

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 308
Week 33
18.08.08
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 09.08.08 until 15.08.08 (both dates inclusive) and covers the revolutions 712 and 713.

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 two raster dithers of Loop I-Loop IV Super (RA 13:57:10.00, DEC +07:34:37.0), and two raster dithers of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4).

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.

Eight slews were missed from TL, during the observation period due to problem at REDU station, FDS failed slew update and problem during S/T process.

The fuel consumption over the period between 09/08/2008 and 15/08/2008 was 0.1534 Kg. The remaining propellant is in the order of 139.1218 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.

Battery 1 reconditioning started on 15/8/2007 at 09.14z and is expected to be completed on 26/8/2008.

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

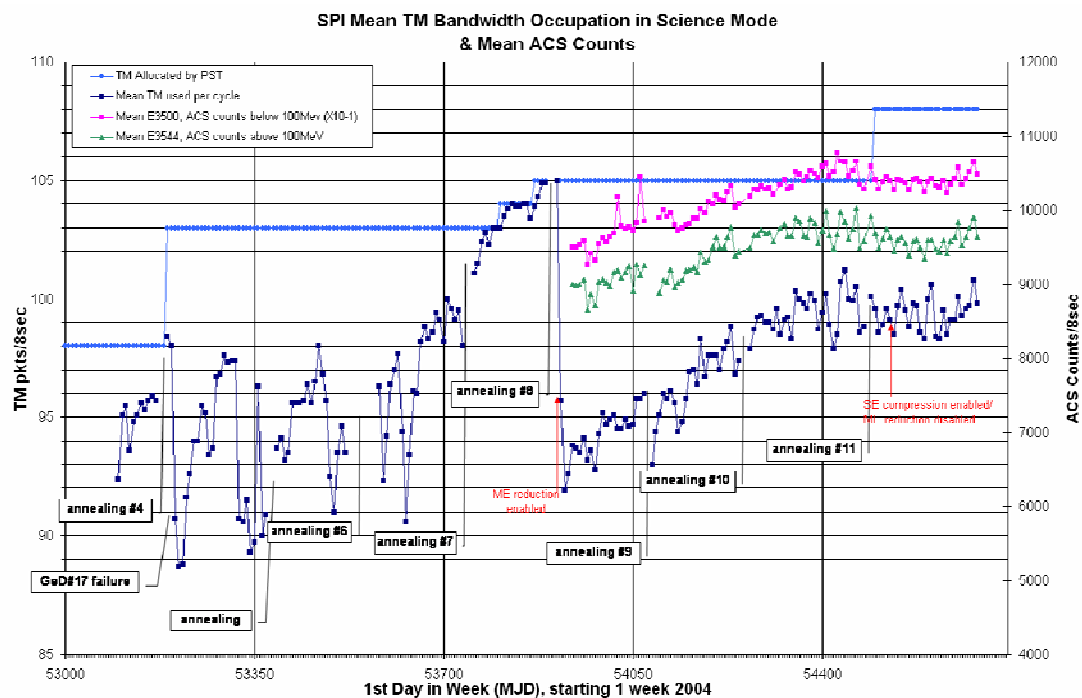
3.2.1 SPI

Following the 11th annealing, which ended on 30th January, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which, although its energy resolution improved since the previous annealing, is still showing a slightly degraded energy resolution compared to the other detectors and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). Detector #2 is failed since 06/12/2003 and detector #17 since 17/07/2004.

The Stirling compressors are working nominally, maintaining the Germanium detectors at 80 +/-1K.

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 99.8 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.

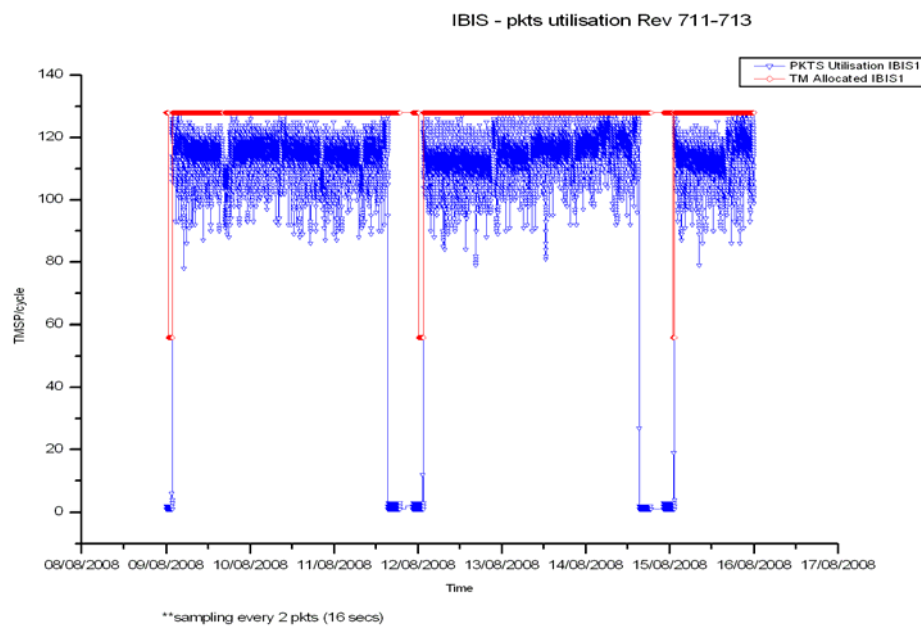
3.2.2 IBIS

The overall status of the unit is nominal.

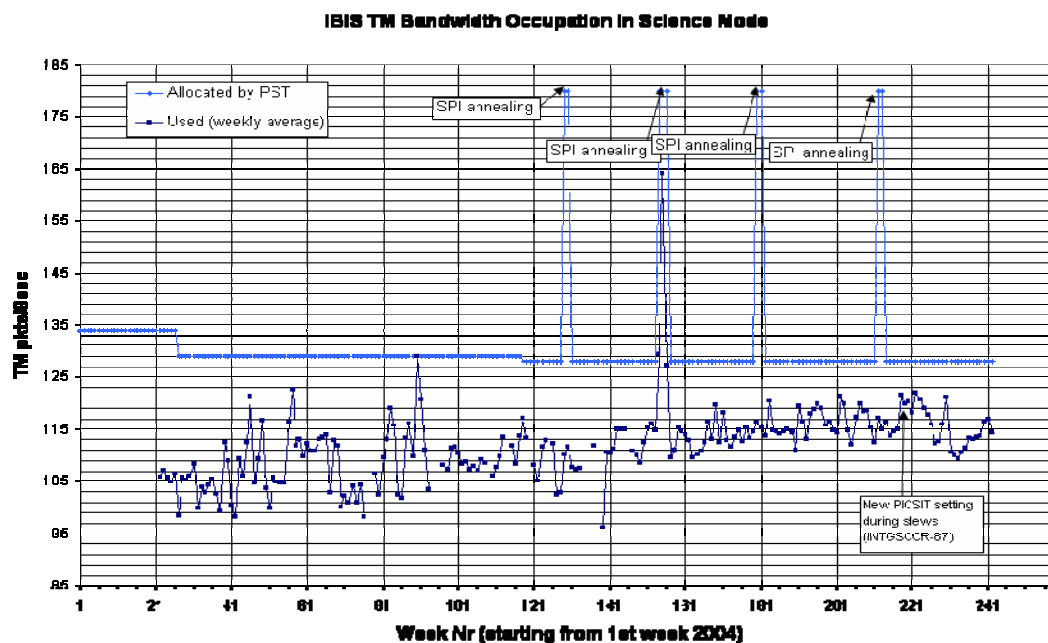
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 114.26 packets/cycle (down 2.85 on last week)
- Percentage of TM cycles in which full bandwidth was used: 1.22%.

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.

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/cycle.

During this reporting period, 145 of the 153 planned science pointings were executed nominally, 8 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. 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. 8 Slews were lost from 170 planned, which is just over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. No problems were reported.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were three drops of the links with Redu, one of which lasted over an hour, and caused the loss of 4 pointings, one drop from DSS27, and the link to ISDC also dropped three times

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 719 to 721.

Revolutions 715 and 716 have been planned. No further planning was done because of the possibility of follow-up TOO observations on PKS 1502+106. A new TOO request was received on Friday 15 August, but given the available data on the source IGR J00291+5934 it was decided to wait for further information before deciding on implementation.

New TSFs have been received for revolutions 713 and 714.

2. Observation status

New ECS files were received and processed for revolutions 703 and 704.

3. ISOC Science Data Archive

No news.

4. ISOC system

Work is continuing on ISOC system V19.4.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 18/08/2008:

- Latest Standard Analysis completed: observation 05200080005 (Loop I-Loop IV Super, Revolution 691, 692 & 693) on 14/08/2008.
- Latest products archived: observation 05200480001 (XMM-LSS, Revolution 695, 696 & 697) on 15/08/2008.
- Latest observation products sent to the observer: observation 05200510009 (Mrk 421, Revolutions 679) on 16/06/2008.

5 Special Events

6 Anomalies

The following problem was reported this week that impacted operations.

- On DoY 222, at 16:12, a TM drop from Redu halted the Timeline. An attempt at 16:45 to go to Vil2 failed, as the carrier was still up at Redu, and no-one was available to shut it down. The TM finally returned at 17:29. A recovery was performed and the Timeline rejoined at 18:30. The impact was the loss of pointings 07110020, 07110021, 07110022 & 07110023
- On DoY 223, at 07:35, a problem with guide stars and slew modes caused an interruption to the Timeline. A manual recovery was performed, and the Timeline rejoined at 09:46. The impact was the loss of pointings 07110040 & 07110041.
- On DoY 227, at 03:18, another problem with guide stars interrupted the Timeline. A manual recovery was performed, and the Timeline rejoined at 04:42. The impact was the loss of pointings 07120054 & 07120055.

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

AR id	Date Created	Subject	Segment	Status
INT-3018	2008-08-09	Communications problems to REDU 9/8/2008	Comms	Pending

7 Future Milestones

- The 11th on-board clock wrap around due at 01:24:34 on 22/08/2008.
- The 12th SPI annealing is due to take place between 17th August and 5th September 2008, during revolutions 714 to 719.
- During the SPI Annealing, it is planned to operate the JEMX-2 instrument, which is currently scheduled to be activated at the end of revolution 713.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 712

The observations in revolution 712 began with a raster dither of Loop I-Loop IV Super (RA 13:57:10.00, DEC +07:34:37.0), lasting ~19.3 hours, they continued with a raster dither of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4), lasting ~36.6 hours, until the end of the revolution.

Revolution 713

The observations in revolution 713 began with a raster dither of Loop I-Loop IV Super (RA 13:57:10.00, DEC +07:34:37.0), lasting ~14.5 hours, they continued with a raster dither of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4), lasting ~41.5 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

2008-07-26T10:26:32.000Z	139.4750	F	Automatic TM processing.
2008-07-28T00:07:16.000Z	139.4649	F	Automatic TM processing.
2008-07-29T10:14:47.000Z	139.4476	F	Automatic TM processing.
2008-07-30T23:51:07.000Z	139.4397	F	Automatic TM processing.
2008-08-01T09:06:22.000Z	139.4183	F	Automatic TM processing.
2008-08-02T23:39:06.000Z	139.4015	F	Automatic TM processing.
2008-08-04T00:40:13.000Z	139.3574	F	Automatic TM processing.
2008-08-05T17:06:09.000Z	139.3465	F	Automatic TM processing.
2008-08-06T21:22:36.000Z	139.3241	F	Automatic TM processing.
2008-08-08T16:55:54.000Z	139.3131	F	Automatic TM processing.
2008-08-08T23:18:18.000Z	139.2752	F	Automatic TM processing.
2008-08-10T09:18:06.000Z	139.2402	F	Automatic TM processing.
2008-08-11T23:06:58.000Z	139.1976	F	Automatic TM processing.
2008-08-12T21:48:20.000Z	139.1539	F	Automatic TM processing.
2008-08-14T22:55:37.000Z	139.1461	F	Automatic TM processing.

