

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 294
Week 19
13.05.08
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 03.05.08 until 09.05.08 (both dates inclusive) and covers the revolutions 679 and 680.

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 hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), two raster dithers of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), a hexagonal dither of Mrk 421 (ToO) (RA 11:03:47.79, DEC +37:48:25.8), two raster dithers of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4) and an OMC Flat Field calibration at attitude (RA 20:02:00.00, DEC -22:36:00.0).

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 03/05/2008 and 09/05/2008 was 0.1496 Kg. The remaining propellant is in the order of 140.4160 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

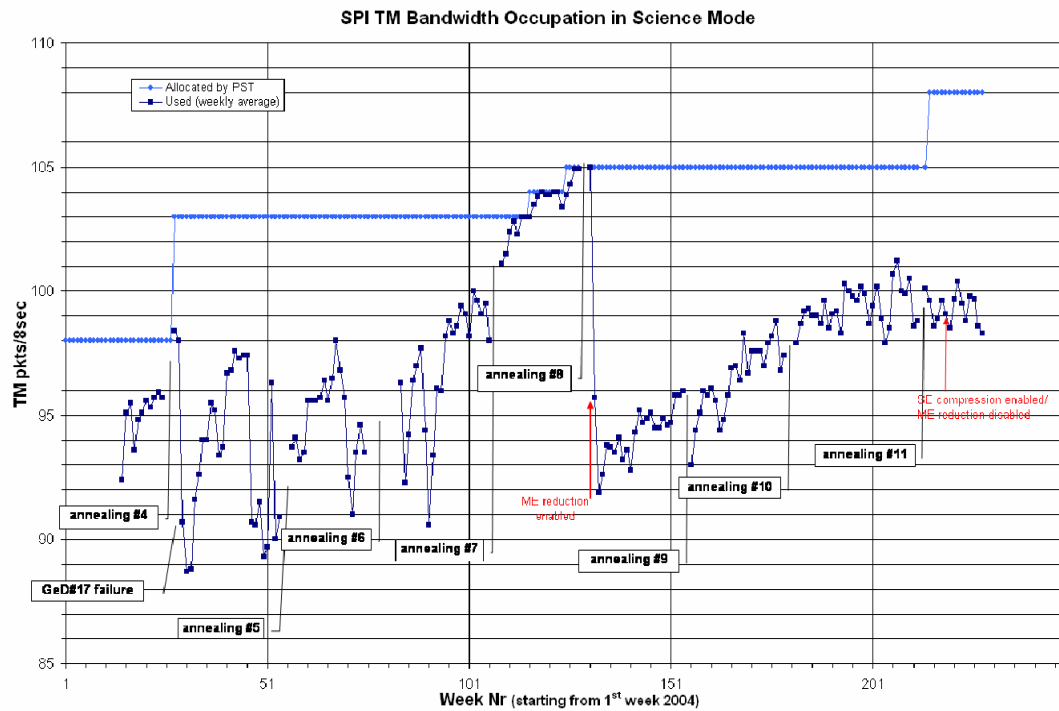
3.2.1 SPI

Following the 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 except from 2008-05-09T15:57:45Z to 2008-05-09T19:41:53Z, when the TM allocation was 88 packets/cycle due to an OMC Flat Field Calibration. The over-allocated PST with an additional 3 packets/cycle for SPI was used however the Broadcast Packet TM allocation was not updated. The average telemetry occupation in the science window when the allocation was 108 packets/cycle was 98.3 packets/cycle.

The following plot shows the assigned and the average occupation of the SPI TM bandwidth.



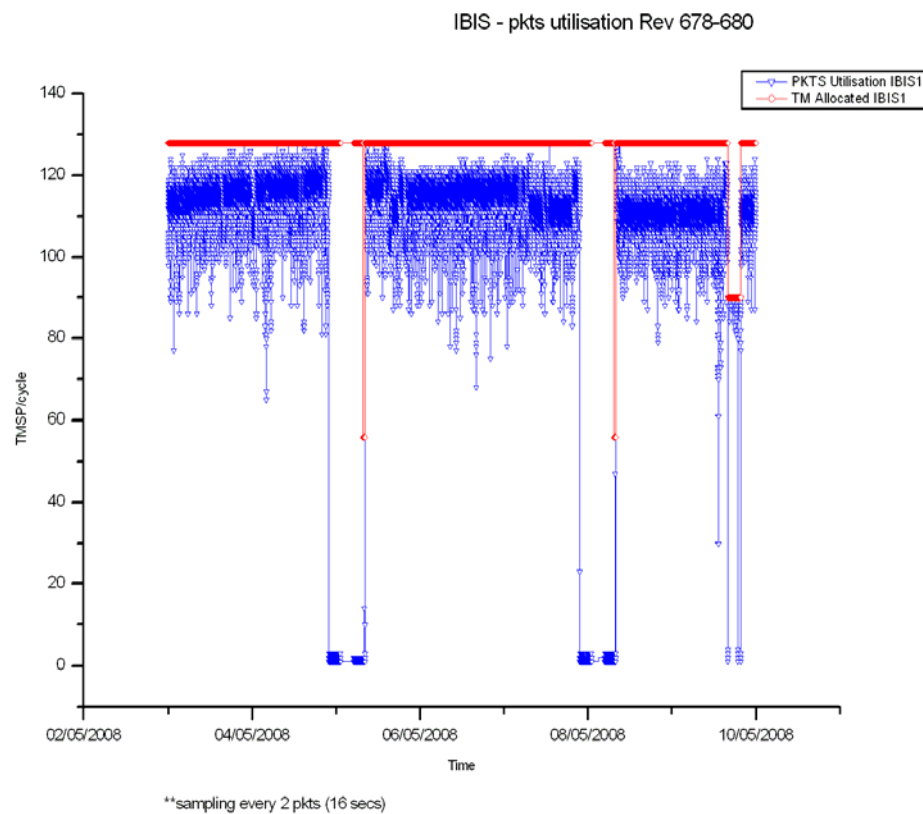
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

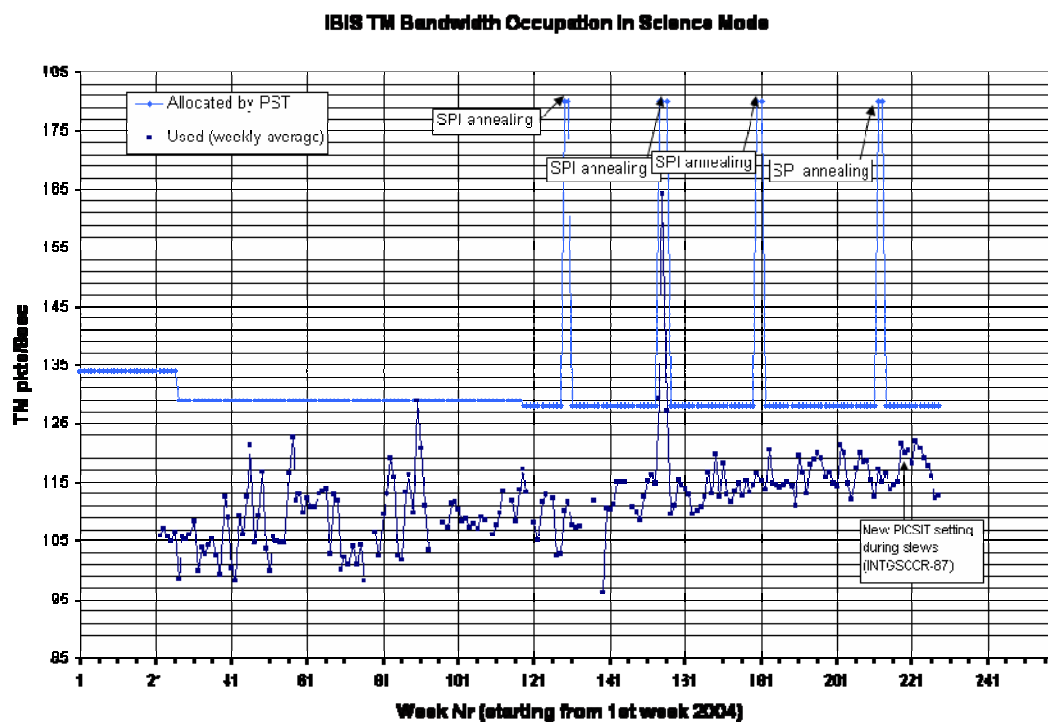
The overall status of the unit is nominal.

During the reporting period, the PST allocation to IBIS above the radiation belts was 128 packets/cycle except from 2008-05-09T15:57:45Z to 2008-05-09T19:41:53Z, when the TM allocation was 90 packets/cycle due to an OMC Flat Field Calibration. During the observation period, when IBIS was in science mode, the IBIS mean bandwidth utilisation was 112.63 packets/cycle (up 0.25 on last week) and the percentage of TM cycles in which the full bandwidth of 128 packets was used was 0.85%.

A plot of the IBIS TM utilisation during the observation period is shown below:



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, except during the Flat Field calibration from 2008-05-09T15:58:28Z to 2008-05-09T19:42:36Z when it was 63 packets/cycle.

During this reporting period, all of the 167 planned science pointings were executed nominally. In addition, a flat field calibration was performed, also nominally.

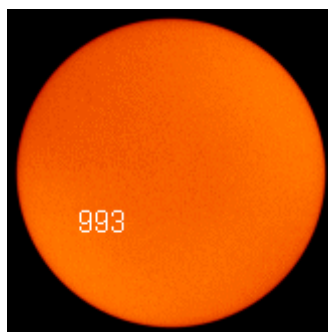
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity. Sun Spot #993 appeared on the 4th May, and had disappeared by the 7th. It was very small and posed no risk of solar flares.



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 very good this week. No pointings were lost to ground problems. The overall performance was nearly 100%.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. There were some problems though, the TPF update failed three times and the HFA task crashed once, all without impact.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were however 5 occasions where the TM dropped from Redu, and 1 occasion where the TM dropped from DSS-27, all without impact. In addition, the links to ISDC dropped once.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Updated PSFs have been received for revolutions 683 and 684, new files for revolutions 685 to 690.

Observations have been planned for revolutions 683 to 687, with 683 replanned due to the updated PSF.

New TSFs have been received for revolutions 680 to 682.

2. Observation status

A new ECS file has been received for revolution 671.

3. ISOC Science Data Archive

An ISDA Status Meeting took place on 07 May discussing progress on the next release. Some technical questions are still open, largely due to the ESAC archive team being very busy with various projects.

4. ISOC system

V19.1 has been released for testing. During a CCB meeting on 08 May the contents of the next two minor releases were defined.

The file transfer problems encountered in recent weeks have been most probably traced back to interference by antivirus filtering done by corporate services on the ftp transfer, which now has been changed. A written report has been requested.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 12/05/2008:

Doc. Title : INTEGRAL Mission Report #294
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
Date : 13/05/08

Issue : 1
Rev. : 0
Page : 9

- Latest Standard Analysis completed: observation 05200710021 (Galactic disk, Revolutions 667) on 10/05/2008.

- Latest products archived: observation 05200710020 (Galactic disk, Revolutions 667) on 10/05/2008.

- Latest observation products sent to the observer: observation 05200500029 (new_source, Revolutions 668) on 12/05/2008.

5 Special Events

6 Anomalies

There were no problems reported this week that impacted operations.

The following anomaly report was entered into the ARTS system this week.

AR id	Date Created	Subject	Segment	Status
INT-2994	2008-05-06	Incorrect IBIS setting in POS/ICP 0678 versions 07 & 15	ISOC	Open
INT_SC-225	2008-05-28	Problem with acquisition of some blocks of SPID 60602 at belt entry	Payload	Pending
INT-2996	2008-04-30	FDS: failed slew update, constraint violation on current wheels speeds	FDS	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 679

The observations in revolution 679 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 raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~2.9 hours. This was followed by a hexagonal dither of Mrk 421 (ToO) (RA 11:03:47.79, DEC +37:48:25.8), lasting ~31.0 hours. Finally, a return to the raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~12.5 hours was performed until the end of the revolution.

