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

INTEGRAL
Mission report

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

No. 405
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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 January and covers the revolutions 1125 until 1135 (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

- Eclipse season on-going until 07/02/2012
- Nominal science operations. During the reporting period, 568 of the 784 planned science pointings were executed nominally. 3 pointings were lost to FDS problems, 3 were lost to on-board antenna problems, 3 pointings were lost to ground station issues, 2 were interrupted when the CCCFs were activated, 14 pointings were lost to an MOC power outage, 191 pointings were lost to high radiation. One Flat-field calibration was performed this month.
- OMC in SAFE for ~6.75 days due to high radiation.
- Lunar eclipse on 23/01/2012
- Kick-off for MCS migration
- E3.5 Testing

Summary of the overall status and performance of S/C

- Nominal for platform and payload except for IBIS DPE1 crash (18/01/2012)
- High radiation following solar flares (23-25/01/2012 and 27-31/01/2012)
- Increased fuel consumption in December and January: probably related to the perigee attitude selected to shelter the SPI cooler from the earth's albedo
- IREM Anomaly: Reset of IREM_CSCI S/W #125 (17/01/2012)
- IREM Anomaly: Reset of IREM_CSCI S/W #126 (17/01/2012)

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
- Unexpected power outage in ESOC

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.

32 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.8166 Kg. The remaining propellant is in the order of 115.0079 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 2012-01-21T09:27:59Z to 2012-01-21T14:14:22Z (OMC Flat Field Calibration), when it was 88 packets/cycle. The average telemetry occupation when the allocation was 99 packets/cycle was 81.5 packets/cycle.

The following plot shows the TM bandwidth allocation and occupation during the reporting period. The two solar flares at the end of the month lead to a higher TM bandwidth occupation.



Figure 1: SPI TM bandwidth utilisation

The following plot illustrates the DPE CPU load during the reporting period. The two solar flares at the end of the month lead to a higher TM bandwidth occupation. The higher DPE CPU load between 2012.023.12.28.50.777 and 2012.023.21.37.06.797 is due to the high number of OEM “SPI1 PARTIAL FLAG OVERFLOW” occurring in this period due to high radiation.

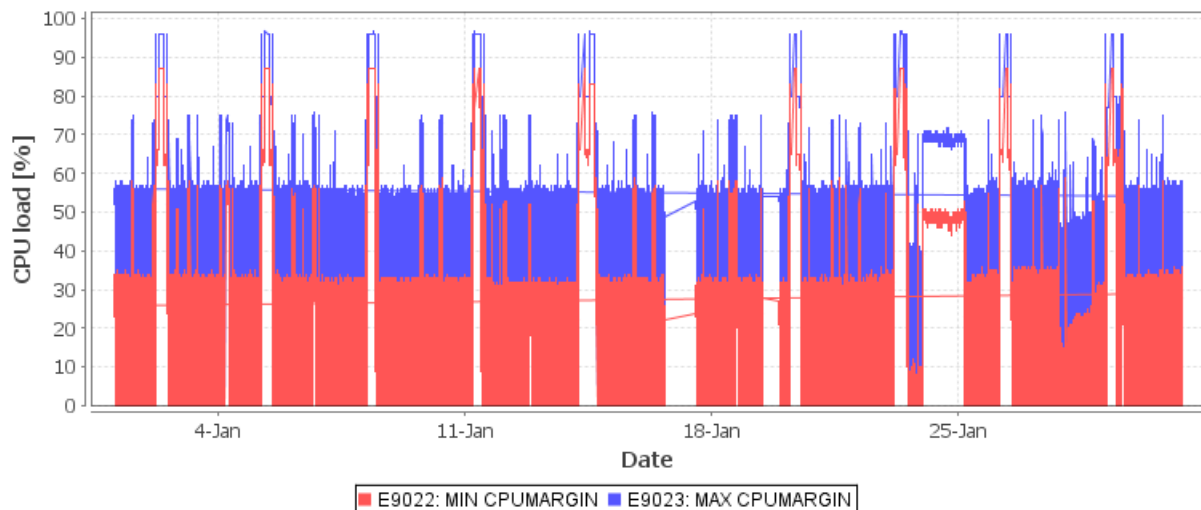


Figure 2: SPI IASW Performance

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005. The two solar flares at the end of the month lead to a higher TM bandwidth occupation.

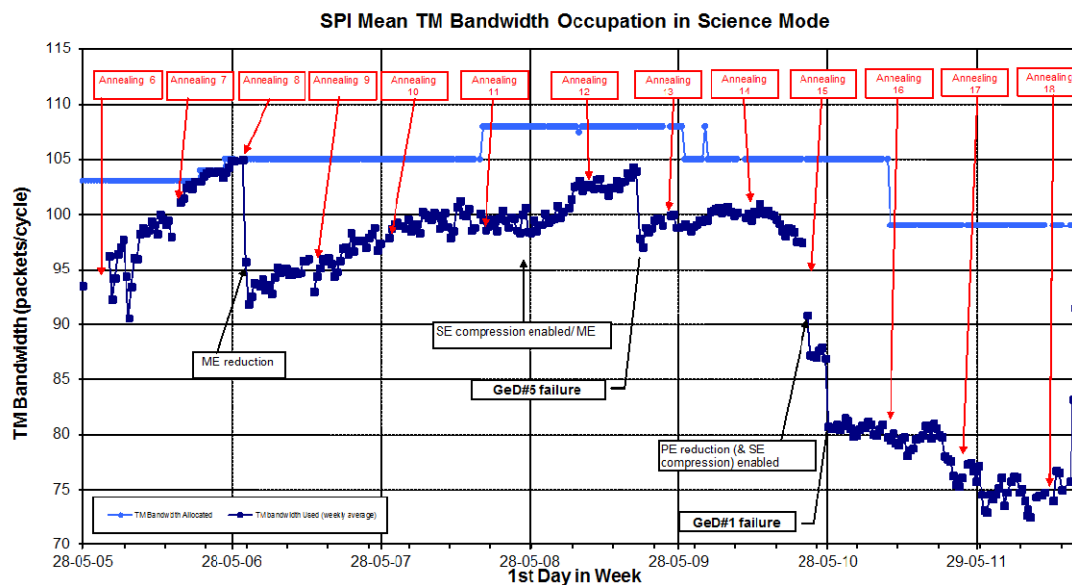


Figure 3: SPI TM bandwidth usage evolution since May 2005

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

2.2.2 IBIS

The overall status of IBIS is nominal except for 2 solar flares as well as an IBIS DPE1 crash on 18/01/2012 at 11:38:17Z. The recovery of the DPE1 was lengthy and took far too long due to procedures being unclear, difficult to follow and containing many mistakes. The recovery was completed at 2012-01-19 at 15:05Z and IBIS operations continued nominally.

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 2012-01-21T09:27:59Z to 2012-01-21T14:14:22Z (OMC Flat Field Calibration), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 111.10 packets/cycle

The plot below shows the IBIS TM utilisation during the reporting period. The two solar flares at the end of the month lead to a higher TM bandwidth occupation. Furthermore, the IBIS DPE1 reset decreased the TM bandwidth utilisation.

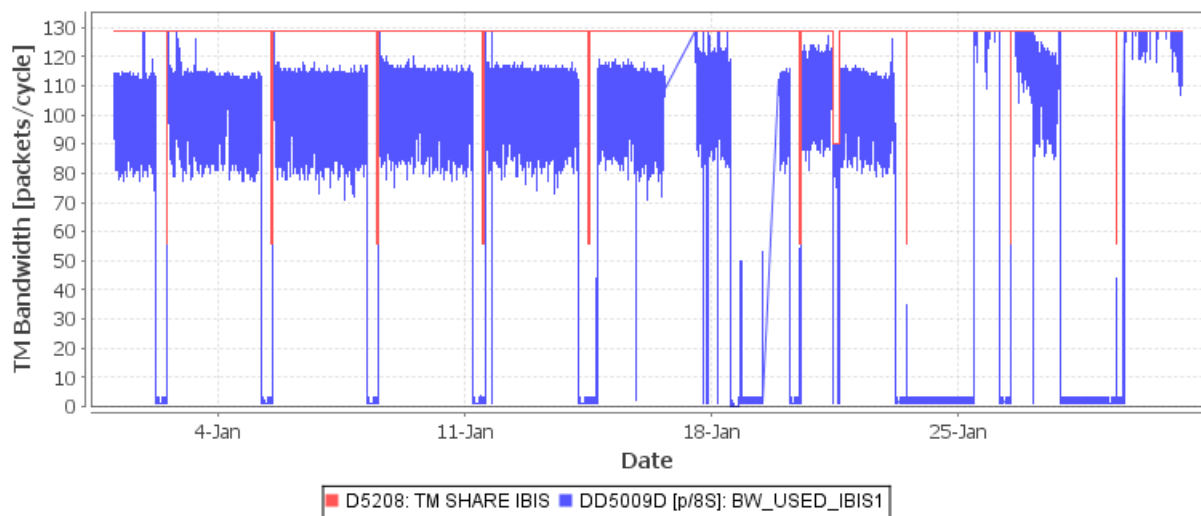


Figure 4: IBIS TM bandwidth utilisation

A plot of the IBIS weekly bandwidth utilisation since May 2005 is shown below. The two solar flares at the end of the month lead to a higher TM bandwidth occupation.

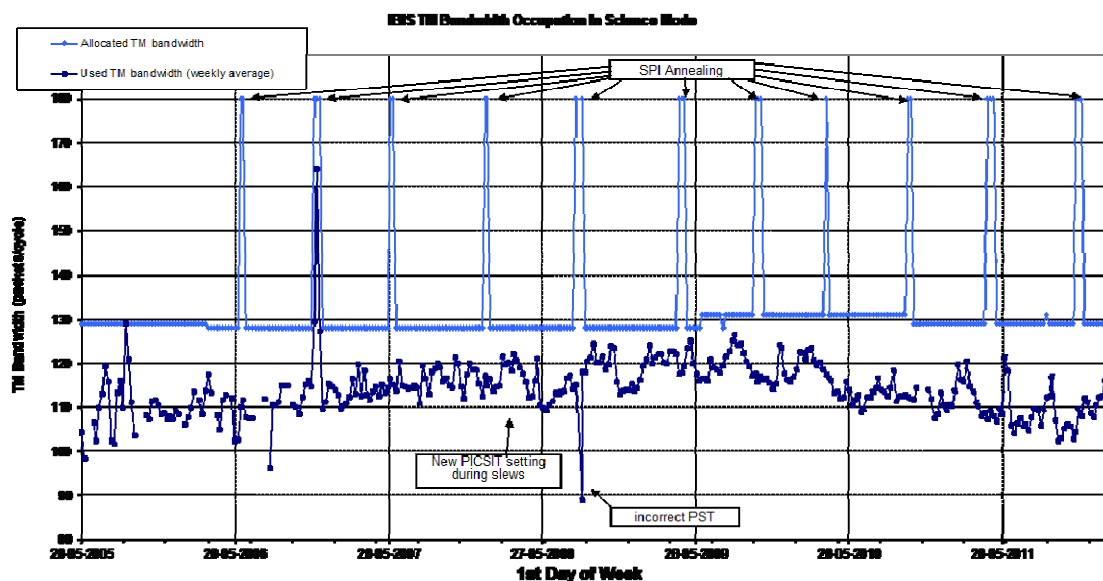


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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 2012-01-21T09:27:59Z to 2012-01-21T14:14:22Z (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 2012-01-21T09:27:59Z to 2012-01-21T14:14:22Z during the Flat-field calibration in revolution 1132, when it was 63 packets/cycle.