This report was generated Fri Aug 15 08:00:21 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, 09/08/2008 – 15/08/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 85 Open Loop Slews, 80 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC).

8 slews (3 OSL, 5 CSL) were missed from TL, during the observation period due to problem at REDU station (drop in TM links), FDS failed slew update and guide star not found during the S/T process for slew ID 07120054.

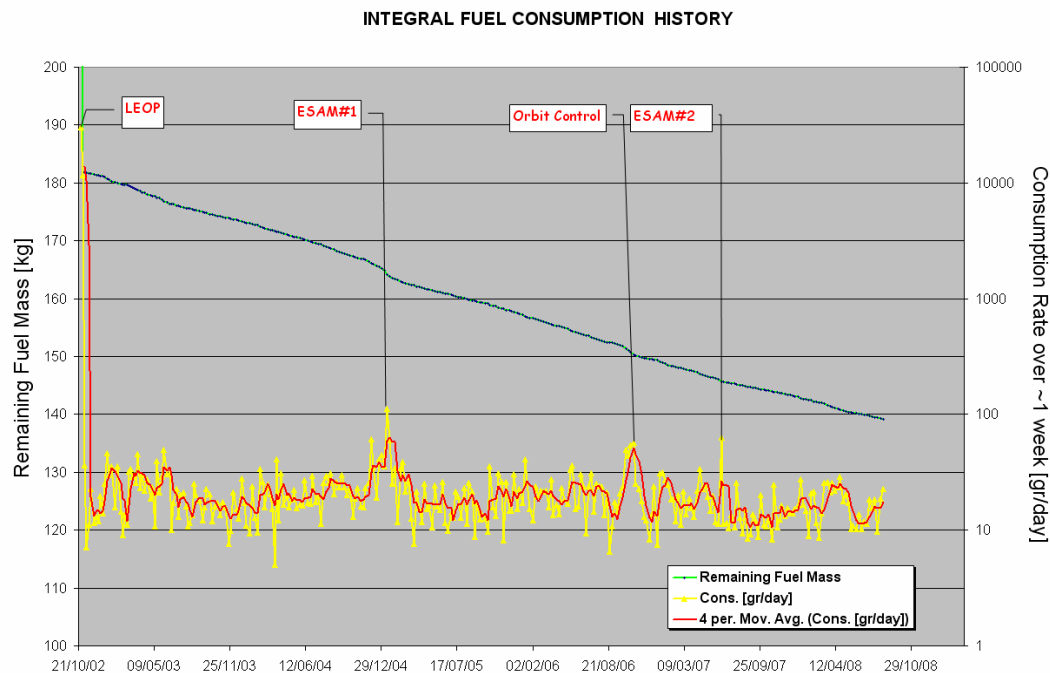
This is equivalent to $\sim 4.7\%$ of the total number of slews planned (170).

Orbit Control

No update

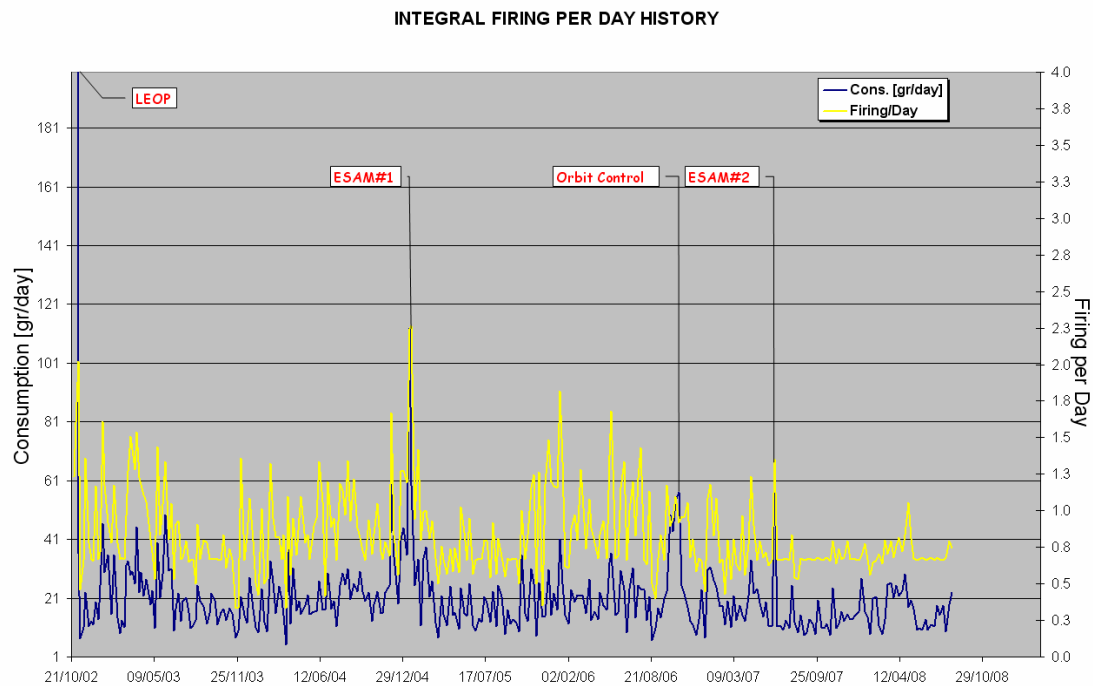
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 15/08/2008 is reported in the plot below.



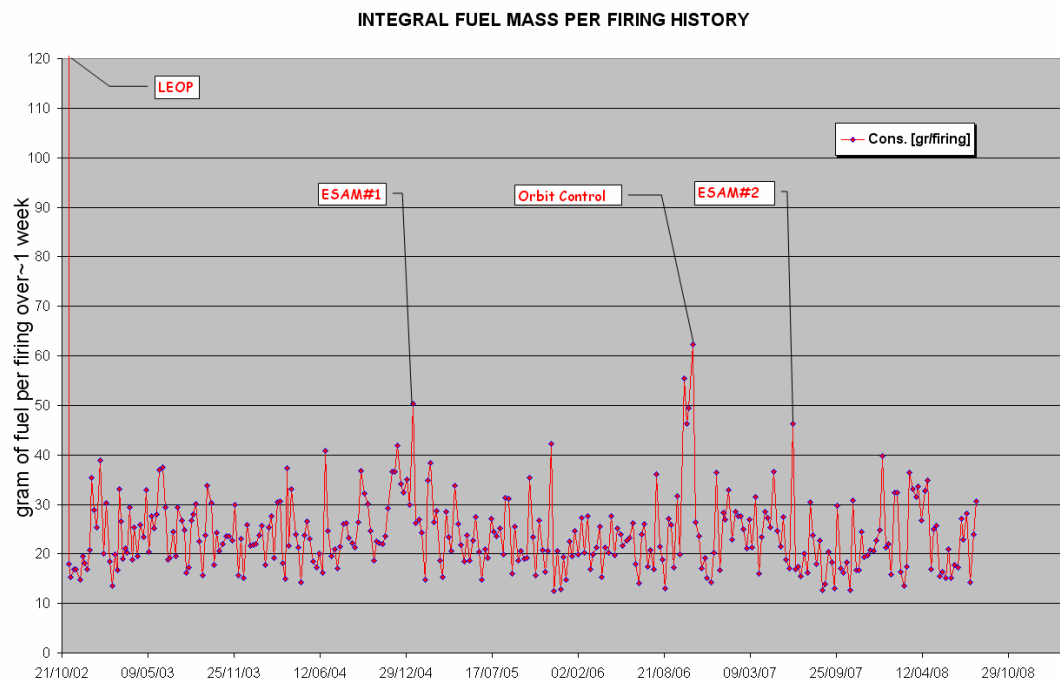
The above plot considers the ESAM fuel consumption spread over period of ~ 1 week.

The firing per day over the period between 01/11/2002 and 15/08/2008 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 15/08/2008 is shown in the plot below.

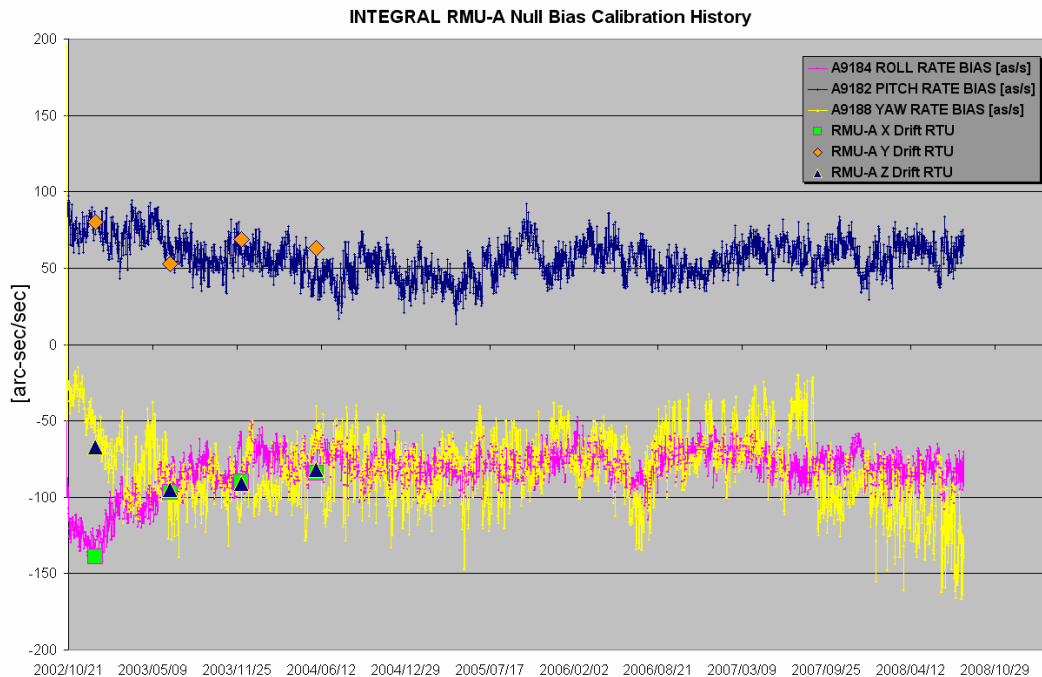


The RMU-A null bias calibration

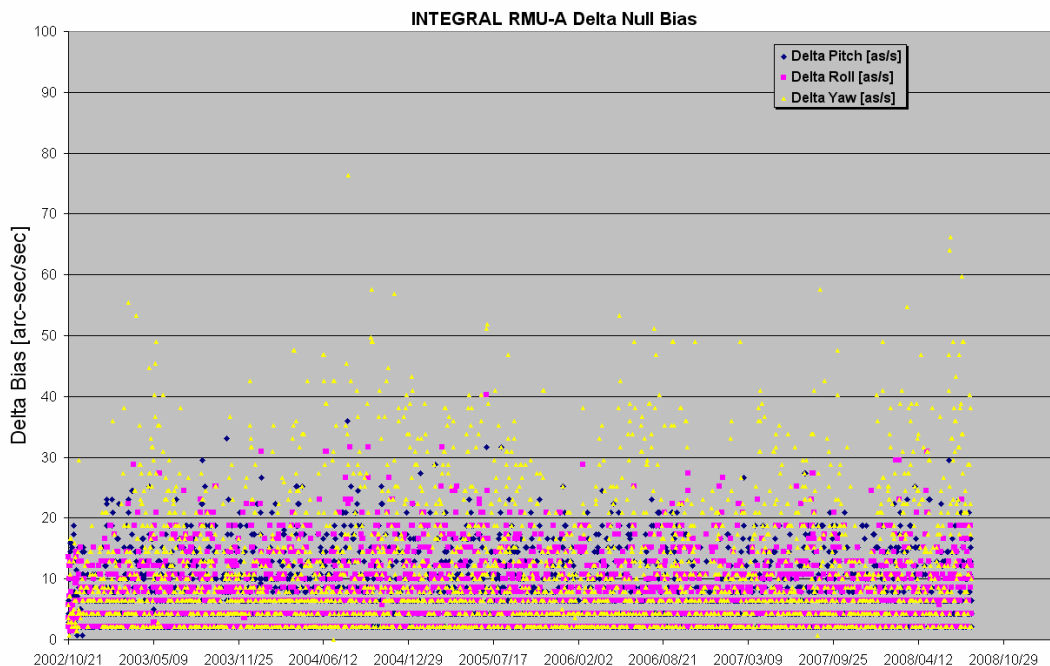
The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 15/08/2008 is reported in the plot below.

