

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 315
Week 40
06.10.08
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.

It addresses the activities from 27.09.08 until 03.10.08 (both dates inclusive) and covers the revolutions 728 and 729.

2 Summary of Activities

The operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

The targets of these revolutions consisted of a raster dither at attitude (RA 05:34:31.90, DEC +22:00:52.0) (the Crab calibration), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1), and 2 parts of a Galactic disk scan at attitudes (RA 19:00:42.00, DEC +04:30:32.4) and (RA 19:08:05.28, DEC +08:03:46.8).

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

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

The Eclipse season started on 22/09/2008. The third (28/09/2008) and fourth (01/10/2008) eclipse passages were nominal from an AOCS point of view.

The load of the TT sequence to re-enable the IMU Auto Switch-Off function in the ACC and the Eclipse ACC\FDE\FCE timers were verified for the 3rd and 4th eclipse passages.

Ten slews were missed from TL, during the observation period due to problem on FDS, on DSS27 and REDU stations.

The fuel consumption over the period between 27/09/2008 and 03/10/2008 was 0.01090 Kg. The remaining propellant is in the order of 138.2808 Kg.

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

3.1.2 Power

The EPS is working nominally; available power from the arrays is of the order of 2100W.

3.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

3.1.4 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.

3.1.5 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.

3.2 Payload

3.2.1 SPI

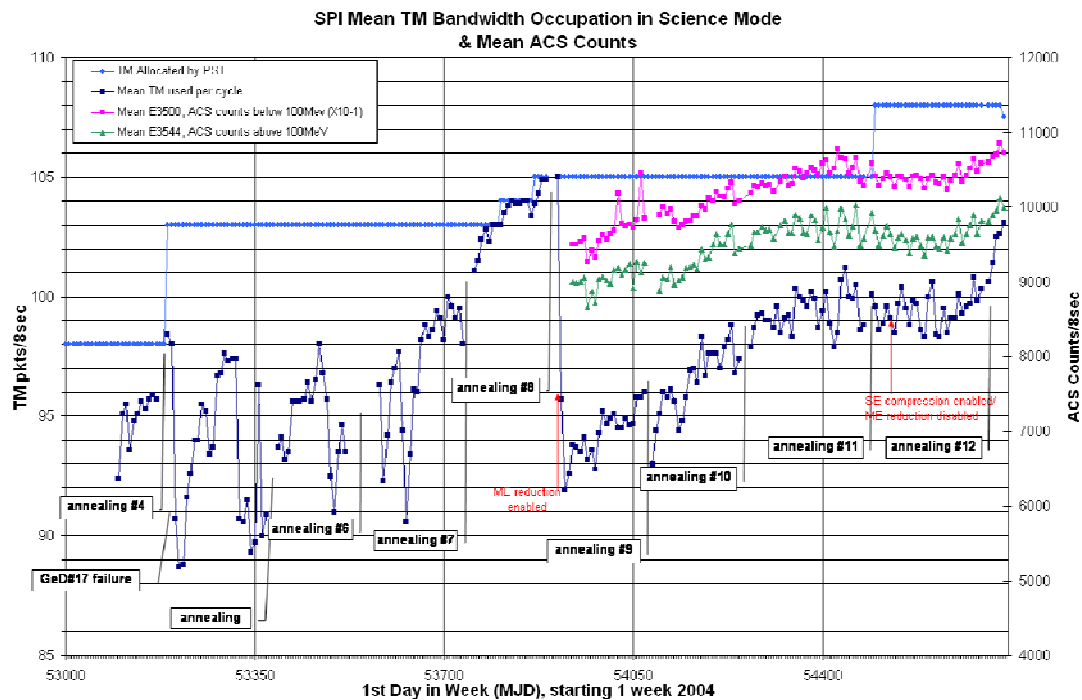
Following the 12th annealing, ended on 04/09/2008 at 23:50Z, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003) and detector #17 (failed since 17/07/2004). The energy resolution of the previously degraded GeD#12 has improved following this annealing and the bias of this detector is now set to 4kV as for the other detectors.

Eclipse operations for SPI were executed nominally.

The Stirling compressors are working nominally. Due to a ground segment anomaly (AR INT-3031) resulting in the stroke of the cryocooler not being increased as required, the Germanium detectors temperature drifted to 82K during the week. This was observed on 29-09-2008 and the temperature was recovered to within the correct range by the end of that day.

During science operations, the instrument was kept in photon-by-photon mode with spectra TM enabled. The assigned TM bandwidth in the science observation windows was 107 packets/cycle in revolutions 727 and 728, except from 2008-09-30T18:17:16Z to 2008-09-30T21:19:08Z when it was 86 packets/cycle for the JEM-X specific Crab observation, and 108 packets/cycle in revolution 729. The average telemetry occupation when the allocation was above 107 packets/cycle was 103.1 packets/cycle.

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth along with the mean ACS count rate evolution (since July 2006). As can be seen, there is a strong correlation between the evolution of the background as measured by the ACS and the overall TM bandwidth usage.



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

3.2.2 IBIS

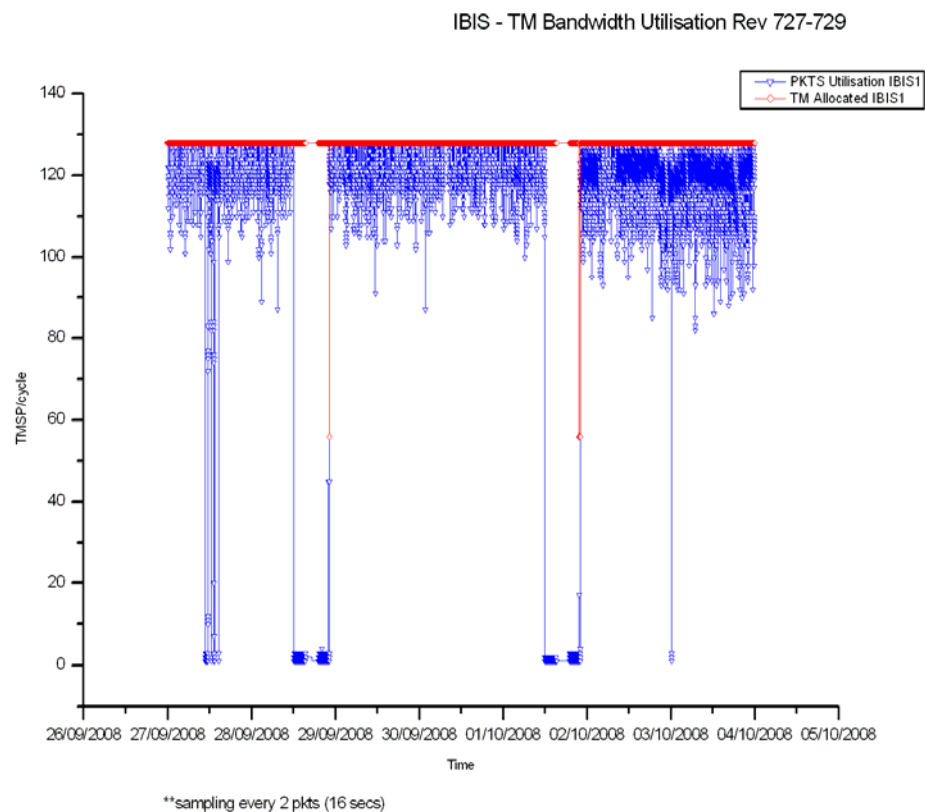
The overall status of the unit is nominal.

Eclipse operations for IBIS continued to be executed nominally.

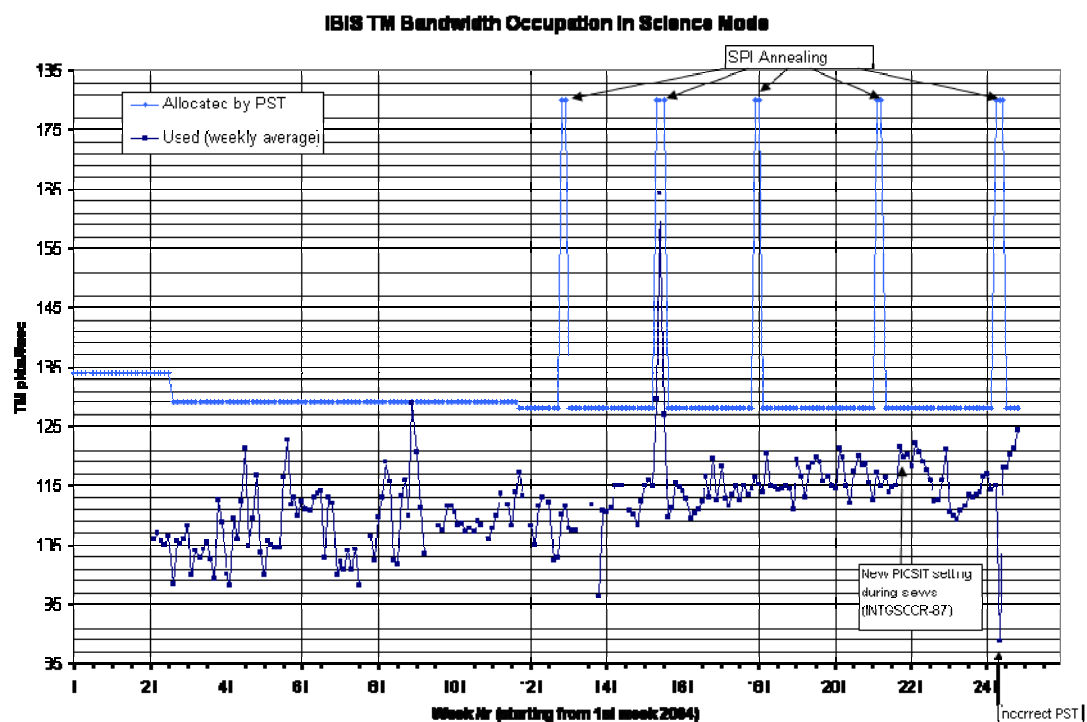
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 124.40 packets/cycle (up 3.06 on previous week)
- Percentage of TM cycles in which full bandwidth was used: 60.01%

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



A plot of the IBIS weekly bandwidth utilisation since 2004 is shown below:



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

3.2.3 JEM-X

The status of both JEM-X units is nominal.

JEM-X operations were performed by the automatic Timeline.

From the beginning of the week until 2008-10-01T11:04:52Z, JEM-X1 & 2 were operated in Data Taking mode with a TM allocation of 6 & 4 packets/cycle respectively. Subsequently, during revolution 729, JEM-X1 was operated in Data Taking mode with a TM allocation of 8 packets/cycle, and. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

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

3.2.4 OMC

The status of OMC is nominal.

OMC operations were performed by the automatic Timeline. OMC was operated in Science Normal mode during science observations, with a TM allocation of 4 packets/cycle, during revolutions 727 & 728, except from 2008-09-30T18:17:59Z to 2008-09-30T21:19:51Z when it was 5 packets/cycle, and 5 packets per cycle during revolution 729.

During this reporting period, 115 of the 228 planned science pointings were executed nominally, 4 were cut short, 1 executed at the wrong attitude and 10 were lost.

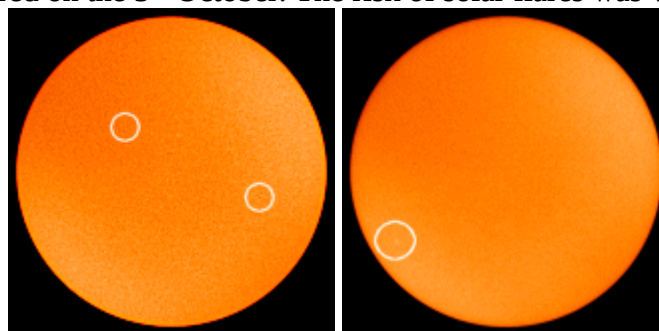
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity. Two small sun spots emerged on the 30th September, but had disappeared by the following day. Another small spot appeared on the 3rd October. The risk of solar flares was very low.



Reference: www.spaceweather.com

Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

4 Ground Facilities

The Operational ground facilities performance was below average this week. Nine pointings were lost and one interrupted to ground problems. The overall performance though was still above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. No pointings were lost to MOC related issues.

4.2 Ground Stations & Network

The performance of the ground stations and Network was not so good this week. There were eight link drops reported from DSS27, probably due to RFI, and two from Redu, the impact was the loss of nine pointings, and the interruption of another. There was also one occasion when the links with ISDC briefly dropped, without impact.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 734, 735, 736.

Revolutions 731-735 planned and sent.

New TSFs have been received for revolutions 729-733.

