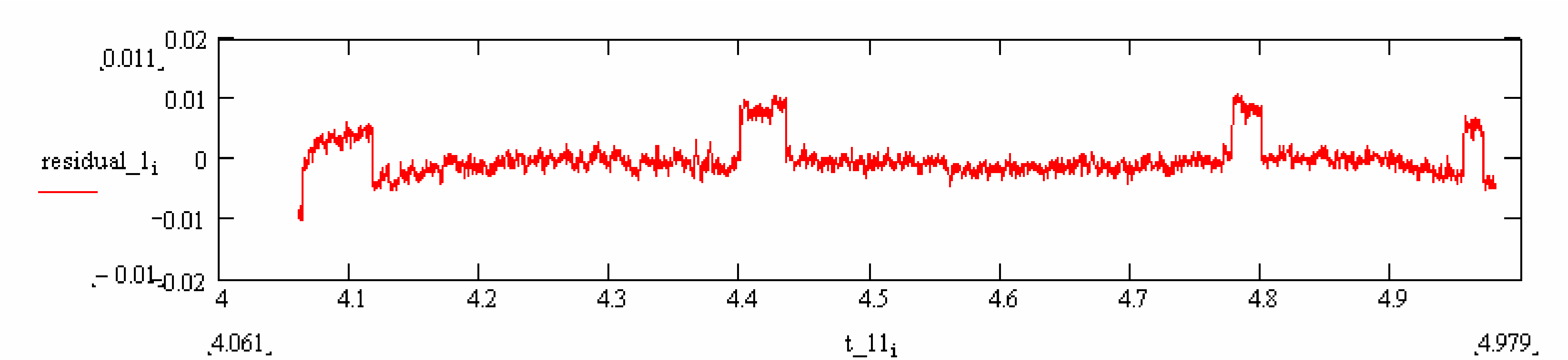
X-band residuals between 089.02:01 and 089.03:01 UT after substracting a polynominal fit. Note the 10 mHz jumps which last several minutes.

6.5.1.3 Doppler with TM ON and RNG OFF, one-way non-coherent USO from 089.03:01 to 089.04:01 UT (first file)



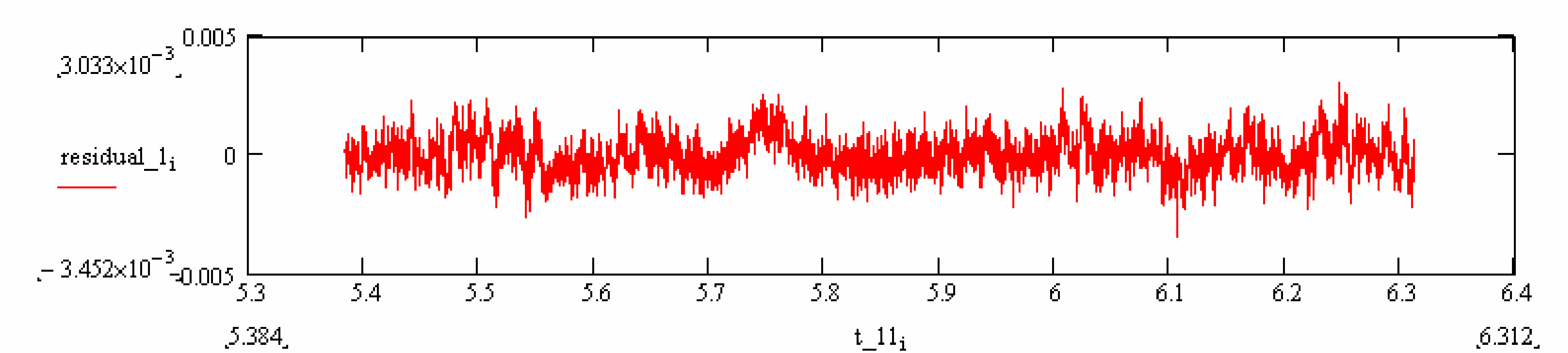
X-band residuals between 089.03:01 and 089.04:01 UT after substracting a polynominal fit. Note the 10 mHz jumps which last several minutes.

6.5.1.4 Doppler with TM ON and RNG OFF, one-way non-coherent USO from 089.04:01 to 089.05:01 UT (second file)



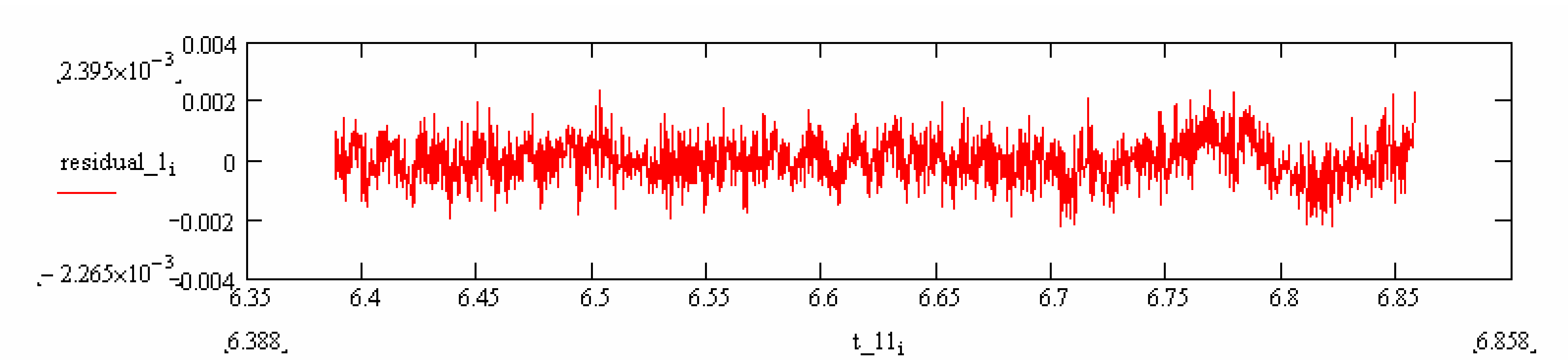
X-band residuals between 089.043:01 and 089.05:01 UT after substracting a polynominal fit. Note the 10 mHz jumps which last several minutes.

6.5.1.5 Doppler with TM ON and RNG OFF, two-way coherent X-band uplink from 089.05:22 to 089.06:22 UT



Two-way X-band Doppler residuals between 089.05:01 and 089.06:01 UT. The 1-sigma rms for this hour of observation is 29 µm/s.

6.5.1.6 Doppler with TM ON and RNG OFF, two-way coherent X-band uplink from 089.06:22 to 089.06:51 UT



Two-way X-band Doppler residuals between 089.06:22 and 089.06:51 UT. The 1-sigma rms for this hour of observation is 26 µm/s.

7 DOY 89, 29.03.2004 – 30.03.2004

7.1 DESCRIPTION

Tracking at NNO performing ONED with USO

7.2 CONFIGURATION

Ground station	NNO, 35-m
ESOC FOP	RF-FCP-012
RSI activity	ONED
Time	DOY 89 – 90; 29.03. – 30.03.2004 20:50 – 06:55 UT
Configuration spacecraft	ONED
Configuration ground segment	IFMS-1: X-band downlink closed-loop IFMS-2: X-band downlink closed-loop IFMS-RS: S-band downlink closed-loop
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

7.3 SEQUENCE

Time (UTC)	NNO
089.22:32	Start of RSI activity X-band ranging
089.22:47	Start TWOD-X TM OFF
090.00:27	Stop TWOD-X reconfigure to ONED
090.00:52	Start ONED TM OFF
090.02:52	Stop ONED
090.02:52	Start ONED TM ON
090.04:52	Stop ONED
090.04:57	Switch-off S-band D/L; reconfiguration to TWOS-X
090.05:07	Start TWOS-X TM ON
090.06:37	Stop TWOS-X
090.06:40	Start X-band ranging
090.06:55	Stop X-band ranging End of RSI activity

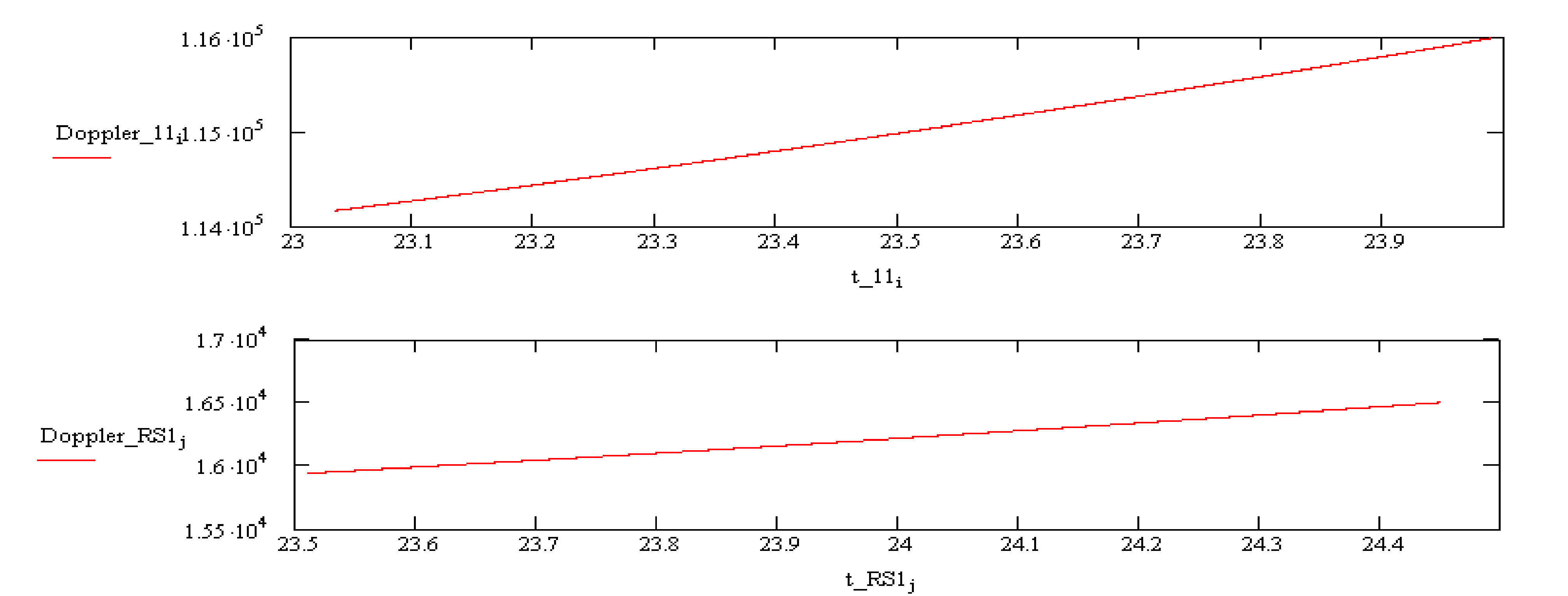
7.4 LATE CHANGES, ANOMALIES

089.22:57 – 090.00:27 Doppler recording of TWOD-X
S-band downlink start at 089.23:28 (fle name)

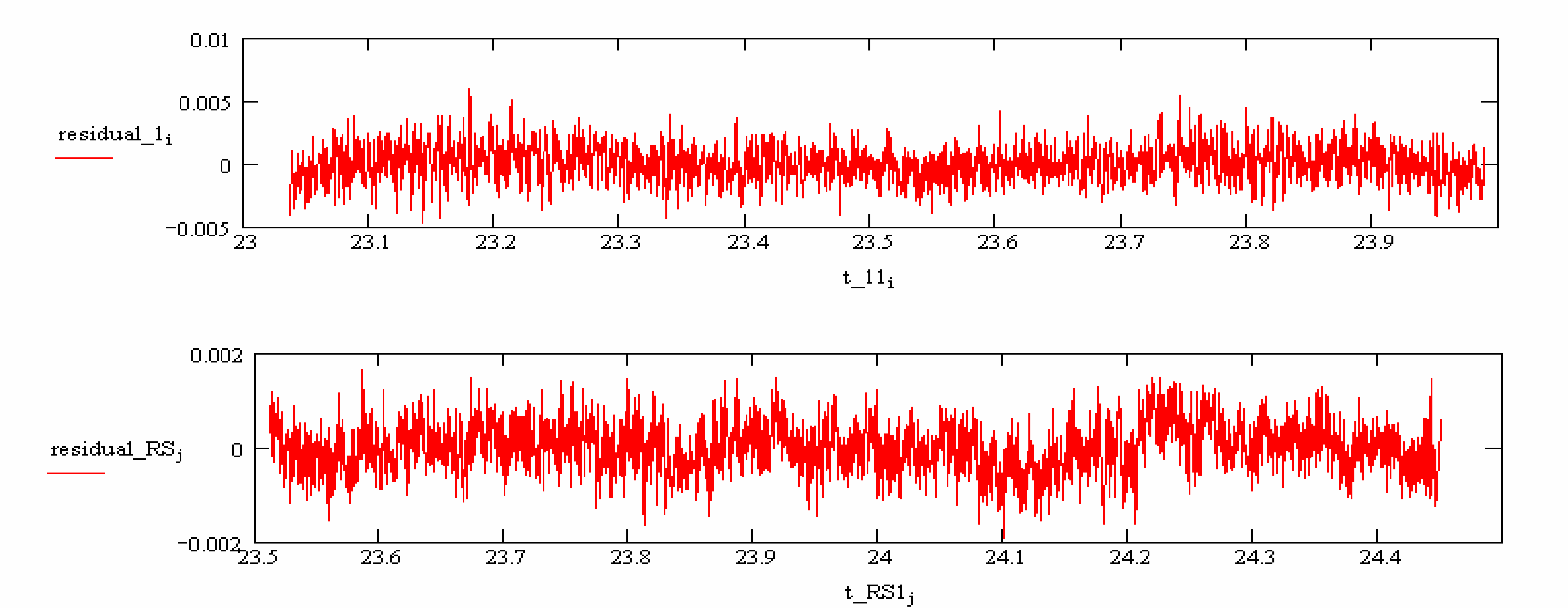
7.5 DATA ANALYSIS

7.5.1 IFMS Doppler on 089.22:57 – 090.06:55 UT

7.5.1.1 Doppler with TM OFF and Ranging two-way coherent from 089.22:57 – 090.00:27



Doppler ecordings at X-band (upper panel) from 23:03 to 24:00 and S-band (lower panel) from 23:30 – 00:27 UT.



residual frequency after substracting a polynominal fit to compensate for the Doppler evolution; X-band (upper panel, unit is Hertz) and S-band (lower panel, unit is Hertz); same times as before.

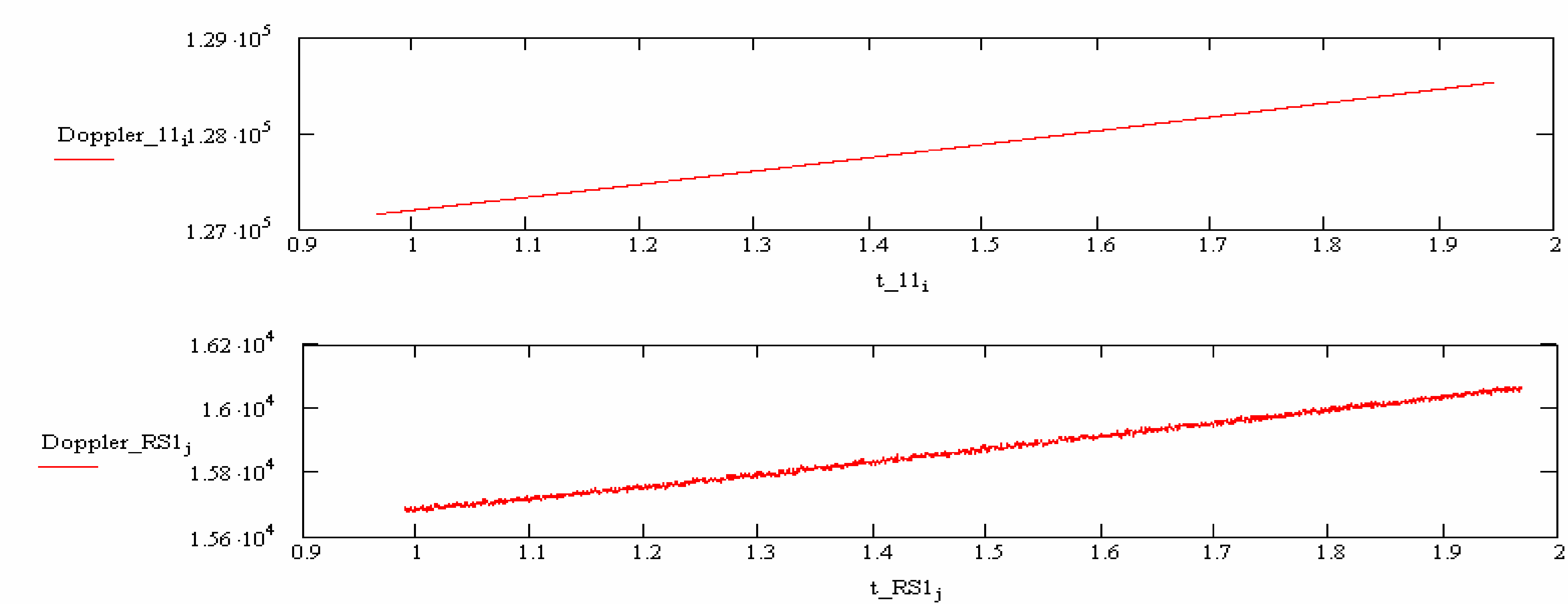
summary 1-sigma r.m.s at one second integration time:

DOY 089.22:57 – 00:27 (DOY90)	**X-band**	**S-band**	**Differential-Doppler**
Frequency	1.43 mHz	0.53 mHz	0.46 mHz
Velocity	51 µm/s	69 µm/s	61 µm/s
Plasma corrected			
Frequency	1.38 mHz	0.38 mHz	
velocity	49 µm/s	49 µm/s	
parameter	TM OFF, RNG OFF Two-way		

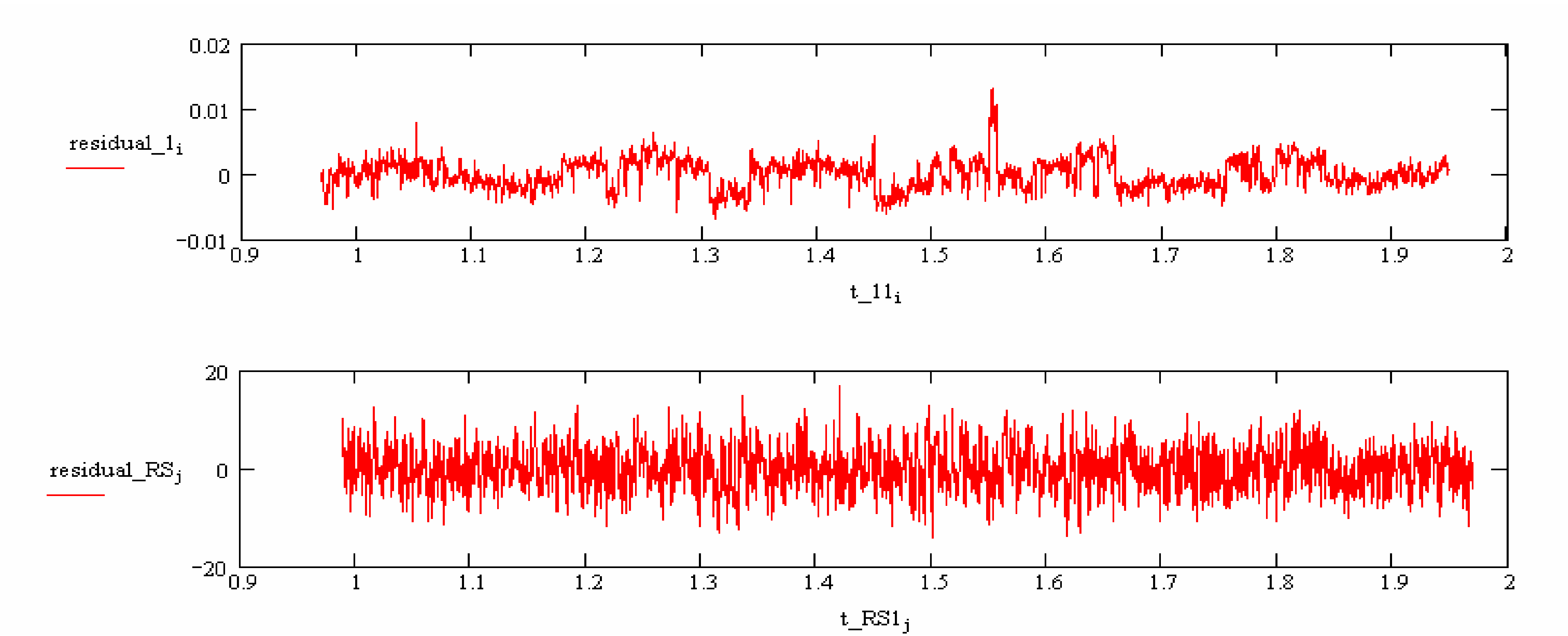
1-sigma rms at higher integration times:

Integration time		**X-band**	**S-band**
10 seconds	Frequency (mHz)	0.74	020
	Velocity (µm/s)	26	26
60 seconds	Frequency (mHz)	0.22	0.06
	Velocity (µm/s)	7.9	7.9
100 seconds	Frequency (mHz)	0.18	0.05
	Velocity (µm/s)	6.6	6.6

7.5.1.2 Doppler ONED with USO, TM OFF, from 090:00:52 – 090.01:52 UT



X-band (upper panel) and S-band (lower panel, unit is Hertz) one-way, USO, from 090.00:52 to 090.01:52 UT. Note the visible noise on the S-band Doppler, a feature never seen in two-way or in MEX one-way data.
Note also that the ratio X-band/S-band is NOT 11/3 but wrong by a factor of two! The reason may be that the coherency flag in the IFMS active table is set "TRUE" although the radio link is non-coherent. The IFMS is internally dividing the received Doppler by a factor of two if the coherency flag is set "TRUE" in order to output downlink Doppler only.



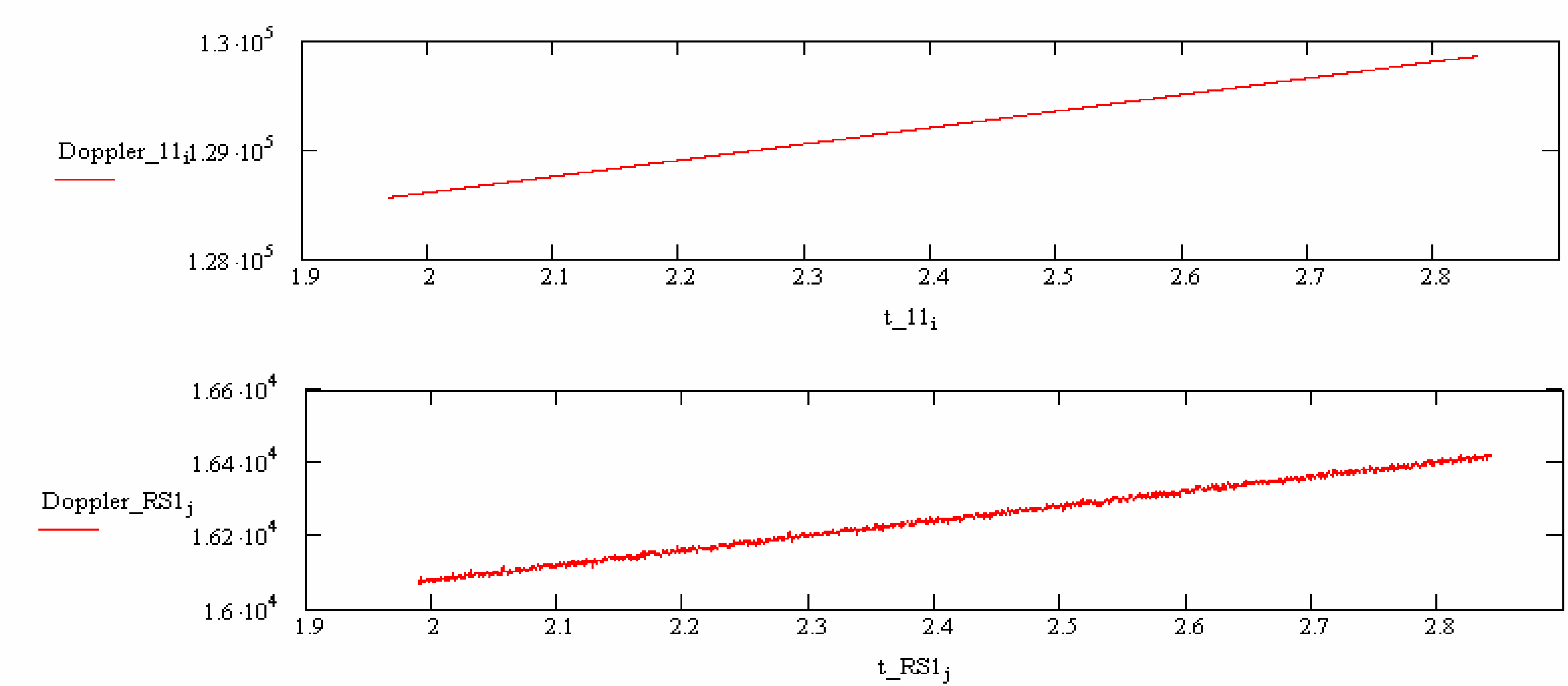
X-band (upper panel) and S-band (lower panel) Doppler residuals for the same times as above after substracting a polynominal fit. The unit is Hertz.
Note the jumps and spikes in the X-band by 5 mHz to 10 mHz.
Note the large S-band noise amplitude.

The differential Doppler is not computed because there is obviously no correlation and coherency between X-band and S-band.

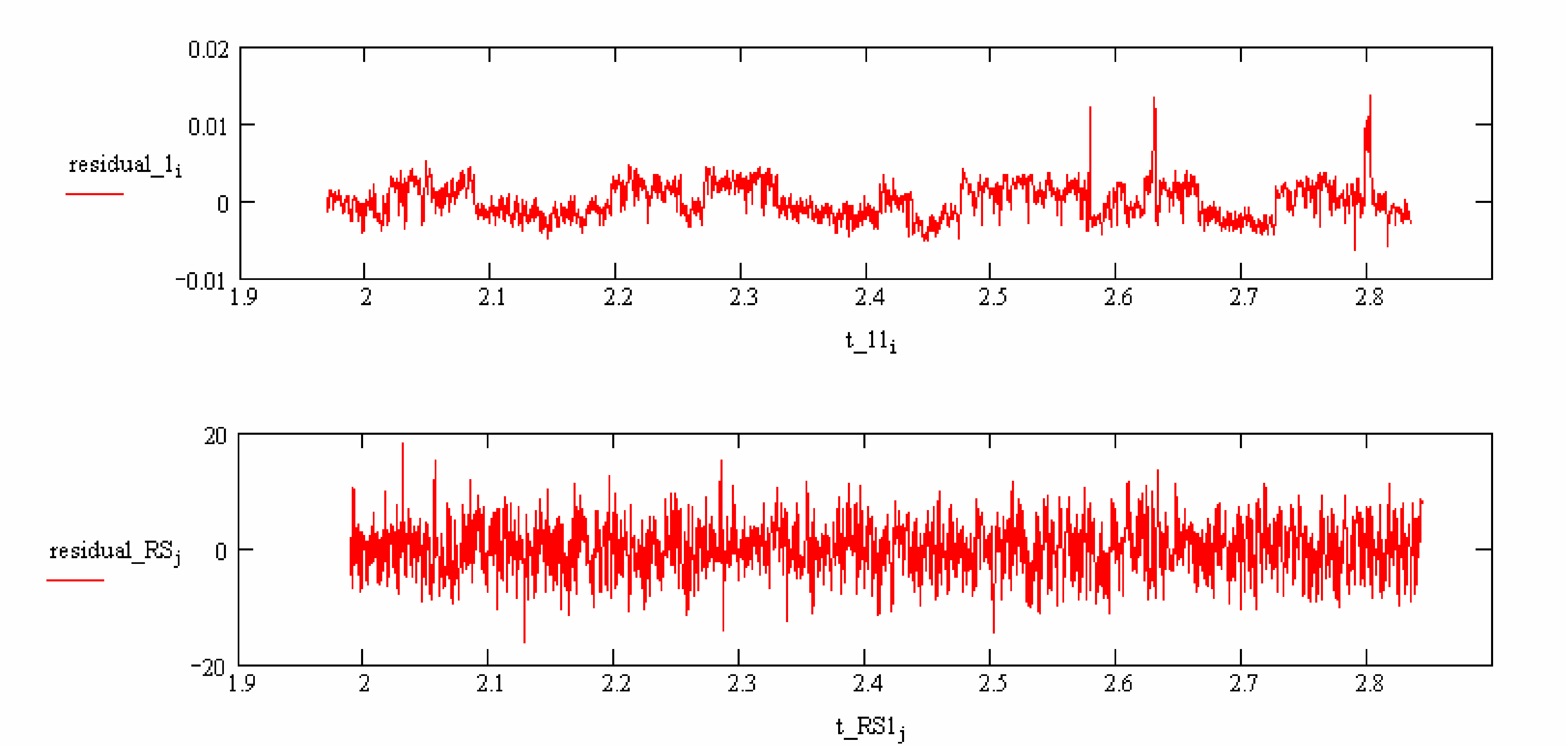
Summary 1-sigma r.m.s at one second integration time:

DOY 090.00:52 – 01:52 UT	**X-band**	**S-band**	
Frequency	2.29 mHz	4.49 Hz	
Velocity	81 µm/s	58.6 cm/s	
parameter	TM OFF, RNG OFF,one-way non-coherent USO		

7.5.1.3 Doppler ONED with USO, TM OFF, from 090:01:52 – 090.02:52 UT (second file)



X-band (upper panel) and S-band (lower panel, unit is Hertz) one-way, USO, from 090.01:52 to 090.02:52 UT (second file). Note the visible noise on the S-band Doppler, as seen in the first file.

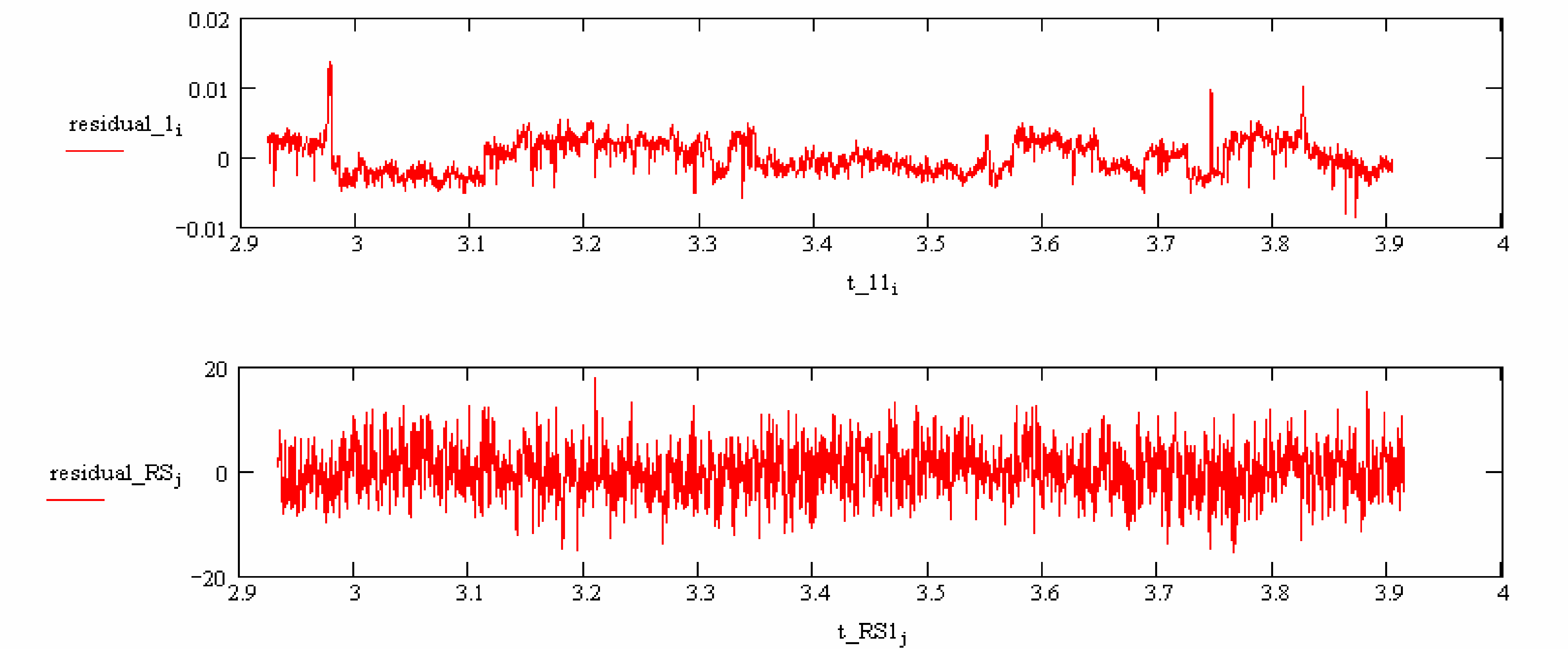


X-band (upper panel) and S-band (lower panel) Doppler residuals for the same times as above after substracting a polynominal fit. The unit is Hertz.
Note the jumps and spikes in the X-band by 5 mHz to 10 mHz.
Note the large S-band noise amplitude.
The differential Doppler is not computed because there is obviously no correlation and coherency between X-band and S-band.

Summary 1-sigma r.m.s at one second integration time:

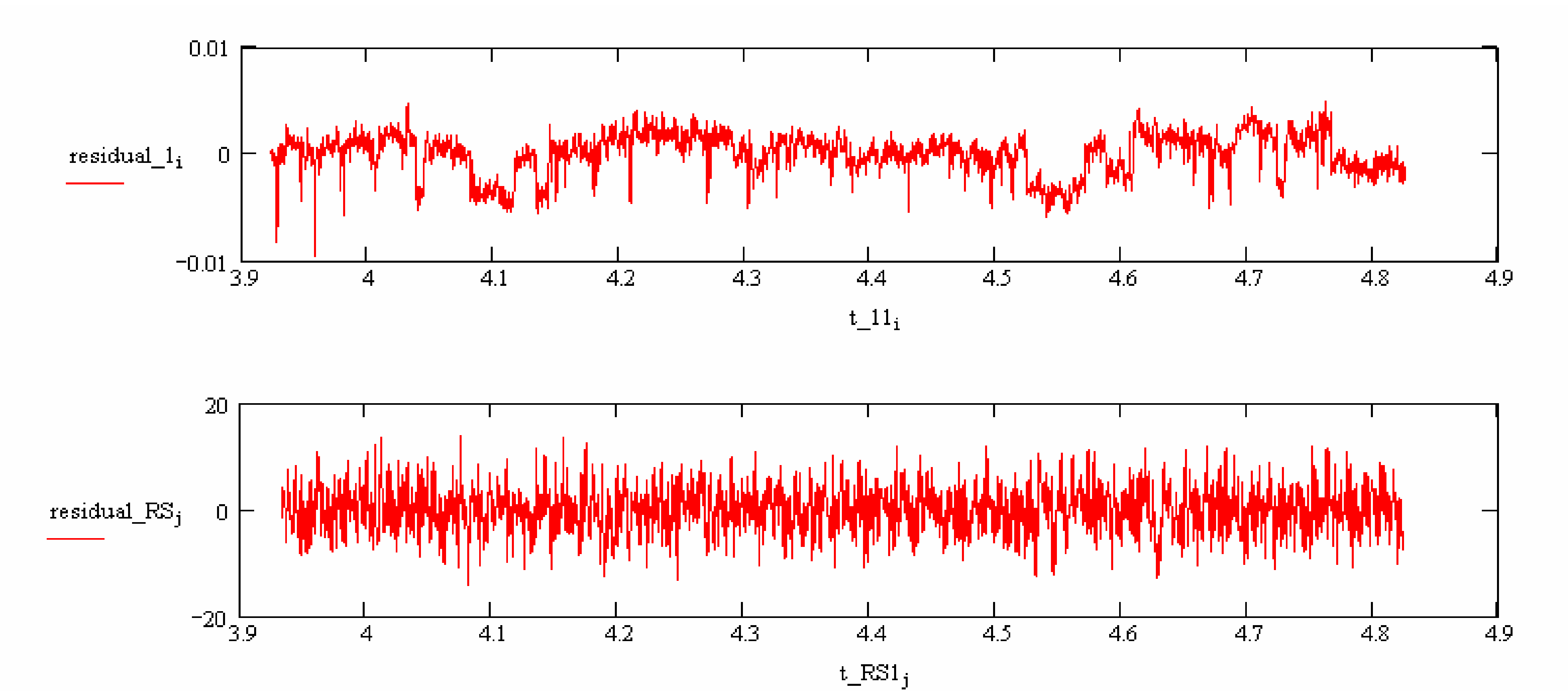
DOY 090.01:52 – 02:52 UT	X-band	S-band	
Frequency	2.29 mHz	4.35 Hz	
Velocity	81 µm/s	56.7 cm/s	
parameter	TM OFF, RNG OFFone-way coherent, USO		

7.5.1.4 Doppler ONED with USO, TM ON, from 090:02:52 – 090.03:52 UT



X-band (upper panel) and S-band (lower panel) Doppler residuals after substracting a polynominal fit. The unit is Hertz.
Note the jumps and spikes in the X-band by 5 mHz to 10 mHz.
Note the large S-band noise amplitude.
The differential Doppler is not computed because there is obviously no correlation and coherency between X-band and S-band.

