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Research and Science Support Department
Planetary Missions Division

ROSETTA

Rosetta Passive Payload Checkout 1 Report

RO-EST-RP-3342

Issue 1

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CHANGE RECORD SHEET

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1. General Remarks

1.1 Summary

The scenario discussed in this report did not have scientific objectives.

All of the payload activities during the Passive PC#1 shall be summarised. Firstly, the scientific results achieved by each experiment team are summarised with a view of the initial high level requests listed in the MSP. PI team reports shall be referenced. Secondly, this is designed to be complementary to the daily pass reports being provided by RMOC by reporting the anomalies or other detected by PI teams that do not show up as OOL or events. Subsequent investigations are tracked in RD2 and RD3.

1.2 Passive PC#1 Details

The following table gives scenario dates and times.

Table 1 : Passive PC#1 dates and times.

Start	End	Comments
DOY273:30SEP05	DOY278: 05OCT05	The scenario exact end time is determined by FCT based on AOS time of the first pass. PCEN event at 03:00 UTC on DOY278.

1.3 Applicable Documents

AD1 RO-EST-PL-3319 MSP issue 1.3, 05-Aug-2005

AD2 RO-EST-TN-3320_1_1_Rosetta_Passive_Checkout_Timeline_Details_2005JUL01.xls

AD3 EVF_MAN_PASSIVE_CHECKOUT_PCn_____.EVF, Livelink.

1.4 Reference Documents

RD1 Rosetta Project Glossary, RO-EST-LI-5012,
http://www.rssd.esa.int/index.php?project=ROSETTA&page=glossary.
RD2 RO-EST-RP-3346_1_a_Rosetta_Payload_Open_Issues_Report_2005.doc
RD3 PL OOL Events Investigation, RO-EST-LI-3326, Issue 1.1, 2005Sep27
RD4 MIDAS Report on Passive Checkout #1, MID-IWF-TN-0091, Issue 1.0
RD5 COSIMA_PC1_report_2005.pdf
RD6 LAP: IRFU-ROS-OPR-PC1_v10.pdf
RD7 MIP: Rapport_PC1.pdf
RD8 Philae_Passive Checkout_1_RP.pdf
RD9 PC1_MPAE-RP-159_1a.pdf
RD10 PC1_MR_FCP100_2005_276.doc
RD11 Internal AL files: pc1_checksheet.xls & pc1_checklist.doc.
RD12 SOP-RSSD-SP-019_1_39_Alice_EDF_Model_2005Oct24.doc
RD13 SOP-RSSD-SP-018_1_33_Miro_EDF_Model_2005Sep22.doc
RD14 SOP-RSSD-SP-020_1_18_Osiris_EDF_Model_2005Oct06.doc

Note: most scenario specific references can be found on livelink (http://www.rssd.esa.int/llink/livelink)under "Rosetta/Operational scenarios".

2. Results of Observations

Table 2 compares the high level requests of observations that have been run in the scenario (Table 4 in AD1) with the reported results. References to the PI team reports are also given.

Table 2: High level requests vs. results of observations.

OBS	Title	Objective	Results	Ref.
AL	6-Months Status check	Health Check: • Self Test: Electronics & software verification • Test pattern and stim test • Memory Check • Dark Exposures	• Alice executed the commands as expected and performed nominally. • There were no instrument-level anomalies. • The door performance test showed nominal behavior and we have added the data to our trending analysis.	RD11
CN	6-Months Status check	• Instrument Verification/setUP in 3 steps : • Consert Orbiter Verification • Consert Lander Verification • Consert Orbiter/Lander Time Synchronisation	• No Input	No Input
CS	Periodical maintenance and status check	• Self-check • Target manipulator unit maintenance • Ion emitter maintenance.	• Refer to Report	RD5
GD	6-Months Status check	• Run Mechanisms - cover operations • Health Check - all subsystems and electronics functional verifications, noise and contamination monitoring, performances estimation	• No Input	No Input
LZ	6-Months Status check	• Tests of the Lander platform to check the overall	• After finalisation of the preparation phase with	RD8

		performance and Secondary Battery status • Short function tests of some Lander experiments: • Lander Extended AFT • Secondary Battery Monitoring • CDMS EEPROM dump • Separate short functional tests for PTOLEMY and CONSERT	STCB-Update in June and September 2005, the modified Passive Checkout was executed as planned. Almost all subsystems and experiments showed nominal behaviour: • More details in reference.	
MD	Check-out and mechanism activation.	• Regular health check and exercising of all mechanisms (shutter, approach mechanism, linear stage, wheel, scanner)	• Test successfully completed. MIDAS is fully operable.	RD4
MR	6-Months Status check	• Regular exercise and health check of all commands in all modes. • Regular dump of EEPROM memory to check for radiation damage.	• All objectives were met. • The MIRO EEPROM memory dump to check for radiation damage has been compared to the benchmark and no change was been seen. This means that there was no radiation damage, so the test was successful.	RD10
RN	-	-	-	-
RP	Status check and instruments calibration	• MAG: Instrument calibration. Passive checkout phase offers a precious opportunity to measure undisturbed solar wind. Such data will be used to calibrate the offsets of the MAG instrument in quiet conditions using, for instance, the Hedgecock method. This method can not be applied at any time since special solar wind conditions have to be fulfilled. • LAP: Instrument calibration. • MIP: Instrument checkout. • IES: IES to make measurements in the	• LAP: Reference Report • MIP: Reference Report • MAG : All PC operations completed successfully with no change in instrument performance • IES: All PC operations completed successfully with no change in instrument performance	RD6 RD7

		undisturbed solar wind (that is, away from planets, etc.) for calibration of its sensors and cross calibration with LAP. Would like to operate for as long as possible.		
RS	two frequency downlink (non coherent) driven by the USO and a ground station that can receive the X- and S-band signals	• Investigate the stability of the USO • Verify interaction with the ground.	• The USO signal in X-band is still difficult to explain from our side. Even if the sharp jumps in the frequency time series we noticed during the last passive check-out are not obvious in the PC1 data, especially the X-band results are still confusing for us and not as good as we would expect. The S-band data fulfill basically our expectations but some of the jumps which can be seen in the X-band signal are also obvious in the S-band signal even if the steps are much weaker here because of the constant frequency ratio between X-band and S-band. • Ranging: During the PC0 the question came up if the behaviour of the USO can in parts be explained by the Ranging configuration on board of the S/C. We investigated the differences between the signals received with Ranging ON and OFF during the PC1, and even if we think that sometimes we can see the switch between Ranging ON/OFF in the signal there is no clear correlation between the USO signal and the Ranging configuration. • We also noticed that the noise in the X-band data is decreasing during the measurement. At the	None

			moment we are investigating the housekeeping data to see if any explanation can be found for this behaviour.	
SR	6-Months Status check	• exercise the instrument mechanisms • verify the sanity of the CCD • verify the focus of the instrument.	• No anomalies occurred. • More details in reference.	RD9
VR	6-Months Status check	• No Input	• No Input	No Input

3. Operations Reporting

All reported issues that impact payload operations, generated during the scenario are listed here. Reporting from each PI team is listed first followed by reporting from RMOC and RSOC. All issues are tracked in RD2 and RD3 giving the status of issues generated in this and all previous scenarios.

