EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-OPS-OAI

No. 306
Week 31

04.08.08

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 26.07.08 until 01.08.08 (both dates inclusive) and covers the revolutions 707 and 708.

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).

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 26/07/2008 and 01/08/2008 was 0.0711 Kg. The remaining propellant is in the order of 139.4183 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

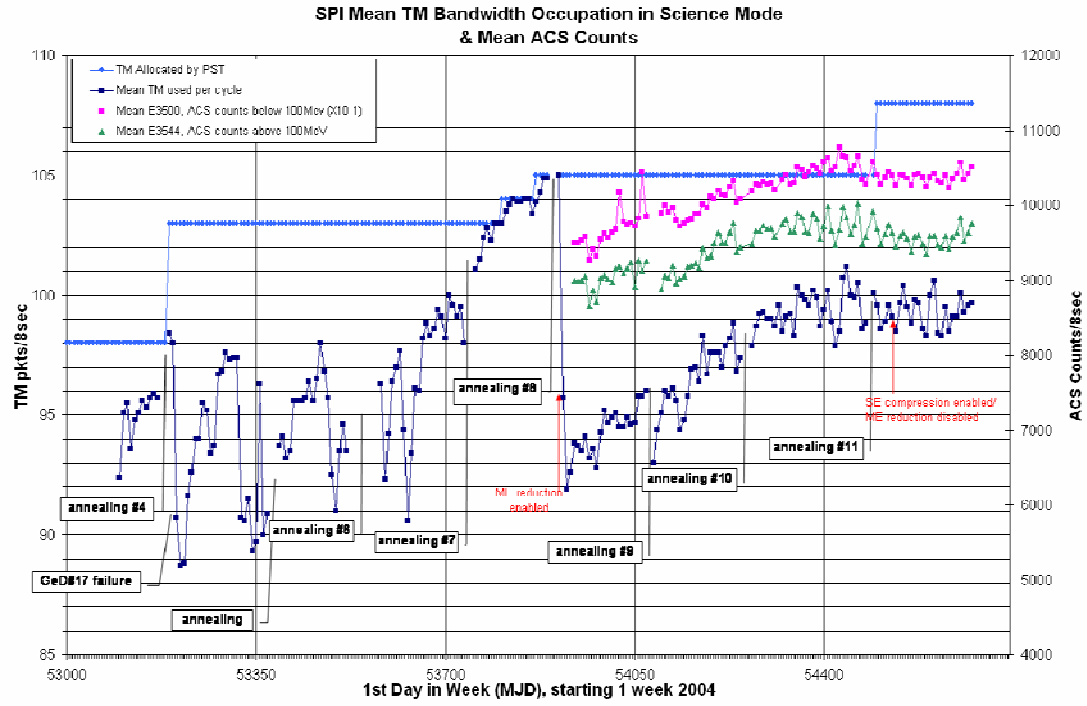
3.2.1 SPI

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 99.7 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.

