EUROPEAN SPACE AGENCY

DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT

MISSION OPERATIONS DEPARTMENT

INTEGRAL

Mission report

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

No. 394

01.03.2011

Routine Phase

Prepared by: M. Walker (OPS-OAI) and INTEGRAL FCT

Table of Contents

Distribution List

ESOC	
G. Winters (D/OPS)	SPACONs
J. F. Kaufeler (OPS-E)	F. Sheasby
N. Bobrinsky (OPS-L)	F. Dreger
A. Rudolf (OPS-OA)	A. Mcdonald
J. Miro (OPS-G)	S. Pallaschke
	W. Hell
M. Kirsch	K.J. Schulz
R. Southworth	M.A. Larsen
S. Fahmy	
J. Martin	J. Howard
F. Cordero	M. Butkovic
F. Di Marco	D. Heinzer
S. DePadova	U. Feucht
D. Webert	Shift – Coord
F. Schmidt	Scheduling Office
C. Lozano	T. Beck
M. Pantaleoni	M. Rossmann
M. Walker	M. Unal
U. Weissmann	
N. von Krusenstiern	A. Mantineo
L. Spiteri	K. Scott
INTEGRAL/XMM Flight Dynamics team	

ESAC	
A. Parmar (SRE-OA)	P. Kretschmar (SRE-OAG)
M. Kessler (SRE-O)	E. Kuulkers (SRE-OAG)
V. Gomes (DG-V)	
ESTEC	
C. Winkler (SRE-SA)	G. Sarri (SRE-PP)
N. Rando (SRE-PAM)	H. Evans (TEC-EES)
S. Taylor (TEC-EPG)	
ESA HQ:	D. Southwood (D/SRE)
Redu:	B. Demelenne
ISDC	
R. Walter	ISDC Shift Team
C. Ferrigno	
ALENIA	
M. Montagna	F. Ravera
PI / Instrument Teams	
A. Bazzano (IBIS)	W. Hajdas (IREM)
G. La Rosa (IBIS)	S. Brandt (JEM X)
F. Lebrun (IBIS)	E. De Miguel (OMC)
P. Ubertini (IBIS)	J. P. Roques (SPI)
C. Brysbaert (SPI)	
JPL / Goldstone	
J. Mattocks	J. Valencia
J. Velasco	S. C. Kurtik
P. Varanasi	DSN - MPSETD
K. Yetter	B. Arroyo

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 February and covers the revolutions 1013 untill 1023 (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.

10 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.1280 Kg. The remaining propellant is in the order of 122.552 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.

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 15th SPI annealing, which ended on 16/04/2010, 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+/-1K.

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 2011-02-01T23:37:00Z to 2011-02-02T04:12:50Z (OMC Flat Field Calibration), when it was 88 packets/cycle and from 2011-02-18T05:43:45Z to 2011-02-18T11:24:35Z (Crab observation) when it was 85 packets/cycle and from 2011-02-18T11:24:35Z to 2011-02-18T13:03:51Z (Crab observation) when it was 33 packets/cycle. The average telemetry occupation when the allocation was 99 packets/cycle was 80.475 packets/cycle.

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

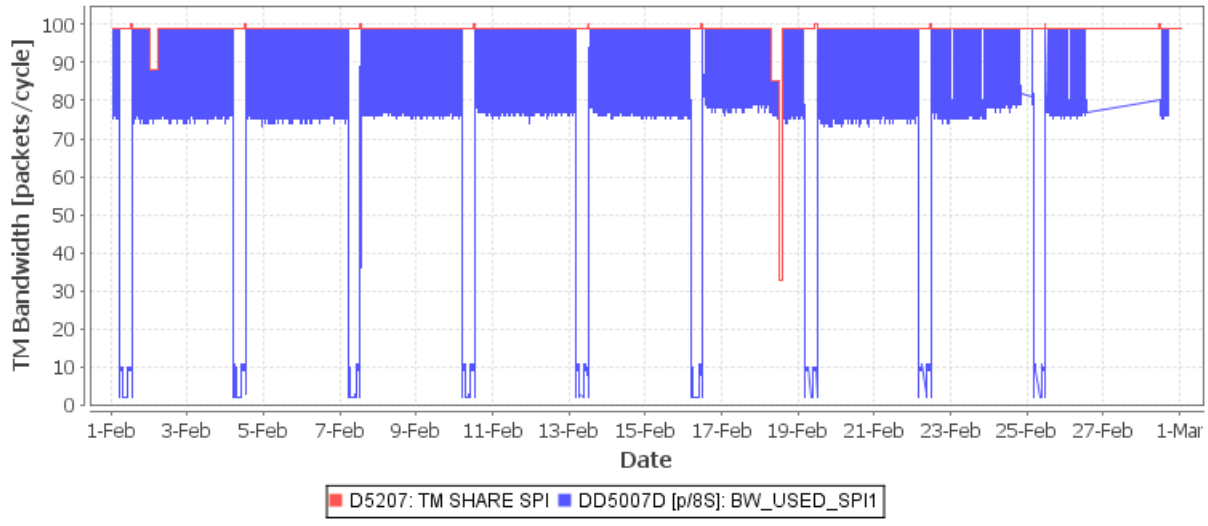


Figure 1: SPI TM bandwidth utilisation

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

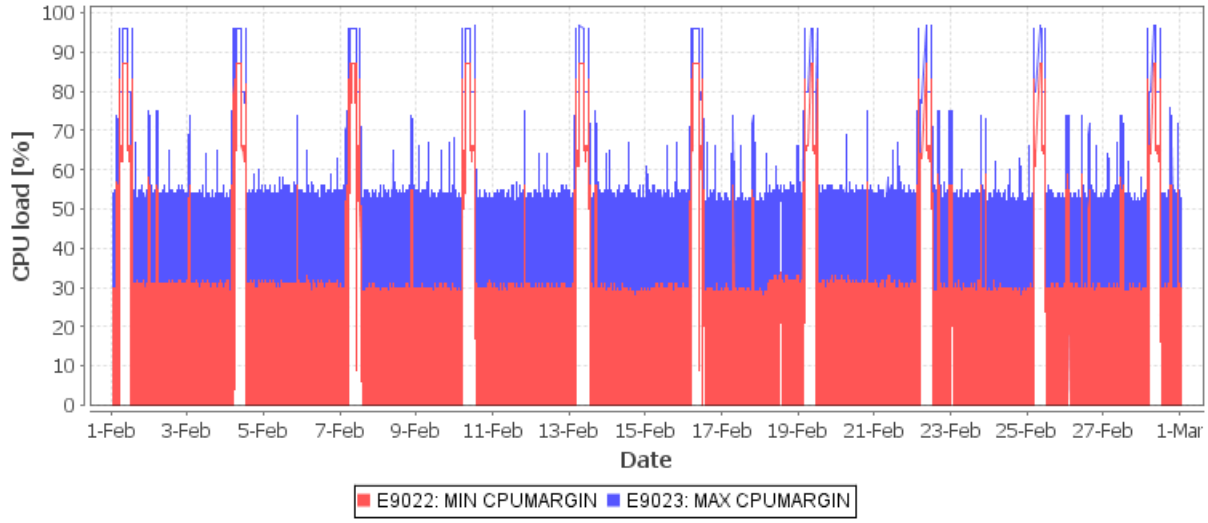


Figure 2: SPI IASW Performance

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

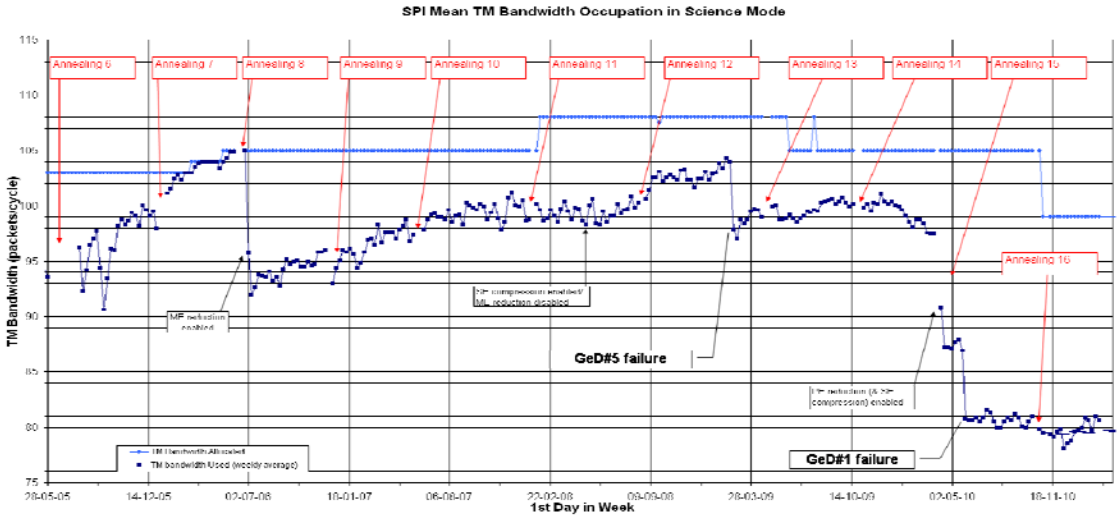


Figure 3: SPI TM bandwidth usage evolution since May 2005

Note: Some more information concerning the SPI operations is provided in Appendix 0.