3.1 MIRO

3.1.1 Timing of Sequences

3.1.1.1 Description

There were some minor problems with the timing of some sequences.

3.1.1.2 Action

Will be addressed in a planned revision of AMRF100A.

3.1.1.3 Conclusion

On-going.

3.2 COSIMA

3.2.1 Bootup event 5,4 Missing

3.2.1.1 Description

The bootup event 5,4 is also missing, for which the reason is yet unknown. It does not have proper SCET time in the packet, so it might at an odd time period in the DDS. It should have be time tagged with downlink time anyway.

3.2.1.2 Action

Investigation.

3.2.1.3 Conclusion

On-going

3.2.2 Emitter A Issues

3.2.2.1 Description

Emitter A exhibited the same behavior as during the commissioning of COSIMA XM, i.e. slow increase of emission current instead of fast ignition.

3.2.2.2 Action

This behavior is still under investigation and results of our findings will be incorporated into the future passive and active checkout procedures.

3.2.2.3 Conclusion

On-going.

3.3 PHILAE

3.3.1 DPU1 Failure

3.3.1.1 Description

STCB update partially performed. DPU-1 could not be switched on and therefore DPU-1 STCB is NOT updated. This is under investigation. Stand-alone tests to be performed. LZ team shall make a decision at GO-NOGO deadline.

3.3.1.2 Action

Tests were performed on the 21st September aiming at restoring DPU-1 to working order and performing the steps to complete the STCB update on DPU1-1.

3.3.1.3 Conclusion

The tests were successful. The GO-NOGO decision will be given on the 22nd of September.

3.3.2 Operating Temperatures

3.3.2.1 Description

The minimum operational temperature of the experiments was defined as -40degC, which was reached for some units during Passive Checkout#1.

3.3.2.2 Action

The decreasing overall temperature level has to be observed in the upcoming hibernation phase of the Lander. It has to be discussed within the Lander Team whether a lower temperature can be tolerated or if a heating period at the beginning of Passive Checkout activities for the Lander has to be introduced.

3.3.2.3 Conclusion

On-going

3.4 RSI

3.4.1 USO Behaviour

3.4.1.1 Description

Investigations of the USO data from PC#0 revealed that the behaviour of the USO is obviously not as good as it was during the last USO test in October.

3.4.1.2 Action

Analysis of TCXO influence concluded that this could not be the cause and in any case could not be switched off. PC#1 was used to investigate the influence of Ranging. Cause of USO interference remains unclear although it is noted that the interference decreases further into the test.

3.4.1.3 Conclusion

On-going.

3.5 RMOC

3.5.1 RMOC Reported OOL / Events and Raised Anomaly Reports

All OOL and unexpected events encountered during the scenario are listed and tracked in RD3. Table 3 indicates the number of OOL and unexpected events that remain open. In addition, the table lists the Anomaly Reports raised and their status.

Table 3: OOL/Events/Anomalies Generated in this Scenario

Experiment	No. of OOL	No. of events	AR Ref.
S/C			AR-SC-102
Alice	5		-
Cosima	3		-
Giada	40		-
Miro	10		-
Rpc	2		-
Virtis	17		-

3.5.2 Loss of Event Packets (5,1) ,(5,2)

3.5.2.1 Description

During the checkout execution, an unexpectedly high event packet data volume generation by one of more instruments has caused the event packet store to wrap around during the non coverage period. As a result, all event packets of type 5,1 and 5,2 generated on-board between the previous LOS (DOY 272.13.32) and DOY 277.03;16 have been overwritten.

3.5.2.2 Action

AR-SC-102 has been raised and RSOC/RMOC have investigated.

3.5.2.3 Conclusion

Packet store C007 capacity shall be increased to 2Mbytes. MSP and dump strategy analysis shall be improved.

3.6 RSOC

None

4. Planning Feedback

Planning feedback is presented here. Comments from each PI team are listed first followed by comments from RMOC and RSOC.

4.1 COSIMA

4.1.1 MSP Document Misprint

4.1.1.1 Comments

COSIMA reported that Table 5 in AD1 page 20, did not match CS request nor the PC1 RMOC provided DAF listing. Especially the PIS emitter A command appears twice and PIS heater startup command missing. This was spotted by Jouni of CS team just before GO-NOGO deadline.

RSOC reaction was slow partly because capture was inefficient and partly because notification was not sent to the general rsoc@rssd.esa.int and so did not get to the instrument responsible within the RSOC team

RMOC were advised of the discrepancy via email and CS team member was advised to use the general RSOC email. An update to issue 2 of the MSP in preparation for PC#2 was also made.

4.2 RMOC

None

4.3 RSOC

4.3.1 Resource Analysis Transition

4.3.1.1 Comments

The current planning process can be improved with the extended use of the EDF models that becoming more reliable at predicting operation resource requirements. A transition to their use in pre-scenario planning as opposed to post-scenario validation should occur during the next scenarios.

The usefulness of power profiles instead of averages is a clear indication of this need.

5. Payload Resources Analysis

Information concerning real data volume production is pending. Therefore the analysis is mainly done between EPS simulation and predicted values for data volume.

Power analysis has been modified to focus on profile accuracy and therefore predicted average values are compared with profiles given by real and EPS simulated data.

