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DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission report

INT-MOC-SYS-RP-1001-OPS-OAI

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Routine Phase

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1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC. Nominal science operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

This report addresses the activities from April and covers the revolutions 1033 until 1043 (included). The targets of these revolutions can be found on the ISOC web: <http://integral.esac.esa.int/isocweb/schedule.html?action=intro> .

The previous weekly and monthly reports are available at the XMM-INTTEGRAL website: <http://xmm.esoc.esa.int/documentation/documentation.php3> .

2 Satellite status

2.1 Platform

2.1.1 AOCS

The AOCS operations were performed from the timeline during this period.

9 slews were missed from the timeline.

The fuel consumption over the reporting period was 0.676 Kg. The remaining propellant is in the order of 121.033 Kg.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix 6.1.

2.1.2 Power

All units of the EPS are working nominally; available power from the arrays is of the order of 2100W.

Battery 1 Reconditioning terminated on 12/4/2011, the detailed timing was:

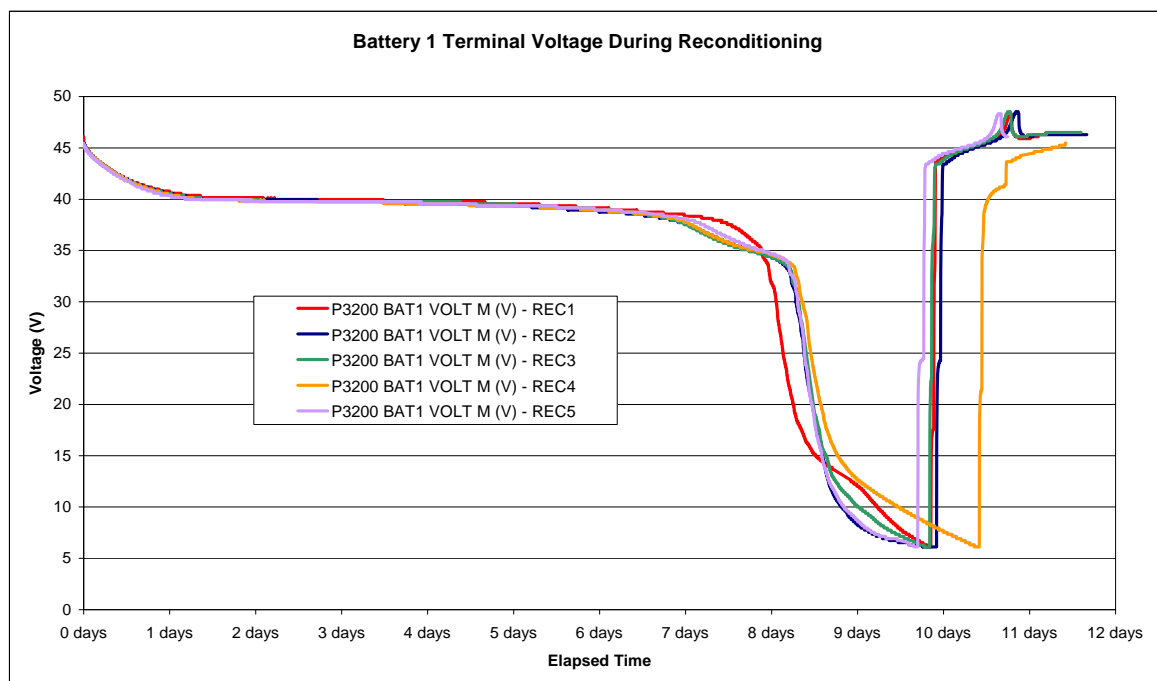
- 1/4/2011 13:38Z: Start of battery 1 discharge
- 11/4/2011 06:27Z: End of battery 1 discharge – terminated by the On-board Monitoring Task at battery Voltage = 6V, discharged capacity was approximately 35.6Ah.
- 11/4/2011 08:06Z: Start of Trickle Charge.
- 11/4/2011 08:17Z: Start of full Charge at C/26.
- 11/4/2011 08:16Z: Start of full Charge at C/13.
- 12/4/2011 05:44Z: End of Charge Detection by ECD Task, recharged capacity was 38.67Ah.

The table below summarises the Batteries Discharged and Charged capacities during the 5 reconditionings to date

Reconditioning	Battery 1		Battery 2	
	Discharge Capacity	Recharge capacity	Discharge Capacity	Recharge capacity
1	35.71Ah	38.67Ah	35.94Ah	38.67Ah
2	35.97Ah	38.67Ah	36.65Ah	38.67Ah
3	35.86Ah	38.67Ah	36.94Ah	38.67Ah
4	36.7Ah	*39.57Ah	35.2Ah	38.67Ah
5	35.6Ah	38.67		

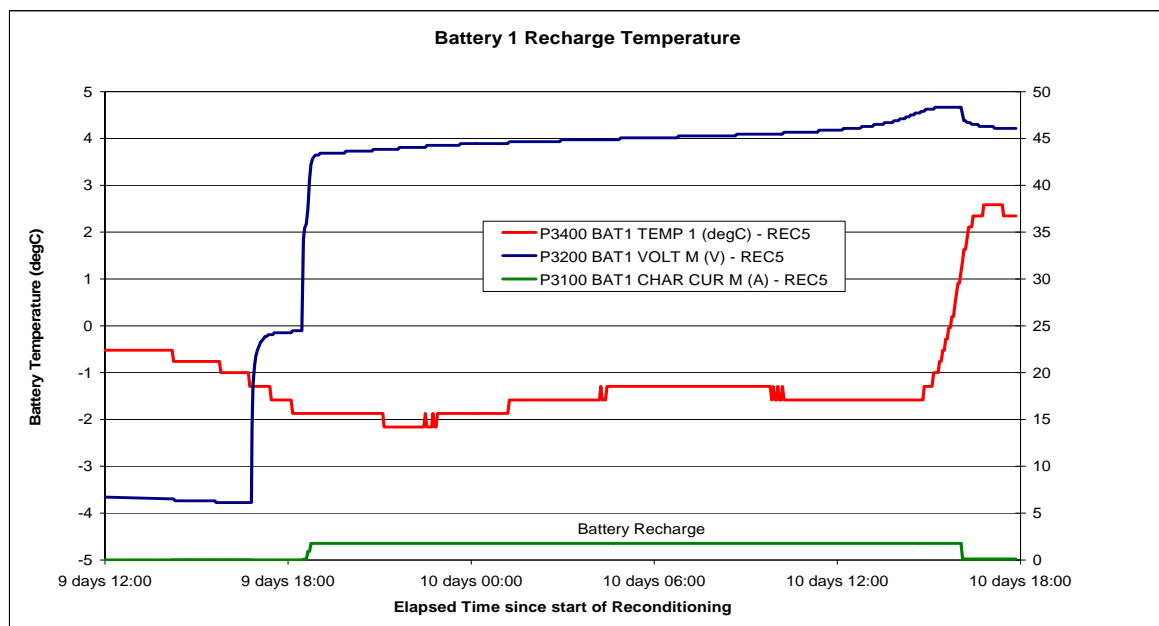
*K factor was 1.1 due to warm battery, for all other reconditionings a K factor of 1.075 was used.

The plot below illustrates the discharge profile of battery 1 during the 5 reconditionings executed to date:

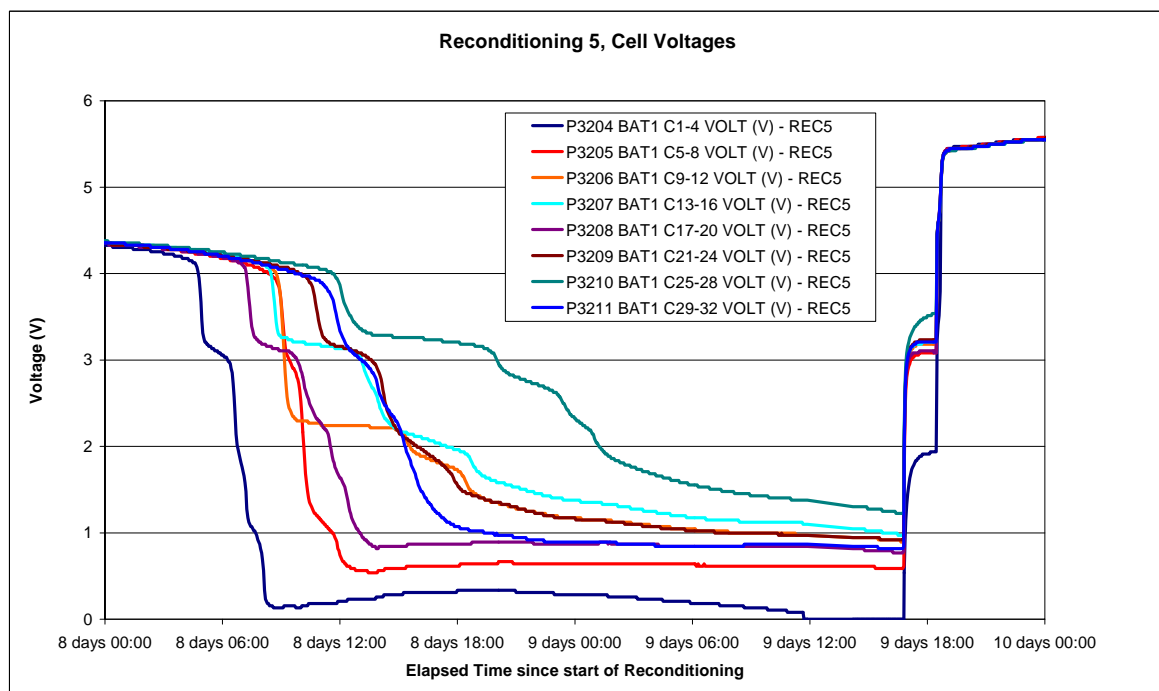


It can be seen that the discharge profile of reconditioning 5 is broadly in line with that of the other reconditionings, the only differences being some variation in the battery capacity with a terminal voltage below 20V and the slightly earlier voltage drop below 30V in reconditioning 1.

The sharp increase in battery 1 temperature towards the end of the recharge phase indicates that in fact the battery was fully recharged – see plot below.



Finally a plot of the batteries cells voltages during the last part of the discharge phase and first part of the charge phase shows that all cell groups reached their nominal values and achieved the same voltage values almost immediately after trickle charge was applied. The differing values of cell voltages during the last part of the discharge phase are probably an indication that some cell groups were slightly weaker than others. This difference only starts to become apparent after the discharged capacity has reached more than 92% of the total, ie when the useful capacity of the battery is exhausted.



