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

INTEGRAL
Mission report

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

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Routine Phase

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2 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 December and covers the revolutions 1237 until 1247 (included). 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. During this reporting period, 696 of the 704 planned science pointings and 2 Flat Field calibrations were executed nominally. 4 pointings were lost to AOCS problems, 2 pointings were interrupted and 1 lost to IREM SEUs, and 1 was lost to a FD problem.
- Testing IMCS on Solaris 10 IMCS E3.6.0 - Validated on DEV LAN and installed on c-Chain for testing (timeline regression test)

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- JEM-X2 DFEE CRC Anomaly following eclipse on 2012-12-05
- PPDU Watchdog Warning Flag Set
- SA WING current deviation (PD3508D OOL)
- IREM Anomaly: Reset of IREM_CSCI S/W #137, 17/12/2012
- IREM Anomaly: Reset of IREM_CSCI S/W #138, 24/12/2012
- TM parameter P2160 LCL STA OMC SH B Closed (SEU)
- JEM-X1 DFEE CRC Anomaly following eclipse on 2012-12-26

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
- Incorrect Ground Station in PSF for revolution 1237
- Unable to connect TM links to VIL2
- Ground station handover earlier than scheduled
- False SCC OOL appears during retrieval (DOY 360)
- TCONmainRT task died due to the configuration not supporting DOY366 (leap year)

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

3 Satellite status

3.1 Platform

3.1.1 AOCS

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

2 slews were 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 0.5860 Kg. The remaining propellant is in the order of 108.4020 Kg.

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

3.1.2 Power

All units of the EPS are working nominally.

3.1.3 Thermal

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

3.1.4 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.

3.1.5 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.

3.2 Payload

3.2.1 SPI

Following the 18th SPI annealing, which ended on 09/12/2011, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003), detector #17 (failed since 17/07/2004), detector #5 (failed since 19/02/2009) and detector #1 (failed since 27/05/2010).

The Germanium detectors' temperature was kept in the range 80K+/-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 89 packets/cycle, except from 2012-12-01T13:27:05Z to 2012-12-01T18:00:21Z and from 2012-12-30T01:40:36Z to 2012-12-

30T05:39:27Z (OMC Flat Field Calibrations), when it was 88 packets/cycle. The average telemetry occupation when the allocation was 89 packets/cycle was 71.6 packets/cycle.

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

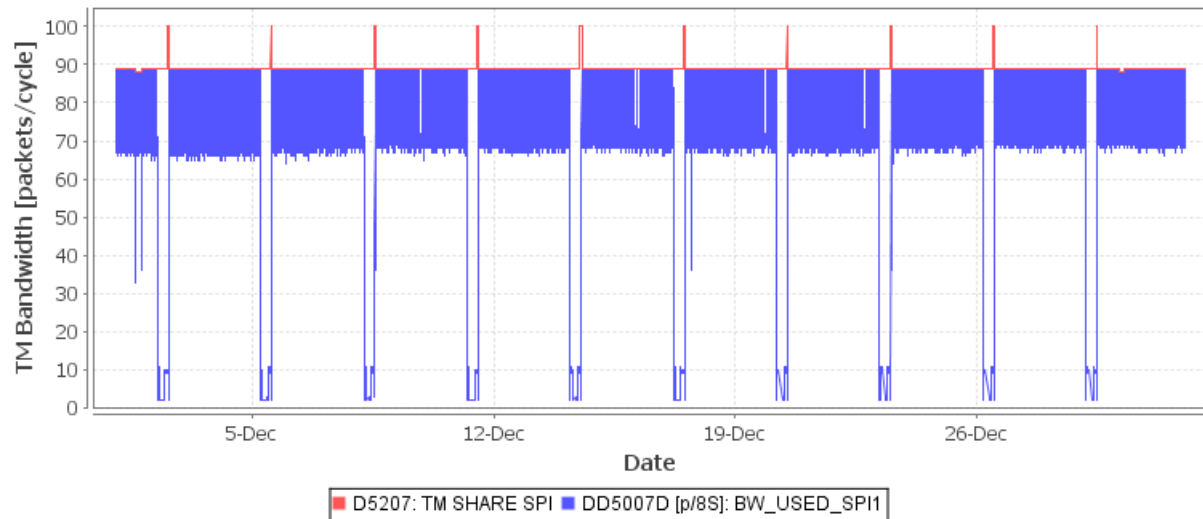


Figure 1: SPI TM bandwidth utilisation

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

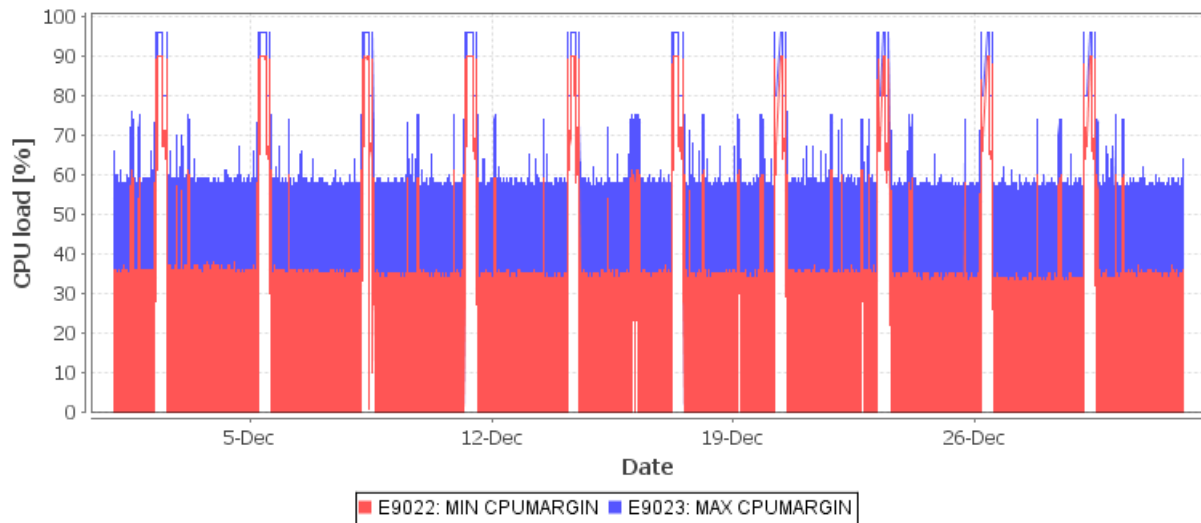


Figure 2: SPI IASW Performance

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

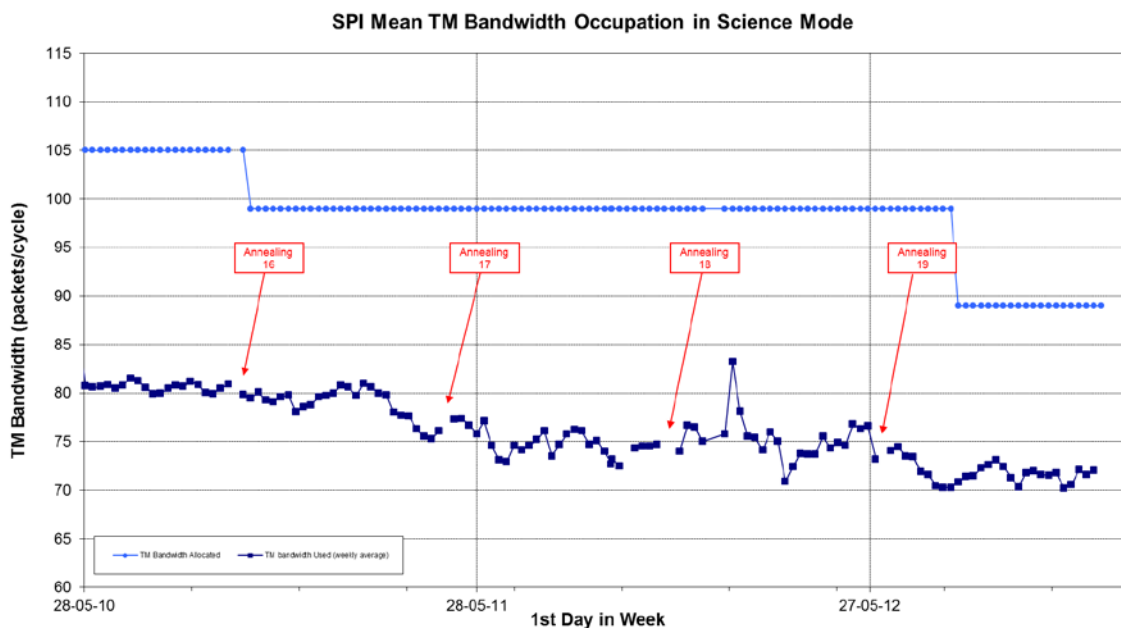


Figure 3: SPI TM bandwidth usage evolution since May 2010

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

3.2.2 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 2012-12-01T13:27:05Z to 2012-12-01T18:00:21Z and from 2012-12-30T01:40:36Z to 2012-12-30T05:39:27Z (OMC Flat Field Calibrations), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 98.4 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.