A comparison is made between

- Resource usage predicted by the PI team during the planning process.
- Resource usage computed by EPS using the EDF models as of 31October2005.
- Real resource usage provided by RMOC (data) and DDS/S2K(power)

Analysis notes:

- Legend: After resource usage predicted by PI team or computed by EPS (columns 3 & 4), ↑ means that value is greater then real resource usage, ↓ means that value is less than real, ↔ means that value is equal to real, ? means unknown. Percentage of inaccuracy is also given. The value that is closer to the real resource usage is formatted in bold.
- In the current mission phase, estimated values within a margin of 20% of real values are considered sufficient concerning data volume.
- Power usage accuracy discussed is based on profile fits between EPS and real.
- DDS headers are NOT included in the reported data volume values.
- Real data volume values should be filtered on S2K received times.
- Real data column only lists data volume information.

Table 4: Payload resources data: Estimated vs. real values.

Experiment	Resource	PI Estimate	EPS Estimate	Real	Comments
AL	**HK (MBytes)**	0.04	-	-	• A 0.001 MBytes memory dump was also received • events were predicted to be 0.001 MBytes • the majority of the estimate/predicted discrepancy for the data volume is that the predicted value is an old value used for PC0 that ran only 1 hour, whereas this final version of the PC1 runs for two hours. • The above is also reflected in the power profile. • Average power is around 3W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	0.18	0.14	No input	
	PWR (W)	4	Power profile EPS/REAL provided in appendix.B.2	-	
CN	**HK (MBytes)**	-	-	-	• Average power is around 2.5W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	0.6	0.13	No input	
	PWR (W)	3	Power profile EPS/REAL provided in appendix.B.3	-	
CS	**HK (MBytes)**	0.23	-	-	• Data volume PI prediction has been overestimated and should be 0.009MBytes for all Passive PC from now on. • Average power is around 7W compared to PI prediction of 16W. This is a significant discrepancy. Note that this is also reflected in EDF model. • Real data volume comparison pending.
	SCI (MBytes)	0.24	4.96	No input	
	PWR (W)	16 peak 26	Power profile EPS/REAL provided in appendix.B.4	-	

Experiment	Resource	PI Estimate	EPS Estimate	Real	Comments
GD	**HK (MBytes)**	0.8	-	-	• Team report under 0.3 MBytes science received. • Average power is around 20W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	0.5	0.5	No input	
	PWR (W)	20.7	Power profile EPS/REAL provided in appendix.B.5	-	
LZ	**HK (MBytes)**	0.53 HK (0.13 Evt)	-	-	• No EPS model • Average power is around 10W with a peak closer to 30W good comparison with PI prediction on average but peak was not predicted. • Real data volume comparison pending.
	SCI (MBytes)	1.86	N/A	No input	
	PWR (W)	6.0 Platform + 4.2 ESS +23.4 peak	Power profile REAL provided in appendix.B.6	-	
MD	**HK (MBytes)**	0.824 x 2	-	-	• New Estimates applicable for PC1 came in late due to Sequence has changed after passive checkout #0 as follows: • 2 x 0.002 MBytes acknowledge data • 2 x 0.772 MBytes housekeepig data • 2 x 0.005 MBytes event data • 2 x 0.079 MBytes science data • The difference is significant. • Average power is around 8-13W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	0.018 x 2	0.16	No input	
	PWR (W)	8.5 - 13.5	Power profile EPS/REAL provided in appendix.B.7	-	

Experiment	Resource	PI Estimate	EPS Estimate	Real	Comments
MR	**HK (MBytes)**	1 HK (0.0002442 acks & reports)	-	-	• Average power is around 20-70W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	2.395	2.2	No input	
	PWR (W)	34 peak 76	Power profile EPS/REAL provided in appendix.B.8	-	
RN	**HK (MBytes)**	N/A	N/A	N/A	• RN do not take part in Passive PC.
	SCI (MBytes)	N/A	N/A	N/A	
	PWR (W)	N/A	N/A	N/A	
RP	**HK (MBytes)**	0.08	-	-	• Average power is around 5-6W good comparison with PI prediction. • Real data volume comparison pending.
	SCI (MBytes)	1.4	1.33	No input	
	PWR (W)	5	Power profile EPS/REAL provided in appendix.B.9	-	
RS	**HK (MBytes)**	N/A	N/A	N/A	• N/A for resource analysis
	SCI (MBytes)	N/A	N/A	N/A	
	PWR (W)	N/A	N/A	N/A	
SE	**HK (MBytes)**	-	-	-	• No EPS model • Real data volume comparison pending.
	SCI (MBytes)	0.71	N/A	No input	
	PWR (W)	2.5	N/A	-	
SR	**HK (MBytes)**	-	-	-	• Average power is around 30-50W good
	SCI (MBytes)	21.1	19.10	No input	

Experiment	Resource	PI Estimate	EPS Estimate	Real	Comments
	PWR (W)	40	Power profile EPS/REAL provided in appendix.B.10	-	comparison with PI prediction. • Real data volume comparison pending.
VR	**HK (MBytes)**	-	-	-	• Average power is around 40-50W with peak nearer to 80W. good comparison with PI prediction on average but peak was not predicted. • Real data volume comparison pending.
	SCI (MBytes)	18.38	18.48	No input	
	PWR (W)	56/45	Power profile EPS/REAL provided in appendix.B.11	-	
Totals	**HK (MBytes)**	5.05			
	SCI (MBytes)	48		No input	

Table 5: Summary of payload resources analysis.

Experiment	Data Volume	Power Consumption
General	• Appendix A gives the science data dump profiles split by instrument. It can be seen from this that in comparison to PC0 data only a small amount of science data was dumped in the first pass and the second pass was almost completely used to dump science. • This is known to be accurate with real values. Pending confirmation from RMOC	• Appendix B gives the power profiles comparing EPS simulated to real over the scenario period. • AppedndixB.1 gives a view of the total P/L power usage. PC has been designed to limit power usage to within 140W and from this chart all power usage is below 80W.
EPS modelling general	• Without real values it is not possible to evaluate EDF modelling accuracy but it is clear that improvements have been made.	• It is evident that improvements have been made in the EDF modelling.
AL	• Inconclusive	• Profile does not take into account modifications in plan in duration. • Very good fit to real. • Discrepancy in average is explained satisfactorily in RD12
CN	• Inconclusive	• EDF model is undebugged. A peak in evidence is not modelled. • Profile is split between CN orbiter and CN lander/orbiter. CN operaitons in second part were contained in the LOR so that EDF modelling could not be performed due state of LZ model.
CS	• Inconclusive	• EDF model is undebugged. • Average is to high but noted to be close to PI predicted.

