

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 318
Week 43
24.10.08
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 18.10.08 until 24.10.08 (both dates inclusive) and covers the revolutions 734, 735 and 736.

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 3 hexagonal dithers of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), 4 pointings of a Galactic disk scan (RA 19:00:42.00, DEC +04:30:32.4), (RA 18:57:02.40, DEC +02:43:48.0), (RA 18:55:12.72, DEC +01:50:24.0) and (RA 19:04:22.80, DEC +06:17:13.2), a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1), and another Target of Opportunity: a raster dither of H 1743-322 (RA 17:46:15.61, DEC -32:14:00.6).

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.

No slews were missed from TL, during the observation period.

The fuel consumption over the period between 18/10/2008 and 24/10/2008 was 0.1032 Kg. The remaining propellant is in the order of 137.9108 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

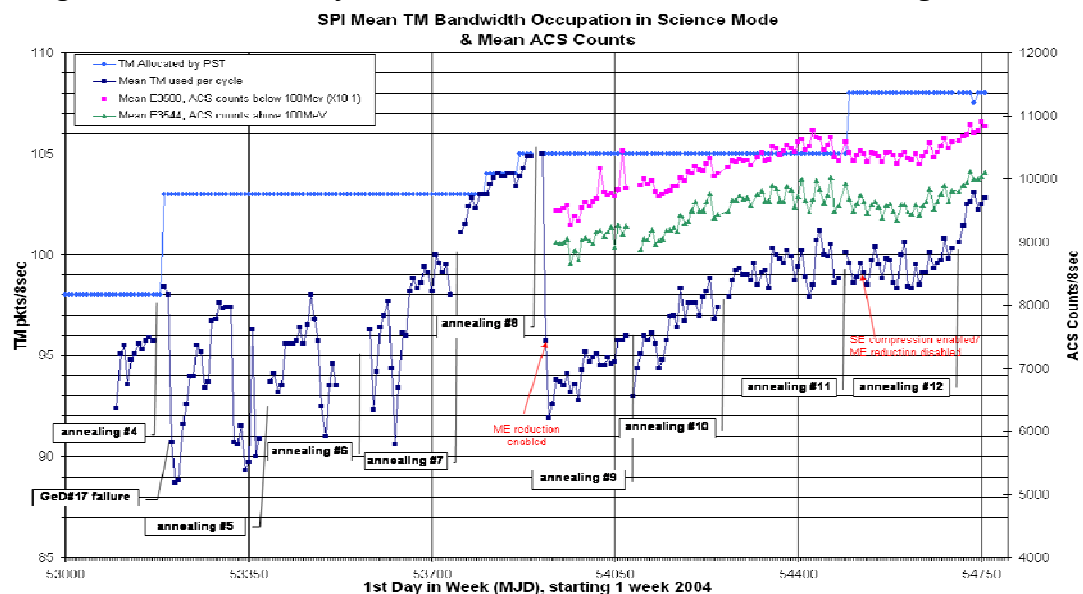
3.2.1 SPI

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.

The Stirling compressors are working nominally. The Germanium detectors temperature was kept in the range 80K $\pm$ 1K throughout the week.

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 108 packets/cycle and the average telemetry occupation was 102.8 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 8.3.2.

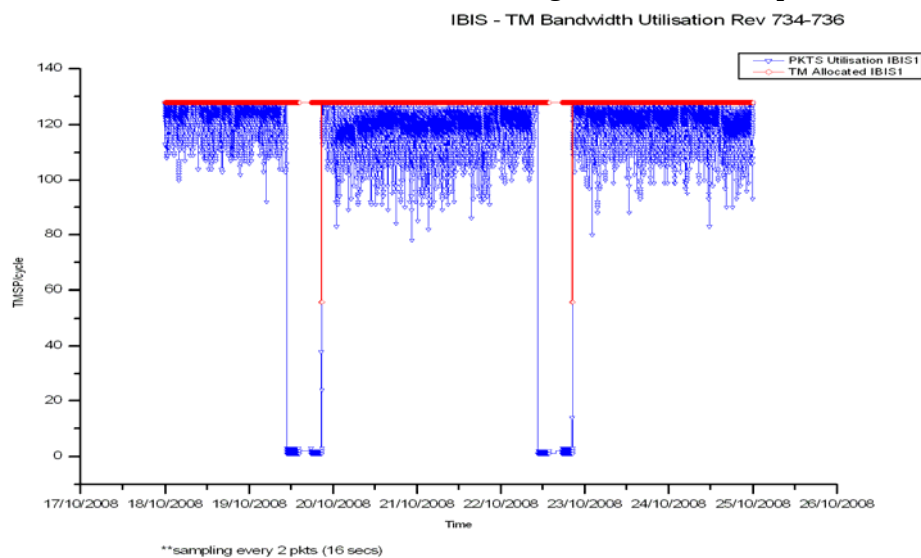
3.2.2 IBIS

The overall status of the unit is nominal.

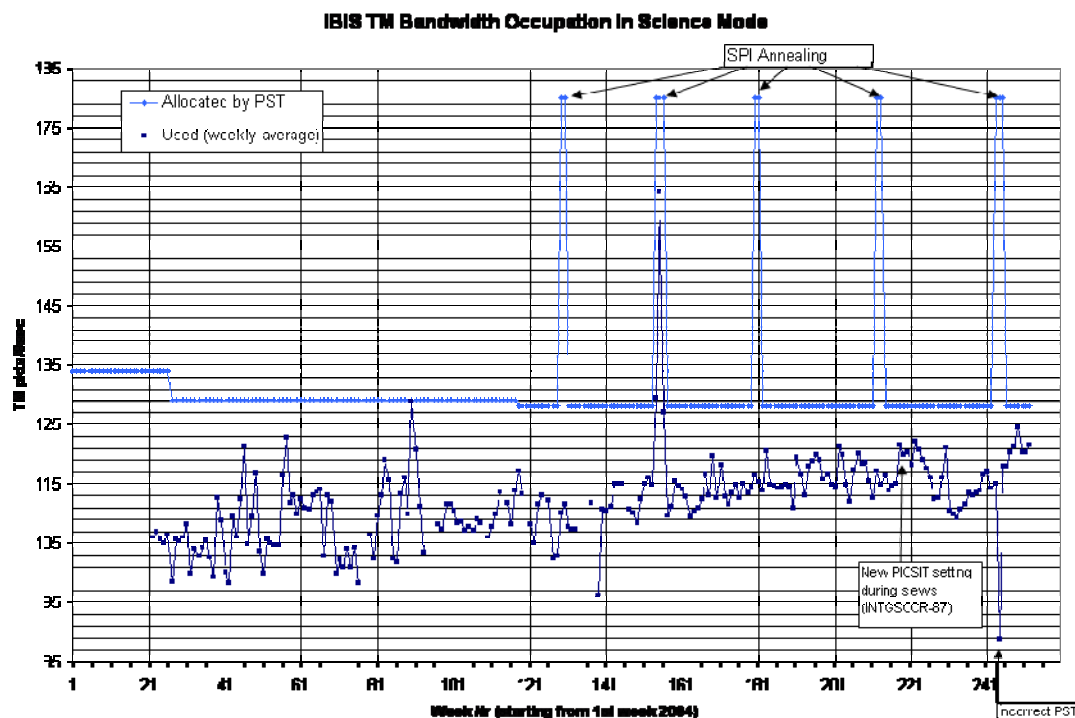
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 121.50 packets/cycle (up 1.22 on previous week)
- Percentage of TM cycles in which full bandwidth was used: 19.00%

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.

JEM-X1 was operated in Data Taking mode with a TM allocation of 8 packets/cycle. 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 Section 8.3.4.

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 5 packets per cycle.

During this reporting period, all of the 202 planned science pointings were executed nominally.

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. The Sun was blank all week. 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 good this week. No pointings were lost due to ground problems. The overall performance though was 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 good this week. On one occasion Bad Frames were received from Redu Groundstation for about 30 sec. The commanding was not affected.

ISOC

1. Mission planning

New PSFs received for revolutions 740-743.

Planning has been made for 737-743, and sent.

New TSFs have been received for revolutions 736 and 737.

2. Observation status

New ECS files received for revolutions 724-727, and processed.

3. ISOC Science Data Archive

Ingestion of IC data files has been done.

4. ISOC system

ISOC system v19.4.1 still working. Work is underway for v20; expected release is end of week 44.

5. Problems

No new problems.

4.2.1 ISDC

Status of ISDC observation processing on 27/10/2008:

- Latest Standard Analysis completed: observation 06200290001 (SS433, Revolution 722) on 13/10/2008.

- Latest products archived: observation 06200290002 (SS433, Revolutions 722-723) on 13/10/2008.

- 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 296, at 01:52, Bad Frames were received from REDU Groundstation for about 30 seconds. No impact of commanding.
- On DoY 297, at 1614, FCP_SPI_2504 was performed to increase the Compressor Stroke. Parameters EC9960, EC9961, EC9980 and EC 9981 were changed to value 40.

No new anomaly reports were entered into the ARTS system this week.

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 734

The observations in revolution 734 began 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 1 pointing of a Galactic disk scan (RA 19:00:42.00, DEC +04:30:32.4), lasting ~16.8 hours, plus a Target of Opportunity: a raster dither H 1743-322 (RA 17:46:15.61, DEC -32:14:00.6) lasting ~33.9 hours, until the end of the revolution.

Revolution 735

The observations in revolution 733 began with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. They continued 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. This was followed by 2 pointings of a Galactic disk scan (RA 18:57:02.40, DEC +02:43:48.0) and (RA 18:55:12.72, DEC +01:50:24.0), both lasting ~16.8 hours. Finally a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1) lasting ~11.6 hours, was performed until the end of the revolution.