Revolution 680

The observations in revolution 680 began with a raster dither of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4), lasting ~30.0 hours. They continued with an OMC Flat Field calibration at attitude (RA 20:02:00.00, DEC -22:36:00.0), for ~3.4 hours. Finally, a return to the raster dither of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4), lasting ~24.2 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, except during the Flat Field calibration from 2008-05-09T15:58:28Z to 2008-05-09T19:42:36Z when it was IBIS 90; SPI 88; JEM-X1 8; JEM-X2 0; OMC 63.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2008-04-24T16:10:06.000Z	140.8029	F	Automatic TM processing.
2008-04-26T00:49:38.000Z	140.7817	F	Automatic TM processing.
2008-04-26T06:54:58.000Z	140.7694	F	Automatic TM processing.
2008-04-27T15:58:46.000Z	140.7444	F	Automatic TM processing.
2008-04-29T06:14:50.000Z	140.7361	F	Automatic TM processing.
2008-04-29T14:42:27.000Z	140.6962	F	Automatic TM processing.
2008-04-30T21:58:22.000Z	140.6940	F	Automatic TM processing.
2008-05-02T01:02:24.000Z	140.6719	F	Automatic TM processing.
2008-05-02T06:02:57.000Z	140.6683	F	Automatic TM processing.
2008-05-02T19:56:58.000Z	140.6341	F	Automatic TM processing.
2008-05-05T00:48:16.000Z	140.6126	F	Automatic TM processing.
2008-05-05T05:50:01.000Z	140.6001	F	Automatic TM processing.
2008-05-05T14:16:50.000Z	140.5668	F	Automatic TM processing.
2008-05-06T15:14:28.000Z	140.5441	F	Automatic TM processing.
2008-05-08T05:35:44.000Z	140.5308	F	Automatic TM processing.

This report was generated Fri May 9 08:00:25 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, 03/05/2008 – 09/05/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 107 Open Loop Slews, 79 Closed Loop Slews and 6 Momentum Biases were executed (as reported by ACC).

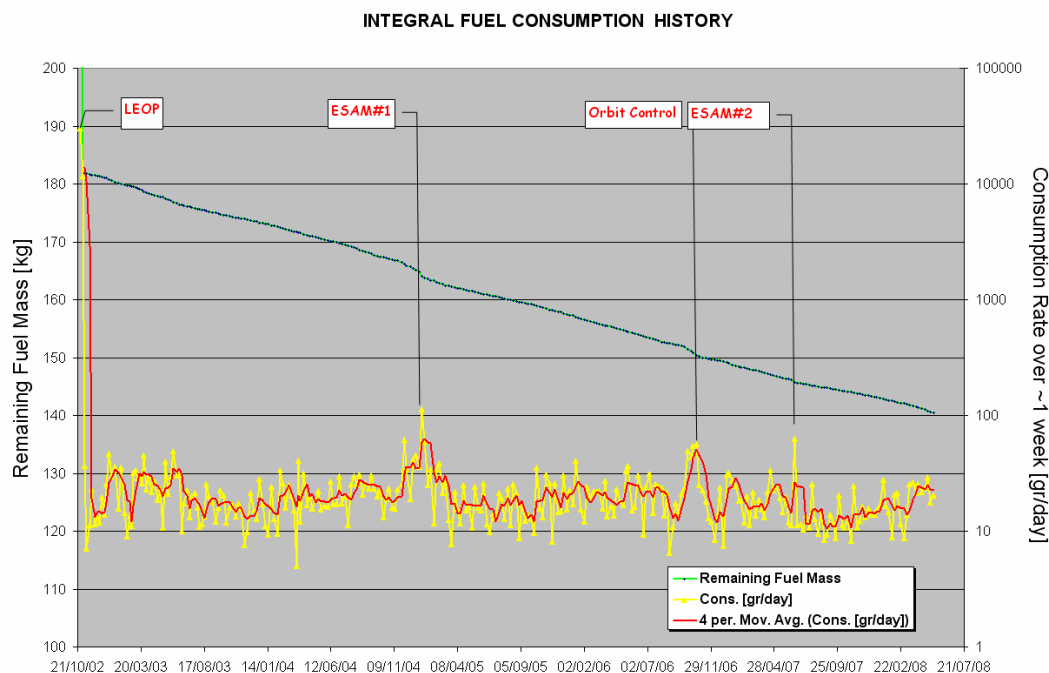
No slews were missed from TL, during the observation period.

Orbit Control

No update

Fuel consumption

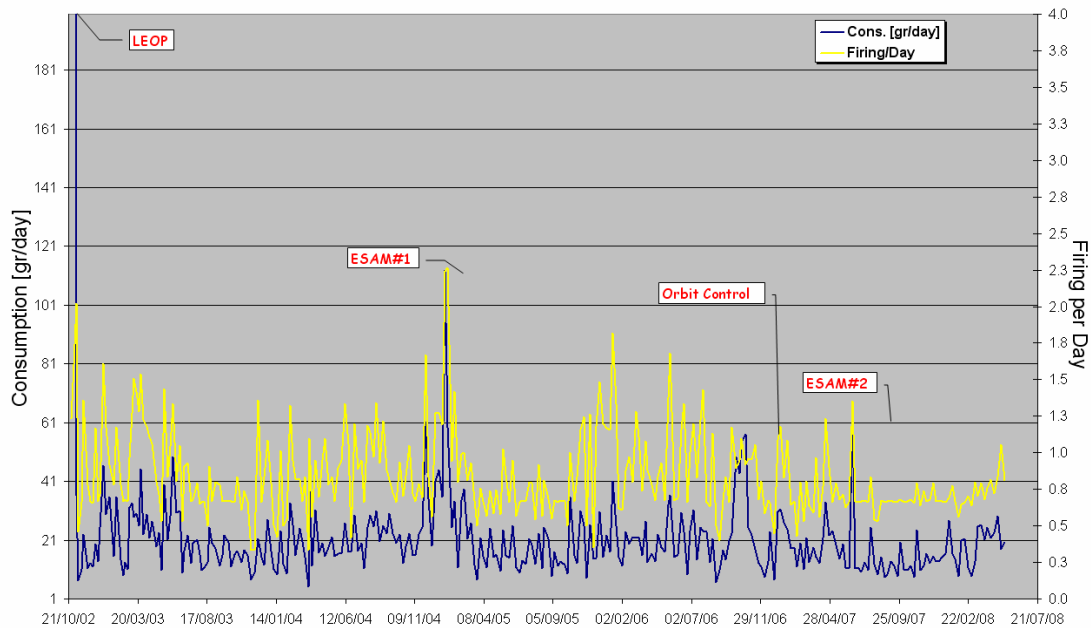
The fuel consumption (total, grams per day) over the period between 01/11/2002 and 09/05/2008 is reported in the plot below.



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 09/05/2008 is reported in the plot below.

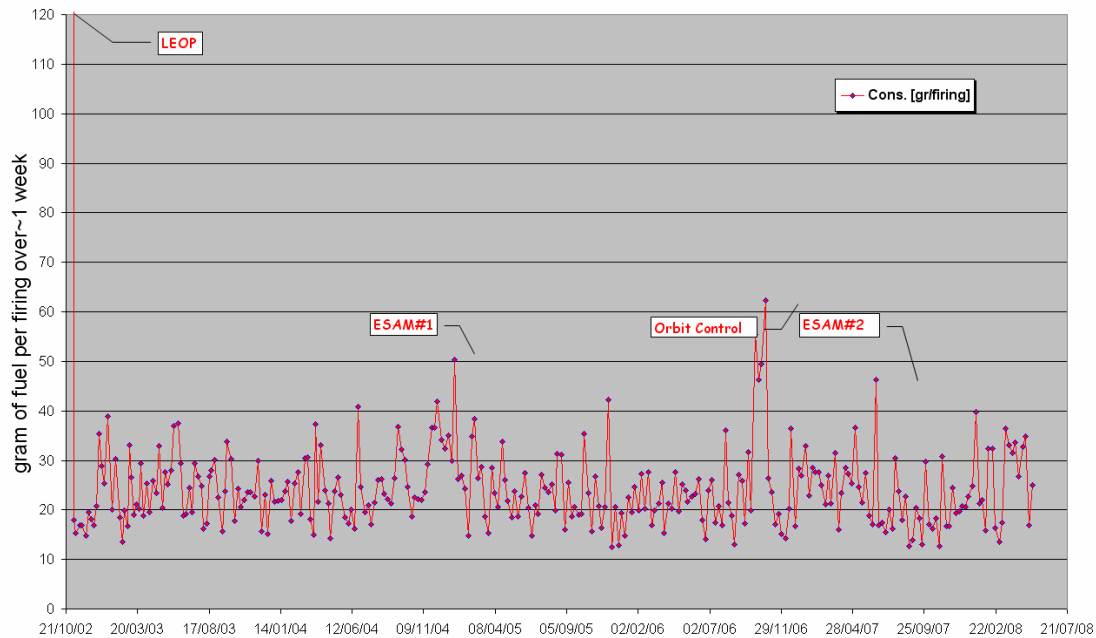
INTEGRAL FIRING PER DAY HISTORY



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

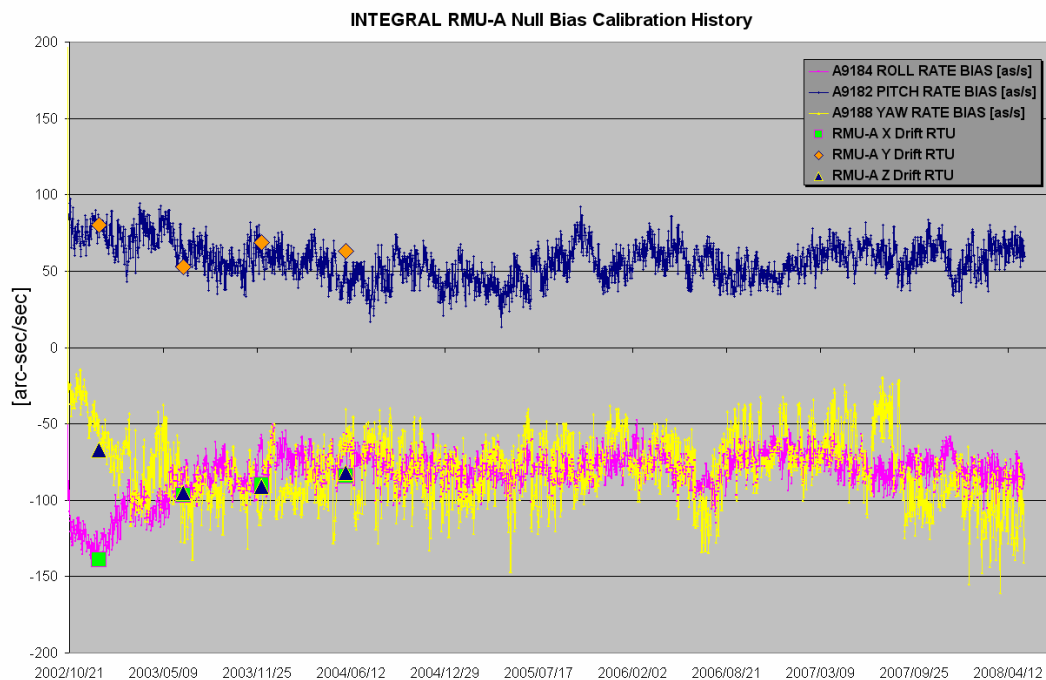
The fuel per firing over the period between 01/11/2002 and 09/05/2008 is shown in the plot below.

