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

INTEGRAL
Mission report

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

No. 404
01.01.2012

Routine Phase

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

Table of Contents

1	General.....	5
2	Satellite status.....	6
2.1	Platform	6
2.1.1	AOCS.....	6
2.1.2	Power	6
2.1.3	Thermal	6
2.1.4	OBDH	6
2.1.5	RFS.....	6
2.2	Payload	6
2.2.1	SPI.....	6
2.2.2	IBIS.....	9
2.2.3	JEM-X.....	11
2.2.4	OMC.....	11
2.2.5	IREM	11
3	Ground Facilities	14
3.1	Mission Control System	15
3.2	Ground Stations and Network.....	15
3.3	ISOC	16
3.3.1	Mission Planning	16
3.3.2	Observation Status	16
3.3.3	ISOC Science Data Archive	16
3.3.4	ISOC System	17
3.3.5	Problems	17
4	Anomalies	17

5	Special Events & Future Milestones.....	18
6	Appendix	18
6.1	AOCS operations.....	18
6.1.1	Fuel consumption.....	18
6.1.2	The RMU-A null bias calibration.....	19
6.1.3	Event log.....	19
6.2	SPI.....	22
6.2.1	Operations.....	22
6.2.2	Event Log.....	27
6.3	IBIS.....	28
6.3.1	Operations.....	28
6.3.2	Event Log.....	29
6.4	JEM-X.....	31
6.4.1	Operations.....	31
6.4.2	Event Log.....	31
6.5	OMC.....	32
6.5.1	Operations.....	32
6.5.2	Event Log.....	32
6.6	IREM.....	35
6.6.1	Operations.....	35
6.6.2	Event Log.....	38

Distribution List

ESOC		ESAC	
	SPACONs	A. Parmar (SRE-OA)	P. Kretschmar (SRE-OAG)
N. Bobrinsky (OPS-L)	F. Sheasby	M. Kessler (SRE-O)	E. Kuulkers (SRE-OAG)
A. Rudolph (OPS-OA)	F. Dreger	V. Gomes (DG-V)	
J. Miro (OPS-G)	A. McDonald	ESTEC	
		C. Winkler (SRE-SA)	G. Sarri (SRE-PP)
J. Roldan	W. Hell	N. Rando (SRE-PAM)	H. Evans (TEC-EES)
M. Kirsch	K.J. Schulz	S. Taylor (TEC-EPG)	
R. Southworth	M.A. Larsen	ESA HQ:	T. Reiter (D-HSO)
S. Fahmy	R. Hussock	Redu:	B. Demelenne
J. Martin	J. Howard	ISDC	
F. Cordero	M. Butkovic	R. Walter	ISDC Shift Team
F. Di Marco	J. Audric	C. Ferrigno	R. Rohlf's
S. DePadova		ALENIA	
D. Weibert	Shift – Coord	M. Montagna	F. Ravera
F. Schmidt	Scheduling Office	PI / Instrument Teams	
C. Lozano	T. Beck	A. Bazzano (IBIS)	W. Hajdas (IREM)
M. Pantaleoni	M. Rossmann	G. La Rosa (IBIS)	S. Brandt (JEM X)
M. Walker	M. Unal	F. Lebrun (IBIS)	E. De Miguel (OMC)
U. Weissmann		P. Ubertini (IBIS)	J. P. Roques (SPI)
N. von Krusenstiern	A. Mantineo	C. Brysbaert (SPI)	
J. Hübner	K. Scott		
INTEGRAL/XMM Flight Dynamics team			

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 December and covers the revolutions 1115 until 1125 (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, 694 of the 709 planned science pointings were executed nominally. 1 pointing was lost due to an FD problem, 6 were lost due to AOCS problems, 2 pointings were lost and 4 interrupted due to IREM crashes, and 2 were interrupted when the CCCFs were activated. One Flat-field calibration was performed this month.
- E3.5 Testing
- SPI Annealing #18
- MCS Database Installation (12/12/2011)
- FOPGEN & DB Handbook update (13/12/2011)
- Eclipse Season: 24/12/2011 until 07/02/2012

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- Slews completed successfully: 99.87% (764 / 765), the requirement is 95%.
- Data return: 99.93% housekeeping, 99.64% science, the requirement is 95%
- IREM Anomaly: Reset of IREM_CSCI S/W #119 (08/12/2011)
- IREM Anomaly: Reset of IREM_CSCI S/W #120 (13/12/2011)
- IREM Anomaly: Reset of IREM_CSCI S/W #121 (17/12/2011)
- IREM Anomaly: Reset of IREM_CSCI S/W #122 (18/12/2011)
- IREM Anomaly: Reset of IREM_CSCI S/W #123 (27/12/2011)
- IREM Anomaly: Reset of IREM_CSCI S/W #124 (29/12/2011)

Summary of the overall status and performance of the ground segment

- Ongoing occasional RFI at Redu, source mostly unknown / some sources identified
- Increased fuel consumption this year is probably related to the perigee attitude selected to shelter the spectrometer cooler from the earth albedo. Since August this special attitude has not been used and fuel consumption is back in line with the long term mean. Post SPI annealing in December this special attitude was again adopted for several months.
- Only some minor anomalies on the ground segment occurred with no significant impact on mission performance, which remained above requirements

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.

13 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.6770 Kg. The remaining propellant is in the order of 115.8604 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

The 18th SPI annealing started on 21/11/2011 and ended on 09/12/2011. Following this annealing, 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). Operations for the annealing were performed according to OCR #316.

The Germanium detectors' temperature was kept in the range 80K $\pm$ 1K since the end of the 18th SPI annealing.

The times for the main activities for SPI annealing #18 in November were as following:

Date/Time	Activity
2011-11-21 06:58:00	Configure SPI for start of Annealing and stop SPI active cooling
2011-11-21 08:28:00	Annealing Heater Main ON
2011-11-21 11:59:00	Annealing Heater Redundant ON
2011-11-21 23:13:10	Heat Pipe Heater Main ON, All Antifreeze Heaters (1A; 2A; 1B; 2B) OFF
2011-11-21 23:13:18	Heat Pipe Heater Redundant ON
2011-11-22 05:26:54	Heat Pipe Heater Main OFF, Antifreeze Heater 1 main ON
2011-11-22 05:29:00	Delete TT TC for Heat Pipe Heater Redundant ON
2011-11-22 19:47:28	Cold plate temperature reached 373K (100degC)
2011-12-02 05:08:00	Stop SPI Annealing: Annealing Heater Main and Redundant OFF; Heat Pipe Heater Main and Redundant OFF; Antifreeze Heater 1A ON
2011-12-02 05:53:00	ACS switch-on and start of ACS calibration (also FEE#57 and FEE#81 ON)
2011-12-04 19:45:36	Thermal braids temperature TM EU0398A reached 308K
2011-12-05 08:14:10	End of ACS Calibration
2011-12-05 09:51:55	Start of cryocooler switch-on
2011-12-05 10:44:51	Cyrocooler switch-on complete and stroke set to 4x45
2011-12-08 15:32:21	Cold plate temperature TM EU0392A reached 127K
2011-12-08 16:13:22	Selected narrow range cold plate temperature acquisition and restored PSD nominal threshold
2011-12-09 11:25:37	Cold plate temperature TM EU0392 reached 100K
2011-12-09 14:49:58	Camera switch-on start; HV of all GeD increased in 0.5kV steps to 0.5kV; 1kV; 1.5kV; 2kV; 2.5kV; 3kV; 3.5kV with acquisitions in PHOTON mode in between from 1.5kV onwards
2011-12-09 14:56:09	Thermal braid temperature TM E0398 reached 86K
2011-12-09 15:58:00	Start of reduction of cryocooler stroke for 80K target (FCP_SPI1_0072)

2011-12-09 17:58:38	Long acquisition at 3.5kV
2011-12-09 20:20:16	Restore nominal ACS configuration (FEE#57 and FEE#81 OFF) and nominal GeD HV: 3kV (HV of failed detectors GeD#1, GeD#2, GeD#5 and GeD#17 set to 0.5kV).
2011-12-09 20:23:23	Camera switch-on end: SPI in PHOTON mode with all GeD HV at 3kV
2011-12-10 11:46:40	End of reduction of cryocooler stroke for 80K target: Stroke set to 4x37
2011-12-11 08:10:09	Cold plate temperature TM EU0392 reached 80.9K
2011-12-11 12:10:53	Set nominal IASW parameters (Cold Plate Monitoring temperature)

SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 99 packets/cycle, except from 2011-12-16T09:53:32Z to 2011-12-16T15:30:09Z (OMC Flat Field Calibration), when it was 88 packets/cycle. The average telemetry occupation when the allocation was 99 packets/cycle was 76.7 packets/cycle.

The eclipse season started on 24/12/2011. Eclipse operations for SPI are progressing nominally.

