
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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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 for February and covers the revolutions 1136 until 1145 (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, 831 of the 841 planned science pointings were executed nominally. 2 pointings were lost and 1 shortened to FDS problems, 3 were interrupted when the CCCFs were activated, 3 pointings were shortened and 1 lost to IREM SEUs. One Flat-field calibration was performed this month.
- E3.5 Testing

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- Increased fuel consumption in December and January: probably related to the perigee attitude selected to shelter the SPI cooler from the earths albedo
- IREM Anomaly: Reset of IREM_CSCI S/W #116 (25/10/2011)

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

The previous weekly and monthly reports are available at the XMM-INTTEGRAL 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.

6 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.4877 Kg. The remaining propellant is in the order of 114.5202 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 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 $\pm$ 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 2012-02-27T16:01:00Z to 2012-02-27T19:55:26Z (OMC Flat Field Calibration), when it was 88 packets/cycle.

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

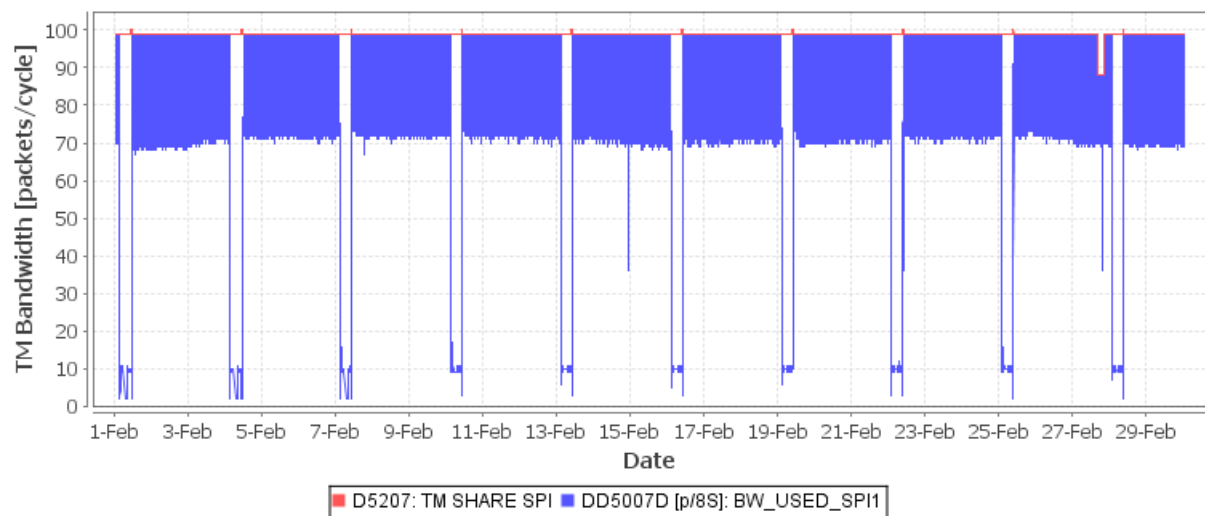


Figure 1: SPI TM bandwidth utilisation

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

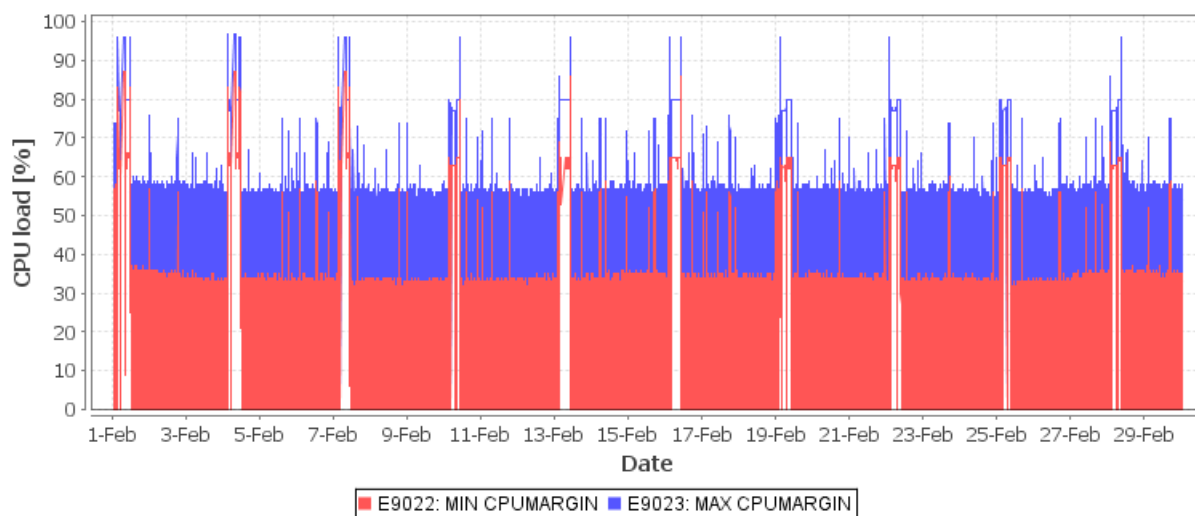


Figure 2: SPI IASW Performance

Note: 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, except from 2012-02-27T16:01:00Z to 2012-02-27T19:55:26Z (OMC Flat Field Calibration), when it was 90 packets/cycle

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

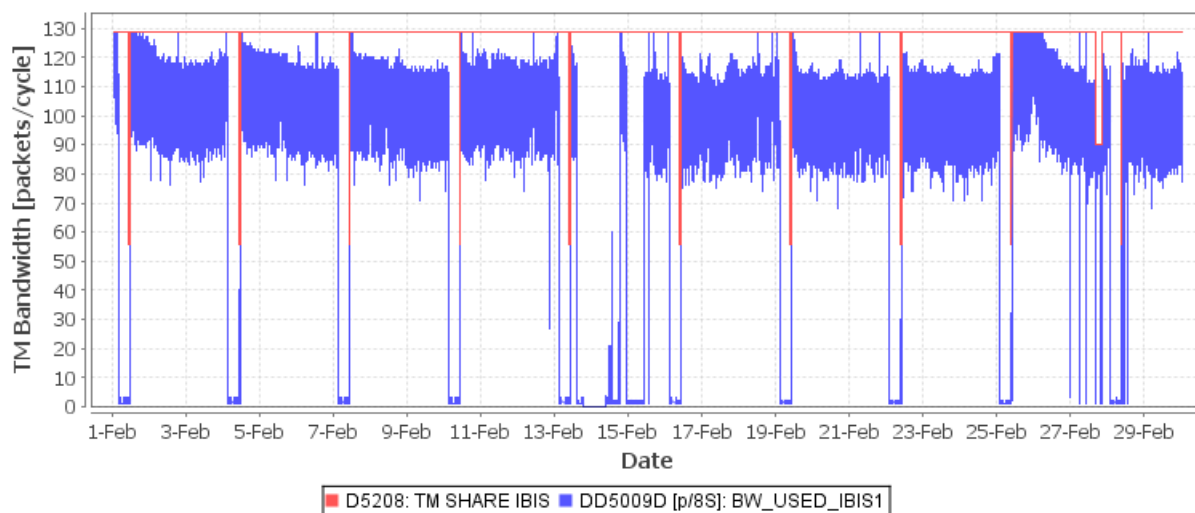


Figure 3: IBIS TM bandwidth utilisation

Note: 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:

- JEM-X1 & 2 were operated in Data Taking mode with a TM allocation of 8 packets/cycle, except from 2012-02-27T16:01:00Z to 2012-02-27T19:55:26Z (OMC Flat field calibration), when it was 4 packets/cycle each.

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 2012-02-27T16:01:00Z to 2012-02-27T19:55:26Z during the Flat-field calibration in revolution 1144, when it was 63 packets/cycle.

During this reporting period, 831 of the 841 planned science pointings were executed nominally. 2 pointings were lost and 1 shortened to FDS problems, 3 were interrupted when the CCCFs were activated, 3 pointings were shortened and 1 lost to IREM SEUs. One Flat-field calibration was performed this month.

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

2.2.5 IREM

The status of IREM is nominal.