INTEGRAL FUEL MASS PER FIRING HISTORY



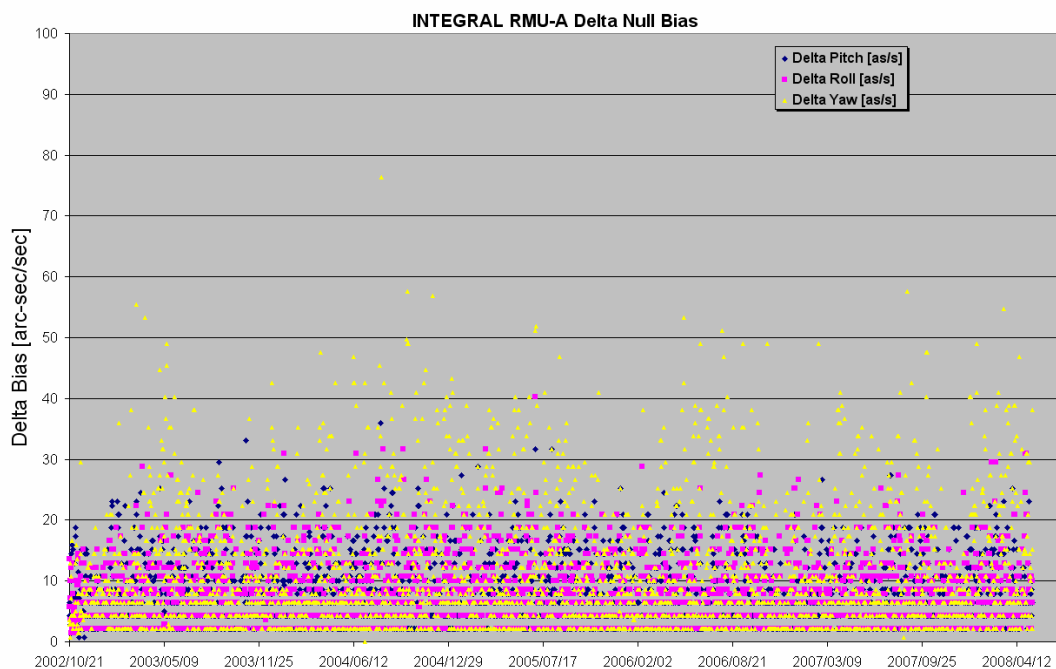
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 09/05/2008 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 09/05/2008 is reported in the plot below.



03/05/2008 (Day of Year 124, Revolution 678)

Nothing to report.

04/05/2008 (Day of Year 125, Revolution 678)

Nothing to report.

05/05/2008 (Day of Year 126, Revolution 678-679)

Nothing to report.

06/05/2008 (Day of Year 127, Revolution 679)

FDS failed slew update: at 07:03z the FDS failed the update of slew ID 06790034. FDS reported an error during the update process and the TPF generation was aborted.

At 07:17z the slew ID 06790034 was manually updated in TL.

No impact on TL.

07/05/2008 (Day of Year 128, Revolution 679)

Nothing to report.

08/05/2008 (Day of Year 129, Revolution 679-680)

FDS failed slew update: at 10:14z the FDS failed the update of planned slew in TL (ID 06800005). FDS reported an error during the update process and the TPF generation was aborted.

FD support was called in.

At 10:19z the TPF was transferred to the MCS and no recovery of schedule requested anymore.

No impact on TL.

FDS failed slew update: at 12:13z the FDS failed the update of planned slew in TL (ID 06800007). FDS reported an error during the update process and the TPF generation was aborted.

At 10:19z the update TPF for slew ID 06800005, was manually generated and transferred to the MCS.

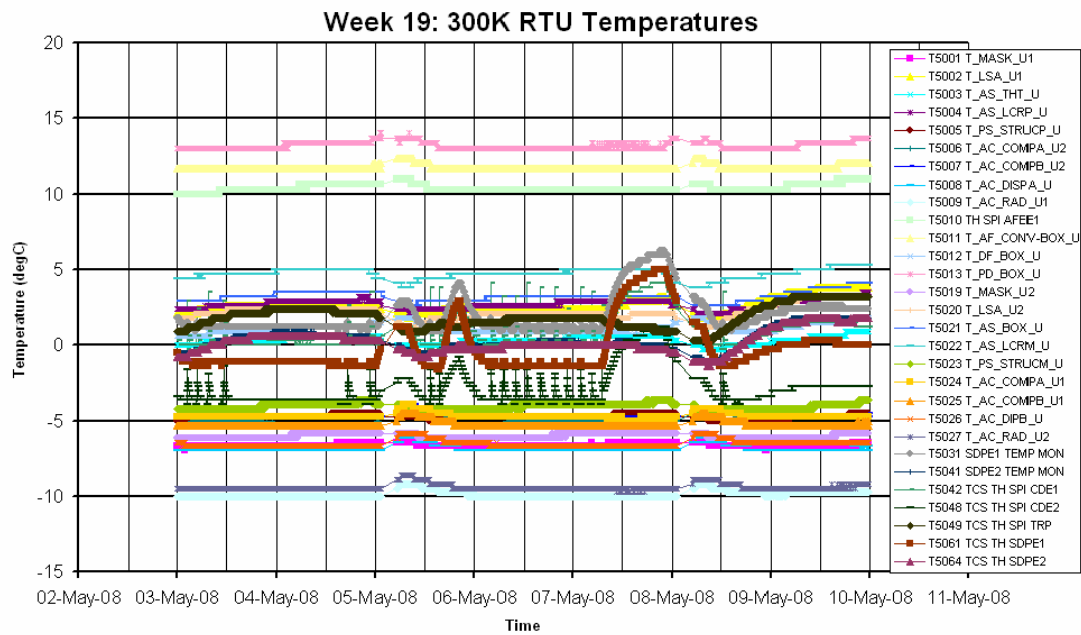
No impact on TL.

09/05/2008 (Day of Year 130, Revolution 680)

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.

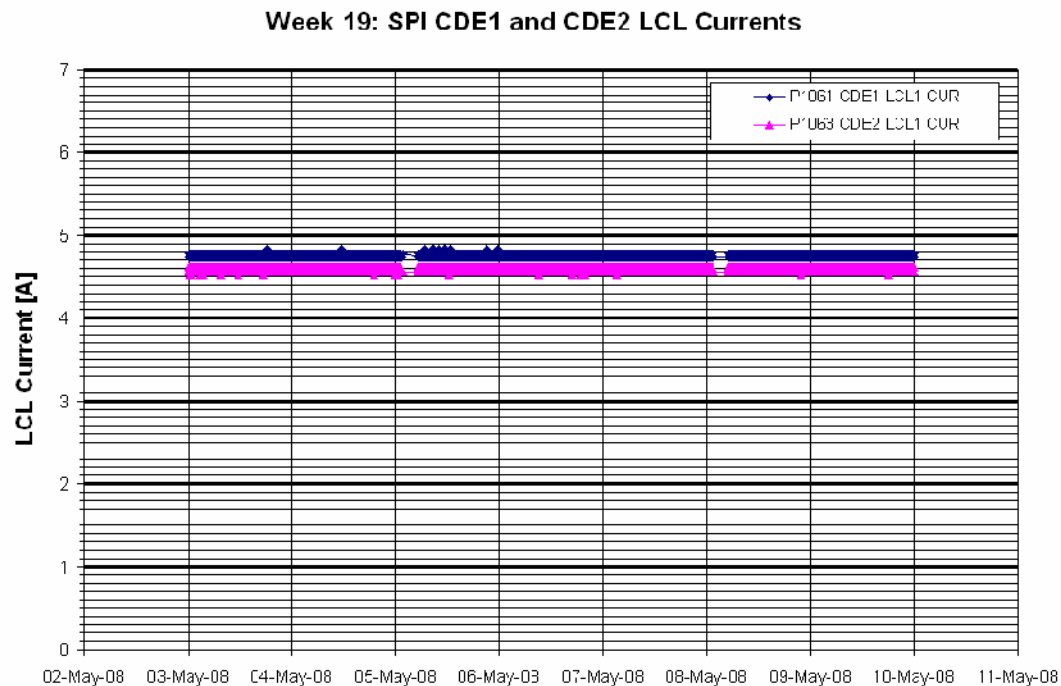


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

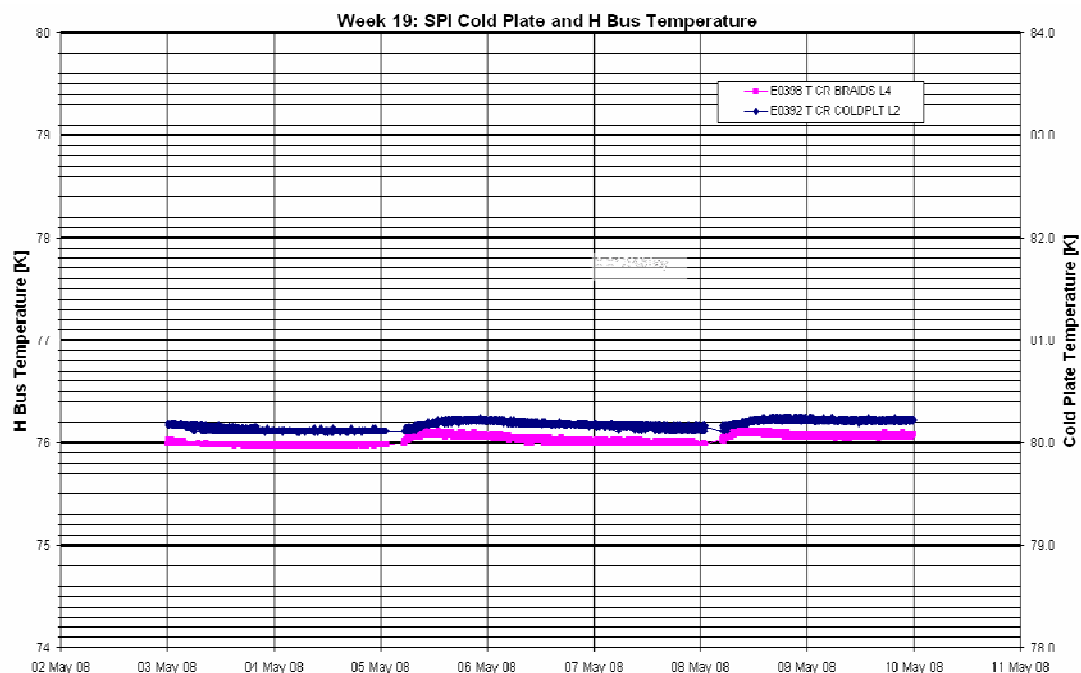
The stroke of all four compressors was set to 40 throughout the week. The average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.77A
- CDE2 LCL Current = 4.57A

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.



