
EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission report

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

No. 412
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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 August and covers the revolutions 1196 until 1206 (inclusive). The targets of these revolutions can be found on the ISOC web: <http://integral.esac.esa.int/isocweb/schedule.html?action=intro> .

Summary of the main activities during the reporting period

- Nominal science operations
- ESAM Entry #4 on 16/8/2012
- Earth Observations 2.2 & 2.3
- IMCS E3.5.4 installed in back up DCA

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- SPI PSD channel rates malfunction
- SPI PSD channel rates malfunction
- SPI automatic reaction at belt entry during ESAM#4
- IREM Anomaly: Reset of IREM_CSCI S/W #135 (23/08/2012)
- High count rate on MCE4 shortly after rad. belt exit

Summary of the overall status and performance of the ground segment

- Ongoing occasional RFI at Redu, some sources identified, filter installed for testing
- Ongoing occasional interruptions to ISDS-ISDC link
- OBSM task freezes
- Stopping autostack during perigee crashes multiplexer
- TMDS_RT uses constantly ~50% CPU after NCTRS switch

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

2 Satellite status

2.1 Platform

2.1.1 AOCS

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

1 slew was missed from the Timeline due to ground segment issues. For slews interrupted due to other issues (guide star problems, etc) please see the INTEGRAL weekly reports: <http://10.33.199.49/documentation/wops.php>

The fuel consumption over the reporting period was 0.871 Kg. The remaining propellant is in the order of 110.4974 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.

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 19th SPI annealing, which ended on 22/06/2012, 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 2012-08-14T15:44:03Z to 2012-08-14T21:15:37Z (OMC Flat Field Calibration), when it was 88 packets/cycle. The TM allocation for SPI changed from 99 to 89 at the beginning of rev. 1199. The average telemetry occupation was 70.6 packets/cycle.

The following plot shows the TM bandwidth allocation and occupation during the reporting period. Furthermore, during the Earth observation 2.2 (rev. 1197, starting 01.08.2012), the TM allocation for SPI is 95 and for EO 2.3 (rev. 1206, starting 28.08.2012), the TM allocation for SPI is 85. The ESAM#4 can clearly be seen in the TM utilisation.

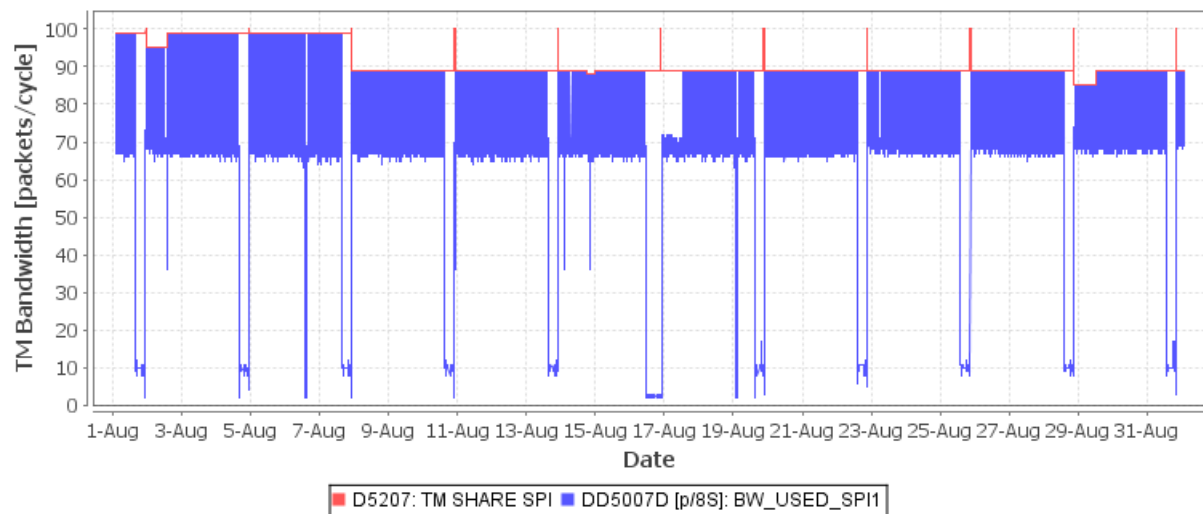


Figure 1: SPI TM bandwidth utilisation

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

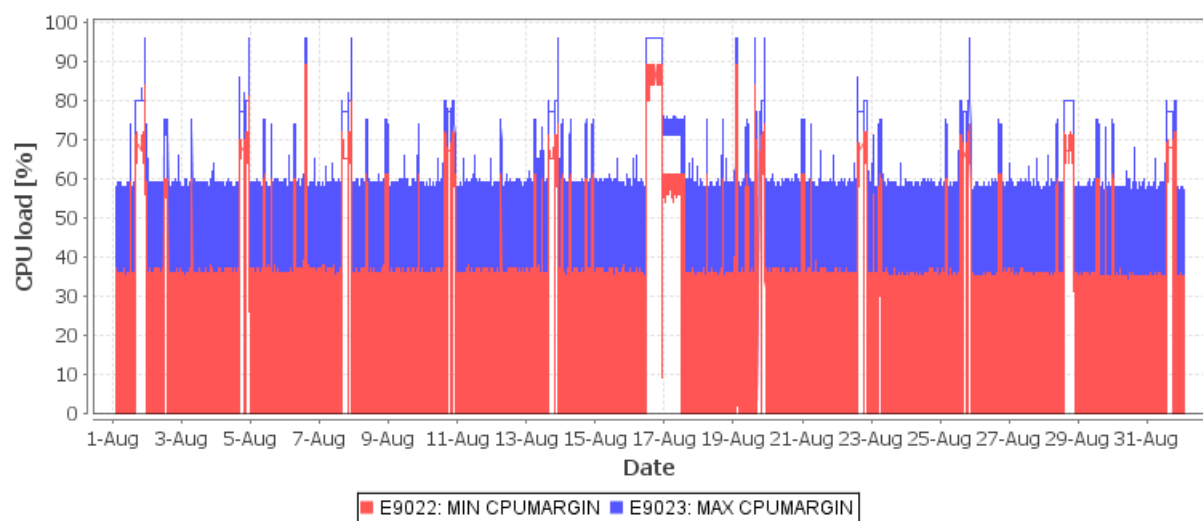


Figure 2: SPI IASW Performance

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2010.

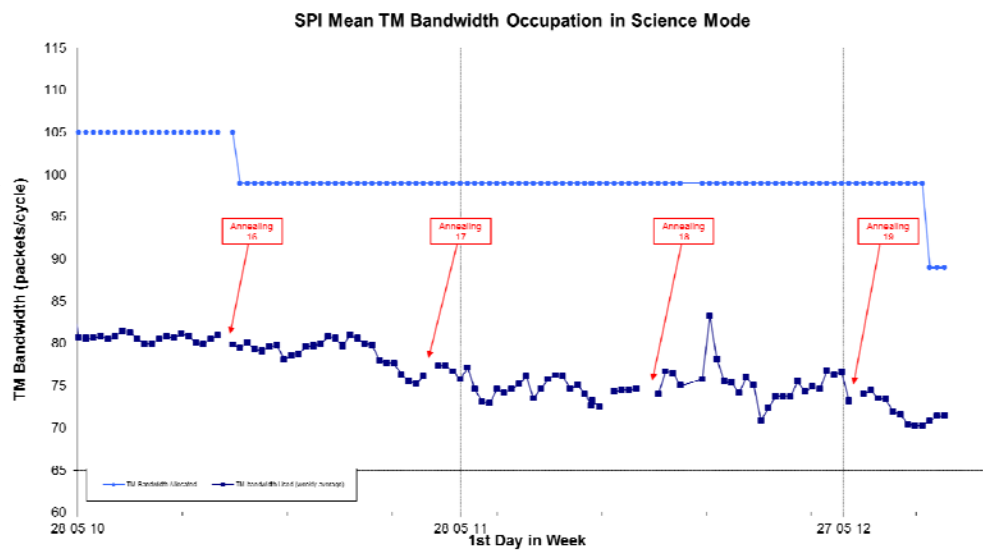


Figure 3: SPI TM bandwidth usage evolution since May 2010

Note: 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 2012-08-14T15:44:03Z to 2012-08-14T21:15:37Z (OMC Flat Field Calibration), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 99.79 packets/cycle