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



Figure 1: SPI TM bandwidth utilisation

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

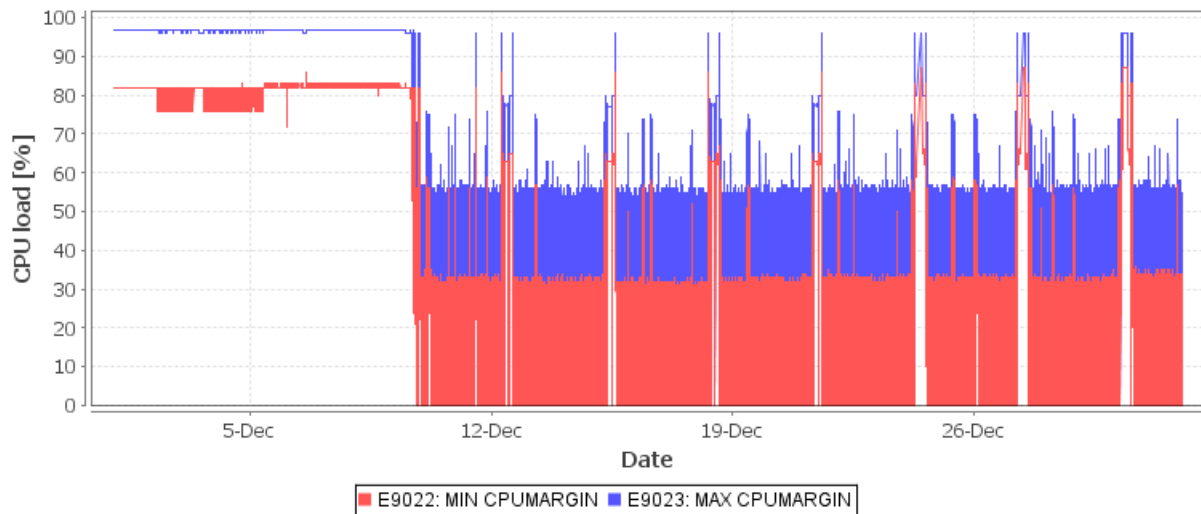


Figure 2: SPI IASW Performance

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

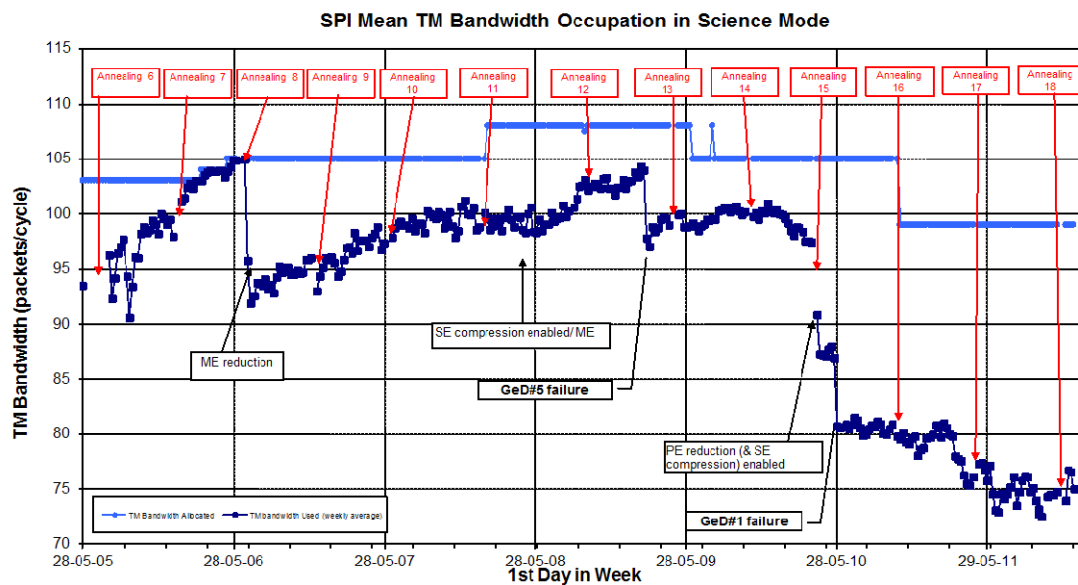


Figure 3: SPI TM bandwidth usage evolution since May 2005

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

2.2.2 IBIS

The overall status of IBIS is nominal. The eclipse season started on 24/12/2011. Eclipse operations for IBIS are progressing 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 2011-12-16T09:53:32Z to 2011-12-16T15:30:09Z (OMC Flat Field Calibration), when it was 90 packets/cycle, and during SPI annealing from beginning of the month until the end of revolution 1117 (2011-12-09T06:48:56Z) when it was 180 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 109.33 packets/cycle

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



Figure 4: IBIS TM bandwidth utilisation

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

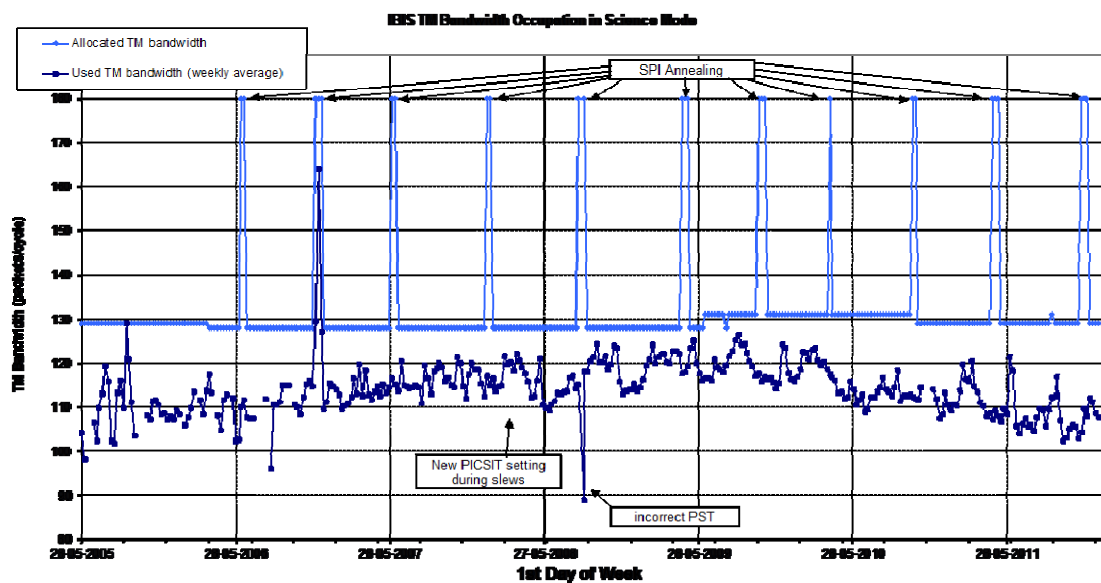


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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

2.2.3 JEM-X

The status of both JEM-X units is nominal:

- JEM-X1 & 2 were operated in Data Taking mode with a TM allocation of 8 packets/cycle, from the beginning of the month until the end of revolution 1118 at 2011-12-09T08:29:19Z during the SPI annealing when it was 15 packets/cycle, and from 2011-12-16T09:53:32Z to 2011-12-16T15:30:09Z (OMC Flat Field Calibration), when it was 4 packets/cycle each.

Note: Some more information concerning the JEM-X operations is provided in Appendix 0.

2.2.4 OMC

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle, except from the beginning of the month until the end of revolution 1118 at 2011-12-09T08:29:19Z during the SPI annealing when it was 9 packets/cycle and from 2011-12-16T09:53:32Z to 2011-12-16T15:30:09Z during the Flat-field calibration in revolution 1120, when it was 63 packets/cycle.

During this reporting period, 694 of the 709 planned science pointings were executed nominally. 1 pointing was lost to an FD problem, 6 were lost to AOCS problems, 2 pointings were lost and 4 interrupted due to IREM crashes, and 2 were interrupted when the CCCFs were activated. 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 342 (08/12/2011), the 119th IREM SEU occurred

On DoY 347 (13/12/2011), the 120th IREM SEU occurred

On DoY 351 (17/12/2011), the 121st IREM SEU occurred

On DoY 352 (18/12/2011), the 122nd IREM SEU occurred

On DoY 361 (27/12/2011), the 123rd IREM SEU occurred

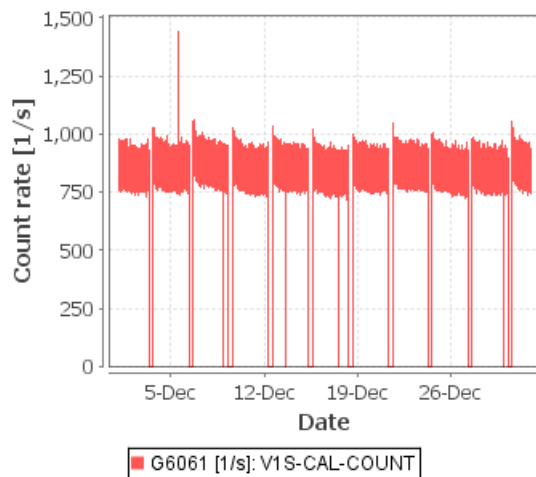
On DoY 363 (29/12/2011), the 124th IREM SEU occurred

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

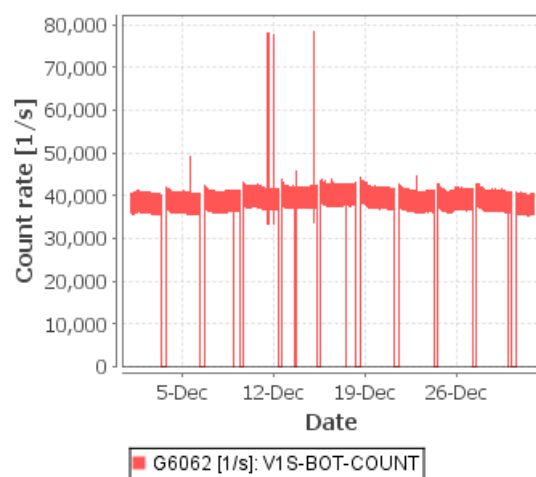
Radiation background

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:

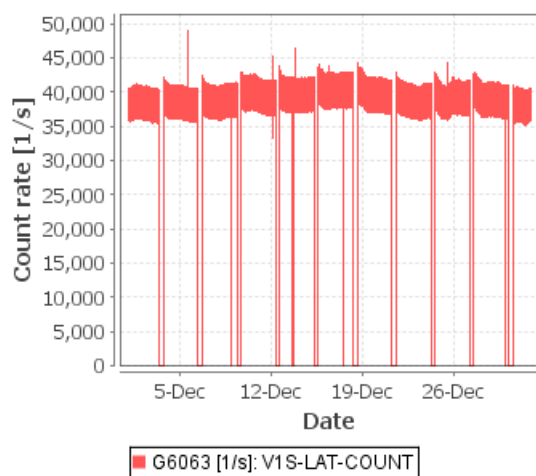
VETO Calibration Source Count Rate



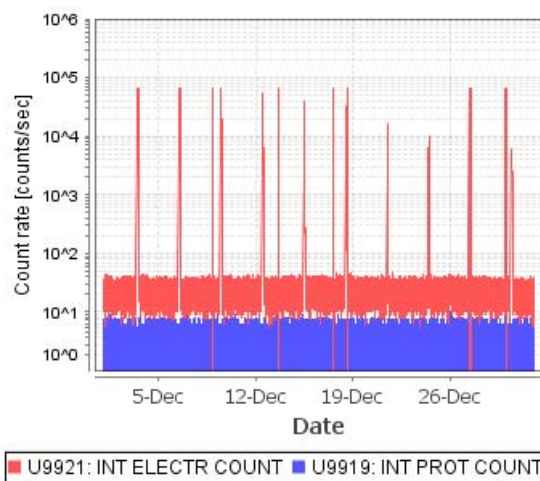
VETO Bottom Count Rate



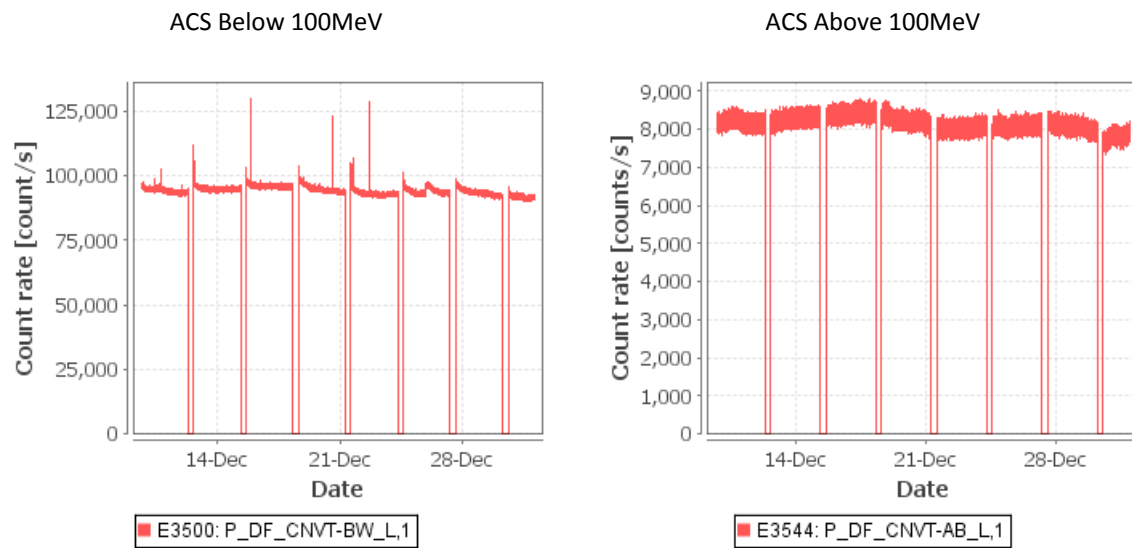
VETO Lateral Count Rate



IREM Proton & Electron Counters¹

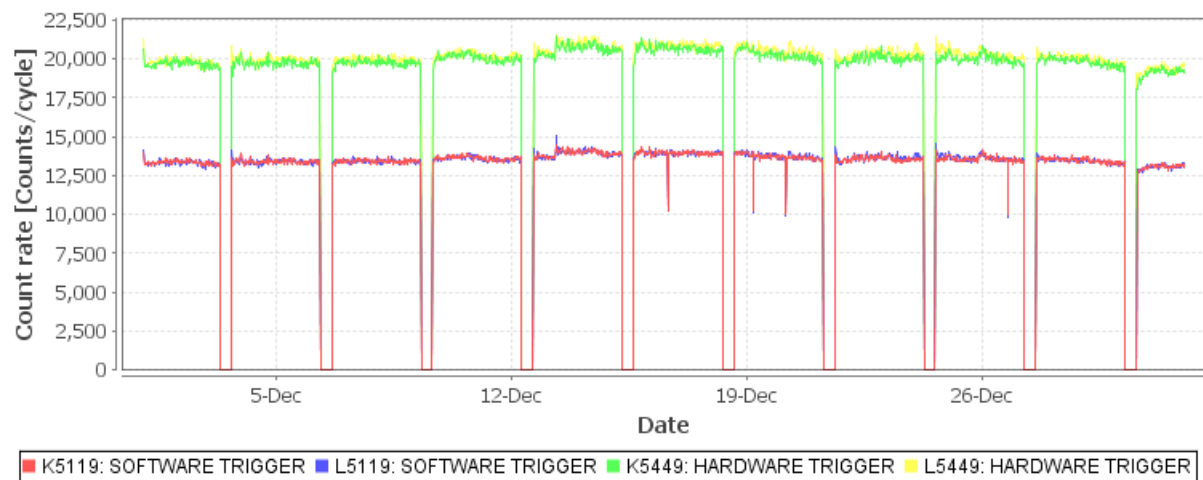


¹ Note that the scale used in this plot is logarithmic.

**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).

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.

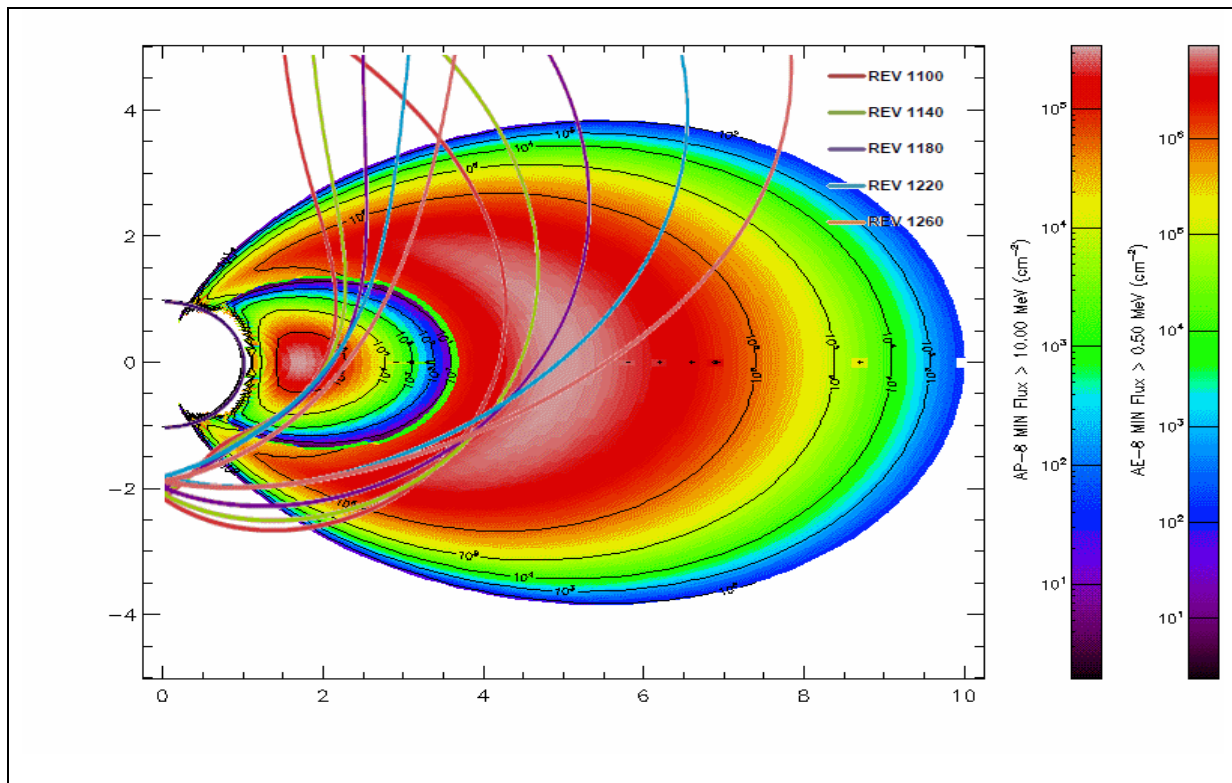


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

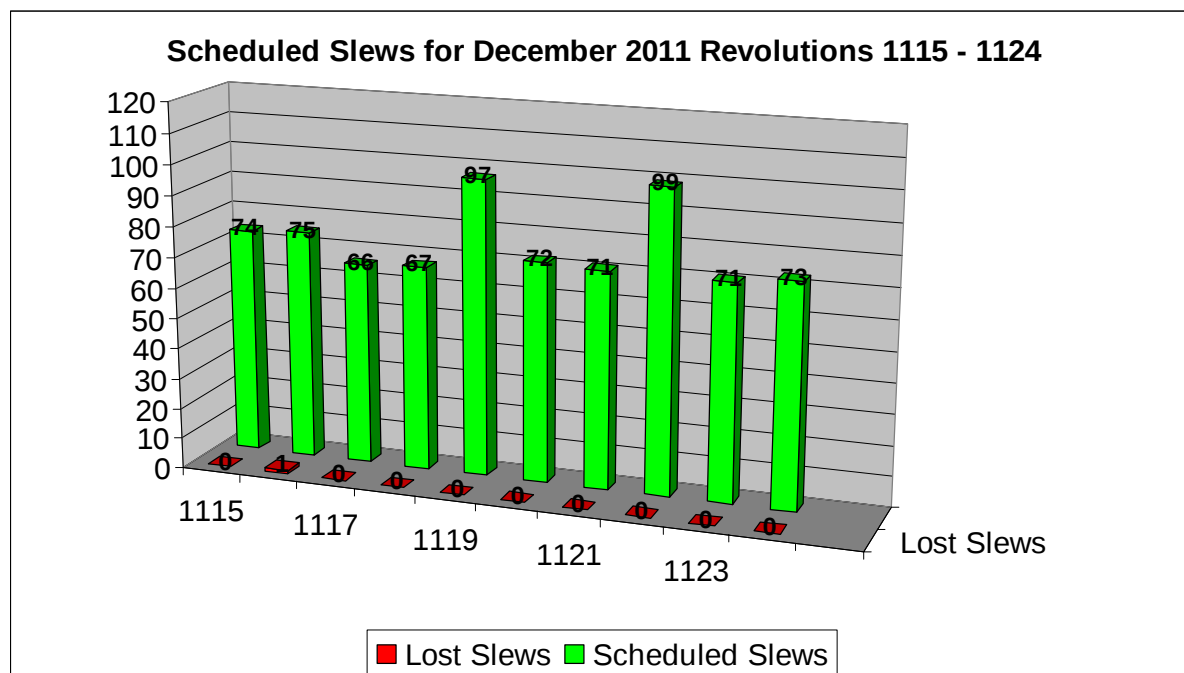


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY 335 the line to ISDC was unavailable due to maintenance from 08:10 - 09:43

On DOY 337 at AOS the OMCH task died on imca and imcb - also the Manual stack died on sun121 - all were restarted successfully

On DOY 340 at AOS the OMCH task died on imca and imcb - also the Manual stack died on sun122 - all were restarted successfully

On DOY 343 at AOS the Manual stack died on sun122 - restarted successfully

On DOY 346 at AOS the Auto stack and Manual stack died on sun122 - restarted successfully

On DOY 352 the Verified died on imca - restarted successfully

On DOY 358 the Multiplexer died on imca - TC chain restarted successfully

On DOY 361 the Multiplexer died on imca - TC chain restarted successfully

The connection to ISDC dropped 5 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.

10 TM drops were identified from REDU and 1 TM drop from VIL2. Bad frames were received from REDU on 8 occasions mostly due to RFI.

Figure 10 shows the quality of the ground station performance. The data received from the ground

stations is compared to the data that is expected to be received.