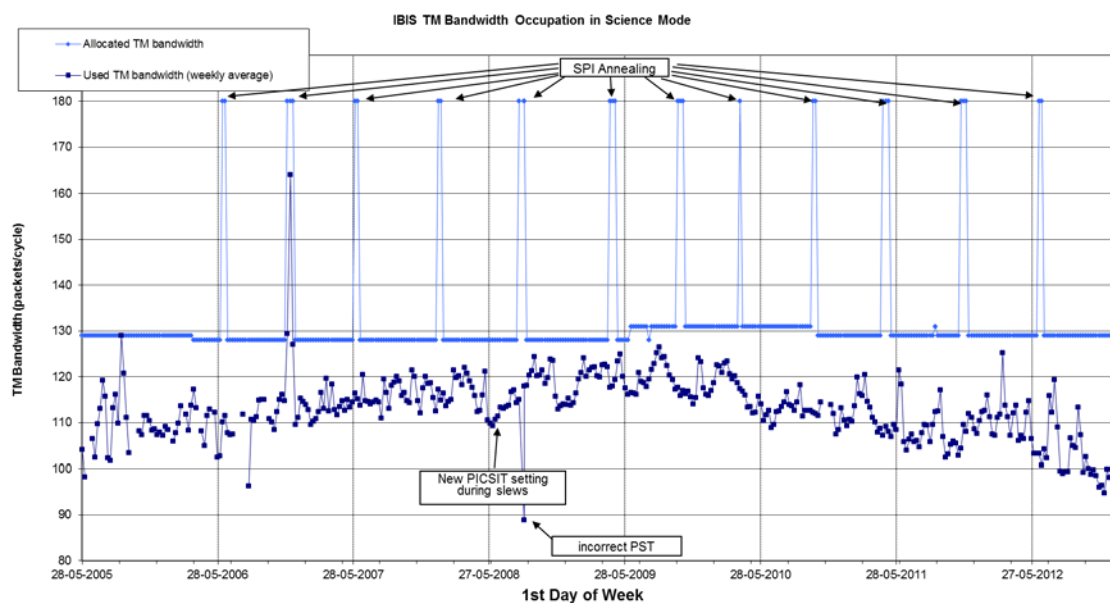


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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

3.2.3 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, except from 2012-12-01T13:27:05Z to 2012-12-01T18:00:21Z and from 2012-12-30T01:40:36Z to 2012-12-30T05:39:27Z during the OMC Flat-Field calibrations, when it was 4 packets/cycle each.

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

3.2.4 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 2012-12-01T13:27:05Z to 2012-12-01T18:00:21Z and from 2012-12-30T01:40:36Z to 2012-12-30T05:39:27Z during the Flat-Field calibrations, when it was 63 packets/cycle.

During this reporting period, 696 of the 704 planned science pointings and 2 Flat Field calibrations were executed nominally. 4 pointings were lost to AOCS problems, 2 pointings were interrupted and 1 lost to IREM SEUs, and 1 was lost to a FD problem.

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

3.2.5 IREM

The status of IREM is nominal.

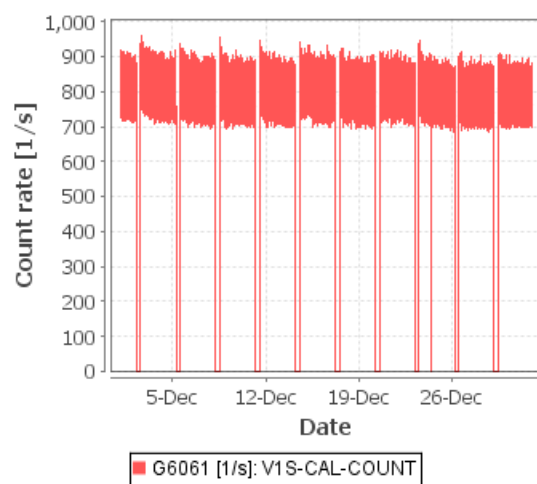
Note: Some more information concerning the IREM operations is provided in Appendix 6.6.

Radiation background

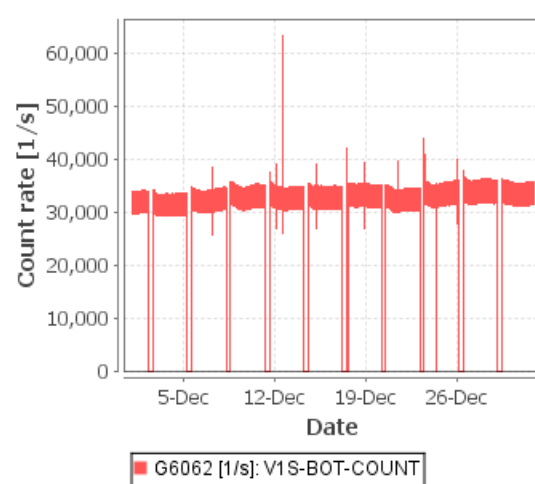
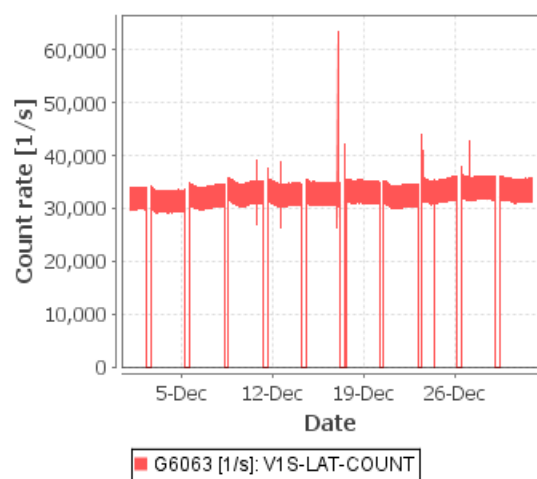
The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:

