
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 September and covers the revolutions 963 until 972 (included). The targets of these revolutions can be found on the ISOC web: <http://integral.esac.esa.int/isocweb/schedule.html?action=intro> .

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.

9 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.663 Kg. The remaining propellant is in the order of 126.0 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; available power from the arrays is of the order of 2100W.

Eclipse Season #17 started on the 2nd August, Table 1 summarises all the important information from an EPS Point of view.

Table 1: Eclipse information

Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Eclipse Duration		Observed Depth of Discharge Ah		Expected Recharge		Recharge Duration Battery	
					Total	Umbra	1	2	Ah	Time	1	2
02/08/10	21:18:34	-	-	21:25:12	0:06:38	0:00:00	1.53	1.52	0.00	0:00:00	-	-
05/08/10	21:00:28	21:01:36	21:20:36	21:22:04	0:21:36	0:19:00	1.86	1.84	1.97	1:05:49	1:05:52	1:05:20

08/08/10	20:44:26	20:45:17	21:12:50	21:14:01	0:29:35	0:27:33	2.69	2.67	2.86	1:35:26	1:36:03	1:35:07
11/08/10	20:28:29	20:29:12	21:03:21	21:04:26	0:35:57	0:34:09	3.28	3.25	3.55	1:58:18	1:57:38	1:56:26
14/08/10	20:15:23	20:16:02	20:55:56	20:56:58	0:41:35	0:39:54	3.82	3.77	4.15	2:18:13	2:17:07	2:15:31
17/08/10	20:04:18	20:04:54	20:49:39	20:50:40	0:46:22	0:44:45	4.51	4.45	4.65	2:35:01	2:42:13	2:40:21
20/08/10	19:53:10	19:53:46	20:42:22	20:43:23	0:50:13	0:48:36	4.73	4.68	5.05	2:48:21	2:50:26	2:48:26
23/08/10	19:40:54	19:41:31	20:32:52	20:33:56	0:53:02	0:51:21	4.98	4.92	5.34	2:57:52	2:59:21	2:57:13
26/08/10	19:27:38	19:28:17	20:21:10	20:22:16	0:54:38	0:52:53	5.25	5.20	5.50	3:03:11	3:09:09	3:01:09
29/08/10	19:14:51	19:15:32	20:08:23	20:09:33	0:54:42	0:52:51	5.34	5.28	5.49	3:03:04	3:12:16	3:10:08
01/09/2010	19:03:38	19:04:24	19:55:06	19:56:23	0:52:45	0:50:42	5.19	5.14	5.27	2:55:37	3:07:11	3:05:19
04/09/2010	18:52:33	18:53:29	19:39:22	19:40:50	0:48:17	0:45:53	4.64	4.59	4.77	2:38:56	2:46:44	2:45:00
07/09/2010	18:41:39	18:42:54	19:20:17	19:22:05	0:40:26	0:37:23	3.84	3.79	3.88	2:09:30	2:17:37	2:16:09
10/09/2010	18:36:08	18:38:36	18:57:52	19:00:55	0:24:47	0:19:16	2.10	2.08	2.00	1:06:44	1:13:59	1:13:11

From the EPS point of view all eclipse passages and subsequent battery recharge periods were completely nominal.

After the eclipse season the Battery Full Charge rate was set to the full charge rate of C/26 (0.9A).

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.

On 13.10.2010 the On-board monitoring tables for use during the non-eclipse season were loaded and enabled.

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 15th 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 Germanium detectors' temperature was kept in the range 80K $\pm$ 1K.

The eclipse season was ongoing and ended on 10/09/2010. Eclipse activities for SPI were nominal.

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 as follows:

- 105 packets/cycle in revolutions 962-965 and 969-972
- 101 packets/cycle in revolutions 966-968 (Crab calibration revolutions). However in revolution 966 it was 88 packets/cycle from 2010-09-11T10:12:47Z to 2010-09-11T13:56:21Z (OMC Flat Field Calibration) and 85 packets/cycle from 2010-09-12T10:30:19Z to 2010-09-12T16:21:56Z (Crab JEM-X staring).

The average telemetry occupation when the allocation was above 100 packets/cycle was 80.5 packets/cycle.

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

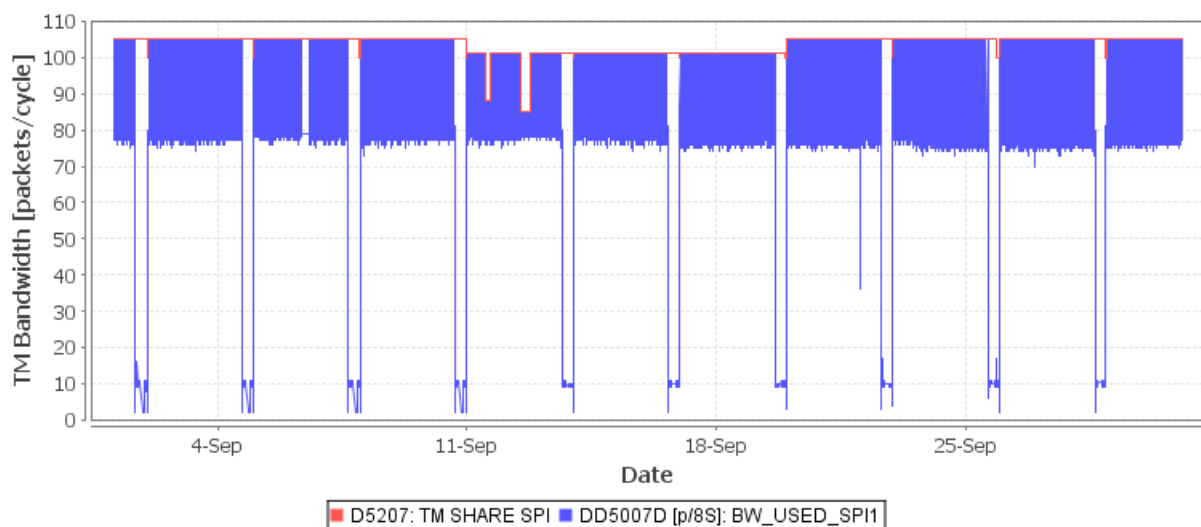


Figure 1: SPI TM bandwidth utilisation

The following plot shows the DPE CPU load during the reporting period:

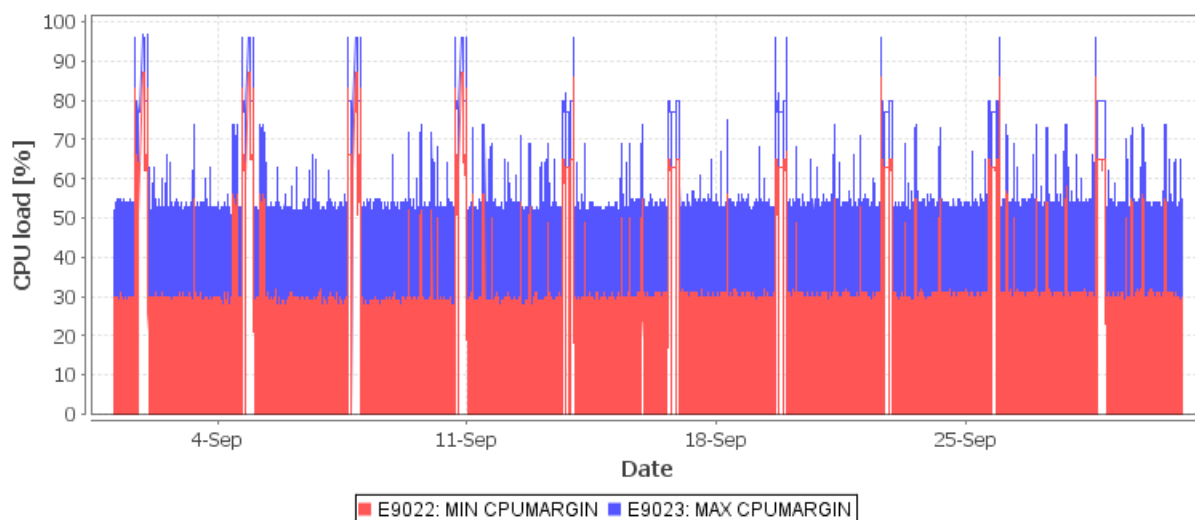


Figure 2: SPI IASW Performance

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

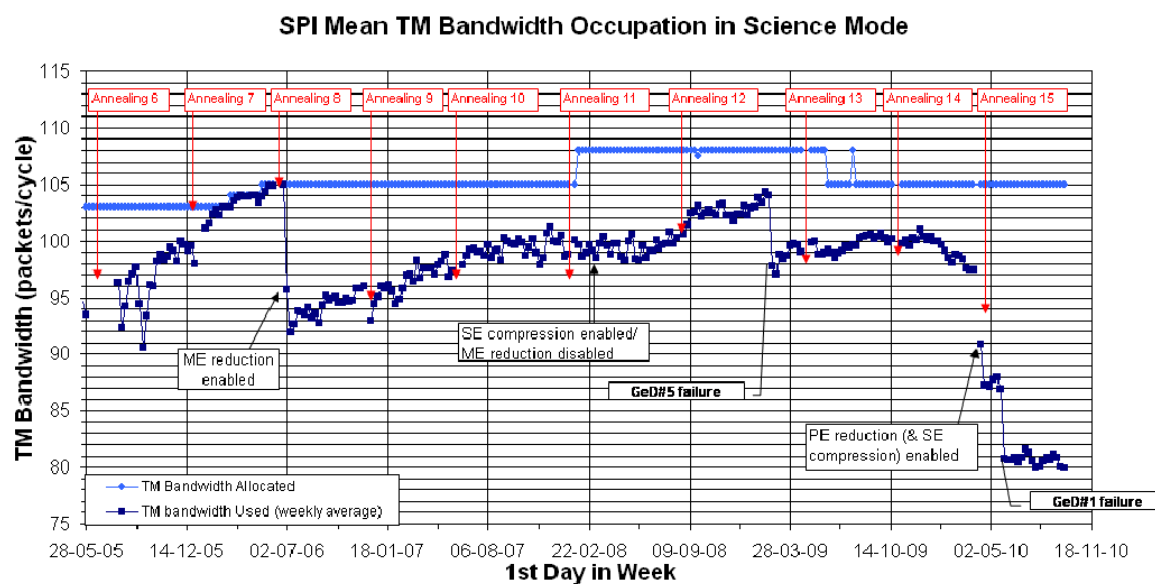


Figure 3: SPI TM bandwidth usage evolution since May 2005

Note: Some 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 was ongoing and ended on 10/09/2010. Eclipse activities for IBIS were 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: 131 packets/cycle, except in revolution 966 from 2010-09-11T10:12:47Z to 2010-09-11T13:56:21Z (OMC Flat Field Calibration), when it was 90 packets/cycle and from 2010-09-12T10:30:19Z to 2010-09-12T16:21:56Z (Crab JEM-X staring), when it was 129 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 114 packets/cycle.