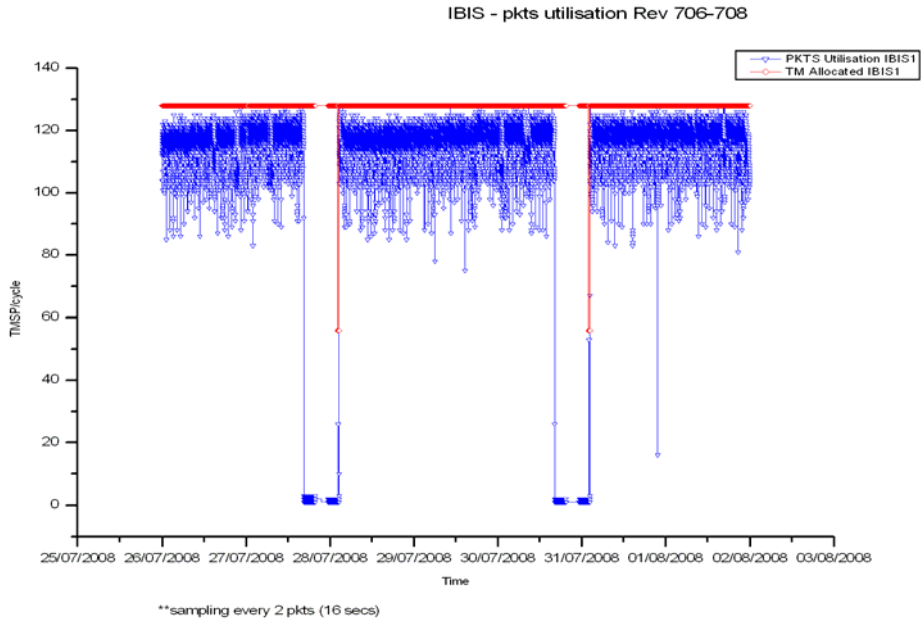
3.2.2 IBIS

The overall status of the unit is nominal.

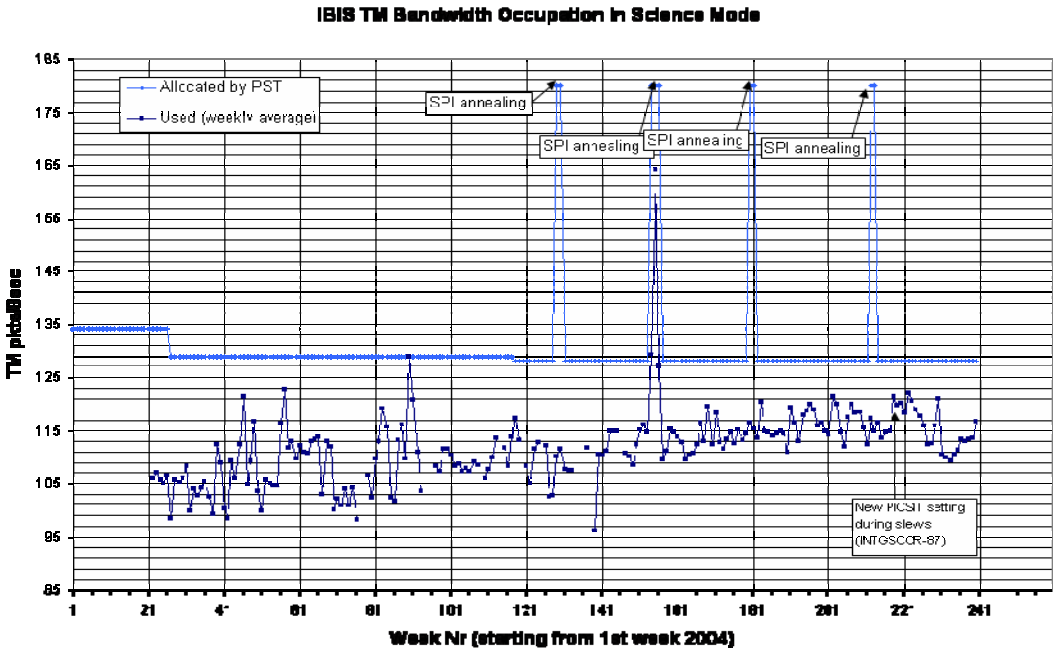
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 116.69 packets/cycle (up 2.93 on last week)
- Percentage of TM cycles in which full bandwidth was used: 0.10%.

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, 140 of the 141 planned science pointings were executed nominally, 1 pointing was lost.

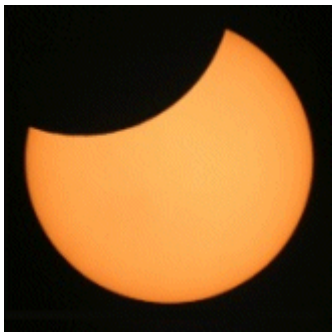
Note: Some more information concerning the OMC operations is provided in the Appendix.

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. A solar eclipse as viewed from the earth was visible on 1st August.



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. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. There was one instance where the FD system failed to update a slew, there was no 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, one of which led to the loss of OMC data for one pointing, and one drop from DSS27. The link to ISDC also dropped briefly once.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Now new PSFs have been received - the latest received is the PSF for revolution 713.

New TSFs have been received for revolutions 711 and 712.

2. Observation status

New ECS files were received for revolutions 696 to 700.

3. ISOC Science Data Archive

The 3rd ISGRI Catalogue and related ISDC data products have been prepared for inclusion in the general Archive system and the next Archive release.