GD	• Inconclusive	• EDF model is undebugged but shows a very close accuracy to real. • Second run does not show ion real values as only data from main side was extracted from S2K and not from the redundant side.
LZ	• Inconclusive	• EDF model is Non existent.
MD	• Inconclusive	• EDF model is undebugged but shows a very close accuracy to real.
MR	• Inconclusive	• Very good fit to real. • Discrepancy in peak is explained satisfactorily in RD13.
RN	• N/A	• EDF model is undebugged
RP	• Inconclusive	• EDF model is undebugged but shows a very close accuracy to real. • One peak is inaccurate.
RS	• N/A	• EDF model is undebugged
SE	• Inconclusive	• EDF model is Non existent.
SR	• Inconclusive	• Very good fit to real. • Any discrepancies are explained satisfactorily RD14
VR	• Inconclusive	• EDF model is undebugged but later stages of profile have good correlation to real. Peak is not modelled.

6. Action Items for RSOC

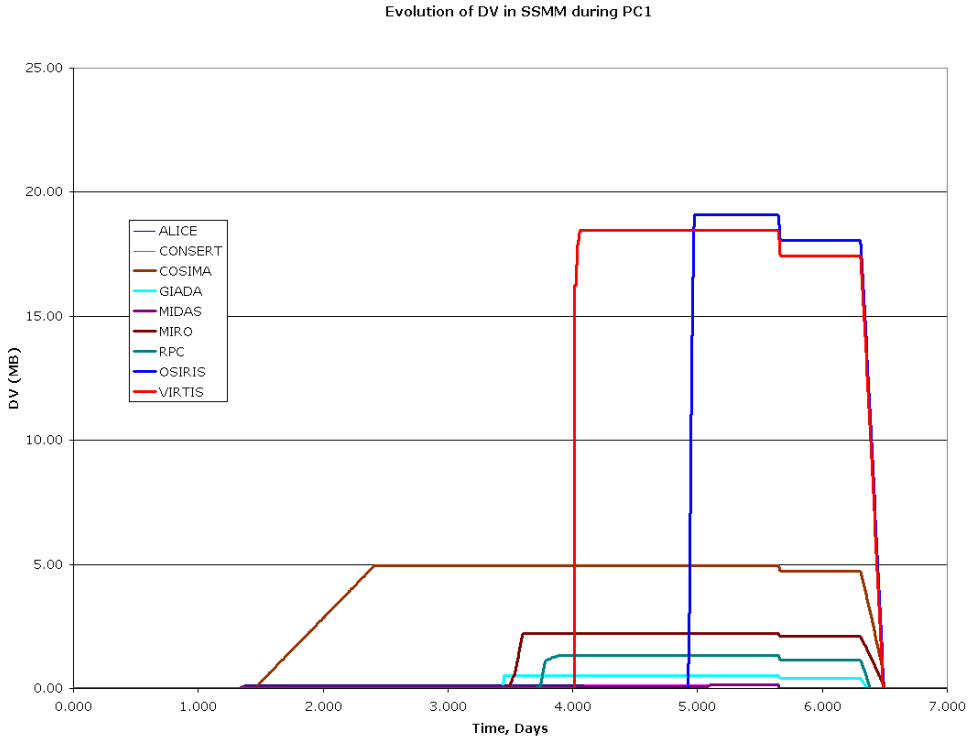
AI-PC-1 RSOC to obtain real science data dump information.

7. Conclusions

- Main objectives, of the scenario for those teams that provided inputs, have been met with very minor issues.
- Several PI teams did not provide inputs, therefore the report is incomplete.
- The only anomaly that had significant impact was the loss of category7 data due to a wrap around that will now be resolved with the described modifications to packet store C007 and improvements in data dump strategy analysis.
- Other anomalies are either known about and on-going, resolved or required long term observation as is required of the Passive PC design.
- The current planning process can be improved with the extended use of the EDF models in pre-scenario planning.
- Resource analysis is incomplete for data volume with pending results from RMOC.
- Power analysis shows generally very good correlation between PI predicted, EDF modelling and real values. improvements still need to be made to cover power peaks.
- All in all a significant improvement has been made from the operations during PC0 and PC1 reflects very closely the operations that shall be run for every successive Passive PC.

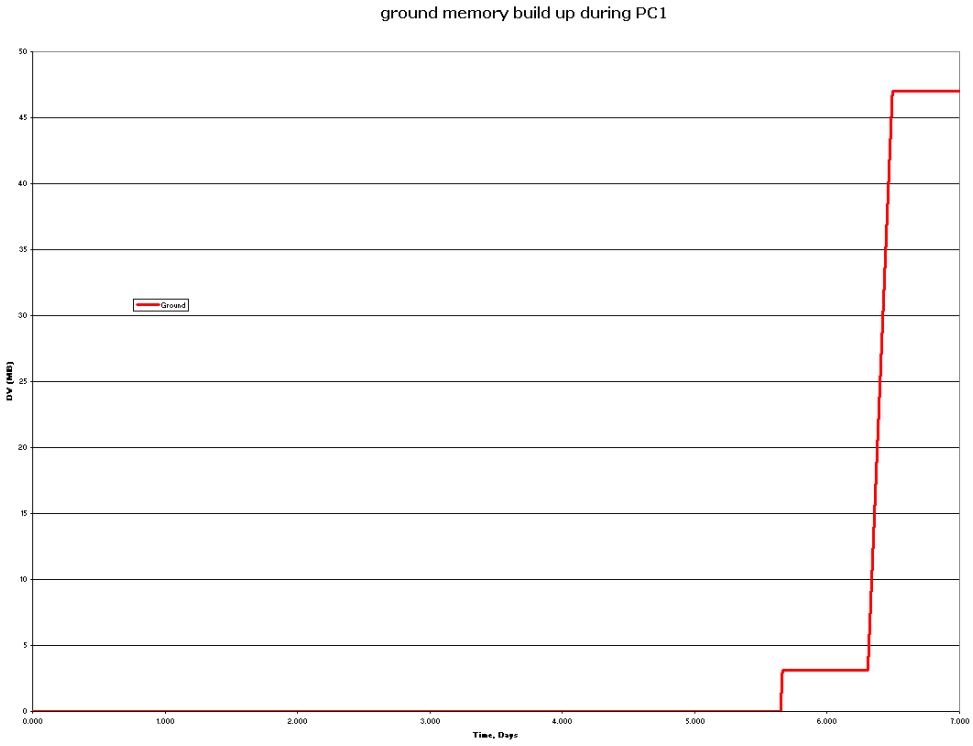
Appendix A.1: Data Volume Profile SSMM

EPS Simulation of the science data volume in the instrument packet stores vs time.