2.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

2.1.4 OBDH

The OBDH subsystem is working flawlessly. No on-board communications problem has been identified.

The PST was over-subscribed by 3 packets, which were allocated to SPI during the Instrument window for the entire reporting period.

2.1.5 RFS

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

2.2 Payload

2.2.1 SPI

Following the 17th SPI annealing, which started on 25/04/2011, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004); detector #5 (failed since 19/02/2009) and detector #1 (failed since 27/05/2010).

The Germanium detectors' temperature was kept in the range 80K \pm 1K until the start of the 17th SPI Annealing on 25/04/2011 at 23:12z.

SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 99 packets/cycle, except from 2011-04-16T01:52:02Z to 2011-04-16T05:19:01Z (OMC Flat Field Calibration), when it was 88 packets/cycle and from 2011-04-26T06:34:26Z to the end of the month (and beyond) during the SPI annealing, when it was 30 packets/cycle. The average telemetry occupation when the allocation was 105 packets/cycle was 76.2 packets/cycle.

The following plot shows the TM bandwidth allocation and occupation during the reporting period:

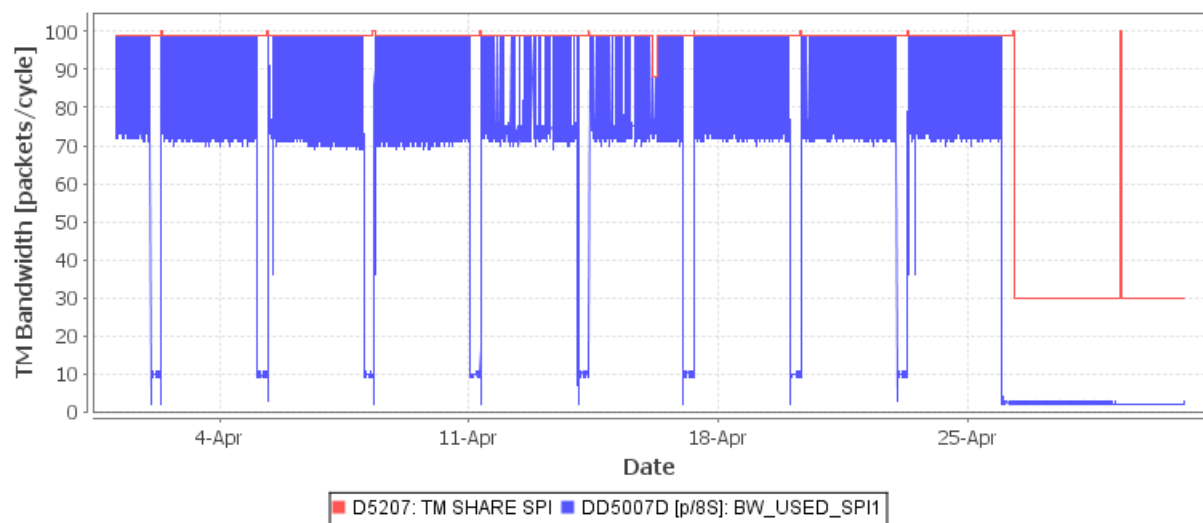


Figure 1: SPI TM bandwidth utilisation

The following plot shows the DPE CPU load during the reporting period:

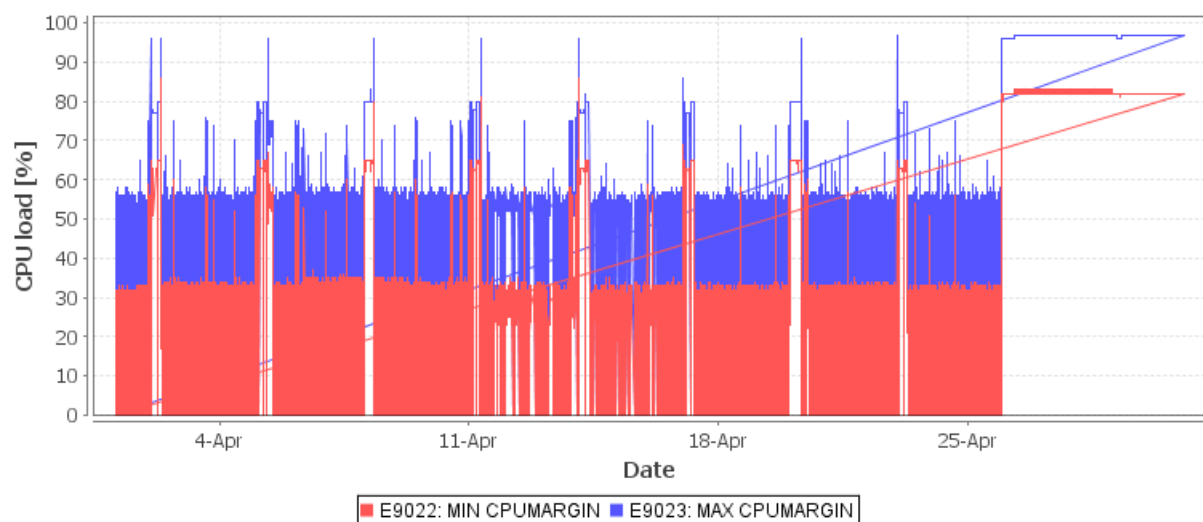


Figure 2: SPI IASW Performance

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005:

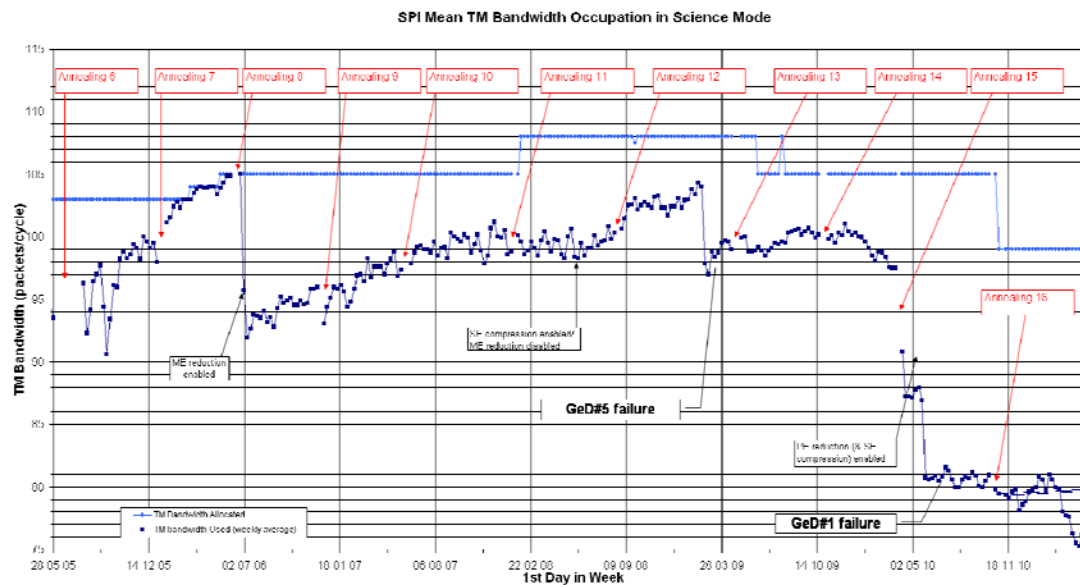


Figure 3: SPI TM bandwidth usage evolution since May 2005

Note: Some more information concerning the SPI operations is provided in Appendix 6.2.

2.2.2 IBIS

The overall status of IBIS is nominal.

During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 129 packets/cycle, except from 2011-04-16T01:52:02Z to 2011-04-16T05:19:01Z (OMC Flat Field Calibration), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 108.43 packets/cycle

The plot below shows the IBIS TM utilisation during the reporting period.



Figure 4: IBIS TM bandwidth utilisation

A plot of the IBIS weekly bandwidth utilisation since May 2005 is shown below:

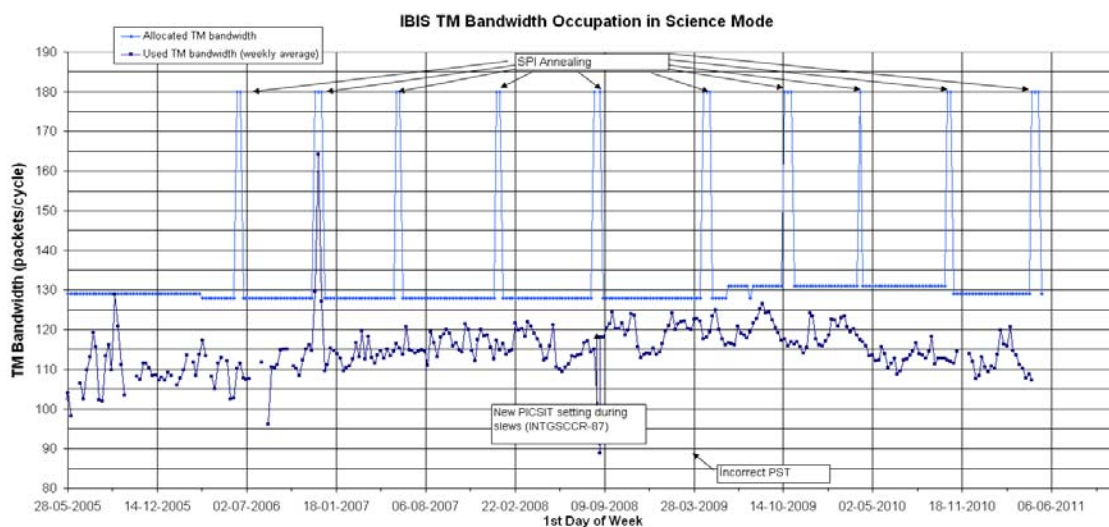


Figure 5: IBIS TM bandwidth usage evolution since May 2005

Note: Some more information concerning the IBIS operations is provided in Appendix 6.3.

2.2.3 JEM-X

The status of both JEM-X units is nominal.

- JEMX-1 & 2 were operated in Data Taking mode with a TM allocation of 8 packets/cycle each, except from 2011-04-26T06:34:26Z to the end of the month, during the SPI annealing, when it was 15 packets/cycle each.

Note: Some more information concerning the JEM-X operations is provided in Appendix 0.