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
- IBIS mean bandwidth utilisation in science mode: 115.37 packets/cycle

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

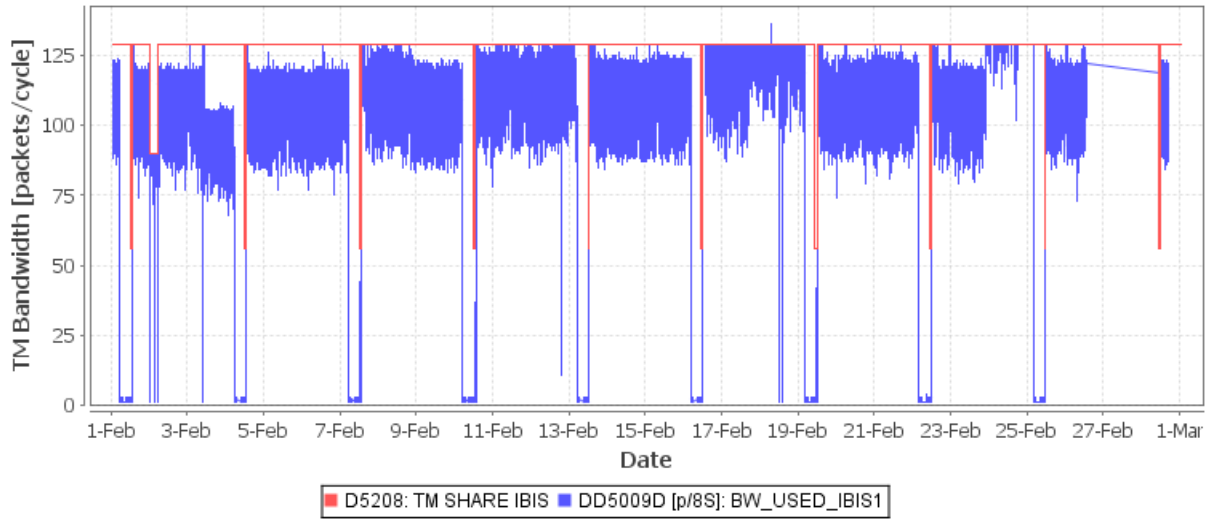


Figure 4: IBIS TM bandwidth utilisation

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

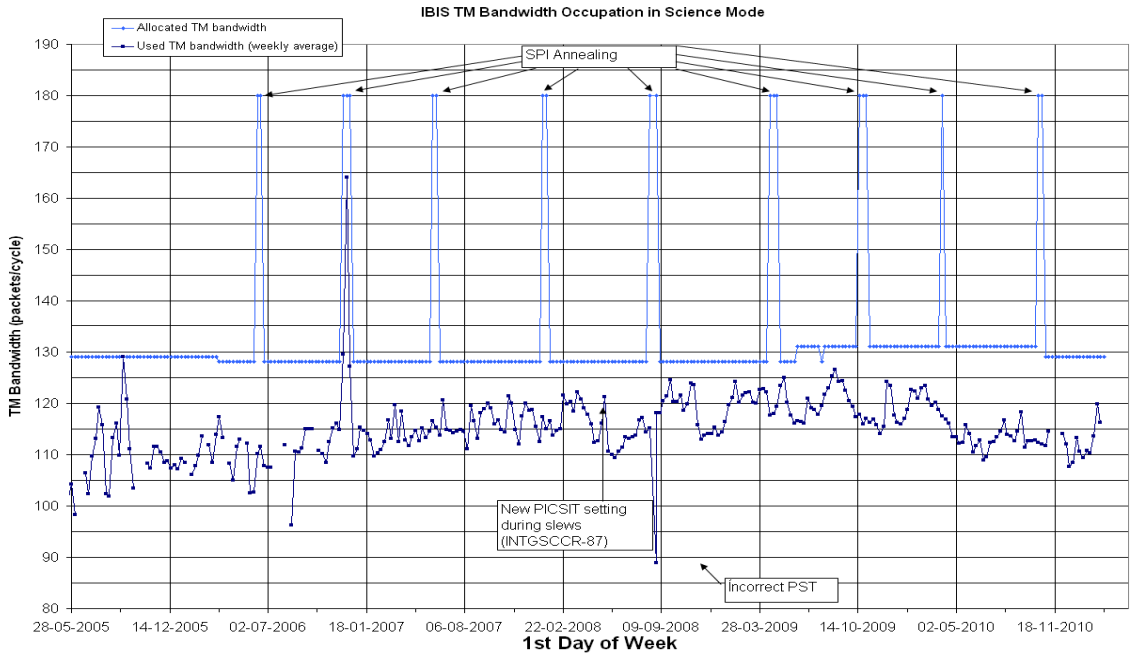


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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 during the JEMX dedicated part of the Crab calibration, that is from 2011-02-18T05:43:45Z to 2011-02-18T11:24:35Z, they were allocated 15 packets/cycle, and from 2011-02-18T11:24:35Z to 2011-02-18T13:03:51Z they were allocated 41 packets/cycle.

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 2011-02-01T23:37:00Z to 2011-02-02T04:12:50Z during the Flat-field calibration, when it was 63 packets/cycle.

During this reporting period, 617 of the 624 planned science pointings were executed nominally. Four pointings were lost and one shortened due to FD problems, one was lost to an AOCS problem, and one was interrupted by an IREM crash. 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.

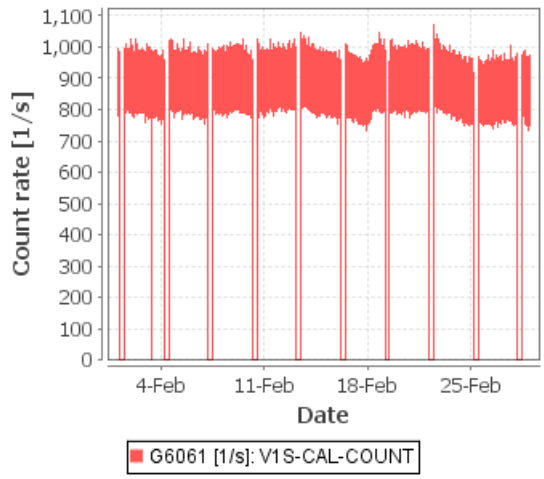
On DoY 034 (03/02/2011), the 104th IREM SEU occurred.

Note: Some more information concerning the IREM operations is provided in Appendix 0.