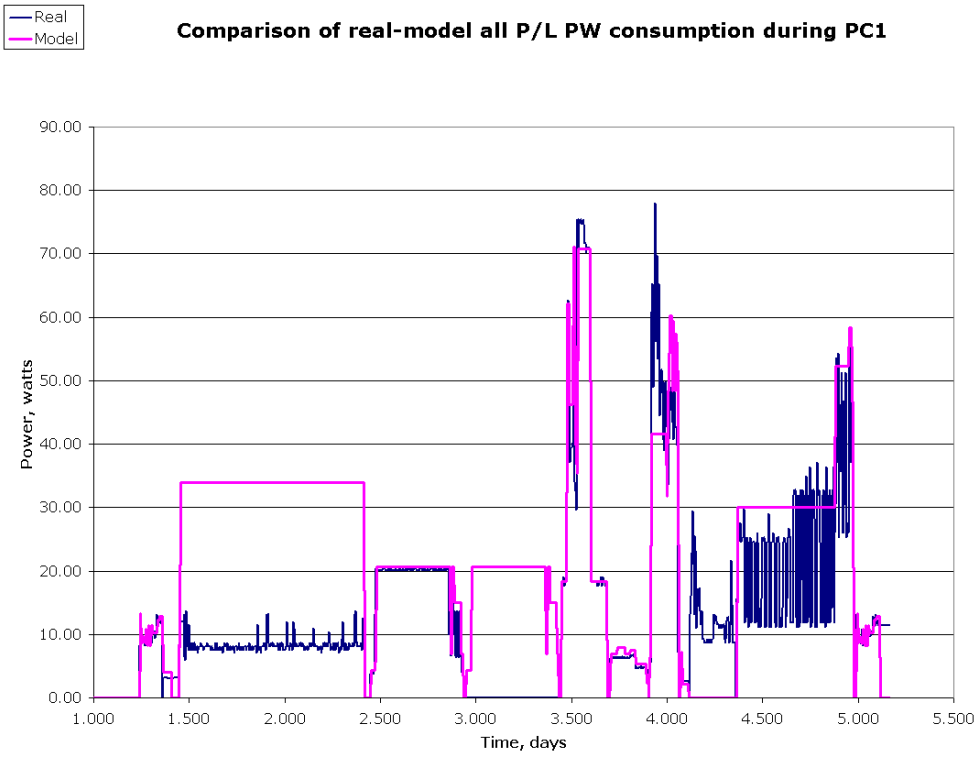
Appendix A.2: Data Volume Profile Ground

EPS Simulation of the science data volume build up on ground vs time.



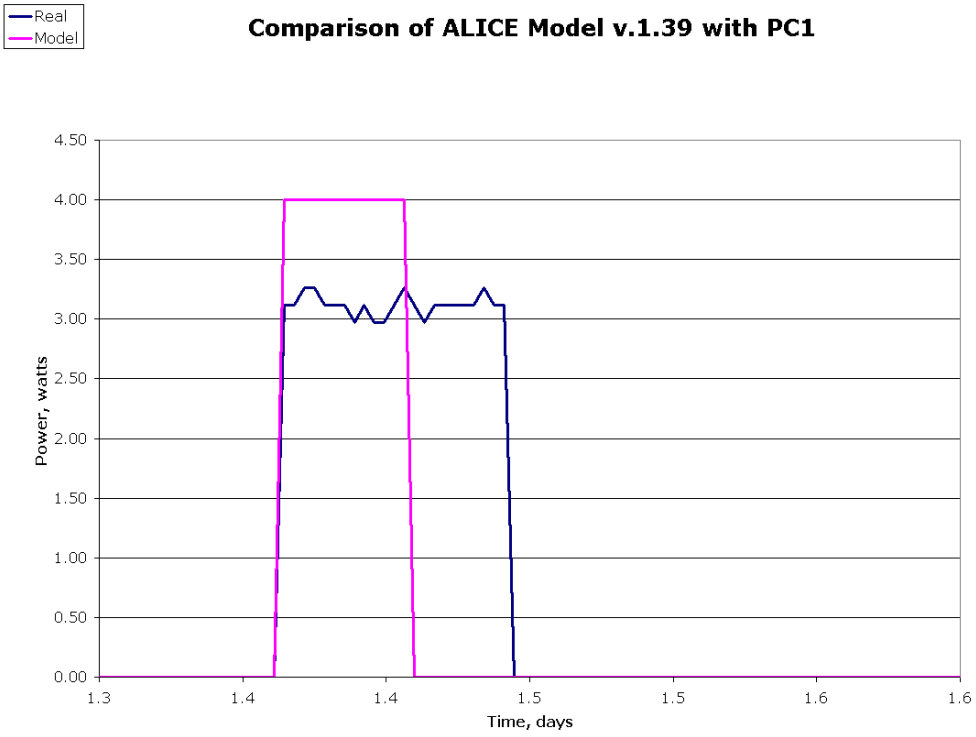
Appendix B.1: Power Profile

EPS Simulation of the total power usage vs time. EPS simulation and real values superimposed.



