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

INTEGRAL
Mission report

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

No. 401
01.10.2011

Routine Phase

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

Table of Contents

1	General.....	5
2	Satellite status.....	5
2.1	Platform	5
2.1.1	AOCS.....	5
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.....	8
2.2.3	JEM-X.....	9
2.2.4	OMC.....	10
2.2.5	IREM	10
3	Ground Facilities	13
3.1	Mission Control System	13
3.2	Ground Stations and Network.....	14
3.3	ISOC	14
3.3.1	Mission Planning	14
3.3.2	Observation Status	14
3.3.3	ISOC Science Data Archive	15
3.3.4	ISOC System	15
3.3.5	Problems	15
4	Anomalies	15

5	Special Events & Future Milestones.....	16
6	Appendix	16
6.1	AOCS operations.....	16
6.1.1	Fuel consumption.....	16
6.1.2	The RMU-A null bias calibration.....	17
6.1.3	Event log.....	17
6.2	SPI.....	21
6.2.1	Operations.....	21
6.2.2	Event Log.....	24
6.3	IBIS	26
6.3.1	Operations.....	26
6.3.2	Event Log.....	27
6.4	JEM-X	28
6.4.1	Operations.....	28
6.4.2	Event Log.....	28
6.5	OMC.....	28
6.5.1	Operations.....	28
6.5.2	Event Log.....	29
6.6	IREM.....	31
6.6.1	Operations.....	31
6.6.2	Event Log.....	34

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. 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 September and covers the revolutions 1084 until 1094 (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
- Crab calibration during rev. 1089
- SAS calibration on 21/09/2011 (DoY 264)
- Science operations were interrupted due to high radiation on 26/09/2011 (DoY 269) at 8:32Z: Due to a solar flare, OMC went to safe mode for a total of about 3 hours. The operations of all other subsystems were proceeding normally.
- MCS Database Update on 27/9/2011 (DoY 270)
- E3.5 Testing

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- Fuel consumption seems to have decreased after the relaxation of the constraints on the INTEGRAL perigee attitude; increased fuel consumption since January under investigation

Summary of the overall status and performance of the ground segment

- Period of severe uplink RFI at Redu, source unknown
- Ongoing occasional error sending data to ISDS

The previous weekly and monthly reports are available at the XMM-INTEGRAL website: <http://xmm.esoc.esa.int/documentation/documentation.php3> .

2 Satellite status

2.1 Platform

2.1.1 AOCS

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

11 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.3579 Kg. The remaining propellant is in the order of 117.5088 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 17th SPI annealing, which ended on 12/05/2011, 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 2011-09-15T03:59:17Z to 2011-09-15T07:02:28Z (Crab Calibration), when it was 85 packets/cycle. The average telemetry occupation when the allocation was 99 packets/cycle was 74.5 packets/cycle.

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

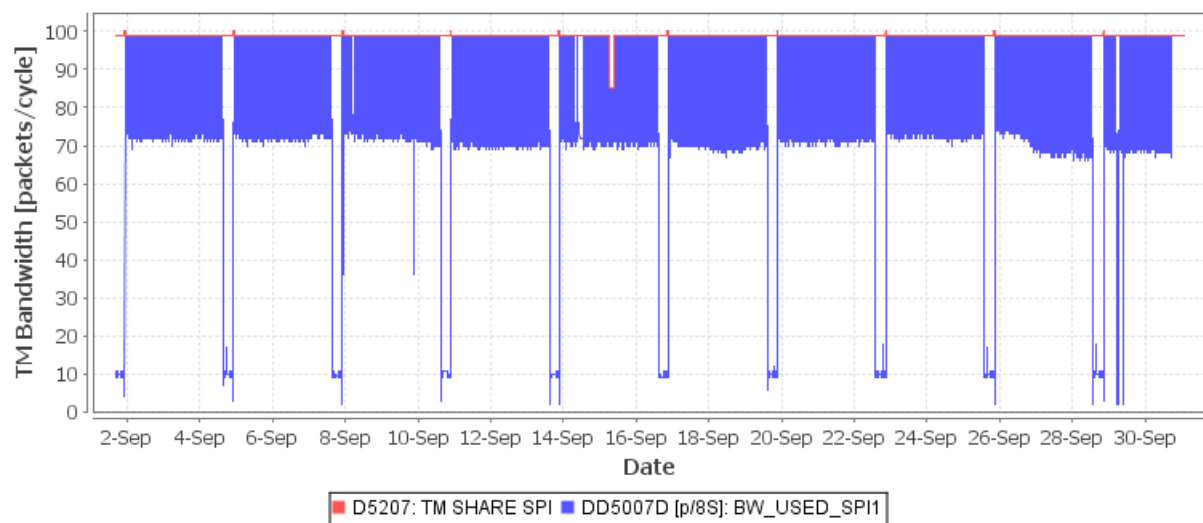


Figure 1: SPI TM bandwidth utilisation

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

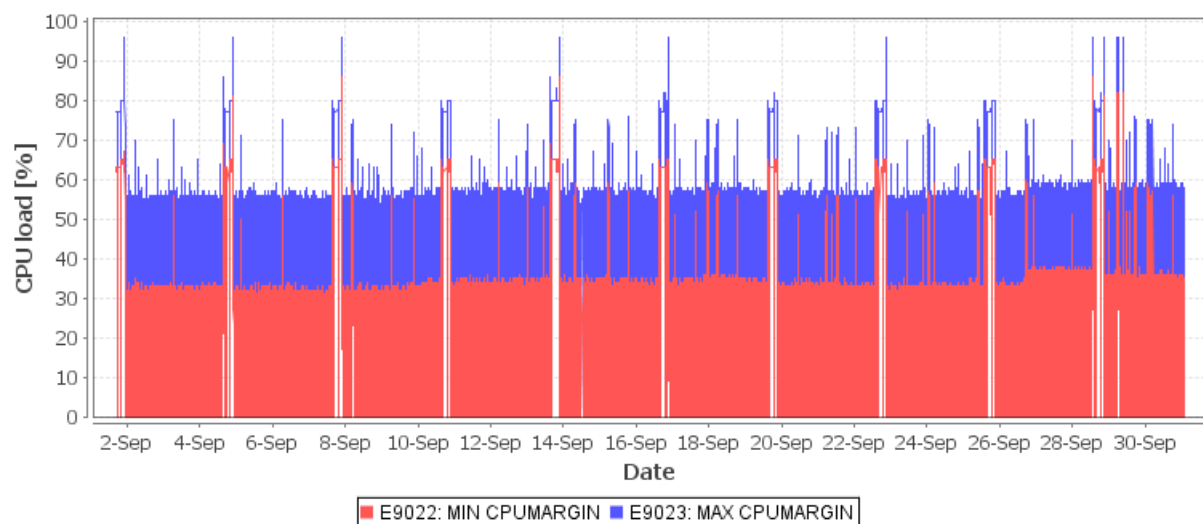


Figure 2: SPI IASW Performance

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

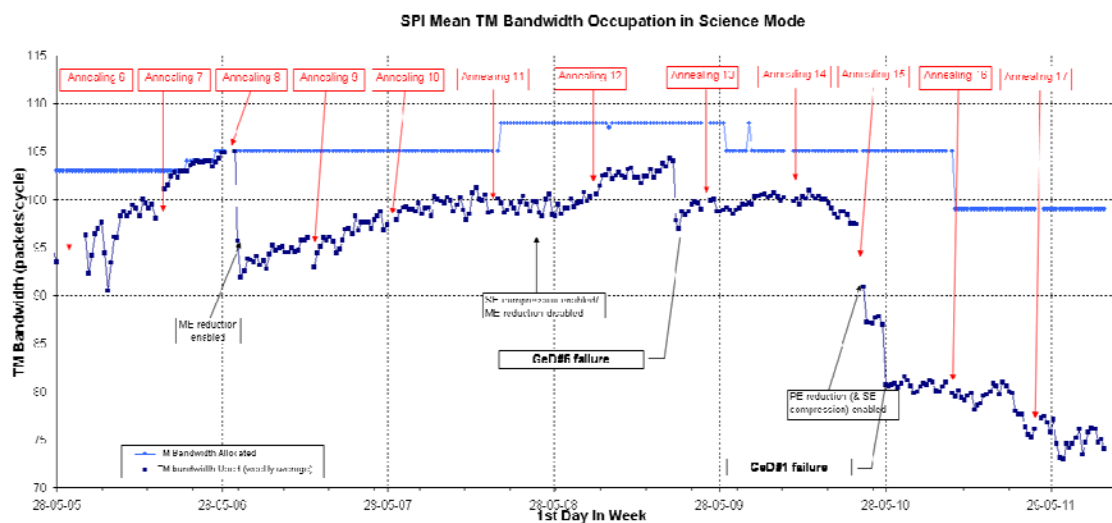


Figure 3: SPI TM bandwidth usage evolution since May 2005

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

2.2.2 IBIS

The overall status of IBIS is nominal.