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

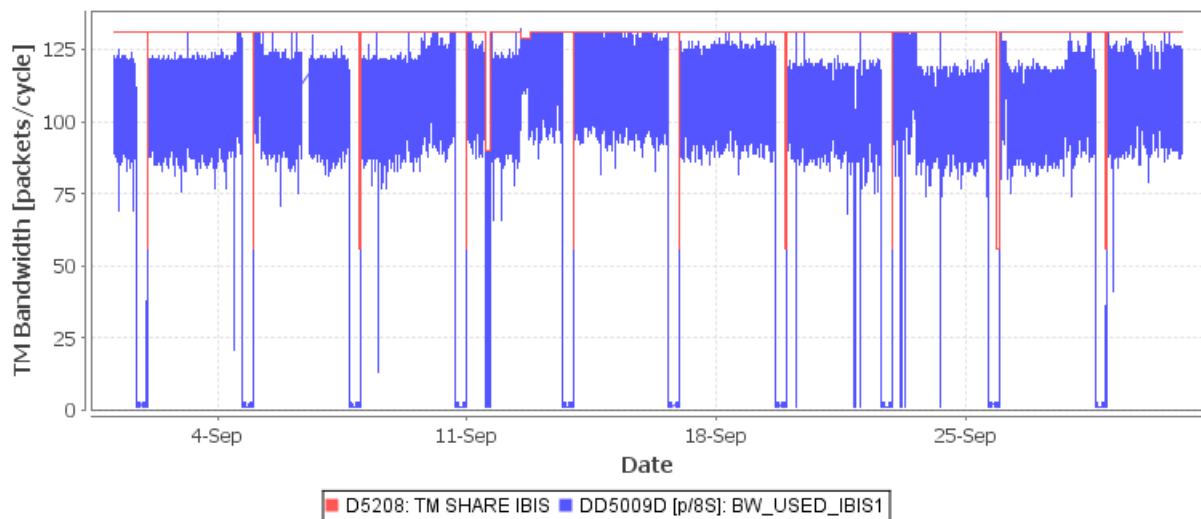


Figure 4: IBIS TM bandwidth utilisation

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

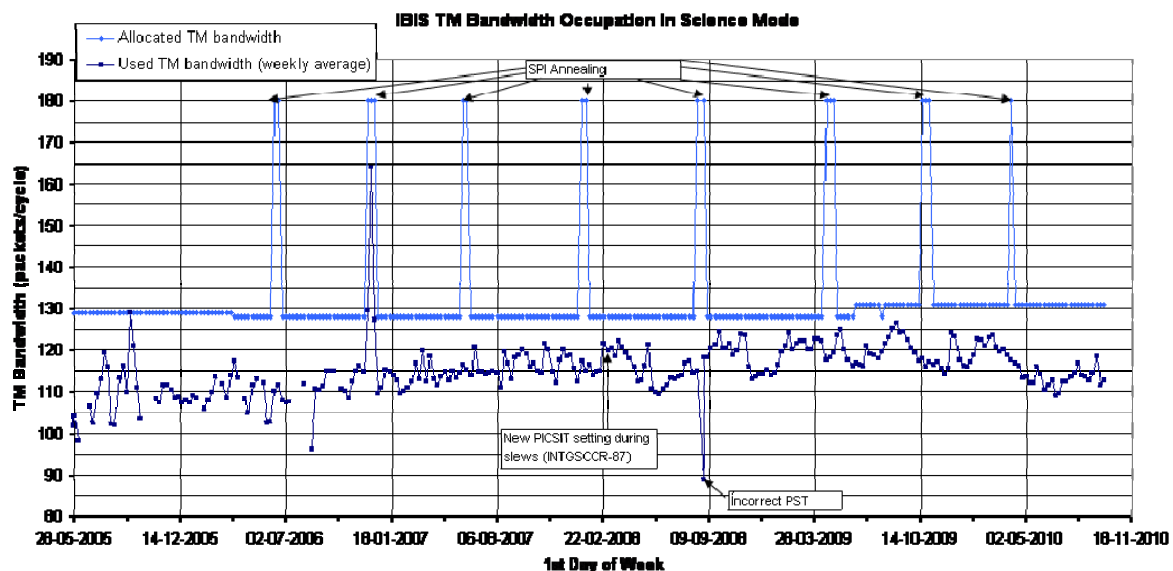


Figure 5: IBIS TM bandwidth usage evolution since May 2005

Note: Some more information concerning the IBIS operations is provided in Appendix 6.3.

2.2.3 JEM-X

The status of both JEM-X units is nominal:

JEM-X2 was operated in Data Taking mode with a TM allocation of 8 packets/cycle. JEM-X1 was dormant (DPE OFF) with no TM slots allocated. In revolutions 966, 967 & 968 during the crab calibration, JEMX-1 was also active, the TM allocation in this interval was 6 packet each per cycle, except in revolution 966 from 2010-09-11T10:12:47Z to 2010-09-11T13:56:21Z, when it was 4 packets each, and from 2010-09-12T10:30:19Z to 2010-09-12T16:21:56Z, when 15 packets were allocated.

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

2.2.4 OMC

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle, except from 2010-09-11T10:12:47Z to 2010-09-11T13:56:21Z (Rev 966) during the Flat-field calibration, when it was 63 packets/cycle.

During this reporting period, 851 of the 861 planned science pointings were executed nominally, 4 pointings were lost and 1 delayed by TPF failing to arrive. 2 pointings were lost to IREM SEUs. 1 pointing was shortened, when the CCCFs caused OMC to get stuck in Standby mode. A power outage at Goldstone caused the loss of 2 pointings. In addition 1 Flat-field calibration was performed this month.

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

2.2.5 IREM

The status of IREM is nominal.

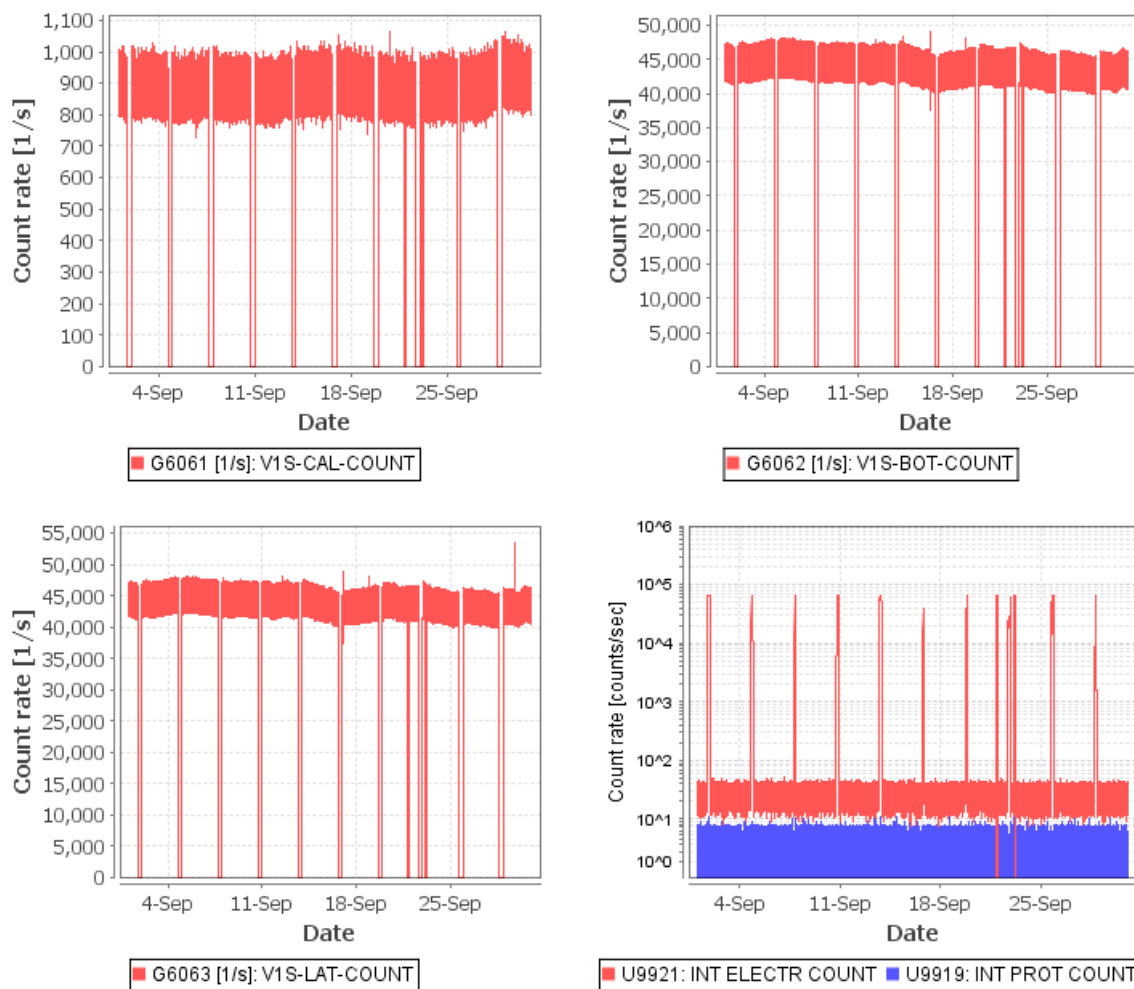
On DoY 264 (21/09/2010), the 95th IREM SEU occurred.