Revolution 736

The observations in revolution 736 began with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. They continued with a Target of Opportunity a raster dither H 1743-322 (RA 17:46:15.61, DEC -32:14:00.6) lasting ~35.4 hours. Finally a Galactic disk scan (RA 19:04:22.80, DEC +06:17:13.2) lasting ~16.8 hours, was performed 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

2008-10-17T20:02:57.000Z	138.0024	F	Automatic TM processing.
2008-10-19T13:38:13.000Z	137.9825	F	Automatic TM processing.
2008-10-19T18:24:53.000Z	137.9744	F	Automatic TM processing.
2008-10-21T03:57:21.000Z	137.9492	F	Automatic TM processing.
2008-10-22T18:12:22.000Z	137.9326	F	Automatic TM processing.
2008-10-24T03:31:13.000Z	137.9108	F	Automatic TM processing.
2008-10-25T17:57:17.000Z	137.8982	F	Automatic TM processing.
2008-10-27T03:15:21.000Z	137.8806	F	Automatic TM processing.
2008-10-28T17:45:49.000Z	137.8618	F	Automatic TM processing.
2008-10-30T03:38:56.000Z	137.8052	F	Automatic TM processing.

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, 18/10/2008 – 24/10/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 149 Open Loop Slews, 69 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

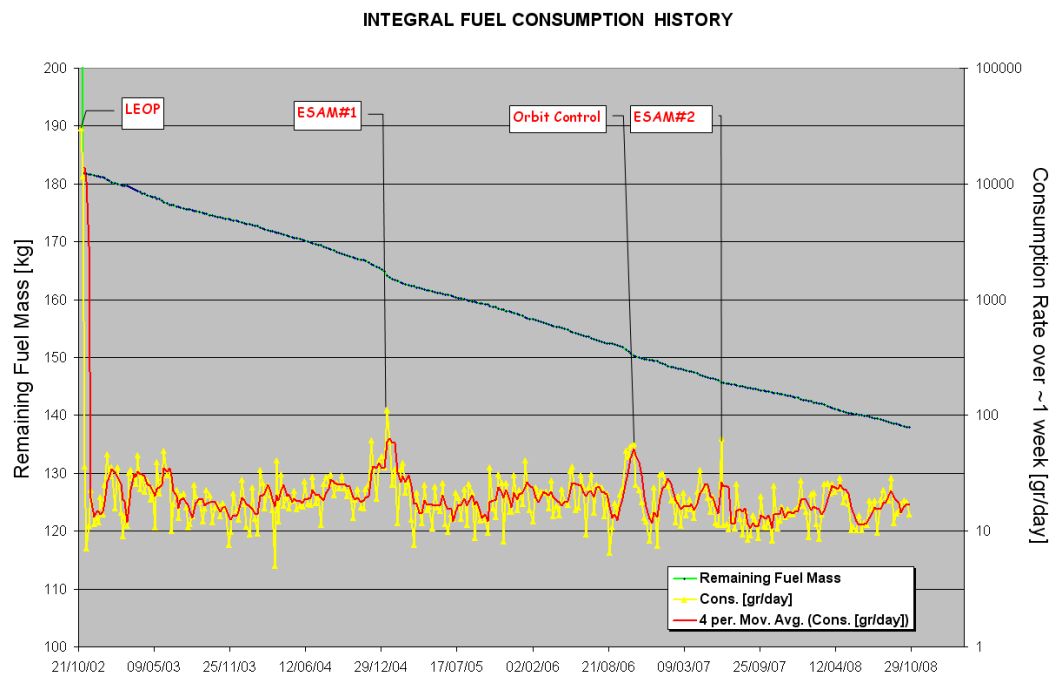
No slews were missed from TL, during the observation period.

Orbit Control

No update

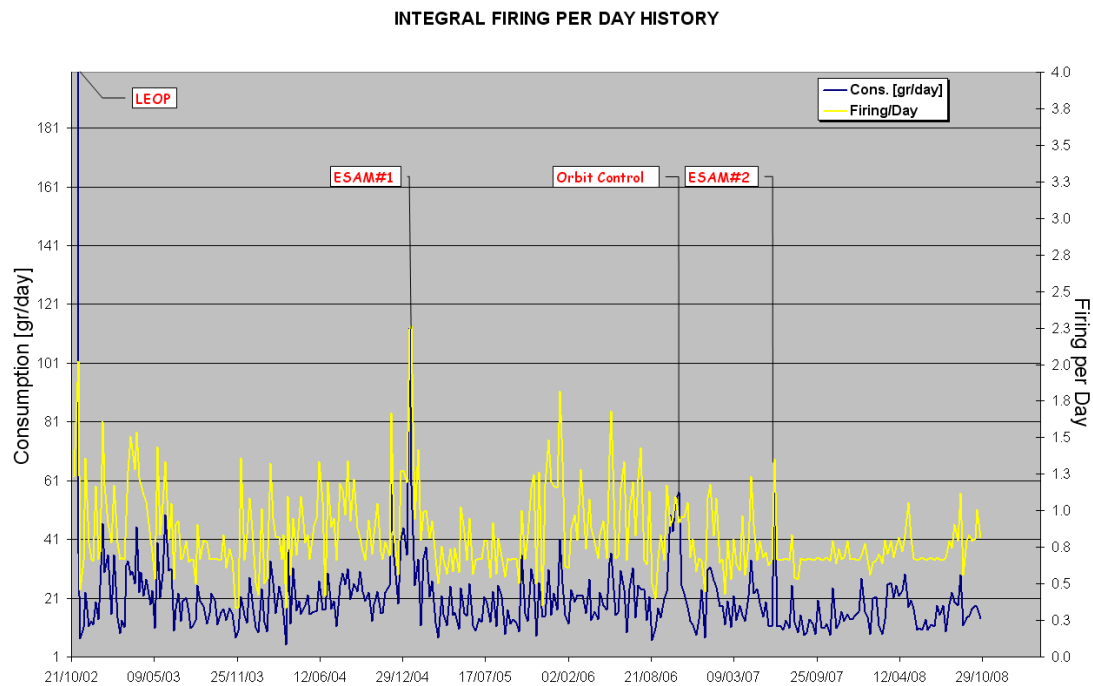
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 24/10/2008 is reported in the plot below.



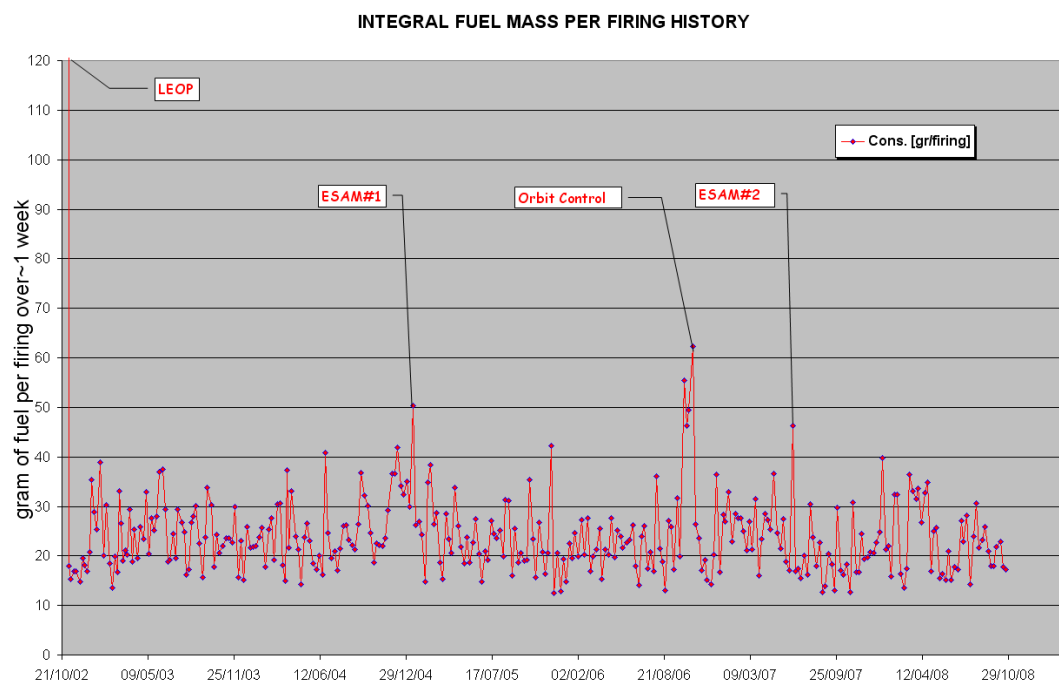
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 24/10/2008 is reported in the plot below.



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

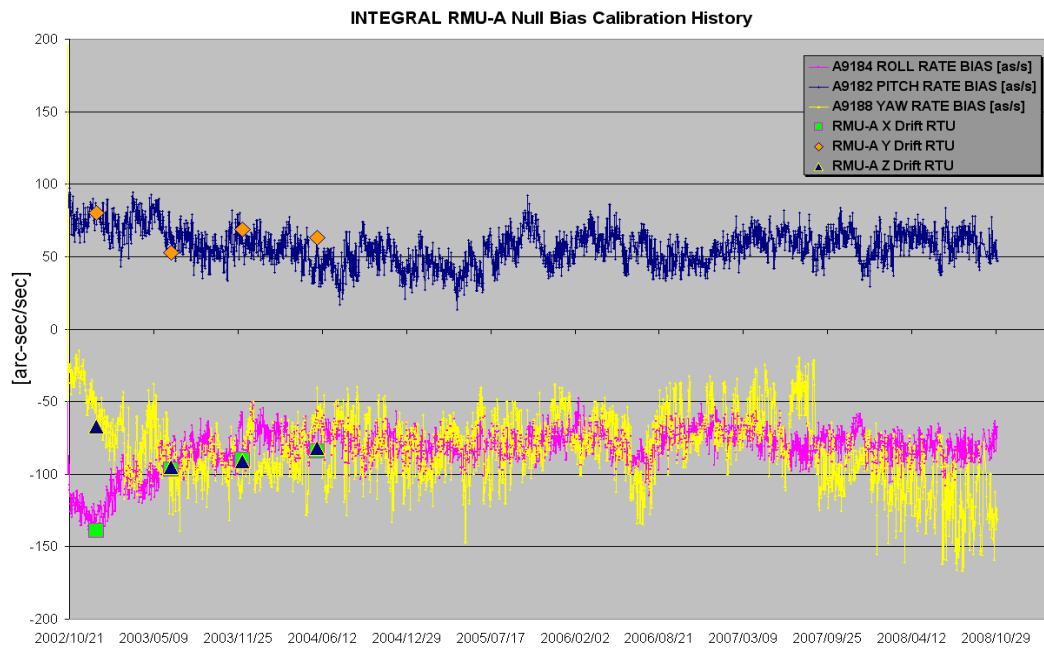
The fuel per firing over the period between 01/11/2002 and 24/10/2008 is shown in the plot below.