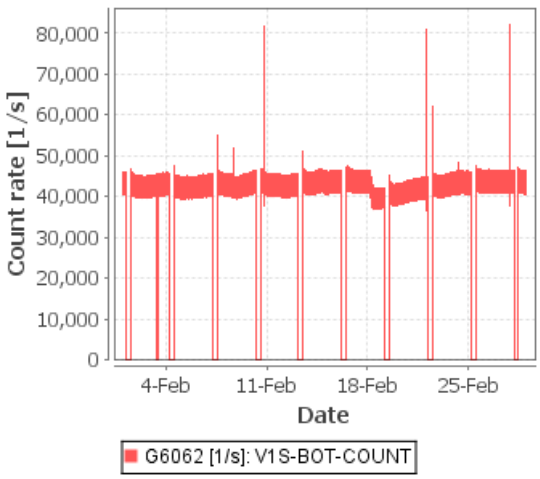
Radiation background

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



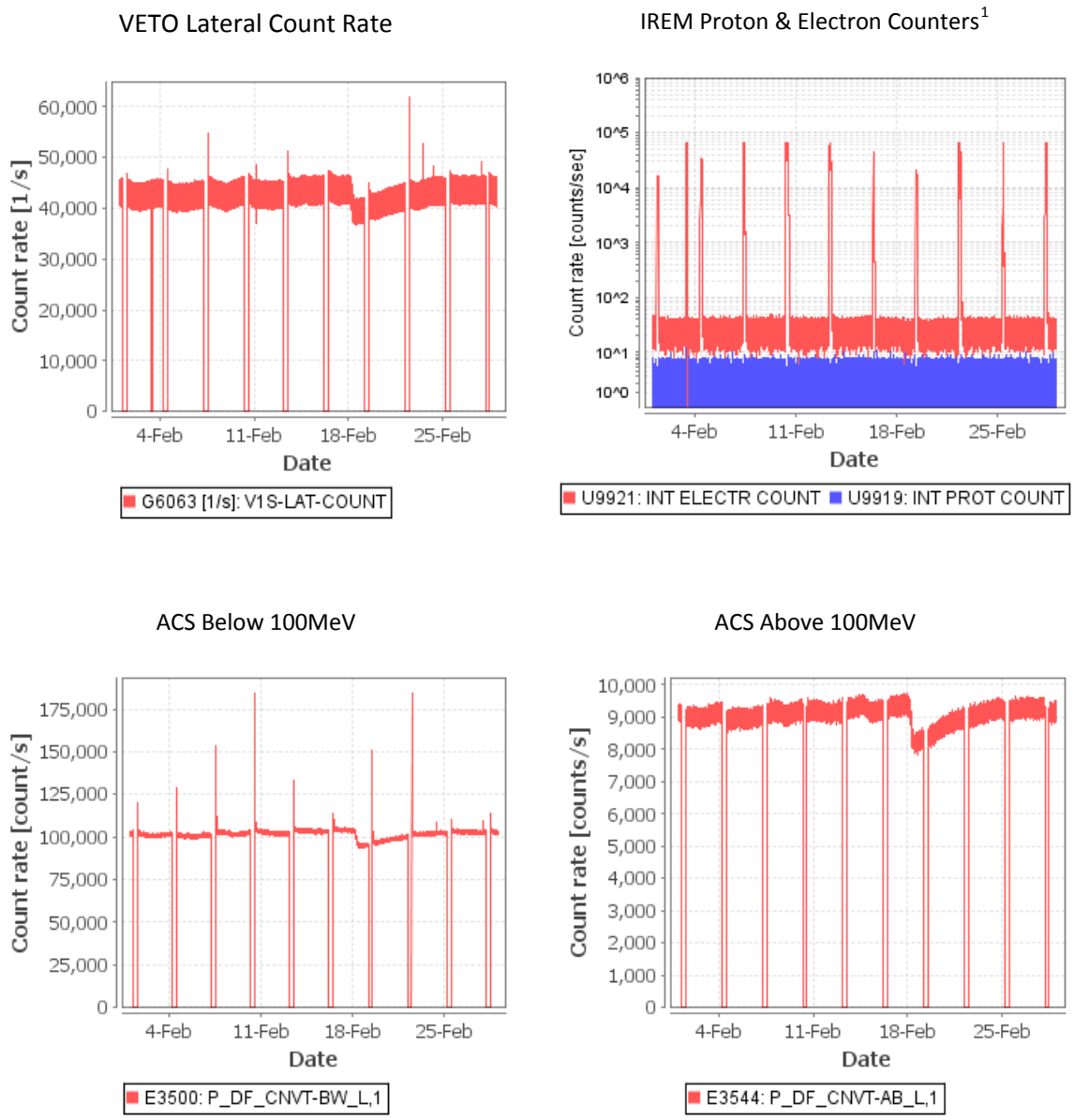


Figure 6: Instrument Count Rates

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

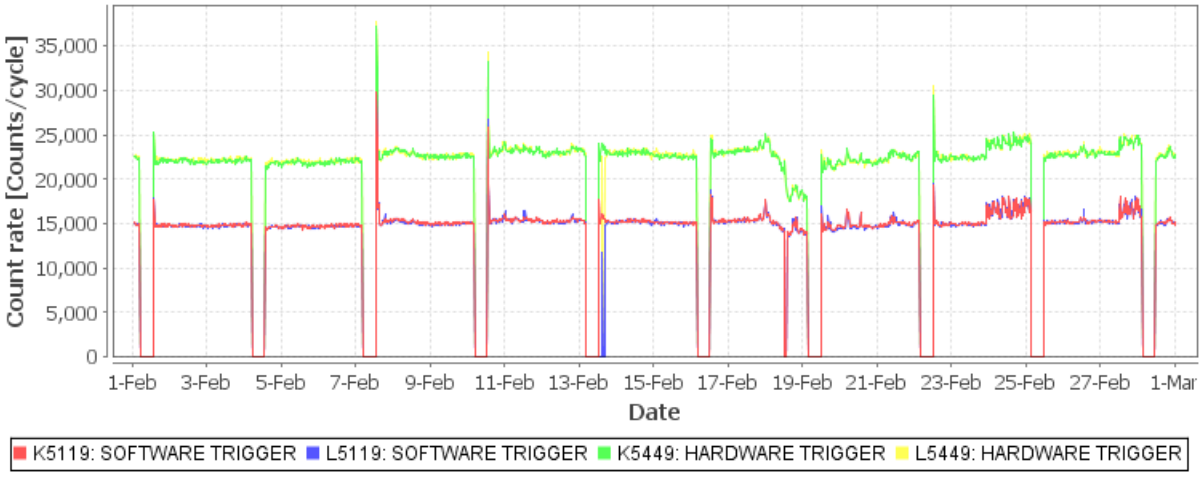


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

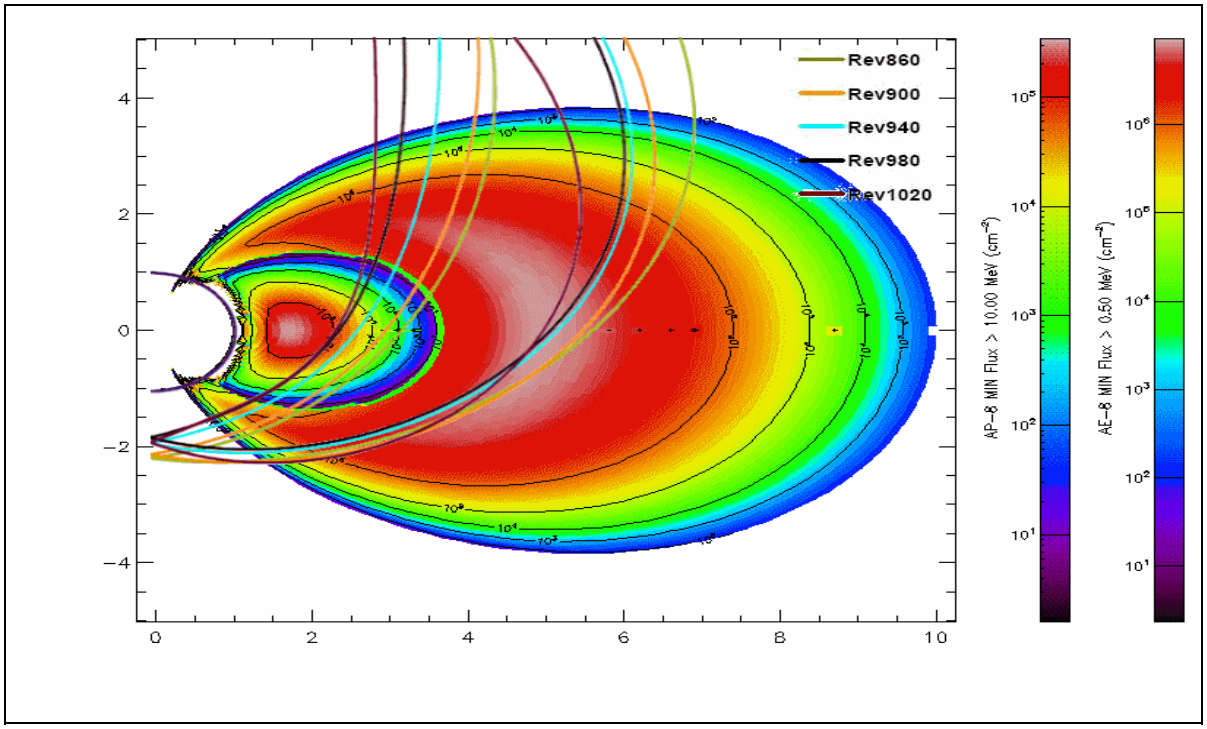


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

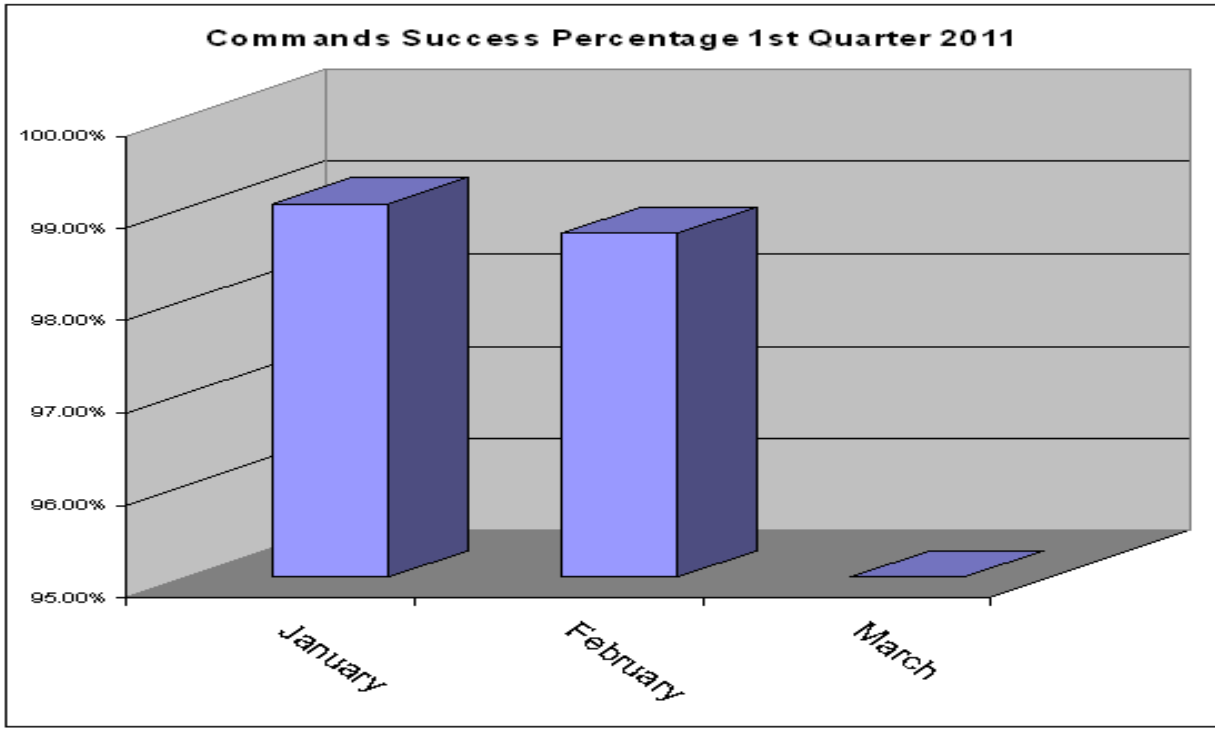


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

The HFA_TM task on IDDB was restarted 3 times due to repeating error messages as result of IXMUST retrievals. On 3 further occasions IDDB was shutdown completely and restarted, again due to IXMUST retrievals.
On DOY 033 sun121 was rebooted as it was not responding anymore.
On DOY 038 the VERIFIER task crashed on IMCA and was restarted.
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.
On DOY 047 SWS installed E3.4.1 on the B-Chain – after the installation the MCS links to the NCTRS were not correctly connected.
On DOY 048 the PACKETISER and TMDS_PB were restarted which partially fixed this.
On DOY 052 the complete B-Chain was eventually restarted to clear all problems as it had been discovered that the problems were due to a restart of the MISCdynSrv performed by SWS after the installation.
On DOY 056 only 4 ISGRI tables were received at MOC (instead of 8). The previous version was up-linked instead.

.

The CD production failed on 3 occasions.
The ISDS and IFRD tasks on isdsa needed to be restarted on 6 occasions.

3.2 Ground Stations and Network

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

REDU
Six data gaps were identified and bad frames were received from REDU on twelve 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.

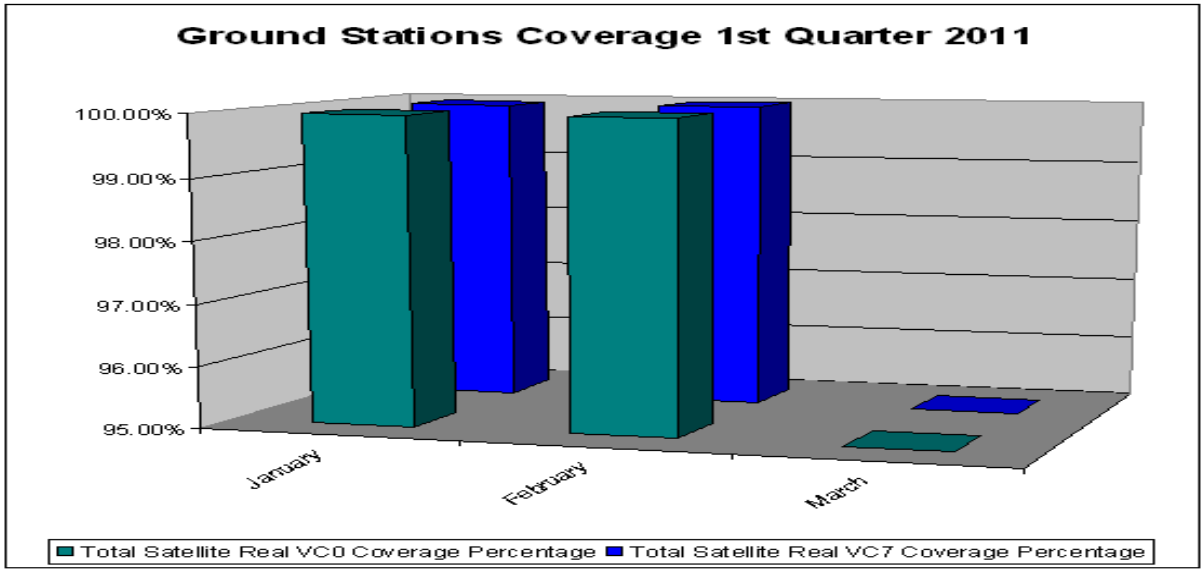


Figure 10: The usage of ESA ground stations compared to the usage of DSN ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1020 to 1030, corresponding to the time range 19 February to 24 March.