On DoY 058 (27/02/2012), the 127th IREM SEU occurred

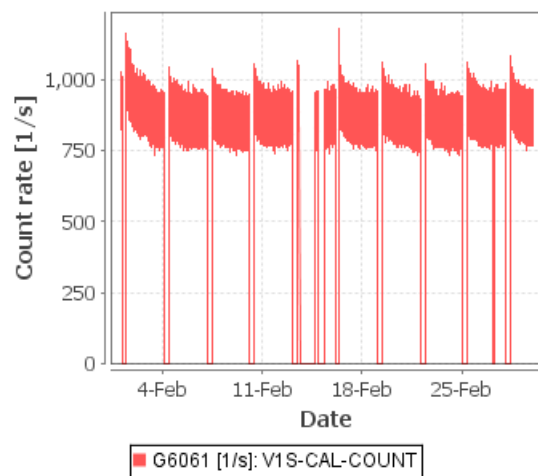
On DoY 059 (28/02/2012), the 128th IREM SEU occurred

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

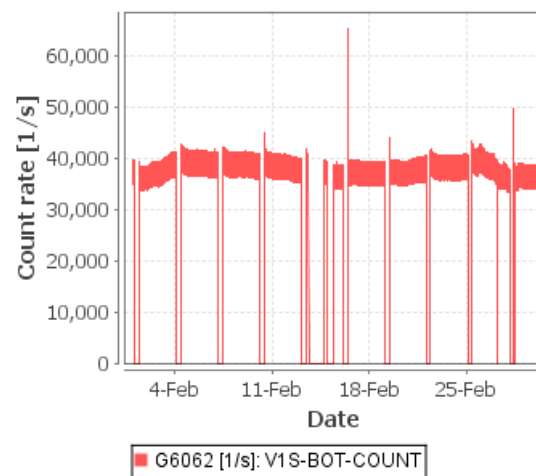
Radiation background

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

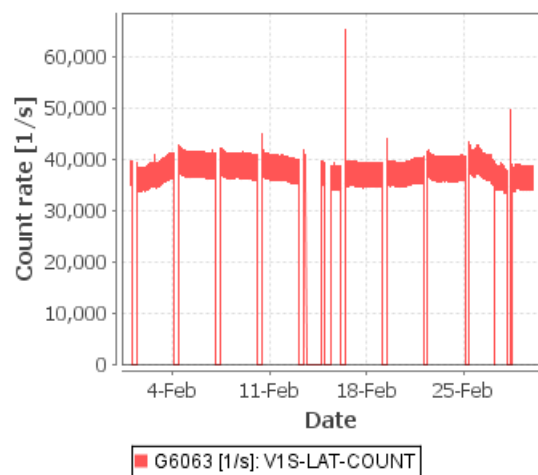
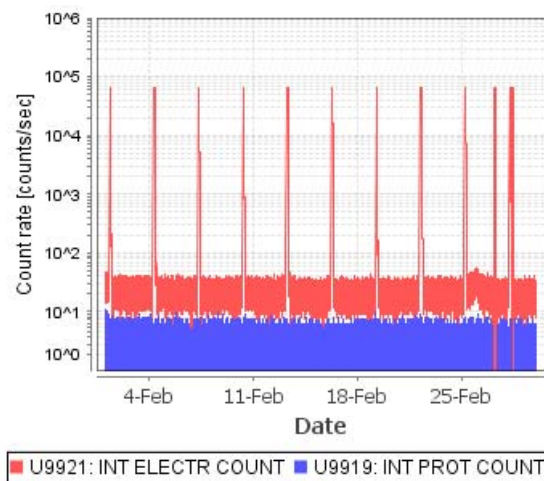
VETO Calibration Source Count Rate



VETO Bottom Count Rate



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.

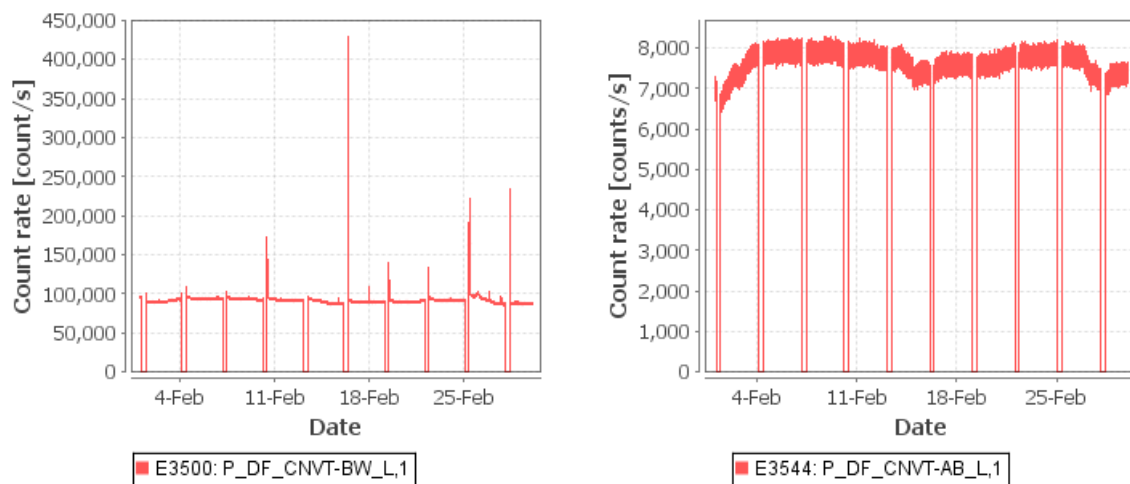


Figure 4: Instrument Count Rates

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

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

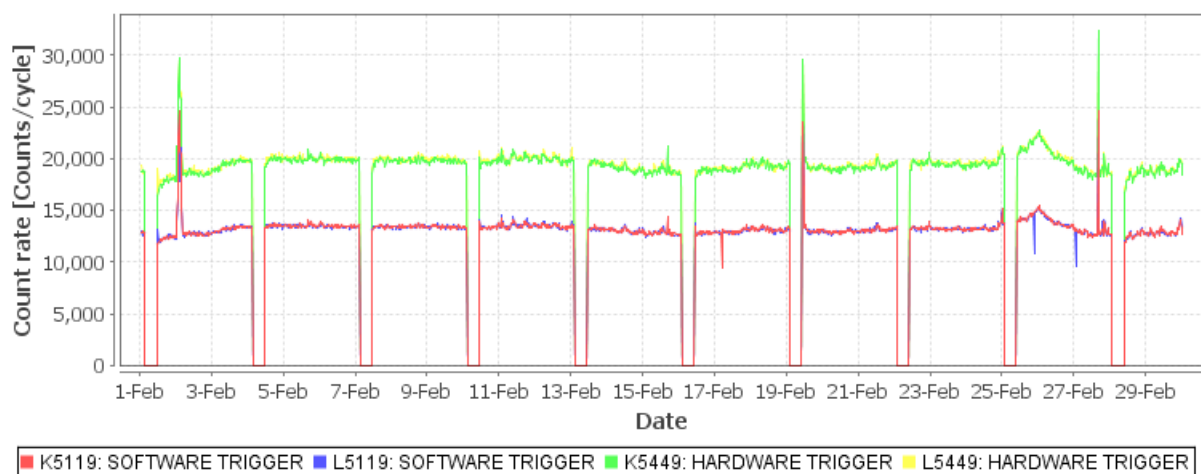


Figure 5: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

Radiation Belts

Figure 6 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.

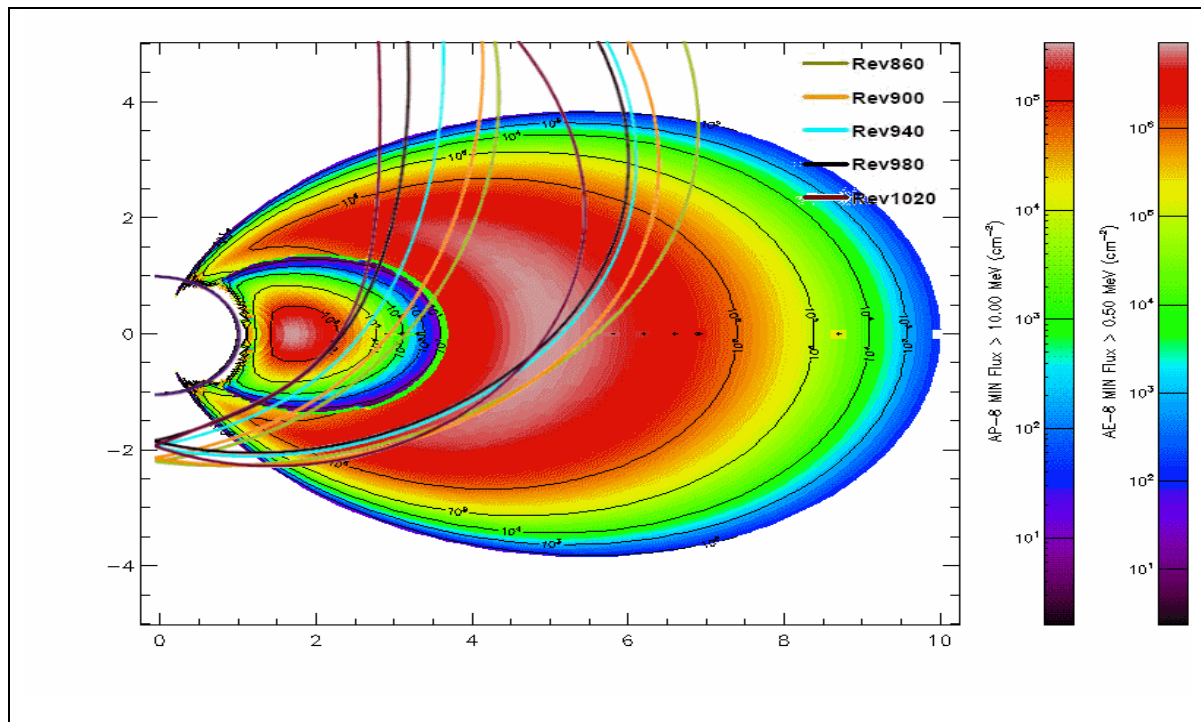


Figure 6: The predicted evolution of the orbit of Integral through the radiation belts

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.