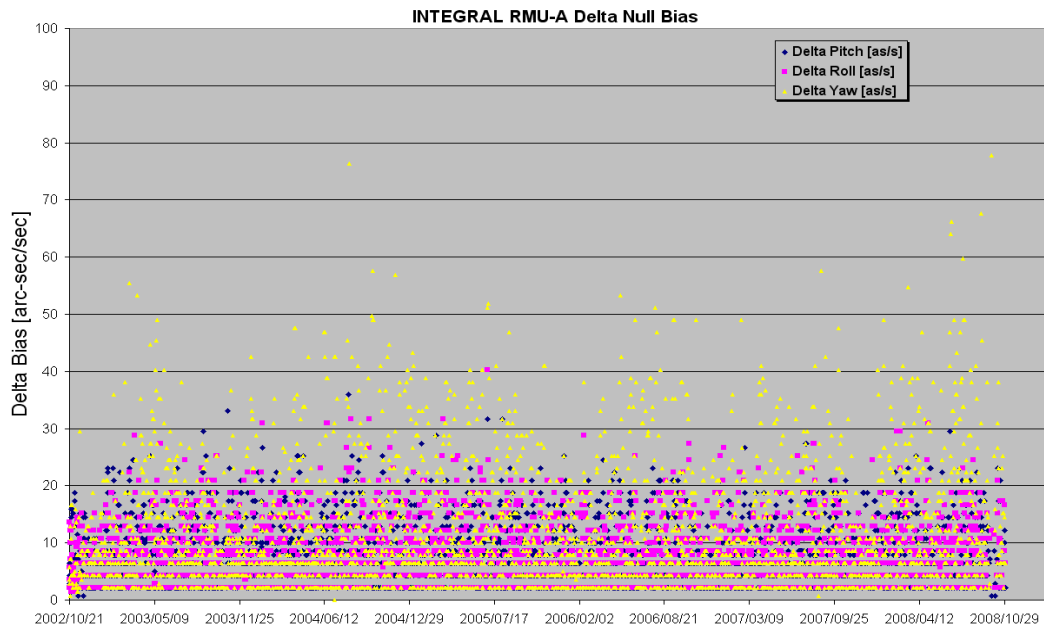
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 24/10/2008 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 24/10/2008 is reported in the plot below.



18/10/2008 (Day of Year 292, Revolution 734)

Nothing to report.

19/10/2008 (Day of Year 293, Revolution 734-735)

Nothing to report.

20/10/2008 (Day of Year 294, Revolution 735)

Nothing to report.

21/10/2008 (Day of Year 295, Revolution 735)

FDS problem during slew update: at 05:00z a problem on FDS caused the slew update to fail for slew ID 07350057.

A manual recovery was then performed and the next slew (ID 07350057) in TL updated.

No impact on TL.

22/10/2008 (Day of Year 296, Revolution 735-736)

Nothing to report.

23/10/2008 (Day of Year 297, Revolution 736)

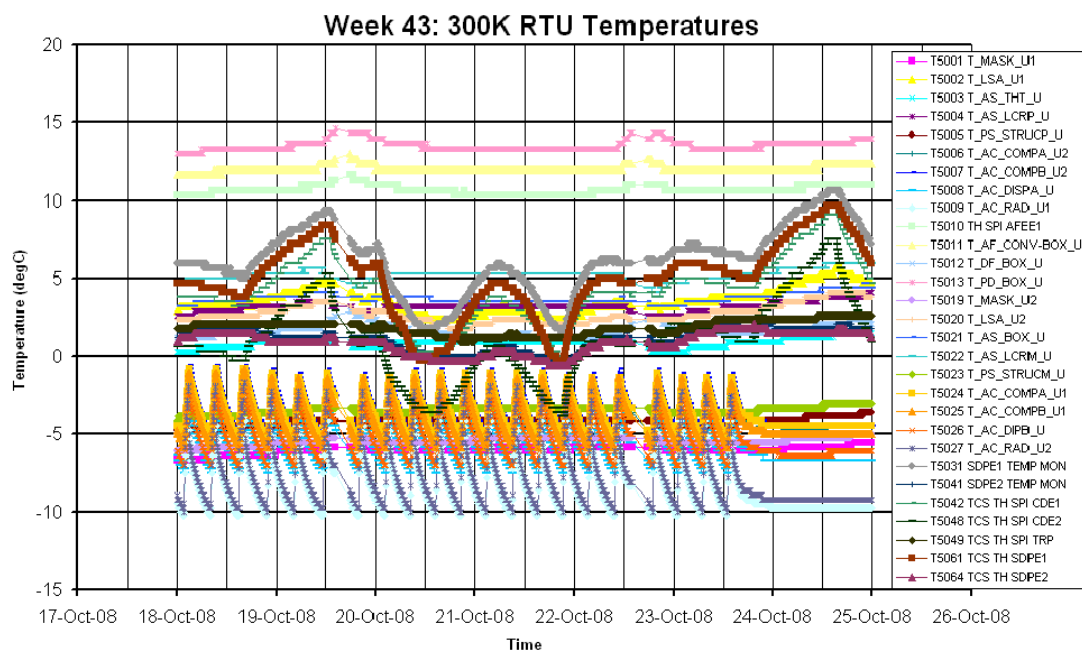
Nothing to report.

24/10/2008 (Day of Year 298, Revolution 736)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period.

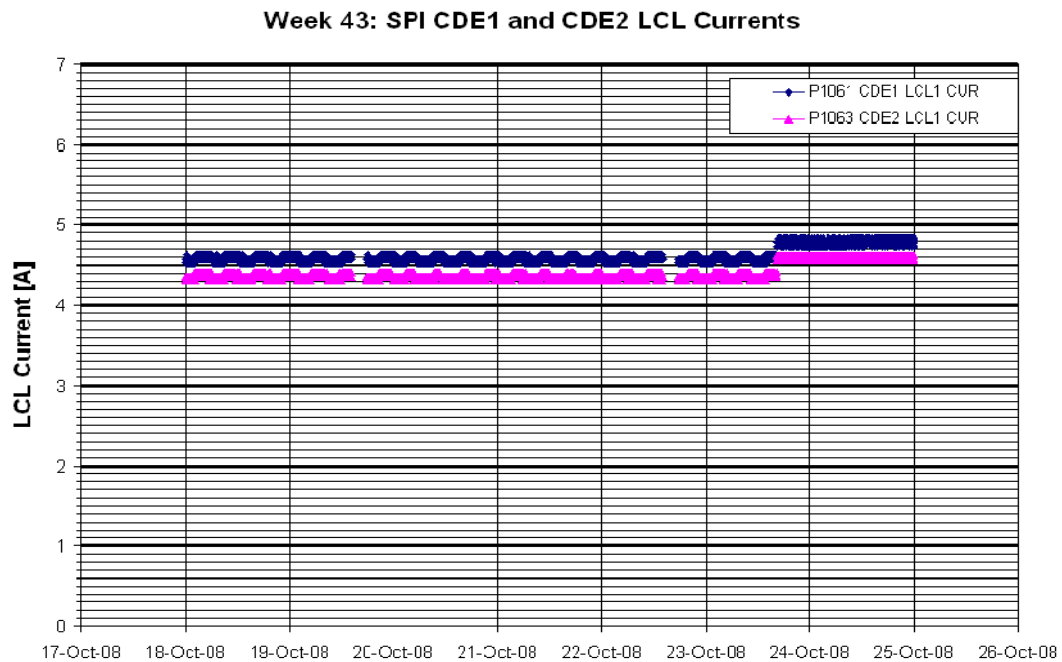


Stirling Compressors and Cryostat: The performance of the compressors is nominal.

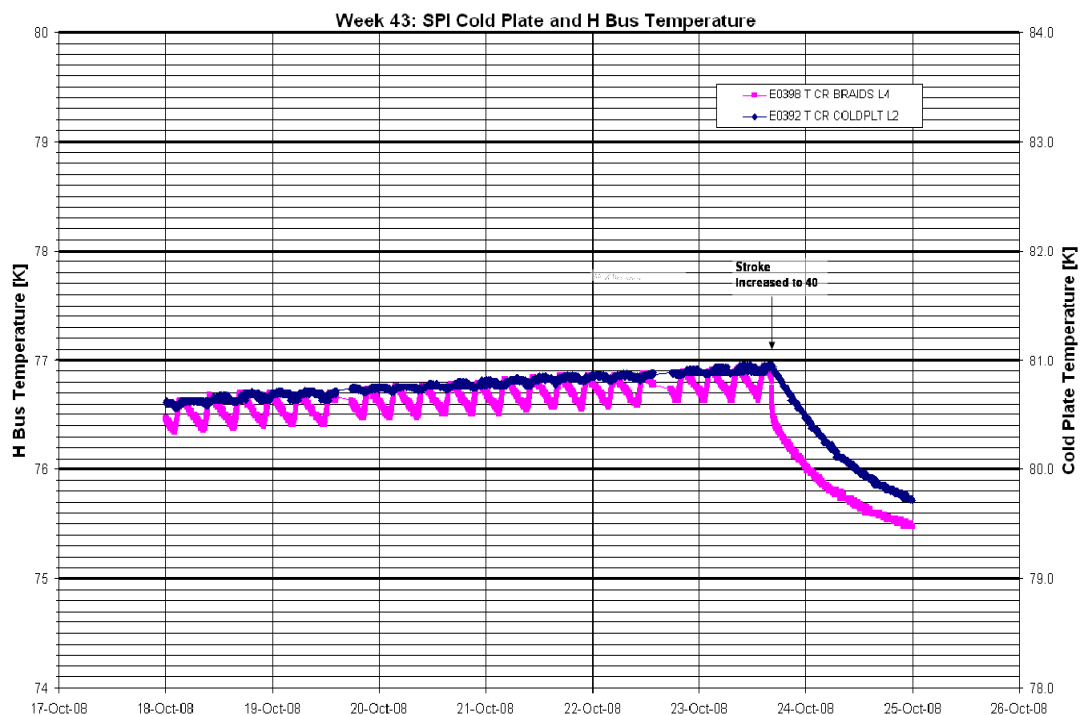
The cold plate temperature was maintained in the range 80K +/-1K.

