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

INTEGRAL
Mission report

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

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Routine Phase

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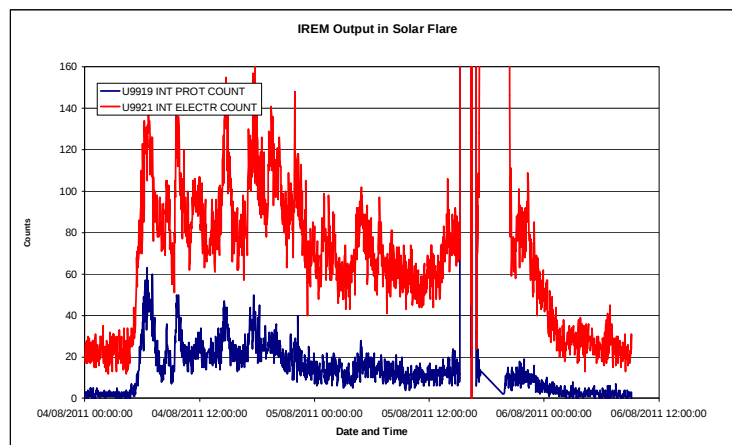
1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC. Nominal science operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

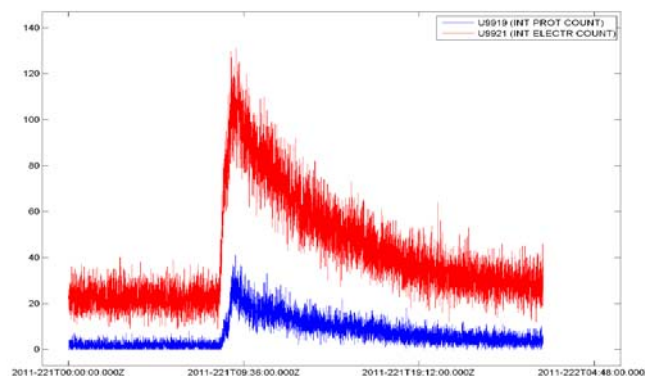
This report addresses the activities from August and covers the revolutions 1074 until 1084 (included). The targets of these revolutions can be found on the ISOC web: <http://integral.esac.esa.int/isocweb/schedule.html?action=intro>.

Summary of the main activities during the reporting period

- Nominal science operations
- Science operations were interrupted by a solar flare on 04/08/2011 (DoY 216): Due to a solar flare, OMC, IBIS, JEMX-1 & 2 were all forced to safe mode (OMC autonomously from on-board) for a total of about 45 hours. SPI, the star tracker and AOCS operations were proceeding normally. The IREM counts are given in the figure below.



- Science operations were interrupted by a solar flare on 09/08/2011 (DoY 221): Due to a solar flare, OMC, JEMX-1 & 2 were all forced to safe mode (OMC autonomously from on-board) for a total of about 12 hours. SPI, IBIS, the star tracker and AOCS operations were proceeding normally. The IREM counts are given in the figure below.



- Eclipse season #19 (27/06/2011 until 17/08/2011; the last eclipse was a penumbra one with the ECL sequence having triggered)
- Reconfiguration to sunlight after eclipse season (18/08/2011)
- Blemish Pixel survey (24/08/2011)

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- Increased fuel consumption since January under investigation

Summary of the overall status and performance of the ground segment

- Ongoing occasional RFI at Redu, source unknown

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

16 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.6933 Kg. The remaining propellant is in the order of 117.8667 Kg.

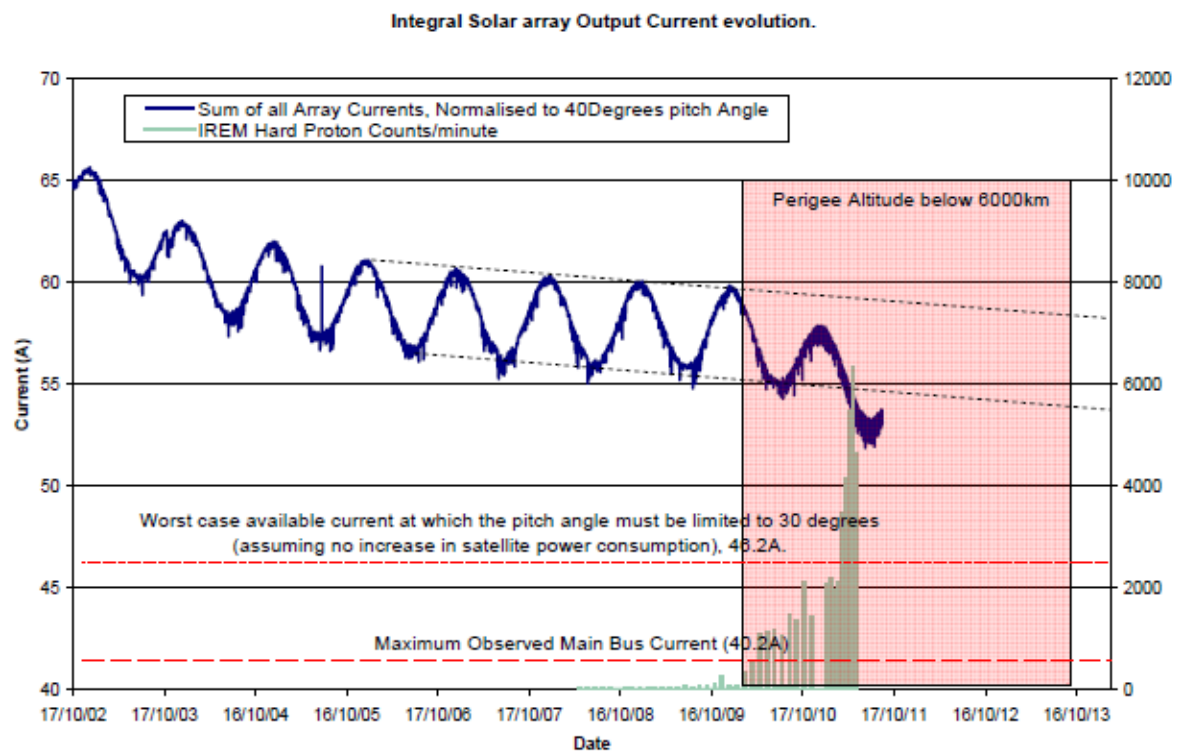
Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix 6.1.

2.1.2 Power

All units of the EPS are working nominally.

The 19th eclipse season finished on 18/8/2010, from the EPS point of view the eclipse season operations were absolutely nominal. The maximum eclipse duration was 48minutes resulting in a battery depth of discharge of about 4.7Ah, compared to a nominal battery capacity of 24Ah. The next eclipse season will start on 24/12/2011.

The perigee altitude continues to fall; the minimum height of about 2750km will be reached on 25/10/2011. The plot below shows the evolution of the worst case (40degrees pitch angle) array output power with respect to Satellite power consumption and the increased (hard) Proton radiation exposure at perigee.



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 16/04/2010, 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 eclipse season started on 27/06/2011 and lasted until 17/08/2011. Eclipse operations for SPI are progressing nominally.

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. The average telemetry occupation was 75.4 packets/cycle.

The following plot shows the SPI TM allocation and utilisation during the reporting period. The solar flare on 04/08/2011 and on 09/08/2011 results in a rise of the TM bandwidth utilisation.