4. ISOC system

Work is continuing on ISOC system V19.4 foreseen for end August.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 04/08/2008:

- 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

The following problem was reported this week that impacted operations.

- On DoY 209, at 00:35, the TM from DSS-27 dropped. Two minutes later, the TC dropped as well. At 00:51, the links return, but drop immediately. At 00:54, the links returned, and a recovery was performed. No slews were lost.
- On DoY 211, at 18:40, a drop in TC to Redu caused the OMC pointing commands to fail uplink. The links returned at 18:46. The impact was the loss of the OMC pointing 07070041.

There were no anomaly reports entered into the ARTS system this week.

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.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 707

The observations in revolution 707 consisted entirely of a raster dither of the Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), lasting ~57.9 hours.

Revolution 708

The observations in revolution 708 consisted entirely of a raster dither of the Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), lasting ~57.9 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

```
2008-07-10T01:16:53.000Z     139.7750    F   Automatic TM processing.
2008-07-11T10:51:12.000Z     139.7218    F   Automatic TM processing.
2008-07-13T01:06:44.000Z     139.7195    F   Automatic TM processing.
2008-07-14T11:21:12.000Z     139.6937    F   Automatic TM processing.
2008-07-16T00:57:24.000Z     139.6844    F   Automatic TM processing.
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.

This report was generated  Fri Aug 1 08:00:12 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, 26/07/2008 – 01/08/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 72 Open Loop Slews, 75 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC).

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

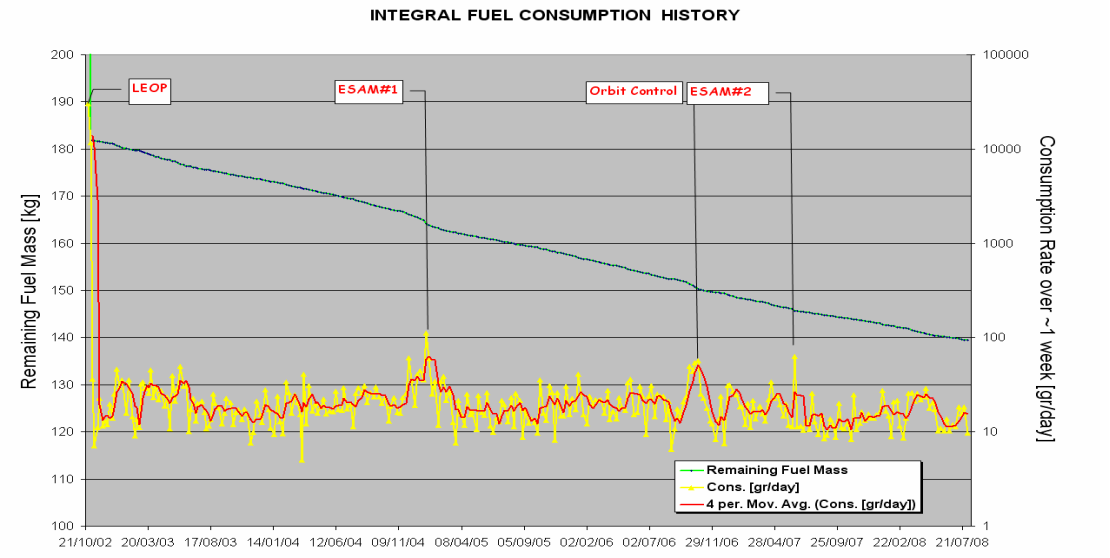
The OTF was not reached (partially) during PID 07060038 and 07080038 due to loss of guide star after an open loop slew.

Orbit Control

No update

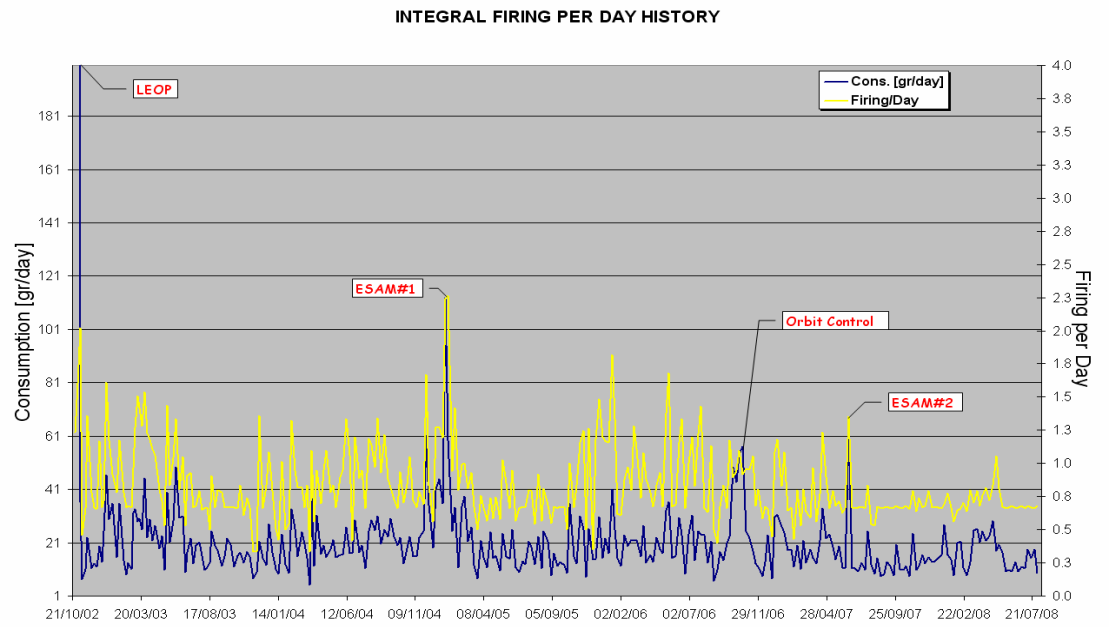
Fuel consumption

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



