EUROPEAN SPACE AGENCY

DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT

MISSION OPERATIONS DEPARTMENT

INTEGRAL

Mission report

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

No. 397

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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 perfomed according to the planning inputs from ISOC combined with some manual commanding by MOC.

This report addresses the activities from May and covers the revolutions 1043 until 1053 (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-INTEGRAL 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.

7 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.800 Kg. The remaining propellant is in the order of 120.233 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.

Battery 2 Reconditioning terminated on 17/5/2011, the detailed timing was:

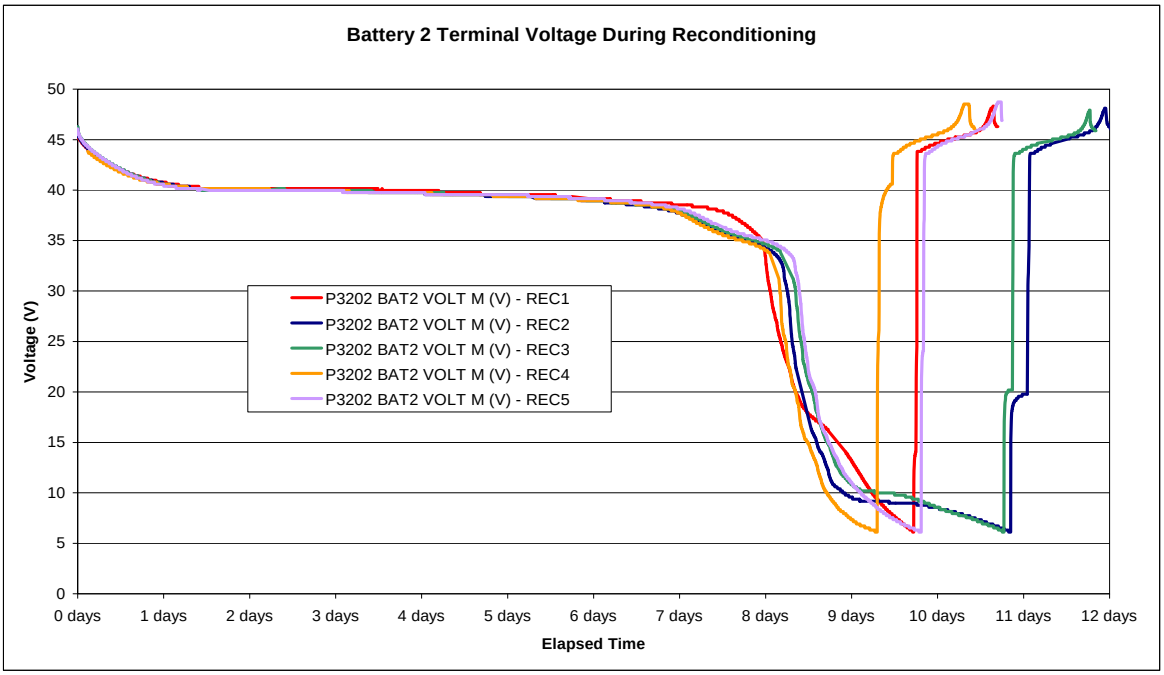
- 6/5/2011 13:25Z: Start of battery 2 discharge
- 16/5/2011 08:51Z: End of battery 2 discharge – terminated by the On-board Monitoring Task at battery Voltage = 6V, discharged capacity was approximately 36.17Ah.
- 16/5/2011 09:29Z: Start of Trickle Charge.
- 16/5/2011 09:40Z: Start of full Charge at C/26.
- 16/5/2011 09:42Z: Start of full Charge at C/13.
- 17/5/2011 07:11Z: 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	36.17	38.67

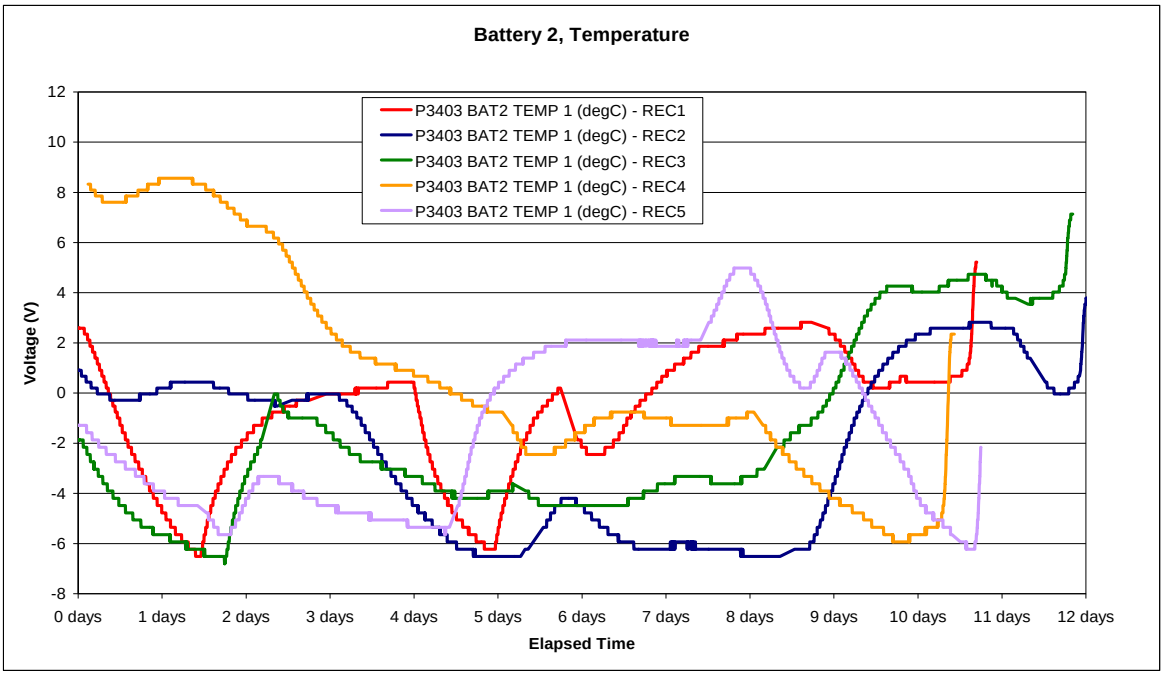
*K factor was 1.1 due to warm battery, for all other reconditionings a K factor of 1.075 was used.

The plot below illustrates the discharge profile of battery 2 during the 5 reconditionings executed to date:

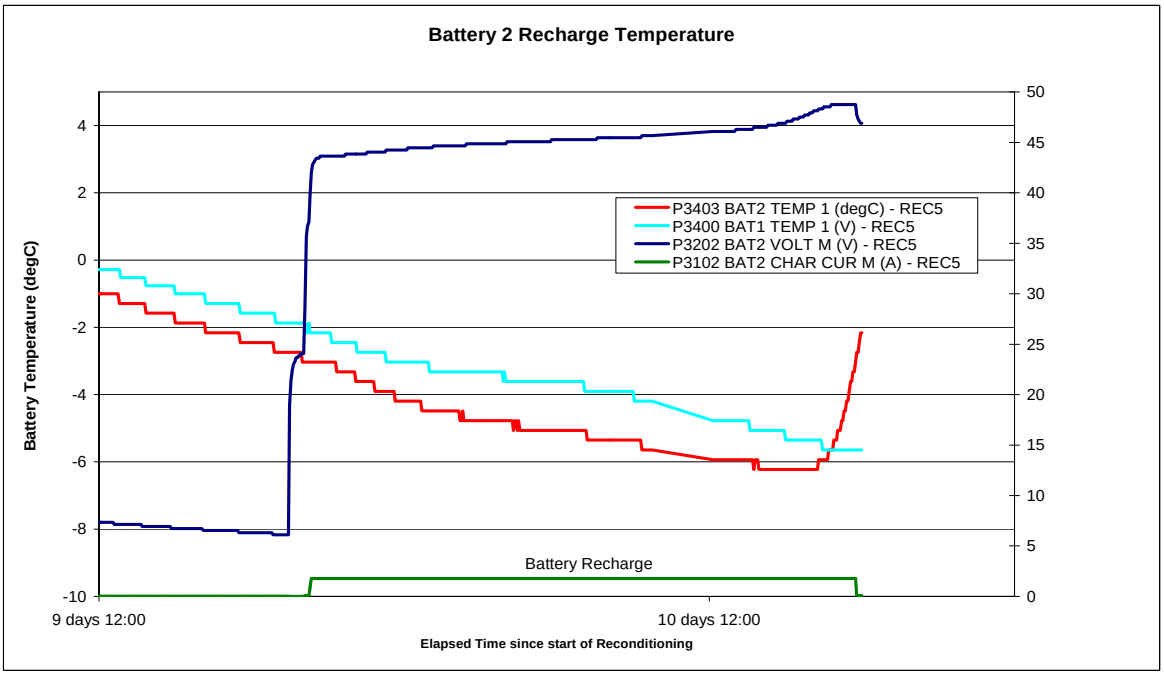


It can be seen that the discharge profile of reconditioning 5 is broadly in line with that of 1 to 4, the only difference being the lower (unusable) capacity below 20V.

The effect of battery temperature during reconditioning can be clearly seen. Reconditionings 2 and 3 with the longest discharge time were executed with the lowest mean battery temperatures (-2.7degC, -2.3degC respectively), reconditioning 4 with the shortest discharge time was executed at the highest mean battery temperature (+1.5degC), reconditionings 1 and 5 were executed with a mean battery temperature of -0.9degC and -1.13degC respectively.

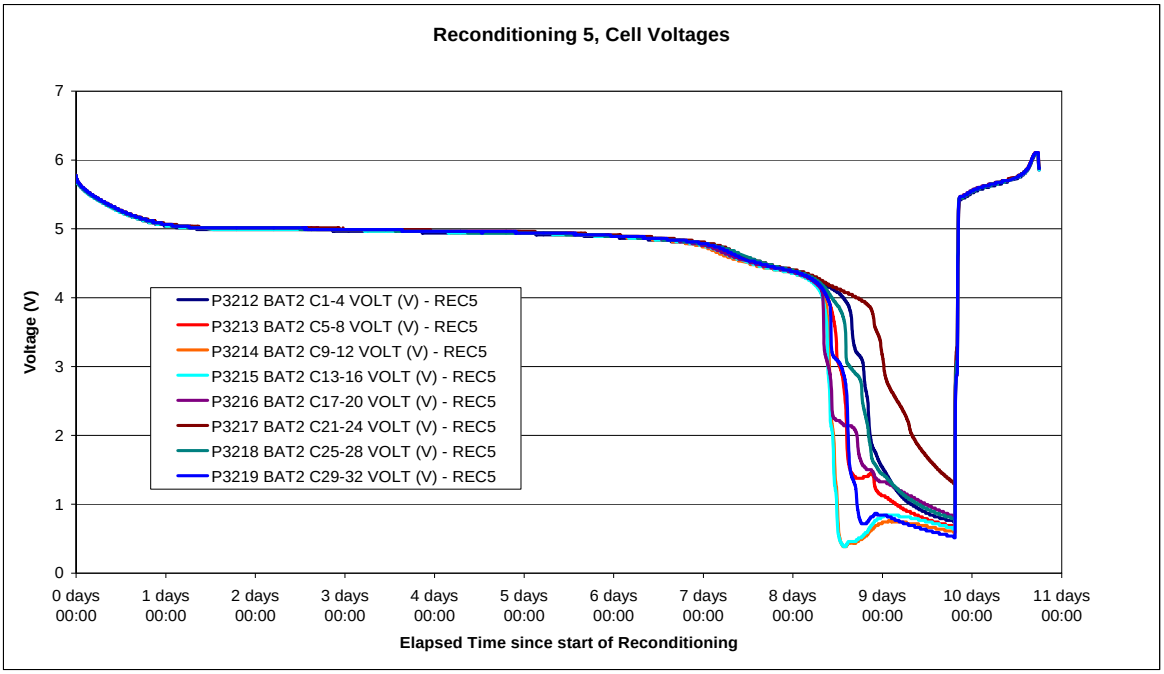


The sharp increase in battery temperature towards the end of the recharge phase indicates that in fact the battery was fully recharged – see plot below.



