

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 307
Week 32
11.08.08
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 02.08.08 until 08.08.08 (both dates inclusive) and covers the revolutions 709, 710 and 711.

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 the Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), two raster dithers of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4) and a raster dither of PKS 1502+106 (RA 15:04:24.96, DEC +10:29:38.4).

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.

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

The fuel consumption over the period between 02/08/2008 and 08/08/2008 was 0.1431 Kg. The remaining propellant is in the order of 139.2752 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.

From the EPS point of view the eclipse passage was entirely nominal.

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

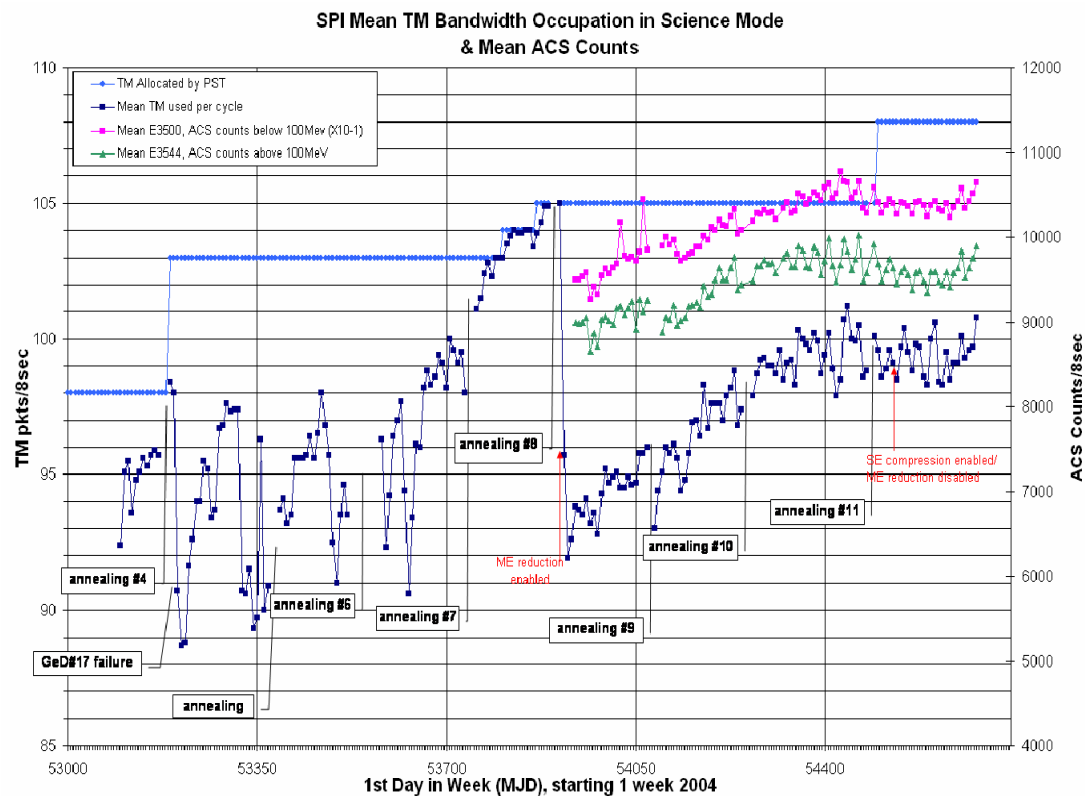
3.2.1 SPI

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 100.8 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.

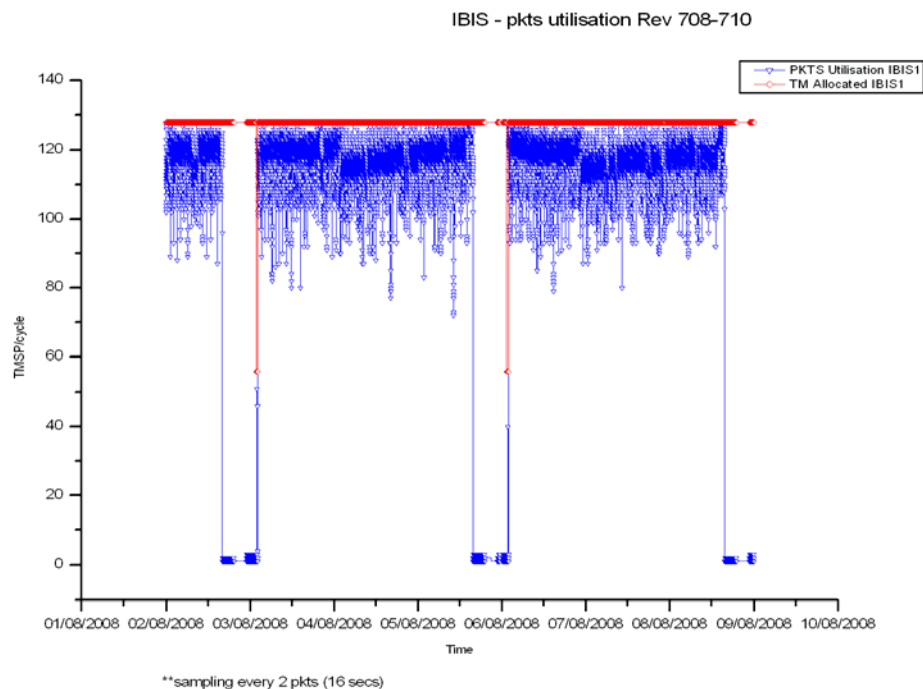
3.2.2 IBIS

The overall status of the unit is nominal.

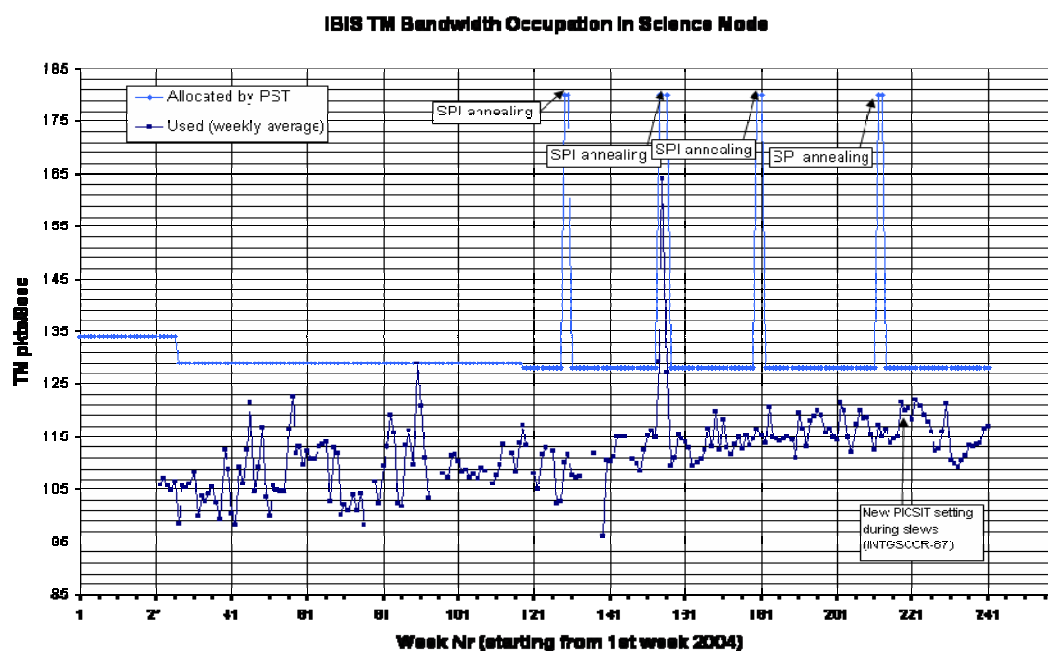
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 117.11 packets/cycle (up 0.43 on last week)
- Percentage of TM cycles in which full bandwidth was used: 1.68%.

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, all of the 128 planned science pointings were executed nominally.

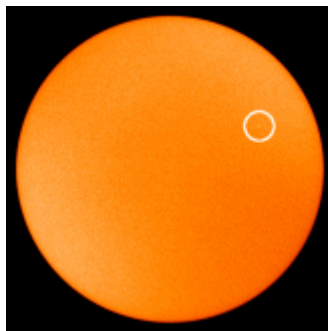
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity. A sun-spot nearly emerged on the 3rd August, apart from that 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 excellent this week. The overall performance was nearly 100%.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. There was one instance where the IMCS went down, but it was recovered without impact.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were two drops of the links with Redu, three drops from DSS27, one occasion where there was difficulty bring up the links during a handover to DSS27, and the link to ISDC also dropped briefly once, all without impact

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 714 to 718. Observations have been planned for revolution 714, the first of AO-7 and of the SPI annealing period.

Due to an urgent TOO on the blazar PKS 1502+106, revolution 711 was re-planned quickly on Friday, 08 August. Thanks to rapid work on all sides, the whole turnaround from the reception of the request to having a confirmed new planning with a TSF took only four hours.

An updated TSF has been received for revolution 711.

2. Observation status

New ECS files were received for revolutions 701 to 703.

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 11/08/2008:

- Latest Standard Analysis completed: observation 05200080005 on 02/08/2008.
- Latest products archived: observation 05200480001 on 03/08/2008.

- Latest observation products sent to the observer: observation 05200510009 (Mrk 421, Revolutions 679) on 16/06/2008.

5 Special Events

6 Anomalies

No problems were reported this week that impacted operations.

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

AR id	Date Created	Subject	Segment	Status
INT-3013	2008-08-08	Incorrect Ground Station configuration files on IMCS	IMCS	Open
INT-3014	2008-08-08	No SIs available for INTG - WEILHEIM Bad Frames Link	NCTRS	Open
INT-3015	2008-08-04	Delayed Handover to DSS-27 and TM drops during pass	NASA Station	Pending
INT-3016	2008-08-05	imca instability affects other systems	IMCS	Pending
INT-3017	2008-08-07	Antenna stopped at DSS-27	NASA Station	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 709

The observations in revolution 709 began with a raster dither of Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), lasting ~21.6 hours. They continued with a raster dither of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4), lasting ~33.7 hours, until the end of the revolution.

Revolution 710

The observations in revolution 710 began with a raster dither of Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), lasting ~18.6 hours. They continued with a raster dither of the Galactic Plane Region 3 (RA 13:09:32.98, DEC -62:47:56.4), lasting ~35.7 hours, until the end of the revolution.

Revolution 711

The observations in revolution 711 consisted entirely of a Target of Opportunity, which was a raster dither of PKS 1502+106 (RA 15:04:24.96, DEC +10:29:38.4), lasting ~56.5 hours.

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

2008-07-17T10:20:16.000Z	139.6300	F	Automatic TM processing.
2008-07-19T00:43:08.000Z	139.5768	F	Automatic TM processing.
2008-07-20T10:03:36.000Z	139.5488	F	Automatic TM processing.
2008-07-22T00:30:13.000Z	139.5421	F	Automatic TM processing.
2008-07-23T00:12:47.000Z	139.5130	F	Automatic TM processing.
2008-07-25T00:19:08.000Z	139.4960	F	Automatic TM processing.
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.

This report was generated Fri Aug 8 08:00:23 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, 02/08/2008 – 08/08/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 74 Open Loop Slews, 68 Closed Loop Slews and 6 Momentum Biases were executed (as reported by ACC).