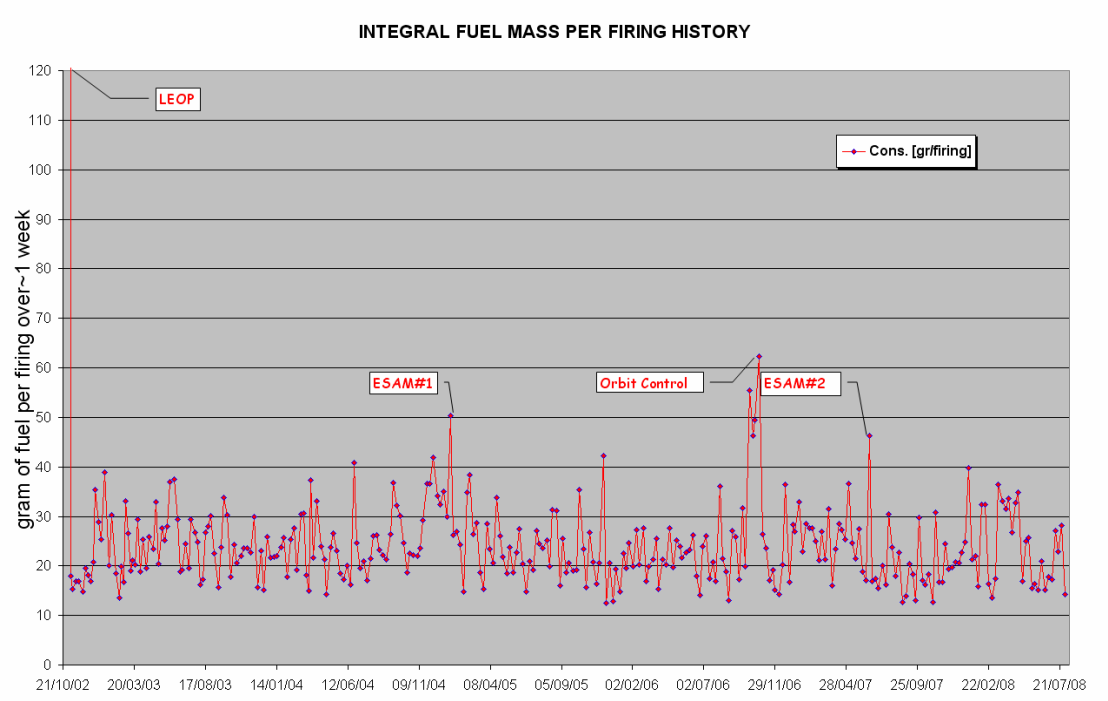
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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



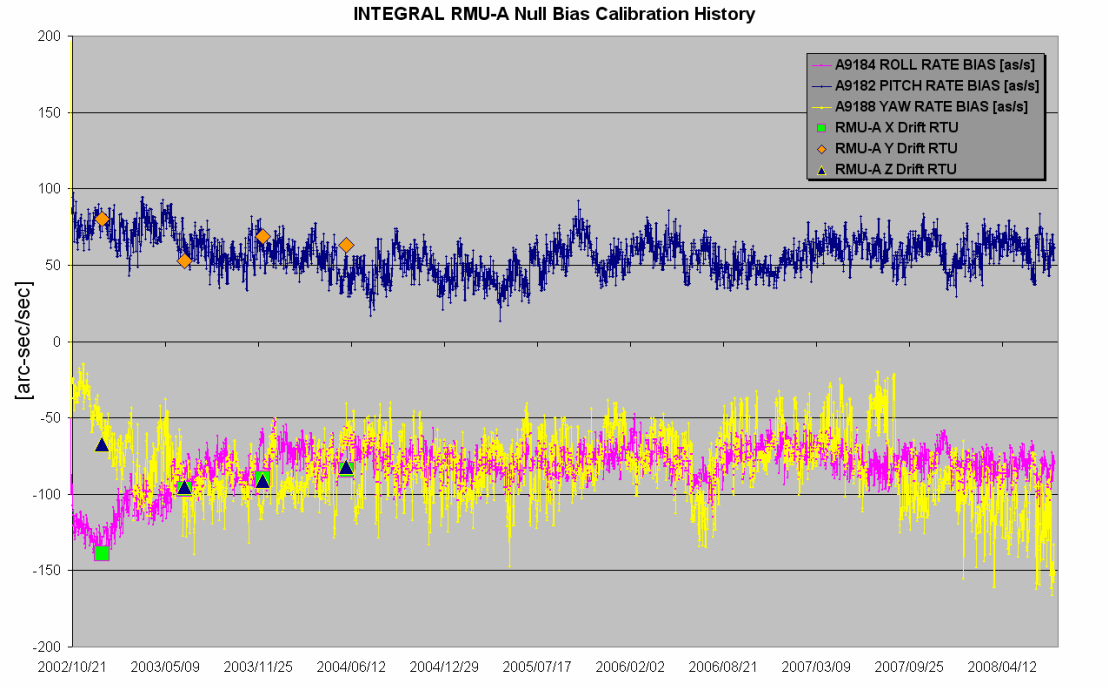
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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

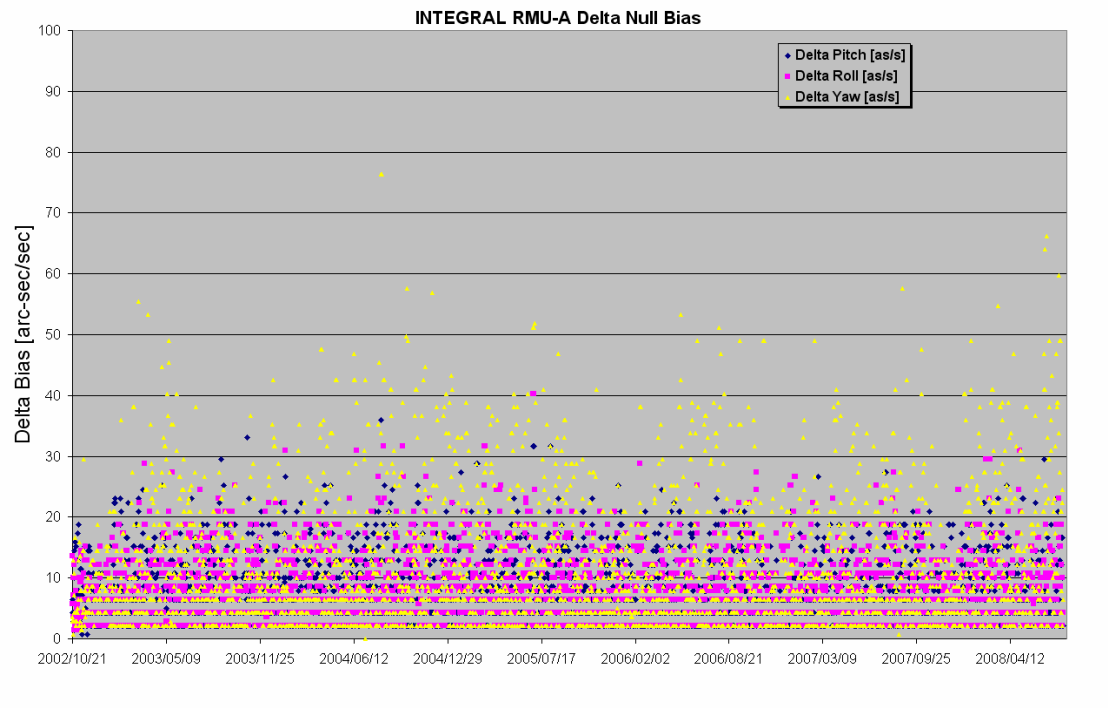


The RMU-A null bias calibration

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



26/07/2008 (Day of Year 208, Revolution 706)

Nothing to report.

27/07/2008 (Day of Year 209, Revolution 706)

Problem at DSS station: at 04:53z the FDS failed the update of slew ID 07060049 due to a problem with the antenna at DSS station: the mapping after slew 07060048 failed released (due to missing TC/TM links) and FDS reported an error during the update process.