VETO Calibration Source Count Rate

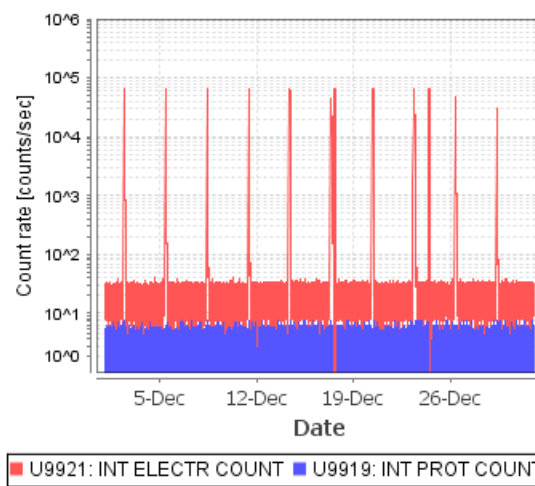
VETO Bottom Count Rate



VETO Lateral Count Rate

IREM Proton & Electron Counters¹

ACS Below 100MeV



ACS Above 100MeV

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

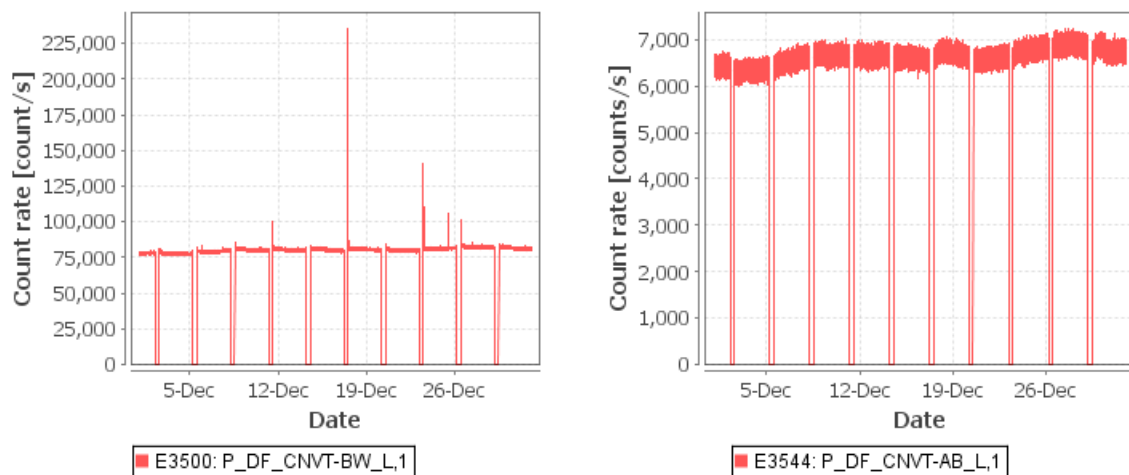


Figure 6: Instrument Count Rates

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

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

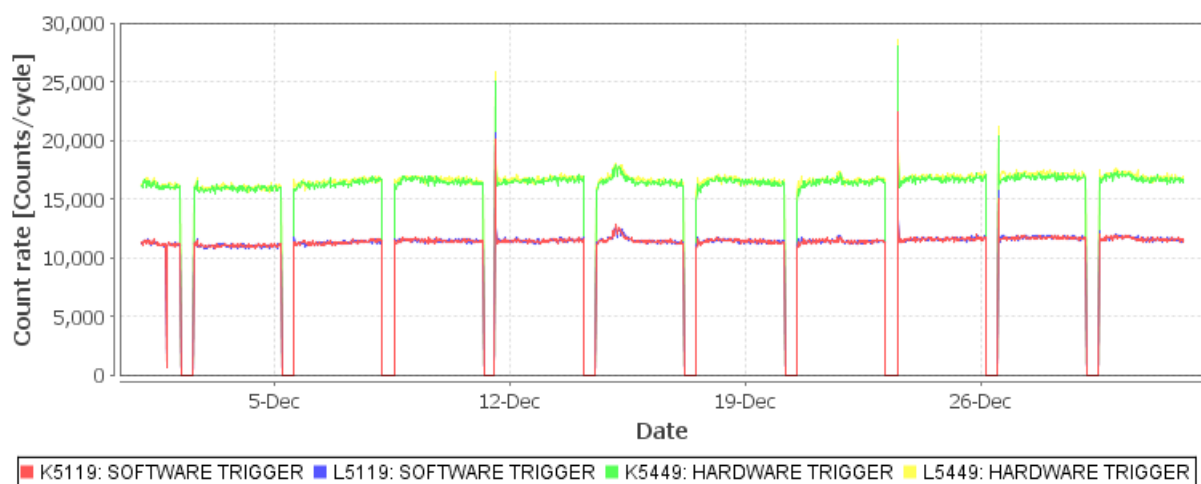


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

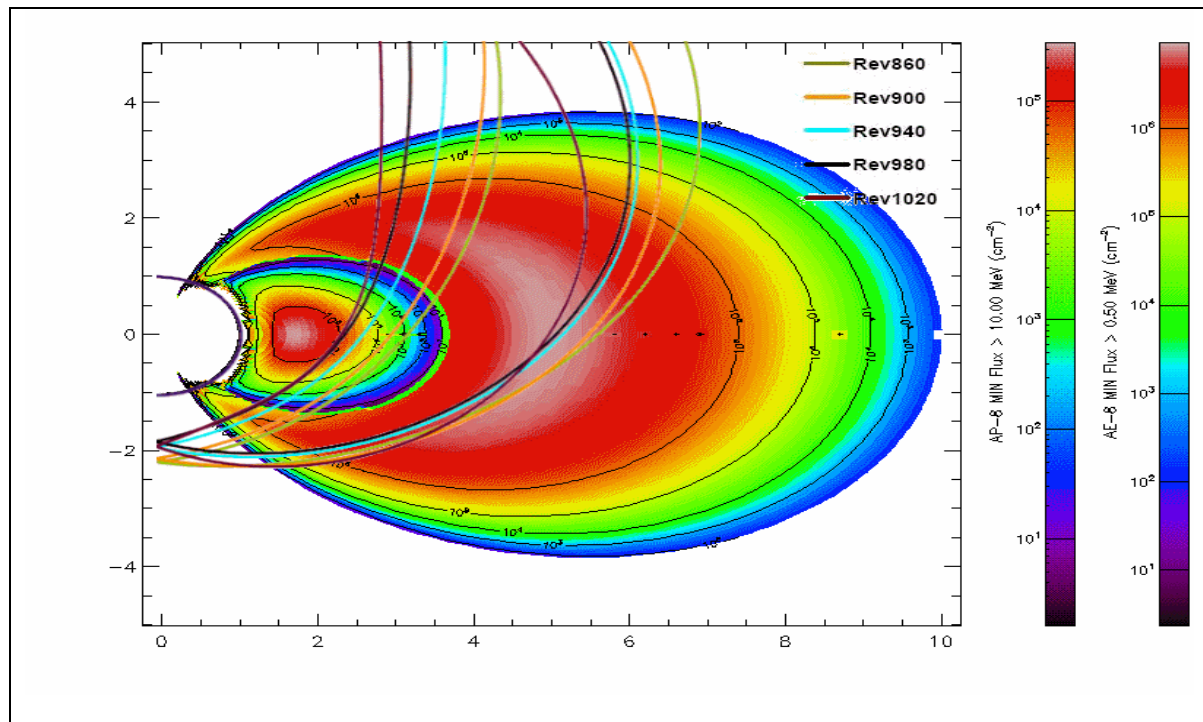


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

4 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.

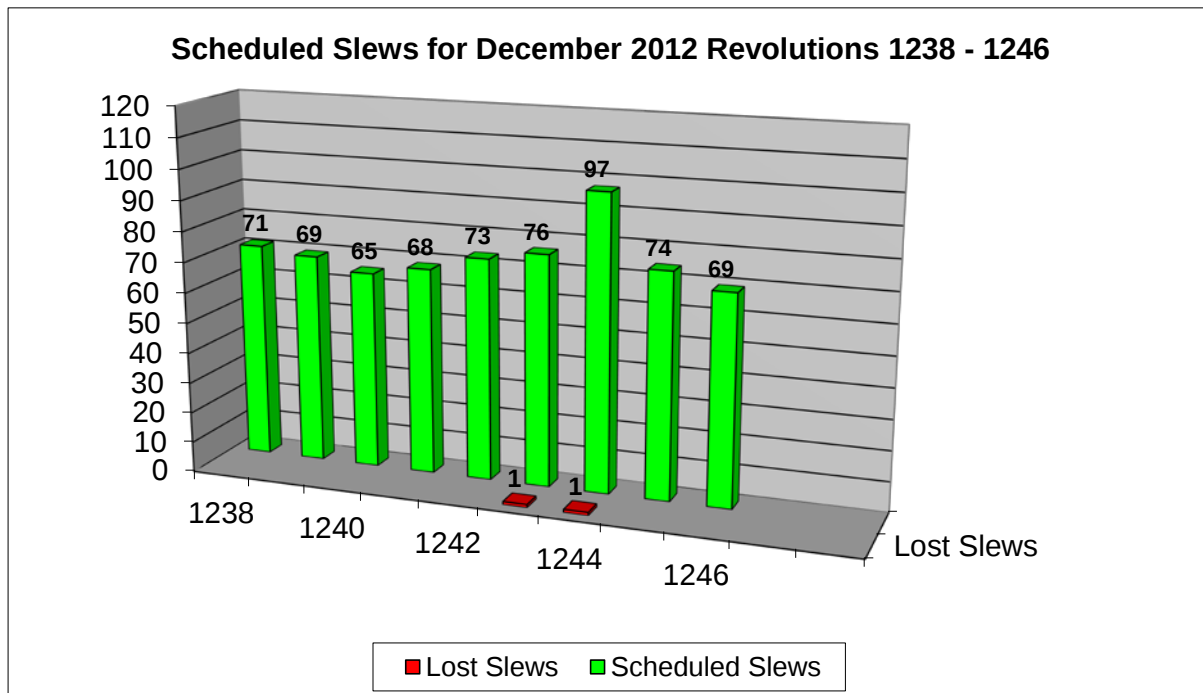


Figure 9: The number of slews scheduled compared to the number of slews lost

4.1 Mission Control System

The new MCS Release E3.6.0 was tested successfully on the C-Chain. This release was delivered to the development Chain in November and tested there as well.