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

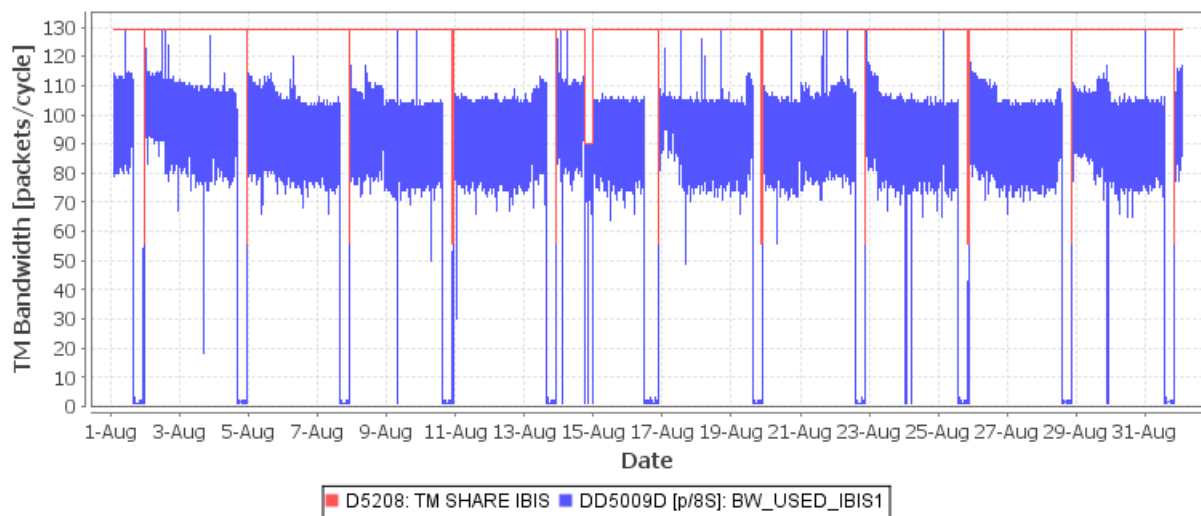


Figure 4: IBIS TM bandwidth utilisation

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

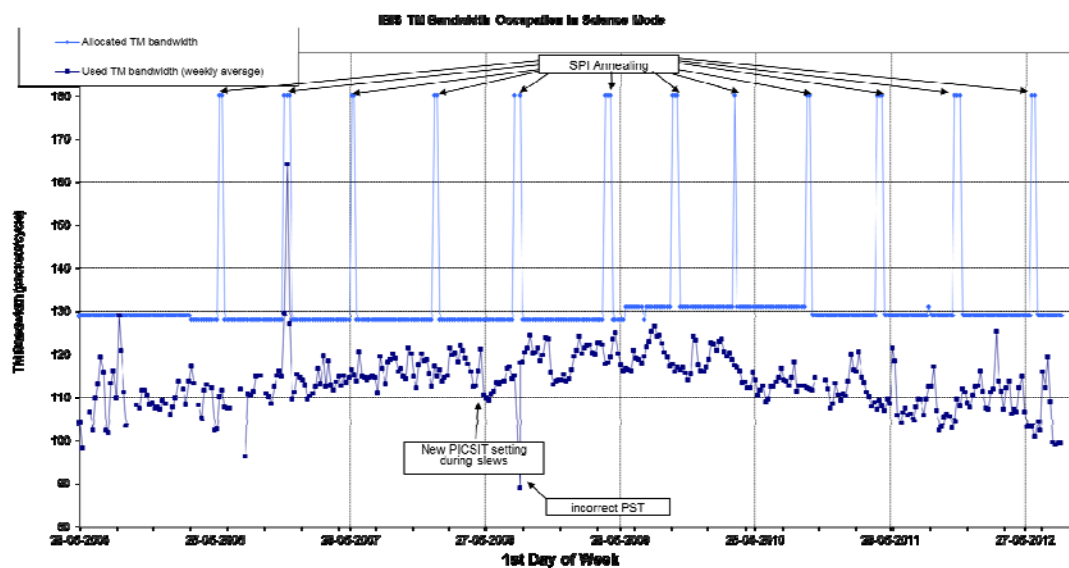


Figure 5: IBIS TM bandwidth usage evolution since May 2005

Note: More information concerning the IBIS operations is provided in Appendix 0.

2.2.3 JEM-X

The status of both JEM-X units is nominal:

- JEM-X1 & 2 were operated in Data Taking mode with a TM allocation of 13 packets/cycle each, except from 2012-01-01T00:00:00Z to 2012-08-07T20:29:18Z when they were allocated 8 packets/cycle and from 2012-08-14T15:44:03Z to 2012-08-14T21:15:37Z (OMC Flat Field Calibration), when they were allocated 4 packets/cycle each.

- 3 hours 18 minutes observation time was lost to an ESAM entry.

Note: Some more information concerning the JEM-X operations is provided in Appendix 6.4.

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 2012-08-01T20:57:22Z to 2012-08-02T11:36:37Z and from 2012-08-28T19:00:16Z to 2012-08-29T10:16:46Z during the Earth observations, when it was 9 packets/cycle and from 2012-08-14T15:44:03Z to 2012-08-14T21:15:37Z during the Flat-Field calibration, when it was 63 packets/cycle.

During this reporting period, 892 of the 937 planned science pointings and a Flat Field calibration were executed nominally. 1 pointing was interrupted and 31 lost to an ESAM. 1 pointing was lost to TMTCs problems at Redu, 2 were lost to a verifier crash, 2 to FD problems, 1 to an AOCs issue. 1 pointing was interrupted and another lost to an IREM SEU. 4 pointings were not executed after the timeline was stopped in preparation for the Earth observation. Finally 1 pointing was lost when the IFTS stopped working.

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

2.2.5 IREM

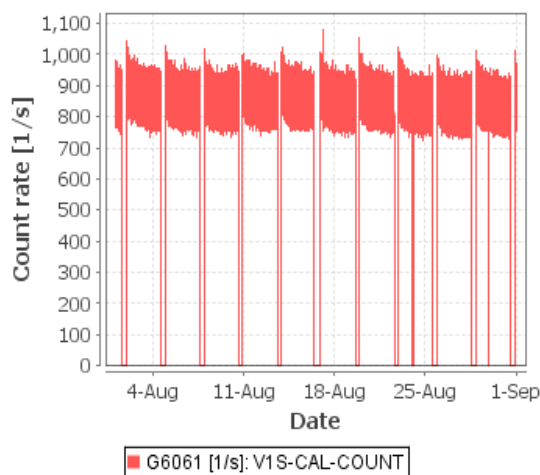
The status of IREM is nominal.

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

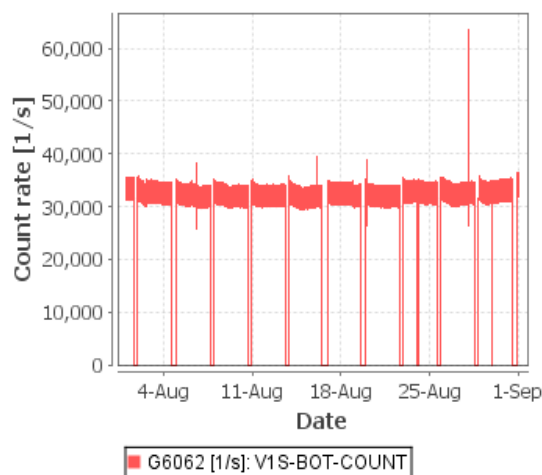
Radiation background

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:

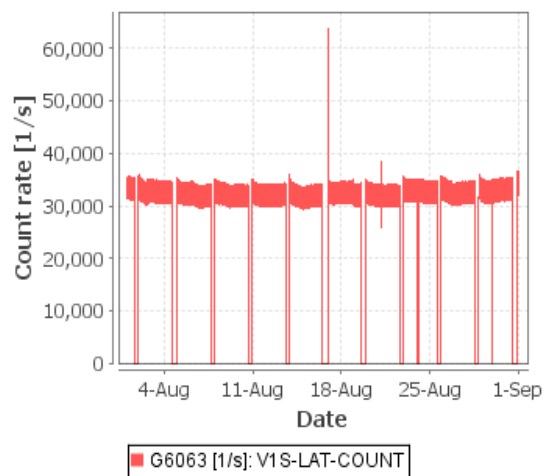
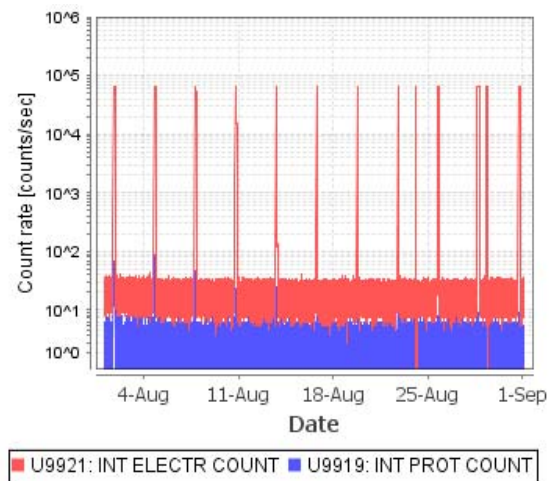
VETO Calibration Source Count Rate