We received TOO requests on new activity seen from the Anomalous X-ray pulsar 1E 1547.0-5408. Note that in the previous week (39) we had received TOO requests for the renewed outburst of the black-hole transient H1743-322. TOO observations are currently foreseen for week 41 (revolutions 731/732), as well as following weeks (734, 736).

2. Observation status

New ECS file for revolution 719 received and processed.

3. ISOC Science Data Archive

No updates.

4. ISOC system

ISOC system v19.4.1 still working. Work is underway for v20.

5. Problems

More problems with receiving (TOO) messages on the duty scientist phone. Continued to be under investigation.

4.3.2 ISDC

Status of ISDC observation processing on 06/10/2008:

- Latest Standard Analysis completed: observation 05200320003 (X Per, Revolutions 715-716) on 29/09/2008.
- Latest products archived: observation 05200320003 (X Per, Revolutions 715-716) on 29/09/2008.
- Latest observation products sent to the observer: observation 05297000004 (Perseus OB2 Cloud, Revolutions 706-710) on 13/09/2008.

5 Special Events

6 Anomalies

The following problems were reported this week that impacted operations.

- On DoY 271 at 10:48:16, there was an IREM SEU (#67), a recovery was performed, see IREM, OMC & IBIS sections below for details.
- On DoY 272, at 19:46:28, there was a JEM-X1 DFEE CRC anomaly. The unit was recovered at 20:39 by power cycling the DFEE.
- On DoY 273, at 09:20, a FD problem forced the interruption of the Timeline. A recovery was performed and the Timeline rejoined at 11:33. The impact was the loss of pointings 07280021, 07280022, 07280023 & 07280024.
- On DoY 274, at 06:22, a drop in the links with DSS27 forced an interruption in the Timeline. The links were recovered at 06:39, and a recovery commenced. Despite another link drop, the timeline was rejoined at 07:25. The impact was the loss of pointings 07280056 & 07280057. There were a total of 8 drops in the link during this pass, probably caused by RFI.
- On DoY 275, at 03:27, an antenna problem at DSS27, caused a drop in the links. After the links were restored, a recovery was performed. The impact was the interruption of pointing 07280090, and the loss of 07280091.
- At 22:05:00, there was a JEM-X1 DFEE CRC anomaly. The unit was recovered at 23:45 by power cycling the DFEE.
- On DoY 276, at 22:57, a drop in the links with Redu caused the suspension of the Timeline. A recovery was performed, and the Timeline rejoined at 23:50. The impact was the loss of pointings 07290034 & 07290035.

The following anomaly reports were entered into the ARTS system this week.

AR id	Date Created	Subject	Segment	Status
INT-3027	2008-09-17	Loss of Connectivity to PI WS on PISA LAN	Comms	Pending
INT-3028	2008-09-30	Problems with DSS-27 pass	NASA Station	Pending
INT-3029	2008-10-02	TDRS packet retrieval not working	IMCS	Pending
INT-3030	2008-10-02	Incorrect Version of FD Recover Schedule Users manual in SPACON	FDS	Pending

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Date : 06/10/08

Issue : 1
Rev. : 0
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AR id	Date Created	Subject	Segment	Status
		folder		
INT-3031	2008-10-02	TM SPACON Constant Incorrect; SPI Temperature too High	IMCS	Pending
INT-3032	2008-08-04	DSS27 - NO TM (DOY 217)	NASA Station	Pending
INT-3033	2008-08-08	DSS27 - NO TM & TC (DOY 220)	NASA Station	Pending
INT_SC-237	2008-10-02	JEM-X1 DFEE CRC Anomaly following eclipse on 2008-09-28	Payload	Pending
INT_SC-238	2008-10-02	JEM-X1 DFEE CRC Anomaly following eclipse on 2008-10-01	Payload	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 728

The observations in revolution 728 were devoted to the Crab calibration for SPI and JEM-X, which was a raster dither at attitude (RA 05:34:31.90, DEC +22:00:52.0), firstly ~40.3 hours for SPI, then ~2.8 hours for JEM-X, then another ~13.4 hours for SPI.

Throughout these observations, all instruments were in their nominal science modes. The TM allocation was IBIS 128; SPI 107; JEM-X1 6; JEM-X2 4; OMC 4.

Revolution 729

The observations in revolution 729 began with a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours. They continued with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. This was followed by a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1), lasting ~11.6 hours. Finally 2 pointings of a Galactic disk scan were executed, first at (RA 19:00:42.00, DEC +04:30:32.4), lasting ~17.2 hours, then at (RA 19:08:05.28, DEC +08:03:46.8), lasting ~17.2 hours until the end of the revolution.

Throughout these observations, all instruments were in their nominal science modes, except JEM-X2, which is switched off. The TM allocation was IBIS 128; SPI 108; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2008-09-15T06:09:55.000Z	138.5450	F	Automatic TM processing.
2008-09-16T20:41:12.000Z	138.5320	F	Automatic TM processing.
2008-09-18T05:54:03.000Z	138.5122	F	Automatic TM processing.
2008-09-19T14:23:35.000Z	138.4947	F	Automatic TM processing.
2008-09-19T20:43:52.000Z	138.4792	F	Automatic TM processing.
2008-09-21T05:48:19.000Z	138.4475	F	Automatic TM processing.
2008-09-22T21:00:31.000Z	138.4370	F	Automatic TM processing.
2008-09-24T05:38:59.000Z	138.4261	F	Automatic TM processing.
2008-09-25T12:40:34.000Z	138.3998	F	Automatic TM processing.
2008-09-25T20:46:07.000Z	138.3898	F	Automatic TM processing.
2008-09-27T05:13:23.000Z	138.3669	F	Automatic TM processing.
2008-09-28T20:34:15.000Z	138.3593	F	Automatic TM processing.
2008-09-30T05:18:26.000Z	138.3379	F	Automatic TM processing.
2008-10-01T20:22:47.000Z	138.3211	F	Automatic TM processing.
2008-10-02T04:01:12.000Z	138.2808	F	Automatic TM processing.

This report was generated Fri Oct 3 08:00:27 GMT 2008

8.3 Detailed Satellite Information

This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS SUMMARY OPERATIONS REPORT, 27/09/2008 – 03/10/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 142 Open Loop Slews, 90 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

10 slews (5 CSL, 5 OSL) were missed from TL, during the observation period due to problem on FDS, on DSS27 (antenna stopped) and REDU stations (drop in TM/TC links).

The OTF was not reached during PID 07270078 due to loss of guide star.

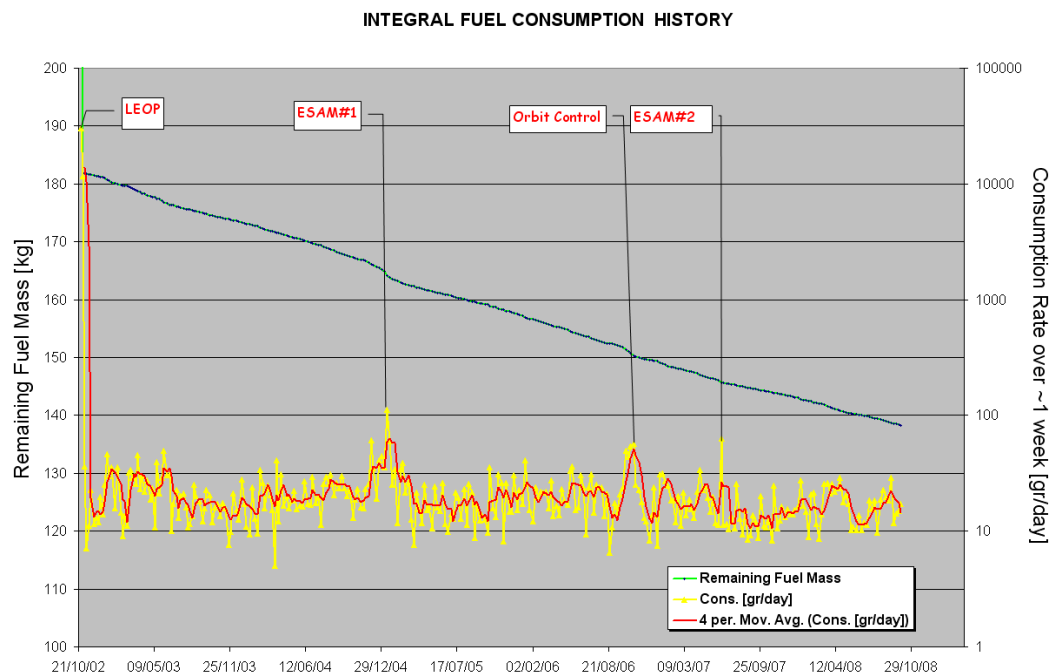
This is equivalent to $\sim 4.2\%$ of the total number of slews planned (237).

Orbit Control

No update

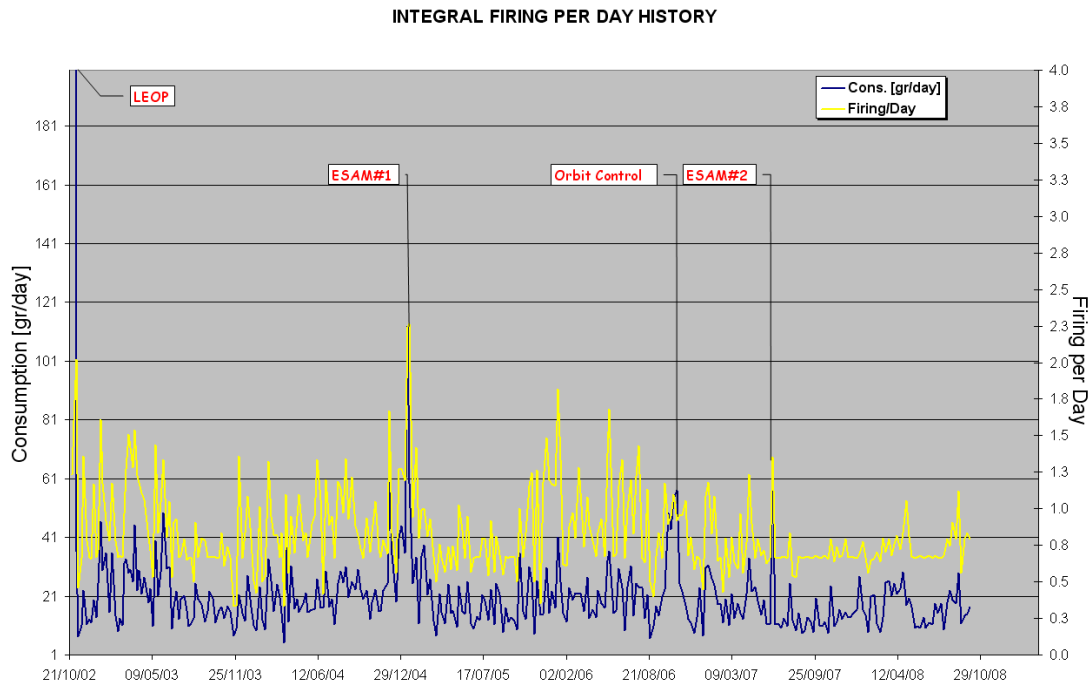
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 03/10/2008 is reported in the plot below.



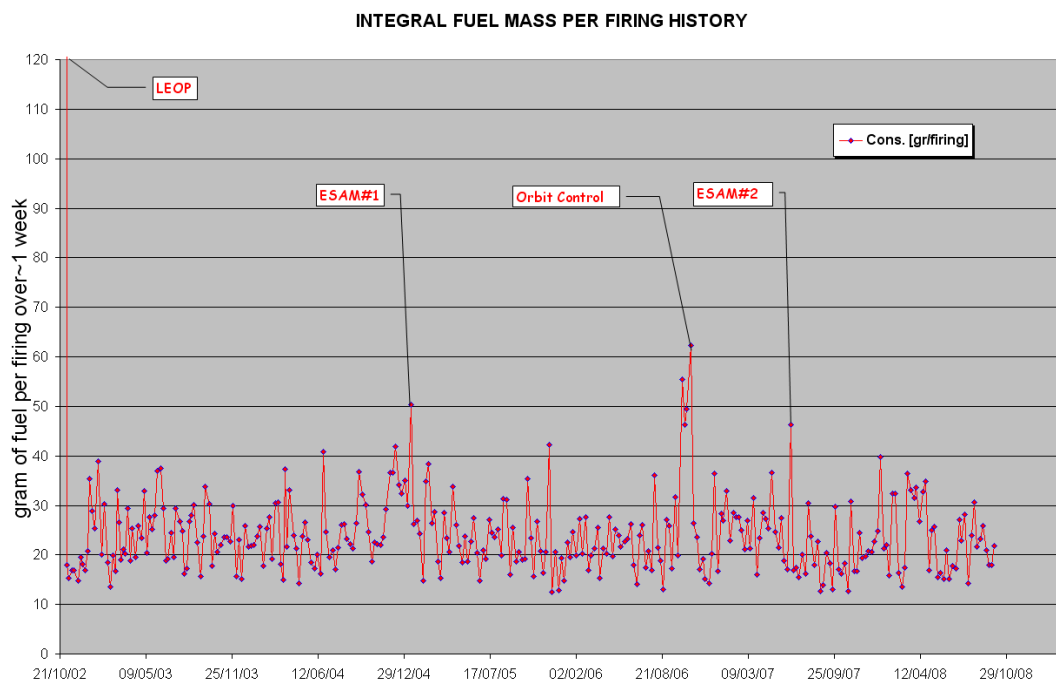
The above plot considers the ESAM fuel consumption spread over period of ~ 1 week.