The new Kiruna configuration is in place on A- and B-Chain plus NCTRS.

IFTS had to be restarted 3 times for sending data to ISDC again. The MCS raised several times the message 'Error sending data to ISDS' on A-Chain and once on the B-Chain. ISDS and IFRD got restarted. According to digilog those problems happened at least 2 times in this month.

Manual Stack crashed after AOS on sun129 on the 9th. The Multiplexer crashed on imca, as a consequence the Autostack crashed as well and both tasks got restarted. OMCH crashed on the 26th and was restarted by the Spacon. The Command Stacks are now normally restarted by the Spacon during Perigee to avoid a potential crash after AOS.

The AUX and ARCH tasks have been restarted on idda to resume the CD production on the 3rd, 4th, 14th, and 27th.

The TM Consolidator (TCON) task died on the 31st in the morning due to a SW problem, because DOY 366 was not properly handled. This was fixed by SWS during the day.

4.2 Ground Stations and Network

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

- On DOY 336 at 07:11, during VIL-2 support, the track was stopped by an STC schedule step executing early. This issue is under investigation by STC s/w support, but likely to be a recurrence of a known problem, for which a patch is already available. To be checked whether this STC database version already includes the patch.
- On DOY 337 at 13:33, during VIL-2 support, data gaps occurred due to RFI; duration ca. 16 seconds. Both D/L chains were affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 338 at 04:17, during Redu-1 support, data gaps occurred due to RFI. Only D/L chain 1 was affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 338 at 12:23, during Redu-1 support, data gaps occurred due to RFI. Only D/L chain 1 was affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 341 at 01:00, during Redu-1 support, data gaps occurred due to RFI. Both D/L chains were affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 341 at 07:07, during Redu-1 support, data gaps occurred due to RFI. Both D/L chains were affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 341 at 08:29, during Redu-1 support, data gaps occurred. No problem seen on STC log or STC charts. Probably a comms glitch between Redu and ESOC.
- On DOY 343 at 02:01, during Redu-1 support, data gaps occurred due to RFI. Both D/L chains were affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 347 at 07:52, during Redu-1 support, data gaps occurred due to RFI. Only D/L chain 1 was affected. This RFI did not correspond to any incident predicted by Flight Dynamics.
- On DOY 348 at 00:13, during Kiruna-1 support, data gaps occurred due to RFI. Predictions for RFI at KIR-1 are not yet available.
- On DOY 348 at 02:36, during Kiruna-1 support, data gaps occurred due to RFI.
- On DOY 348 at 12:00, during Redu-1 support, the track was ended by the STC schedule, due to a scheduling miscommunication. In the meantime, the Scheduling Office have agreed to not change any Integral scheduling until an EOCR has officially been submitted and the request agreed by Integral, and also to issue a new OMS 11 whenever the support times in any already issued OMS 11 have changed.
- On DOY 349 at 03:47, during VIL-2 support, the Spacon reported loss of onboard lock. The STC log shows that the uplink dropped at 03:47:22. ECC restarted the uplink, however there was a problem with starting the Forward Session on TMTCS-1, so TMTCS-2 was made prime for the rest of the support. The incident will be forwarded to the Station Engineer for investigation.

- On DOY 349 at 17:42, during Redu-1 support, data gaps occurred. No problem was seen on STC log or STC charts. Probably a comms glitch between Redu and ESOC.

ECC also reported the following incident:

- On DOY 350 at 19:55, during Kiruna-1 support, data gaps occurred due to RFI.

4.3 ISOC

4.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1247 to 1252, corresponding to the time range 29 December to 16 January. The PSFs for revolutions 1251 and 1252 had to be updated due to a change in ground-station scheduling.

New observations have been planned for revolutions 1243 (17-20 December) to 1252 (13-16 January). Re-planning was necessary for revolutions 1247 to 1249 for different issues. Revolution 1250 was set up with only open loop slews for testing. SPI Annealing #20 began in revolution 1249.

TSFs have been received for revolutions 1242 to 1251.

4.3.2 Observation Status

New ECS files have been for revolutions 1225 to 1235, covering observations up to 26 November.

4.3.3 ISOC Science Data Archive

A roadmap for the further ISDA development has been set up with the SAT. Data synced from ISDC directly to disks maintained by SAT.

4.3.4 ISOC System

No release in December, working on V34.0 to be released in January.

4.3.5 Problems

No new problems.

5 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-3315	2012-12-01	Incorrect Ground Station in PSF for revolution 1237.	FDS	Pending
INT-3316	2012-12-01	Unable to connect TM links to VIL2	ESA Stations	Pending

AR id	Date of occurrence	Subject	Segment	Status
INT-3317	2012-12-11	OOLs raised after restoring delivery breakpoints	Simulator	Pending
INT-3318	2012-12-12	Simulator tmp file not automatically deleted	Simulator	Pending
INT-3319	2012-12-13	Ground station Handover Earlier than scheduled	ESA Stations	Pending
INT-3320	2012-12-27	False SCC OOL appears during retrieval (DOY 360)	IMCS	Pending
INT_SC-412	2012-12-05	JEM-X2 DFEE CRC Anomaly following eclipse on 2012-12-05	Payload	Pending
INT_SC-413	2012-12-05	SA WING current deviation -> PD3508D OOL	Spacecraft	Pending
INT_SC-414	2012-12-05	PPDU Watchdog Warning Flag Set	Spacecraft	Pending
INT_SC-415	2012-12-17	IREM Anomaly: Reset of IREM_CSCI S/W #137, 17/12/2012	Payload	Pending
INT_SC-416	2012-12-24	IREM Anomaly: Reset of IREM_CSCI S/W #138, 24/12/2012	Payload	Pending
INT_SC-417	2012-12-25	TM parameter P2160 LCL STA OMC SH B Closed (SEU)	Payload	Pending
INT_SC-418	2012-12-26	JEM-X1 DFEE CRC Anomaly following eclipse on 2012-12-26	Payload	Pending

6 Special Events & Future Milestones

Virtualised Solaris environments

MCS development

Set up and validation of Kiruna

Eclipse season ends 04/01/2013

SPI annealing starts 03/01/2013

Testing IMCS on Solaris 10

IMCS E3.6.0 - Validated on DEV LAN and installed on C-Chain for testing (timeline regression test ongoing)

7 Appendix

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

7.1 AOCS operations

During this period, 446 Open Loop Slews, 315 Closed Loop Slews and 23 Momentum Biases were executed (as reported by ACC OEM).

2 slews were 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>

7.1.1 Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 01/01/2013 is reported in the following plot:

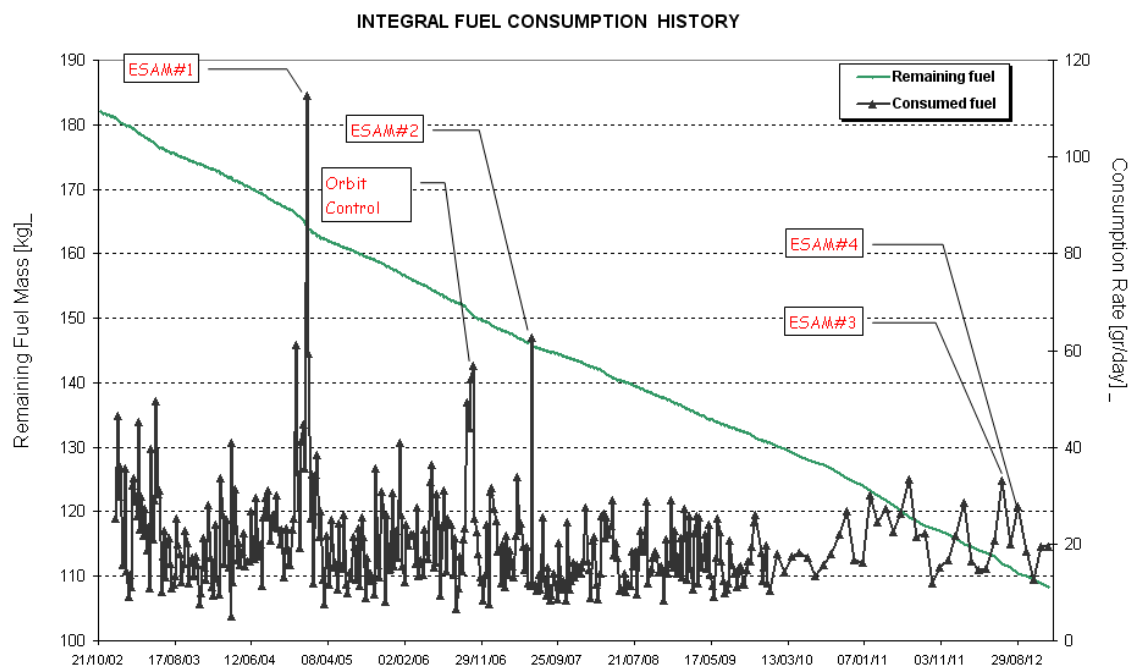


Figure 10: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

7.1.2 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.