Problems have been reported during the last period on FDS when generating the drift update for the RMU-A Yaw channel: the limits set on FDS have been violated few times. 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 15/08/2008 is reported in the plot below.



09/08/2008 (Day of Year 222, Revolution 710-711)

Problem at REDU station: at 16:12z a problem on TM links at REDU station cause the slews ID 07110020-21-22-23 to fail release. Once the TM links back and stable, a manual recovery was performed from the attitude of PID 07110019 to the attitude of PID 07110023. The next slew ID 07110024 was manually updated in TL.

The following slews were missed in TL: PID 07110020(OSL)-21(CSL)-22(CSL)-23(OSL)

10/08/2008 (Day of Year 223, Revolution 711)

FDS failed slew update: at 07:35z the FDS failed the update of CSL ID 07110040. FDS reported an error during the update process: few valid stars found in the FOV and not matching the catalogue position. The next slew update requested to be performed as an OSL.

A manual recovery was performed, the slew to PID 07110040 was discarded due to time problem and the next Change of Guide Star and Reaction Wheel Bias activities were performed manually. Several problems were reported during the Bias execution and the FD on-call engineer and AOCS SOE were involved in the recovery. Finally a manual slew from the attitude of PID 07110039 to the attitude of PID 07110041 was executed and the next slew ID 07110042 updated in TL.

The following slews were missed in TL: PID 07110040(CSL)-41(OSL)

11/08/2008 (Day of Year 224, Revolution 711)

Nothing to report.

12/08/2008 (Day of Year 225, Revolution 711-712)

Nothing to report.

13/08/2008 (Day of Year 226, Revolution 712)

Nothing to report.

14/08/2008 (Day of Year 227, Revolution 712)

Problem during S/T process: at 03:18z due to a problem with S/T process (no guide star found in slot #2) the slew ID 07120054 failed release. The problem was likely caused by sparse stellar field with very faint stars at the limit of the STR threshold magnitude set for the S/T.

A manual recovery was performed from the attitude of PID 07120053 to the attitude of PID 07120055. The next slew ID 07120056 was manually updated in TL.

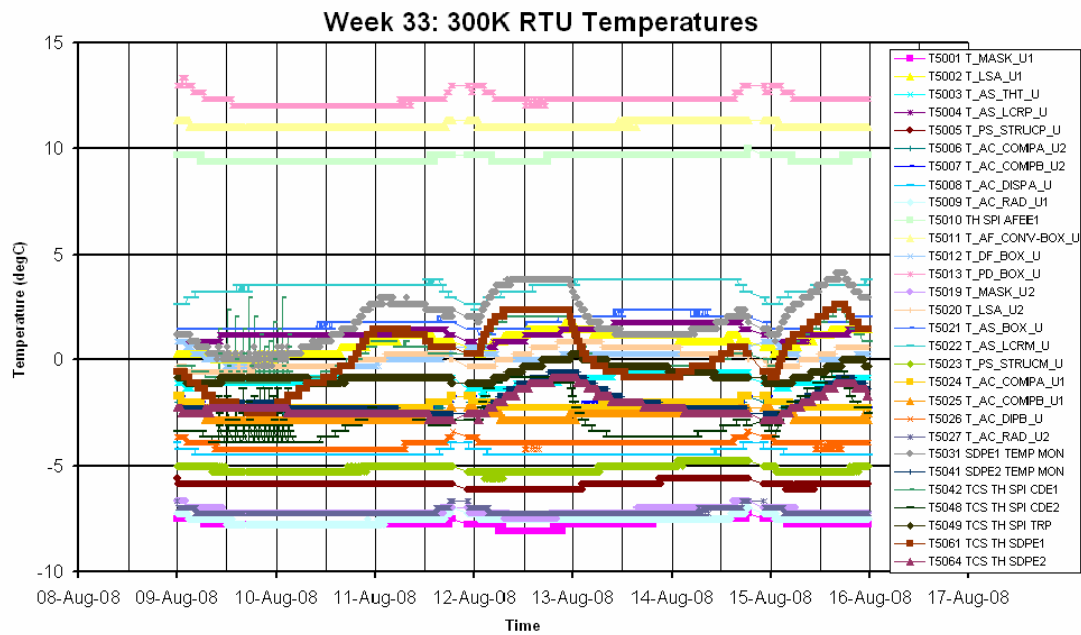
The following slews were missed in TL: PID 07120054(CSL)-55(CSL)

15/08/2008 (Day of Year 228, Revolution 712-713)

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.

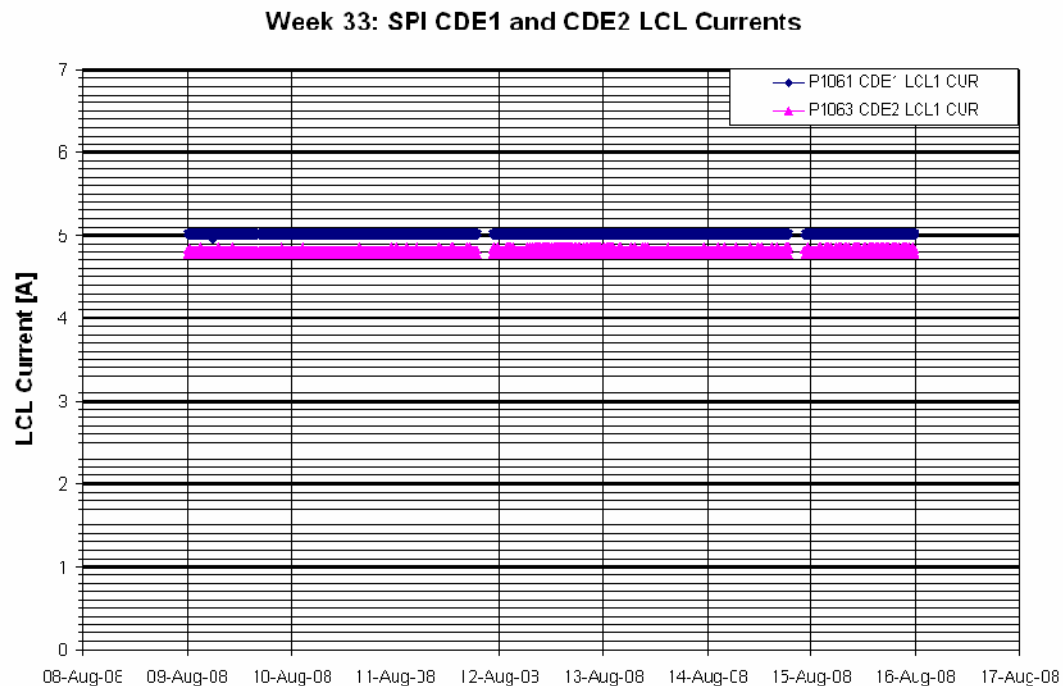


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

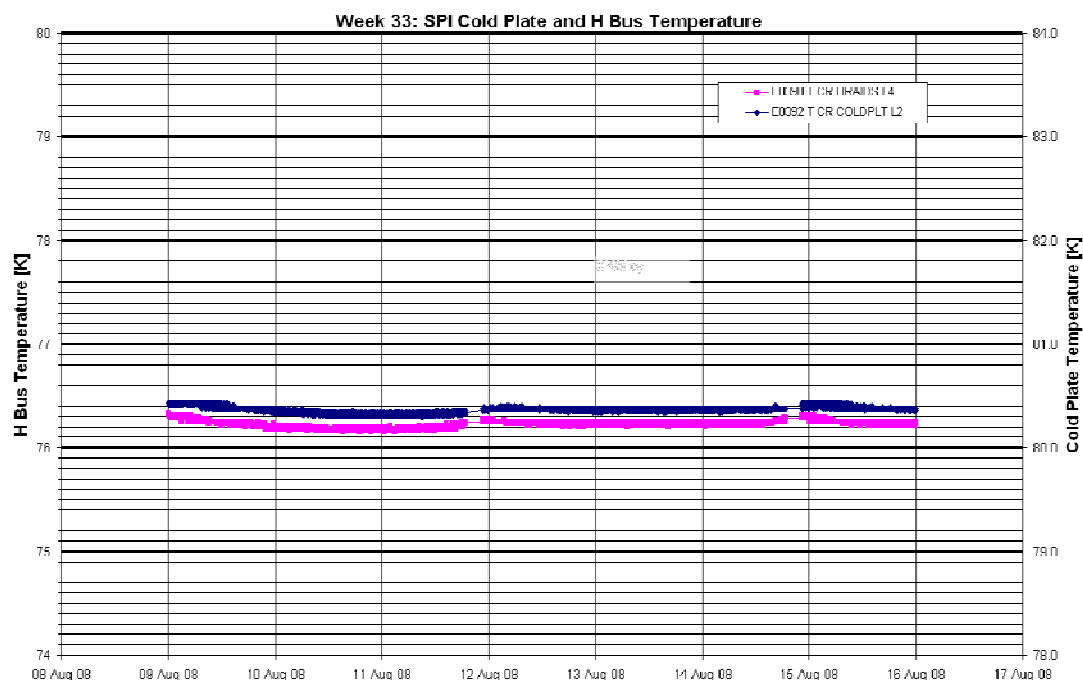
The stroke of all four compressors was set to 41 throughout the week. The average CDE LCL currents were as follows:

- CDE1 LCL Current = 5.01A
- CDE2 LCL Current = 4.81A

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.