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.
- IBIS mean bandwidth utilisation in science mode: 111.5 packets/cycle

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

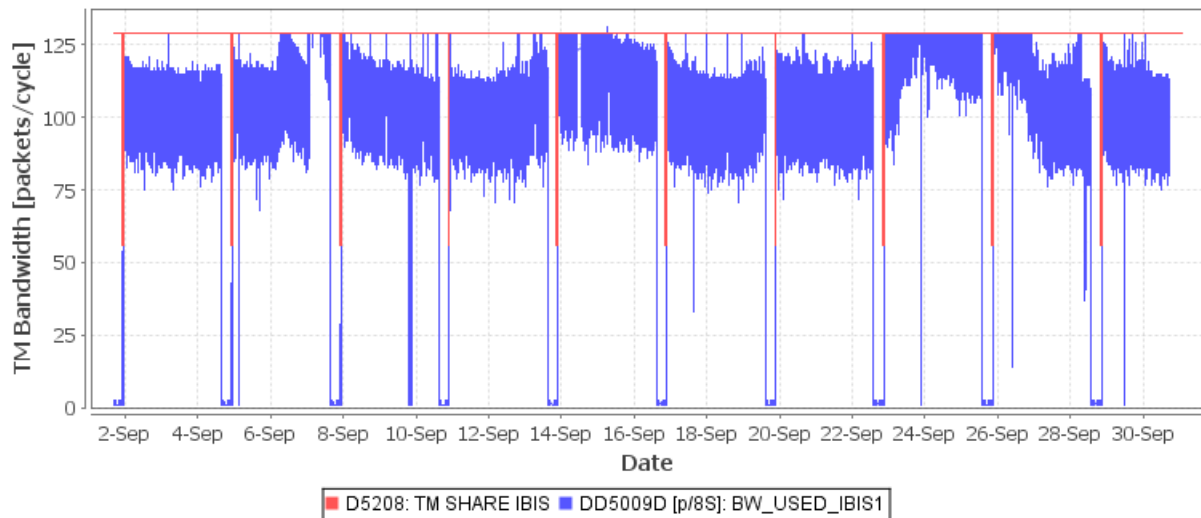


Figure 4: IBIS TM bandwidth utilisation

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

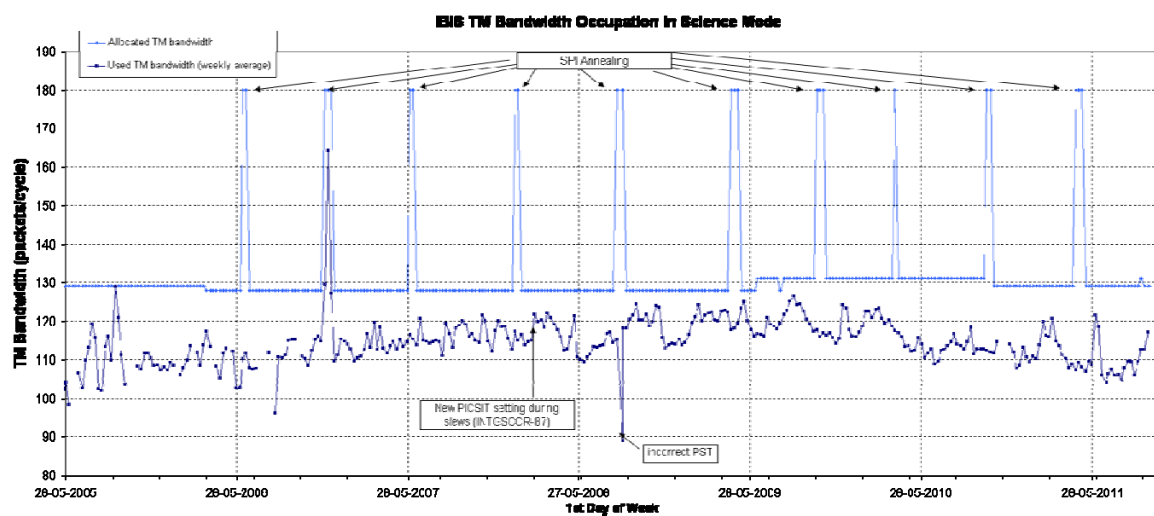


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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, except from 2011-09-15T03:59:17Z to 2011-09-15T07:02:28Z (Crab Calibration), when it was 15 packets/cycle.

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.

During this reporting period, 875 of the 892 planned science pointings were executed nominally. 4 pointings were interrupted, and 4 lost to high radiation. 4 pointings were lost to problems with the AOCS. 1 pointing was lost to an FD problem. 2 pointings were interrupted due to IREM crashes. 1 pointing was interrupted when the CCCFs were activated. Finally, 1 pointing was lost to a ground station problem. No Flat-field calibrations were performed this month.

Note: Some more information concerning the OMC operations is provided in Appendix 0.

2.2.5 IREM

The status of IREM is nominal.

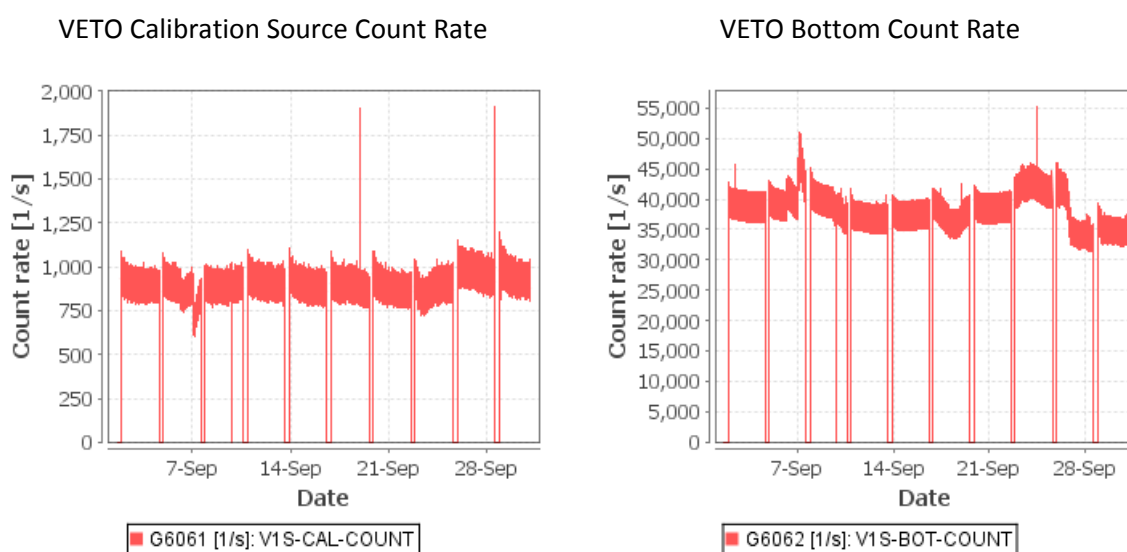
On DoY 247 (04/09/2011), the 114th IREM SEU occurred

On DoY 252 (09/09/2011), the 115th IREM SEU occurred

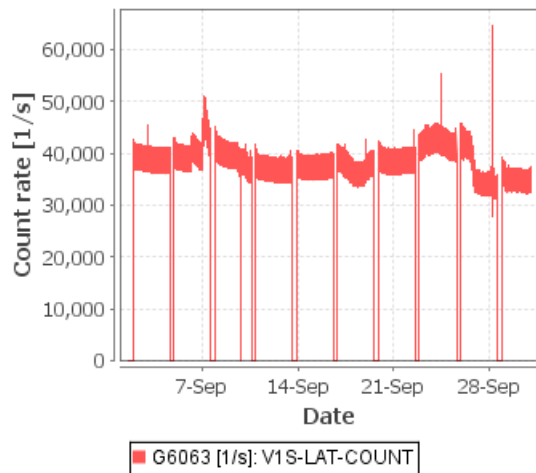
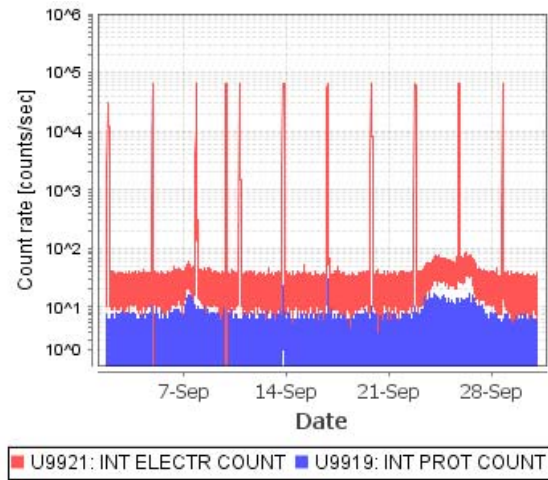
Note: Some more information concerning the IREM operations is provided in Appendix 6.6.

Radiation background

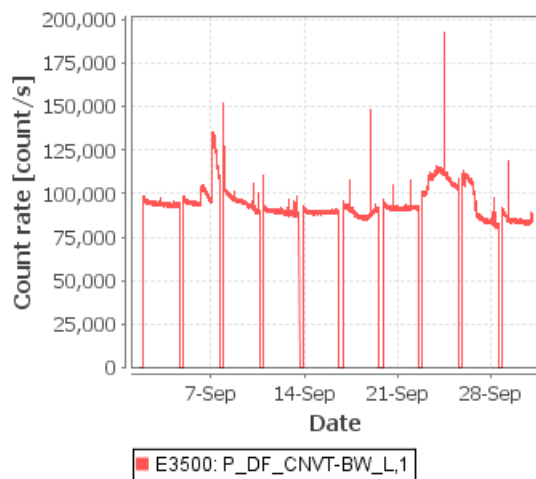
Except for the 23rd and 26th of the month, the background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:



VETO Lateral Count Rate

IREM Proton & Electron Counters¹

ACS Below 100MeV



ACS Above 100MeV

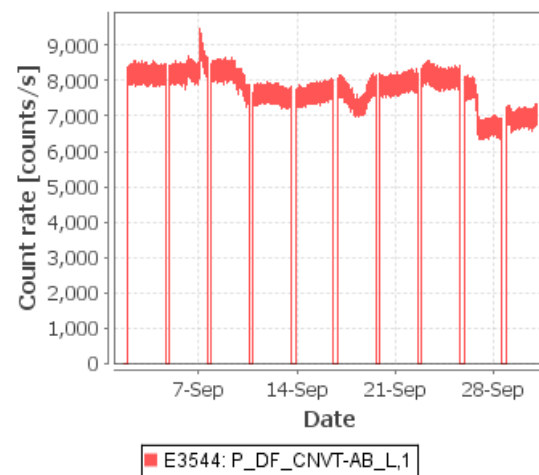


Figure 6: Instrument Count Rates

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

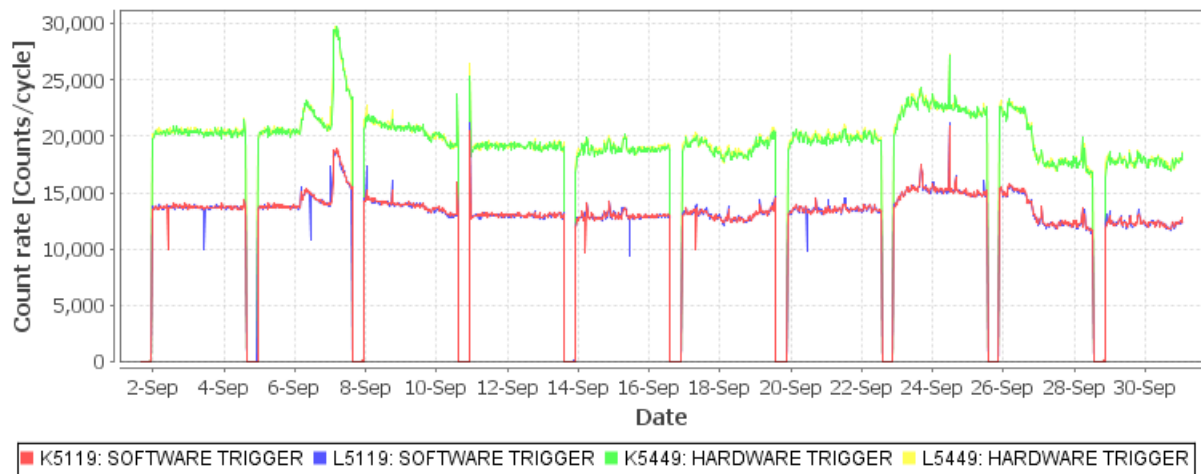


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

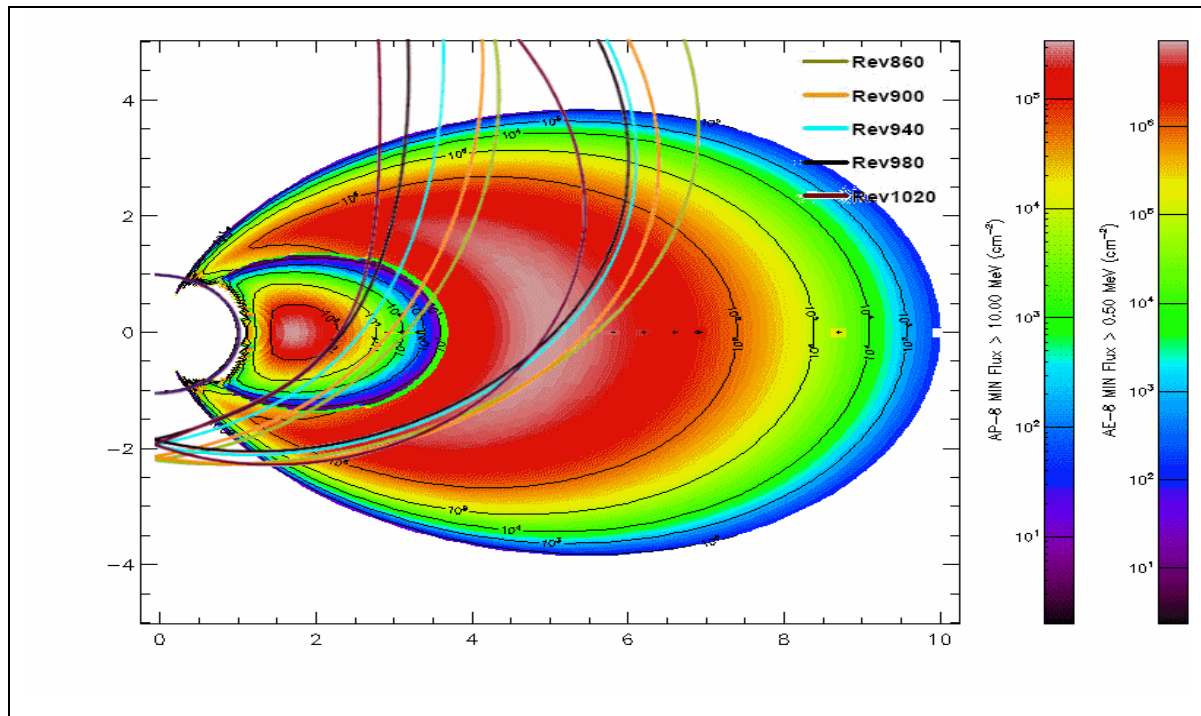


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

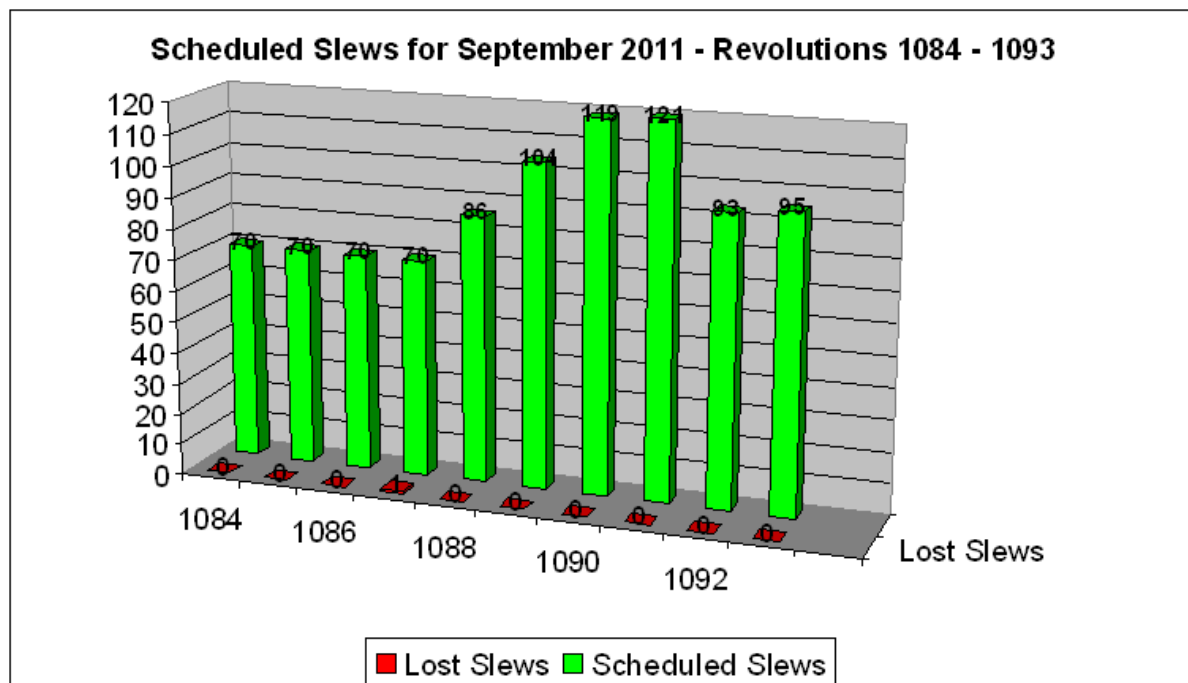


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY 247 the multiplexer crashed at AOS and was restarted.

On DOY 250 the autostack crashed at AOS and was restarted

On DOY 262 the OMCH task on IMCB crashed at AOS and was restarted

On DOY 262 the multiplexer crashed at AOS and was restarted

On DOY 271 the IFTS instances on IMCA stopped distributing TPF files properly and had to be restarted.

On DOY 271 the REDU ground-station stopped tracking, due to unauthorised access to the antenna room.

On DOY 272 the IFTS instances on IDDA were restarted as they were no longer receiving ASF files.

On DOY 274 the OBQM task crashed on IMCA and was restarted.

The connection to ISDC dropped 9 times and the ISDS and IFRD tasks needed to be restarted on 2 occasions.

3.2 Ground Stations and Network

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

12 TM drops and 6 data gaps were identified from REDU and 3 TM drops from VIL2. Bad frames were received from REDU on 12 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.

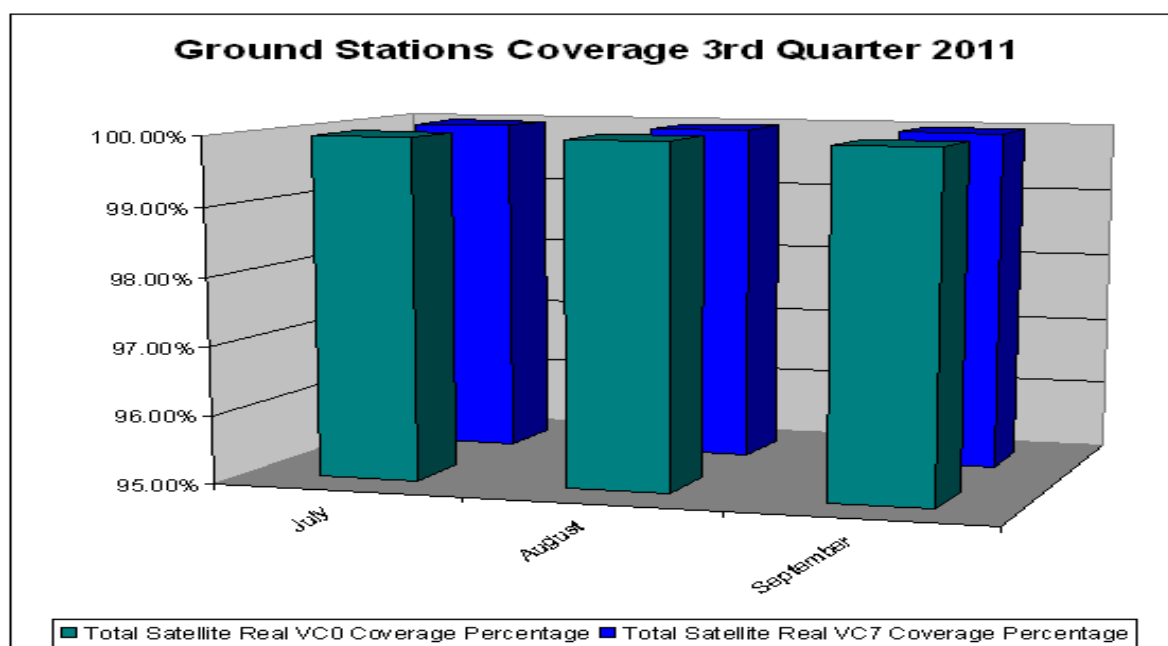


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1092 to 1101, corresponding to the time range 22 September to 22 October.