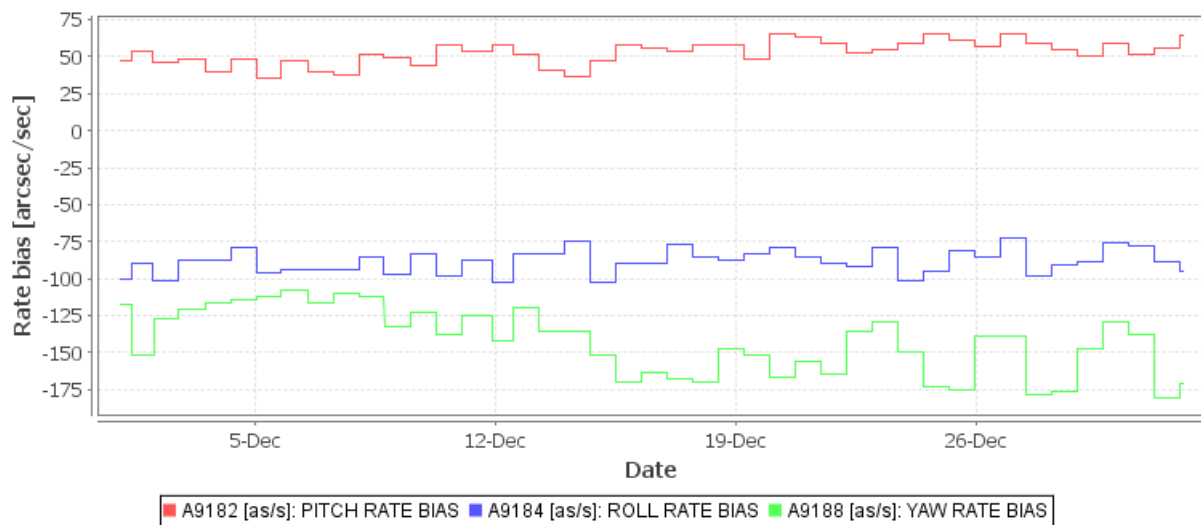


Figure 11: RMU pitch, roll and yaw. Historic data is available on request

7.1.3 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,...). There were no AOCS anomalies listed this month, which occurred during the reporting period.

7.2 SPI

7.2.1 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 vertical lines correspond to the eclipses.

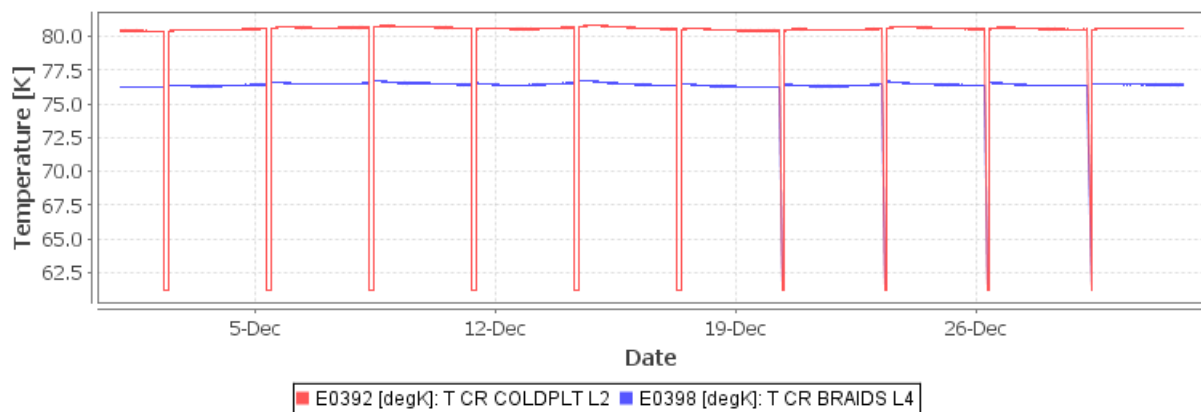


Figure 12: SPI Cold plate and H-bus temperature

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

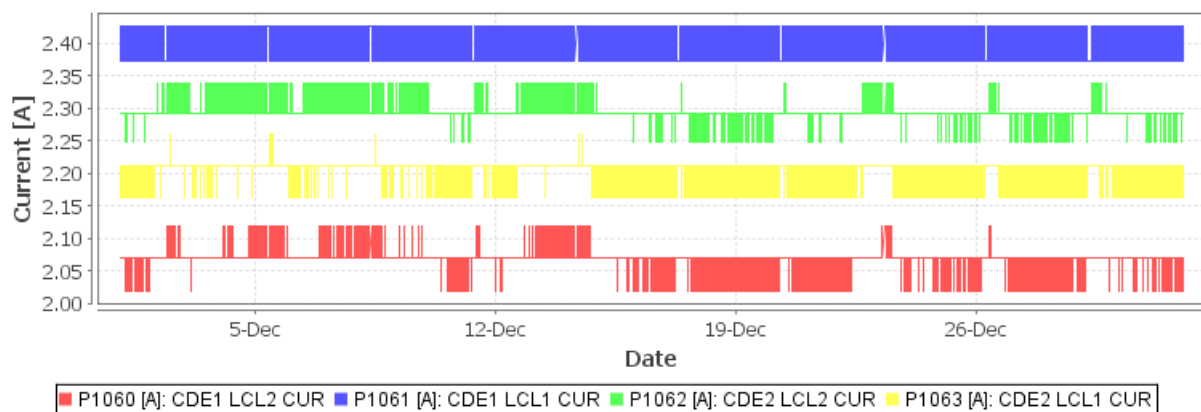


Figure 13: SPI CDE LCL current

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.

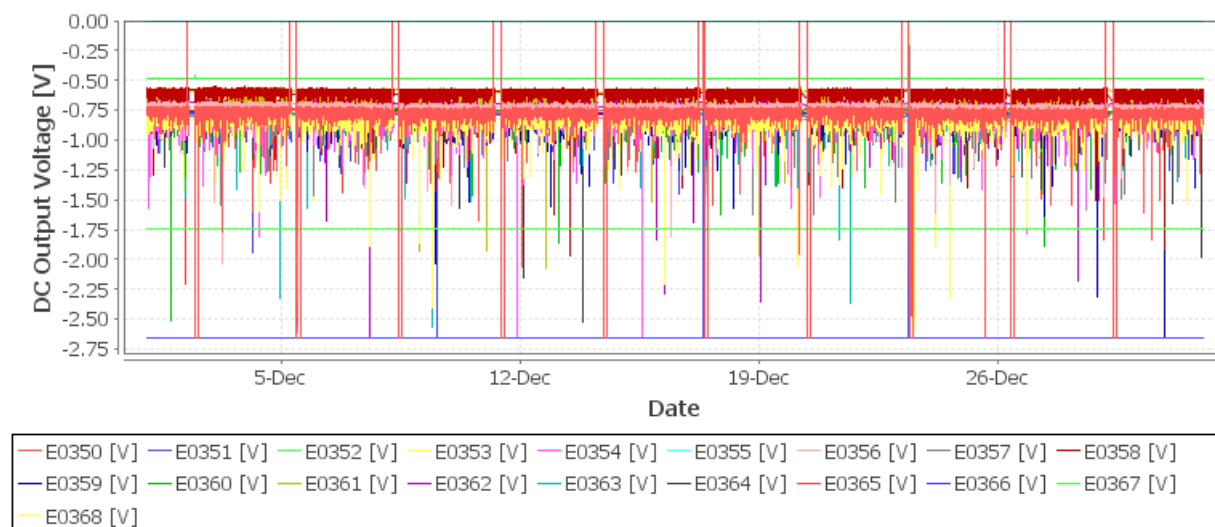


Figure 14: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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