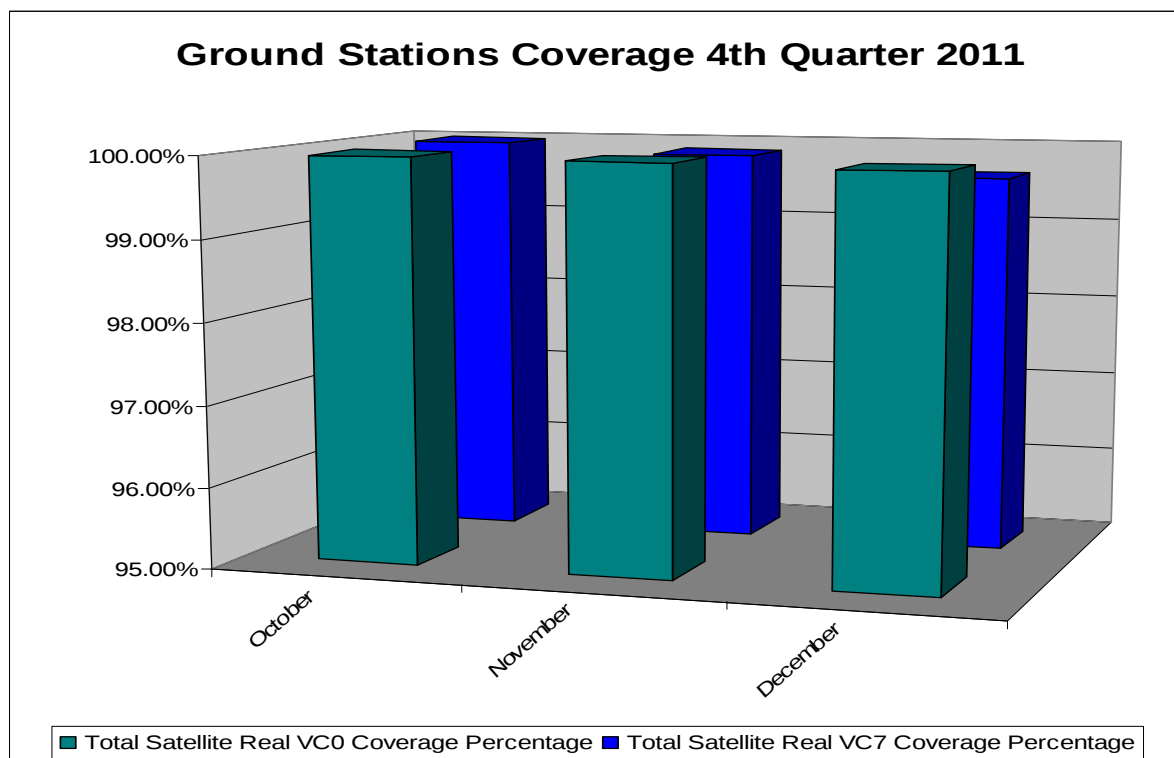


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1124 to 1133, corresponding to the time range 27 December to 26 January.

New observations have been planned for revolutions 1120 (15-18 December to 1129 (11-14 January), Revolutions 1117 to 1119 had to be re-planned to use the recommended attitudes for keeping SPI cooling plates shadowed.

TSFs have been received for revolutions 1117 to 1128.

3.3.2 Observation Status

New ECS files have been received for revolutions 1101 to 1109 (covering observations up to 15 November).

3.3.3 ISOC Science Data Archive

There have been several problems copying over data from ISDC, both with access rights and with recurrent network interruptions at ISDC.

Raw telemetry copied from MOC is available up to 12 December, but with gaps for December 4+10.

The ICD for the new ISDA has been further discussed with the ESAC archive team. A Product Definition Document is being prepared.

The Product Definition Document and ICD for the new ISDA are in preparation.

3.3.4 ISOC System

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

3.3.5 Problems

Observation planning difficulties with non-valid wheel patterns etc appear to increase.

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-3217	2011-12-04	TM, TC link Problems	FDS	Testing
INT-3218	2011-12-13	History file corruption on FTS	FDS	Pending
INT-3219	2011-12-12	TPF to update slew does not arrive on autostack	FDS	Pending
INT-3220	2011-12-15	REDU - Both TMTCSes crashed at the same time	ESA Stations	Pending
INT-3221	2011-12-20	OOL display and TM Desktop not in Synch (DOY 354)	IMCS	Pending
INT_SC-353	2011-12-08	IREM Anomaly: Reset of IREM_CSCI S/W #119, 08/12/2011	Payload	Closed
INT_SC-354	2011-12-13	IREM Anomaly: Reset of IREM_CSCI S/W #120, 13/12/2011	Payload	Closed
INT_SC-355	2011-12-17	IREM Anomaly: Reset of IREM_CSCI S/W #121, 17/12/2011	Payload	Closed
INT_SC-356	2011-12-18	IREM Anomaly: Reset of IREM_CSCI S/W #122, 18/12/2011	Payload	Closed
INT_SC-357	2011-12-20	Attitude jump in PID 11180055	Spacecraft	Pending
INT_SC-358	2011-12-20	No OEM HEPI IASW Resynch	Payload	Pending
INT_SC-359	2011-12-27	JEM-X1 DFEE CRC Anomaly following eclipse on 2011-12-27	Payload	Closed
INT_SC-360	2011-12-27	IREM Anomaly: Reset of IREM_CSCI S/W #123, 27/12/2011	Payload	Closed

AR id	Date of occurrence	Subject	Segment	Status
INT_SC-361	2011-12-29	IREM Anomaly: Reset of IREM_CSCI S/W #124, 29/12/2011	Payload	Testing

5 Special Events & Future Milestones

Eclipse season started on 24th December, with a double eclipse expected on 23rd January 2012 continuing until 7th February.

Star Tracker Blemish Pixel survey is delayed until February.

FSS/Star Tracker calibration 21st March 2012.

E3.5 testing is on-going.

6 Appendix

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

6.1 AOCS operations

During this period, 476 Open Loop Slews, 313 Closed Loop Slews and 31 Momentum Biases were executed (as reported by ACC OEM).

13 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 31/12/2011 is reported in the following plot:

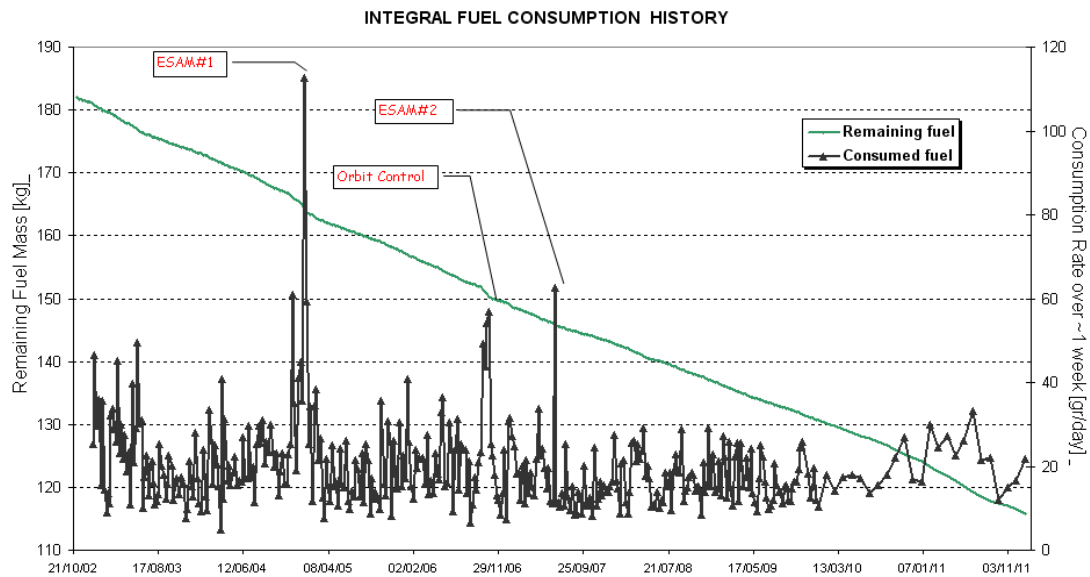


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

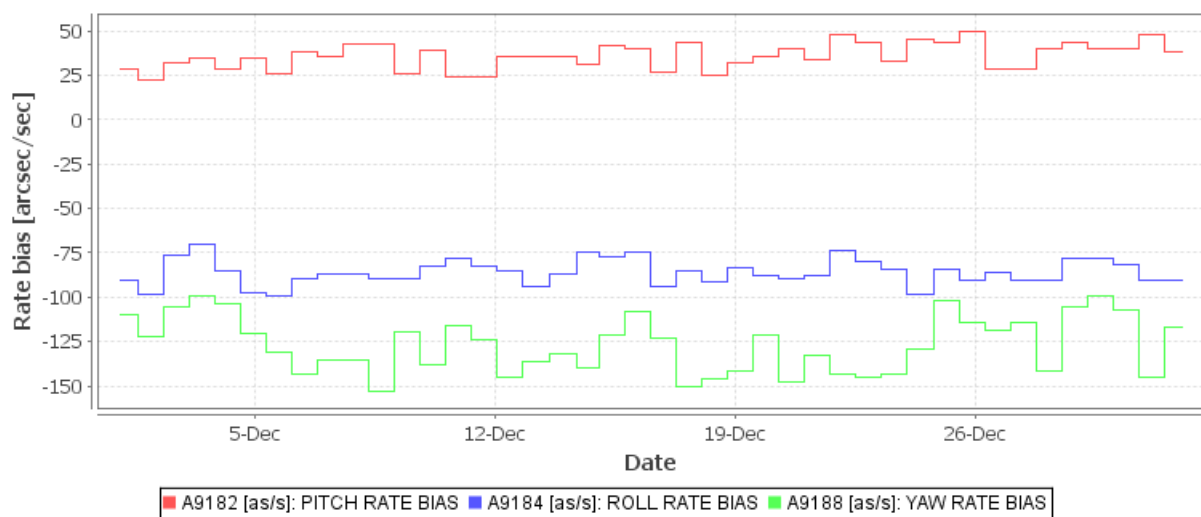


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

04/12/2011 (Day of Year 338, Revolution 1116)

Autostack commanding for slew 11160036 (18:03:00Z) was interrupted due to TM link problems. The AOCs was suspended in the Timeline, then a manual mapping was commanded and a slew was manually generated from attitude 11160035 to attitude 11160036.

After the manual slew was completed, the parameters for slew 11160037 were manually updated (spacontool).

Slew 11160036 was missed from the Timeline. The OTF was not reached for its PID.

07/12/2011 (Day of Year 341, Revolution 1117)

FDS TPF update failed for slew 11170032 (21:02:00Z) due to a failure in attitude determination. AOCS subsystem was disabled and FD was called in.

A slew was generated by FD from attitude 11170031 to attitude 11170034. After the manual slew was completed, the parameters for slew 11170035 were manually updated (spacontool).

Slews 11170032, 11170033 and 11170034 were missed from the Timeline. The OTF was not reached for their PID.

09/12/2011 (Day of Year 343, Revolution 1117 to 1118)

IMU1 switched ON during perigee passage (10:53:36Z). A mapping was commanded and the SPACON manually checked that the guide star at that time was valid for the upcoming RWB.

No impact on the Timeline.

10/12/2011 (Day of Year 344, Revolution 1118)

- IMU1 switched ON during the stable pointing of PID 11180014 (01:27:00Z). After the IMU switched back OFF, a manual slew was performed from attitude 11180014 to attitude 11180016.

Then a mapping was commanded and the parameters for slew 11180017 were manually updated (spacontool).

Slews 11180015 and 11180016 were missed from the Timeline. The OTF was not reached for PIDs 11180014, 11180015 and 11180016.