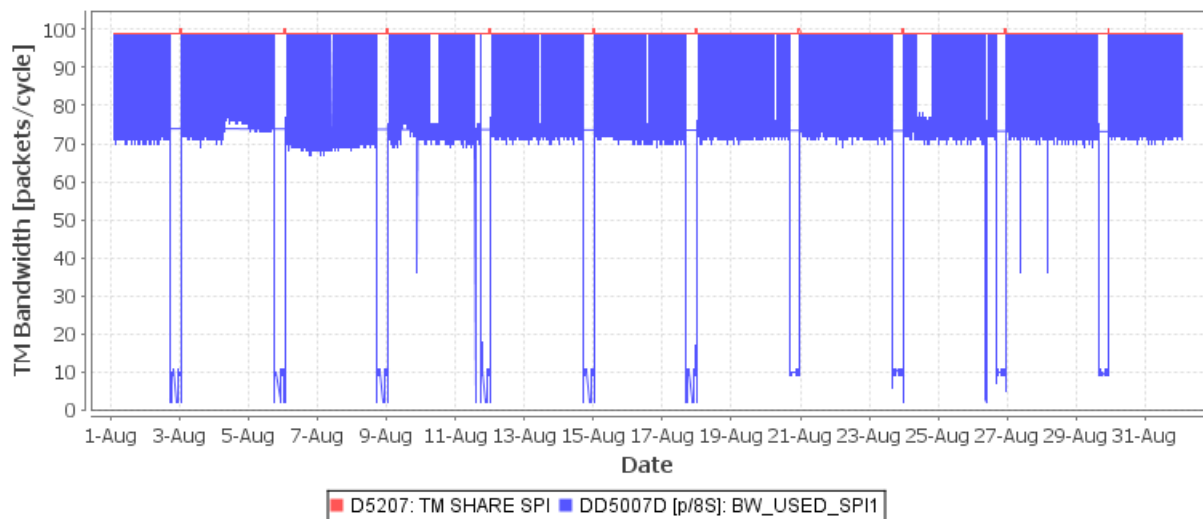


Figure 1: SPI TM bandwidth utilisation

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

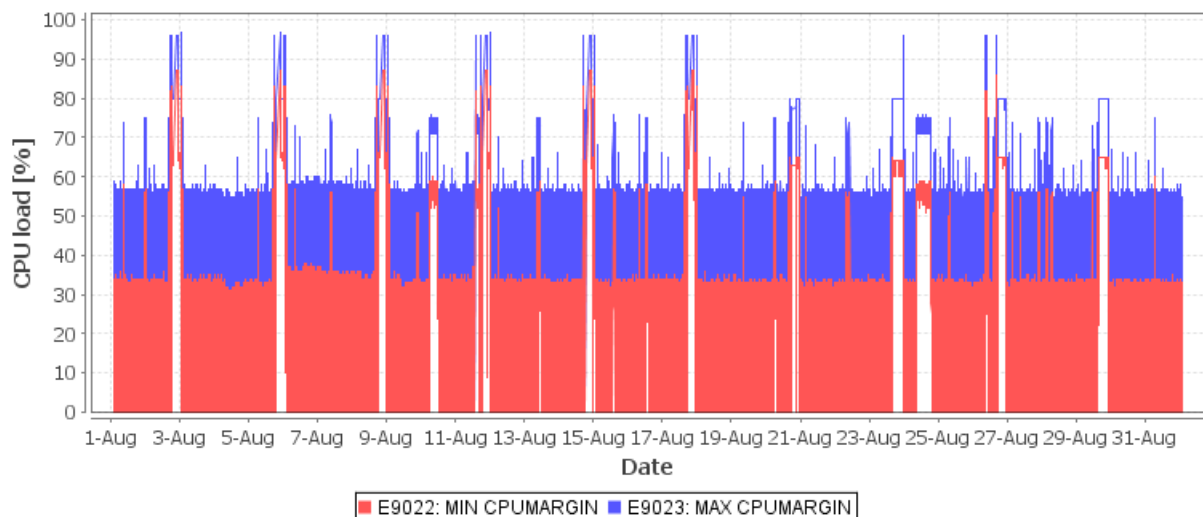


Figure 2: SPI IASW Performance

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

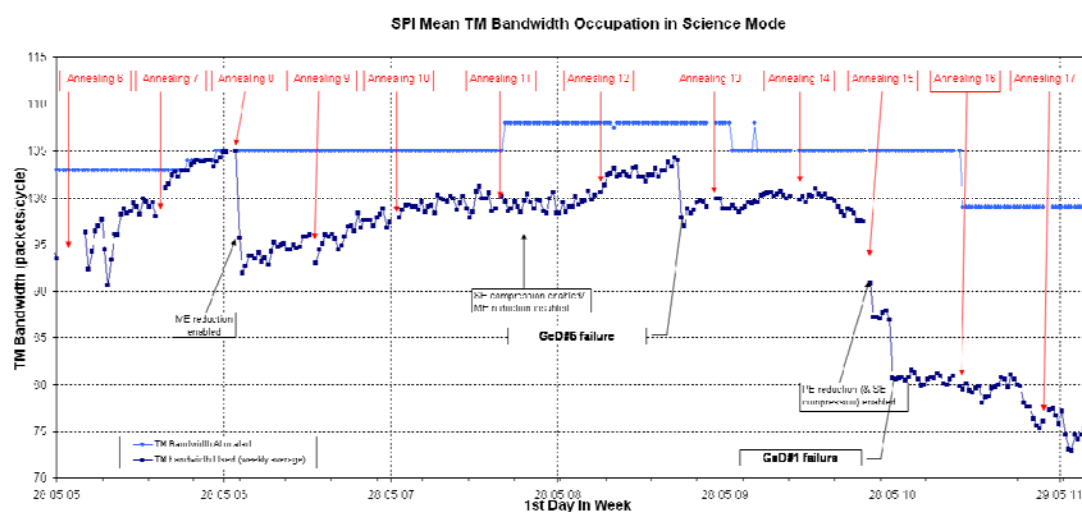


Figure 3: SPI TM bandwidth usage evolution since May 2005

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

2.2.2 IBIS

The overall status of IBIS is nominal. The eclipse season started on 27/06/2011 and lasted until 17/08/2011. 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
- IBIS mean bandwidth utilisation in science mode: 107.91 packets/cycle

The following plot shows the IBIS TM allocation and utilisation during the reporting period. The solar flare on 04/08/2011 and on 09/08/2011 results in a rise of the TM bandwidth utilisation.

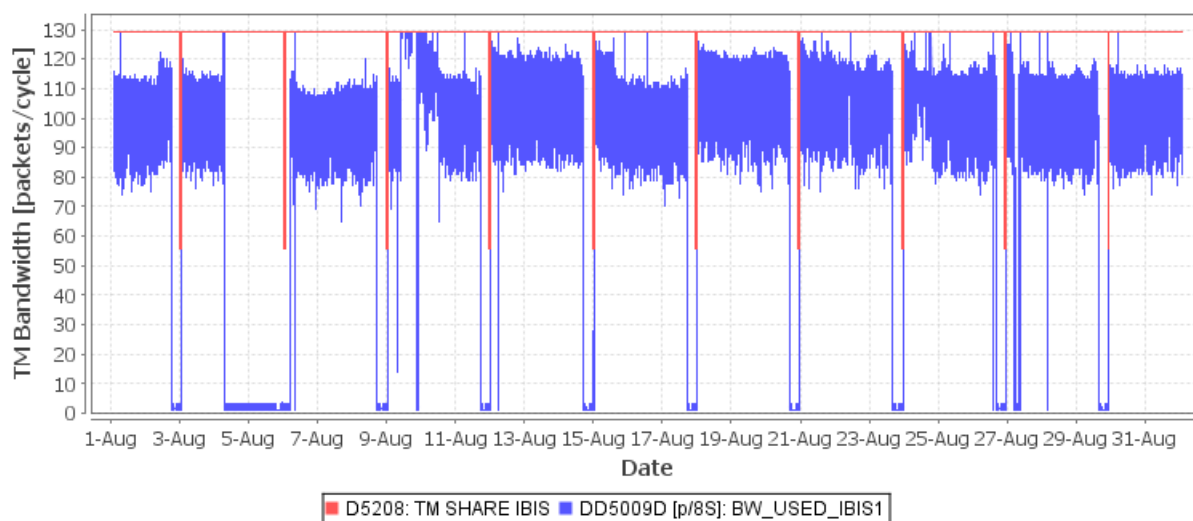


Figure 4: IBIS TM bandwidth utilisation

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

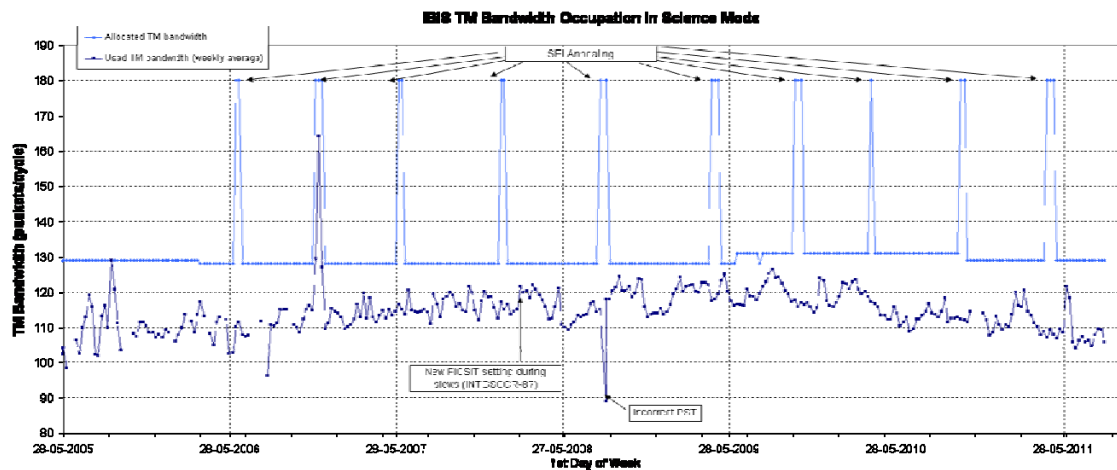


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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.

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

2.2.4 OMC

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle.

During this reporting period, 659 of the 723 planned science pointings were executed nominally. 1 pointing was interrupted, and 47 lost to high radiation. 6 pointings were lost and 1 executed at an incorrect attitude due to problems with the AOCS. 2 pointings were lost to an FD problem. 1 pointing was lost and another cut short by lost guide stars. 1 pointing was lost and 1 interrupted due to an IREM crash. 1 pointing was interrupted when the CCCFs were activated. Finally, 2 pointings were lost due to a bit-lock problem. No Flat-field calibrations were 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 217 (05/08/2011), the 112th IREM SEU occurred

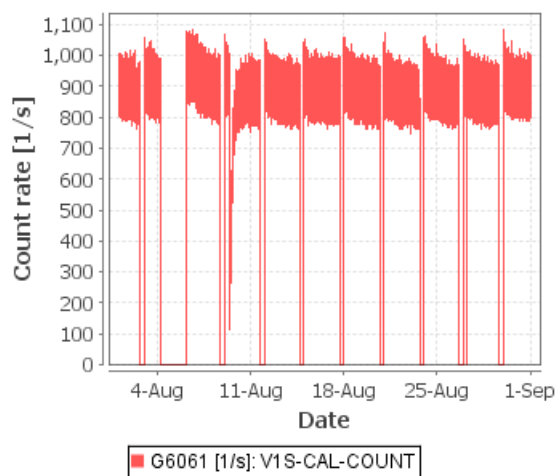
On DoY 239 (27/08/2011), the 113th IREM SEU occurred

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

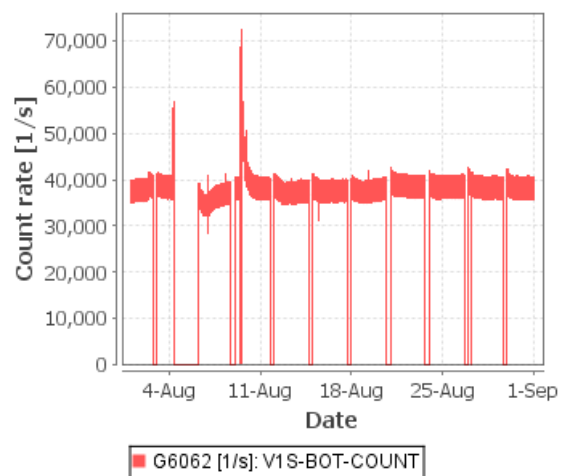
Radiation background

The background radiation level as measured by the instrument counters was low during the reporting period, except from the 4th to the 6th August, and again on the 9th August, when solar flares caused the background radiation to rise forcing OMC, JEMX and IBIS to Safe mode. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:

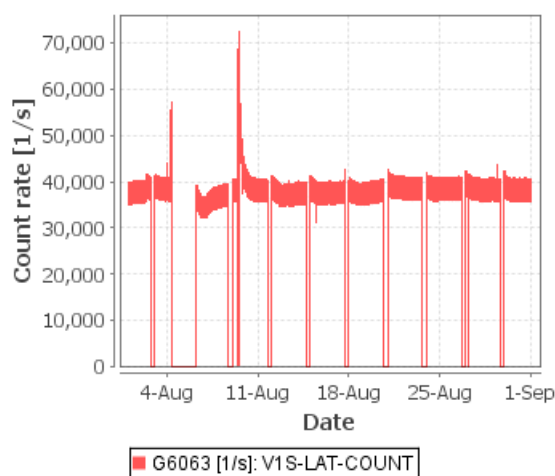
VETO Calibration Source Count Rate



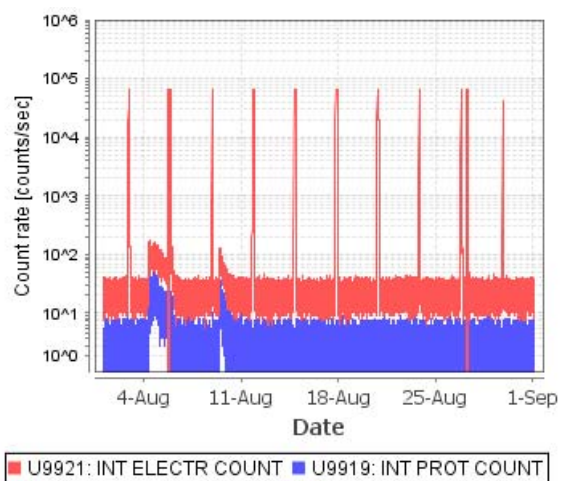
VETO Bottom Count Rate



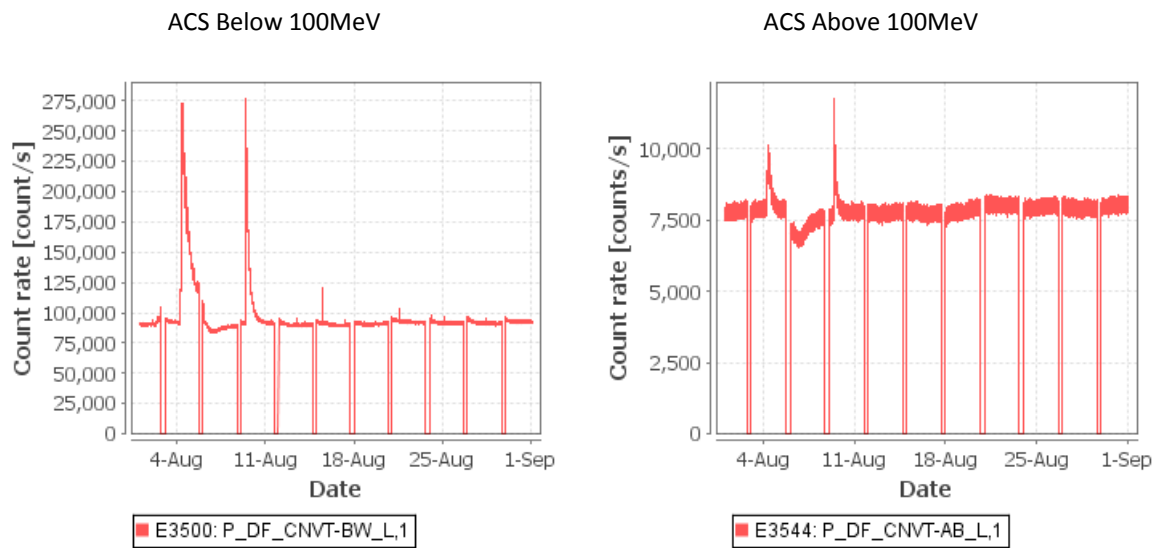
VETO Lateral Count Rate



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

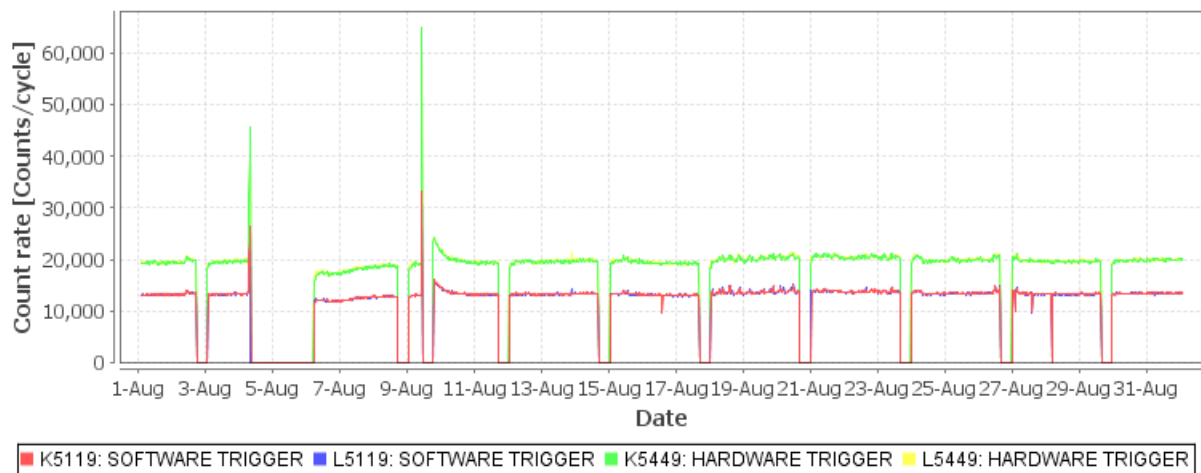


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

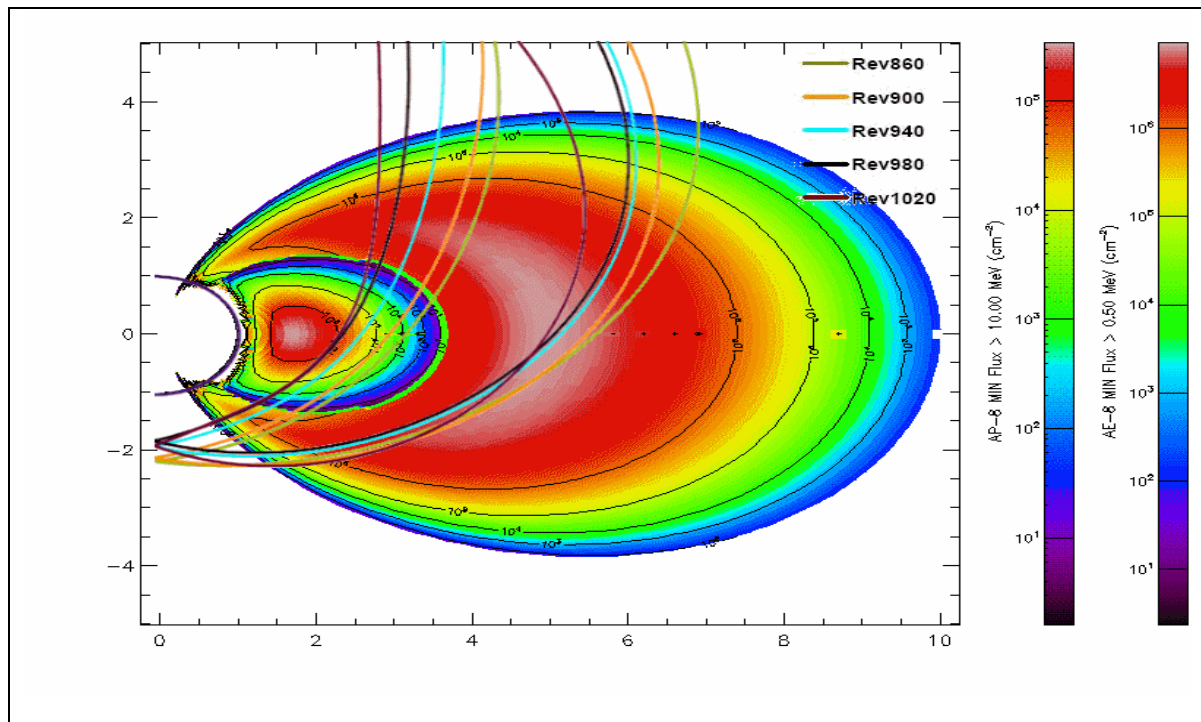


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

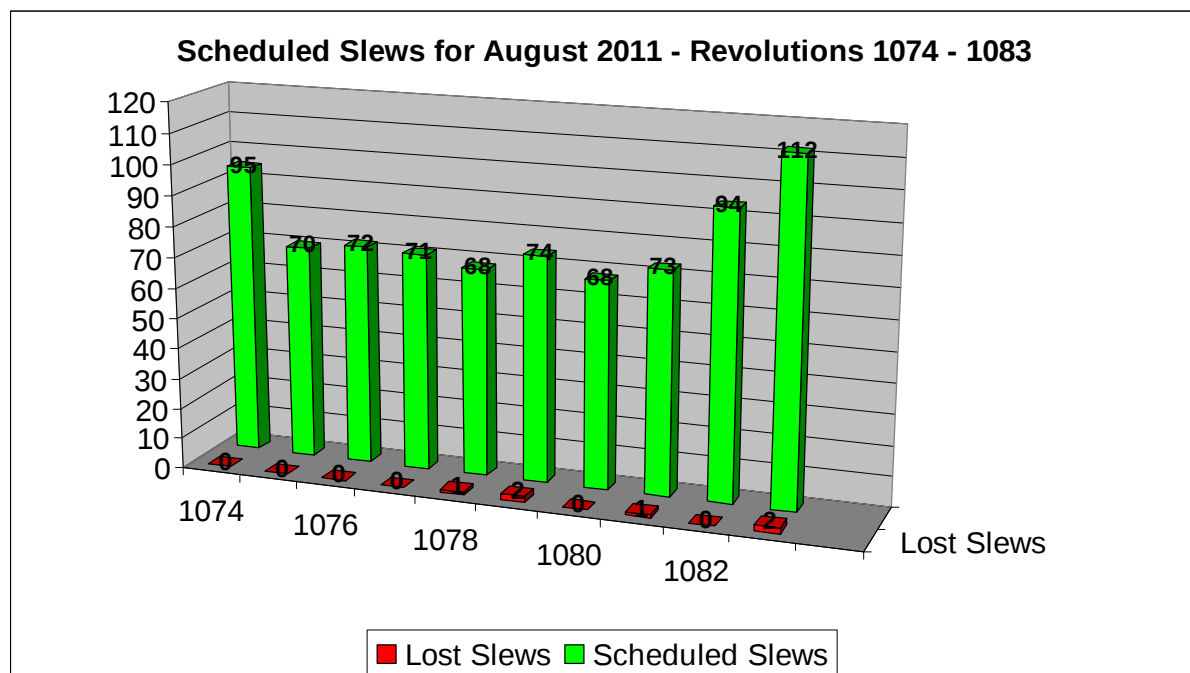


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY 217 TMTCS1 had problems accessing the CLCW information from the TPS - TMTCS2 was used instead. It was agreed to reboot TMTCS1 during the next perigee.