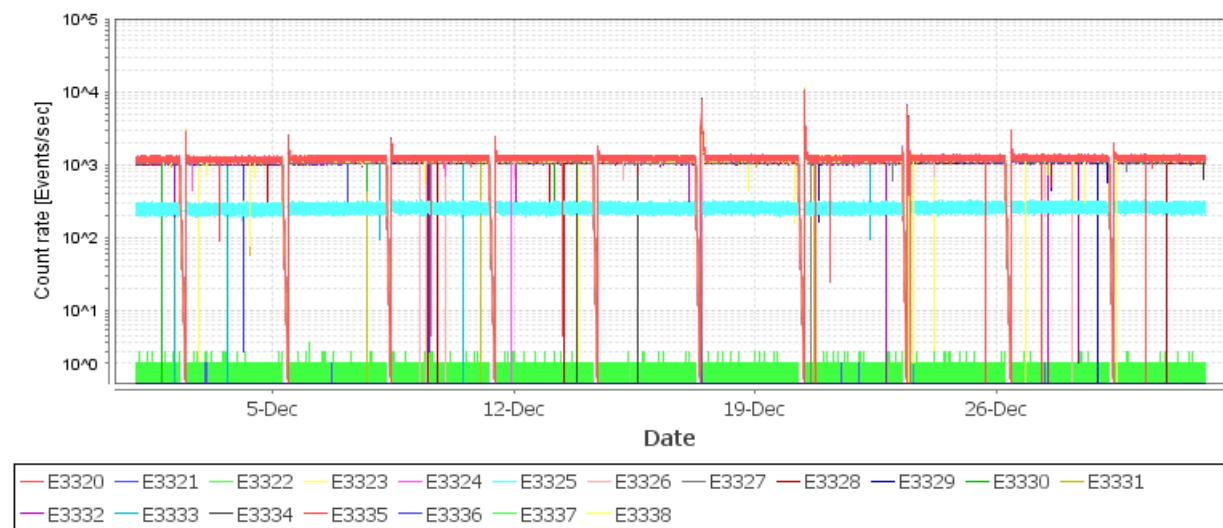


Figure 16: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic.



Figure 17: 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.

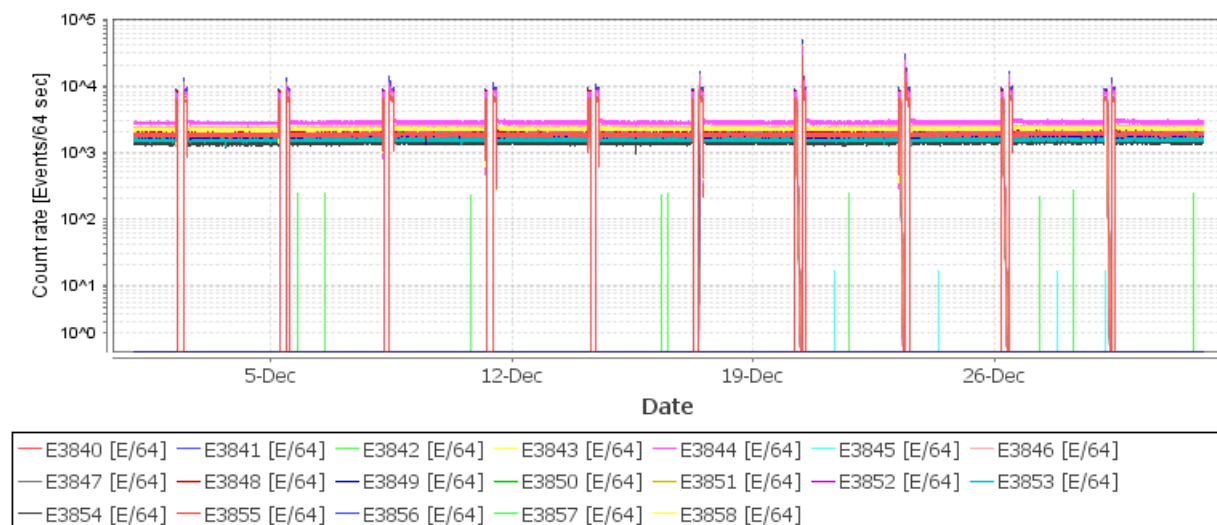


Figure 18: SPI PSD GeD Channel rates

7.2.2 Event Log

No SPI anomalies occurred in the reporting period.

7.3 IBIS

7.3.1 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:

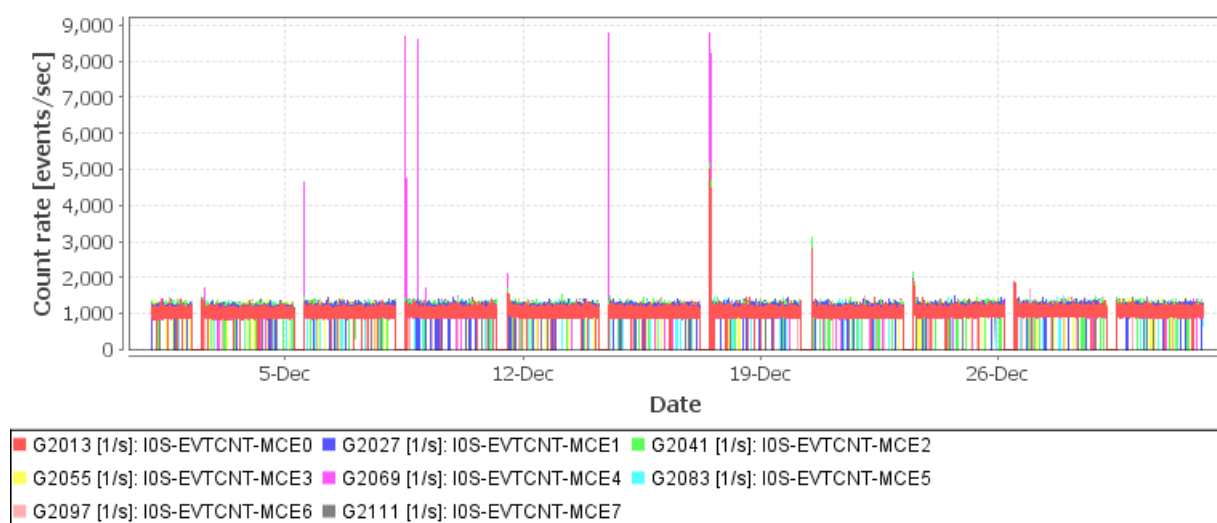


Figure 19: ISGRI MCE Counters

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.

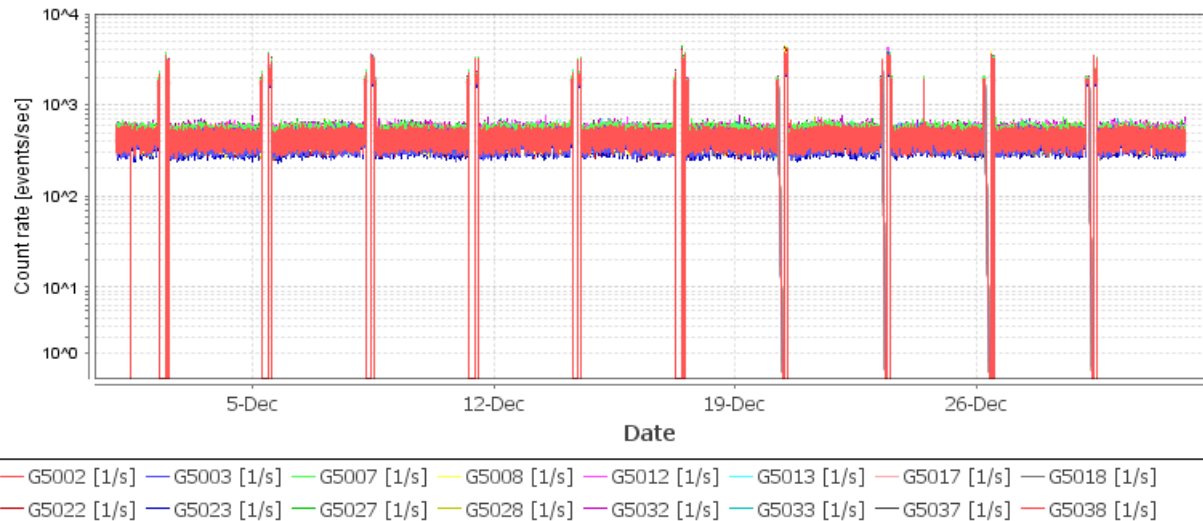


Figure 20: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic.