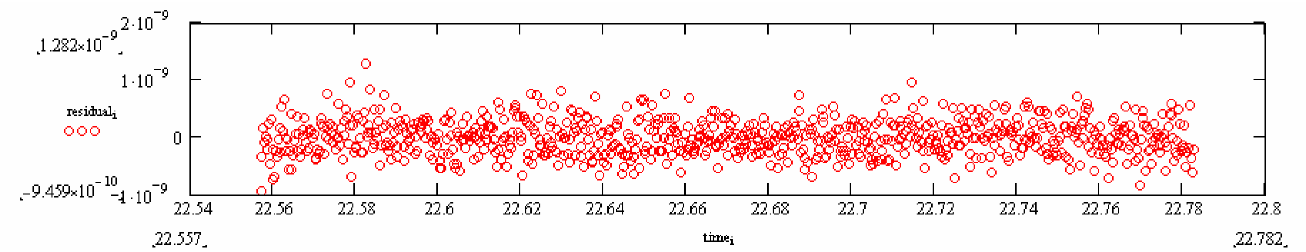
7.5.1.5 Doppler ONED with USO, TM ON, from 090:03:52 – 090.04:52 UT (second file)



X-band (upper panel) and S-band (lower panel) Doppler residuals after substracting a polynominal fit. The unit is Hertz.
Note the jumps and spikes in the X-band by 5 mHz to 10 mHz.
Note the large S-band noise amplitude.
The differential Doppler is not computed because there is obviously no correlation and coherency between X-band and S-band.

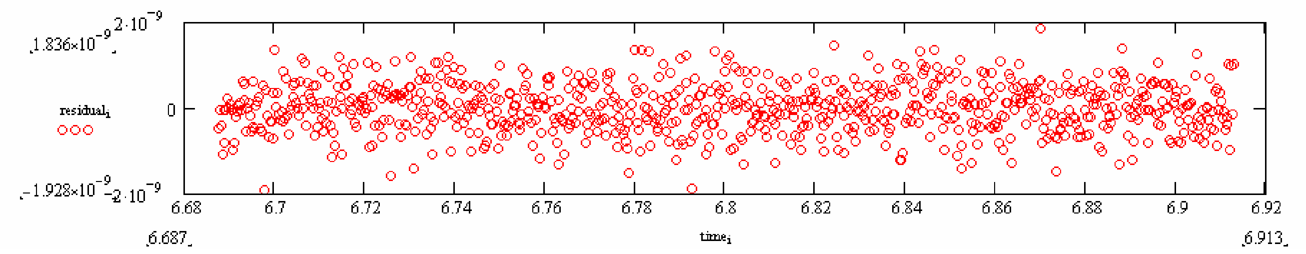
7.5.2 Ranging

7.5.2.1 Ranging observations on DOY 89 from 22:30 to 22:45 UT



uncertainty	RTLT	Two-way distance
1 sigma	0.31 nsec	9 cm
3 sigma	0.93 nsec	27 cm

7.5.2.2 ranging observations on DOY 90 from 06:40 to 06:55 UT



uncertainty	RTLT	Two-way distance
1 sigma	0.56 nsec	16 cm
3 sigma	1.70 nsec	51 cm

8 DOY 123, 02.05. – 03.05.2004

8.1 DESCRIPTION

Tracking at NNO performing a sequence of RSI procedures in order to check the strange behaviour of the USO during RSI Part 1 and to compare the data with two-way and one-way data using the TCXO.

<u>This pass is performed on Transponder 2.</u>

8.2 CONFIGURATION

Ground station	NNO, 35-m
ESOC FOP	
RSI activity	ONES, ONED
Time	DOY 123, 02.05. – 03.05.2004 20:45 UT – 02:15 UT
Configuration spacecraft	ONES, ONED **TRANSPONDER 2**
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: S-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

8.3 SEQUENCE

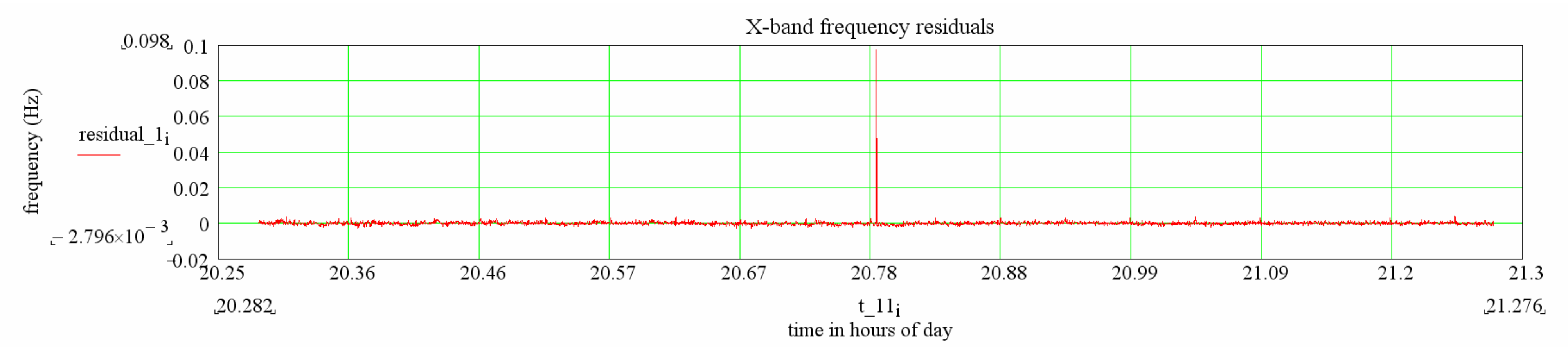
Time (UTC)	NNO	Duration (min)
123.20:45	S-band D/L ON TM ON on X-band Transponder 2	35
123.21:20	RNG stop	
123.21:20	Coherency OFF One-way TCXO S- & X-band	
123.21:22	TM OFF	10
123.21:32	TM ON	43
123.22:25	ONED USO	
123.22:27	TM OFF	10
123.22:37	TM ON	53
123.23:30	ONES USO	
123.23:32	TM OFF	10
123.23:42	TM ON	50
124.00:35	One-way TCXO X-band USO muted	
124.00:37	TM OFF	10
124.00:47	TM ON	53
124.01:40	TWOS RNG ON	35
124.02:15	Switch to TRSP 1	

8.4 LATE CHANGES, ANOMALIES

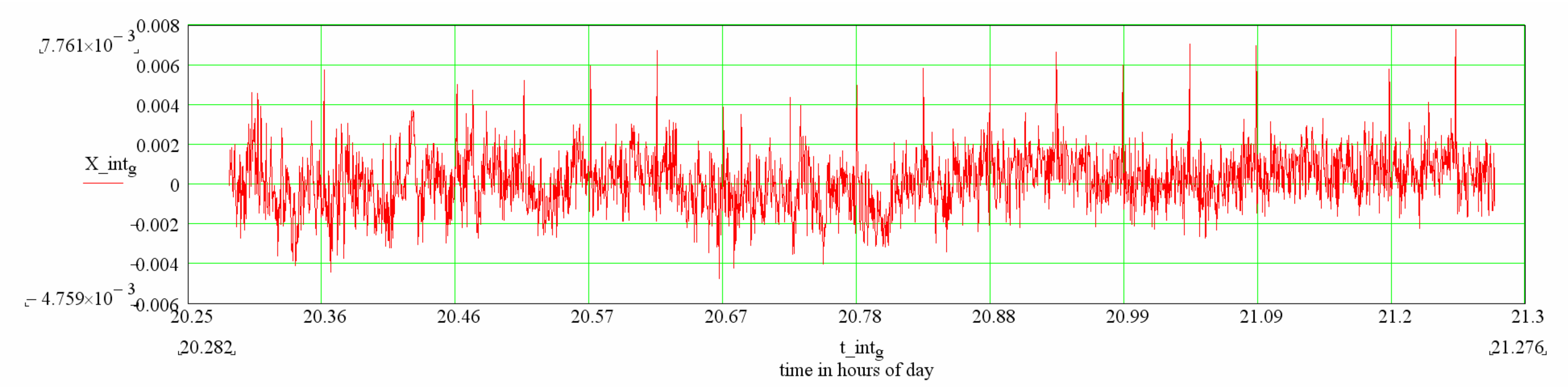
- Only two S-band Doppler files on IFMS_RS with 360 samples each (10 minutes) starting at 20:45 for TWOD

8.5 DATA ANALYSIS

8.5.1 IFMS Doppler from 123.20:18 to 123.21:16 UT (TWOS -> TWOD)

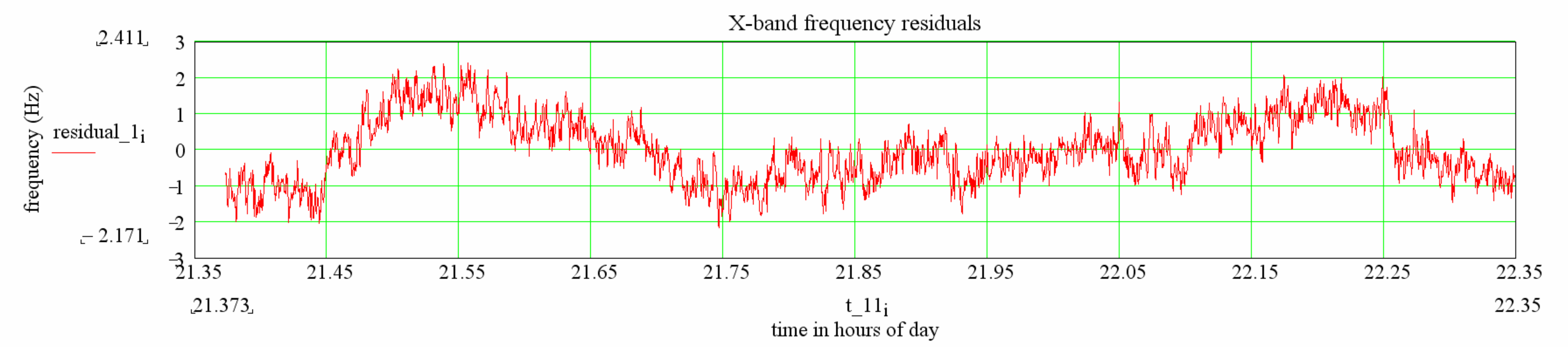


Frequency residuals at X-band from 20:18 to 21:16 UT two-way. The spike occurred at the time when the S-band was switched on at 20:45 UT.



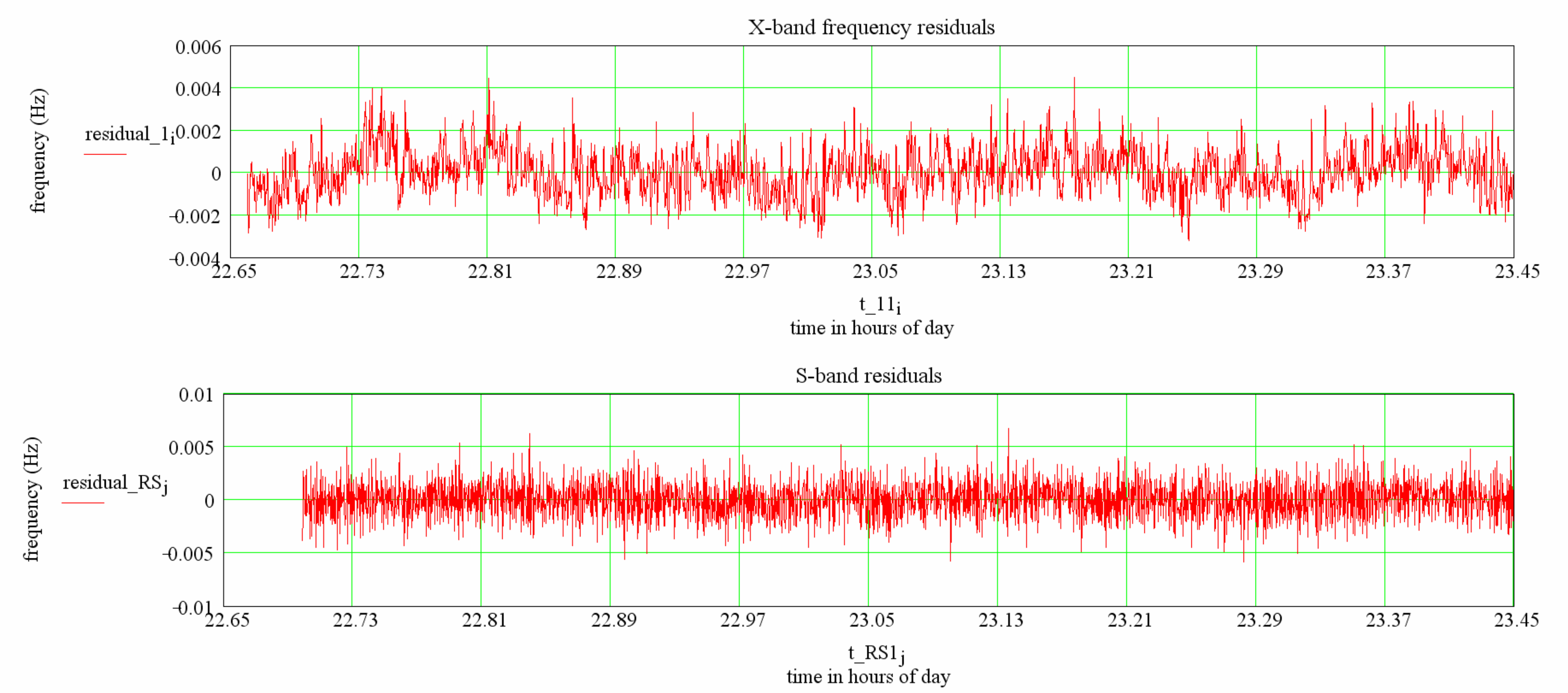
Same data as above (X-band two-way residuals) but spike removed. There is a periodical spike every 3 minutes. The 1-sigma noise is 50 µm/s.

8.5.2 IFMS Doppler from 123.21:20 to 123.22:21 UT ONED TCXO



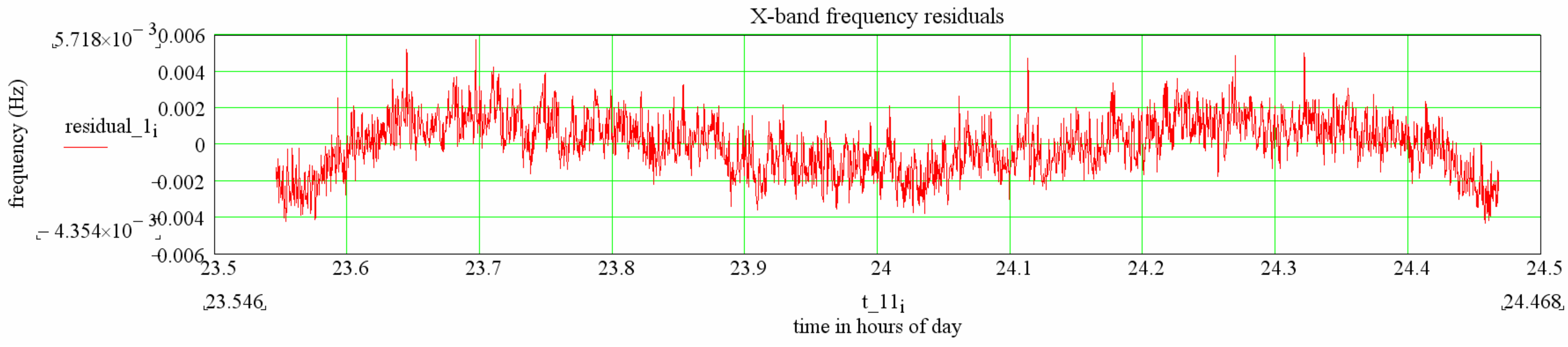
X-band frequency residuals one-way after coherency was switched off. The frequency stability is driven by the TCXO. Note the change in scale. The 1-sigma noise is 6.7 cm/s, a change by three orders of magnitude. Note also the large amplitude variations.

8.5.3 IFMS Doppler from 123.22:27 to 123.23:27 UT ONED USO



X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO. The 1-sigma noise uncorrected for plasma contributions is 46 µm/s and 425 µm/sec at X-band and S-band, respectively.

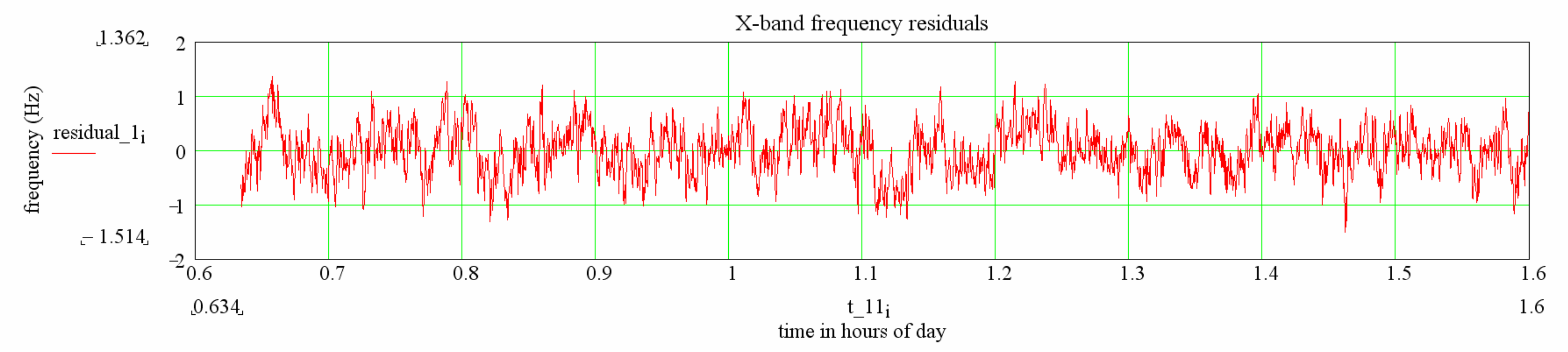
8.5.4 IFMS Doppler from 123.23:30 to 124.00:35 UT ONES USO



X-band frequency residuals one-way ONES driven by the USO with TM ON starting on 23:42 (23.7). 1-sigma frequency noise is 46µm/s mainly caused by the long-period variation. There are spikes every three minutes in the data.

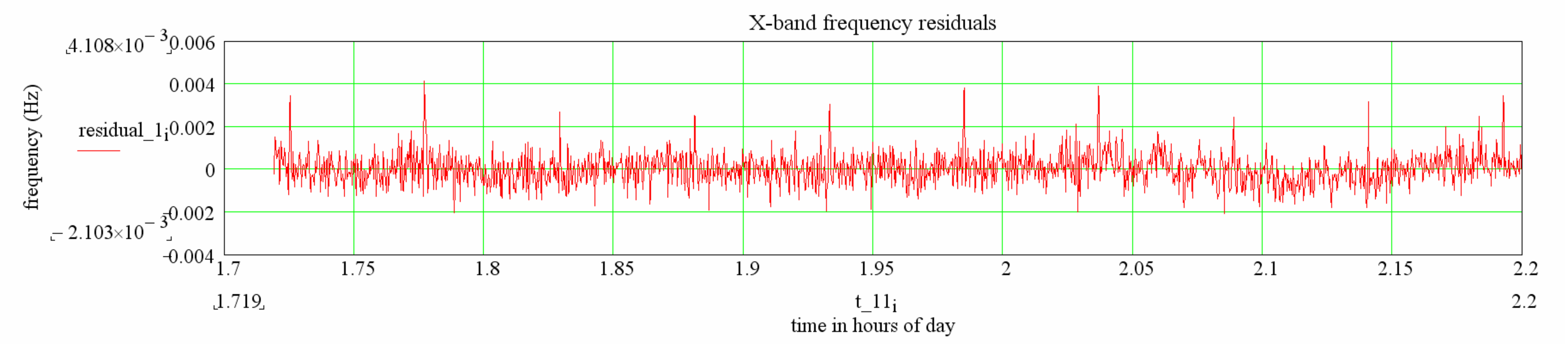
DOY 123	frequency		velocity		Allan Deviation	
ONED, ONES USO	X-band	S-band	X-band	S-band	X-band	S-band
22:27 – 00:35 UT	1.3 mHz	3.3 mHz	46 mm/s	420 mm/s	1.3 10^{-13} @1 sec	1.7 10^{-12} @1 sec
					6.3 10^{-14} @1 sec	2.1 10^{-13} @1 sec
					4.1 10^{-14} @1 sec	8.1 10^{-14} @1 sec

8.5.5 IFMS Doppler from 124.00:35 to 124.01:40 UT ONES TCXO



X-band residuals driven by the TCXO (USO muted). TM was OFF until 00:47 and TM ON for the rest of the pass. The 1-sigma noise is 3.1 cm/sec.

8.5.6 IFMS Doppler from 124.01:45 to 124.02:12 UT TWOS



X-band residuals two-way TWOS-X at the end of the pass. TM was ON. Note the spikes in the data every 3 minutes. The 1-sigma noise is 41 µm/sec.

9 DOY 124, 03.05. – 04.05.2004

9.1 DESCRIPTION

Tracking at NNO performing a sequence of RSI procedures in order to check the strange behaviour of the USO during RSI Part 1 and to compare the data with two-way and one-way data using the TCXO.

This pass is performed on Transponder 1.

The USO was switched active at the end of the pass and left active to be prepared for the pass next day.

9.2 CONFIGURATION

Ground station	NNO, 35-m
ESOC FOP	
RSI activity	ONES, ONED
Time	DOY 124, 03.05. – 04.05.2004 20:43 UT – 02:20 UT
Configuration spacecraft	ONES, ONED **TRANSPONDER 1**
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: S-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

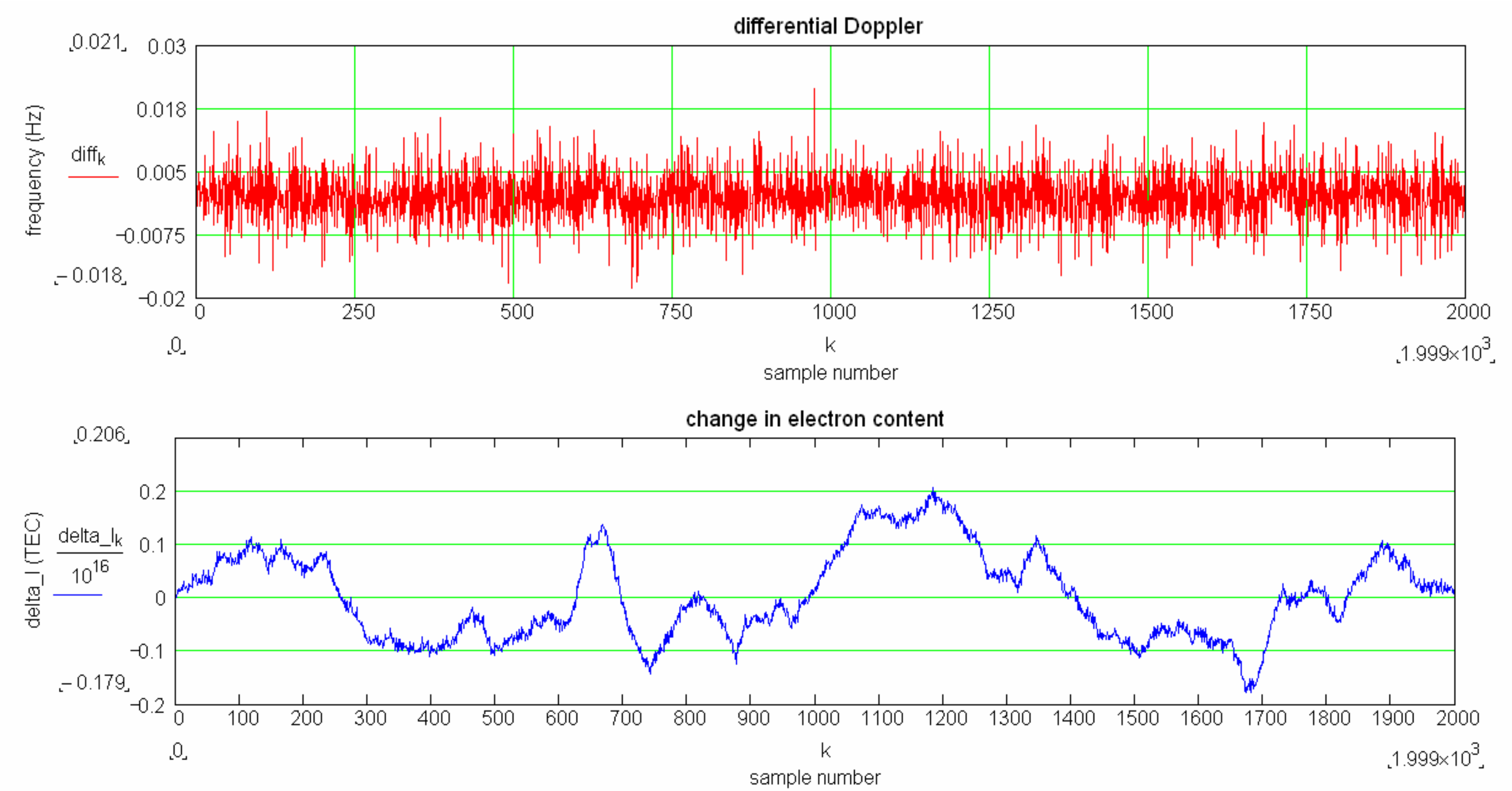
9.3 SEQUENCE

Time (UTC)	NNO	Duration (min)
124.20:43	S-band D/L ON TM ON on X-band Transponder 1	35
124.21:18	RNG stop	
124.21:18	Coherency OFF One-way TCXO S- & X-band	
124.21:20	TM OFF	10
124.21:30	TM ON	43
124.22:23	USO active ONED USO	
124.22:25	TM OFF	10
124.22:35	TM ON	53
124.23:28	ONES USO	
124.23:30	TM OFF	10
124.23:40	TM ON	50
125.00:33	One-way TCXO X-band USO muted	
125.00:35	TM OFF	10
125.00:45	TM ON	53
125.01:38	TWOS RNG ON	35
125.02:13	Switch to TRSP 2	
125.02.20	USO active	

9.4 DATA ANALYSIS

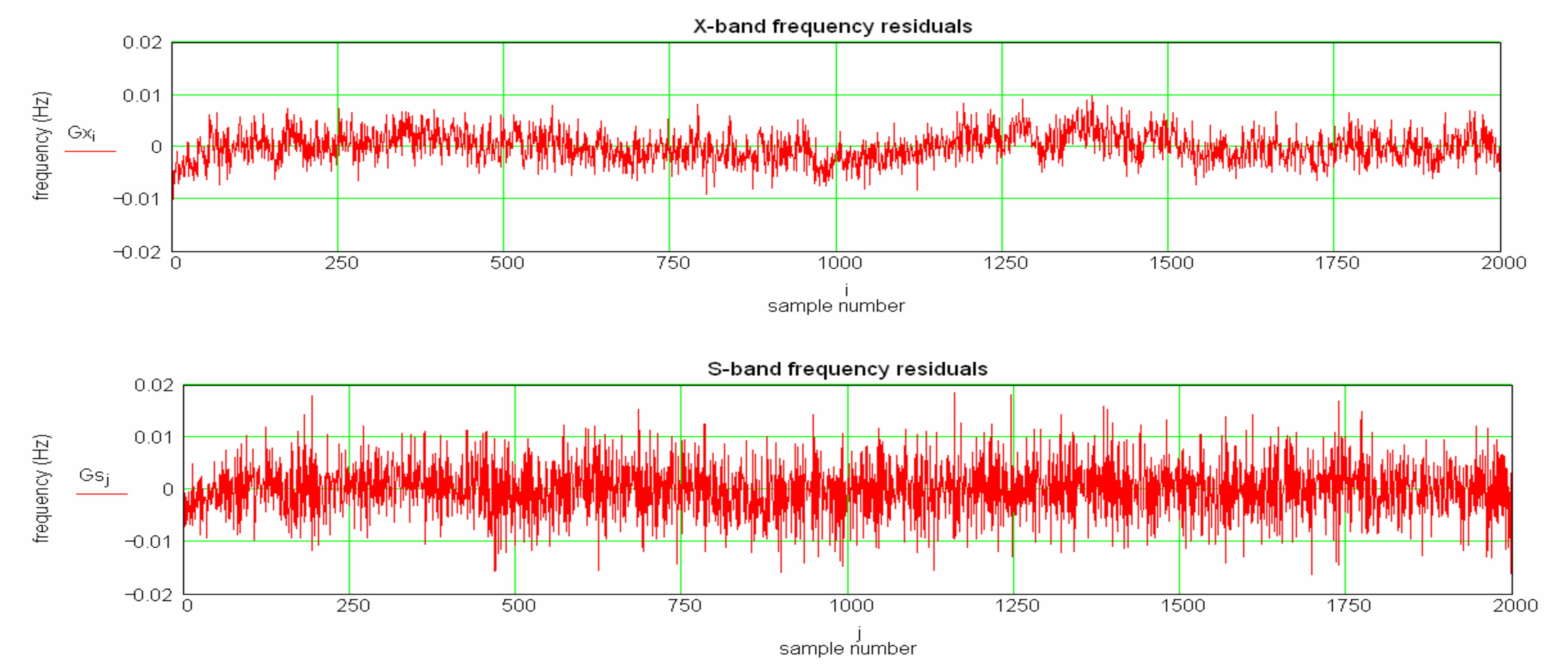
IFMS Doppler from 124.21:42 to 124.22:21 UT ONED TCXO

X-band (upper panel) and S-band (lower panel) frequency residuals, one-way driven by the TCXO; TM is ON. The average noise is 3.8 cm/s.

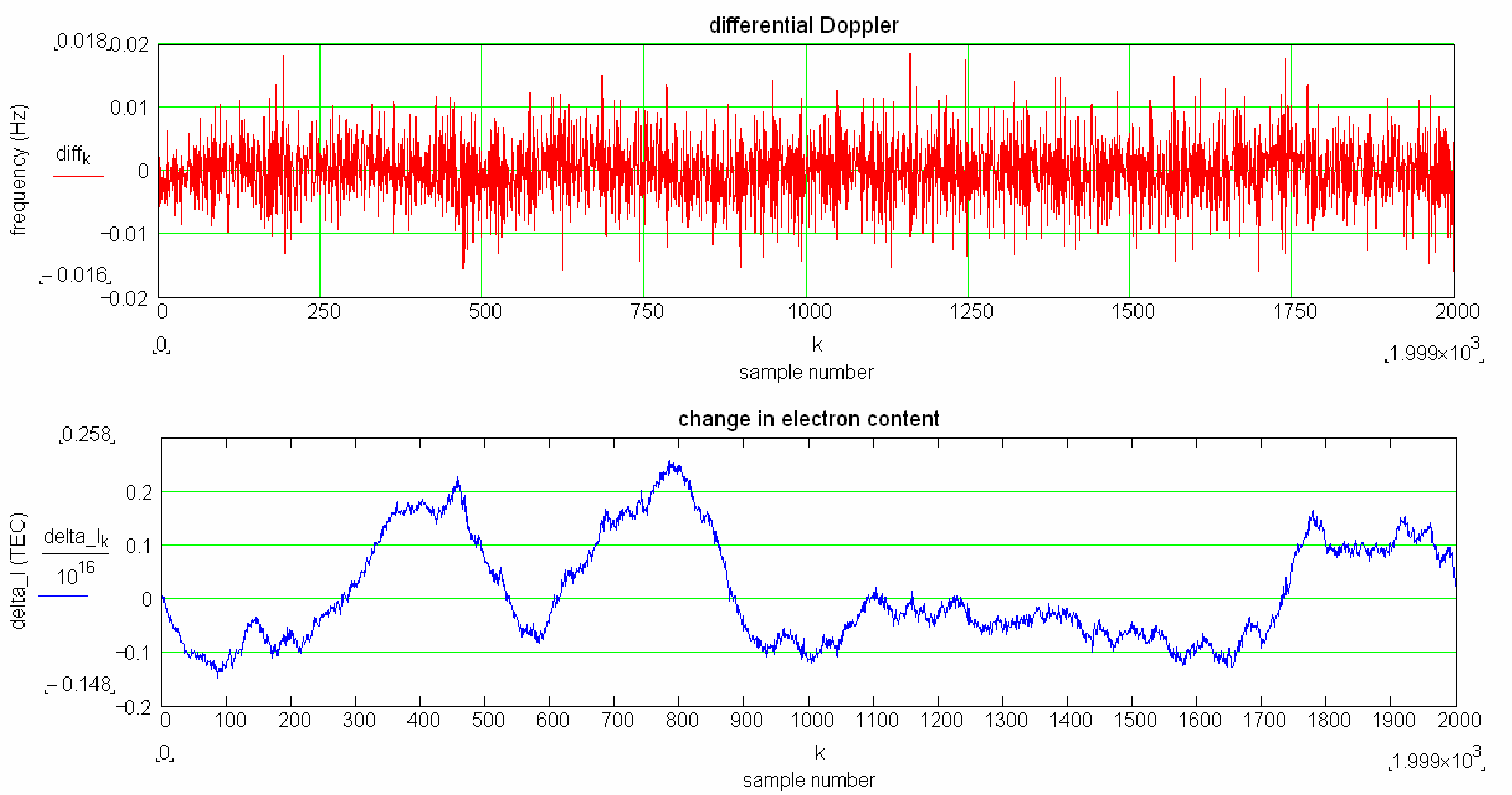


Differential Doppler (upper panel) and computed change in electron content for 2000 seconds of TCXO one-way data. It turns out that the differential Doppler is as stable as the two-way data due to the common noise source. The sensitivity in electron content is in the order of 0.01 TEC units.