A manual recovery was performed at 01:02z and the slew ID 07060049 was manually updated in TL.

No impact on TL.

FDS failed slew update: at 04:53z the FDS failed the update of slew ID 07060053. FDS reported an error during the update process.

A manual recovery was performed and the slew ID 07060053 was manually updated in TL.

No impact on TL.

28/07/2008 (Day of Year 210, Revolution 706-707)

Nothing to report.

29/07/2008 (Day of Year 211, Revolution 707)

Nothing to report.

30/07/2008 (Day of Year 212, Revolution 707)

Nothing to report.

31/07/2008 (Day of Year 213, Revolution 707-708)

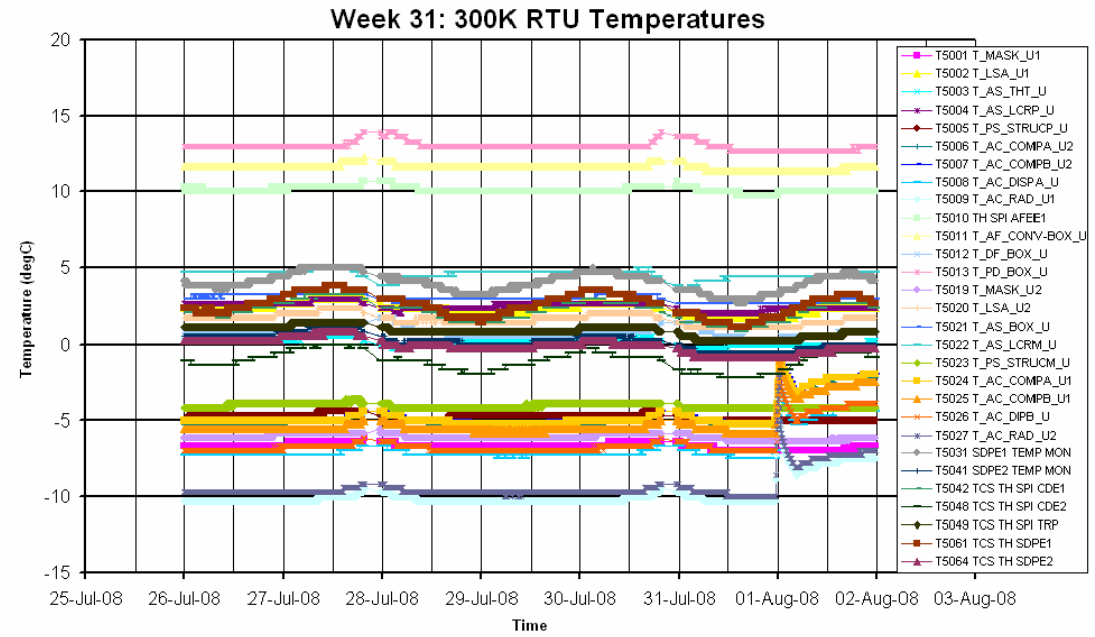
Nothing to report.