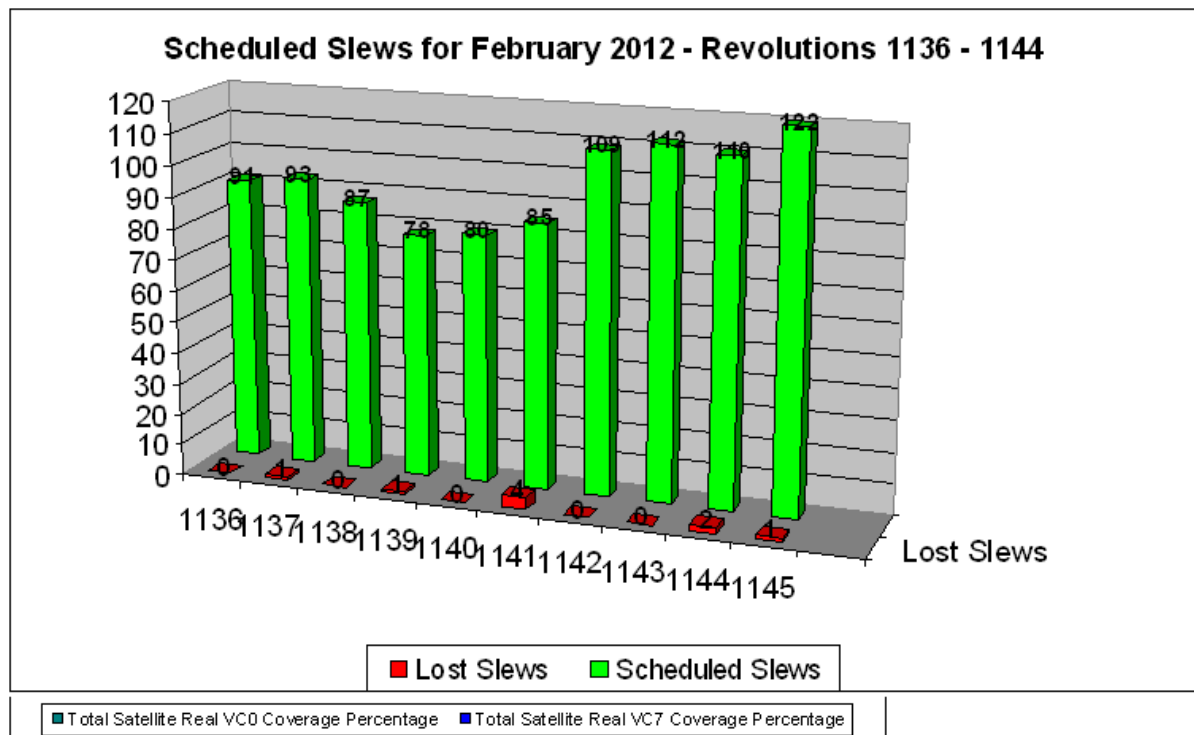


Figure 7: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

- Investigated why occasional commands in IBIS post eclipse sequences were not verified successfully. Performed various tests with simulator. Identified that problem is caused by the PIF server not deregistering CEV parameters before next registration request.
- Performed system checks on all machines after power outage. Identified corruption of Short Term Archive on IMCA and Long Term Archive on IDDA. Deleted complete archive on IMCA and rebuilt from RAPID files. Identified and removed corrupted segments on IDDA, rebuilt segment catalogue. Gaps filled by exporting each SPID individually from IDDB and importing into IDDA. Gap in consolidated archive filled by TM playbacks from groundstation.
- Mainboard in IDDA failed. Reconfigured all IFTS nodes to run on backup chains. Tested all file transfers between MOC, ISOC and ISDC. Hardware team replaced mainboard. Performed system checks on IDDA after replacement. Identified corruption of Long Term Archive on IDDA again. Identified and removed corrupted segments on IDDA, rebuilt segment catalogue. Filling of gaps ongoing. Reconfigured all IFTS nodes to run on prime chains again. Tested all file transfers between MOC, ISOC and ISDC. Hardware team replaced mainboard. . Gap in consolidated archive filled by TM playbacks from groundstation.
- Performed shutdown of all Halley and DCR machines in preparation of power maintenance to switch back to external supplier. Power maintenance postponed by one day – Started up all Halley and DCR machines. Next day performed shutdown again and restart after maintenance.
- Planned, scheduled and performed full test of backup control facility at REDU (LCTF) including simulation of ESOC failure. Tested all relevant procedures,

telemetry reception, command transmission, file transfer system, checked TCP/IP routing (identified DNS configuration issue for client machine).

3.2 Ground Stations and Network

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

REDU

DOY 033 (02/02)	18:52:00 - Bad Frames -> Confirmed RFI - SMOS
DOY 035 (04/02)	17:41:00 - Data gaps on VC-0 & VC-7
	17:41:01 - Bad Frames -> Confirmed RFI
DOY 036 (05/02)	08:11:00 - TM Drop on VC-0 & VC-7 -> Confirmed RFI
	15:16:00 - Data gaps on VC-0 & VC-7 -> Confirmed RFI
DOY 045 (14/02)	18:29:00 - Bad Frames -> Confirmed RFI
DOY 047 (16/02)	06:00:00 - TM Drop on VC-0 & VC-7 from G/S: RED, duration: 15min, reason: TMTCS1+2 crash and need to be restarted at ground station (network cannot reach TMTCS)

Feedback from the GS team:

RED 047 2012-02-16 06:00:55 INT TMTCS unoperable, reset from ECC failed:
Station starts reset on TMTCS 1 & 2
RED 047 2012-02-16 06:15:02 INT REDU reports TMTCS reboot in progress
RED 047 2012-02-16 06:21:48 INT TMTCS 1&2 Operable again, TMTCS
reconnected, test command successful
This is the fourth occurrence of this simultaneous TMTCS crash.

Follow-up:

TMTCS SW support and Redu GS Engineer are currently investigating the issue, together with VEGA SW support. It looks like an important step has been made to identify the cause the underlying bug. If this analysis is confirmed, the bug-fix can be delivered in the upcoming end of warranty delivery for TMTCS, which is expected in the coming weeks. Currently the verification of the analysis is ongoing. TMTCS SW re-installation aimed at addressing the issue was successfully performed on DOY 053.

19:45:00 - Bad Frames -> Confirmed RFI

DOY 051 (20/02) 21:27:00 - Bad frames -> Confirmed RFI

DOY 052 (21/02) 18:09:00 - TM drop on VC-0 & VC-7 from RED TMTCS2 on B-chain

18:29:00 - ESTRACK restarted TMTCS2

19:22:00 - NCTRSB rebooted - > connections to NCTRS-B are OK from TMTCS1, but not from TMTCS2

19:30:00 - ESTRACK performs reboot of TMTCS2 -> no change

20:00:00 - Requested ESTRACK to configure MASPALOMAS for INTEGRAL --> all TM links OK

Feedback from the Redu GS team and from the GS Engineer:

TMTCS2 was not the problem, but IFMS2, that was generating time stamps with 1958 as Year. IFMS2 has been rebooted after the pass and telemetry time stamps was back to nominal after this.

Both Redu IFMSes are running on IFMS SW v.11. The telemetry time stamping issue observed on this occasion seems to be an issue of the current IFMS SW version, and it will be fixed with the future IFMS version upgrade.

DOY 054 (23/02) 06:29:00 - Bad Frames -> Confirmed RFI

DOY 055 (24/02) 06:08:02 - Bad Frames -> Confirmed RFI

DOY 056 (25/02) 17:05:00 - Bad Frames -> Confirmed RFI

Figure 8 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.