2.2.4 OMC

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle, except from 2011-04-16T01:52:02Z to 2011-04-16T05:19:01Z during the Flat-field calibration, when it was 63 packets/cycle, and from 2011-04-26T06:34:26Z to the end of the month (and beyond) during the SPI annealing, when it was 9 packets/cycle.

During this reporting period, 815 of the 829 planned science pointings were executed nominally. Eight pointings were lost to AOCs problems, 1 pointing was lost to FD problems, another to a FEC crash, and another to operator error. Finally two pointings were interrupted on 23/04/2011 to 2 separate IREM SEUs. One Flat-field calibration was performed this month.

Note: Some more information concerning the OMC operations is provided in Appendix 6.5.

2.2.5 IREM

The status of IREM is nominal.

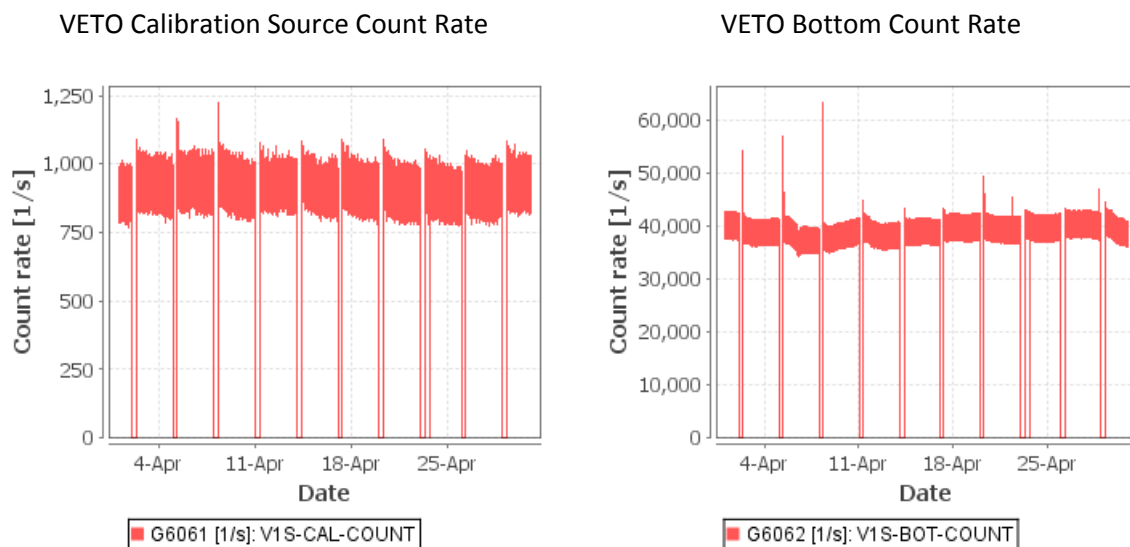
On DoY 113 (23/04/2011), the 107th IREM SEU occurred.

On DoY 113 (23/04/2011), the 108th IREM SEU occurred.

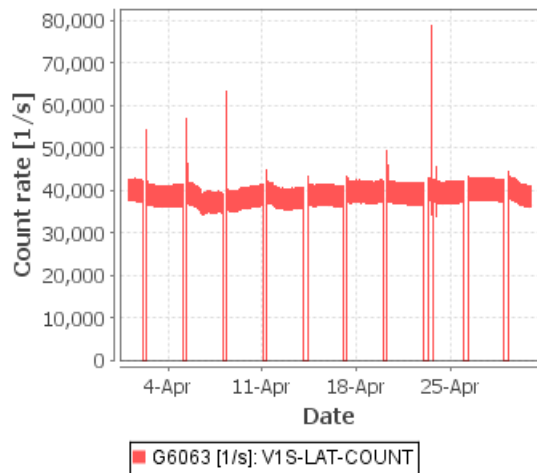
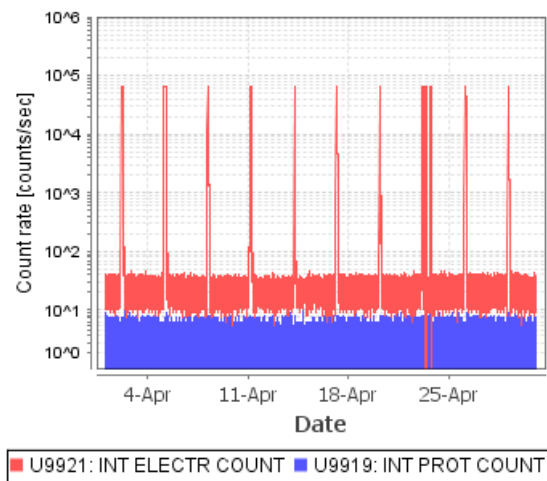
Note: Some more information concerning the IREM operations is provided in Appendix 6.6.

Radiation background

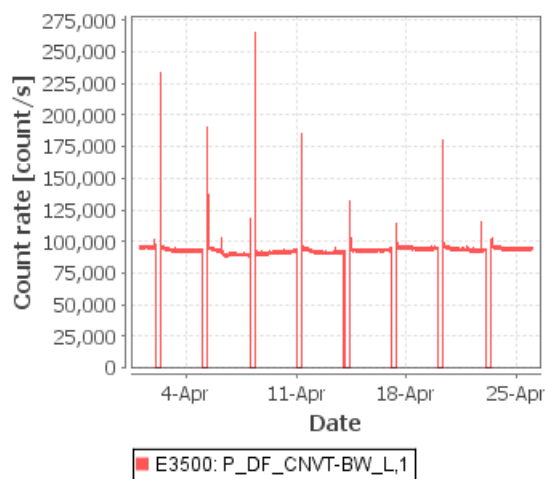
The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:



VETO Lateral Count Rate

IREM Proton & Electron Counters¹

ACS Below 100MeV



ACS Above 100MeV

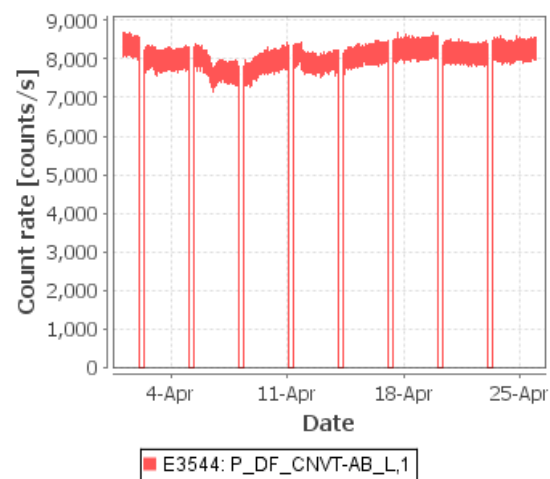


Figure 6: Instrument Count Rates

The JEM-X count rates are only plotted for the active JEM-X unit, the data is sampled every 8th packet (64sec).

¹ Note that the scale used in this plot is logarithmic.

K5119/L5119 - JEM-X1/2 Software trigger, K5449/L5449 - JEM-X1/2 Hardware trigger

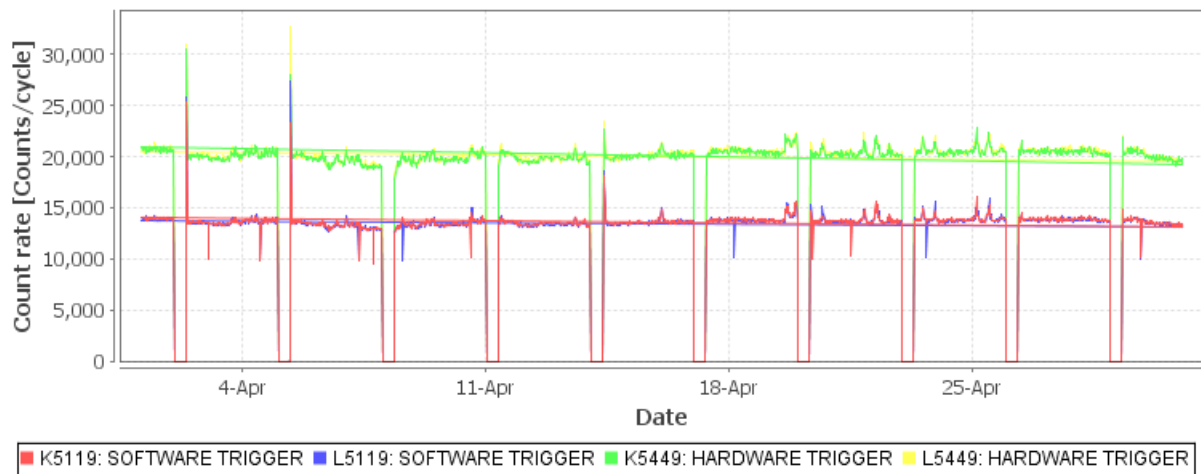


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

Radiation Belts

Figure 8 gives a prediction of the trapped radiation environment sensed by the S/C when descending into perigee; the different areas crossed, the Radiation Belt entry/exit points, the shape of the Radiation Belt passage and a rough estimation of the trapped proton and electron fluxes.