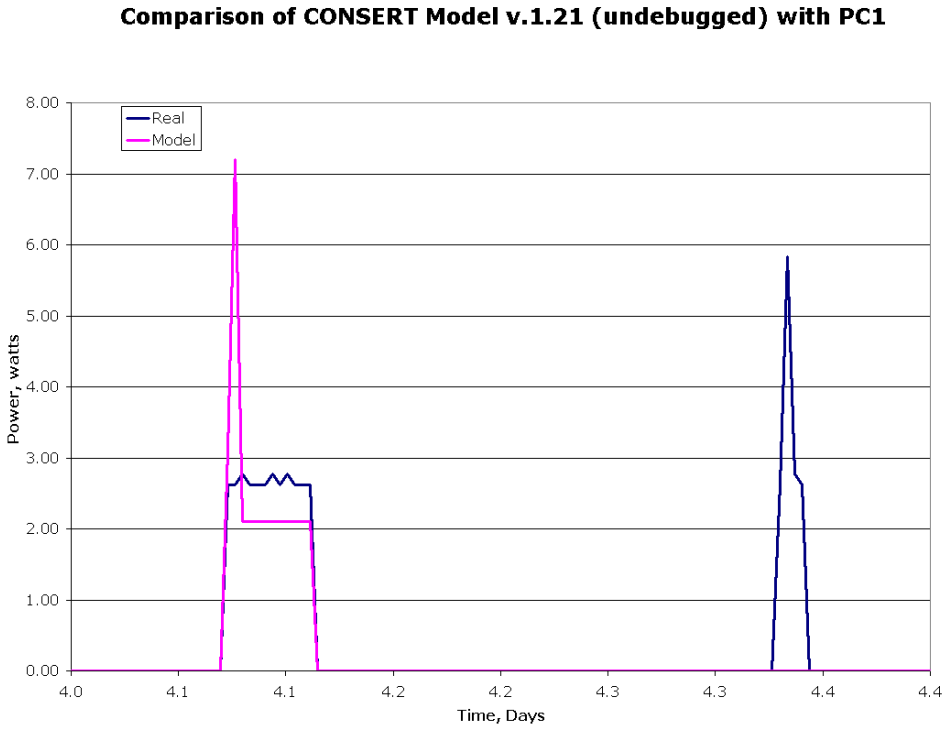
Appendix B.2: Power Profile ALICE

EPS Simulation of the Alice power usage vs time. EPS simulation and real values superimposed.



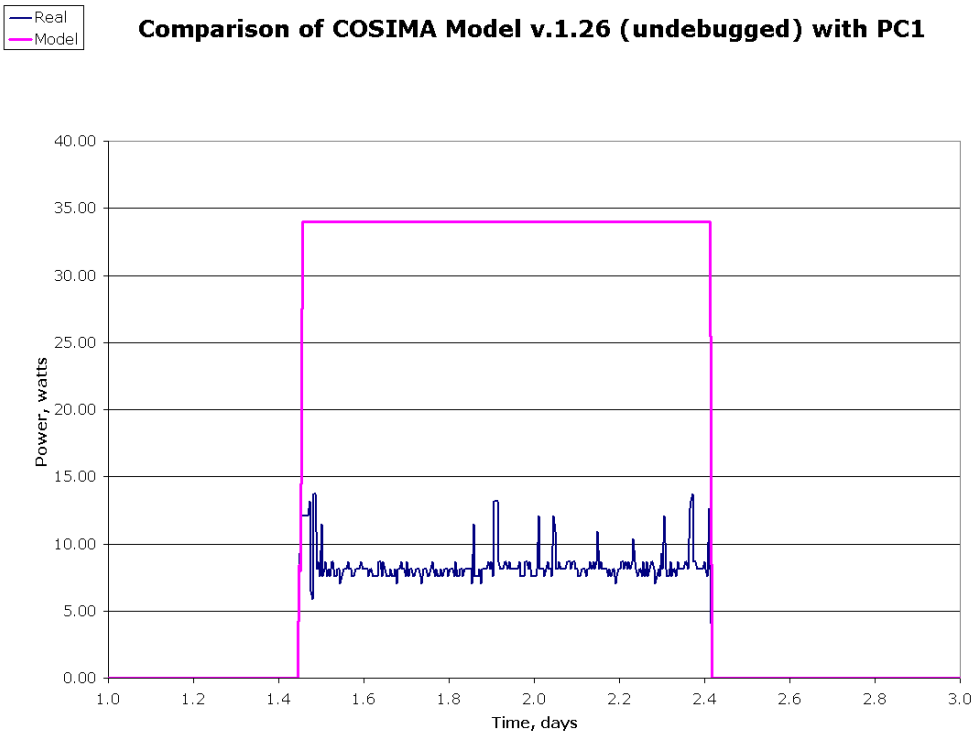
Appendix B.3: Power Profile CONSERT

EPS Simulation of the Consert power usage vs time. EPS simulation and real values superimposed.



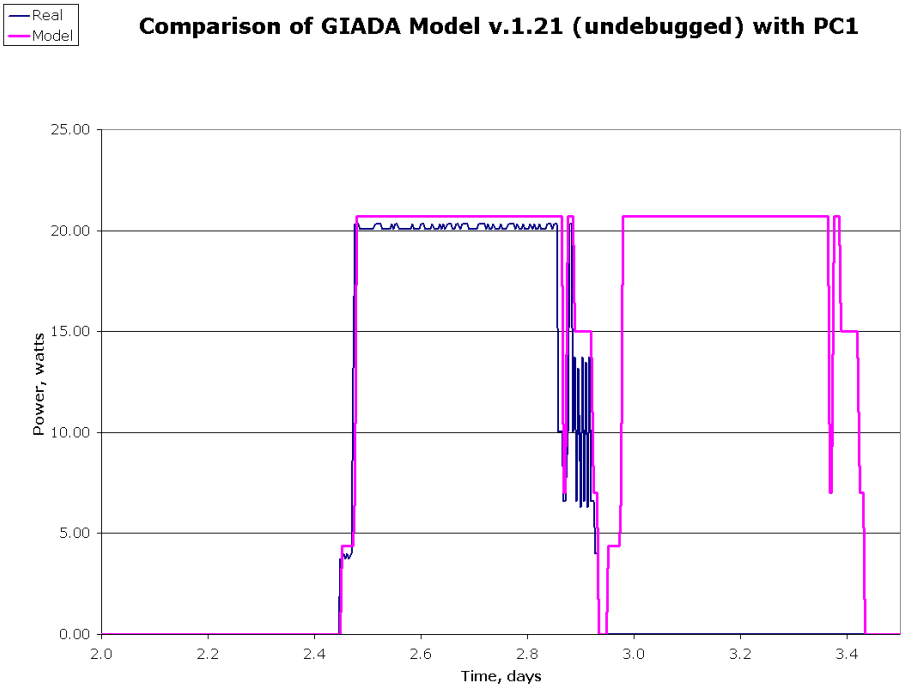
Appendix B.4: Power Profile COSIMA

EPS Simulation of the Cosima power usage vs time. EPS simulation and real values superimposed.