On DoY 266 (23/09/2010), the 96th IREM SEU occurred.

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

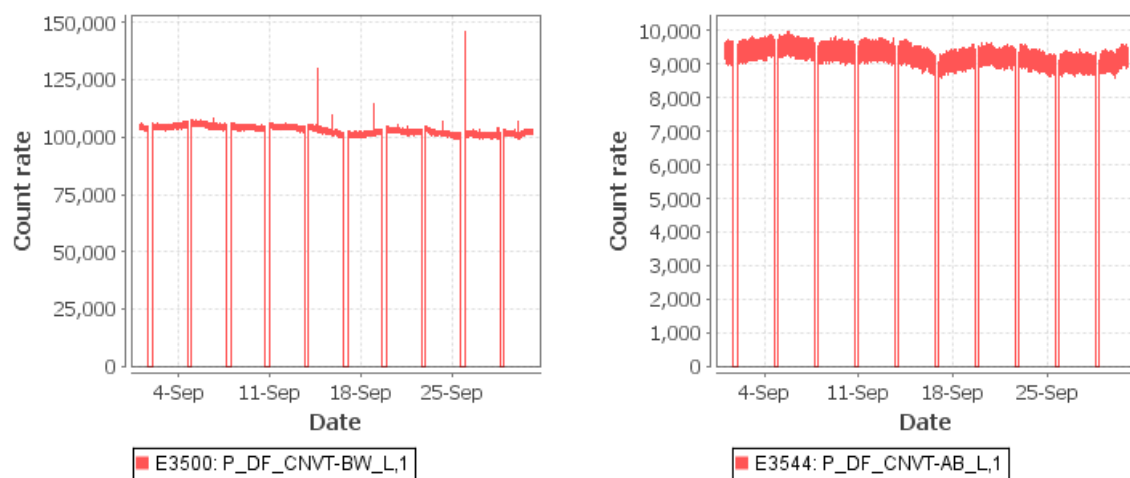
Radiation background

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

IREM proton & electron counters¹

ACS below 100MeV

ACS above 100MeV

**Figure 6: Instrument Count Rates**¹ Note that the scale used in this plot is logarithmic.

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

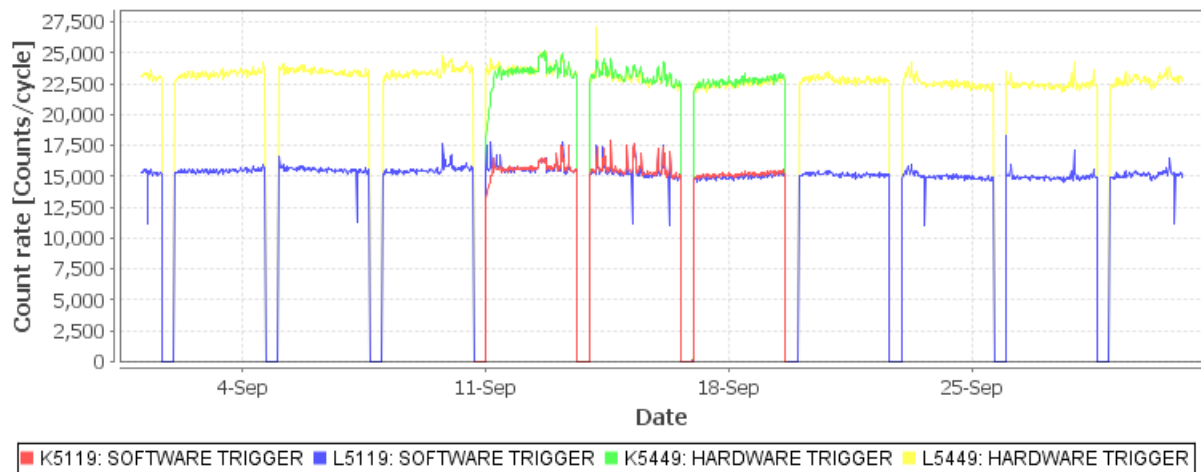


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

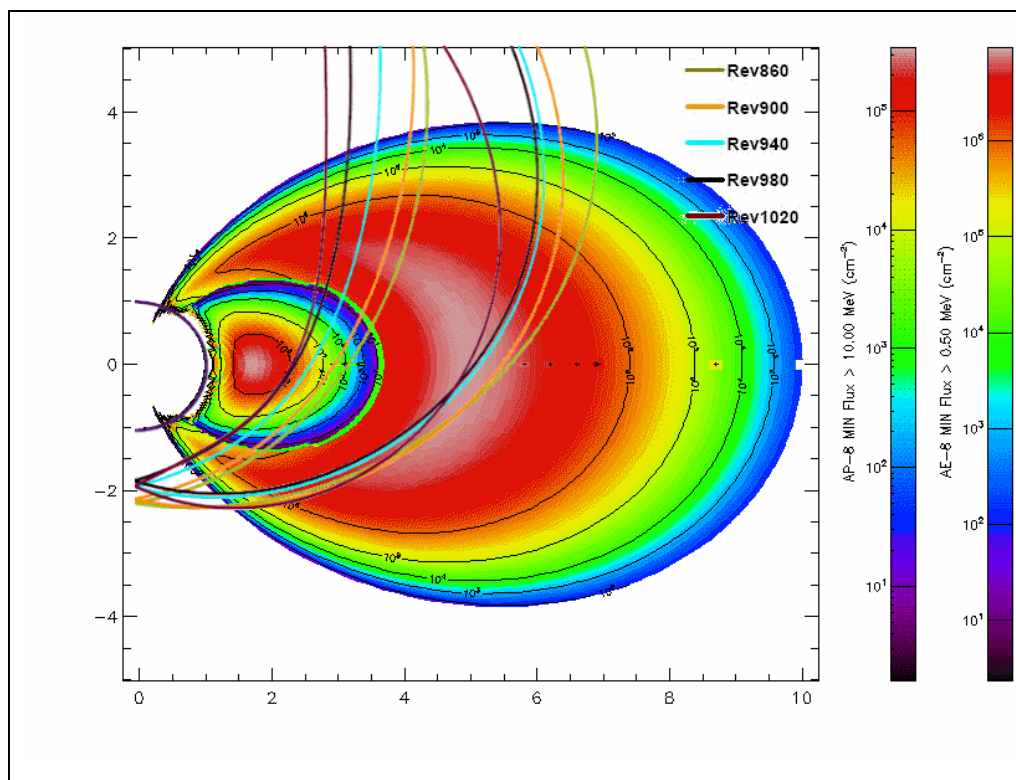


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

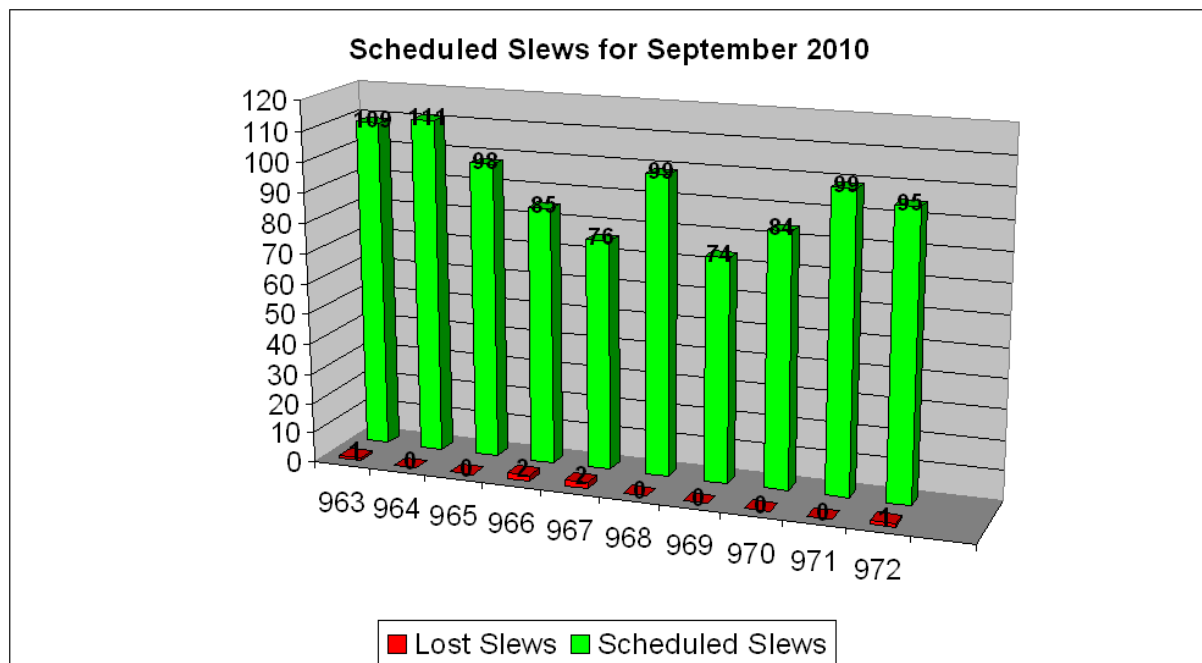


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

Due to problems with the dataflow to ISDC this month, the ISDS and the IFRD were restarted numerous times on both isdsa and isdsb. Currently data is transferred to ISDC via the A-chain, while the PI-workstations are receiving the data via the B-chain. See anomaly report INT-3110 for more information.

On DOY257 it was discovered that SUN120, an IMCS client, was connected for TM to IMCA, see AR INT-3115 for more detailed information. The connection to the TM CPD task was lost for 16 seconds on DOY261. This had an impact on command A7192 START MAN TIMER CEV status U, but it caused no effect. On DOY262 the connection to TM CPD was lost again. The verifier task was still green on the MMI and no alarm was given on the MCCM. JEM-x2 failed activation due to this problem, after stopping and starting the verifier task on IMCA operations could continue.

3.2 Ground Stations and Network

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

REDU

There were several occasions of RFI from an unknown source reported. Bad frames were received on DOY247, DOY253 and DOY266. On DOY253 there was a data gap on VC-0 and VC-7, while there was a data gap on VC-7 only on DOY266 and on VC-0 only on DOY270.