During this reporting period, 568 of the 784 planned science pointings were executed nominally. 3 pointings were lost to FDS problems, 3 were lost to on-board antenna problems, 3 pointings were lost to ground station issues, 2 were interrupted when the CCCFs were activated, 14 pointings were lost to an MOC power outage, 191 pointings were lost to high radiation. 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 017 (17/01/2012), the 125th IREM SEU occurred

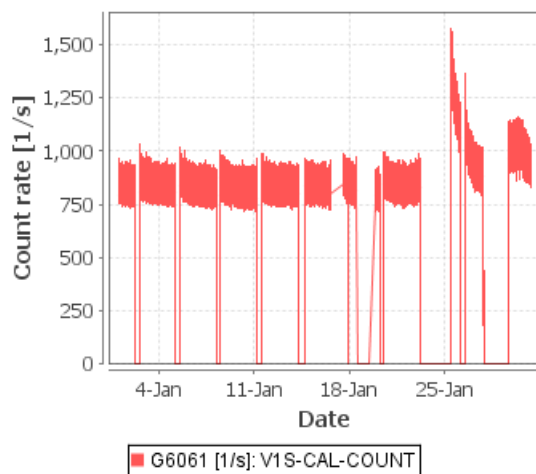
On DoY 017 (17/01/2012), the 126th IREM SEU occurred

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

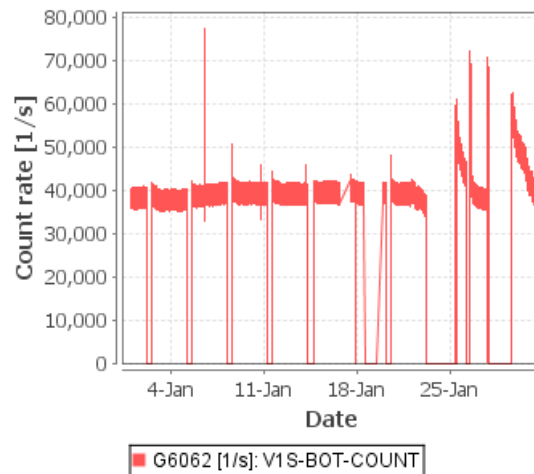
Radiation background

The background radiation level as measured by the instrument counters was low during the first part of the month, however from the 25th onward, the radiation levels increased significantly. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:

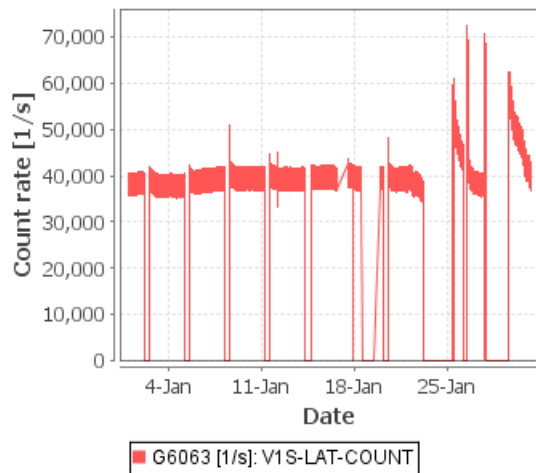
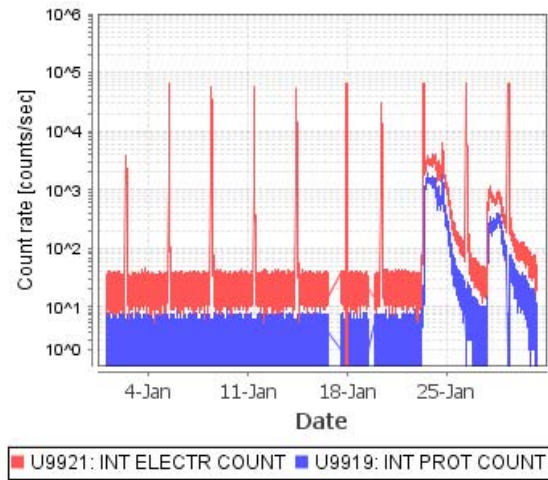
VETO Calibration Source Count Rate



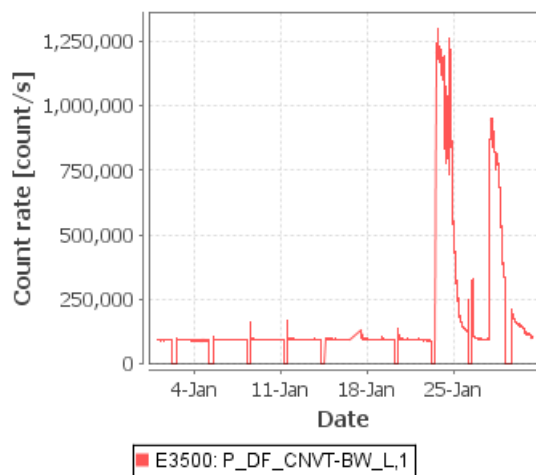
VETO Bottom Count Rate



VETO Lateral Count Rate

IREM Proton & Electron Counters¹

ACS Below 100MeV



ACS Above 100MeV

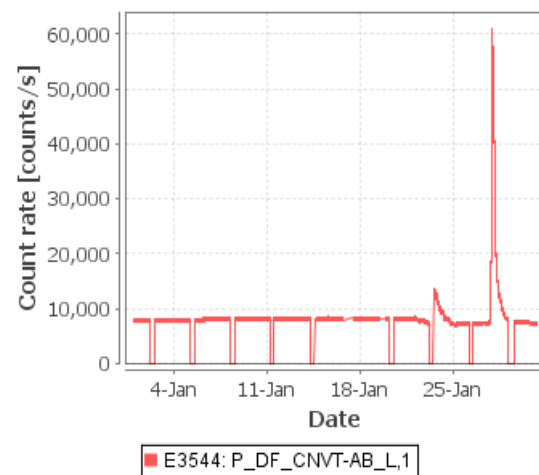


Figure 6: Instrument Count Rates

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

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

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

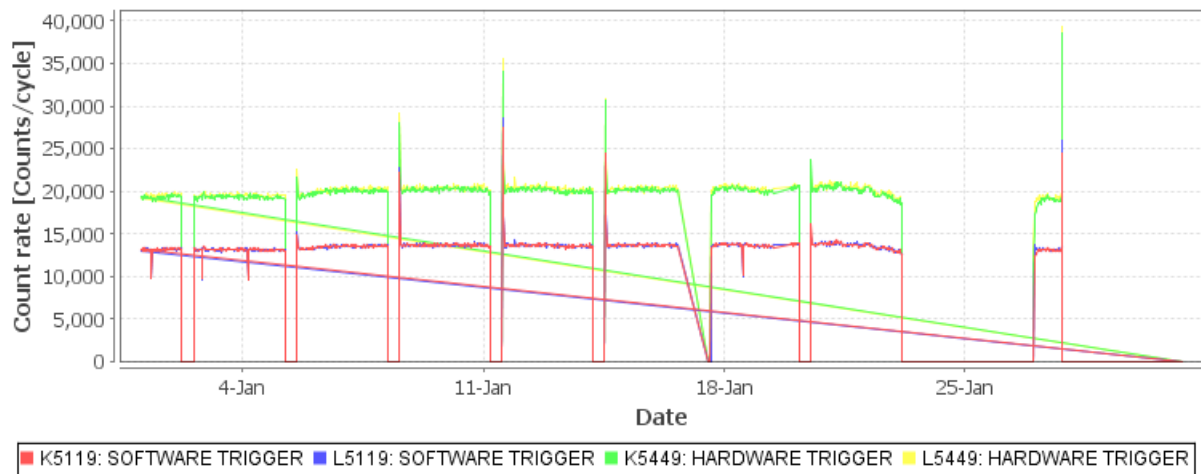


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

Radiation Belts

Figure 8 gives a prediction of the trapped radiation environment sensed by the S/C when descending into perigee; the different areas crossed, the Radiation Belt entry/exit points, the shape of the Radiation Belt passage and a rough estimation of the trapped proton and electron fluxes.

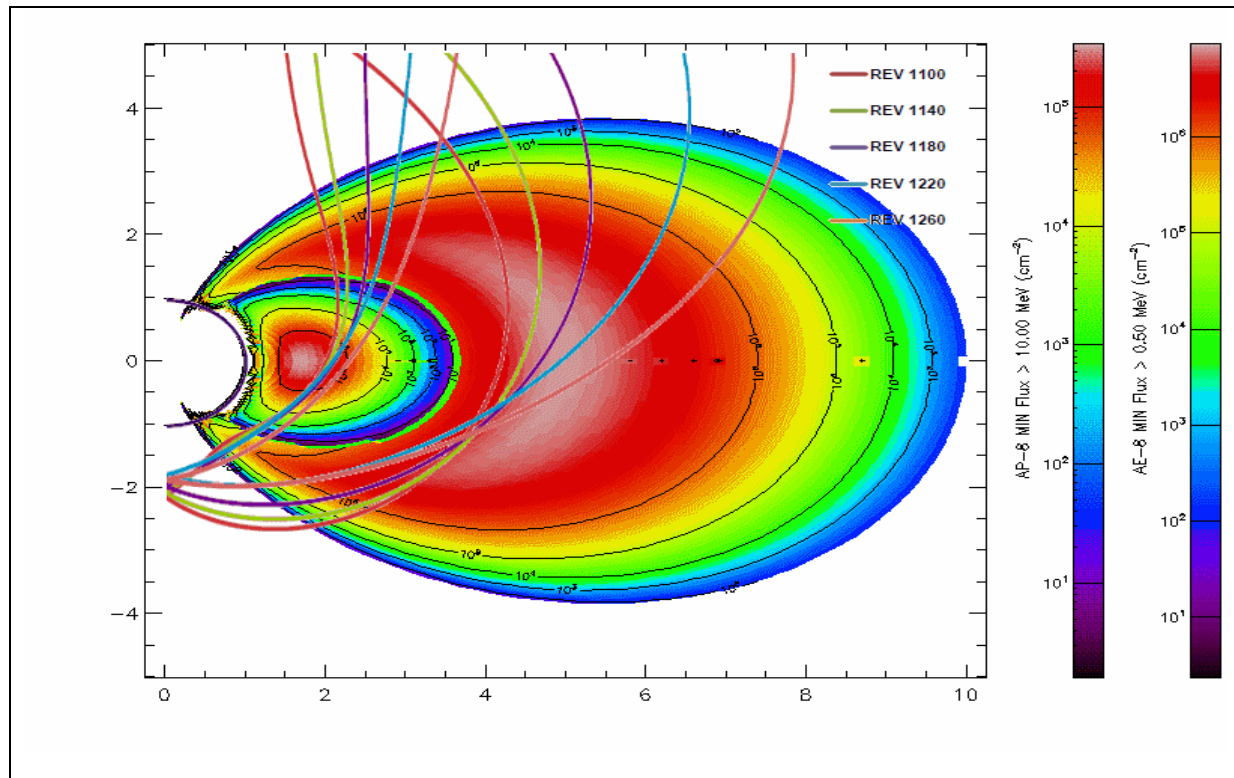


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

3 Ground Facilities

The Operational ground facilities performance was good this month. The overall performance was over the 95% requirement.

The following figure shows the number of slews executed and the number of slews missed per revolution. These numbers give a very good indication of the performance of the operational ground facilities, because it involves all the different elements of the ground facilities to complete all slews scheduled.

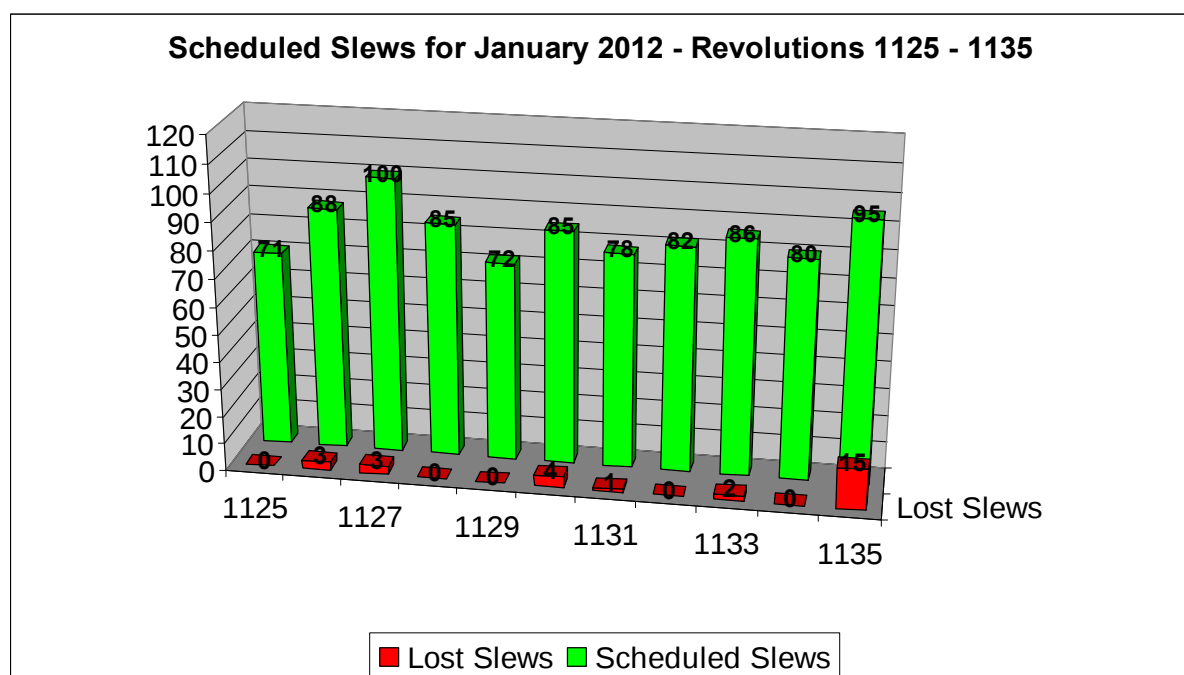


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY 011 the TCON_RT tasks on both IDDA and IDDB crashed. The tasks were restarted, but crashed again. This was retried several times but the tasks kept on crashing. Further investigation showed that the consolidator hfiles had not been created and therefore no frames could be stored. The relevant hfiles were then manually created and the data gap was filled by offline retrievals.