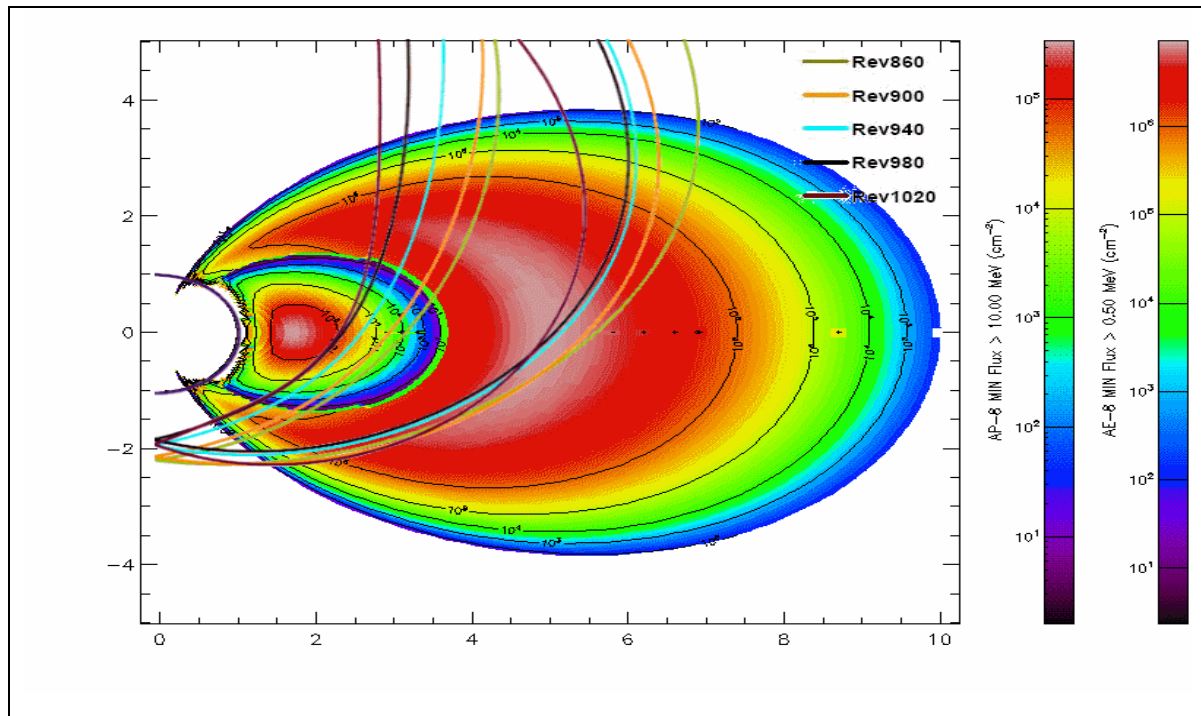


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

3 Ground Facilities

The Operational ground facilities performance was good this month. The overall performance was over the 95% requirement.

The following figure shows the number of slews executed and the number of slews missed per revolution. These numbers give a very good indication of the performance of the operational ground facilities, because it involves all the different elements of the ground facilities to complete all slews scheduled.

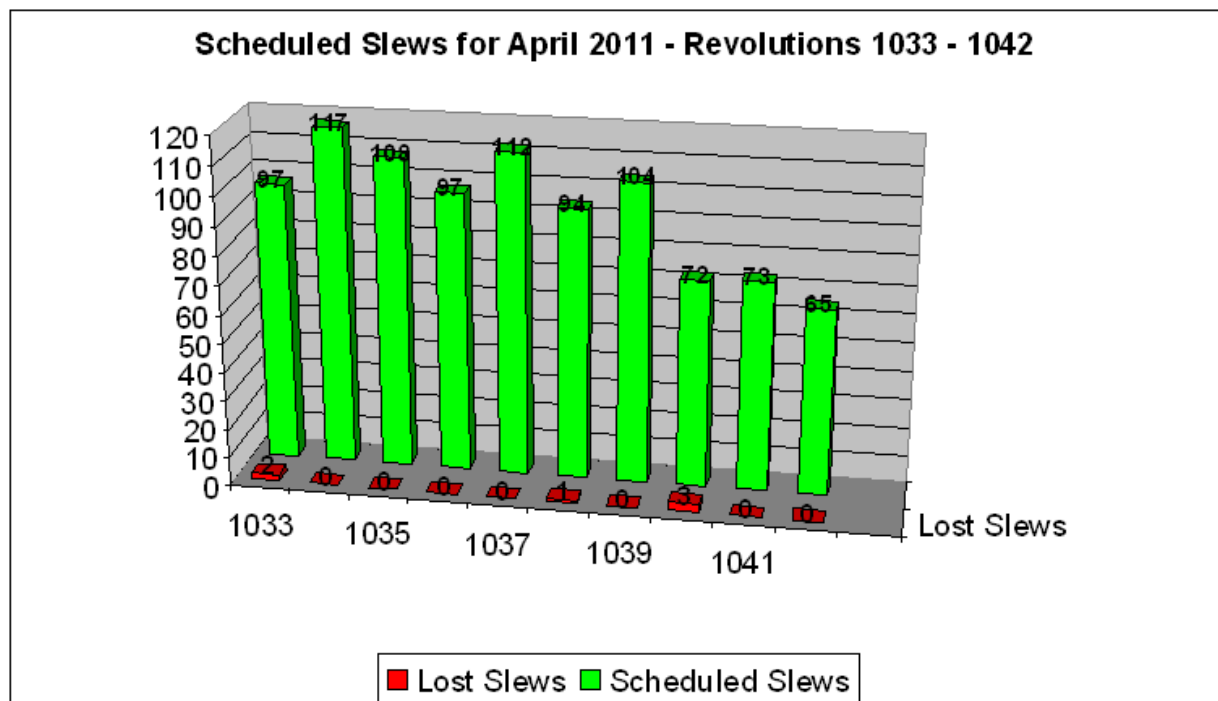


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY 112 major problems on the communications line to REDU were experienced causing a total loss of 90 minutes of science data. The ISDN line was brought up incorrectly and therefore did not clear the problem. Stable TM delivery was only regained by moving to VIL2.

On DOY 119 at AOS the Multiplexer crashed on imca and the OMCH task crashed on imca and imcb. All Tasks were restarted OK.

On DOYs 039 and 048 the remaining disk space on the Flight Dynamics system went below 6 GB, old files were removed to free up space.

The ISDS and IFRD tasks needed to be restarted on 10 occasions.

3.2 Ground Stations and Network

12 TM drops were identified and bad frames were received from REDU on 6 occasions which were

due to RFI.

Figure 10 shows the quality of the ground station performance. The data received from the ground stations is compared to the data that is expected to be received.

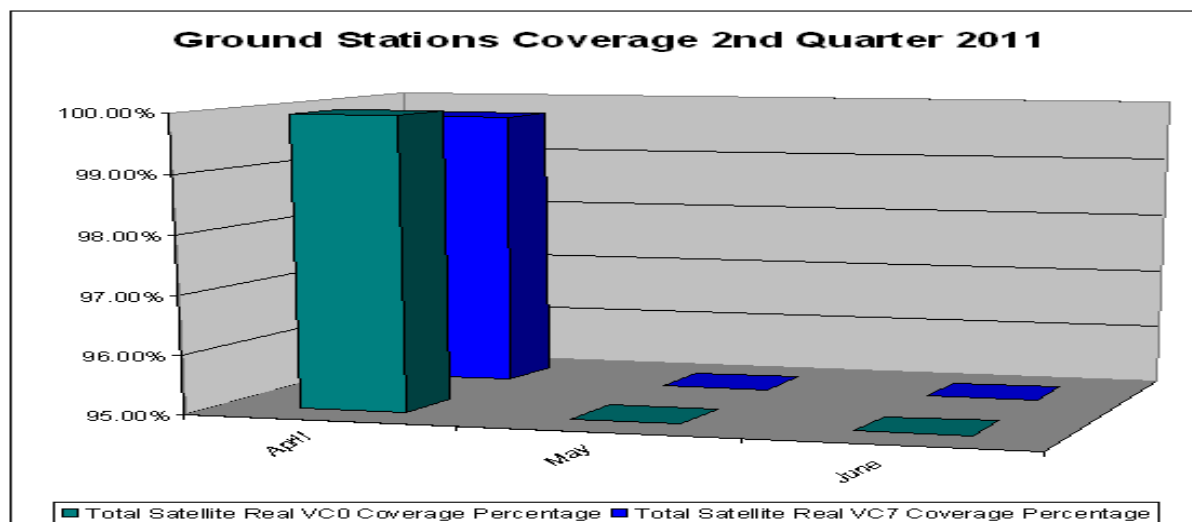


Figure 10: The usage of ESA ground stations compared to the usage of DSN ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1042 to 1049, corresponding to the time range 26 April to 19 May.

New observations have been planned for revolutions 1037 (11-13 April) to 1047, with SPI annealing starting in revolution 1042.

TSFs have been received for revolutions 1035 to 1045.

3.3.2 Observation Status

New ECS files have been received for revolutions 1010 to 1024 (up to 6 March).

3.3.3 ISOC Science Data Archive

Syncing of rev_3 data has been done up to revolution 873.

Raw telemetry copied from MOC is available up to 15 April.

3.3.4 ISOC System

V29 (AO9 TAC support) was released on 28 March for the opening of the Web pages with proposal data to the TAC.

3.3.5 Problems

Two different issues were encountered with OMC Flat-field calibrations. In one case insufficient time was left to complete the last dark current data in the other a short slew after the calibration led to a wrong ED sequence. Both are being tackled.

4 Anomalies

Table 1 contains the anomalies that occurred in the reporting period:

Table 1: Anomalies reported

AR id	Date of occurrence	Subject	Segment	Status
INT-3145	2011-04-09	REDU - ECC lost control of FEC	ESA Stations	Testing
INT-3146	2011-04-16	Incorrect Sequence of OMC commands in revolution 1038	ISOC	Pending
INT-3147	2011-04-19	Duplicated EDs (RET1*) in revolution 1039	FDS	Pending
INT-3148	2011-04-22	Problems with REDU groundstation	ESA Stations	Closed
INT-3149	2011-04-17	Possible TCO or OLF problems revolution 1039	IMCS	Rejected
INT_SC-322	2011-04-23	IREM Anomaly: Reset of IREM_CSCI S/W #107, 23/04/2011	Payload	Closed
INT_SC-323	2011-04-23	IREM Anomaly: Reset of IREM_CSCI S/W #108, 23/04/2011	Payload	Testing

5 Special Events & Future Milestones

Battery 2 reconditioning will start on 6th May.

6 Appendix

The appendix contains some detailed information concerning the AOCS subsystem and the instruments.

6.1 AOCS operations

During this period, 399 Open Loop Slews, 503 Closed Loop Slews and 25 Momentum Biases were executed (as reported by ACC OEM).

9 slews were missed from the timeline.