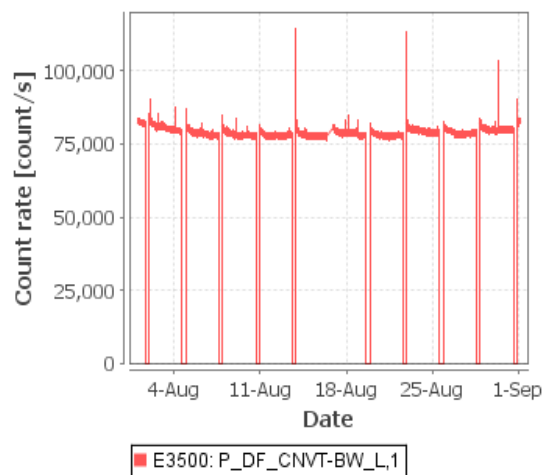
VETO Bottom Count Rate



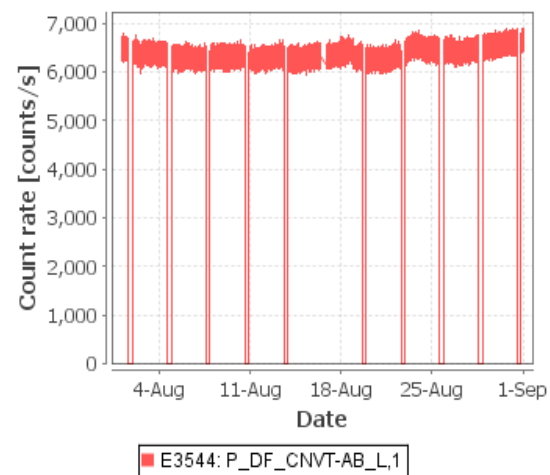
VETO Lateral Count Rate

IREM Proton & Electron Counters¹

ACS Below 100MeV



ACS Above 100MeV

**Figure 6: Instrument Count Rates**

The JEM-X count rates are plotted for both JEM-X units, 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

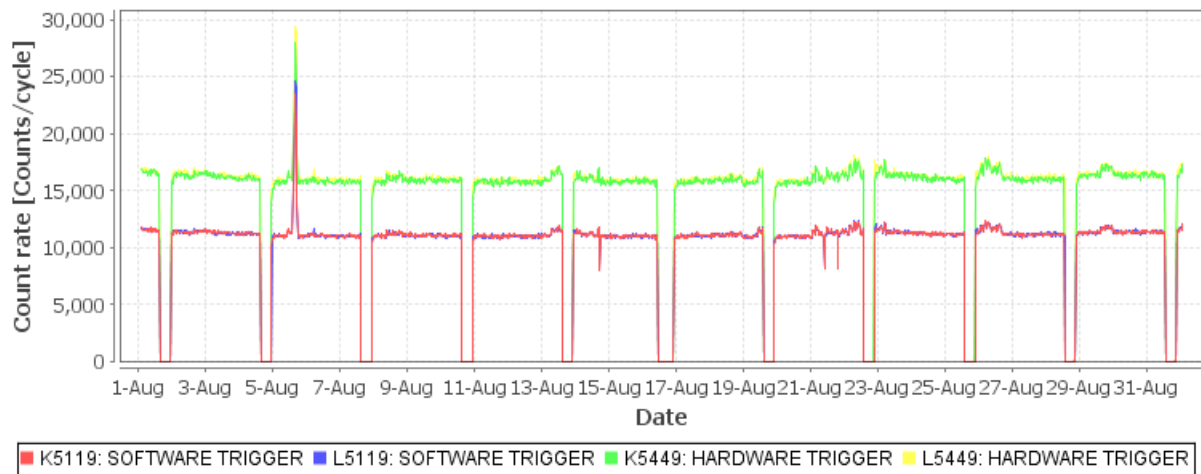


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

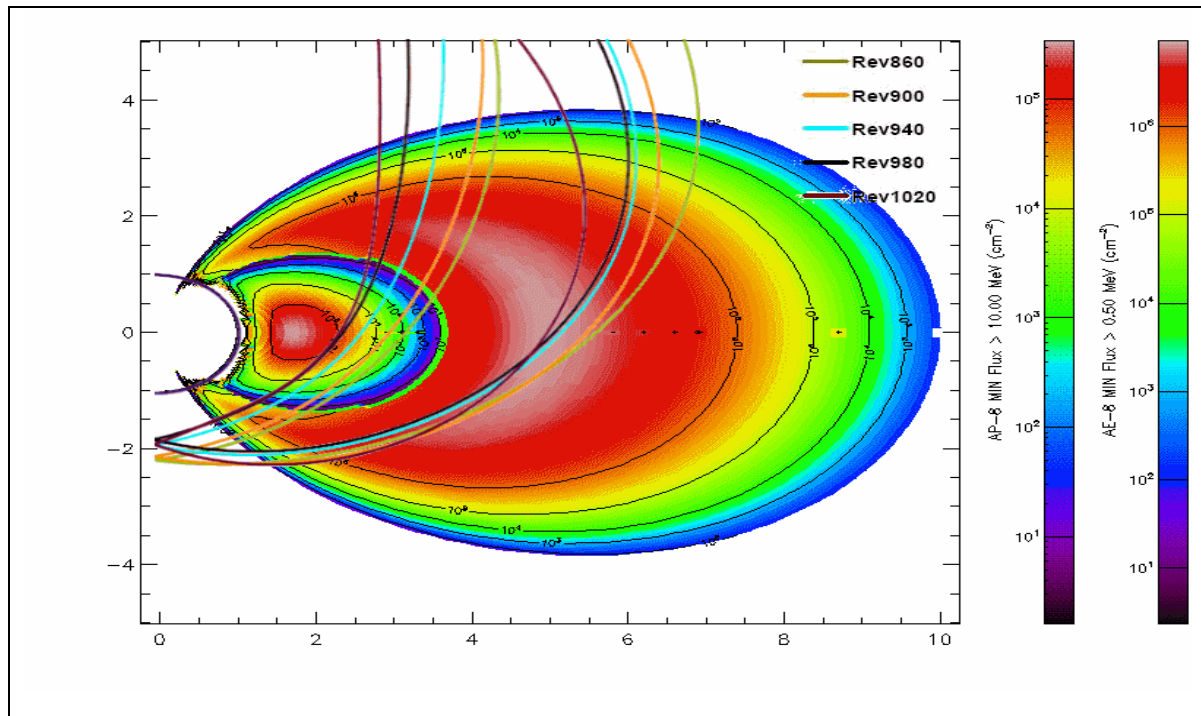


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

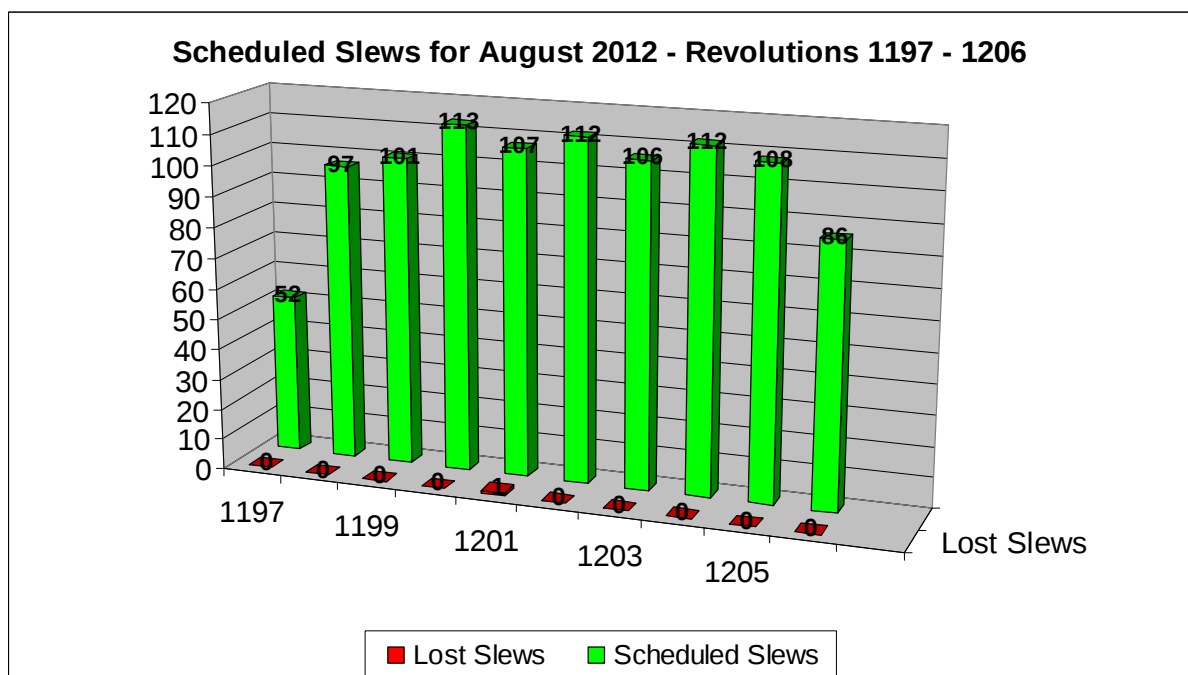


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

No information available this month.