9.4.2 IFMS Doppler from 124.22:36 to 124.23:24 UT ONED USO

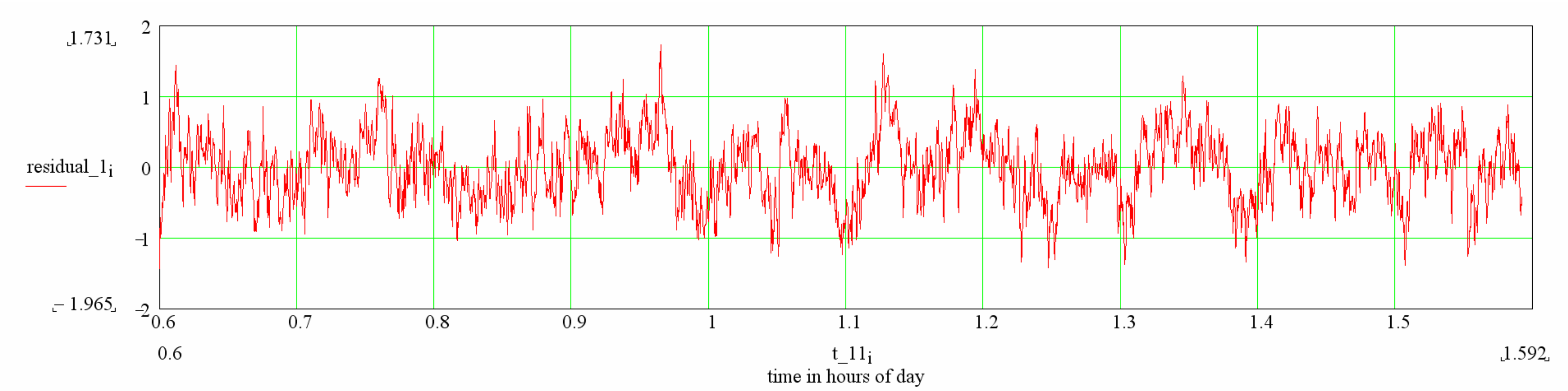


X-band (upper panel) and S-band (lower panel) frequency residuals, one-way driven by the USO; TM is ON. Note the change in scale concerning the noise levels with TCXO.



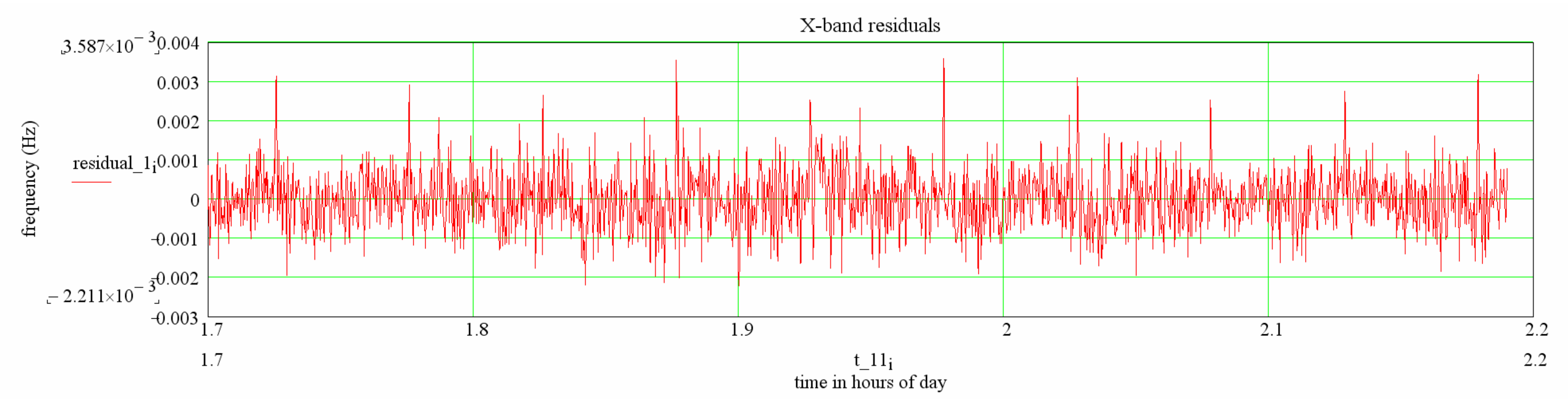
Differential Doppler (upper panel) and change in electron content (lower panel) with one-way USO.

9.4.3 IFMS Doppler from 125.00:36 to 125.01:36 UT ONES TCXO



X-band residuals from 00:36 to 01:36 UT on DOY 125 driven by the transponder TCXO.

9.4.4 IFMS Doppler from 125.01:42 to 125.02:12 UT TWOS-X



X-band residuals after establishing the two-way link X-band up/X-band down from 01:42 to 02:12 UT. Note the change in scale compared to the one-way TCXO data. The USO data are comparable to the two-way link. There are spikes every three minutes in the data.

10 DOY 125, 04.05. – 05.05.2004

10.1 DESCRIPTION

Tracking at NNO performing a sequence of RSI procedures in order to check the strange behaviour of the USO during RSI Part 1 and to compare the data with two-way and one-way data using the TCXO.

This pass is performed on Transponder 2.

The USO was switched active at the end of the previous pass and left active to be prepared for this pass.

10.2 CONFIGURATION

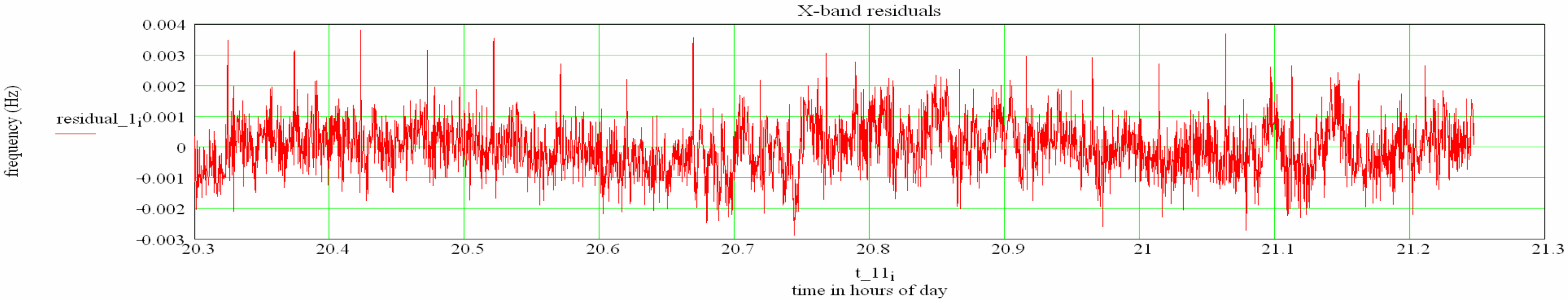
Ground station	NNO, 35-m
ESOC FOP	
RSI activity	ONES, ONED
Time	DOY 125, 04.05. – 05.05.2004 20:41 UT – 02:21 UT
Configuration spacecraft	ONES, ONED **TRANSPONDER 2**
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: S-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

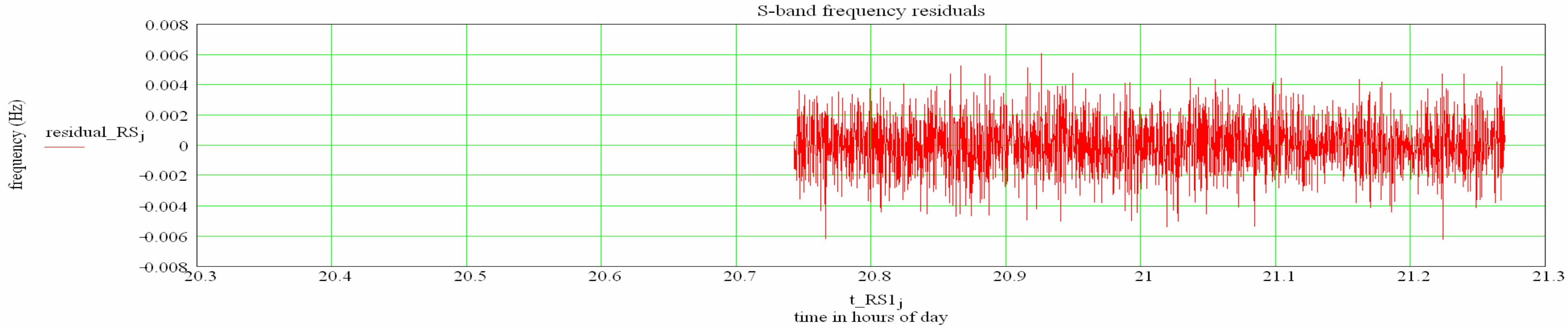
10.3 SEQUENCE

Time (UTC)	NNO	Duration (min)
125.20:41	S-band D/L ON TM ON on X-band Transponder 2 USO active	35
125.21:16	RNG stop	
125.21:16	Coherency OFF ONED USO S- & X-band	
125.21:18	TM OFF	10
125.21:28	TM ON	120
125.23:31	ONES USO	
125.23:33	TM OFF	10
125.23:43	TM ON	50
126.01:46	TWOS RNG ON	120
126.02.21	USO mute	

10.4 DATA ANALYSIS

10.4.1 IFMS Doppler from 125.20:18 to 125.21:16 UT (TWOS -> TWOD)

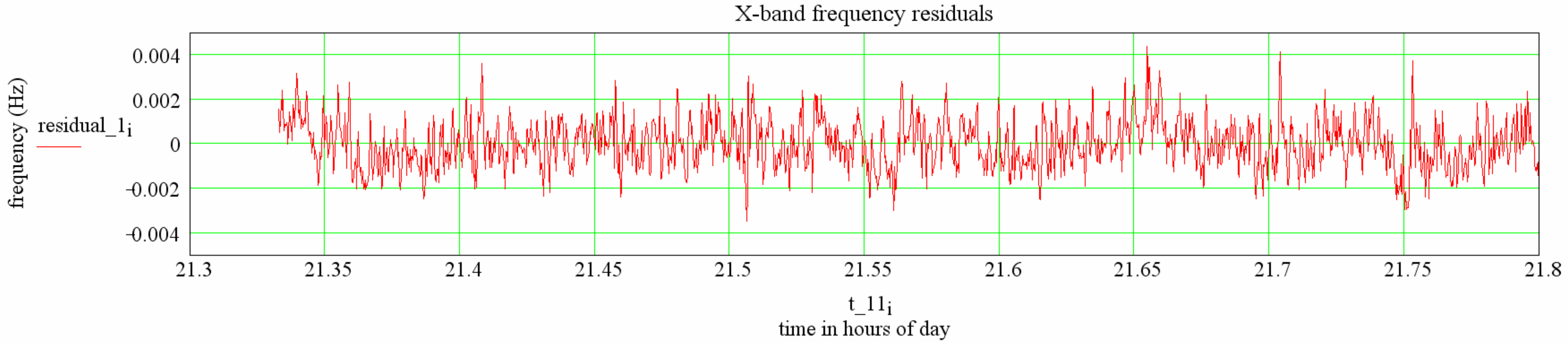


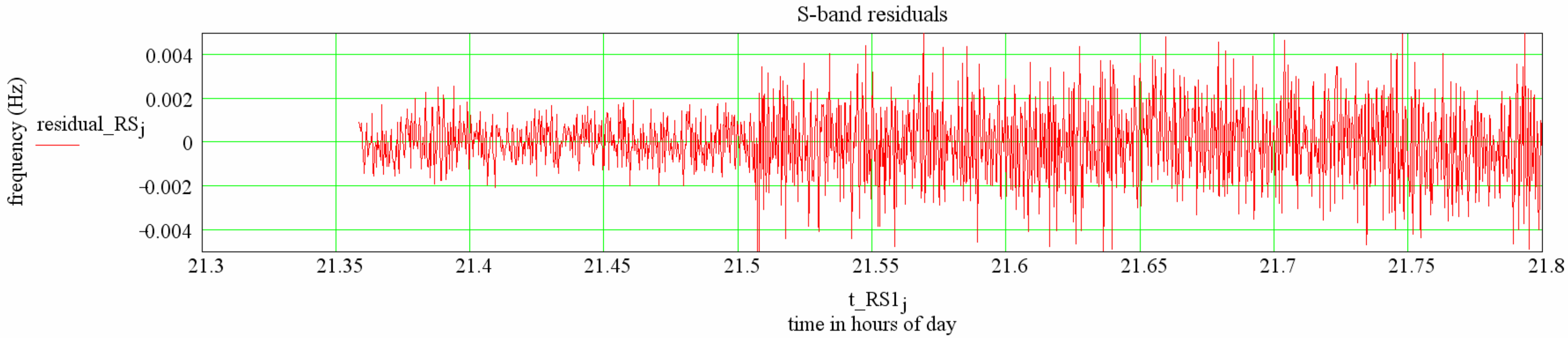


X-band residuals and S-band residuals (starting at 20:41 UT) from 20:18 TO 21.16 ut: Note the spikes in the X-band data every 3 minutes. TM is ON at X-band. There was a spike of 0.15 Hz at the time of the S-band downlink switch-on (here removed).

DOY 125	**frequency**		**velocity**	
TWOS -> TWOD	**X-band**	**S-band**	**X-band**	**S-band**
20:18 – 20:44 UT TWOS	1.2 mHz	-	42 μm/s	42 μm/s
20:44 – 21:16 UT TWOD	1.3 mHz	3.5 mHz	47 μm/s	455 μm/s
Parameter	TM ON, RNG ON, sample rate 1 sample/sec			

10.4.2 IFMS Doppler from 125.21:18 to 125.23:31 UT ONED USO





One-way X-band residuals and S-band residuals from 21:18 to 23:31 UT driven by the USO. The TM was OFF and was switched ON at 21:28 UT which is clearly visible in the S-band data by an increased noise level of a factor of 2.5. Note the spikes in the X-band every three minutes. Apparently, these spikes are present at TM ON as well as for TM OFF.

DOY 125	frequency		velocity	
ONED-USO	X-band	S-band	X-band	S-band
21:18 –21:30 UT TM OFF	1.2 mHz	1.4 mHz	43 µm/s	186 µm/s
21:30 – 23:31 UT TM ON	1.4 mHz	3.8 mHz	49 µm/s	492 µm/s
Parameter	TM ON, RNG ON, sample rate 1 sample/sec			

11 DOY 255, 07.09. – 08.09.2004, CENTER OF MASS DETERMINATION

11.1 DESCRIPTION

Tracking at NNO performing turns of the spacecraft body in azimuth and elevetaion while the HGA was kept Earth pointing for the purpose of the center of mass determination with respect to the phase center of the antenna.

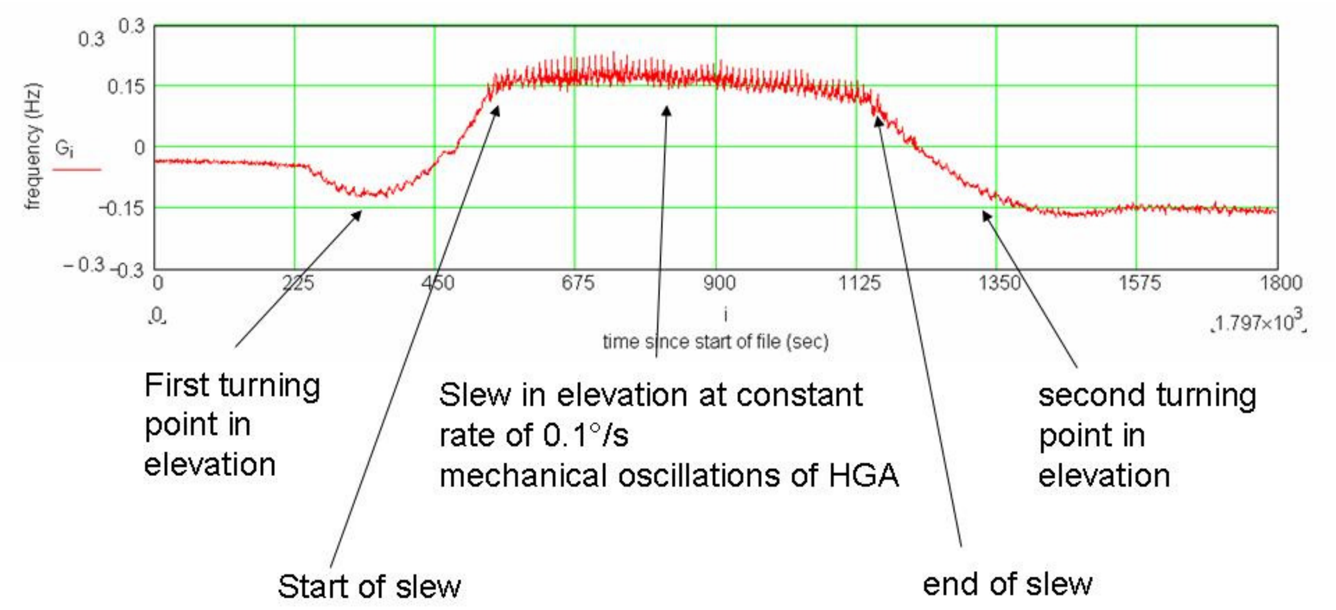
11.2 CONFIGURATION

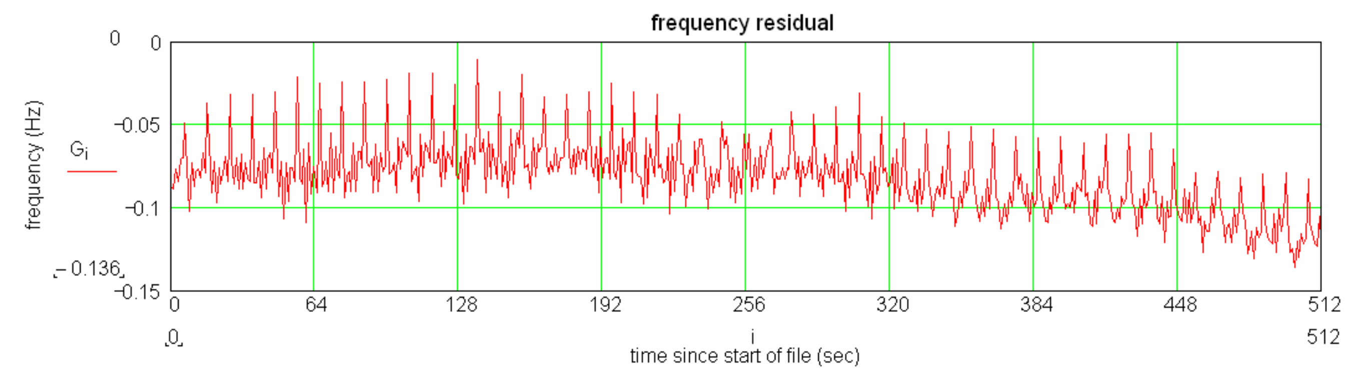
Ground station	NNO, 35-m
ESOC FOP	Ad hoc
RSI activity	TWOD-X
Time	DOY 255, 07.09.2004 – 08.09.2004
Configuration spacecraft	TWOD-X
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: S-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

11.3 DATA ANALYSIS

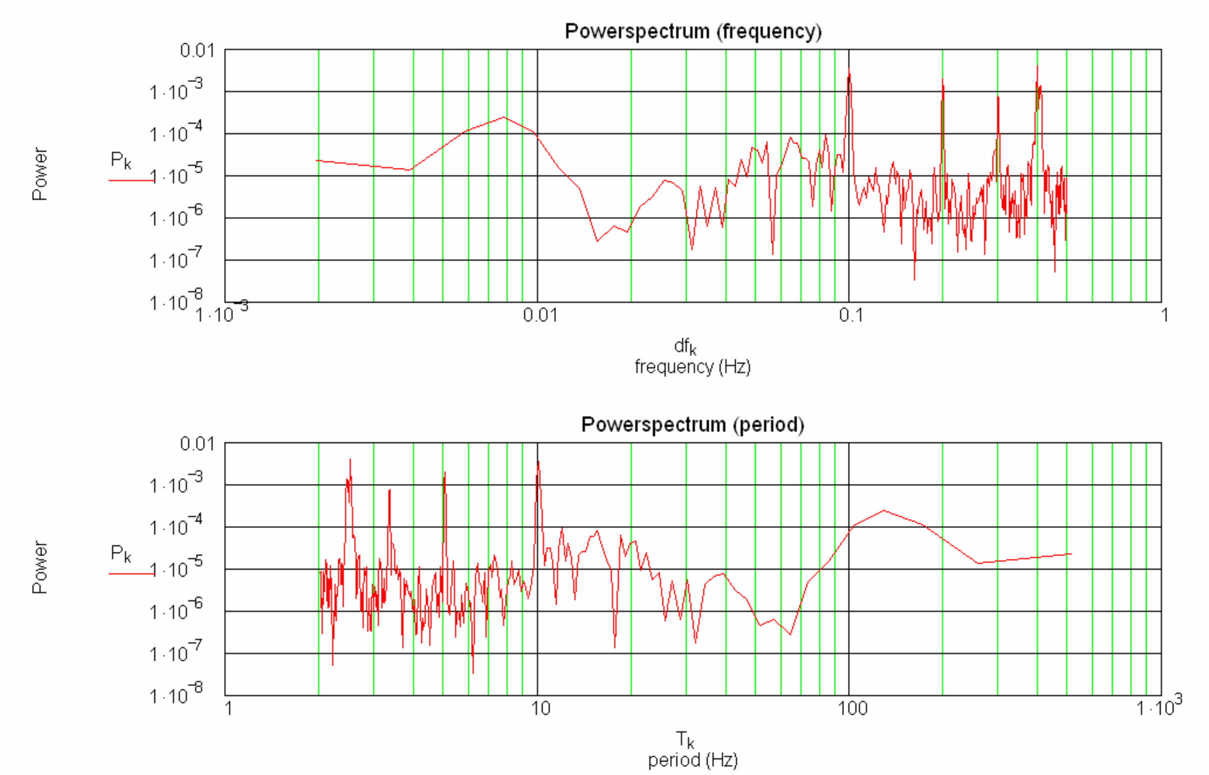
11.3.1 IFMS Doppler from 255.20:00 – 255.20:30, TWOD, two-way coherent

X-band residuals after detrending.





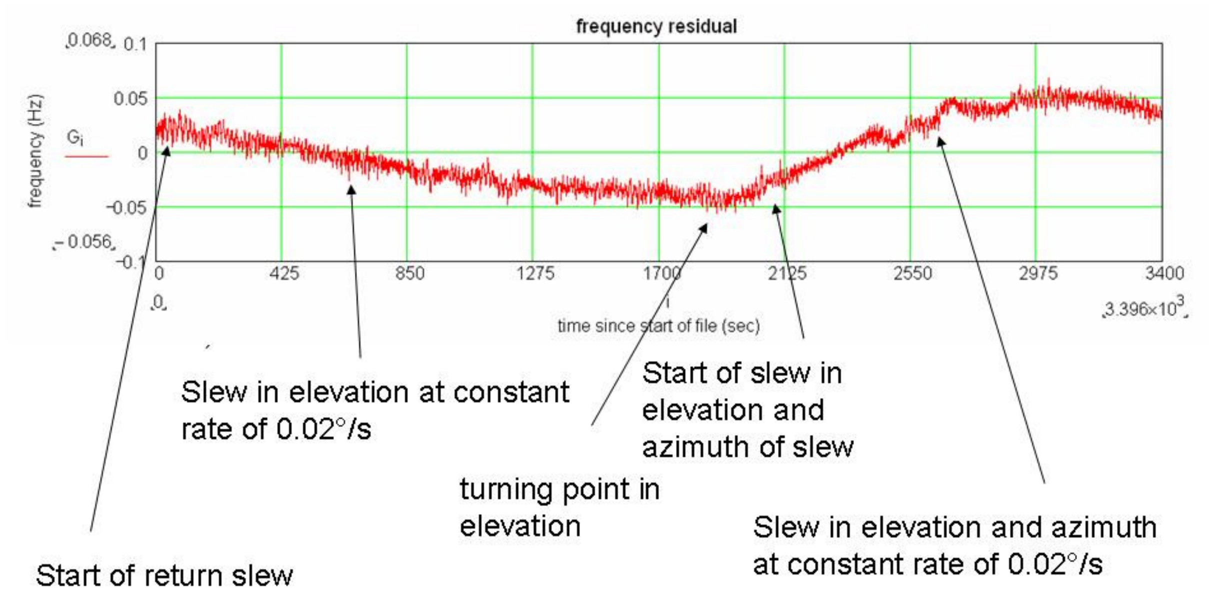
The mechanical oscillations of the HGA during the slew show a peak-to-peak amplitude of up to 70 mHz or 2.5 mm/s.

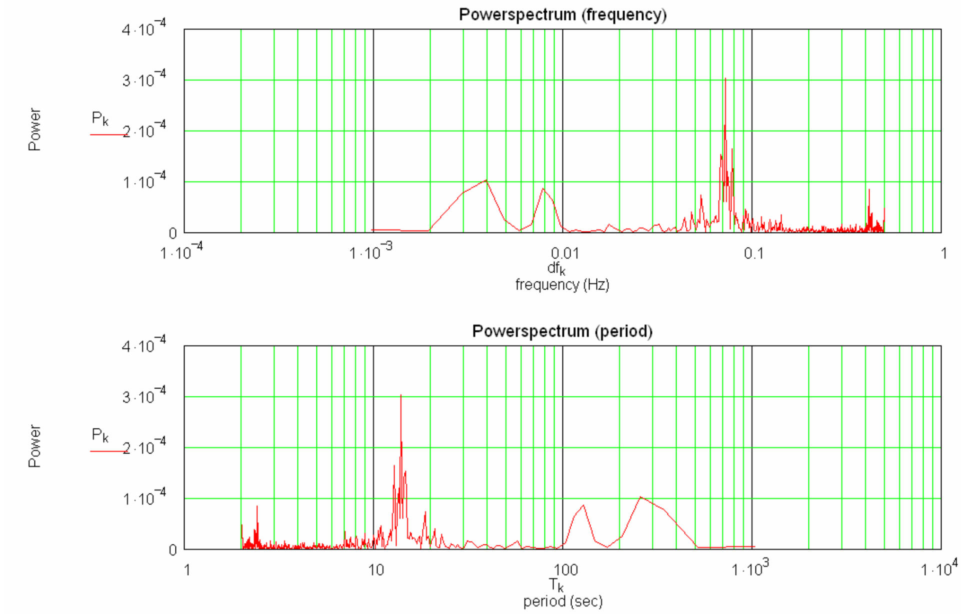


The power spectrum of the oscillations show strong peaks at 2.5 sec, 3.3 sec, 5 sec and 10 seconds.

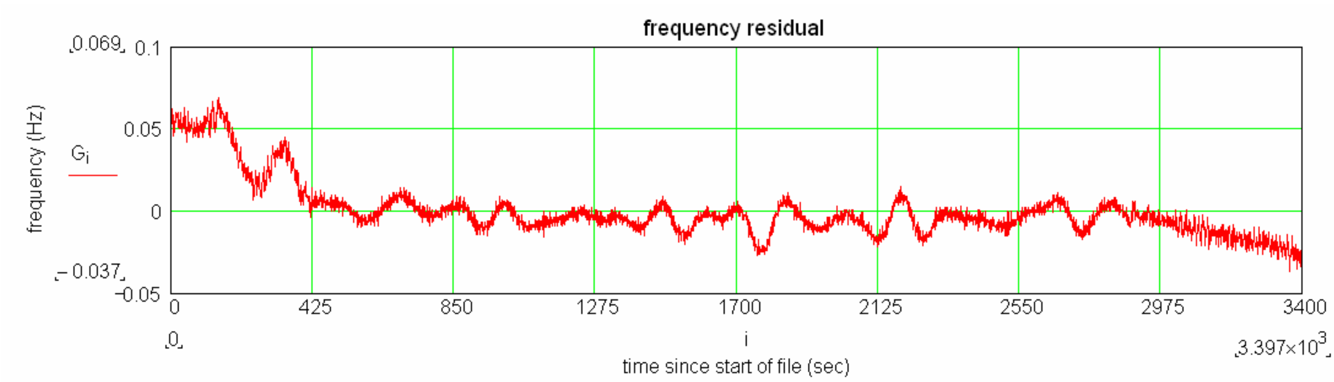
11.3.2 FMS Doppler from 255.20:30 – 255.21:30, TWOD, two-way coherent

X-band residuals after detrending. Return slew in elevation at slower rate of 0.02°/s and folloed by a slew in elevation and azimuth at 0.02°/s. The power spectra show a 15 seconds oscillation.





11.3.3 FMS Doppler from 255.21:30 – 255.22:30, TWOD, two-way coherent



X-band residuals after detrending. Constant slew in azimuth with slew rate 0.02°/sec. Prominent are 200 seconds oscillations of up to 25 mHz peak-to-peak.

12 DOY 283, 09.10. – 10.10.2004

12.1 DESCRIPTION

Tracking at NNO performing a sequence of RSI procedures in order to check the stability of the USO and to compare the data with two-way and one-way data using the TCXO.

12.2 CONFIGURATION

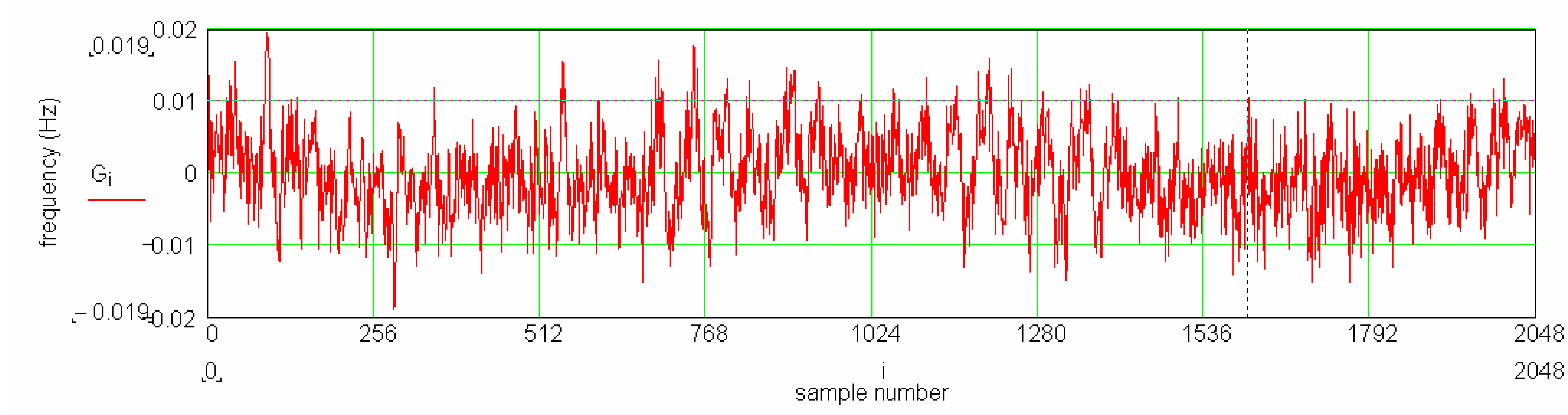
Ground station	NNO, 35-m
ESOC FOP	Ad hoc, defined by RSI
RSI activity	ONES, ONED
Time	DOY 283, 09.10.2004 – 10.10.2004 08:17 – 02:11 UT (DOY 284)
Configuration spacecraft	ONES, ONED
Configuration ground segment	IFMS-1: X-band D/L IFMS-2: X-band D/L IFMS-RS: S-band D/L
Data	Doppler D1 1 sample/sec Doppler D2 1 sample/sec AGC G1 1 sample/sec AGC G2 1 sample/sec range RNG 1 sample/sec meteo MET 1 sample/minute range calibration CAL 1 sample/sec

12.3 SEQUENCE

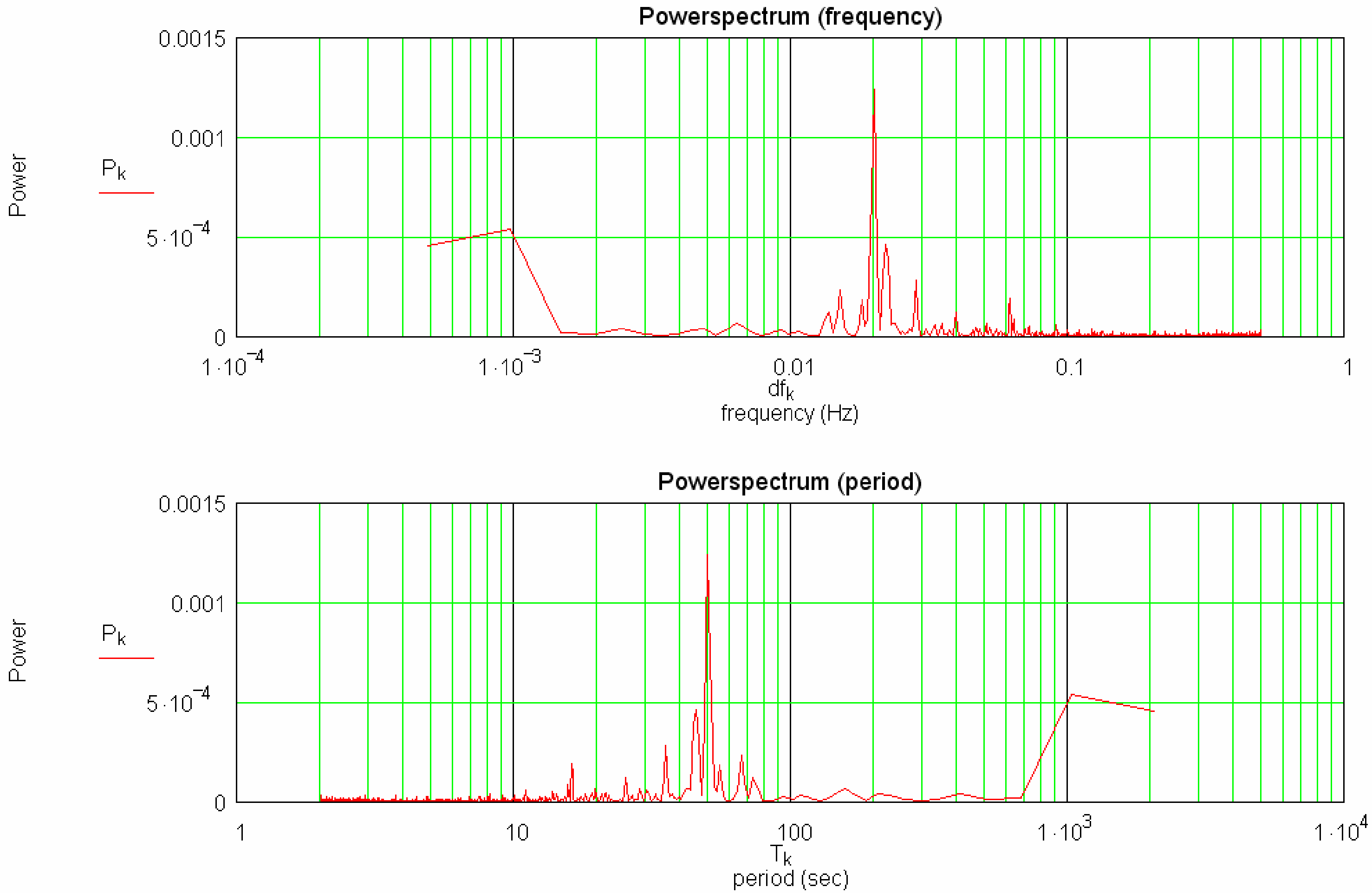
Time (UTC)	NNO	Duration (min)
283.18:17	TWOD TM ON at X-band RNG ON at X-band USO mute	60
283.19:15	RNG stop Coherency OFF TM ON at X-band ONED-TCXO	30
283.19:45	Unmute USO TM ON at X-band ONED-USO	120
283.21:45	TM OFF	60
283.22:45	TM ON	120
284.00:40	Mute USO TM ON ONES-TCXO	30
284.01:12	Coherency ON TM ON RNG ON at X-band TWOD	60
125.02:15	S-band OFF End of activity	