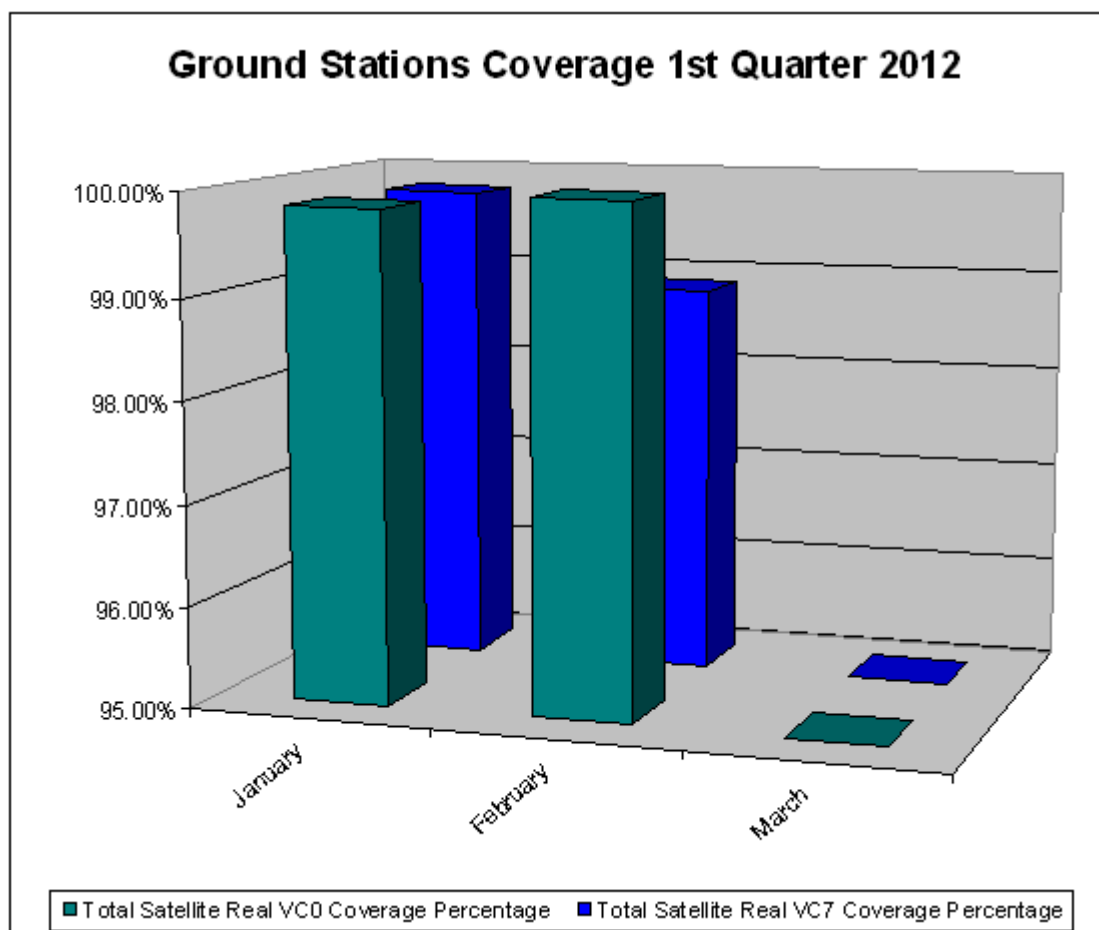


Figure 8: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1143 to 1152, corresponding to the time range 22 February to 23 March.

New observations have been planned for revolutions 1137 (4-7 February) to 1147 (5-8 March). Revolution 1137 had to be re-planned to find a valid wheel bias. Revolution 1138 was re-planned to accommodate a final ToO observation of the transient pulsar GX 304-1. Planning files for revolutions 1143 and 1144 were sent twice due to IFTS problems.

TSFs have been received for revolutions 1137 to 1146.

3.3.2 Observation Status

New ECS files have been received for revolutions 1116 to 1125 (covering observations up to 2 January).

3.3.3 ISOC Science Data Archive

There have been various gaps in the raw telemetry received from MOC. The issue is being worked on.

The Product Definition Document for the new ISDA is being prepared, the URD has been updated in some details.

The interface of the archive with the ISDC is foreseen to be changed and simplified. A meeting has been scheduled at ISDC for end of March to discuss this in detail.

3.3.4 ISOC System

ISOC software V32, including the AO-10 PGT was released for testing on 13 February as planned and has been extensively tested.

3.3.5 Problems

There were several problems with the IFTS connection between ISOC and MOC requiring multiple re-starts of the system.

The Flight Dynamics server is producing exception messages since 22 February, while continuing to work for planning purposes. The problem is under investigation.

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-3238	2012-02-02	FCT check on eclipse timers	MPS	Pending
INT-3239	2012-01-17	TC E0110 (ED GEISCL03) failed release possibly due to delay in releasing cmd	IMCS	Pending
INT-3240	2012-02-04	GEISCL03: completion status unknown & PIF error message & timing issue	IMCS	Pending
INT-3241	2012-02-01	PIF server errors	IMCS	Pending
INT-3242	2012-02-10	idda Hardware Failure	IMCS	Pending
INT-3243	2012-02-14	NCTRS MMI reacting extremely slow due to constant data gap messages	NCTRS	Pending
INT-3244	2012-02-29	OBQD does not create a DELETE TC stack if using right-click menu	IMCS	Pending
INT-3245	2012-02-29	LCTF - Problems identified during test	IMCS	Pending

AR id	Date of occurrence	Subject	Segment	Status
INT_SC-369	2012-02-01	JEM-X2 DFEE CRC Anomaly following eclipse on 2012-02-01	Payload	Closed
INT_SC-370	2012-02-04	JEM-X2 DFEE CRC Anomaly following eclipse on 2012-02-04	Payload	Testing
INT_SC-371	2012-02-07	ACC-B LCL closed (SEU). P1143 OOL	Spacecraft	Closed
INT_SC-372	2012-02-13	IBIS DPE (suspected) reset	Payload	Pending
INT_SC-373	2012-02-15	IBIS1 MCE7 TIME-OUT	Payload	Closed
INT_SC-374	2012-02-27	IREM Anomaly: Reset of IREM_CSCI S/W #127, 27/02/2012	Payload	Closed
INT_SC-375	2012-02-28	IREM Anomaly: Reset of IREM_CSCI S/W #128, 28/02/2012	Payload	Closed

5 Special Events & Future Milestones

- E3.5 Testing
- FSS/Star Tracker calibration 21st March 2012.
- 2nd Earth Observation campaign starts 9th May.

6 Appendix

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

6.1 AOCS operations

During this period, 436 Open Loop Slews, 499 Closed Loop Slews and 23 Momentum Biases were executed (as reported by ACC OEM).

6 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 01/03/2012 is reported in the following plot:

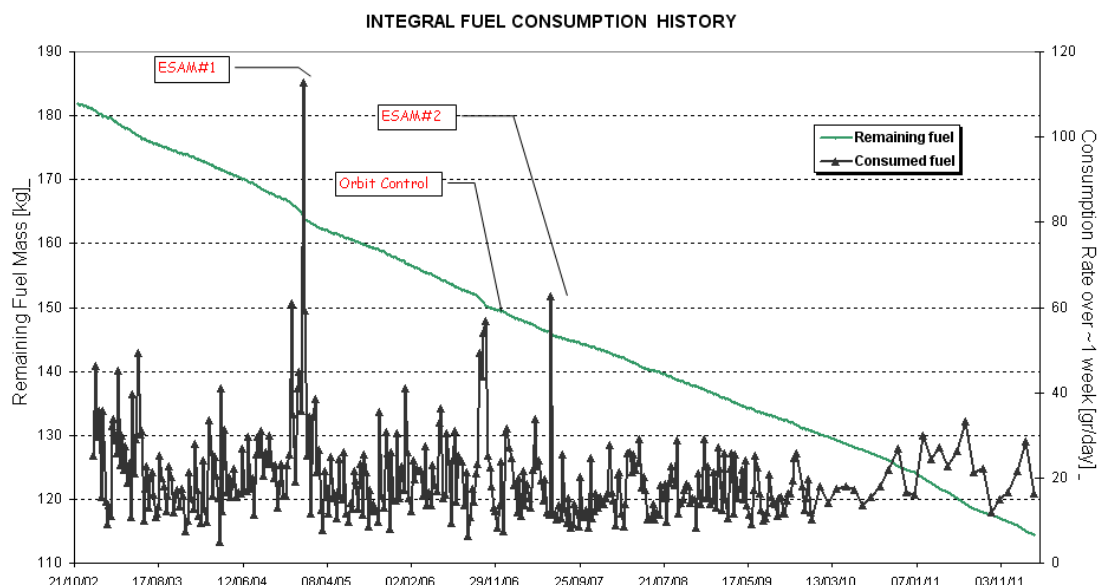


Figure 9: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

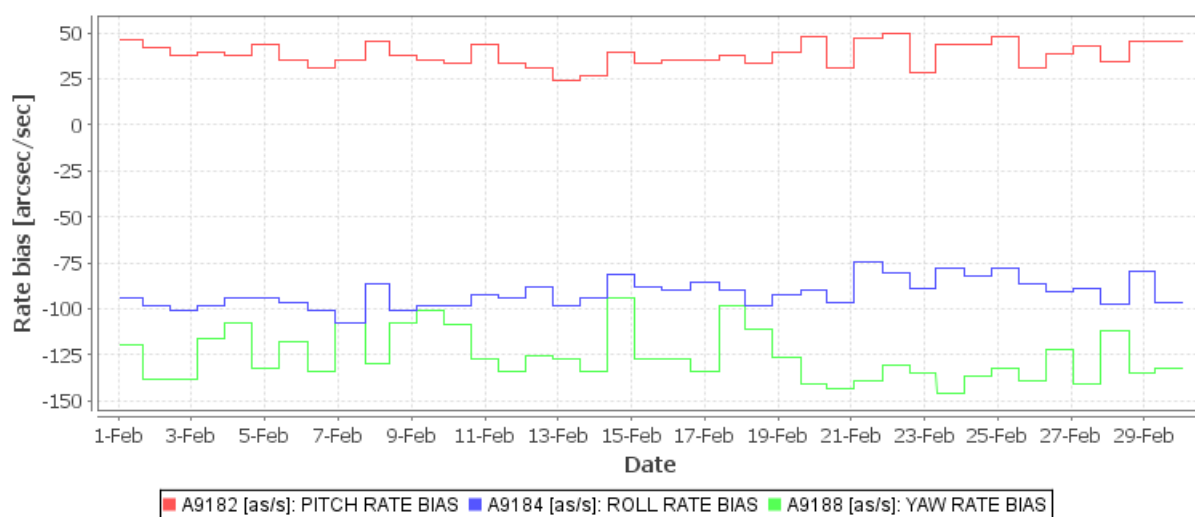


Figure 10: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

02/02/2012 (Day of Year 033, Revolution 1136)

IMU1 switched ON during the stable pointing of PID 11360041 (16:46:44Z). AOCS was suspended in the timeline. After the IMU switched back OFF, a manual mapping was performed to generate a new

CGS prior to the RWB. The generated CGS was uplinked and original CGS planned in the Timeline was skipped. The RWB was performed from the Timeline as planned.