The stroke of all four compressors was set to 39 until 2008-10-23 at 16:14:36Z, when the stroke of all four compressors was increased to 40 as the Cold Plate temperature (TM parameter E0392) had reached 80.9K.

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



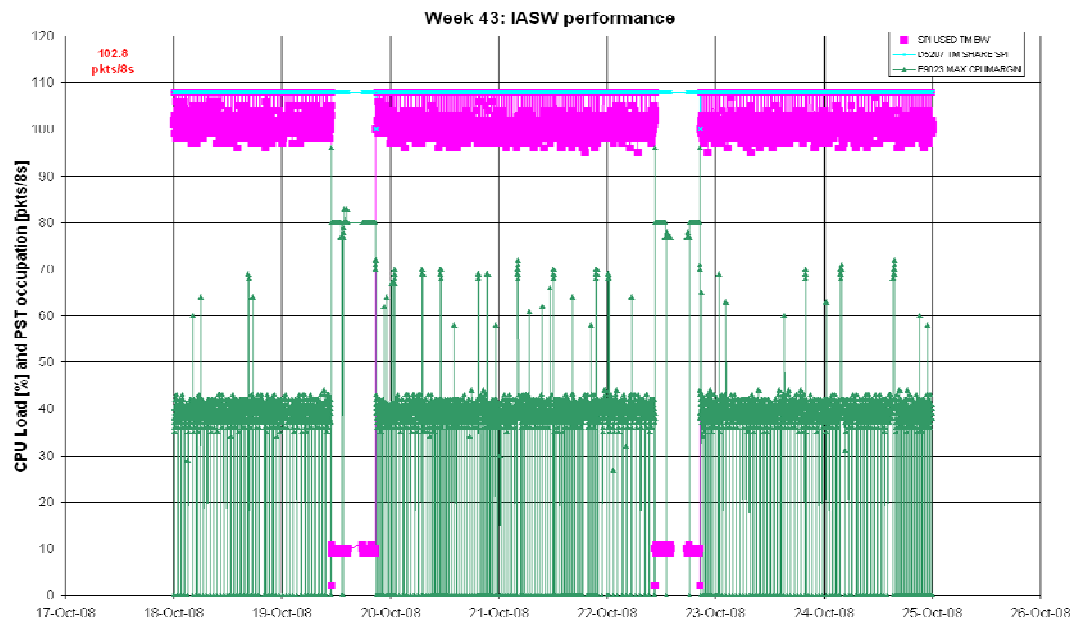
The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.



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

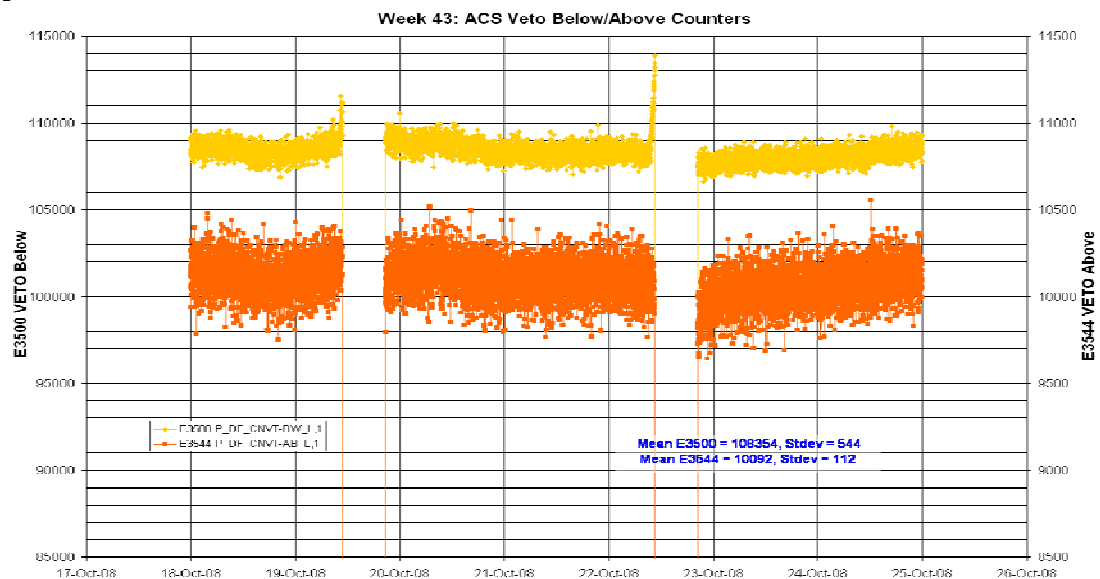
The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The average TM bandwidth occupation of SPI was 102.8 packets/cycle over the science window when the TM allocation was 108 packets/cycle.

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

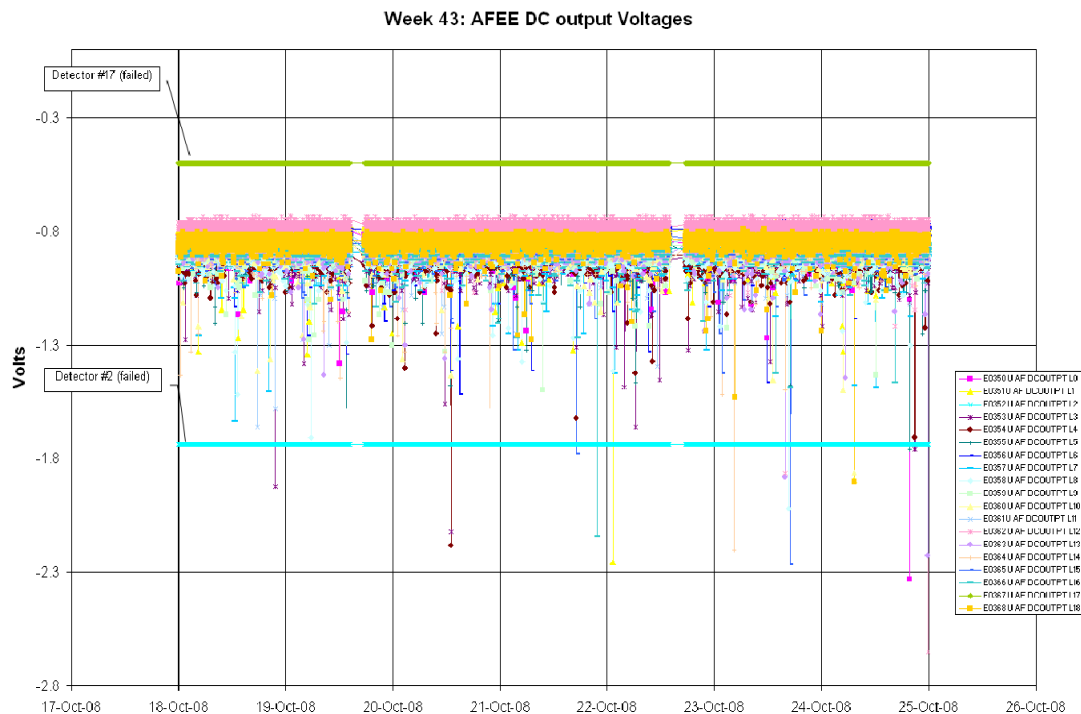


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

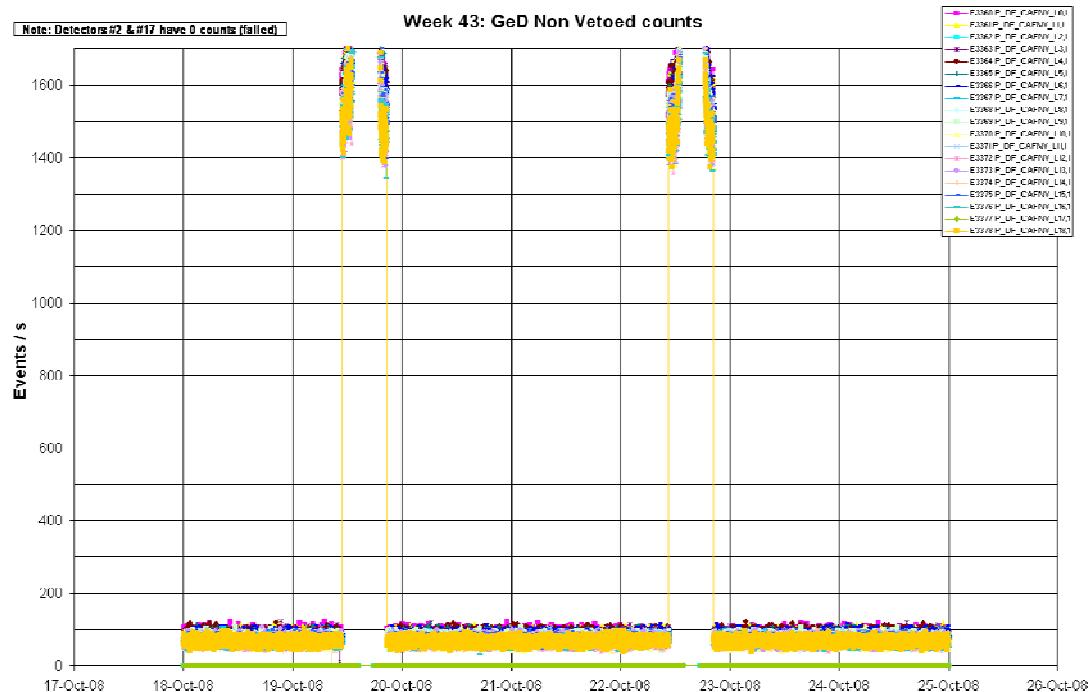
The following plot shows the ACS overall count rate evolution during the reporting period:

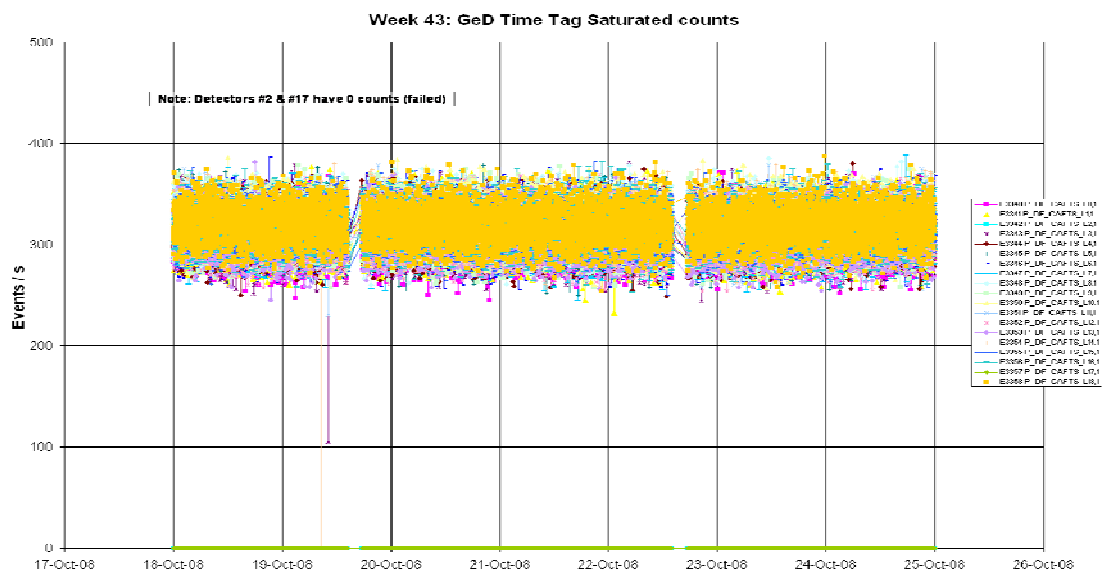
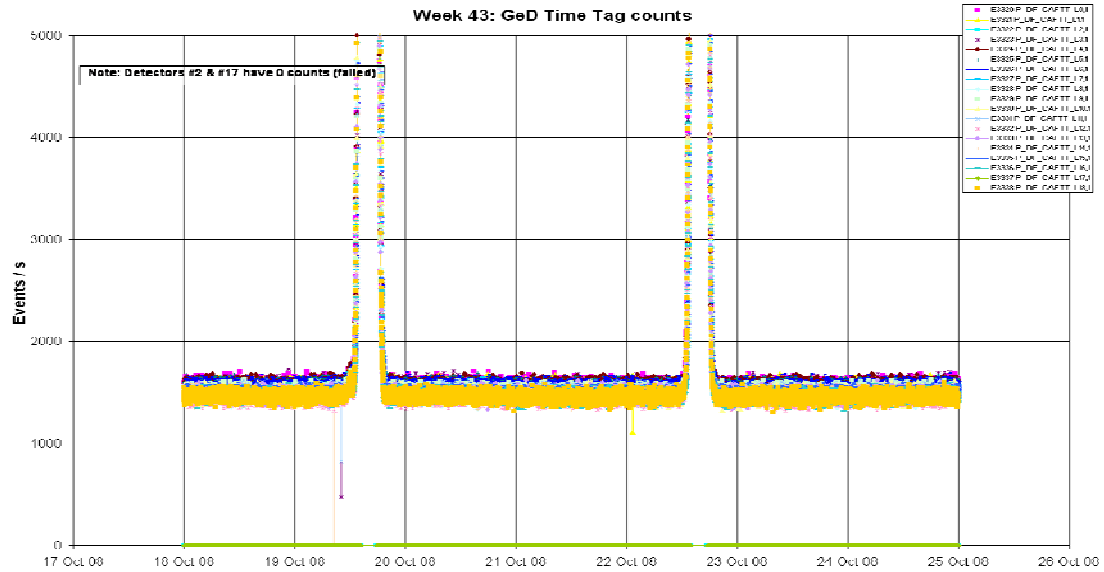


AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

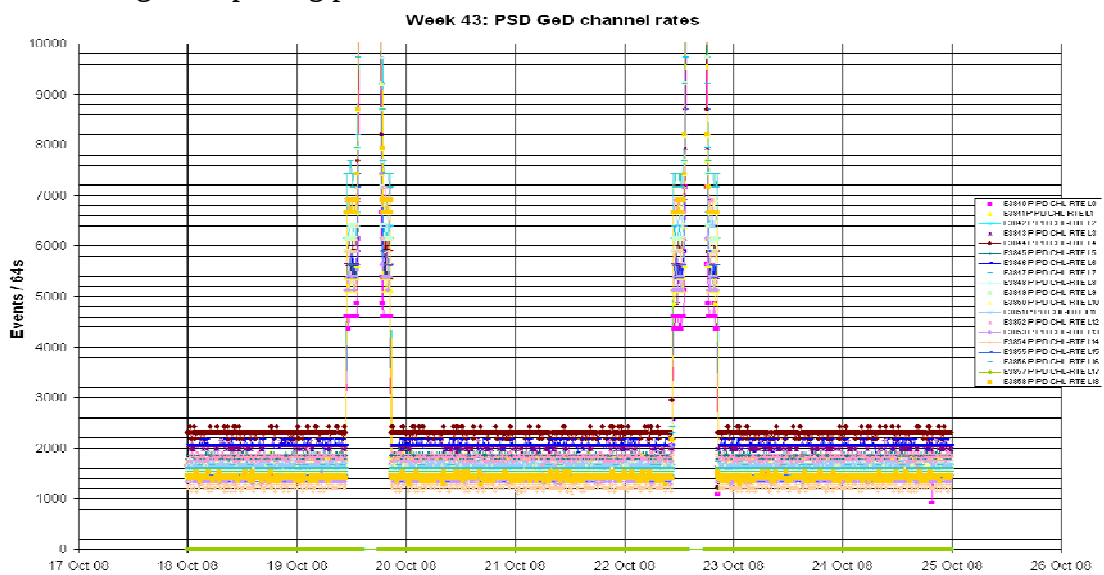


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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



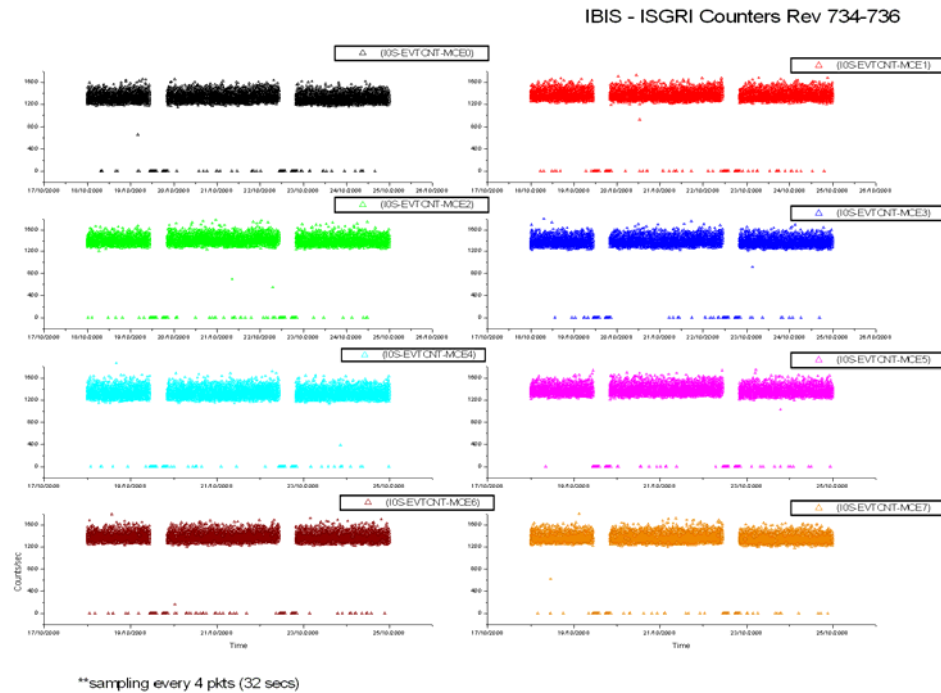
Event Log:

No non-nominal event occurred on SPI over the reporting period.