6.1.1 Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 30/04/2011 is reported in the following plot:

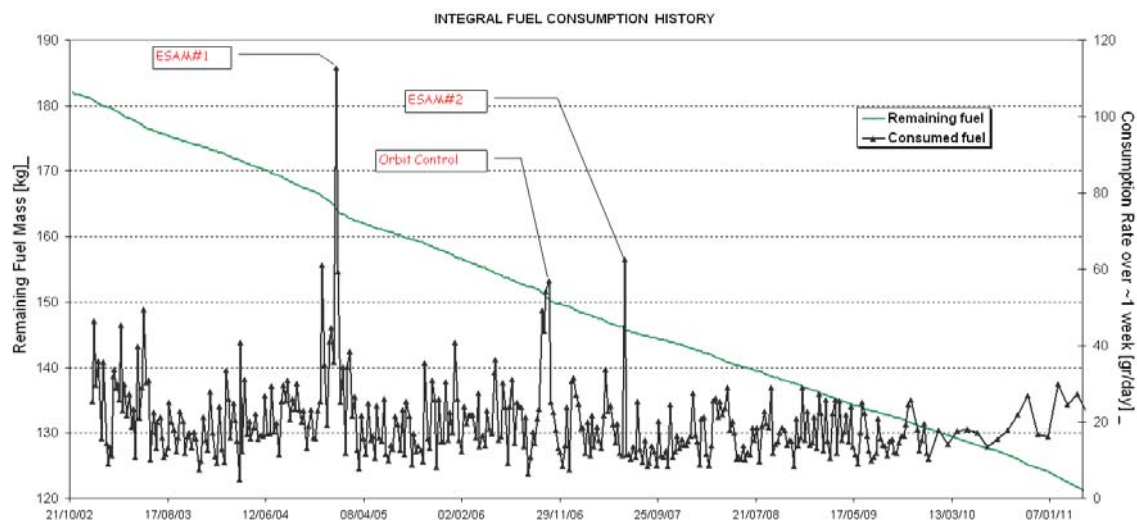


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

6.1.2 The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the last month are reported in the plot below. The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs.

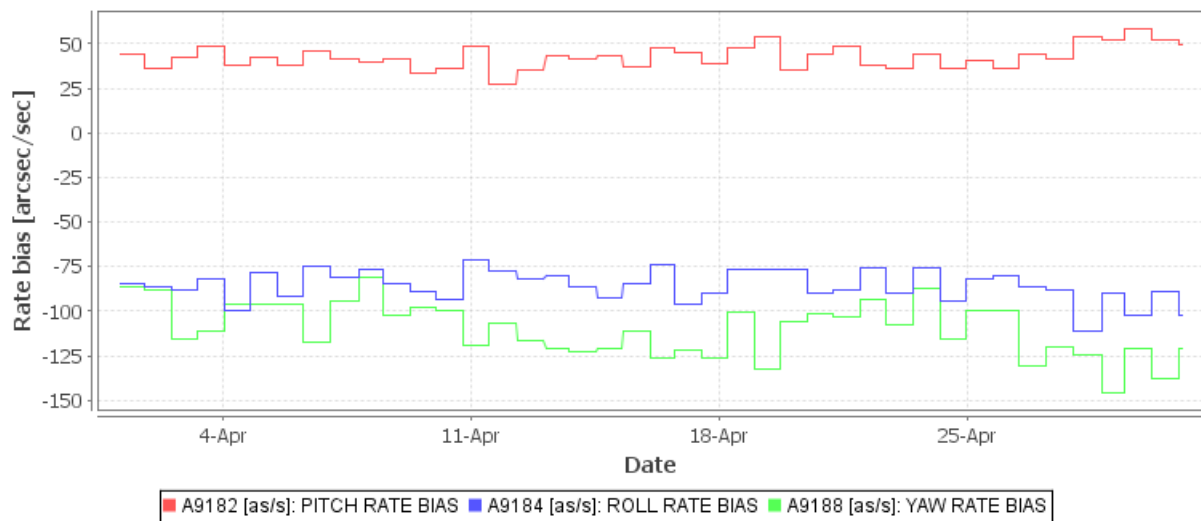


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

01/04/2011 (Day of Year 91, Revolution 1033)

IMU1 switched ON during the stable pointing of PID 10330075 (03:30:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 10330076 (which completed actually earlier than the one in the timeline would have).

Then a mapping was commanded and the parameters for slew 10330077 were manually updated (spacontool).

OTF was not reached for PIDs 10330075.

Slew 10330076 was missed from the timeline.

02/04/2011 (Day of Year 92, Revolution 1033 to 1034)

Autostack commanding for slew 10340015 (15:41:00Z) failed release (TC A3189 "START GUIDE STAR"). The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was performed from attitude 10340014 to attitude 10340016.

Slew 10340015 was missed from the timeline.

OTF was not reached for PIDs 10340015.

04/04/2011 (Day of Year 94, Revolution 1034)

- IMU1 switched ON during the stable pointing of PID 10340106 (18:29:00Z). After the IMU switched back OFF, a manual mapping was commanded and the parameters for slew 10340106 were manually updated (spacontool).

OTF was not reached for PID 10340106.

No slew was missed

05/04/2011 (Day of Year 95, Revolution 1034 to 1035)

Because of the presence of a Bright Object in the perigee passage STR FoV, the guide star was lost several times causing several cycles of IMU1 ON-OFF, preventing slews 10350001 to 10350008 to go via timeline.

After the last IMU1 OFF (08:17:00Z), a manual slew was performed to go to attitude 10350008, then a mapping was commanded and the parameters for slew 10350009 were manually updated (spacontool).

OTF was not reached for PIDs 10350001 to 10350008.

Slews 10350001 to 10350008 were missed from the timeline.

11/04/2011 (Day of Year 101, Revolution 1036 to 1037)

Guide star was lost and IMU1 switched ON during perigee passage (02:20:31). After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was not the case, a manual CGS was generated and uplinked prior to the RWB.

No impact in the timeline.

12/04/2011 (Day of Year 102, Revolution 1037)

- Performance of CSL 10370055 was interrupted (16:37:46Z).

OTF was not reached for PIDs 10370055.

- Autostack commanding for slew 10370056 (17:06:00Z) failed release (TC A3189 "START GUIDE STAR"). The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was performed from attitude 10370055 to attitude 10370056.

Slew 10370056 was missed from the timeline.

OTF was not reached for PIDs 10370056.

14/04/2011 (Day of Year 104, Revolution 1037 to 1038)

Guide star was lost and IMU1 switched ON during perigee passage (02:04:00). After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was not the case, a manual CGS was generated and uplinked prior to the RWB.

No impact in the timeline.

20/04/2011 (Day of Year 110, Revolution 1039 to 1040)

- FDS TPF update failed for slew 10400004 (07:56:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10400003 to attitude 10400004.

After the manual slew was completed, the parameters for slew 10400005 were manually updated (spacontool).

Slew 10400004 was missed from the timeline. The OTF was not reached for its PID.

- Timeline was accidentally disabled for AOCS subsystem, causing slew 10400005 to fail release.

SPACON commanded a mapping and performed a manual slew from attitude 10400004 to attitude 10400006. Parameters for slew 10400007 were updated afterwards.

Slews 10400005 and 10400006 were missed from the timeline. The OTF was not reached for their PIDs.

26/04/2011 (Day of Year 116, Revolution 1041 to 1042)

Guide star was lost and IMU1 switched ON during perigee passage (01:27:00). After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was the case, the AOCS subsystem got re-enabled.

No impact in the timeline.

29/04/2011 (Day of Year 119, Revolution 1042 to 1043)

Autostack commanding for slew 10430008 (12:27:00Z) failed release (TC A3189 "START GUIDE STAR"). The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10430007 to attitude 10430008.

After the manual slew was completed, the parameters for slew 10430009 were manually updated (spacontool).

Slew 10430008 was missed from the timeline. The OTF was not reached for its PID.

6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

The stroke of all four compressors was set to 41 throughout the month until the start of the 17th SPI Annealing on 25/04/2011 at 23:12z.

The following plot shows the evolution of the cold plate and H bus temperature during the reporting period. During the 17th Annealing the cold plate temperature was kept at -65 degC:

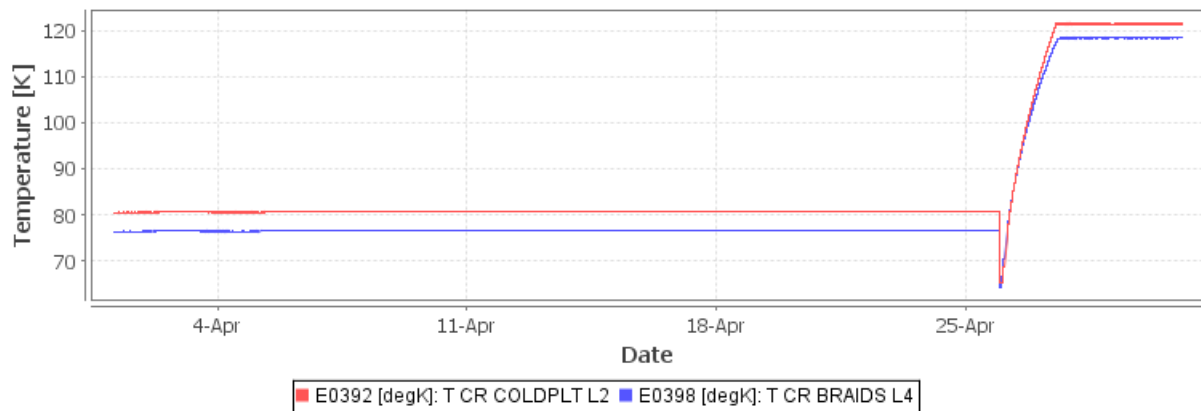


Figure 13: SPI Cold plate and H-bus temperature

The following plot shows the evolution of the CDE LCL currents during the reporting period:

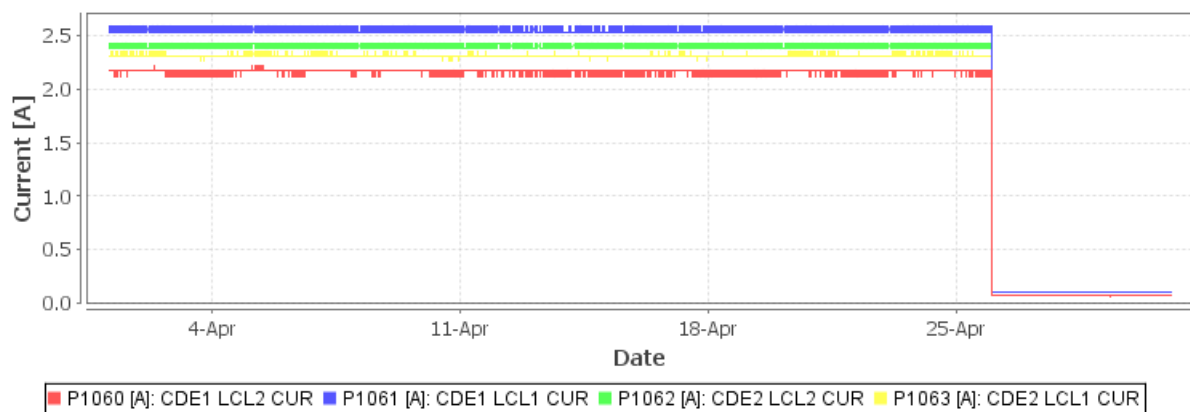


Figure 14: SPI CDE LCL current

DPE & IASW

The DPE health and IASW performance are nominal. The IASW version installed is v4.3.5 with both SE compression and PE reduction enabled and the spectra scaling factor set to 7/19 SE. The DPE CPU usage was nominal during the reporting period (see Figure 2). Due to the annealing operations, the IASW was in CONF mode until the camera switch-on performed on 12/05/2011.