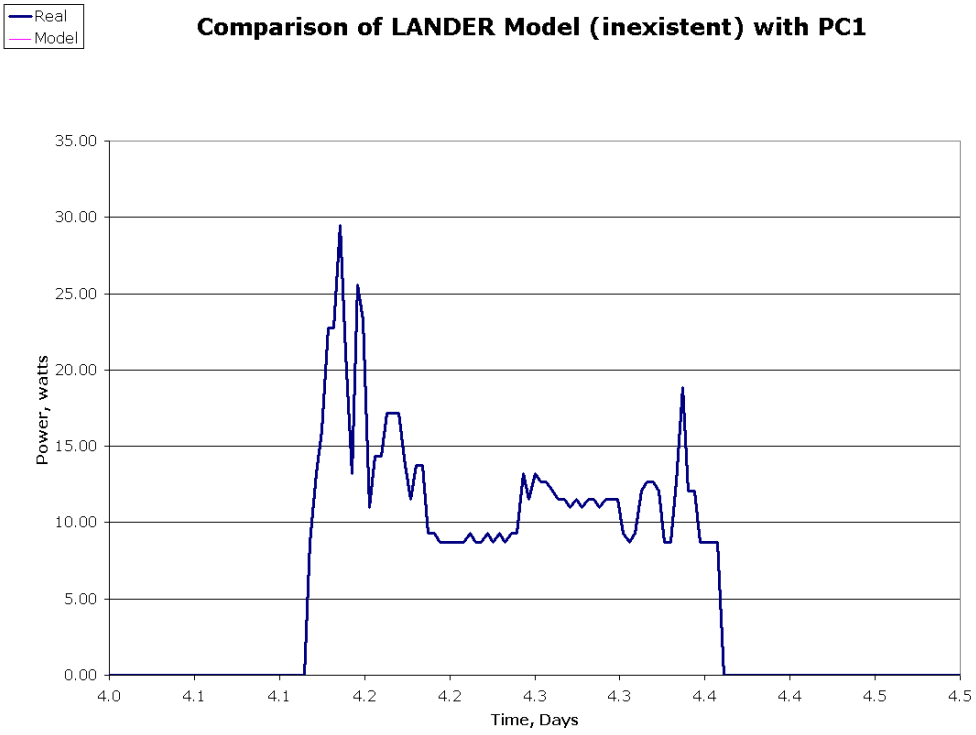
Appendix B.5: Power Profile GIADA

EPS Simulation of the Giada power usage vs time. EPS simulation and real values superimposed.



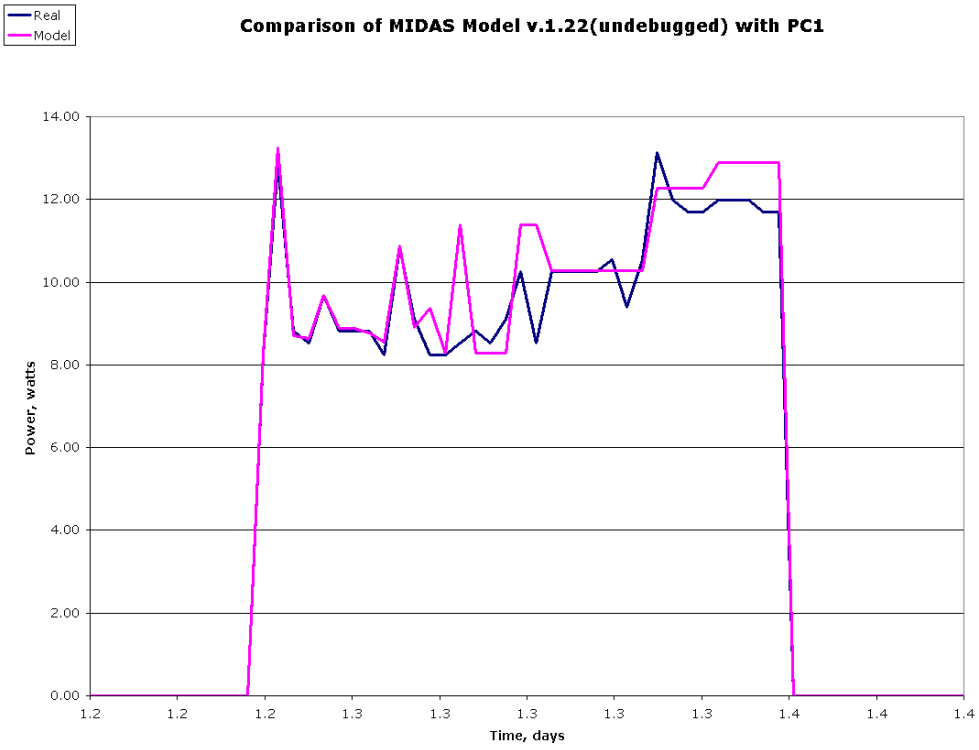
Appendix B.6: Power Profile PHILAE

EPS Simulation of the Philae power usage vs time. EPS simulation and real values superimposed.



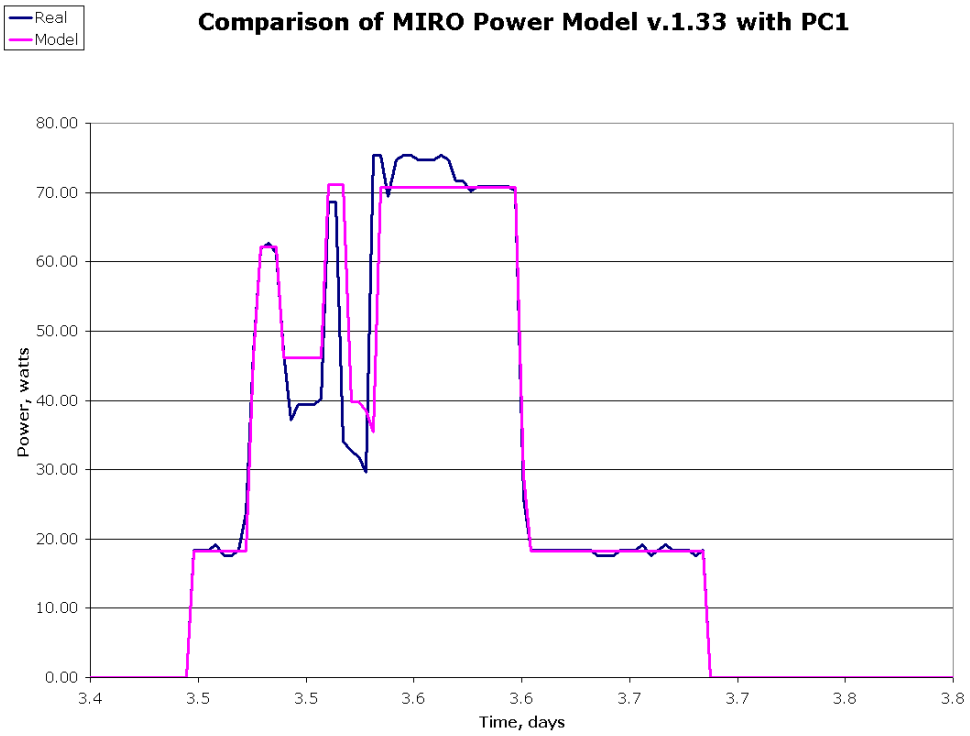
Appendix B.7: Power Profile MIDAS

EPS Simulation of the Midas power usage vs time. EPS simulation and real values superimposed.