3.2 Ground Stations and Network

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

DOY 227 (2012-08-14)

12:49:00 G/S: Data gaps from Redu --> RFI (both chains)

15:04:00 G/S: Data gaps from Redu --> RFI (chain 1 only)

16:12:00 G/S: Data gaps from Redu --> RFI (both chains)

DOY 230 (2012-08-17)

11:55:00 G/S: Data gaps from Redu --> RFI (both chains)

16:01:00 G/S: Data gaps from Redu --> RFI (both chains)

19:50:00 Redu IFMS-2 lost lock on the downlink. ECC attempted to manually relock the IFMS. but without success. IFMS-2 relocked without further intervention. On DOY 233 at 06:22. Investigation has shown that the IFMS's CFE board (Common Front End) has a loose contact. A replacement board has been requested by the station staff.

22:07:00 G/S: Data gaps from Redu --> 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.

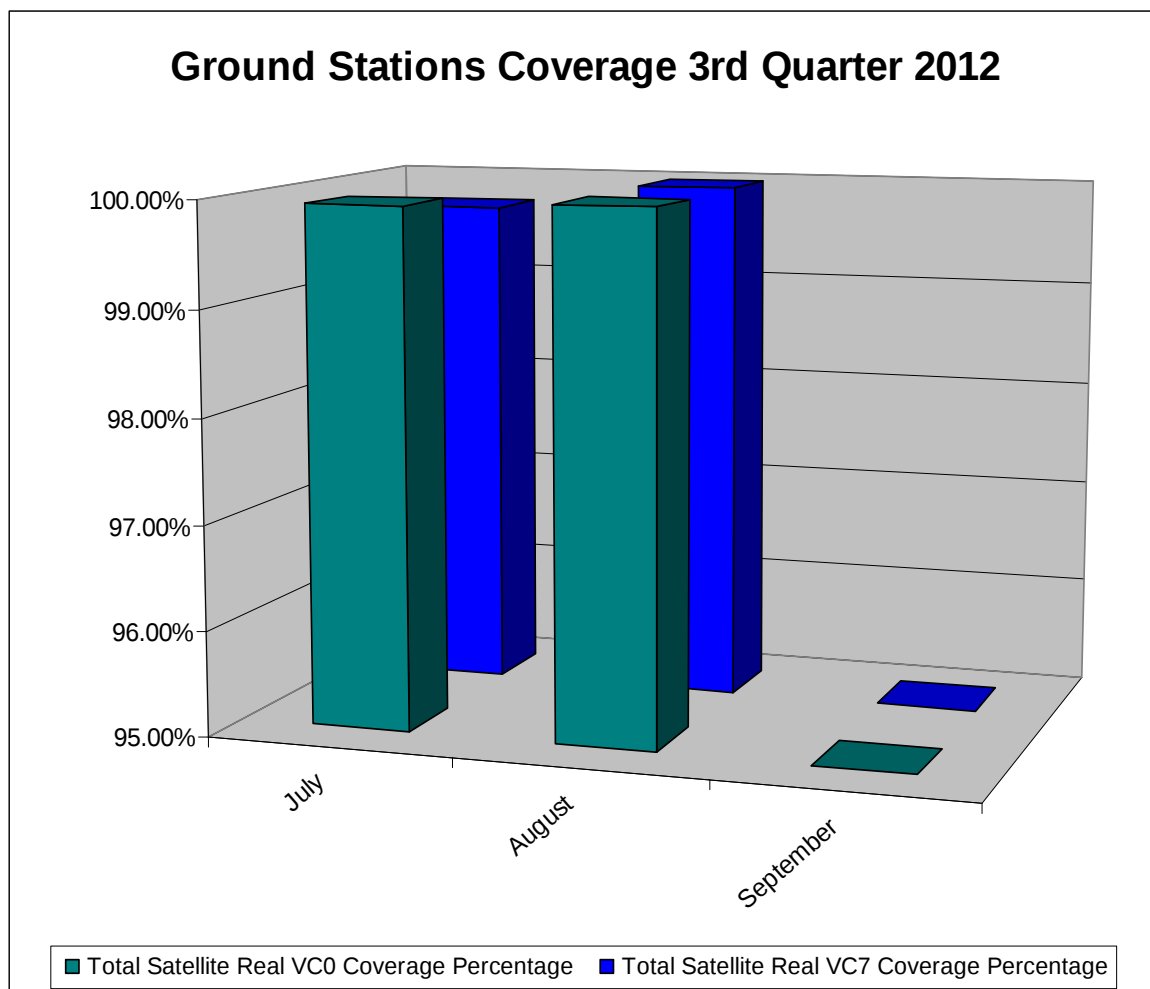


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1203 to 1217, corresponding to the time range 19 August to 3 October.

New observations have been planned for revolutions 1203 (19-22 August) to 1213 (18-21 Sep), including ToO observations of the new Black Hole candidate Sw J174510.8-262411

TSFs have been received for revolutions 1198 to 1210.

3.3.2 Observation Status

New ECS files have been for revolutions 1184 to 1189, covering observations up to 11 July.

3.3.3 ISOC Science Data Archive

Work is ongoing on the development of the new ISDA and the corresponding documentation. There remain some gaps in the telemetry data transferred from MOC.

3.3.4 ISOC System

ISOC system V33.0.1 was released on 9 August, including a fix to plan Earth Observations with correct OMC settings.

3.3.5 Problems

No new problems.

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-3296	2012-08-10	OBSM task freezes	IMCS	Testing
INT-3297	2012-08-10	Stopping autostack during perigee crashes multiplexer	IMCS	Testing
INT-3298	2012-08-23	TMDS_RT uses constantly ~50% CPU after NCTRS switch	IMCS	Testing
INT-3300	2012-08-16	Comments on ESAM recovery procedure	Offline Tools	Pending
INT_SC-399	2012-08-06	SPI PSD channel rates malfunction	Payload	Closed
INT_SC-400	2012-08-16	Integral ESAM Entry #4	Spacecraft	Closed
INT_SC-401	2012-08-18	SPI PSD channel rates malfunction	Payload	Testing

AR id	Date of occurrence	Subject	Segment	Status
INT_SC-402	2012-08-16	SPI automatic reaction at belt entry during ESAM#4	Payload	Pending
INT_SC-403	2012-08-23	IREM Anomaly: Reset of IREM_CSCI S/W #135, 23/08/2012	Payload	Closed
INT_SC-404	2012-08-28	A5135 "Wheel status R" OOL during EO2.3	Spacecraft	Testing
INT_SC-405	2012-08-29	IREM Anomaly: Reset of IREM_CSCI S/W #136, 29/08/2012	Payload	Testing
INT_SC-406	2012-08-29	IBIS VETO VDM07 HV Breakdown	Payload	Closed
INT_SC-407	2012-08-31	High count rate on MCE4 shortly after rad. belt exit	Payload	Closed

5 Special Events & Future Milestones

Virtualised Solaris environments

MCS development

Battery 1 Reconditioning

Earth observation 2.4

6 Appendix

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

6.1 AOCS operations

During this period, 449 Open Loop Slews, 524 Closed Loop Slews and 26 Momentum Biases were executed (as reported by ACC OEM).