New observations have been planned for revolutions 1089 (13-16 September) to 1100 (16-19 October). Further TOO observations of the nearby supernova SN2011fe have begun in revolution 1097 and are ongoing.

TSFs have been received for revolutions 1087 to 1097.

3.3.2 Observation Status

New ECS files have been received for revolutions 1071 to 1084 (up to 1 October).

3.3.3 ISOC Science Data Archive

Syncing of rev_3 data has been done up to revolution 1051, no change since last report as this is waiting for reprocessing at ISDC to finish.

Raw telemetry copied from MOC is available up to 16 September.

The URD for the new ISDA is being iterated with the ESAC archive team.

3.3.4 ISOC System

ISOC software V31 was released for testing on 19 September and is scheduled for operational release in early October.

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-3191	2011-09-06	JEMX parameters K5136 & L5136 (BUFFER LOSS) OOL.	Payload	Open
INT-3192	2011-09-14	Incorrect data burnt on CD (MADDS)	IMCS	Pending
INT-3193	2011-09-28	REDU Antenna Stopped due to Unauthorised Access to Elevation Cabin.	ESA Stations	Pending
INT-3194	2011-06-18	TM Desktop 'TM FLOW' status does not show short disconnections	IMCS	Pending
INT-3195	2011-09-23	No alarm generated when OMC went to SAFE mode during High Radiation	IMCS	Pending
INT-3196	2011-09-23	No alarm generated when OMC went to SAFE mode during High Radiation	IMCS	Pending
INT-3197	2011-09-26	No alarm generated when OMC went to SAFE mode during High Radiation	IMCS	Pending
INT_SC-342	2011-09-04	IREM Anomaly: Reset of IREM_CSCI S/W #114, 04/09/2011	Payload	Pending

INT_SC-343	2011-09-09	IREM Anomaly: Reset of IREM_CSCI S/W #115, 09/09/2011	Payload	Pending
INT_SC-344	2011-09-23	OMC to SAFE / update reaction to OEM 231	Payload	Pending
INT_SC-345	2011-09-27	STR CCD temperature OOL	Spacecraft	Pending
INT_SC-346	2011-09-29	SPI PSD malfunction	Payload	Pending

5 Special Events & Future Milestones

The 17th OBC wrap-around will take place on 31st October 2011.

Thruster Torque Calibration planned for 07.11.2011.

18th SPI annealing is currently scheduled for late November 2011.

Next S/C database update scheduled for early December 2011.

6 Appendix

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

6.1 AOCS operations

During this period, 495 Open Loop Slews, 450 Closed Loop Slews and 22 Momentum Biases were executed (as reported by ACC OEM).

11 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 01/10/2011 is reported in the following plot:

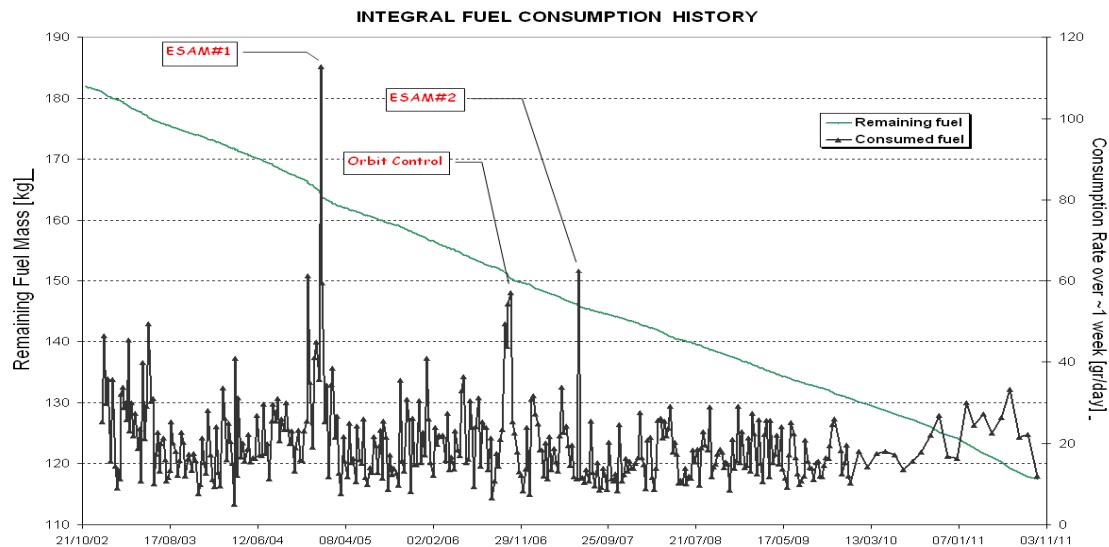


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

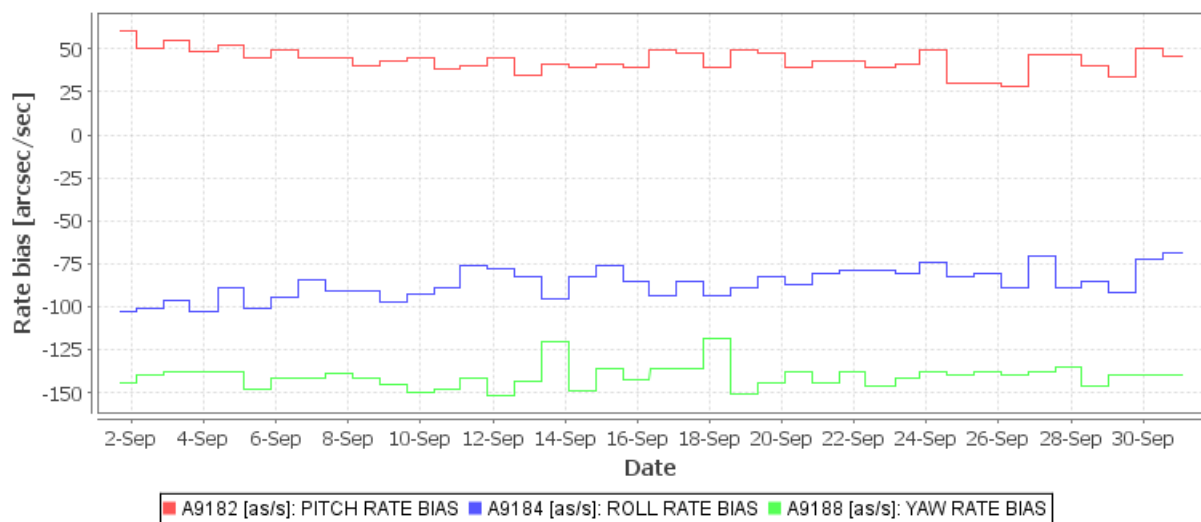


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

01/09/2011 (Day of Year 244, Revolution 1084)

- FDS TPF update failed for slew 10840069 (12:50:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 10840069 were manually updated by Flight Dynamics.

No impact on the timeline.

- Guide star was lost during perigee LOS (16:14z AIMU ON). A manual mapping was commanded and the spacontool was used to determine suitability of currently tracked guide star or create a CGS. Tracked star was determined suitable.

No impact on timeline

05/09/2011 (Day of Year 248, Revolution 1085 to 1086)

FDS TPF update failed for slew 10860014 (07:10:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 10860014 were manually updated by Flight Dynamics.

No impact on the timeline.

07/09/2011 (Day of Year 250, Revolution 1086)

FDS TPF update failed for slew 10860067 (10:33:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 10860067 were manually updated (spacontool).

No impact on the timeline.

08/09/2011 (Day of Year 251, Revolution 1086 to 1087)

Due to problems with the GS, autostack commanding for slew 10870008 (02:16:00Z) was interrupted. The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10870007 to attitude 10870008.

After the manual slew was completed, the parameters for slew 10870009 were manually updated (spacontool).

Slew 10870008 was missed from the timeline. The OTF was not reached for its PID.

09/09/2011 (Day of Year 252, Revolution 1087)

FDS TPF update failed for slew 10870033 (01:16:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 10870033 were manually updated (spacontool).

No impact on the timeline.

12/09/2011 (Day of Year 255, Revolution 1088)

FDS TPF update failed for slew 10880044 (09:12:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and the parameters for slew 10880044 were manually updated by Flight Dynamics.

No impact on the timeline.

14/09/2011 (Day of Year 257, Revolution 1088 to 1089)

FDS TPF update failed for slew 10890016 (04:45:00Z). The AOCS was suspended in the timeline, then a manual mapping was commanded and a slew was manually generated from attitude 10890015 to attitude 10890017.

After the manual slew was completed, the parameters for slew 10890018 were manually updated (spacontool).

Slews 10890016 and 10890017 were missed from the timeline. The OTF was not reached for their PID.

15/09/2011 (Day of Year 258, Revolution 1089)

Command A3189 'START GUIDE STAR' at the beginning of slew 10890071 failed (16:51:06Z). The slew was not executed from timeline. The AOCS was suspended in the timeline, then a manual mapping was commanded and a manual slew was generated (spacontool) from attitude 10890070 to 10890071.

After the manual slew was completed, another manual mapping was commanded and the parameters for slew 10890072 were updated (spacontool).

Slew 10890071 was missed from the timeline. The OTF was not reached for this PID.

16/09/2011 (Day of Year 259, Revolution 1089 to 1090)

IMU switched ON during perigee gap (15:05:52Z). The AOCS was suspended in the timeline and FD support was called in. A manual mapping was commanded and the spacontool was started to check the current guide star. A manual RWB was executed using TPF provided by FD. A manual slew was performed from attitude 10890104 to 10900001. Another manual mapping was commanded and the spacontool was used to update slew 10900002 in the timeline.

Slew 10900001 was missed from timeline. The OTF was not reached for this PID.