DOY253 19:06:00: On DOY253 at AOS Network were late with connecting the TC link, hence the TX time-tags were missed from the timeline. The sequences were re-sent manually at 20:45:00 hrs. On DOY270 there was a loss in telemetry, since network scheduled the end of track without a warning. The SPACON was not informed of this and remained on REDU.

DSS27

On DOY246 TC was lost, bind closed at DSN. The reason for this is unknown. VC-0 and VC-7 was lost on DOY251, see DSN Discrepancy Report DR #G110505. On DOY267 at 03:07 the track stopped due to a power outage at Goldstone. Track was restarted afterwards and TM was delivered again at about 03:39. DSN raised a Discrepancy Report for this incident: DR #G100551. On the same day at 05:30, TM went to drop. No reason was received from DSN. There was a drop on VC-0 and VC-7 on DOY272.

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.

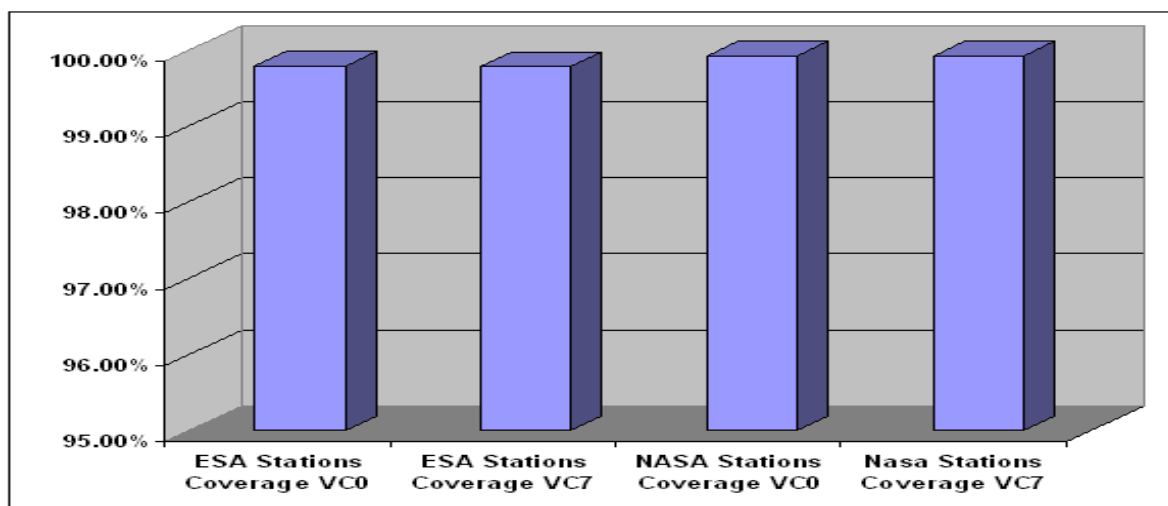


Figure 10: The usage of ESA ground stations compared to the usage of DSN ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 970 to 979, corresponding to the time range 22 September to 22 October.

New observations have been planned for revolutions 966 (10-13 September) to 975 (7-10 October).

Three TOO requests were received in September, one on the Crab and two on the new transient MAXI J1659-152. All were implemented, the first two very rapidly, leading to replanning of revolutions 970 to 973. For revolutions 971 and 972 a RPOS had to be generated.

TSFs have been received for revolutions 964 to 973.

3.3.2 Observation Status

New ECS files have been received for revolutions 949 to 954 (up to 8 August).

3.3.3 ISOC Science Data Archive

Ingestion of OSA7 data products is working and has been done up to revolution 953.

A new ISDA machine is being installed. Extended disk space has been ordered.

Raw telemetry copied from MOC is available up to 3rd September with some gaps. Work is ongoing to close the gaps. Historical telemetry has been copied at Toulouse and will be shipped.

3.3.4 ISOC System

ISOC software release V26.3 has been released on 8 Sep, V27 is being prepared.

3.3.5 Problems

No new problems.

4 Anomalies

Table 2 contains the anomalies that occurred in the reporting period:

Table 2: Anomalies reported

AR id	Date of occurrence	Subject	Segment	Status
INT-3114	06.09.2010	COMMS - Scheduled maintenance on ESC-SOPS0-D12 caused unexpected impact (DOY 249)		Pending
INT_SC-301	11.09.2010	MCE5 High Count Rate	Payload	Pending
INT-3115	14.09.2010	IMCS - SUN120 connected for TM to IMCA	IMCS	Pending
INT-3116	16.09.2010	Consolidated Data (CD Images) not transferred to PI	IMCS	Pending
INT-3117	16.09.2010	TC: U4921 INT GND LINK OFF failed CEV.	IMCS	Open
INT_SC-302	21.09.2010	IREM Anomaly: Reset of IREM_CSCI S/W #95, 21/09/2010	Payload	Pending
INT_SC-303	23.06.2010	IREM Anomaly: Reset of IREM_CSCI S/W #96, 23/09/2010	Payload	Pending

5 Special Events & Future Milestones

- On September 21 and 22 operations were moved back to the renovated DCA E41
- FSS/STR Misalignment Calibration is planned for rev 978.
- ISDC Communications Upgrade is an ongoing activity
- Analysis for possible Earth observations in 2011
- Routine use of DSN will be discontinued after December
- 16th SPI Annealing: 10-28/10 2010
- SPI GeD HV will be reduced to 3kV one revolution before annealing for a test of detector characteristics.
- Further attempt to change power supply configuration of SPI Compressor Drive Electronics (moving CDE1 relay) planned during annealing period.
- From 10th October onwards it is planned to operate both JEM-X units in parallel as the nominal configuration. The required additional TM bandwidth for JEM-X will be taken from SPI and IBIS.

6 Appendix

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

6.1 AOCS operations

During this period, 574 Open Loop Slews, 358 Closed Loop Slews and 26 Momentum Biases were executed (as reported by ACC OEM).

9 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 30/09/2010 is reported in the following plot:

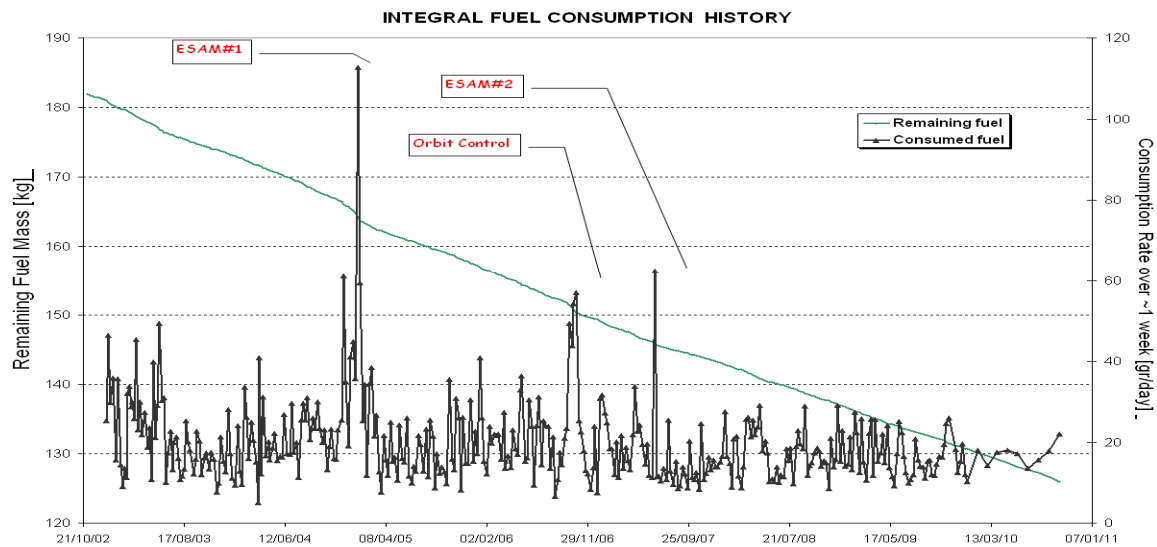


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

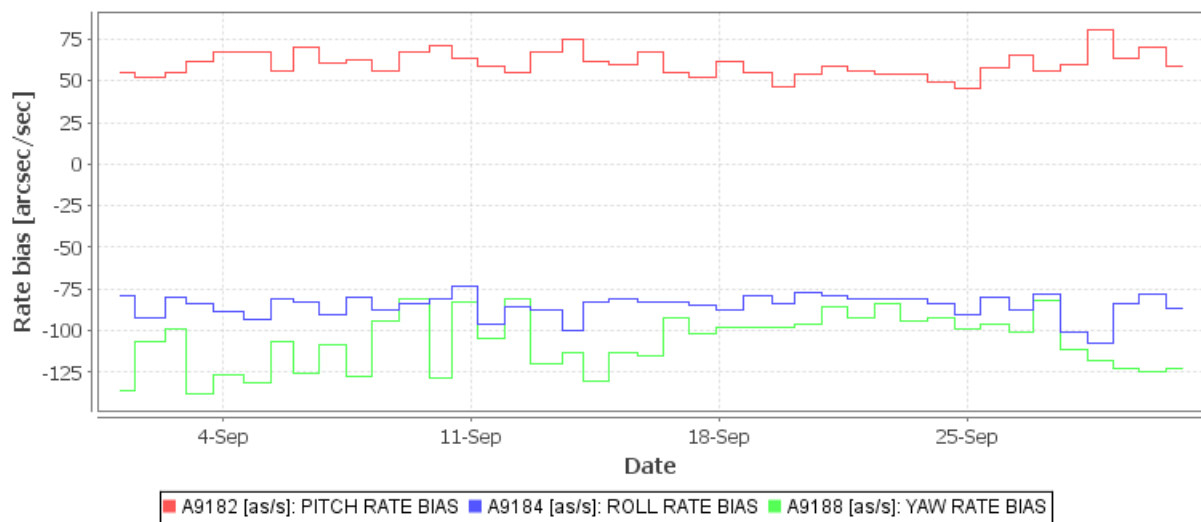


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Eclipse season

The summer eclipse season is summarized in Table 3:

Table 3: Summary of eclipse season

AOCS Eclipse Times													Winter 2010
Date	ACC Eclipse Imminent	Eclipse Start						Eclipse End					Eclipse Duration
		ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE	ACC	
2010-08-02	20:18:56	21:00:52	21:11:52	21:12:35	21:18:36	penumbra only	00:00:00	00:00:00	penumbra only	21:25:11	21:31:07	21:34:48	0:06:35
2010-08-05	20:00:50	20:42:48	20:53:48	20:54:31	21:00:30	21:01:16	21:01:38	21:20:38	21:21:05	21:22:05	21:28:27	21:31:45	0:21:35
2010-08-08	19:44:48	20:26:48	20:37:48	20:38:31	20:44:28	20:45:03	20:45:19	21:12:51	21:13:14	21:14:03	21:19:47	21:23:45	0:29:35
2010-08-11	19:28:59	20:10:55	20:21:55	20:22:38	20:28:39	20:29:11	20:29:22	21:03:30	21:03:52	21:04:36	21:10:30	21:14:14	0:35:57
2010-08-14	19:16:05	19:57:56	20:08:56	20:09:39	20:15:45	20:16:12	20:16:24	20:56:19	20:56:35	20:57:20	21:03:23	21:06:53	0:41:35
2010-08-17	19:05:07	19:46:59	19:57:59	19:58:42	20:04:47	20:05:51	20:05:23	20:50:08	20:50:24	20:51:09	20:56:50	21:00:43	0:46:22
2010-08-20	18:54:04	19:35:59	19:46:59	19:47:42	19:53:44	19:54:10	19:54:20	20:42:55	20:43:12	20:43:56	20:50:14	20:53:34	0:50:12
2010-08-23	18:41:49	19:23:49	19:34:49	19:35:32	19:41:28	19:41:52	19:42:05	20:33:27	20:33:56	20:34:30	20:40:16	20:44:13	0:53:02
2010-08-26	18:28:32	19:10:28	19:21:28	19:22:11	19:28:12	19:28:38	19:28:51	20:21:54	20:22:01	20:22:50	20:29:07	20:32:28	0:54:38
2010-08-29	18:15:45	18:57:41	19:08:41	19:09:24	19:15:25	19:16:00	19:16:06	20:08:57	20:09:20	20:10:07	20:16:20	20:19:45	0:54:42
2010-09-01	18:04:32	18:46:28	18:57:28	18:58:11	19:04:12	19:04:53	19:04:59	19:55:41	19:56:09	19:56:57	20:02:55	20:06:35	0:52:45
2010-09-04	17:53:27	18:35:23	18:46:23	18:47:06	18:53:07	18:53:57	18:54:03	19:39:57	19:40:28	19:41:24	19:47:26	19:51:02	0:48:17
2010-09-07	17:42:33	18:24:37	18:35:37	18:36:20	18:42:13	18:43:05	18:43:28	19:20:52	19:21:20	19:22:40	19:28:36	19:32:25	0:40:27
2010-09-10	17:36:54	18:18:50	18:29:50	18:30:33	18:36:34	18:38:18	18:39:03	18:58:17	18:59:12	19:01:20	19:07:25	19:10:59	0:24:46

Table 4 shows a summary of the IMU-1 drifts and time consumption during the eclipse season:

Table 4: Summary of IMU drift and times

IMU Usage during Eclipse Season						Winter 2010	
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time	
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]			
2010-08-02 16:09:16	2010-08-02 21:49:32	0.2645	0.2829	0.3693	5:40:16	10:20:12	
2010-08-05 15:45:08	2010-08-05 21:35:48	0.1580	0.3717	0.4257	5:50:40	16:10:52	
2010-08-08 15:25:48	2010-08-08 21:26:20	0.3838	0.2911	0.3438	6:00:32	22:11:24	
2010-08-11 15:39:49	2010-08-11 21:16:45	0.0981	0.1917	0.3100	5:36:56	27:48:20	
2010-08-14 15:12:45	2010-08-14 21:09:25	0.2304	0.2483	0.3448	5:56:40	33:45:00	
2010-08-17 14:55:09	2010-08-17 21:03:17	0.1958	0.2451	0.2901	6:08:08	39:53:08	
2010-08-20 14:37:09	2010-08-20 20:56:05	0.2288	0.2122	0.2902	6:18:56	46:12:04	
2010-08-23 14:33:01	2010-08-23 20:46:45	0.2597	0.3273	0.2948	6:13:44	52:25:48	
2010-08-26 14:18:53	2010-08-26 20:35:01	0.2846	0.2335	0.3006	6:16:08	58:41:56	
2010-08-29 14:06:38	2010-08-29 20:22:14	0.2484	0.2094	0.3253	6:15:36	64:57:32	
2010-09-01 14:19:10	2010-09-01 20:09:10	0.2282	0.1974	0.1944	5:50:00	70:47:32	
2010-09-04 13:41:42	2010-09-04 19:53:34	0.1917	0.2057	0.2897	6:11:52	76:59:24	
2010-09-07 13:14:14	2010-09-07 19:34:54	0.2383	0.2200	0.1894	6:20:40	83:20:04	
2010-09-10 13:10:22	2010-09-10 19:13:21	0.2993	0.2067	0.2701	6:02:59	89:23:03	

6.1.4 Event log

01/09/2010 (Day of Year 244, Revolution 962 to 963)

FDS TPF update failed for slew 09630002 (22:42:00Z).The AOCS was suspended in the Timeline and FD was called in. Then a manual mapping was commanded and a slew was manually generated from attitude 09630001 to attitude 09630002.

After the manual slew was completed, the parameters for slew 09630003 were manually updated (spacontool).

Slew 09630002 was missed from the Timeline.

OTF was not reached for PIDs 09630002 and 09630003.

11/09/2010 (Day of Year 254, Revolution 966)

FDS TPF update failed for slew 09660022 (13:49:00Z).The AOCS was suspended in the Timeline and FD was called in. Then a manual mapping was commanded and a slew was manually generated from attitude 09660021 to attitude 09660024.

After the manual slew was completed, the parameters for slew 09660025 were manually updated (spacontool).

Slews 09660022, 09660023 and 09660024 were missed from the Timeline.

OTF was not reached for PIDs 09660022, 09660023 and 09660024.

15/09/2010 (Day of Year 258, Revolution 967)

FDS TPF update failed for slew 09670054 (18:52:00Z). The AOCS was suspended in the Timeline and FD was called in. Then a manual mapping was commanded and a slew was manually generated from attitude 09670053 to attitude 09670055.

After the manual slew was completed, the parameters for slew 09660025 were manually updated (spacontool).

Slews 09670054 and 09670055 were missed from the Timeline.

OTF was not reached for PIDs 09670054 and 09670055.

23/09/2010 (Day of Year 266, Revolution 970)

- IMU1 switched ON during the stable pointing of PID 09700008 (00:46:00Z). After the IMU switched back OFF, a manual mapping was commanded and the parameters for slew 09700009 were manually updated (spacontool).

OTF was not reached for PID 09700008.

- IMU1 switched ON during the stable pointing of PID 09700027 (11:59:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09700028.

Then a mapping was commanded and the parameters for slew 09700029 were manually updated (spacontool).

OTF was not reached for PIDs 09700027 and 09700028.

Slew 09700028 was missed from the Timeline.

24/09/2010 (Day of Year 267, Revolution 970)

As a consequence of DSS27 GS TM drops, the commanding release for slew 09700045 failed (03:08:00Z). AOCS subsystem was disabled.

Once GS TC link was recovered, a manual slew was performed from attitude 09700044 to attitude 09700046.

After the manual slew was completed, a change of guide star TPF was manually generated, prior to the subsequent RWB.

OTF was not reached for PIDs 09700045 and 09700046.

Slews 09700045 and 09700046 were missed from the Timeline.

28/09/2010 (Day of Year 271, Revolution 971 to 972)

IMU1 switched ON during the stable pointing of PID 09720003 (21:15:00Z). After the IMU switched back OFF, a manual mapping was commanded and the parameters for slew 09720004 were manually updated (spacontool).

OTF was not reached for PID 09720003.

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 stroke of all four compressors was set to 41 until 2010.248.02.00Z, when it was increased to 42. It was then increased to 43 at 2010.262.22.15Z, in both instances as the Cold Plate temperature had reached 80.9K. The stroke remained at 43 for the rest of the reporting period.

The following plot shows the evolution of the cold plate and H bus temperature during the reporting period. The downward spikes should be disregarded as they are due to missing data during the time the AFEE is off due to eclipse:

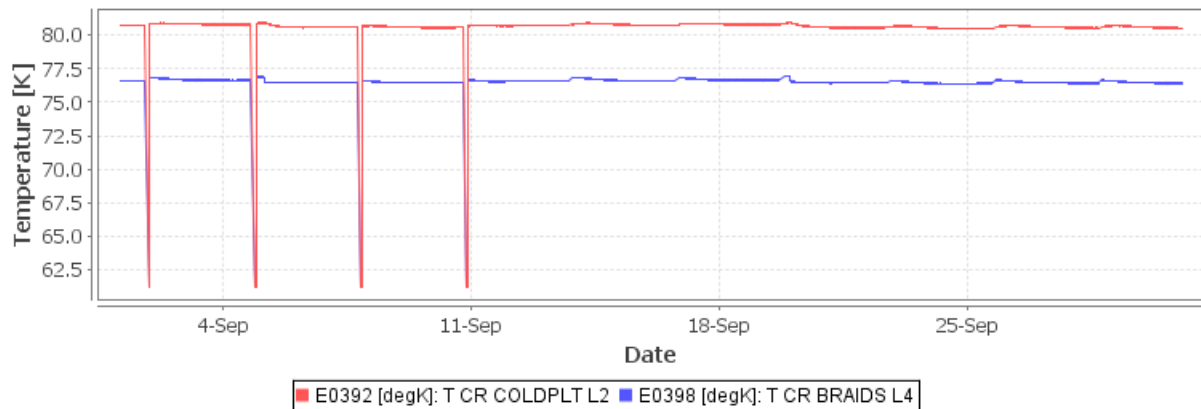


Figure 13: SPI Cold plate and H-bus temperature

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

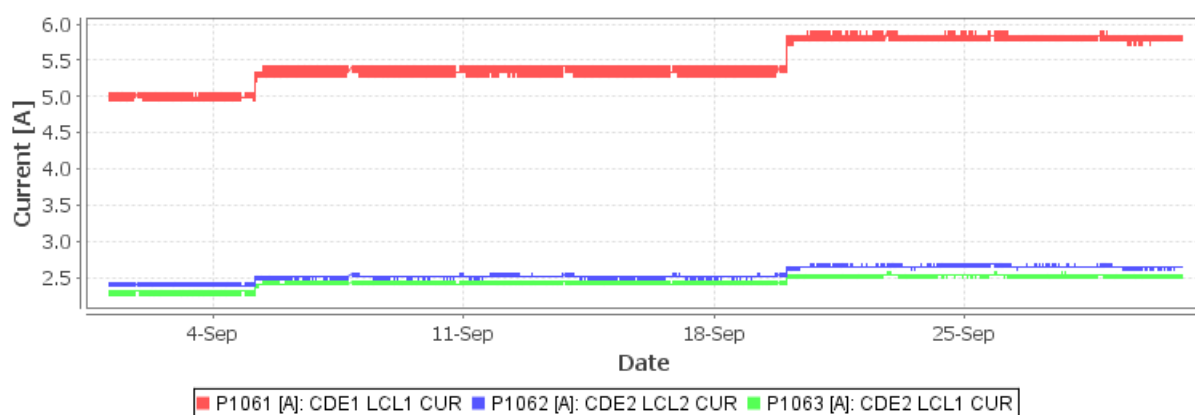


Figure 14: SPI CDE LCL current

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. GeD#8 DC output voltage is still higher than the others but remains stable.

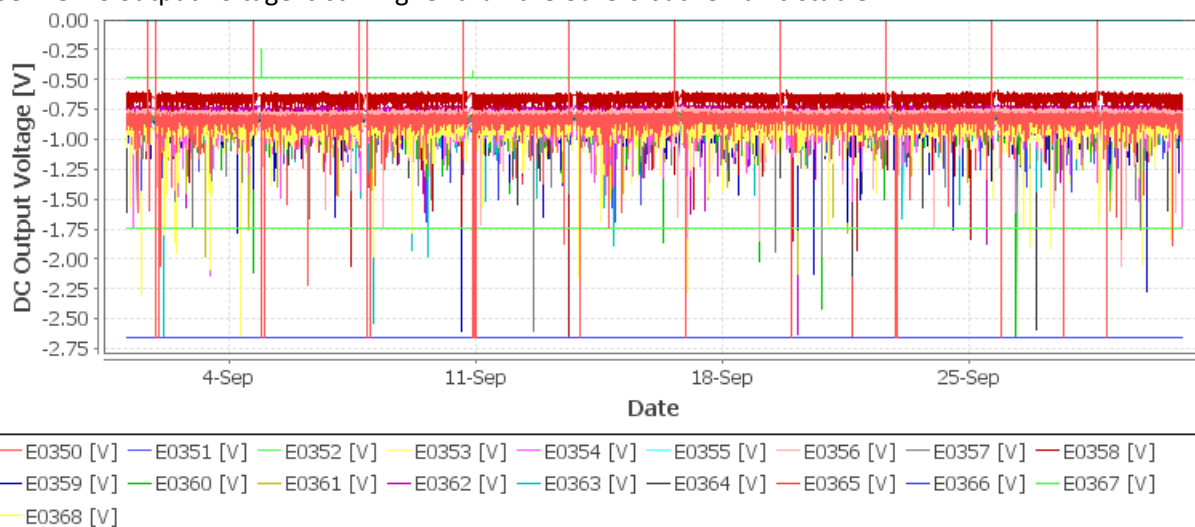


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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.

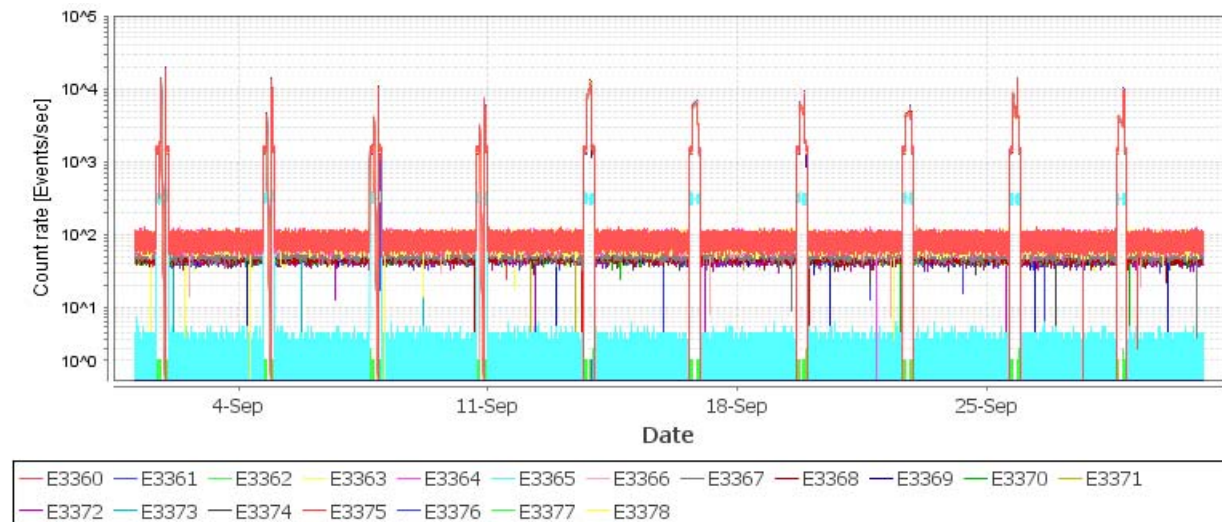


Figure 16: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic.



Figure 17: SPI GeD Time tag 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:

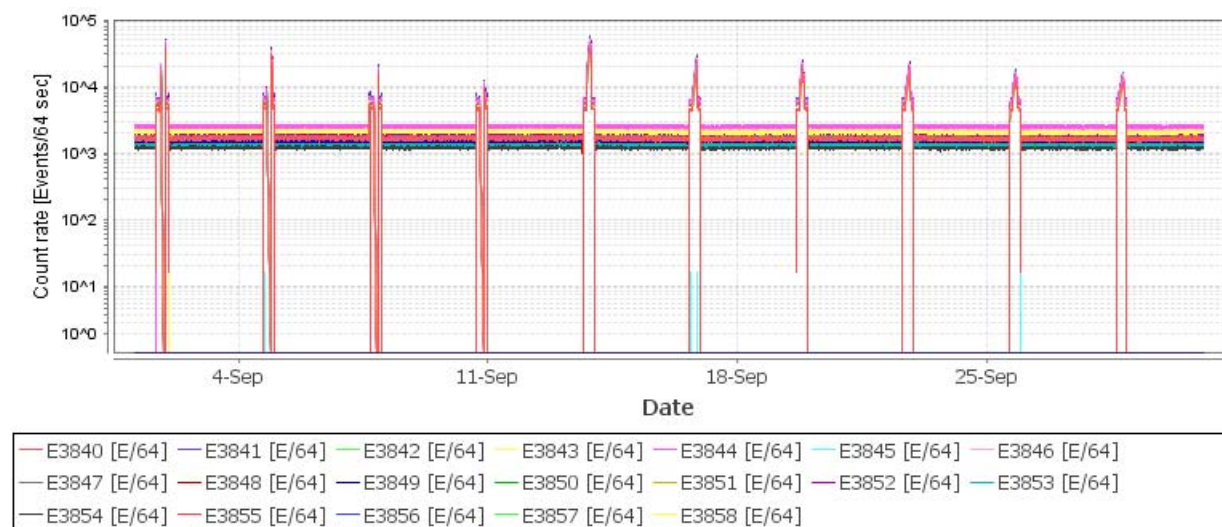


Figure 19: SPI PSD GeD Channel Rates

6.2.2 Event Log

23-09-2010 (Day of Year 266, Revolution 970)

At 16.28.12Z TM parameter E2224 went OOL (value = PARAM < SPEC). This is the ACS FEE#74 5V digital status. As it returned within limits of its own accord when the next packet was received at 16.38.52Z, no action was taken.

6.3 IBIS

6.3.1 Operations

ISGRI

The health and performance of ISGRI was nominal during the reporting period, other than an anomaly of high count rates observed on MCE5. This is reported in the Event Log section below. The following plot shows the ISGRI MCE counters during the reporting period. Spikes on the MCE5 count rate can be seen throughout the month:

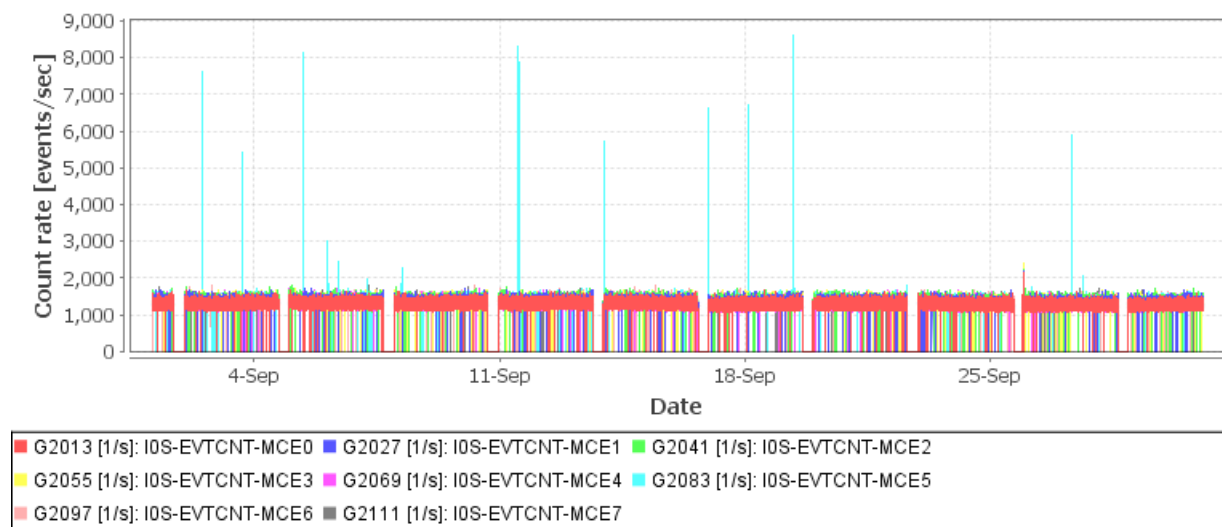


Figure 20: ISGRI MCE Counters

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

TM parameter G2070 went OOL several times during the reporting period, indicating an overflow of the noisy pixel address buffer in MCE5. As in each case it returned within limits of its own accord after a few TM cycles, no action was taken. However this is related to the general problem with spikes on the MCE5 count rate and the anomaly on DOY 254 reported below.