On DOY 219 the PSRV fastchild on idda was using a high amount of CPU and was restarted.

On DOY 220 during perigee TMTCS1 was rebooted - however it did not come back up again and did not react to any inputs. It was eventually powered-off and on again.

On DOY 226 at AOS no bitlock was achieved, ECC performed a resweep and moved to TMTCS2.

On DOY 234 the TM desktop on sun122 lost connection to the CPD TM and couldn't reconnect. sun121 showed the same problem. Operations were moved to B-chain.

While moving, the OMCH and MULTIPLEXER crashed on imcb and had to be restarted. Once routine operations were resumed, imca was restarted.

On DOY 238 the Verifier lost connection to the CPD TM causing one command to be unverified. No further impact.

On DOY 240 during various problems seen on AGC levels (probable RFI) the multiplexer crashed and was successfully restarted, later on (still during AGC problems)

the verifier crashed and was also restarted successfully.

On DOY 241 the OMCH task on imcb died at AOS 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.

5 TM drops and 1 data gap were identified from REDU and 1 TM drop from VIL2. Bad frames were received from REDU on 9 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.

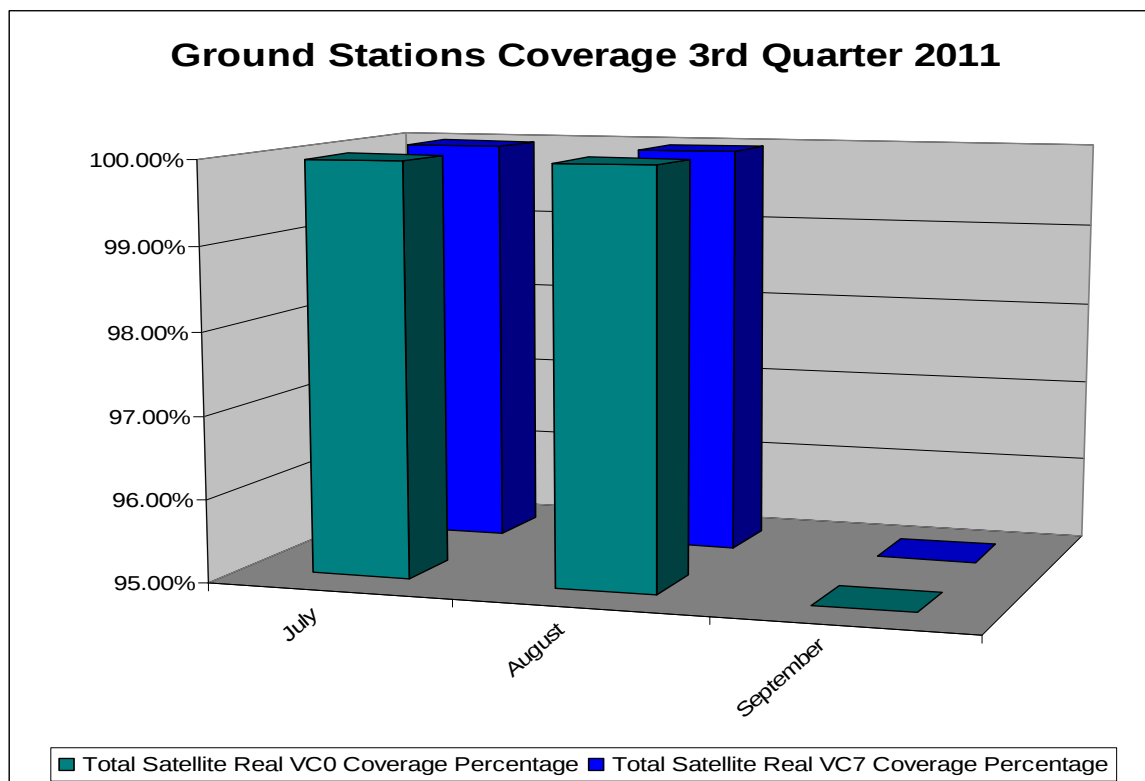


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1080 to 1091, corresponding to the time range 17 August to 22 September.

New observations have been planned for revolutions 1080 (17-20 August) to 1088 (10-13 September). TOO observations were planned on the newly discovered accreting millisecond pulsar IGR J17498-2921 in revolution 1080 and on the nearby supernova SN2011fe in revolutions 1085-1088. To allow for uninterrupted observations of the supernova, the first set of Crab calibration observations have been moved to revolution 1089. Revolution 1082 contained a window of 11 ½ hours in order to conduct a star tracker blemish pixel survey. In comparison to preceding months the planning cycle was rather smooth, with few issues requiring SOC/MOC interactions.

TSFs have been received for revolutions 1076 to 1086.

3.3.2 Observation Status

New ECS files have been received for revolutions 1065 to 1069 (up to 18 July).

3.3.3 ISOC Science Data Archive

Syncing of rev_3 data has been done up to revolution 1051 (no change since last report).

Raw telemetry copied from MOC is available up to 8 August.

The URD for the ISDA within the new archive framework at ESAC has been reviewed with the SAT working towards a stable version.

3.3.4 ISOC System

ISOC software V30, supporting the data rights submission phase was released on 18 August.

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-3181	2011-08-02	ISDSA restart causing back-pressure up to NCTRS (DOY 209)	IMCS	Pending
INT-3182	2011-08-04	Science Operations Interrupted by Solar Flare	Payload	Pending
INT-3183	2011-08-05	Recoveryschedule option 6 generates automatic OSLs to update CSLs		Pending
INT-3184	2011-08-05	EEXIT-03: Timing problem of TCs with dynamic default parameters	IMCS	Pending
INT-3185	2011-08-10	IMU ON during 16000 seconds	FOPGEN	Pending
INT-3188	2011-08-28	Uplink RFI on Integral	Spacecraft	Pending
INT-3189	2011-08-22	Multiple MCS Failures A+B Chain, DOY 234	IMCS	Open
INT-3190	2011-08-31	FD reaction wheel speed plot crashed	FDS	Pending
INT_SC-336	2011-08-05	IREM Anomaly: Reset of IREM_CSCI S/W #112, 05/08/2011	Payload	Testing
INT_SC-337	2011-08-11	SPI PSD channel rates malfunction	Payload	Testing

AR id	Date of occurrence	Subject	Segment	Status
INT_SC-338	2011-08-16	T0107 TCP_4B = SL Toggling	Spacecraft	Pending
INT_SC-339	2011-08-11	JEM-X1 DFEE CRC Anomaly following eclipse on 2011-08-11	Payload	Pending
INT_SC-340	2011-08-26	SPI PSD channel rates malfunction	Payload	Pending
INT_SC-341	2011-08-27	IREM Anomaly: Reset of IREM_CSCI S/W #113, 27/08/2011	Payload	Pending

5 Special Events & Future Milestones

The Crab calibration is planned for revolution 1089 (13th to 16th September)

The SPI Annealing is currently foreseen for November

There is a SAS calibration planned for 21st September 2011.

6 Appendix

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

6.1 AOCS operations

During this period, 369 Open Loop Slews, 434 Closed Loop Slews and 35 Momentum Biases were executed (as reported by ACC OEM).

16 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 01/09/2011 is reported in the following plot:

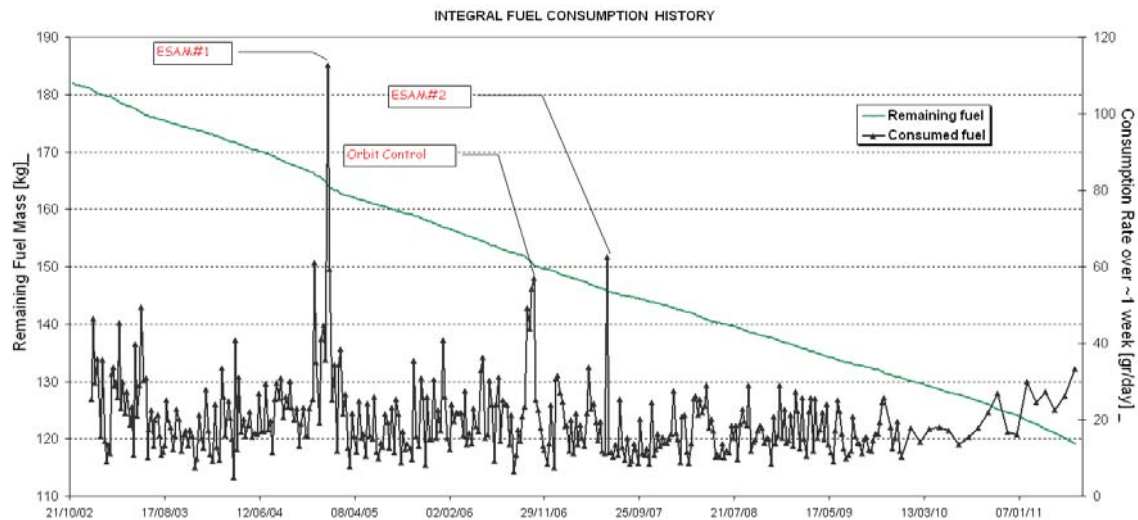


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

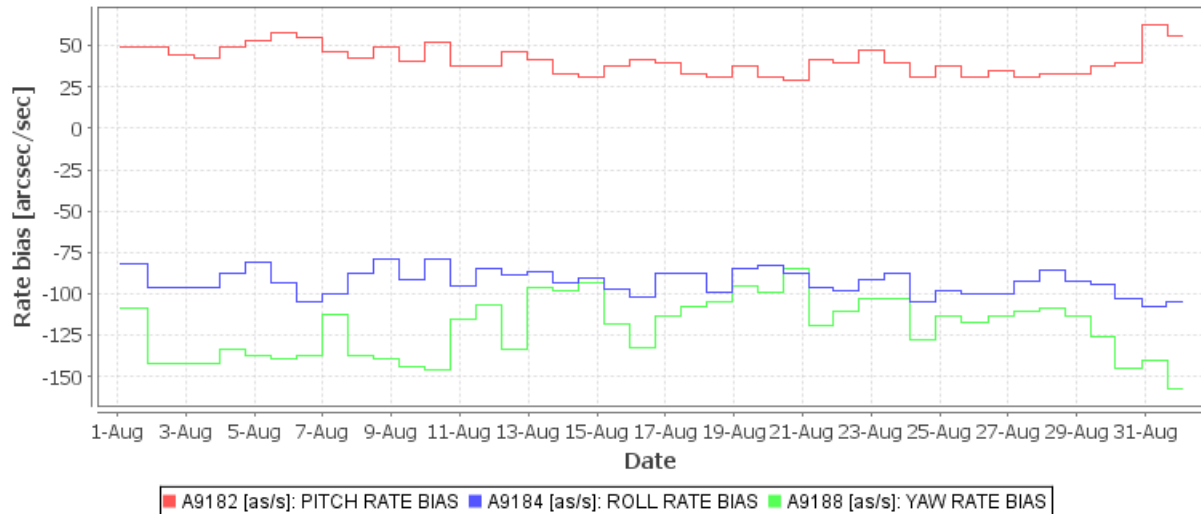


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

04/08/2011 (Day of Year 216, Revolution 1075)

FDS TPF update failed for slew 10750040 (10:46:00Z). A manual mapping was commanded and the parameters for 10750040 manually updated.

05/08/2011 (Day of Year 217, Revolution 1075)

FDS TPF update for slew 10750057 failed (03:06:00Z). The AOCS was suspended in the Timeline, then a manual mapping was commanded. A CSL was foreseen as the next slew in the timeline, but the recovery tool returned an OSL. A slew was manually generated from attitude 10750056 to attitude 10750057. OTF was not reached in time for PID 10750057

After the manual slew was completed, a manual mapping was performed and the parameters for slew 10750058 were manually updated using the spacontool.

10/08/2011 (Day of Year 222, Revolution 1077)

IMU1 switched ON during the stable pointing of PID 10770034 (03:32:17Z), but did not switch off after 10 minutes as usual. Spacon called both SOE and FD support.

Slews 10770035, 10770036, 10770037, 10770038, 10770039 and 10770040 were missed from the timeline, while the problem was investigated. Also a reaction wheel bias scheduled for 05:58:54z was missed from the timeline.

IMU1 was eventually switched OFF at 07:58Z. A manual mapping was performed and a slew was manually generated from attitude 10770034 to attitude 10770040.

An RWB TPF was provided by FD and manually performed.

After the RWB was completed a manual mapping was performed and slew 10770041 in the timeline was updated.

13/08/2011 (Day of Year 225, Revolution 1078)

Slew 10780035 was prevented from execution by TM drops during uplink. AOCS was suspended in the Timeline, a manual mapping was commanded. A manual slew from attitude 10780034 to 10780035 was performed. After completion of the slew another mapping was performed and the parameters of slew 10780036 updated in the timeline.

The OTF was not reached for PID 10780035

15/08/2011 (Day of Year 227, Revolution 1079)

IMU1 switched ON during the stable pointing of PID 10790029 (19:19:00Z). AOCS was suspended in the Timeline. As the IMU did not switch off after 10 minutes, the spacon called SOE support. Under SOE instruction ACC Word B was updated setting IMU FOR YAW to NONE and IMU1 was switched OFF manually at 19:50Z. A manual mapping was commanded and slew 10790030 in the timeline was updated (spacontool).

16/08/2011 (Day of Year 228, Revolution 1079)

FDS TPF update failed for slew 10790044 (09:20:00Z). AOCS was suspended in the timeline. An ongoing contingency recovery on XMM prevented the spacon from taking immediate action. Recovery was begun at 10:41Z. A manual mapping was commanded, a slew from attitude 10790043 to attitude 10790045 was performed. Slew 10790046 was updated in the timeline (spacontool)

OTF was not reached for PID 1079044 and 10790045.

20/08/2011 (Day of Year 232, Revolution 1080)

IMU1 switched ON right after open loop slew 10800056. FDS TPF update failed. AOCS was suspended in the timeline, a manual mapping was commanded and the slew 10800057 updated in the timeline.

PID 1080056 was lost.

22/08/2011 (Day of Year 234 Revolution 1081)

IMU1 switched ON during the stable pointing of PID 10810042(07:17:00Z). MCS problems at the same time prevented an immediate recovery. Slew 10810043 was missed from timeline. After the MCS problems were resolved a manual mapping was commanded and a slew from attitude 10810042 to attitude 1081043 was performed. Slew 10810044 was updated in the timeline (spacontool).

25/08/2011 (Day of Year 237 Revolution 1082)

FDS TPF update failed for slew 10820032 failed(05:44:00Z). AOCS was suspended in the timeline while commands for the reaction wheel bias were still in uplink. The spacon re-uplinked the missed commands by means of copy and paste from TC History. Slew 10820032 was missed from the timeline. A manual mapping was commanded and a slew from attitude 10820031 to attitude 10820032 was performed. Slew 10820033 was updated in the timeline (spacontool)

26/08/2011 (Day of Year 238 Revolution 1082)

PID 10820085 was lost (11:46:00Z). Why and what recovery actions were taken not reconstructable from logbook entries. Further investigations are pending.

27/08/2011 (Day of Year 239 Revolution 1083)

IMU1 switched ON during slew commanding (19:39:00). AOCS was suspended in the timeline. Slew 10830043 was missed from the timeline. A manual mapping was commanded and a slew from attitude 10830043 to 10830044 was performed. Slew 1083045 was updated in the timeline.

OTF was not reached for PID 10830044.

28/08/2011 (Day of Year 240 Revolution 1083)

Bitlock problem interrupted uplink of slew 10830052(00:33:00Z). AOCS was suspended in the timeline. Slew 10830053 was missed from the timeline due to problems with the ground segment (multiplexer crashed, G/S problems). After commanding could be resumed, a manual mapping was commanded and a slew from attitude 10830051 to 10830054 was performed. Slew 10830055 was updated in the timeline.

30/08/2011 (Day of Year 242 Revolution 1084)

IMU1 switched ON during stable pointing 10840007 (01:48:00Z). A manual mapping was commanded and slew 1084008 was updated in the timeline.

31/08/2011 (Day of Year 243 Revolution 1084)

FDS TPF update failed for slew 10840039 (08:04:00Z). A manual mapping was commanded and the recovery tool used to update slew 10840039 in the timeline. No PID was lost, no slew was missed from the timeline.

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 downward spikes in the cold plate temperature should be disregarded as these are zero values acquired when the AFEE is OFF during eclipse. During the reporting period, there was no increase of the stroke of the compressors.

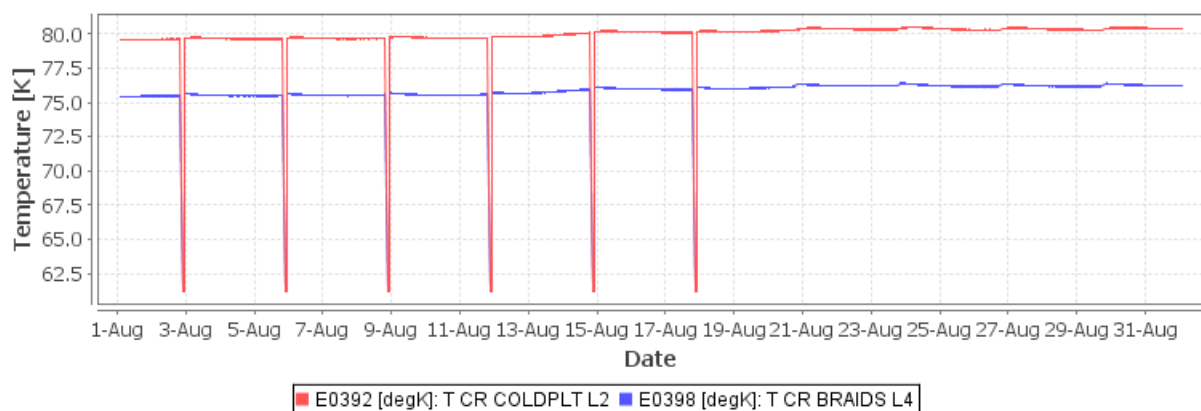


Figure 13: SPI Cold plate and H-bus temperature

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

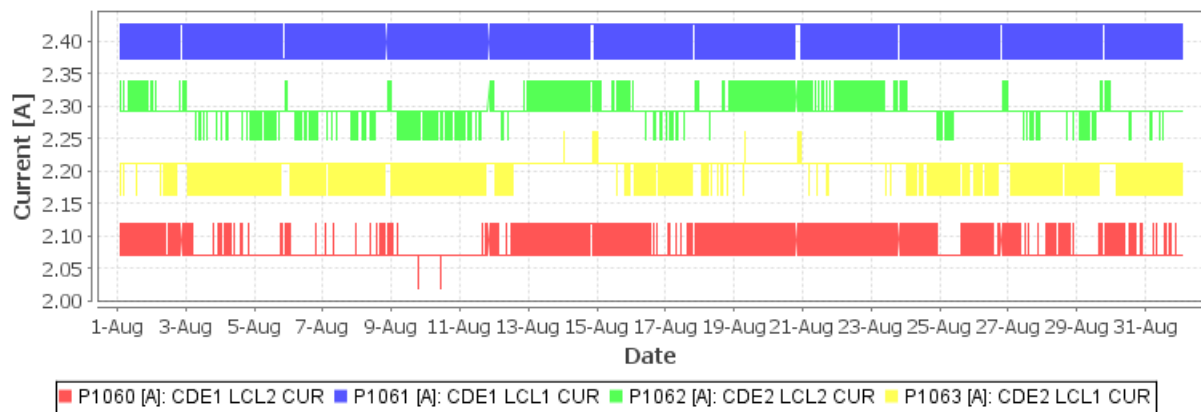


Figure 14: SPI CDE LCL current

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.