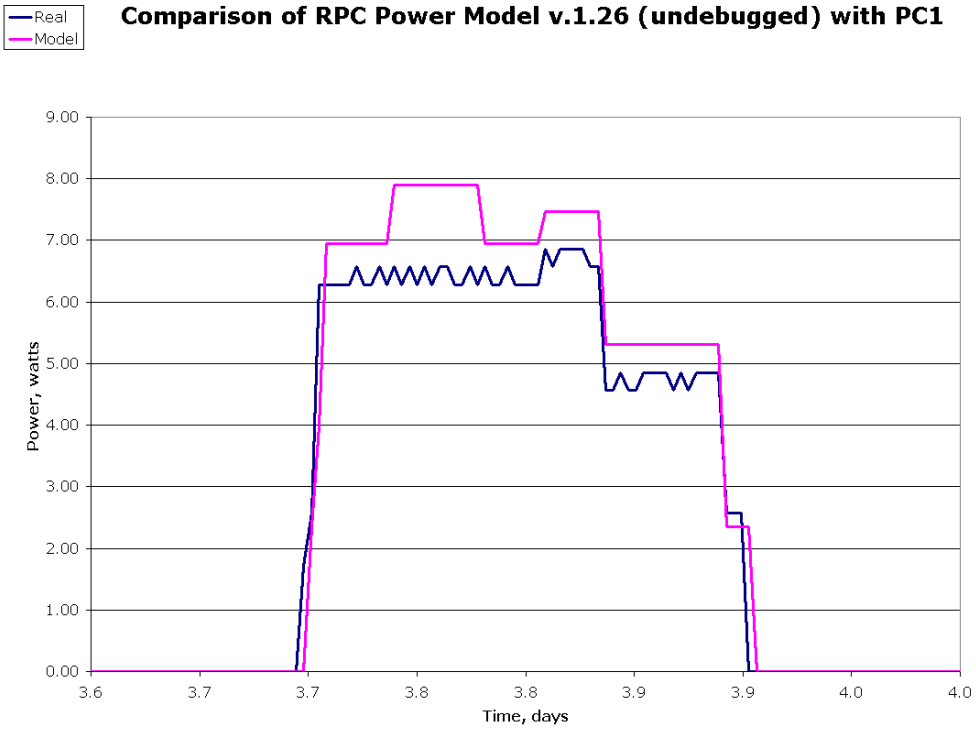
Appendix B.8: Power Profile MIRO

EPS Simulation of the Miro power usage vs time. EPS simulation and real values superimposed.



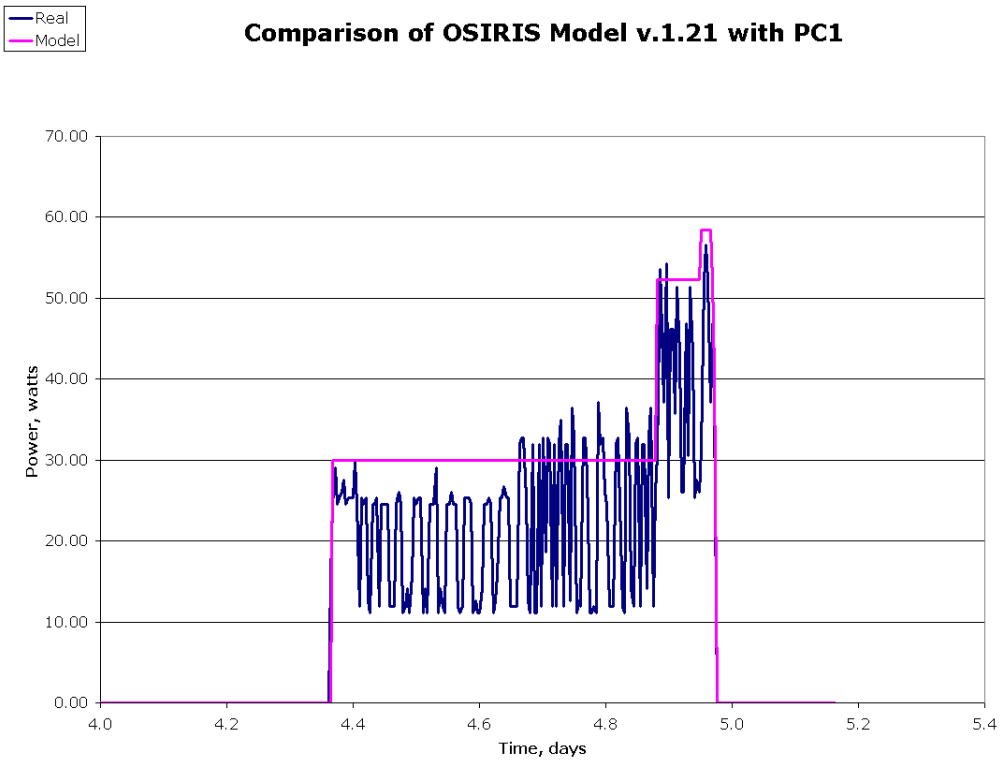
Appendix B.9: Power Profile RPC

EPS Simulation of the RPC power usage vs time. EPS simulation and real values superimposed.



Appendix B.10: Power Profile OSIRIS

EPS Simulation of the Osiris power usage vs time. EPS simulation and real values superimposed.



Appendix B.11: Power Profile VIRTIS

EPS Simulation of the Virtis power usage vs time. EPS simulation and real values superimposed.