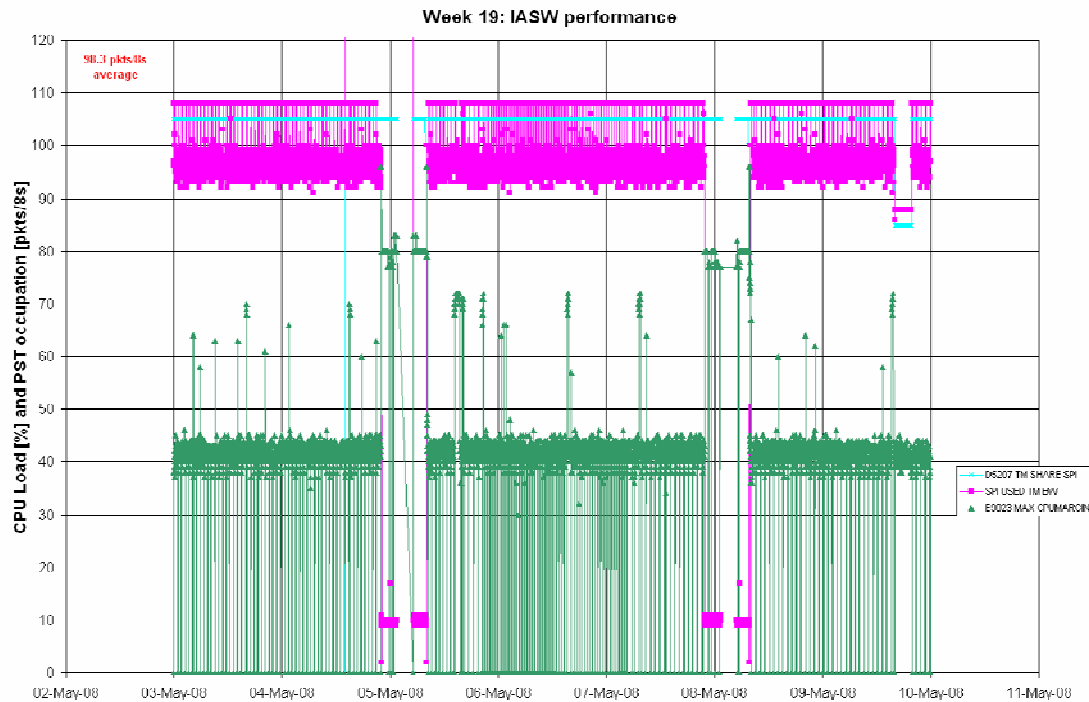
DPE & IASW: The DPE health and IASW performance is nominal.

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 98.3 packets/cycle over the science window. The TM allocation in the science window was 108 packets/cycle.

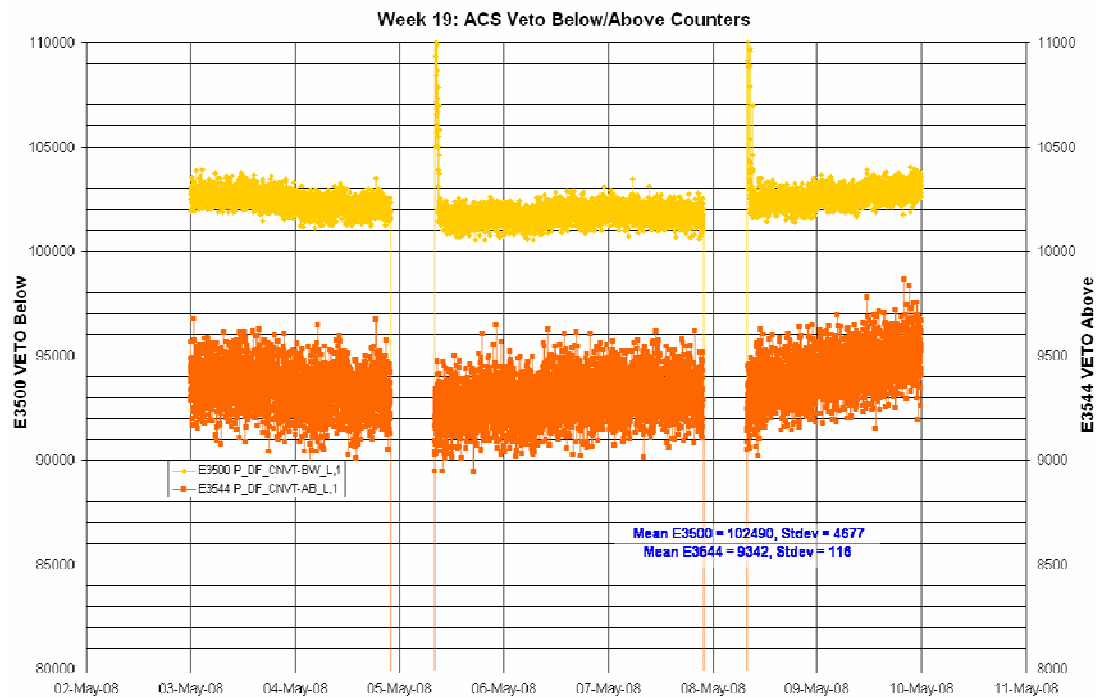
This allocation is considering that the over-allocated PST with the additional 3 packets/cycle for SPI was being used, however the Broadcast Packet TM allocation was not updated (see plot below).

The following plot shows the IASW performance in terms of TM bandwidth occupation and DPE CPU load during the reporting period. Note that from 2008-05-09T15:57:45Z to 2008-05-09T19:41:53Z the TM allocation was 88 packets/cycle due to an OMC FFC.

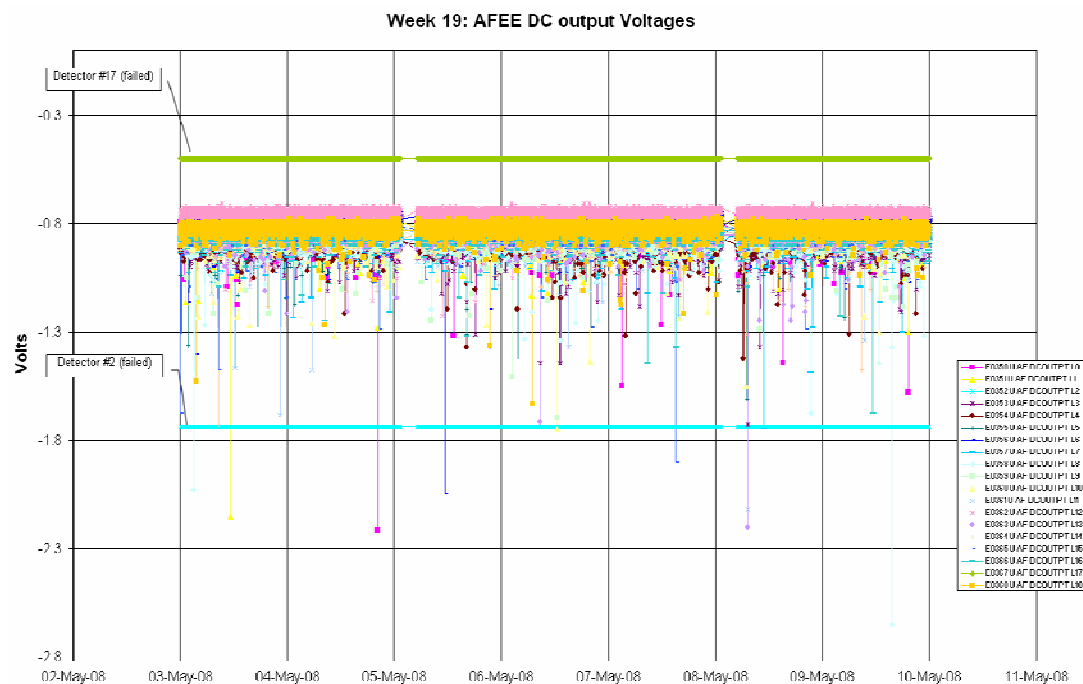


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

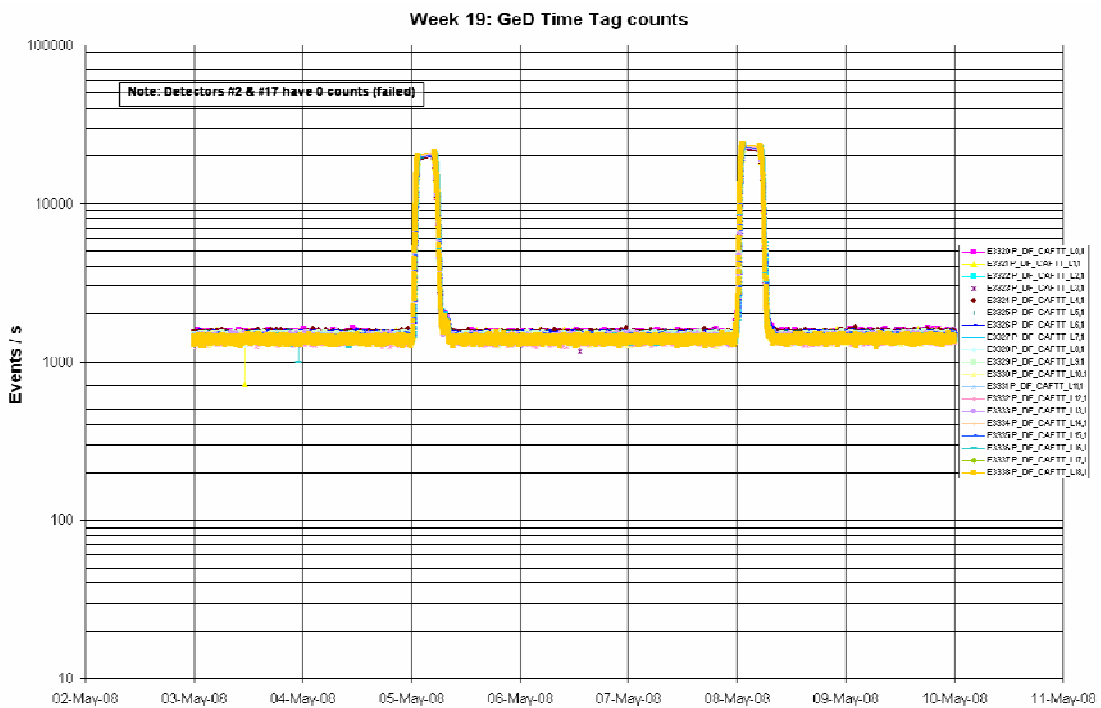
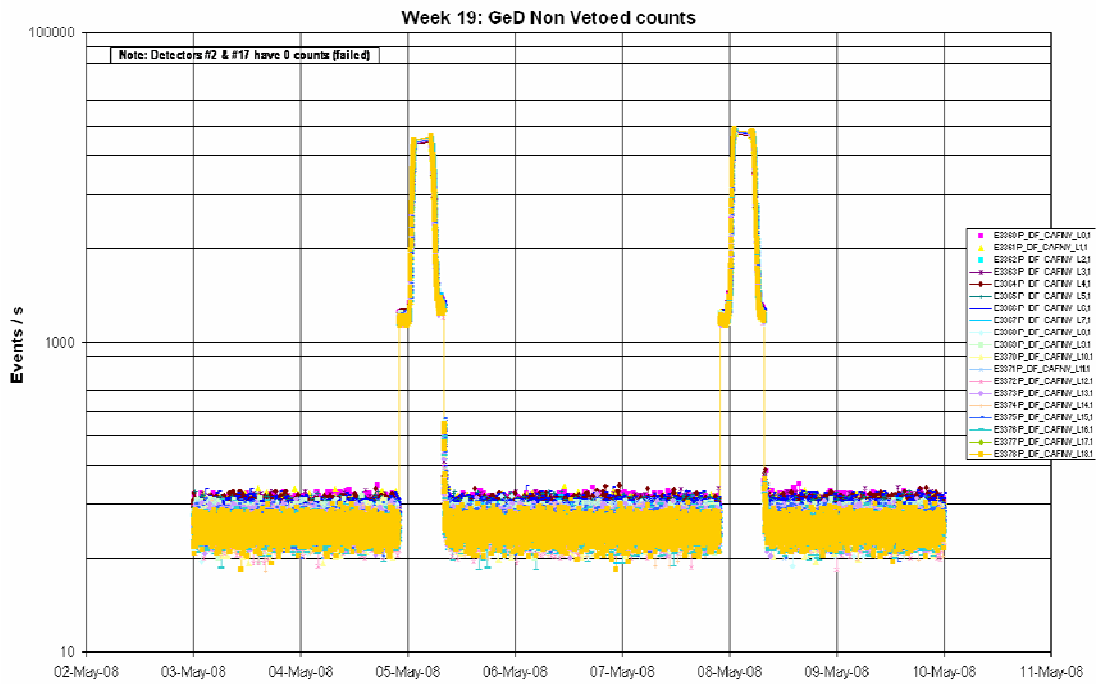
The following plot shows the ACS overall count rate evolution during the reporting period:

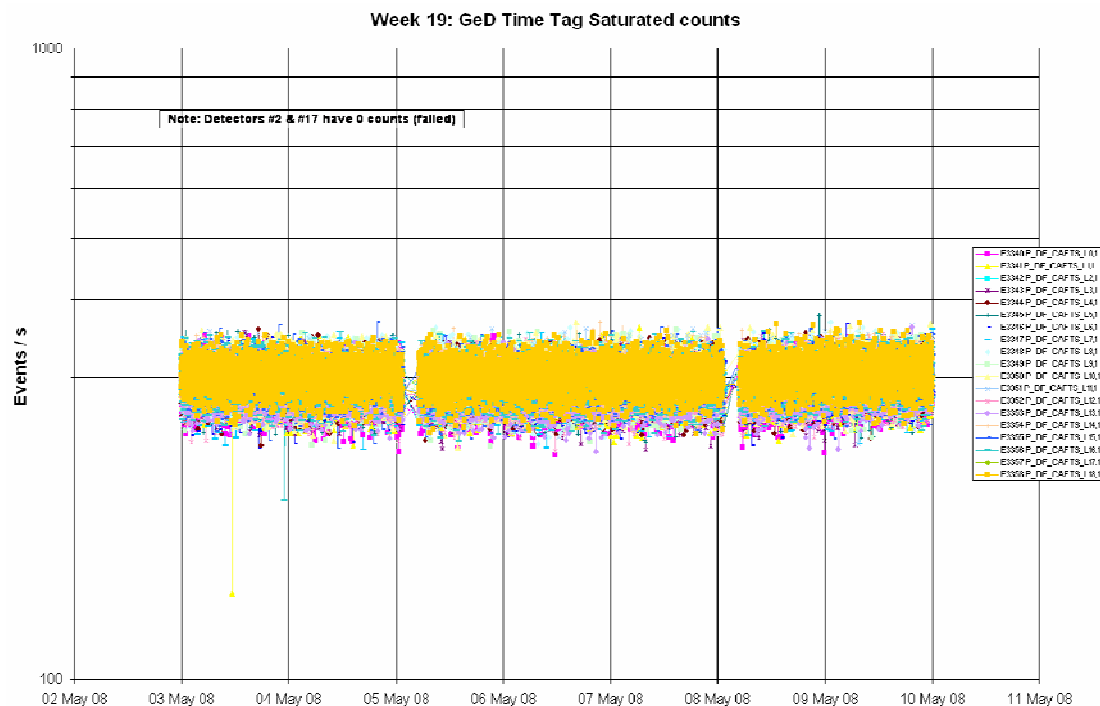


AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

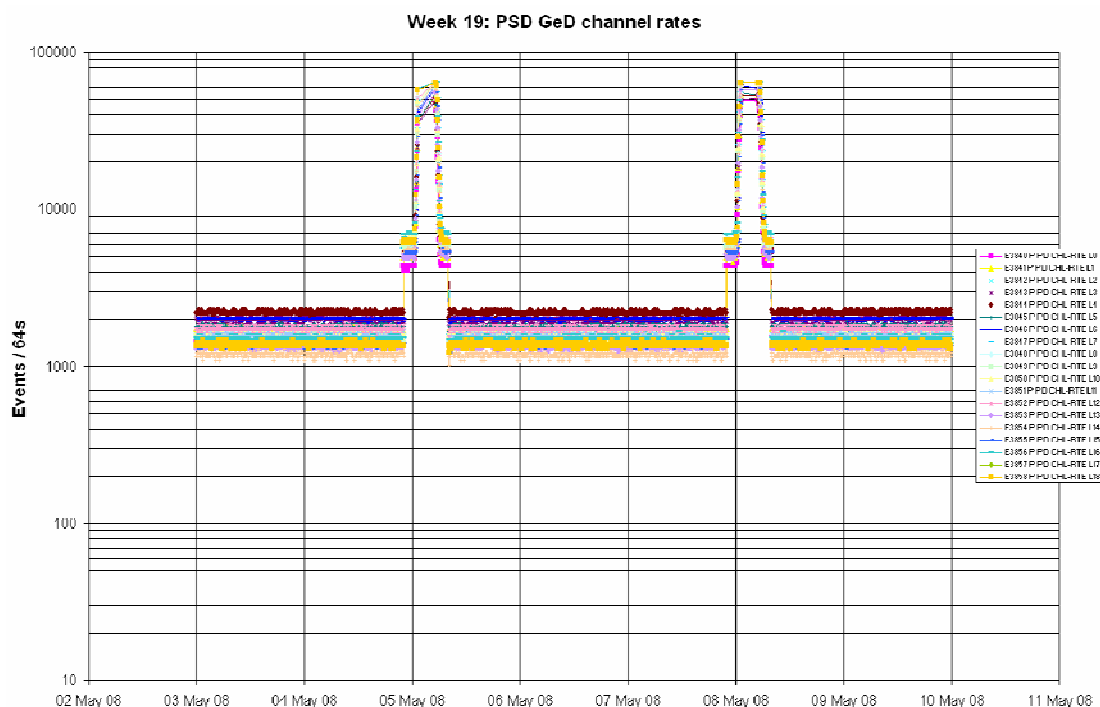


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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:

- Due to high background radiation after the expected radiation belt exit of revolution 679, TM parameter E3500 was OOL High on 2008-05-05 from 08:11:40Z to 08:20:20Z, returning within limits of its own accord.

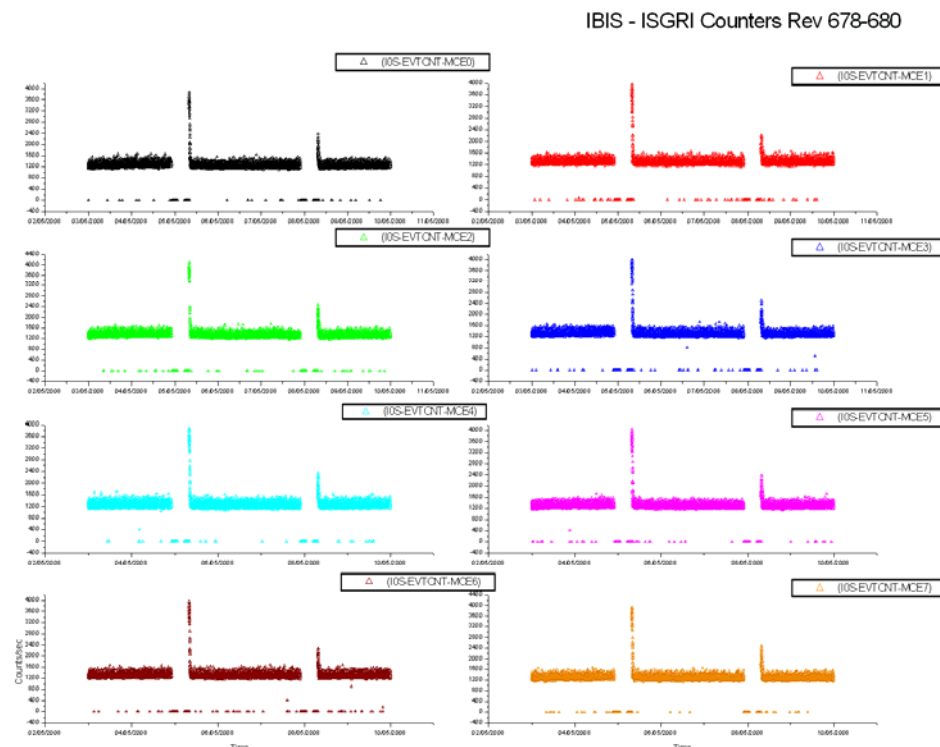
- Due to high background radiation after the expected radiation belt exit of revolution 680, TM parameter E3500 toggled OOL High on 2008-05-08 from 08.08.28Z to 08.22.52Z, returning within limits of its own accord.
- On 2008-05-07 at 21:50:41Z, during the reconfiguration of SPI at radiation belt entry of revolution 679, TM parameters E0219- E0228 went OOL (value = 0). These are the AFEE PA 2 temperatures for GeD#9-GeD#18. These are in SPID 60602 and this was the first mode-change packet received during the reconfiguration. They returned within limits when the second mode-change packet was received at 21:53:25Z. This seems to be a new anomaly, similar to the anomaly INT_SC-205, fixed by IASW patch 4.3.4. A new Anomaly Report, INT_SC-225, has been raised to cover this.
- As usual following periods of low TM allocation to SPI, the following OEMs were received after the OMC Flat Field Calibration on 2008-05-09:
 - o From 19:54:45Z to 20:00:22Z 17 occurrences (one for each GeD) of OEM APID 1024 ID 245 EXCEPTION SPI1 SPECTRA COMPRESSION OVERFLOW
 - o 20:00:22Z one occurrence of OEM APID 1024 ID 244 EXCEPTION SPI1 SPECTRA COMPRESSION NOT COMPLETED

The OEMs stopped of their own accord and no action was taken.

8.3.3 IBIS Operations

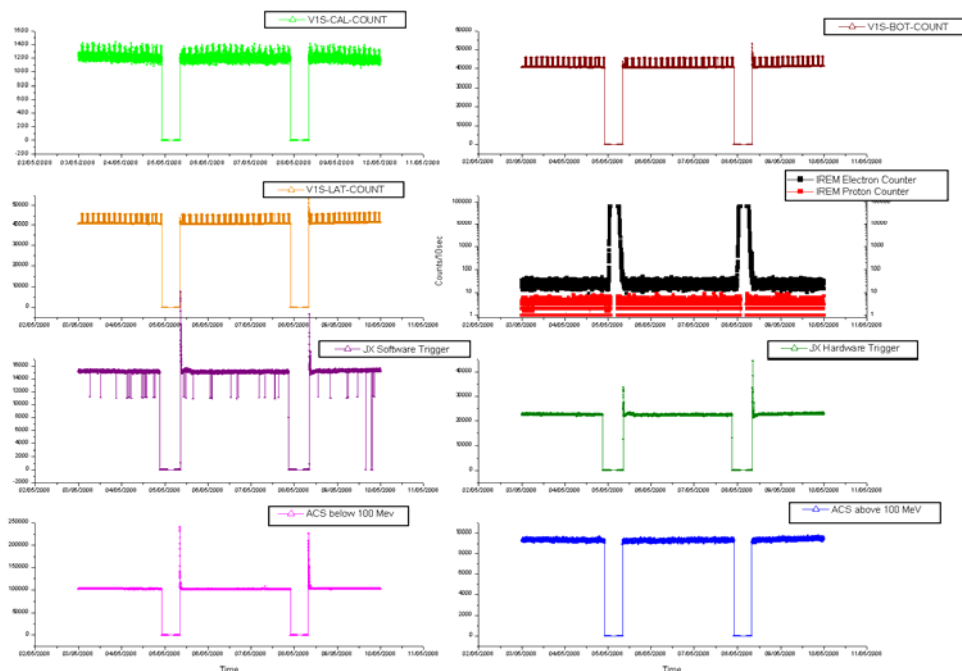
IBIS Event Counters Plots

ISGRI Counters:



VETO vs Payload Counters:

IBIS-VETO vs Payloads Counters Rev 678-680

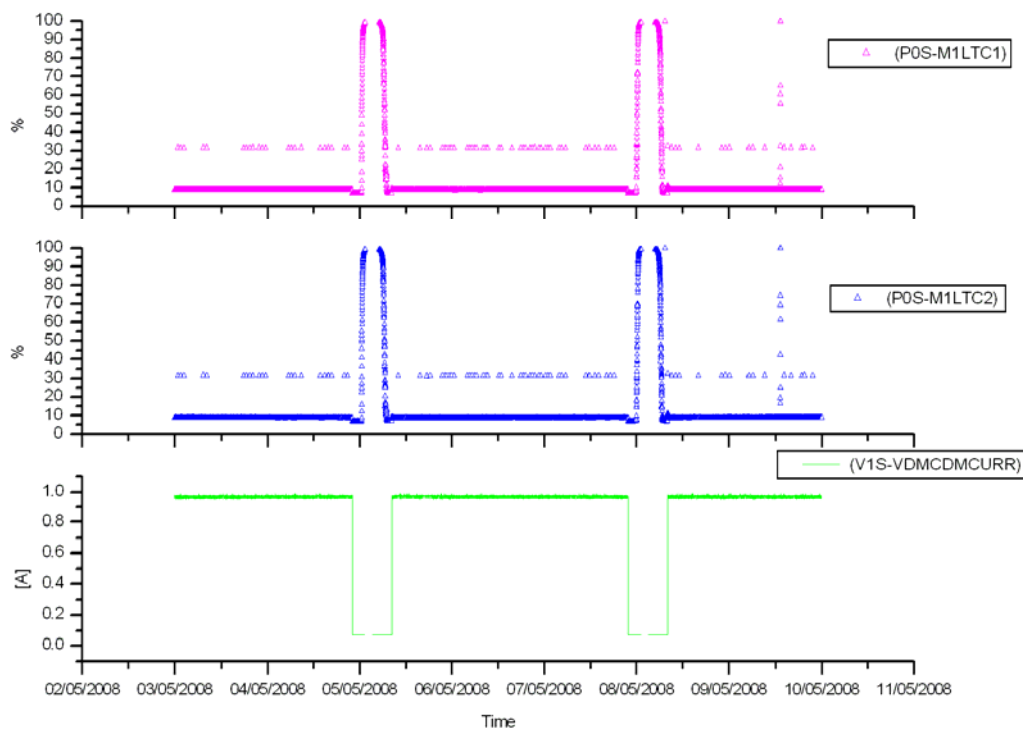


*with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

The week was characterised by slightly high radiation after the expected radiation belt exit of these revolutions as reported by the payload.

VETO Current:

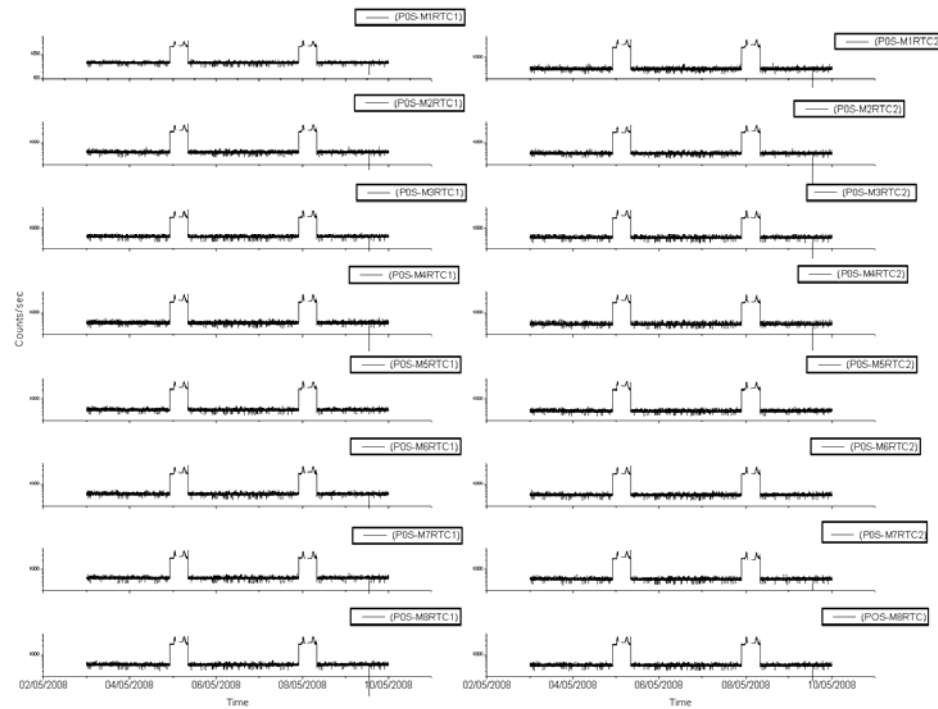
IBIS-VETO Current & PICsIT dead times Rev 678-680



**sampling every 4 pkts (32 secs)

PICsIT Counters:

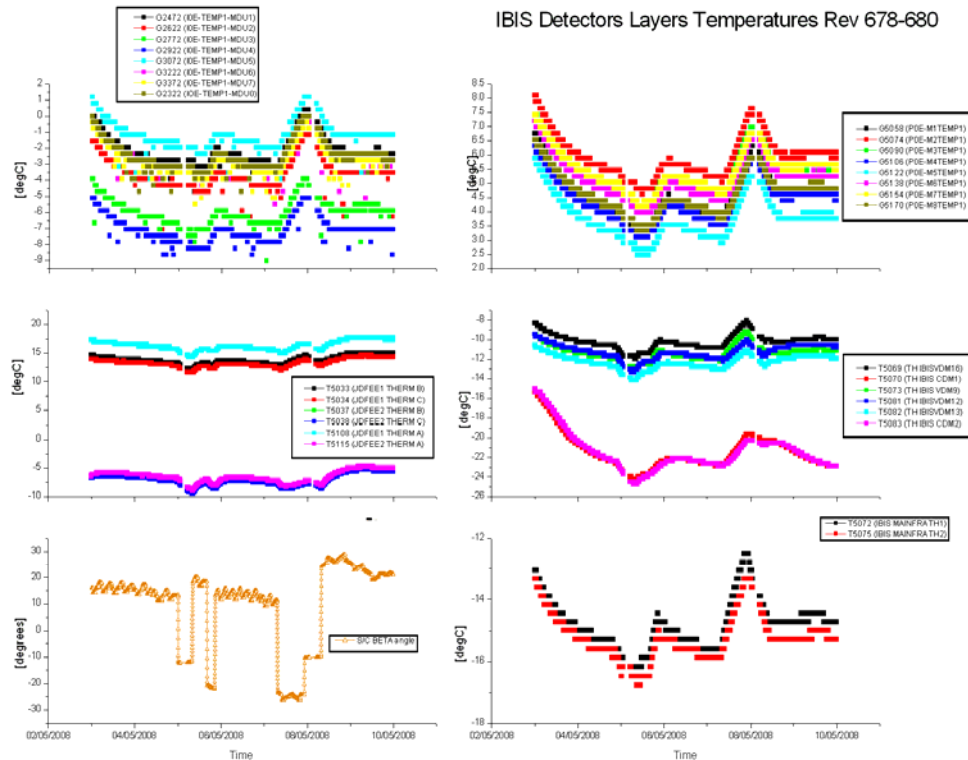
IBIS - PICsIT Counters Rev 678-680



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:

IBIS Detectors Layers Temperatures Rev 678-680



**sampling every 8 pkts (64 secs)

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.

In addition:

- At the start of revolutions 679 and 680, during the execution of the ED GEISCL03, the TM parameter family G2013 started toggled OOL Warning High. These are the number of events triggering the MCEi per second. They all returned within limits of their own accord shortly after radiation belt exit and no action was taken.
- Following a request from the IBIS PI, the Module Counter Maximum of the Noisy Pixel Handling System was changed from 10000 to 20000 at the start of each revolution. This was done by disabling the Timeline such that the ED GEISCL03 for the ISGRI calibration was not released and a manually edited GEISCL03 sequence with the new parameter value was uplinked instead.

2008-05-03 (DOY 124, Rev 678) to 2008-05-07 (DOY 128, Rev 679)

IBIS operations executed nominally.

2008-05-08 (DOY 129, Rev 679-680)

Due to slightly high radiation after the expected radiation belt exit of revolution 680, from 08:06:31Z to 08:07:35Z the VETO counters, TM parameters G6062 and G6063, were OOL High. As they returned within limits of their own accord, no action was taken.

2008-05-09 (DOY 130, Rev 680)

At 13:14:28Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 13:16:55Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 13:21:13Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

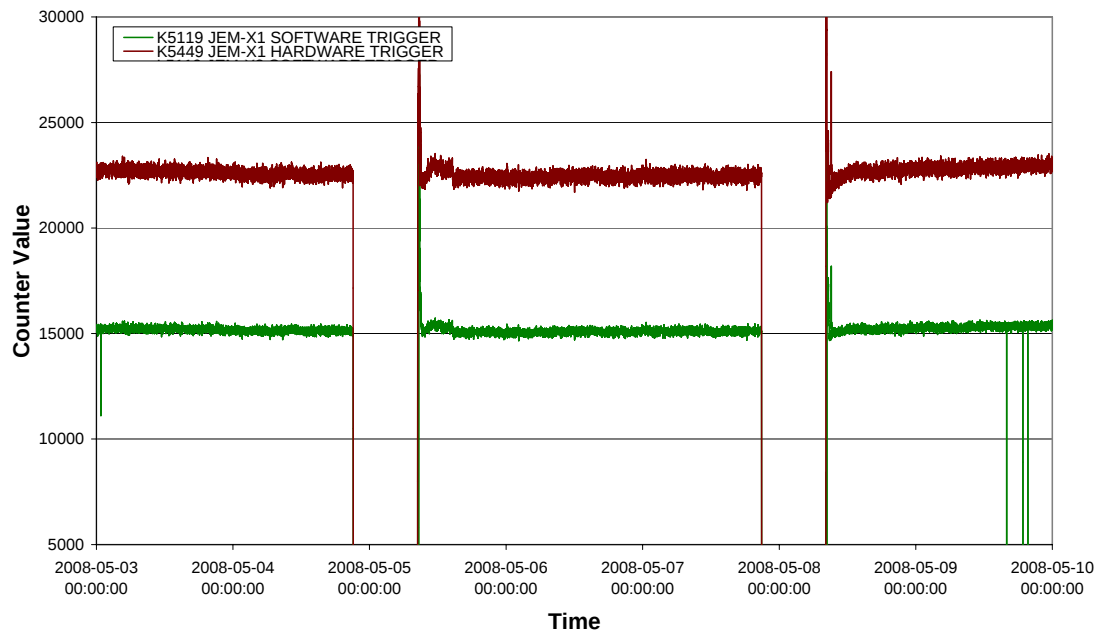
8.3.4 JEM-X Operations

JEM-X Count Rates

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

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

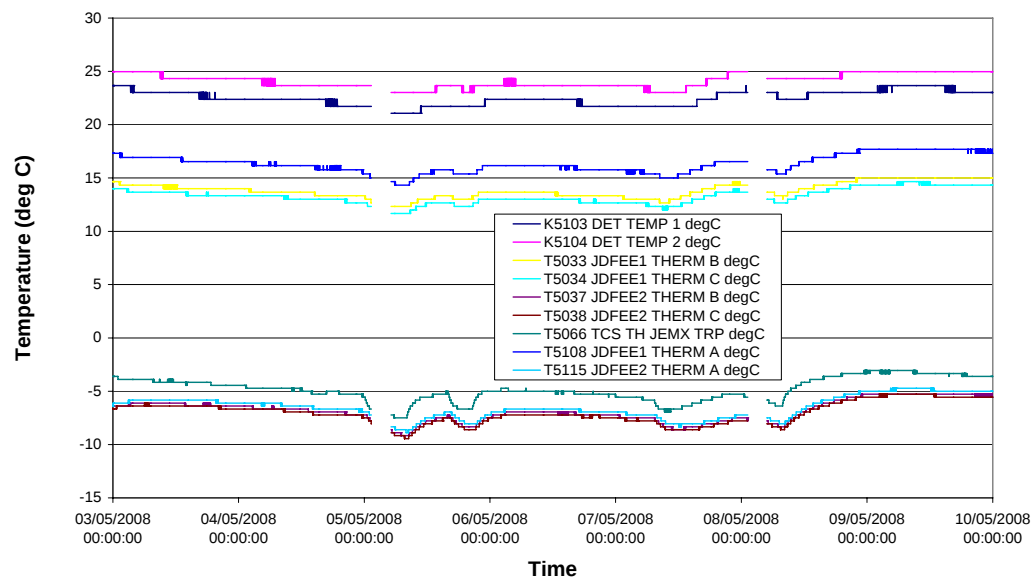
JEM-X Count Rates



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.