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

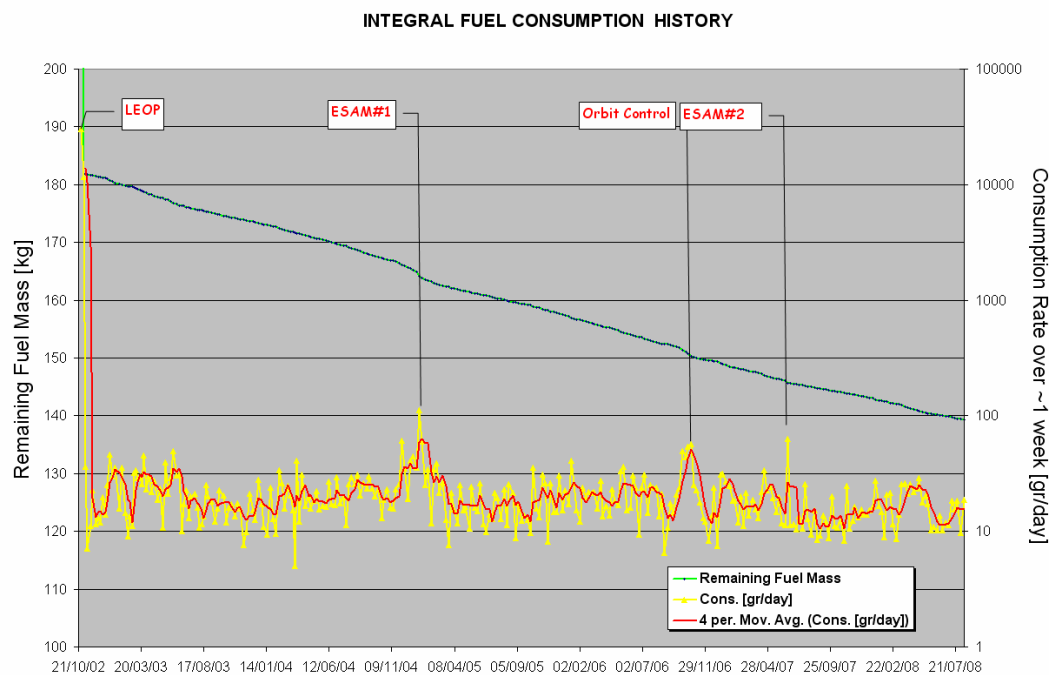
The OTF was partially not reached during PID 07090019 due to loss of guide star after an open loop slew.

Orbit Control

No update

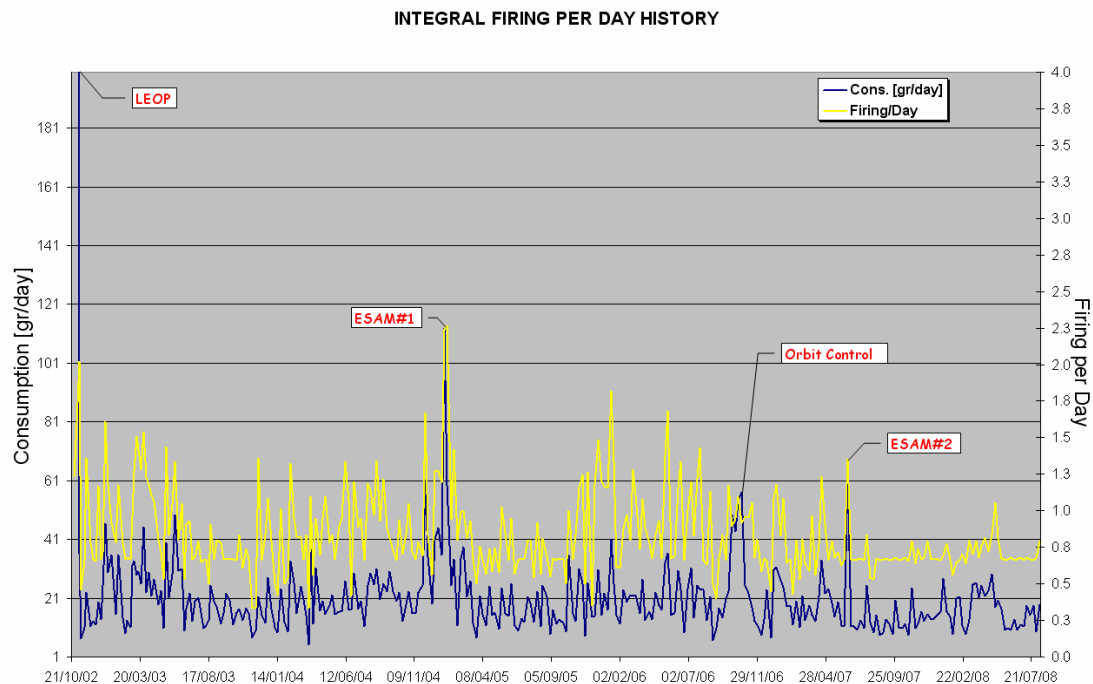
Fuel consumption

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



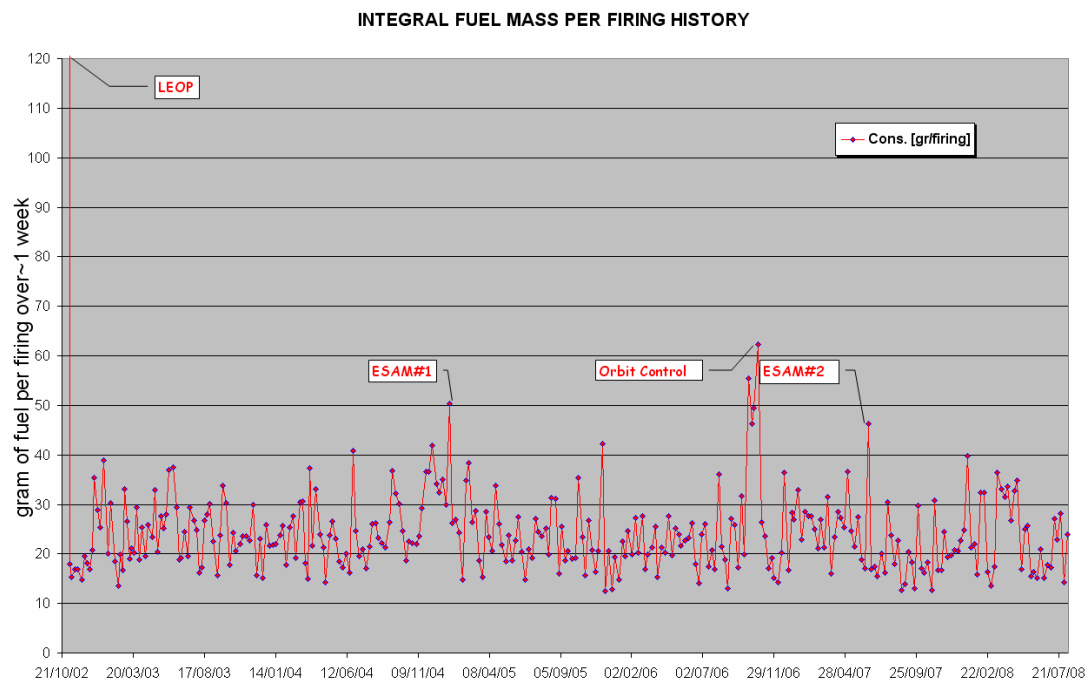
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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

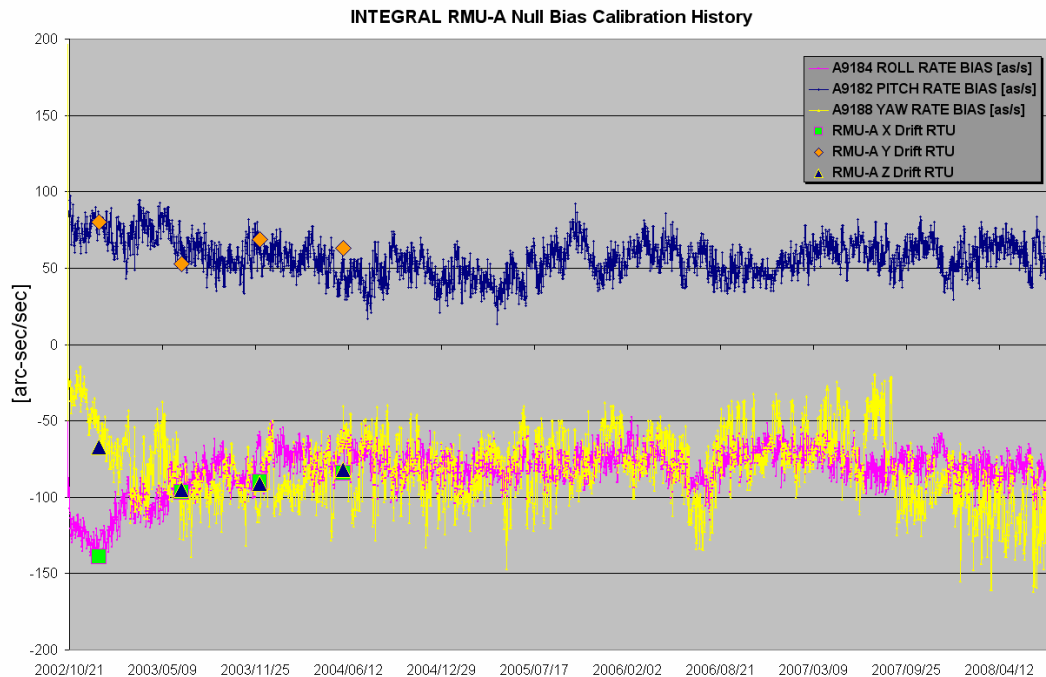


The RMU-A null bias calibration

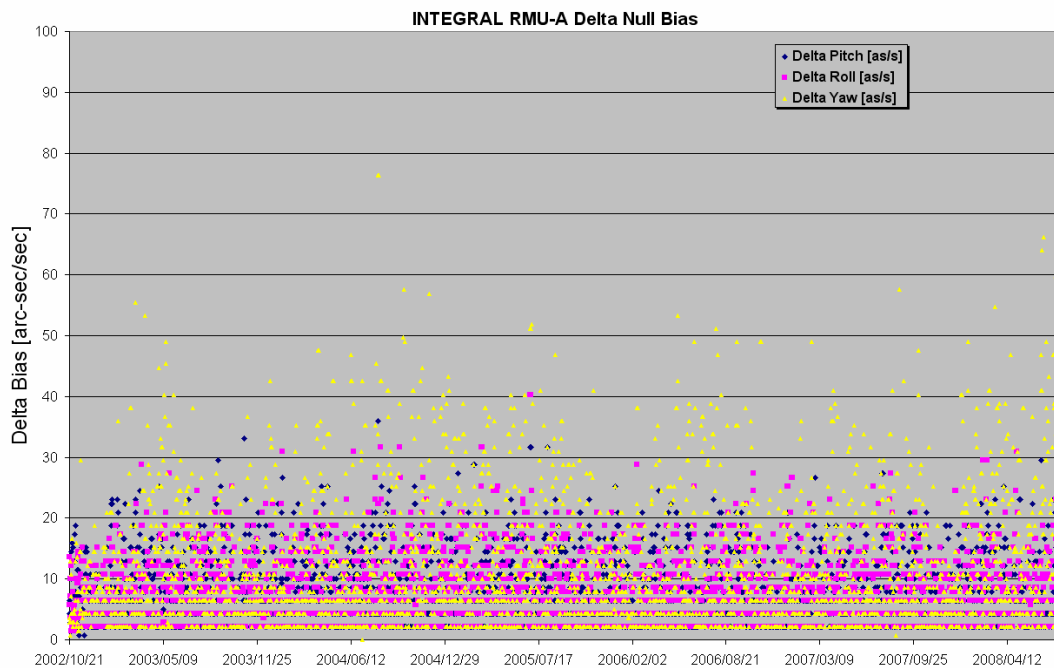
The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 08/08/2008 is reported in the plot below.