- IMU1 switched ON during the stable pointing of PID 11180029 (16:57:00Z). After the IMU switched back OFF, a manual slew was performed from attitude 11180029 to attitude 11180030.

Then a mapping was commanded and the parameters for slew 11180031 were manually updated (spacontool).

Slew 11180030 was missed from the Timeline. The OTF was not reached for PIDs 11180029 and 11180030.

11/12/2011 (Day of Year 345, Revolution 1118)

IMU1 switched ON during the stable pointing of PID 11180055 (18:33:45Z). After the IMU switched back OFF, a manual slew was performed from attitude 11180055 to attitude 11180056.

Then a mapping was commanded and the parameters for slew 11180057 were manually updated (spacontool).

Slew 11180056 was missed from the Timeline. The OTF was not reached for PIDs 11180055 and 11180056.

22/12/2011 (Day of Year 356, Revolution 1122)

IMU1 switched ON during the stable pointing of PID 11220031 (10:22:54Z). After the IMU switched back OFF, a manual slew was performed from attitude 11220031 to attitude 11220033.

Then a mapping was commanded and the parameters for slew 11220034 were manually updated (spacontool).

Slews 11220032 and 11220033 were missed from the Timeline. The OTF was not reached for PIDs 11220031, 11220032 and 11220033.

25/12/2011 (Day of Year 359, Revolution 1123)

FDS TPF update failed for slew 11230040 (21:59:00Z) due to a failure in attitude determination. AOCS subsystem was disabled and FD was called in.

A slew was generated by FD from attitude 11230039 to attitude 11230041. After the manual slew was completed, the parameters for slew 11230042 were manually updated (spacontool).

Slews 11230040 and 11230041 were missed from the Timeline. The OTF was not reached for their PIDs.

26/12/2011 (Day of Year 360, Revolution 1123)

IMU1 switched ON during the stable pointing of PID 11230059 (18:29:00Z). After the IMU switched back OFF, a manual mapping was commanded and the parameters for slew 11230060 were manually updated (spacontool).

OTF was not reached for PID 11230059.

No slew was missed.

29/12/2011 (Day of Year 363, Revolution 1124)

FDS TPF update failed for slew 11240064 (20:01:00Z). The AOCS was suspended in the Timeline, then a manual mapping was commanded and a slew was manually generated from attitude 11240063 to attitude 11240064.

After the manual slew was completed, the parameters for slew 11240065 were manually updated (spacontool).

Slew 11240064 was missed from the Timeline. The OTF was not reached for its PID.

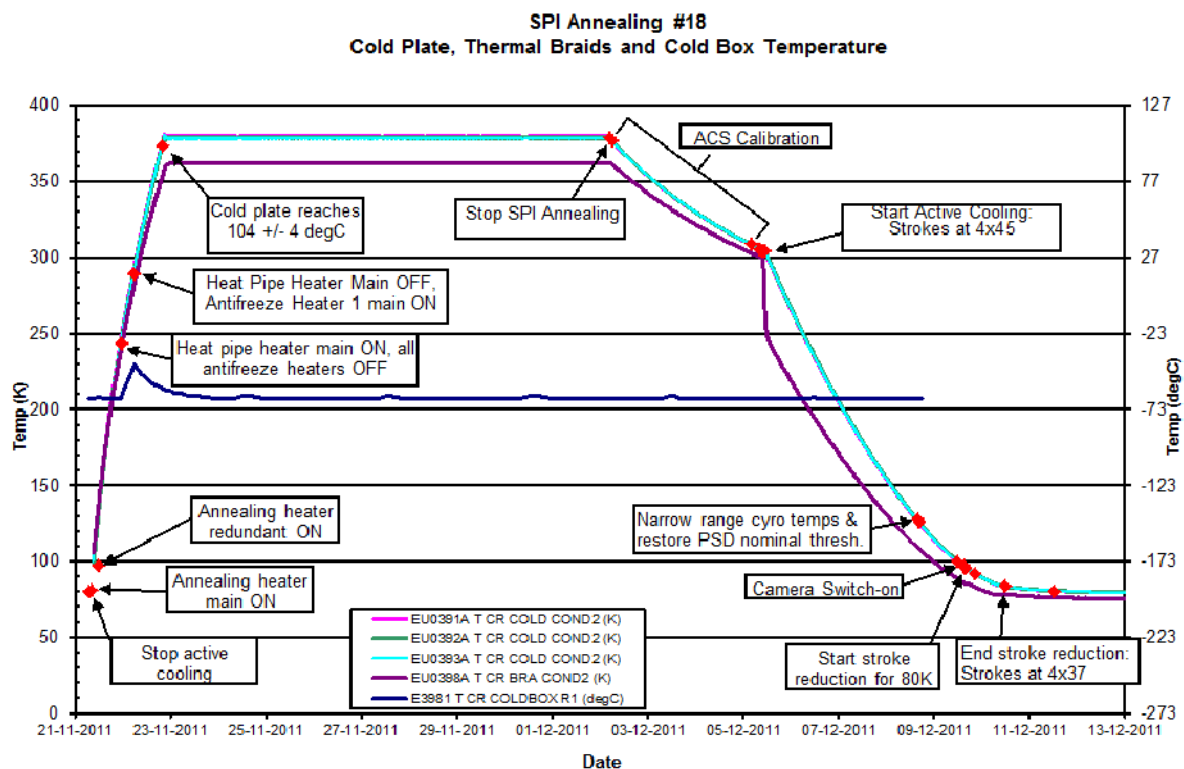
6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

The cryocooler had been put in Standby at the start of annealing on 21/11/2011 and remained in Standby until the start of active cooling on 09/12/2011. After the cryocooler switch-on, all four compressors were operated at full stroke (45) until 10/12/2011 07:30:00Z, when the stroke reduction to achieve 80K on the cold plate was started. The final stroke of 37 was reached at 10/12/2011 11:46:40Z and the 80K range on the cold plate was reached at 11/12/2011 08:10:09. Since then the cold plate temperature was maintained in the range 80K $\pm$ 1K. The cold box temperature was maintained at -65 degC after the anomaly of the steady increase of the AFEE DC output voltages of the detectors #2, #8 and #11 (see report 11/2011) for the rest of the annealing cycle. On 01/01/2012T05:15:29Z the stroke of all four compressors was set to 38.

The following plot shows the evolution of the Cold Plate, thermal braids and Cold Box temperatures during the annealing cycle.



The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K $\pm$ 1K after annealing #18.

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

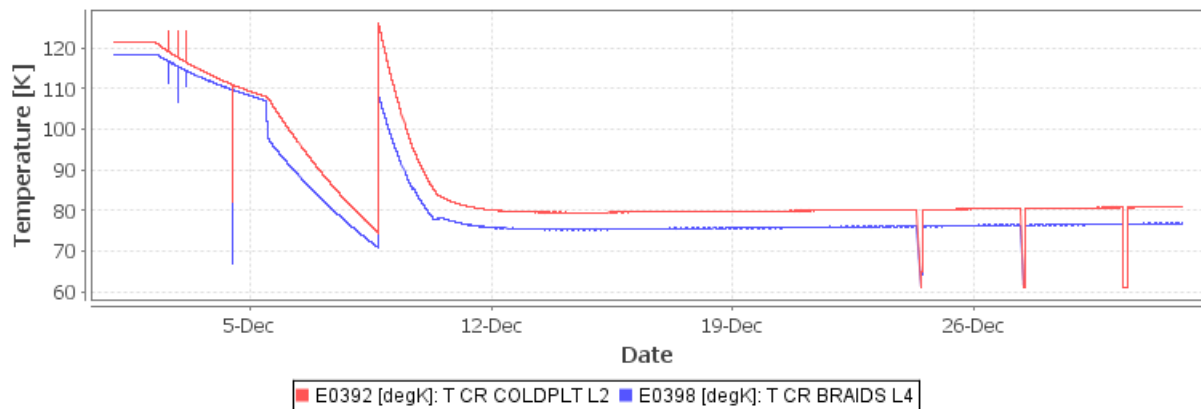


Figure 13: SPI Cold plate and H-bus temperature

The evolution of the cold plate and H bus temperature since the end of annealing is illustrated in the following plot.

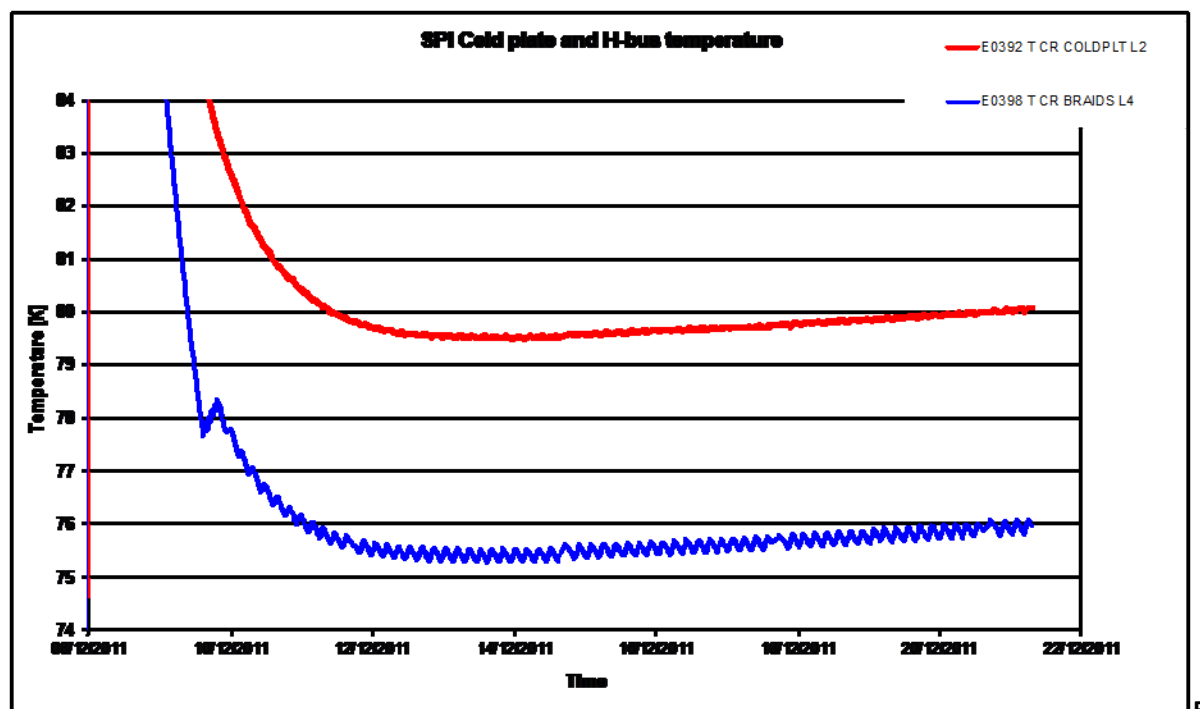


Figure 14: SPI Cold plate and H-bus temperature since the end of annealing #18.