OTF was not reached for PID 11360041

06/02/2012 (Day of Year 037, Revolution 1137)

FDS TPF update failed for slew 11370061 due to FDS problems. The AOCS was suspended in the timeline then a manual mapping was commanded. The SPACON tool generated a TPF for a CGS instead of a TPF to update slew id 11370061. Slew 11370061 does not execute from the timeline.

A manual CGS (TPF 1137_0501_M.CGS) is carried out, followed by a manual RWB (TPF 1137_0501_M.RWB). A slew was manually generated from attitude 11370060 to attitude 11370061. After the manual slew was completed, the SPACON tool was used to update slew 11370062.

Slew 11370061 was missed from the Timeline. OTF was not reached for its PID.

07/02/2012 (Day of Year 038, Revolution 1138)

The following OOL was observed (02:22:50Z): P1143 LCL STA ACC B (value=close). The SPACON performed procedure FCP_AOC_1004 "ACC B power OFF".

No impact in the Timeline.

12/02/2012 (Day of Year 043, Revolution 1139)

FDS TPF update failed for slew 11390062 (08:35:36Z) . The AOCS was suspended in the timeline then a manual mapping was commanded. After some initial investigation, it was found that the Autostack had not dispatched any commands since 08:17:11Z. A slew was manually generated from attitude 11390060 to attitude 11390061. After the manual slew was completed, the SPACON tool was used to update slew 11390062.

Slew 11390061 was missed from the Timeline. OTF was not reached for its PID.

14/02/2012 (Day of Year 045, Revolution 1140)

FDS TPF update failed for slew 11400046 due to FDS problems (15:56:52Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 11400046 were manually updated.

No impact in the Timeline.

15/02/2012 (Day of Year 046, Revolution 1140)

FDS TPF update failed for CSL 11400078 since the manoeuvre had to be done as an OSL (23:42:00Z). The AOCS was suspended in the timeline then a manual mapping was commanded. A slew was manually generated from attitude 11400077 to attitude 11400078. After the manual slew was completed, the SPACON tool was used to update slew 11400079.

Slew 11400078 was missed from the Timeline. OTF was not reached for its PID.

16/02/2012 (Day of Year 047, Revolution 1141)

IMU1 switched ON during perigee passage (04:16:00Z). After the AOS at Redu the AOCS was suspended in the timeline then a manual mapping was performed. Using the SPACON tool a manual CGS was commanded. The AOCS was enabled at 06:29:00Z.

No impact in the Timeline

18/02/2012 (Day of Year 049, Revolution 1141)

-IMU1 switched ON during the stable pointing of PID 11410068 (10:27:59Z). AOCS was suspended in the timeline. After the IMU switched back OFF, a manual mapping was performed in order to update the parameters for slew 11410069 manually.

OTF was not reached for PID 11410068.

- IMU1 switched ON during the stable pointing of PID 11410078 (20:03:51Z). AOCS was suspended in the timeline. After the IMU switched back OFF, a manual mapping was performed in order to update the parameters for slew 11410079 manually.

OTF was not reached for PID 11410078.

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 40 on 29-02-2012 leading to a decrease of the temperature of the cold plate as well to an increase of the SPI CDE LCL currents.

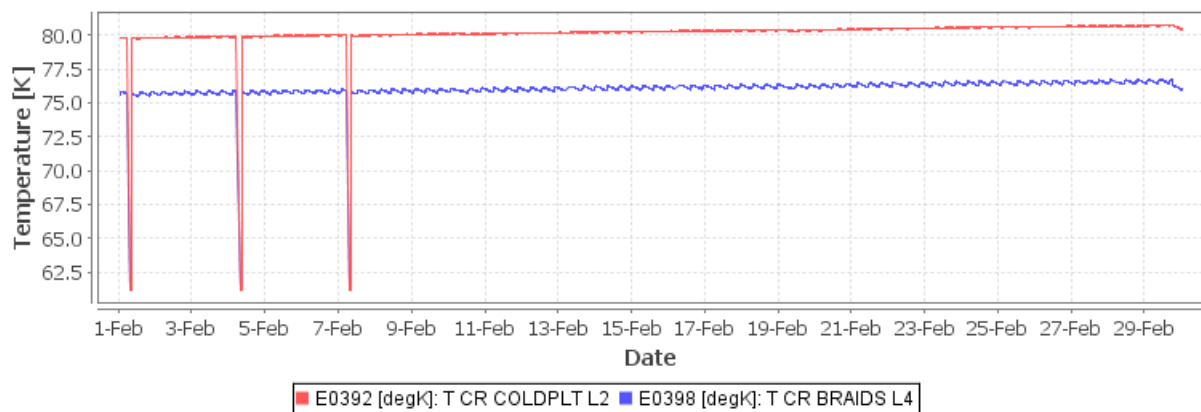


Figure 11: SPI Cold plate and H-bus temperature

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

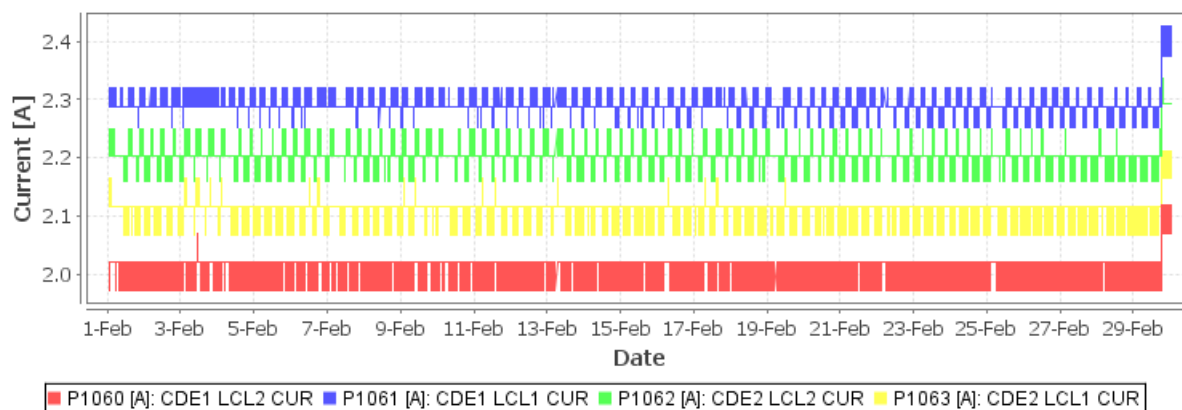


Figure 12: SPI CDE LCL current

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 4: 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.

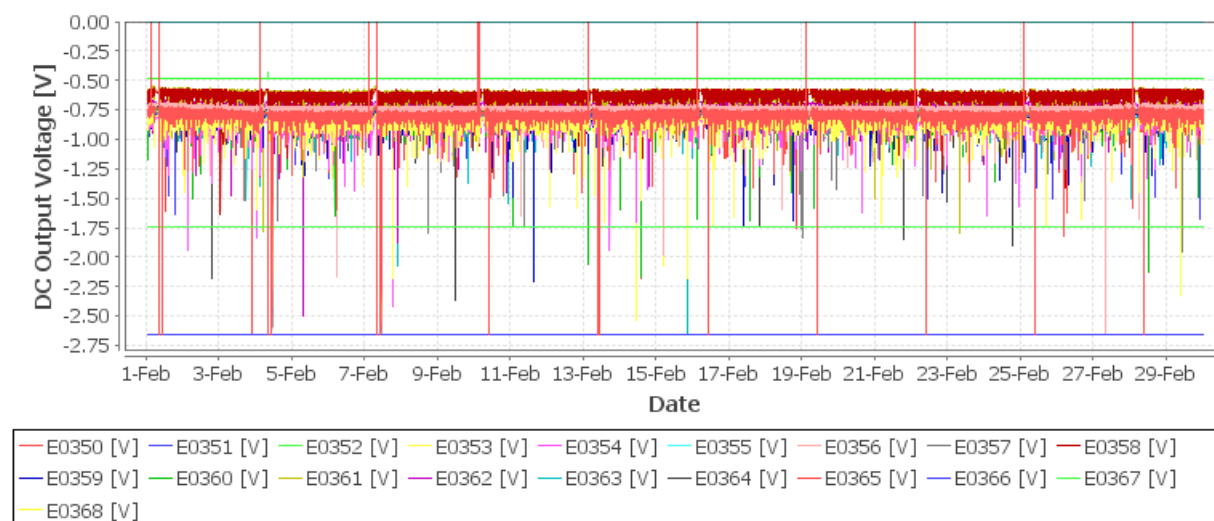


Figure 13: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.