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

The 17th SPI annealing started on 25/04/2011 and ended on 12/05/2011. Following this annealing 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). Operations for the annealing were performed nominally (OCR 308).

The times for the main activities performed were as follows:

Date/Time	Activity
2011-04-25 23:12:44Z	**Configure SPI for start of Annealing and stop SPI active cooling**
2011-04-25 23:30:00Z	**Annealing Heater Main ON**
2011-04-26 01:30:00Z	**Annealing Heater Redundant ON**
2011-04-27 10:53:48Z	**Cold plate temperature reached 373K (100°C)**
2011-05-05 19:00:00Z	**Stop SPI Annealing: Annealing Heater Main and Redundant OFF; Heat Pipe Heater Main and Redundant OFF; Antifreeze Heater 1A ON**
2011-05-05 19:31:45Z	**ACS switch-on and start of ACS calibration (also FEE#57 and FEE#81 ON)**
2011-05-07 21:57:12Z	**End of ACS Calibration**
2011-05-08 10:05:01Z	**Thermal braids temperature TM EU0398A reached 308K**
2011-05-08 10:29:12Z	**Start of cryocooler switch-on**
2011-05-08 11:20:22Z	**Cyrocooler switch-on complete and stroke set to 4x45**
2011-05-11 19:15:41Z	**Cold plate temperature TM EU0392A reached 127K**
2011-05-11 20:38:00Z	**Selected narrow range cold plate temperature acquisition and restored PSD nominal threshold**
2011-05-12 15:17:01Z	**Cold plate temperature TM EU0392 reached 100K**
2011-05-12 16:04:00Z	**Camera switch-on start; HV of all GeD increased in 0.5kV steps to 0.5kV; 1kV; 1.5kV; 2kV; 2.5kV; 3kV; 3.5kV; 4kV with acquisitions in PHOTON mode in between from 2kV onwards**
2011-05-12 18:36:05Z	**Thermal braid temperature TM E0398 reached 86K**
2011-05-12 18:49:00Z	**Start of reduction of cryocooler stroke for 80K target (FCP_SPI1_0072)**
2011-05-12 19:03:00Z	**Camera switch-on end: SPI in PHOTON mode with all GeD HV at 3kV**
2011-05-12 19:16:00Z	**Restore nominal ACS configuration (FEE#57 and FEE#81 OFF) and nominal GeD HV: 3kV (HV of failed detectors GeD#1, GeD#2, GeD#5 and GeD#17 set to 0.5kV).**
2011-05-13 14:38:00Z	**End of reduction of cryocooler stroke for 80K target: Stroke set to 4x37**
2011-05-14 13:06:13Z	**Cold plate temperature TM EU0392 reached 80.9K**
2011-05-14 13:56:00Z	**Set nominal IASW parameters (Cold Plate Monitoring temperature)**

The Germanium detectors' temperature was kept in the range 80K+/-1K since the end of annealing #17.

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 2011-05-24T22:53:50Z to 2011-05-25T03:14:37Z (OMC Flat Field Calibration), when it was 88 packets/cycle and during the SPI annealing, when it was 30 packets/cycle.

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

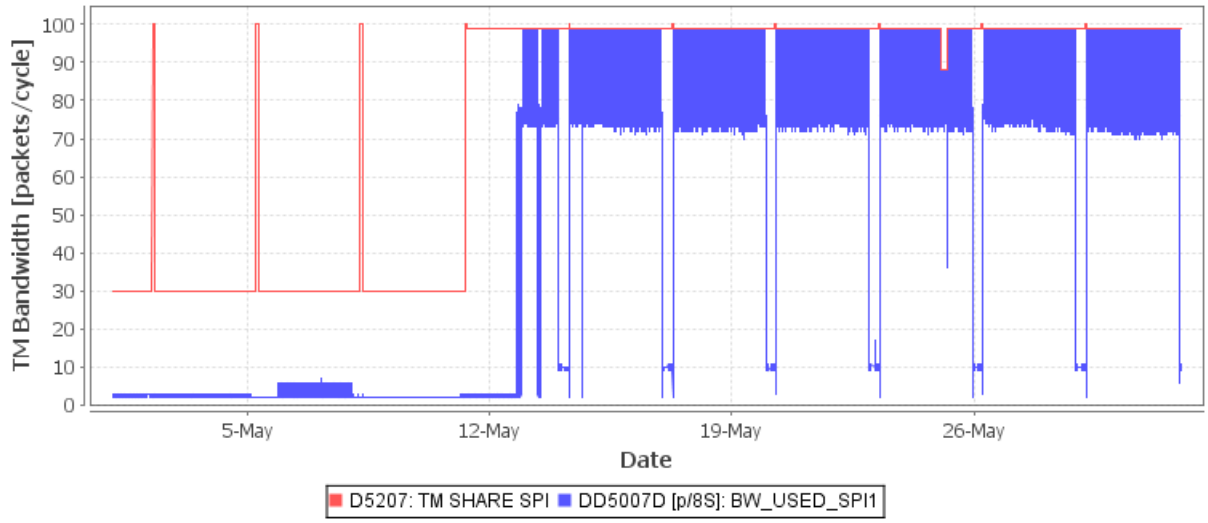


Figure 1: SPI TM bandwidth utilisation

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

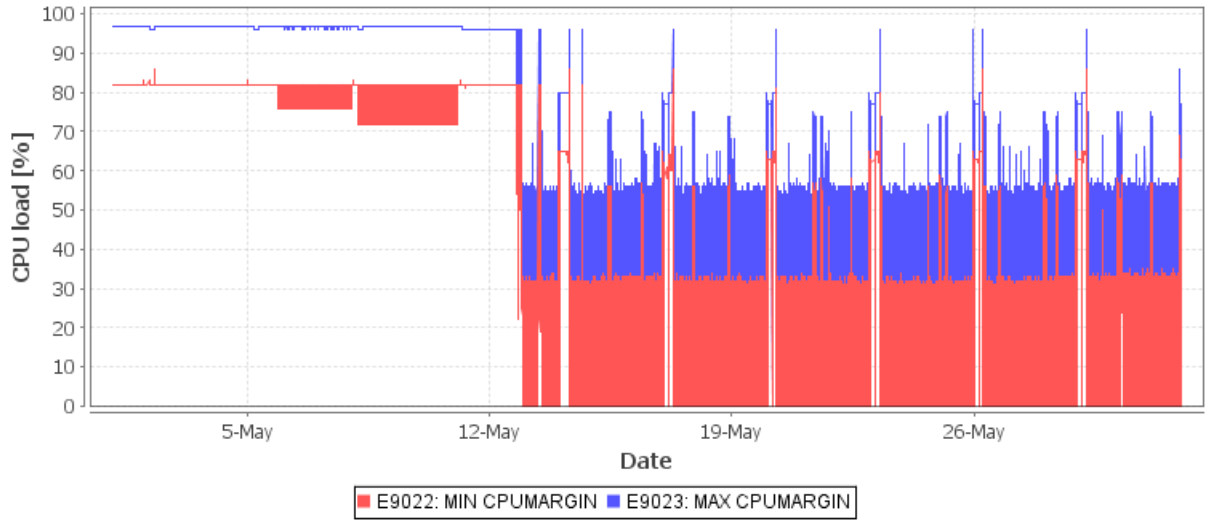


Figure 2: SPI IASW Performance

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

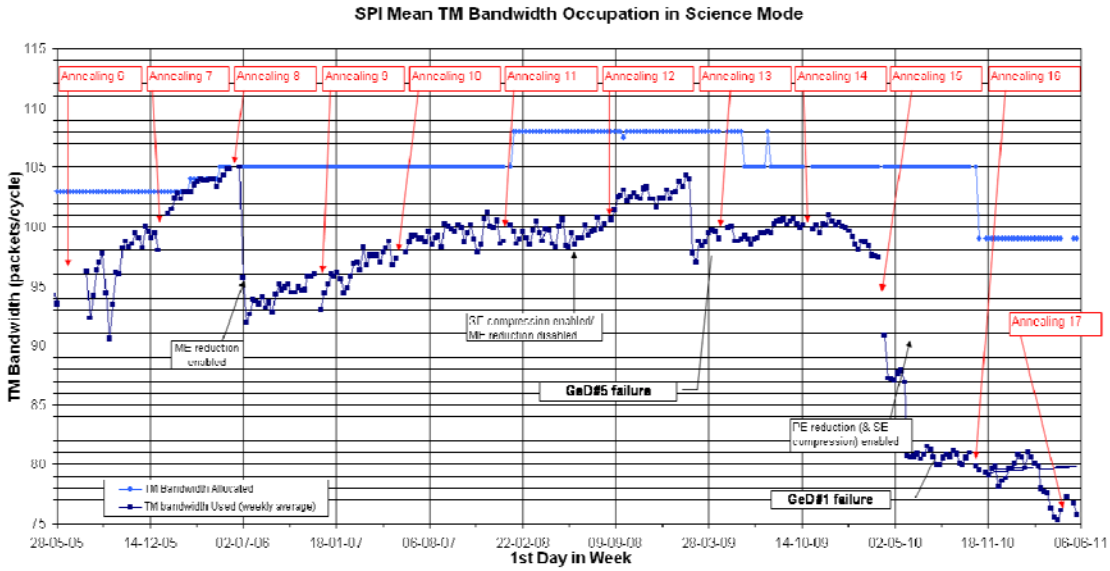


Figure 3: SPI TM bandwidth usage evolution since May 2005

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

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 2011-05-24T22:53:50Z to 2011-05-25T03:14:37Z (OMC Flat Field Calibration), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 108.346259 packets/cycle