On DOY 014 the software warning message "Store of Packet (65535:100:....)" was received repeatedly from IMCA and various commands were unverified. Operations were moved to the B-chain and IMCA was restarted. This did not fix the problem. Further investigation showed that the segmentation of the telecommand history hfile had failed resulting in the corrupted of the file. The hfiles were deleted and recreated from IMCB. Operations were moved back to the A-chain on DOY 016.

On DOY 017 it was noticed that all generated auxiliary files were empty since the operations swap on DOY 016. All applications on IDDA were shutdown and restarted and the files were regenerated. The

regenerated files were also all empty. The problem was traced back to a bug in the software which set the RAPID file generation to disabled on IMCA overriding what was set in TM SPACON. This also meant that no data (TM/TC/EV) was written to the archives on IDDA or IDDB since DOY 016. Operations were moved to the B-chain. The setting was changed on IMCA and all applications were restarted. Operations were moved back to the A-chain. The gaps in the Long Term Archives on IDDA and IDDB were filled by exporting the data from the Short Term Archive on IMCA. The gaps in the Consolidator Archives were filled by offline retrievals.

On DOY 023 it was noticed that IMCB had crashed. The CCC operator, who had been requested to check the machine, reported that the machine was OK. The SPACON tried to restart the applications on IMCB but they did not start up correctly. CCC were then requested to reboot the machine. After the reboot all applications were started correctly.

On DOY 031 a power outage at ESOC caused all servers in the DENEb server room (INCTRA, IMCA, IDDA, ISDSA) and all clients in the control room to switch off unexpectedly. Once the power was restored operations were moved to the B-chain. The C-chain was reconfigured as backup. All IFTS nodes were reconfigured to use the backup network. All affected machines were checked and it was identified that both the Short Term Archive on IMCA and the Long Term Archive on IDDA were corrupted. The corrupted segment files were identified and deleted. The segment catalogue was then rebuilt to allow operations to be continued. Operations were moved back to the A-chain on DOY 037. The gaps caused are still in the process of being filled.

The CD production failed on 9 occasions. The generation and reception of auxiliary files failed on 7 occasions. The ISDS-ISDC connection dropped 10 times and the ISDS and IFRD tasks needed to be restarted on 3 occasions.

3.2 Ground Stations and Network

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

DOY 4 (4/1) 22:06:00 - TM Drop on VC-0 & VC-7 -> RFI - JASON-1

DOY 5 (5/1) 08:59:00 - TM Drop on VC-0 & VC-7 -> Problem with TMTCS Software update

DOY 6 (6/1) 00:31:00 - TM Drop on VC-0 & VC-7 -> RFI – unknown source

DOY 7 (7/1) 04:37:00 - Bad frames -> RFI – unknown source

16:47:00 - TM Drop on VC-7 -> RFI – unknown source

DOY 016 (16/1) 17:45:34 - TM Drop on VC-0 & VC-7 -> RFI – unknown source

DOY 018 (18/1) 11:09:00 - TM Drop on VC-0 -> unknown cause

13:11:01 - TM Drop on VC-0 & VC-7 -> hit on COMMS line

DOY 019 (19/1) 14:53:00 - TM Drop on VC-0 -> hit on COMMS line

16:05:00 - TM Drop on VC-0 -> hit on COMMS line

16:09:00 - TM Drop on VC-0 -> hit on COMMS line

DOY 020 (20/1) 05:41:00 - Bad Frames -> RFI – unknown source

DOY 025 (25/1) 10:25:00 - Bad frames -> unknown cause.

DOY 026 (26/1) 07:30:00 - TM links VC-0 & VC-7 disconnected unexpectedly

→ Both TMTCS's went to Basic state INOPERABLE. Could not command TMTCS from STC. Could not RESET TMTCS's from STC. Stn staff rebooted manually.

DOY 030 (30/01) 03:51:00 - Bad Frames -> RFI – SMOS

DOY 031 (31/01) 18:30:00 - TM Drop on VC-0 & VC-7 -> RFI – SMOS

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.

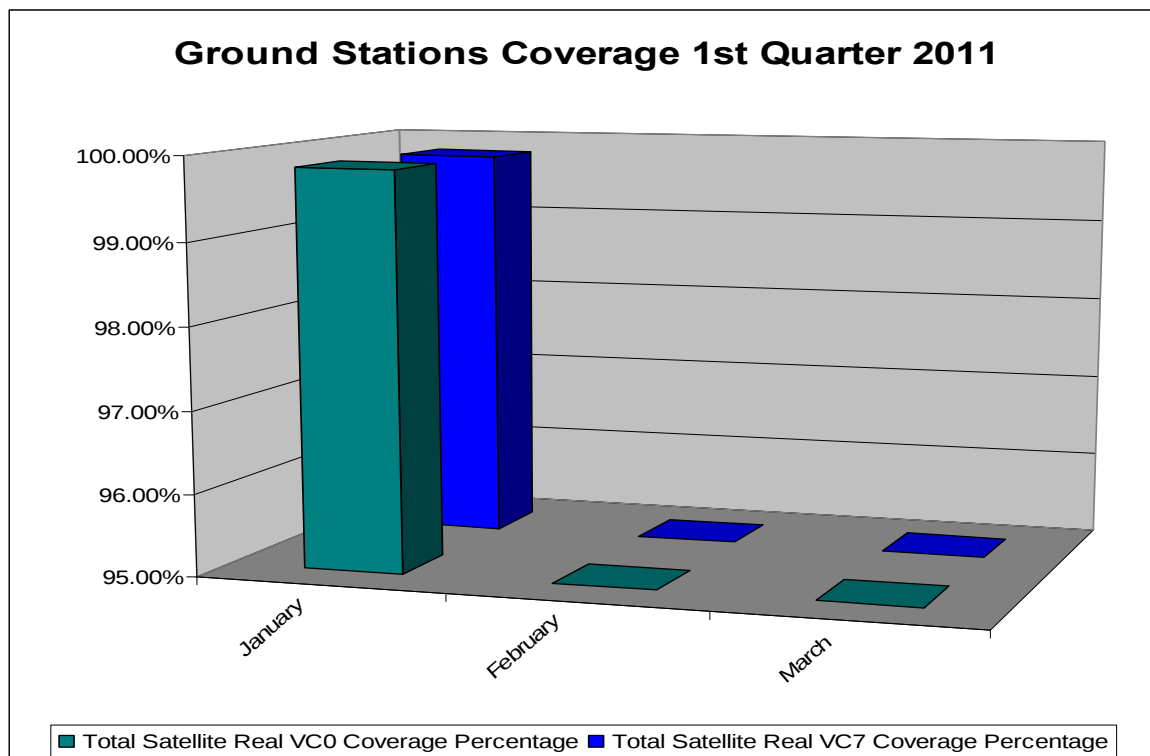


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1134 to 1142, corresponding to the time range 26 January to 22 February.

New observations have been planned for revolutions 1130 (14-17 January) to 1137 (4-7 February). Revolutions 1131-1134 and 1136 had to be re-planned because of ToO observations of the transient pulsar GX 304-1.

TSFs have been received for revolutions 1129 to 1136.

3.3.2 Observation Status

New ECS files have been received for revolutions 1110 to 1115 (covering observations up to 3 December).

3.3.3 ISOC Science Data Archive

No news.

3.3.4 ISOC System

ISOC software V32 is being prepared for a release in February.

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-3222	2012-01-04	No TM after switching to -Z antenna probably due to shadowing effect on DOY 4	FDS	Pending
INT-3223	2012-01-11	No ISGRI context tables on DOY 11/2012	ISDC	Pending
INT-3224	2012-01-14	PDsSerTC error	IMCS	Pending
INT-3225	2012-01-11	Loss of Guide Star within one minute after OSL was finished	FDS	Pending
INT-3226	2012-01-11	TCON_RT error on IDDA and IDDB	IMCS	Pending
INT-3227	2012-01-16	No RAPID file generation on imca	IMCS	Pending
INT-3228	2012-01-19	Frame checker does not identify gaps spanning	IMCS	Pending

AR id	Date of occurrence	Subject	Segment	Status
		past midnight		
INT-3229	2012-01-23	Printouts not in colour	IMCS	Pending
INT-3230	2012-01-23	OOL printouts show EVLprintFile.tmp in header	IMCS	Pending
INT-3231	2012-01-22	IMCB system crash on DOY 023	IMCS	Pending
INT-3232	2012-01-18	Timer for enabling subsystems couldn't enable AOCS before RWB	IMCS	Pending
INT-3233	2012-01-18	OBSM task freezes	IMCS	Open
INT-3235	2012-01-23	IBIS, JEM-X and OMC Safe Following Solar Flare	Payload	Pending
INT-3236	2012-01-27	IBIS, JEM-X and OMC Safe Following Solar Flare	Payload	Pending
INT-3237	2012-01-31	Unexpected power outage in ESOC		Pending
INT-3246	2012-01-23	EEXIT failed release due to dynamic PTV	IMCS	Pending
INT_SC-362	2012-01-05	JEM-X2 DFEE CRC Anomaly following eclipse on 2012-01-05	Payload	Closed
INT_SC-363	2012-01-11	JEM-X1 DFEE CRC Anomaly following eclipse on 2012-01-11	Payload	Testing
INT_SC-364	2012-01-17	JEMX-1 & JEMX-2 went to SAFE mode after HV activation.	Payload	Pending
INT_SC-365	2012-01-17	IREM Anomaly: Reset of IREM_CSCI S/W #125, 17/01/2012	Payload	Pending
INT_SC-366	2012-01-17	IREM Anomaly: Reset of IREM_CSCI S/W #126, 17/01/2012	Payload	Pending
INT_SC-367	2012-01-19	IBIS IDPE1 Failure	Payload	Pending
INT_SC-368	2012-01-25	IBIS increased VETO count rates during activation followed by many OOL	Payload	Pending
INT_SC-376	2012-01-23	IBIS VEB reset by watchdog	Payload	Pending

5 Special Events & Future Milestones

- E3.5 Testing
- End of eclipse season on 7th February 2012
- AOCS reconfiguration post-eclipse season
- FSS/Star Tracker calibration 21st March 2012.
- 2nd Earth Observation campaign starts 10th May.

6 Appendix

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

6.1 AOCS operations

During this period, 461 Open Loop Slews, 415 Closed Loop Slews and 33 Momentum Biases were executed (as reported by ACC OEM).