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

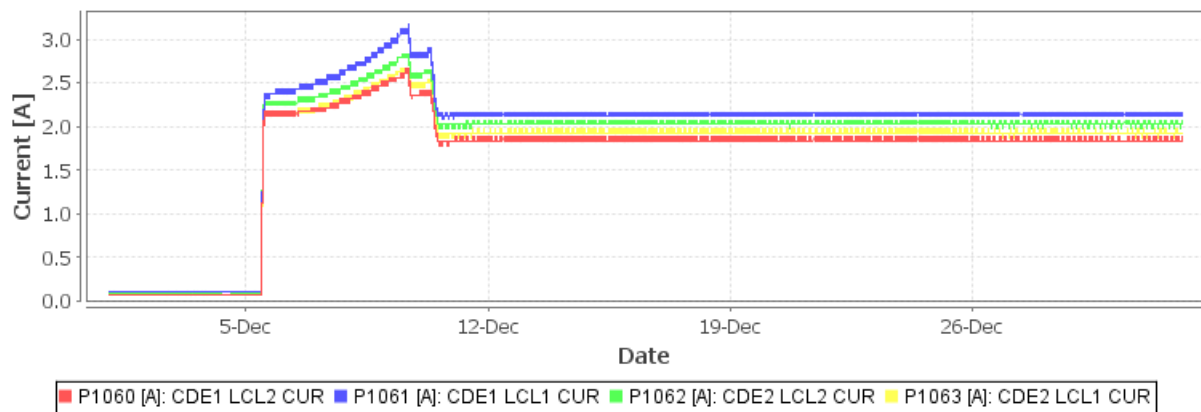


Figure 15: SPI CDE LCL current

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. Due to the annealing operations, the IASW was in CONF mode from the start of annealing until the camera switch-on performed on 09/12/2011. The spectra scaling factor has remained 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). Due to the annealing operations, the ACS High Voltages were set to the minimum voltage (~980V) and the ACS was in CONF mode until the start of passive cooling on 02/12/2011, when the ACS Calibration was performed. 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.

Due to the annealing operations, all detector HVPSSs were switched off and only the LVPSs left on with the AFEE in CONF mode from the start of annealing until the SPI camera switch-on, which started on 09/12/2011 at 14:49:58Z. Following the end of the camera switch-on, in line with OCR-316, the nominal GeD High Voltages have been set to 3kV.

The following plot shows the AFEE DC output voltages over the reporting period.

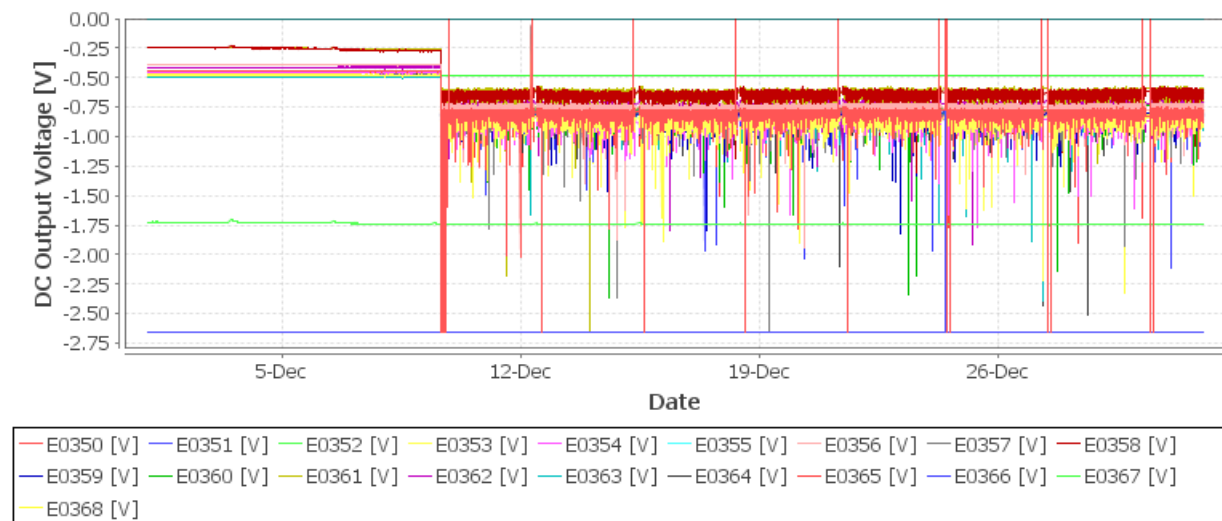


Figure 16: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.

Due to the annealing operations, the DFEE was in CONF mode from the start of annealing until the SPI camera switch-on, which started on 09/12/2011 at 14:49:58Z.



Figure 17: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic.

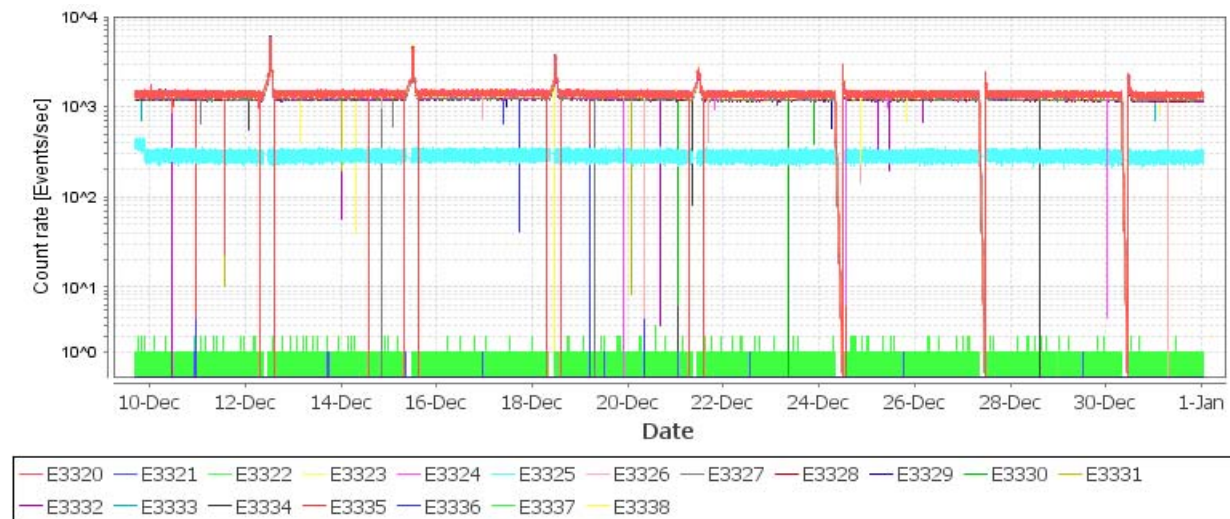


Figure 18: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic.



Figure 19: SPI GeD Time Tagged Saturated count rates

PSD

The health of the PSD is nominal. Due to the annealing operations, the PSD was in CONF mode from the start of annealing until the SPI camera switch-on, which started on 09/12/2011 at 14:49:58Z (OCR-316). The following plot shows the PSD channel rates over the reporting period.

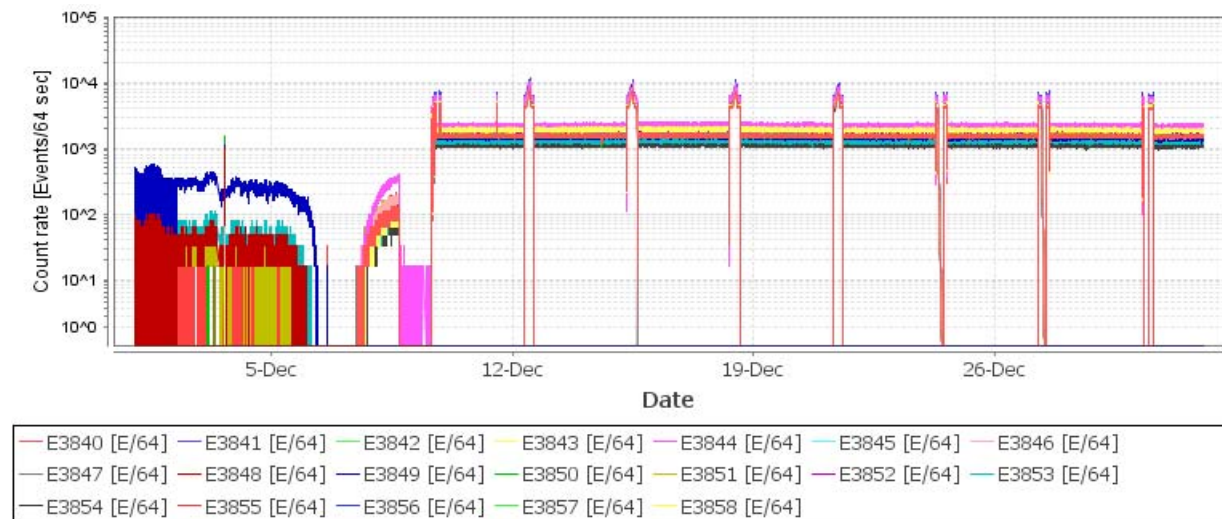


Figure 20: SPI PSD GeD Channel rates

6.2.2 Event Log

21-11-2011 until 09-12-2011 (Day of Year 325-343, Revolution 1112-1118)

SPI annealing #18 (OCR#316): planned with outgassing of the coldbox, but aborted outgassing of the cold box on 22-11-2011 (see monthly report for November).

02-12-2011 (Day of Year 336, Revolution 1115)

At 2011.336.05.08.00Z the 18th SPI annealing was stopped by TT: the annealing heaters were switched off, the OBM entries used for annealing were deleted, ACS was switched on and the ACS calibration started.

Manage cold box temperature (step 29 of SPI annealing timeline) was not executed, since the heating of the coldbox was disabled on 2011-11-22 05:26:54 as agreed with PI (see monthly report 11/2011).

After the passive cooling when the thermal braids reached 308K on 04-12-2011 at 19:45:36Z the cryocooler has been switched on on 05-12-2011 at 09:51:55.986Z and all four compressors were operated at full stroke (45; reached at 10:44:51Z) until 09-12-2011T15:58:00Z. Then the stroke reduction was started to achieve 80K on the Cold Plate.

09-12-2011 (Day of Year 343, Revolution 1118)

The camera was switched on on 09-12-2011 at 14:35Z and the HV increased in steps of 0.5kV from 0.5kV to 3.5kV. A long acquisition of 2.5 hours was performed at 3.5kV from 17.58.38 until 20.23.23Z.

On 09-12-2011 at 20:23Z the IASW parameters were set to nominal. The nominal detector HV was restored (3kV but 0.5kV for failed detectors #1, #2, #5 and #17) as well as the nominal ACS configuration (FEE#57 & FEE#81 OFF).