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 08/08/2008 is reported in the plot below.



02/08/2008 (Day of Year 215, Revolution 708)

Nothing to report.

03/08/2008 (Day of Year 216, Revolution 708-709)

Nothing to report.

04/08/2008 (Day of Year 217, Revolution 709)

Nothing to report.

05/08/2008 (Day of Year 218, Revolution 709)

Nothing to report.

06/08/2008 (Day of Year 219, Revolution 709-710)

Nothing to report.

07/08/2008 (Day of Year 220, Revolution 710)

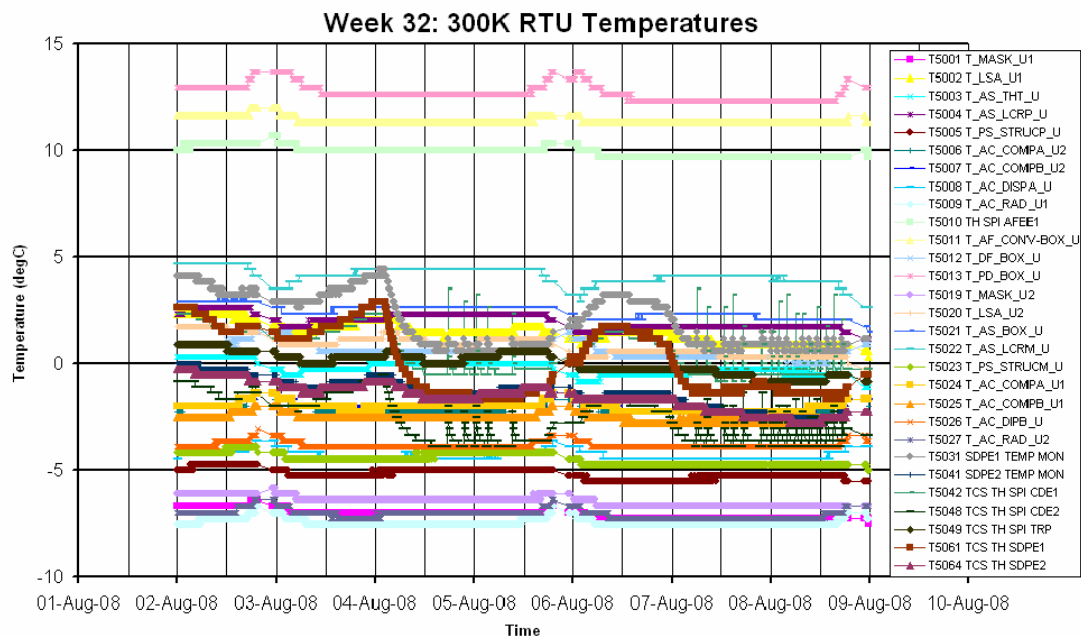
Nothing to report.

08/08/2008 (Day of Year 221, Revolution 710)

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.



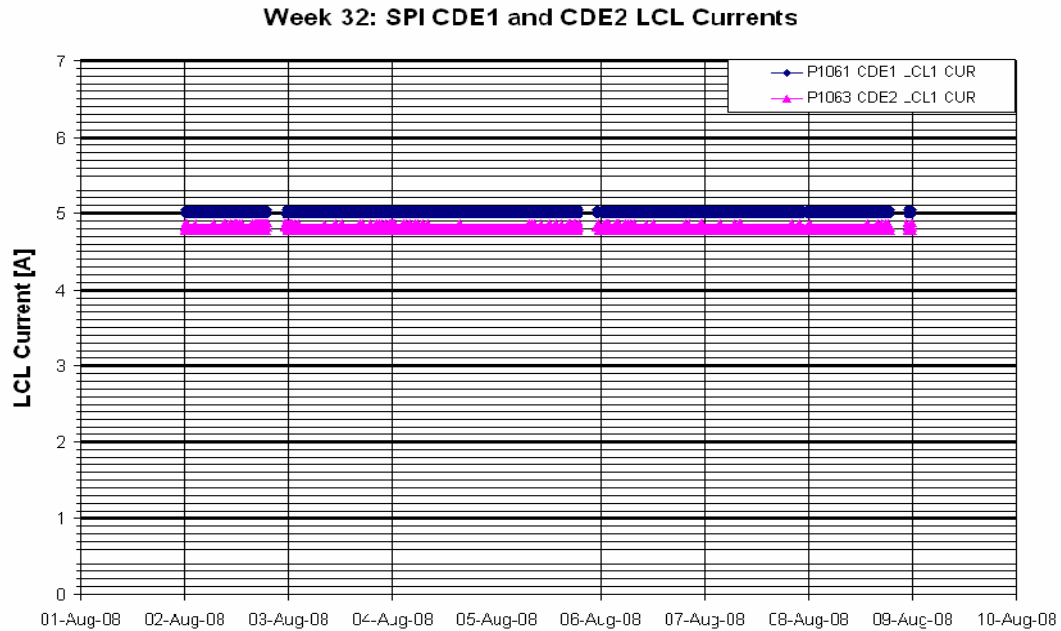
Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

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

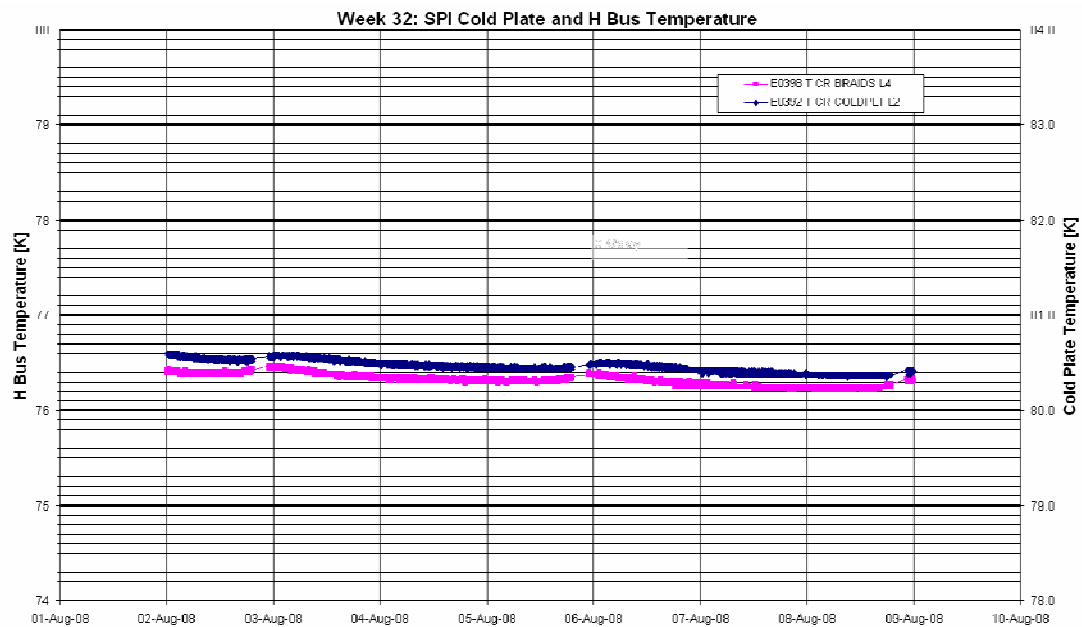
- CDE1 LCL Current = 5.01A

- 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.

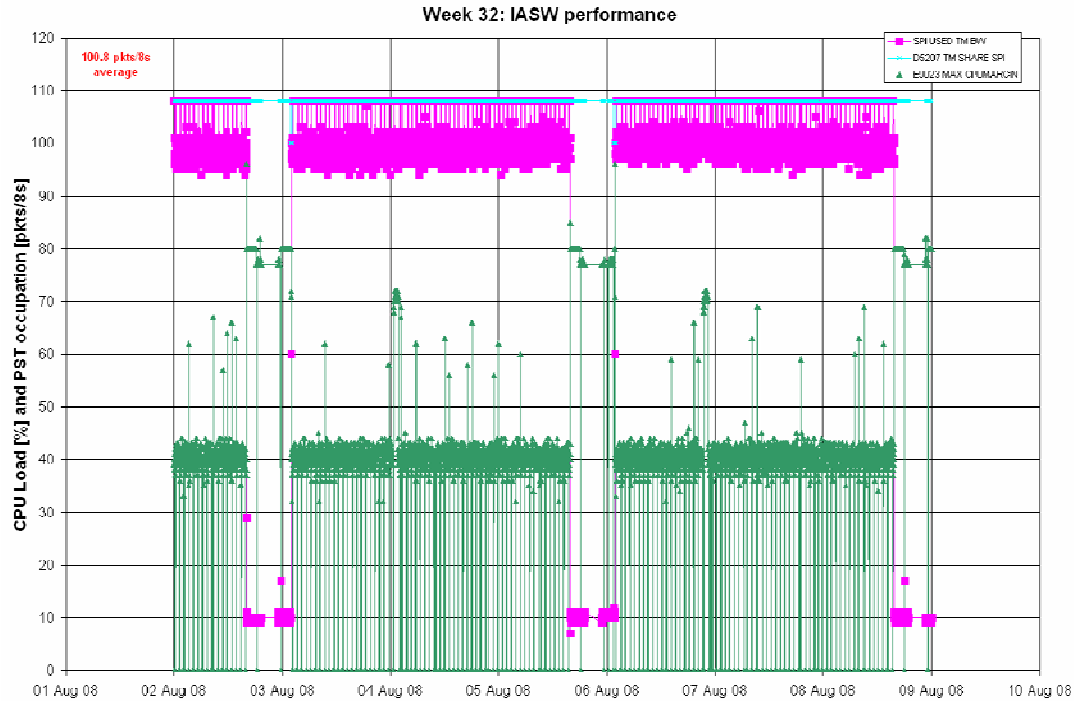


DPE & IASW: The DPE health and IASW performance is nominal.

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

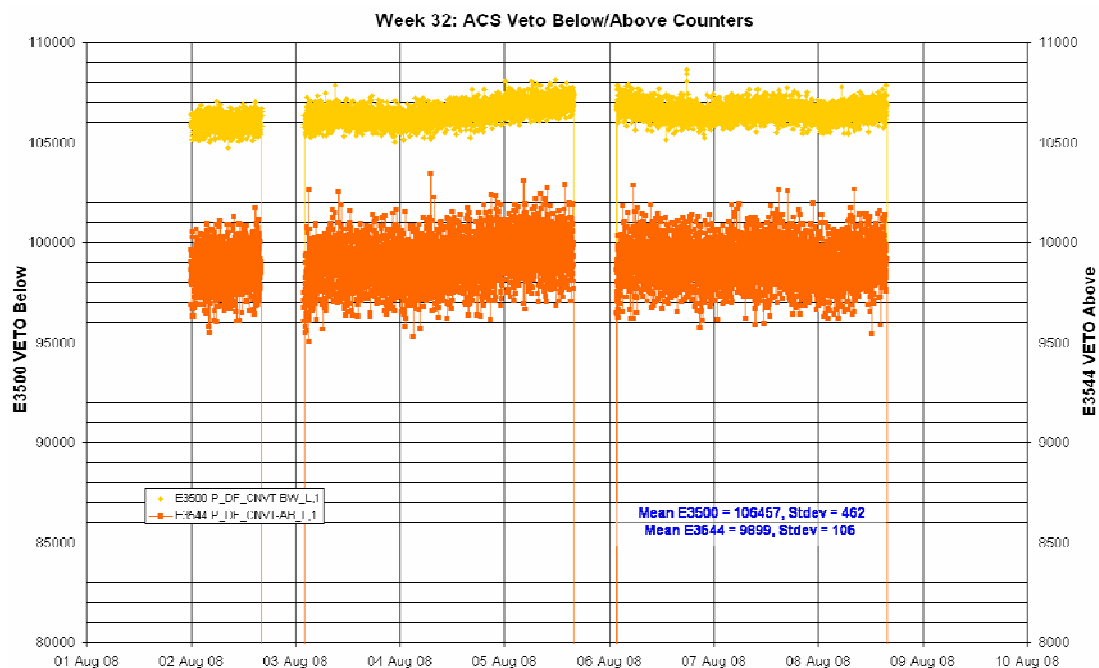
The average TM bandwidth occupation of SPI was 100.8 packets/cycle over the science window when the TM allocation was 108 packets/cycle.