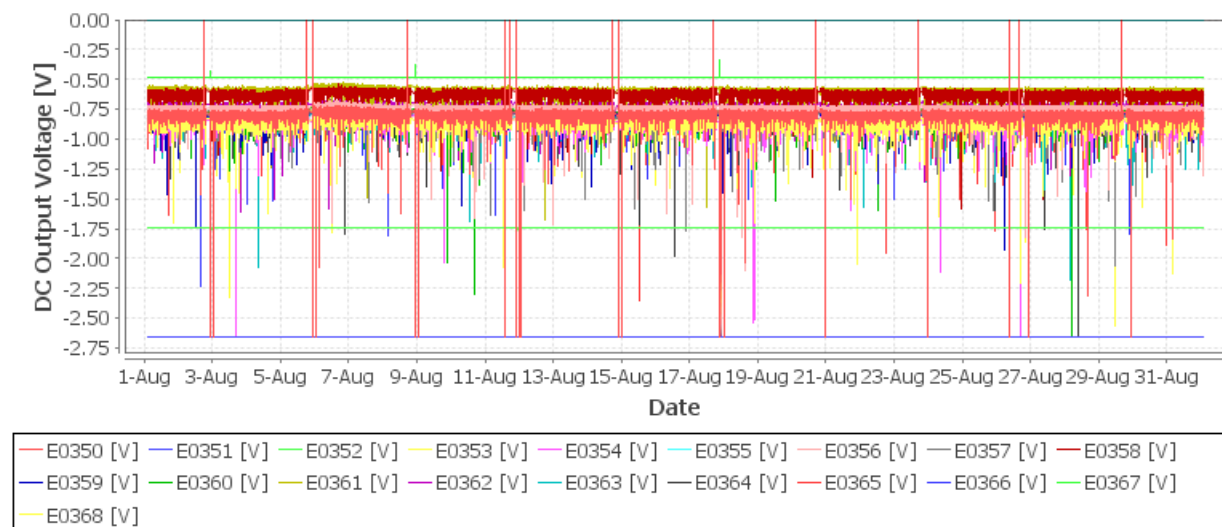


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.



Figure 19: SPI PSD GeD Channel rates

6.2.2 Event Log

27-06-2011 until 17-08-2011 (Revolution 1063-1079)

Eclipse season #19: Lots of OOLs occur during the post eclipse activation. Until the next eclipse season, these OOLs should be dissolved.

02-08-2011 (Day of Year 214, Revolution 1074)

At 17.04Z 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.

02-08-2011, 05-08-2011, 08-08-2011, 11-08-2011 (Day of Year 214, 217, 220, 223, Revolution 1075, 1076, 1077, 1078)

At 23:04Z, 22:52Z, 22:41Z and 22:29Z respectively the SPI ED EEXIT-03 failed release from the timeline (reason: PTV failure). The reason for the EEXIT-03 fail release seems to be due to the sequence EEXIT-03 colliding with GEBENT-02: EEXIT-03 fails release during the uplink of the parameters EU0102D, EU0518D, EU0201D with dynamic default (after the refresh of TM parameters) whenever there are 10 or more commands (mostly from GEBENT-02 sequence) between the refresh command and the following EEXIT-command with parameters set by dynamic default. This is due to the autostack only handling the next 10 commands. The investigations are ongoing. SPI operations continued nominally.

The recovery was as following:

- reuplink ED: EEXIT-03 as per Guide to SPI TL-Recovery
- transition to photon mode & S/S SPI enabled on A/S (23:13Z, 23:09Z, 23:21Z and 22:44 respectively)

04-08-2011 until 05-08-2011 (Day of Year 216-217, Revolution 1075)

Science operations were interrupted by a solar flare. TM: E3500 OOL HIGH HIGH with value 132422 at 04:56Z. E3500 was back within limits on August 5th at 15:38Z. SPI was unaffected by this flare.

09-08-2011 (Day of Year 221, Revolution 1077)

Science operations were interrupted by a solar flare. TM: E3500 OOL HIGH HIGH at 08:25Z with value 153766. E3500 was back within limits at 17:11Z. SPI was unaffected by this flare.

11-08-2011 and 26-08-2011 (Day of Year 223, 238, Revolution 1077, 1088)

At 10:24Z/05:40Z respectively a SPI PSD channel rate malfunction occurred: the PSD channel rates (TM parameters E3840 to E3858 (PSD CHL-RTE L0 to L18)) for all detectors except the failed GeD #1, #2, #5 and #17 (E3841, E3842, E3845 and E3857 - which have no OOL defined as they are permanently zero) went OOL Alarm hard Low, with value 0. The PSD channel rates did not self-recover.

The recovery consisted of the following actions:

- 1) At 11:30Z/07:00Z respectively: Sent sequence EEORTM01 to report and update PSD parameters. OOL not disappear.
- 2) At 11:40Z/07:07Z respectively: SPI was commanded to CONF mode (FCP_SPI_0160) and then back to PHOTON (FCP_SPI_0130). However this did not fix the problem.
- 3) At 11:46Z/07:09Z respectively: a PSD reset was performed (CRP_SPI_3030). Operations were completed at 12:32Z/07:32 respectively (SPI Transition to Photon Mode). SPI operations continued nominally.

17-08-2011 (Day of Year 229, Revolution 1079)

At 15:58Z 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.

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.

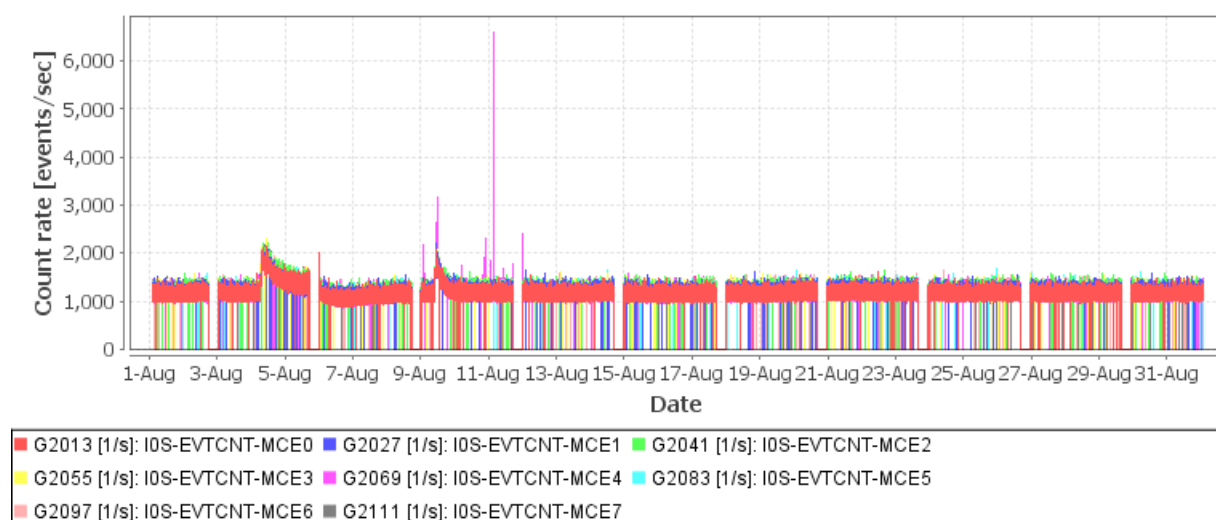


Figure 20: ISGRI MCE Counters

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**27-06-2011 until 17-08-2011 (Revolution 1063-1079)**

Eclipse season #19: Lots of OOLs occur during the post eclipse activation. Until the next eclipse season, these OOLs should be dissolved.

04-08-2011 until 06-08-2011 (Day of Year 216-218, Revolution 1075-1076)

Science operations were interrupted by a solar flare. The events were as following:

- 04:38Z G6061 (Vis Cal Count) OOL soft low
- 04:49Z G6061 (VETO Calibration Unit Countrate) OOL hard low
- 05:23Z GU6062, G6063, G6062 OOL soft high (VETO Bottom + Lateral counters, warning flags)
- 09:41Z IBIS disabled from timeline

Therefore, at 05:28Z IBIS IASW was set to Stand-by (FCP_IBIS1_0313) and Veto to Stand-by (FCP_IBIS1_0203). On August 6th at 02:49Z IBIS was reactivated (FCP_IBIS1_0803) and enabled on the A/S. IBIS operations continued nominally.

05-08-2011 (Day of Year 217, Revolution 1075)

At 15:15Z the limits for G6061 have been changed on A- and B-chains to following values according to an email from Giovanni La Rosa:

- Hard High: 4.000
- Soft High: 3.000

- Soft Low: 450

- Hard Low: 250

09-08-2011 (Day of Year 221, Revolution 1077)

Science operations were interrupted by a solar flare. SPI & IBIS were unaffected by this flare.

09-08-2011 (Day of Year 221, Revolution 1077)

At 05:04Z following OOLs occurred for a single occurrence:

G5068 family (PDMi semi-module #1 FIFO error)

part of G5072 family (PDMi semi-module #2 FIFO error)

G5002 family (PICsIT event count-rates semi-module #1)

G5003 family (PICsIT event count-rates semi-module #2)

These were followed at 05:07Z (by which time all the above parameters had returned within limits) by OEM APID 1280 ID 132: "IBIS1 IASW HEPI RESYNCHRONISED" indicating that HEPI resynchronised autonomously. No action was required.

11-08-2011 (Day of Year 223, Revolution 1078)

At 22:24Z IBIS was disabled from the timeline to prevent uplink of GEBENT02 and possible commanding clash with EEXIT03. IBIS again was enabled at 22:35Z. The sequence GEBENT02 was reuplink at 22:52Z. IBIS operations continued nominally.

21-08-2011 (Day of Year 233, Revolution 1081)

At 03:56Z following OOLs occurred for a single occurrence:

G5068 family (PDMi semi-module #1 FIFO error)

G5072 family (PDMi semi-module #2 FIFO error)

G5002 family (PICsIT event count-rates semi-module #1)

G5003 family (PICsIT event count-rates semi-module #2)

As it was a single occurrence, no action was required. IBIS operations continued nominally.