17/09/2011 (Day of Year 260, Revolution 1090)

- Command A3189 'START GUIDE STAR' at the beginning of slew 10900050 failed. The AOCS was suspended in the timeline. A manual mapping was commanded and the spacontool was used to generate a TPF for a manual slew from attitude 10900049 to attitude 10900050, which also failed at the same point. Another manual mapping was commanded and the spacontool was used to produce a TPF for a manual OSL to PID 10900051. After a third manual mapping slew 10900051 was updated in the timeline using the spacontool.

Slews 10900050 and 10900051 were missed from timeline. The OTF was not reached for these PIDs.

- At the end of OSL 10900054 OOLs A5091 '1750_FAULT' and A5089 'H/C 1 FLAG' occurred. The AOCS was suspended in the timeline. In accordance with the AOCS cross reference a manual mapping was commanded and the spacontool was used to update slew 10900055 in the A/S.

No impact on timeline.

18/09/2011 (Day of Year 261, Revolution 1090)

The guide star was lost and IMU-1 switched ON automatically (10:36:33Z) during PID 10900075. After the IMU switched off again a manual mapping was commanded and parameters for slew 10900076 were updated in the timeline

The OTF was not reached for PID 10900075.

19/09/2011 (Day of Year 262, Revolution 1090 to 1091)

The guide star was lost during perigee and the IMU-1 switched ON automatically (14:52:54Z). A manual mapping was commanded and spacontool was used to generate a manual CGS.

No impact on timeline.

24/09/2011 (Day of Year 267, Revolution 1092)

The guide star was lost and IMU-1 switched ON automatically (23:08:00Z) during PID 10920077. A manual mapping was commanded and a corrective slew was generated from attitude 10920077 to 10920077. After the manual slew was completed another manual mapping was performed and the parameters for slew 10920078 were updated.

The OTF was not reached for PID 10920077.

28/09/2011 (Day of Year 271, Revolution 1093 to 1094)

FDS failed to update slews 10930089, 10930090 and 10930091. These slews were executed without real time update.

29/09/2011 (Day of Year 272, Revolution 1094)

- Command A3189 failed release for slew 10940041 (15:03Z), the slew was not executed from the timeline. The AOCS was disabled, a manual mapping was commanded and the spacontool started. A manual CSL was generated from pointing 10940040 to 10940042. After completion of the slew another mapping was performed and slew 10940043 was updated in the timeline.

Slews 10940041 and 10940042 were missed from timeline. The OTF was not reached for PID 10940041

- Command A3189 failed release for slew 10940057 (23:36Z), the slew was not executed from the timeline. A manual mapping was commanded and the spacontool was started. A manual OSL was generated from pointing 10940056 to 10940058. After completion of the slew another mapping was performed and slew 10490059 was updated in the A/S using the spacon tool.

Slews 10940057 and 10940058 were missed from the timeline. The OTF was not reached for PID 10940057

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 41 on 07-09-2011 leading to a decrease of the temperature of the cold plate as well to an increase of the SPI CDE LCL currents.

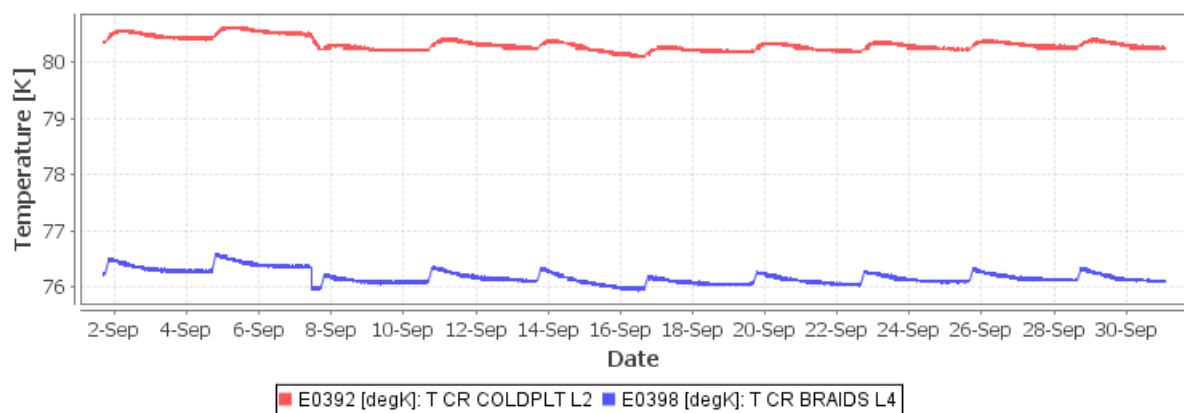


Figure 13: SPI Cold plate and H-bus temperature

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

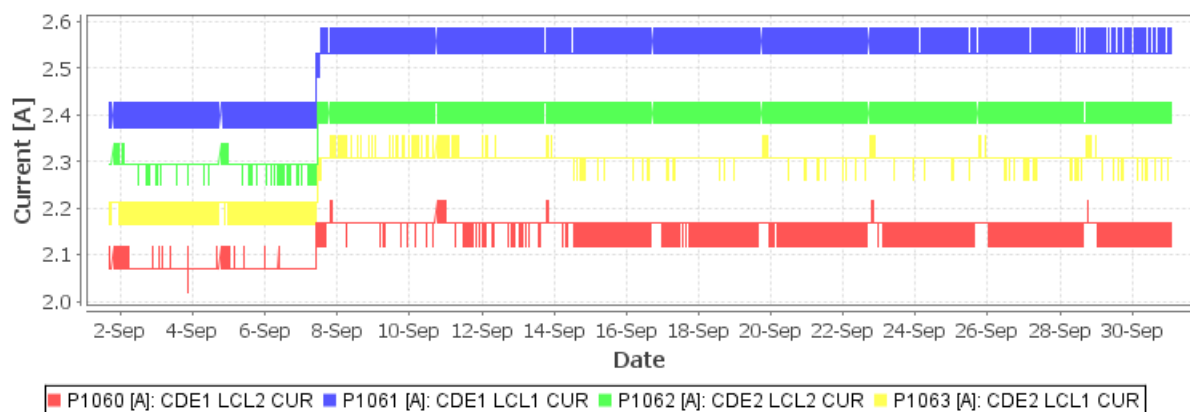


Figure 14: SPI CDE LCL current

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.

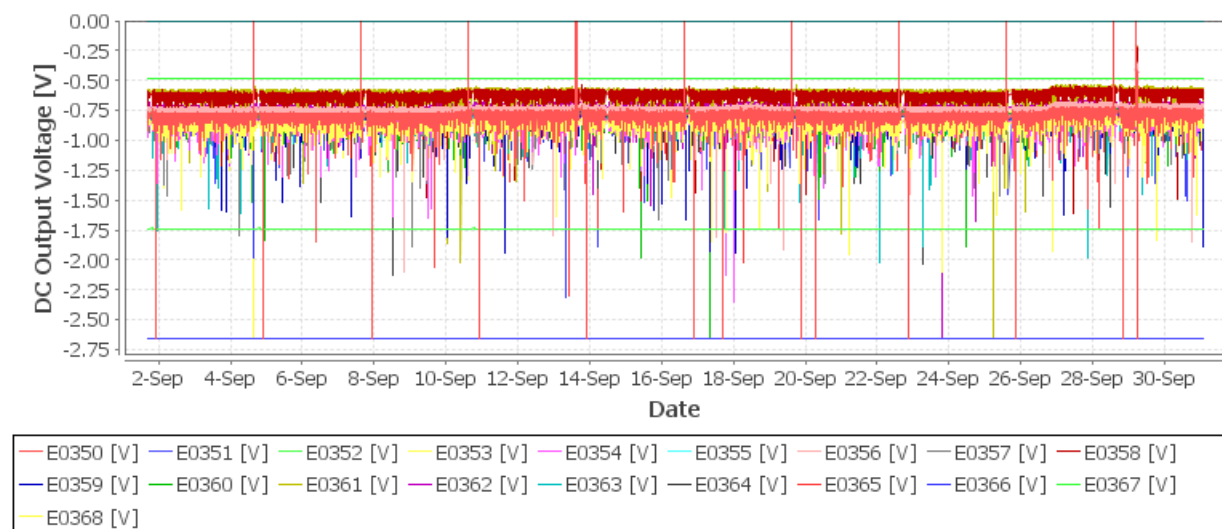


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.

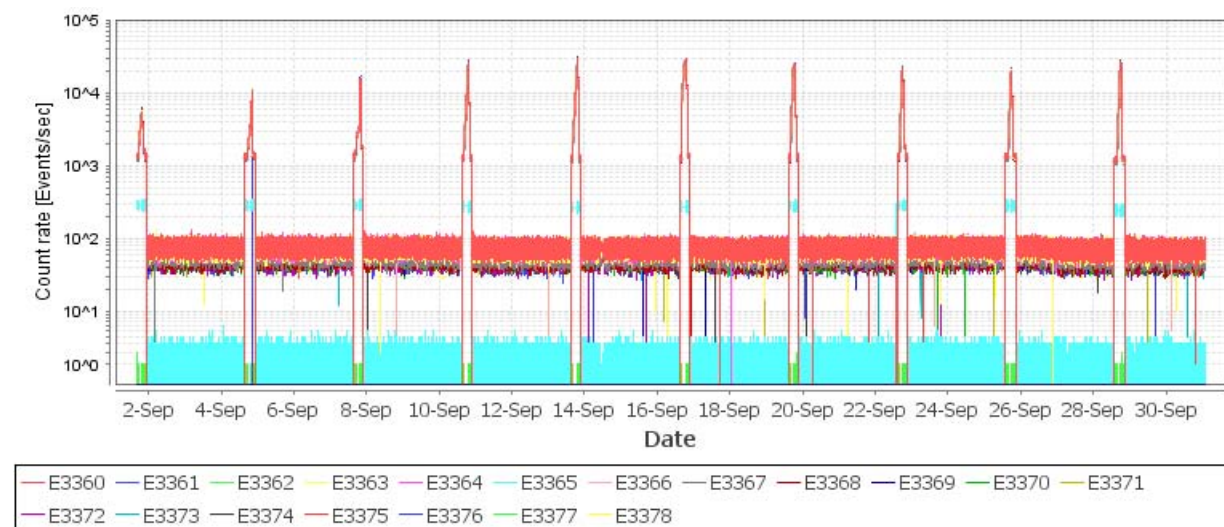


Figure 16: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic.