New observations have been planned for revolutions 1016 (7-10 February) to 1025 (9 March). TOO observations of the Be X-ray binary A0535+26 in a bright outburst led to re-planning of revolutions 1021-1025 and more observations are probable. Dummy pointings needed to be inserted in revolutions 1022 and 1024 in order to find a valid reaction wheel bias.

TSFs have been received for revolutions 1015 to 1023.

3.3.2 Observation Status

New ECS files have been received for revolutions 998 to 1009 (up to 20 January).

3.3.3 ISOC Science Data Archive

Scw data has been ingested up to revolution 1009. Raw telemetry copied from MOC is available up to 14 January with some gaps remaining.

Syncing of rev_3 data is ongoing.

3.3.4 ISOC System

V28 (AO9 call for proposals) released for testing on 17 February. Formal release scheduled for 7 March.

3.3.5 Problems

The handling of data right proposals for the PAD was found to be incorrect on completion of observing proposals. This has been fixed.

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-3136	2010-02-10	IBAS Command not executed	IMCS	Testing
INT-3137	2011-02-16	FD update slew failure on DOY 47	FDS	Pending
INT-3138	2011-02-16	MCS - connection problems after installation of E3.4.1	IMCS	Pending
INT_SC-315	2011-02-03	IREM Anomaly: Reset of IREM_CSCI S/W #104, 03/02/2011	Payload	Pending
INT_SC-316	2011-02-07	Wheel oscillation during OSL 10160001	Spacecraft	Pending
INT_SC-317	2011-02-13	JEM-X2 DFEE CRC Anomaly following eclipse on 2011-02-13	Payload	Pending
INT_SC-318	2011-02-17	Guide Star loss during CSL on doy 48	Spacecraft	Pending

5 Special Events & Future Milestones

Star Tracker Calibration planned for 22nd March 2011(Revolution 1030)
SPI annealing planned for end of April – Beginning of May 2011
ISDC Communications Upgrade is an ongoing activity
Analysis for possible Earth observations in 2012

6 Appendix

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

6.1 AOCS operations

During this period, 307 Open Loop Slews, 383 Closed Loop Slews and 26 Momentum Biases were executed (as reported by ACC OEM).

10 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 01/03/2010 is reported in the following plot:

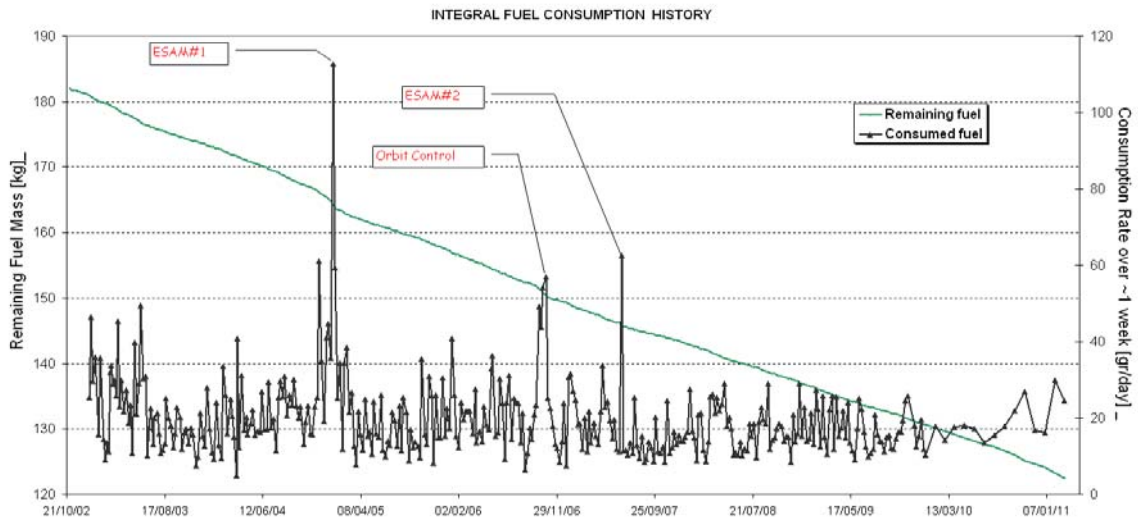


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

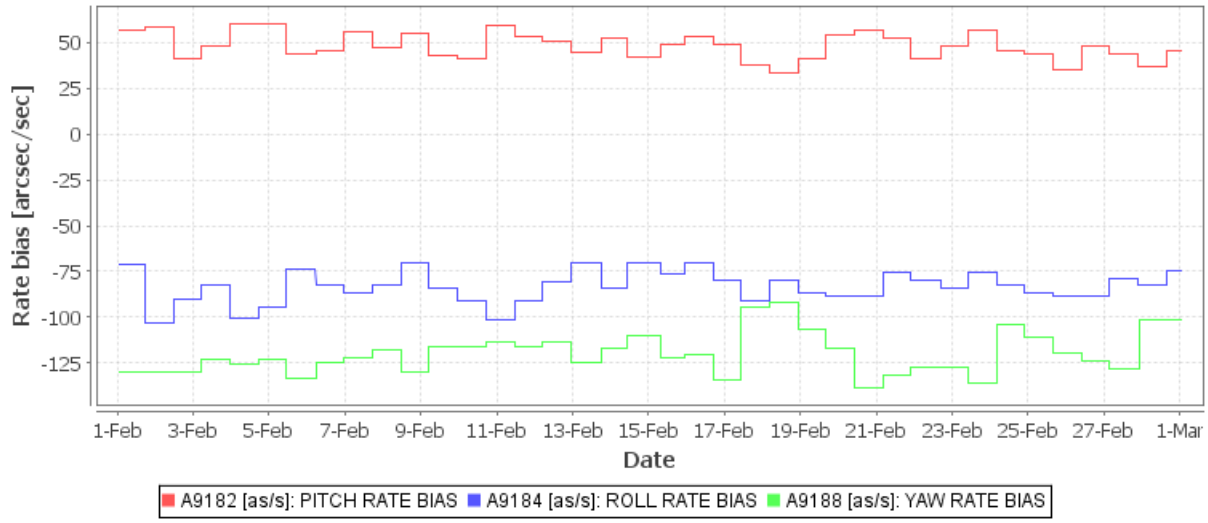


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

02/02/2011 (Day of Year 33, Revolution 1014)

IMU1 switched ON during the stable pointing of PID 10140036 (23:53:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 10140037.

Then a mapping was commanded and the parameters for slew 10140038 were manually updated (spacontool).

OTF was not reached for PIDs 10140036 and 10140037.

Slew 10140037 was missed from the Timeline.

07/02/2011 (Day of Year 38, Revolution 1015 to 1016)

- IMU1 switched ON during perigee passage (08:59:00Z). After the IMU switched back OFF, a manual mapping was performed to update the slew to attitude 10150001.

The first RWB on the revolution was skipped.

No slew were missed

- Because of MCS verifier problems, the manual mapping after slew 10150002 failed release. A manual mapping was commanded and the parameters for slew 10150003 updated.

No impact on the Timeline

16/02/2011 (Day of Year 47, Revolution 1018 to 1019)

FDS TPF update failed for slew 10190002 (10:19:00Z). A manual 1019_0500_M.OSL TPF was generated with Spacontool from PID 10190001 to 10190003.

After completion of 1019_0500_M.OSL, a new manual mapping was commanded in order to update the parameter for slew 10190005.

Slews 10190002, 10190003 and 10190004 were missed from the Timeline. OTF was not reached for their corresponding PIDs.

17/02/2011 (Day of Year 48, Revolution 1019)

During the execution of CSL 10190036 the guide star was lost, leading to the interruption of the slew before having reached its target attitude.

PID 10190036 missed.

19/02/2011 (Day of Year 50, Revolution 1019 to 1020)

Autostack commanding for slew 10190109 (01:33:00Z) 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 10190108 to attitude 10190110.

After the manual slew was completed, the parameters for slew 10190111 were manually updated (spacontool).

Slews 10190109 and 10190110 were missed from the Timeline. The OTF was not reached for its PID.

22/02/2011 (Day of Year 53, Revolution 1020 to 1021)

Autostack commanding for slew 10210116 (21:38:00Z) 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 10210115 to attitude 10210117.

After the manual slew was completed, the parameters for slew 10210118 were manually updated (spacontool).

Slews 10210116 and 10210117 were missed from the Timeline. The OTF was not reached for its PID.

25/02/2011 (Day of Year 56, Revolution 1021 to 1022)

Autostack commanding for slew 10220114 (22:46:00Z) 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 10220113 to attitude 10220115.

After the manual slew was completed, the parameters for slew 10220116 were manually updated (spacontool).

Slews 10220114 and 10220115 were missed from the Timeline. The OTF was not reached for its PID.

6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

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 40 until 2011-02-19T12:10Z when it was increased to 41 on all four compressors as the Cold Plate temperature had reached 80.9K. The CDE LCL currents for a given stroke setting are stable.

The following plot shows the evolution of the cold plate and H bus temperature during the reporting period. The downward spikes in the cold plate temperature should be disregarded as these are zero values acquired when the AFEE is OFF during eclipse.

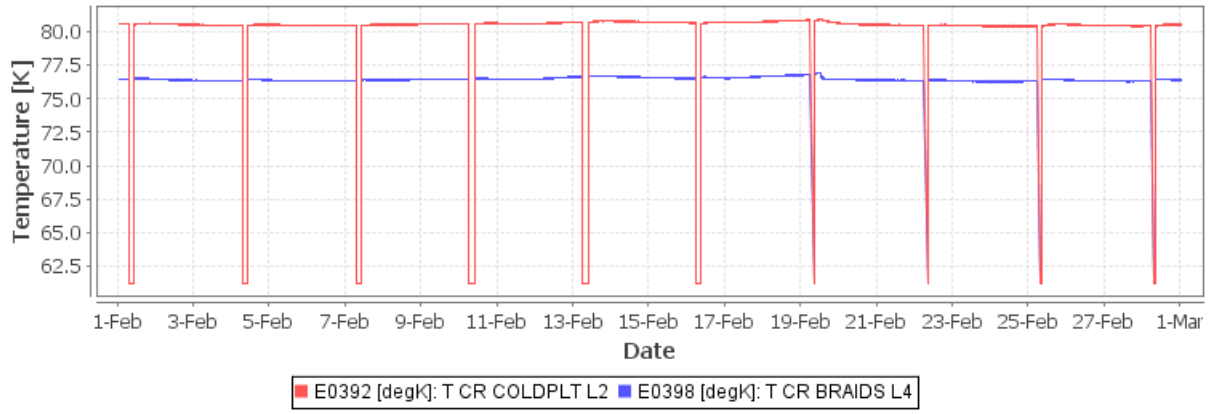


Figure 13: SPI Cold plate and H-bus temperature

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

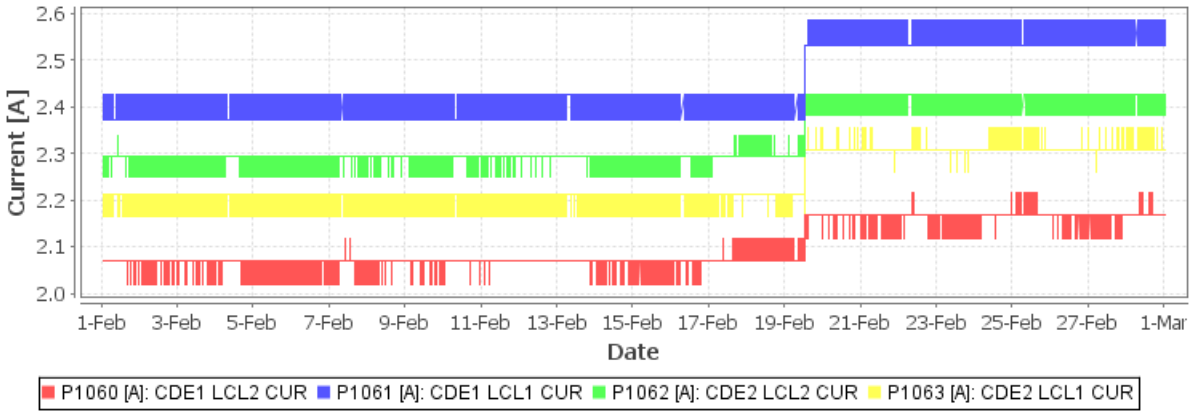


Figure 14: SPI CDE LCL curent

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 and the spectra scaling factor 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). 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.