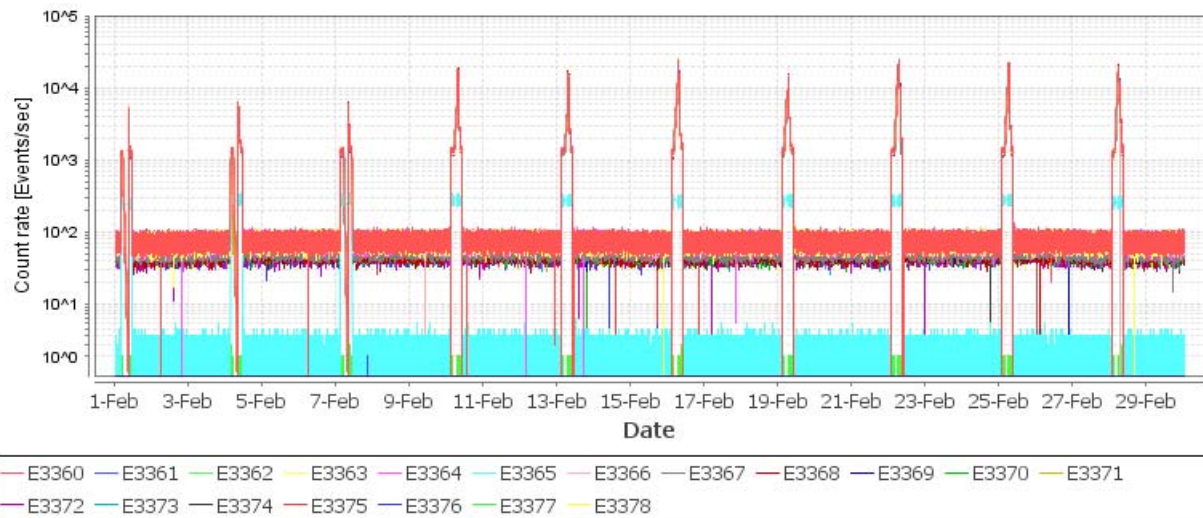


Figure 14: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic.

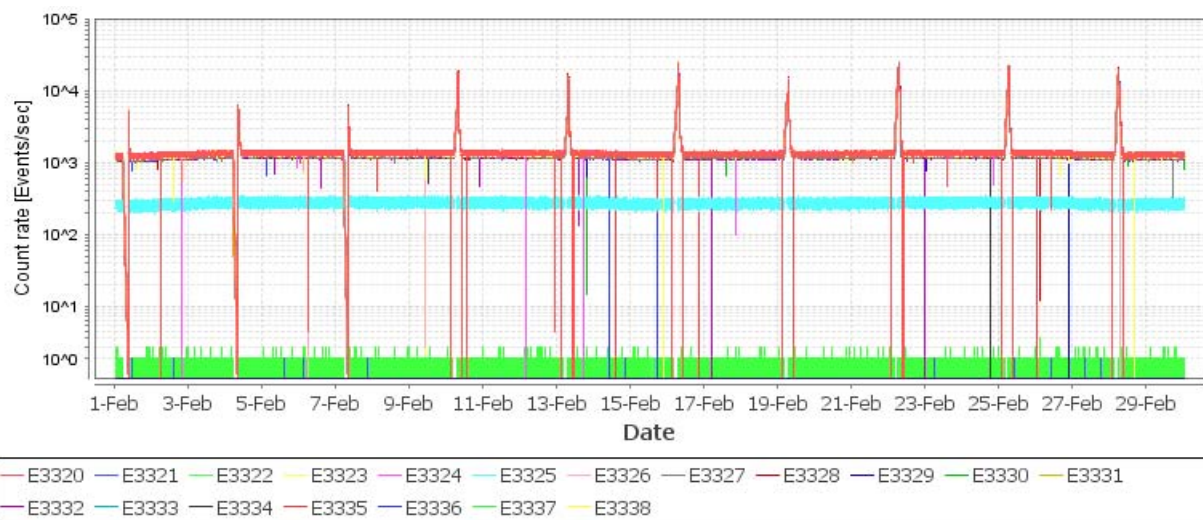


Figure 15: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic.

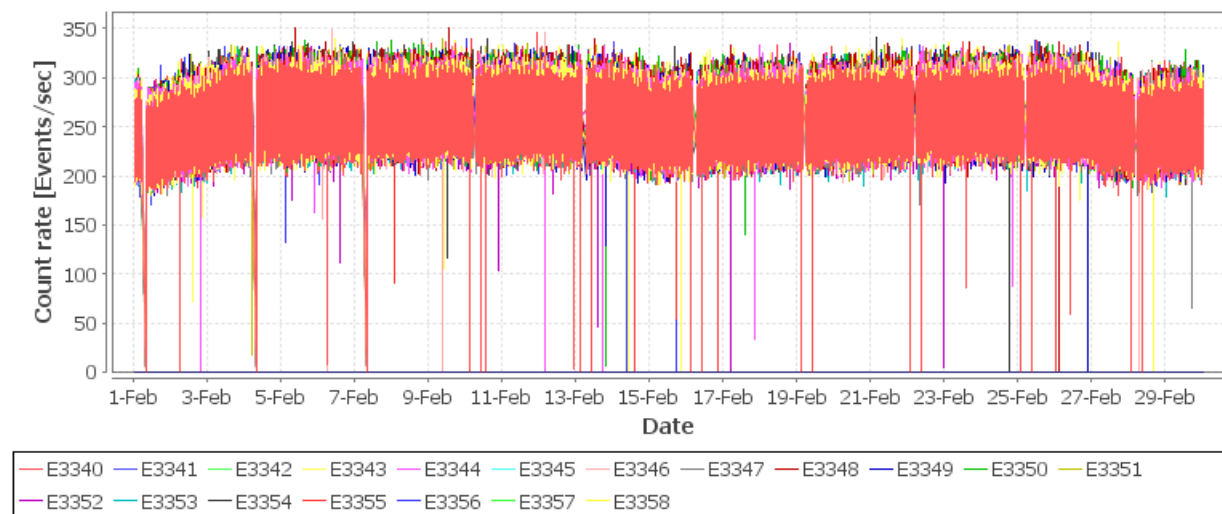


Figure 16: SPI GeD Time Tagged Saturated count rates

PSD

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

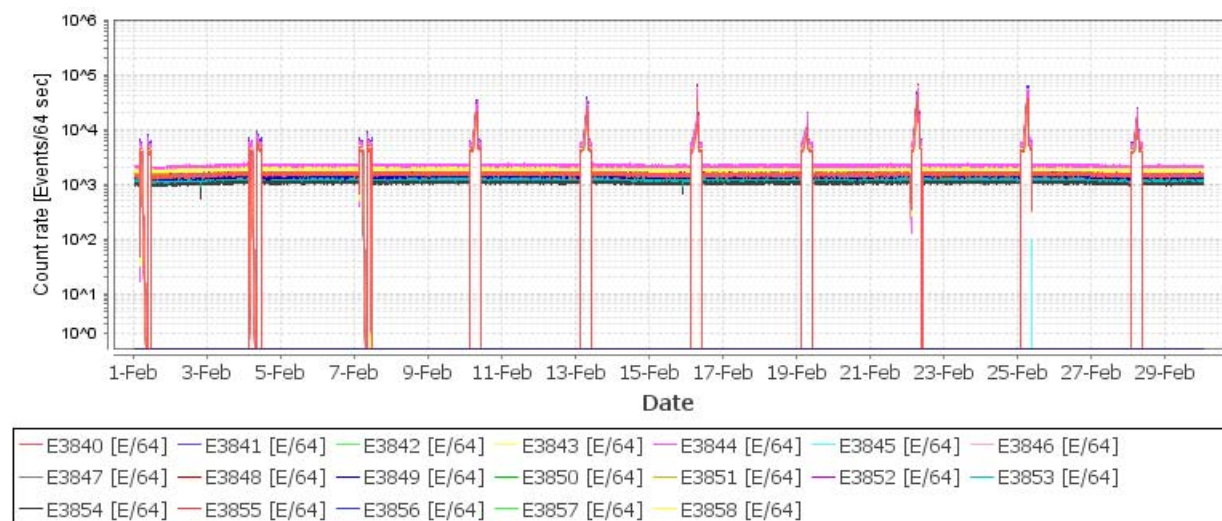


Figure 17: SPI PSD GeD Channel rates

6.2.2 Event Log

Not available this month

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:

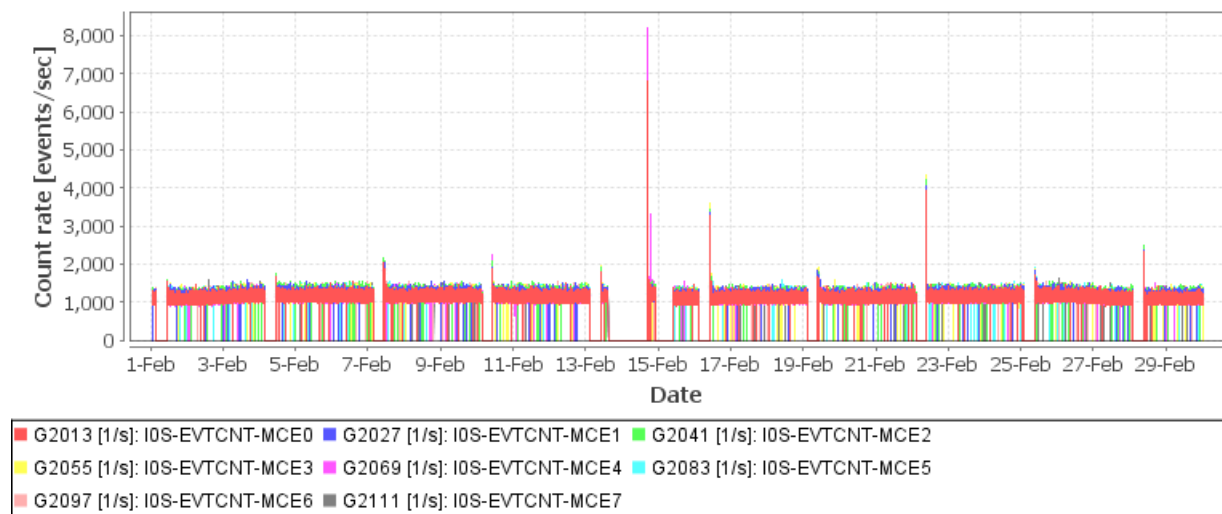


Figure 18: ISGRI MCE Counters

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 19: 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 4: Instrument Count Rates.