32 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 01/02/2012 is reported in the following plot:

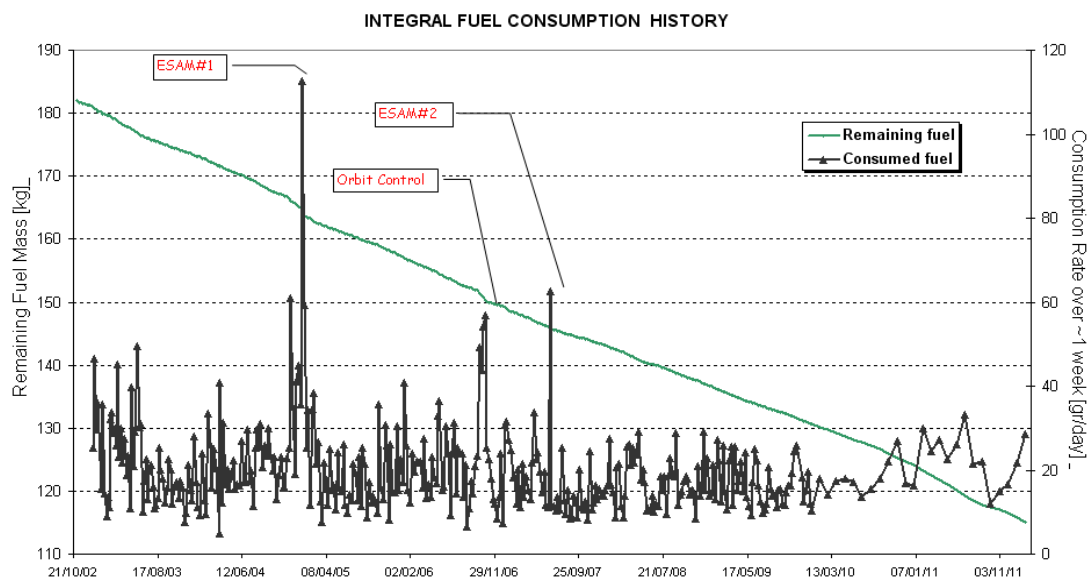


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

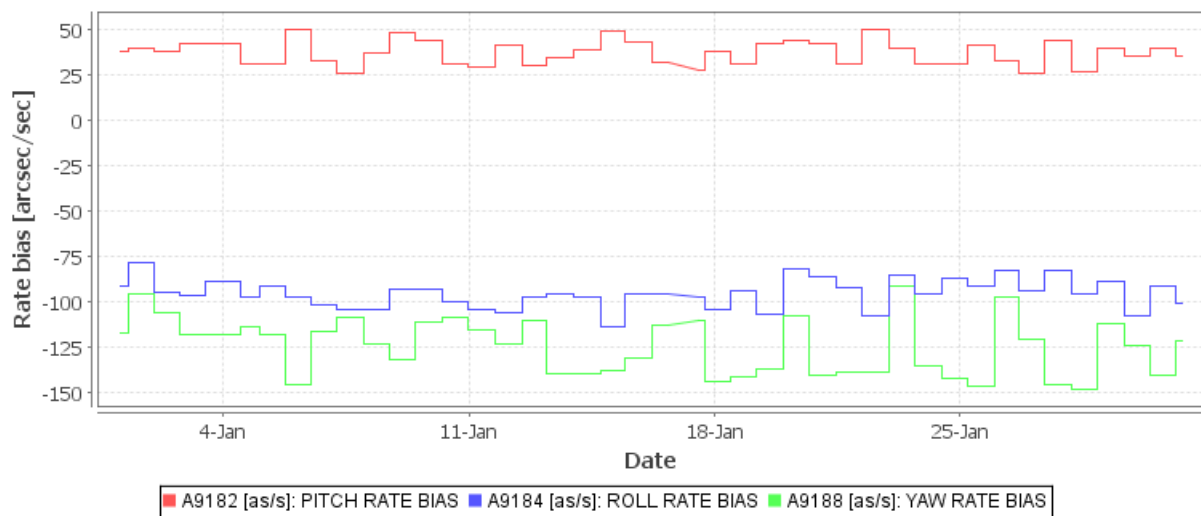


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

01/01/2012 (Day of Year 1, Revolution 1125)

IMU1 switched ON during the stable pointing of PID 11250059 (19:46:00Z). After the IMU switched back OFF a mapping was commanded and the parameters for slew 11250060 were manually updated (spacontool).

OTF was not reached for PIDs 11250059.

No slews were missed from the timeline.

02/01/2012 (Day of Year 2, Revolution 1126)

IMU1 switched ON during the stable pointing of PID 11260009 (17:58:00Z). After the IMU switched back OFF a mapping was commanded and the parameters for slew 11260010 were manually updated (spacontool).

OTF was not reached for PIDs 11260009.

No slews were missed from the timeline.

03/01/2012 (Day of Year 3, Revolution 1126)

FDS TPF update failed for slew 11260029 (07:24:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and Spacon tried to update the parameters for slew 11260029 but received the error message from FD system: planned CSL, has to be done as OSL. Then a manual mapping was commanded and a slew was manually generated from attitude 11260028 to attitude 11260029.

After the manual slew was completed, the parameters for slew 11260030 were manually updated (spacontool).

Slew 11260029 was missed from the timeline.

04/01/2012 (Day of Year 4, Revolution 1126)

Autostack commanding for slew 11260049 (03:56:15Z) failed release due to loss TM after timeline Antenna switch (+Z to -Z).The slew11260049 was executed, only last CMD's(seq. AESSS_00) were missed. The AOCS was suspended in the timeline, then a manual Antenna switch (-Z to +Z) was commanded(04:37:04) and TM came back(04:37:06Z). Then a manual mapping was commanded and a slew was manually generated from attitude 11260049 to attitude 11260051.

After the manual slew was completed, the parameters for slew 11260052 were manually updated (spacontool).

Slews 11260049, 11260050, 11260051 were missed from the timeline. The OTF was not reached for its PID.

05/01/2012 (Day of Year 5, Revolution 1127)

FDS TPF update failed for slew 11270002 (11:29:00Z).The AOCS was suspended in the timeline , then a manual mapping was commanded and Spacon tried to update the parameters for slew 11270002 but received the error message from FD system : wheel speeds not OK for CSL and FD was informed. Then a manual mapping was commanded and a slew was manually generated and executed from attitude 11270001 to attitude 11270004. Then a corrective slew was generated and executed for 11270004.

After the manual slew was completed, the parameters for slew 11270005 were manually updated (spacontool).

Slew 11270002, 11270003 and 11270004 were missed from the timeline. The OTF was not reached for its PID.

09/01/2012 (Day of Year 9, Revolution 1128)

FDS TPF update failed for slew 11280029 (12:39:00Z).The AOCS was suspended in the timeline , then a manual mapping was commanded and Spacon tried to update the parameters for slew 11260029 but received the error message from FD system : ATTD verification failed: Not enough stars in TM. FD was called then a manual mapping was commanded and the parameters for slew 11280030 were manually updated (spacontool).

No slew was missed from the timeline.

11/01/2012 (Day of Year 11, Revolution 1129)

Autostack commanding for slew 11290019 (22:43:31Z) failed release due to OEM:TC reject bad RGA. After investigation Spacon noticed that the Guide star was lost(22:43:27Z) in the first minute after slew end. The slew 11260049 was executed, only last CMD's(seq. AESSS_00) were missed. Then a manual mapping was commanded the parameters for slew 11290020 were manually updated (spacontool).

Slew 11290019 was missed from the timeline. The OTF was not reached for its PID.

14/01/2012 (Day of Year 14, Revolution 1029 to 1130)

- Guide star was lost and OEM:ACC STR THR received during perigee passage (06:40:53Z). IMU1 was already ON due to eclipse. After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was not the case, a manual CGS was generated and uplinked prior to the RWB.

No impact in the timeline.

- Autostack commanding A3039(start eclipse) failed release(09:58:38Z) due to interlock(previous CMD not verified). The Spacon did uplink manually the CMD(10:03:37Z).

Autostack commanding A3699(auth IMU timers) failed release(11:16:28Z) due to interlock(previous CMD not verified).

Caused by MCS problems, the AOCS subsystem had to be suspended in the timeline (11:16:45Z). During the time it was disabled, slews 11300001, 11300002, 11300003 and 11300004 failed release.

After the MCS problem was solved, a manual mapping was commanded and a slew was manually generated from attitude 11300001 to attitude 11300004(13:40:00Z). Then a corrective slew was generated and executed for 11300004(14:14:00Z).

Once the manual slew was completed, the parameters for slew 11300005 were manually updated (spacontool).

Due to the problem with the eclipse timers(09:58:38Z) FD did generate new eclipse timers TPF and they were uplinked later(15:15:00Z)

Slews 11300001, 11300002, 11300003 and 11300004 were missed from the timeline. The OTF was not reached for its PID.

17/01/2012 (Day of Year 14, Revolution 1031)

Guide star was lost and OEM:ACC STR THR received during perigee passage (06:26:31Z). IMU1 was already ON due to eclipse. After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was not the case, a manual CGS was generated and uplinked prior to the RWB.

No impact in the timeline.

18/01/2012 (Day of Year 18, Revolution 1131)

- IMU1 switched ON during the stable pointing of PID 11310016 (02:47:42Z). After the IMU switched back OFF a mapping was commanded and a slew was manually generated and executed from attitude 11310016 to attitude 11310017.

Then a manual mapping was commanded and the parameters for slew 11310018 were manually updated (spacontool).

Slew 11310017 was missed from the timeline.

OTF was not reached for PIDs 11310016 and 11310017.

- FDS TPF update failed for slew 11310024 (09:12:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and Spacon tried to update the parameters for slew 11260024 but received the error message from FD system: planned CSL, has to be done as OSL. Then a manual mapping was commanded and a slew was manually generated from attitude 11310023 to attitude 11310024.

After the manual slew was completed, the parameters for slew 11310025 were manually updated (spacontool).

Slew 11310024 was missed from the timeline. OTF was not reached for its PID.

- Manual RMU Calibration performed by Spacon (09:59:00Z) due to wrong automatic RMU Cal received from FD (CMD A7283 was not sent due to AOCS disabled).

No impact in the timeline.

20/01/2012 (Day of Year 20, Revolution 1031 to 1132)

Guide star was lost and OEM: ACC STR THR received during perigee passage (06:15:57Z). IMU1 was already ON due to eclipse. After AOS, the SPACON commanded a manual mapping in order to check whether the current guide star was suitable for a RWB.

Since that was not the case, a manual CGS was generated and uplinked prior to the RWB.

No impact in the timeline.

24/01/2012 (Day of Year 24, Revolution 1033)

Caused by FD server problems, the AOCS subsystem had to be suspended in the timeline (08:01:00Z). During the time it was disabled, slews 11330026 and 11330027 failed release.

After the FD server problem was solved, a manual mapping was commanded and a slew was manually generated from attitude 11330025 to attitude 11330027 (08:45:00Z).

Once the manual slew was completed, the parameters for slew 11330028 were manually updated (spacontool).

Slews 11330026 and 11330027 were missed from the timeline. The OTF was not reached for its PID.

26/01/2012 (Day of Year 26, Revolution 1134)

IMU1 switched ON during the stable pointing of PID 11340009 (18:41:00Z). After the IMU switched back OFF a mapping was commanded and the parameters for slew 11340010 were manually updated (spacontool).

OTF was not reached for PID 11340009.

No slews were missed from the timeline.

27/01/2012 (Day of Year 27, Revolution 1134)

FDS TPF update failed for slew 11340022 (06:48:00Z). The OTF was not reached for PID 11340021. The AOCS was suspended in the timeline, then a manual mapping was commanded and Spacon did update the parameters for slew 11340022(06:56:00Z).

No slews were missed from the timeline.

31/01/2012 (Day of Year 31, Revolution 1135)

Caused by a power outage on all clients in the DCR (07:22:12Z) Autostack commanding for slew 11350063 (07:22:12Z) was interrupted (Last CMD sent was A3036 at 07.21.55Z). During the power outage and the MCS and FDS recovery, slews 11350063 to 11350078(16 slews) were not executed.

After the power outage problem was solved, and the recovery of MCS and FDS was completed a manual mapping was commanded and a slew was manually generated from attitude 11350062 to attitude 11350078(16:12:00Z).

Once the manual slew was completed, the parameters for slew 11350079 were manually updated (spacontool).

Slews 11350063 to 11350078 were missed from the timeline. The OTF was not reached for their PIDs.

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 38 on 01-01-2012 and to 39 on 24-01-2012 leading to a decrease of the temperature of the cold plate as well to an increase of the SPI CDE LCL currents.