04-09-2010 (Day of Year 247, Revolution 963 - 964)

At 2010.247.09.09.22Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 2010.247.09.10.37Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 2010.247.09.13.59Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

08-09-2010 (Day of Year 251, Revolution 965)

At 2010.251.10.25.38Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE) and at 2010.251.10.27.01Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 2010.251.10.30.17Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

11-09-2010 (Day of Year 254, Revolution 966)

On 2010-09-11 at 10.37.25Z TM parameter G2083 IOS-EVTCNT-MCE5 (number of events triggering the MCE5 per second) went Out of Limits High with a value of 7788. The count rates on all other MCEs were nominal and also all other TM parameters were nominal. This was during a routine OMC Flat Field Calibration staring observation.

However, just before the anomaly, at 10.35.17Z TM parameter G2070 had gone out of limits, indicating an overflow of the noisy pixel address buffer in MCE5. This parameter had returned within limits of its own accord at 10.35.33Z. (N.B. This parameter routinely goes OOL for a few TM cycles.)

At 11.32.55Z CRP_IBIS1_0196 ISGRI MDUs High Count Rate Recovery was started. During the execution of this procedure, following the lowering of the MCE5 bias to -70V, the MCE5 count rate returned within limits (at 11.38.05Z). The recovery procedure was completed, with the MCE5 bias back to the nominal value of -120V and IBIS back to Science Standard mode, at 12.14.41Z. Following this, the MCE5 count rate remained nominal.

This is recorded as Anomaly Report INT_SC-301.

21-09-2010 (Day of Year 264, Revolution 969)

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 2010.264.19.04.02Z. It was recovered as follows:

- At 2010.264.19.47.17Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2010.264.20.13.23Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.

IBIS operations continued nominally.

23-09-2010 (Day of Year 266, Revolution 970)

Following a ground station handover, at 01:19Z TM parameter X7500 went OOL indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

- 2010.266.01.32.26Z FCP_IBIS1_0312
- 2010.266.01.36.21Z TC G0129 uplinked to return IBIS to Science Standard mode.

Following this, due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 2010.266.01.50.49Z. It was recovered as follows:

- At 2010.266.02.42.38Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 2010.266.02.54.56Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.

IBIS operations continued nominally.

6.4 JEM-X

6.4.1 Operations

The Status of JEMX-2 is nominal. JEMX-1 was activated for revolutions 966-968 (10th to 19th September). The following plot shows the JEMX DFEE and detector temperatures over the reporting period.

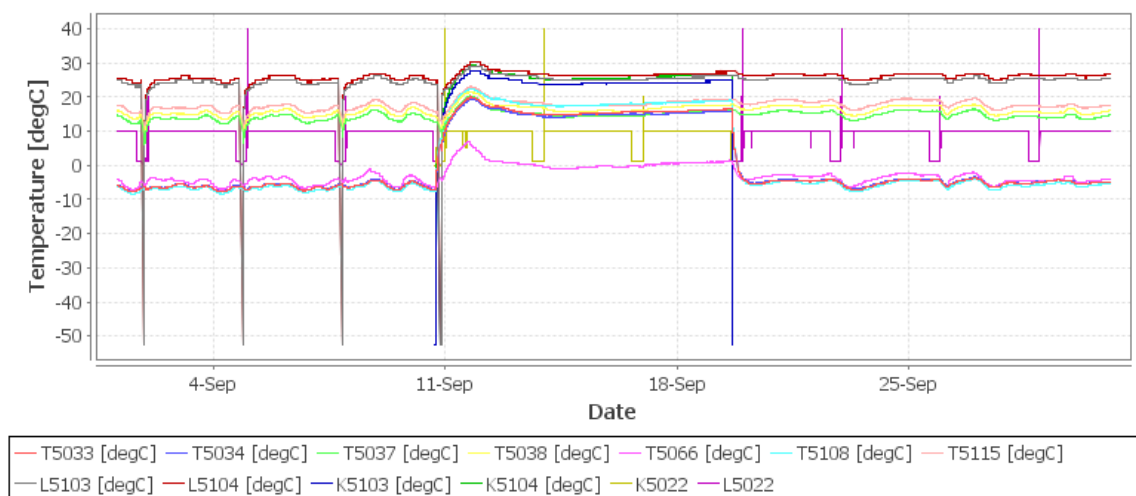


Figure 22: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

10-09-2010 (Day of Year 253, Revolution 965)

At 14:09, operations to activate JEMX-1 were commenced. At the indicated times, the following procedures were completed:

14:11:15 DEBWHI00 (Allocation of PST)

14:14:48 FCP_JEM1_0010 JEMX1 DPE AND CSSW ACTIVATION

14:46:04 FCP_JEM1_0015 JEMX1 IASW ACTIVATION

14:52:38 FCP_JEM1_0016 JEMX1 ENABLE BCP DISTRIBUTION

14:57:44 FCP_JEM1_0017 JEMX IASW EXTENDED TM CHECK

15:02:28 FCP_JEM1_0020 JEMX1 DFEE 1ST ACTIVATION AFTER DPE SWITCH

At 15:48:14, the transition to SAFE mode occurred automatically when the reaction to the broadcast packet was re-enabled.

The operations were completed before LOS at 15:05:00.

At 19:33:24, the command K0010 (State Memory, part of the sequence to dump the on-board CRCs) failed release, as JEMX-1 was in SETUP (owing to the final State SAFE command being omitted before LOS). This was rectified by manually sending K0008 (State SAFE command), there was no impact.

The KECLXT01 ED was manually uplinked, as the time-tagged ED had not been loaded in the timeline.

At 11:26, the KEHVAC01 & LEHVAC01 EDs both failed release due to high radiation at belt exit. A recovery was performed, with JEMX-2 being recovered at 12:27, and JEMX-1 at 12:55.

19-09-2010 (Day of Year 262, Revolution 969)

At 13:35, manual operations were commenced to turn off JEMX-1. These consisted of:

13:36:47 FCP_JEM1_0120 JEMX1 SET BCP OVERRIDES inhibiting reaction to belt entry.

13:38:06 FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF.

13:43:01 FCP_JEM1_0120 JEMX1 SET BCP OVERRIDES enabling reaction to belt entry.

13:45:14 FCP_JEM1_9001 JEMX1 DISABLE BCP DISTRIBUTION

13:48:54 FCP_JEM1_9000 JEMX1 DPE SWITCH OFF

These operations were completed at 13:51:48.

At 21:24, due to a command verifier problem, the LEHVAC01 failed to be uplinked. A recovery was performed, and the unit correctly configured by 22:07. The impact was the loss of about 33 minutes science time.

21-09-2010 (Day of Year 264, Revolution 969)

At 19:04:36 JEMX-2 parameters L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#95). There was no impact as the reaction has been disabled.

23-09-2010 (Day of Year 266, Revolution 970)

At 01:51:22 JEMX-2 parameters L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#96). There was no impact as the reaction has been disabled.

Out of limits observed this month were: L5316, L5317, L5317, K5101, but these were sporadic.

Additionally during the month, dumps were performed of the DPE between addresses 1E6D8 & 1E6DB inclusive & the DFEE CRCs after AOS, to verify their content following the post-eclipse switch-on. The results were identical for JEMX-1 & 2:

Start Address	Length of dump	CRC value	DPE Dump
B000	2000	F1B3	2A23 296A CBFF F1B3
B000	1000	F074	
C000	1000	CF9F	

6.5 OMC***6.5.1 Operations***

The status and performance of OMC is nominal.

6.5.2 Event Log**01-09-2010 (Day of Year 244, Revolution 962 - 963)**

At 22:42, a TPF slew-update failed. Operations were stopped, and a recovery performed. The timeline was recovered at 23:32. The impact was the loss of pointing 09630002. It was at this time that the following pair of commands were rejected:

2010.244.23.13.30.543	2010.244.23.13.39.587	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E
2010.244.23.13.36.668	2010.244.23.13.47.126	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.

11-09-2010 (Day of Year 254, Revolution 966)

At 13:49, a TPF slew-update failed. Further problems delayed the recovery to 14:49:10. The impact was the loss of pointings 09660023 & 09660024. It was at this time that the following pair of commands were rejected:

2010.254.14.30.24.817	2010.254.14.30.33.728	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N E	E

2010.254.14.30.31.317	2010.254.14.30.40.526	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 09660024.

15-09-2010 (Day of Year 258, Revolution 967)

At 18:52, the TPF slew-update failed for pointing 09670054. A recovery was performed, and the timeline rejoined at 20:53. The impact was the loss of pointing 09670054 and the shortening of pointing 09670055 from a planned 2838 to 2064 seconds.

20-09-2010 (Day of Year 263, Revolution 969)

At 04:14, owing to a commanding problem near AOS, a manual recovery of JEM-X was performed, with subsequent activation of the CCCF. This caused OMC to switch from Science mode to Stand-by. At 04:44:40, the unit was then manually commanded back to Science mode. The impact was the shortening of pointing 09690009 from a planned 2934 to 847 seconds.

21-09-2010 (Day of Year 264, Revolution 969)

At 19:03:52 an IREM SEU (#95) forced OMC to SAFE mode, a recovery was performed, and the unit returned to science at 19:28:24. The impact was a delay in the start of pointing 09690052, such that the pointing was shortened to 1576 from a planned 2934 seconds.

23-09-2010 (Day of Year 266, Revolution 970)

At 01:50:41 an IREM SEU (#96) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 02:21:20. The impact was the loss of pointing 09700010.