ACS

The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). Due to the ongoing annealing operations, the ACS High Voltages were set to the minimum voltage (~980V) and the ACS was in CONF mode until the start of passive cooling, when the ACS Calibration was performed. A plot of the ACS counts is given in Figure 6: Instrument Count Rates.

AFEE

The health of the AFEE is nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004; detector #5 is failed since 19/02/2009 and detector #1 is failed since 27/05/2010. The HV of the failed detectors are nominally set to 0.5kV and events from these GeDs are disabled in the DFEE and PSD. The following plot shows the AFEE DC output voltages over the reporting period.

Due to the ongoing annealing operations, all detector HVPSs were off and only the LVPSs left on, with the AFEE in CONF mode, until the SPI camera switch-on, which started on 12/05/2011at 16:00Z.

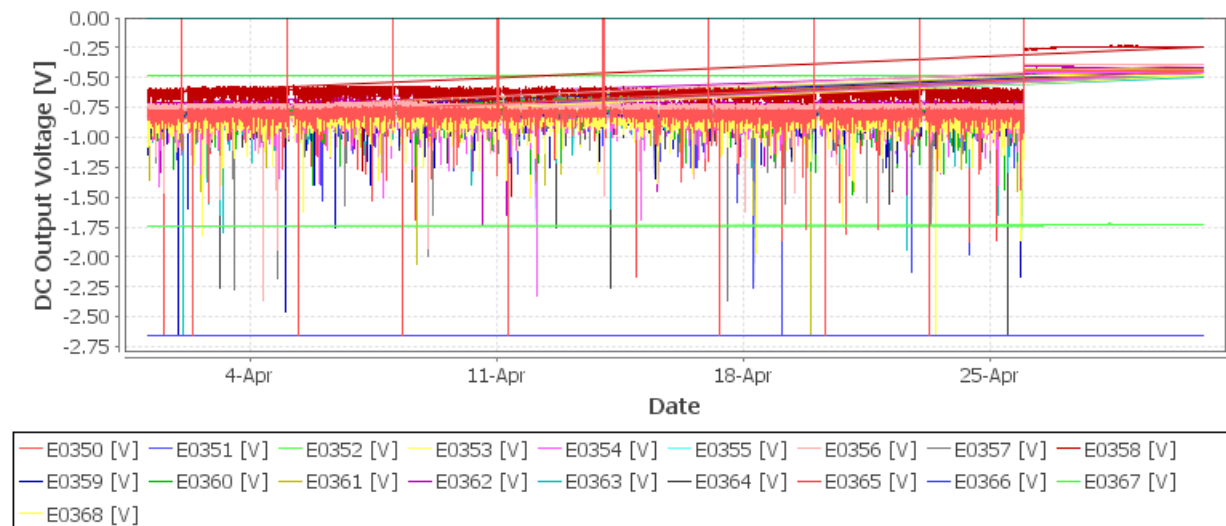


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

DFEE

The health of the unit is nominal. The following plots show the Non Vetoes, Time Tagged and Time Tagged Saturated Event count rates during the reporting period.

Due to the ongoing annealing operations, the DFEE was in CONF mode until the SPI camera switch on, which started on 12/05/2011at 16:00Z.

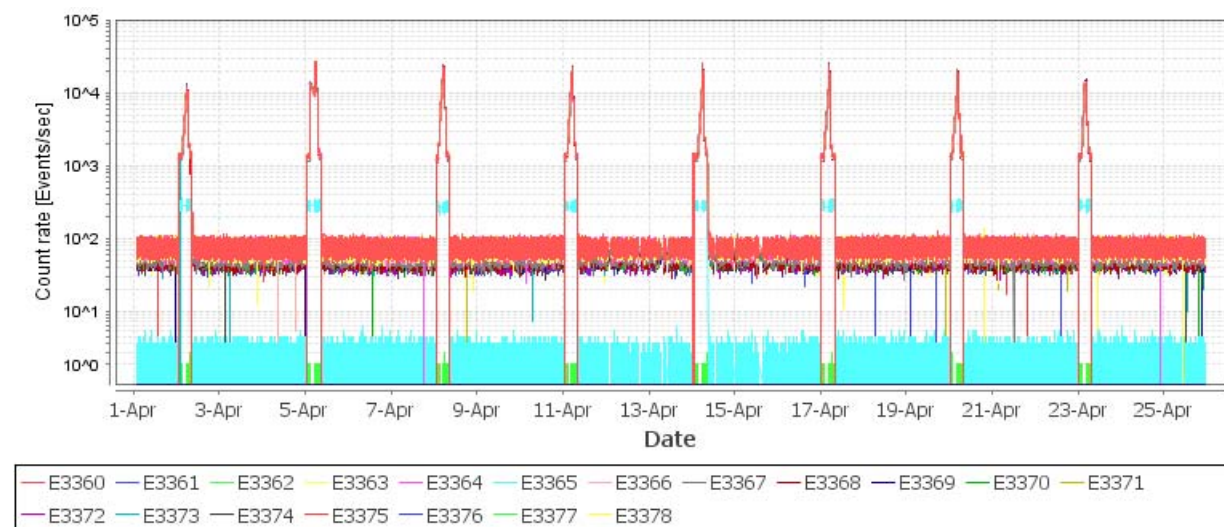


Figure 16: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic



Figure 17: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic

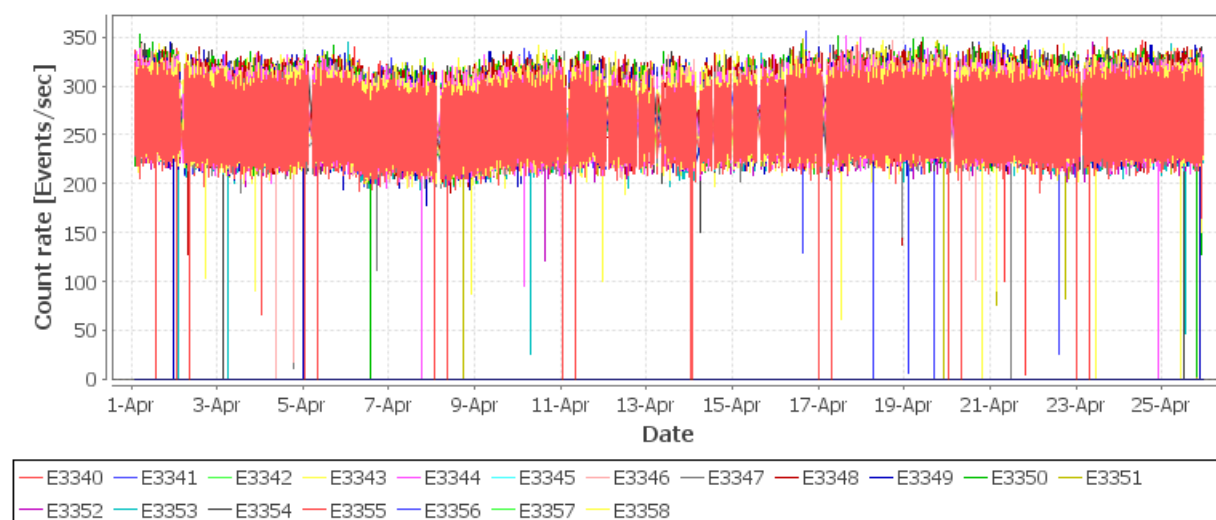


Figure 18: SPI GeD Time Tagged Saturated count rates

PSD

The health of the PSD is nominal. The following plot shows the PSD channel rates over the reporting period:

Due to the ongoing annealing operations, the PSD was in CONF mode until the SPI camera switch-on, which started on 12/05/2011 at 16:00Z.

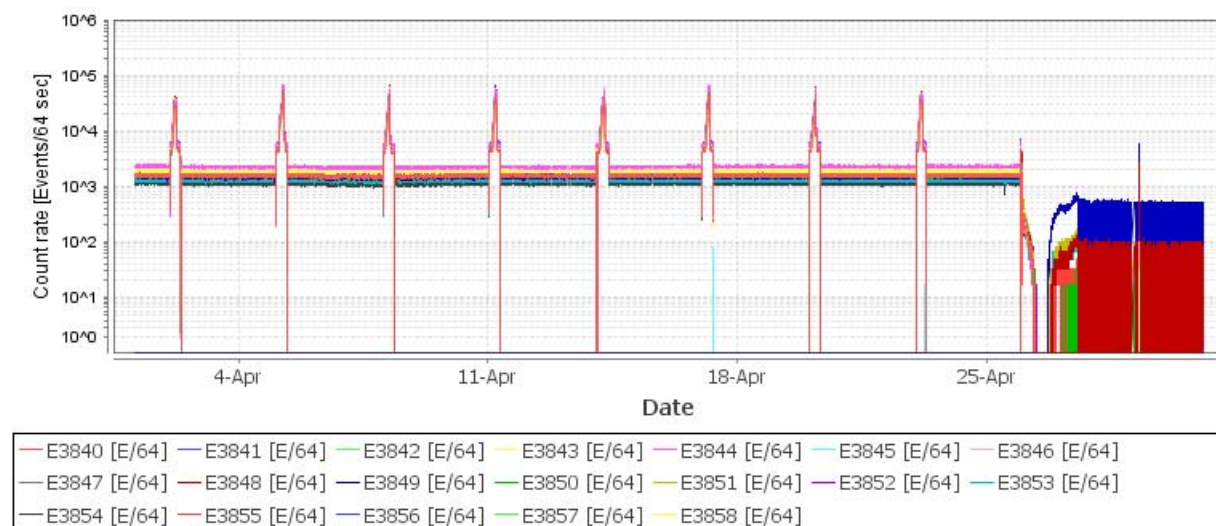


Figure 19: SPI PSD GeD Channel rates

6.2.2 Event Log

Due to continuing high background radiation after the expected radiation belt exit of revolutions 1034, 1035, 1036 and 1038, TM parameter E3500 (ACS Counts Below 100MeV) was OOL from 2011.092.07.58.06Z - 2011.092.08.34.06Z, 2011.095.08.22.47Z - 2011.095.08.24.47Z, 2011.098.07.34.55Z - 2011.098.07.45.38Z and 2011.104.07.36.57Z - 2011.104.07.38.23Z. As in each

case it returned within limits of its own accord as the background radiation level decreased, no action was taken.