12.4 DATA ANALYSIS

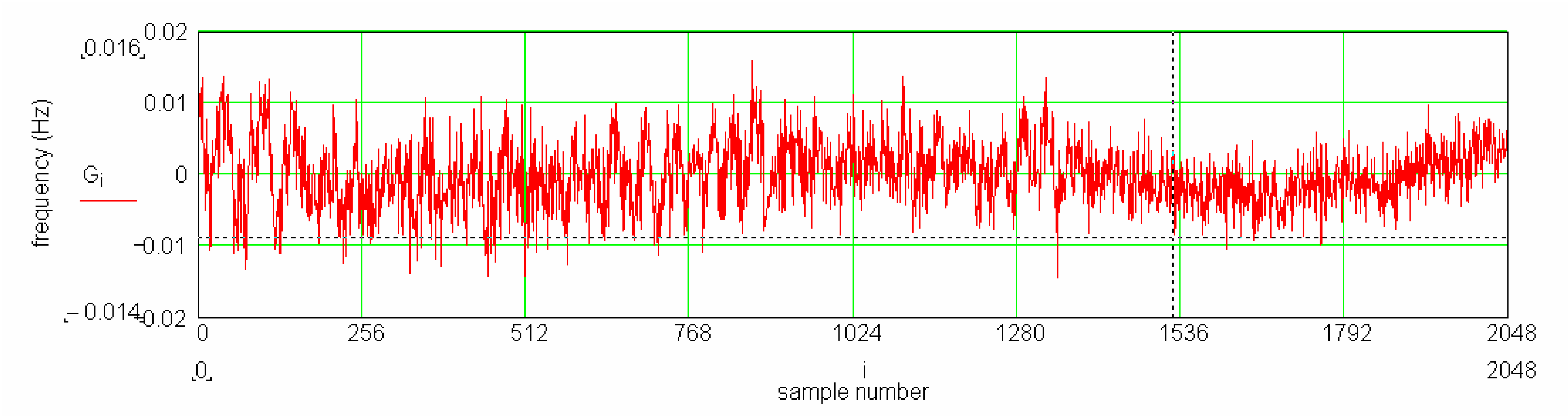
12.4.1 IFMS Doppler from 283.18:17 – 283.1915, TWOD, two-way coherent



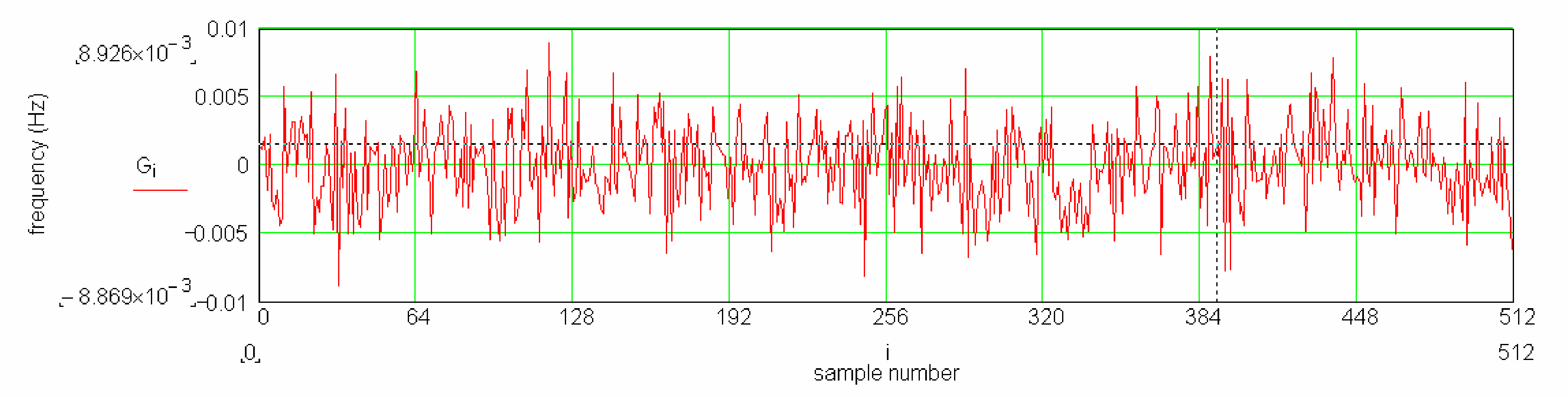
X-band frequency residuals after detrending the received antenna frequency, first 2048 samples starting at 283.18:17, TM and ranging is ON



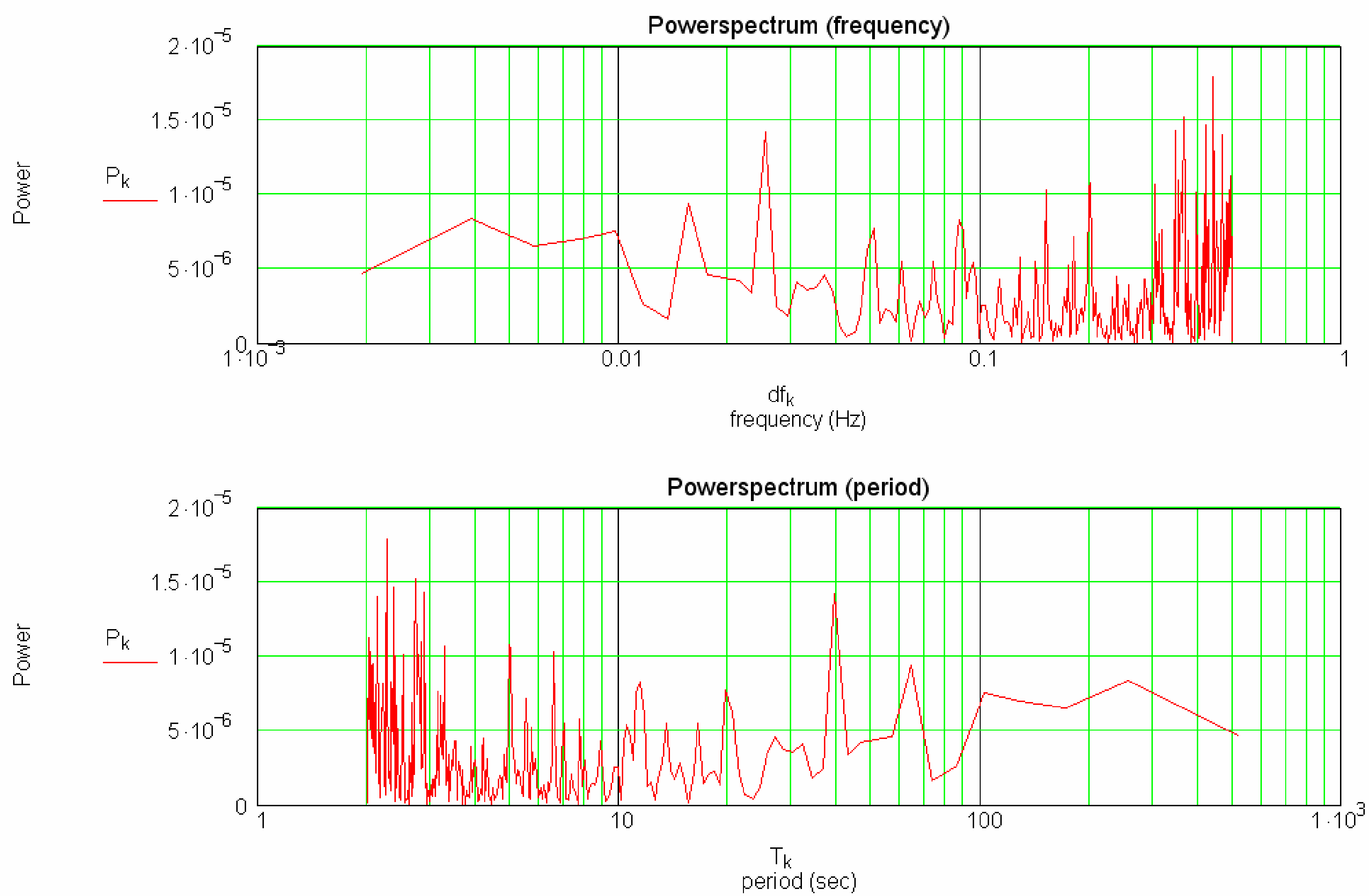
Power spectrum of the X-band time series above: apparent frequencies are 50 seconds, 45 seconds



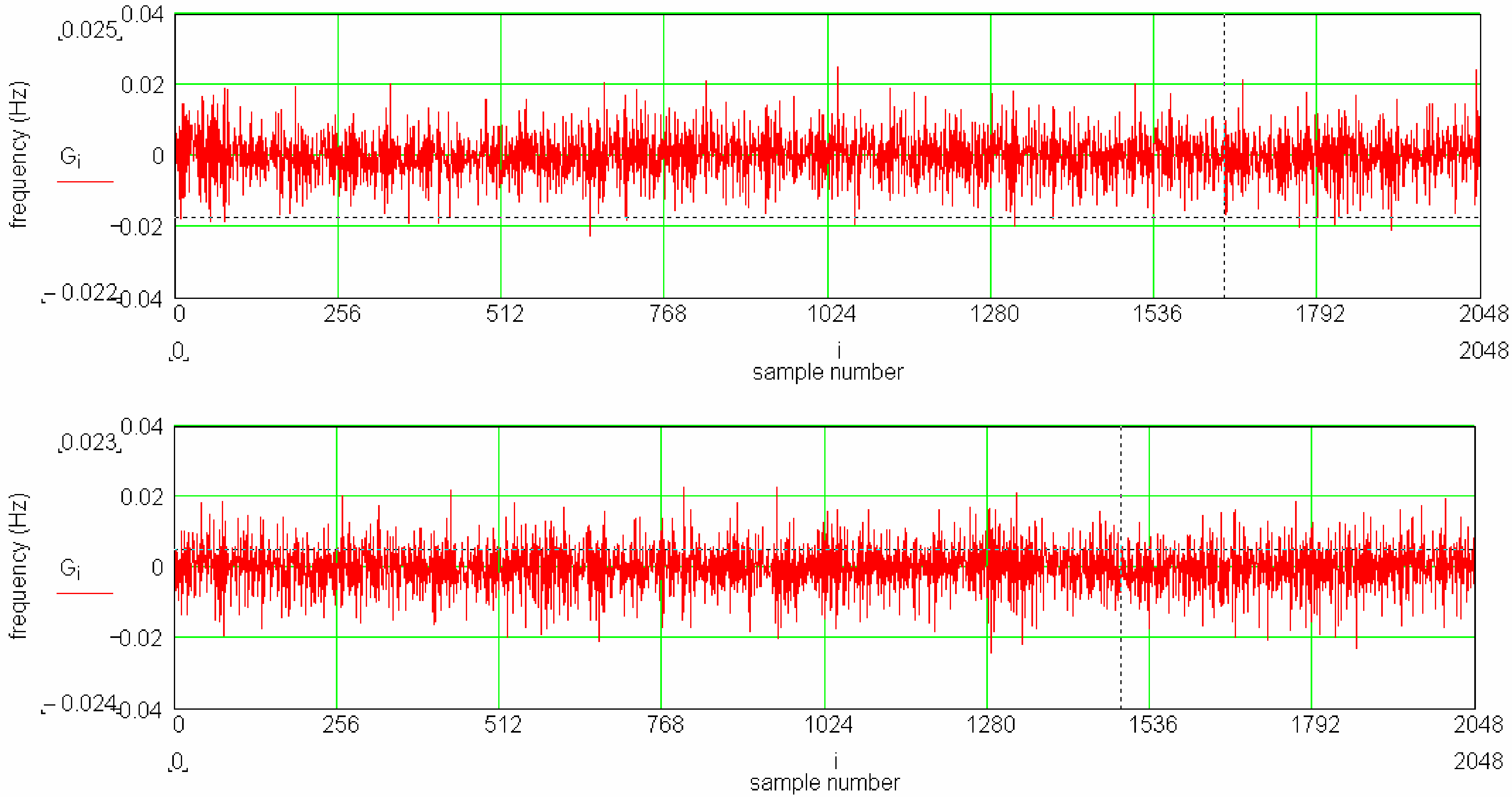
X-band residuals after detrending the received antenna frequency
Last 2048 X-band samples from the first TWOD time series starting at 283.18:38 UT Note the change in noise fluctuation at sample 1360 or 283.19:00 UT. This may mark a change in TM or range modulation.



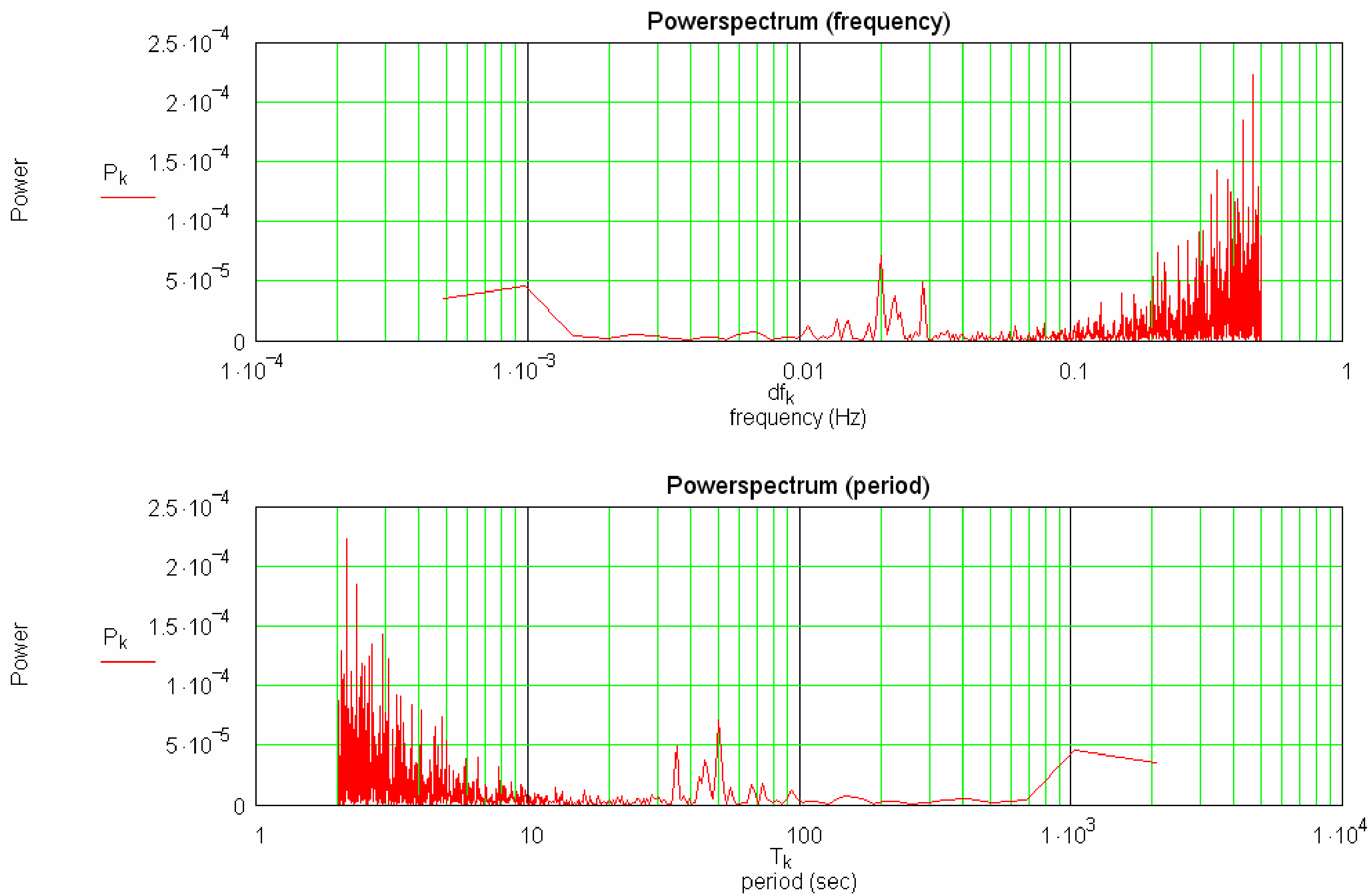
X-band frequency residuals after detrending the received antenna frequency
Last 690 X-band samples starting at 283.19:00 UT, switch OFF or change of TM OR ranging modulation? Power of oscillations are two orders of magnitude less.



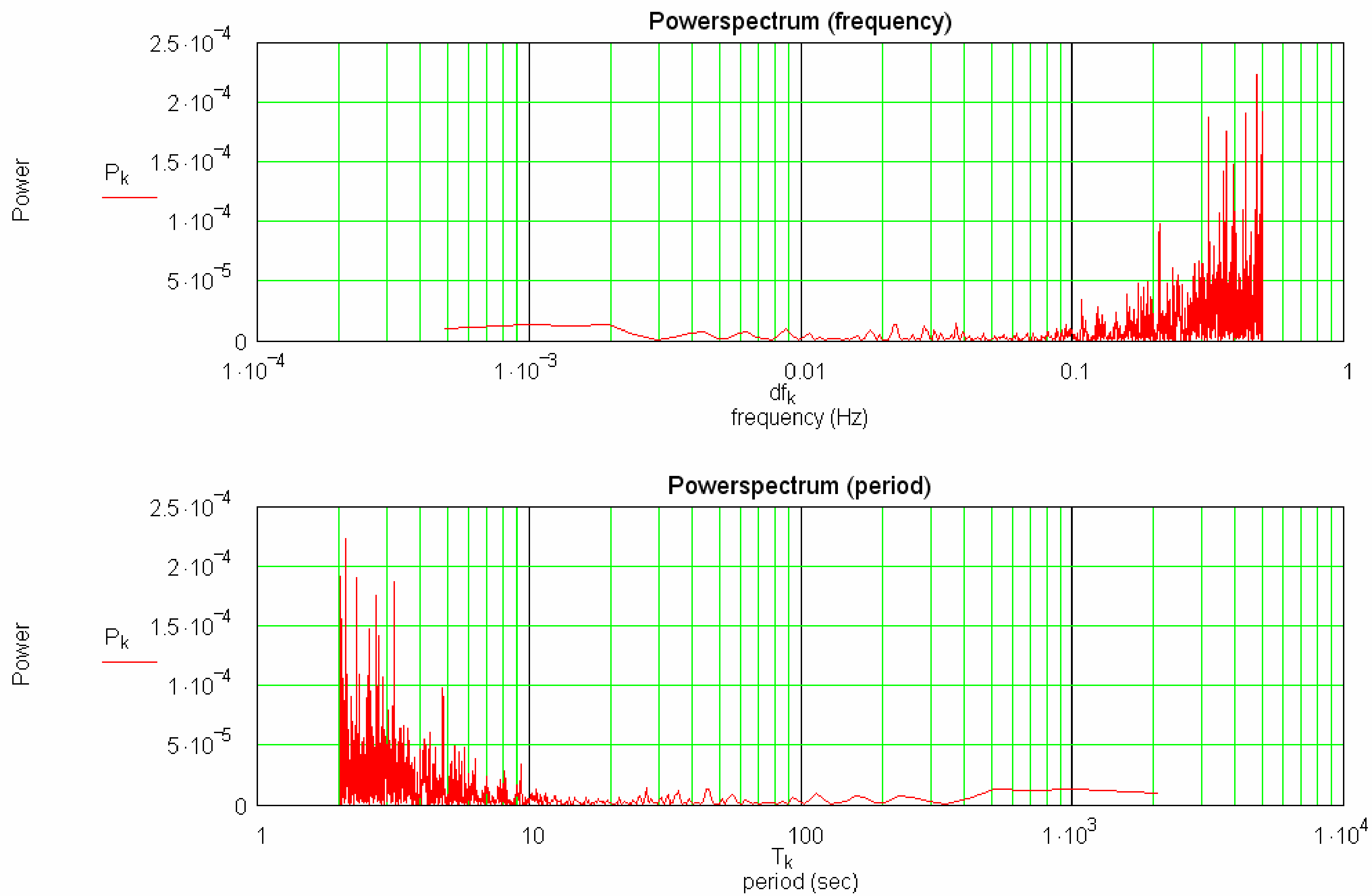
Power spectra of last 690 X- band samples starting at 283.19:00 UT, Dominant period of 40 seconds is two orders of magnitude weaker than periods before 283.19:00 UT.



S-band residuals after detrending of the received antenna frequency
First 2048 S-band residual samples starting at 283.18:17 UT (upper panel) and last 2048 S-band residuals samples starting at 283.18:38 UT. No apparent oscillations visible.



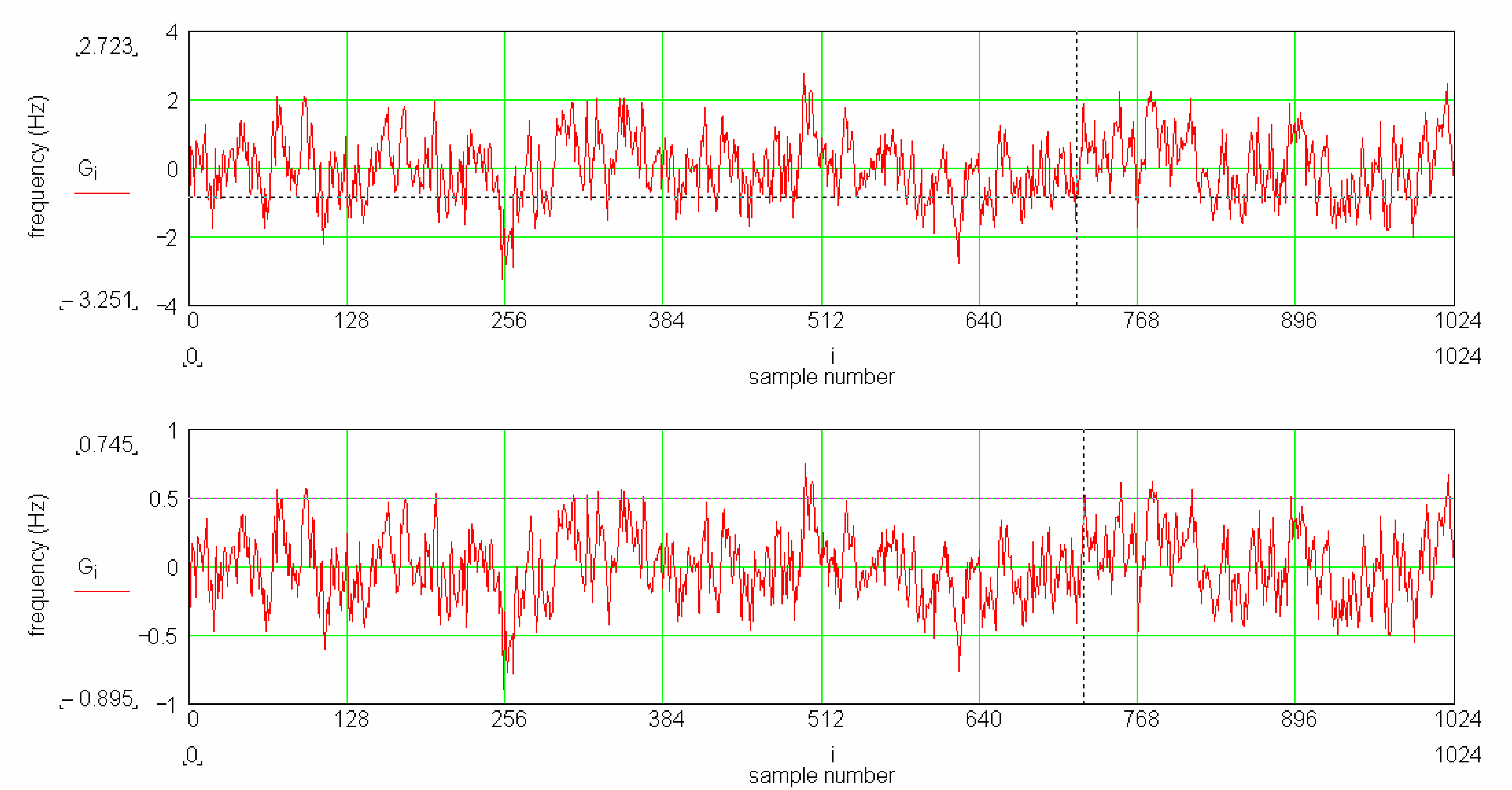
S-band power spectrum of the first 2048 samples starting at 283.18:17 UT. An apparent period of 50 seconds and 45 seconds are visible as in the X-band spectrum, but two orders of magnitude weaker. In fact the power of the high frequency noise is much stronger.



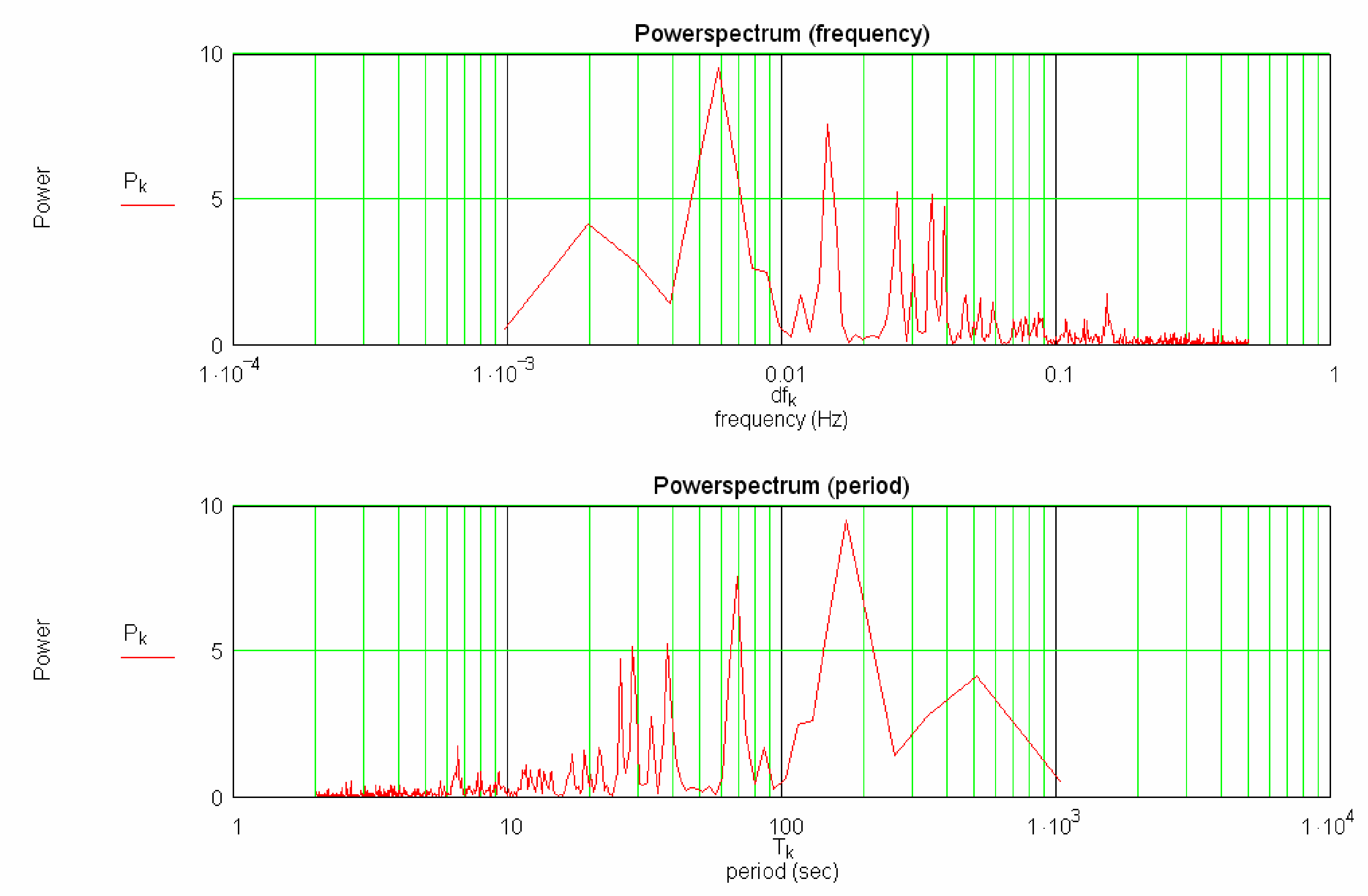
S-band power spectrum of the last 2048 samples starting at 283.18:38 UT. No dominant periods above 10 seconds visible. The spectrum does not change after 283.19:00 UT or for the last 690 samples.

DOY 283	**frequency**		**velocity**	
	X-band	**S-band**	**X-band**	**S-band**
18:17 UT – 18:38 UT	5.8 mHz	7 mHz	200 µm/s	910 µm/s
18:38 UT -. 19:15 UT	4.6 mHz	7 mHz	166 µm/s	910 µm/s
19:00 UT – 19:15 UT	3 mHz	7 mHz	110 µm/s	910 µm/s
Parameter	TM ON, RNG ON, sample rate 1 sample/sec			

12.4.2 IFMS Doppler from 283.19:19 UT – 19:49 UT, ONED-TCXO

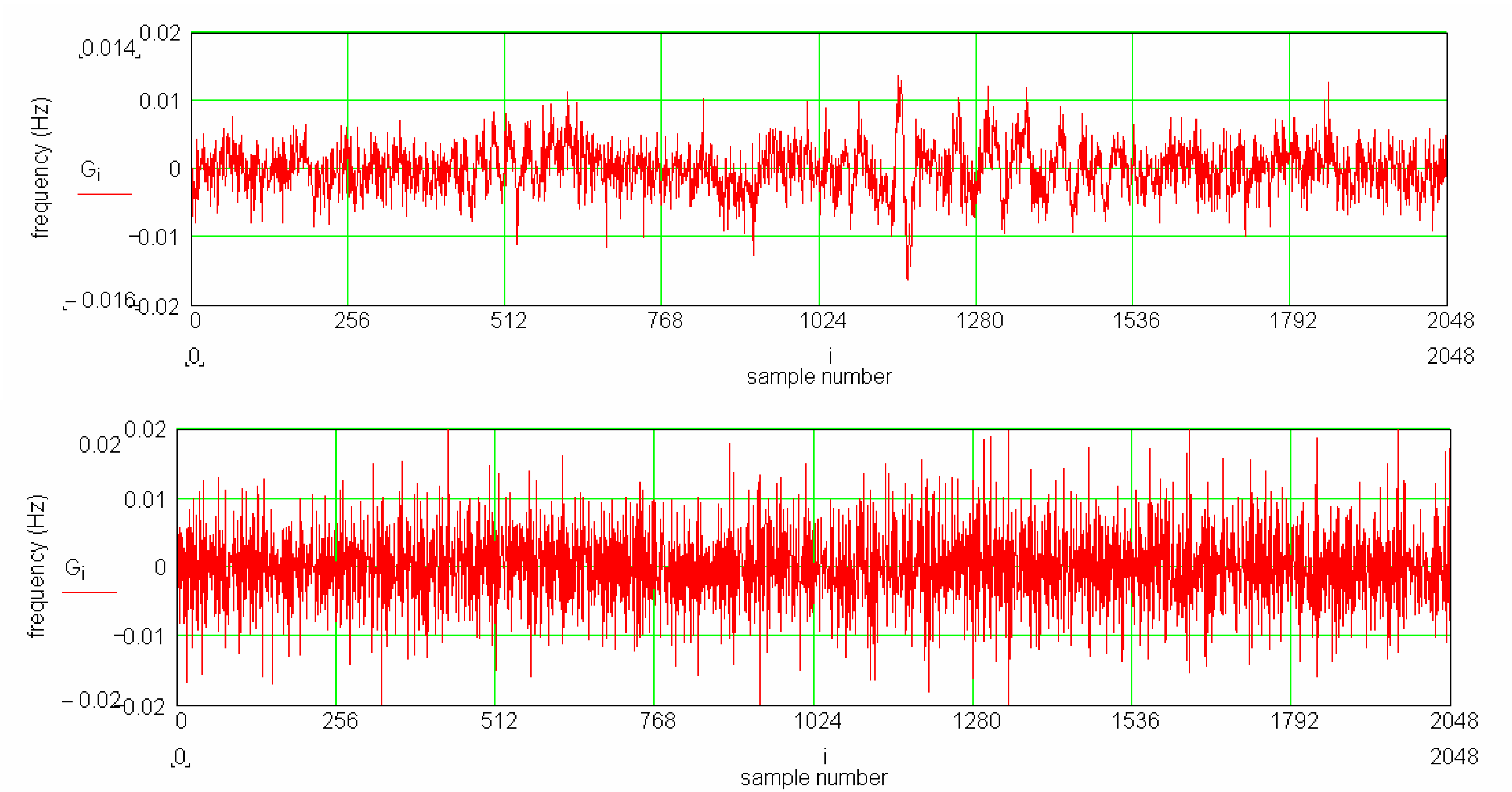


X-band (upper panel) and S-band (lower panel) frequency residuals after detrending the received antenna frequencies. The large ampltide fluctuations of the TCXO make it unusuable for radio science purposes.

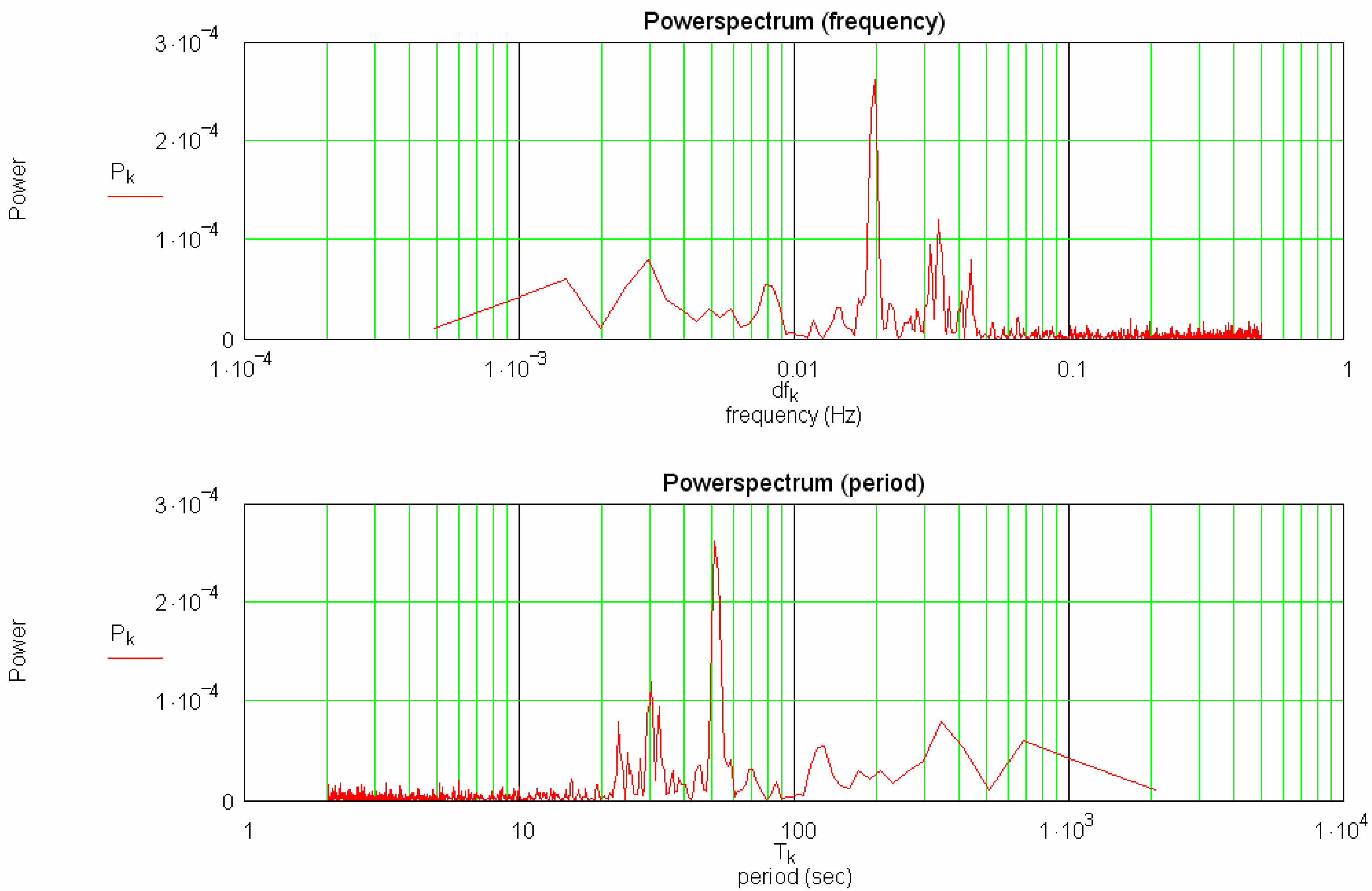


Power spectrum of X-band frequency residuals from 19:15 – 19:45 UT.