The firing per day over the period between 01/11/2002 and 03/10/2008 is reported in the plot below.



The above plot considers the ESAM fuel consumption spread over period of ~1 week.

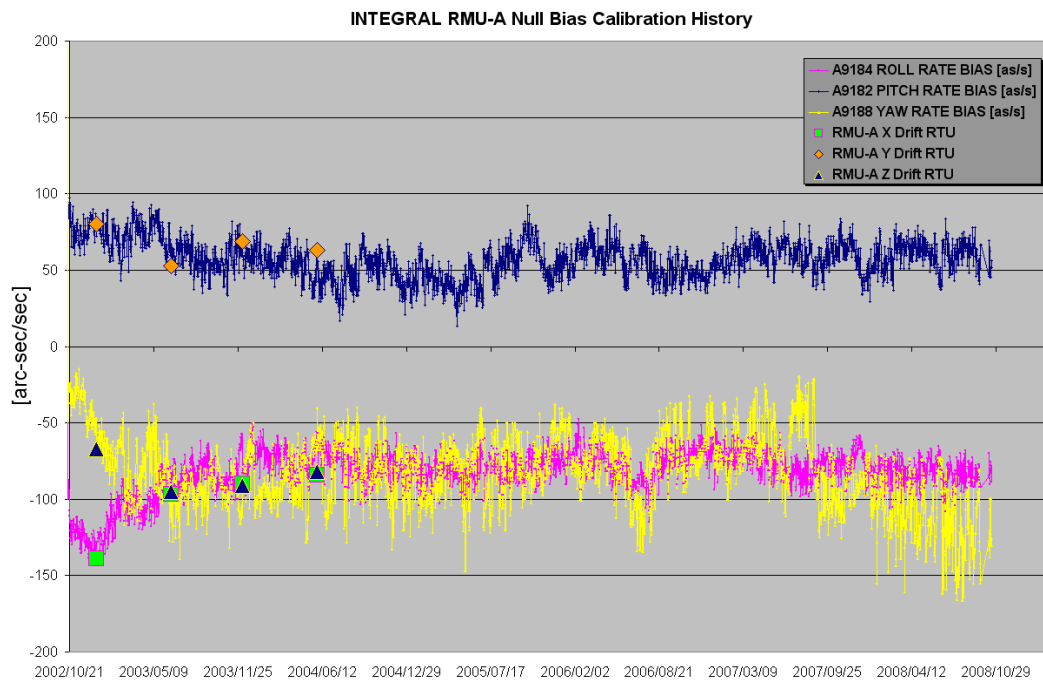
The fuel per firing over the period between 01/11/2002 and 03/10/2008 is shown in the plot below.



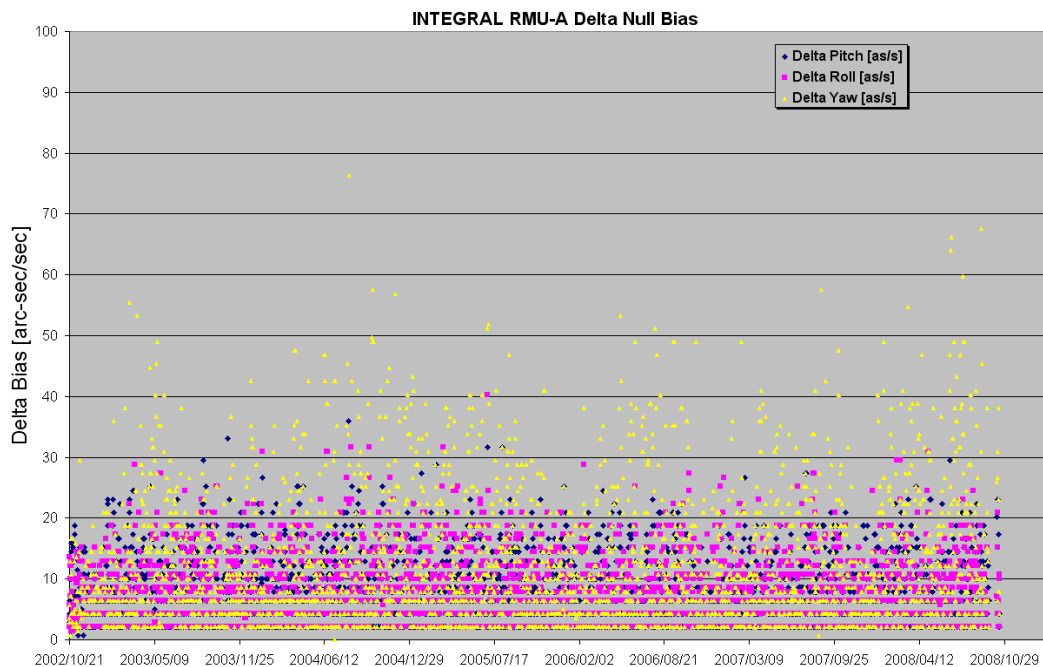
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 17/10/2008 is 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. At moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 17/10/2008 is reported in the plot below.



27/09/2008 (Day of Year 271, Revolution 727)

Loss of guide star: at 21:12z a loss of the current guide star occurred. As foreseen by the IPS logic, the IMU1 went on until a new guide star picked.

The operator performed a manual mapping and the next slew was manually updated in TL.

The OTF was not reached during PID 07270078.

No impact on TL.

28/09/2008 (Day of Year 272, Revolution 727-728)

The third eclipse passage operations were nominal from the AOCS point of view. A summary of the eclipse passage during rev 727 is given below:

INPUT		AOCS ECLIPSE MONITORING Winter 2008				Revolution: 727
						Date: 28/09/2008
						DoY: 272
Penumbra Start	28/09/2008 18:30:45	Penumbra Start:	28/09/2008 18:30:45	LOS:	28/09/2008 15:18:00	
Penumbra End	28/09/2008 19:26:21	Umbra Start:	28/09/2008 18:40:13	AOS:	28/09/2008 19:11:00	
Umbra Start	28/09/2008 18:40:13	Umbra End:	28/09/2008 19:26:21			
Umbra End	28/09/2008 19:26:21					
ACC Sample Time	28/09/2008 10:13:42	Eclipse Duration:	0:49:36			
FDE Sample Time	28/09/2008 10:13:42	Eclipse Duration [sec]:	2976			
FCE Sample Time	28/09/2008 10:13:42					
ACC Eclipse Counter	49038	IMU Health Check Start	28/09/2008 12:11:00			
ACC Eclipse Start	251071	Eclipse Imminent Flag	28/09/2008 17:39:05			
ACC Eclipse End	255989	ACC IMU AutoCal Start	28/09/2008 17:53:31			
		ACC IMU AutoCal End	28/09/2008 18:13:31			
FDE Eclipse Start	251490	Sun out of FSS FoV	28/09/2008 18:39:56			
FDE Eclipse End	252952	Sun back in FSS FoV	28/09/2008 19:36:49			
FCE Eclipse Start	251534					
FCE Eclipse End	252006					
FCE Eclipse Duration	3707					
		Eclipse Timers				
		From Loaded Timers		Actual From Telemetry		
		Absolute	WRT Pen. Start [sec]	Absolute	WRT Pen. Start [sec]	UM [sec] LSO [sec]
		28/09/2008 18:32:05	-1067.00	28/09/2008 18:21:01	-1064.00	-364 176
		FCE Eclipse Start	-641.00			-404 176
		FDE Eclipse Start	-497.00			-360 176
		From Loaded Timers		Actual From Telemetry		
		Absolute	WRT Pen. End [sec]	Absolute	WRT Pen. End [sec]	UM [sec] LSO [sec]
		28/09/2008 19:32:15	734			360 176
		FCE Eclipse End	235			360 176
		FDE Eclipse End	595	28/09/2008 19:37:49	578.00	578
		ACC Eclipse End				
		IMU	Uplink	Execution	WRT Penumbra End [sec]	
		IMU Auto Off Enable	25/09/2008 20:26	28/09/2008 19:39	692	
		IMU On	28/09/2008 12:17:51	IMU H/C Noise Roll [sec]	0.3690	
		IMU Off	28/09/2008 19:40:12	IMU H/C Drift Roll [sec]	0.2517	
		IMU On Time	7:22:21	IMU Auto Cal Drift Roll [sec]		

29/09/2008 (Day of Year 273, Revolution 728)

FDS problem during slew update: at 09:20z a problem on FDS caused the slew update to fail for slew ID 07280021. A manual recovery was attempted but a fatal error was reported from the Spacon Recovery Schedule Tool, therefore the FD engineer was called in.

A manual recovery was then performed to the attitude of PID 07280024 and the next slew (ID 07280025) in TL updated.

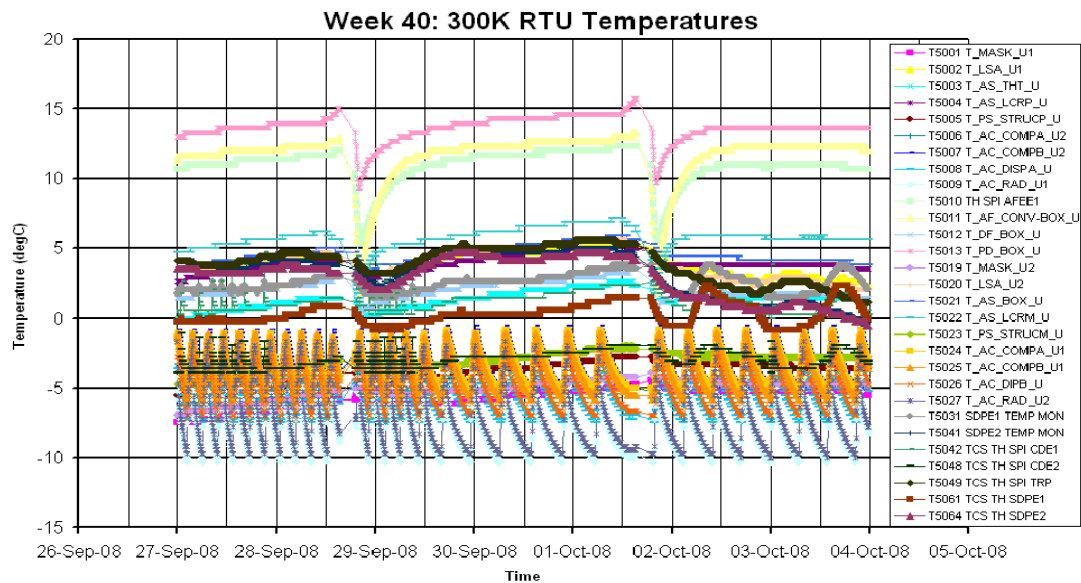
The following slews were not executed in TL: PID 07280021(OSL)-22(OSL)-23(CSL)-24(CSL).

30/09/2008 (Day of Year 274, Revolution 728)

DSS27 station problem during slew commanding: at 06:29z a drop in TM from DSS27 station caused the commanding to fail for slew ID 07280056. A manual recovery was attempted but during the execution a loss of the current guide star occurred. As foreseen by the IPS logic, the IMU1 went on until a new guide star picked.

A manual recovery was then continued from the attitude of PID 07280056 to the attitude of PID 07280057 and the next slew (ID 07280058) in TL updated.

The following slews were not executed in TL: PID 07280056(OSL)-58(OSL).