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

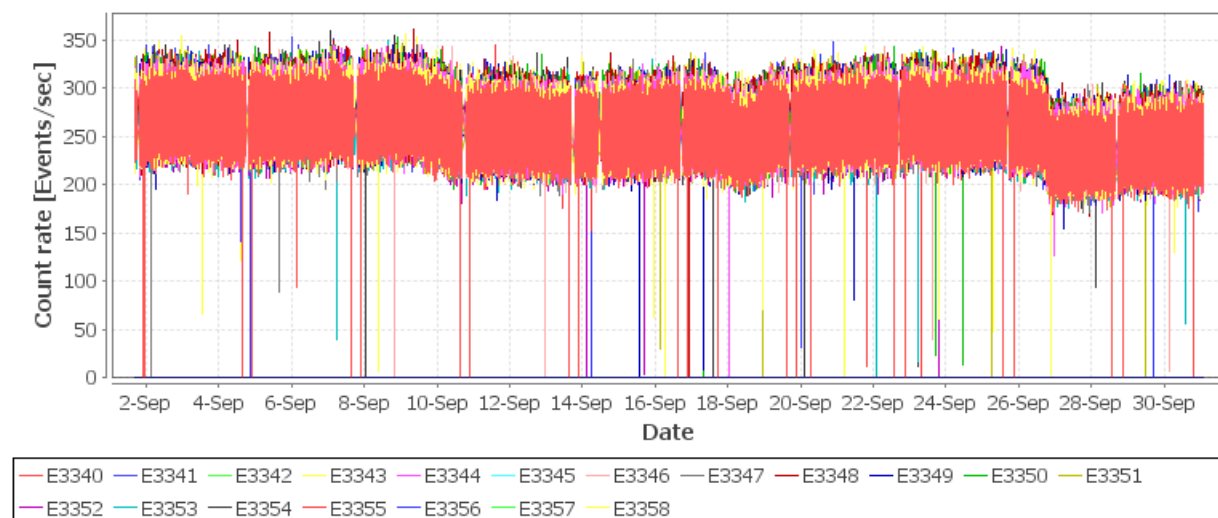


Figure 18: SPI GeD Time Tagged Saturated count rates

PSD

The health of the PSD is nominal. The following plot shows the PSD channel rates over the reporting period. On 29-09-2011 a SPI PSD malfunction occurred. A PSD reset resolved the issue.

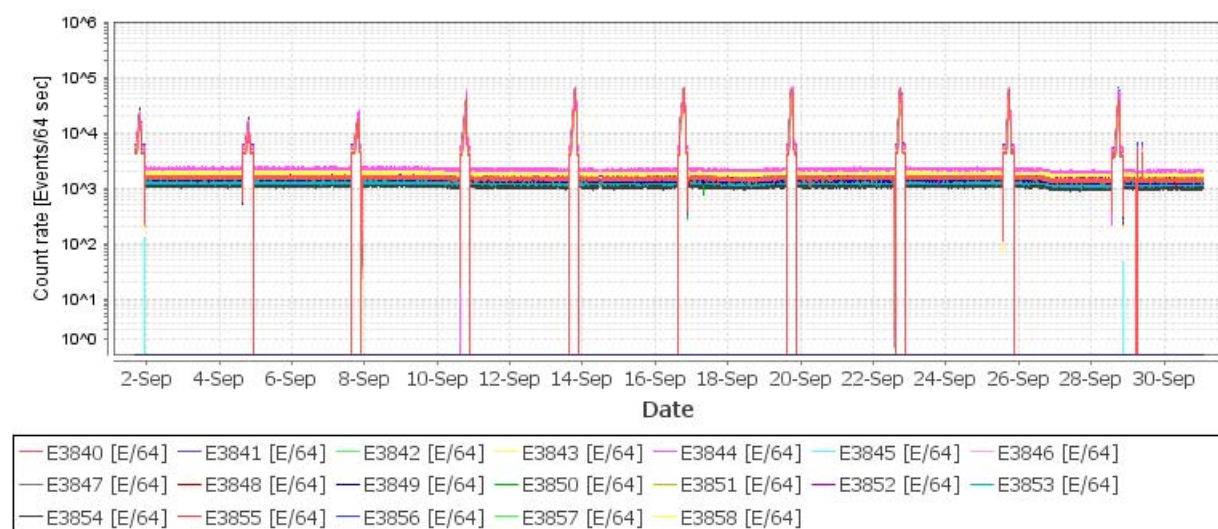


Figure 19: SPI PSD GeD Channel rates

6.2.2 Event Log

01-09-2011 (Day of Year 244, Revolution 1084)

At 15.01Z OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. As it was a single occurrence, no action was required. SPI operations continued nominally.

07-09-2011 (Day of Year 250, Revolution 1068)

Science operations were interrupted by a solar flare. TM: E3500 OOL HIGH HIGH with value 126445 at 00:43Z. E3500 was back within limits at 06:24Z. SPI was unaffected by this flare.

07-09-2011 (Day of Year 250, Revolution 1068)

FCP_SPI1_2504 was executed to increase the stroke of all four compressors from 40 to 41 at a coldplate temperature of 80.5K (agreed with PI). SPI operations continued nominally.

16-09-2011 (Day of Year 259, Revolution 1089)

At 13.53Z OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. As it was a single occurrence, no action was required. SPI operations continued nominally.

29-09-2011 (Day of Year 272, Revolution 1094)

At 03:06Z a SPI PSD malfunction occurred. It was different than all the other PSD channel rate malfunctions occurred so far. TM parameter E0795 (PSD acknack check) went OOL (status). This was followed by following OEMs:

- OEM: SPI1 FAILURE In ANALYSING HSL DATA (6x; EvID242)
- OEM: EvID SPI1 LSL ERROR (5x; EvID145)
- OEM: SPI MODE CHANGE (EvID128) @ 03.06.21

The last OEM indicates that an autonomous transition to standby2 had been performed.

The transition to standby2 lead to numerous OOL:

- TM: P2014 (SPI ACS-A LCL Current) OOL H/L with value 1.28A (03:06.59)
- TM: E2134-E2141 (Rate meter of FEE 1 to 8 in group MSB+LSB) OOL H/L with value 0 (03:07.01)
- TM: E3824-2831 (PSD voltages & temperatures) OOL H/L and H/H with value 0 for the voltages and >360degC for temp
- TM: E0350 family (GeD DC Output Voltage) & ED0250D family OOL H/H with value 0 (03:10)
- TM: P2016 (LCL CUR PSD A) OOL S/L with value 0.31 (03:10) ED0250D-0268D (DET 00 to 18 CHECK M) (03:10) OOL H/H with value 3kV for all detectors but the failed ones (value 0.5kV)

The recovery consisted of the following actions:

- 1) Following Xref for E0795
 - Wait 5 minutes → OOL is persistent
 - Transition to conf mode → TC reject (was not part of the XRef but advised by on call SOE)
 - Perform SPI PSD RESET (CRP SPI1 3030) according to the Xref for TM parameter E0795.
 - This eliminated all OOLs but the OOL on TM parameter E3944 (automatic reconfiguration capability).
- 2) Following Xref for E3944: only last step (TPF uplink: FCP SPI1 1700) has been executed, since the rest is identical with the PSD reset that just had been performed:
 - FCP SPI1 0160: Mode transition to required configuration: Photon -> Conf
 - FCP SPI1 1700: SPI LOAD/REPORT IASW CONFIG PARAMETERS
 - FCP SPI1 0130: SPI MODE transition from conf to Photon
 - informed ISDC

After the SPI PSD reset & the configuration of the IASW parameters SPI operations continued nominally.

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:

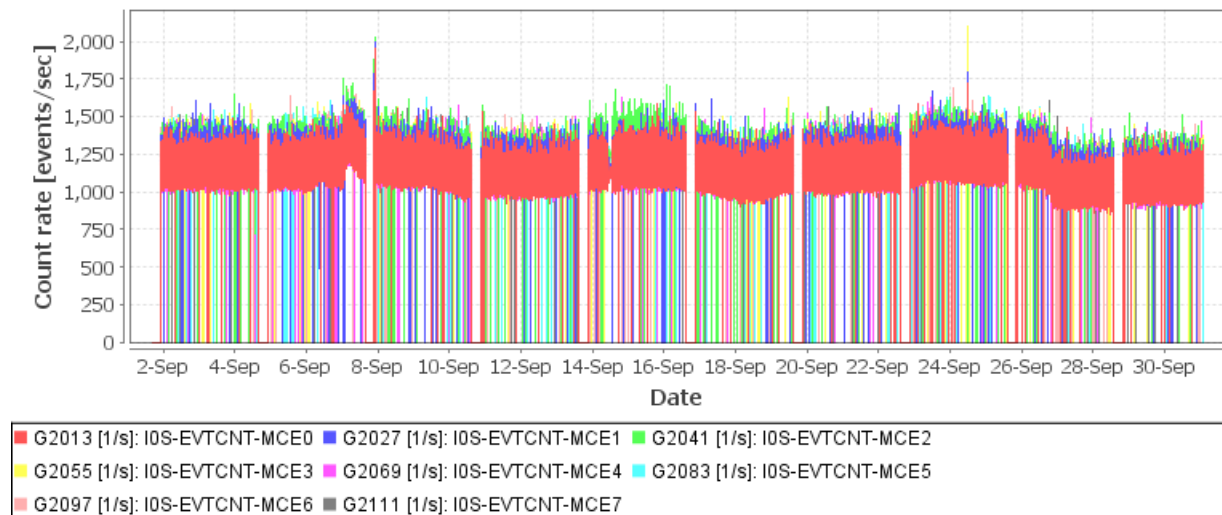


Figure 20: ISGRI MCE Counters

PICsIT

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



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

VETO

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

6.3.2 Event Log

01-09-2011 (Day of Year 244, Revolution 1084)

At 06:15Z the parameter G2098 (overflow of the noisy pixel address register in MCEi) failed status consistency check. IBIS operations continued nominally.