JEM-X Detector & DFEE Temperatures



JEM-X Daily Report

2008-05-03 (DoY 124, Rev 678) to 2008-05-04 (DoY 125, Rev 678)

² Data sampled (1 frame in 8)

JEM-X1 operations executed nominally.

2008-05-05 (DoY 126, Rev 679)

From 07:51:45 to 08:09:23 parameter K5317 intermittently exceeded hard limits. From 08:39:13 to 08:40:19 parameter K5136 exceeded soft limits. From 08:39:30 to 08:45:15 parameter K5449 exceeded soft limits. No action was taken on any of the above events, and there was no impact.

2008-05-06 (DoY 127, Rev 679) to 2008-05-07 (DoY 128, Rev 679)

JEM-X1 operations executed nominally.

2008-05-08 (DoY 129, Rev 680)

From 07:35:31 to 08:07:53 parameter K5317 intermittently exceeded hard limits. From 08:12:33 to 08:22:57, parameter K5449 intermittently exceeded soft limits, and at 08:12:50 it briefly exceeded hard limits. At 08:14:35 parameter K9128 briefly exceeded soft limits. From 08:16:18 to 08:19:32, parameter KD5020D briefly exceeded hard limits. This was during start-up, and cleared without intervention. It was at this time the following OEMs were received:

2008.129.08.14.30.763	2008.129.08.14.35.034	1536	RealTime	189	EVENT		
JEM-X1 PROB DFEE 9			0	0	65535	PR	N
E E							
2008.129.08.19.26.763	2008.129.08.19.31.626	1536	RealTime	254	EVENT		
ERROR OFF			0	0	65535	PR	N
E E							

From 08:20:01 to 08:23:48, parameter K5136 intermittently exceeded soft limits. No action was taken on any of the above events, and there was no impact.

2008-05-09 (DoY 130, Rev 680)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2008-05-03 (DoY 124, Rev 678) to 2008-05-08 (DoY 129, Rev 680)

Nothing to Report.

2008-05-09 (DoY 130, Rev 680)

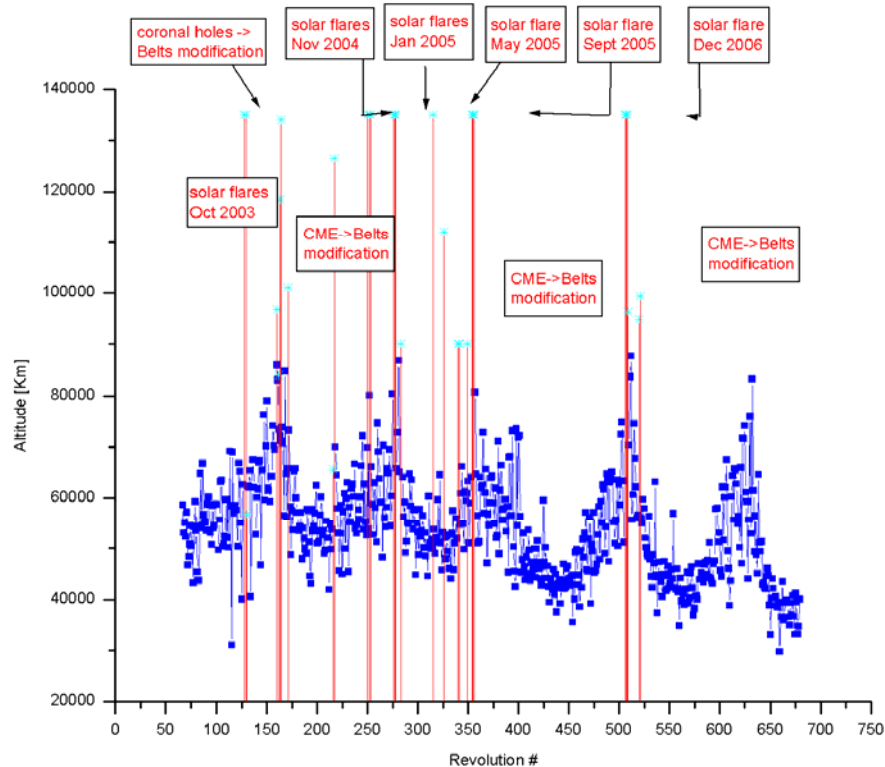
At 16:27:48, a Flat Field calibration commenced. This continued nominally until 18:49:31. Subsequently, a Dark Current calibration was executed from 18:50:01 until 19:21:41, also nominally.

On DoY 125 at 22:01:45 and DoY 128 at 21:48:01 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]
678	RAD_ENTR R 2008-05-04T22:01:41Z	05/05/2008 00:24:08	34728.3	04-May-2008 23:39:33	41764.75
679	RAD_EXIT R 2008-05-05T08:02:59Z	05/05/2008 08:10:08	53947.2	05-May-2008 07:09:33	45423.37
679	RAD_ENTR R 2008-05-07T21:47:58Z	07/05/2008 23:38:28	40018.0	07-May-2008 23:28:15	41792.94
680	RAD_EXIT R 2008-05-08T07:48:12Z	08/05/2008 08:08:16	55554.2	08-May-2008 06:58:15	45543.86

Reference

High radiation

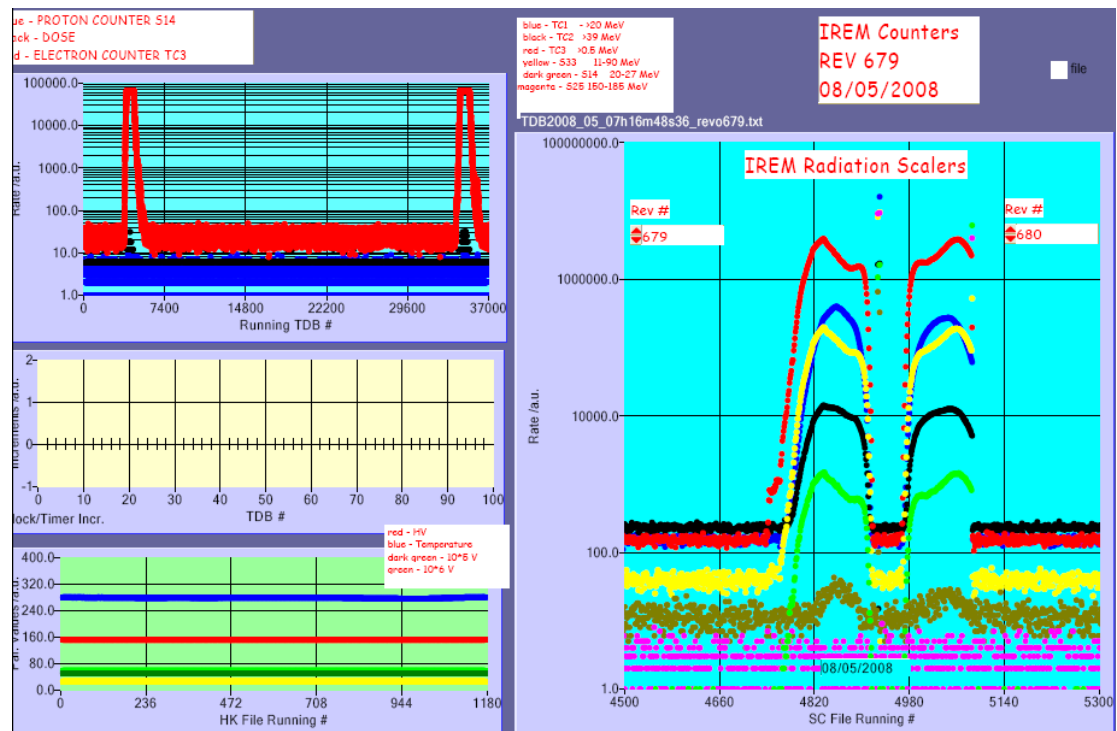
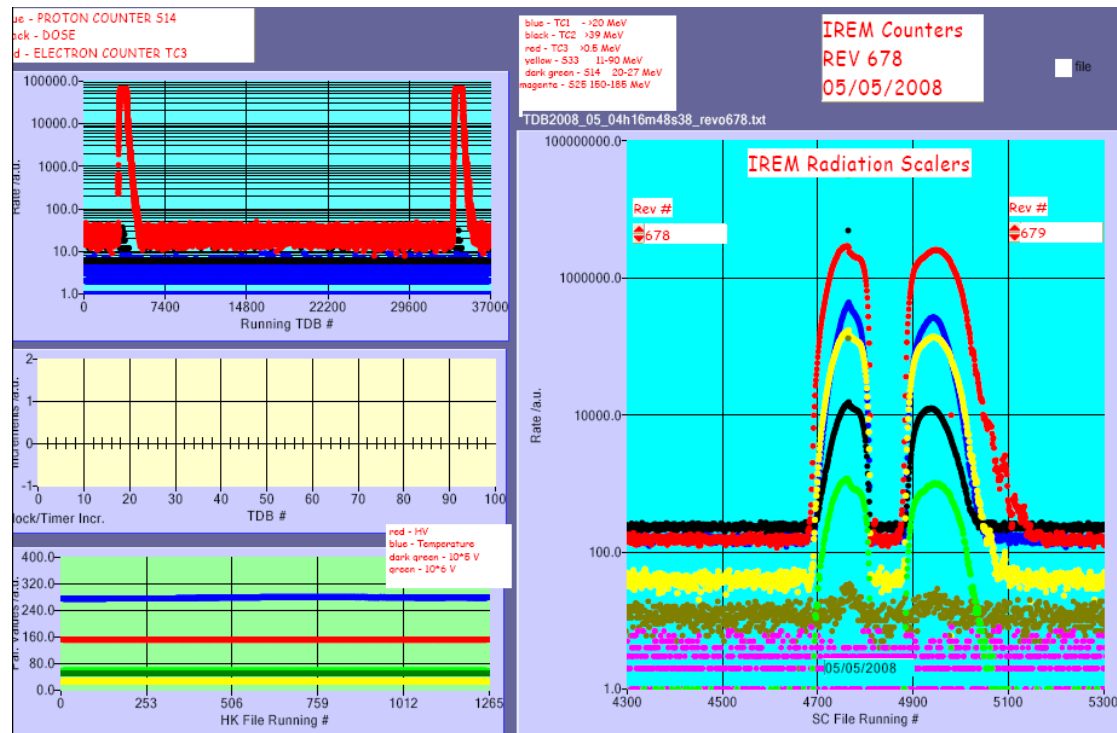
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