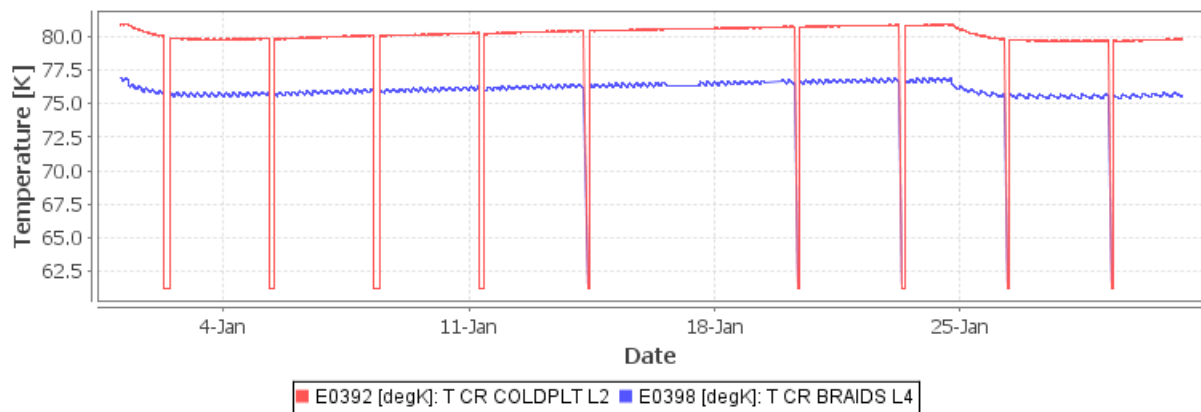


Figure 13: SPI Cold plate and H-bus temperature

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

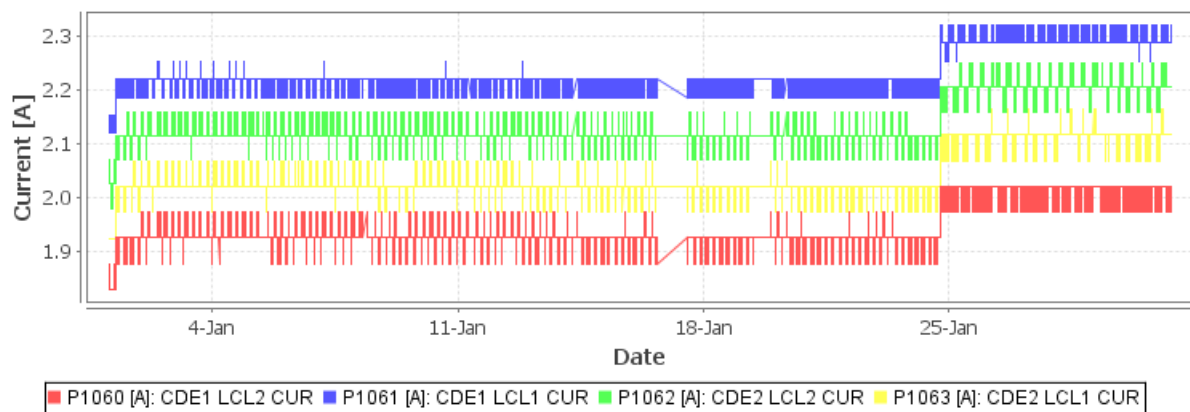


Figure 14: SPI CDE LCL current

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.

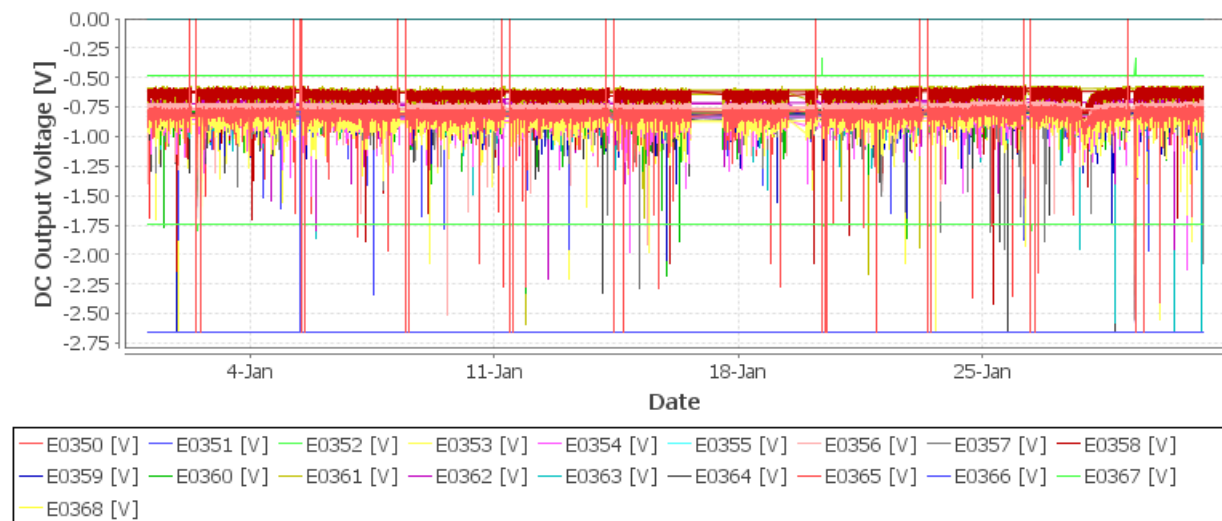


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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. The two solar flares at the end of the month lead to higher count rates.



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.

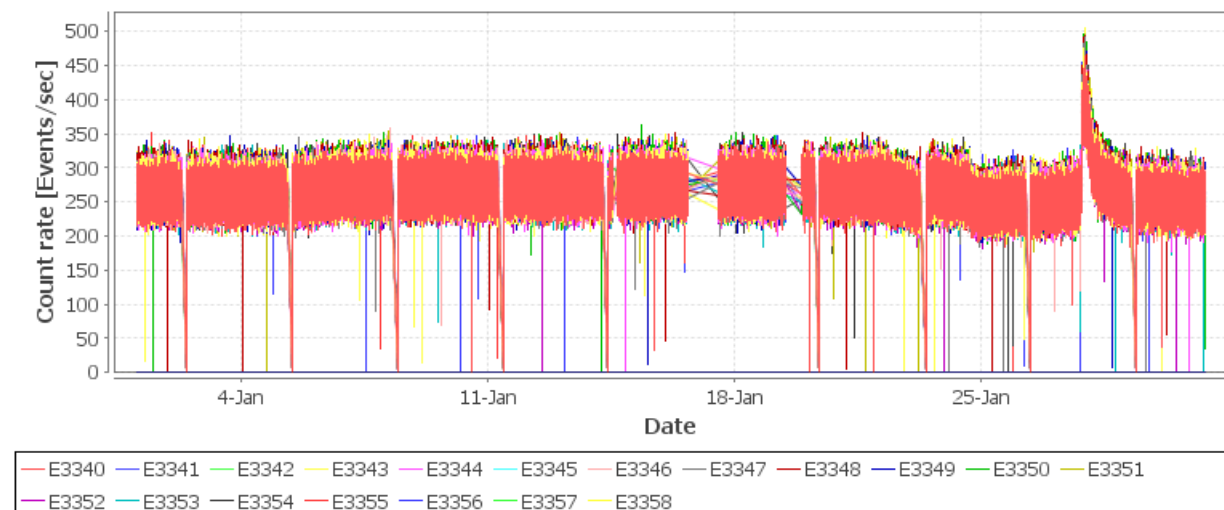


Figure 18: SPI GeD Time Tagged Saturated count rates

PSD

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

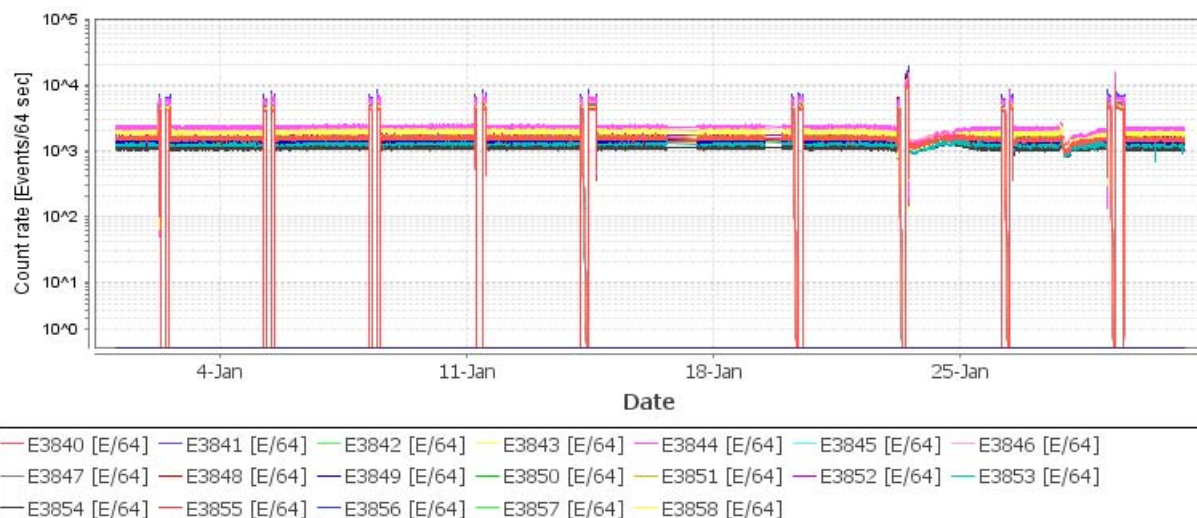


Figure 19: SPI PSD GeD Channel rates

6.2.2 Event Log

24-12-2011 — 07-02-2012 (until Day of Year 38, Revolutions: all within the reporting period)

Eclipse season #20 (pre-perigee eclipse): The number of OOLs occurring during the post eclipse activation has been reduced drastically compared to the eclipse season #19 (see report 06/2011). For the next eclipse season this number shall be minimized again.

01-01-2012 (Day of Year 1, Revolution 1125)

On 01-01-2012 at 05:15Z the stroke of the compressors was increased to 38 as a reaction to a S/H OOL on the TM E0392 'T CR COLDPLT L2' S/H-OOL (value= 80.9209K).

11-01-2012 (Day of Year 11, Revolution 1128)

OEM APID 1024 ID 242 EXCEPTION SPI1 FAILURE IN ANALYSING HSL DATA were received at 2012.011.05.50.58.737 and 2012.011.05.50.58.862. As these were the only occurrences, no action was required. SPI operations continued nominally.

13-01-2012 (Day of Year 13, Revolution 1128)

At 04:33:59 TM parameter E2005 'S AS HV-ST L3' went OOL (STATUS) with value PARAM>SPEC. Therefore, the TCs E0282 to E0287 have been sent at 04:40:00. TM E2005 went back within limits. SPI operations continued nominally.

14-01-2012 and 29-01-2012 (Day of Year 14 and 29, Revolution 1129 and 1135)

OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW were received at 2012.014.05.13.11.268 and 2012.029.07.43.49.107. As in each case it was a single occurrence, no action was required. SPI operations continued nominally.

14-01-2012 (Day of Year 14, Revolution 1130)

SPI operations was interrupted by a MCS problem on 14/01/2012 (DOY 14): A corruption of the HFA-TC archive segment - whilst the file was being segmented and at the same time ca. 70

commands were in the process of being uplinked or verified – lead to the following: all report commands got unverified and the next command of the sequence with dynamic PTV could not be started.

This affected 3 subsystems: AOCS, SPI (EEXIT03) and IBIS (ISGRI CTX tables). The operations were continued on the B-chain. The recovery of SPI was performed after the recovery of AOCS as following: EEXIT03 was resent at 15:25Z (originally planned for 11:37:01Z) and SPI was enabled from the timeline at 15:31Z. Operations continued on the B-chain. SPI operations continued nominally.

23-01-2012 (Day of Year 23, Revolution 1133)

During the recovery of the VEB reset generated by watchdog after the lunar eclipse, TC EU0201D (seq. EEXIT-03) failed release due to dynamic PTV at 11:07:15. This is due to too much commanding going on in parallel: GEISCL03 from timeline with IBIS enabled, GEISCL03 from man. stack and EEXIT-03.

ED EEXIT-03 was re-uplinked at 11:47:53 and SPI was enabled from the autostack at 11:58:00. SPI operations continued nominally.

23/24-01-2012 (Day of Year 23/24, Revolution 1133)

About 3400 OEM APID 1024 ID 229 EXCEPTION SPI1 PARTIAL FLAG OVERFLOW were received between 2012.023.13.29.21.654 and 2012.024.16.05.29.087 due to a solar flare (E3500 OOL; back within limits: DOY 26 02:14Z). Furthermore, 14 occurrences of EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received during the reporting period, between 2012.023.12.28.50.777 and 2012.023.21.37.06.797. After consultation with the PI, it was agreed to leave SPI operational and just monitor the OEMs, since it should be avoided to put SPI into standby during a solar flare. SPI operations continued nominally.

24-01-2012 (Day of Year 24, Revolution 1133)

Parameter E3287(S AS PC-PS1) went OOL STATUS with value PARAM<SPEC at 02:57:00. After sending the report TCs E0282 to E0287 to request the FEE analog status, E3287 went back within limits. SPI operations continued nominally.