1 slew was missed from the Timeline due to ground segment issues. For slews interrupted due to other issues (guide star problems, etc) please see the INTEGRAL weekly reports: <http://10.33.199.49/documentation/wops.php>

6.1.1 Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 01/09/2012 is reported in the following plot:

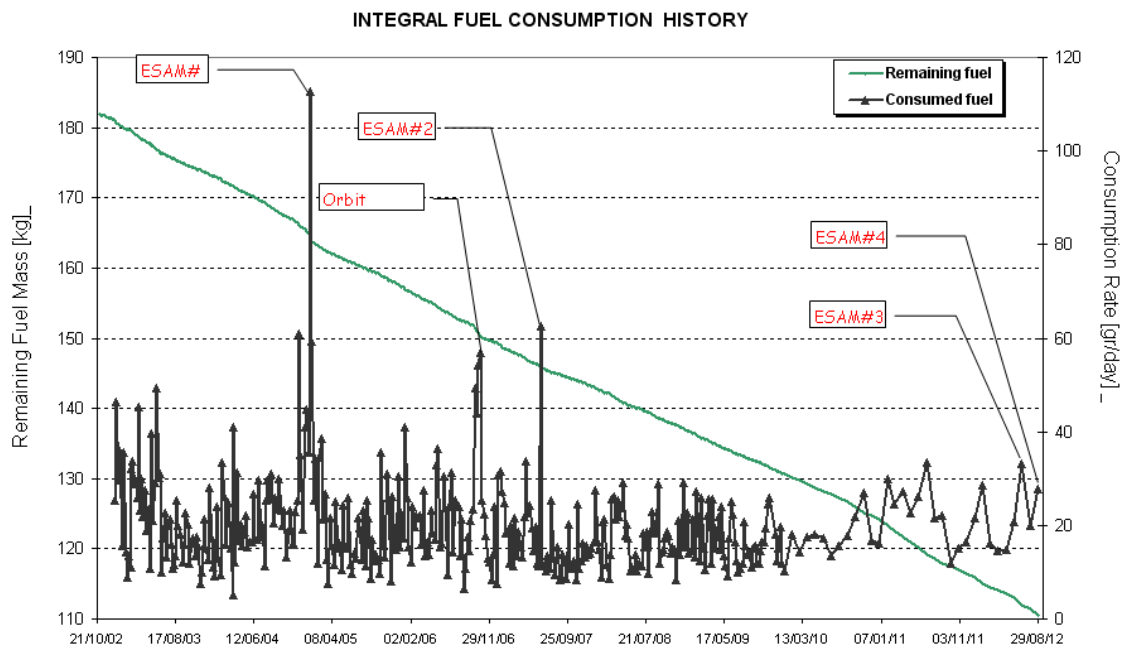


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

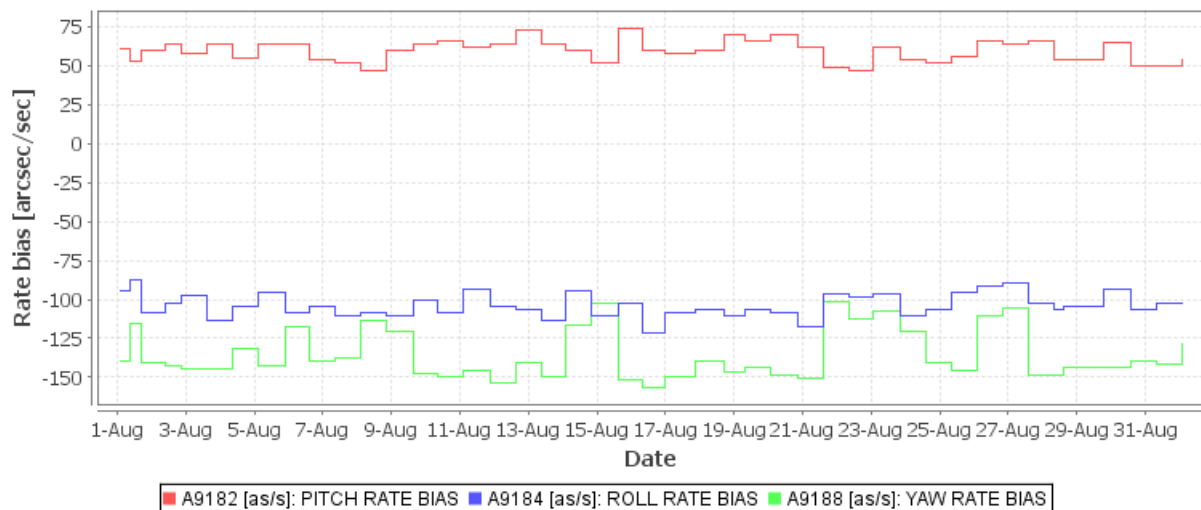


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

Please refer to the INTEGRAL weekly reports for all AOCS issues not considered as anomaly (e.g., TPF update failures that forced an interruption to the timeline and have led to a loss of a slew, TC Start

Sun Steer Law failed at CEV level completion, events where the IMU came on due to the loss of a guide star,..). In the following, only the AOCS anomalies are listed which occurred during the reporting period.

16-08-2012 (Day of Year 229, Revolution 1201)

Integral ESAM Entry #4, which resulted in the last seven PIDs being lost from revolution 1201 and the first twenty eight lost from revolution 1202: see INT_SC-400

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 following plot shows the evolution of the cold plate and H bus temperature during the reporting period. The stroke of all four compressors was increased to 39 on 18-08-2012 leading to a decrease of the temperature of the cold plate as well to an increase of the SPI CDE LCL currents.

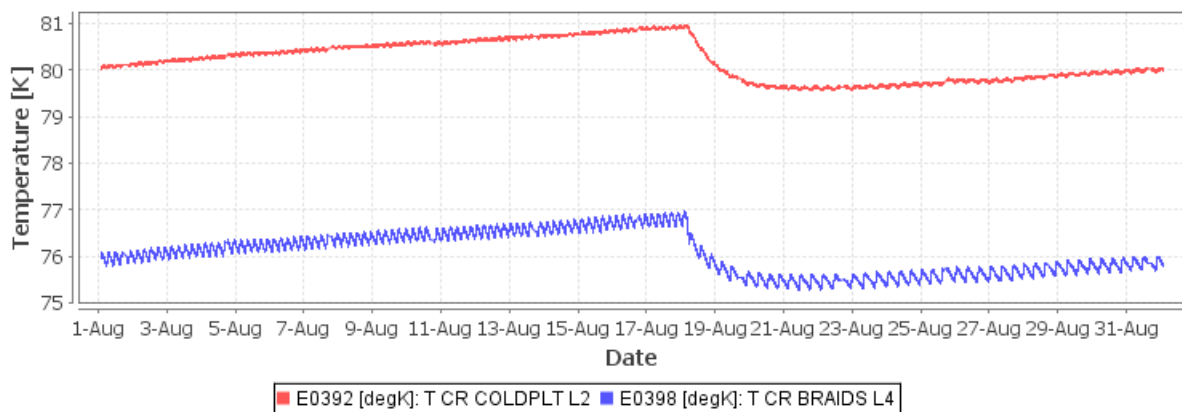


Figure 13: SPI Cold plate and H-bus temperature

The following plot shows the evolution of the CDE LCL currents during the reporting period. The increase of the LCL currents on 18-08-2012 is due to the stroke increase.

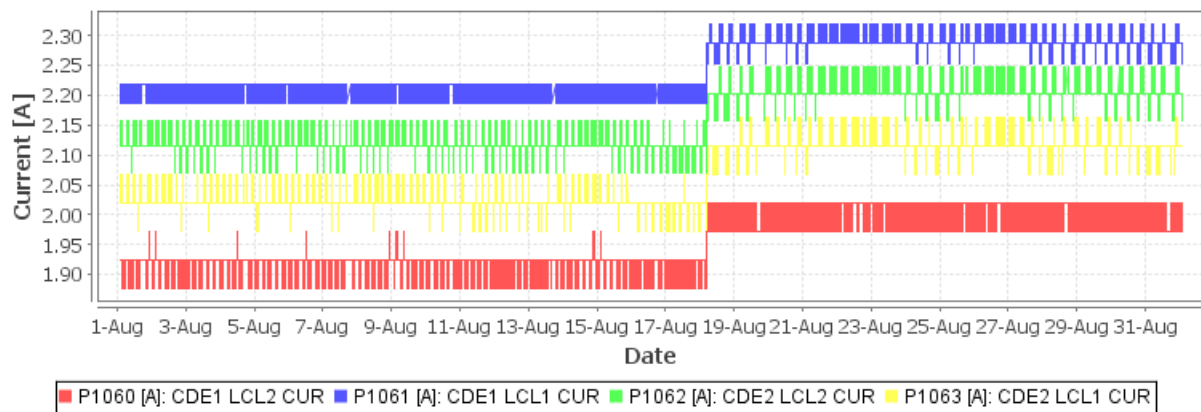


Figure 14: SPI CDE LCL current

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).

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.

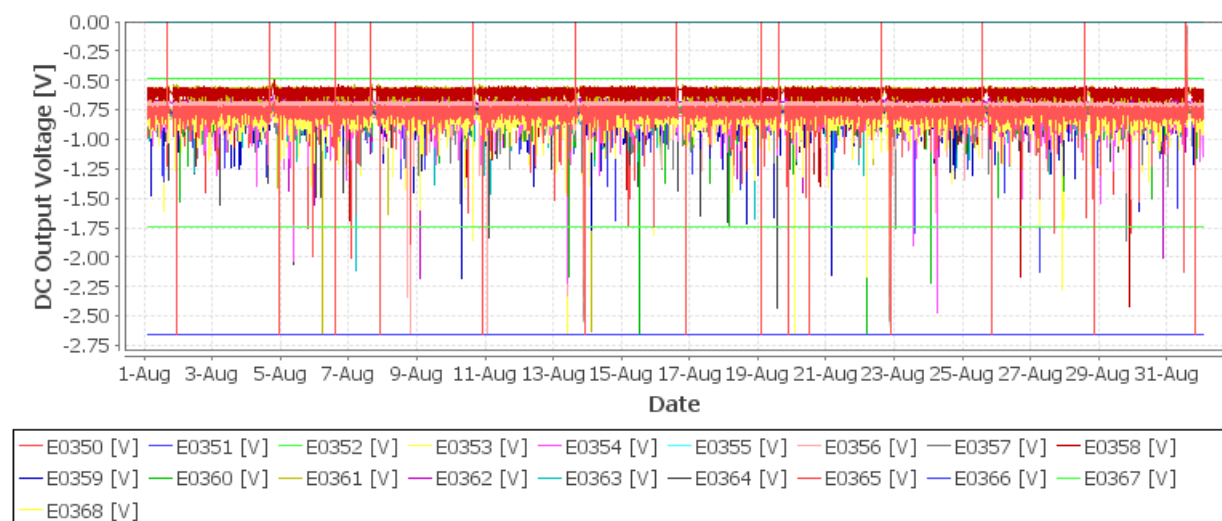


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.