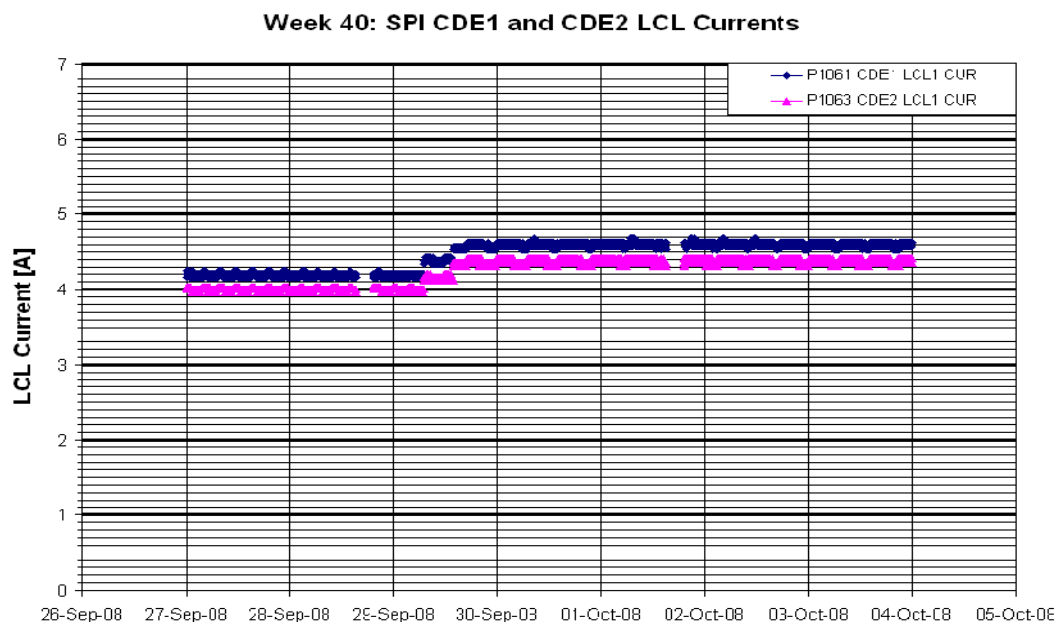


Stirling Compressors and Cryostat: The performance of the compressors is nominal.

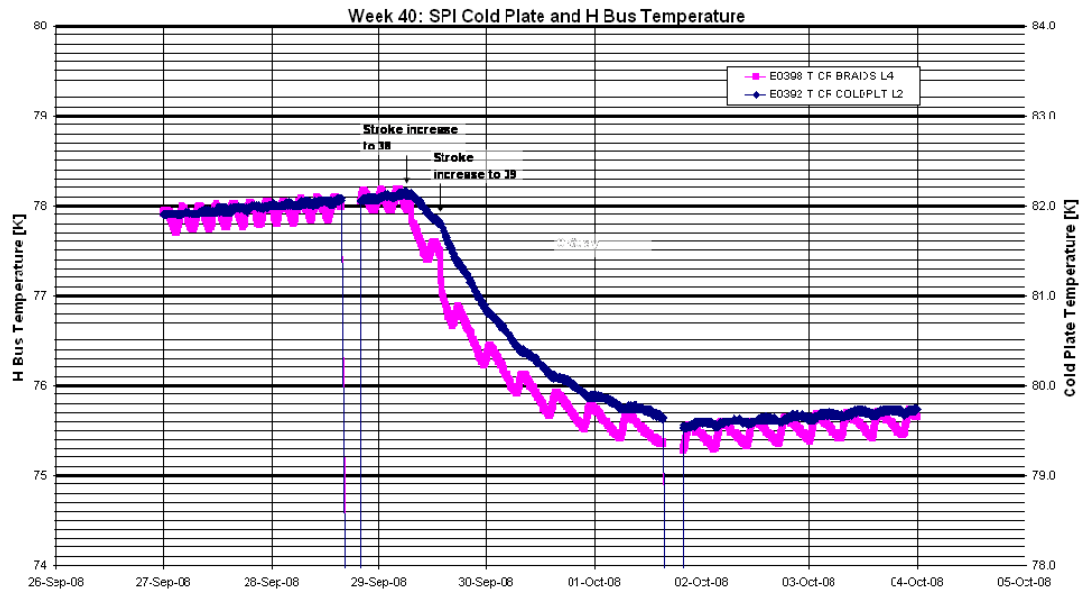
As detailed in the previous weekly report (see also AR INT-3031), the cold plate temperature exceeded the range 80K +/-1K, reaching 82.1K when the problem was observed on 29-09-2008. In order to recover the cold plate temperature to the nominal range, the compressor strokes were increased as follows:

- On 2008-09-29 at 07:06Z the stroke was increased from 37 to 38 on all four compressors;
- On 2008-09-29 at 13:44Z the stroke was increased from 38 to 39 on all four compressors.

The stroke remained at 39 for the rest of the week. The cold plate temperature returned below 81K on 2008-09-29 at approximately 22:00Z. The following plot shows the evolution of the CDE LCL currents during the reporting period.



The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.

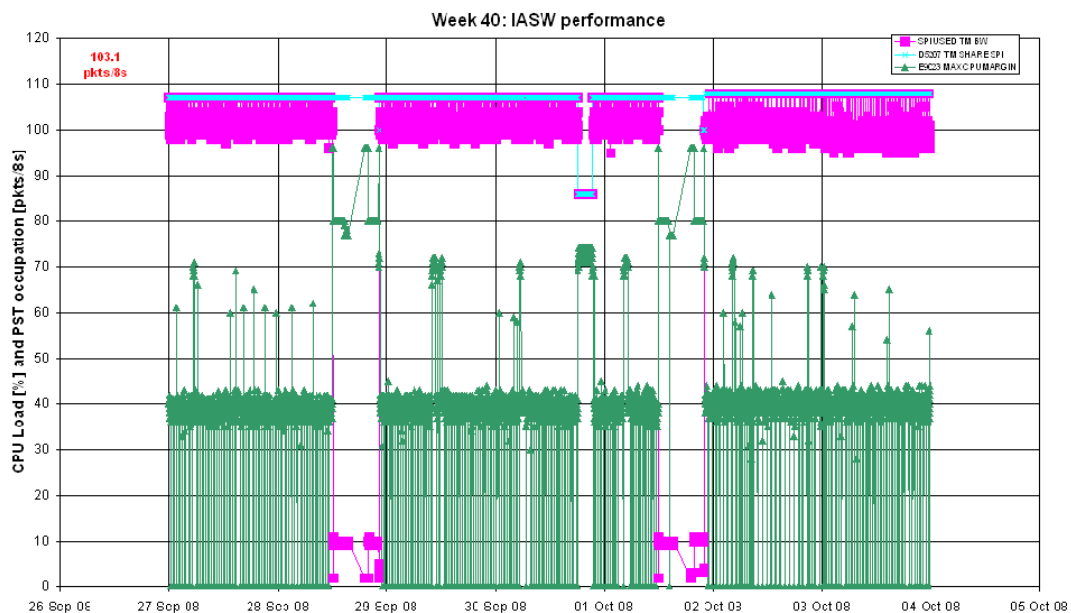


DPE & IASW: The DPE health and IASW performance are nominal.

The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE.

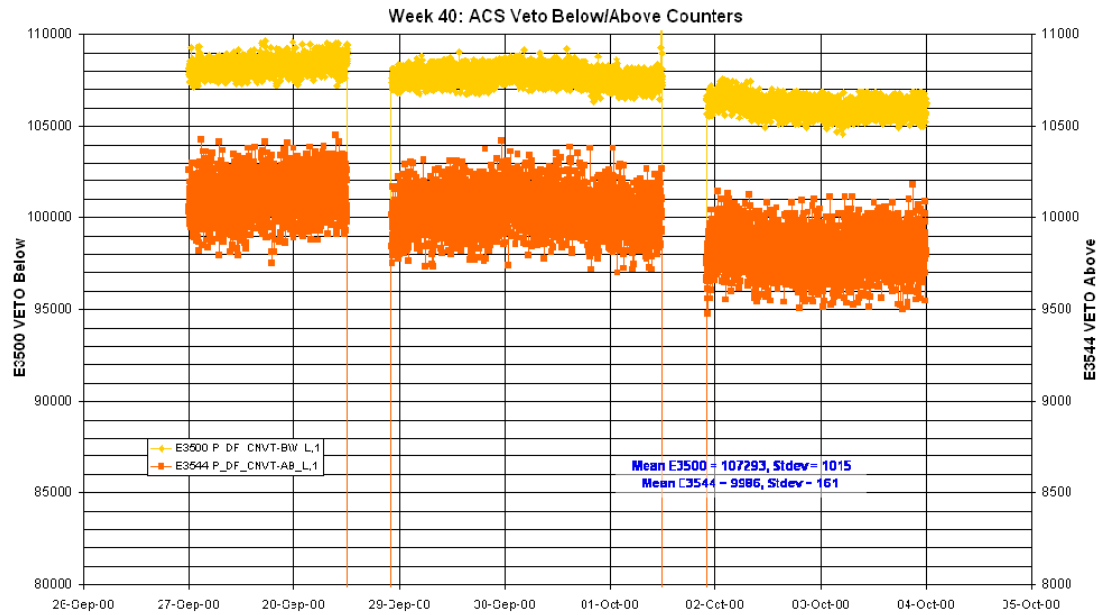
The average TM bandwidth occupation of SPI was 103.1 packets/cycle over the science window when the TM allocation was above 107 packets/cycle.

The following plot shows the IASW performance in terms of TM bandwidth occupation and DPE CPU load during the reporting period.