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

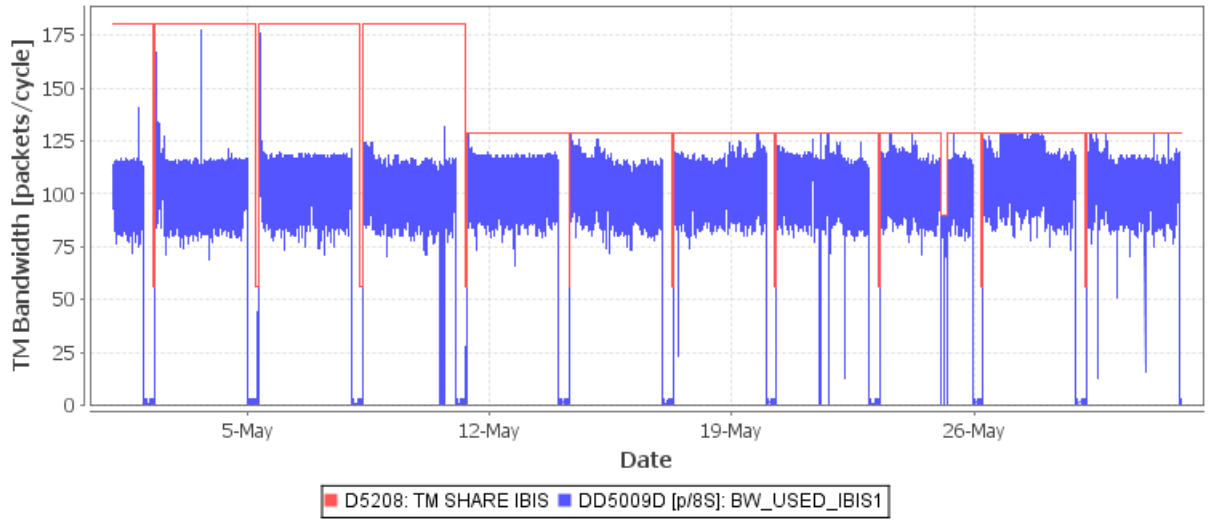


Figure 4: IBIS TM bandwidth utilisation

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

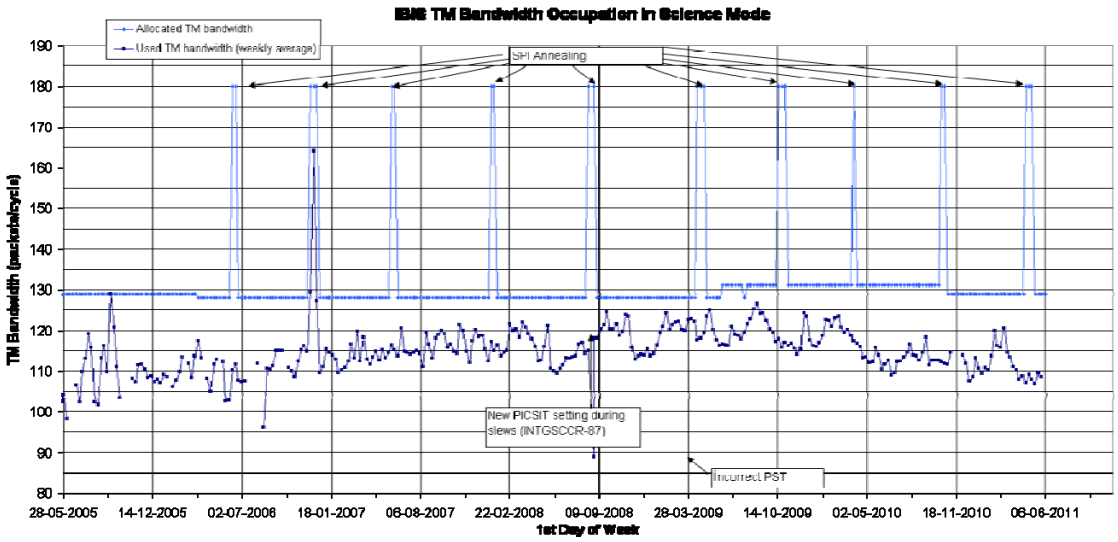


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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 the beginning of the month to 2011-05-10T21:18:10Z, 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 2011-05-24T22:53:50Z to 2011-05-25T03:14:37Z during the Flat-field calibration, when it was 63 packets/cycle, and from the beginning of the month up to 2011-05-10T21:56:58Z during the SPI annealing, when it was 9 packets/cycle.

During this reporting period, 655 of the 659 planned science pointings were executed nominally. One pointing was lost to an AOCS problem, one pointing was cut short by a SEU, and two pointings were cut short after the CCCFs were activated. 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.

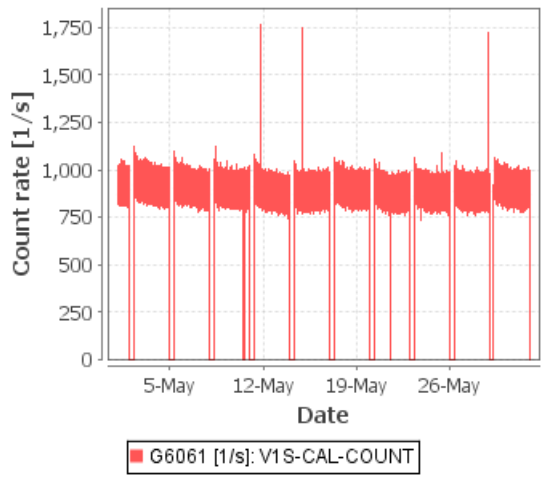
On DoY 141 (21/05/2011), the 109th IREM SEU occurred.

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

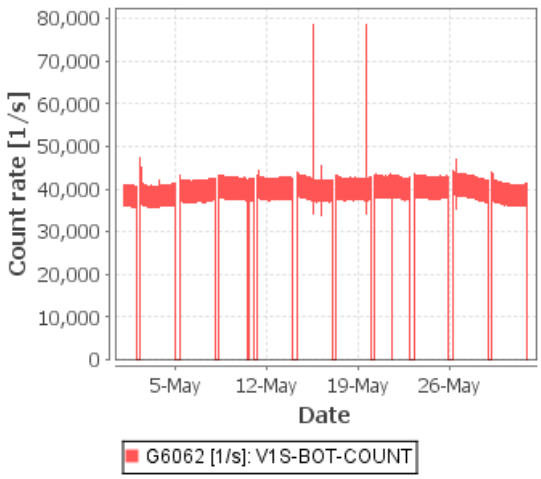
Radiation background

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 Calibration Source Count Rate