02-04-2011 (Day of Year 092, Revolution 1034)

At 04:52:02Z one occurrence of OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. As it was a single occurrence, no action was required.

17-04-2011 (Day of Year 107, Revolution 1039)

At 03:51:15Z one occurrence of OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. As it was a single occurrence, no action was required.

25-04-2011 (Day of Year 115, Revolution 1041)

At 22:18Z the 17th SPI Annealing was started. After setting the AFEE HV to 0 and reducing the ACS HV to 980V the compressor shutdown was performed at 23:30z. The cold plate temperature reached 100 degC on 27/04/2011 at 10:53:48Z. The Cold box temperature was maintained at -65 degC during the complete Annealing cycle. A complete report about the 17th Annealing operations will follow in the next monthly report.

6.3 IBIS

6.3.1 Operations

ISGRI

The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the reporting period:

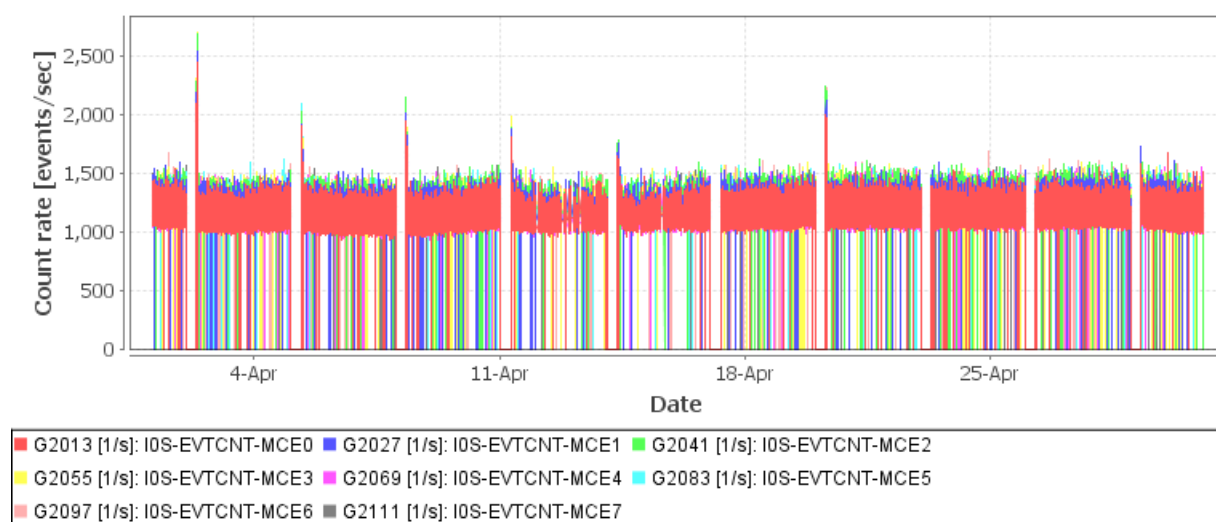


Figure 20: ISGRI MCE Counters

PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the reporting period:



Figure 21: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic

VETO

The health and performance of VETO was nominal during the reporting period. Plots of the VETO counters are given in Figure 6: Instrument Count Rates.

6.3.2 Event Log

23/04/2011 (Day of Year 113, Revolution 1040 to 1041)

- Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 2011.113.07.04.00Z. It was recovered as follows:

- 2011.113.07.30.00Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- 2011.113.07.44.00Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the timeline re-enabled.

IBIS operations continued nominally.

- Due to another IREM SEU, IBIS transitioned autonomously to Safe configuration at 2011.113.16.40.00Z. It was recovered as follows:

- 2011.113.16.58.00Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- 2011.113.17.08.00Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the timeline re-enabled.

IBIS operations continued nominally.

6.4 JEM-X

6.4.1 Operations

The Status of JEMX-1 & 2 is nominal. The following plot shows the JEMX DFEE and detector temperatures over the reporting period.

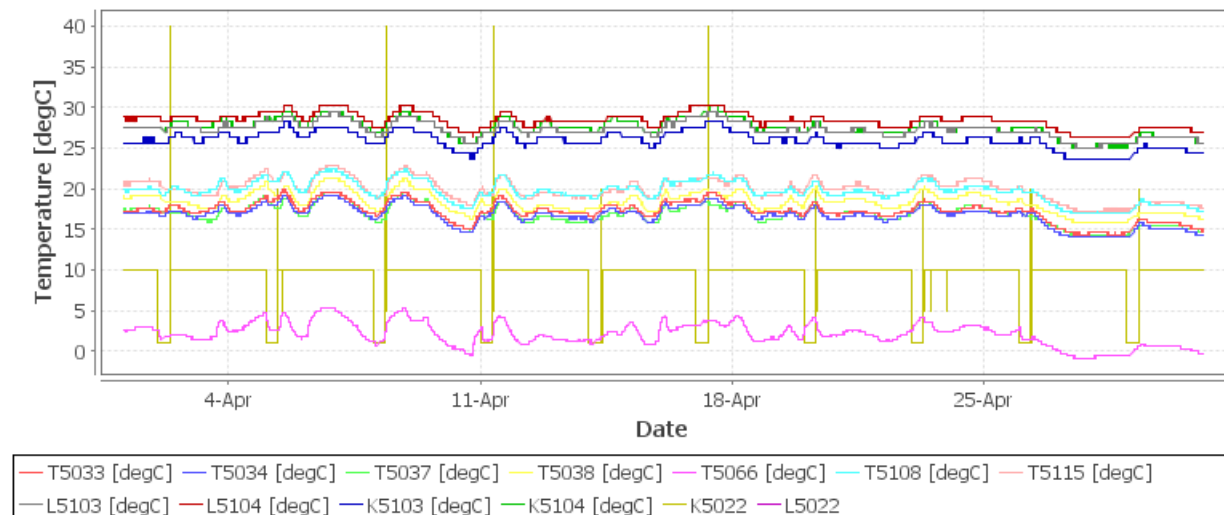


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

08-04-2011 (Day of Year 098, Revolution 1036)

At 07:09:00 parameters K5317 & L5317 went out of hard limits. No action was taken. There was no impact, at the time Integral was within the radiation belts.

23-04-2011 (Day of Year 112, Revolution 1041)

At 07:04:30 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#107). There was no impact as the reaction has been disabled.

At 16:40:00 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#108). There was no impact as the reaction has been disabled.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

2011-04-02 (DoY 092, Rev 1034)

At 15:41:00, the Start guide star command failed, forcing a suspension of operations. A recovery was performed, and the timeline rejoined at 16:02. The impact was the loss of pointing 10340015. It was at this time that the following pair of commands was rejected:

2011.092.15.44.54.770	2011.092.15.44.59.316	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2011.092.15.45.00.770	2011.092.15.45.11.485	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

2011-04-05 (DoY 095, Rev 1035)

At 06:56:21, an AOCs problem forced a suspension of operations. A recovery was performed, and the timeline rejoined at 10:17. The impact was the loss of pointings 10350004 to 10350008 inclusive.

2011-04-12 (DoY 102, Rev 1037)

At 17:05, the Start guide star command failed, forcing a suspension of operations. A recovery was performed, and the timeline rejoined at 17:26. The impact was the loss of pointing 10370056.

2011-04-15 (DoY 105, Rev 1038)

At 21:43, control of the FEC at Redu was lost, which caused the link to drop for 12 minutes. A recovery was subsequently performed, and the timeline rejoined at 22:05. The impact was the loss of pointing 10380067.

2011-04-16 (DoY 106, Rev 1038)

At 05:18:34, the OMC commands for pointing 10380076 failed. This was because the unit was still in calibration mode (Dark Current). At 05:20:03, the Stand-by command was uplinked from the timeline which should have been uplinked first. The problem was caused by a planning error. No further action was taken. The impact was the loss of pointing 10380076. It was at this time that the following pair of commands was rejected:

2011.106.05.18.34.293	2011.106.05.18.36.717	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2011.106.05.18.41.043	2011.106.05.18.43.906	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

2011-04-20 (DoY 110, Rev 1040)

At 07:56, the FD update for slew 10400004 failed, forcing an interruption. A recovery was performed, and the timeline rejoined at 08:49. The impact was the loss of pointing 10400004. It was at this time that the following pair of commands was rejected:

2011.110.08.46.35.649	2011.110.08.46.44.517	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2011.110.08.46.41.774	2011.110.08.46.44.546	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

At 09:36, the Spacon erroneously stopped the timeline when an independent alarm was raised, which was then confused with the previous failed slew. Another recovery was performed, and the timeline rejoined at 10:40. The impact was the loss of pointing 10400005. It was at this time that the following pair of commands was rejected:

2011.110.09.41.27.652	2011.110.09.41.33.903	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.110.09.41.33.777	2011.110.09.41.40.027	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

2011-04-23 (DoY 113, Rev 1041)

At 07:04:04, an IREM SEU (#107) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 07:26:29. The impact was pointing 10410002 was shortened from a planned 3160 to 912 seconds.

At 16:39:16, an IREM SEU (#108) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 16:52:35. The impact was pointing 10410013 was shortened from a planned 3160 to 1592 seconds.

2011-04-29 (DoY 119, Rev 1043)

At 12:27, the Start guide star command failed, forcing a suspension of operations. A recovery was performed, and the timeline rejoined at 13:06. At 13:18:28 OMC was returned to Normal mode, after the pointing commands were manually uplinked. The impact was pointing 10430008 was cut short from a planned 3556 to 808 seconds. It was at this time that the following pair of commands was rejected:

2011.119.12.30.52.175	2011.119.12.31.00.356	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.119.12.30.57.800	2011.119.12.31.00.399	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the original M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the timeline for that pointing.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 23, red line) and Exit times (Figure 24, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 23 and the magenta line in Figure 24 are the altitudes used by the MOC for planning purposes.