09-09-2011 (Day of Year 252, Revolution 1087)

At 17:43Z, a local reset of the IREM CSCI S/W (SEU #115) was observed. The IREM reset forced IBIS to automatically enter Safe configuration inducing following OEMS:

2011.252.17.43.15.917 IBIS1 IASW VETO SWITCH OFF PERFORMED DUE TO AUTOMATISM

2011.252.17.43.15.523 IBIS1 IASW EMERGENCY SWITCH OFF PERFORMED (GOTO STANDBY

IBIS recovery was completed by 2011-09-09 at 18:15Z and IBIS operations continued nominally.

09-09-2011 (Day of Year 252, Revolution 1087)

At 18:18Z Parameter X7500 (IBIS HIST DWN LD) was OOL STATS with value FALSE. Since a CCCF reconfiguration was foreseen in the next 30 minutes, CCCF was enabled in the automatic timeline. IBIS operations continued nominally.

10-09-2011 (Day of Year 253, Revolution 1087)

At 18:03Z FCP_IBIS1_0401 had been executed. This was done in order to uplink the ISGRI CTX Tables with the tables from the previous revolution since there were only four tables available for the current revolution.

10-09-2011 and 19-09-2011 (Day of Year 253 and 262, Revolution 1088 and 1091)

OEM: "IBIS1 PICSIT NOISY SEMIMODULE..." occurred on 10-09-2011 at 17.52Z and on 19-09-2011 at 17.20Z. Since IASW was in stand by and the S/C inside the radiation belts, no action was required. IBIS operations continued nominally.

17-09-2011 (Day of Year 260, Revolution 1090)

On 2011.260.13.32.57.989 OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED was received indicating that HEPI resynchronised autonomously after the parameter of the families G5002, G5068 and G5072 had been OOL for a few cycles. No action had to be taken. IBIS operations continued nominally.

18-09-2011 (Day of Year 261, Revolution 1090)

At 11:22Z Parameter X7500 (IBIS HIST DWN LD) was OOL STATS with value FALSE for less than one minute. No action had to be taken. IBIS operations continued nominally.

26-09-2011 (Day of Year 269, Revolution 1093)

On 2011.269.08.07.31.450 OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED was received indicating that HEPI re-synchronised autonomously after the parameter of the families G5002, G5003, G5068 and G5072 had been OOL for a few cycles. No action had to be taken. 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.

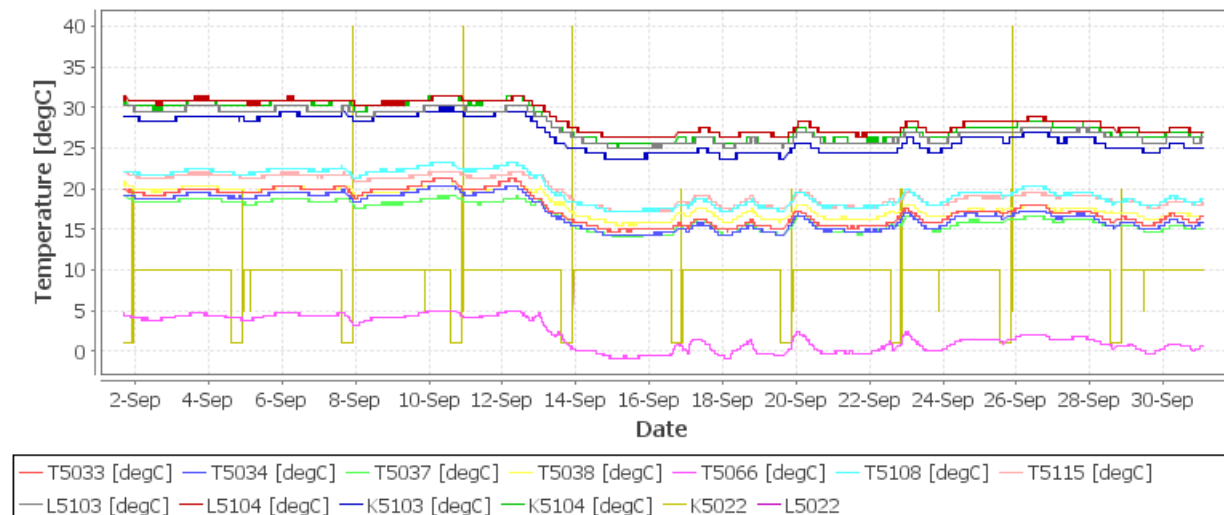


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

04-09-2011 (Day of Year 247, Revolution 1085)

At 12:58:19 JEMX-1 & 2 TCs K0021, L0021, KU0014, LU0014 all failed completion, the units however nominally went to SAFE, there was no impact.

06-09-2011 (Day of Year 249, Revolution 1086)

At 22:19:00 JEMX-1 & 2 TM parameters K/L5136 BUFFER LOSS went out-of-limit for about 1 minute. There was no impact.

09-09-2011 (Day of Year 252, Revolution 1087)

At 17:43:22 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#115). There was no impact as the reaction has been disabled.

25-09-2011 (Day of Year 268, Revolution 1087)

At 20:00:00 The TC L0021 'SW READ INT' failed its CEV "uncertain failed (N)". The Command was released from the timeline at 19:11Z as part of JEM_X2 activation sequence LEDATA02, which was successfully completed at 19:12. No action was taken and there was no impact.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log**05-09-2011 (Day of Year 248, Revolution 1086)**

At 01:26:44, after the CCCFs (which were enabled after an IREM SEU during the perigee passage) were sent, OMC returned to stand-by prematurely. The pointing commands were then manually resent. The impact was pointing 10860007 was cut short from a planned 3334 to 2816 seconds.

08-09-2011 (Day of Year 251, Revolution 1087)

At 02:06:45, a drop in TM from the ground station forced an interruption in operations. At 02:29:00, after the TM link was restored, a recovery was performed, and the timeline rejoined at 02:53. The impact was the loss of pointing 10870008. It was at this time that the following pair of commands was rejected:

2011.251.02.07.37.755	2011.251.02.07.40.908	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	
2011.251.02.07.43.755	2011.251.02.07.48.283	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	

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

09-09-2011 (Day of Year 252, Revolution 1087)

At 17:43:16, an IREM SEU (#115) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 17:54:12. The impact was 10870048 was cut short from a planned 3334 to 2528 seconds.

14-09-2011 (Day of Year 257, Revolution 1089)

At 04:45, a FD problem forced a suspension of the timeline. After a recovery, the timeline was rejoined at 05:30. The impact was the loss of pointing 10890017. It was at this time that the following pair of commands was rejected:

2011.257.05.19.23.957	2011.257.05.19.33.291	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	
2011.257.05.19.29.832	2011.257.05.19.33.339	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	

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

15-09-2011 (Day of Year 258, Revolution 1089)

At 16:51:06, an AOCs problem interrupted the timeline. A recovery was performed and the timeline rejoined at 17:20. The impact was the loss of pointing 10890071. It was at this time that the following pair of commands was rejected:

2011.258.16.54.20.032	2011.258.16.54.32.454	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	
2011.258.16.54.26.032	2011.258.16.54.32.519	1792	RealTime	131	TC REJECT	REJECTED
TC1		0	0	65535 PR	N E E	

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

17-09-2011 (Day of Year 260, Revolution 1090)

At 20:50, the start guide star command failed. After a recovery, the timeline was rejoined at 21:34. The impact was the loss of pointing 10900050. It was at this time that the following pair of commands was rejected:

2011.260.20.53.35.021	2011.260.20.53.40.736	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E
2011.260.20.53.41.022	2011.260.20.53.52.546	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E

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

23-09-2011 (Day of Year 266, Revolution 1092)

At 16:24:29, due to high radiation, (Proton count), OMC went to SAFE mode. At 17:06:03, after waiting to see if further spikes came, the unit was returned to standby, and then back to NORMAL mode by manually sending the OMC pointing commands. The impact was pointings 10920042 and 10920043 were both cut short from a planned 1800 to 257 and 921 seconds respectively.

At 22:05:17, due to high radiation, (Proton count), OMC went to SAFE mode.

2011.266.22.05.17.091	2011.266.22.05.25.649	1792	RealTime	231	EVENT	TO SAFE
0 0 65535	PR N E E					

The impact was pointing 10920052 was cut short from a planned 1800 to 1449 seconds, and pointing 10920054 was lost. It was at this time that the following pair of commands was rejected:

2011.266.23.35.09.219	2011.266.23.35.17.294	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E
2011.266.23.35.15.219	2011.266.23.35.17.397	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 10920054.

26-09-2011 (Day of Year 269, Revolution 1093)

At 08.32.05, high radiation forced OMC into SAFE mode. After waiting for the radiation to die away, the instrument was recovered at 11.40.24. The impact was that pointing 10930015 was cut short from a planned 3479 to 1832 seconds, and pointings 10930016, 10930017 & 10930018 were lost. It was at this time that the following pair of commands was rejected:

2011.269.08.59.56.593	2011.269.09.00.08.797	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E
2011.269.09.00.01.843	2011.269.09.00.08.853	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 10930016.

29-09-2011 (Day of Year 272, Revolution 1094)

At 09:34:21, was sent to Stand-by mode by the CCCF activation performed as part of the recovery of a SPI problem earlier that morning. The impact was pointing 10940030 was cut short from a planned 1800 to 312 seconds.

At 15:03, an AOCS problem forced an interruption to operations. A recovery was performed, and the timeline rejoined at 15:46. The impact was the loss of pointing 10940041. It was at this time that the following pair of commands was rejected:

2011.272.15.06.16.886 TC1	2011.272.15.06.24.757	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.272.15.06.23.011 TC1	2011.272.15.06.30.673	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.

At 23:36, an AOCS problem forced an interruption to operations. A recovery was performed, and the timeline rejoined at 00:12 the following morning. The impact was the loss of pointing 10940057. It was at this time that the following pair of commands was rejected:

2011.272.23.39.17.905 TC1	2011.272.23.39.26.866	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.272.23.39.24.780 TC1	2011.272.23.39.33.989	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.

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.