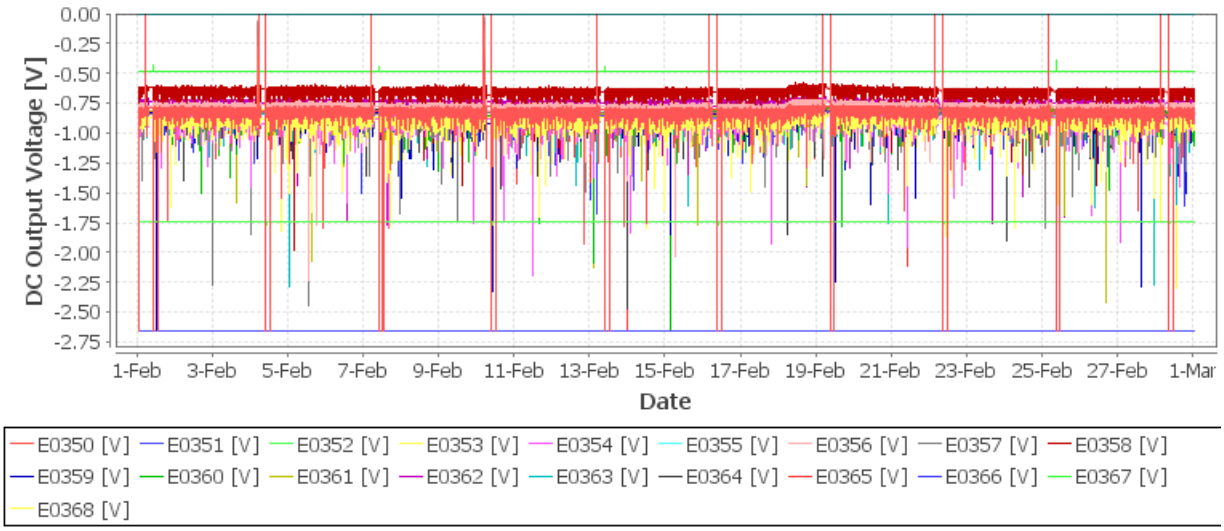


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

DFEE

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

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

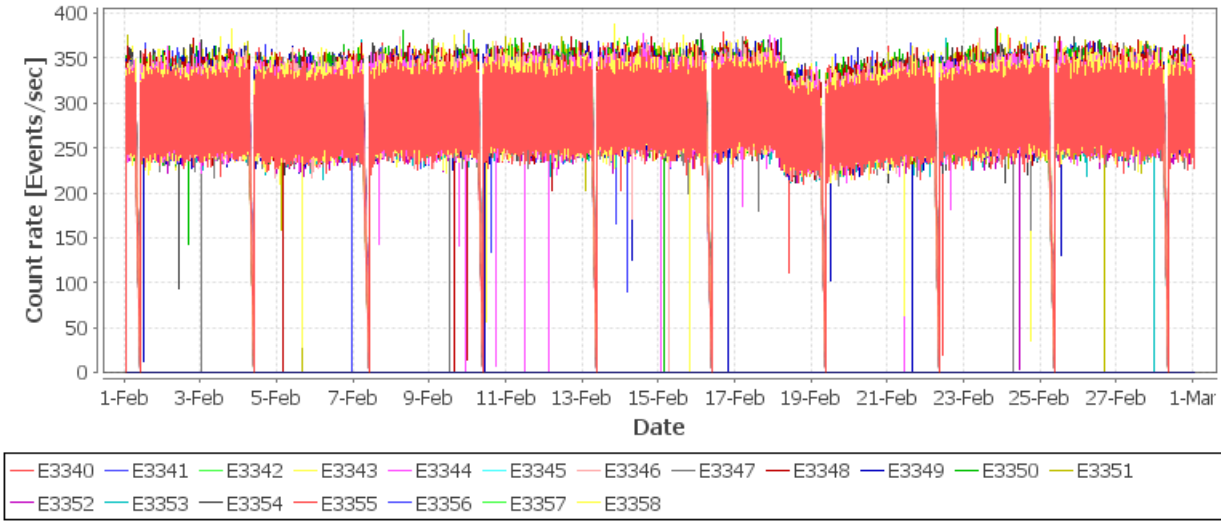


Figure 18: SPI GeD Time Tagged Saturated count rates

PSD

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

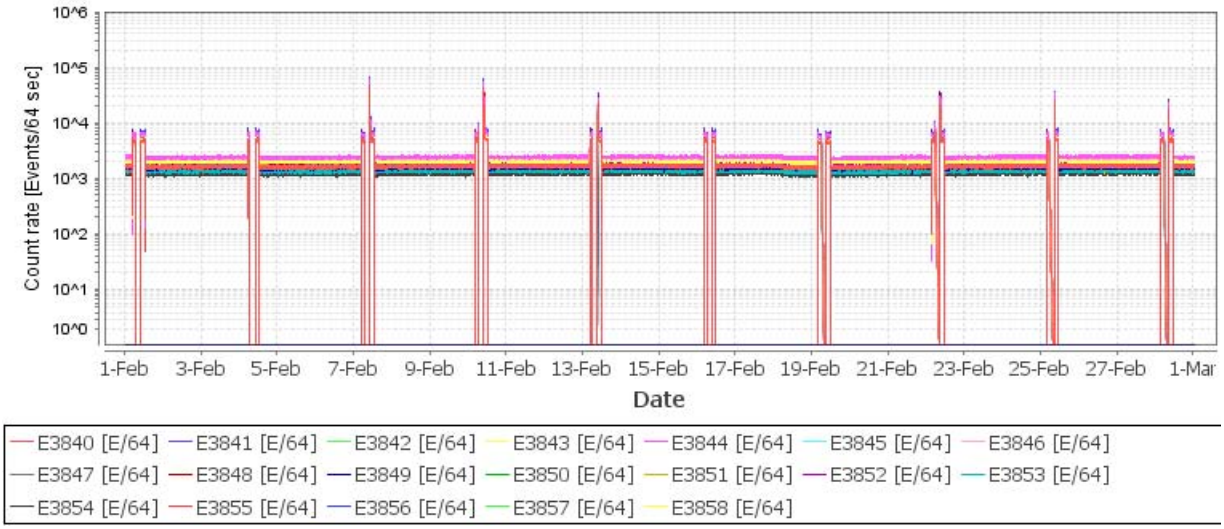


Figure 19: SPI PSD GeD Channel rates

6.2.2 Event Log

13-02-2011 (Day of Year 044, Revolution 1018)

At 11:17:29z the TC EU0518D of the sequence EEXIT-03 failed release form the Timeline. The problem seems located on ground with the update of the dynamic default parameters. Actually the command failed release because of dynamic PTV in WAIT. The sequence was re-uplinked successfully according to the cross reference at 11:24:38Z. No further Action was taken. For more information see SPR-1202.

Since this TC is using dynamic default parameters which are updated by a TM packet of the previous report TC the timing interval between these commands needs to be increased.

22-02-2011 (Day of Year 053, Revolution 1021)

At 10:38:30z the TC EU0518D of the sequence EEXIT-03 failed release form the Timeline. The problem seems located on ground with the update of the dynamic default parameters. Actually the command failed release because of dynamic PTV in WAIT. The sequence was re-uplinked successfully according to the cross reference at 11:53:59Z. No further Action was taken.

On 25-02-2011 DOY 056 the sequence EEXIT-03 was manually uplinked. The timing interval between the report TC and the dynamic default TC has been increased to 30 seconds instead of 20seconds. The sequence executed successfully. The sequence EEXIT-03 will be updated with next database release.

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:

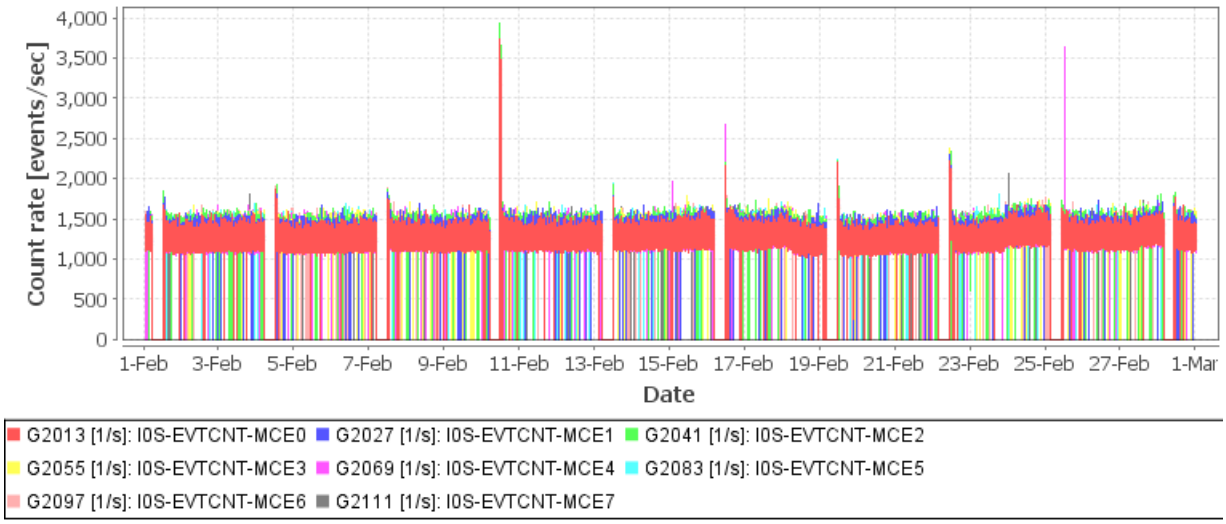


Figure 20: ISGRI MCE Counters

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

03/02/2011 (Day of Year 34, Revolution 1014)

At 2011.034.06.02.27Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 2011.034.06.02.27Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 2011.034.06.02.27Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

08/02/2011 (Day of Year 39, Revolution 1016)

Temperatures G2473 'IOE-TEMP-MCE1' S/H-OOL (value= 37.237 degC) and G2623 'IOE-TEMP-MCE2' S/H-OOL (value= 37.237 degC) stayed OOL (08:01:00) during a stable pointing period (~1 hour) at a high pitch angle (~37 degrees).