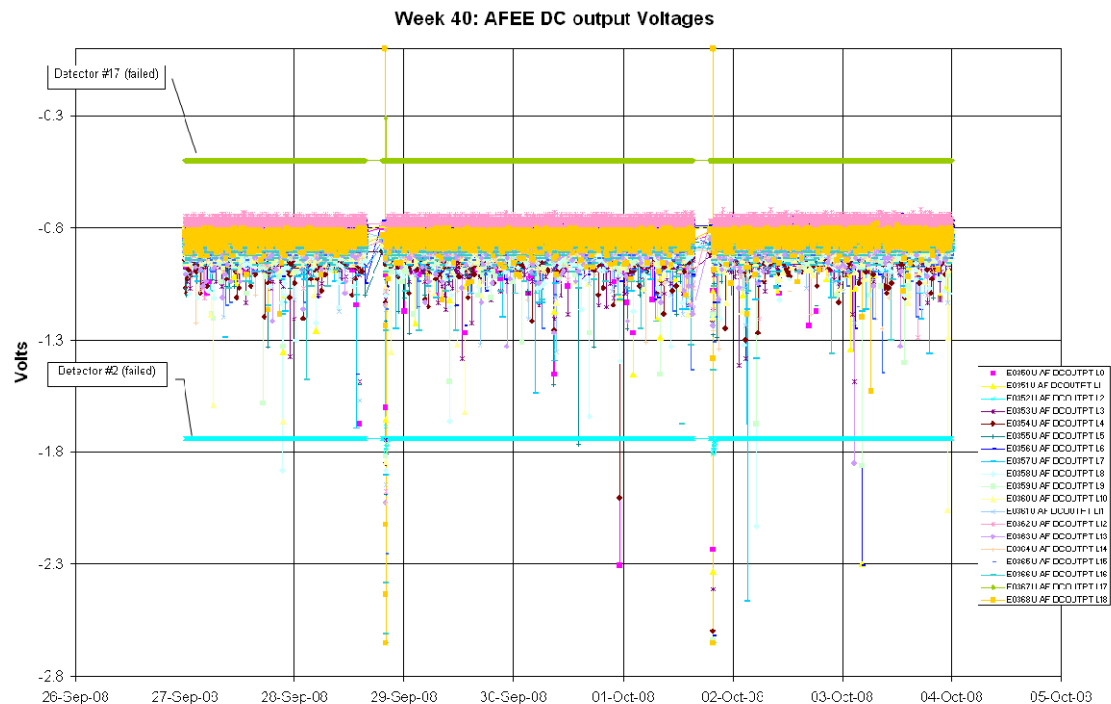


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

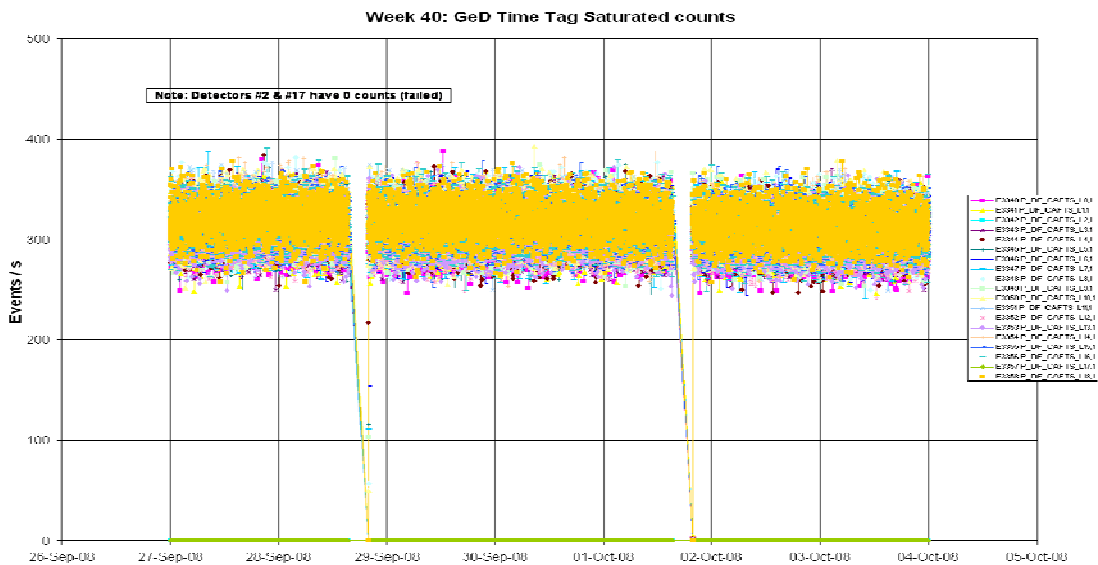
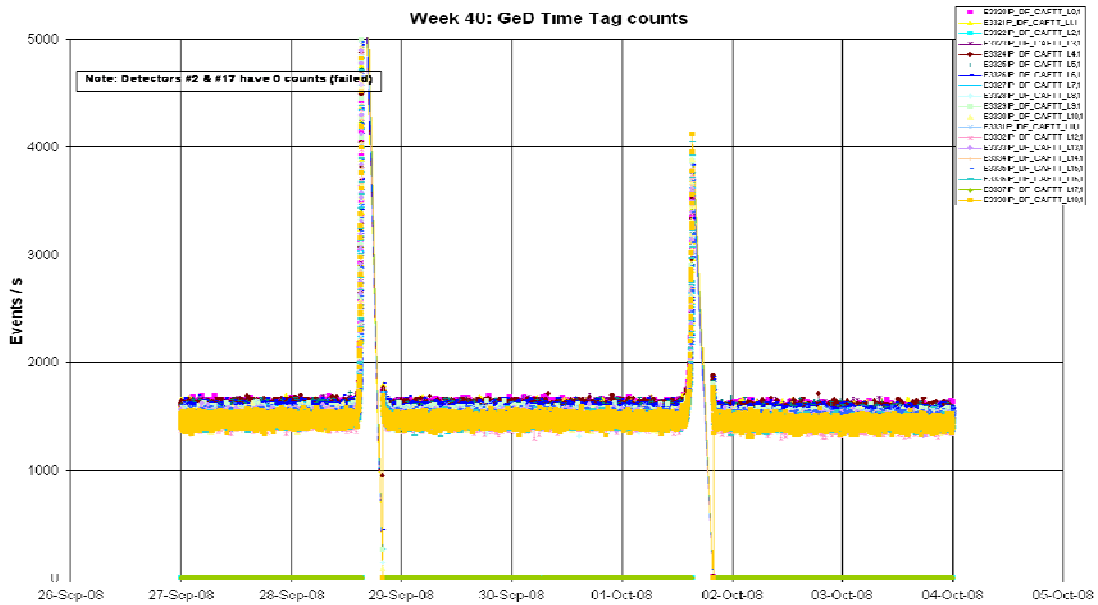
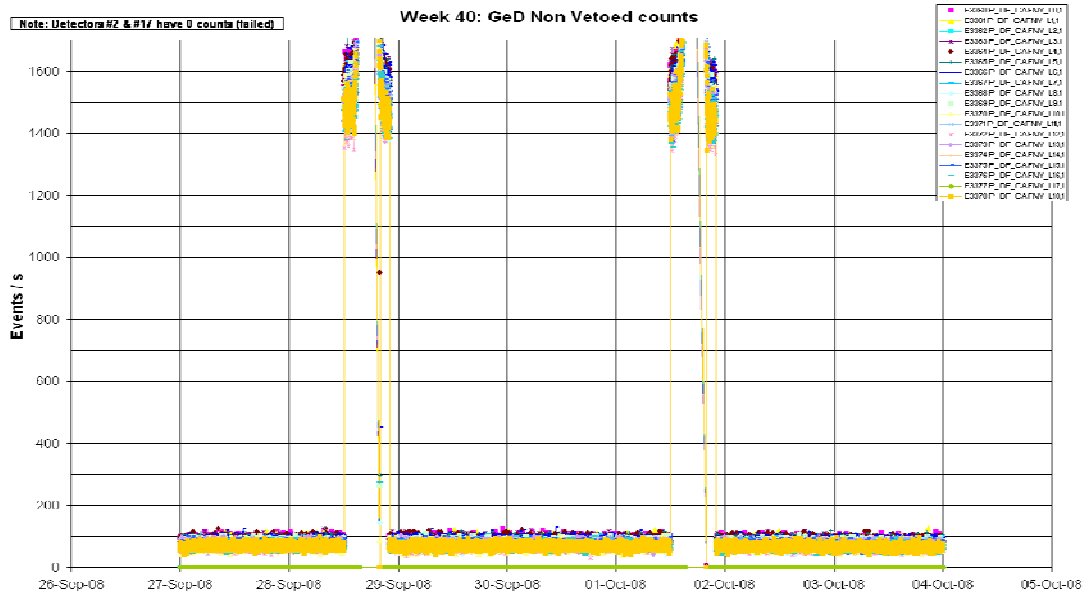
The following plot shows the ACS overall count rate evolution during the reporting period:



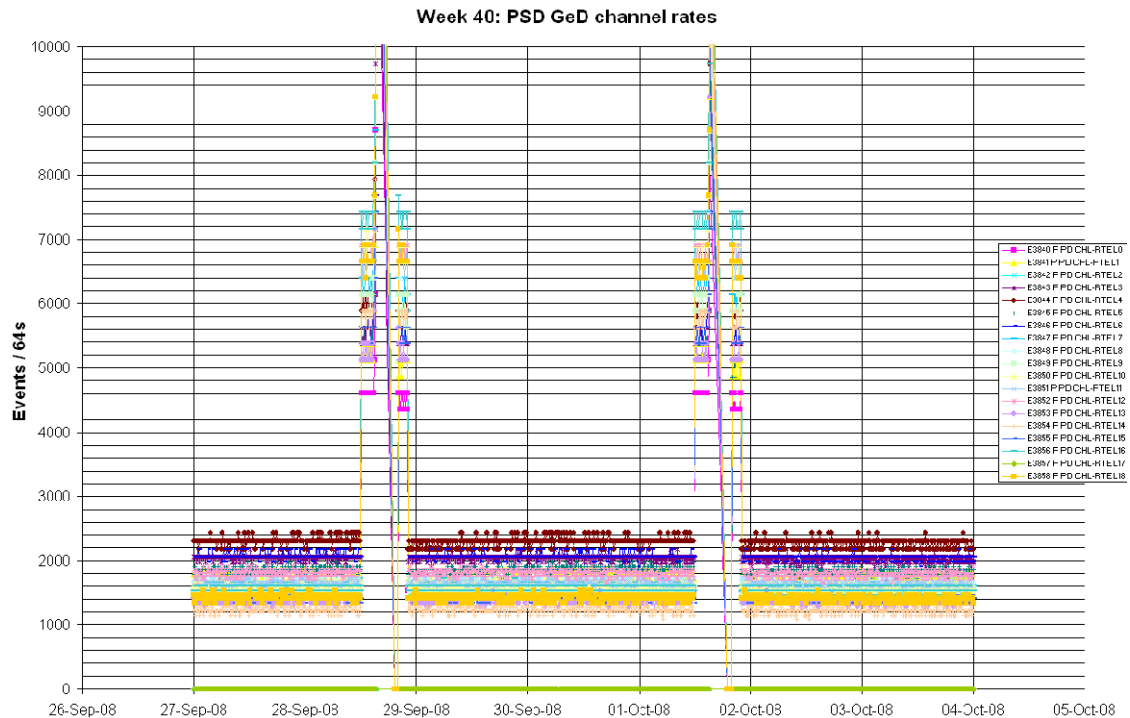
AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.



DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.



PSD: The health of the unit is nominal. The following plot shows the PSD channel rates during the reporting period.



Event Log:

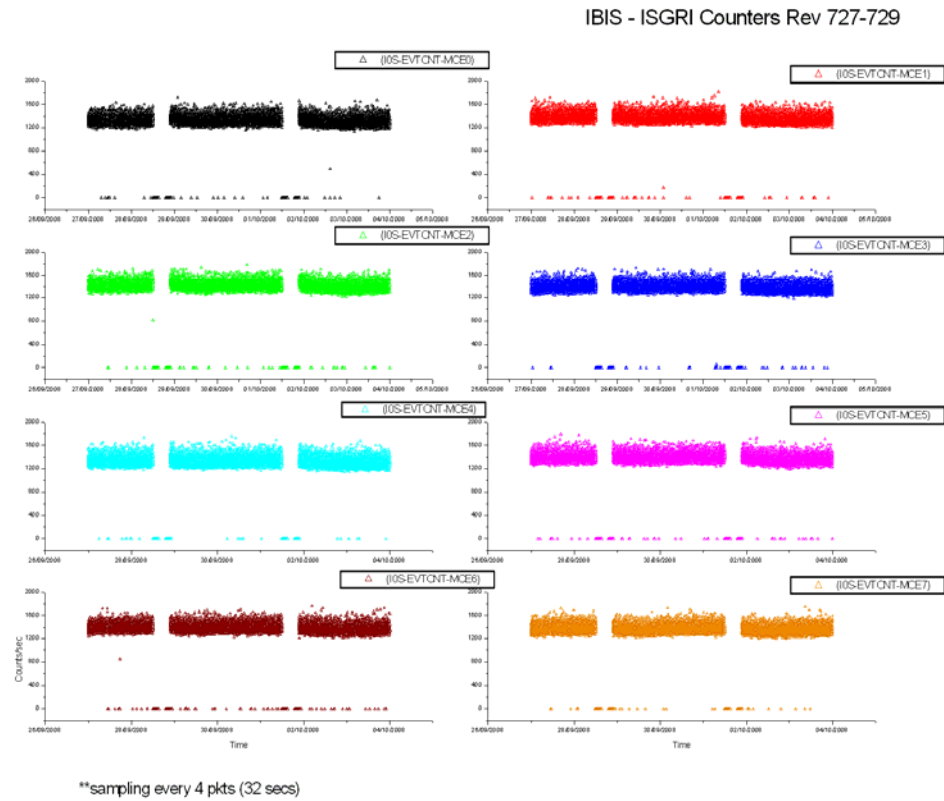
As well as Anomaly INT-3031 reported above, the following non-nominal event occurred on SPI over the reporting period:

- On 2008-09-28 at 11:39:57Z TM parameter E3210 went OOL Status (value = NO EXIST VAL). This is the ACS FEE temperature status #46. As it returned within limits when the next packet was received at 11:50:37Z, no action was taken.

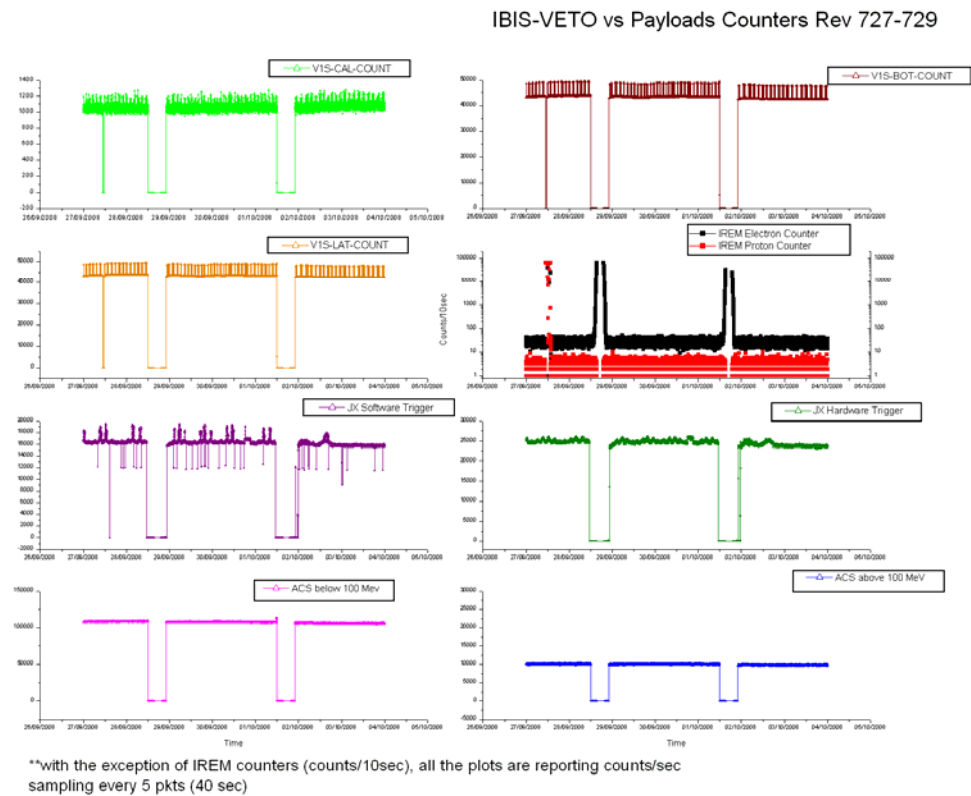
8.3.3 IBIS Operations

IBIS Event Counters Plots

ISGRI Counters:

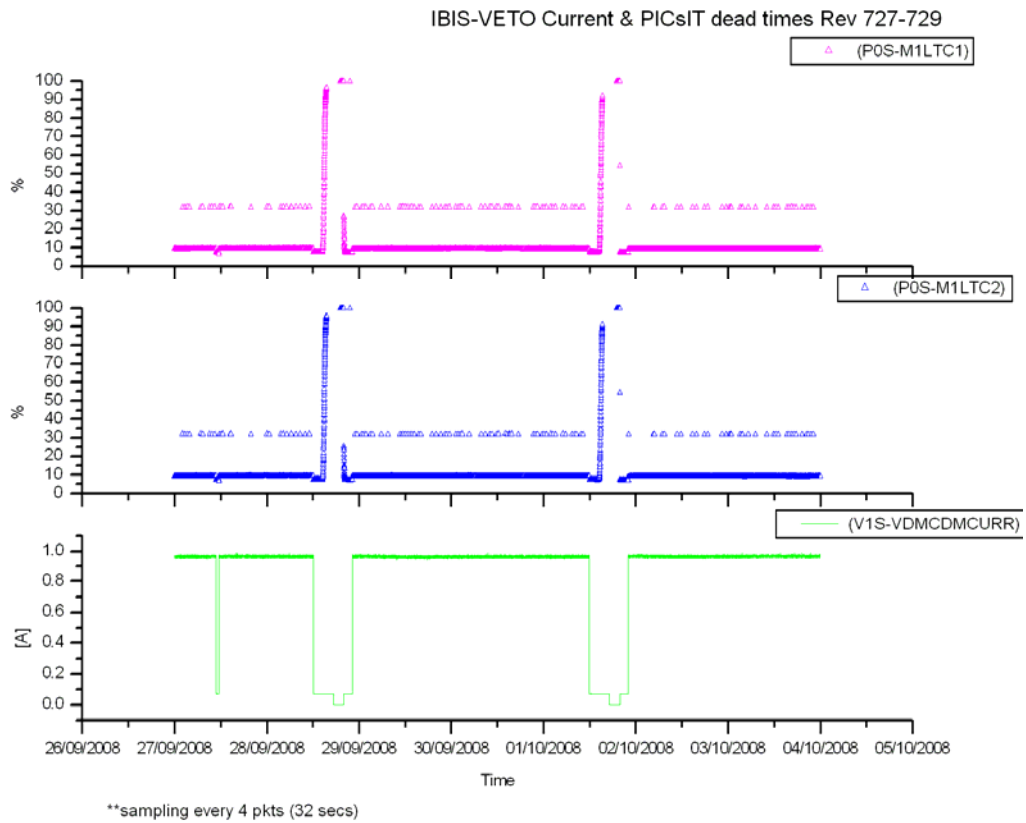


VETO vs Payload Counters:

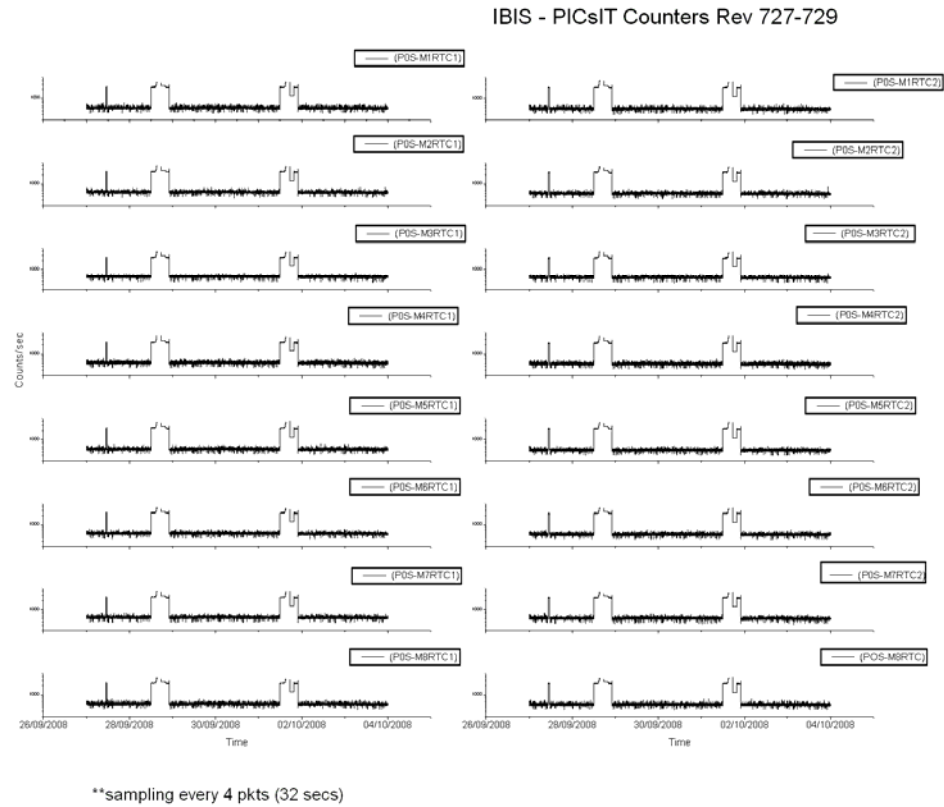


The week was characterised by low radiation as reported by the payload.

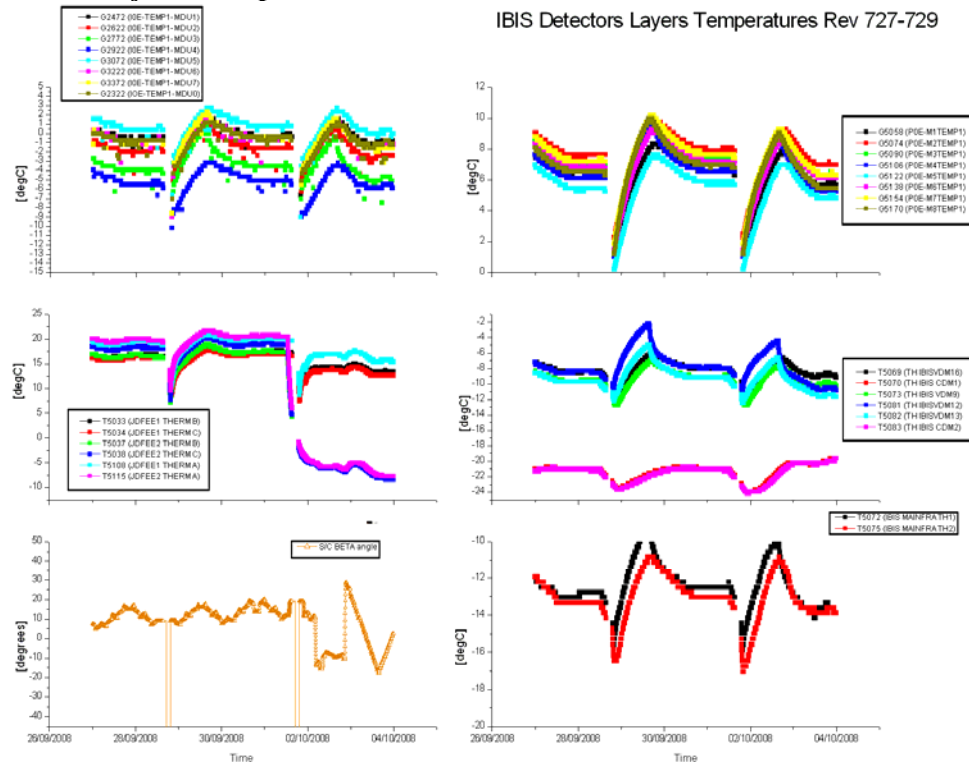
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



**sampling every 8 pkts (64 secs)

IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), G5002 (P0S-Mi_RTC1) and G5003 (P0S-Mi_RTC2) families and G2000 family (IOE-OVFWPXADD-Mi) were received during the radiation belt passages.

2008-09-27 (DOY 271, Rev 727)

At 01:22:23Z TM parameter G2000 went OOL, indicating an overflow of the noisy pixel address buffer in MCE0. As it returned within limits of its own accord at 01:22:31Z, no action was taken.

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 10:48:27Z. It was recovered as follows:

- At 11:24:52Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 11:34:12Z ED GESTAN02 up-linked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.

At 12:13Z, following the IREM SEU recovery, 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:

- 12:33:01Z FCP_IBIS1_0312
- 12:34:47Z TC G0129 up-linked to return IBIS to Science Standard mode.

However, at 12:49Z the TM parameter X7500 went OOL again and the recovery procedure was repeated as follows:

- 13:14:36Z FCP_IBIS1_0312

- 13:30:07Z TC G0129 up-linked to return IBIS to Science Standard mode.

As this was performed partly before and partly after a slew, the histogram process did not resume at that pointing however it resumed nominally at the start of the following pointing.

IBIS operations continued nominally.

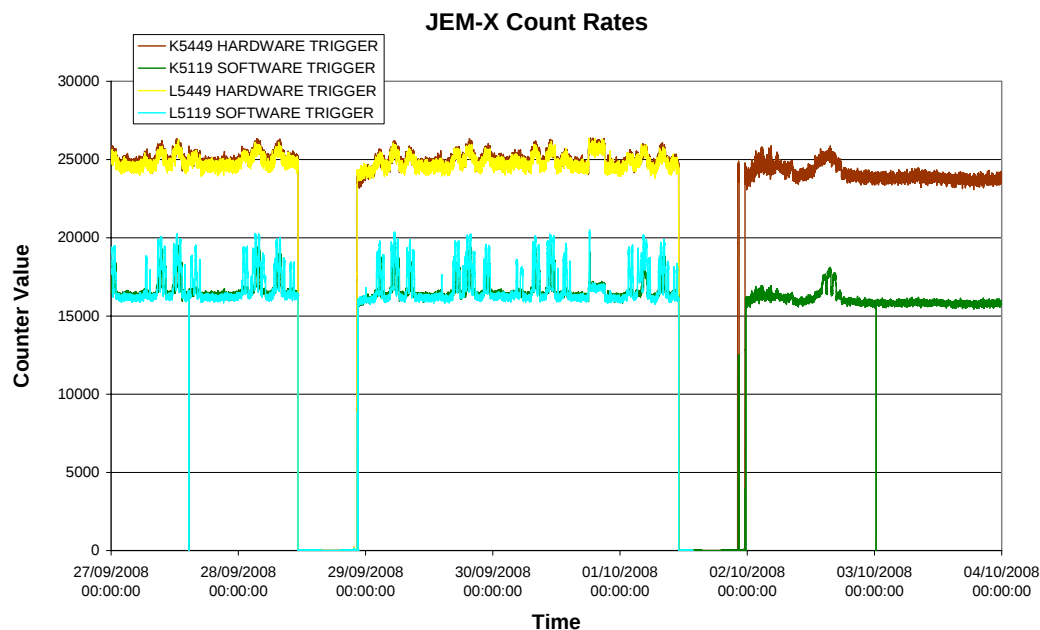
2008-09-28 (DOY 272, Rev 727-728) to 2008-10-03 (DOY 277, Rev 729)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph¹.