24-01-2012 (Day of Year 24, Revolution 1133)

On 24-01-2012 at 16:42:06Z the stroke of the 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).

27/28-01-2012 (Day of Year 27/28, Revolution 1134)

12 occurrences of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received between 2012.027.20.01.47.517 and 2012.028.08.07.07.545. This is due to a solar flare: OOL H/H on TM parameter E3544, but value <65000. Therefore, no action was required. SPI operations continued nominally.

29-01-2012 (Day of Year 29, Revolution 1135)

Due to high radiation and the ops. instruction being unclear, SPI was disabled on the A/S on 10:32:00Z and EEXIT-03 was uplinked at 14:09Z instead of 10:34Z. SPI operations continued nominally.

31-01-2012 (Day of Year 31, Revolution 1135)

At 07:22:12Z an unexpected power outage occurred at ESOC for 10min: all DENEb machines were powered off, DENEb LAN lost, power outage on all clients in DCR, lost connection to all W/S located in the DCR, all printers, voice loop and time panels. Only 2 PCs used for DigiLog were up and running. At 16:12:00 AOCS was recovered, a slew was performed from PID #11350062 to #11350078 and timeline operations were re-joined. SPI remained operational throughout the whole period.

6.3 IBIS

The overall status of IBIS is nominal except for 2 solar flares as well as an IBIS DPE1 crash on 18/01/2012 at 11.38.17Z. The recovery for this was completed at 2012-01-19 at 15:05Z and IBIS operations continued nominally. In the following figures these anomalies can clearly be seen.

6.3.1 Operations**ISGRI**

The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the reporting period:

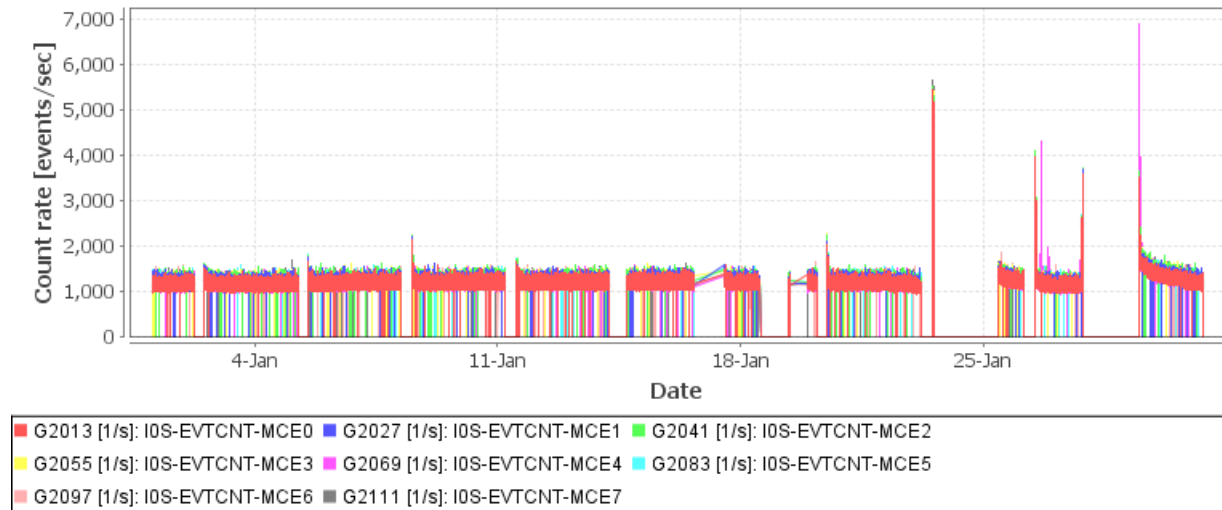


Figure 20: ISGRI MCE Counters

PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the reporting period.

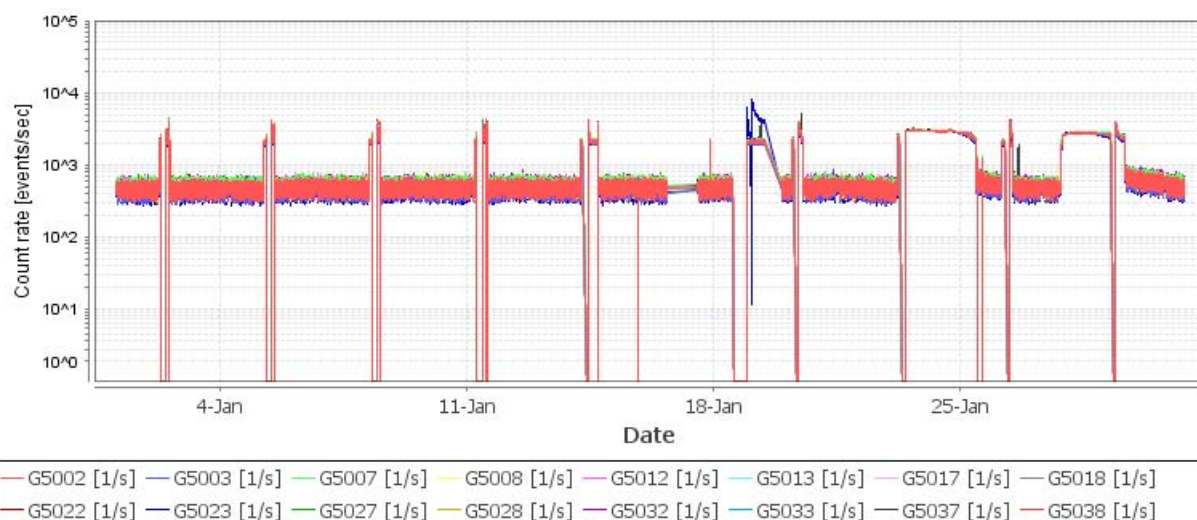


Figure 21: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic.

VETO

The health and performance of VETO was nominal during the reporting period except for a VEB reset on 2012.023.09.43.22.739Z. Plots of the VETO counters are given in Figure 6: Instrument Count Rates.

6.3.2 Event Log

24-12-2011 — 07-02-2012 (until Day of Year 38, Revolutions: all within the reporting period)

Eclipse season #20 (pre-perigee eclipse): The number of OOLs occurring during the post eclipse activation has been reduced drastically compared to the eclipse season #19 (see report 06/2011). For the next eclipse season this number shall be minimized again.

5., 8., 11., 14., 18., 20. and 26-01-2012 (Revolution 1127, 1128, 1129, 1130, 1131, 1132 & 1134)

From 2012.005.09.54.29.761 until 2012.005.10.04.37.762 (only on B chain) and
 from 2012.008.09.42.37.935 until 2012.008.10.11.09.936 (only on B chain) and
 from 2012.011.09.31.02.112 until 2012.011.09.56.38.113 (only on B chain) and
 from 2012.014.09.14.22.276 until 2012.014.09.15.50.276 (only on B chain) and
 from 2012.018.22.03.26.483 until 2012.019.15.34.54.522 (only on B chain) and
 from 2012.020.08.52.22.564 until 2012.020.10.45.10.568 and
 from 2012.026.08.25.02.895 until 2012.026.08.58.22.897 and
 at 2012.026.14.20.38.910

OEM "IBIS1 PICSIT NOISY SEMIMODULE ..." was received. No action was required since inside radiation belts, during recovery from IDPE1 failure or a single occurrence. IBIS operations continued nominally.

11-01-2012 (Day of Year 11, Revolution 1129)

On 2012-01-11 ISDC tried to switch to a new isdc-ifts machine starting 07:15Z. Since they had problems with this migration, the line was down longer than planned. Therefore the ISGRI context tables were not received from ISDC. Since no older set of context tables was available (only 4 tables for rev. 1127 were available and therefore the CTX tables for rev. 1126 have been sent last revolution) and the connection to ISDC was down, the uplink of the CTX tables was delayed until 11:57Z. The missed EDs were uplinked according to the missed ED guideline and IBIS was re-enabled in the T/L at 12:42Z.

14-01-2012 (Day of Year 14, Revolution 1130)

SPI operations was interrupted by a MCS problem on 14/01/2012 (DOY 14): A corruption of the HFA-TC archive segment - whilst the file was being segmented and at the same time ca. 70 commands were in the process of being uplinked or verified – lead to the following: all report commands got unverified and the next command of the sequence with dynamic PTV could not be started.

This affected 3 subsystems: AOCS, SPI (EEXIT03) and IBIS (ISGRI CTX tables). The operations were continued on the B-chain. The recovery of IBIS was performed after the recovery of AOCS and SPI as following:

- Uploading CTX tables
- GEISCL03 resent at 16:00Z (originally planned for 11:06:17Z)
- GEBEXT01 resent at 16:35Z (originally planned for 11:43:17Z)
- GESTAN02 resent at 17:09Z (originally planned for 11:46:27Z)
- IBIS back in Science at 17:18Z

Operations continued on the B-chain. IBIS operations continued nominally.

15-01-2012 (Day of Year 15, Revolution 1130)

At 2012.015. 19.43.30Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 2012.015.19.46.01Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED at 2012.015.19.49.13.132Z, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken. IBIS operations continued nominally.

17-01-2012 (Day of Year 017, Revolution 1131)

On 17/01/2012 (DOY17) at 10.56.24.477 the TC G0110 TC-Y-5390F1 (Seq: GEISCL03; Restore Context Table from DPEE to MCEs, MCE7) failed release (PTV = GO DYN PTV flag = fcf). The PTV check on parameter G2101 raw = 0 actually was fulfilled, i.e., IBIS was in the correct configuration. Furthermore there was no TM drop or bad frames during the period. A delay of 15s in releasing the TC G0110 could be identified in TC history, which probably lead to the release window being exceeded.

The recovery was as follows:

- 11:02Z CRP_IBIS1_0010 IBIS safe config (fast)
- 11:14Z Re-uplink ISGRI CTX-tables, GEISCL03 & GEBEXT01
- 12:09Z IBIS enabled in TL

IBIS operations continued nominally.

17-01-2012 (Day of Year 017, Revolution 1131)

Due to IREM SEU #126, IBIS transitioned autonomously to Safe configuration at 2012.017.19.55.54.723Z. It was recovered as follows:

- At 2012.017.20.29.24Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2012.017.20.39.05Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS

IBIS was enabled at 20:40Z and operations continued nominally.

18-01-2012 (Day of Year 018, Revolution 1131)

These three OEM occurred at 2012.018.10.08.19.516 but have not been logged by the Spacon. However, no action is required since it is a single occurrence:

- OEM ID 128 APID 1280: IBIS1 IASW EXCEPTION WAS RAISED
- OEM ID 7 APID 1280: IBIS1 CONSTRAINT DPE CULPR
- OEM ID 1 APID 1280: IBIS1 FIXED POINT OVERFLOW

18-01-2012 (Day of Year 018, Revolution 1131)

On DoY 018.11.38.17Z a failure was reported on IBIS DPE1 resulting in the following:

- At 11.39.09Z OEM ID 82 APID 129 'EX OBIH TM ST22 WRONG RBI STATUS' flagging a communication problem between DPE and CDMU, i.e. the CDMU did not get any response from the DPE
- At 11.39.14Z OEM ID 91 APID 129 'EX OBIH TC ST9 WRONG RBI STATUS 2' reporting a problem in the distribution of the BCPKT from the CDMU to the IDPE1
- At 11.39.22 the parameter D6703 (IBIS 1 IBIS1 RBI Status Word: Running State) failed the SCC reporting the status 'NOT RUNNING' indicating a problem with the on-board S/W
- HK1-HK3-HK4 were not received since 11.39.09Z
- The HK SSC stopped to increase at 11.39.14Z

The STATUS of the unit at the time of the anomaly was:

- IASW = STANDARD MODE
- PICSIT = NOMINAL
- ISGRI = NOMINAL+NP/LTH
- VETO = NOMINAL

with all the HVs and Biases switched ON.

The following first actions were performed: At 12:05Z: IBIS 1 deactivation using CRP_IBIS1_5140 IBIS1 RECOVERY AFTER IDPE FAILURE and powering OFF ISGRI PICSIT and VETO modules. The power OFF of the peripherals of the unit was performed successfully. In order to recover the IASW a cold

reset was performed by applying CRP_IBIS1_5140 (IDPE1 FAILURE). The reset was successfully executed and the IDPE went back in 'RUNNING' status.