27-08-2011 (Day of Year 239, Revolution 1083)

At 03:12Z, a local reset of the IREM CSCI S/W (SEU #113) was observed. The IREM reset forced IBIS to automatically enter Safe configuration inducing following OEMS:

03.12.19.067 IBIS1 IASW VETO SWITCH OFF PERFORMED DUE TO AUTOMATISM

03.12.18.797 IBIS1 IASW EMERGENCY SWITCH OFF PERFORMED (GOTO STANDBY

IBIS recovery was completed by 03:53Z (FCP_IBIS1_0803 - IBIS from Safe).

At 05:24Z Apon carrying out a double check, the spacon notices that IBIS is not in observing mode, but in standby mode. At 05:36Z the sequence GESTAN02 had been uplinked. At 05:37Z IBIS is in science mode. IBIS operations continued nominally.

02-08-2011 to 26-08-2011 (Day of Year 214 to 238, Revolution 1074 to 1082)

OEM: "IBIS1 PICSIT NOISY SEMIMODULE..." occurred during the following periods:

2011.238.18.50.54.520 until 2011.238.19.06.38.520

2011.235.19.24.38.344

2011.235.19.14.38.343 until 2011.235.19.20.46.344

2011.229.20.01.57.936 until 2011.229.20.04.37.936

2011.226.20.07.17.751 until 2011.226.20.13.17.751

2011.226.20.03.25.751 until 2011.226.20.05.33.751

2011.223.20.43.57.533 until 2011.223.20.50.29.534
 2011.220.20.50.21.369 until 2011.220.21.00.21.370
 2011.220.20.44.45.369 until 2011.220.20.45.57.369
 2011.214.21.08.37.045 until 2011.214.21.14.53.045
 2011.214.21.05.49.045

Since IASW was in stand by and the S/C inside the radiation belts, no action was required. 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.

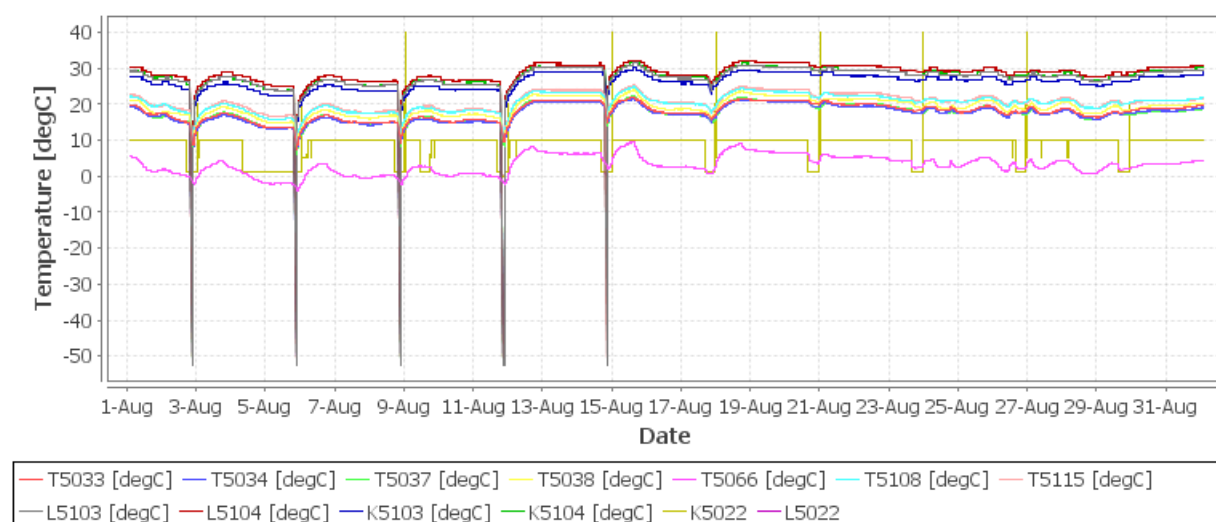


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

01-08-2011 (Day of Year 213, Revolution 1074)

At 10:14, the ED LECLXT01 (JEMX-2 eclipse exit (time-tagged)) was manually up-linked, as it had been missed during the previous recovery. There was no impact.

04-08-2011 (Day of Year 216, Revolution 1075)

At 05:40, after L5317 went OOL, JEMX-2 was sent manually to SAFE as a precaution due to rising radiation levels caused by a solar flare.

At 06:14, JEMX-1 was also manually sent to SAFE for the same reason.

06-08-2011 (Day of Year 218, Revolution 1076)

At 03:21, after waiting for radiation levels to subside, JEMX-1 & 2 were recovered and returned to Data-taking.

09-08-2011 (Day of Year 221, Revolution 1077)

At 08:36:39, and at 08:39:27, the DFEEs of JEMX-1 & 2 went autonomously to SAFE, owing to rising radiation levels triggered by a solar flare. Subsequently, at 08:40, they were disabled from the timeline, and at 08:43, the DPEs were manually sent to SAFE for consistency.

At 15:47, after radiation levels had dropped, JEMX 1 & 2 were returned to Stand-by, and at 16:44, they were returned to Data-Taking.

11-08-2011 (Day of Year 223, Revolution 1078)

At 19:26, 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_5010 JEMX1 DFEE POWER CYCLE, consisting of:

- Three CRC dumps:
 - start address B000, length 2000, returned value of F1B3
 - start address C000, length 1000, returned value of F074
 - start address B000, length 1000, returned value of CF9F, which are all nominal
- 20:01:00Z FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF
- 20:16:00Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION

At 20:23:00Z, the unit was back in the nominal configuration, no timeline commands were missed, and there was no impact.

26-07-2011 (Day of Year 207, Revolution 1072)

At 03:12:19 JEMX-1 & 2 parameters K5315, K5316, K5317, L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#113). 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

04-08-2011 (Day of Year 216, Revolution 1075)

At 05:32:18, OMC switched autonomously to SAFE mode due to the ongoing high radiation. A recovery was not possible until 02:45:27 on DoY 218. The impact was the loss of pointings 10750035 through to 10760007 (35 pointings). It was at this time that the following pairs of commands were rejected:

2011.216.06.24.23.948 TC1	2011.216.06.24.30.354	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.216.06.24.30.073 TC1	2011.216.06.24.36.292	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.216.07.47.32.076 TC1	2011.216.07.47.38.531	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.216.07.47.38.076 TC1	2011.216.07.47.46.131	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.216.08.45.01.953 TC1	2011.216.08.45.10.328	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.216.08.45.08.078 TC1	2011.216.08.45.14.533	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 pointings 10750035, 10750036 & 10750037.

09-08-2011 (Day of Year 221, Revolution 1077)

At 08:43:46, OMC switched autonomously to SAFE mode due to the ongoing high radiation. At 15:18:34, an attempt was made to recover the instrument but it switched back to SAFE almost immediately at 15:26:58. Another attempt at recovery at 16:47:01 fared little better, with a further return to SAFE at 18:31:54. Finally a recovery performed at 20:54:52 had the desired effect, and the instrument then remained operational for the rest of the revolution. The impact was pointing 10770014 was interrupted after 2912 from a planned 3334 seconds, and pointings 10770015 through to 10770023, and then 10770025 to 10770027 (12 in all) were lost.

10-08-2011 (Day of Year 222, Revolution 1077)

At 03:32:17, a lost guide star caused the IMU to switch on. Due to a ping-pong filter issue, this did not switch off again until 07:58. A recovery was then performed, and the timeline resumed at 09:19:06. The impact was the loss of pointings 10770035 to 10770039 inclusive.

13-08-2011 (Day of Year 225, Revolution 1078)

At 06:32:00, an AOCS problem forced an interruption to the timeline. A recovery was performed, and the timeline rejoined at 08:01:00. The impact was that pointing 10780035 was executed at the wrong attitude and pointing 10780036 was lost. It was at this time that the following pairs of commands were rejected:

2011.225.07.58.03.964 TC1	2011.225.07.58.11.214	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
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2011.225.07.58.10.089	2011.225.07.58.22.161	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 10780036.

16-08-2011 (Day of Year 228, Revolution 1079)

At 09:20:00, an FD problem forced a suspension of the timeline. After a recovery, operations resumed at 11:25. The impact was the loss of pointings 10790044 & 10790045. It was at this time that the following pairs of commands were rejected:

2011.228.10.10.24.057	2011.228.10.10.31.489	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.228.10.10.30.057	2011.228.10.10.38.286	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.228.11.08.10.309	2011.228.11.08.22.447	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.228.11.08.16.059	2011.228.11.08.22.480	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 those pointings.

20-08-2011 (Day of Year 232, Revolution 1080)

At 03:56:00, a loss of guide star forced a suspension of the timeline. A recovery was performed, and the timeline rejoined at 04:15. The impact was the loss of pointing 10800056.

22-08-2011 (Day of Year 234, Revolution 1081)

At 07:17:00, a loss of guide star forced a suspension of the timeline. Further problems with the imcs complicated things, which delayed the recovery until 08:36. The impact was that pointing 10810043 was cut short from a planned 3334 to 2313 seconds.

26-08-2011 (Day of Year 238, Revolution 1082)

At 11:48:11, after the CCCFs were enabled for an unrelated issue, OMC switched back to standby. The impact was that pointing 10820085 was cut short from a planned 1800 to 304 seconds.

27-08-2011 (Day of Year 239, Revolution 1083)

At 03:12:19, an IREM SEU (#113) forced OMC to SAFE mode. A recovery was performed, and the timeline rejoined at 03:32:15. The impact was 10830014 was cut short from a planned 1955 to 1282 seconds, and pointing 10830015 was lost. It was at this time that the following pair of commands was rejected:

2011.239.03.23.59.743	2011.239.03.24.07.891	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E
2011.239.03.24.05.743	2011.239.03.24.15.181	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 10830015.

28-08-2011 (Day of Year 240, Revolution 1083)

At 00:04, problems with the bit-lock between the satellite and the ground station led to a series of issues. At 01:04, a re-sweep was performed, which improved the situation. A recovery was then performed, and the timeline resumed at 01:37. The impact was the loss of pointings 10830052 & 10830053. It was at this time that the following pair of commands was rejected:

2011.240.01.14.32.921 TC1	2011.240.01.14.37.637	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2011.240.01.14.39.046 TC1	2011.240.01.14.43.981	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 10830053.