6.3.2 Event Log

Not available this month

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.

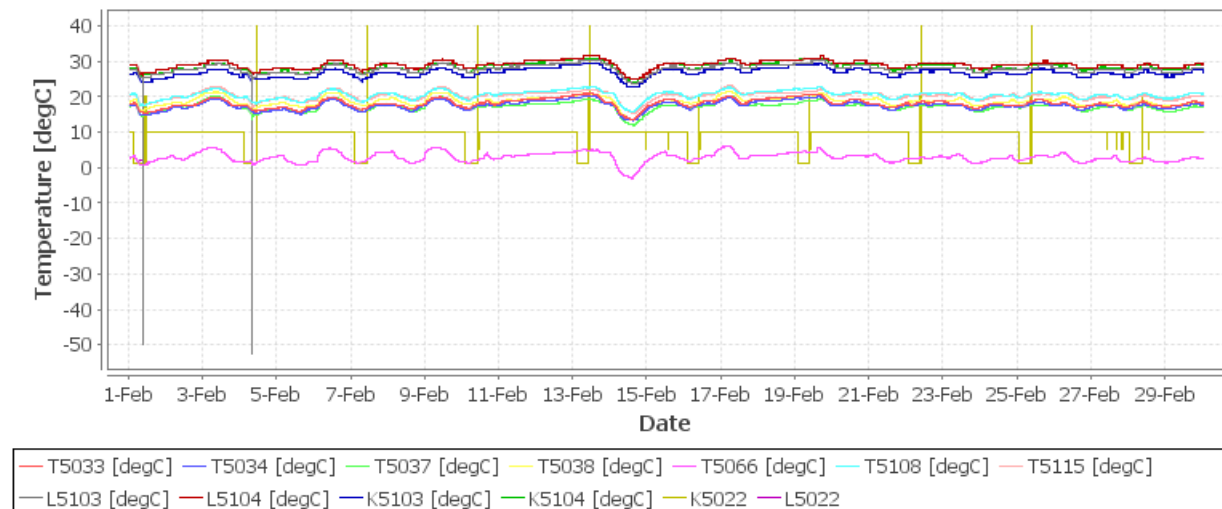


Figure 20: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

01-02-2012 (Day of Year 032, Revolution 1137)

At 07:10:00, after AOS, it was observed that JEMX-2 had not switched-on correctly after the eclipse. The symptoms were as follows:

1) Following the execution of LECLXT01 ED, the JEM-X2 DFEE state (TM parameter L5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter L5381) remained ECLIPSE instead of RAD. BELTS.

3) The DFEE CPU speed, TM parameter L5583 CPU MODE, remained at a value of 8 MHz WAIT (as at start-up) rather than the nominal value of 16MHz.

4) A power cycle was performed according to CRP_JEM2_5011 JEMX2 Recovery after eclipse anomaly, consisting of:

- 08:02:00 3 dumps of DFEE CRCs yielding values of F1B3, F074, CF9F
- 08:04:00Z FCP_JEM2_9010 JEMX2 DFEE SWITCH OFF, which involved disabling the reactions to the BCP)
- 08:06:00Z FCP_JEM2_0021 JEMX2 DFEE ACTIVATION
- 08:12:00 FCP_JEM2_0120 (JEMX-2 recovered)

There was no impact.

04-02-2012 (Day of Year 035, Revolution 1137)

At 07:10:00, after AOS, it was observed that JEMX-2 had not switched-on correctly after the eclipse. The symptoms were as follows:

1) Following the execution of LECLXT01 ED, the JEM-X2 DFEE state (TM parameter L5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter L5381) remained ECLIPSE instead of RAD. BELTS.

3) The DFEE CPU speed, TM parameter L5583 CPU MODE, remained at a value of 8 MHz WAIT (as at start-up) rather than the nominal value of 16MHz.

4) A power cycle was performed according to CRP_JEM2_5011 JEMX2 Recovery after eclipse anomaly, consisting of:

- 07:00:00 3 dumps of DFEE CRCs yielding values of F1B3, F074, CF9F
- 07:05:00Z FCP_JEM2_9010 JEMX2 DFEE SWITCH OFF, which involved disabling the reactions to the BCP)
- 07:14:00 FCP_JEM2_0120 (Disable JEMX-2 reactions to BCP)
- 07:21:00Z FCP_JEM2_0021 JEMX2 DFEE ACTIVATION
- 07:30:00 FCP_JEM2_0120 (Enable JEMX-2 reactions to BCP)

There was no impact.

27-02-2012 (Day of Year 058, Revolution 1144)

At 04:41:26 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#127). There was no impact as the reaction has been disabled.

28-02-2012 (Day of Year 059, Revolution 1145)

At 09:35:18 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#128). There was no impact as the reaction has been disabled.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

03-02-2012 (Day of Year 034, Revolution 1136)

At 13:02:48, a Trigger command was received from ISDC. This performed nominally.

06-02-2012 (Day of Year 037, Revolution 1137)

At 10:42, a TPF update failed to arrive. After a lengthy recovery involving a manual reaction wheel bias, the timeline was restored at 12:03. The impact was the loss of pointing 11370061. It was at this time the following OEMs were received:

2012.037.11.10.01.784 TC1	2012.037.11.10.06.702	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2012.037.11.10.07.909 TC1	2012.037.11.10.12.899	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E

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

10-02-2012 (Day of Year 041, Revolution 1139)

At 16:17:54, a Trigger command was received from ISDC. This performed nominally.

14-02-2012 (Day of Year 045, Revolution 1140)

At 22:13:17, OMC went to stand-by after the CCCFs were sent as part of the IBIS recovery. At 22:19:17, the pointing commands were manually resent. The impact was pointing 11400051 was cut short from a planned 3334 to 2664 seconds.

15-02-2012 (Day of Year 046, Revolution 1140)

At 12:37:09, OMC went to stand-by after the CCCFs were sent as part of the IBIS recovery. At 13:03:00, the pointing commands were manually resent. The impact was pointing 11400066 was cut short from a planned 3334 to 1480 seconds.

At 23:42:18, the FD TPF update failed for slew 11400078. A recovery was performed, and the timeline rejoined at 00:48. The impact was the loss of pointing 11400078. It was at this time the following OEMs were received:

2012.047.00.38.46.565 TC1	2012.047.00.38.53.219	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2012.047.00.38.52.690 TC1	2012.047.00.39.06.661	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E

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

25-02-2012 (Day of Year 056, Revolution 1144)

At 14:38:00, a FD problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 15:57. The impact was the loss of pointing 11440013, and pointing 11440014 was shortened from a planned 1955 to 1096 seconds.

27-02-2012 (Day of Year 058, Revolution 1144)

At 04:41:26, an IREM SEU (#127) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 04:59:57. The impact was 11440078 was cut short from a planned 1955 to 1921 seconds, and pointing 11440079 was also shortened from a planned 1955 to 992 seconds.

At 09:34:53, OMC returned to stand-by, after the CCCFs went off as part of the IREM recovery. The impact was pointing 11440087 was shortened from a planned 1955 to 304 seconds.

28-02-2012 (Day of Year 059, Revolution 1145)

At 09:35:18, an IREM SEU (#128) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 10:12:05. The impact was 11450003 was cut short from a planned 1800 to 1641 seconds, and pointing 11450004 was lost. It was at this time the following OEMs were received:

2012.059.09.38.22.622 TC1	2012.059.09.38.33.285	1792 0	RealTime 0	131 65535	PR	TC REJECT N	REJECTED E
2012.059.09.38.29.247 TC1	2012.059.09.38.39.467	1792 0	RealTime 0	131 65535	PR	TC REJECT N	REJECTED E

These correspond to the rejected M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the auto-stack for pointing 11450004.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 21, red line) and Exit times (Figure 22, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 21 and the magenta line in Figure 22 are the altitudes used by the MOC for planning purposes.