The RECOVERY of the complete unit started in the afternoon on DoY 018 following the IBIS1 Activation (FCP_IBIS1_0005). It was organised in two steps:

- Step 1 (Doy 018)
 - Reactivation of the IDPE, load and verification of the IASW patch 1.9
 - Uplink & verification of the on-board CTX (new HEPI, LUT1, LUT2, VETO, PICSIT)
 - Uplink & verification of the last ISGRI CTX processed by ISDC
 - Activation and reconfiguration of IASW
 - Activation and reconfiguration of peripherals (division factor and zoning setting)
 - Thermal stabilization of the system
- Step 2 (Doy 019)
 - VETO patch 3.1+3.2
 - ISGRI calibration
 - Peripherals biases and high voltages activation
 - Reconfiguration to science mode

The recovery of the DPE1 was lengthy and took far too long due to procedures being unclear, difficult to follow and containing many mistakes (for more information, please refer to ARTS INT_SC-367). This will be fixed in the near future. The recovery was completed at 2012-01-19 at 15:05Z and IBIS operations continued nominally.

19-01-2012 (Day of Year 019, Revolution 1131)

During and following the IBIS IDPE1 recovery (see above), following OEMs occurred:

- 2012.019.09.31.17.016 1280 RealTime 129 ANOMALY IBIS1 IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FR
- 2012.019.09.31.17.020 1280 RealTime 134 TC REJECT IBIS1 IASW EXTERNAL TC REJECTED COULD NOT BE EXECUTED
- 2012.019.09.33.02.508 1280 RealTime 167 ANOMALY IBIS1 PICSIT NOISY SEMIMODULE SIGNALLING: ORIGIN SM COO 0
- 2012.019.10.18.14.576 until 2012.019.10.59.34.578 1280 RealTime 180 ANOMALY IBIS1 VETO COUNTER FOR VETO LATERAL EXCEEDS ALERT VALUE 0 (Several instances per 8s seconds)
- 2012.019.15.35.02.522 1280 RealTime 175 EVENT IBIS1 PICSIT KILLED PIXEL NOTIFICATION
- 2012.020.08.52.22.564 1280 RealTime 167 ANOMALY IBIS1 PICSIT NOISY SEMIMODULE SIGNALLING
- 2012.020.10.43.10.568 1280 RealTime 167 ANOMALY IBIS1 PICSIT NOISY SEMIMODULE SIGNALLING: ORIGIN
- 2012.023.09.43.10.864 1280 RealTime 129 ANOMALY IBIS1 IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FR 0
- 2012.026.14.20.46.910 1280 RealTime 175 EVENT IBIS1 PICSIT KILLED PIXEL NOTIFICATION

23-01-2012 (Day of Year 23, Revolution 1133)

During execution of ED GEVESP01 for the VETO patch after the lunar eclipse (see OR 636) at 2012.023.09.43.22.739Z a SCC violation occurred on TM parameters G8012 indicating a VEB reset

generated by watchdog. Recovering according to IBIS Timeline Recovery Guide has been performed as followed:

- 10:20:25 FCP_IBIS1_0332
- 10:39:35 FCP_IBIS1_0111
- 10:52:45 FCP_IBIS1_0199
- 10:54:41 GEVESP01
- 11:01:34 GEDHON01
- 11:02:10 FCP_IBIS1_0401 - ISGRI CTX Tables uplinked
- 11:15:54 GEISCL03
- 13:05:00 FCP_IBIS1_0801 TRANSITION TO SAFE MODE due to high radiation

Following perigee on 23/1/2012 activation of JEM-X, OMC and IBIS could not be completed due to the effects of a solar flare. IBIS was reactivated at 09.40z on 25/1/2012.

25-01-2012 (Day of Year 25, Revolution 1133)

At 2012.025.09.09.05Z during the activation of IBIS after the solar flare (FCP_IBIS1_0803 IBIS exit from safe mode), following OOLs occurred right after setting the HV to nominal (TC G0600):

- (1) At 2012.025.09.09.22.844 TM parameters G6062 (VETO Bottom Count Rate), G6063 (VETO Lateral Count Rate) and GU6062 went soft high after setting VETO to nominal (TC G0600) with value 52128/s for all three parameters. The VETO calibration source counter (G6061) was within limits.
- (2) In addition, at 2012.025.09.13.38.844 TM parameter G2041 (Event Count Rate MCE3) went hard low OOL with value 0 for about a minute until 09.14.34.844.
- (3) At 2012.025.09.13.50.844 the TM parameters G6192-G6197 (VDM12 currents, voltages & temperature (all reported in SPI 70040)), G6214-G6227 (VDM15&16 currents, voltages & temperature and CDM01 BGO/PMT temperature (all reported in SPID70040)) went hard high or hard low all with raw value = 0.
- (4) At 2012.025.09.17.54 the TM parameter X7500 IBIS Histo Download went OOL (STATUS) until 09.29.46.

No OEMs were present.

A VETO mode cycle was applied as recovery:

- 2012.025.09.36.34 IBIS-IASW in Stand-By (TC G0125)
- 2012.025.09.38.41 IBIS-VETO in Stand-By (TC G0601)
- 2012.025.09.39.13 IBIS-VETO in Nominal (TC G0600)
- 2012.025.09.39.14 IBIS-IASW in Science Standard (TC G0129)

Following this, all OOLs disappeared but G6062, G6063 and GU6062 (i.e., the VETO count rates). The VETO count rates were monitored by the spacon and decreased. Around 11.27Z they started to toggle and around 12.15Z they returned to nominal values. IBIS operations continued nominally.

27-01-2012 (Day of Year 27, Revolution 1134)

Following a solar flare on 27/1/2012 evening, IBIS went to standby at 19.48.43.239 (due to automatism) and was disabled in the timeline (27). IBIS remained in safe for the rest of revolution 1134. Following perigee on 29/1/2012 the background levels had decreased sufficiently to allow IBIS to be reactivated: 10:30Z IBIS disabled on A/S (OR #638), 14:38Z GEBEXT01 uplinked, 15:20Z

GESTAN02 IBIS to Science. The recovery was completed at 15: 47Z and IBIS operations continued nominally.

31-01-2012 (Day of Year 31, Revolution 1135)

At 07:22:12Z an unexpected power outage occurred at ESOC for 10min: all DENEb machines were powered off, DENEb LAN lost, power outage on all clients in DCR, lost connection to all W/S located in the DCR, all printers, voice loop and time panels. Only 2 PCs used for DigiLog were up and running. At 16:12:00 AOCS was recovered, a slew was performed from PID #11350062 to #11350078 and timeline operations were re-joined. IBIS remained operational throughout the whole period.

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.

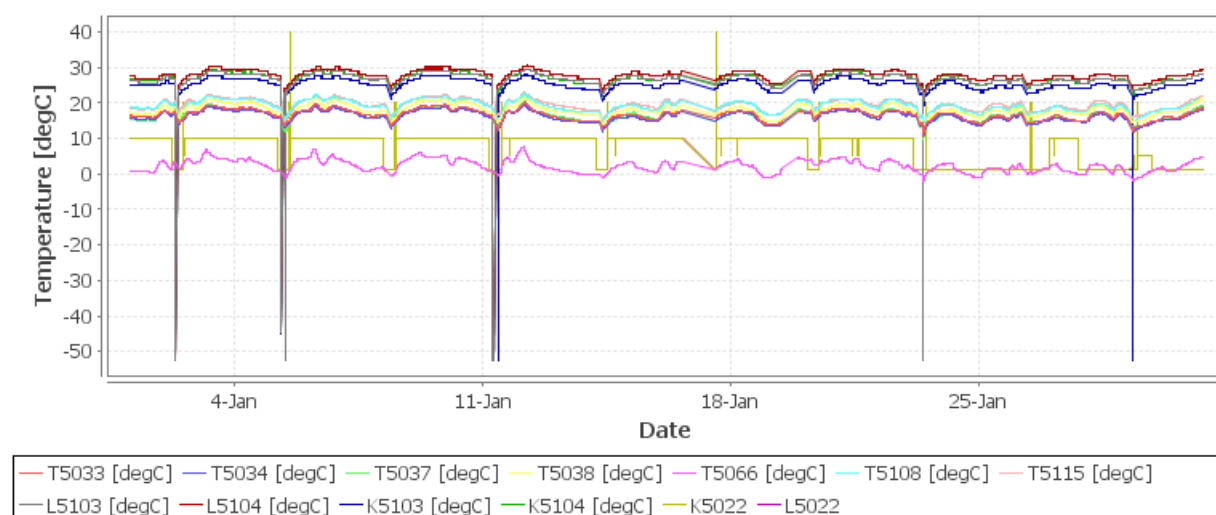


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

05-01-2012 (Day of Year 005, Revolution 1127)

At 08:49:00, 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:

- 09:10:00 3 dumps of DFEE CRCs yielding values of F1B3, F074, CF9F
- 09:20:00Z FCP_JEM2_9010 JEMX2 DFEE SWITCH OFF, which involved disabling the reactions to the BCP)
- 09:25:00Z FCP_JEM2_0021 JEMX2 DFEE ACTIVATION
- 09:46:00 FCP_JEM2_0120 (Enable JEMX-2 reactions to BCP)

There was no impact.

11-01-2012 (Day of Year 011, Revolution 1129)

At 08:33:00, after AOS, it was observed that JEMX-1 had not switched-on correctly after the eclipse. The symptoms were as follows:

1) Following the execution of KECLXT01 ED, the JEM-X1 DFEE state (TM parameter K5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter K5381) remained ECLIPSE instead of RAD. BELTS.

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

4) A power cycle was performed according to CRP_JEM1_5011 JEMX1 Recovery after eclipse anomaly, consisting of:

- 08:50:00 3 dumps of DFEE CRCs yielding values of F1B3, F074, CF9F
- 09:00:00Z FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF, which involved disabling the reactions to the BCP)
- 09:15:00Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION
- 09:42:00 FCP_JEM1_0120 (Enable JEMX-1 reactions to BCP)

There was no impact.

17-01-2012 (Day of Year 017, Revolution 1131)

At 11:54:10, shortly after HV switch-on, both JEMX due to a brief period of high radiation, units switched back to SAFE. Manual recoveries were performed, with JEMX-1 back in Data-Taking at 13:28, and JEMX-2 at 13:45.

At 19:55:54 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#119). There was no impact as the reaction has been disabled.

23-01-2012 (Day of Year 023, Revolution 1133)

At 08:00:00, after AOS, it was observed that both JEMX-1 & JEMX-2 had not switched-on correctly after the eclipse. The symptoms were as follows:

1) Following the execution of K/LECLXT01 EDs, the JEM-X DFEE state (TM parameters K/L5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameters K/L5381) remained ECLIPSE instead of RAD. BELTS.

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

No action was taken.

From 08:47 to 09:18, there was a lunar eclipse, after which both JEMX units emerged back in their nominal modes!!

There was no impact.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

03-01-2012 (Day of Year 003, Revolution 1126)

At 07:24:00 a FD problem forced an interruption in operations. After a recovery the timeline was rejoined at 08:33. The impact was the loss of pointing 11260029.

04-01-2012 (Day of Year 004, Revolution 1126)

At 03:55:00 a problem with on-board antenna selection forced an interruption in operations. After the antenna had been swapped, and a recovery performed, the timeline was rejoined at 06:00. The impact was the loss of pointings 11260049, 11260050 & 11260051.

17-01-2012 (Day of Year 017, Revolution 1131)

At 16:50:43, after the CCCFs executed as part of a JEM-X recovery, OMC went to Standby. The science commands were then manually re-uplinked. The impact was that pointing 11310007 was cut short from a planned 3572 to 776 seconds.

At 19:55:56, an IREM SEU (#126) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 20:26:23. The impact was 11310010 was cut short from a planned 3572 to 353 seconds.

18-01-2012 (Day of Year 018, Revolution 1131)

At 06:05:30, a TRIGGER command was received from ISDC, which worked nominally.

At 09:12:00, a FD problem forced an interruption to the timeline. After a recovery, the timeline was rejoined at 10:15. The impact was the loss of pointing 11310024. It was at this time the following OEMs were received:

2012.018.10.09.04.950	2012.018.10.09.07.915	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535 PR	N	E	E

2012.018.10.09.10.950	2012.018.10.09.21.136	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 11:09, a drop in TM from Redu forced another interruption to the timeline. A recovery was performed, and the timeline rejoined at 11:34. The impact was the loss of pointing 11310025. It was at this time the following OEMs were received:

2012.018.11.10.31.952	2012.018.11.10.41.133	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535 PR	N	E	E

2012.018.11.10.38.077	2012.018.11.10.44.442	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 13:08, another TM drop from Redu caused another interruption. The recovery was completed at 15:31. The impact was the loss of pointings 11310027 & 11310029. It was at this time the following OEMs were received:

2012.018.13.13.36.956	2012.018.13.13.39.783	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535 PR	N	E	E

2012.018.13.13.42.956	2012.018.13.13.51.807	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 pointing 11310027.