It was recovered in the next pointing.

09/02/2011 (Day of Year 40, Revolution 1016)

TM parameter G2098 IOE OVFWPXADD-M7 OOL 8secs stayed OOL during 8 seconds.

10/02/2011 (Day of Year 41, Revolution 1016 to 1017)

The execution of command G0219 (last one of GEISCL03) from the Timeline failed completion. The following recovery was performed:

- 11:24:00Z IBIS disabled in the Timeline
- 11:28:00Z CRP_IBIS1_0010
- 11:53:00Z CRP_IBIS1_0401 to uplink the ISGRI CTX tables.
- 12:12:00Z Sequence GEISCL03 sent
- 12:42:00Z Sequence GEBENT02 sent
- 12:48:00Z Sequence GEBEXT01 sent
- 12:55:00Z Sequence GEBENT02 sent
- 12:58:00Z IBIS re-enabled in the Timeline

19/02/2011 (Day of Year 50, Revolution 1019 to 1020)

ISGRI Context tables for MCEs 3 to 7 were not received. The context tables from revolution 1018 were used instead.

25/02/2011 (Day of Year 56, Revolution 1021 to 1022)

ISGRI Context tables for MCEs 4 to 7 were not received. The context tables from revolution 1020 were used instead.

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.

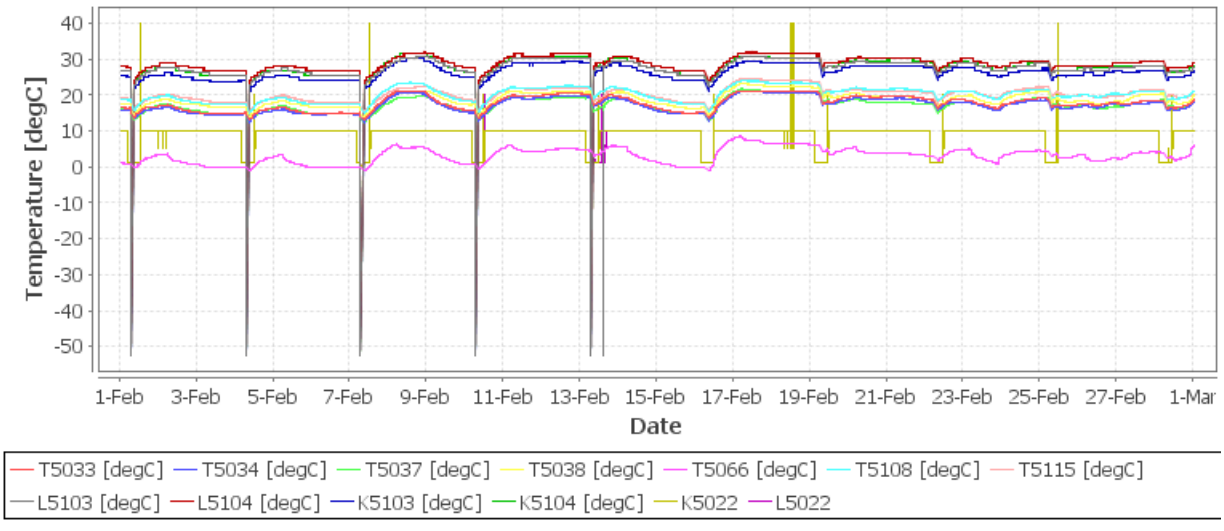


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

03-02-2011 (Day of Year 034, Revolution 1014)

At 08:20:40 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#104). There was no impact as the reaction has been disabled.

04-02-2011 (Day of Year 035, Revolution 1015)

At 14:09:00, the tele-command K0021 SW READ INT showed UNCERTAIN FAILED. No action was taken, and there was no impact.

13-02-2011 (Day of Year 044, Revolution 1018)

At 07:49, after AOS, it was observed that JEMX-2 had not switched-on correctly after the

The symptoms were as follows:

1) Following the execution of LECLXT01 ED, the JEM-X1 DFEE state (TM parameter K5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter K5381) remained ECLIPSE instead of RAD. BELTS.

3) The DFEE CPU speed, TM parameter K5583 CPU MODE, remained at a value of 8 MHz WAIT (as at start-up) rather than the nominal value of 16MHz.

4)A dump was performed according to the XRef table, which gave results of:

Start Length CRC Value

B000 2000 F1B3

B000 1000 F074

C000 1000 CF9F

which are correct.

5)A manual recovery was then performed, which did not have the required effect, this was then repeated from 13:16Z to 13:42Z with the same result.

In response to this, the following operations were performed:

1) To recover JEM-X2, a DFEE power cycle was then performed according to CRP_JEM2_5010 JEMX2 DFEE POWER CYCLE, – 15:34Z JEMX2 re-enabled in T/L.

The above recovery proceeded nominally and JEM-X2 operations then continued from the Timeline.

18-02-2011 (Day of Year 049, Revolution 1019)

From 2011-02-18T05:43:45Z to 2011-02-18T13:03:51Z a sequence of operations was performed manually on both JEMX 1 & 2. This comprised a sequence of 3 observations conducted at different HV settings followed by 10 diagnostics. The operation was carried out on both JEMX units simultaneously and was completed successfully.

At 12:14, the JEM-X parameters K/L5002 went out of limits high, this had been expected by the PI, no action was taken.

22-02-2011 (Day of Year 053, Revolution 1021)

At 10:49, the High Voltage switch-on sequences after perigee for both units failed due to high radiation. At 11:31, after the radiation level had dropped, the activation sequences were restarted, and by 11:45, they were both back in Data-taking.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

02-02-2011 (Day of Year 33, Revolution 1014)

At 23:53:02, a lost guide star caused the IMU to switch on. The AOCS and OMC were disabled, and a manual recovery was performed. The impact was pointing 10140037 was shortened from a planned 3530 to 2320 seconds.

03-02-2011 (Day of Year 34, Revolution 1014)

At 08:20:20, an IREM SEU (#104) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 08:45:22. The impact was pointing 10140045 was shortened from a planned 3530 to 849 seconds.

16-02-2011 (Day of Year 47, Revolution 1019)

At 10:19:00, a Flight Dynamics problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 11:23. The impact was the loss of pointing 10190004.

17-02-2011 (Day of Year 48, Revolution 1019)

At 05:45, during a CSL, the guide was lost, which interrupted the slew. This caused the OTF flag not to be reached, and the loss of pointing 10190036.

19-02-2011 (Day of Year 50, Revolution 1019)

At 01:33, a lost guide star forced an interruption to the schedule. A recovery was performed, and the timeline rejoined at 02:14. The impact was the loss of pointing 10190109. It was at this time that the following pair of commands was rejected:

```
2011.050.01.36.36.545   2011.050.01.36.40.844   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E

2011.050.01.36.42.670   2011.050.01.36.48.683   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E
```

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

22-02-2011 (Day of Year 53, Revolution 1021)

At 21:38, a start guide star failed release (owing to no available star in slot #2), which forced an interruption. A recovery was performed, and the timeline rejoined at 22:44. The impact was the loss of pointing 10210016. It was at this time that the following pair of commands was rejected:

```
2011.053.21.41.46.754   2011.053.21.41.55.682   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E

2011.053.21.41.52.879   2011.053.21.42.01.793   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E
```

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

25-02-2011 (Day of Year 56, Revolution 1022)

At 22:46, an AOCS problem forced an interruption. A recovery was performed, and the timeline rejoined at 23:55. The impact was the loss of pointing 10220014. It was at this time that the following pair of commands was rejected:

```
2011.056.22.49.56.057   2011.056.22.50.01.982   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E

2011.056.22.50.02.057   2011.056.22.50.09.283   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E
```