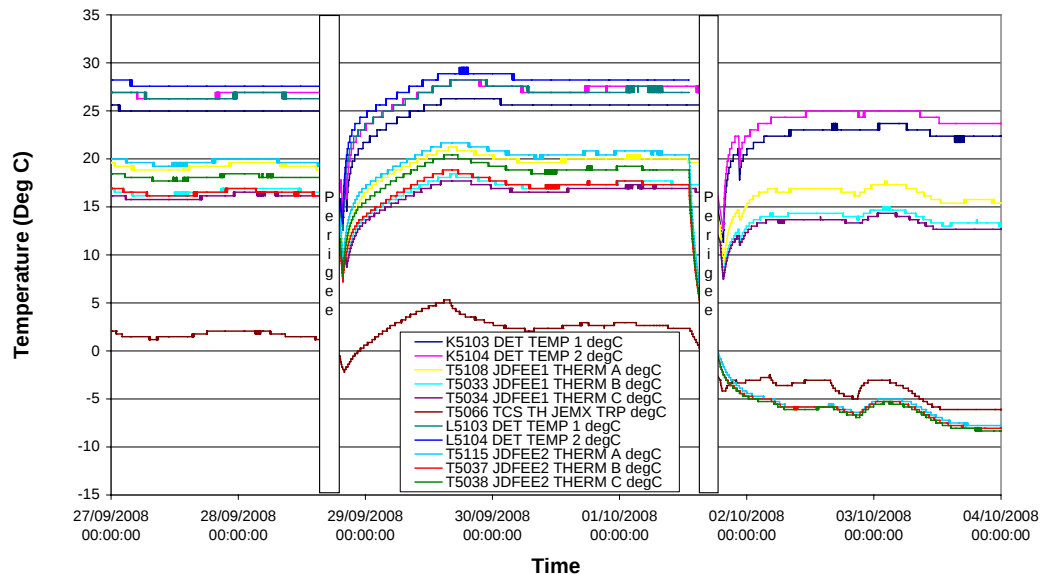
JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph².

¹ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

² Data sampled (1 frame in 8)

JEMX Detector & DFEE Temperatures



JEM-X Daily Report

2008-09-27 (DoY 271, Rev 727)

At 10:48:59 JEMX2 parameters L5315, L5316 & L5317 went Out-of-Limits due to an IREM SEU (#67). This was followed at 10:49:03, by JEMX1 parameters K5315, K5316 & K5317. There was no impact as the reaction has been disabled on both units.

2008-09-28 (DoY 272, Rev 727-728)

From 19:46:17 to 19:46:41, parameter LD5380D was showing a False state. No action was taken, and there was no impact.

At 19:19:53, an operator error resulted in the JEM-X1 DFEE being switched on during eclipse. This was subsequently switched off again at 19:25:35. There was no impact.

At 19:46:28, during the post-eclipse reconfiguration of JEM-X1, there was a JEM-X1 DFEE CRC error, the symptoms were as follows:

1) The following OEMs were received after the JEM-X1 DFEE was switched on by the ED KECLEX01 (uplinked manually at 2008-09-28T19:45:45Z):

```
2008.272.19.46.28.778 2008.272.19.46.39.177 1536 RealTime 191 EVENT
JEM-X1 PROB DFEE 11 0 0 65535 PR N E E
FIX6 11
K9079 MESS CLASS 0
K9080 MESS ID 191
FIX16 8
FIX16 0
```

>> Indicating that the operation "Load DFEE context" was unsuccessful due to CRC failure of the area B000 (hex) to CFFF (hex).

2008.272.19.46.28.778 2008.272.19.46.39.187 1536 RealTime 234 EVENT
JEM-X1 AUTO EVENT 4 0 0 65535 PR N E E
FIX6 4
K9079 MESS CLASS 0
K9080 MESS ID 234
K5419 ACTUAL LEVEL ECLIPSE
K5420 TARGET LEVEL RAD.

>>> Indicating failure of the automatic recovery from shutdown level ECLIPSE to shutdown level RAD. BELTS

2) Following the KECLEX01 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.

In response to this, the following operations were performed:

4) To recover JEM-X1, a DFEE power cycle was then performed according to CRP_JEM1_5010 JEMX1 DFEE POWER CYCLE, consisting of:
- 20:10Z FCP_JEM1_5010 JEMX1 DFEE power cycle
- 20:39Z JEMX re-enabled in T/L, and CCCFs activated.
- 21:49Z KEHVAC01 uplinked from the Timeline.

The above recovery proceeded nominally and JEM-X1 operations then continued from the Timeline.

From 20:27:58 to 20:29:07, parameter KD5380D was showing a False state. No action was taken, and there was no impact.

2008-09-29 (DoY 273, Rev 728) to 2008-09-30 (DoY 274, Rev 728)

JEM-X 1 & 2 operations executed nominally.

2008-10-01 (DoY 275, Rev 728-729)

At 12:45, procedure FCP_JEM2_9010 was commenced to switch JEMX-2 off. This proceeded smoothly, and the unit was turned off at 13:37:10.

At 19:34:23, during the post-eclipse reconfiguration of JEM-X1, there was a JEM-X1 DFEE CRC error, the symptoms were as follows:

1) The following OEMs were received after the JEM-X1 DFEE was switched on by the ED KECLEX01 (uplinked manually at 2008-10-01T19:34:23Z):

```
2008.275.19.35.08.828 2008.275.19.35.19.255 1536 RealTime 191 EVENT
JEM-X1 PROB DFEE 11 0 0 65535 PR N E E
FIX6 11
K9079 MESS CLASS 0
K9080 MESS ID 191
FIX16 8
FIX16 0
```

>> Indicating that the operation “Load DFEE context” was unsuccessful due to CRC failure of the area B000 (hex) to CFFF (hex).

```
2008.275.19.35.08.828 2008.275.19.35.19.309 1536 RealTime 234 EVENT
JEM-X1 AUTO EVENT 4 0 0 65535 PR N E E
FIX6 4
K9079 MESS CLASS 0
K9080 MESS ID 234
K5419 ACTUAL LEVEL ECLIPSE
K5420 TARGET LEVEL RAD.
```

>>> Indicating failure of the automatic recovery from shutdown level ECLIPSE to shutdown level RAD. BELTS

2) Following the KECLEX01 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.

In response to this, the following operations were performed:

4) To recover JEM-X1, a DFEE power cycle was then performed according to CRP_JEM1_5010 JEMX1 DFEE POWER CYCLE, consisting of:

- 22:05Z FCP_JEM1_5010 JEMX1 DFEE power cycle

(In-between, the following was observed:

From 22:38:50 to 22:39:13, parameter KD5380D was showing a False state. No action was taken, and there was no impact.)

- 23:12Z KEACAL01 uplinked

- 23:27Z KEHVAC01 uplinked with parameters taken from the APF.

- 23:45Z JEMX re-enabled in T/L.

The above recovery proceeded nominally and JEM-X1 operations then continued from the Timeline.

2008-10-02 (DoY 276, Rev 729) to 2008-10-03 (DoY 277, Rev 729)

JEM-X 1 operations executed nominally.

8.3.5 OMC Operations

2008-09-27 (DoY 271, Rev 727)

At 10:48:17, OMC was sent to SAFE mode by an IREM SEU (#67). A recovery was performed, and the instrument returned to Stand-by at 11:02:43, and back into Science at 11:04:33. The impact was pointing 07270061 was cut short after 1512 from a planned 2036 seconds, and pointing 07270062 started late and was cut short to 1735 from a planned 2036 seconds. After the recovery, as a precaution, the imaging commands for pointing 07270068 were manually re-sent, which caused pointing 07270068 to be cut short to 3144 from a planned 3720 seconds.

2008-09-28 (DoY 272, Rev 727-728)

Nothing to report.

2008-09-29 (DoY 273, Rev 728)

At 09:20, a FD problem forced the interruption of the Timeline. A recovery was performed and the Timeline rejoined at 11:33. The impact was the loss of pointings 07280021, 07280022, 07280023 (executed at the wrong attitude) & 07280024. It was at this time that the following pairs of commands were rejected:

2008.273.09.47.14.803	2008.273.09.47.22.361	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							
2008.273.09.47.20.928	2008.273.09.47.30.364	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							
2008.273.10.21.26.805	2008.273.10.21.31.284	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							
2008.273.10.21.32.930	2008.273.10.21.38.298	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							
2008.273.11.30.06.807	2008.273.11.30.11.263	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							
2008.273.11.30.12.932	2008.273.11.30.18.386	1792	RealTime	131	TC	REJECT	
REJECTED TC1			0	0	65535	PR	N
E E							

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 07280021, 07280022 & 07280024 respectively.

2008-09-30 (DoY 274, Rev 728)

At 06:22, a drop in the links with the ground station forced an interruption in the Timeline. The links were recovered at 06:39, and a recovery commenced. Despite another link drop, the timeline was rejoined at 07:25. The impact was the loss of pointings 07280056 & 07280057.

2008-10-01 (DoY 275, Rev 728-729)

Doc. Title : INTEGRAL Mission Report #315
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
Date : 06/10/08

Issue : 1
Rev. : 0
Page : 30

At 03:27, an antenna problem at the ground-station, caused a drop in the links. After the links were restored, a recovery was performed. The impact was the cutting short of pointing 07280090 to 1395 from a planned 1936 seconds, and the loss of 07280091. It was at this time that the following pair of commands was rejected:

2008.275.04.10.51.156	2008.275.04.10.59.286	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2008.275.04.10.57.281	2008.275.04.11.06.477	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 07280091.

2008-10-02 (DoY 276, Rev 729)

At 22:57, a drop in the links with the ground station caused the suspension of the Timeline. A recovery was performed, and the Timeline rejoined at 23:50. The impact was the loss of pointings 07290034 & 07290035. It was at this time that the following pair of commands was rejected:

2008.276.23.34.16.948	2008.276.23.34.26.106	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2008.276.23.34.23.135	2008.276.23.34.26.157	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 07290035.

2008-10-03 (DoY 277, Rev 729)

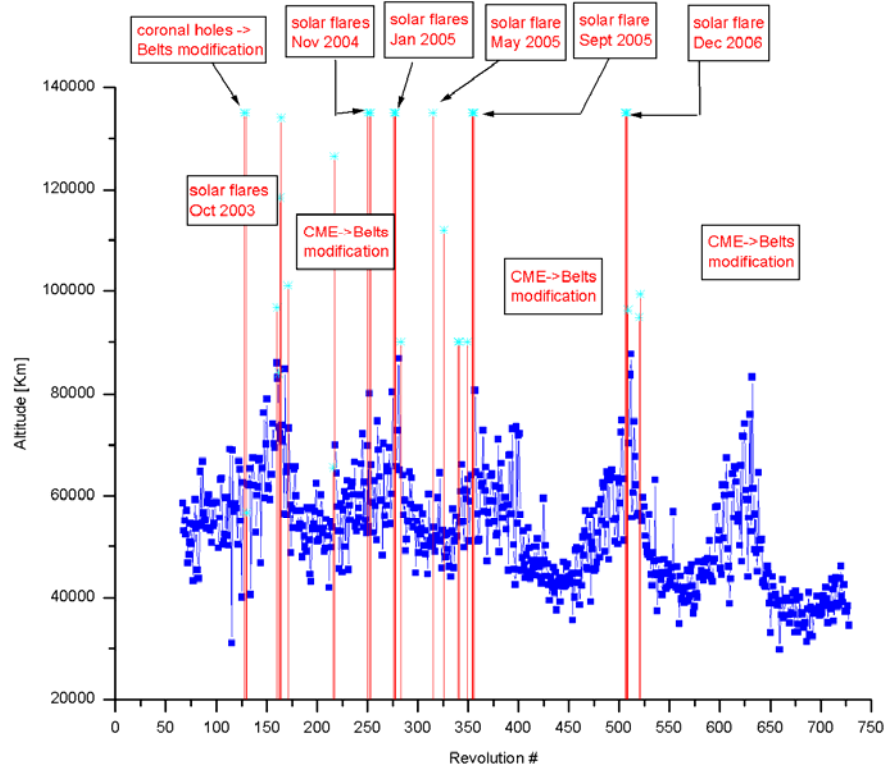
Nothing to report.

On DoY 272 at 12:10:01 and DoY 275 at 11:58:10 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.3.6 IREM Operations

Radiation Belts Entry

Evolution of Radiation Belt Entry 2003-2008



IREM daily report

DoY 2008.271 (27/09/2008):

At 10:48:16Z, a local reset of the IREM CSCI S/W (SEU #67) occurred. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2008.271.10:48:16Z (150176.9 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 14:07:25Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the PIs request. OMC was recovered at 11:04:33Z and IBIS at 11:34:12Z.

The cause of these S/W resets is apparently due to the unit's memory device that is sensitive to high energy radiation, as proved during test campaign on-ground.