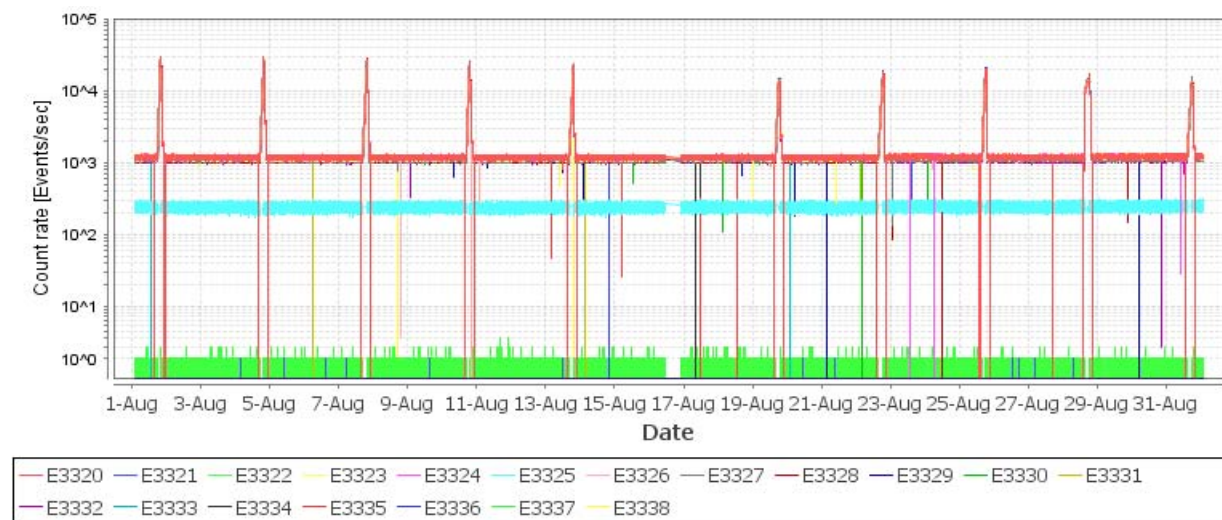


Figure 17: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic.

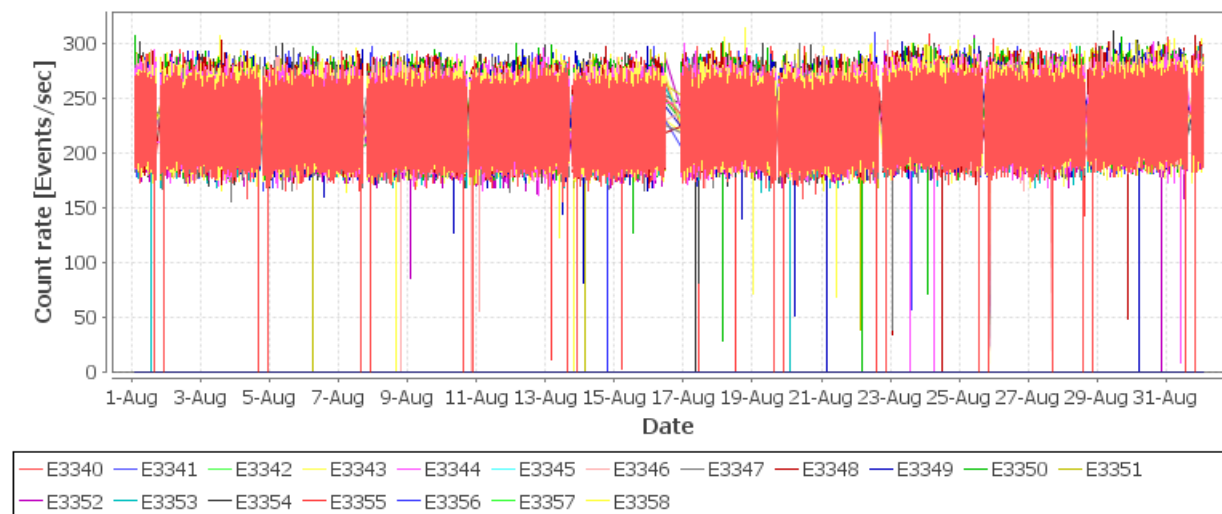


Figure 18: SPI GeD Time Tagged Saturated count rates

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

06-08-2012 (Day of Year 219, Revolution 1198)

SPI PSD channel rates malfunction: please see INT_SC-399.

07-08-2012 (Day of Year 220, Revolution 1199)

The TM allocation for SPI changed from 99 to 89 at the beginning of rev. 1199.

16-08-2012 (Day of Year 229, Revolution 1201)

Integral entered Emergency Sun Acquisition Mode (ESAM) at 08.52Z. As ESAM exit to SSA occurred before the time of planned instrument activation, the instrument was activated via the automatic timeline (rev. 1202). However, for SPI activation – which normally is autonomous - some manual intervention was required following ESAM exit. This was completed at 20.11Z. For further information, please see INT_SC-400.

18-08-2012 (Day of Year 231, Revolution 1202)

On 18-08-2012 at 03:09Z the stroke of all four compressors was increased to 39 as a reaction to a S/H OOL on the TM E0392 'T CR COLDPLT L2' S/H-OOL (value= 80.92K).

18-08-2012 (Day of Year 231, Revolution 1202)

SPI PSD channel rates malfunction: please see INT_SC-401.

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. In rev. 1207 (starting 31.8.2012), there were high count rates on MCE4 shortly after rad. belt exit (please see INT_SC-407):

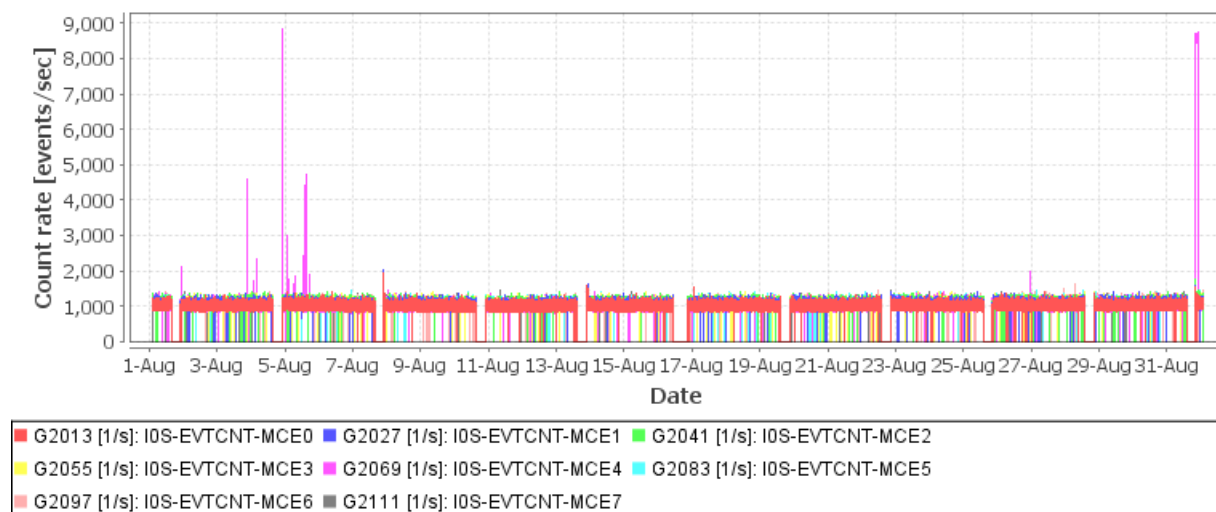


Figure 20: ISGRI MCE Counters

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

16-08-2012 (Day of Year 229, Revolution 1201)

Integral entered Emergency Sun Acquisition Mode (ESAM) at 08.52Z. As ESAM exit to SSA occurred before the time of planned instrument activation, the instrument were activated via the automatic timeline (rev. 1202). This was done successfully for IBIS. For further information, please see INT_SC-400.