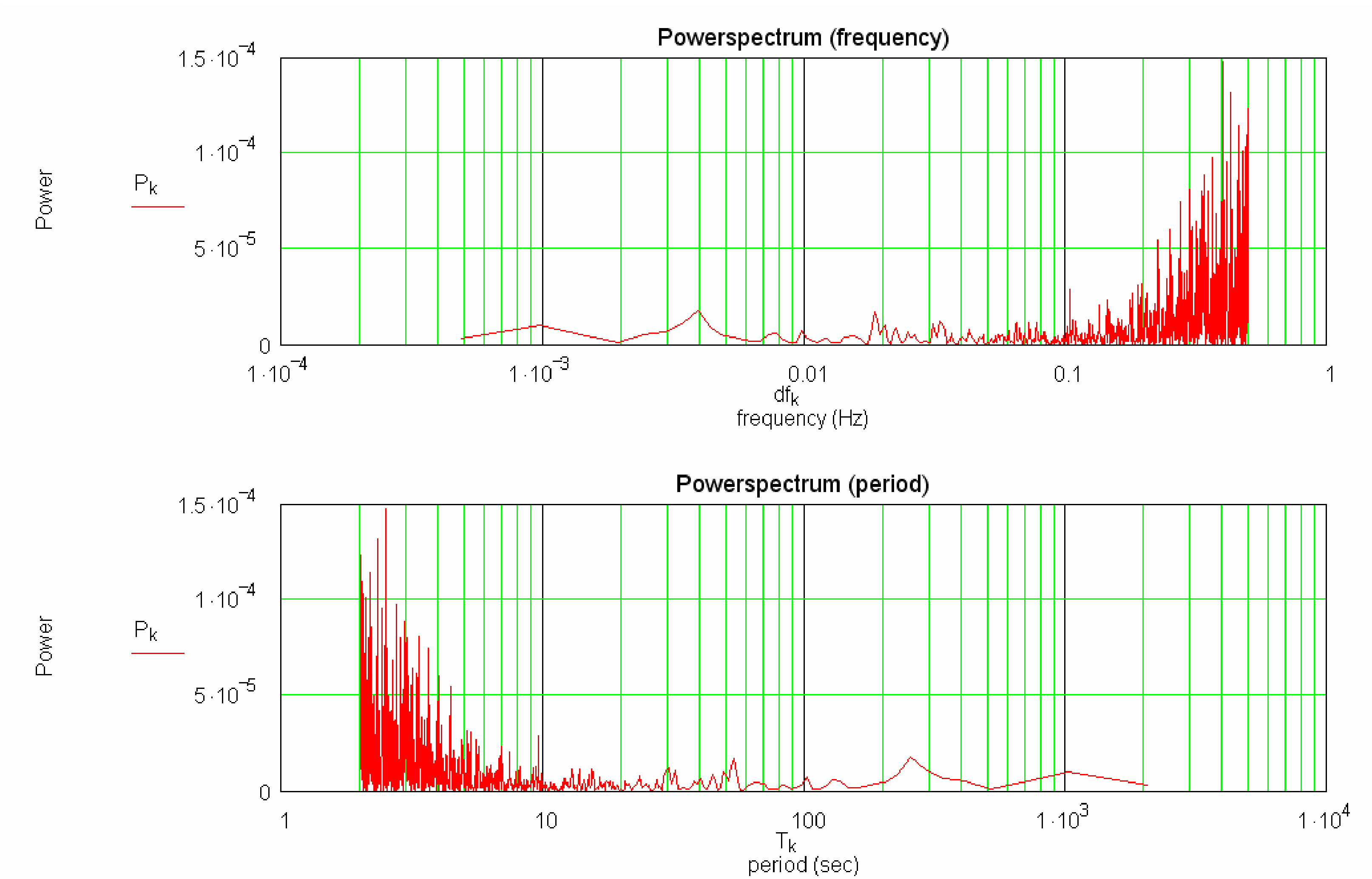
12.4.3 IFMS Doppler from 283.19:49 – 21:49 UT, ONED-USO, TM ON



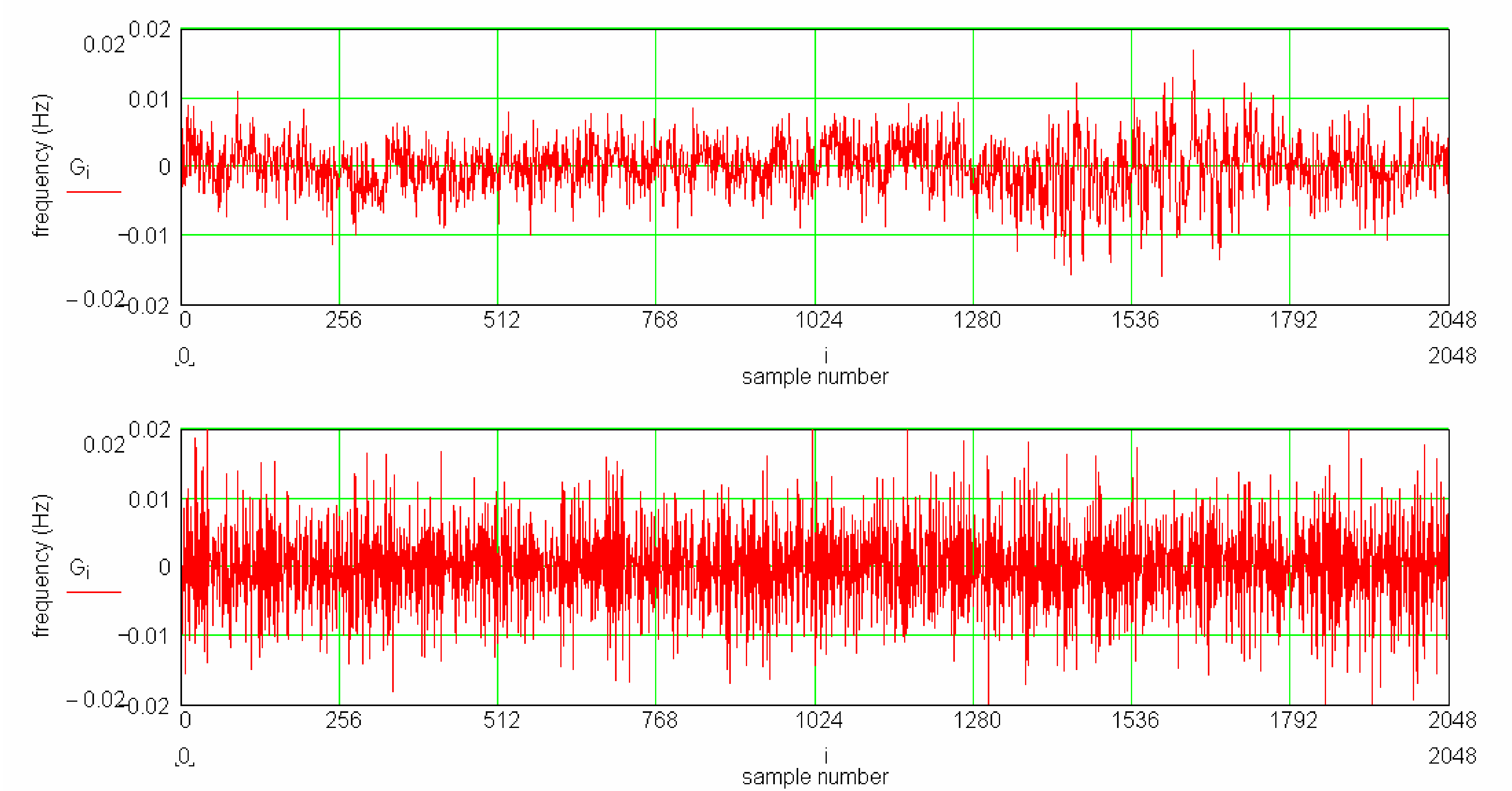
One-way X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO after detrending between 19:49 UT and 20:49 UT. TM is ON at X-band.



Power spectrum of the X-band frequency residual time series shown above between 19:49 to 20:49 UT, TM is ON. A 50 seconds period is prominent.

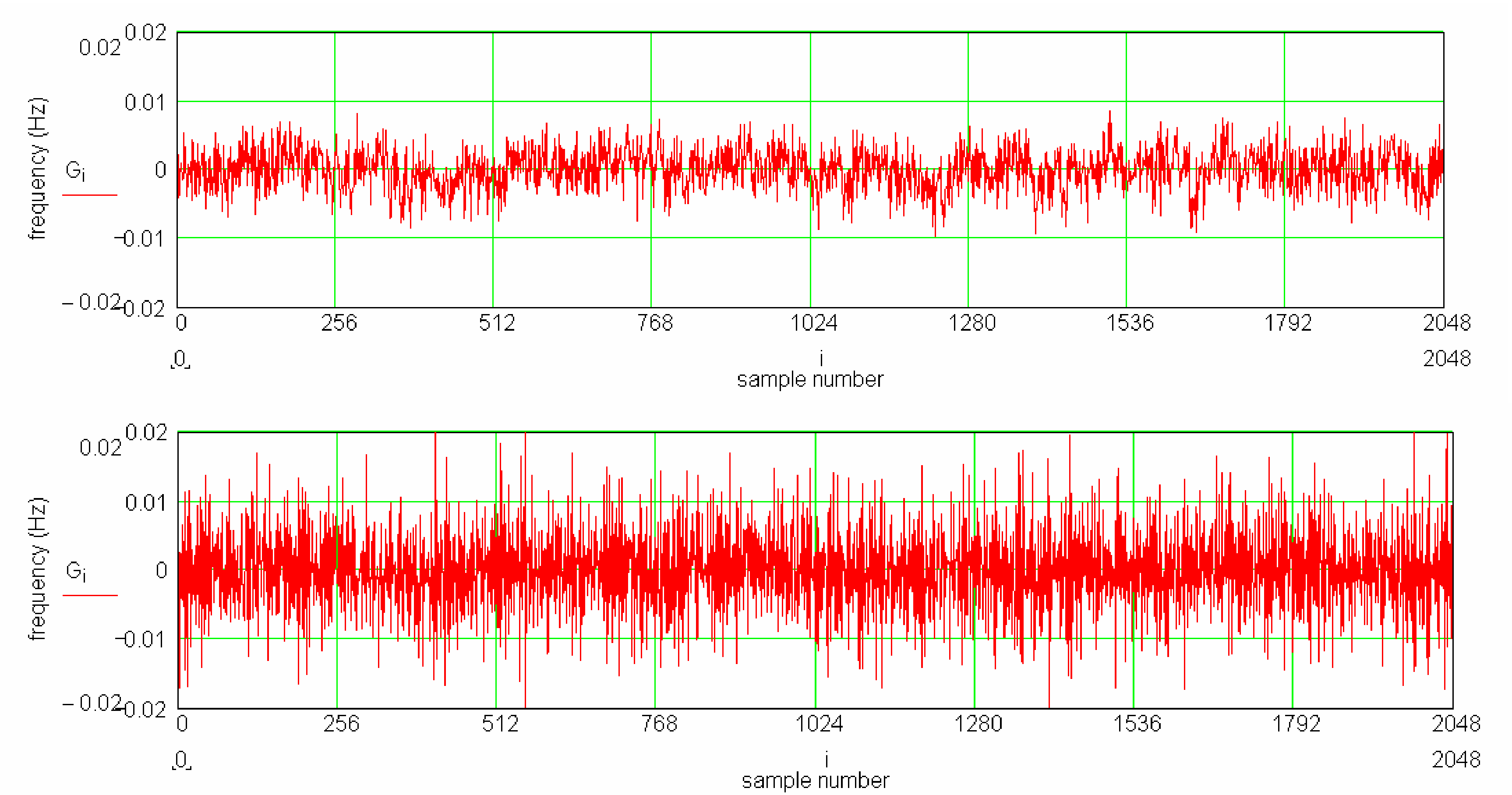


Power spectrum of the S-band frequency residual time series shown above. No modulation on the S-band carrier. No specific periods above 10 seconds are prominent. The spectrum is essentially white noise.

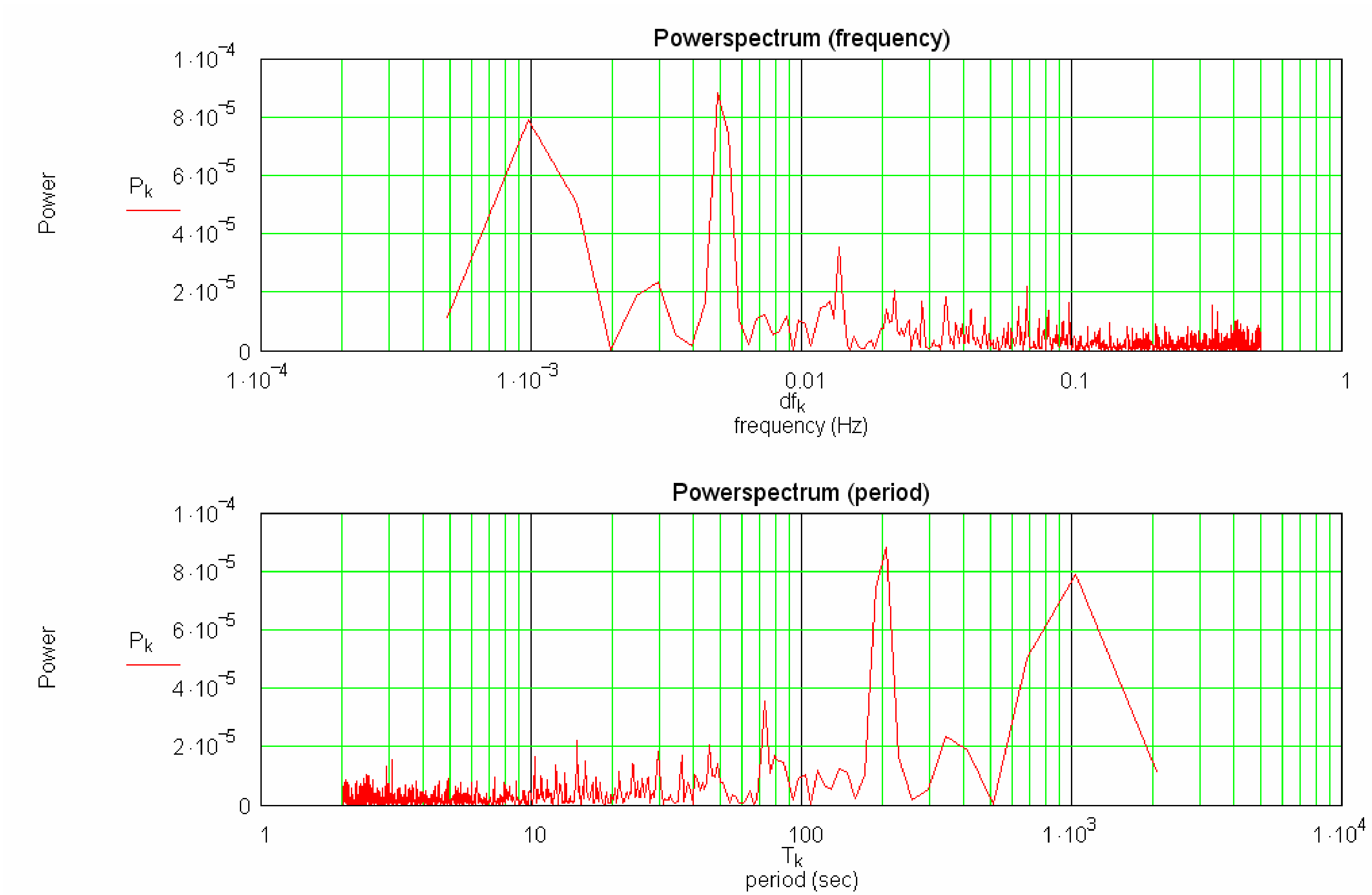


One-way X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO after detrending between 20:49 UT and 21:49 UT. TM is ON at X-band. TM was switched OFF at 21:45 (sample 1700), but no immediate transition can be seen.

12.4.4 IFMS Doppler from 283.21:49 – 22:49 UT, ONED-USO, TM OFF

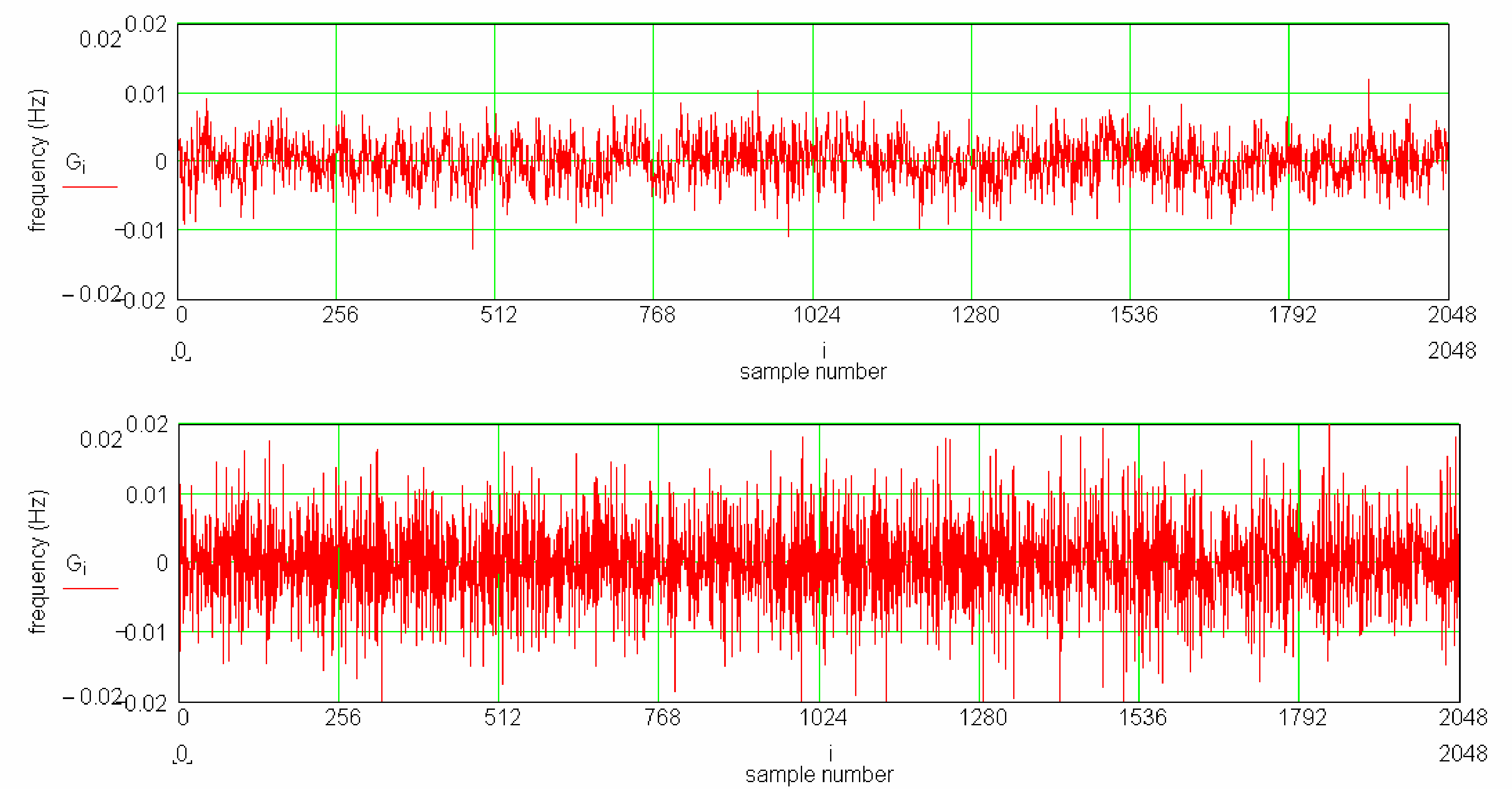


One-way X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO after detrending between 21:49 UT and 22:49 UT. TM is OFF at X-band. TM was switched ON at 22:45 (sample 1700), but again no immediate transition can be seen. X-band noise level is 20% lower than with TM ON, S-band noise level is unchanged.

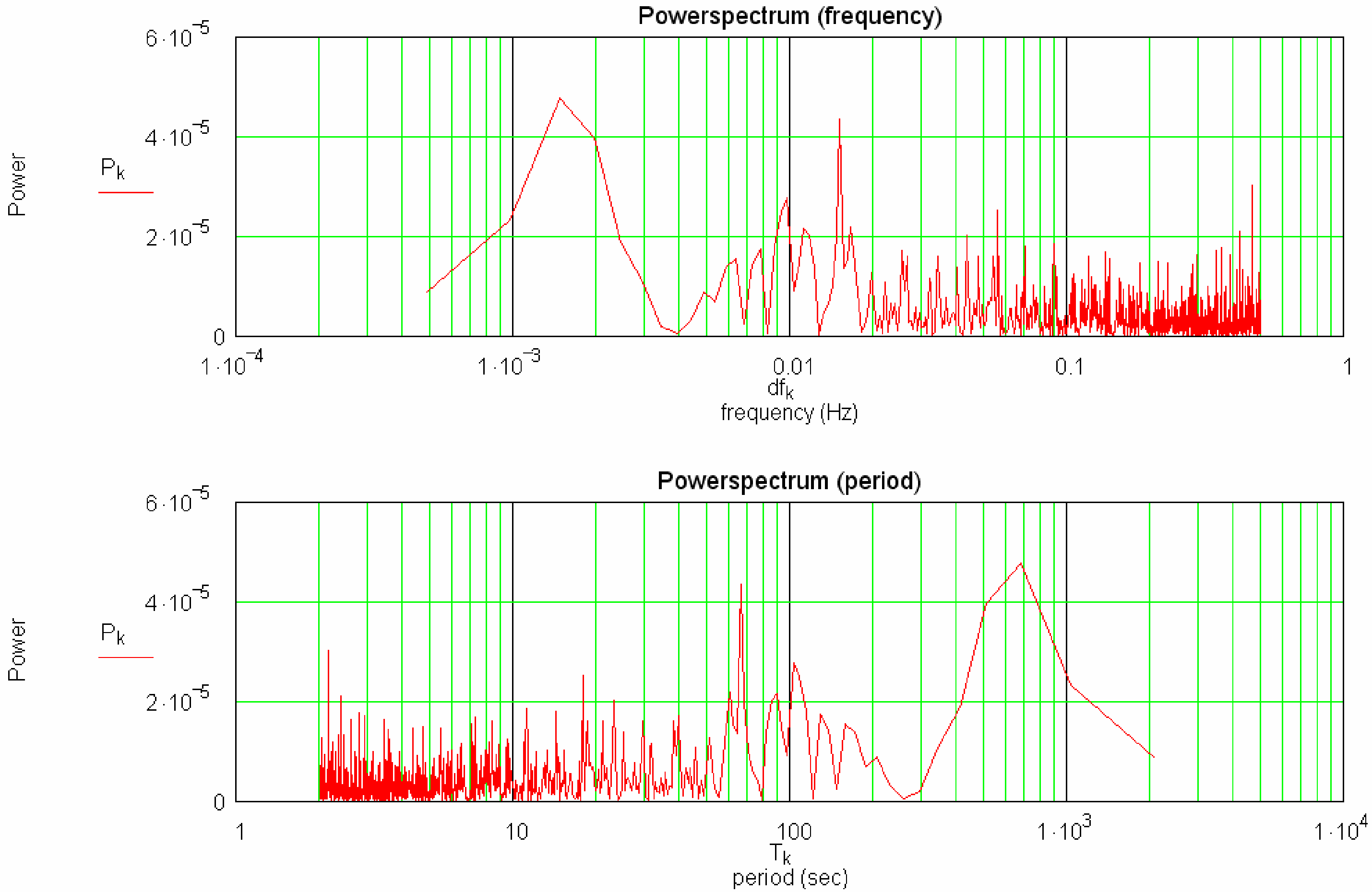


Power spectrum of the X-band frequency residual time series shown above between 21:49 to 22:49 UT, TM is OFF. the 50 seconds period disappeared. The S-band power spectrum is unchanged.

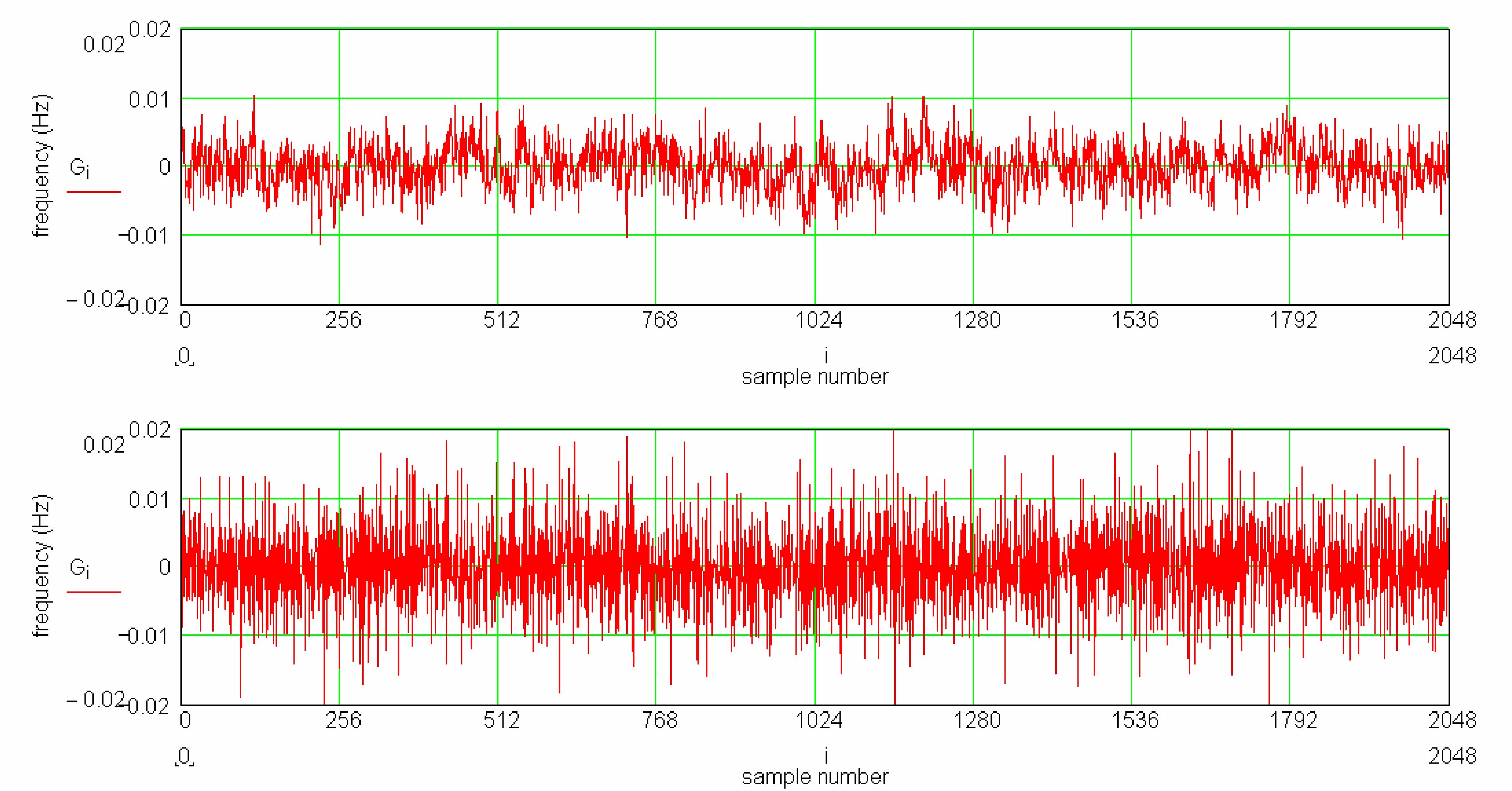
12.4.5 Doppler from 283.22:49 – 284.00:49 UT, ONED-USO, TM ON



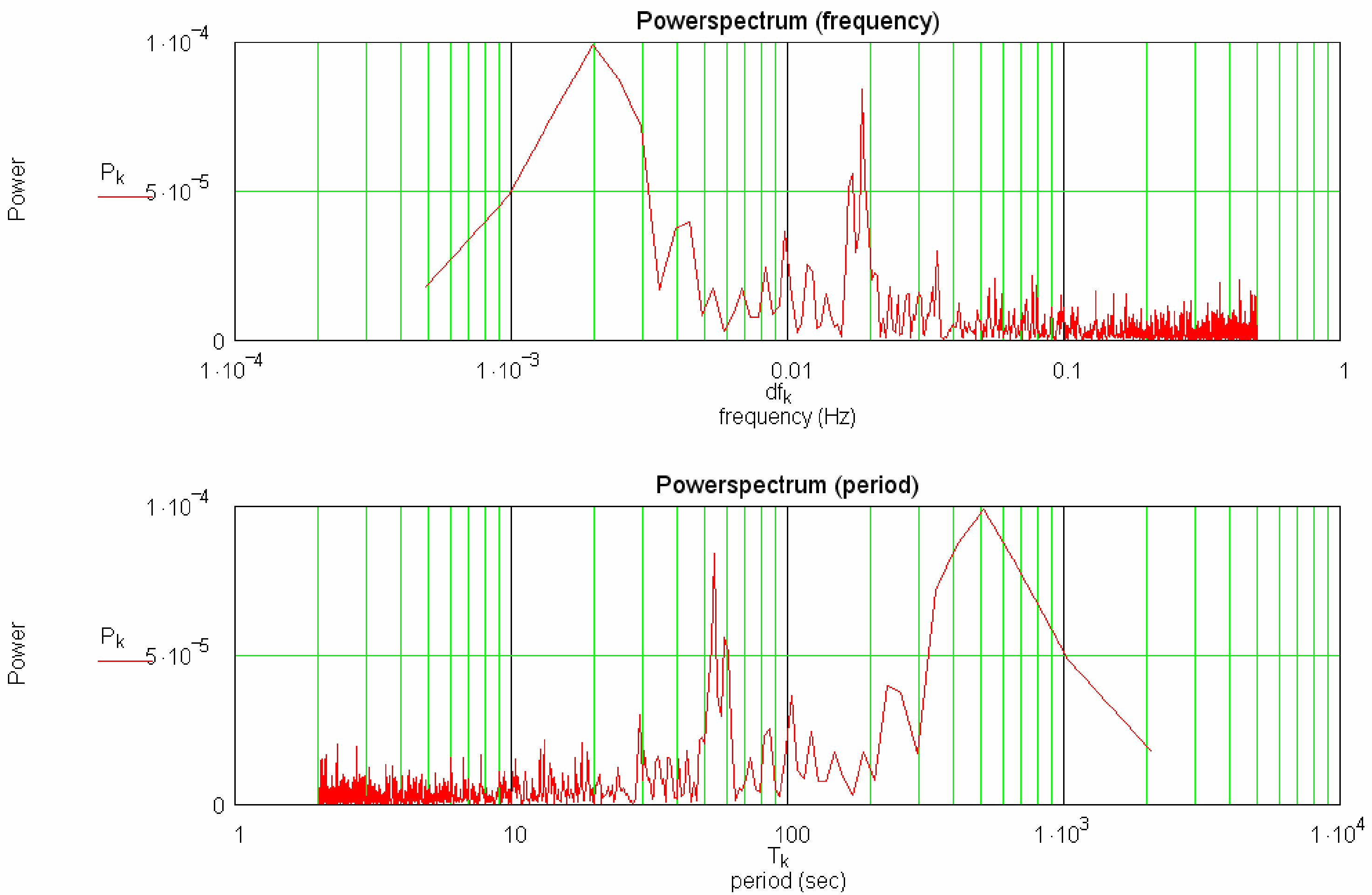
One-way X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO after detrending between 22:49 UT and 23:49 UT. TM is ON again at X-band. X-band noise level is 20% higher again than with TM OFF, S-band noise level is unchanged.



Power spectrum of the X-band frequency residual time series shown above between 22:49 to 23:49 UT, TM is ON again. The 50 seconds period appears again, although weaker than before the TM switch. The S-band power spectrum is unchanged.



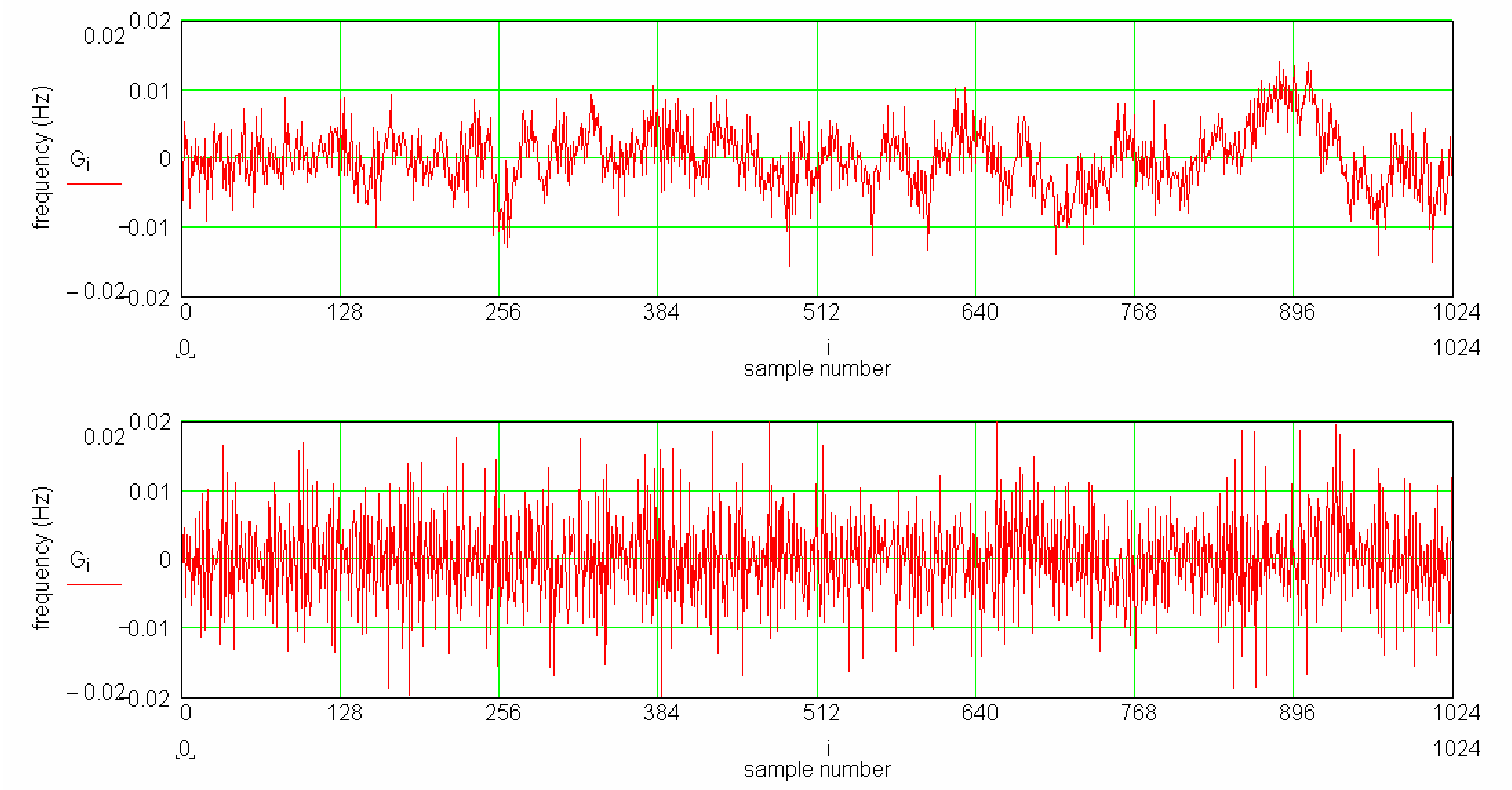
One-way X-band (upper panel) and S-band (lower panel) frequency residuals driven by the USO after detrending between 23:49 UT and 00:49 UT on DOY 284. TM is ON at X-band.