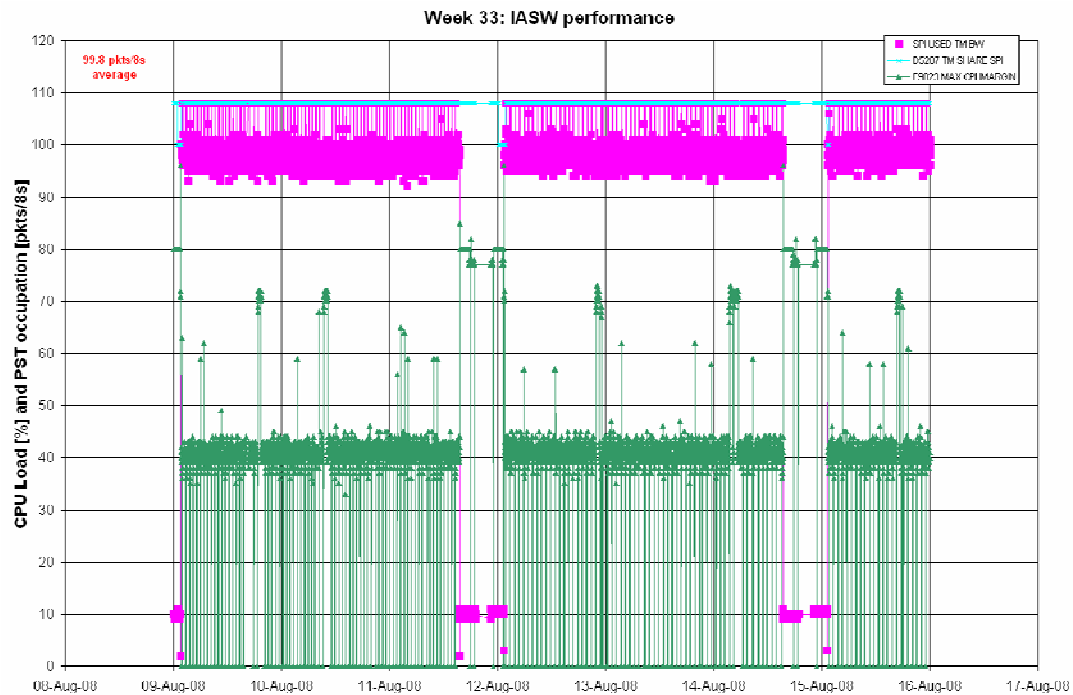


DPE & IASW: The DPE health and IASW performance is nominal.

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

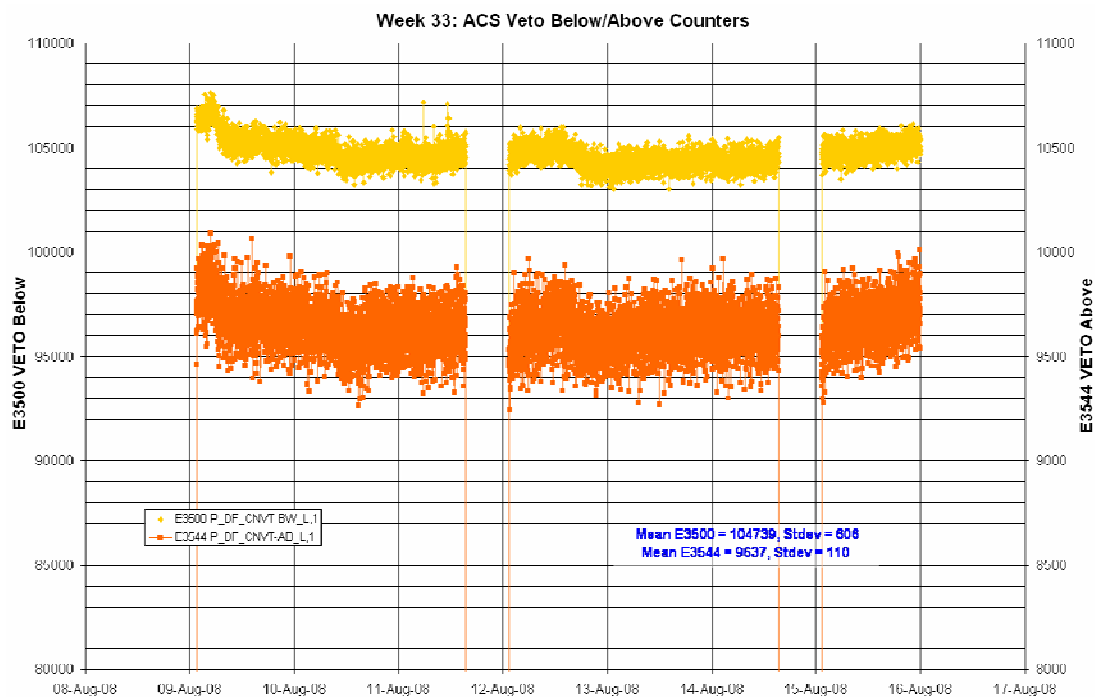
The average TM bandwidth occupation of SPI was 99.8 packets/cycle over the science window when the TM allocation was 108 packets/cycle.

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

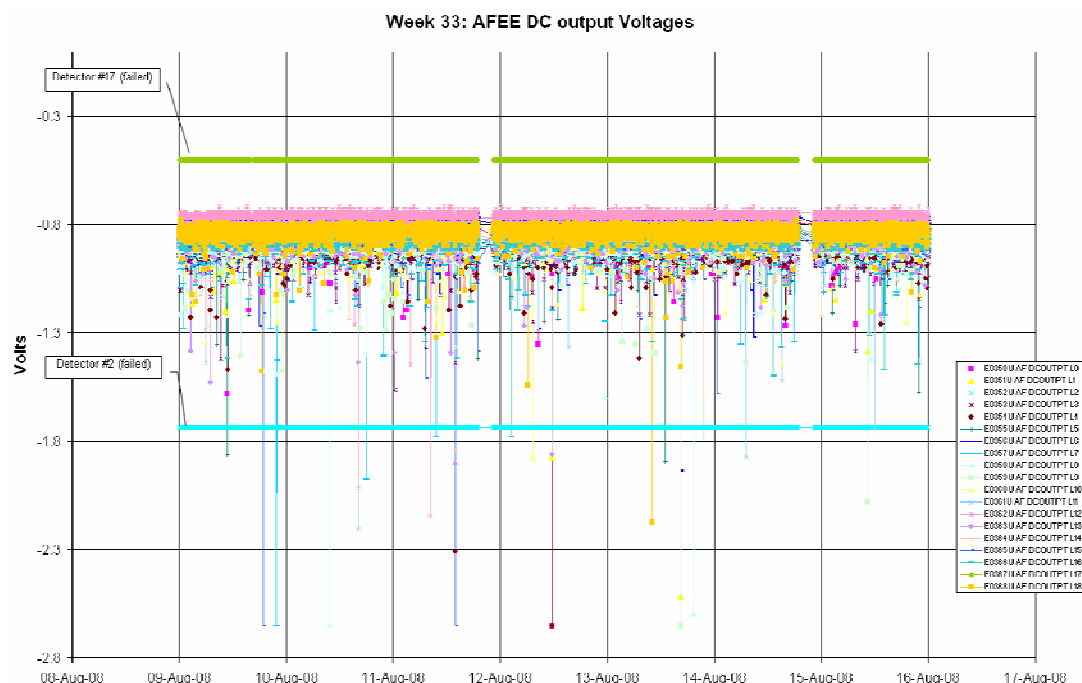


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

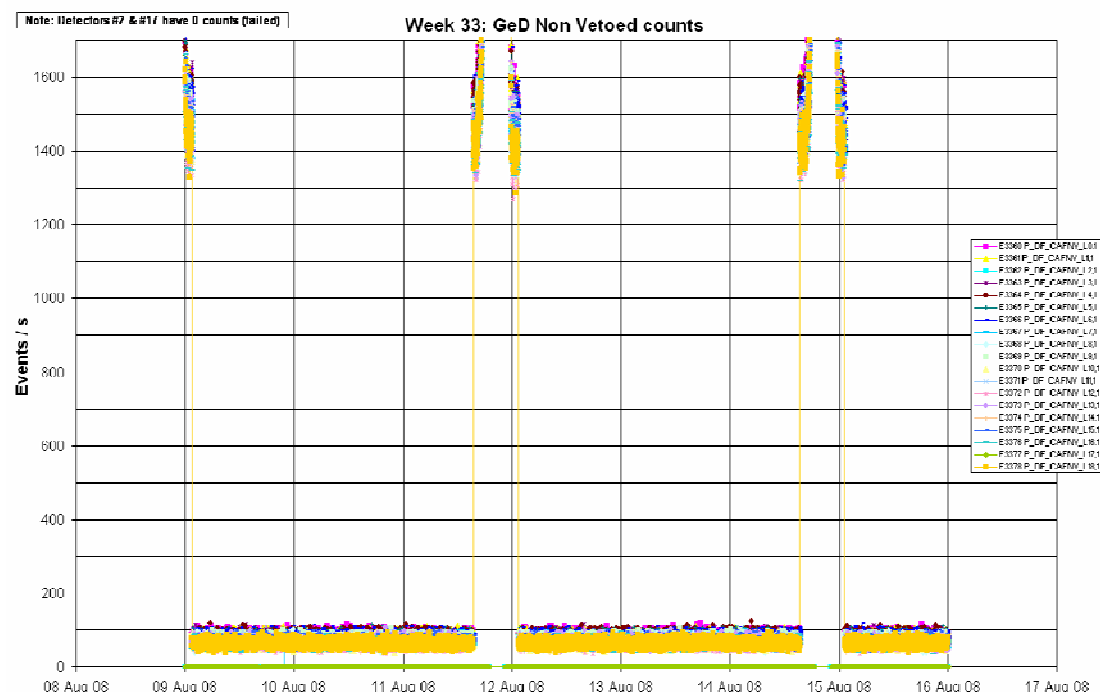
The following plot shows the ACS overall count rate evolution during the reporting period:

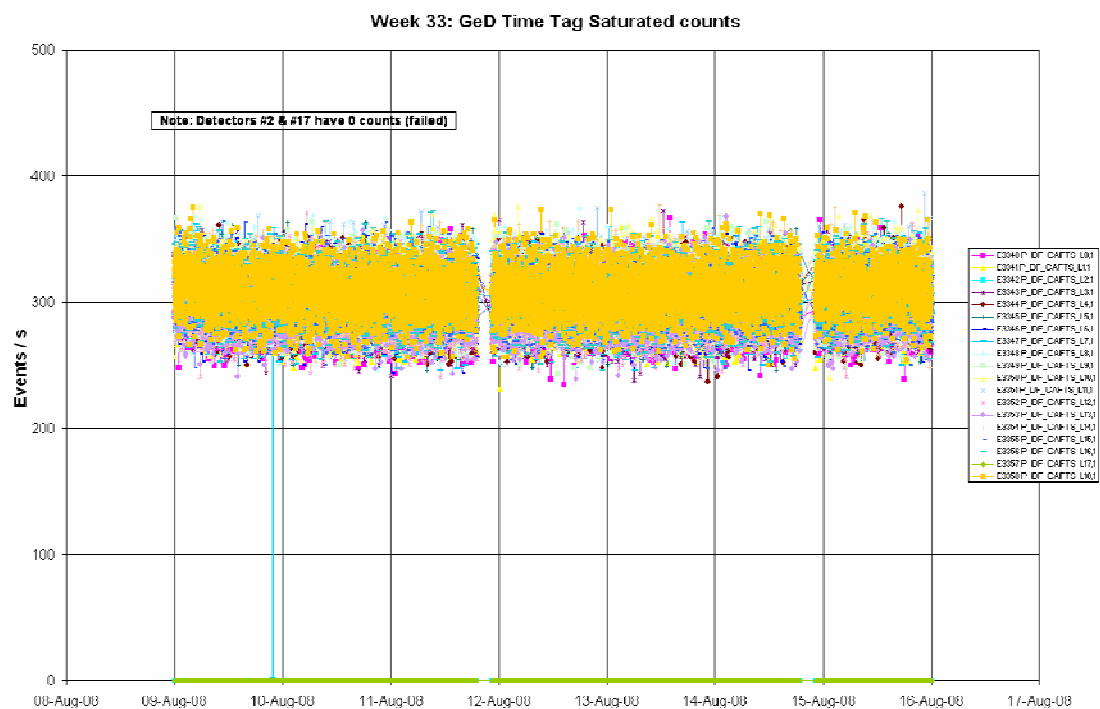
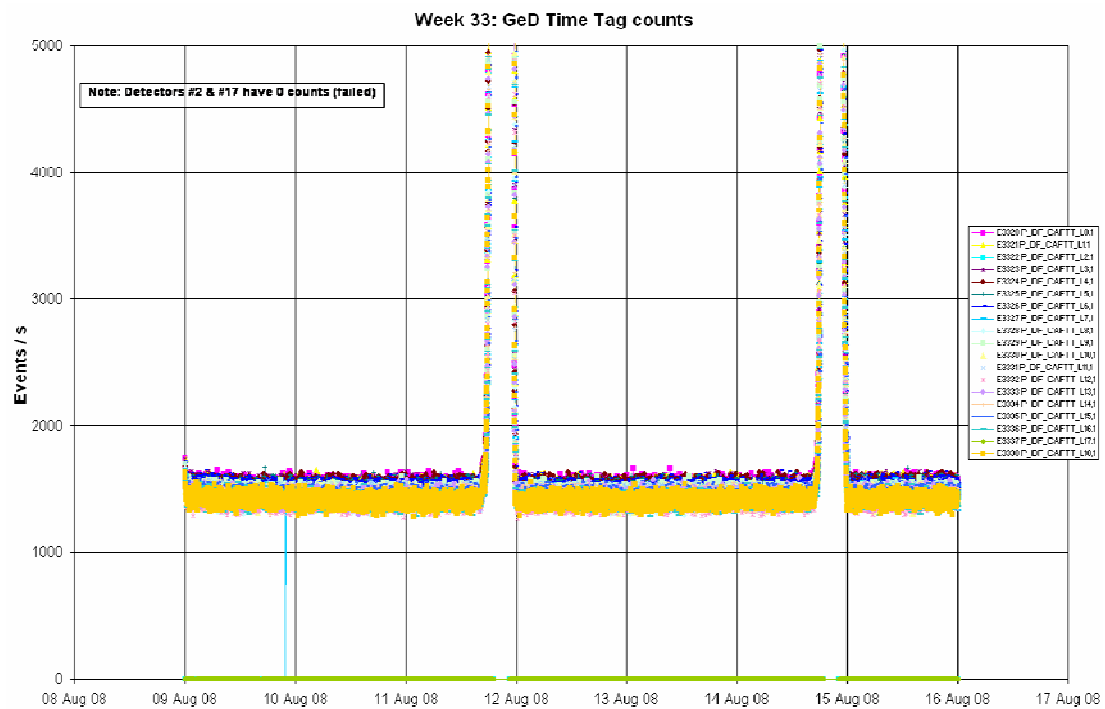


AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

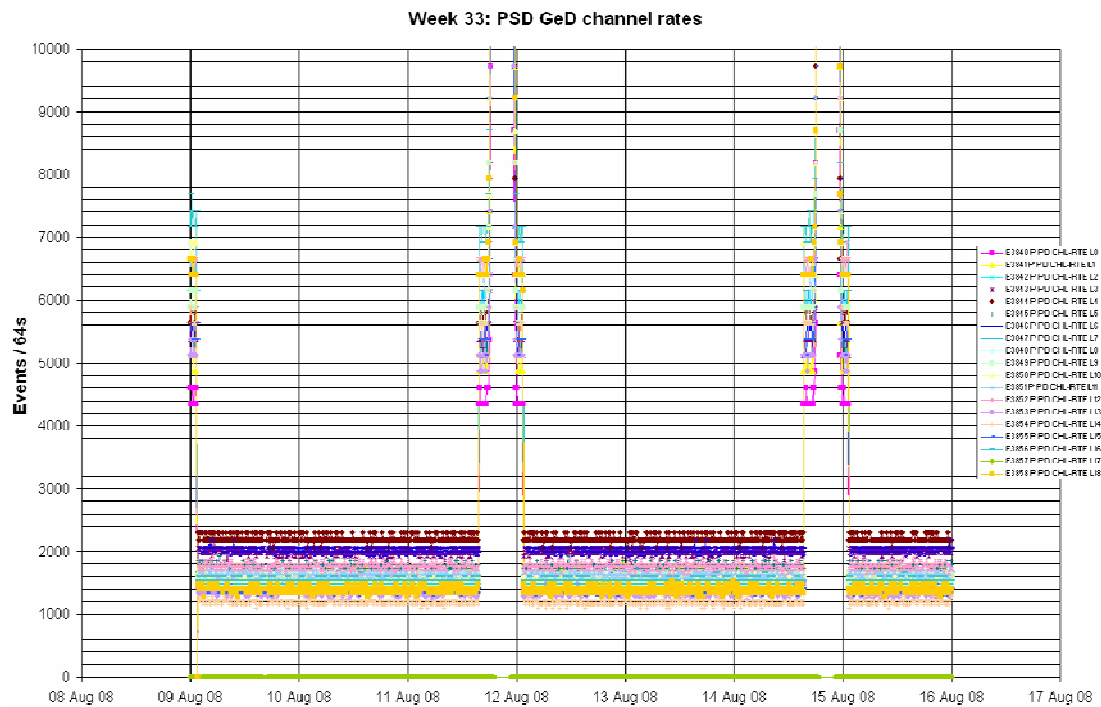


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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



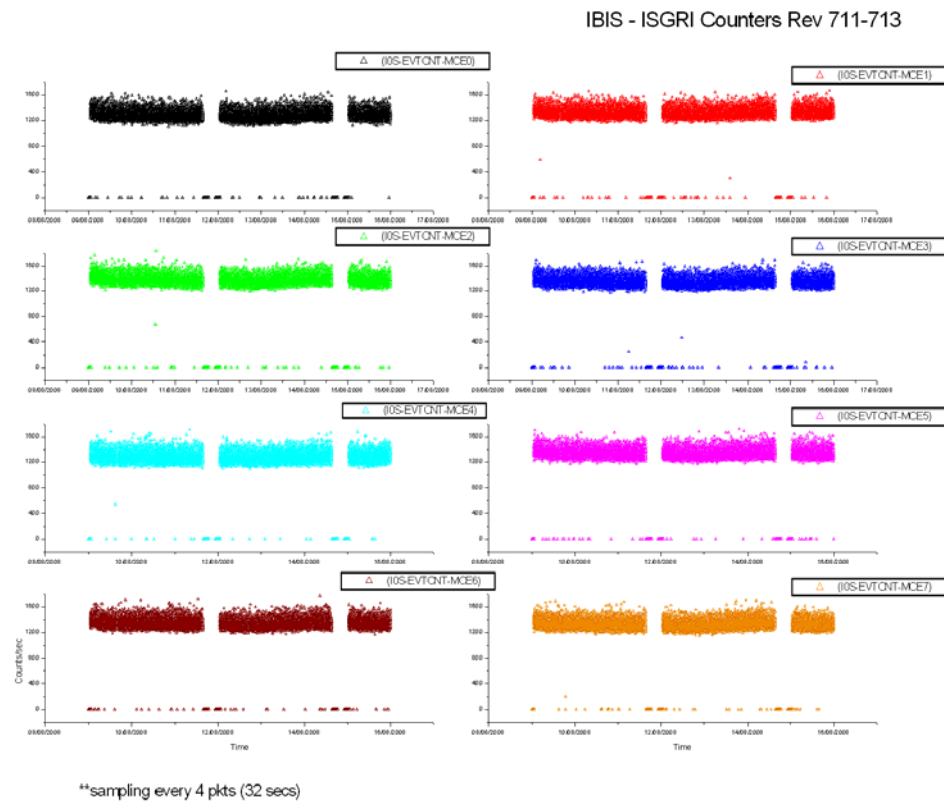
Event Log:

The following non-nominal events occurred on SPI over the reporting period:
 On 2008-08-12 at 15:00:52Z TM parameter E1296 went OOL (value = ERROR STATE), indicating an ASC ISB response parity error. As it returned within limits at the next TM cycle, no action was taken.

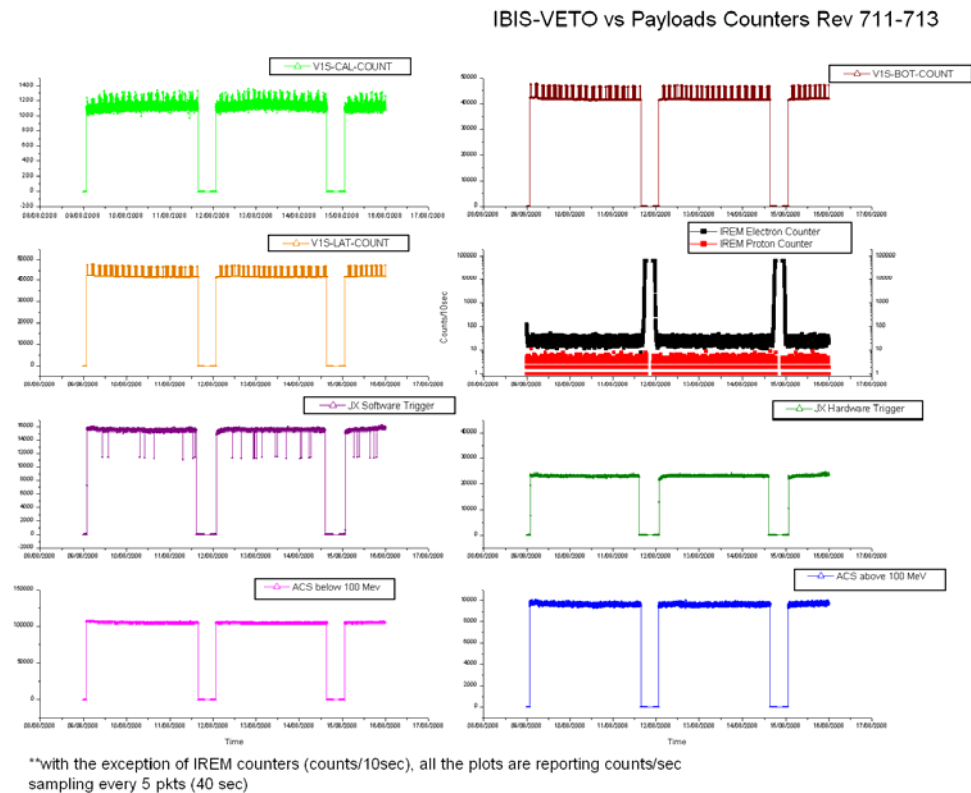
8.3.3 IBIS Operations

IBIS Event Counters Plots

ISGRI Counters:

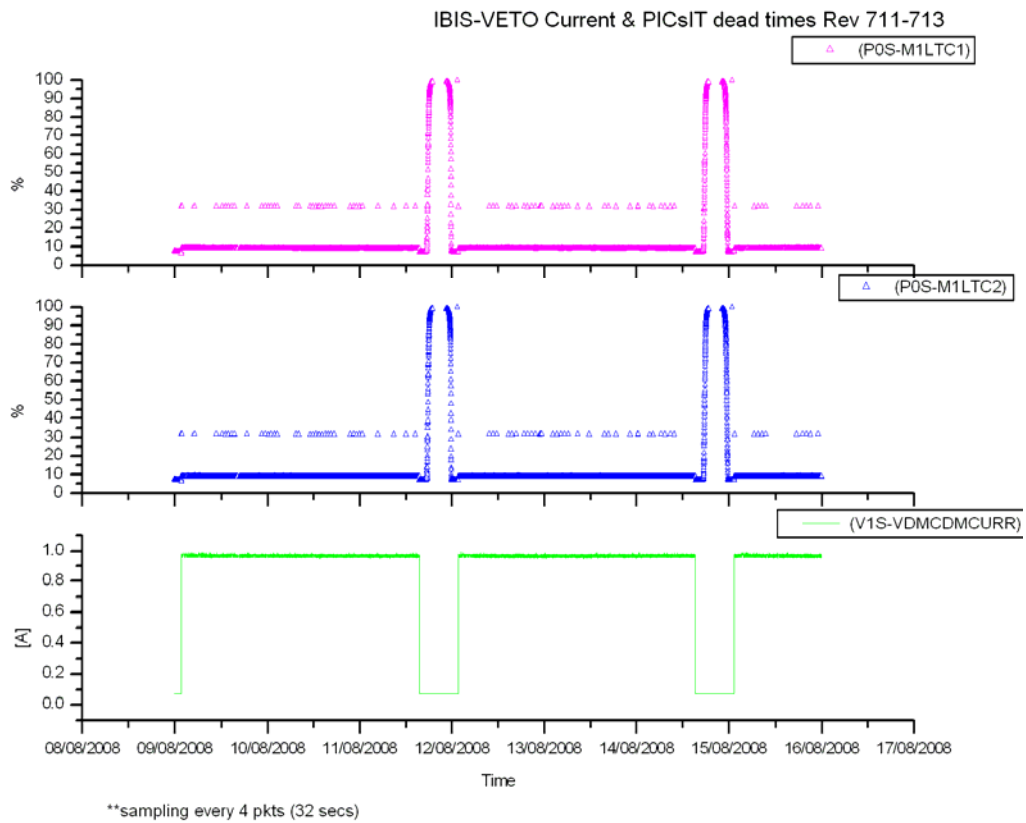


VETO vs Payload Counters:

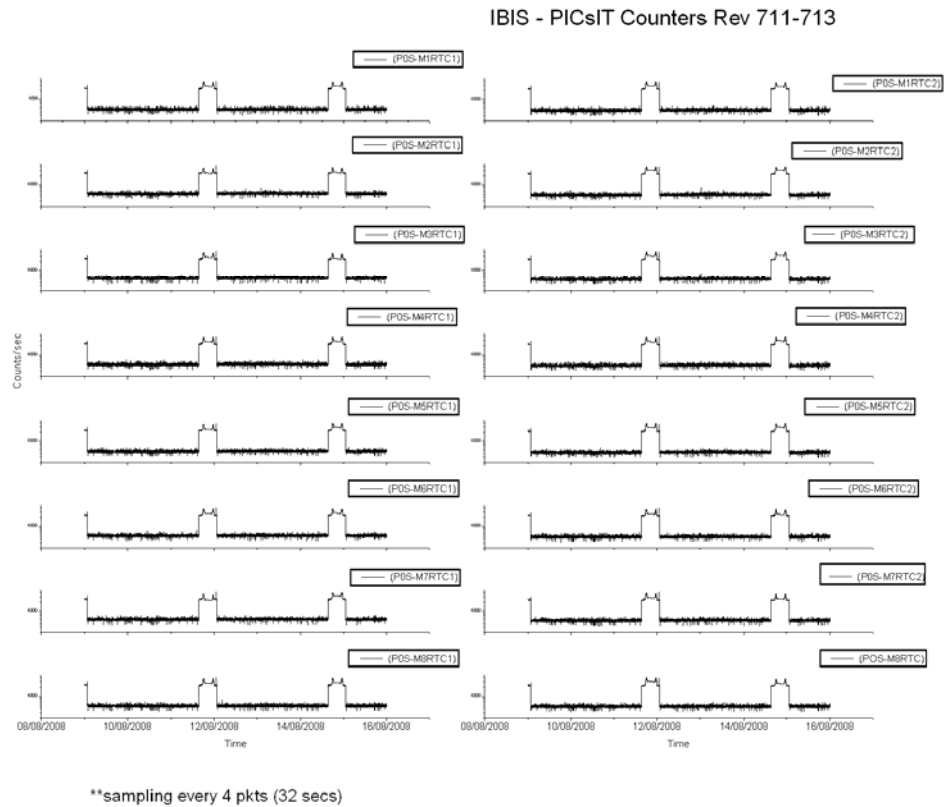


The week was characterised by low radiation as reported by the payload.

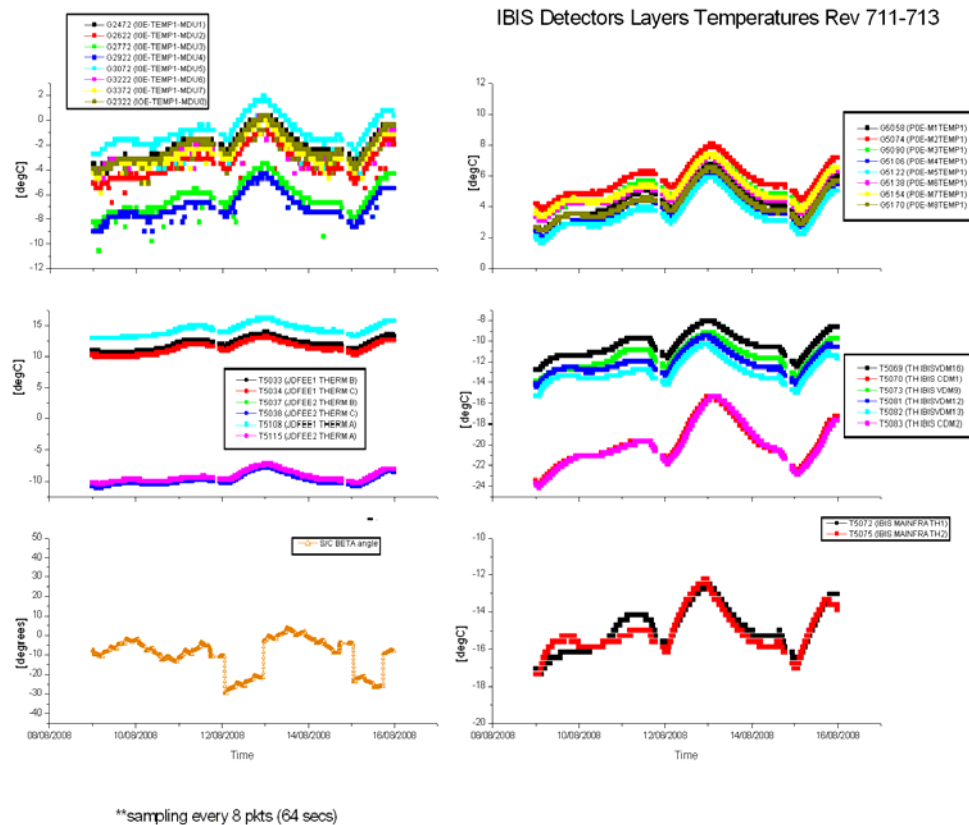
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



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.

2008-08-09 (DOY 222, Rev 711) to 2008-08-13 (DOY 226, Rev 712)

IBIS operations executed nominally.

2008-08-14 (DOY 227, Rev 712-713)

At 23:36:25Z TM parameter G5079 went OOL High (value = 2.60509804V). This is the PDM2 +2.5V. As it returned within limits of its own accord at 23:36:57Z, no action was taken.

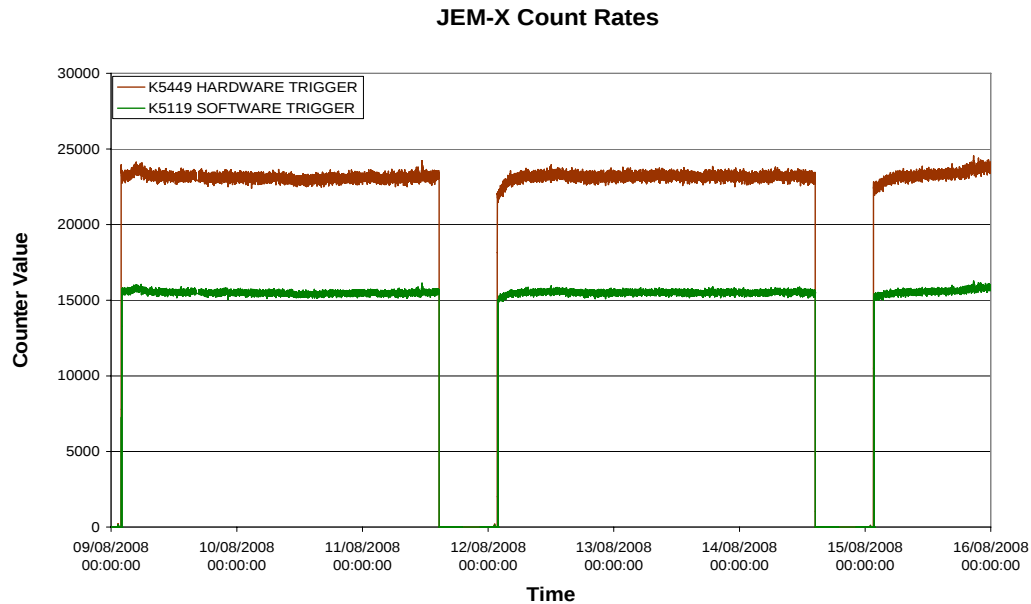
2008-08-15 (DOY 228, Rev 713)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

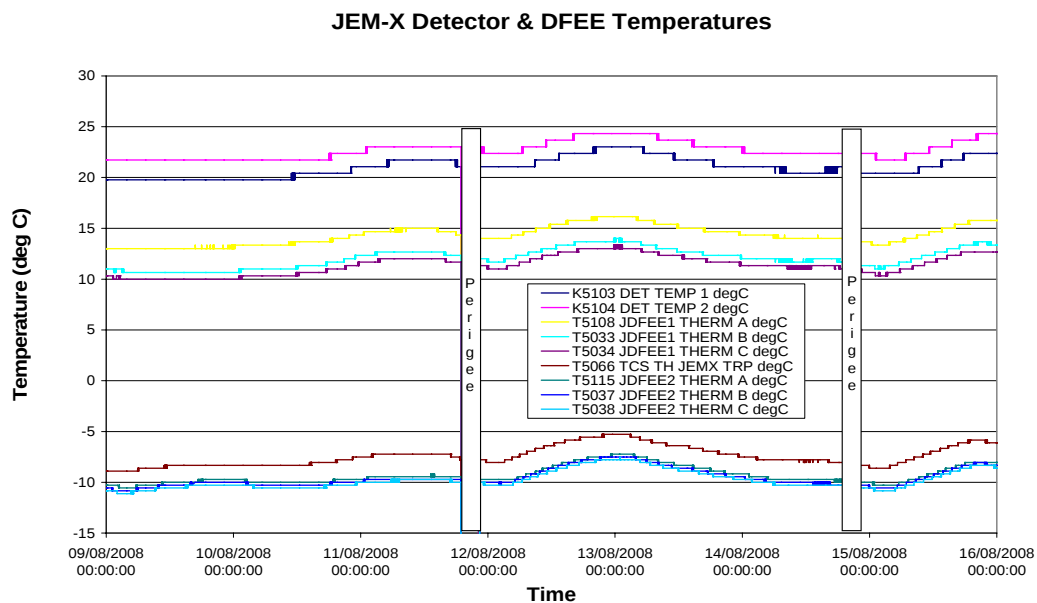
JEM-X Count Rates

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

2008-08-09 (DoY 222, Rev 711) to 2008-08-11 (DoY 224, Rev 711)

JEM-X1 operations executed nominally.