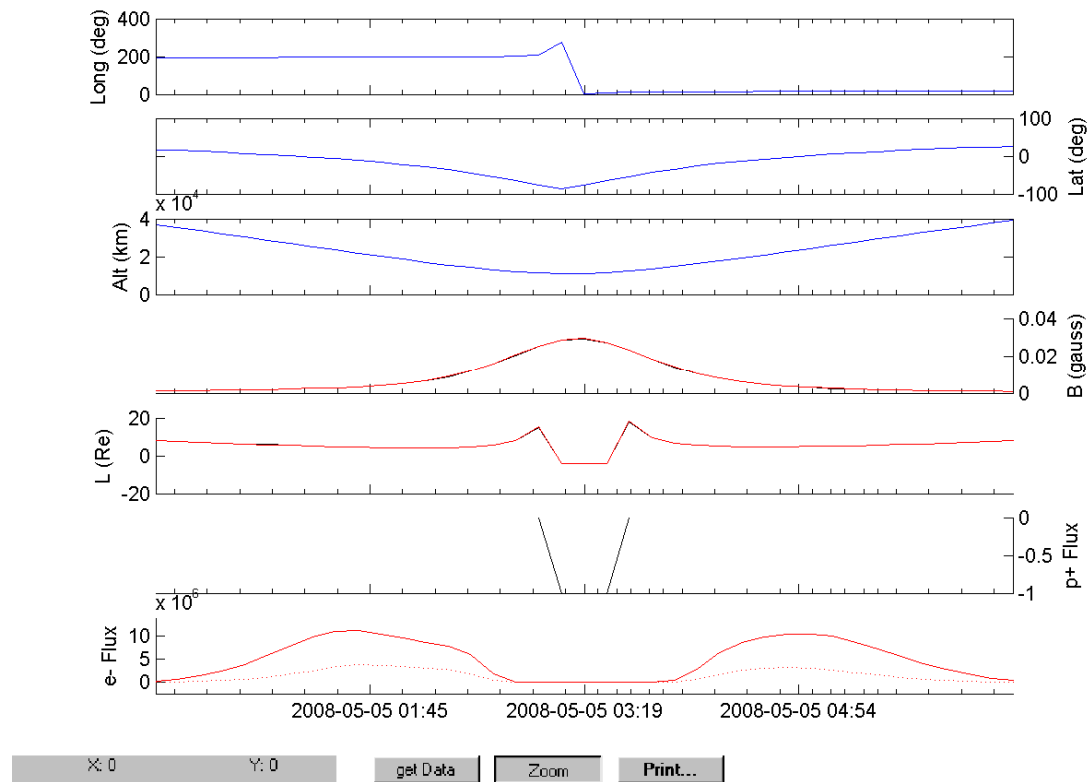
* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

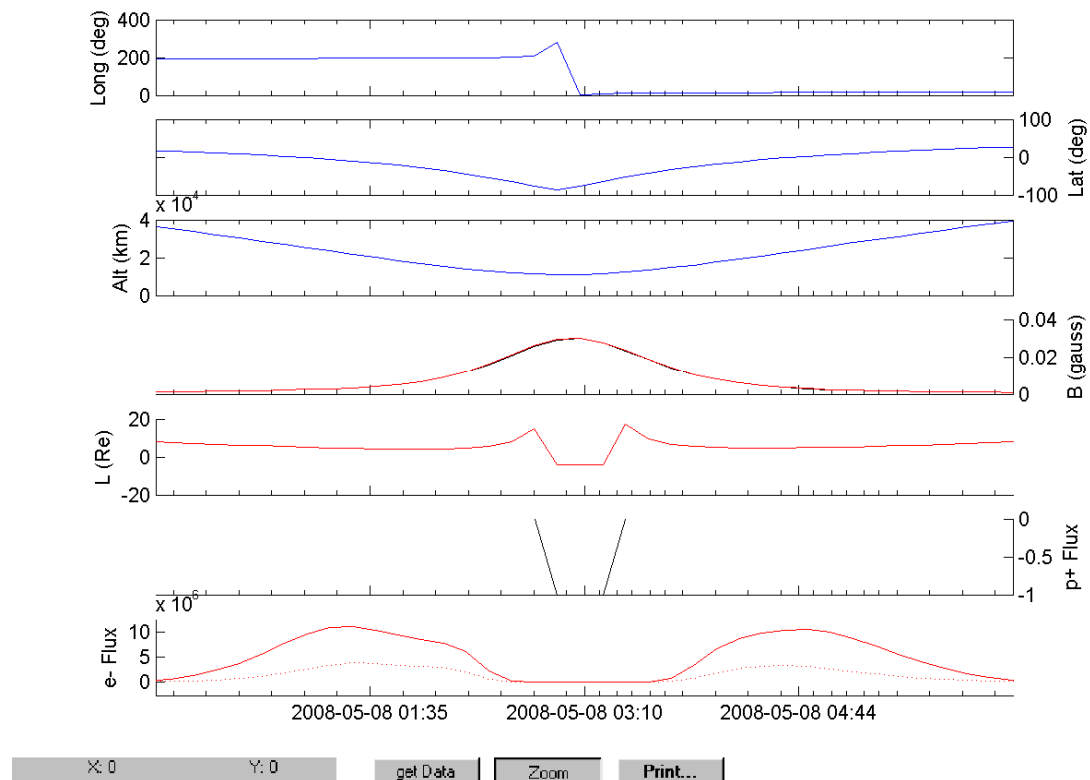


IREM Predicted Radiation Belt Passages

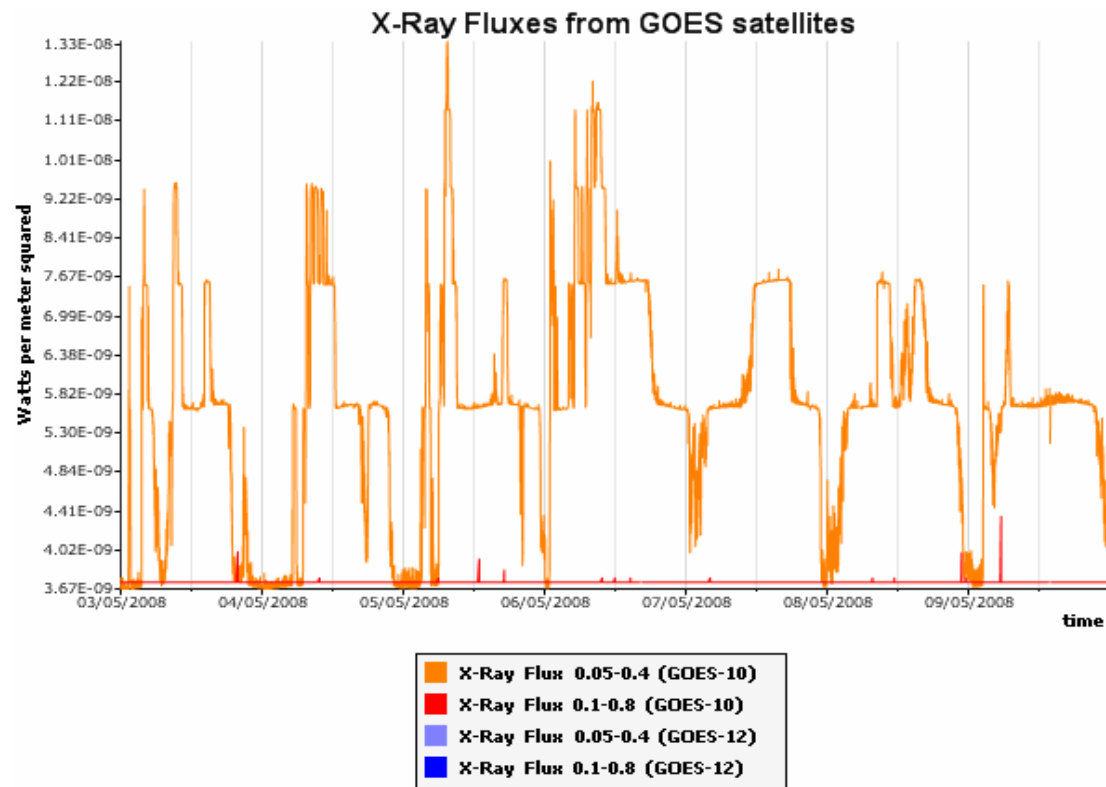
Rev 678



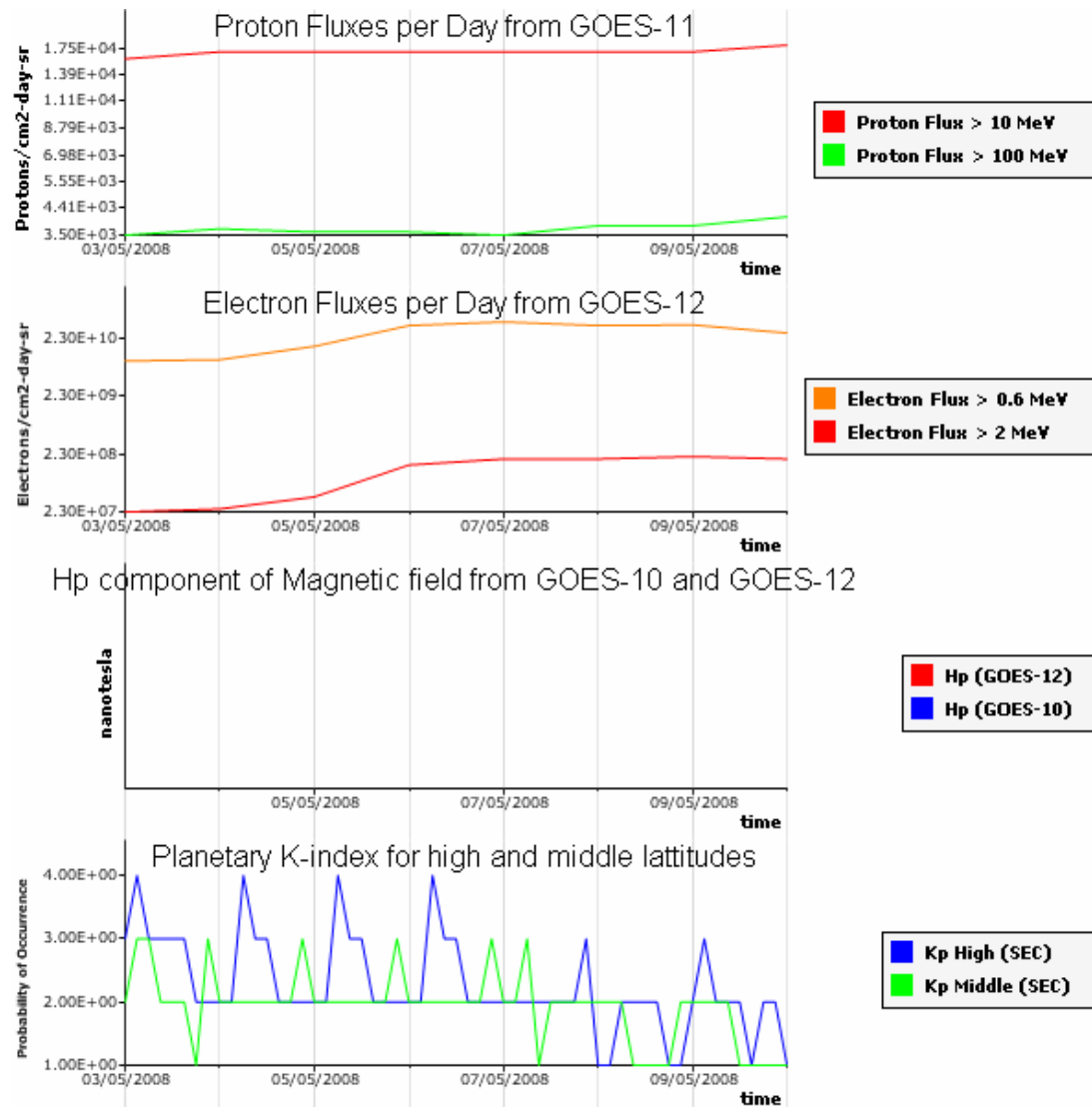
Rev 679



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.