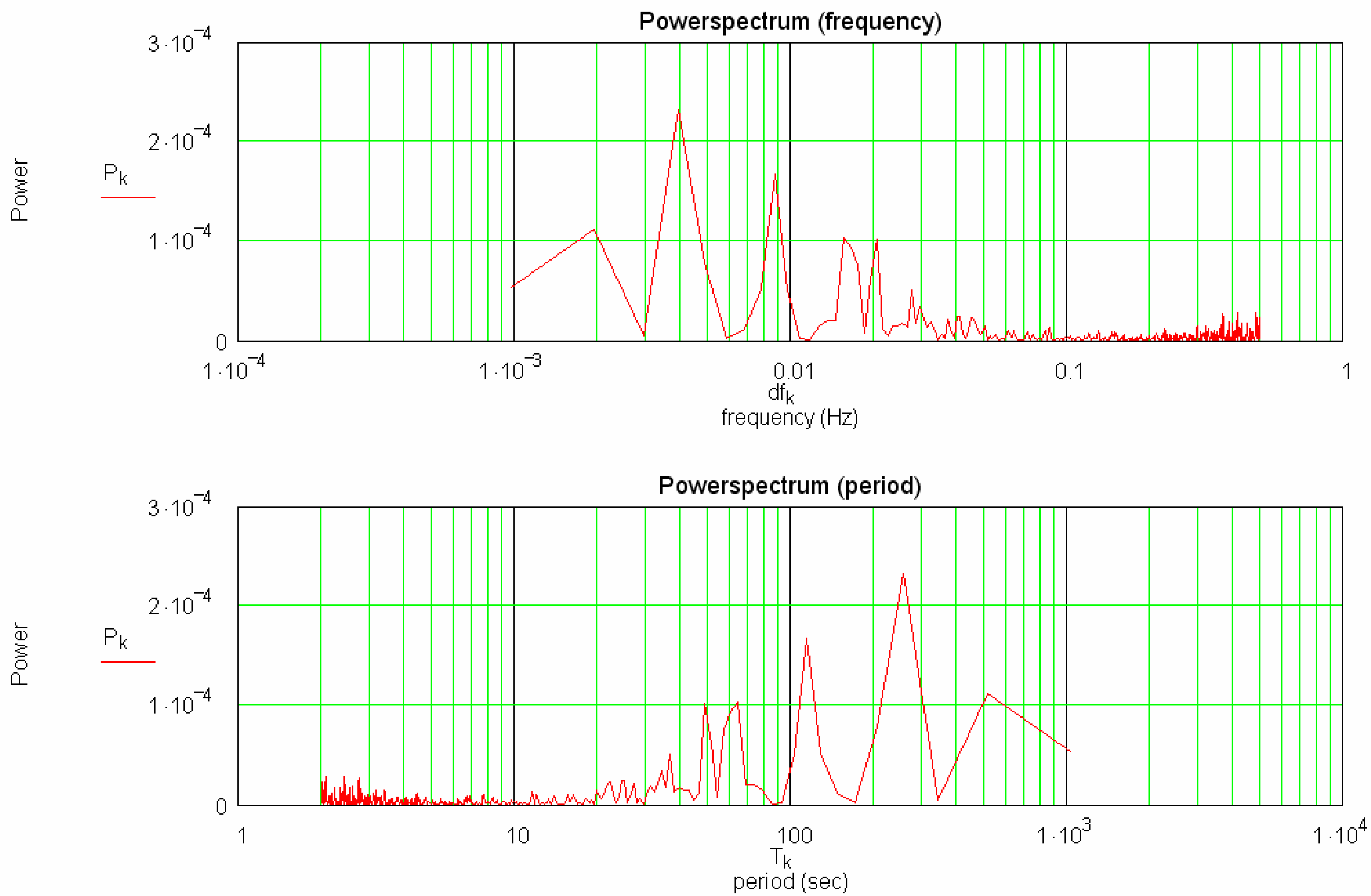


Power spectrum of the X-band frequency residual time series shown above between 23:49 to 00:49 UT, TM is ON. The 50 seconds period is getting stronger. The S-band power spectrum is unchanged.

DOY 283	frequency		velocity	
ONED	**X-band**	**S-band**	**X-band**	**S-band**
19:15 – 19:45 UT TM ON TCXO	910 mHz	250 mHz	33 mm/s	33 mm/s
19:49 – 20:49 UT TM ON USO	3.7 mHz	6.2 mHz	132 μm/s	807 μm/s
20:49 – 21:49 UT TM ON USO	3.8 mHz	6.5 mHz	137 μm/s	859 μm/s
21:49 – 22:49 UT TM OFF USO	2.9 mHz	6.4 mHz	105 μm/s	843 μm/s
22:49 – 23:49 UT TM ON USO	3.2 mHz	6.7 mHz	115 μm/s	871 μm/s
23:49 – 00:49 UT TM ON USO	3.3 mHz	6.4 mHz	119 μm/s	838 μm/s
Parameter	sample rate 1 sample/sec			

12.4.6 Doppler from 284.01:12 – 284.01:41 UT, TWOD, TM ON





Power spectrum of the X-band frequency residual time series shown above between 01:12 to 01:49 UT, TM is ON. The 50 seconds period is strong. The S-band power spectrum is unchanged.

DOY 283 / 284	**frequency**		**velocity**	
TWOD	**X-band**	**S-band**	**X-band**	**S-band**
18:17 UT – 18:38 UT TM ON	5.8 mHz	7 mHz	200 μm/s	895 μm/s
18:38 UT -. 19:15 UT TM ON	4.6 mHz	7 mHz	166 μm/s	895 μm/s
19:00 UT – 19:15 UT TM OFF?	3 mHz	7 mHz	110 μm/s	895 μm/s
01:12 – 01:49 UT TM ON	4.6 mHz	6.8 mHz	165 μm/s	890 μm/s
Parameter	sample rate 1 sample/sec			

13. SREM

PAUL BUEHLER

Rosetta/SREM commissioning

Issue	:	2.0
Date	:	November 11, 2004

Dr. Paul Bühler
Windbergstrasse 25
01189 Dresden
Germany

PAUL BUEHLER	Rosetta/SREM commissioning	
November 11, 2004	2.0	

Contents

List of Reference Documents

[RO-ESC-IF-5003]	Rosetta/MARS EXPRESS Data Delivery Interface Document
[RO-MMT-IF-2011]	Rosetta/MARS EXPRESS Generic TM/TC Interface Control Document
[RO-ESC-PL-5000]	Rosetta Flight Operations Plan
[RO-SE-SURD]	SREM Rosetta Software Requirements Document
[RO-DSS-RS-1033]	SREM Experiment OBCP URD
[Hajdas et al, 2003.]	Radiation environment along INTEGRAL orbit measured with the IREM monitor, *Astron. Astrophys.* 411, L43-L47, 2003

Acronyms and Abbreviations

APID	Application Process ID
DDS	Data Disposition System
ESOC	European Space Operations Center
SREM	Standard Radiation Environment Monitor
SCET	Spacecraft Event Time
SCOS 2000	Spacecraft Operation System

1 Introduction

The commissioning of the Standard Radiation Environment Monitor (SREM) aboard Rosetta took place on May 12 and May 13, 2004 at ESOC in Darmstadt, Germany. Two passe of each approximately 6 hours were allocated for the operation of the instrument.

After successful completion of the tests it was decided to switch on SREM for continuous operation. It was realized then, that with the original OBCP a continuous operation of SREM would rapidly result in an overflow of the S1 packet store and that the OBCP needed to be modified. In the meantime the necessary modification were implemented and since October 21 SREM is continuously accumulating data.

The first part of this report summarizes the results from the SREM commissioning from May 2004. The second part briefly summarizes the actions taken to allow a continuous operation of SREM.

SREM was also switched on during the interference tests. In summary we note, that no signs of disturbing interference were seen in the SREM data.

2 Part I: SREM commissioning May 2004

2.1 Brief instrument description

SREM is a particle detector developed for space applications. It consists of two detector systems measuring the energy deposit of penetrating charged particles. Figure 1 shows a picture of SREM. The box measures $242 \times 122 \times 96$ mm and has a weight of approximately 2.7 kg. It contains the sensitive detectors and the analog and digital electronics. SREM was developed by the Paul Scherrer Institute, Switzerland and is manufactured for ESA by Contraves Space, Switzerland.

Figure 1: The Standard Radiation Environment Monitor, SREM.

There are two detector systems. One is a coincidence detector telescope (D1-D2) consisting of two solid state detectors. It is mostly sensitive to protons. The second is a single detector (D3) which measures electrons and protons. The detectors are covered with thin absorber shields. The thickness of the absorber defines the lower energy cut-off for particles to be detected. From the side and back the detectors are shielded with a layer of 4.2 mm Tantalum and 5 mm of Aluminum. Detector characteristics and absorber thicknesses are listed in table 1. The detectors are from EG&G Ortec and are 500 μm thick.

Table 1: Detector and absorber characteristics.

Detector	active areas [mm^2]	absorber [mm]	cut-off energy [MeV] electrons	protons
D1	70	0.5 Al + 0.7 Brass	1.3	20
D2	110	D1 + 0.7 Ta + 0.5 Al	2.0	40
D3	70	0.65 Al	0.5	10

SREM is run in a histograming mode. For a selectable time interval, the detections are binned into 15 scalers according to the registered energy deposit. The accumulated histograms are stored in the internal memory from where they are read out on request. There are 15 scalers. Their characteristics are listed in table 2. Scalers C1 to C4 are coincidence counters and measure particles which penetrate both detectors D1 and D2.

In addition the SREM on board Rosetta is equipped with a radiation sensitive Field Emission Transistor (radFET) which measure deposited doses.

Besides the scientific data SREM also delivers housekeeping (HK) data (temperatures, voltages) for health checking of the instrument.

Table 2: Characteristics of 15 SREM scalers

Scaler name	Detector	Discriminator levels [MeV]
TC1	D1	0.085
S12	D1	0.25
S13	D1	0.6
S14	D1	2.0
S15	D1	3.0
TC2	D2	0.085
S25	D2	9.0
C1	D1·D2	0.6, 2.0 (coincidence)
C2	D1·D2	0.6, 1.1-2.0 (coincidence)
C3	D1·D2	0.6, 0.6-1.1 (coincidence)
C4	D1·D2	0.085-0.6, 0.085-0.6 (coincidence)
TC3	D3	0.085
S32	D3	0.25
S33	D3	0.75
S34	D3	2.0

SREM has its own memory which is partly used for program execution and partly for storage of the accumulated data. The data part is split into 1024 accumulation files and 256 housekeeping files.

Aboard Rosetta SREM is operated with five Telecommand (TC) procedures (see table 3).

SE-FCP-001 is used to power up and switch on SREM.

SE-FCP-002 is used to switch off and power down SREM.

SE-FCP-003 is used to start data accumulation. On issue of this TC procedure SREM starts a sequence of accumulations and readouts of the radFET. Each accumulation is preceeded by a HK

Table 3: TC procedures for SREM aboard Rosetta [RO-ESC-PL-5000]

SE-FCP-001	SREM Switch ON
SE-FCP-002	SREM Switch OFF
SE-FCP-003	SREM Accumulation via OBCP
SE-FCP-004	SREM Hibernation Data Read via OBCP
SE-FCP-005	SREM Memory Dump via OBCP

parameter acquisition. Accumulation times and number of radFET readouts are parameters of the TC procedure. After each accumulation the data is read out from the memory and transfered to the on board memory of the satellite where it is kept ready for download to ground. The sequence of accumulations and readouts is stopped with an other issue of SE-FCP-003 and the parameter STOP set to true.

SE-FCP-004 can be used to read out several accumulation/HK files in the SREM memory. This TC procedure is however not used because in the current implementation of SE-FCP-003 each HK/accumulation file is directly transfered to the satellites on board memory.

SE-FCP-005 is used to read out parts of or the entire SREM memory.

2.2 Summary of scientific objectives

The purpose of SREM is to monitor the high energetic, ionizing particle environment aboard spacecrafts. These particles can penetrate several mm of shielding material and reach sensitive parts inside the spacecraft. The energy deposition into semiconductor devices can lead to slow degradation or failure of the device. Measurements of the particle environment allow to estimate absorbed doses which is helpful in anomaly analysis and for the planing of future missions. The objective of SREM aboard Rosetta is to provide a continuous, (nearly) uninterrupted measurement of the high energetic particles encountered by Rosetta and provide this information for mission analysis as well as for update of existing models. Currently there are two other SREMs in operation aboard he Belgium satellite PROBA-1 and ESA's gamma-ray mission Integral. Launches of additional SREMs are planed.

The particle environment along Rosetta's path is dominated by cosmic rays and solar particles. Both components are subjected to temporal variations. The cosmic background varies with solar cycle. During solar minimum, the shielding effect of the suns magnetic field against particles penetrating from deep space into the inner regions of the solar system is smaller than during solar maximum, leading to higher particle fluxes during solar minimum (a few %). In absence of solar events, the high energetic particle fluxes are relatively low. During solar events however, the high energetic proton fluxes can rise within a few hours by several magnitudes. Figure 2 shows data from the SREM which is operated aboard Integral [Hajdas et al, 2003]. The panel shows the count rates in counters C1, C2, and C3 as function of time. On October 28, 2003 around 11:30 UTC the count rates started to rapidly increase and reached an approximately 500-fold rate at 14:00.

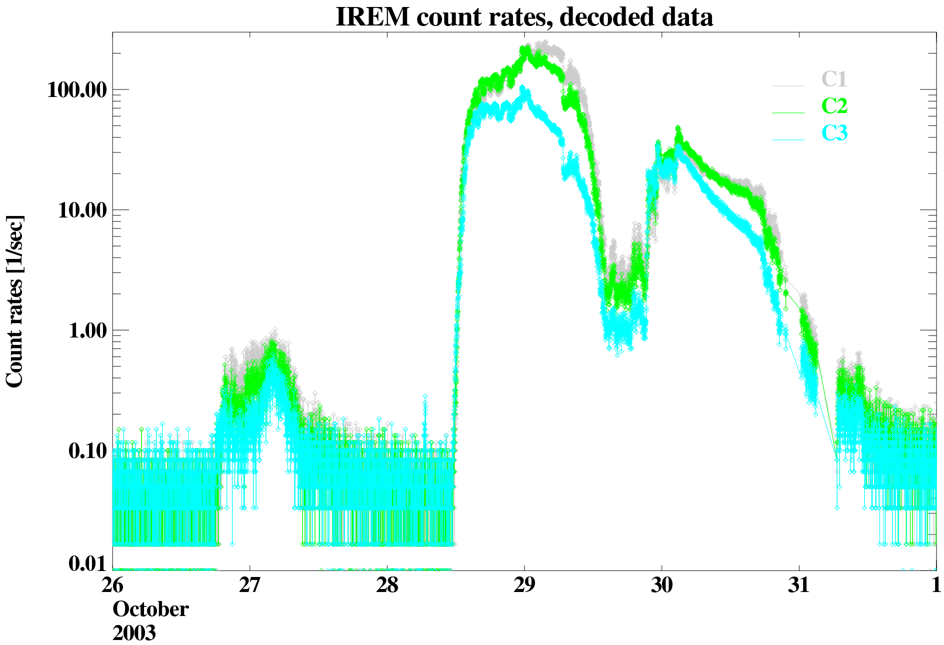


Figure 2: Solar proton event seen by the SREM aboard the Integral satellite.

3 Commissioning results

The ultimate goal of the commissioning of SREM was to switch on the instrument and to check its proper functioning. There were two passes allocated for the SREM tests - on May 12 (day 71) and May 13 (day 72). The test procedure is summarized in table 4.

During the first pass SREM was successfully powered up two times (one time on each redundant power line A and B). The current on the power lines was measured and was in the expected range. Figure 3 shows a screen shot from the Spacecraft Operation System (SCOS 2000). The left part shows the situation before upload of the SREM-Power-ON TC procedure. The parameter NPWDA11A is OFF (instrument not powered up) and NPWDA588 shows a negative current value (no current on power line A). The right part of the figure shows the situation after SREM was powered up. NPWDA11A is now ON and NPWDA588 shows a value of 0.08 A. After a warming-up period SREM was then commanded to accumulate data with an accumulation time of 90 seconds and to perform a radFET read out after every accumulation. On SCOS it was checked, that the accumulated data and radFET readouts were available and the status bits delivered by SREM were nominal. It was also verified that the data was available on the DDS. The measurements of two external temperature sensors (NTSA0022 and NTSA0085) were also monitored. It was noted, that these temperatures slightly but steadily increased (from 21^o to 23^o) without reaching a stable level until the end of the tests. After one hour the data accumulation was stopped and a memory dump was started. AT 01:43 SREM was switched off with TC procedure SE-FCP-002.

During the second pass SREM was switched on and after a warm-up period of 10 minutes data accumulation was started. Accumulation time was set to 300 seconds. After 2.5 hours the data accumulation was stopped and the instrument was powered down. All available information indicated that SREM has been working properly.

Table 4: SREM operations plan for commissioning.

		duration	start	stop
May 12/13,2004 (day 71)				
SREM Power ON	SE-FCP-001	00:30	22:00	22:30
SREM Power OFF	SE-FCP-002	00:30	22:30	23:00
SREM Power ON	SE-FCP-001	00:30	23:00	23:30
SREM Warming up	-	00:10	23:30	23:40
SREM Accumulation1	SE-FCP-003	01:50	23:40	01:30
FSK01480=0919<hex>, FSK01481=90, FSK01482=2, FSK01483=NO				
SREM Memory Dump	SE-FCP-005	01:00	01:30	02:30
FSK01490=4800<hex>, FSK01491=2047				
SREM Power OFF	SE-FCP-002	00:30	02:30	03:00
May 13/14,2004 (day 72)				
SREM Power ON	SE-FCP-001	00:10	21:30	21:40
SREM Warming up	-	00:10	21:40	21:50
SREM Accumulation1	SE-FCP-003	04:10	21:50	02:00
FSK01480=0881<hex>, FSK01481=300, FSK01482=1, FSK01483=NO				
SREM Power OFF	SE-FCP-002	00:10	02:00	02:10

Figure 3: Screen shot of the SCOS before power up of SREM (left part) and after SREM was switched on (right part).

3.1 Experiment status at end of commissioning period

After completion of the tests the instrument was powered off.

3.2 Performance verification matrix (key parameters)

The parameters verified during commissioning are summarized in table 5. All available information indicates that SREM was working absolutely nominal. In figure 4 counting rates of selected SREM counters measured during the commissioning are compared with the rates observed by the SREM aboard Integral during the same period of time. The values are in good agreement. The differences in statistical variations reflect the different accumulation times of 90 seconds during the first pass of the commissioning, 300 seconds during the second pass, and 60 seconds aboard Integral.

Table 5: Verification of SREM performance during commissioning

SREM can be switched on	OK
current is nominal	OK
data accumulation can be started	OK
TC procedure parameters are correctly inherited by the instrument	OK
data accumulation can be stopped	OK
SREM can be switched off	OK
SREM memory dump works	OK
data is available on DDS	OK
HK data is nominal	OK
accumulation data is nominal	OK

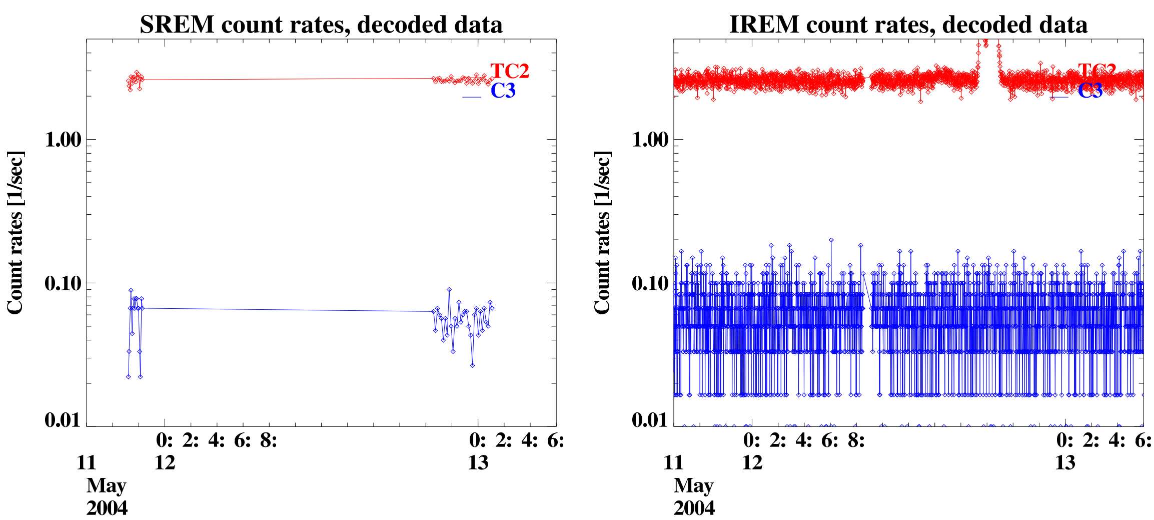


Figure 4: Comparison of Rosetta and IREM count rates.

3.3 Problem areas and anomaly reports

Two questions have arisen during the tests.

1. It was noted, that there is a time gap between two consecutive accumulations of 100 seconds (time between stop of accumulation and start of following accumulation) and 240 seconds in case a total dose reading is performed between the two accumulations. It was not clear where these gaps are created. SREM is able to start and stop accumulations without any time gaps.
2. During the test it was noted that the temperatures measured by the two external sensors NTSA0022 and NTSA0085 were slightly but steadily increasing during operation without reaching a stable value.

These two questions have been investigated in the meantime

1. The time gaps are introduced in the TC procedure SE-FCP-003. The observed durations of these gaps are consistent with the software code. Actually it is further investigated whether these time gaps can be reduced.
2. In an out-of-pass action SREM was switched on for 24 hours and the temperature sensors NTSA0022 and NTSA0085 were monitored. The result of this test is shown in figure 5. The lower panel shows, that approximately 6 hours after switch-on a stable temperature is reached. The maximum temperature of 28^o is well below the maximum acceptable temperature of 55^o.

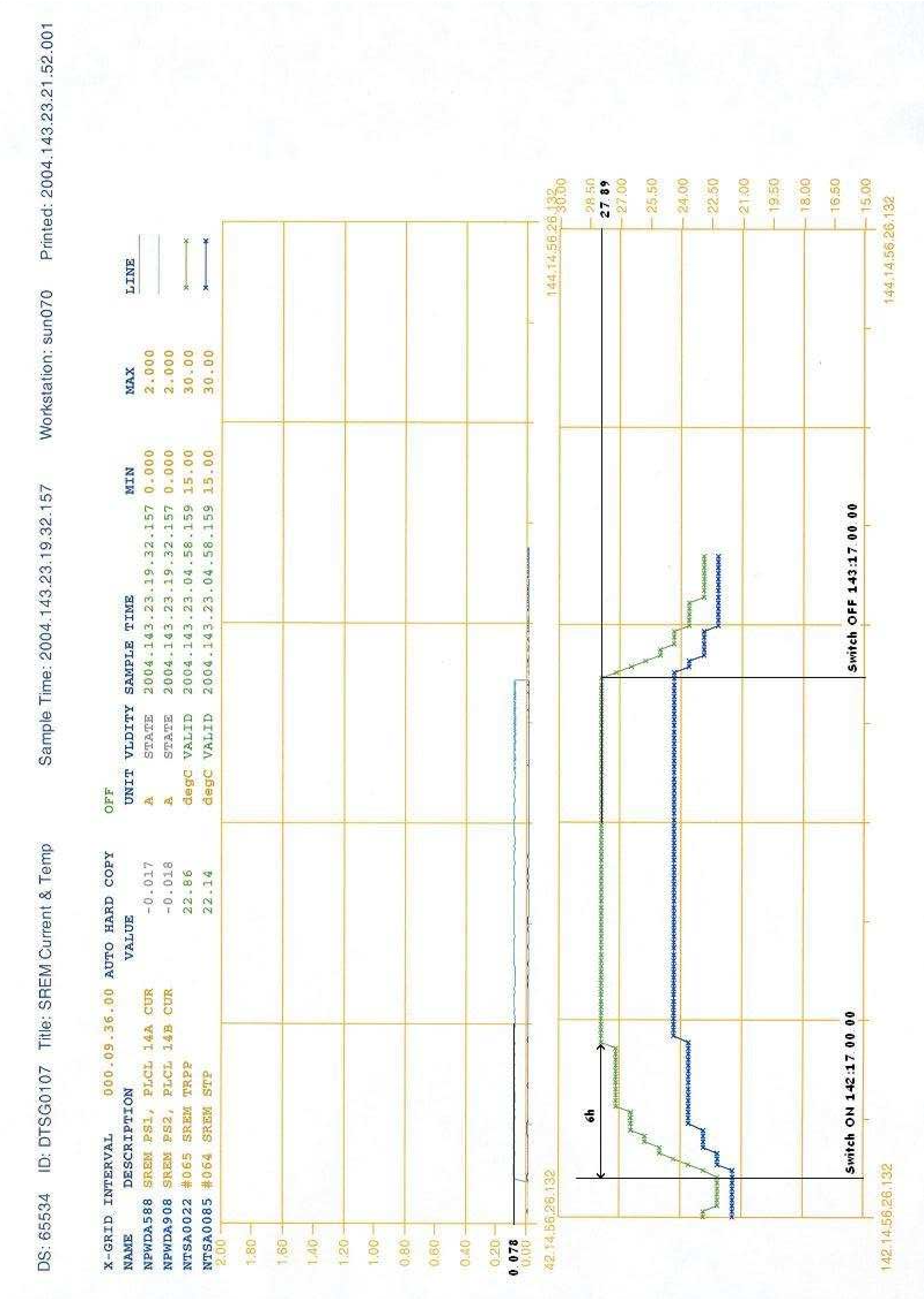


Figure 5: Out-of-pass test of SREM. The external temperature sensors NTSA0022 and NTSA0085 show that a stable temperature is reached after 6 hours of operation.

4 Conclusions and lessons learned

All TC procedures to operate SREM aboard Rosetta were successfully tested. No anomalies were observed. Since there are only five TC procedures with few parameters SREM is very simple to operate.

4.1 Recommendations for Comet Science operation (interaction with other experiments, spacecraft operation

Rosetta provides with its long journey to its final destination a unique platform for SREM to perform a continuous measurement of the radiation environment over an extended period of time. SREM should be continuously operated during the cruise phases to obtain a complete data set. SREM produces a relatively small amount of data. Table 6 shows a summary of the expected data rates as function of selected accumulation time and the number of radFET readings. At an accumulation time of e.g. 90 seconds and a radFET reading rate of 1 per 10 accumulations a data rate of 15 bits per second is produced. The data rates can be further reduced by choosing longer accumulation times (up to 2580 seconds is possible, resulting in data rates of below 2 bits per second). However, in view of the short time scales of the solar proton flux variations the accumulation times should not be longer than 300 seconds.

Table 6: SREM data rates in bits per second as function of the accumulation time T_{acc} and the number of accumulations per radFET readout (radFET rate).

radFET rate t_{acc}	1	2	5	10
60	13	15	17	18
90	12	13	15	15
120	11	12	13	13
180	10	10	11	11
300	8	8	8	8
2580	1.4	1.3	1.2	1.2

5 Part II: Continuous operation of SREM

After successful completion of the May 2004 SREM commissioning it was discussed, that SREM should be continuously operated. At the beginning of June SREM was switched on for continuous operation, but had to be stopped again after a few hours, because its operation was producing too many service 1 packets, which risked to overflow the S1 packet store.

In the following a brief summary of the actions taken since then to reactivate the continuous operation of SREM is given. The problem was solved by the ESOC team and since October 21 SREM is accumulating data again.

Figure 6 shows a summary plot of the data accumulated received on ground since October 21.

- At the beginning of June, OSIRIS requested a test with SREM, for which the instrument had to be switched on. In the evening of June 3 SREM was started to accumulate data, but had to be stopped again in the morning of June 4 because service 1 packets were generated autonomously by the system (about 30 packets every 10 minutes) and risked to overflow the S1 packet store. It was therefore decided to investigate the problem before keeping SREM continuously on.
- The analysis of the problem revealed, that the code of the OBCP was such, that it basically needed to be rewritten to be able to operate SREM continuously. Since manpower and EQM were booked at that moment for the upload of a new on-board software, the SREM OBCP development and testing was scheduled for August and the reactivation of SREM was scheduled for the beginning of September.
- In late August the new SREM OBCP was uploaded to the spacecraft and on August 26 SREM was tested with the new OBCP. A memory dump was performed which seemed to be successful.
- In the night of August 30 SREM was switched on again for continuous operation.
- However, the data received on ground was not as expected. Some counter values were out of limits and the counting rate histograms did not have the expected shape.
- Due to the running interference tests the analysis of the problem had to be postponed until October 6, when a test run was performed with the EQM and the new OBCP. The conclusions of the test was, that the new SREM OBCP had some timing problems, i.e. some commands were sent too early with respect to the previous one.
- Until October 15 further test were performed which confirmed the timing problem. The OBCP was modified and successfully tested. with the EQM
- In the following the modified OBCP was uploaded to the spacecraft and in the night of October 21, SREM was switched on again with the new OBCP.
- The data received since then looks good!

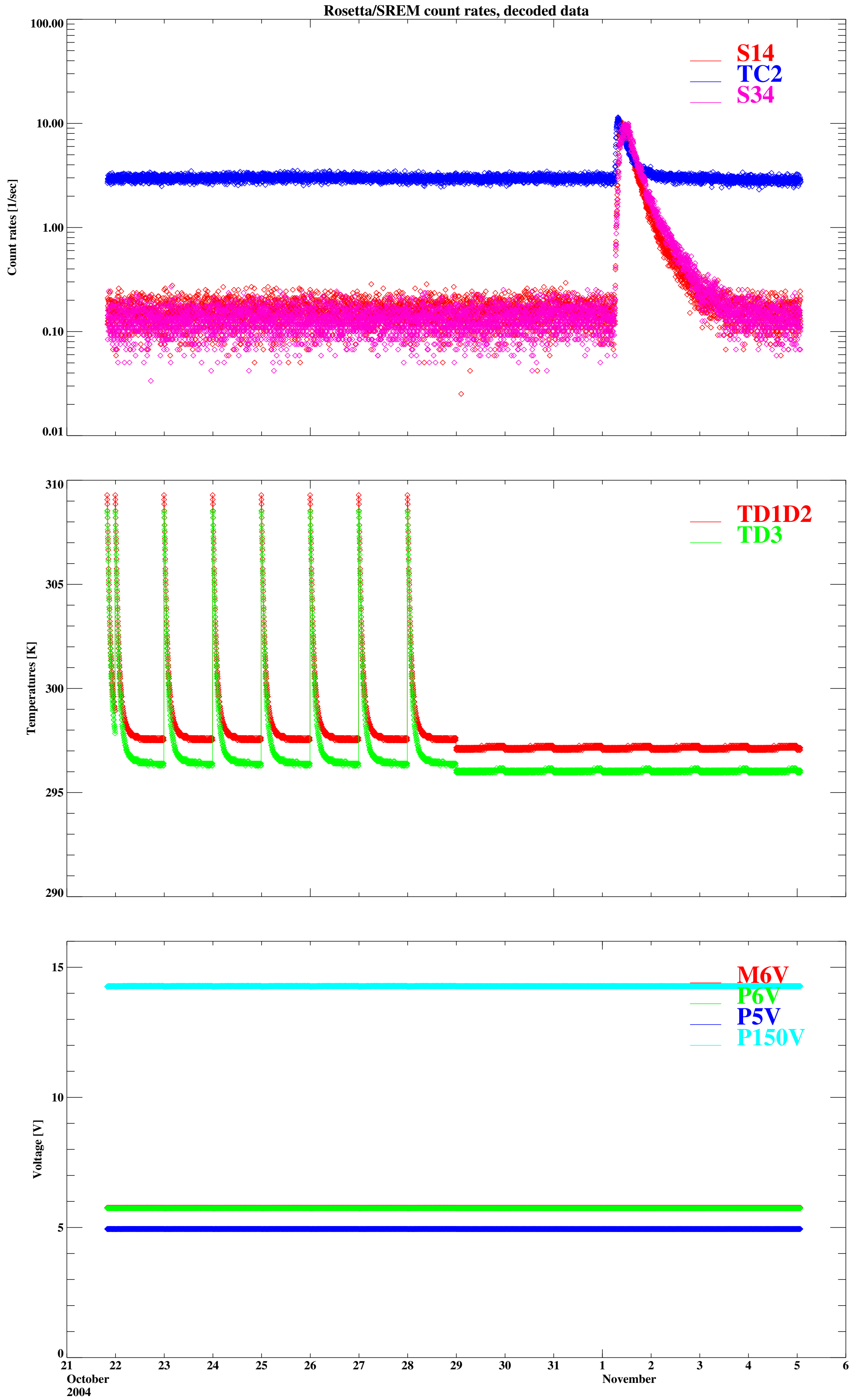
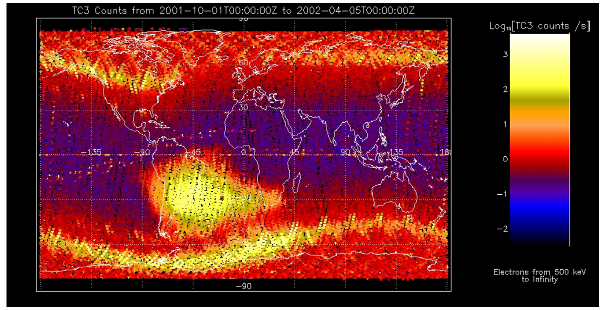
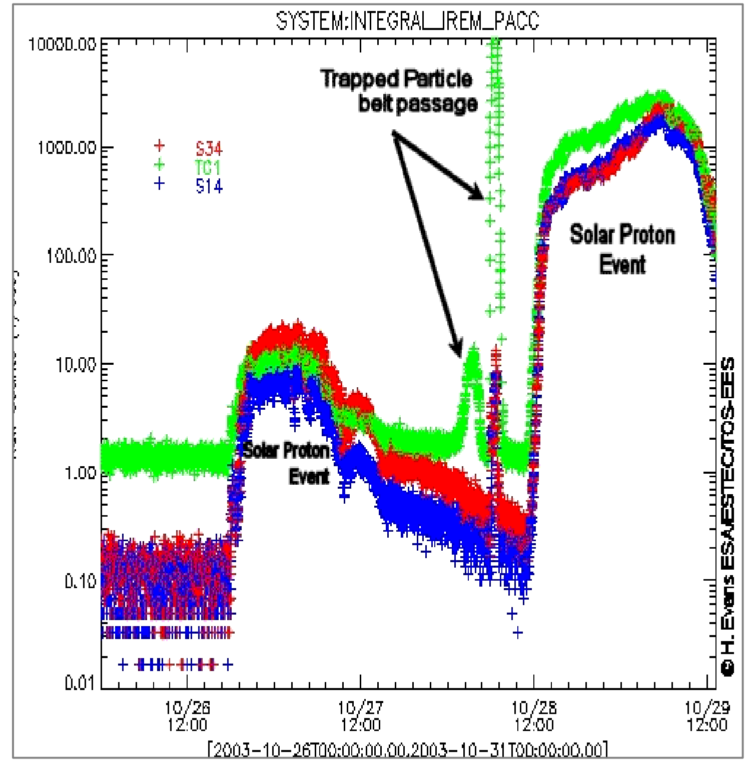
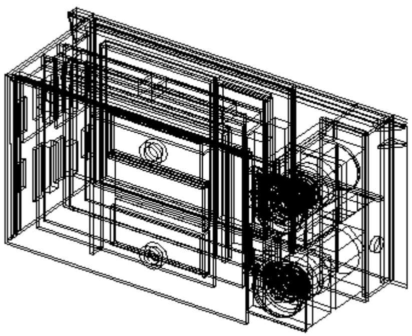


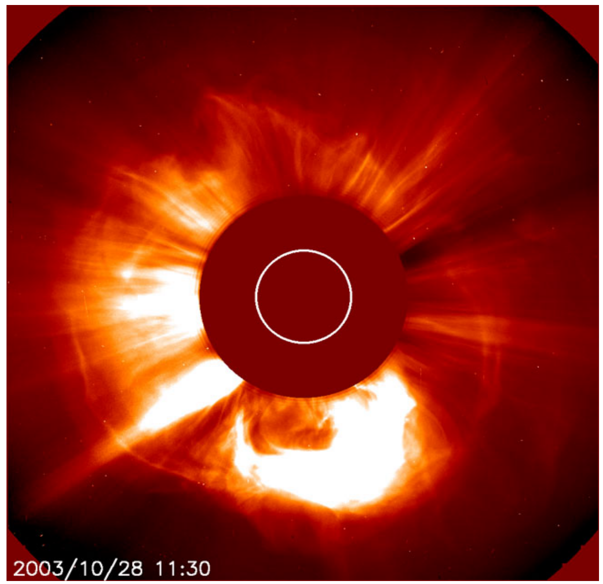
Figure 6: SREM/Rosetta summary plot from October 21 to November 6. The upper panel shows count rates of three SREM counters. The enhancement on November 1 is due to solar protons. The middle panel shows the two detector head temperatures. In the lower panel the SREM voltages are plotted, which are very stable and at nominal level.