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.

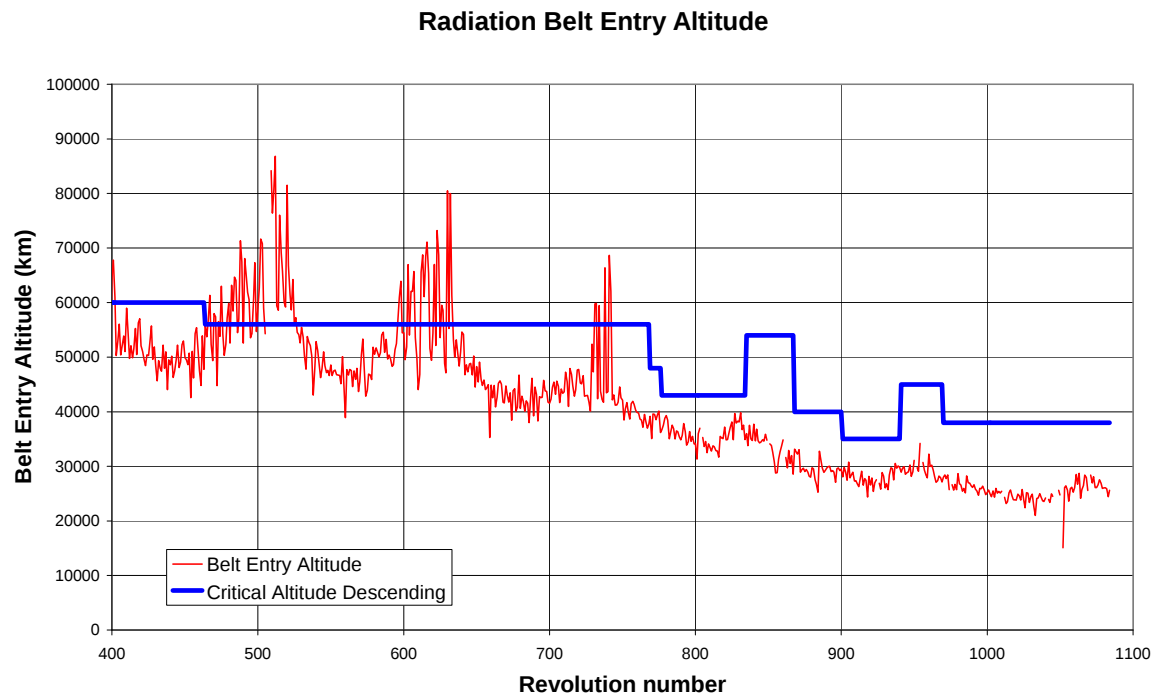


Figure 23: Radiation belt entry

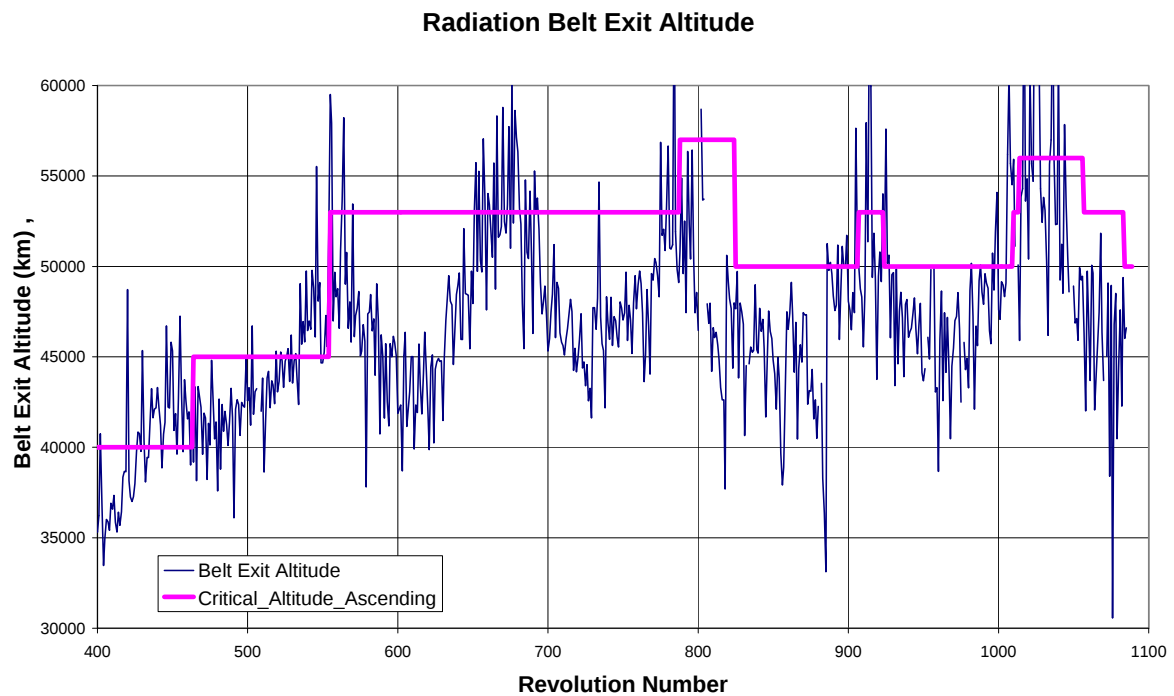


Figure 24: Radiation belt exit

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
1074	RAD_ENTR R 2011-08-02T15:57:48Z	02/08/2011 17:22:25	20158.8	02-Aug-2011 17:29:55	18409.12	02-Aug-2011 18:09:55	8611.571
1075	RAD_EXIT R 2011-08-02T22:58:28Z	02/08/2011 21:57:37	38673.0	02-Aug-2011 22:29:55	48612.96	02-Aug-2011 18:39:55	3440.816
1075	RAD_ENTR R 2011-08-05T15:47:09Z	N/A	N/A	05-Aug-2011 17:16:13	19001.5	05-Aug-2011 17:56:13	9200.333
1076	RAD_EXIT R 2011-08-05T22:47:21Z	N/A	N/A	05-Aug-2011 22:16:13	48229.56	05-Aug-2011 18:36:13	3476.059
1076	RAD_ENTR R 2011-08-08T15:35:56Z	08/08/2011 16:55:37	22642.1	08-Aug-2011 17:09:32	18108.82	08-Aug-2011 17:49:32	8334.103
1077	RAD_EXIT R 2011-08-08T22:36:25Z	08/08/2011 21:23:29	40699.2	08-Aug-2011 22:09:32	48782.58	08-Aug-2011 18:19:32	3443.464
1077	RAD_ENTR R 2011-08-11T15:22:41Z	11/08/2011 16:40:49	22805.2	11-Aug-2011 16:50:52	19476.6	11-Aug-2011 17:30:52	9766.421
1078	RAD_EXIT R 2011-08-11T22:23:38Z	11/08/2011 21:17:38	>38650.3	11-Aug-2011 21:50:52	47757.92	11-Aug-2011 18:10:52	3524.833
1078	RAD_ENTR R 2011-08-14T15:08:18Z	14/08/2011 16:23:14	22837.3	14-Aug-2011 16:37:05	19226.56	14-Aug-2011 17:17:05	9489.591
1079	RAD_EXIT R 2011-08-14T22:09:11Z	14/08/2011 20:23:46	34865.5	14-Aug-2011 21:37:05	47968.21	14-Aug-2011 17:57:05	3529.516
1079	RAD_ENTR R 2011-08-17T14:53:49Z	17/08/2011 16:19:14	20638.6	17-Aug-2011 16:28:49	18047.54	17-Aug-2011 17:08:49	8232.889
1080	RAD_EXIT R 2011-08-17T21:54:06Z	17/08/2011 20:28:42	>34910.1	17-Aug-2011 21:28:49	48892.74	17-Aug-2011 17:38:49	3365.258

1080	RAD_ENTR R 2011-08- 20T14:40:46Z	20/08/2011 16:04:18	21363.4	20-Aug-2011 16:17:49	17406.75	20-Aug-2011 16:57:49	7589.776
1081	RAD_EXIT R 2011-08- 20T21:40:44Z	20/08/2011 20:30:42	>>28880.4	20-Aug-2011 21:07:49	47699.16	20-Aug-2011 17:27:49	3334.932
1081	RAD_ENTR R 2011-08- 23T14:26:49Z	23/08/2011 15:48:10	21463.1	23-Aug-2011 16:00:17	18492.81	23-Aug-2011 16:40:17	8701.339
1082	RAD_EXIT R 2011-08- 23T21:26:59Z	23/08/2011 19:52:42	>>28868.2	23-Aug-2011 21:00:17	48549.74	23-Aug-2011 17:10:17	3467.037
1082	RAD_ENTR R 2011-08- 26T14:11:56Z	26/08/2011 15:35:54	20833.0	26-Aug-2011 15:51:43	17037.51	26-Aug-2011 16:21:43	9634.274
1083	RAD_EXIT R 2011-08- 26T21:11:54Z	26/08/2011 20:20:58	44628.4	26-Aug-2011 20:41:43	47942.22	26-Aug-2011 17:01:43	3387.615
1083	RAD_ENTR R 2011-08- 29T13:58:50Z	29/08/2011 15:30:27	18573.3	29-Aug-2011 15:37:31	17224.17	29-Aug-2011 16:17:31	7331.521
1084	RAD_EXIT R 2011-08- 29T20:39:06Z	29/08/2011 19:39:23	>>28939.4	29-Aug-2011 20:27:31	47947.9	29-Aug-2011 16:47:31	3220.325

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

05-08-2011 (Day of Year 217, Revolution 1075)

At 15:17:53Z, a local reset of the IREM CSCI S/W (SEU #112) 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 2011.217.15:17:53Z (44158.6 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex);

5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e the Checksum Failure Flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON. 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 03:14:00Z the following day.

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 the following day at 02:45:27Z and IBIS at 02:49:00Z.

27-08-2011 (Day of Year 239, Revolution 1083)

At 03:12:19Z, a local reset of the IREM CSCI S/W (SEU #113) 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 2011.239.03:12:19Z (96542.8 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;

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. 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 05:18:00Z.

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 03:32:15Z and IBIS at 05:36:00Z