Electron Belts

REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
727	RAD_ENTR R 2008-09-28T12:09:56Z	28/09/2008 14:10:00	38354.1	28-Sep-2008 14:25:36	37624.98
728	RAD_EXIT R 2008-09-28T22:03:16Z	28/09/2008 20:26:08	38517.8	28-Sep-2008 21:35:36	47133.1
728	RAD_ENTR R 2008-10-01T11:58:05Z	01/10/2008 14:17:20	34531.4	01-Oct-2008 14:08:54	38516.53
729	RAD_EXIT R 2008-10-01T21:50:41Z	01/10/2008 19:55:52	35259.8	01-Oct-2008 21:18:54	46421.06

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)

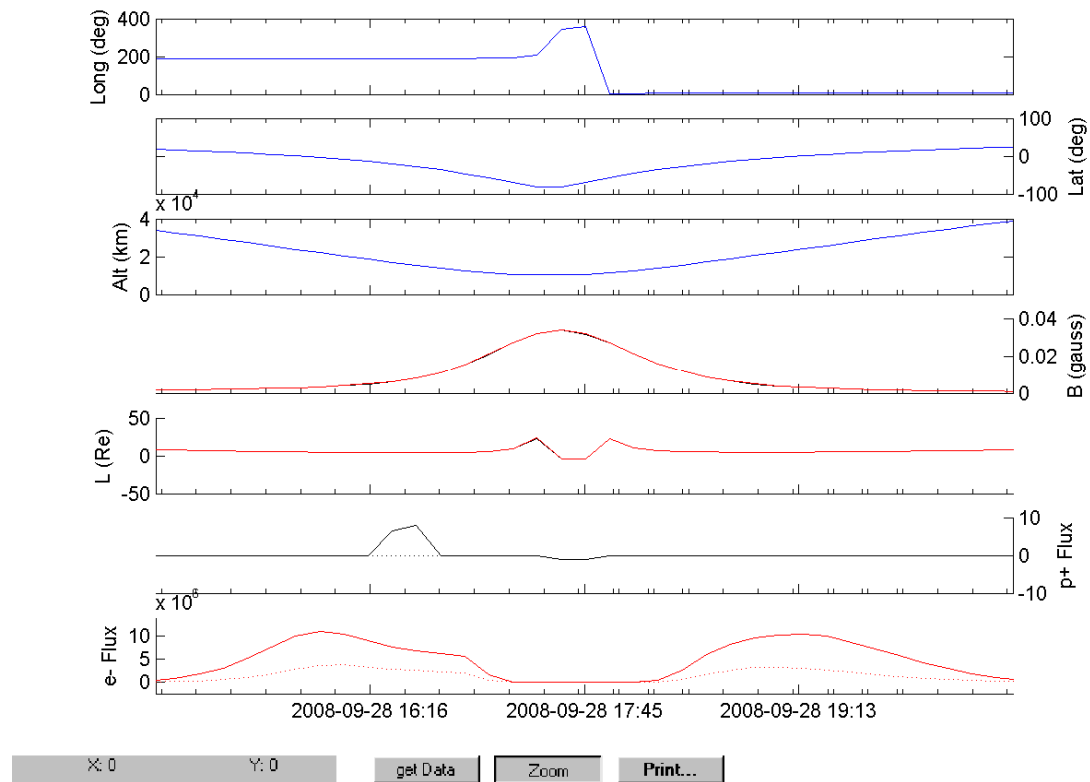
* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

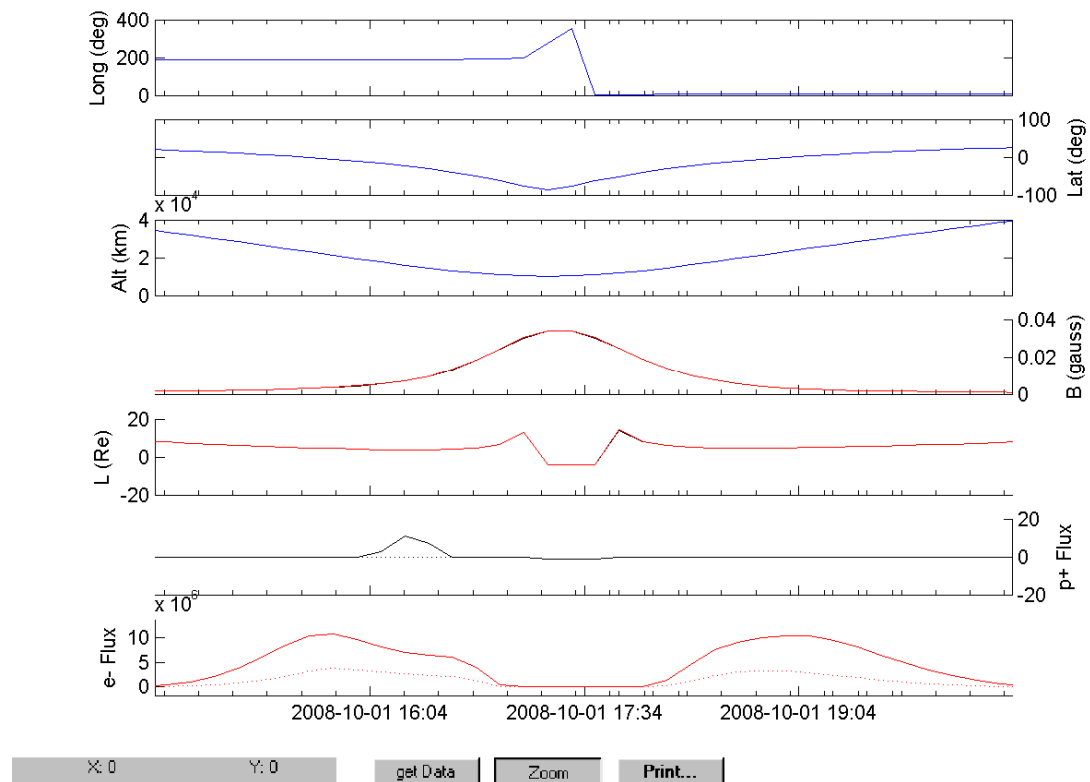
The IREM radiation counter plots are not available this week.

IREM Predicted Radiation Belt Passages

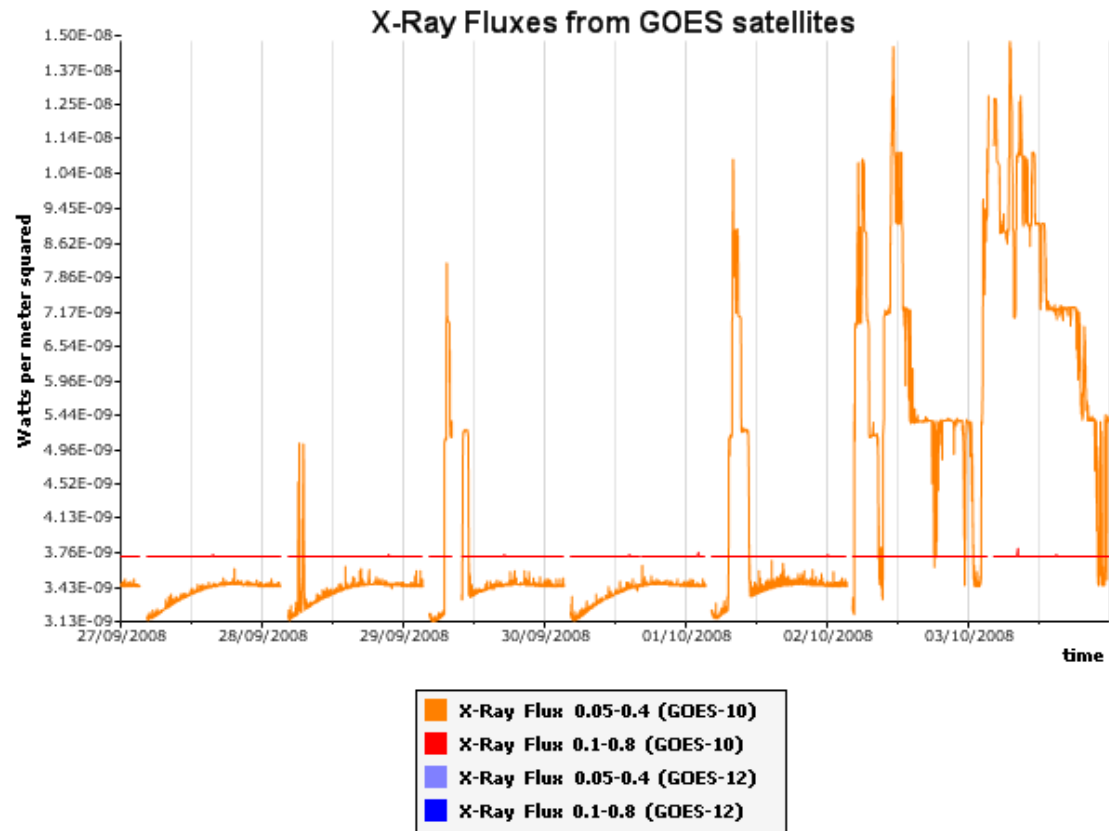
Rev 727



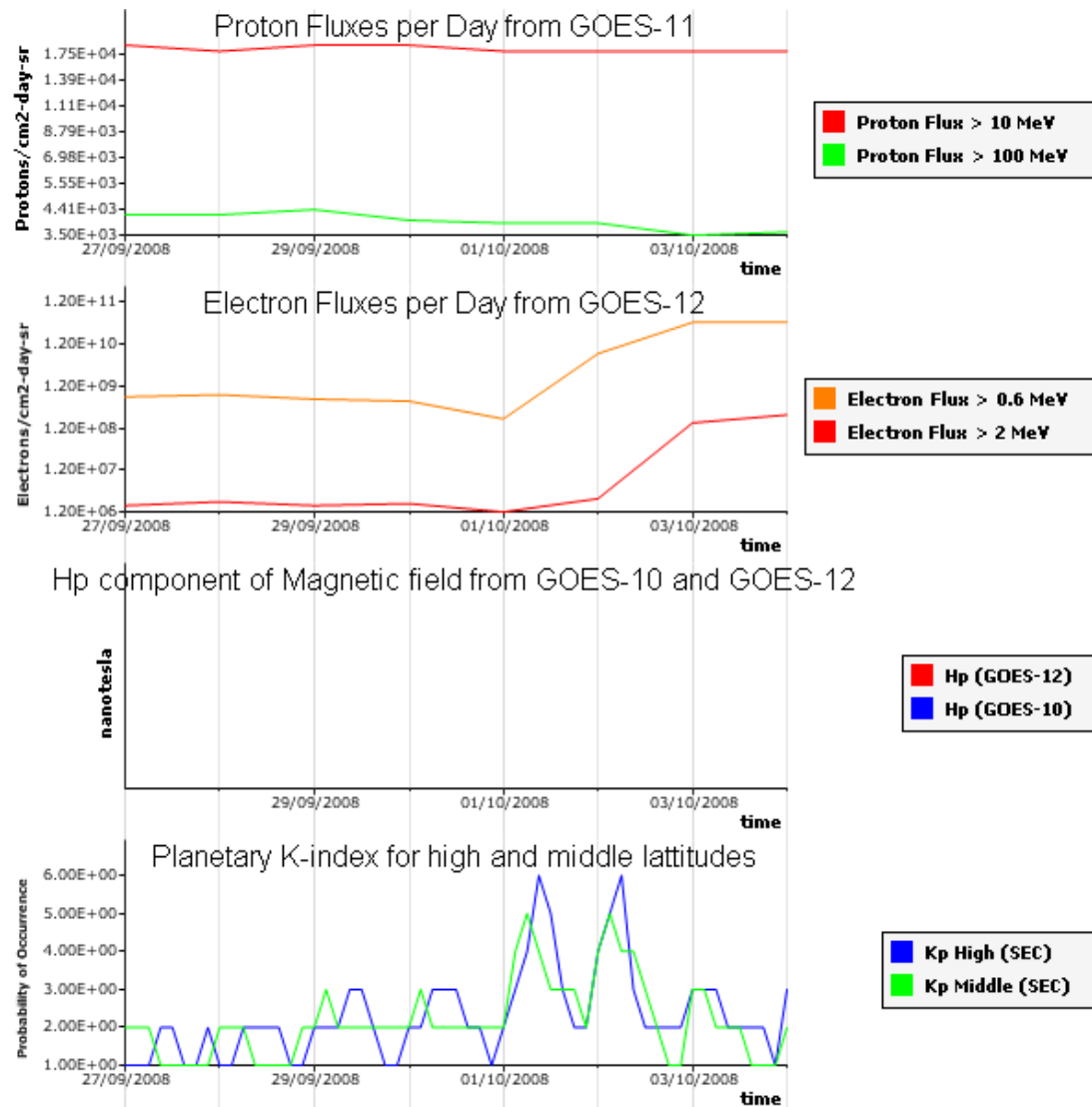
Rev 728



SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):



X-Ray fluxes start to be significant over 10^{-5} W/m^2 (corresponding to M-class flares). Above 10^{-4} W/m^2 , they correspond to strong X-class flares.



Proton and electron flux report low radiation background.

Hp component of the Geomagnetic Field is essentially parallel to the Earth's rotation axis. A drop near 0 nT is associated with a significant variation in the magnetic field. Kp index is based on ground magnetometers. Kp ≥ 5 features storm-level geomagnetic activity.