From 09-12-2011 at 15:58:00Z the stroke of the compressors was gradually reduced from 45 to 37 (37 was reached on 10-12-2011 at 11:46:30Z) for the 80K target temperature:

09-12-2011T15:58:00	Compressor Stroke TTs to 44
09-12-2011T16:28:30	Compressor Stroke TTs to 43
10-12-2011T07:29:00	Compressor Stroke TTs to 42
10-12-2011T08:14:30	Compressor Stroke TTs to 41
10-12-2011T09:00:00	Compressor Stroke TTs to 40
10-12-2011T09:45:30	Compressor Stroke TTs to 39
10-12-2011T10:46:00	Compressor Stroke TTs to 38
10-12-2011T11:46:30	Compressor Stroke TTs to 37

10-12-2011 (Day of Year 344, Revolution 1118)

Several occurrences of OEM APID 1024 ID 229 EXCEPTION SPI1 PARTIAL FLAG OVERFLOW were received during the reporting period, in between the time of the camera switch-on post annealing (2011-12-09 14:49:58) and the time that the 80K range was reached on the Cold Plate (2011-12-11 08:10:09). As they were each single occurrences and this is known to happen when the Cold Plate is warmer than nominal, no action was required.

24-12-2011 (Day of Year 358, Revolution 1123)

Start of 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.

15-12-2011 & 30-12-2011 (Day of Year 349 & 364, Revolution 1120 & 1124)

OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW were received at 2011.349.07.26.15.562 and 2011.364.06.22.46.405. As in each case it was a single occurrence, no action was required.

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).

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 21: 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 22: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic.

VETO

The health and performance of VETO was nominal during the reporting period. Plots of the VETO counters are given in Figure 6: Instrument Count Rates.

6.3.2 Event Log

02-12-2011 (Day of Year 336, Revolution 1115)

From 2011.336.18.40.41.507 until 2011.337.07.12.50.287 several occurrences of OOL on the parameters G2056, G2098 and G2000 (Overflow of the noisy pixel address register in MCEi). No further action required. IBIS operations continued nominally.

08-12-2011 (Day of Year 342, Revolution 1117)

Due to IREM SEU #119, IBIS transitioned autonomously to Safe configuration at 2011.342.19.42.48.474Z. It was recovered as follows:

- At 2011.342.20.10.25Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2011.342.20.24.08Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS

IBIS operations continued nominally.

12-12-2011 and 15-12-2011 (Day of Year 346 & 349, Revolution 1119 & 1120)

2011.346.11.23.40.410 until 2011.346.11.53.40.411 and from

2011.349.10.37.08.570 until 2011.349.11.20.20.571

every 8s OEM: "IBIS1 PICSIT NOISY SEMIMODULE ..." No action required since inside radiation belts.

IBIS operations continued nominally.

13-12-2011 (Day of Year 347, Revolution 1119)

Due to IREM SEU #120, IBIS transitioned autonomously to Safe configuration at 2011.347.13.44.40.726Z. It was recovered as follows:

- At 2011.347.14.25.21Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2011.347.14.37.40Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS

IBIS operations continued nominally.

17-12-2011 (Day of Year 351, Revolution 1120)

Due to IREM SEU #121, IBIS transitioned autonomously to Safe configuration at 2011.351.11.40.40.949Z. It was recovered as follows:

- At 2011.351.12.05.18Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2011.351.12.19.08Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS

IBIS operations continued nominally.

20-12-2011 & 24-12-2011 (Day of Year 354 & 358, Revolution 1121 & 1123)

At 2011.354.09.38.55 & 2011.358.19.18.55 H/L OOL occurred on all parameters of the families G5002 and G5003 (PICsIT event count rates semimodule 1 and 2) in coincidence of the G5072/68 parameter families being OOL. The PICsIT count rates came back to nominal (especially the deadtime counters) after 16sec / 4min respectively. The system fixed the problem autonomously without the need for re-synchronization. No OEM HEPI IASW Resynch occurred. IBIS operations continued nominally.

24-12-2011 (Day of Year 358, Revolution 1123)

Start of 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.

29-12-2011 (Day of Year 363, Revolution 1124)

Due to IREM SEU #124, IBIS transitioned autonomously to Safe configuration at 2011.363.22.50.41.650Z. It was recovered as follows:

- At 2011.363.23.14.02Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2011.363.23.30.38Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS

IBIS operations continued nominally.

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.

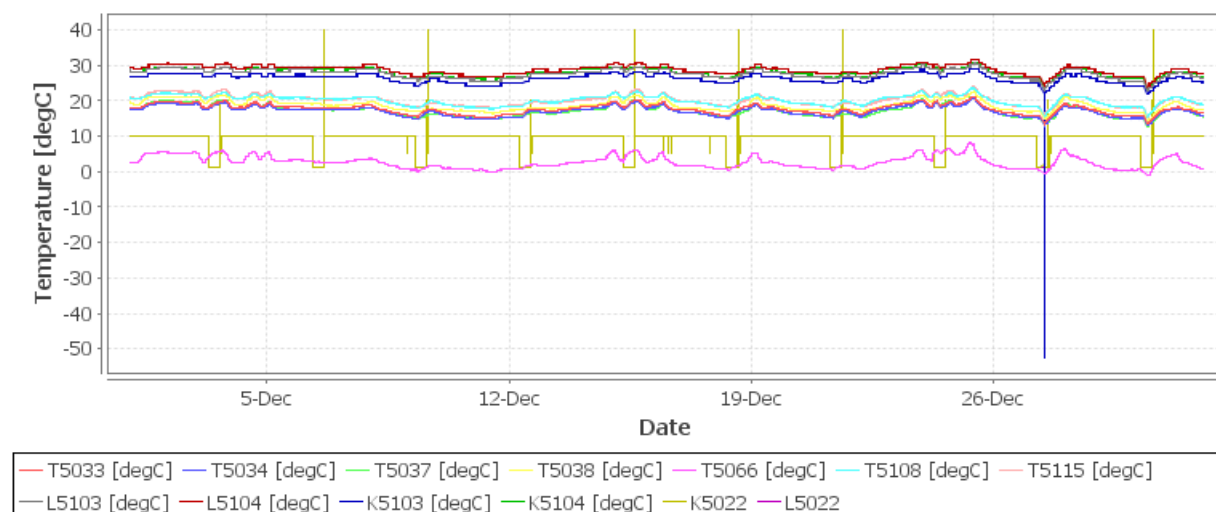


Figure 23: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

08-12-2011 (Day of Year 342, Revolution 1117)

At 19:42:49 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.

13-12-2011 (Day of Year 347, Revolution 1119)

At 13:44:42, JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#120). There was no impact as the reaction has been disabled.

17-12-2011 (Day of Year 351, Revolution 1120)

At 11:40:42, JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#121). There was no impact as the reaction has been disabled.

27-12-2011 (Day of Year 361, Revolution 1124)

At 20:16:00, 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:

- 09:40:00 3 dumps of DFEE CRCs yielding values of F1B3, F074, CF9F
- 09:51:00Z FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF, which involved disabling the reactions to the BCP)
- 09:59:00Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION
- 10:00:00 FCP_JEM1_0120 (Enable JEMX-1 reactions to BCP)

There was no impact.

29-12-2011 (Day of Year 363, Revolution 1124)

At 22:50:42, JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#124). 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

07-12-2011 (Day of Year 341, Revolution 1117)

At 22:09:00 a FD sequence failed (Change of Guide star), this forced an interruption in operations. After a lengthy recovery the timeline was rejoined at 23:47. The impact was the loss of pointings 11170033 & 11170034. It was at this time that the following pair of commands was rejected:

2011.341.22.37.48.123	2011.341.22.37.53.222	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2011.341.22.37.54.123	2011.341.22.38.01.169	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 11170033.

08-12-2011 (Day of Year 342, Revolution 1117)

At 19:42:49, an IREM SEU (#119) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 20:02:40. The impact was 11170053 was cut short from a planned 3572 to 1992 seconds.

09-12-2011 (Day of Year 343, Revolution 1117)

At 00:25:00, after the CCCFs executed as part of the above IREM recovery, OMC went to Standby. The science commands were then manually re-uplinked. The impact was that pointing 11170058 was cut short from a planned 3572 to 3072 seconds.

10-12-2011 (Day of Year 344, Revolution 1118)

At 01:27:00, an AOCS problem (loss of guide star) forced an interruption to operations. A recovery was performed, and the timeline rejoined at 02:41, the impact was the loss of pointing 11180015.

11-12-2011 (Day of Year 345, Revolution 1118)

At 18:33:45, an AOCS problem (loss of guide star) forced an interruption to operations. A recovery was performed, and the timeline rejoined at 19:35, the impact was the loss of pointing 11180056. It was at this time that the following pair of commands was rejected:

2011.345.19.25.22.829	2011.345.19.25.31.313	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2011.345.19.25.28.829	2011.345.19.25.37.795	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

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

13-12-2011 (Day of Year 347, Revolution 1119)

At 13:44:42, an IREM SEU (#120) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 14:18:12. The impact was 11190031 was cut short from a planned 1785 to 721 seconds, and pointing 11190032 was lost.

17-12-2011 (Day of Year 351, Revolution 1120)

At 11:40:42, an IREM SEU (#121) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 11:53:22. The impact was 11200053 was cut short from a planned 3530 to 1641 seconds.

At 18:26:00, after the CCCFs executed as part of the above IREM recovery, OMC went to Standby. The science commands were then manually re-uplinked. The impact was that pointing 11200060 was cut short from a planned 3530 to 3080 seconds.

22-12-2011 (Day of Year 356, Revolution 1122)

At 10:22:54, a lost guide star forced an interruption in operations. A recovery was performed, and the timeline rejoined at 11:17. The impact was 11220032 was executed at the wrong attitude and 11220033 was lost. It was at this time that the following pair of commands was rejected:

2011.356.11.13.45.413 TC1	2011.356.11.13.56.025	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.356.11.13.50.913 TC1	2011.356.11.13.56.094	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 11220033.

25-12-2011 (Day of Year 359, Revolution 1123)

At 21:59:00 a FD problem forced an interruption in operations. After a lengthy recovery the timeline was rejoined at 00:13 the following day. The impact was the loss of pointings 11230040. It was at this time that the following pair of commands was rejected:

2011.359.22.54.25.873 TC1	2011.359.22.54.34.713	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.359.22.54.32.123 TC1	2011.359.22.54.34.784	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E

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

29-12-2011 (Day of Year 363, Revolution 1124)

At 20:01:00 a FD problem forced an interruption in operations. After a recovery the timeline was rejoined at 21:28. The first set of pointing commands were rejected, however, these were manually resent. The pointing was then completed nominally. It was at this time that the following OEMs were received:

2011.363.20.57.00.212 TC1	2011.363.20.57.06.530	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.363.20.57.05.837 TC1	2011.363.20.57.16.437	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 pointing 11240064.