VETO Bottom Count Rate



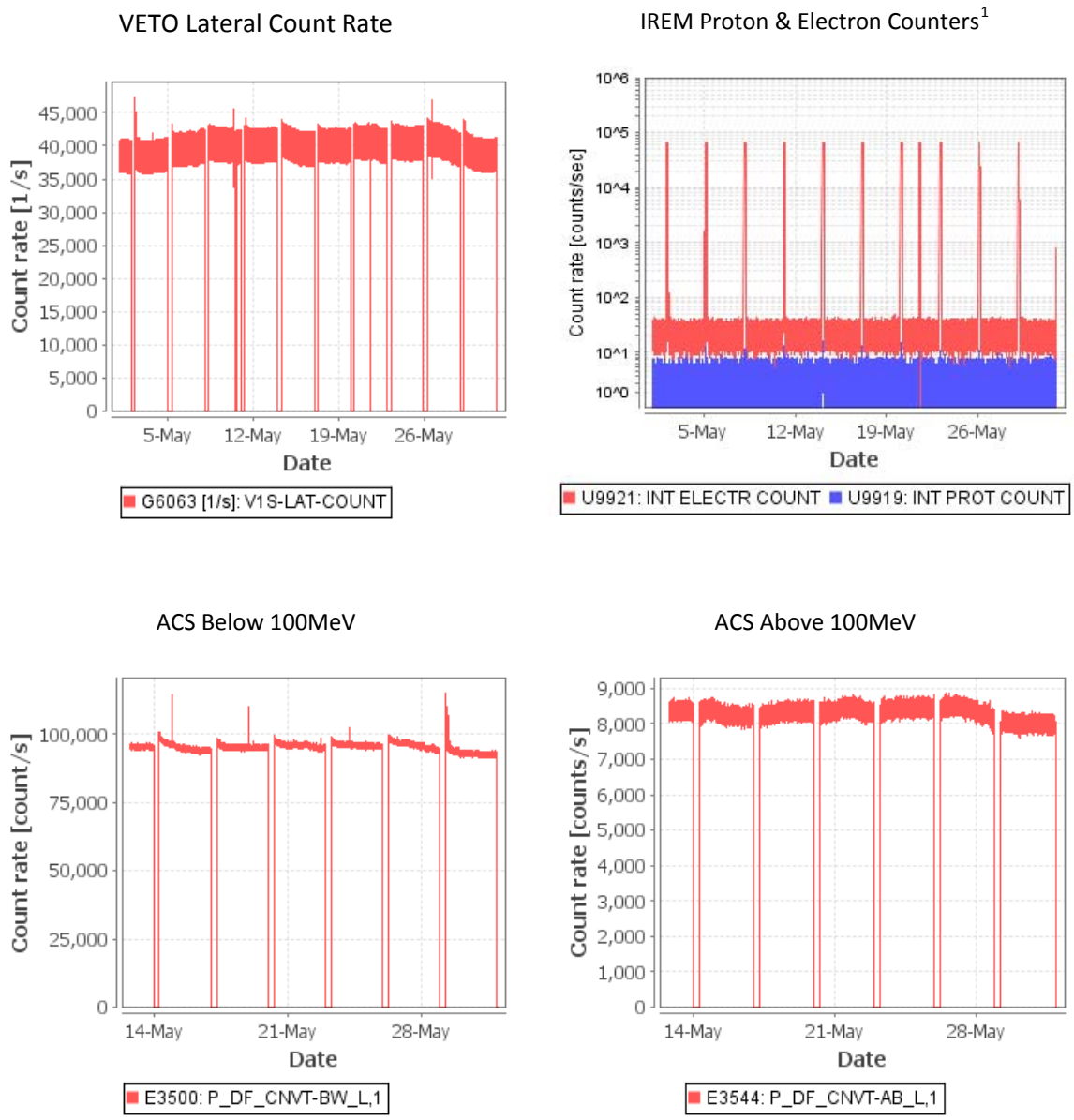


Figure 6: Instrument Count Rates

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

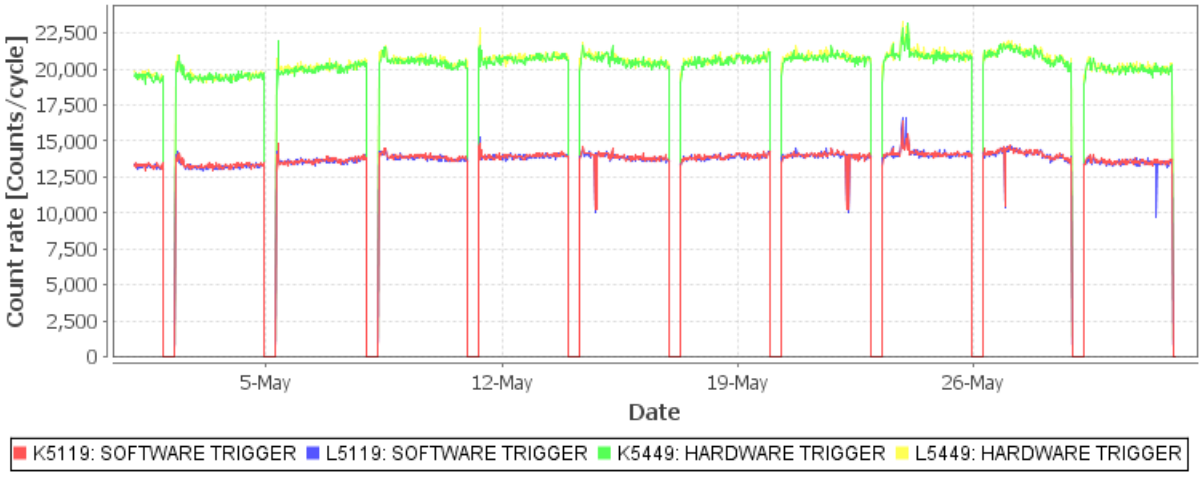


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

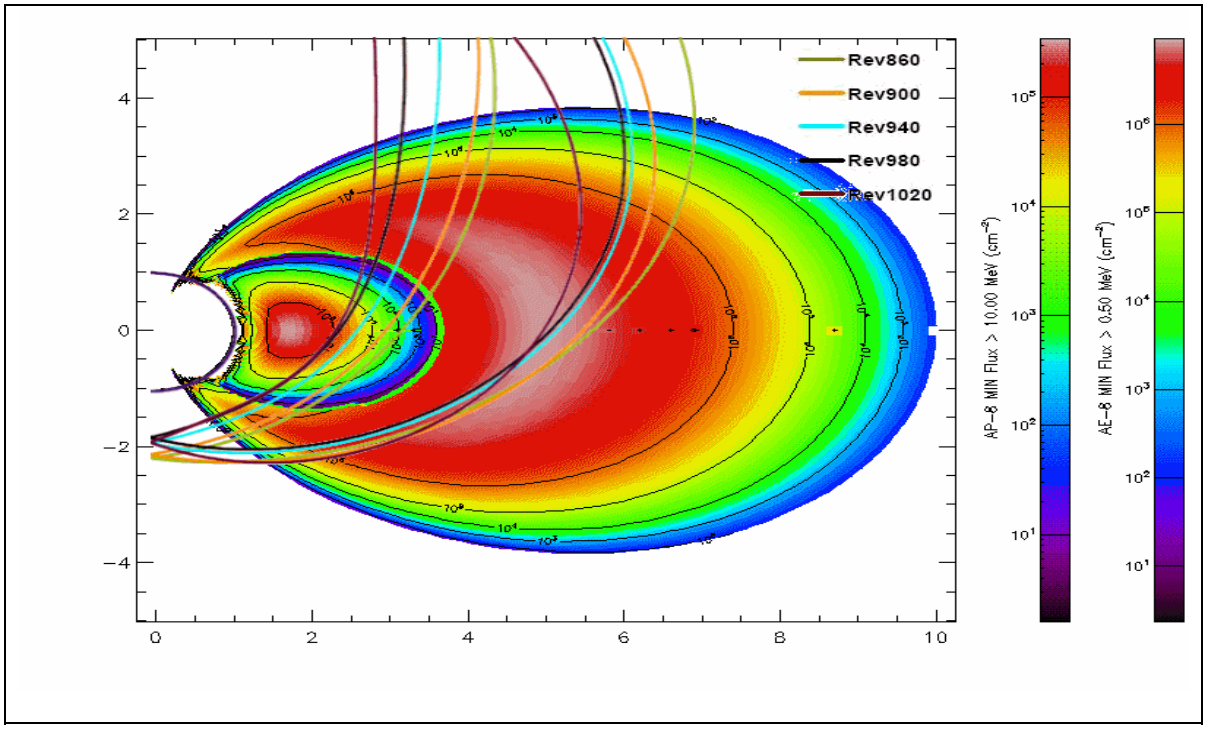


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

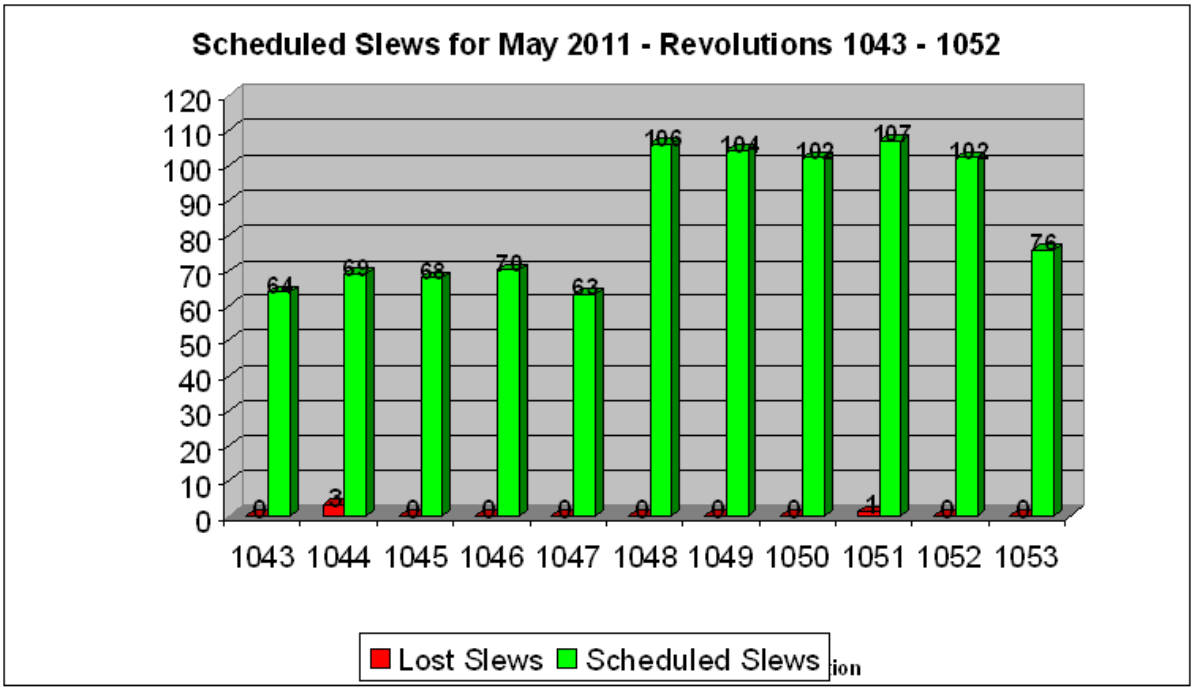


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DoY 127 the connection to ISDC dropped, however restarting the applications did not clear the problem. Even a reboot showed no effect.
This seemed to cause a build up of back-pressure down to the NCTRS and affected the VC7 data transfer to the MCS. The cause of the problem
was identified as a machine at ISDC which had crashed. The machine was rebooted and the problem was cleared.

On DoY 128 at AOS the multiplexer crashed on imca and as result the Automatic and Manual Stacks on the clients crashed too. The applications
were restarted without problems.
On DoY 131 all GTPs on the Flight Dynamics machine crashed and needed to be restarted.
On DoY 134 at AOS the multiplexer crashed again on imca and was restarted without further problems.
On DoY 140 at AOS the multiplexer died once more on imca as well as the OMCH task on imcb
On DoY 143 at AOS the CPD-EV and CPD-TM died on sun122 as well as the Manual Stack on sun121,

then the TCO-Client CPU usage increased and exceeded 75%.
All tasks were restarted which cleared the problems. Later both clients were fully restarted to be 100% sure.
On DoY 145 the TMDS_RT on imca exceeded the CPU usage threshold. The task was restarted and the CPU usage returned to nominal

The connection to ISDC dropped 31 times and the ISDS and IFRD tasks needed to be restarted on 15 occasions.

3.2 Ground Stations and Network

The performance of the ground stations and Network was good this month.

10 TM drops were identified and bad frames were received from REDU on 27 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.

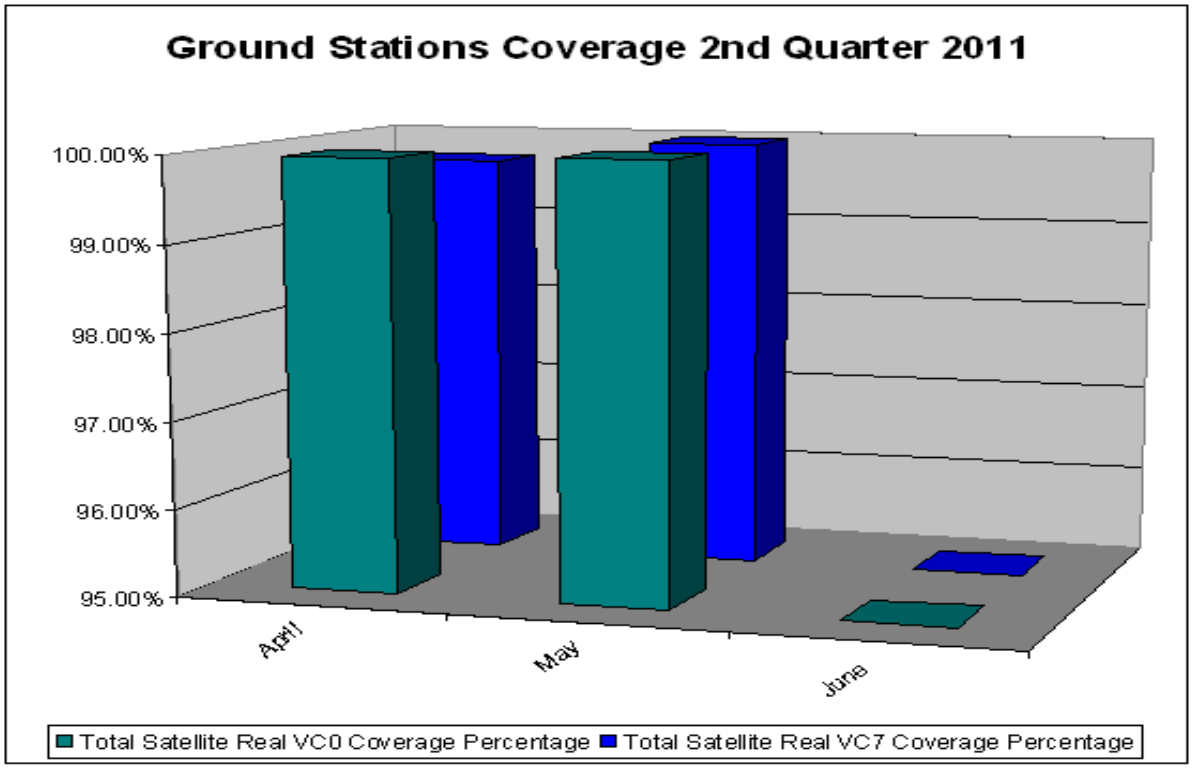


Figure 10: The usage of ESA ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1050 to 1062, corresponding to the time range 20 May to 27 June.

New observations have been planned for revolutions 1047 (11-13 May) to 1058 (13-15 June). TOO observations on the SMC source SXP85.4 were planned in revolution 1050. Problems with finding valid reaction wheel profiles led to urgent updates for revolutions 1051 and 1052.

TSFs have been received for revolutions 1046 to 1055.

3.3.2 Observation Status

New ECS files have been received for revolutions 1025 to 1034 (up to 5 April).

3.3.3 ISOC Science Data Archive

Syncing of rev_3 data has been done up to revolution 917, waiting for progress at the ISDC to continue.

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

3.3.4 ISOC System

V29.1 (AO9 TAC support) was released on 31 May fixing the PSF import for keywords with identical time stamps among other issues.

3.3.5 Problems

Besides the difficulties in obtaining valid reaction wheel patterns, the OMC Flatfield calibration in revolution 1051 had an ED placed outside the instrument window.

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-3150	2011-05-11	Definition of derived parameter PD3200D & PD3202D	IMCS	Pending
INT-3151	2011-05-09	ISGRI context tables missing on sun129	IMCS	Pending
INT-3152	2011-05-24	MCCM monitoring of the FDS	IMCS	Pending
INT-3153	2011-05-18	no audible alarm for TM drop on VC7		Pending
INT-3154	2011-05-19	MCCM alarm incorrectly caused by temp file	IMCS	Pending

		system full on FDS		
INT-3155	2011-05-31	X-Reference for ED Failure for OMC and JEM-X		Pending
INT_SC-324	2011-05-10	IBIS: VETO CDM01 HV breakdown	Payload	Pending
INT_SC-325	2011-05-21	IREM Anomaly: Reset of IREM_CSCI S/W #109, 21/05/2011	Payload	Pending
INT_SC-326	2011-05-25	A7213 Reset TIM accumulators failed	Spacecraft	Pending

5 Special Events & Future Milestones

The upcoming eclipse season #19 starts on June 27th 2011.