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.

7.3.2 Event Log

17-12-2012 (Day of Year 352, Revolution 1243)

IREM Anomaly: Reset of IREM_CSCI S/W #137 which forced IBIS to automatically enter safe configuration. Please see INT_SC-415.

24-12-2012 (Day of Year 359, Revolution 1245)

IREM Anomaly: Reset of IREM_CSCI S/W #138 which forced IBIS to automatically enter safe configuration. Please see INT_SC-416.

7.4 JEM-X

7.4.1 Operations

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

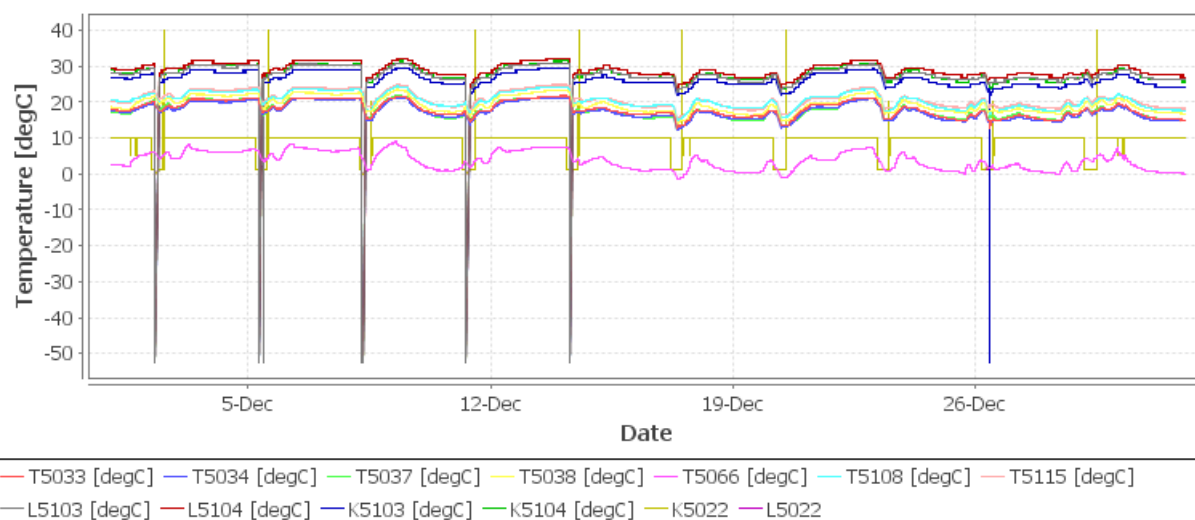


Figure 21: JEMX Detector and DFEE Temperatures

7.4.2 Event Log

05-12-2012 (Day of Year 340, Revolution 1239)

At 09:41Z after AOS, it was observed that JEMX-2 had not switched-on correctly after the eclipse. To recover, a DFEE power cycle was performed according to CRP_JEM2_5011. The unit was recovered at 10:06, before the start of science operations (see anomaly report INT_SC-412).

26-12-2012 (Day of Year 361, Revolution 1246)

At 07:31Z after AOS, it was observed that JEMX-1 had not switched-on correctly after the eclipse. To recover, a DFEE power cycle was performed according to CRP_JEM1_5011. The unit was recovered at 08:39, before the start of science operations (see anomaly report INT_SC-418).

7.5 OMC

7.5.1 Operations

The status and performance of OMC is nominal.

7.5.2 Event Log

15-12-2012 (Day of Year 350, Revolution 1242)

At 23:24, an AOCS command failed release, which halted the timeline. A recovery was performed, and the timeline rejoined at 00:30 the following day. The impact was the loss of pointing 12420042. It was at this time the following OEMs were received:

2012.350.23.27.18.948	2012.350.23.27.26.434	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	
2012.350.23.27.25.073	2012.350.23.27.33.725	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	

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

16-12-2012 (Day of Year 351, Revolution 1242)

At 02:54, the same AOCS command failed release, which again halted the timeline. A recovery was performed, and the timeline rejoined at 05:00. The impact was the loss of pointing 12420046. It was at this time the following OEMs were received:

2012.351.02.56.07.081	2012.351.02.56.14.041	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E
2012.351.02.56.13.081	2012.351.02.56.26.323	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E

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

17-12-2012 (Day of Year 352, Revolution 1243)

At 13:28:22, an IREM SEU caused OMC to switch to SAFE mode. A recovery was performed, and OMC returned to Stand-by at 13:44:06 and was back in Science mode at 14:27:01. The impact was pointing 12430003 was cut short from a planned 2200 to 1337 seconds and pointing 12430004 was lost.

19-12-2012 (Day of Year 354, Revolution 1243)

At 01:26, a Close Loop Slew failed forcing a suspension of the timeline. A recovery was performed, and the timeline rejoined at 02:27. The impact was the loss of pointing 12430046. It was at this time the following OEMs were received:

2012.354.01.29.57.987	2012.354.01.30.05.642	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E
2012.354.01.30.03.987	2012.354.01.30.05.695	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E

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

At 18:15, a problem with the wheel speeds forced a suspension of operations. The subsequent RWB was allowed to execute, which recovered the timeline. The impact was pointing 12430064 was executed at an incorrect attitude.

22-12-2012 (Day of Year 357, Revolution 1244)

At 14:47, a FD problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 16:00. The impact was the loss of pointing 12440083. It was at this time the following OEMs were received:

2012.357.15.43.01.312	2012.357.15.43.09.784	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E
2012.357.15.43.06.812	2012.357.15.43.09.853	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E	E

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

24-12-2012 (Day of Year 359, Revolution 1245)

At 09:40:14, an IREM SEU caused OMC to switch to SAFE mode. A recovery was performed, and OMC returned to Stand-by at 09:53:51 and was back in Science mode at 10:30:53. The impact was pointing 12450030 was cut short from a planned 3530 to 617 seconds.

25-12-2012 (Day of Year 360, Revolution 1245)

At 03:42:28, the parameter TM P2160 (LCL STA OMC SH B) changed state from OPEN to CLOSED. At 03:56:36, without operator intervention, the state changed back from CLOSED to OPEN, but remained out-of-limits. At 04:08:03, the TC P4278 (LCL OMC SH B OFF) was manually sent and at 04:08:04, the out-of-limit vanished. There was no impact (see anomaly report INT_SC-417).

31-12-2012 (Day of Year 366, Revolution 1247)

At 03:34:44, the following OEMs were received:

2012.366.03.34.44.936	2012.366.03.34.46.954	1792	RealTime	7	EXCEPTION	OMC
CONSTRAINT D		0	0	65535	PR N E E	
2012.366.03.34.44.936	2012.366.03.34.47.003	1792	RealTime	5	ANOMALY	OMC CSSW
INT ER		0	0	65535	PR N E E	

These messages have in the past preceded an OMCAS crash, since the patch was installed in 2003, there have been no further crashes. There was no impact.

7.6 IREM

7.6.1 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.