2008-08-12 (DoY 225, Rev 712)

At the indicated times, the following OEMs were received:

2008.225.04.37.57.676	2008.225.04.37.59.441	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.480	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.481	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.482	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.482	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.483	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						
2008.225.04.37.57.676	2008.225.04.37.59.484	1536	RealTime	5		ANOMALY
JEM-X1 CSSW INT ER EXCEPTIO			0	0	65535	PR N
E E						

No action was taken, and there was no impact.

2008-08-13 (DoY 226, Rev 712) to 2008-08-15 (DoY 228, Rev 713)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2008-08-09 (DoY 222, Rev 711)

At 16:12, a drop in the Telemetry from Redu forced a suspension of the Timeline. Subsequent problems at the ground station prevented an immediate recovery being performed. A good link was eventually restored at 17:29 with the Timeline rejoined at 18:30. The impact was the loss of pointings 07110020, 07110021, 07110022 & 07110023. At was at this time the following OEMs were received:

2008.222.18.36.31.797	2008.222.18.36.42.338	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2008.222.18.36.37.985	2008.222.18.36.48.610	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 07110023.

2008-08-10 (DoY 223, Rev 711)

At 07:28, FD problems forced the suspension of the Timeline. A lengthy recovery ensued after which the Timeline was rejoined at 09:45. The impact was the loss of pointings 07110040 & 07110041.

2008-08-11 (DoY 224, Rev 711) to 2008-08-13 (DoY 226, Rev 712)

Nothing to report.

2008-08-14 (DoY 227, Rev 712)

At 03:18, an AOCS command failed release interrupting the Timeline. A recovery was performed, and the Timeline rejoined at 04:42. The impact was the loss of pointings 07140054 & 07140055.

2008-08-15 (DoY 228, Rev 713)

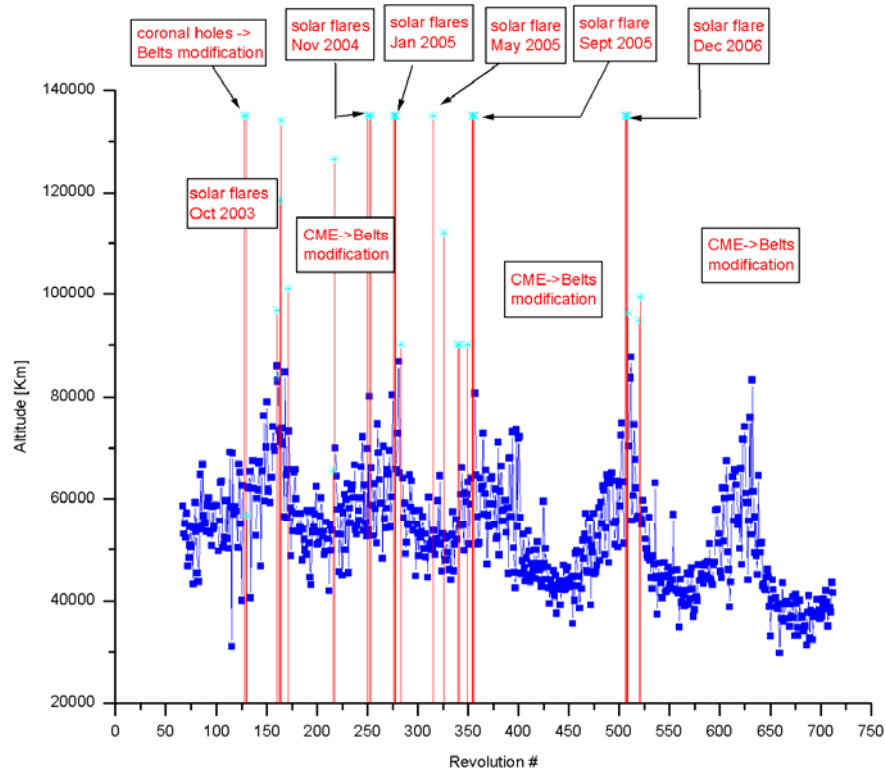
Nothing to report.

On DoY 224 at 15:30:55 and DoY 227 at 15:21:03 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

Nothing to report.

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]
711	RAD_EXIT R 2008-08-09T01:33:41Z	09/08/2008 00:10:46	>>33566.7	09-Aug-2008 00:39:40	45176.1
711	RAD_ENTR R 2008-08-11T15:30:48Z	11/08/2008 16:55:34	43607.9	11-Aug-2008 17:19:40	39463.88
712	RAD_EXIT R 2008-08-12T01:23:16Z	12/08/2008 00:13:26	42486.2	12-Aug-2008 00:29:40	45580.71
712	RAD_ENTR R 2008-08-14T15:20:59Z	14/08/2008 17:02:14	41536.1	14-Aug-2008 15:11:56	41577.44
713	RAD_EXIT R 2008-08-15T01:13:37Z	14/08/2008 23:53:26	>>33575.1	14-Aug-2008 22:41:56	46071.56

Reference

High radiation

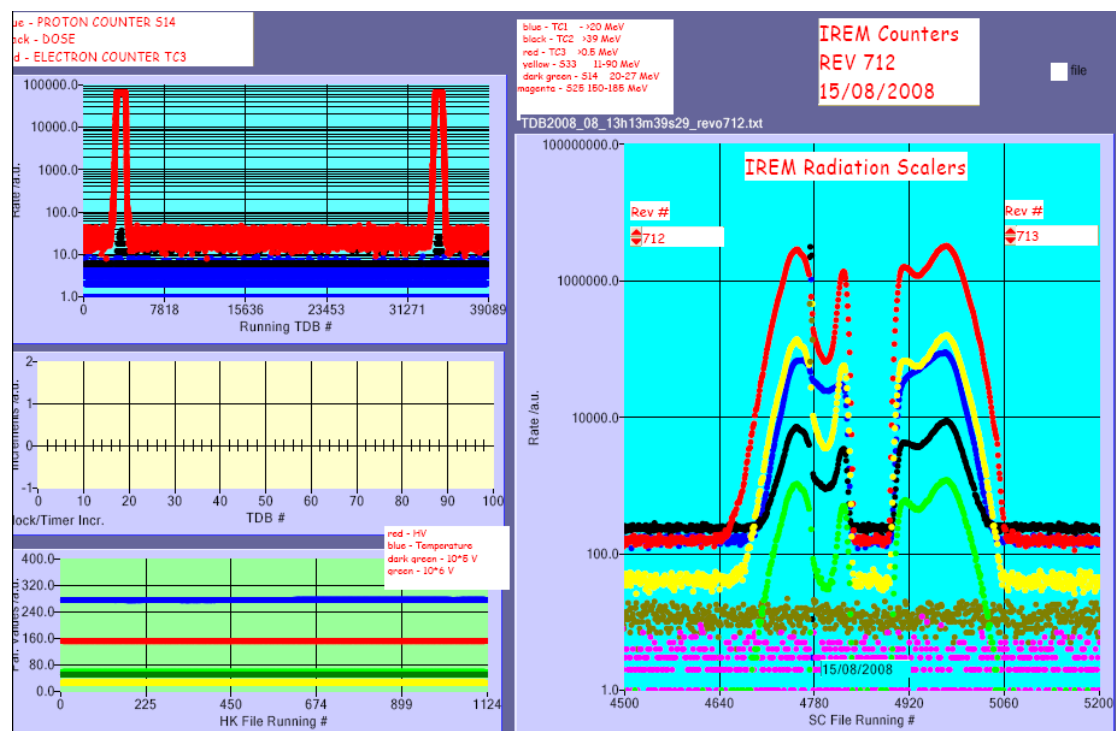
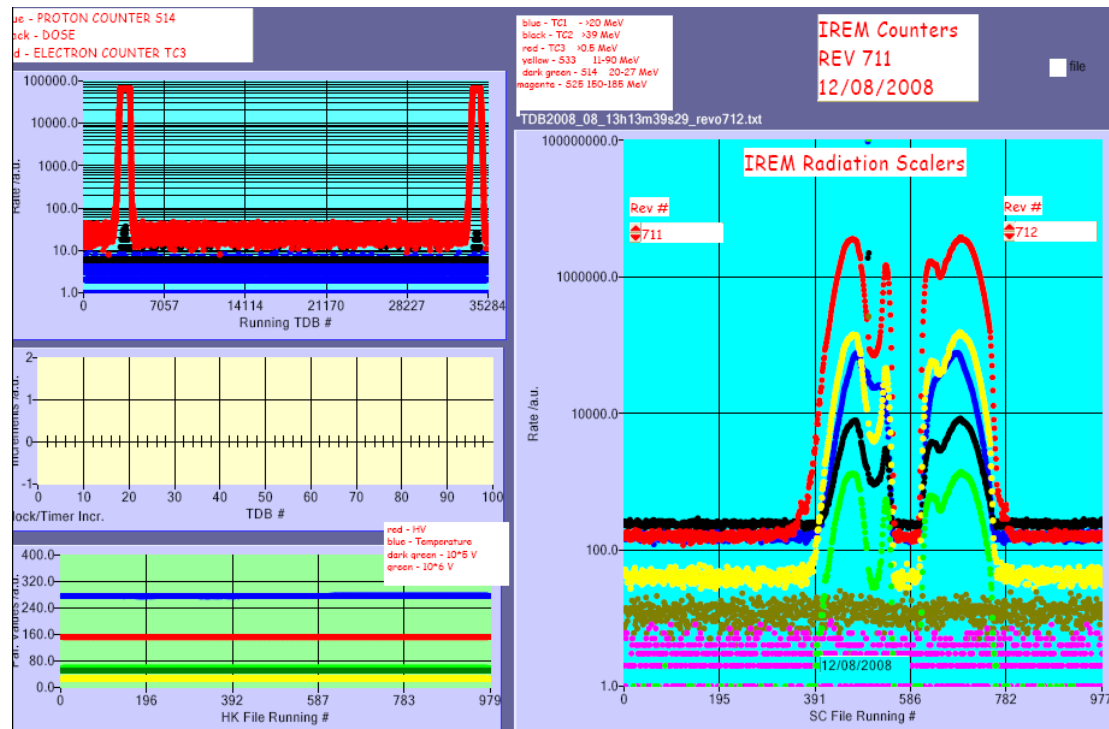
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