6 Appendix

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

6.1 AOCS operations

During this period, 483 Open Loop Slews, 404 Closed Loop Slews and 29 Momentum Biases were executed (as reported by ACC OEM).

7 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 31/05/2011 is reported in the following plot:

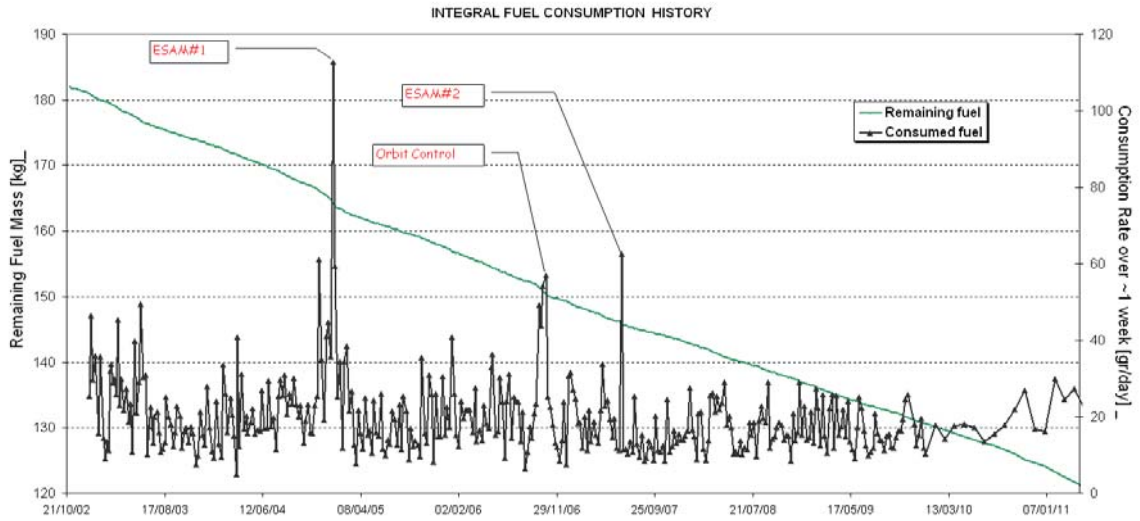


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

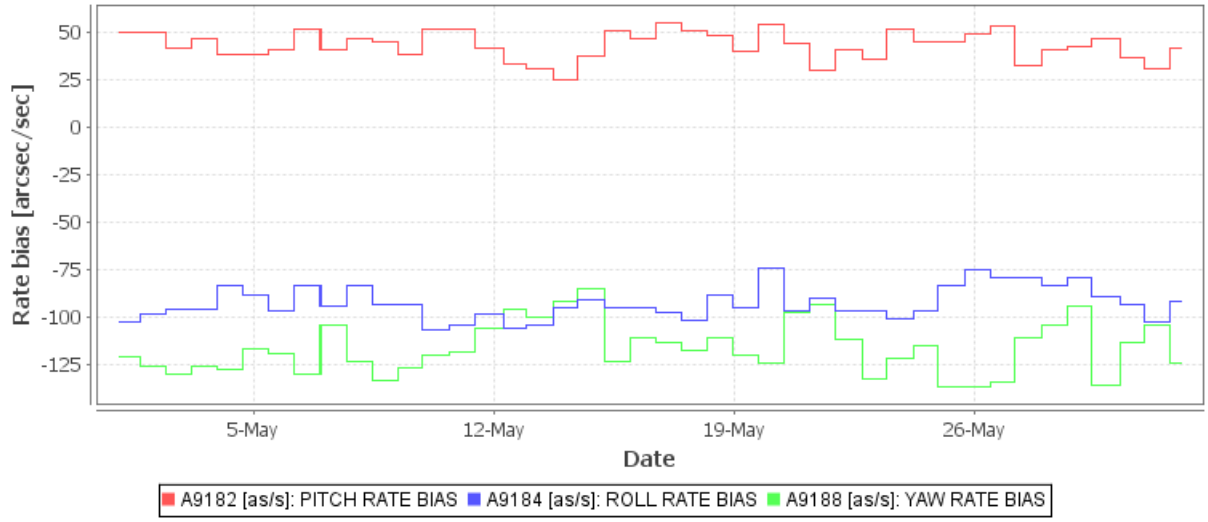


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

02/05/2011 (Day of Year 122, Revolution 1043 to 1044)

FDS TPF update failed for slew 10440020 (20:07:00Z).The AOCS was suspended in the Timeline, then a manual mapping was commanded and the parameters for slew 10440020 were manually updated (spacontool).

No impact in the timeline

03/05/2011 (Day of Year 123, Revolution 1044)

Autostack commanding for slew 10440036 (13:49:04Z) failed release. The AOCS was suspended in the Timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10440035 to attitude 10440037.

After the manual slew was completed, the parameters for slew 10440038 were manually updated (spacontool).

Slews 10440036 and 10440037 were missed from the Timeline. The OTF was not reached for their PIDs.

04/05/2011 (Day of Year 124, Revolution 1044)

Autostack commanding for slew 10440067 (22:01:57Z) failed release. The AOCS was suspended in the Timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10440066 to attitude 10440067.

After the manual slew was completed, the parameters for slew 10440068 could not be updated since a RWB was necessary. FD was called in to perform a RWB, just before LOS at perigee.

After AOS, a manual slew was performed from attitude 10440067 to attitude 10440069 followed by a manual RWB.

Following completion of the RWB, a manual mapping was commanded and the parameters for 10450001 updated.

Slews 10440067, 10440068 and 10440069 were missed from the Timeline. The OTF was not reached for their PIDs.

24/05/2011 (Day of Year 144, Revolution 1051)

FDS TPF update failed for slew 10510042 (03:12:00Z).The AOCS was suspended in the Timeline , then a manual mapping was commanded and a slew was manually generated from attitude 10510041 to attitude 10510042.

After the manual slew was completed, the parameters for slew 10510043 were manually updated (spacontool).

Slew 10510042 was missed from the Timeline. The OTF was not reached for its PID.

30/05/2011 (Day of Year 150, Revolution 1053)

FDS TPF update failed for slew 10530032 (03:09:00Z).The AOCS was suspended in the Timeline , then a manual mapping was commanded and a slew was manually generated from attitude 10530031 to attitude 10530032.

After the manual slew was completed, the parameters for slew 10530033 were manually updated (spacontool).

Slew 10530032 was missed from the Timeline. The OTF was not reached for its PID.

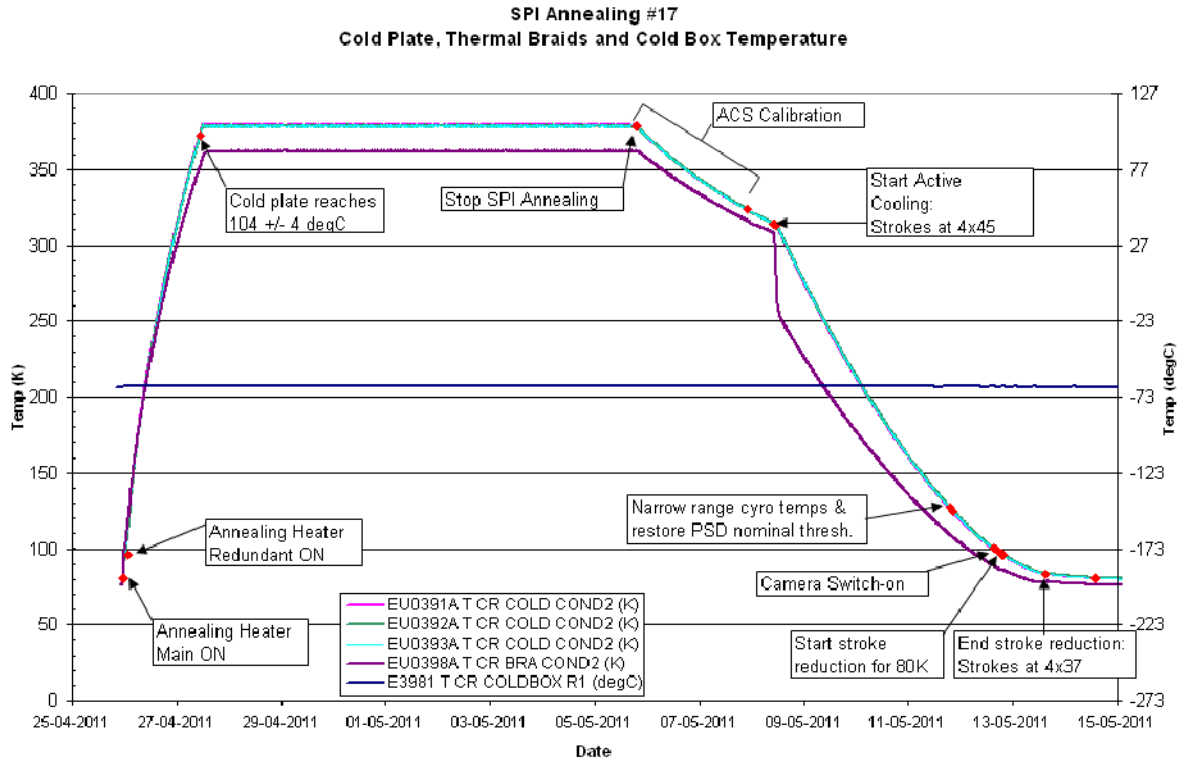
6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

The cryocooler had been put in Standby at the start of annealing on 25/04/2011 and remained in Standby until the start of active cooling on 08/05/2011. After the cryocooler switch-on, all four compressors were operated at full stroke (45) until 12-05-2011T18:49:00Z, when the stroke reduction to achieve 80K on the Cold Plate was started. The final stroke of 37 was reached at 13/05/2011 T14:37:30Z and the 80K range on the Cold Plate was reached at 14/05/2011. Since then the Cold Plate temperature was maintained in the range 80K +/- 1K. The Cold Box temperature was maintained at -65 degC during the complete annealing cycle. On 31-05-2011T20:45:00Z the stroke of all four compressors was set to 38.

The following plot shows the evolution of the Cold Plate, thermal braids and Cold Box temperatures during the annealing cycle.



The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K after annealing #17.

The following plot shows the evolution of the cold plate and H bus temperature during the reporting period.