19-01-2012 (Day of Year 019, Revolution 1131)

At 15:07:31, after the CCCFs executed as part of a JEM-X recovery, OMC went to Standby. The science commands were then manually re-uplinked. The impact was that pointing 11310056 was cut short from a planned 1961 to 1352 seconds.

23-01-2012 (Day of Year 023, Revolution 1133)

At 10:57:50, due to high radiation, OMC did not emerge from SAFE mode. The unit was left in SAFE mode until DoY 026 at 18:23:53, when a recovery was performed. The impact was the loss of all pointings in revolution 1133 plus pointings 11340002, to 11340009 were lost. (86 pointings lost in total) It was at this time the following OEMs were received:

2012.023.11.45.58.728	2012.023.11.46.03.665	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535 PR	N	E	E

2012.023.11.46.05.978	2012.023.11.46.11.714	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 pointing 11330002.

27-01-2012 (Day of Year 027, Revolution 1134)

At 06:48, an FD problem prevented the execution of slew 11340021. Operations were interrupted, and a recovery performed. At 06:57, the timeline was recovered. The impact was the loss of pointing 11340021.

At 19:06:12, due to high radiation, OMC returned to SAFE mode. The unit remained SAFE until the end of the revolution. The impact was the loss of pointings 11340032 to 11340079 (46 pointings).

29-01-2012 (Day of Year 029, Revolution 1135)

From the start of this revolution, high radiation prevented OMC from emerging from SAFE mode. This caused the loss of 59 pointings, and continued into the next problem...

31-01-2012 (Day of Year 031, Revolution 1135)

At 07:22:12, a power outage caused an immediate interruption of all operations. OMC had been in SAFE mode for the entire revolution up to that point due to the ongoing high radiation, but the outage delayed a recovery as the FDS was not available to support s/c slewing. At 16:58:34, OMC was put back into Stand-by mode, and at was again in Science at 17:04:44. The impact of the power outage was the loss of 14 pointings.

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.

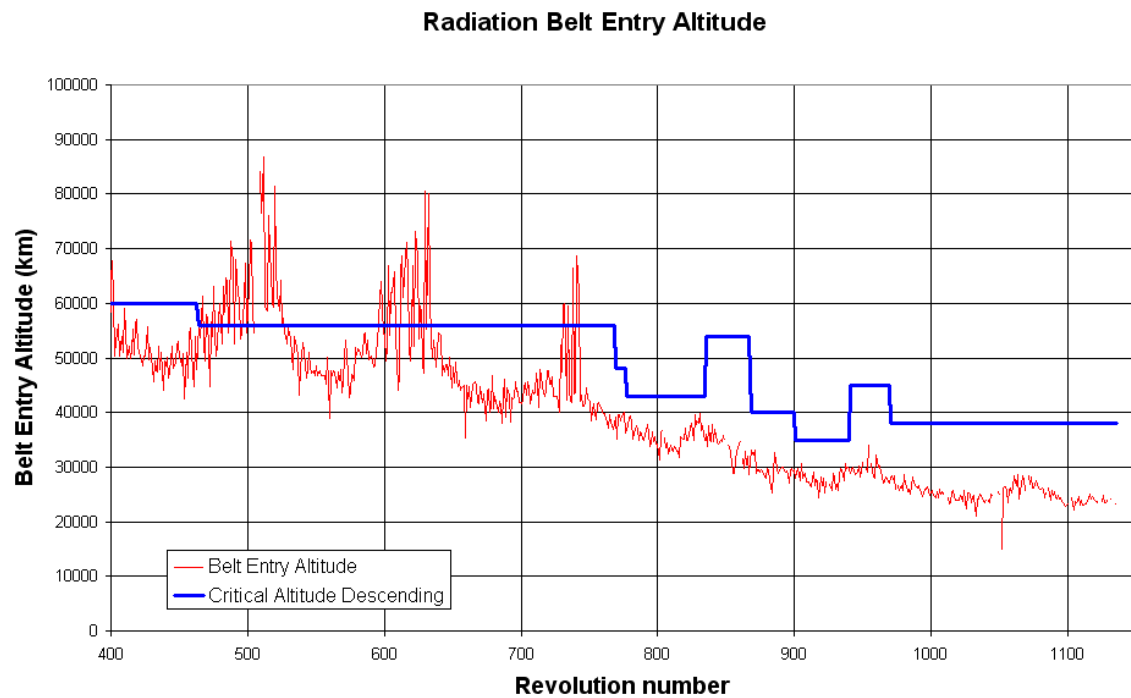


Figure 23: Radiation belt entry

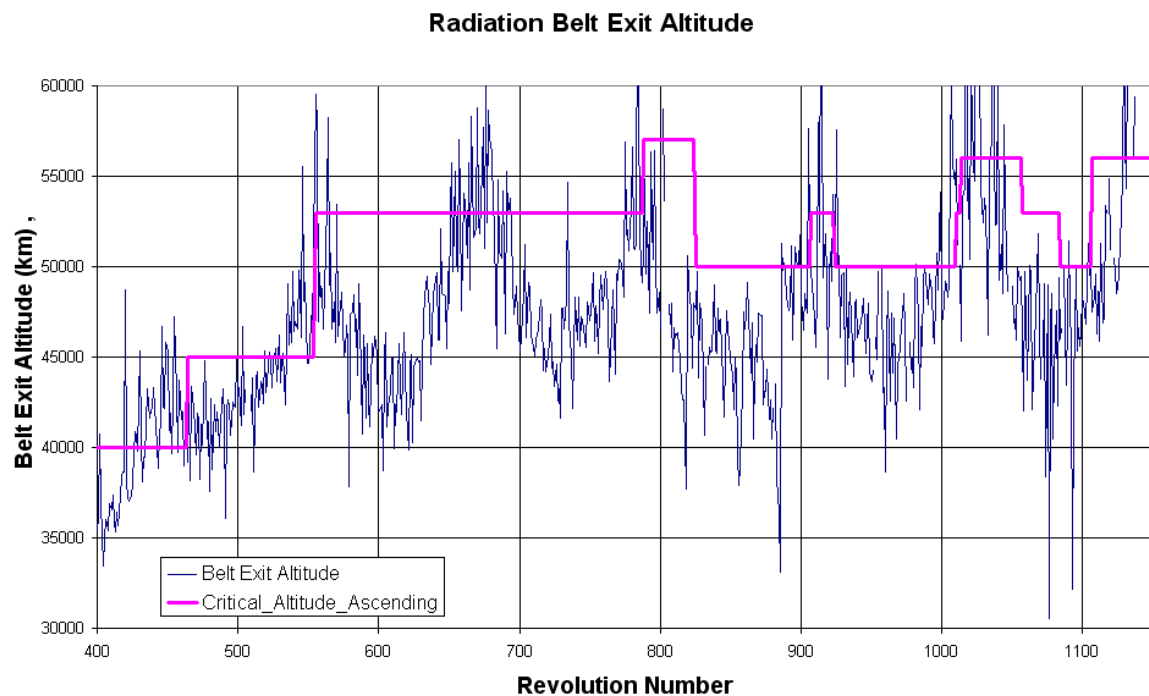


Figure 24: Radiation belt exit

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
1125	RAD_ENTR R 2012-01- 02T05:04:45Z	N/A	N/A	02-Jan-2012 06:36:58	18322.11	02-Jan-2012 07:16:58	8505.9
1126	RAD_EXIT R 2012-01- 02T12:24:17Z	02/01/2012 11:21:54	>>40554.1	02-Jan-2012 11:36:58	48705.62	02-Jan-2012 07:46:58	3392.49
1126	RAD_ENTR R 2012-01- 05T04:51:13Z	N/A	N/A	05-Jan-2012 06:16:45	19925.56	05-Jan-2012 07:06:45	7803.462
1127	RAD_EXIT R 2012-01- 05T12:11:11Z	05/01/2012 11:26:10	48864.2	05-Jan-2012 11:26:45	49144.7	05-Jan-2012 07:36:45	3432.96
1127	RAD_ENTR R 2012-01- 08T04:37:07Z	N/A	N/A	08-Jan-2012 06:06:34	19285.72	08-Jan-2012 06:46:34	9563.42
1128	RAD_EXIT R 2012-01- 08T11:57:28Z	08/01/2012 12:51:22	64185.8	08-Jan-2012 11:16:34	49545.86	08-Jan-2012 07:26:34	3541.526
1128	RAD_ENTR R 2012-01- 11T04:23:29Z	N/A	N/A	11-Jan-2012 05:59:21	17969.15	11-Jan-2012 06:39:21	8185.197
1129	RAD_EXIT R 2012-01- 11T11:43:30Z	11/01/2012 12:18:18	61457.1	11-Jan-2012 10:59:21	48898.53	11-Jan-2012 07:09:21	3412.538
1129	RAD_ENTR R 2012-01- 14T04:12:34Z	N/A	N/A	14-Jan-2012 05:43:07	18668.58	14-Jan-2012 06:23:07	8840.988
1130	RAD_EXIT R 2012-01- 14T11:32:01Z	14/01/2012 12:06:10	61246.5	14-Jan-2012 10:43:07	48494.22	14-Jan-2012 07:03:07	3541.021
1130	RAD_ENTR R 2012-01- 17T04:02:28Z	N/A	N/A	17-Jan-2012 05:34:48	18167.13	17-Jan-2012 06:14:48	8345.106
1131	RAD_EXIT R 2012-01- 17T11:21:52Z	17/01/2012 11:08:18	53885.3	17-Jan-2012 10:34:48	48819.48	17-Jan-2012 06:44:48	3362.038
1131	RAD_ENTR R	N/A	N/A	20-Jan-2012	18282	20-Jan-2012	8519.346

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
	2012-01-20T03:51:08Z			05:22:53		06:02:53	
1132	RAD_EXIT R 2012-01-20T11:11:08Z	20/01/2012 11:20:27	57311.0	20-Jan-2012 10:22:53	48640.99	20-Jan-2012 06:32:53	3486.368
1132	RAD_ENTR R 2012-01-23T03:37:22Z	23/01/2012 04:37:23	N/A	23-Jan-2012 05:05:38	19567.04	23-Jan-2012 05:45:38	9860.063
1133	RAD_EXIT R 2012-01-23T10:57:50Z	N/A	N/A	23-Jan-2012 10:15:38	49341.04	23-Jan-2012 06:25:38	3512.962
1133	RAD_ENTR R 2012-01-26T03:23:11Z	N/A	N/A	26-Jan-2012 04:55:12	18517.33	26-Jan-2012 05:35:12	8742.56
1134	RAD_EXIT R 2012-01-26T10:43:21Z	N/A	N/A	26-Jan-2012 09:55:12	48503.41	26-Jan-2012 06:15:12	3679.167
1134	RAD_ENTR R 2012-01-29T03:10:18Z	N/A	N/A	29-Jan-2012 04:40:40	18829.41	29-Jan-2012 05:20:40	9024.805
1135	RAD_EXIT R 2012-01-29T10:30:01Z	N/A	N/A	29-Jan-2012 09:40:40	48348.64	29-Jan-2012 06:00:40	3523.472

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

17-01-2011 (Day of Year 017, Revolution 1131)

At 08:00:42Z, a local reset of the IREM CSCI S/W (SEU #125) 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 2012.017.08:00:42Z (<17658.4 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 3CC0 HEX = 15552 DEC = 0011110011000000, 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 OFF. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

6) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 10:07:00Z.

The anomaly did not affect the other instruments as they were in SAFE mode due to the on-going perigee passage.

17-01-2011 (Day of Year 017, Revolution 1131)

At 19:55:54Z, a local reset of the IREM CSCI S/W (SEU #126) 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 2012.017.19:55:54Z (111090.6 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 = 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 21:58:00Z.

7) At 22:15, it was noted that the values of U9921 (Electron count) remained zero, and that a power cycle was needed. This was successfully performed, and completed at 00:06 the following day, after which the values of U9921 were in the nominal range.

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 20:26:23Z and IBIS at 20:40:00Z.