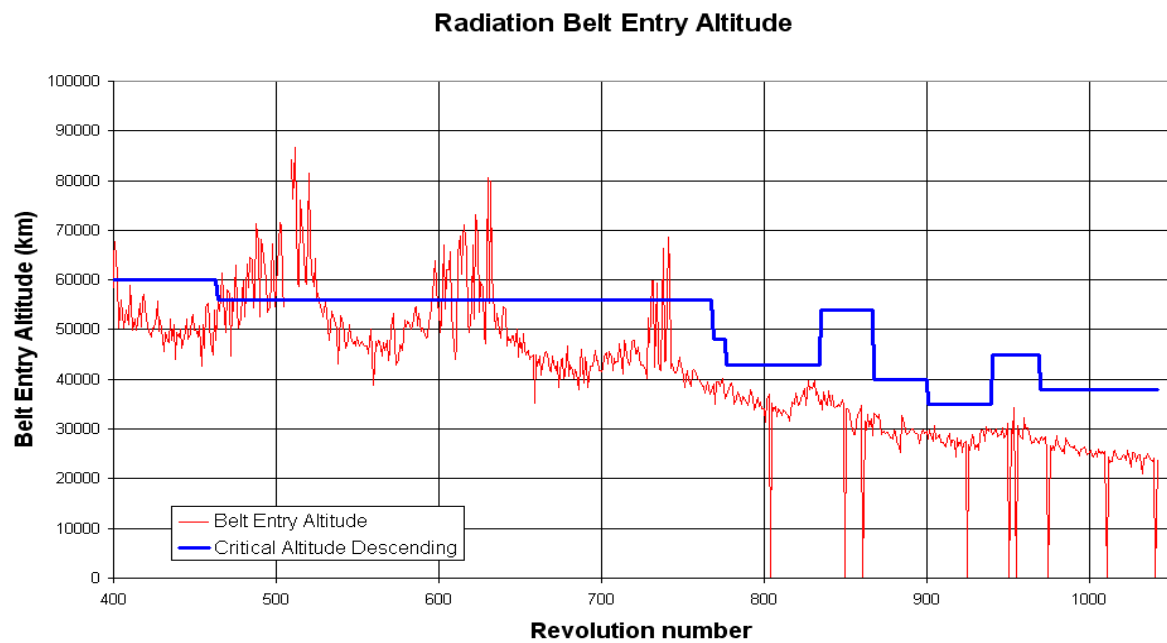


Figure 23: Radiation belt entry

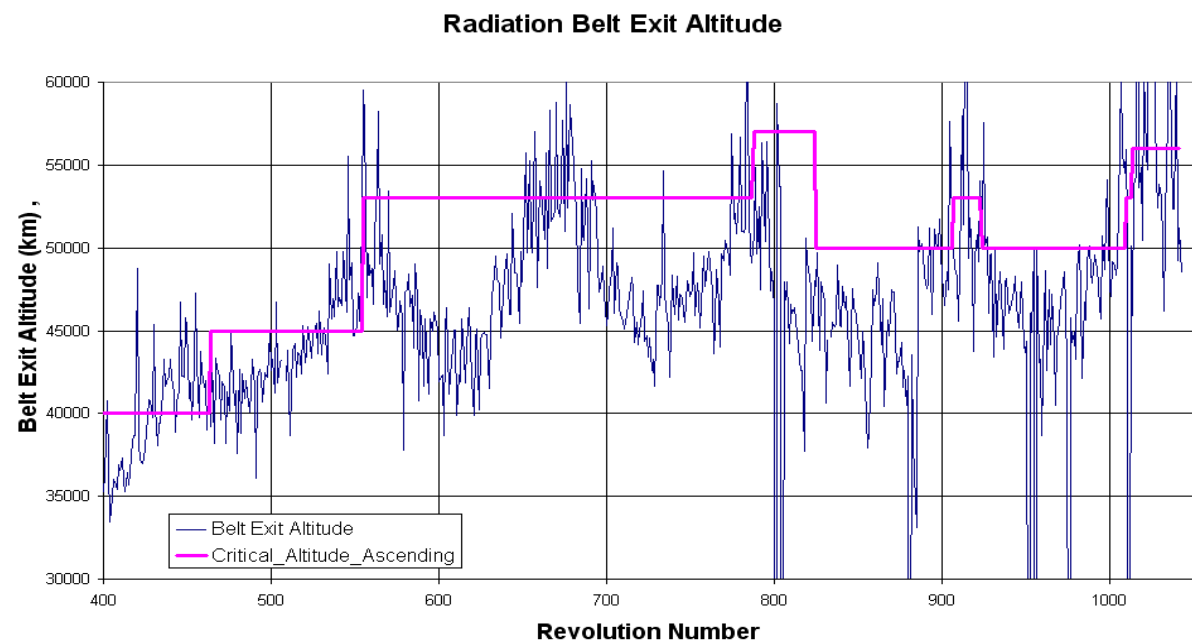


Figure 24: Radiation belt exit

Table 2: Radiation belts. Radiation belt entry crossings are ignored if there is a subsequent gap of at least 30 minutes of low radiation.

Revo number	Spacecraft BCPKT (electron)	Observed entry/exit time by Electron CUT-OFF	Observed entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Electron CUT-OFF	Predicted entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Proton CUT-OFF	Predicted entry/exit altitude [km] by Proton CUT-OFF
1033	RAD_ENTR R 2011-04-02T00:29:01Z	N/A	N/A	02-Apr-2011 02:04:30	18037.47	02-Apr-2011 02:44:30	8262.095
1034	RAD_EXIT R 2011-04-02T07:49:15Z	02/04/2011 08:34:10	62758.5	02-Apr-2011 06:54:30	47179.01	02-Apr-2011 03:14:30	3435.841
1034	RAD_ENTR R 2011-04-05T00:17:50Z	05/04/2011 01:51:54	18949.2	05-Apr-2011 01:50:26	18261.69	05-Apr-2011 02:30:26	8425.523
1035	RAD_EXIT R 2011-04-05T07:37:21Z	05/04/2011 09:04:58	68173.9	05-Apr-2011 06:40:26	47119.86	05-Apr-2011 03:00:26	3349.116
1035	RAD_ENTR R 2011-04-08T00:06:41Z	08/04/2011 01:40:26	19193.7	08-Apr-2011 01:35:50	18916.32	08-Apr-2011 02:15:50	9104.18
1036	RAD_EXIT R 2011-04-08T07:26:06Z	08/04/2011 07:55:30	59729.1	08-Apr-2011 06:35:50	48306.79	08-Apr-2011 02:55:50	3484.864
1036	RAD_ENTR R 2011-04-10T23:53:49Z	11/04/2011 01:22:03	19746.0	11-Apr-2011 01:20:49	19374.5	11-Apr-2011 02:00:49	9595.183
1037	RAD_EXIT R 2011-04-11T07:13:22Z	11/04/2011 07:20:43	56506.8	11-Apr-2011 06:20:49	47955.22	11-Apr-2011 02:40:49	3416.94
1037	RAD_ENTR R 2011-04-13T23:41:30Z	N/A	N/A	14-Apr-2011 01:16:40	17083.6	14-Apr-2011 01:46:40	9647.936
1038	RAD_EXIT R 2011-04-14T07:00:30Z	14/04/2011 06:30:35	51295.4	14-Apr-2011 06:06:40	47983.75	14-Apr-2011 02:26:40	3303.454
1038	RAD_ENTR R 2011-04-16T23:31:26Z	17/04/2011 01:07:07	17168.5	17-Apr-2011 00:58:35	18742.82	17-Apr-2011 01:38:35	8820.069
1039	RAD_EXIT R 2011-04-17T06:49:29Z	17/04/2011 06:58:03	58029.5	17-Apr-2011 05:48:35	46948.23	17-Apr-2011 02:08:35	3255.891

1039	RAD_ENTR R 2011-04- 19T23:22:32Z	N/A	N/A	20-Apr-2011 00:56:03	17236.28	20-Apr-2011 01:26:03	9751.869
1040	RAD_EXIT R 2011-04- 20T06:40:18Z	20/04/2011 07:23:31	62924.5	20-Apr-2011 05:46:03	47998.31	20-Apr-2011 02:06:03	3159.338
1040	RAD_ENTR R 2011-04- 22T23:11:59Z	23/04/2011 00:44:11	19525.4	23-Apr-2011 00:42:25	17775.72	23-Apr-2011 01:22:25	7889.191
1041	RAD_EXIT R 2011-04- 23T06:30:11Z	23/04/2011 05:20:27	>>28958.0	23-Apr-2011 05:32:25	47541.22	23-Apr-2011 01:52:25	3221.198
1041	RAD_ENTR R 2011-04- 25T22:59:31Z	26/04/2011 00:29:31	19774.3	26-Apr-2011 00:30:00	17992.93	26-Apr-2011 01:10:00	8130.01
1042	RAD_EXIT R 2011-04- 26T06:18:04Z	26/04/2011 05:16:35	46135.3	26-Apr-2011 05:20:00	47353.21	26-Apr-2011 01:40:00	3274.653
1042	RAD_ENTR R 2011-04- 28T22:46:46Z	29/04/2011 00:20:52	17337.6	29-Apr-2011 00:17:03	17769.66	29-Apr-2011 00:57:03	7871.259
1043	RAD_EXIT R 2011-04- 29T06:05:03Z	29/04/2011 04:53:48	28952.6	29-Apr-2011 05:07:03	47566.75	29-Apr-2011 01:27:03	3201.156

Reference:

- High radiation
- Very small error vs reference (less than 10 minutes)
- Small error vs reference (between 10 and 30 minutes)
- Large error vs reference (more than 30 minutes)

6.6.2 Event Log

23-04-2011 (Day of Year 113, Revolution 1041)

At 07:04:03Z, a local reset of the IREM CSCI S/W (SEU #107) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;

4) The anomaly occurred at 2011.113.07:04:03Z (61485.1 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;

5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of BCA0 HEX = 48288 DEC = 1011110010100000, i.e the Checksum Failure Flag OFF and the Watchdog Elapsed flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

6) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 10:00:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the Pls request. OMC was recovered at 07:25:00Z and IBIS at 08:20:00Z.

23-04-2011 (Day of Year 113, Revolution 1041)

At 16:39:15Z, a local reset of the IREM CSCI S/W (SEU #108) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

1) The temperatures were nominal;

2) The LCL current was nominal;

3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;

4) The anomaly occurred at 2011.113.16:39:15Z (118913.2 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;

5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e the Checksum Failure Flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

6) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 18:13:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the Pls request. OMC was recovered at 16:52:00Z and IBIS at 17:15:00Z. The DMRC flag was enabled at 18:47.