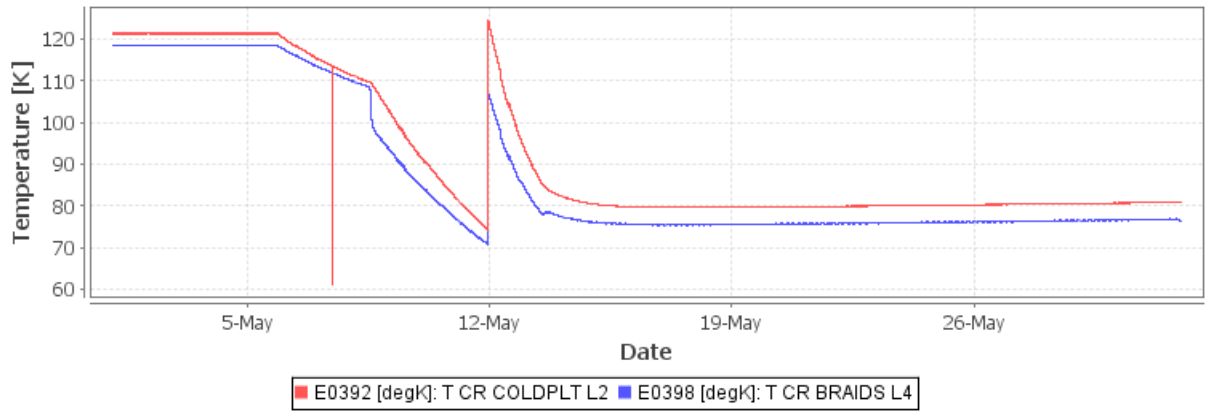


Figure 13: SPI Cold plate and H-bus temperature

The evolution of the cold plate and H bus temperature since the end of annealing is illustrated in the following plot:

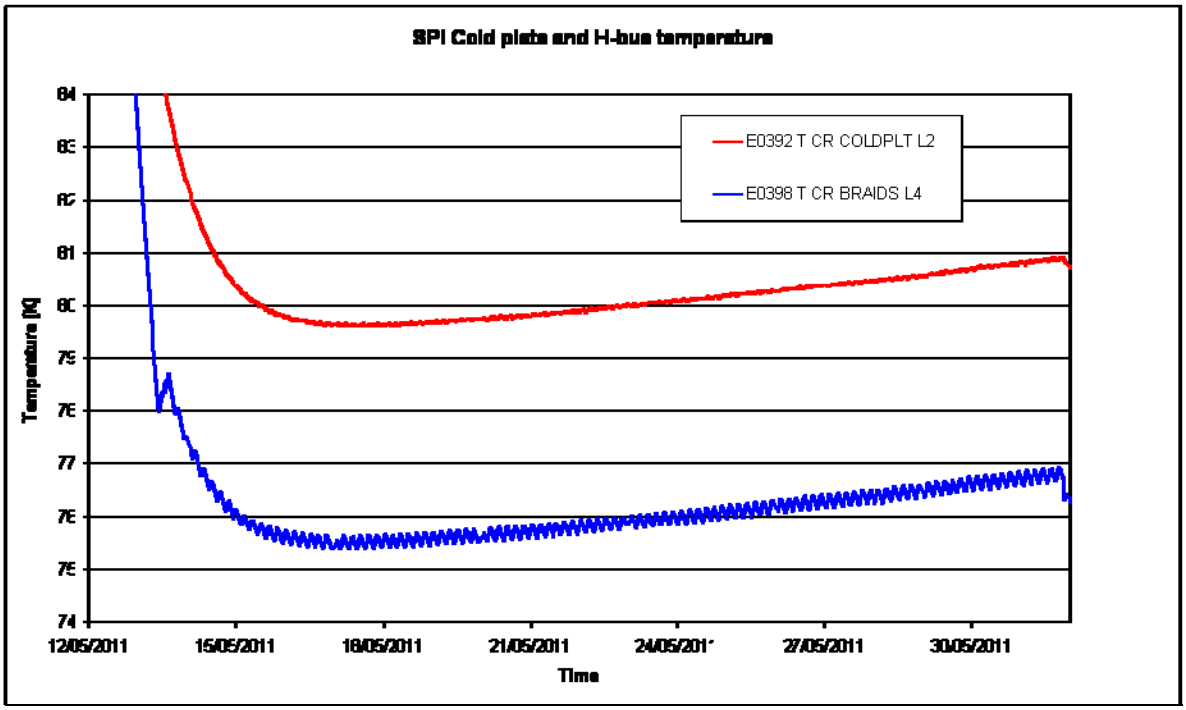


Figure 14: SPI Cold plate and H-bus temperature since the end of annealing.

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

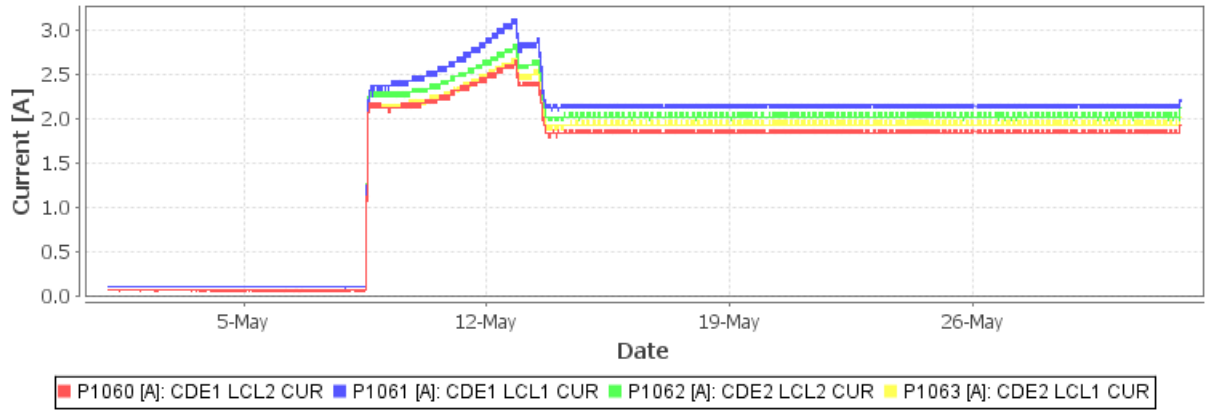


Figure 15: SPI CDE LCL curent

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. Due to the annealing operations, the IASW was in CONF mode from the start of annealing until the camera switch-on performed on 12/05/2011. The spectra scaling factor has remained set to 7/19 SE. The DPE CPU usage was nominal during the reporting period (see Figure 2).

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 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.

Due to the annealing operations, all detector HVPSs were switched off and only the LVPSs left on with the AFEE in CONF mode from the start of annealing until the SPI camera switch-on, which started on 12/05/2011 at 16:00Z. Following the end of the camera switch-on, in line with OCR-308, the nominal GeD High Voltages have now been set to 3kV.

The following plot shows the AFEE DC output voltages over the reporting period.

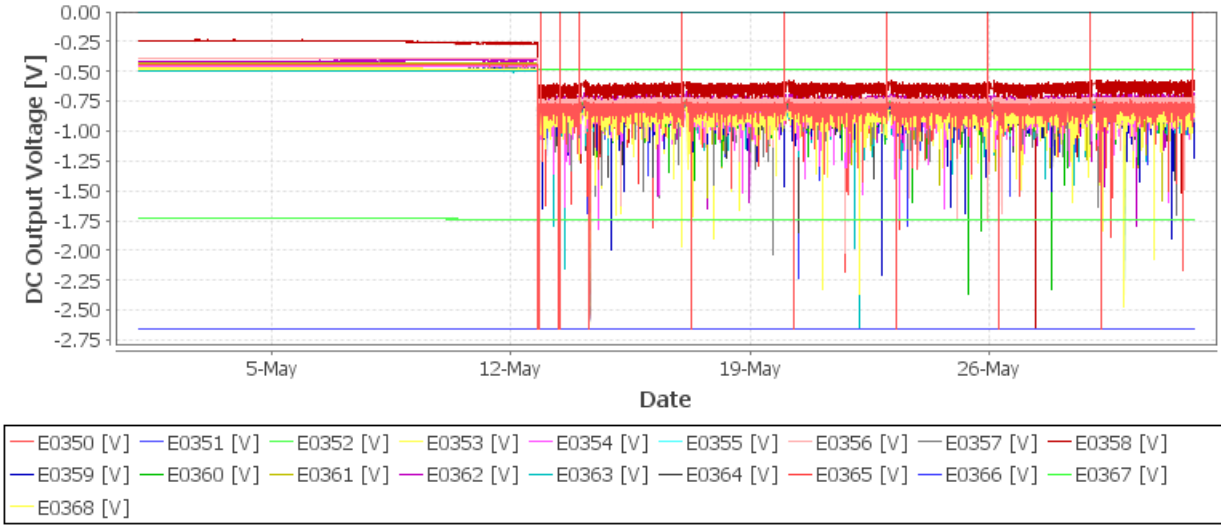


Figure 16: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

DFEE

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

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

Figure 17: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic

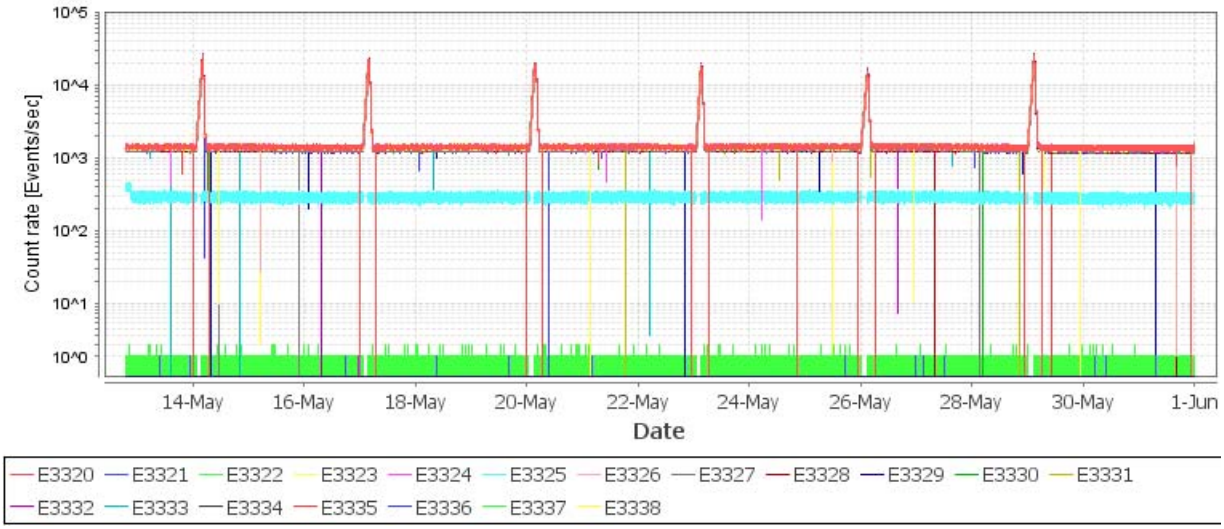


Figure 18: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic

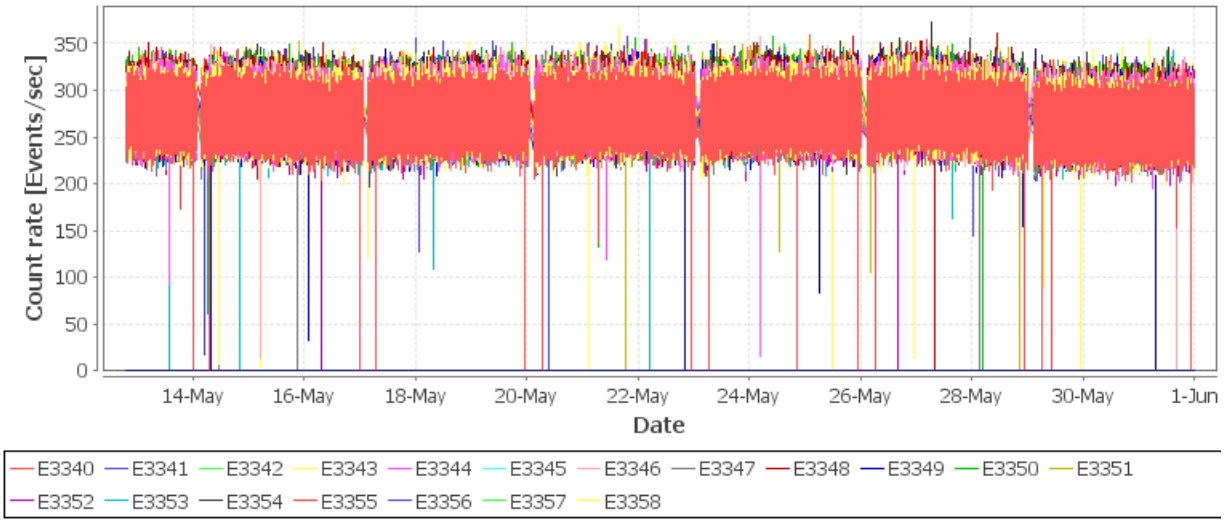


Figure 19: SPI GeD Time Tagged Saturated count rates

PSD

The health of the PSD is nominal. Due to the annealing operations, the PSD was in CONF mode from the start of annealing until the SPI camera switch-on, which started on 12/05/2011 at 16:00Z (OCR-308). The following plot shows the PSD channel rates over the reporting period:

Figure 20: SPI PSD GeD Channel rates

6.2.2 Event Log

05-05-2011 (Day of Year 125, Revolution 1045)

At 19:00Z the 17th SPI annealing was stopped: the annealing heaters were switched off, ACS was switched on and the ACS calibration started. After the passive cooling when the thermal braids reached 308K on 08-05-2011 at 10:05Z the cryocooler has been switched on on 08-05-2011 at 10:29Z and all four compressors were operated at full stroke (45) until 12-05-2011T18:49:00Z. Then the stroke reduction was started to achieve 80K on the Cold Plate.