23-08-2012 (Day of Year 236, Revolution 1204)

IREM Anomaly: Reset of IREM_CSCI S/W #135 which forced IBIS to automatically enter safe configuration. Please see INT_SC-403.

29-08-2012 (Day of Year 242, Revolution 1206)

IREM Anomaly: Reset of IREM_CSCI S/W #136 which forced IBIS to automatically enter safe configuration. Please see INT_SC-405.

29-08-2012 (Day of Year 242, Revolution 1206)

IBIS VETO VDM07 HV Breakdown: please see INT_SC-406.

31-08-2012 (Day of Year 244, Revolution 1207)

High count rate on MCE4 shortly after rad. belt exit: please see INT_SC-407.

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.

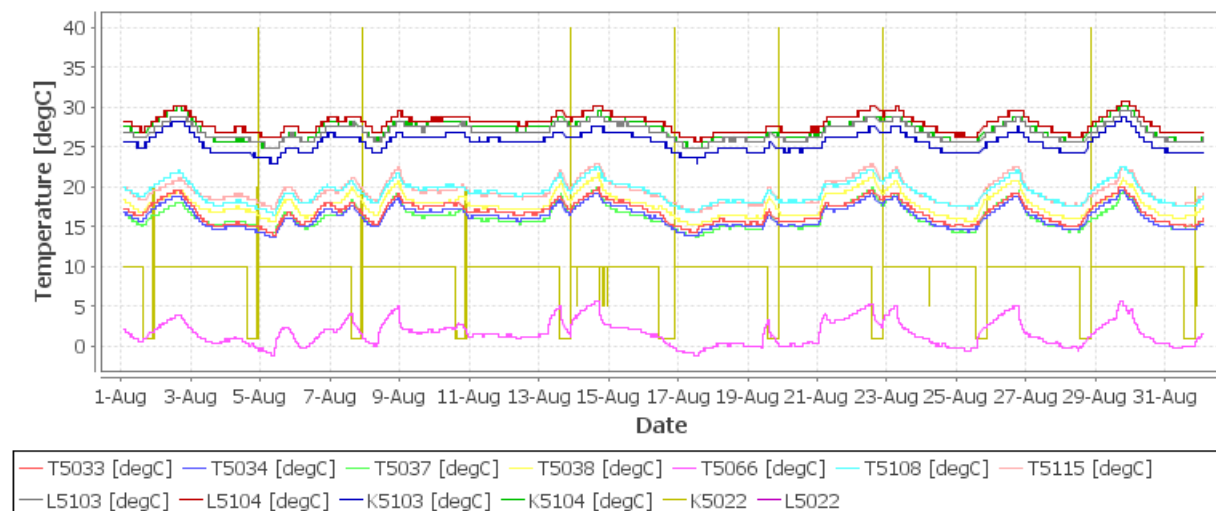


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

16-08-2012 (Day of Year 229, Revolution 1201)

At 08:52:22 JEMX 1 & 2 went to SAFE owing to an ESAM. They were nominally recovered by the timeline after AOS in revolution 1202, albeit at an incorrect attitude. The impact was the loss of 3 hours 18 minutes of observation time.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

01-08-2012 (Day of Year 214, Revolution 1196)

At 06:33, problems with the TMTCs at Redu caused a timeline interruption. After a recovery, the timeline was rejoined at 07:40. The impact was the loss of pointing 11960087.

01-08-2012 (Day of Year 214, Revolution 1197)

At 21:15, an operator error meant that the first flat-field calibration to be performed as part of the Earth observation was not sent. The impact was the first image was lost. It was at this time the following OEMs were received:

2012.214.21.20.32.164	2012.214.21.20.39.282	1792	RealTime	133	TC	REJECT	REJECTED
TC3		0	0	65535	PR	N	E

2012.214.21.19.27.164	2012.214.21.19.33.920	1792	RealTime	133	TC	REJECT	REJECTED
TC3		0	0	65535	PR	N	E

These correspond to 2 failed attempts to re-send the M1340 (FFCALIBRATE PAR) commands from the manual-stack for that image.

13-08-2012 (Day of Year 226, Revolution 1201)

At 22:08, a verifier crash interrupted the timeline. A recovery was performed, and the timeline rejoined at 23:23. The impact was the loss of pointings 12010006 & 12010007.

14-08-2012 (Day of Year 227, Revolution 1201)

At 03:40, a FD problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 04:17. The impact was the loss of pointing 12010017. It was at this time the following OEMs were received:

2012.227.04.08.45.842	2012.227.04.08.56.211	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2012.227.04.08.51.842	2012.227.04.08.56.259	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

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

16-08-2012 (Day of Year 229, Revolution 1201)

At 08:52:22, OMC went to SAFE mode owing to an ESAM entry. After recovery from ESAM, OMC was commanded back to stand-by mode at 19:33:02, and at 10:03:26 the following day was returned to Science mode albeit at an incorrect attitude. The timeline was eventually resumed at 11:07:18. The impact was the loss of pointings 12010101 to 12010105 (5 pointings) and pointings 12020002 to 12020027 (26 pointings) were lost. Pointing 12020028, was initially rejected, but the commands were resent. The impact was the duration was cut short from a planned 2000 to 1930 seconds. It was at this time the following OEMs were received:

2012.230.11.04.17.776	2012.230.11.04.23.700	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2012.230.11.04.23.901	2012.230.11.04.31.145	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the rejected M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the auto-stack for pointing 12020028.

18-08-2012 (Day of Year 231, Revolution 1202)

At 14:01, a FD problem led to the suspension of the timeline. A recovery was performed, and the timeline rejoined at 14:36. The impact was the loss of pointing 12020074. It was at this time the following OEMs were received:

2012.231.14.28.57.835	2012.231.14.29.07.811	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2012.231.14.29.03.960	2012.231.14.29.13.609	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

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

At 22:07, bad frames from Redu caused the loss of the OEM indicating the start of pointing 12020087, the pointing was, however, executed nominally.

19-08-2012 (Day of Year 232, Revolution 1203)

At 17:40, an IFTS problem forced an interruption to the timeline. After a recovery, the timeline was rejoined at 20:17:02. The impact was the loss of pointing 12030002.

23-08-2012 (Day of Year 236, Revolution 1204)

At 22:54:07, owing to an IREM SEU, OMC switched to SAFE mode. A recovery was performed, and the timeline rejoined at 23:34:46. The impact was pointing 12040049 was interrupted after 1785 from a planned 2000 seconds, and pointing 12040050 was lost. It was at this time the following OEMs were received:

2012.236.22.58.00.897	2012.236.22.58.08.922	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2012.236.22.58.07.147	2012.236.22.58.15.460	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the rejected M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the auto-stack for pointing 12040050.

25-08-2012 (Day of Year 238, Revolution 1204)

At 01:10:28, an AOCS problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 02:25:34. Pointing commands were issued at 01:41:18, but the attitude was wrong. The impact was the loss of pointing 12040095.

2012.238.01.48.49.705	2012.238.01.48.58.795	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2012.238.01.48.55.955	2012.238.01.49.04.868	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the rejected M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the auto-stack 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.