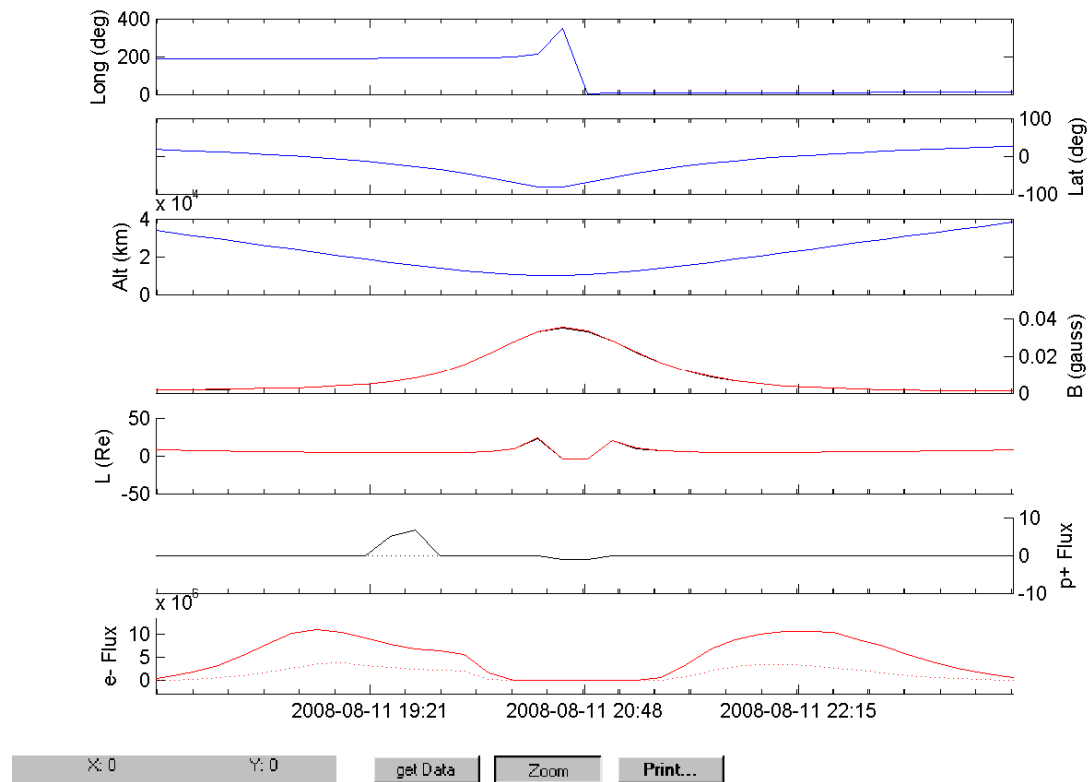
* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

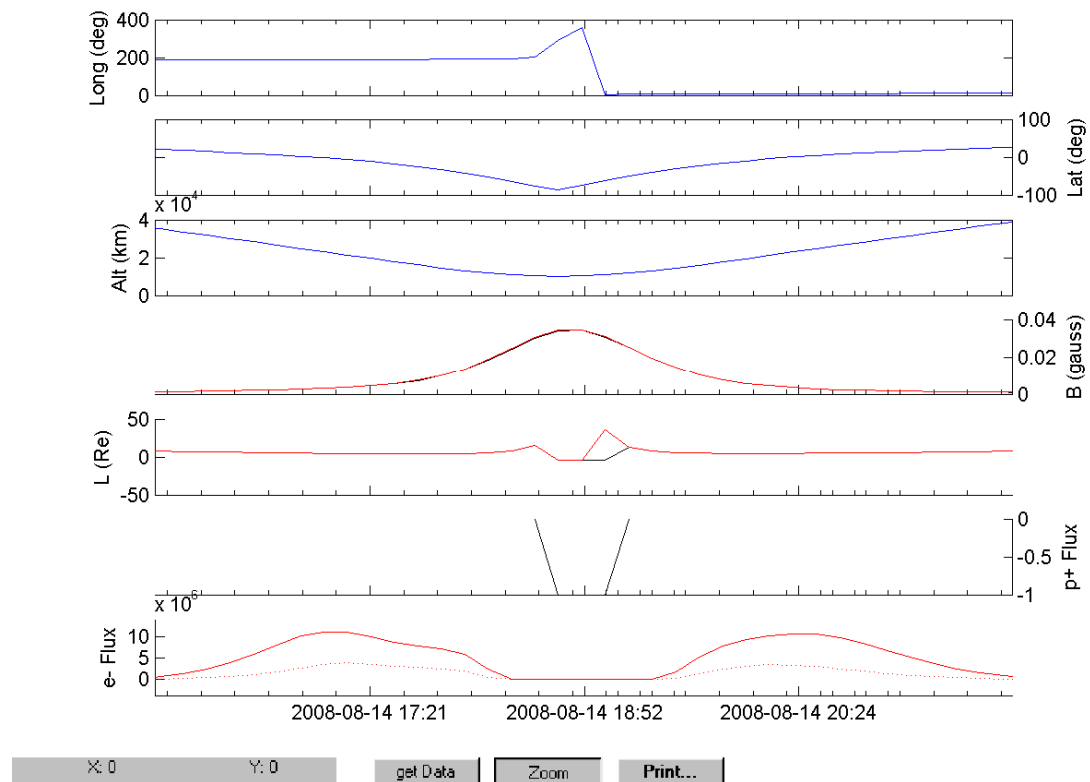


IREM Predicted Radiation Belt Passages

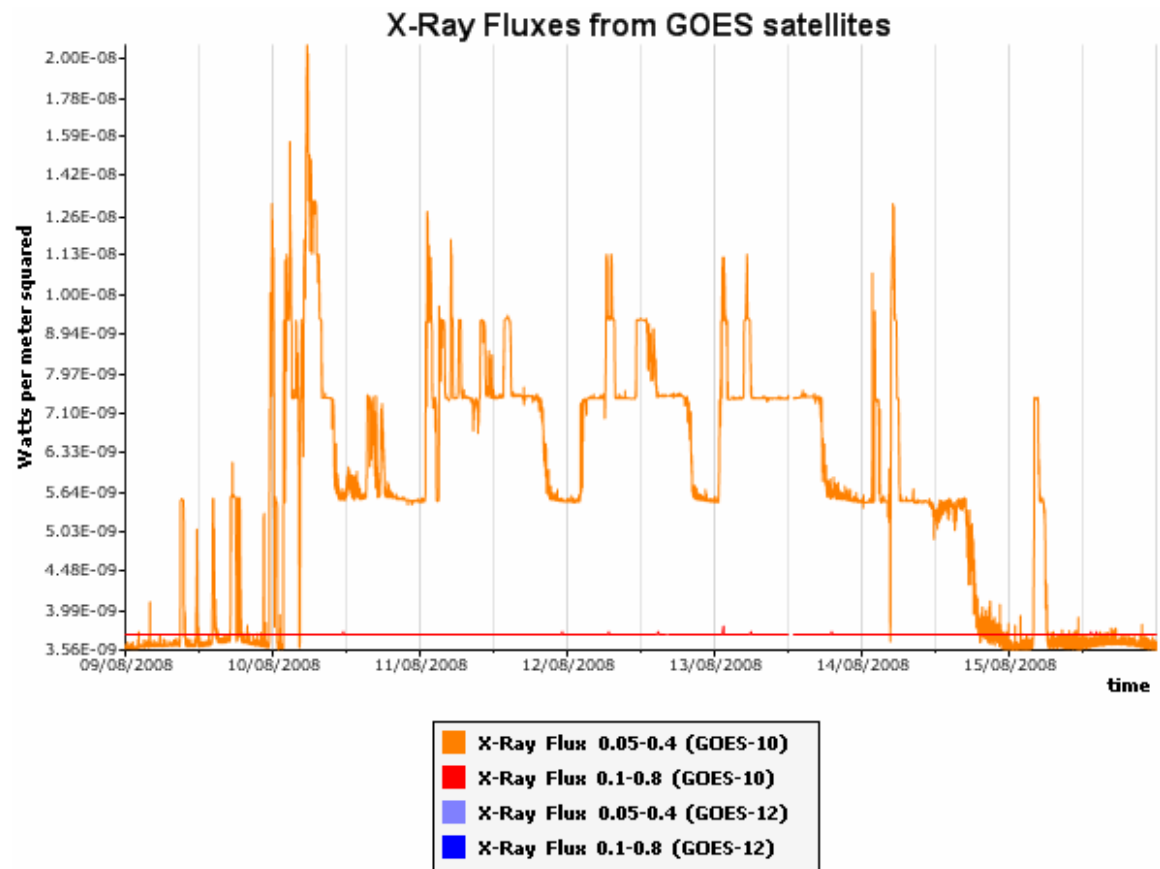
Rev 711



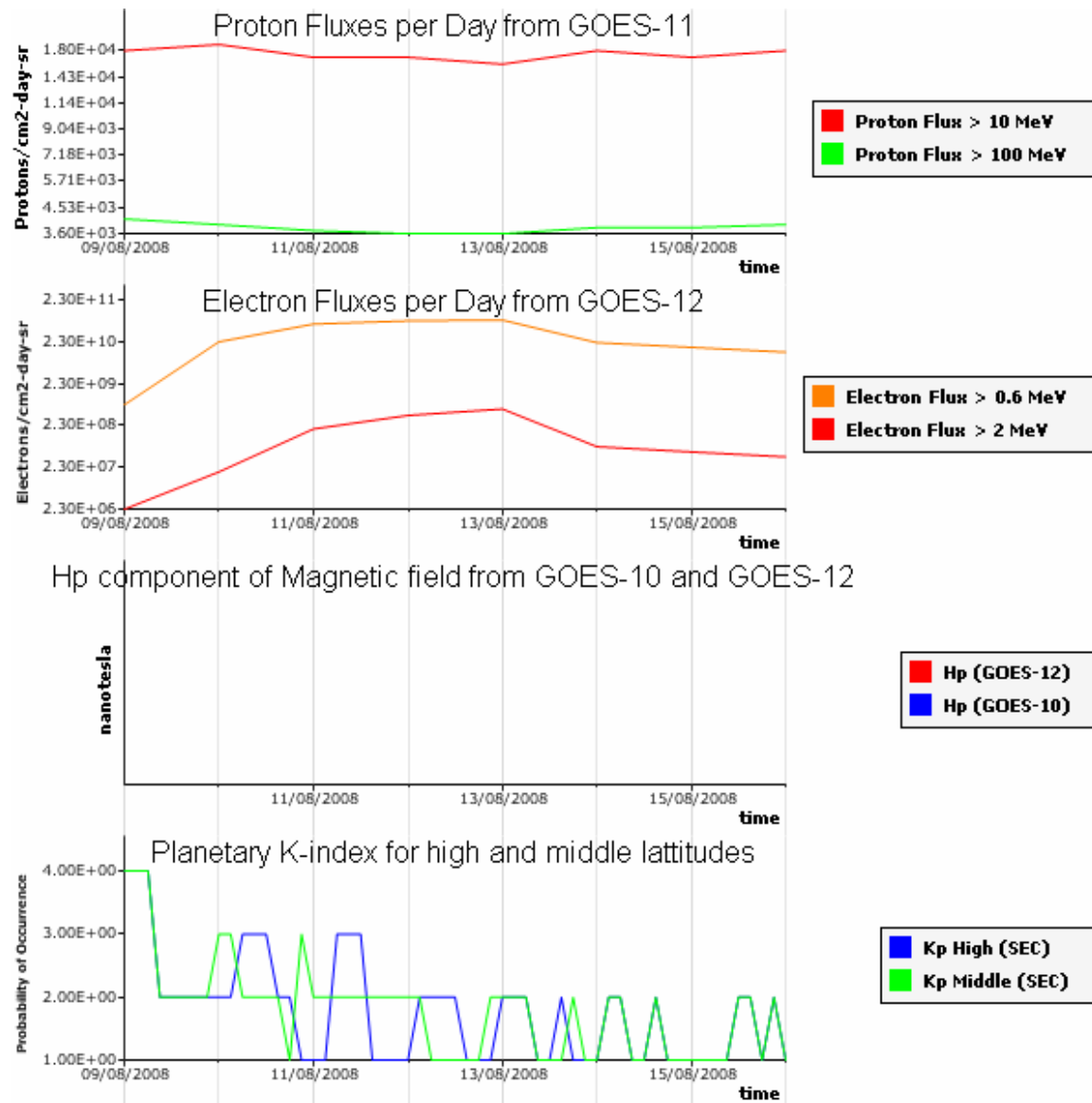
Rev 712



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.