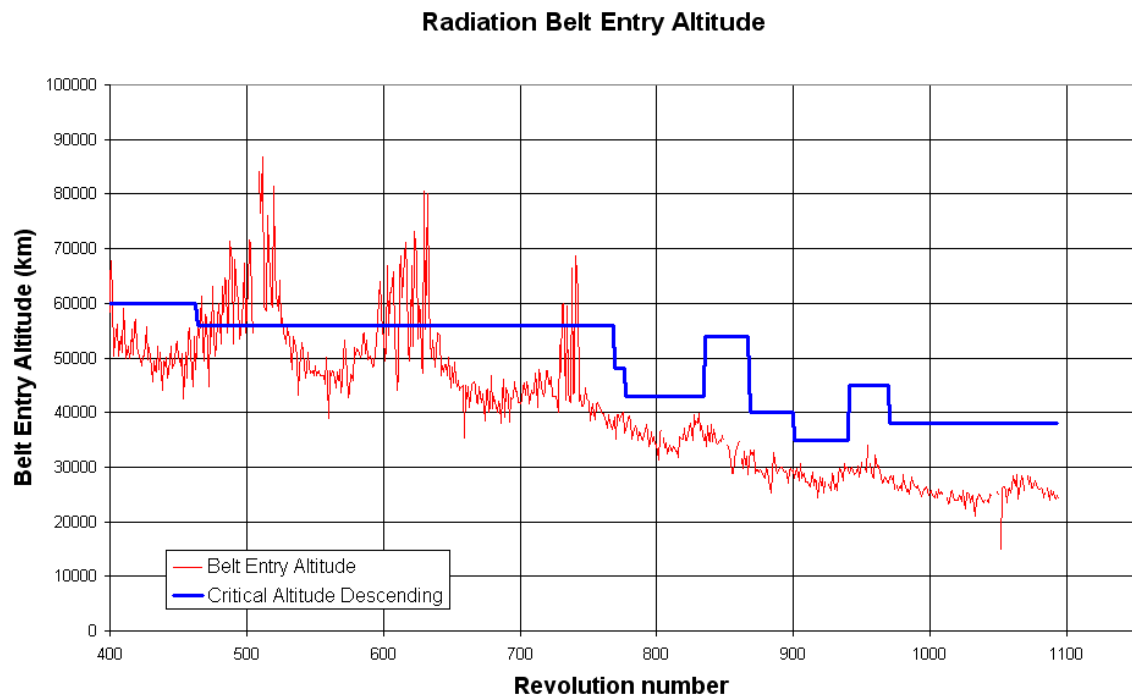


Figure 23: Radiation belt entry

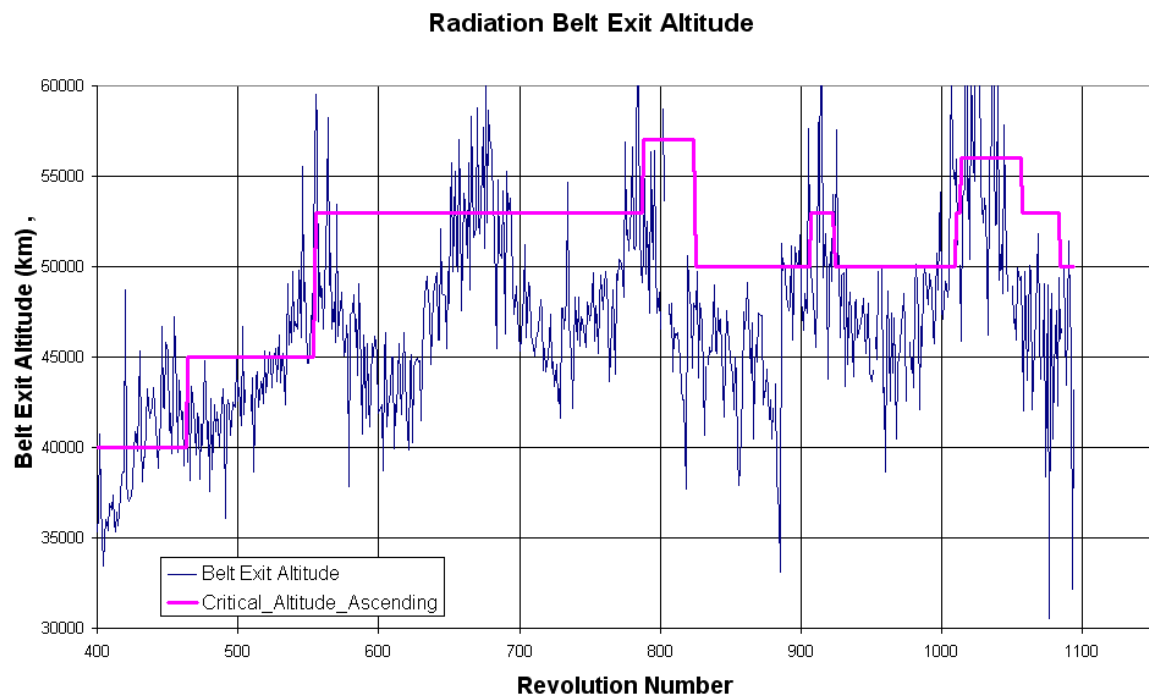


Figure 24: Radiation belt exit

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
1084	RAD_ENTR R 2011-09-01T13:48:09Z	01/09/2011 15:14:19	20710.9	01-Sep-2011 15:25:43	16854.56	01-Sep-2011 15:55:43	9364.397
1085	RAD_EXIT R 2011-09-01T20:27:45Z	01/09/2011 19:30:11	>>28985.7	01-Sep-2011 20:15:43	48250.19	01-Sep-2011 16:35:43	3229.68
1085	RAD_ENTR R 2011-09-04T13:36:51Z	04/09/2011 15:05:15	18562.4	04-Sep-2011 15:07:02	18497.82	04-Sep-2011 15:47:02	8586.308
1086	RAD_EXIT R 2011-09-04T20:16:32Z	N/A	N/A	04-Sep-2011 20:07:02	48753.46	04-Sep-2011 16:17:02	3237.656
1086	RAD_ENTR R 2011-09-07T13:23:37Z	07/09/2011 14:45:47	21040.9	07-Sep-2011 14:56:37	18037.02	07-Sep-2011 15:36:37	8154.631
1087	RAD_EXIT R 2011-09-07T20:03:39Z	07/09/2011 19:38:51	>>28956.0	07-Sep-2011 19:56:37	49011.71	07-Sep-2011 16:06:37	3242.208
1087	RAD_ENTR R 2011-09-10T13:09:14Z	10/09/2011 14:42:11	18983.4	10-Sep-2011 14:46:54	16875.56	10-Sep-2011 15:16:54	9407.498
1088	RAD_EXIT R 2011-09-10T19:49:08Z	10/09/2011 18:42:03	>>28962.6	10-Sep-2011 19:36:54	48189.85	10-Sep-2011 15:56:54	3274.311
1088	RAD_ENTR R 2011-09-13T12:55:30Z	13/09/2011 14:17:39	21158.9	13-Sep-2011 14:30:10	17446.4	13-Sep-2011 15:10:10	7477.954
1089	RAD_EXIT R 2011-09-13T19:34:46Z	13/09/2011 18:40:59	41652.1	13-Sep-2011 19:20:10	47904.95	13-Sep-2011 15:40:10	3086.671
1089	RAD_ENTR R 2011-09-16T12:42:53Z	16/09/2011 14:12:36	19025.8	16-Sep-2011 14:11:44	18843.95	16-Sep-2011 14:51:44	8875.278
1090	RAD_EXIT R 2011-09-16T19:21:45Z	16/09/2011 18:56:12	45824.0	16-Sep-2011 19:11:44	48640.06	16-Sep-2011 15:31:44	3252.422
1090	RAD_ENTR R 2011-09-	19/09/2011 13:55:48	21276.1	19-Sep-2011 14:07:15	16811.83	19-Sep-2011 14:37:15	9300.943

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
	19T12:29:13Z						
1091	RAD_EXIT R 2011-09-19T19:08:13Z	19/09/2011 18:16:36	>>29023.3	19-Sep-2011 18:57:15	48324.95	19-Sep-2011 15:17:15	3195.618
1091	RAD_ENTR R 2011-09-22T12:14:55Z	22/09/2011 13:45:48	19372.0	22-Sep-2011 13:50:22	17630.64	22-Sep-2011 14:30:22	7650.607
1092	RAD_EXIT R 2011-09-22T18:53:47Z	22/09/2011 18:04:28	>>29033.3	22-Sep-2011 18:50:22	49452.01	22-Sep-2011 15:00:22	3062.12
1092	RAD_ENTR R 2011-09-25T12:02:02Z	25/09/2011 11:47:24	39947.2	25-Sep-2011 13:37:17	17154.46	25-Sep-2011 14:17:17	7097.927
1093	RAD_EXIT R 2011-09-25T18:40:06Z	25/09/2011 17:34:36	>>29087.6	25-Sep-2011 18:27:17	48248.14	25-Sep-2011 14:47:17	2972.672
1093	RAD_ENTR R 2011-09-28T11:51:13Z	28/09/2011 13:16:44	21190.1	28-Sep-2011 13:25:23	17431.22	28-Sep-2011 14:05:23	7318.068
1094	RAD_EXIT R 2011-09-28T18:28:33Z	28/09/2011 17:20:28	>>29138.0	28-Sep-2011 18:15:23	48142.92	28-Sep-2011 14:35:23	2853.715

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

04-09-2011 (Day of Year 247, Revolution 1086)

At 17:32:19Z, at AOS, a local reset of the IREM CSCI S/W (SEU #114) 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 2011.247.17:32:19Z (17705.8 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex);

5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of 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 20:27:00Z.

There was no impact on the other instruments as the anomaly occurred during the perigee passage, when the instruments are anyway in SAFE mode.

09-09-2011 (Day of Year 252, Revolution 1087)

At 17:43:15Z, a local reset of the IREM CSCI S/W (SEU #115) occurred. 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 2011.252.17:43:15Z (143376.4 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 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 19:50:00Z.

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 17:55:00Z and IBIS at 18:15:00Z.