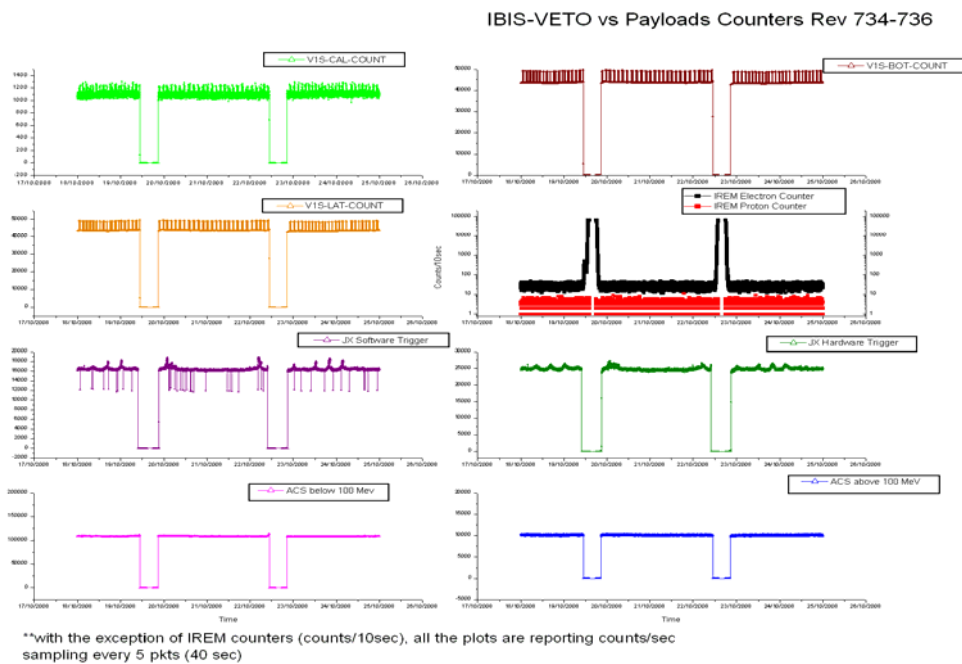
8.3.3 IBIS Operations

IBIS Event Counters Plots

ISGRI Counters:

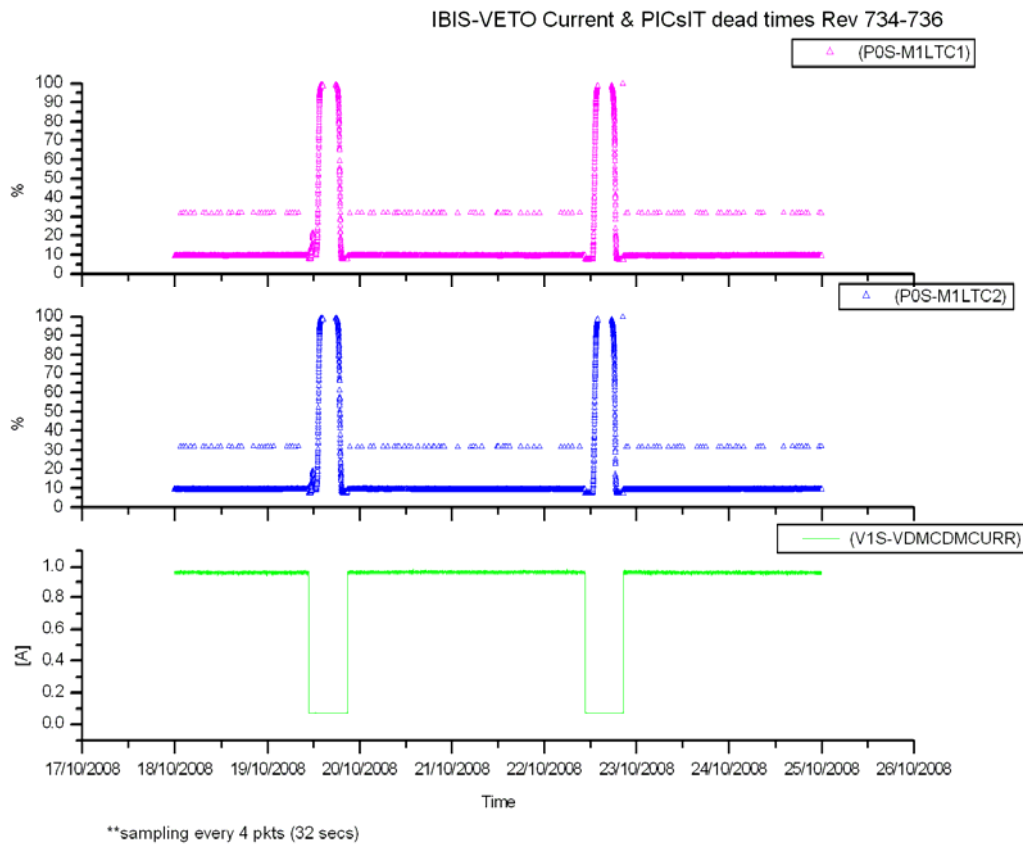


VETO vs Payload Counters:

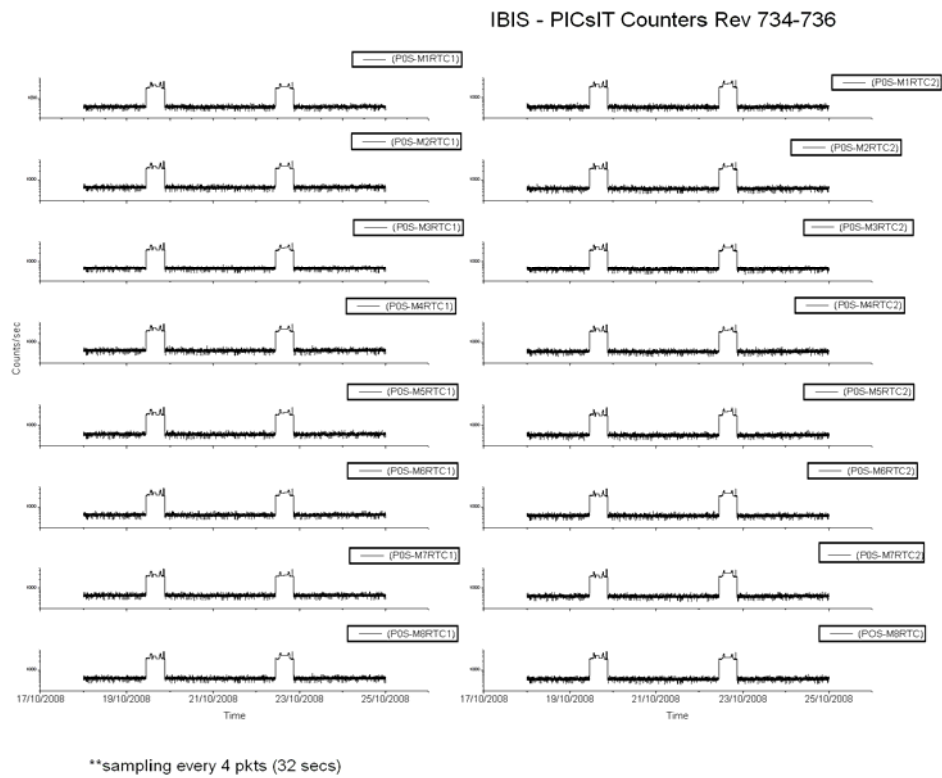


The week was characterised by low radiation as reported by the payload.

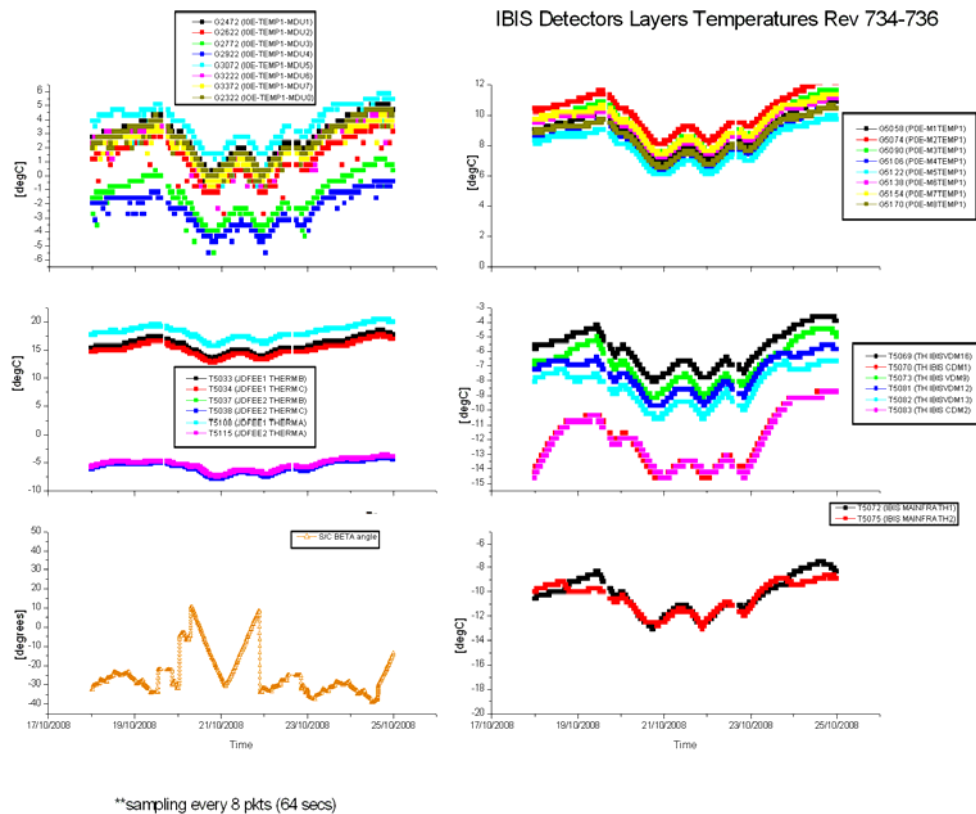
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report:

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

2008-10-18 (DOY 292, Rev 734)

IBIS operations executed nominally.

2008-10-19 (DOY 293, Rev 734-735)

Between 07:26:48Z and 09:07:12Z TM parameter G2070 briefly went OOL a couple of times, indicating an overflow of the noisy pixel address buffer in MCE5. As each time it returned within limits of its own accord, no action was taken.