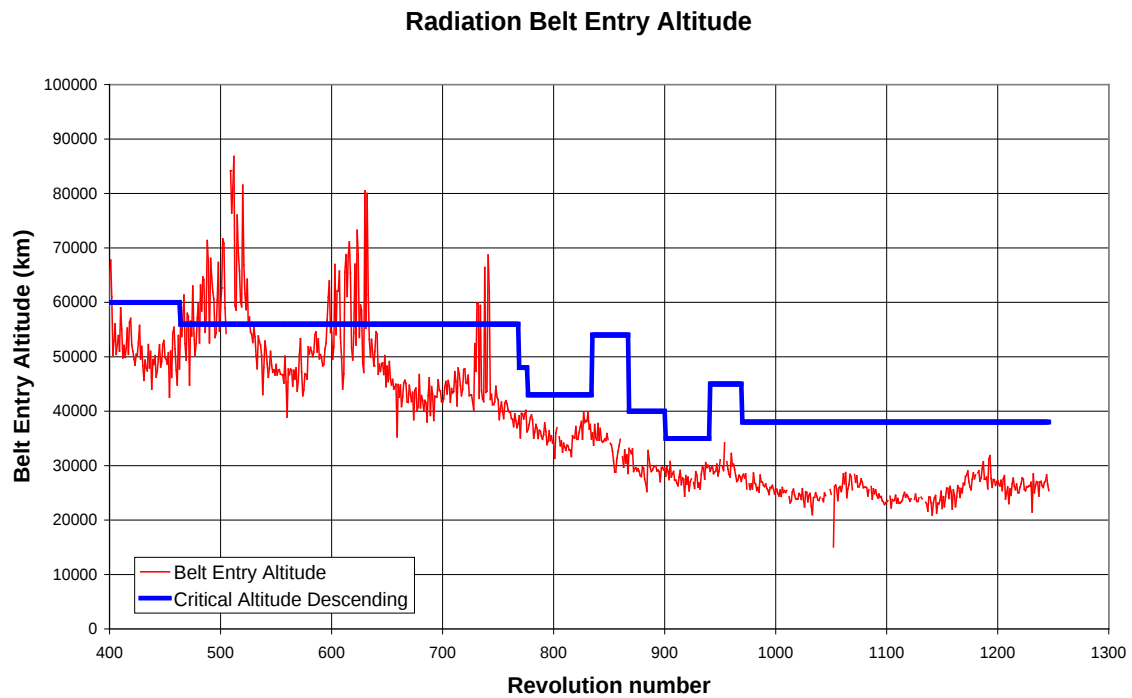


Figure 22: Radiation belt entry

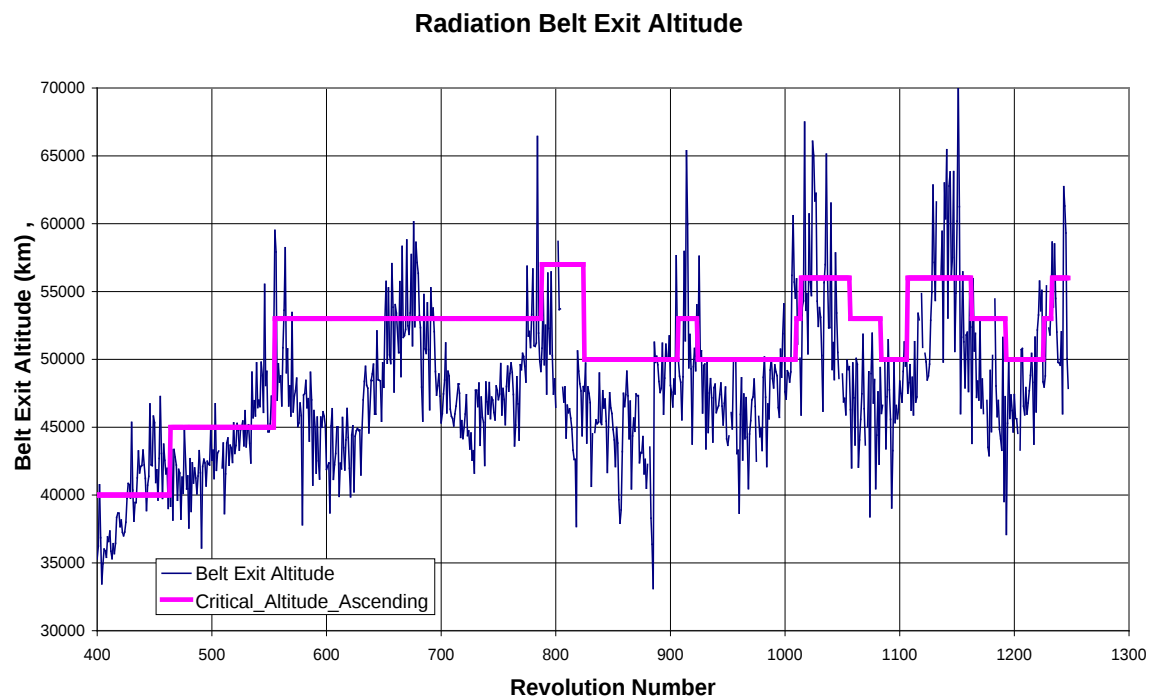


Figure 23: Radiation belt exit

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
1237	RAD_ENTR R 2012-12- 02T05:03:33Z	N/A	N/A	02-Dec-2012 06:22:43	21761.87	02-Dec-2012 07:12:43	10193.8
1238	RAD_EXIT R 2012-12- 02T12:31:04Z	02/12/2012 11:24:52	51891	02-Dec-2012 11:52:43	50246.75	02-Dec-2012 07:52:43	4280.389
1238	RAD_ENTR R 2012-12- 05T04:51:35Z	N/A	N/A	05-Dec-2012 06:07:37	22255.39	05-Dec-2012 06:57:37	10675.16
1239	RAD_EXIT R 2012-12- 05T12:18:48Z	05/12/2012 11:10:12	51484	05-Dec-2012 11:37:37	49943.91	05-Dec-2012 07:37:37	4224.837
1239	RAD_ENTR R 2012-12- 08T04:40:56Z	N/A	N/A	08-Dec-2012 05:53:35	22646.38	08-Dec-2012 06:43:35	11101.84
1240	RAD_EXIT R 2012-12- 08T12:08:13Z	08/12/2012 11:00:04	51576	08-Dec-2012 11:23:35	49629.72	08-Dec-2012 07:23:35	4292.261
1240	RAD_ENTR R 2012-12- 11T04:29:58Z	N/A	N/A	11-Dec-2012 05:44:33	22471.19	11-Dec-2012 06:34:33	10986.24
1241	RAD_EXIT R 2012-12- 11T11:58:00Z	11/12/2012 11:12:04	55274	11-Dec-2012 11:14:33	49635.89	11-Dec-2012 07:14:33	4403.091
1241	RAD_ENTR R 2012-12- 14T04:16:05Z	N/A	N/A	14-Dec-2012 05:28:14	22792.91	14-Dec-2012 06:28:14	9141.77
1242	RAD_EXIT R 2012-12- 14T11:45:02Z	14/12/2012 10:10:44	47025	14-Dec-2012 11:08:14	50877.42	14-Dec-2012 06:58:14	4572.376
1242	RAD_ENTR R 2012-12- 17T04:01:28Z	N/A	N/A	17-Dec-2012 05:17:05	22051.61	17-Dec-2012 06:07:05	10596.27
1243	RAD_EXIT R 2012-12-	17/12/2012 11:43:01	64201	17-Dec-2012	49859.31	17-Dec-2012	4458.561

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
	17T11:30:29Z			10:47:05		06:47:05	
1243	RAD_ENTR R 2012-12- 20T03:48:11Z	N/A	N/A	20-Dec-2012 05:05:50	21356.61	20-Dec-2012 05:55:50	9866.381
1244	RAD_EXIT R 2012-12- 20T11:17:04Z	20/12/2012 11:10:13	61303	20-Dec-2012 10:35:50	50393.07	20-Dec-2012 06:35:50	4458.247
1244	RAD_ENTR R 2012-12- 23T03:35:17Z	23/12/2012 04:53:49	28683	23-Dec-2012 04:45:42	22922.14	23-Dec-2012 05:45:42	9286.182
1245	RAD_EXIT R 2012-12- 23T11:04:36Z	23/12/2012 11:32:53	66443	23-Dec-2012 10:25:42	50763.3	23-Dec-2012 06:15:42	4622.699
1245	RAD_ENTR R 2012-12- 26T03:21:50Z	N/A	N/A	26-Dec-2012 04:38:23	21448.67	26-Dec-2012 05:28:23	10043.61
1246	RAD_EXIT R 2012-12- 26T10:51:32Z	26/12/2012 09:52:29	53031	26-Dec-2012 10:08:23	50193.72	26-Dec-2012 06:08:23	4586.551
1246	RAD_ENTR R 2012-12- 29T03:08:50Z	N/A	N/A	29-Dec-2012 04:16:36	23076.5	29-Dec-2012 05:16:36	9431.669
1247	RAD_EXIT R 2012-12- 29T10:38:20Z	29/12/2012 09:17:33	49342	29-Dec-2012 09:56:36	50664.3	29-Dec-2012 05:46:36	4644.309

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)

7.6.2 Event Log

Nothing to report.

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