Standard Radiation Environment Monitor (SREM)







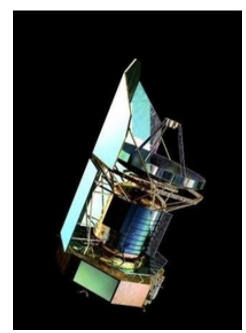


INTEGRAL

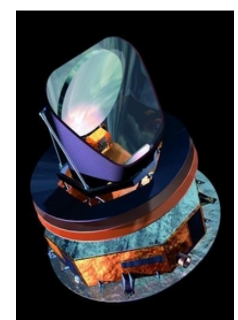
ROSETTA

PROBA-1

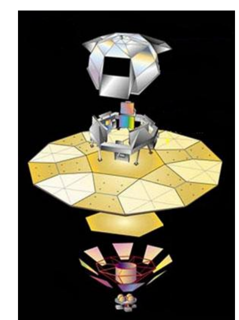
GSTB V2



HERSCHEL



PLANCK



GAIA

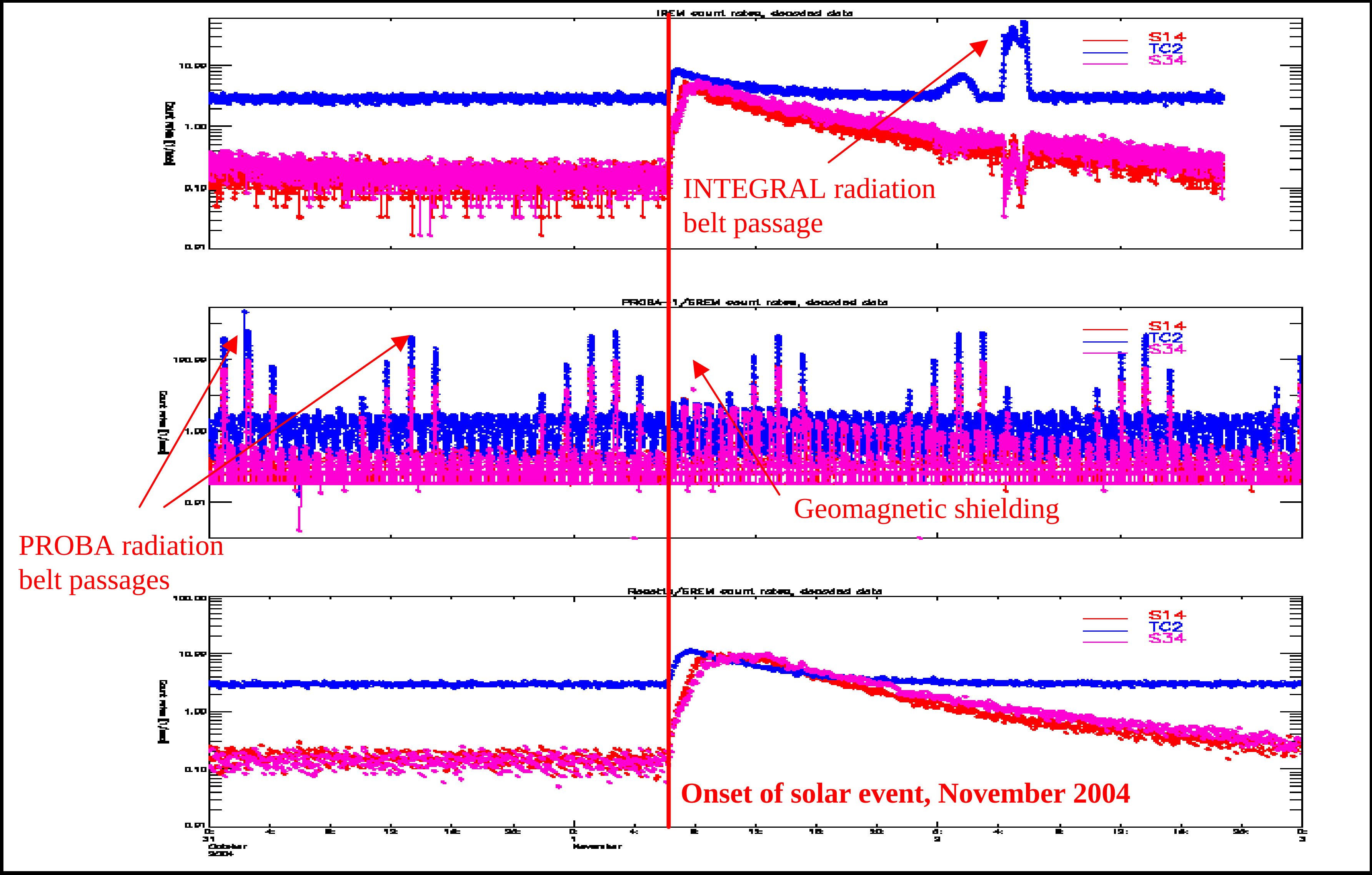
SREM on Rosetta

Standard Radiation Environment Monitor (SREM)

	Logic	dE discr. level [MeV]	Particle	E min [MeV]	E max [MeV]
1.	D1	0.085	Proton Electron	20 2	Inf. Inf.
2.	D1	0.25	Proton	20	550
3.	D1	0.6	Proton	20	120
4.	D1	2	Proton	20	27
5.	D1	30	Proton	20	34
6.	D2	0.085	Proton	39	Inf.
7.	D2	9	Ions	150	185
8.	D1*D2	0.6, 2	Proton coincidence	40	50
9.	D1*D2	0.6, 1.1-2.0	Proton coincidence	50	70
10.	D1*D2	0.6, 0.6-1.1	Proton coincidence	70	120
11.	D1*D2	0.085-0.6, 0.085-0.6	Proton coincidence	130	Inf.
12.	D3	0.085	Electron	0.5	Inf.
13.	D3	0.25	Electron	0.55	2.3
14.	D3	0.75	Proton	11	90
15.	D3	2	Proton	11	30

- SREM commission completed successfully (minor data issues; corrected)
- Observation baseline: accumulation period of 120 seconds (114 bytes/ accumulation period)
- No pointing requirements
- No specific observation requests
- However: SREM to be kept on during both the cruising and comet observation phases

SREM data comparison: INTEGRAL (top), PROBA, and ROSETTA (bottom)



14. VIRTIS

VIRTIS PFM
Flight Commissioning Report

	NAME	FUNCTION	SIGNATURE	DATE
PREPARED	VIRTIS team			
CHECKED	F. CAPACCIONI	TM		11/06/2004
APPROVED	A. CORADINI	PI		11/06/2004
AUTHORIZED	A. CORADINI	PI		11/06/2004

DOCUMENT CHANGE RECORD

ISSUE	DATE	AFFECTED PAGES	CHANGE DESCRIPTION
1	10/05/2004	all	First issue
2	11/11/2004		Update to include Pointing and Interference Scenarios

REFERENCE

RD 1	VIR-GAL-IC-048 issue 7	VIRTIS OBDH ICD
RD 2	RO-VIR-UM-001 issue 2	VIRTIS User manual
RD 3	VIR-DLR-MA-006 issue 2 rev3	VIRTIS SW User Manual
RD 4	RO-ESC-PL-5000 issue 4	ROSETTA FLIGHT OPERATIONS PLAN
RD 5	VIR-GAL-TR-227 issue 1	VIRTIS Commissioning electrical & functional test report

TABLE OF CONTENT

1 Scope

Purpose of this document is to give an overview of the VIRTIS instrument after the commissioning phase, with particular attention to:

- the status of the experiment at the end of the commissioning period,
- the completeness of the verification of the instrument functional and scientific performances (through an appropriate performance matrix)
- Identification of the problem areas (if any) and of the anomaly reports issued.

The overall commissioning activity is divided in three separate time slots, specifically devoted to:

- Functional tests — From 24th through 26th March 2004
- Pointing/Calibration/performance Scenario — From 05th through 18th October 2004
- Interference Scenario — From 19th through 28th October 2004

In addition to the above activities strictly related to the commissioning, two scientific observation have been attempted:

- Observation of the Earth-Moon system during the MIRO functional test slot on 24th April 2004.
- Observation of the Comet C/2002 T7 Linear during the OSIRIS functional tests slot on 30th April 2004.

2 Instrument description and scientific objectives

This chapter is presently being updated with respect to the one in RD2 to comply with requirements from RSOC: description of scientific objectives in terms of Science Themes and Sub-Themes for each mission phase.

3 Summary of Tests Results

3.1 Functional Tests

The functional tests was carried out on 24 – 26 March 2004 and run under responsibility of RMOC in ESOC – DARMSTADT.

The tests performed so far were aimed at the verification of the functional capabilities of the instrument, in particular were devoted to:

- tests of all the mechanisms:
    - opening/closing of protective covers

  - opening/closing of shutters
  - operability of the cryocoolers, in closed loop and open loop mode
  - operability of the scan mirror
- verification of the calibration unit: operation with different lamp currents;
- verification of all the operational modes
- verification of the instrument performances, by means of the comparison of ground and in-flight internal calibration.

Tests were performed both during PASS (direct S/C visibility from ground station) and also during OUT-OF-PASS condition through a dedicated MTL (Mission TimeLine).

The outcome of the functional tests can be considered highly successful. All the VIRTIS mechanisms and subsystems have performed nominally and no major anomalies have been reported. A detailed report of the functional tests has been issued by Galileo Avionica (RD5). Notwithstanding, a number of anomalies report have been issued both from RMOC (2 AR) and from VIRTIS (24AR), which requires attention. A full list of the issued AR and their present status is given in chapter 5, the majority of the AR have been already closed by either DCRs (Rosetta Database Change Request) of by PCRs (in flight Procedures Change Request), some other have been closed by analysis; few of them are still open and shall be closed before the final issue of the present document.

The functional tests have been started with VIRTIS operating at a temperature above the operational one for the optical heads (approximately 143K for both optical heads). We have been explained by RMOC that this anomalous temperature has been due to a not nominal S/C orientation prior to the start of the VIRTIS functional tests. The sun was not on the X axis as expected but was oriented with the sun on the +X panel making an angle of 50 degrees with +Z axis, to avoid overheating of the S/C antenna transmitter. Prior to the beginning of VIRTIS functional tests, the S/C has been reoriented in the nominal condition with the Sun perpendicular to the +X panel. In figure 1 and 2 are reported the trend of the internal temperatures of M channel during the two days operations. Figure 3 and 4 reports the same behaviour for M channel.
A thermal analysis is currently being performed by the VIRTIS team to evaluate VIRTIS thermal inertia from the in-flight temperature data during the functional tests activities.

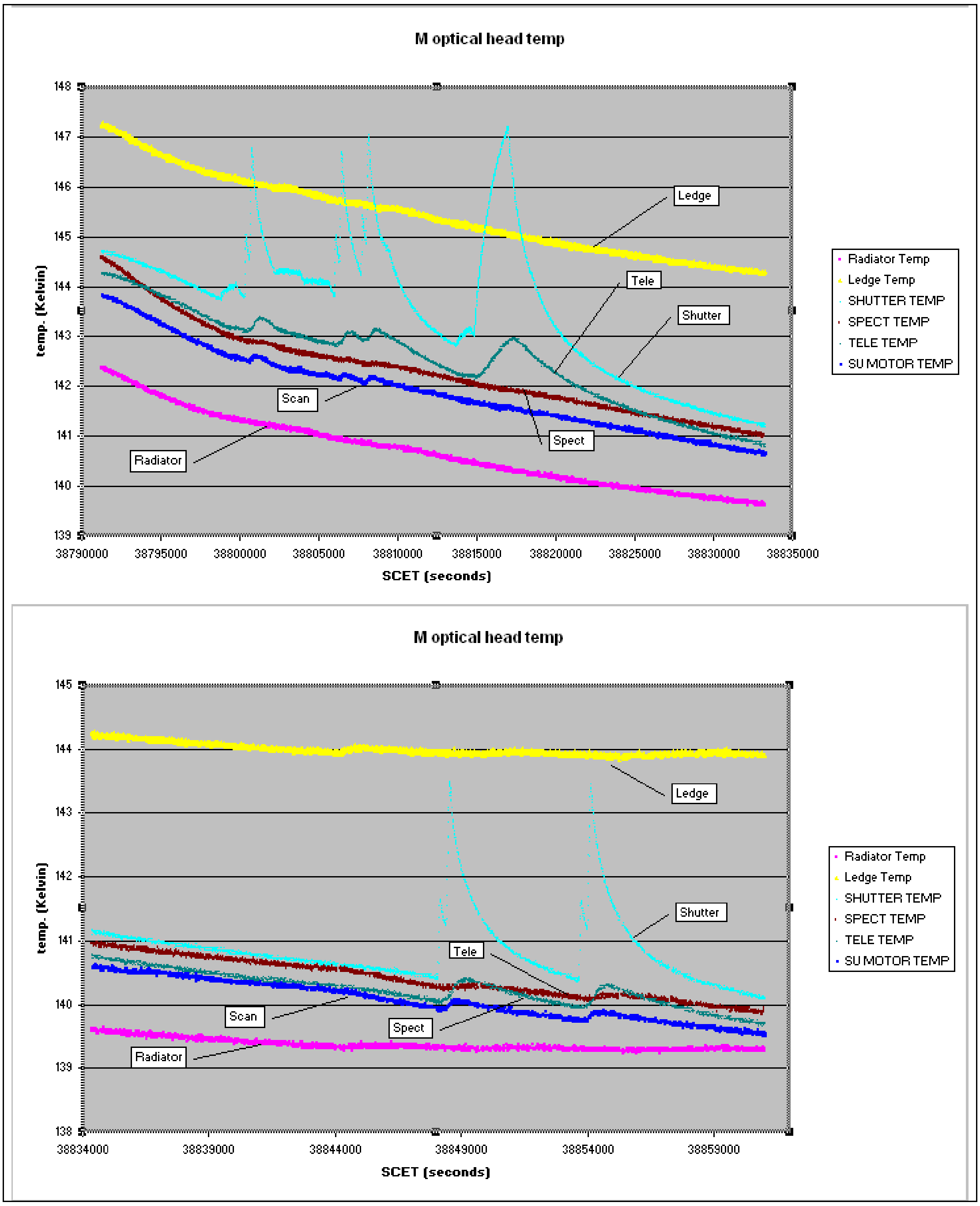


Figure 1. M Channel Optical Head Temperature during the first day of commissioning (Main Channel).

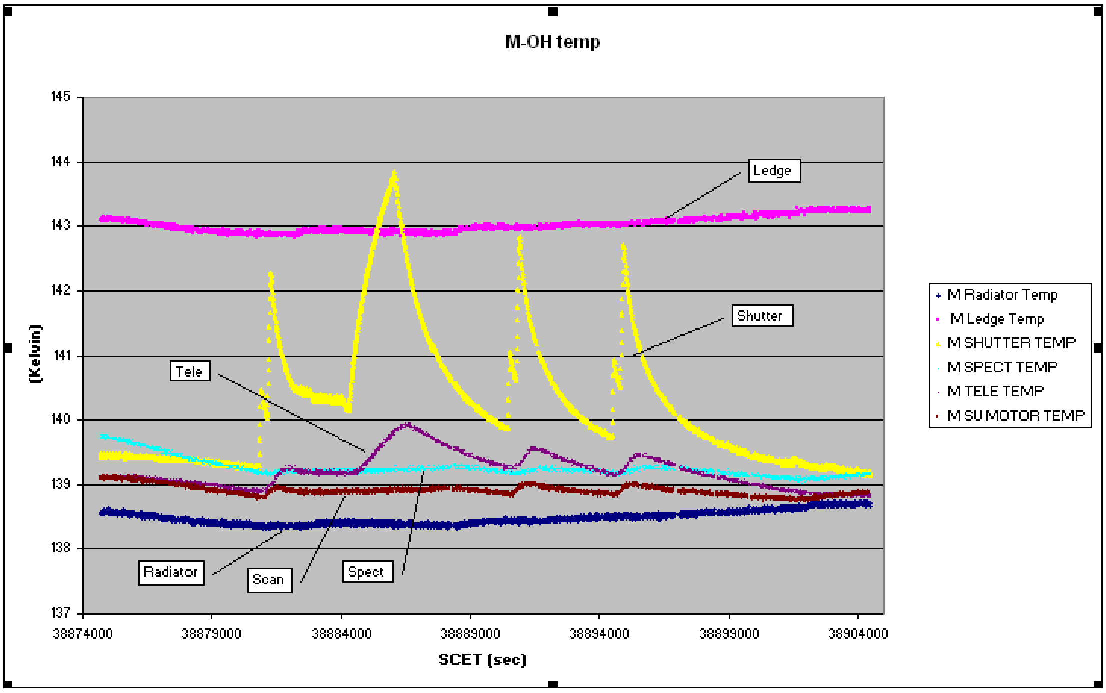


Figure 2. M Channel Optical Head Temperature during second day of the commissioning (Redundant Channel).

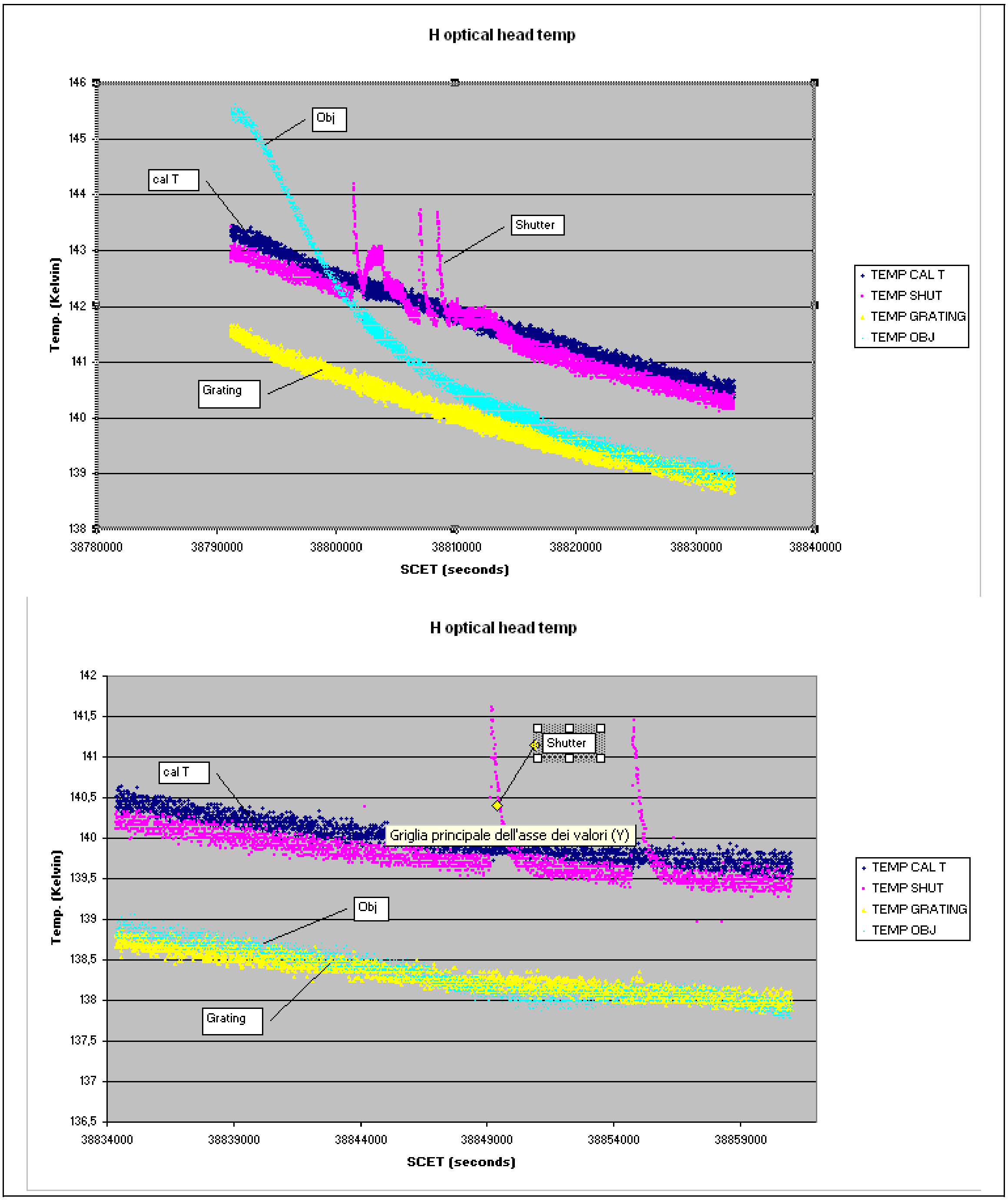


Figure 3. H Channel Optical Head Temperature during the first day of commissioning (Main Channel).

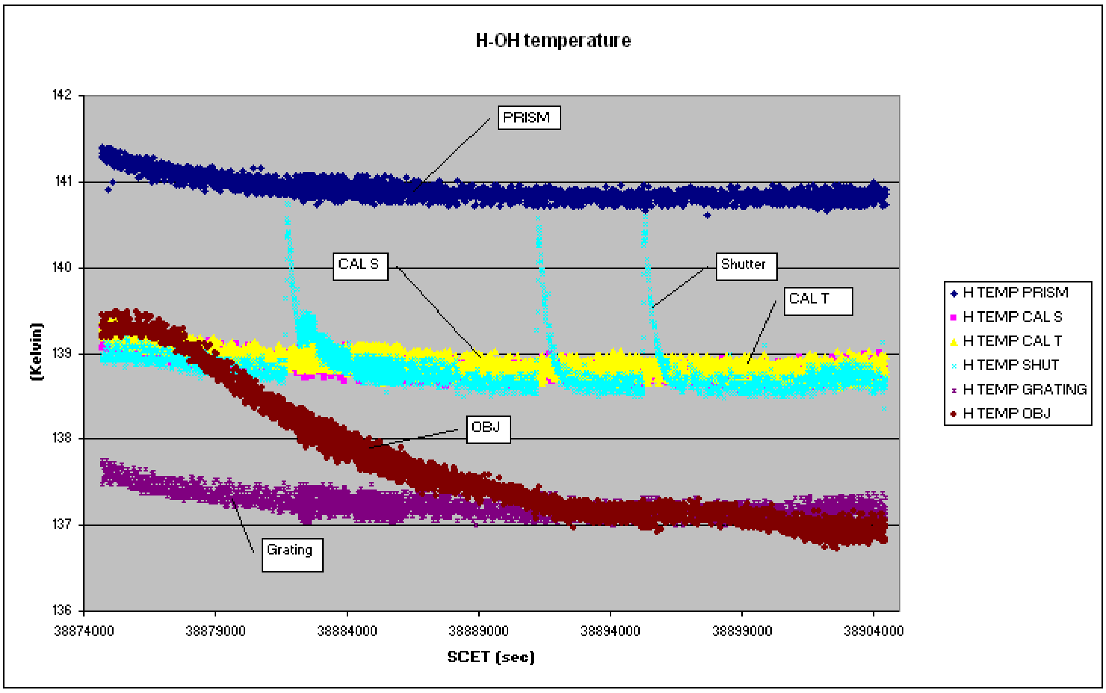


Figure 4. H Channel Optical Head Temperature during the second day of commissioning (Redundant Channel).

3.1.1 Analysis of internal Calibration performance

The functional tests have also included several calibration runs using the internal calibration units, which use special spectral lamps for both VIRTIS-H and VIRTIS-M. The calibration have been performed both with nominal (default) parameters settings as well as changing detector temperature and internal calibration lamp currents. For both channels the analysis of the calibration data is still ongoing, here we present our preliminary results, while a complete analysis shall be included in the December version of the present document.

The preliminary analysis of H calibration data is shows reasonable agreement between on-ground and in-flight calibration data. Calibration performances with the nominal calibration sequence shows the following:

- nominal behaviour of both the spectral and radiance calibration lamps
- spectral reconstruction according to the pre-launch pixel map table of the VIRTIS-H spectrum shows only minor shift; a pixel map reconstruction (a normal process for VIRTIS H operations) is underway to upload a new pixel map for the October commissioning, the shift in the position of the 8 orders of VIRTIS-H being of the order of 1 pixel only.
- radiance calibration is ongoing; no substantial disagreement is found with pre-launch calibration, implying a good performance conditions for the detectors and for the lamp itself

The operations were performed at a detector temperature of 81.36K (nominal) and a temperature of the optical box between 140 and 143 K; this temperature is higher than the 135 K specified temperature, and allow us to detect a thermal background of the optics in the detector area corresponding to the longer wavelength range. This behaviour is fully consistent with expectations.

The focussing of the optics on the detector, as retrieved from the radiance calibration observation is nominal.

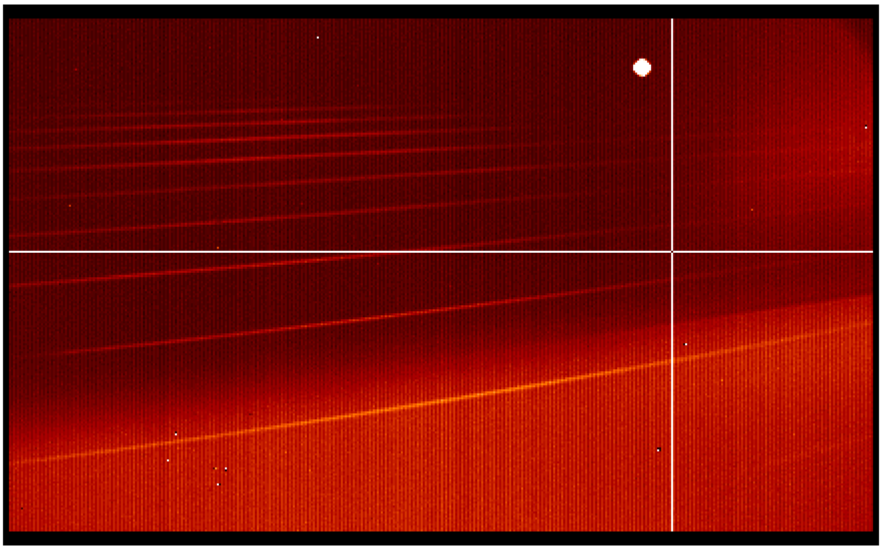


Figure 5. Radiance calibration of March 25th, 2004 / Rosetta commissioning. Virtis H frame.

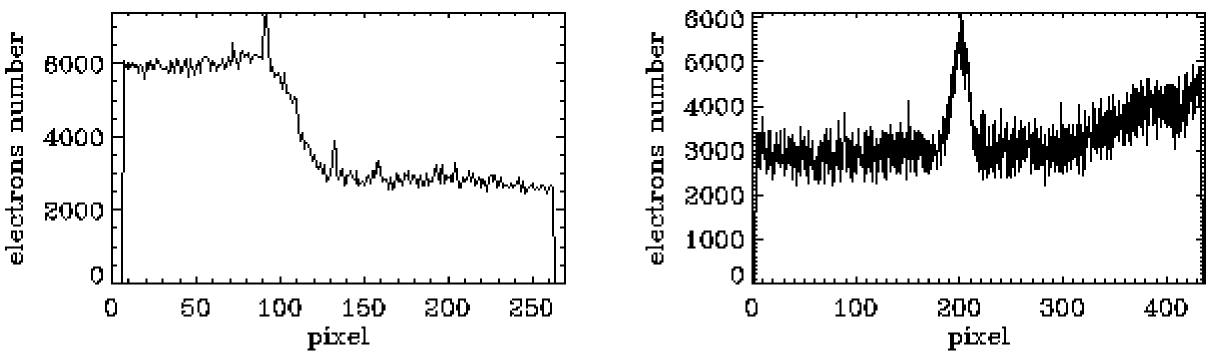


Figure 6. On the left is shown the vertical profile while on the right the horizontal one of figure 5.

Also for M the preliminary evaluation has pointed out a substantial agreement with the on-ground calibration runs. However, minimal differences exists which have been interpreted in terms of the anomalously high temperature of the optical heads (see previous chapter).
For instance, the internal calibration of VIRTIS-M uses, for both infrared and visible channel, special coatings on the calibration lamp units which introduce absorption features throughout the spectral range (Holmium-doped glass for Vis and polystyrene for IR). In both cases the exact location of the absorption features is temperature dependent. Indeed, a spectral shift is present in the data when compared to the on-ground calibration runs.

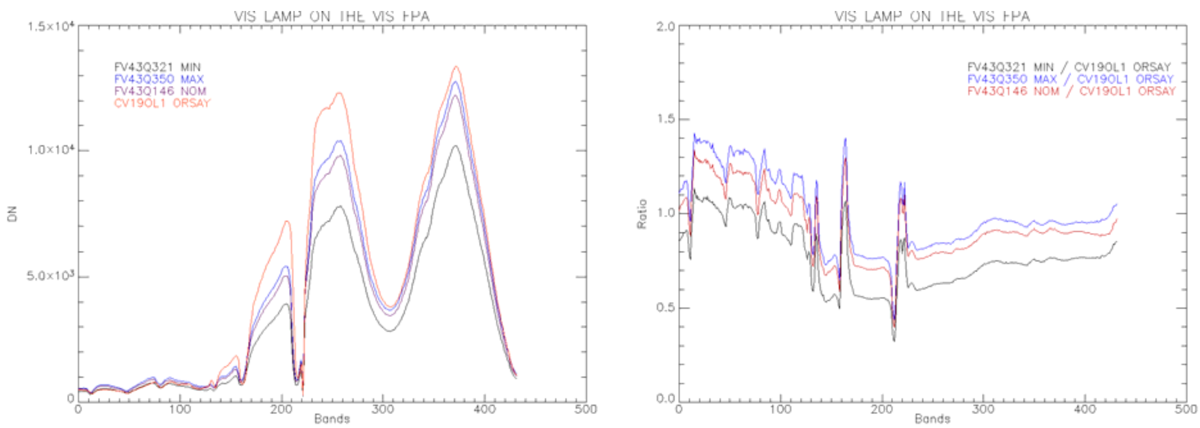


Figure 7. Calibration of VIRTIS-M Visible channel. On the left the spectral curves are compared with ground data (ORSAY), and on the right their ratio.

For the visible (figure 7) the signal for nominal current value is higher for On-Ground calibration (named Orsay on the plot) respect to in flight data of about 1000 DN at b=370 peak and 2500 DN at b=250 and b=200 peaks. The spectral shifts is observed near the filter position (b=222) and for peak at b=200.