At 22:50:42, an IREM SEU (#124) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 23:09:13. The impact was 11240065 was cut short from a planned 3530 to 3048 seconds, and 11240066 was lost.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 24, red line) and Exit times (Figure 25, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 24 and the magenta line in Figure 25 are the altitudes used by the MOC for planning purposes.

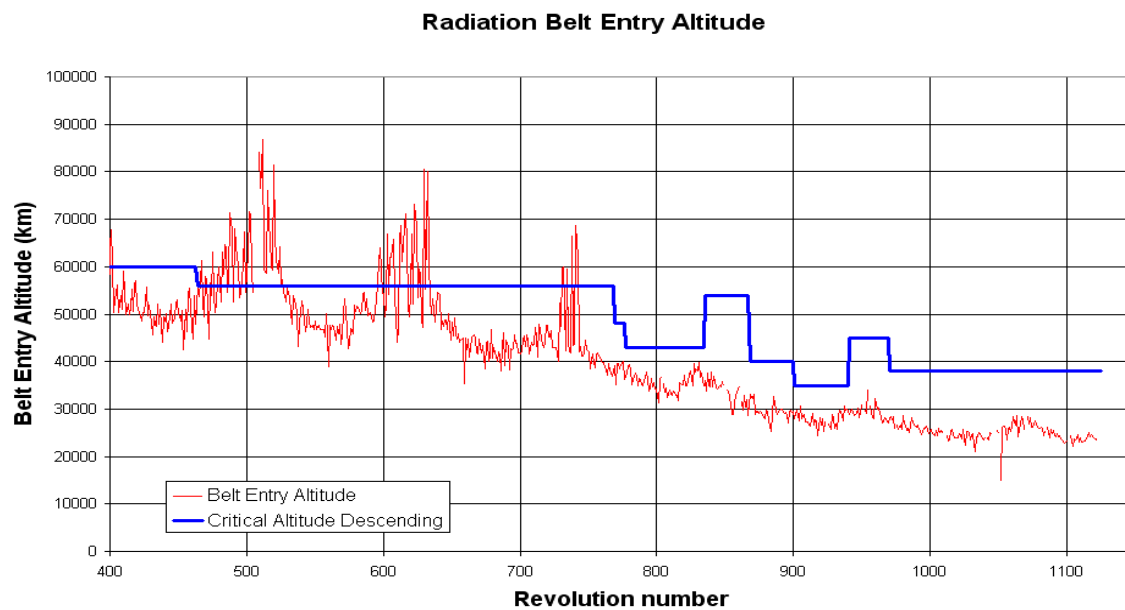
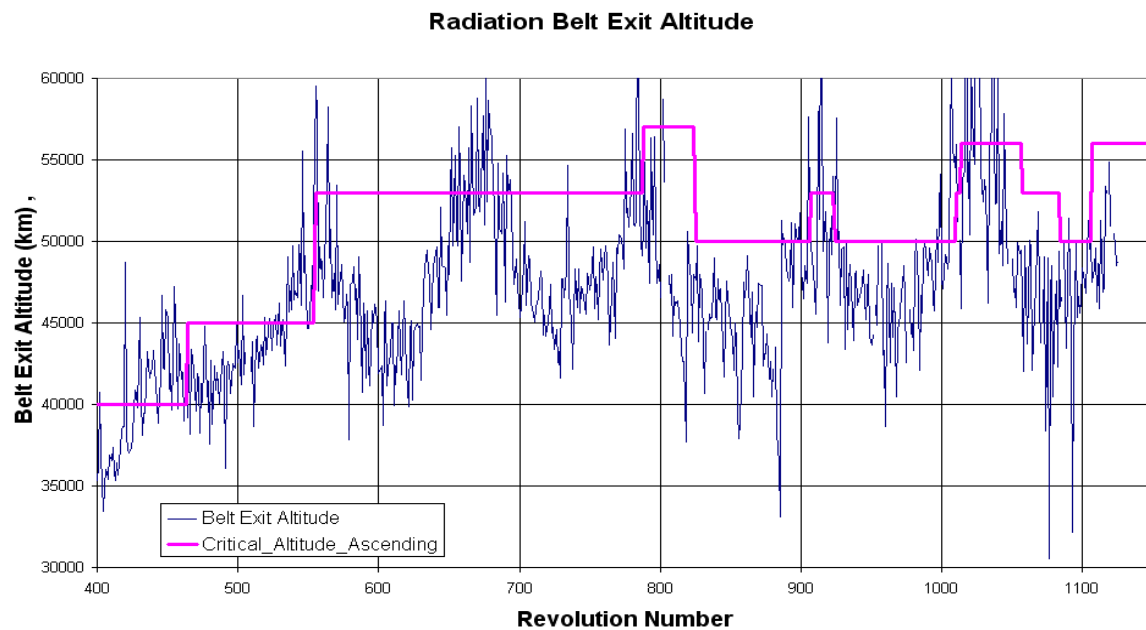


Figure 24: Radiation belt entry

**Figure 25: 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
1115	RAD_ENTR R 2011-12-03T07:14:17Z	03/12/2011 08:46:56	18025.7	03-Dec-2011 08:48:50	17155.27	03-Dec-2011 09:18:50	9656.948
1116	RAD_EXIT R 2011-12-03T14:31:43Z	03/12/2011 13:54:32	50251.4	03-Dec-2011 13:38:50	48080.07	03-Dec-2011 09:58:50	3140.868
1116	RAD_ENTR R 2011-12-06T07:01:27Z	N/A	N/A	06-Dec-2011 08:30:47	18198.03	06-Dec-2011 09:10:47	8247.447
1117	RAD_EXIT R 2011-12-06T14:18:55Z	06/12/2011 13:32:00	>>29004.6	06-Dec-2011 13:30:47	49017.27	06-Dec-2011 09:40:47	3129.629
1117	RAD_ENTR R 2011-12-09T06:48:21Z	N/A	N/A	09-Dec-2011 08:18:37	18908.34	09-Dec-2011 08:58:37	9041.312
1118	RAD_EXIT R 2011-12-	09/12/2011 13:22:32	49102.1	09-Dec-2011 13:18:37	48414.44	09-Dec-2011 09:38:37	3394.72

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
	09T14:06:27Z						
1118	RAD_ENTR R 2011-12-12T06:34:15Z	N/A	N/A	12-Dec-2011 08:03:20	19180.15	12-Dec-2011 08:43:20	9352.506
1119	RAD_EXIT R 2011-12-12T13:52:51Z	N/A	N/A	12-Dec-2011 13:03:20	48169.95	12-Dec-2011 09:23:20	3378.18
1119	RAD_ENTR R 2011-12-15T06:20:44Z	N/A	N/A	15-Dec-2011 07:56:29	17504.51	15-Dec-2011 08:36:29	7621.755
1120	RAD_EXIT R 2011-12-15T13:39:10Z	15/12/2011 12:37:21	>>31017.6	15-Dec-2011 12:56:29	49383.01	15-Dec-2011 09:06:29	3224.825
1120	RAD_ENTR R 2011-12-18T06:09:06Z	N/A	N/A	18-Dec-2011 07:40:02	18517.25	18-Dec-2011 08:20:02	8604.931
1121	RAD_EXIT R 2011-12-18T13:27:09Z	N/A	N/A	18-Dec-2011 12:40:02	48743.48	18-Dec-2011 08:50:02	3238.297
1121	RAD_ENTR R 2011-12-21T05:58:43Z	N/A	N/A	21-Dec-2011 07:34:08	17555.79	21-Dec-2011 08:14:08	7671.977
1122	RAD_EXIT R 2011-12-21T13:17:00Z	21/12/2011 12:10:49	>>35016.8	21-Dec-2011 12:34:08	49346.93	21-Dec-2011 08:44:08	3222.142
1122	RAD_ENTR R 2011-12-24T05:46:47Z	N/A	N/A	24-Dec-2011 07:16:25	19087.17	24-Dec-2011 07:56:25	9295.096
1123	RAD_EXIT R 2011-12-24T13:05:56Z	24/12/2011 11:58:57	>>40584.1	24-Dec-2011 12:16:25	48161.67	24-Dec-2011 08:36:25	3466.972
1123	RAD_ENTR R 2011-12-27T05:32:26Z	N/A	N/A	27-Dec-2011 07:01:51	19075.18	27-Dec-2011 07:41:51	9316.603
1124	RAD_EXIT R 2011-12-27T12:52:14Z	27/12/2011 11:35:45	43513.5	27-Dec-2011 12:01:51	48106.61	27-Dec-2011 08:21:51	3528.856
1124	RAD_ENTR R 2011-12-30T05:18:07Z	N/A	N/A	30-Dec-2011 06:45:07	19552.13	30-Dec-2011 07:25:07	9783.768

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_EXIT R 2011-12- 30T12:37:47Z	30/12/2011 11:31:21	45989.3	30-Dec-2011 11:55:07	49469.09	30-Dec-2011 08:05:07	3396.608

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

08-12-2011 (Day of Year 342, Revolution 1117)

At 19:42:48Z, a local reset of the IREM CSCI S/W (SEU #119) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2011.342.19:42:48Z (115290.7 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 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 21:41:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the PIs request. OMC was recovered at 20:02:00Z and IBIS at 20:25:00Z.

13-12-2011 (Day of Year 347, Revolution 1119)

At 13:44:40Z, a local reset of the IREM CSCI S/W (SEU #120) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2011.347.13:44:40Z (155957.2 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 16:00:00Z.

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 14:18:00Z and IBIS at 14:37:00Z.

17-12-2011 (Day of Year 351, Revolution 1120)

At 11:40:41Z, a local reset of the IREM CSCI S/W (SEU #121) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2011.351.11:40:41Z (140745.7 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 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 15:49:00Z.

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 11:54:00Z and IBIS at 12:21:00Z.

18-12-2011 (Day of Year 352, Revolution 1121)

At 12:29:37Z, a local reset of the IREM CSCI S/W (SEU #122) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2011.352.12:29:37Z (48013.1 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 13:53:00Z.

The IREM automatic transition to Standard Mode had no effect on the instruments as they were already in SAFE mode due to the on-going radiation belt passage.

27-12-2011 (Day of Year 361, Revolution 1124)

At 09:28:41Z, at AOS, a local reset of the IREM CSCI S/W (SEU #123) 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 before AOS at 2011.361.09:28:41Z (<17645.1 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 11:15:00Z.

The IREM automatic transition to Standard Mode had no effect on the instruments as they were already in SAFE mode due to the on-going radiation belt passage.

29-12-2011 (Day of Year 361, Revolution 1124)

At 22:50:41Z, a local reset of the IREM CSCI S/W (SEU #124) 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 before AOS at 2011.361.09:28:41Z (<17645.1 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 23:43:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the Pls request. OMC was recovered at 23:10:00Z and IBIS at 23:34:00Z.