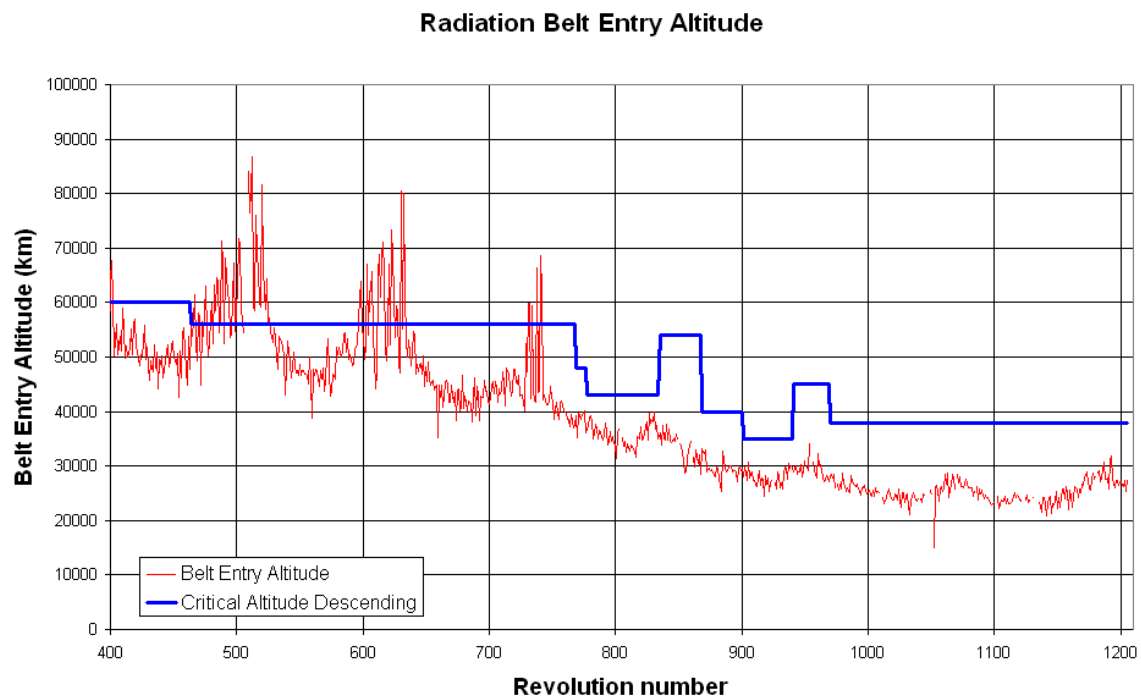
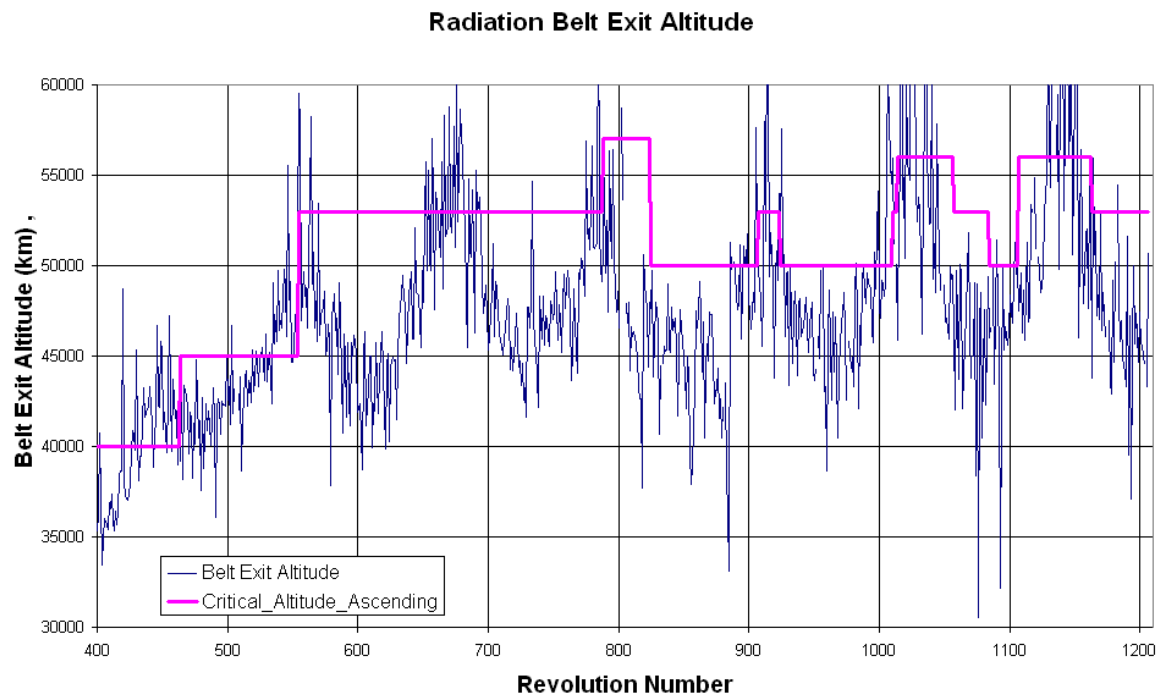


Figure 23: Radiation belt entry

**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
1196	RAD_ENTR R 2012-08- 01T13:56:36Z	01/08/2012 15:16:53	28000	01-Aug-2012 15:21:22	20463.24	01-Aug-2012 16:11:22	8556.055
1197	RAD_EXIT R 2012-08- 01T20:41:08Z	01/08/2012 19:49:09Z	47498	01-Aug-2012 20:41:22	50071.42	01-Aug-2012 16:41:22	3792.288
1197	RAD_ENTR R 2012-08- 04T13:42:29Z	04/08/2012 15:02:13	28104	04-Aug-2012 15:06:46	20634.51	04-Aug-2012 15:56:46	8673.597
1198	RAD_EXIT R 2012-08- 04T20:26:31Z	04/08/2012 19:26:53	46102	04-Aug-2012 20:26:46	50037.51	04-Aug-2012 16:26:46	3727.455
1198	RAD_ENTR R 2012-08-	N/A	N/A	07-Aug-2012	18856.99	07-Aug-2012	9216.376

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
	07T13:29:50Z			15:00:25		15:40:25	
1199	RAD_EXIT R 2012-08- 07T20:13:40Z	07/08/2012 19:37:09	50262	07-Aug-2012 20:10:25	49670.36	07-Aug-2012 16:20:25	3789.155
1199	RAD_ENTR R 2012-08- 10T13:16:28Z	10/08/2012 14:38:13	27527	10-Aug-2012 14:39:17	20671.7	10-Aug-2012 15:29:17	8744.185
1200	RAD_EXIT R 2012-08- 10T20:00:28Z	10/08/2012 19:08:13	47518	10-Aug-2012 19:59:17	49959.49	10-Aug-2012 15:59:17	3787.626
1200	RAD_ENTR R 2012-08- 13T13:02:36Z	N/A	N/A	13-Aug-2012 14:29:36	19721.37	13-Aug-2012 15:09:36	10121.62
1201	RAD_EXIT R 2012-08- 13T19:46:31Z	13/08/2012 18:45:09	45894	13-Aug-2012 19:39:36	49032.87	13-Aug-2012 15:49:36	3699.169
1201	RAD_ENTR R 2012-08- 16T12:49:42Z	16/08/2012 14:11:01	27510	16-Aug-2012 14:11:44	20621.85	16-Aug-2012 15:01:44	8601.637
1202	RAD_EXIT R 2012-08- 16T19:33:01Z	16/08/2012 18:29:42	45562	16-Aug-2012 19:31:44	50135.89	16-Aug-2012 15:31:44	3627.535
1202	RAD_ENTR R 2012-08- 19T12:37:57Z	N/A	N/A	19-Aug-2012 14:01:41	20687.54	19-Aug-2012 14:51:41	8616.643
1203	RAD_EXIT R 2012-08- 19T19:20:42Z	19/08/2012 18:13:10	44552	19-Aug-2012 19:21:41	50173.37	19-Aug-2012 15:21:41	3552.52
1203	RAD_ENTR R 2012-08- 22T12:27:20Z	N/A	N/A	22-Aug-2012 13:56:12	19194.48	22-Aug-2012 14:36:12	9493.599
1204	RAD_EXIT R 2012-08- 22T19:10:03Z	22/08/2012 18:19:58	47584	22-Aug-2012 19:06:12	49557.07	22-Aug-2012 15:16:12	3596.843
1204	RAD_ENTR R 2012-08-	N/A	N/A	25-Aug-2012 13:45:43	19523.15	25-Aug-2012 14:25:43	9879.542

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
	25T12:15:23Z						
1205	RAD_EXIT R 2012-08- 25T18:58:37Z	25/08/2012 17:43:18	42849	25-Aug-2012 18:55:43	49244.08	25-Aug-2012 15:05:43	3640.567
1205	RAD_ENTR R 2012-08- 28T12:00:36Z	28/08/2012 13:22:54	28120	28-Aug-2012 13:27:38	20505.59	28-Aug-2012 14:17:38	8519.651
1206	RAD_EXIT R 2012-08- 28T18:44:02Z	28/08/2012 18:16:30	51270	28-Aug-2012 18:47:38	50163.99	28-Aug-2012 14:47:38	3670.282
1206	RAD_ENTR R 2012-08- 31T11:45:54Z	N/A	N/A	31-Aug-2012 13:17:38	19845.97	31-Aug-2012 13:57:38	10193.49
1207	RAD_EXIT R 2012-08- 31T18:28:54Z	31/08/2012 18:22:22	54661	31-Aug-2012 18:27:38	49059.48	31-Aug-2012 14:37:38	3576.956

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

23-08-2012 (Day of Year 236, Revolution 1204)

At 22:54:12Z, a local reset of the IREM CSCI S/W (SEU #135) 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 2012.236.22:54:12Z (157656.8 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex);

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 = 10111100**11**000000, 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, and ground link 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 02:13:00Z.

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 23:24:00Z and IBIS at 23:57:00Z.

29-08-2012 (Day of Year 242, Revolution 1206)

At 06:25:18Z, a local reset of the IREM CSCI S/W (SEU #136) 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 2012.242.06:25:18Z (121794.6 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex);
- 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 = 10111100**11**000000, 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, and ground link 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 07:58:00Z.

OMC & IBIS were unaffected, as the DRMC flag was set owing to the on-going Earth observation.