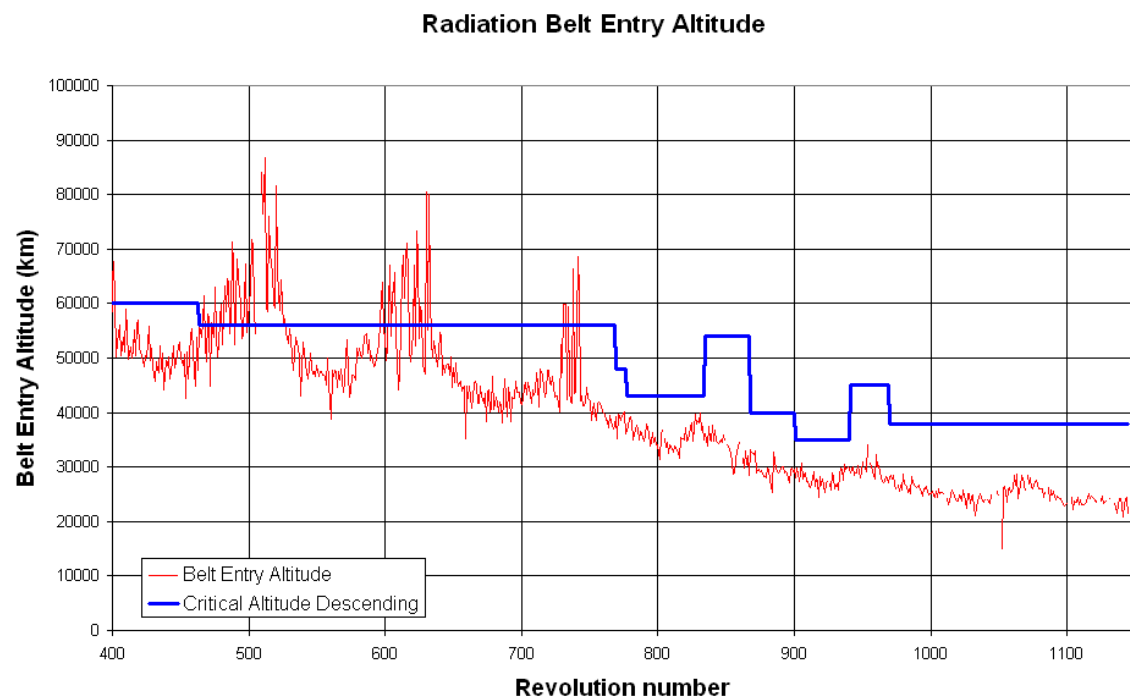


Figure 21: Radiation belt entry

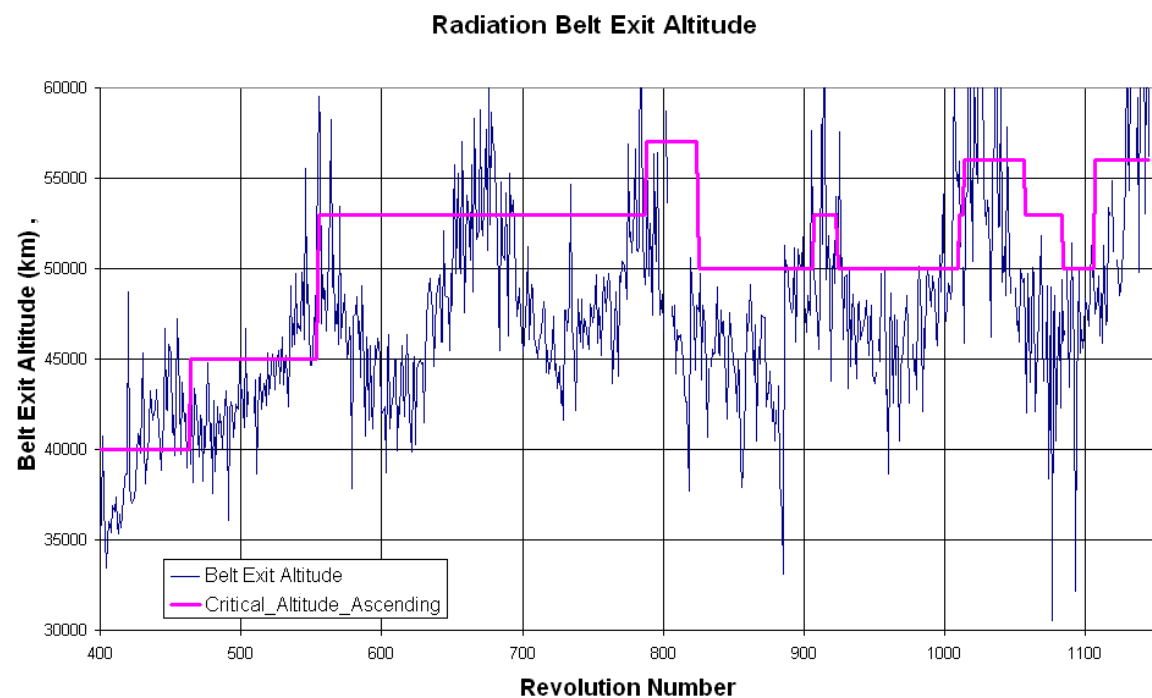


Figure 22: Radiation belt exit

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
1135	RAD_ENTR R 2012-02-01T02:56:50Z	N/A	N/A	01-Feb-2012 04:23:05	19710.03	01-Feb-2012 05:03:05	9955.648
1136	RAD_EXIT R 2012-02-01T10:16:42Z	01/02/2012 09:58:59	59672	01-Feb-2012 09:33:05	49341.92	01-Feb-2012 05:43:05	3392.247
1136	RAD_ENTR R 2012-02-04T02:42:33Z	N/A	N/A	04-Feb-2012 04:11:58	19069.65	04-Feb-2012 04:51:58	9315.255
1137	RAD_EXIT R 2012-02-04T10:02:36Z	04/02/2012 09:51:39	60736	04-Feb-2012 09:21:58	49742.01	04-Feb-2012 05:31:58	3537.672
1137	RAD_ENTR R 2012-02-07T02:28:23Z	N/A	N/A	07-Feb-2012 04:04:49	17659.68	07-Feb-2012 04:44:49	7841.72
1138	RAD_EXIT R 2012-02-07T09:47:56Z	07/02/2012 09:58:28	63990	07-Feb-2012 09:04:49	49172.01	07-Feb-2012 05:14:49	3335.019
1138	RAD_ENTR R 2012-02-10T02:16:03Z	10/02/2012 03:49:16	24672	10-Feb-2012 03:44:52	18958.74	10-Feb-2012 04:24:52	9086.213
1139	RAD_EXIT R 2012-02-10T09:34:45Z	10/02/2012 09:47:48	64321	10-Feb-2012 08:44:52	48388.67	10-Feb-2012 05:04:52	3366.884
1139	RAD_ENTR R 2012-02-13T02:05:32Z	13/02/2012 03:39:00	24548	13-Feb-2012 03:40:15	17574.88	13-Feb-2012 04:20:15	7677.635
1140	RAD_EXIT R 2012-02-13T09:23:55Z	13/02/2012 09:08:36	60042	13-Feb-2012 08:40:15	49353.15	13-Feb-2012 04:50:15	3199.04
1140	RAD_ENTR R 2012-02-16T01:53:49Z	N/A	N/A	16-Feb-2012 03:22:29	18909.55	16-Feb-2012 04:02:29	9071.351
1141	RAD_EXIT R 2012-02-16T09:12:35Z	16/02/2012 09:35:32	58819.8	16-Feb-2012 08:22:29	48357	16-Feb-2012 04:42:29	3440.721
1141	RAD_ENTR R 2012-02-	N/A	N/A	19-Feb-2012 03:13:17	18124.83	19-Feb-2012 03:53:17	8294.458

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
	19T01:39:49Z						
1142	RAD_EXIT R 2012-02- 19T08:58:53Z	19/02/2012 08:50:04	54690.3	19-Feb-2012 08:13:17	48865.94	19-Feb-2012 04:23:17	3343.122
1142	RAD_ENTR R 2012-02- 22T01:25:34Z	N/A	N/A	22-Feb-2012 02:55:06	19059.78	22-Feb-2012 03:35:06	9204.384
1143	RAD_EXIT R 2012-02- 22T08:44:15Z	22/02/2012 08:52:28	57856.1	22-Feb-2012 08:05:06	49937.63	22-Feb-2012 04:15:06	3364.81
1143	RAD_ENTR R 2012-02- 25T01:12:34Z	25/02/2012 02:46:05	19093.9	25-Feb-2012 02:46:09	17793.44	25-Feb-2012 03:26:09	7865.925
1144	RAD_EXIT R 2012-02- 25T08:30:40Z	25/02/2012 08:56:05	59914.1	25-Feb-2012 07:46:09	49251.32	25-Feb-2012 03:56:09	3149.417
1144	RAD_ENTR R 2012-02- 28T00:59:35Z	28/02/2012 02:29:49	18546.7	28-Feb-2012 02:35:54	17230.32	28-Feb-2012 03:05:54	9768.777
1145	RAD_EXIT R 2012-02- 28T08:17:39Z	28/02/2012 08:37:57	58569.3	28-Feb-2012 07:35:54	49598.66	28-Feb-2012 03:45:54	3213.26

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

27-02-2012 (Day of Year 058, Revolution 1144)

At 04:41:25Z, a local reset of the IREM CSCI S/W (SEU #127) 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 2012.027.04:41:25Z (145341.2 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 = 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, 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 07:14:00Z.

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 05:01:00Z and IBIS at 05:16:00Z.

28-02-2011 (Day of Year 059, Revolution 1145)

At 09:35:17Z, a local reset of the IREM CSCI S/W (SEU #128) 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 2012.059.09:35:17Z (67399.7 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 BCA0 HEX = 48288 DEC = 1011110010100000, i.e the Watchdog elapsed Flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON, 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 12:09:00Z.

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 10:02:00Z and IBIS at 10:35:00Z.