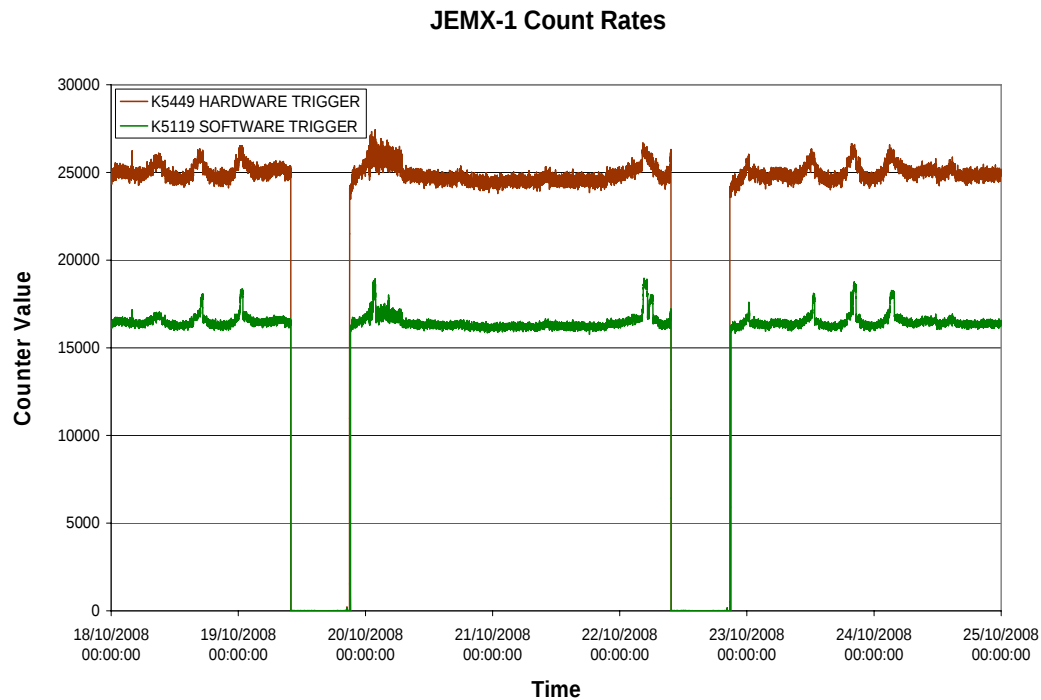
2008-10-20 (DOY 294, Rev 735) to 2008-10-24 (DOY 298, Rev 736)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

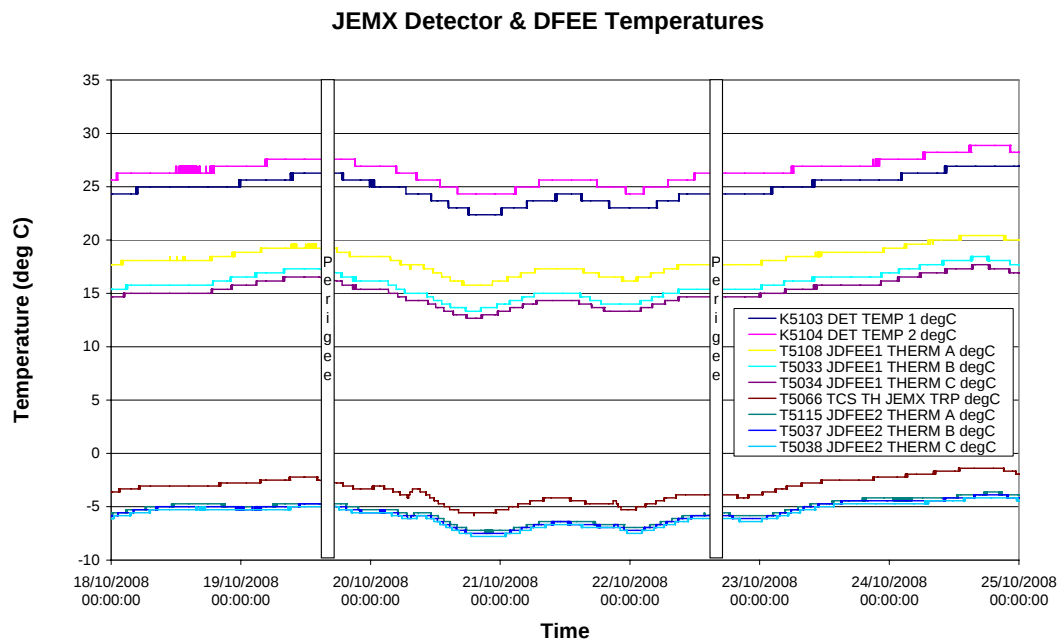
JEM-X Count Rates

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)

JEM-X Daily Report

2008-10-18 (DoY 292, Rev 734) to 2008-10-24 (DoY 298, Rev 736)

JEM-X 1 operations executed nominally.

8.3.5 OMC Operations

2008-10-18 (DoY 292, Rev 734) to 2008-10-24 (DoY 298, Rev 736)

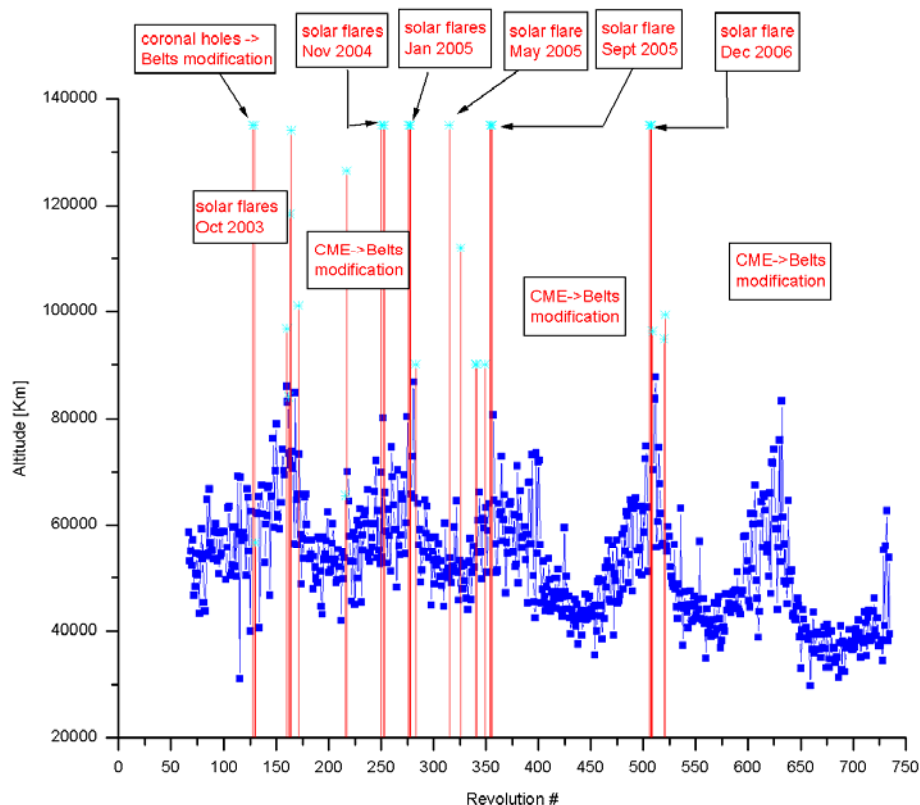
Nothing to report.

On DoY 293 at 10:47:47 and DoY 296 at 10:34:35 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):

Nothing to report.

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]
734	RAD_ENTR R 2008-10-19T10:47:39Z	19/10/2008 11:08:49	53777.9	19-Oct-2008 12:50:56	37259.93
735	RAD_EXIT R 2008-10-19T20:38:19Z	19/10/2008 19:30:01	>>33643.6	19-Oct-2008 19:50:56	46274.78
735	RAD_ENTR R 2008-10-22T10:34:33Z	22/10/2008 12:32:02	39425.0	22-Oct-2008 12:33:27	38063.27
736	RAD_EXIT R 2008-10-22T20:25:13Z	22/10/2008 19:18:26	>>33644.4	22-Oct-2008 19:43:27	47007.5

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)

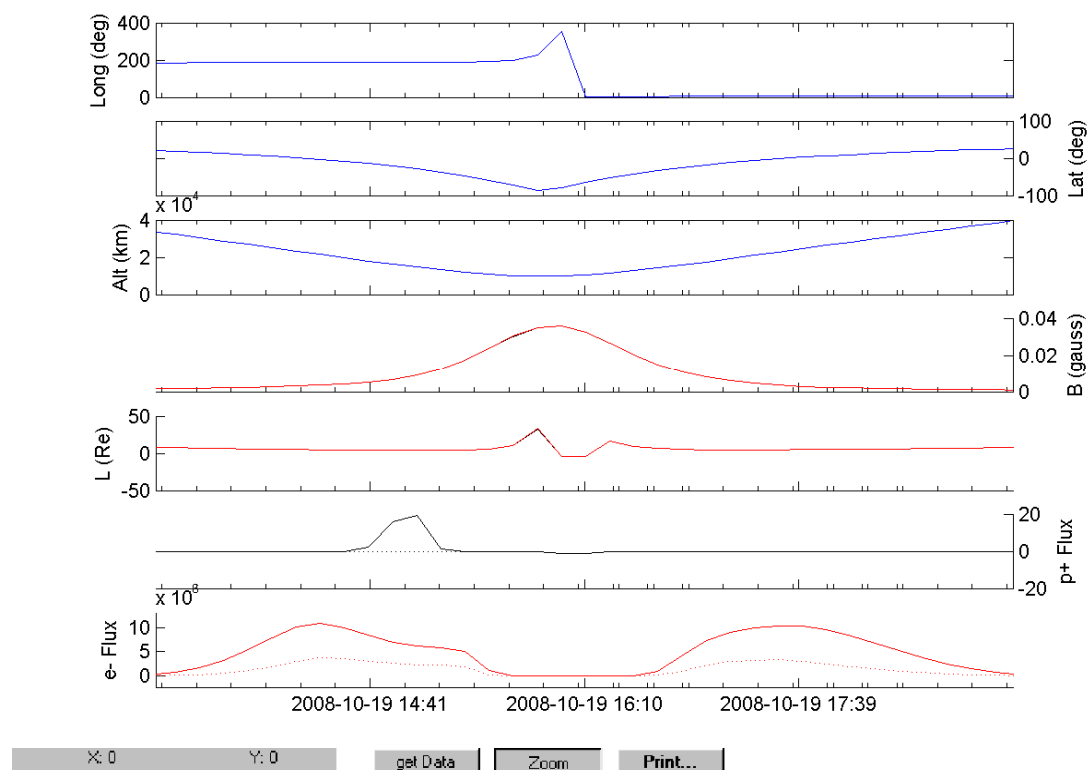
* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