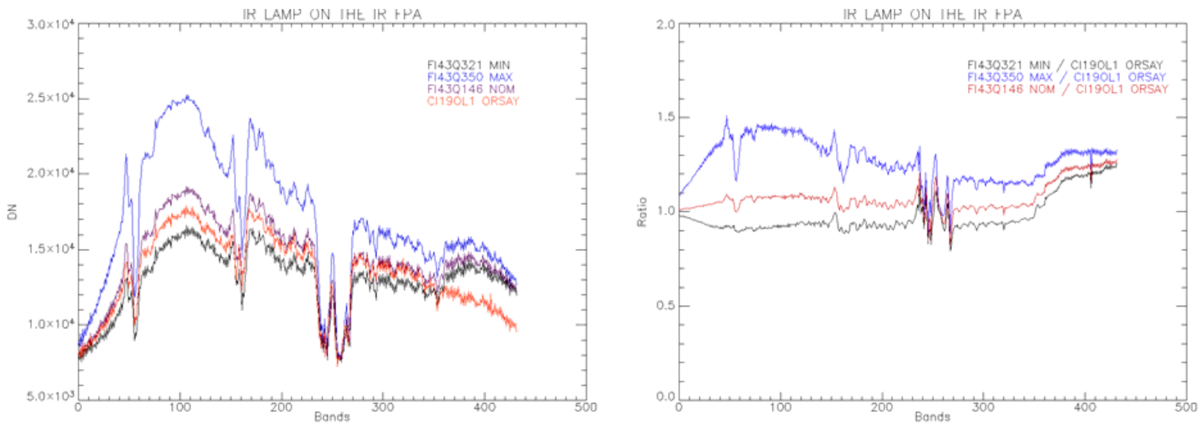
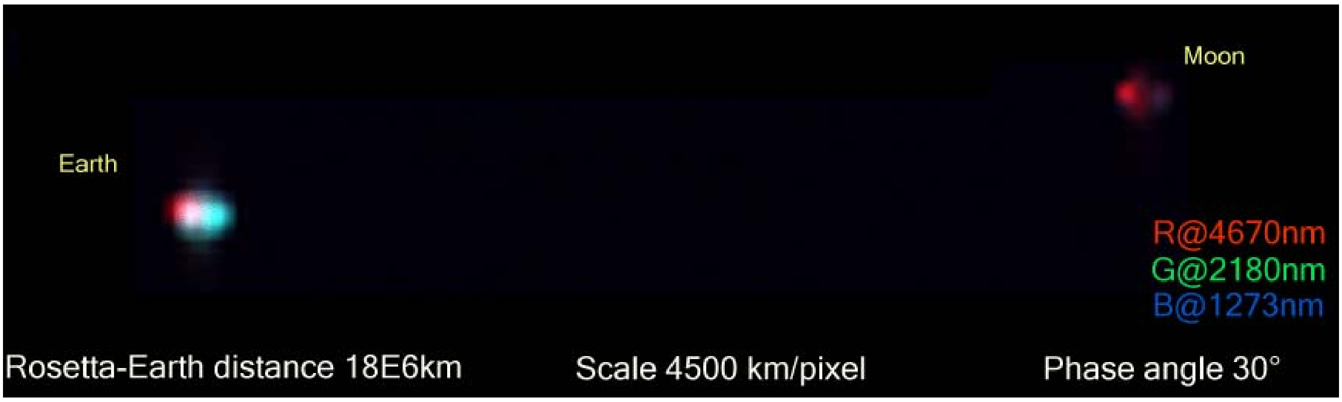


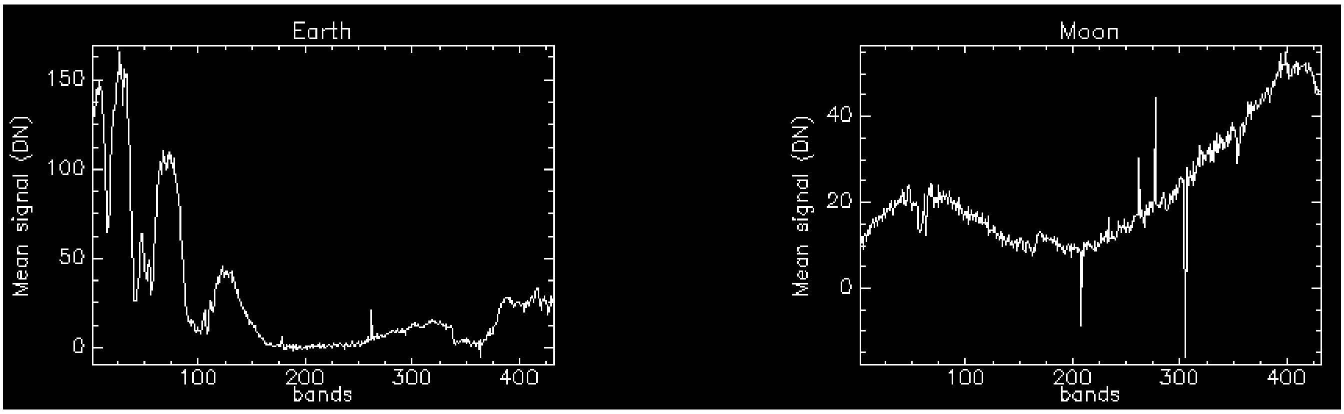
Figure 8. Calibration of VIRTIS-M Infrared channel. On the left the spectral curves are compared with ground data (ORSAY), and on the right their ratio.

For the infrared (figure 8) both nominal acquisitions are similar in intensity (on ground DN max about 1700 at band 110 vs. in flight DN max about 1900) and in shape; the signal at bands > 350 is higher for in flight acquisition: this effect is introduced by the higher temperatures of the telescope-spectrometer assembly during commissioning (142-143 K) respect to the ground calibrations (128-129 K). Many lab-measurements made on the polystyrene filter confirm the shifts (of about one channel) observed in the main absorption features around bands 230-260, varying the temperature of the calibration unit.

3.2 Earth-Moon Observation.

On the 24th of April MIRO planned to observe the Earth to verify their boresight location. VIRTIS decided to run along to have the opportunity of imaging the Earth-Moon system with a spatial resolution much better than the resolution to be expected for the same observation in October during the Pointing Session.
Unfortunately, due to a S/C problem the observations had to be interrupted earlier than expected and only two cubes (the second one incomplete) were acquired. Only the imaging channel (M) was powered on, as is the only one with pointing capabilities.
Only VIRTIS-M was powered as being the Earth in MIRO's boresight and having VIRTIS-H no pointing capability it was judged useless to power VIRTIS-H as it would have missed the Earth entirely.
In the spectra shown below, the raw signal in DN is plotted for the Earth and Moon for the IR channel.





In the Earth spectrum are clearly visible (although this is still an un-calibrated image) the absorption bands of water, CO_2, CH_4. On the contrary the Moon spectrum lacks of absorption features being dominated by the thermal emission.
These observations are directly comparable with the Mars Express Omega observations performed the 3 of July 2003. A preliminary check has shown a substantial coincidence of the two observations, although only raw DN were compared and a more accurate analysis is required after data calibration.

3.3 Comet C/2002 T7 Linear Observation.

The observation of the comet was planned in two steps a first run on the 30th of April and a second run the 17th of May. VIRTIS participated only to the first attempt. Also in this case only VIRTIS-M was involved in the observations.
No detection on VIRTIS H was possible during the Comet C/2002 T7 Linear observation because the field of view of VIRTIS is shifted compared to the centre of field of MIRO; calculations show that the detection level was too low for the comet to be detectable with VIRTIS-H.
The comet C/2002 T7 Linear is much dimmer than expected and thus the signal in the continuum is relatively low; for this reason VIRTIS-M was not able to detect any signal. After this observation the team decided not to take part to the second attempt.
An anomaly event has been issued by RMOC (AR-SC-32), and is described in chapter 4.

3.4 Pointing Scenario

The pointing scenario goals as far as VIRTIS was concerned were related to :

- Verification of the alignment among the remote sensing instruments (ALICE, MIRO, OSIRIS) using specific targets; these observations were also used for calibration purposes.
- Identification of VIRTIS-H boresight and co-alignment of VIRTIS-H and VIRTIS-M.

These objectives have been translated by RSOC/PIs into a number of observations. VIRTIS has taken part in the observations described in the following table.

OBS#	Observation type	Date	VIRTIS goal
13	Raster Scan of Aldebaran (αTau)	10/09/04	Determination of V-H boresight wrt S/C Z axis and measurements of the deviation between V-H and V-M boresights
12	Staring at Pleiades	11/09/04	V-M geometric distortion
11	Stare at Venus	24/09/04	Alignment verification of V-M and OSIRIS; reference spectra for VIRTIS VEX observations
15	Stare at Vega (αLir)	24/09/04	Alignment verification of V-M, S/C Z axis and OSIRIS
3	Stare at Earth	25/09/04	Alignment verification of V-M and MIRO
20	Jailbar at αGru	26/09/04	Alignment verification of V-M and ALICE
18	Stare at Saturn	26/09/04	Alignment verification of V-M and OSIRIS
31	Raster scan of Venus	28/09/04	Determination of V-H boresight wrt S/C Z axis and measurements of the deviation between V-H and V-M boresights
10	Stray light test	30/09/04	Stray light on VIRTIS at 45, 35, 20 degrees from Sun wrt S/C Z axis

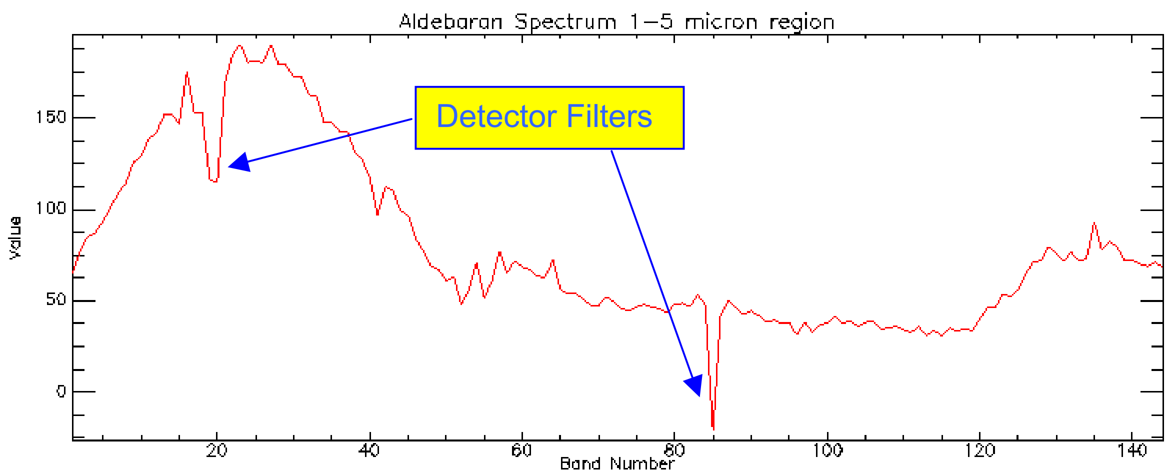
3.4.1 Observation 13

VIRTIS-H (V-H) is a point spectrometer, thus it relies on the S/C motion to point specific locations in the sky. This implies that the V-H boresight must be determined with at least a V-H FOV accuracy to be able to command the S/C to point a given target.

We planned a raster scan of 25 points distributed on a 5x5 grid centered at the "assumed" location of the V-H boresight. The only available information about the V-H boresight respect the S/C Z axis is the pre-launch measurements performed during instrument mounting on the S/C.
This preliminary information gave an estimate for the location of the V-H boresight at X= -16 arcmin and Y=+5 arcmin with respect to Z axis. We selected Aldebaran (αTau) as a point target for this observation, and performed the scan keeping Aldebaran in the central point. The separation between each point is 2 arcmin, and the scan ranged from-10' to -20' in X and from 1' to 9' in Y.

At the first and last point of the raster, V-M was commanded to take a scan image, to verify the location of the star and hence the location of V-M b/sight as well.
The star was imaged as expected by V-M in both images (which thus allowed to identify the V-M b/sight wrt the S/C Z axis), but unfortunately we missed it with V-H

We agreed with RSOC to repeat this observation as observation 31, using Venus as a target instead of Aldebaran. However, the implication of the missing identification of the V-H b/sight prior to the execution of the subsequent observations was that we could not specify the exact location of the V-H boresight and hence the correct pointing. This implied that V-H was blind in the subsequent observations 11,3 and 18 whose pointing, in principle, should have been driven by V-H requirements. For those observation we have only V-M data.



The figure shows the raw (not calibrated) spectrum of Aldebaran in the IR. Arrows point out the location of the junction of the different order filters, not yet removed.

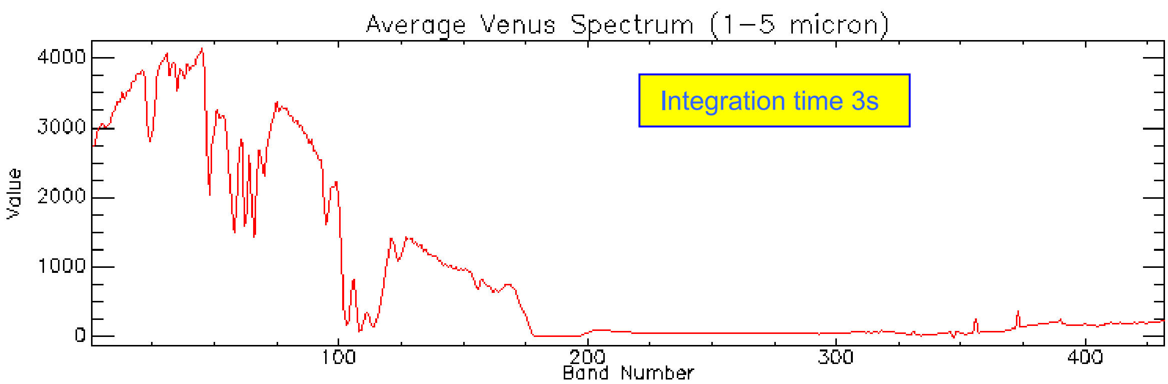
3.4.2 Observation 12

Only VIRTIS-M has been working during this observation. The S/C pointed V-M b/sight to the Pleiades and V-M took two scan images, however due to a misunderstanding with RSOC the overall duration of this observation was set to one hour. We were thus forced to use short integration times for the two scan images which resulted to be insufficient to get reasonable signal for identification of the relatively low magnitude stars in the cluster.

3.4.3 Observation 11

The objectives of this observation were the verification of the alignment of V-M and V-H, which unfortunately has not been possible (see 3.4.1), and the acquisition of a Venus spectrum to be compared with the results to be obtained by the twin VIRTIS instrument mounted on board Venus Express mission.
Venus was located at about 75x10^6 km from the S/C at a phase angle of approximately 110°, which gives a 32% of illuminated area as seen from Rosetta. At this distance Venus is sub-pixel (it behaves like a point-like object), however, due to the instrument point spread function and to the finite size of the pixels, more than one pixel is illuminated by the radiation from Venus.

The results has been very useful as allowed as to verify the absolute calibration of the IR channel of V-M. VIRTIS was commanded to take three scan images around Venus location (Venus was a point source); two images were taken with integration times 10s and 3s for the IR channel and 10s and 50s for the Vis channel; the third image has failed due to a wrong instrument programming. The raw spectrum (instrument transfer function not yet removed) shown in figure is the average raw spectrum of the illuminated pixels.

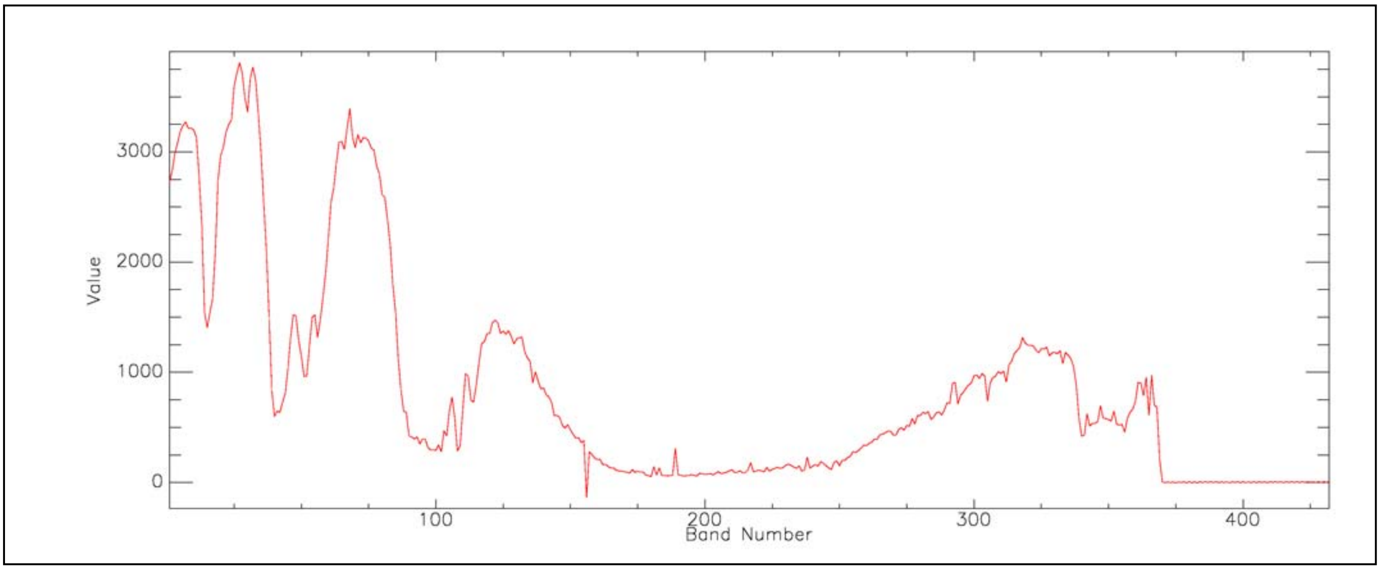


3.4.4 Observation 15

This observation is devoted to the verification of the response of VIRTIS and of the Osiris camera towards the UV part of the spectrum, as the maximum emission of Vega is concentrate ed in this spectral region. Our intention when this observation was first proposed was to use it for coalignment with ALICE. However, in the meantime ALICE selected another better suited target and this observation was left here on Osiris request. The star has been identified in both channels VIS and IR of V-M

3.4.5 Observation 3

MIRO has been the leading instrument for this observation and VIRTIS operated in ride along mode to verify alignment between the two instruments.
VIRTIS was commanded to take three scan images around Earth location (Earth was a point source), however one of the scans has failed due to a wrong instrument programming. The failure has been due to an incorrect instrument programming which has been understood. A reminder has been added in the VIRTIS user manual.



The raw spectrum shown in the figure is essentially very similar to the one shown in paragraph 3.2 except for the region above 4.45 micron (band larger than 375) where saturation of the dark current occur due to the long integration time used (we have adopted a 10s integration against the 0.1 seconds used during the observation reported in paragraph 3.2).
The Earth has been identified in both channels VIS and IR of V-M and thus co-alignment with MIRO can be considered achieved.

3.4.6 Observation 20

This observation was devoted to verify the alignment of VIRTIS and ALICE by observing the UV star αGrus. The goal has been achieved by taking a single long exposure scan image around the star location (ALICE was leading during this pointing). The star has been identified in both channels VIS and IR of V-M and thus co-alignment with ALICE can be considered achieved.

3.4.7 Observation 18

This observation has Saturn as the main target and was originally planned to verify alignment of V-H with Osiris. The S/C pointing should have been driven by V-H, being a point spectrometer, however as the V-H boresight orientation was not known at the time of this measurement (see comments to observation 13), V-H could not be pointed to Saturn. Thus only V-M was able to collect Saturn data. Signal from Saturn was very low summing up to a maximum of 2000 DN for a very long integration time in the IR of 30s, and badly perturbed by the dark current build up over such a long integration time.

3.4.8 Observation 31

After observation 13 we were able to identify V-M boresight orientation wrt the S/C Z axis, while the V-H boresight still remained unknown. We were allowed to repeat the raster scan in order to verify both boresights orientations.
To provide an evaluation of the V-H boresight orientation we have then used the results from the on-ground calibration of the instrument, which give the relative orientation of V-H respect to V-M boresight, and the knowledge, acquired in flight, of the orientation of V-M boresight wrt the Z S/C axis. This analysis provided the following results for V-H boresight: X=-23.4 arcmin and Y=-6.5 arcmin.

We planned a larger raster scan of 49 points distributed on a 7x7 grid centered at the assumed location of the V-H boresight.
We selected Venus as a point target for this observation, and performed the scan keeping Venus in the central point. The separation between each point is 2 arcmin, and the scan ranged from -30.4 arcmin to –16.4 arcmin in X and from –13.5 to –0.5 in Y.

At the first and last point of the raster, V-M was commanded to take a scan image, to verify the location of the star and hence the location of V-M b/sight as well.
The planet was imaged as expected by V-M in both images but remained still undetected by V-H. As soon as the data were received we started a reanalysis of the on-ground calibration results, retracing back to the original data from which the relative pointing of V-M and V-H was retrieved. This investigation allowed us to identify a sign error in the derivation of the orientation of the V-M boresight wrt the V-H boresight and thus to provide a wrong input for the observation 31 raster scan. With the new analysis we have a definitive assessment of V-M and V-H relative orientation and with a delta-commissioning activity of less than one day we shall be able to finally specify the V-H orientation wrt the S/C Z axis.

3.4.9 Observation 10

Observation 10 has been devoted to the analysis of any stray-light by means of moving the S/C towards the Sun and taking measurements at fixed angles from the Sun. VIRTIS took images with both V-M and V-H when the Sun was 45, 35 and 20 degrees from the S/C Z axis.

In each location we investigated the full FOV of V-M and V-H using the integration times given in the next table.

	VIRTIS-H	VIRTIS-M Vis	VIRTIS-M IR
First acquisition	10s	25s	10s
Second Acquisition	20s	50s	20s

VIRTIS-H is virtually free from any stray-light, which is reasonable being a point spectrometer with a very narrow FOV (it coincides with its IFOV of 0.5mradx1.5mrad).
On the other hand for VIRTIS-M we observed two separate phenomena. For the Vis channel we identified a disturbance appearing in the instantaneous acquisition of the dark current (shutter is closed) at 35 and 20 degrees (no signal is present in the 45 degrees acquisition). The implication is that some light leakage is present when the shutter is closed. Normally, the light level is considerably low with respect to the integration time reaching a maximum level of 25% of the saturation signal for 50s integration time at 20degrees (at 35 degrees and with 50s integration time we get a stray light signal of about 3%). Although this kind of signal could introduce disturbances in the data interpretation the long integration times used and the very low sun angle (nominal operations are performed with a minimum sun angle of 45 degrees) make these observation to be classified as strongly non nominal operations.
We have performed an analysis to identify the cause of the leakage; after analysis of the mechanical layout of the instrument we have identified as the most probable origin for this light leakage a not completely protected aperture present in between the telescope and spectrometer subassemblies.

For the IR channel of V-M we have observed a dependence of the signal on the detector as a function of the sun angle and of the scan angle. A larger signal is visible at 20degrees of the Z axis from the Sun and at the edge of the FOV of the instrument, while boresight observation are completely unaffected by stray light. At the edge of the FOV, for an integration time of 20s and for a sun angle of 20 degrees we get a stray light of about 20% of the saturation signal.

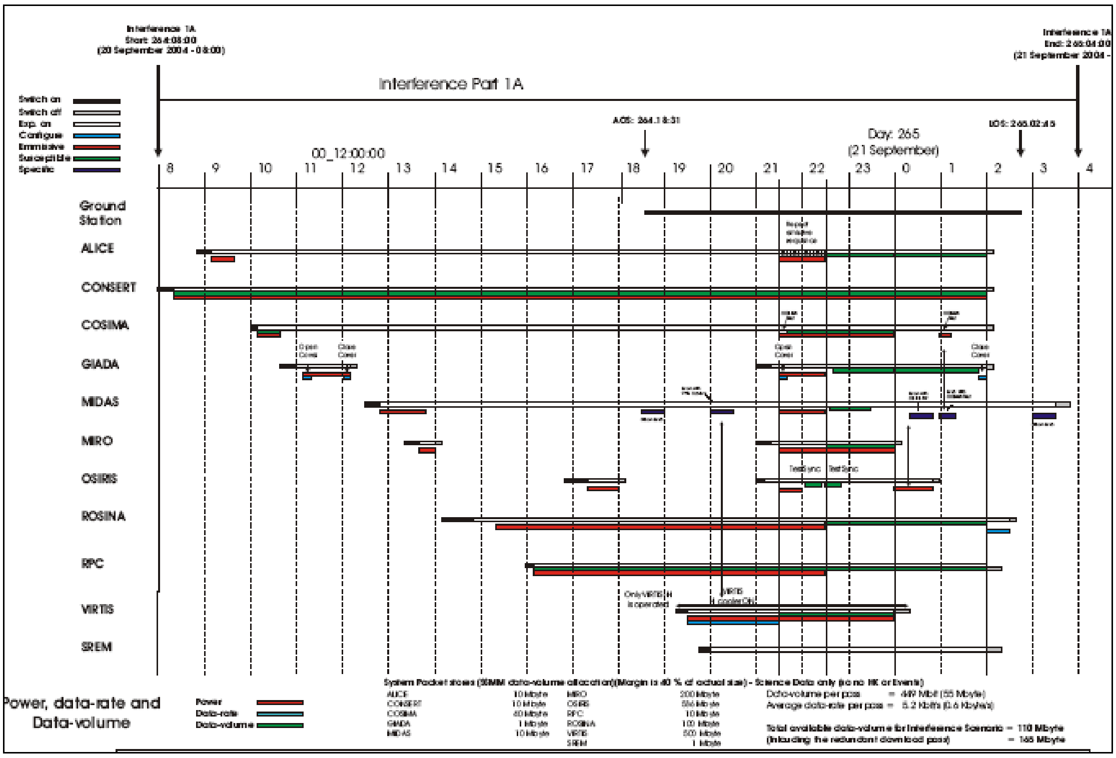
It has to be pointed out that all on-ground measurements performed during the calibration sessions did not show any stray light contribution down to an angle of less than 10 degrees from boresight, at the edge of the FOV. This implies that any stray light identified during the commissioning must be caused by mechanical elements external to the VIRTIS instrument added after the on-ground calibration. In fact, such element do exist and is the additional baffle present on the protective sun shield on the Z panel, which was not present when calibration was performed. This is of course a preliminary analysis which shall be investigated in more details in the next months.
As for the visible channel during nominal operations the expected level of stray light shall be almost negligible and we do not consider it as an issue for the performances of the instrument.

3.4.10 VIRTIS-M boresight location

After the analysis of the observations 11, 13, 15, 18, 20 and 31 we were able to specify the location of the VIRTIS-M boresight with respect the S/C Z axis as X=-4.5 arcmin (1.3 mrad) and Y=-1.3 arcmin (0.4 mrad).

3.5 Interference Scenario

The interference test was performed in the period 20-21/09 ,during that VIRTIS was switched ON for about five hours in emissive mode with only H-channel On.



The post processing of the data has shown NO problem of interference nor on the Housekeeping values nor on the science data.
In particular the dark frame were checked in order to check if the dark values shown anomaly behaviours.

No evidenced problems are still open or under investigation.

During the interference test 8 science packets went missing we were later explained that the problem was related to the failure of the new Norcia ground station that caused an irrecoverable loss of data.

4 Problem Areas and Anomaly Reports

No specific problem areas have been identified for VIRTIS, in this chapter we list the issued anomaly reports and investigations.
It has to be pointed out that we issued all the relevant DCRs and PCRs required to close any action on VIRTIS.

We should point out a topic which could be useful for the analysis of the behaviour of the instrument. A twin instrument is being built which shall be mounted on the Venus Express S/C. The twin instrument shall be identical to the VIRTIS-ROSETTA one in all the main S/W features allowing to compare functional performances of the two instruments. We believe that this is a profitable situation which shall allow a considerable deeper insight into the instruments functional behaviour.

4.1 S/C issued ARs

Ref.	Description	Analysis
AR-SC-21	VIRTIS TC not acknowledged after corrupted OBSM TC	Investigation was done at the time of commissioning first part. Our opinium is that the TC (or part of TC) was not received by VIRTIS. Anyway we can only confirm that acceptance or any other warning report (like TC corrupted or not complete) was not issued by VIRTIS because no Sequence counter gap were found in the VIRTIS telemetries in the relevant time span.
AR-SC-22	VIRTIS-H data Gap on RTU acquisitions	VIRTIS verified the output data rate which was : Failed test : 12Kbits Correct test : 6Kbits In both cases the data rate is much below the max data rate allowed on RTU. Additionally, VIRTIS does not reported any data lost, which should have been the case if the VIRTIS output buffer was not emptied fast enough by the DMS. So from VIRTIS point of view no anomalies were registered in this instance
AR-SC-32	During the observation of Comet LINEAR out of coverage on DOY 121 (30 April) a number of anomalous event packets were generated by	All the anomaly events issued during the operation are in fact **expected event.** These event can be considered like normal progress event. The proposed solution for the future is to list in the relevant procedures all the events issued by the

	VIRTIS and several ground out-of-limits triggered.	instrument in reply to a given action. All the OOLs evidenced during the OFFline check depend on: 1) error in the Data base, in this case the relevant DCRs has been issued to correct the problem 2) to a marginal over temperature of the instrument during operation; in this case the limit were really too tight and the limit curves were relaxed. The following three OOLs were not found during the OFFline check 1) NVRA0096 HKMs_IShut_Heat 2) NVRA0095 HKMs_ILamp 3) NVRA0081 HKMs_VDetAna In this case probably the OOL were due to an error in the conditioning of calibration curve respect the state of other parameters. This case has been investigated by ESOC and after iteration with them, the problem has been identified and solved

4.2 VIRTIS Issued ARs

Ref.	Description	Analysis	Status
AR-VR-001	Difference of 14s between UTC and SCET of the instrument	The conversions from RAW to TIME made by EGSE SW are verified and have no error. .	Verify with ESOC if the problem could be relevant to problem of synchronization of the instrument
AR-VR-002	#33 missing packets in APID860	Refer to AR-SC-22	Open
AR-VR-003	Temperature of the VIRTIS optical head are above operational at the beginning of the functional tests	Initial temperature related to S/C orientation. As soon the S/C was put in the right position, the VIRTIS temperature decrease even if with a very slow trend. At the begin of test OH temp were about 142-145K and at the end of commissioning (30hours later) were about 138-149K.	A dedicated thermal analysis is being made to verify VIRTIS thermal inertia.
AR-VR-004	3K discrepancy between S/C Thermistors and VIRTIS internal thermistors	No problems were found on the calibration curves of the internal thermistor. All the 14 internal thermistors (driven by four different electronic circuits) give a similar reading of the temperature. They were considered correct.	Verify with ESOC if the error could be present in the reading of the S/C thermistors.

Ref.	Description	Analysis	Status
AR-VR-005	EGSE event: Probably Error Bad Packet length on “Event [51;7;17;2]-> Connection Test Report”	The telemetry packet is correct. The warning is due to an EGSE problem	Correct EGSE SW
AR-VR-006	A TC containing an odd number of bytes (not foreseen by the Rosetta TC protocol) has been sent to VIRTIS (ZDMX4202 load MID142). VIRTIS rejected the TC with invalid checksum failure ID (the last byte of the released TC has not been considered by VIRTIS). The next TC released to VIRTIS (ZVR14205) has never been acknowledged by the PL. The problem is already described in AR-SC-21	Refer to AR-SC-21	Open
AR-VR-007	EEPROM Voltage out of limits. The voltage value remains about 4.3V even if the EEPROM is switched off.	The problems is known and is related to a PROM SW (2.0) bug. The bug has been fixed in the EEPROM SW but cannot be fixed for PROM S/W. The real voltage of the EEPROM is shown as soon the Secondary bootstrap is executed (VTC_Enter_Idle ZVR0000)	No further action
AR-VR-008	There is no possibility to verify the status of the High Speed Link	No event are foreseen neither in the VIRTIS SW nor in the SSMM SW when the link is initialized. VIRTIS SW performs the relevant check of the link status only when the link is really used after VTC_Enable_Science_HSlink	No further action
AR-VR-009	H temp FPA value out of limits due to an error in the limits curve of the Data Base	The limits curve is set in Kelvin while the calibration curve is in °C	A DCR has been issued to correct data base (VIR-DCR-027)
AR-VR-010	After the second issue of the TC”Enable_Science” was commanded the event [47754]-> “VIRTIS-M cover is already open” was issued.	VIRTIS SW check the cover position before performing the science acquisition. If cover was left open after previous acquisition (default case) this event is issued. The event is classified as Anomaly/warning (type 2) event, but have to be considered as a normal progress event (see AR-SC-32)	A DCR has been issued to add a note in the VR-FCP-010 and CV-FCP-202 procedures (VIR-PCR-002)
AR-VR-011	The internal calibration was performed with the scan mirror in OFF instead of pointing to boresight. This is due to a missing TC in the procedure.	Need ZVR00014 in the procedure	A DCR has been issued to insert ZVR00014 MTC_ChangeFun_R VR-FCP-005 with the right parameters to command SCAN in point mode (VIR-PCR-003)
AR-VR-012	The voltage value of the IR lamp result out of range in the ESOC system. This is due to an error in the limit curve of	The limit curve is wrong	A DCR has been issued to correct the limits curve in the

Ref.	Description	Analysis	Status
	the data base. The expected range for the lamp voltage is 2.2V to 3V.		RSDB(VIR-DCR-028)
AR-VR-013	When the ZVR00135 H cover close TC is sent while the cover is already closet, the event [47955]->"H cover is already closed" was issued	VIRTIS SW check the cover position before execute the TC. If cover was left open after previous acquisition (default case) this event is issued. The event is classified as Anomaly/warning (type 2) event, but have to be considered as a normal progress event (see AR-SC-32)	A DCR has been issued to add a note in the VR-FCP-012 (VIR-PCR-004)
AR-VR-014	Event [47928]-> "VIRTIS-H data acquisition is lost" was issued once during nominal default acquisition	It could depend on a temporary peak of traffic load on the link.	No further action. Investigation on ESOC side possible?
AR-VR-015	When the TC ZVR00134 "H cover open" is sent while the cover is already open, the event [47956]-> "H cover already open" is issued	See AR-VR-013	A PCR has been issued to add a note in VR-FCP-019 and VR-FCP-020 (VIR-PCR-005)
AR-VR-016	Wrong H mode reported in the procedure VR-FCP-020	It is confirmed the error in the procedure	A PCR has been issued to correct VR-FCP-020 (VIR-PCR-006)
AR-VR-017	When the internal calibration was commanded while the M cover is already closed, the event [47753]->"M cover already closed" is issued	See AR-VR-013	A PCR has been issued to add a note in VR-FCP-005 (VIR-PCR-007)
AR-VR-018	Event [47738]->"VIRTIS-M Vis data slice lost" issued during MAX DATA RATE procedure	The procedure tests the max data rate limit of the instrument. Few warning event of this type were expected during the execution.	No further action
AR-VR-019	Wrong H mode reported in procedure CV-FCP-203	It is confirmed the error in the procedure	A DCR has been issued to correct CV-FCP-203 (VIR-PCR-008)
AR-VR-020	During tests several H science packets were lost	Refer to AR-SC-22	
AR-VR-021	Event [47777]-> and event [47954]-> "M and H cool-down not successful, expected temperature not reached", were issued after TC ZVR00113	These are due to an onboard SW problem. The SW doesn't reset the cool-down timeout if the TC is sent while VIRTIS is already in steady state. This is not an operative sequence but only a test procedure	A SPR could be issued, but being a minor problem, the implementation shall be postponed to a future EEPROM SW release
AR-VR-022	Event [47804]-> "M cover is not open and not closed"	The event is issued if at PEM ON the cover was found NOT close. In this case, due to an error in the procedure VR-FCP-011, the cover was left OPEN at PEM-M power off, thus causing the event at next power on.	A PCR has been issued to correct VR-FCP-011 (VIR-PCR-009)
AR-VR-023	Execution failure report after PEM-M switch on was issued	The event is issued due to AR-VR-22. However, the PEM-M was correctly switched ON and the cover correctly closed by the	No further actions

Ref.	Description	Analysis	Status
		initialization procedure performed automatically by the SW.	
AR-VR-024	Event [47965]-> "commanded H cooler temperature not equal to current cold tip temperature in steady state"	The event could be issued during the steady state.	No further actions

5 Conclusions and Outstanding Issues

Until now the instrument has performed nominally; no malfunctions have been pointed out.
Both during the functional tests and during the scientific observations (Earth-Moon system and comet Linear and throughout the pointing scenario) we were able to use the instrument without any relevant problems.

The analysis of the instrument performances (internal calibration and observations of specific targets) has shown consistent results with on-ground calibration, with main differences only due to the different thermal environment of the measurements. Stray light observations are an exception as a difference with respect to the ground measurements has been observed and an analysis is being carried out to identify the causes.

It has to be pointed out that except for the internal calibration, only observations of sub-pixel (point-like) sources could be performed due to the observations geometries, as we were very far from any planetary object like Earth or Moon.
As the main scientific tasks of the instrument, during its nominal scientific activity, is to observe extended objects, a complete assessment on the scientific capabilities of the instrument shall be performed during the next opportunity which will be provided in March 2005 during the Earth fly-by.

We have to point out, however, that not all the planned tasks were completed during the commissioning phase. In particular one of the main objective of the pointing scenario, the V-H boresight orientation respect to the Z S/C axis, could not be achieved. Reasons for this have been given in paragraphs 3.4.1 and 3.4.8 and shall not be restated here. It is sufficient to say that after a full reanalysis of the on-ground measurements we have now a clear understanding of the instrument pointing, so we shall be able to locate V-H boresight whenever we shall be given the opportunity to do so. We consider this an outstanding issue and presently, we are discussing with RMOC and RSOC to identify a suitable time slot to perform this measurement prior to the Earth fly-by in March next year.