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

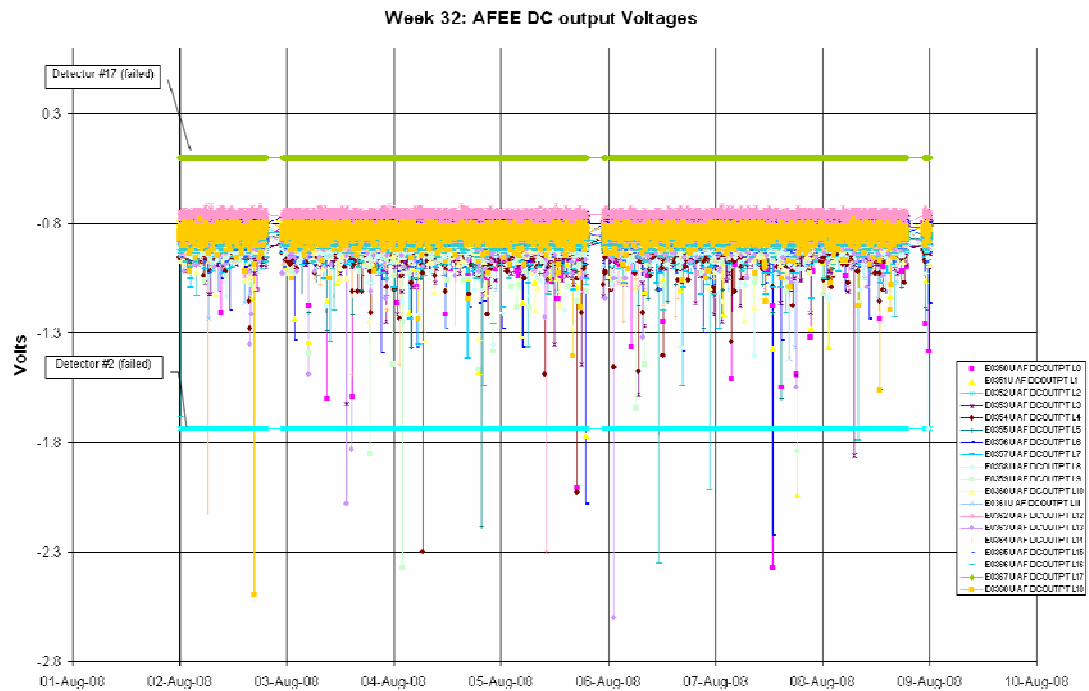


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

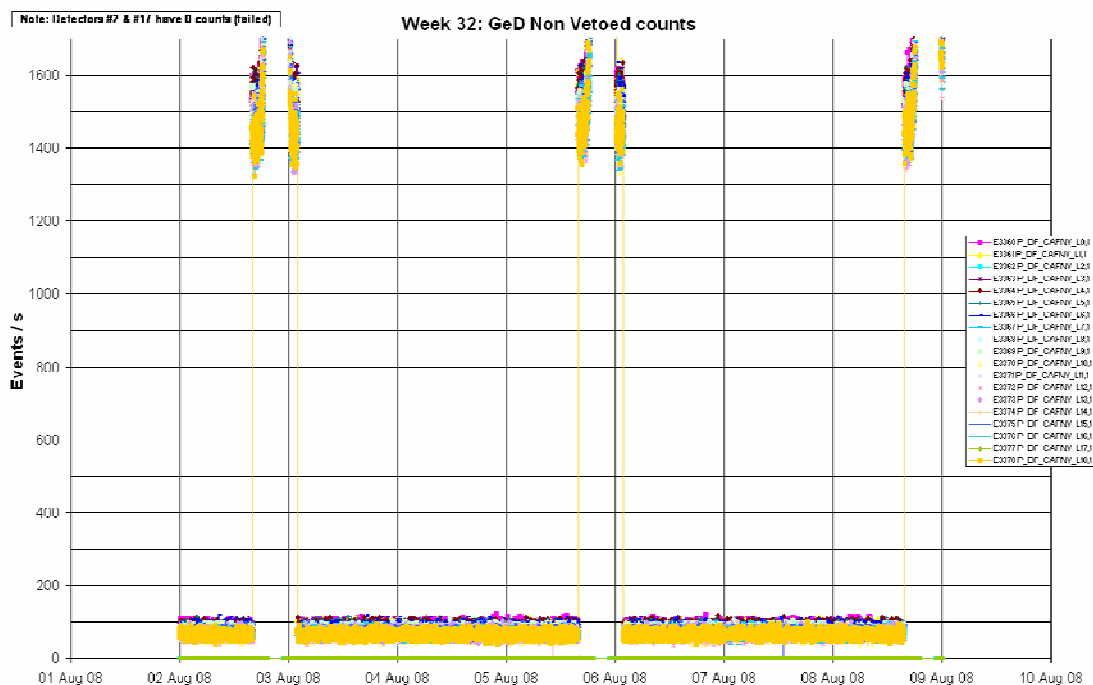
The following plot shows the ACS overall count rate evolution during the reporting period:

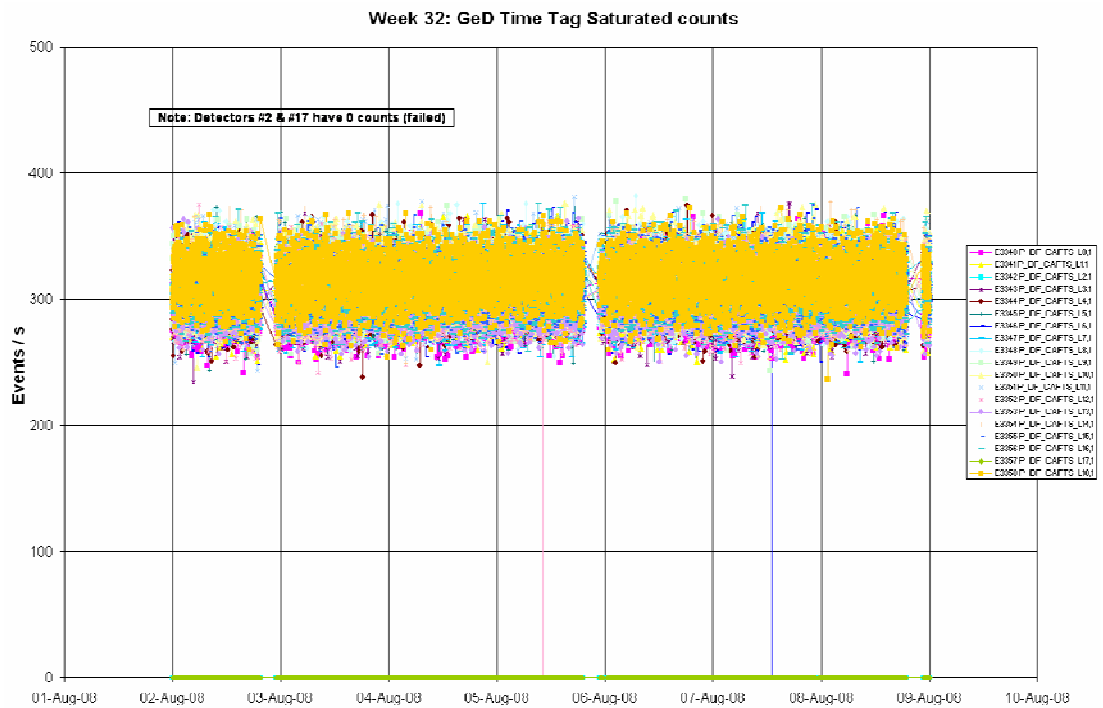
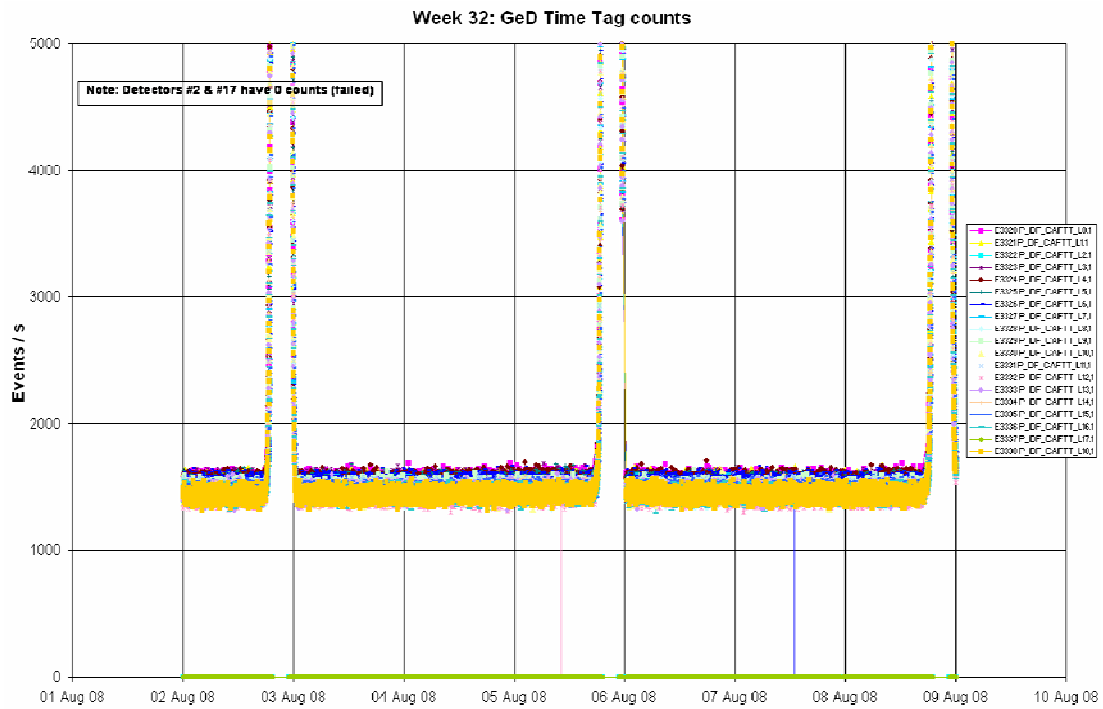


AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

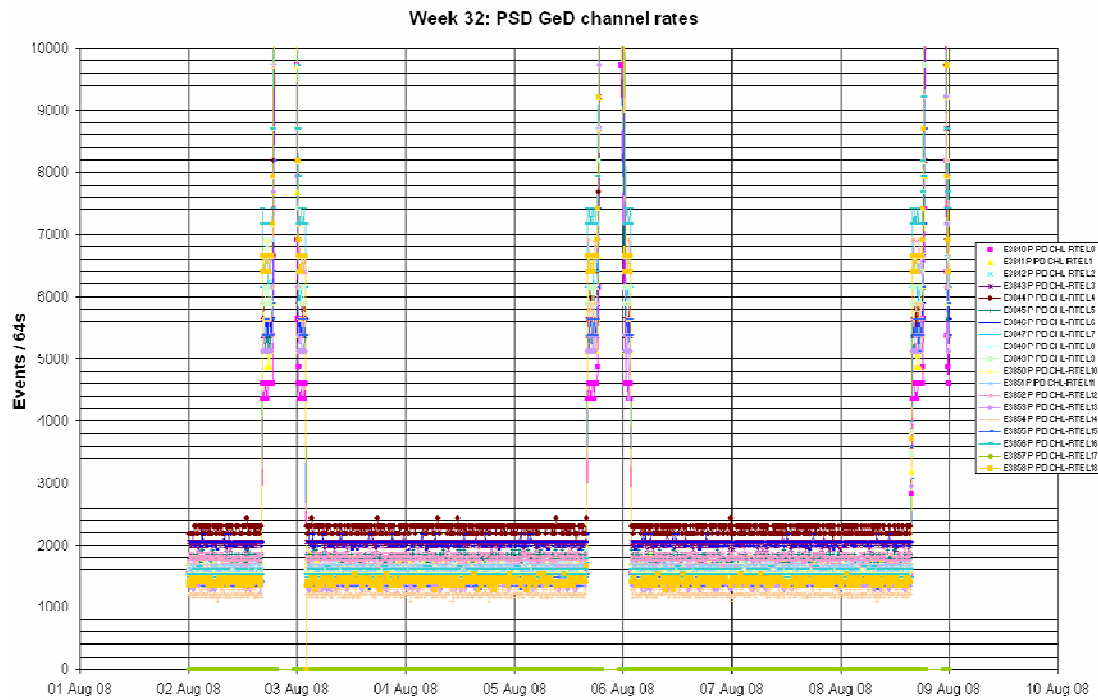


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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



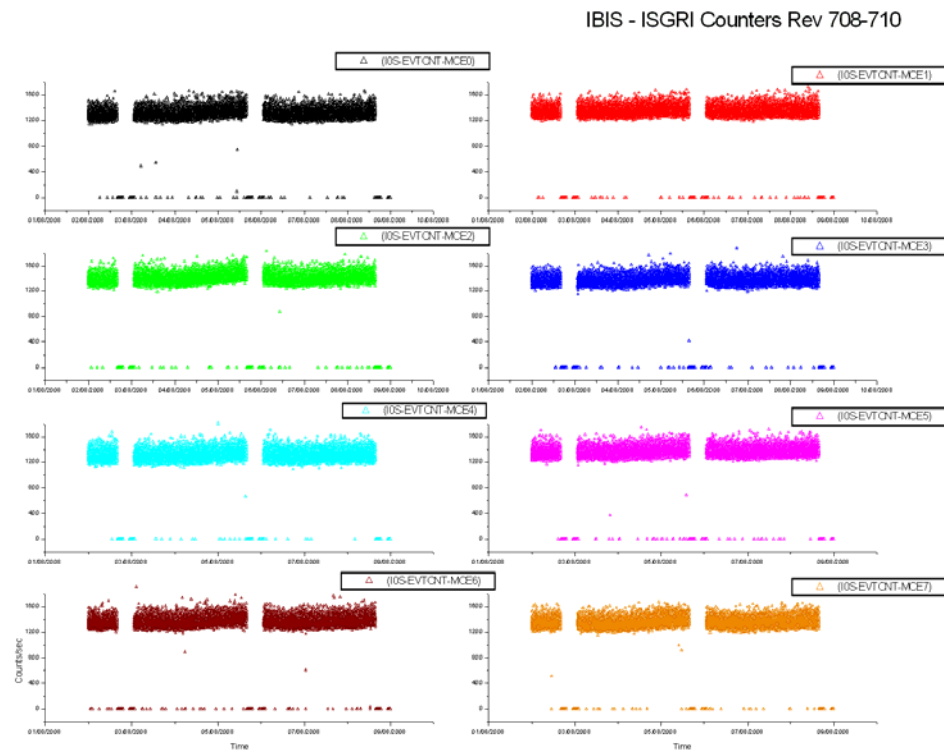
Event Log:

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

8.3.3 IBIS Operations

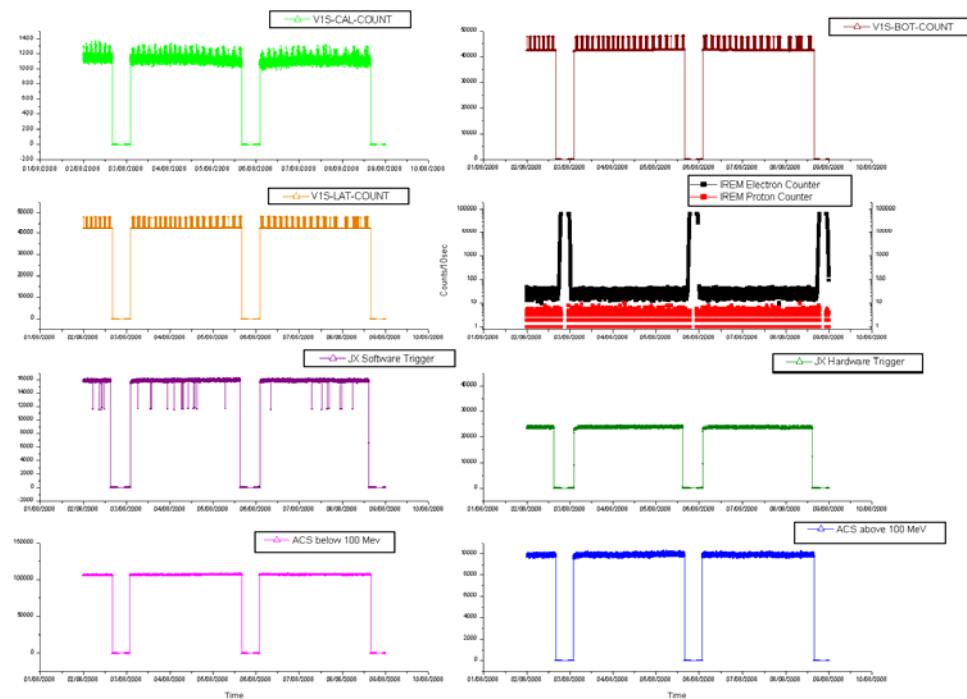
IBIS Event Counters Plots

ISGRI Counters:



VETO vs Payload Counters:

IBIS-VETO vs Payloads Counters Rev 708-710

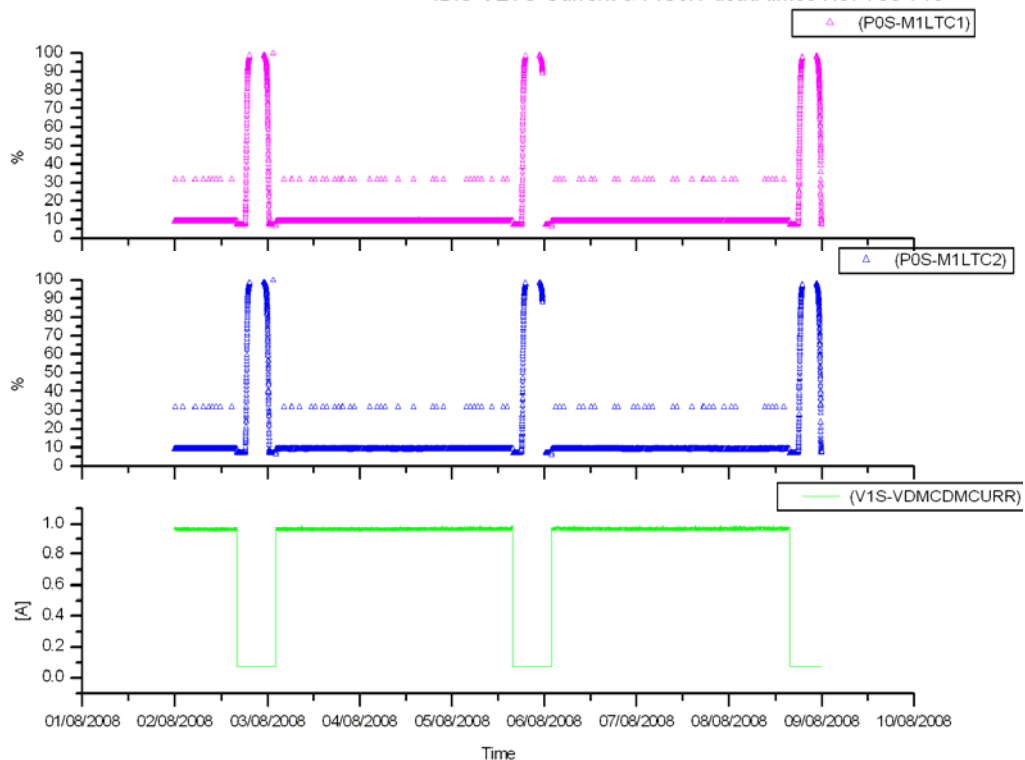


**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

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

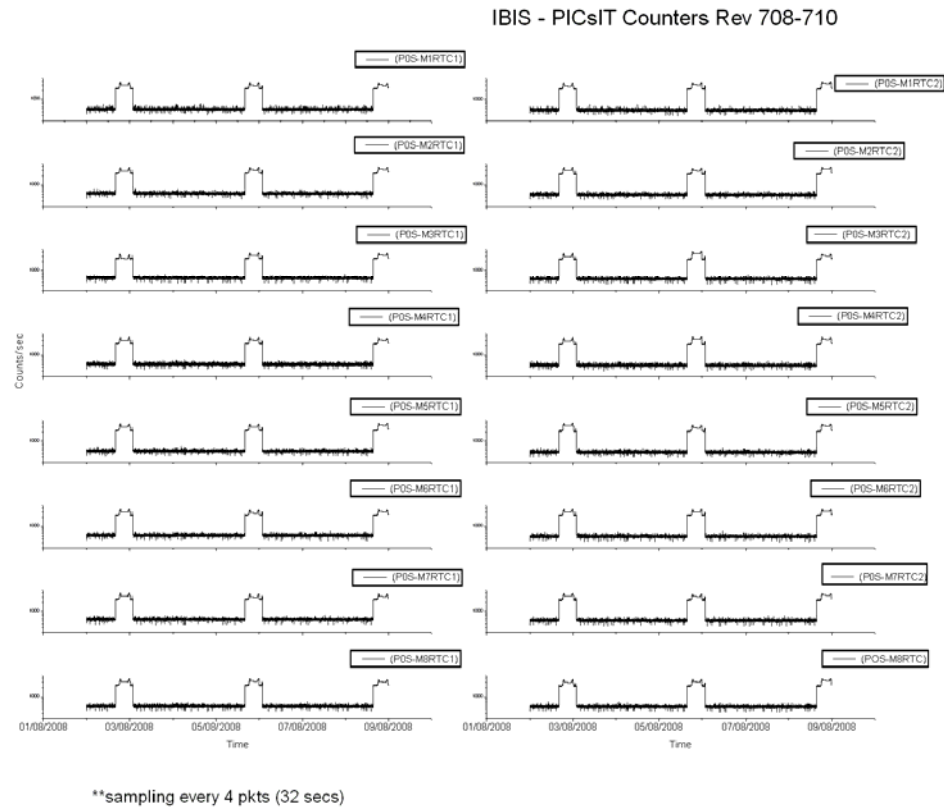
VETO Current:

IBIS-VETO Current & PICsIT dead times Rev 708-710

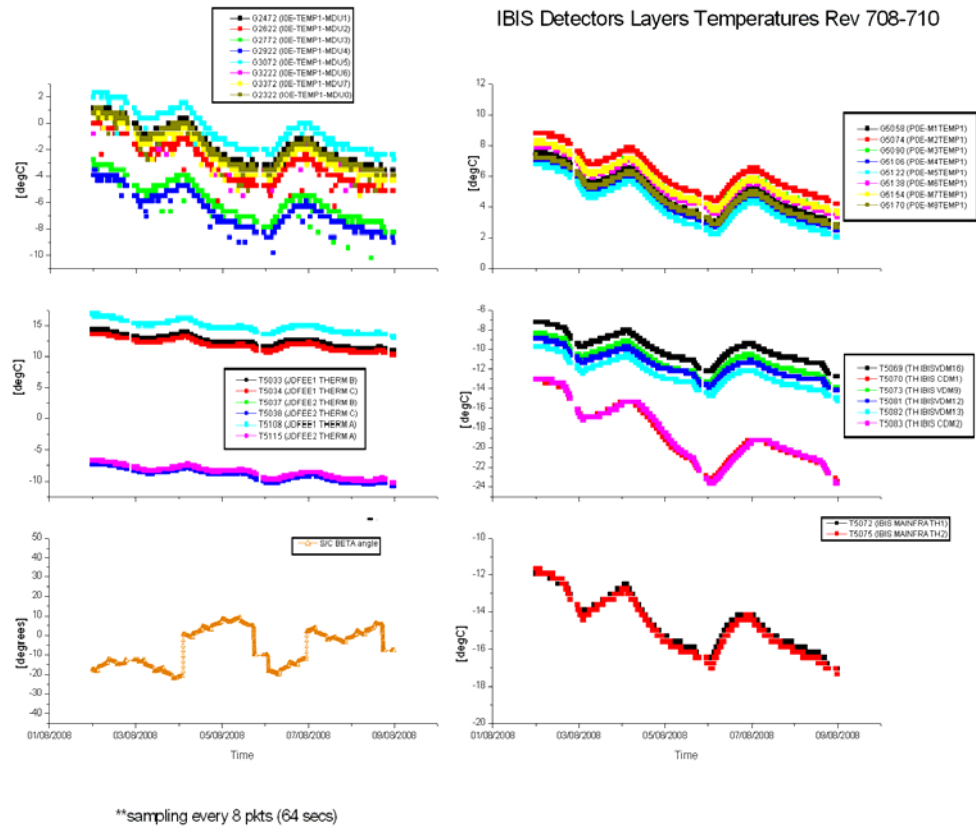


**sampling every 4 pkts (32 secs)

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.

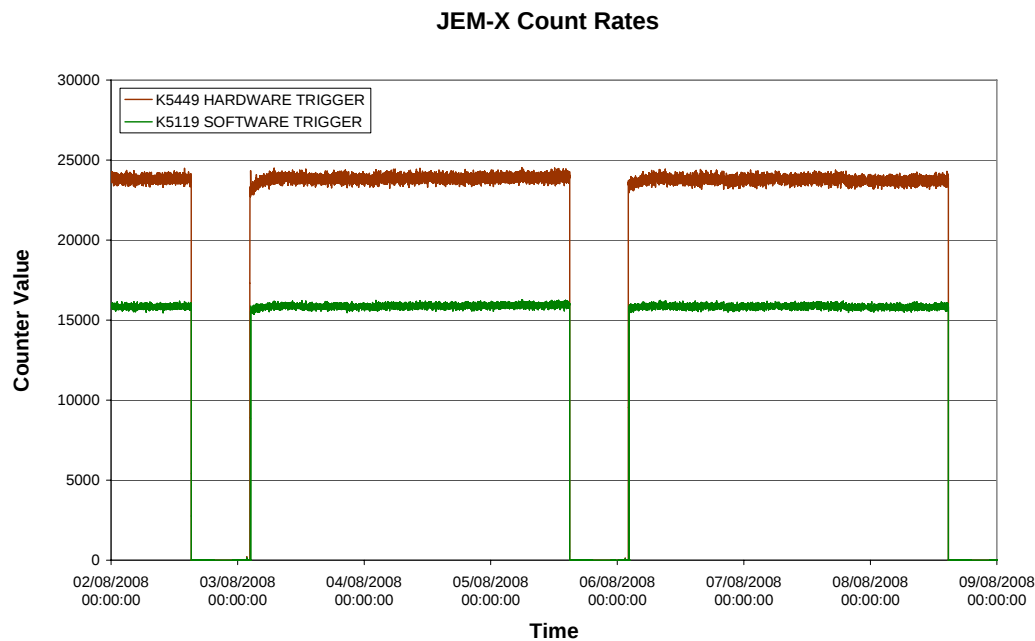
2008-08-02 (DOY 215, Rev 708) to 2008-08-08 (DOY 221, Rev 710-711)

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.



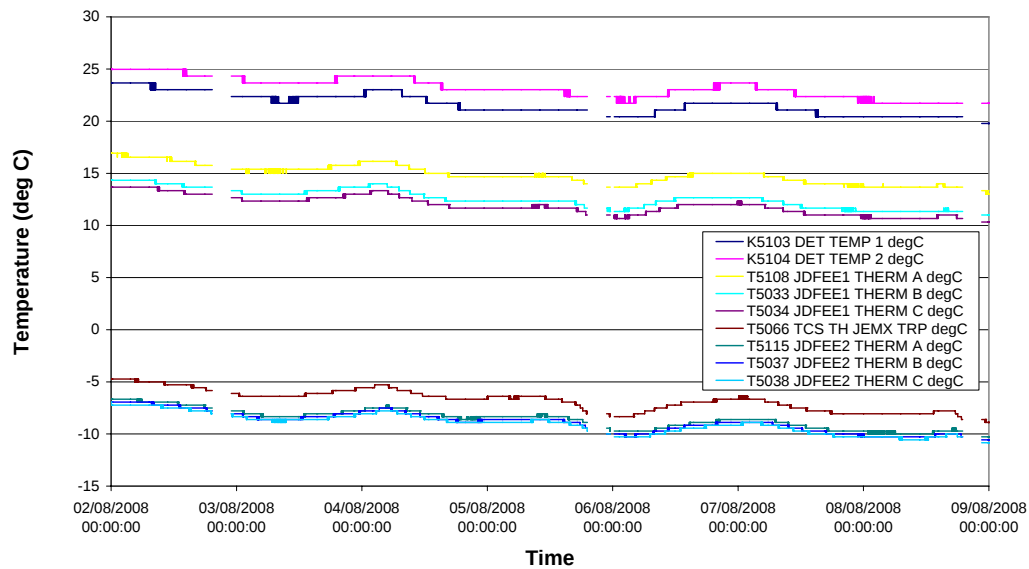
JEM-X Temperatures

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 Detector & DFEE Temperatures



JEM-X Daily Report

2008-08-02 (DoY 215, Rev 708) to 2008-08-08 (DoY 221, Rev 711)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2008-08-02 (DoY 215, Rev 708) to 2008-08-08 (DoY 221, Rev 711)

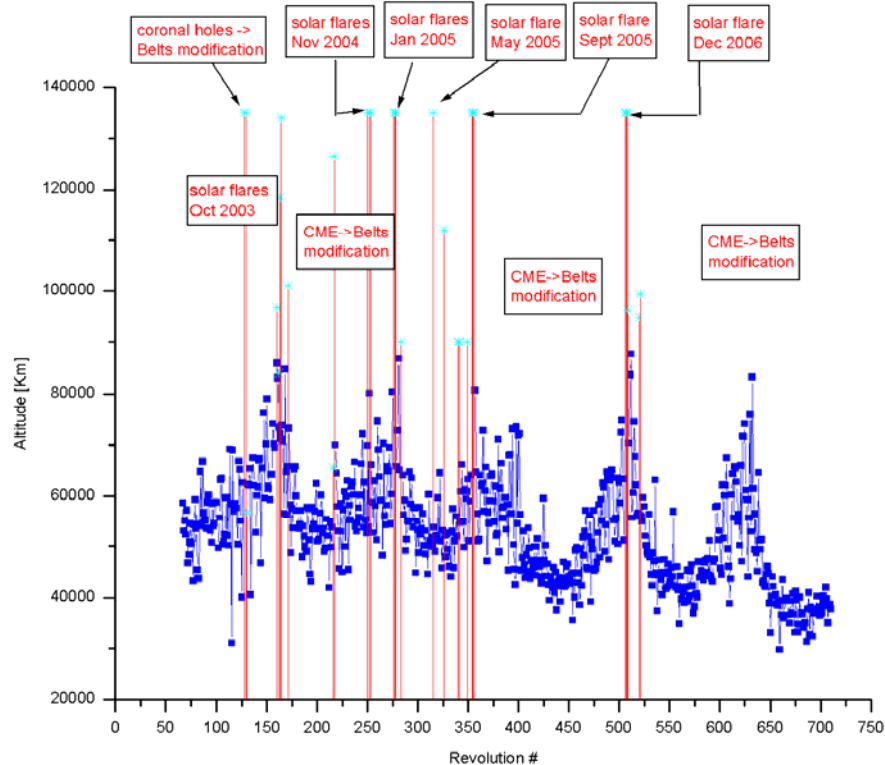
Nothing to report.