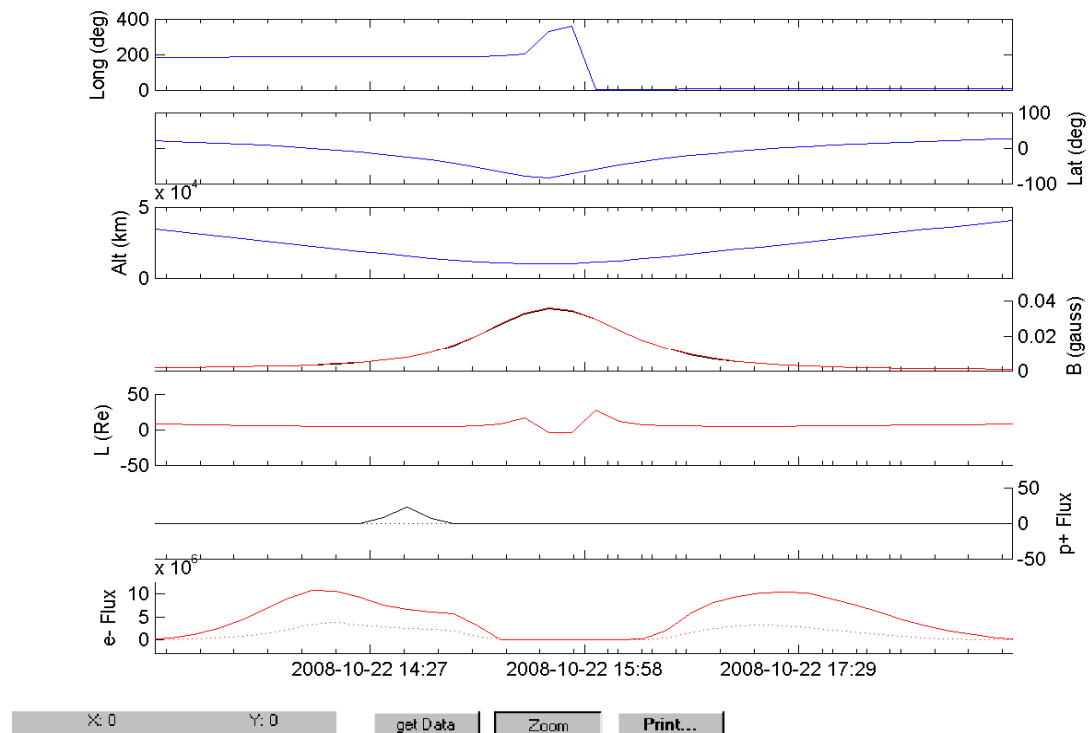
The IREM radiation counter plots are not available this week.

IREM Predicted Radiation Belt Passages

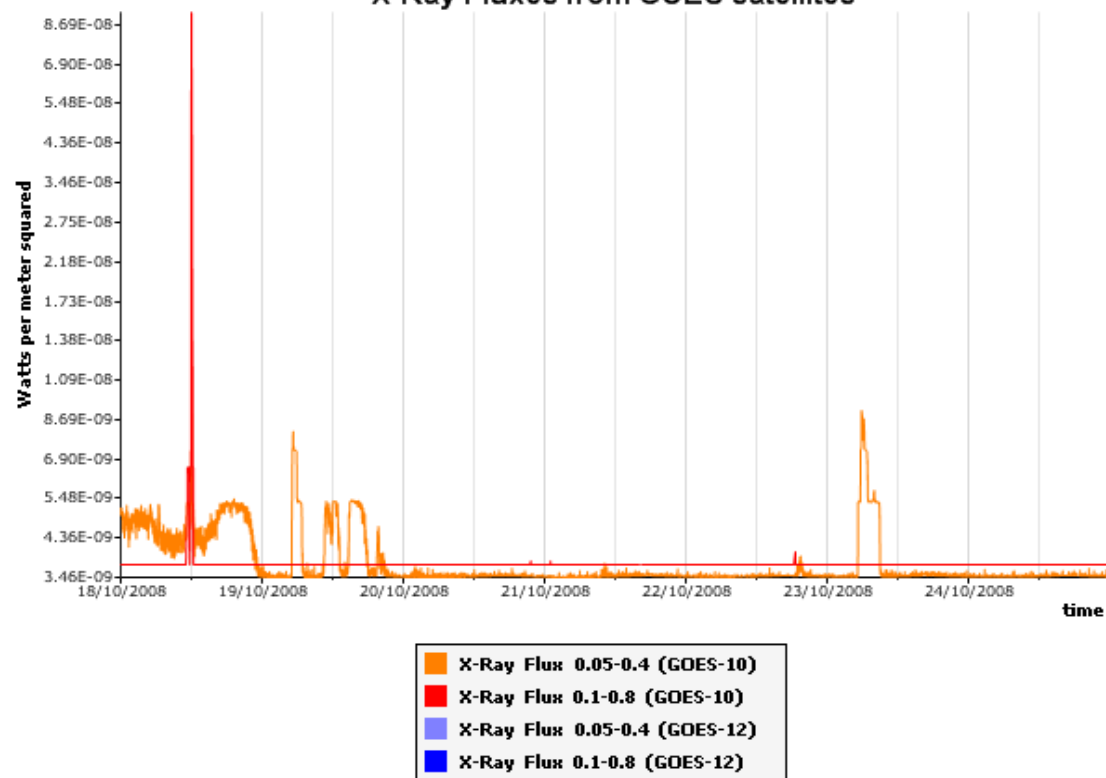
Rev 734



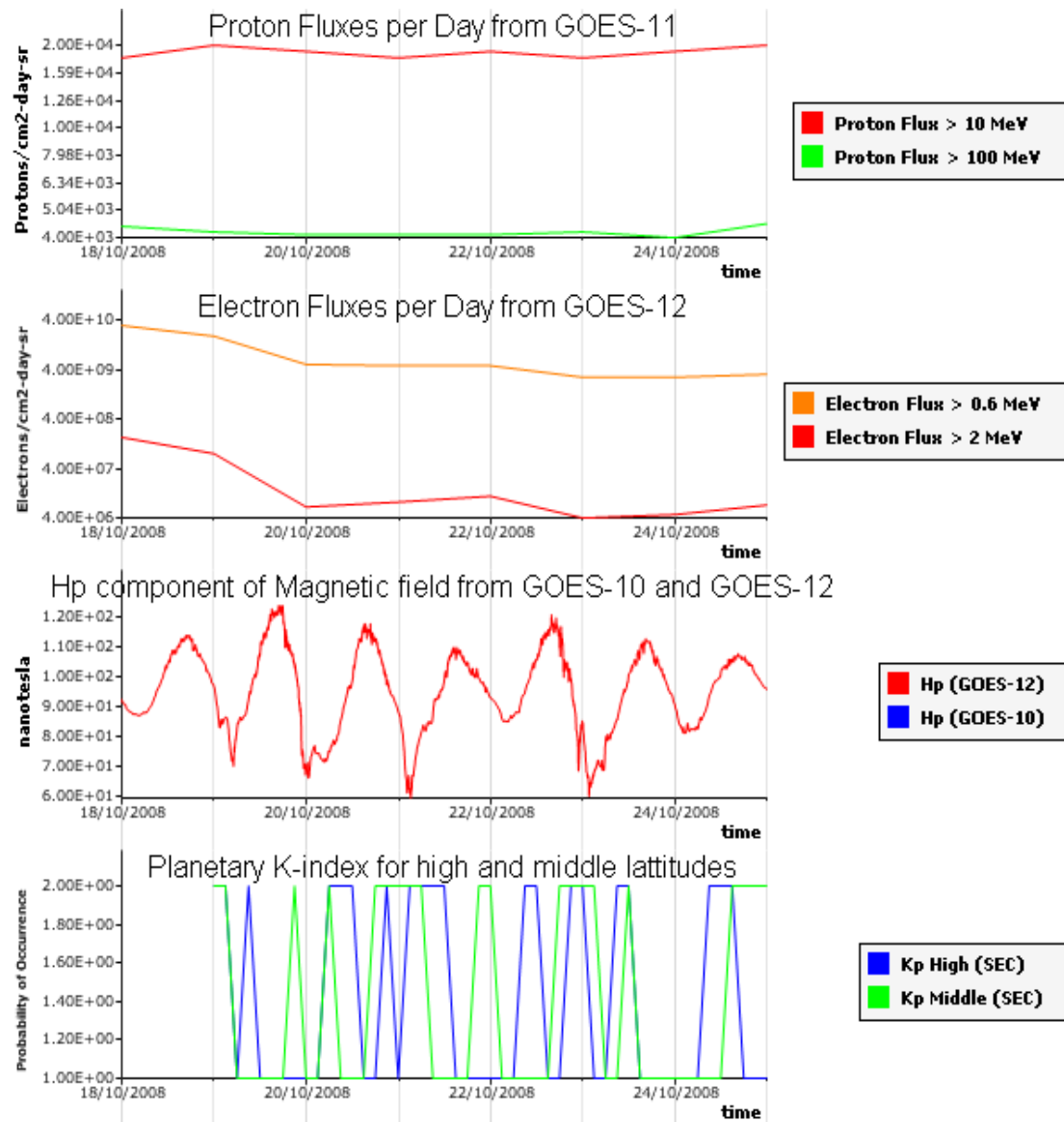
Rev 735



SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):
X-Ray Fluxes from GOES satellites



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.