24-09-2010 (Day of Year 267, Revolution 970)

At 03:07, a power outage at DSS-27 forced an interruption to operations. The ground station was recovered at 03:39, and a recovery performed. The timeline was rejoined at 04:27. The impact was the loss of pointings 09700045 & 09700046. It was at this time the following commands were rejected:

2010.267.03.59.30.020	2010.267.03.59.37.682	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2010.267.03.59.36.145	2010.267.03.59.46.765	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 09700046.

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.

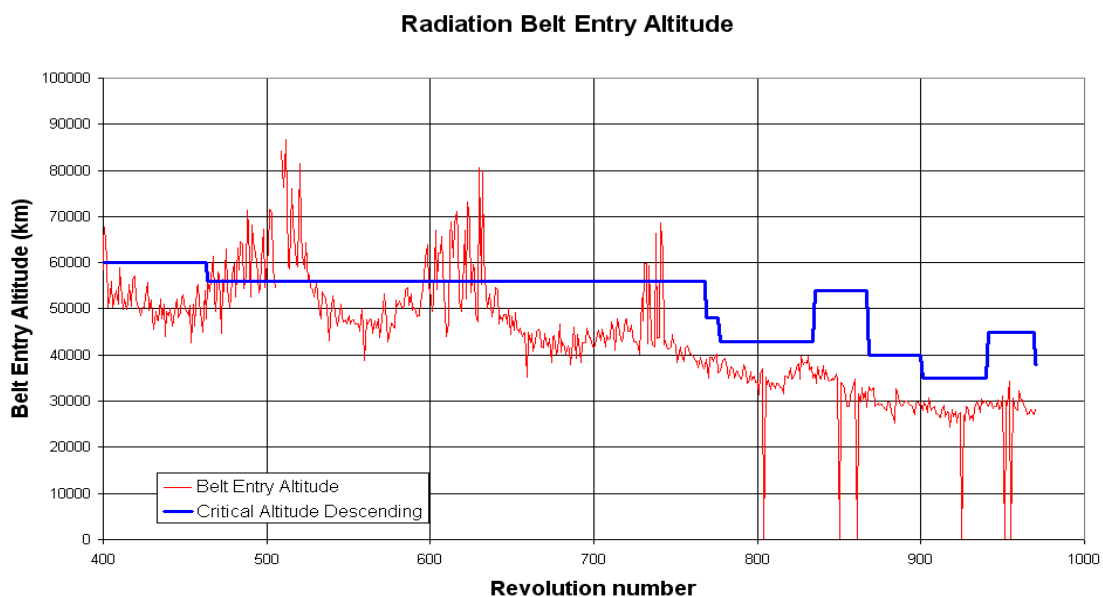


Figure 23: Radiation belt entry

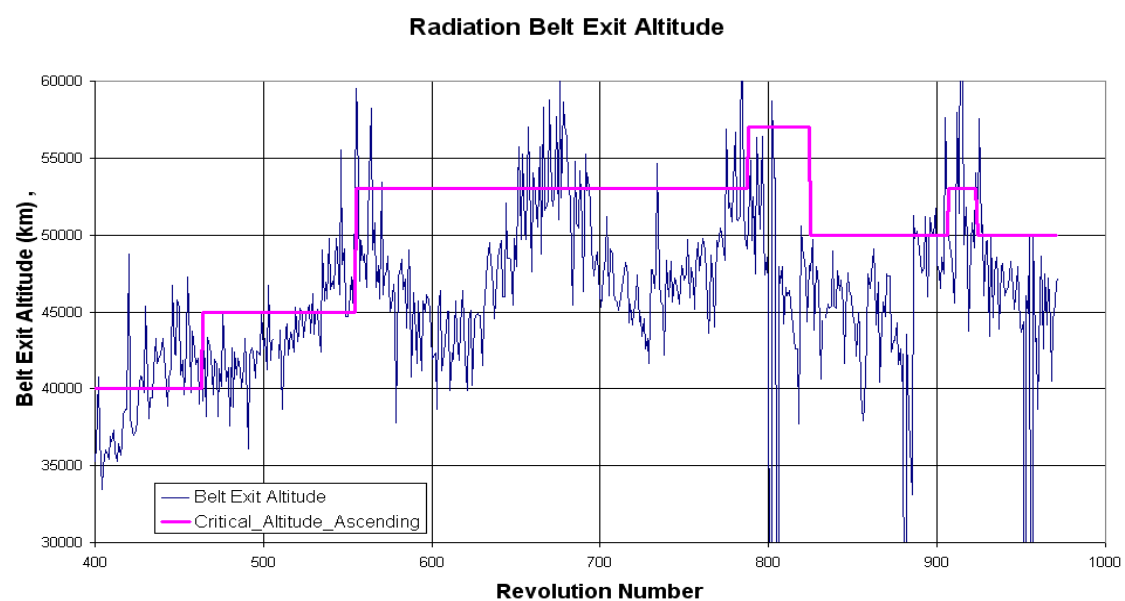


Figure 24: Radiation belt exit

Table 5: Radiation belts. Radiation belt entry crossings are ignored if there is a subsequent gap of at least 30 minutes of low radiation.

Revo no.	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
962	RAD_ENTR R 2010-09-01T14:50:34Z	01/09/2010 16:38:06	25124.1	01-Sep-2010 16:56:13	20623.21	01-Sep-2010 17:36:13	11548.21
963	RAD_EXIT R 2010-09-01T22:23:13Z	01/09/2010 21:53:02	>37820.7	01-Sep-2010 22:06:13	47391.74	01-Sep-2010 18:16:13	4860.635
963	RAD_ENTR R 2010-09-04T14:35:26Z	04/09/2010 16:25:18	24992.1	04-Sep-2010 16:38:13	21493.57	04-Sep-2010 17:28:13	10231.55
964	RAD_EXIT R 2010-09-04T22:08:18Z	04/09/2010 21:15:42	>>37805.1	04-Sep-2010 21:48:13	46701.21	04-Sep-2010 17:58:13	5163.816
964	RAD_ENTR R 2010-09-07T14:20:24Z	07/09/2010 16:16:07	22570.1	07-Sep-2010 16:23:29	21773.5	07-Sep-2010 17:13:29	10458.8
965	RAD_EXIT R 2010-09-07T21:52:47Z	07/09/2010 20:38:31	37839.6	07-Sep-2010 21:43:29	48212.93	07-Sep-2010 17:53:29	4722.727
965	RAD_ENTR R 2010-09-10T14:08:07Z	10/09/2010 16:03:03	22390.8	10-Sep-2010 16:14:02	20937.36	10-Sep-2010 17:04:02	9530.412
966	RAD_EXIT R 2010-09-10T21:39:25Z	10/09/2010 20:46:39	>>36067.3	10-Sep-2010 21:24:02	47345.01	10-Sep-2010 17:34:02	4725.476
966	RAD_ENTR R 2010-09-13T13:57:24Z	13/09/2010 15:58:39	22332.4	13-Sep-2010 15:58:47	21568.27	13-Sep-2010 16:48:47	10134.03
967	RAD_EXIT R 2010-09-13T21:28:09Z	13/09/2010 20:17:11	>>28275.3	13-Sep-2010 21:08:47	46914.83	13-Sep-2010 17:18:47	4881.544
967	RAD_ENTR R 2010-09-16T13:45:32Z	16/09/2010 15:43:19	22099.4	16-Sep-2010 15:45:17	22135.87	16-Sep-2010 16:35:17	10742.98
968	RAD_EXIT R 2010-09-16T21:16:24Z	16/09/2010 19:50:15	>>28267.7	16-Sep-2010 21:05:17	48083.11	16-Sep-2010 17:15:17	4575.305
968	RAD_ENTR R 2010-09-19T13:32:01Z	19/09/2010 15:31:11	22241.1	19-Sep-2010 15:36:55	21110.72	19-Sep-2010 16:26:55	9730.91
969	RAD_EXIT R 2010-09-19T21:03:06Z	19/09/2010 19:51:03	>>30281.0	19-Sep-2010 20:46:55	47172.72	19-Sep-2010 16:56:55	4824.147
969	RAD_ENTR R 2010-09-22T13:17:45Z	22/09/2010 15:17:51	22520.3	22-Sep-2010 15:27:10	20047.94	22-Sep-2010 16:07:10	10867.98
970	RAD_EXIT R 2010-09-22T20:48:34Z	22/09/2010 19:46:07	>>30296.3	22-Sep-2010 20:37:10	48003.23	22-Sep-2010 16:47:10	4567.543
970	RAD_ENTR R 2010-09-25T13:44:11Z	25/09/2010 15:00:56	22112.1	25-Sep-2010 15:05:43	21684.91	25-Sep-2010 15:55:43	10195.25

Revo no.	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
971	RAD_EXIT R 2010-09-25T20:34:21Z	25/09/2010 19:50:24	42710.2	25-Sep-2010 20:15:43	46921.83	25-Sep-2010 16:35:43	4425.611
971	RAD_ENTR R 2010-09-28T13:31:19Z	28/09/2010 14:42:32	24256.9	28-Sep-2010 14:54:30	21393.77	28-Sep-2010 15:44:30	9868.711
972	RAD_EXIT R 2010-09-28T20:21:00Z	28/09/2010 19:25:28	>>30378.2	28-Sep-2010 20:04:30	47187.56	28-Sep-2010 16:14:30	4658.866

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

16-09-2010 (Day of Year 259, Revolution 967)

At 15:37:00 the TC: U4921 INT GND LINK OFF (part of the sequence UEGROF01) failed its CEV. The TM parameter U9903 SR INT GND LINK was OFF. No action was taken, and there was no impact.

21-09-2010 (Day of Year 264, Revolution 969)

At 19:03:51Z, a local reset of the IREM CSCI S/W (SEU #95) 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 2010.264.19:03:51Z (140804.0 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 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 21:43:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the Pls request. OMC was recovered at 19.28.18Z and IBIS at 20:15:00Z.

23-09-2010 (Day of Year 266, Revolution 970)

At 01:50:39Z, a local reset of the IREM CSCI S/W (SEU #96) 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 2010.266.01:50:39Z (88278.6 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 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 05:08:00Z.

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 02.21.20Z and IBIS at 03:05:00Z.