On DoY 215 at 16:04:54, DoY 218 at 15:51:58 and DoY 221 at 15:40:55 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]
708	RAD_ENTR R 2008-08-02T16:04:49Z	02/08/2008 18:02:13	38661.2	02-Aug-2008 18:00:28	38630.52
709	RAD_EXIT R 2008-08-03T01:58:14Z	03/08/2008 00:35:01	>>33548.7	03-Aug-2008 01:10:28	46198.55
709	RAD_ENTR R 2008-08-05T15:51:51Z	05/08/2008 17:48:29	38685.2	05-Aug-2008 17:47:54	38619.11
710	RAD_EXIT R 2008-08-06T01:45:15Z	Not Available		06-Aug-2008 00:57:54	46211.5
710	RAD_ENTR R 2008-08-08T15:40:49Z	08/08/2008 17:42:54	37739.2	08-Aug-2008 17:37:54	38503.32

Reference

High radiation

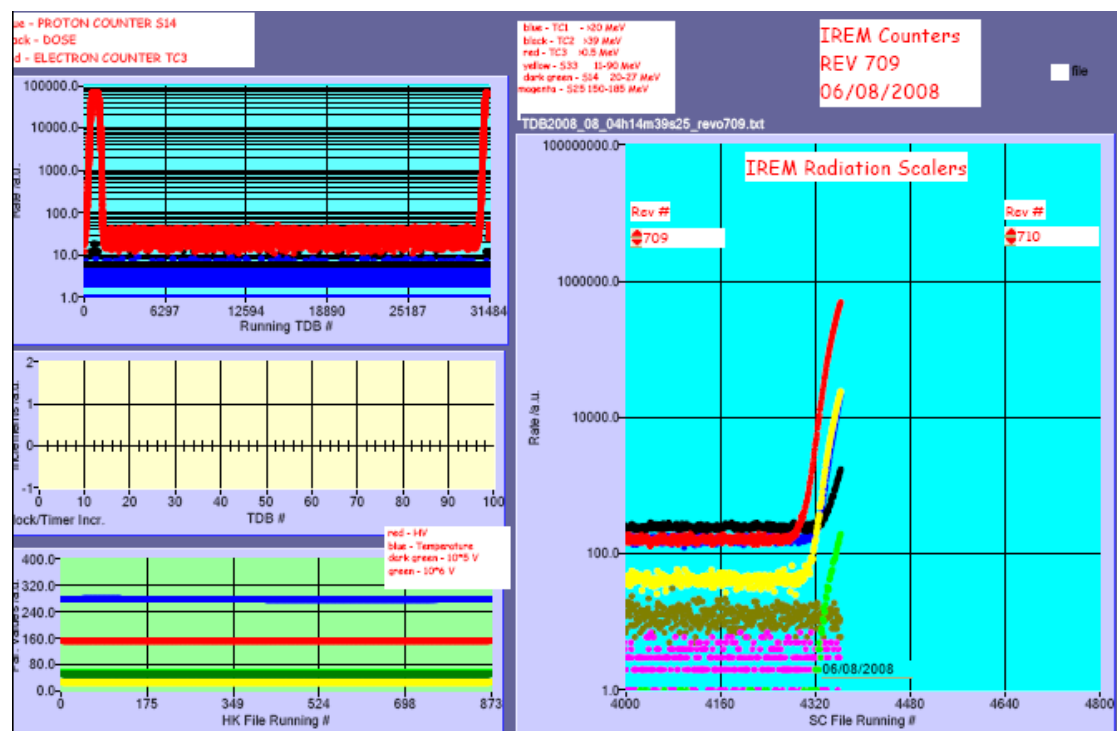
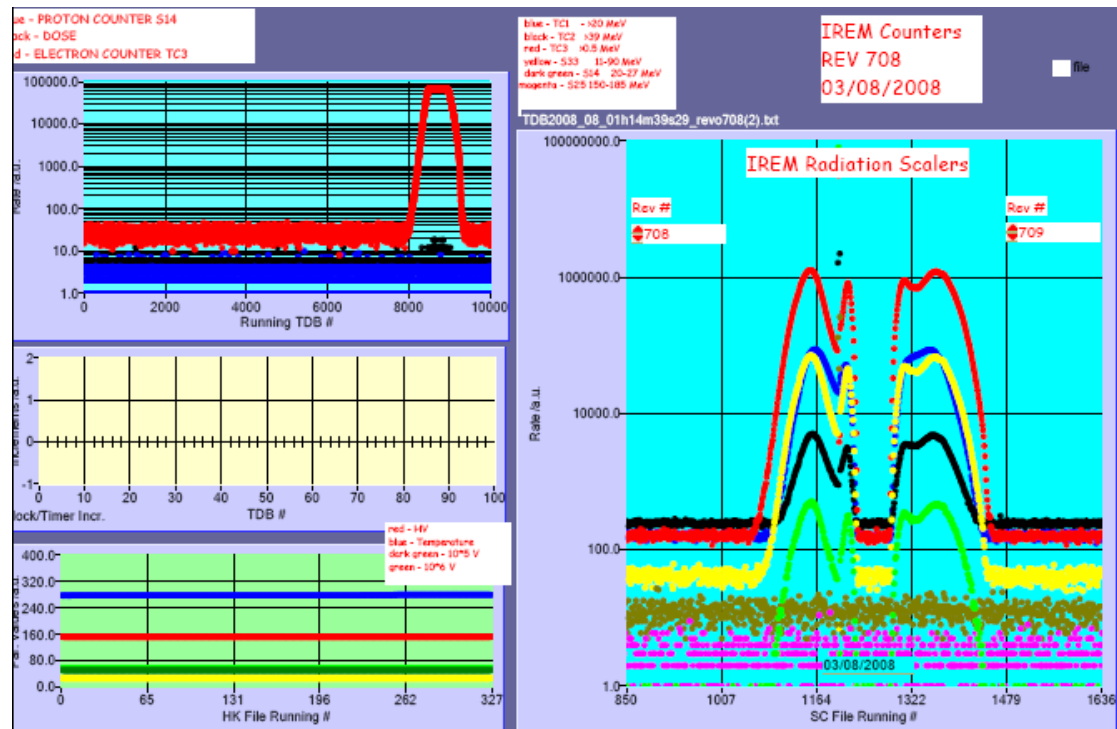
Very small error vs reference (less than 10 minutes)

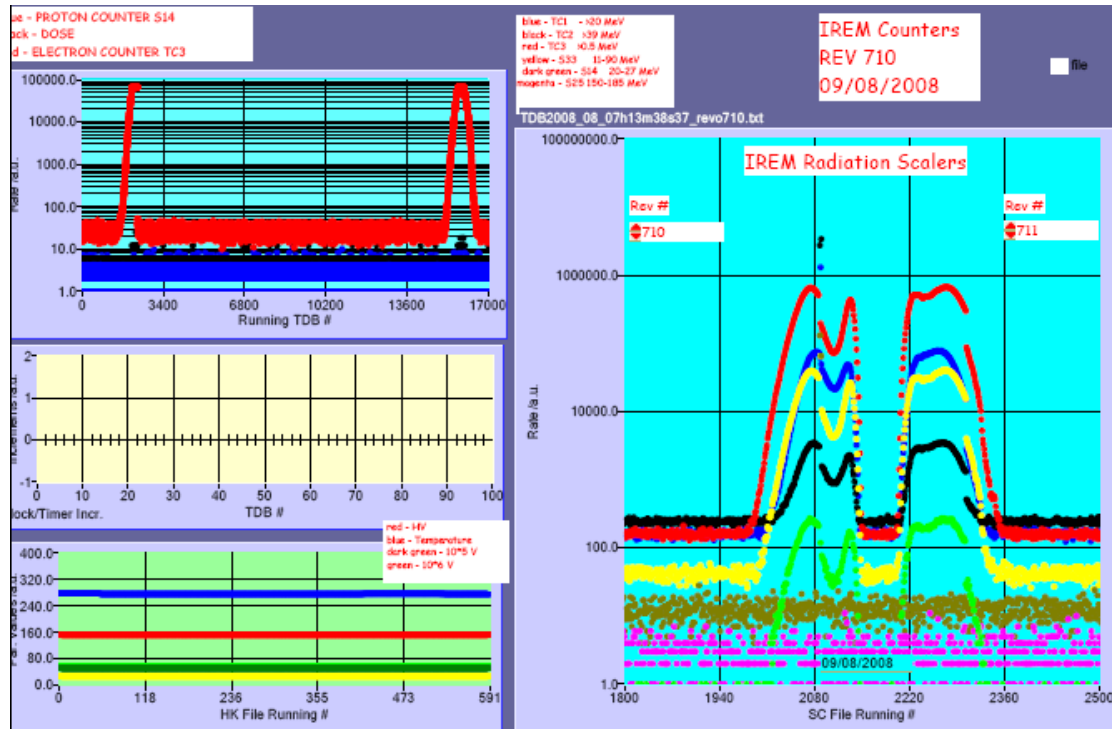
Small error vs reference (between 10 and 30 minutes)

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.

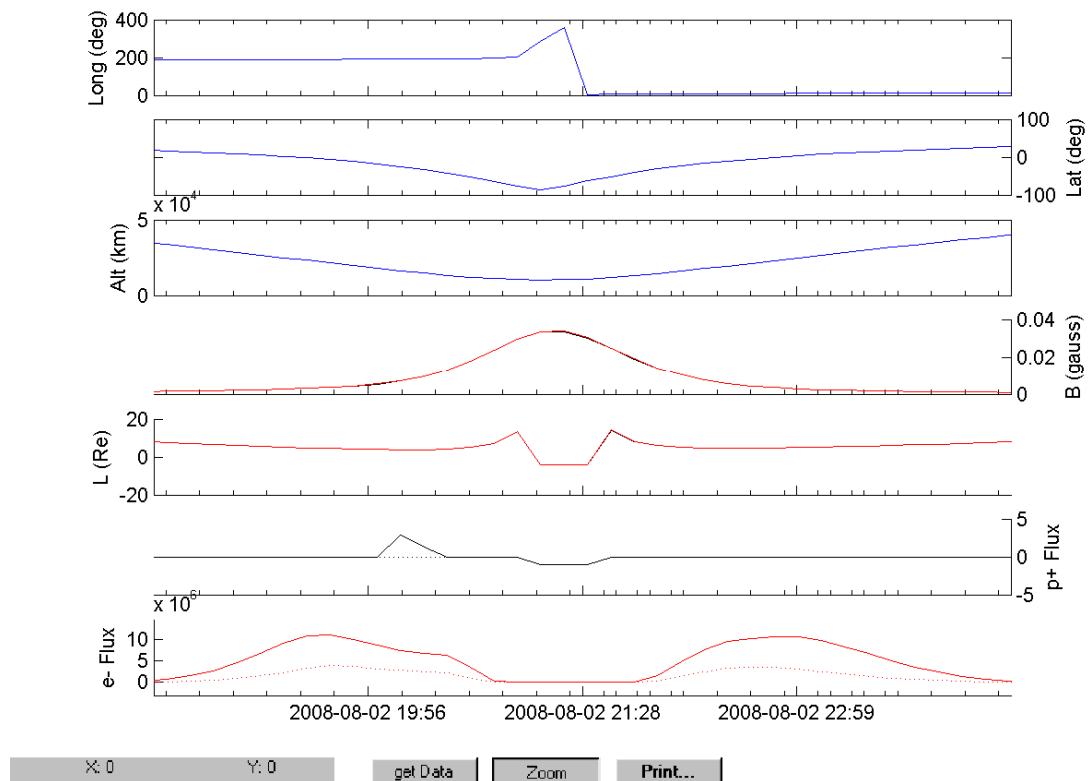
IREM radiation counters:



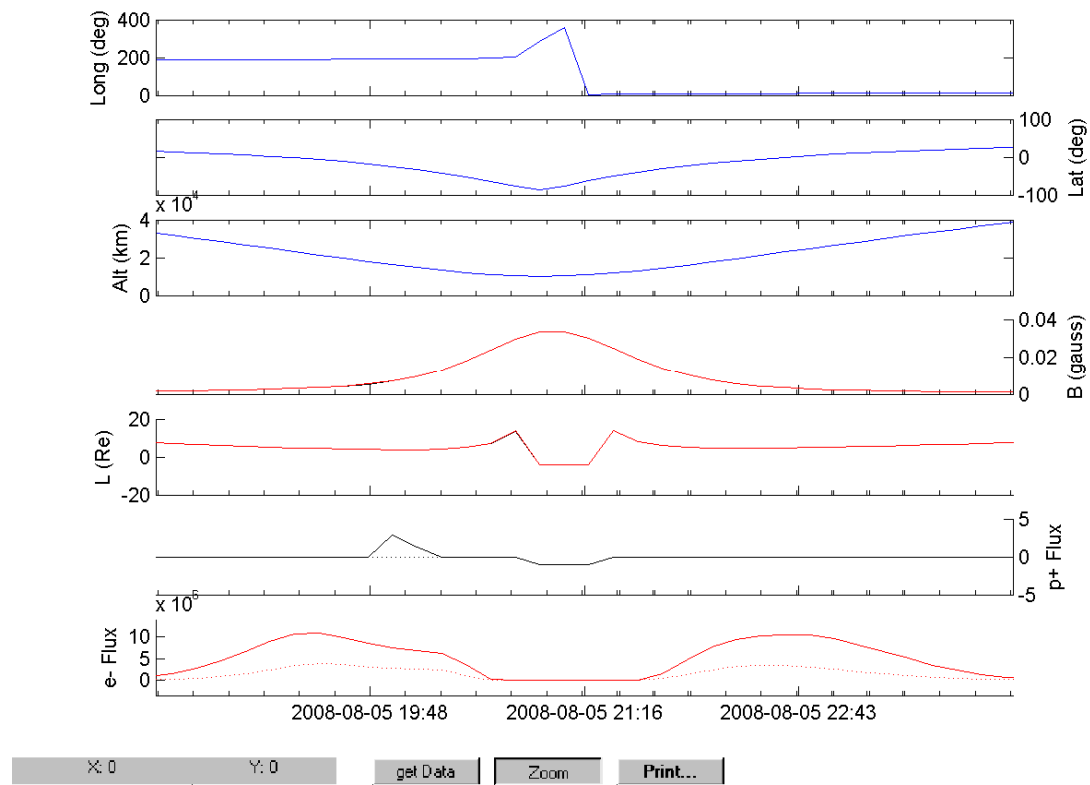


IREM Predicted Radiation Belt Passages

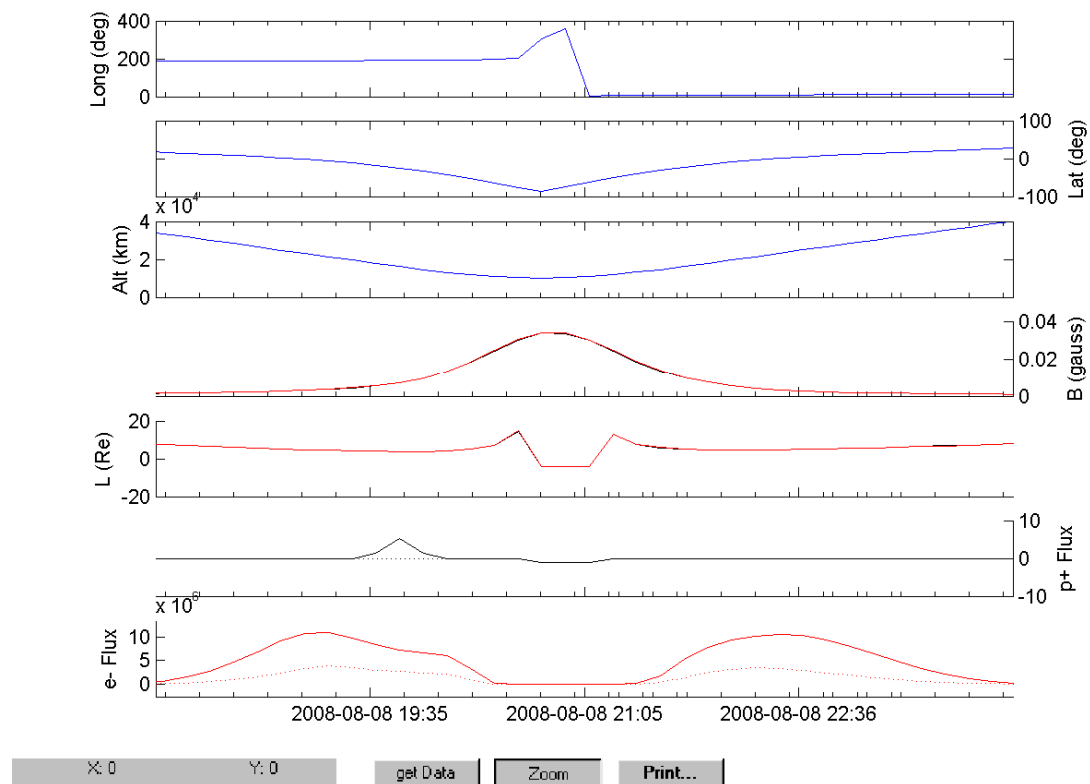
Rev 708



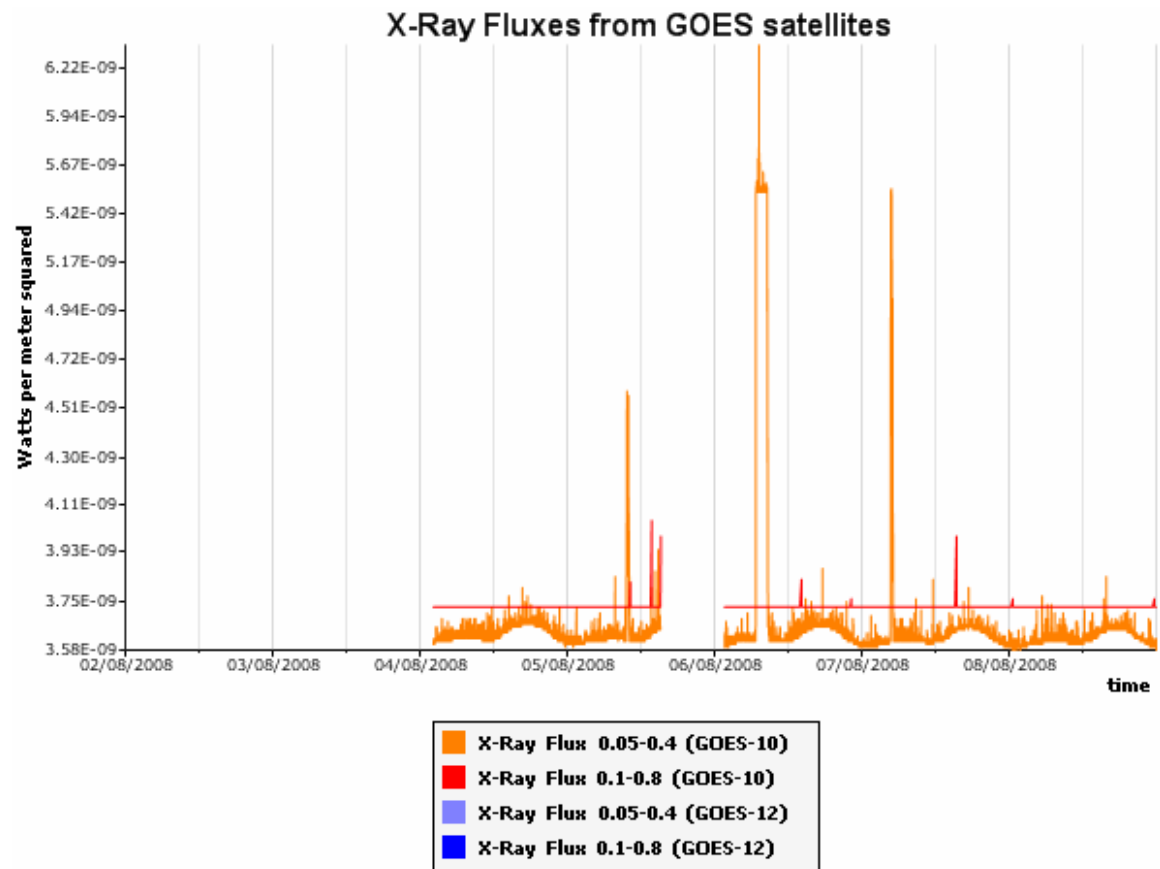
Rev 709



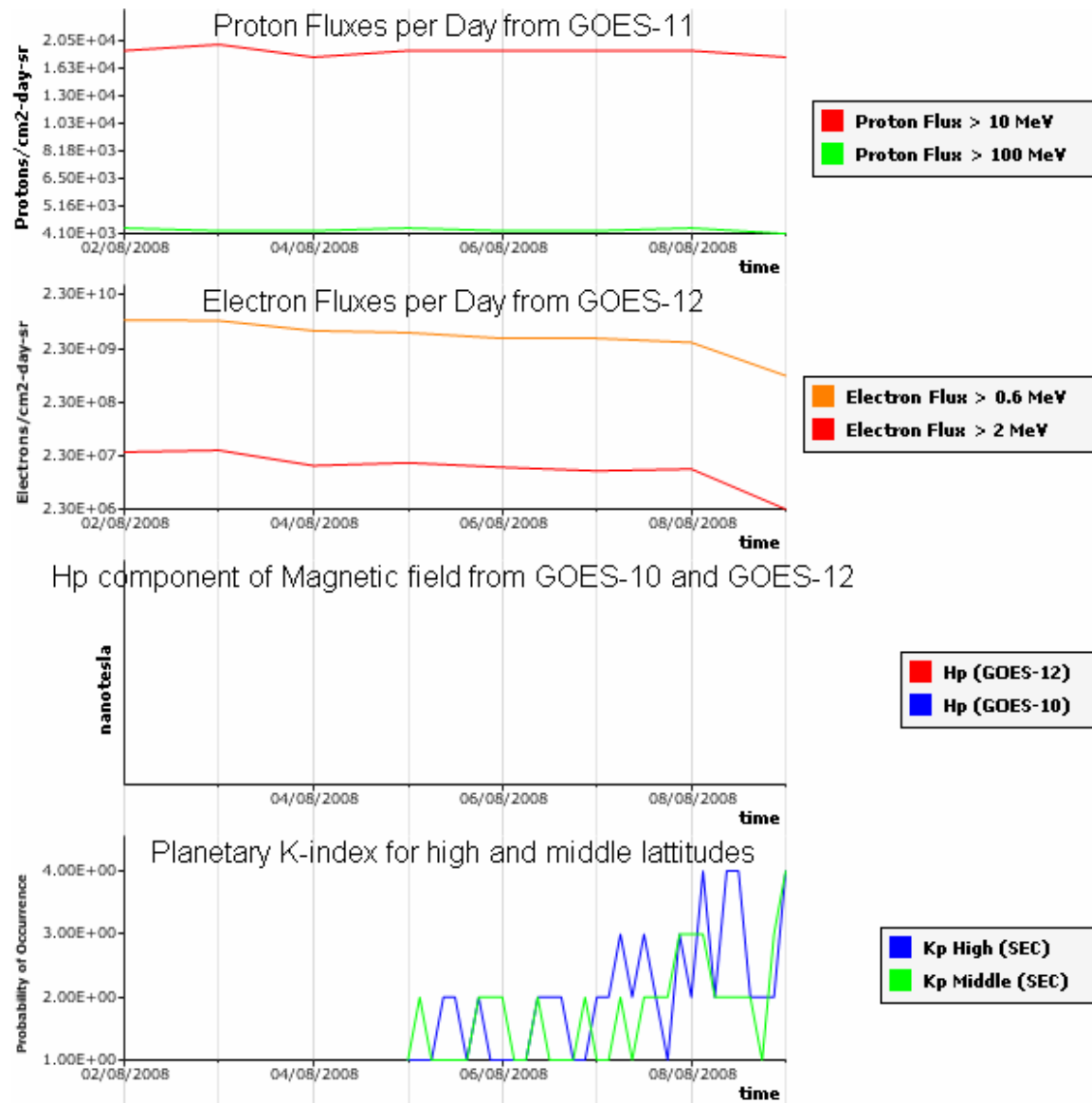
Rev 710



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



X-Ray fluxes start to be significant over 10^{-5} W/m² (corresponding to M-class flares). Above 10^{-4} W /m², 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.