The camera was switched on on 12-05-2011 at 16:05Z and the HV increased in steps of 0.5kV from 0.5kV to 4kV.

From 12-05-2011 at 18:50Z the stroke of the compressors was gradually reduced from 45 to 37 (37 was reached on 13-05-2011 at 14:40Z) for the 80K target temperature followed by the restoration of the nominal ACS configuration (FEE#57 and FEE#81 OFF) and the nominal GeD HV (failed GeD#1, #2, #5 and #17 set to 0.5kV).

On 14-05-2011 at 14:00Z the IASW parameters were set to nominal.

On 31-05-2011 at 20:50Z the stroke of the compressors was increased to 38.

02-05-2011 (Day of Year 122, Revolution 1044)

At 02:54Z 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.

12-05-2011 & 13-05-2011 (Day of Year 132 & 133, Revolution 1047)

Several occurrences (at 2011.132.19.31.15.056Z, 2011.132.19.31.15.181Z, 2011.133.02.20.10.949Z, 2011.133.02.38.48.950Z, 2011.133.02.38.49.075Z, 2011.133.14.58.24.983Z and 2011.133.14.58.25.108Z) of OEM APID 1024 ID 229 EXCEPTION SPI1 PARTIAL FLAG OVERFLOW were received during the reporting period, in between the time of the camera switch-on post annealing

and the time that the 80K range was reached on the Cold Plate. As they were each single occurrences and this is known to happen when the Cold Plate is warmer than nominal, no action was required.

17-05-2011 (Day of Year 137, Revolution 1048/1049)

At 01:54Z 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.

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:

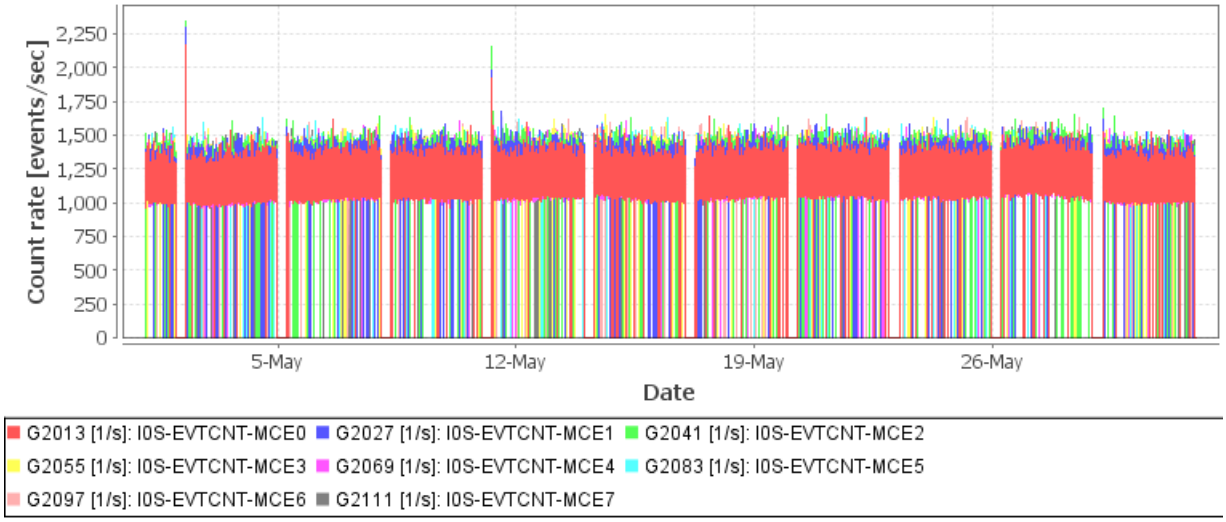


Figure 21: ISGRI MCE Counters

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:

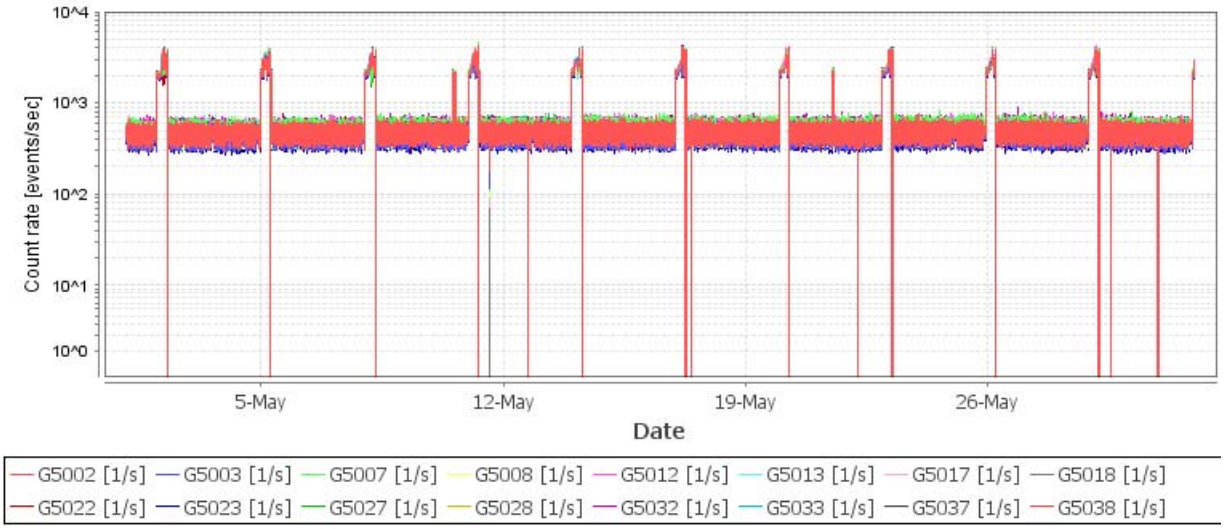


Figure 22: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic

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

10/05/2011 (Day of Year 130, Revolution 1046)

On 10-05-2011 at 10:43:00Z, the following VETO OOL appeared:
TM: G6011 'V1S-CDM1TEMP' H/H-OOL (value= 104.40 degC)
TM: G6051 'V1S-CDM01HV' H/L-OOL (value= -31.50 degC)
TM: G6061 'V1S-CAL-COUNT' H/L-OOL (value= 340 1/s)

Simultaneously, several OEM APID 1280 ID 186 ANOMALY IBIS1 VETO PMTXX IS ON AND CORRESPONDING HV MONIT IS ABOUT ZERO were received (8 OEMs every 8 second cycle).

In order to perform the recovery the cross reference was entered by parameter G6051 (recovery as per G6035). This consideres two options for recovery depending on whether the OOL is persistent or not.

Although the OOL was still present, the recovery was performed via the "OOL not present" recovery, which involved:

2011-05-10 10:44:00 (130) S/S IBIS disabled on the A/S

2011-05-10 10:49:00 (130) FCP_IBIS1_0313 IBIS to standby

2011-05-10 10:50:00 (130) FCP_IBIS1_0203 VETO to standby

2011-05-10 11:16:00 (130) FCP_IBIS1_0201 VETO to nominal

2011-05-10 11:17:00 (130) TC: G0129 sent IBIS1 to scien. standard

Once the recovery was completed, even though the peripheral behaviour look nominal, after checking with the instrument SOE it was decided to go back to stand-by and perform the procedure as per cross-reference, that is:

2011-05-10 12:33:00 (130) FCP_IBIS1_0313 IBIS to standby

2011-05-10 12:34:00 (130) FCP_IBIS1_0203 VETO to standby

2011-05-10 12:35:00 (130) FCP_IBIS1_0205 VETO to maintenance

2011-05-10 13:22:00 (130) FCP_IBIS1_0203 VETO to standby

2011-05-10 13:23:00 (130) FCP_IBIS1_0201 VETO to nominal

2011-05-10 13:23:01 (130) TC: G0129 sent IBIS1 to scien. standard

Nominal operations resumed at this point.

17/05/2011 (Day of Year 137, Revolution 1048 to 1049)

OEM: "IBIS1 PICSIT NOISY SEMIMODULE ..."

OEM: IBIS1 HEPI RESYNCHRONIZED

21/05/2011 (Day of Year 141, Revolution 1050)

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 2011.141.10.55.00Z. It was recovered as follows:

- 2011.141.11.08.00Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- 2011.141.11.18.00Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.

IBIS operations continued nominally.

22/05/2011 (Day of Year 142, Revolution 1050)

OEM: IBIS1 HEPI RESYNCHRONIZED

29/05/2011 (Day of Year 149, Revolution 1053)

OEM: IBIS1 HEPI RESYNCHRONIZED

30/05/2011 (Day of Year 150, Revolution 1053)

OEM: IBIS1 HEPI RESYNCHRONIZED

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.

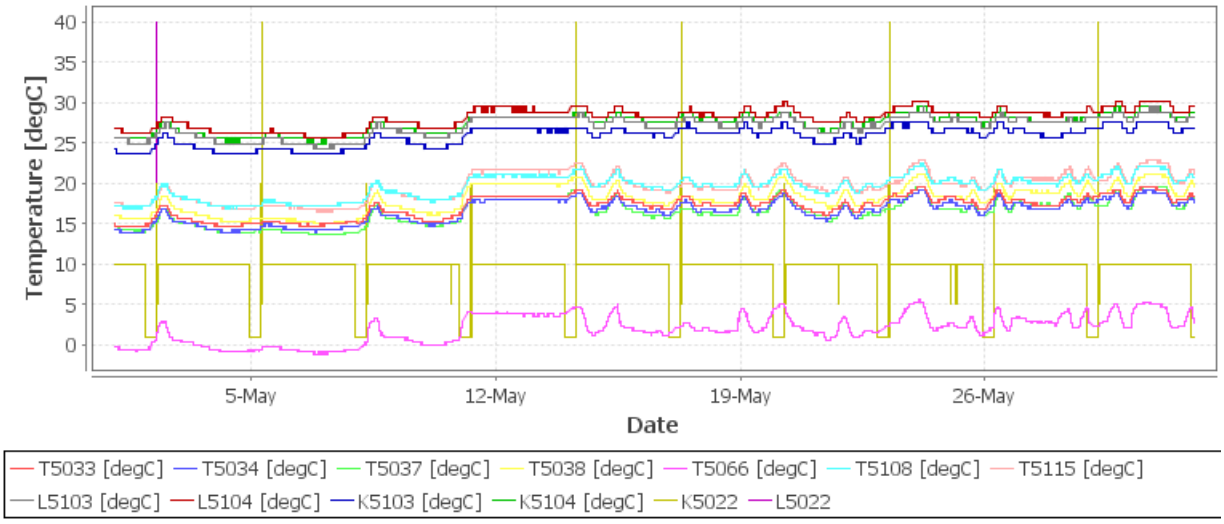


Figure 23: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

2011_05_21 (Day of Year 141, Revolution 1050)

At 10:55:10 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#109). 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

2011-05-03 (DoY 123, Rev 1044)

At 13:49:04, an AOCS problem forced a suspension of the timeline. At 14:33, after a recovery, OMC was re-enabled. The impact was the loss of pointing 10440036.