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

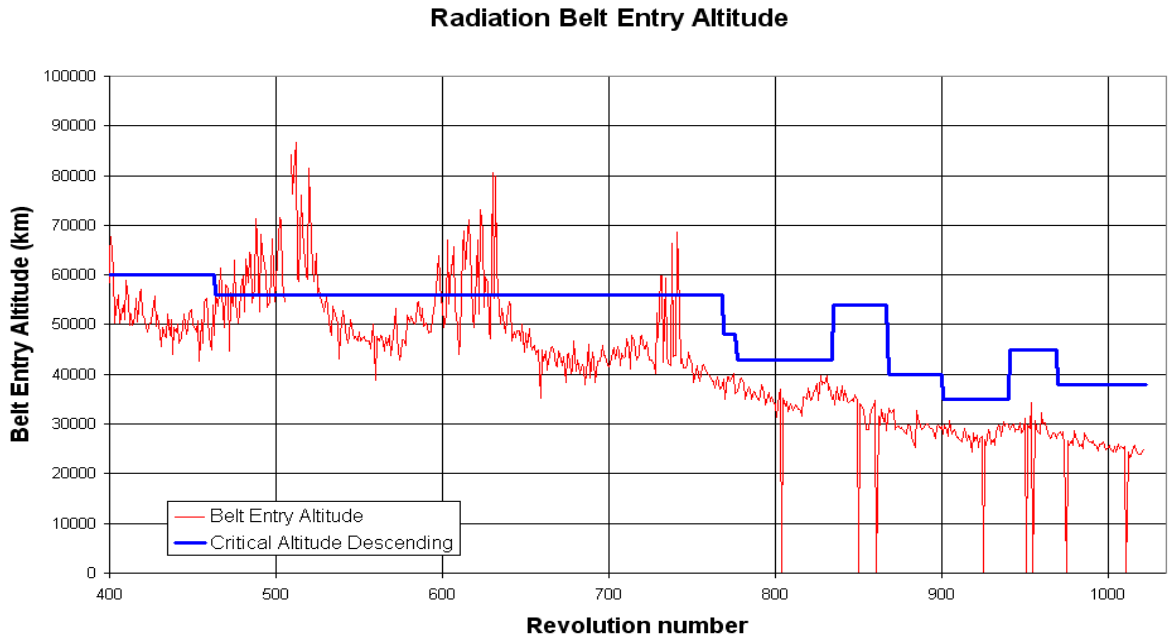


Figure 23: Radiation belt entry

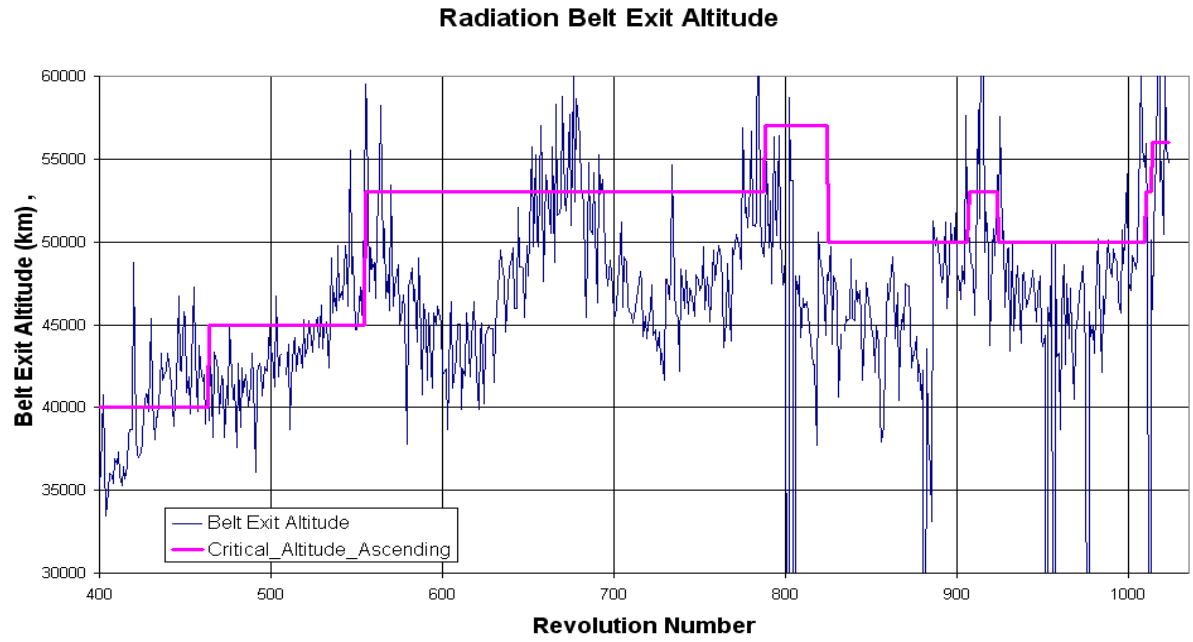


Figure 24: Radiation belt exit

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
1013	RAD_ENTR R 2011-02-01T04:37:53Z	N/A	N/A	01-Feb-2011 06:09:43	18762.61	01-Feb-2011 06:49:43	9320.321
1014	RAD_EXIT R 2011-02-01T12:03:23Z	01/02/2011 10:32:15	>>38274.2	01-Feb-2011 11:09:43	47754.07	01-Feb-2011 07:19:43	4201.863
1014	RAD_ENTR R 2011-02-04T04:24:36Z	04/02/2011 05:59:03	17415.6	04-Feb-2011 05:49:43	20394.47	04-Feb-2011 06:39:43	8710.43
1015	RAD_EXIT R 2011-02-04T11:50:24Z	04/02/2011 11:46:31	55506.4	04-Feb-2011 10:59:43	48166.99	04-Feb-2011 07:09:43	4145.205
1015	RAD_ENTR R 2011-02-07T04:10:58Z	07/02/2011 05:42:23	19153.3	07-Feb-2011 05:37:53	19874.81	07-Feb-2011 06:17:53	10437.85
1016	RAD_EXIT R 2011-02-07T11:36:24Z	07/02/2011 10:53:59	>>38279.5	07-Feb-2011 10:47:53	48615.44	07-Feb-2011 06:57:53	4023.799
1016	RAD_ENTR R 2011-02-10T03:58:45Z	10/02/2011 05:27:11	20757.7	10-Feb-2011 05:25:30	19882.3	10-Feb-2011 06:05:30	10409.26
1017	RAD_EXIT R 2011-02-10T11:23:41Z	10/02/2011 12:18:07	64231.4	10-Feb-2011 10:35:30	48680.23	10-Feb-2011 06:45:30	3948.166
1017	RAD_ENTR R 2011-02-13T03:46:09Z	13/02/2011 05:18:39	17750.8	13-Feb-2011 05:09:59	20268.06	13-Feb-2011 05:59:59	8518.382
1018	RAD_EXIT R 2011-02-13T11:11:13Z	13/02/2011 10:47:27	52668.2	13-Feb-2011 10:19:59	48353.16	13-Feb-2011 06:29:59	4021.825
1018	RAD_ENTR R 2011-02-16T03:31:26Z	16/02/2011 05:08:15	16805.2	16-Feb-2011 05:04:42	18572.28	16-Feb-2011 05:44:42	9124.72
1019	RAD_EXIT R 2011-02-16T10:56:37Z	16/02/2011 10:39:20	53321.3	16-Feb-2011 10:04:42	47907.03	16-Feb-2011 06:14:42	4142.04
1019	RAD_ENTR R	19/02/2011 04:54:32	18123.1	19-Feb-2011	18364.5	19-Feb-2011	8846.334

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
	2011-02-19T03:18:25Z			04:51:38		05:31:38	
1020	RAD_EXIT R 2011-02-19T10:42:51Z	19/02/2011 09:55:04	48541.3	19-Feb-2011 09:51:38	48173.79	19-Feb-2011 06:01:38	3959.196
1020	RAD_ENTR R 2011-02-22T03:08:25Z	22/02/2011 04:41:52	19678.6	22-Feb-2011 04:40:35	18748.09	22-Feb-2011 05:20:35	9165.917
1021	RAD_EXIT R 2011-02-22T10:31:58Z	22/02/2011 11:23:52	63352.6	22-Feb-2011 09:40:35	48008.94	22-Feb-2011 05:50:35	3925.787
1021	RAD_ENTR R 2011-02-25T02:58:46Z	25/02/2011 04:32:00	18531.5	25-Feb-2011 04:26:19	19526.68	25-Feb-2011 05:06:19	9966.533
1022	RAD_EXIT R 2011-02-25T10:22:11Z	25/02/2011 10:14:32	54864.3	25-Feb-2011 09:26:19	47435.61	25-Feb-2011 05:46:19	3805.706
1022	RAD_ENTR R 2011-02-28T02:47:00Z	28/02/2011 04:20:40	17754.0	28-Feb-2011 04:16:19	18962.16	28-Feb-2011 04:56:19	9413.259
1023	RAD_EXIT R 2011-02-28T10:10:44Z	28/02/2011 09:46:32	52291.1	28-Feb-2011 09:16:19	47800.42	28-Feb-2011 05:26:19	4049.474

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

03-02-2011 (Day of Year 034, Revolution 1014)

At 08:19:59Z, a local reset of the IREM CSCI S/W (SEU #104) 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 2011.034.08:19:59Z (144269.8 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 10:12:00Z.

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 08:46:00Z and IBIS at 09:04:00Z.