2011-05-10 (DoY 130, Rev 1046)

At 14:55:57, as part of the recovery of an earlier IBIS problem, the CCCFs were activated. This caused OMC to switch back to standby. At 15:00:00, the pointing commands were manually resent. The impact was pointing 10460063 was cut short from a planned 3479 to 2912 seconds.

2011-05-21 (DoY 141, Rev 1050)

At 10:55:10, an IREM SEU (#109) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 11:05:12. The SEU occurred a few seconds after the end of pointing 10500035, OMC was recovered to standby at 11:05:12. However, it was not enabled in the timeline, and the commands had to be manually sent. The impact was pointing 10500037 was cut short from a planned 2600 to 2584 seconds.

At 17:40:13, as part of the recovery of the earlier IREM SEU, the CCCFs were activated. This caused OMC to switch back to standby. At 17:48:00, the pointing commands were manually resent. The impact was pointing 10500049 was cut short from a planned 2600 to 1736 seconds.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 24, red line) and Exit times (Figure 25, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 24 and the magenta line in Figure 25 are the altitudes used by the MOC for planning purposes.

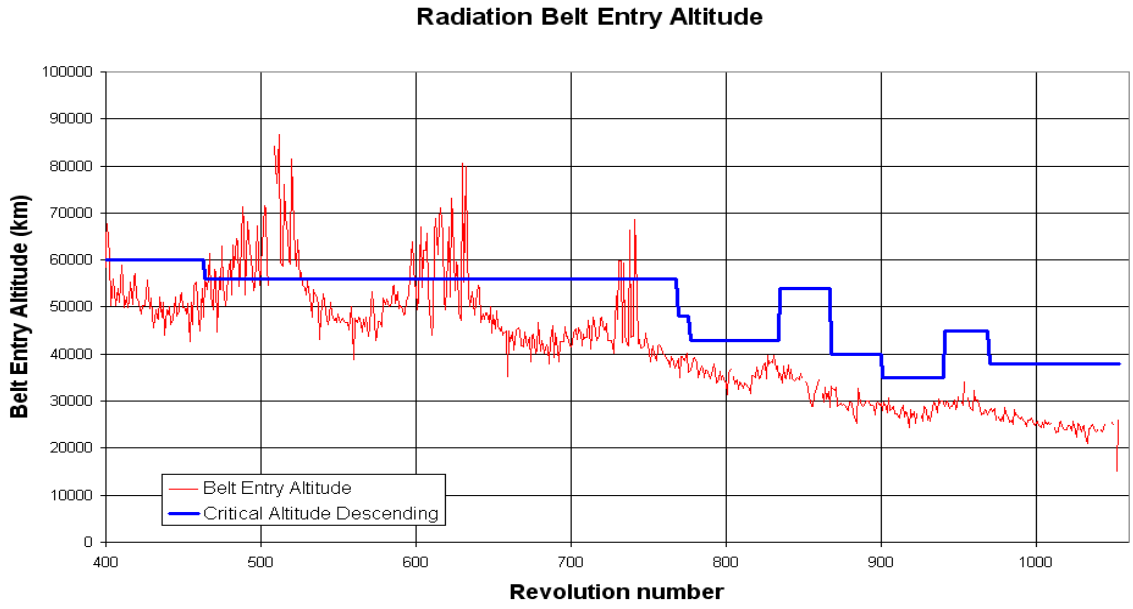


Figure 24: Radiation belt entry

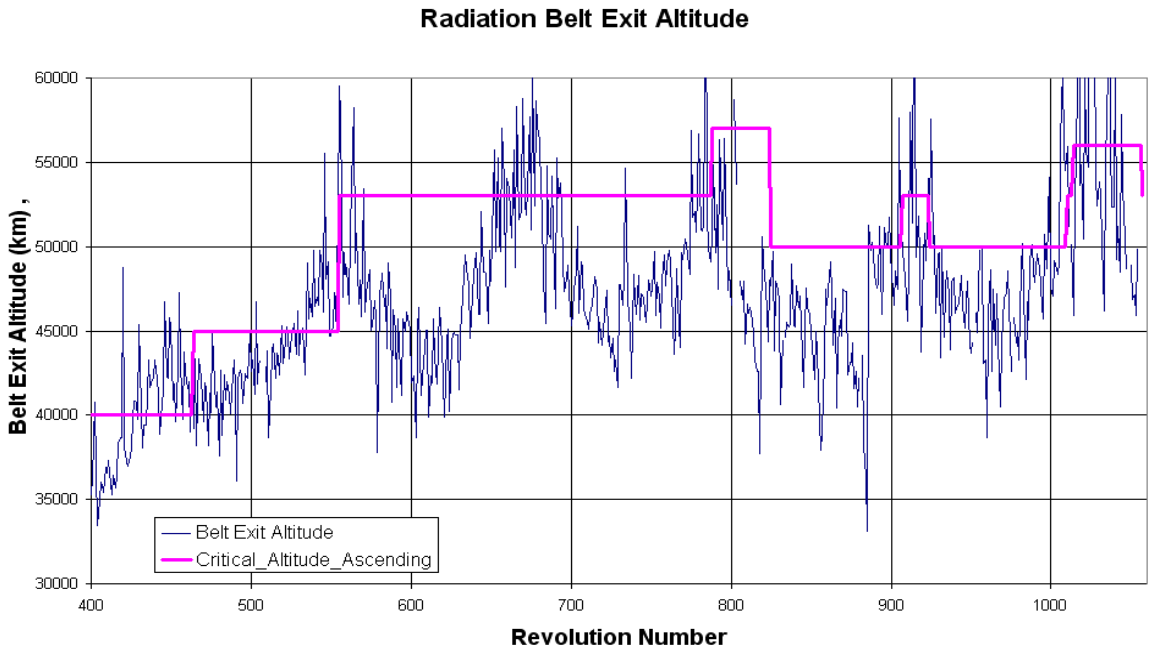


Figure 25: Radiation belt exit

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
1043	RAD_ENTR R 2011-05-01T22:34:59Z	N/A	N/A	02-May-2011 00:05:56	17415	02-May-2011 00:45:56	7481.426
1044	RAD_EXIT R 2011-05-02T05:52:46Z	02/05/2011 07:43:56	71083.3	02-May-2011 04:55:56	47874.26	02-May-2011 01:15:56	3145.282
1044	RAD_ENTR R 2011-05-04T22:23:13Z	04/05/2011 23:52:44	19730.1	04-May-2011 23:54:59	17026.84	05-May-2011 00:24:59	9550.76
1045	RAD_EXIT R 2011-05-05T05:41:05Z	05/05/2011 05:19:00	52546.9	05-May-2011 04:44:59	48110.01	05-May-2011 01:04:59	3221.289
1045	RAD_ENTR R 2011-05-07T22:10:07Z	N/A	N/A	07-May-2011 23:34:02	18995.91	08-May-2011 00:14:02	9133.693
1046	RAD_EXIT R 2011-05-	08/05/2011 04:19:00	44776.5	08-May-2011 04:34:02	48349.26	08-May-2011 00:54:02	3374.873

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
	08T05:28:22Z						
1046	RAD_ENTR R 2011-05-10T21:57:06Z	N/A	N/A	10-May-2011 23:26:52	17466.97	11-May-2011 00:06:52	7551.621
1047	RAD_EXIT R 2011-05-11T05:15:05Z	11/05/2011 03:58:20	>>28973.1	11-May-2011 04:16:52	47808.45	11-May-2011 00:36:52	3173
1047	RAD_ENTR R 2011-05-13T21:46:37Z	13/05/2011 23:14:12	19689.6	13-May-2011 23:12:09	18187.67	13-May-2011 23:52:09	8213.625
1048	RAD_EXIT R 2011-05-14T05:03:56Z	14/05/2011 03:42:52	>>29015.5	14-May-2011 04:02:09	47403.1	14-May-2011 00:22:09	3087.229
1048	RAD_ENTR R 2011-05-16T21:37:32Z	N/A	N/A	16-May-2011 23:01:44	18256.82	16-May-2011 23:41:44	8290.972
1049	RAD_EXIT R 2011-05-17T04:54:41Z	17/05/2011 03:25:09	>>3229022.5	17-May-2011 03:51:44	47342.4	17-May-2011 00:11:44	3107.773
1049	RAD_ENTR R 2011-05-19T21:26:43Z	19/05/2011 22:53:57	20599.9	19-May-2011 22:46:03	19328.88	19-May-2011 23:26:03	9460.47
1050	RAD_EXIT R 2011-05-20T04:44:32Z	20/05/2011 03:24:53	42959.2	20-May-2011 03:46:03	48151.87	20-May-2011 00:06:03	3263.143
1050	RAD_ENTR R 2011-05-22T21:13:40Z	N/A	N/A	22-May-2011 22:33:39	19452.5	22-May-2011 23:13:39	9629.857
1051	RAD_EXIT R 2011-05-23T04:32:07Z	23/05/2011 03:00:13	>>28942.7	23-May-2011 03:33:39	47990.15	22-May-2011 23:53:39	3316.953
1051	RAD_ENTR R 2011-05-25T21:00:11Z	N/A	N/A	25-May-2011 22:25:40	18209.74	25-May-2011 23:05:40	8334.901
1052	RAD_EXIT R 2011-05-26T04:18:38Z	26/05/2011 02:49:49	41304.2	26-May-2011 03:15:40	47223.16	25-May-2011 23:35:40	3272.149
1052	RAD_ENTR R 2011-05-	N/A	N/A	28-May-2011 22:12:59	17938.74	28-May-2011 22:52:59	8028.589

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
	28T20:48:03Z						
1053	RAD_EXIT R 2011-05-29T04:06:13Z	29/05/2011 02:35:33	>>28960.2	29-May-2011 03:02:59	47466.8	28-May-2011 23:22:59	3186.679
1053	RAD_ENTR R 2011-05-31T20:35:37Z	31/05/2011 22:01:01	20508.0	31-May-2011 22:02:59	17258.91	31-May-2011 22:32:59	9808.51
1054	RAD_EXIT R 2011-06-01T03:54:02Z	N/A	N/A	01-Jun-2011 02:52:59	47906.97	31-May-2011 23:12:59	3236.578

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

21-05-2011 (Day of Year 141, Revolution 1050)

At 10:55:09Z, a local reset of the IREM CSCI S/W (SEU #109) 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 2011.141.10:55:09Z (159406.6 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 = 1011110010100000, 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 12:42:00Z.

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 PIs request. OMC was recovered at 11:12:00Z and IBIS at 11:19:00Z.