01/08/2008 (Day of Year 214, Revolution 708)

Nothing to report.

8.3.2 SPI Operations

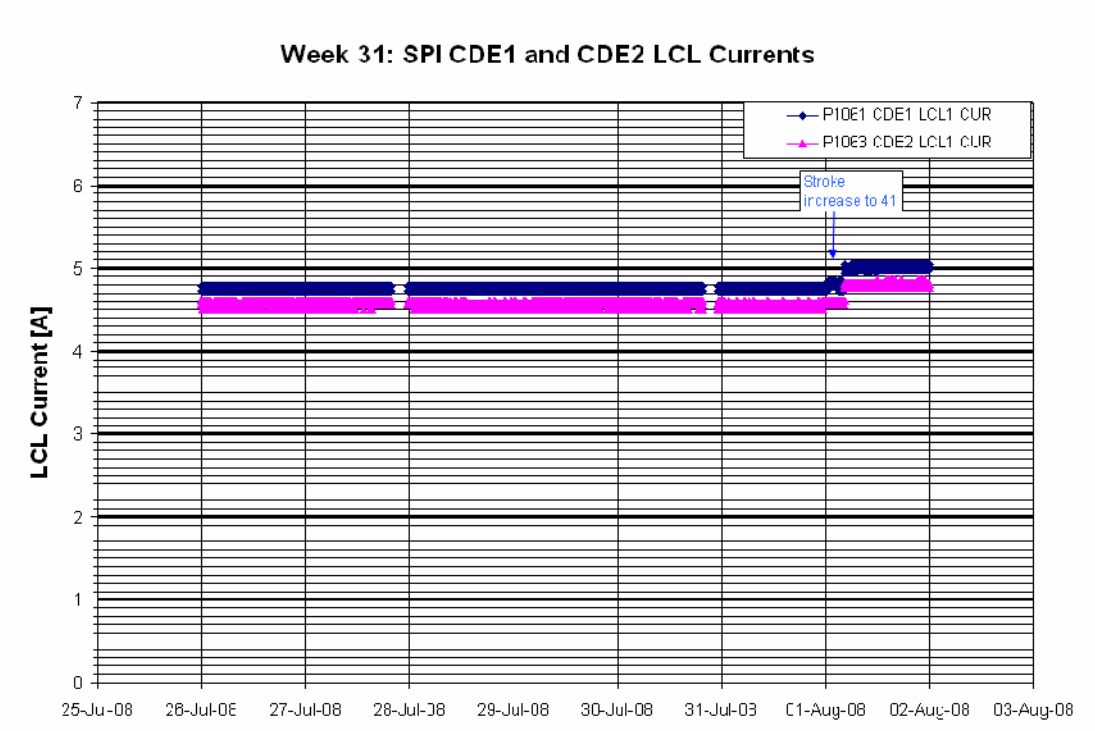
Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period.



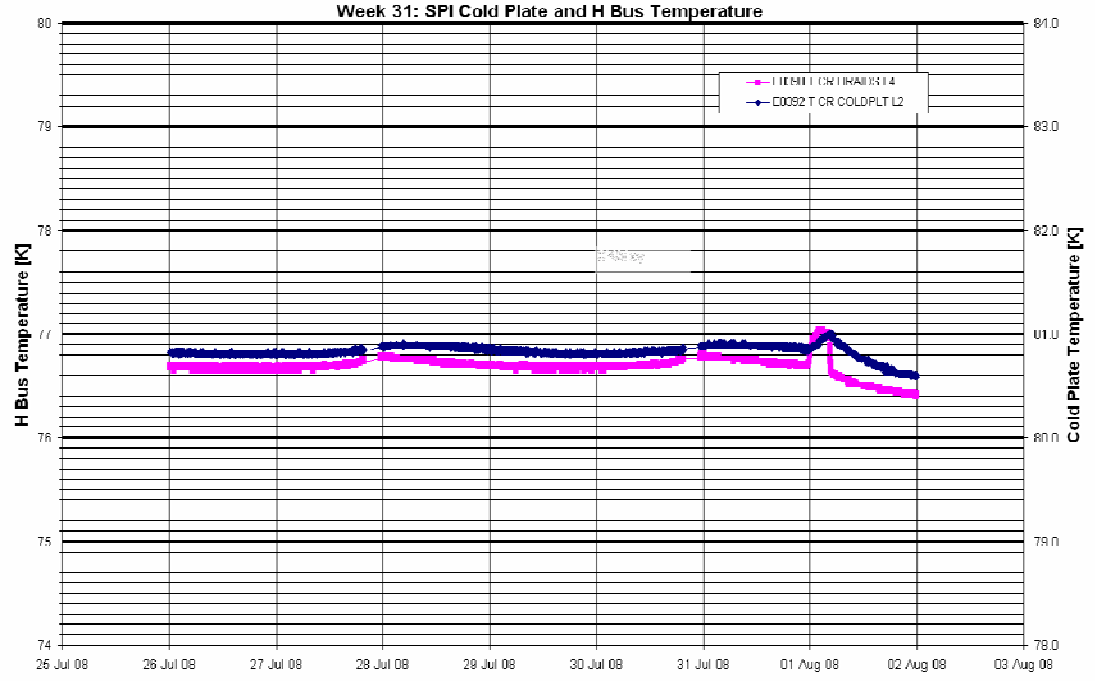
Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

The stroke of all four compressors was set to 40 until 2008-08-01 at 04:19:26Z, when the stroke of all four compressors was increased to 41 as the Cold Plate temperature had reached 81K. The compressors' stroke remained at 41 for the rest of the reporting period.

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.

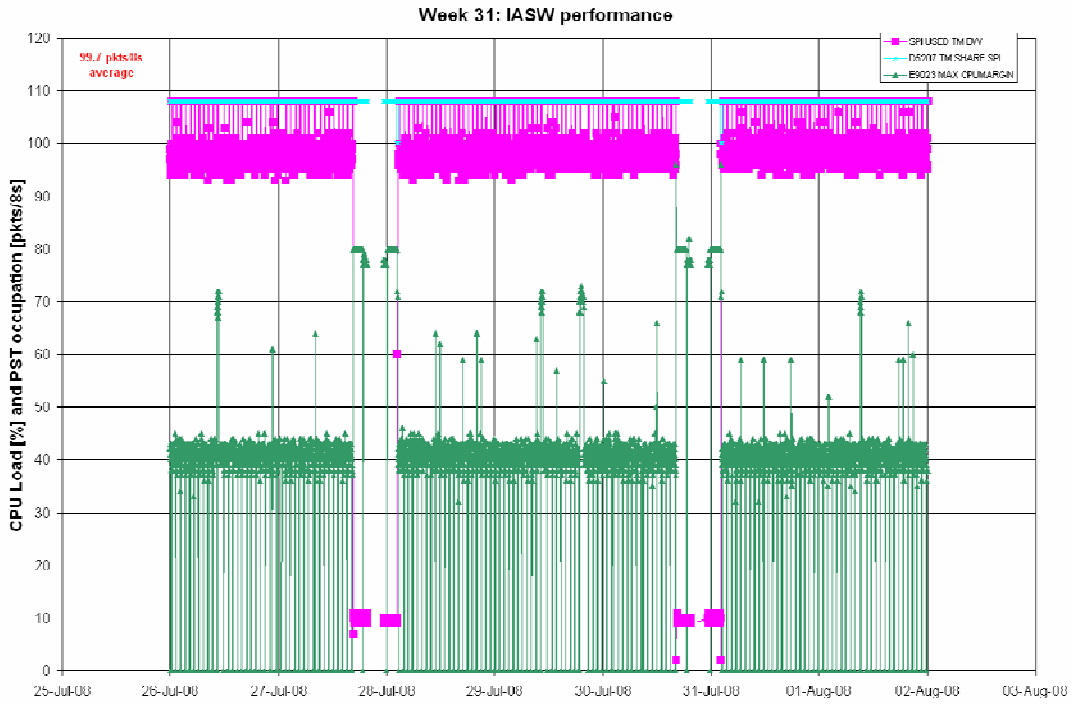


DPE & IASW: The DPE health and IASW performance is nominal.

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

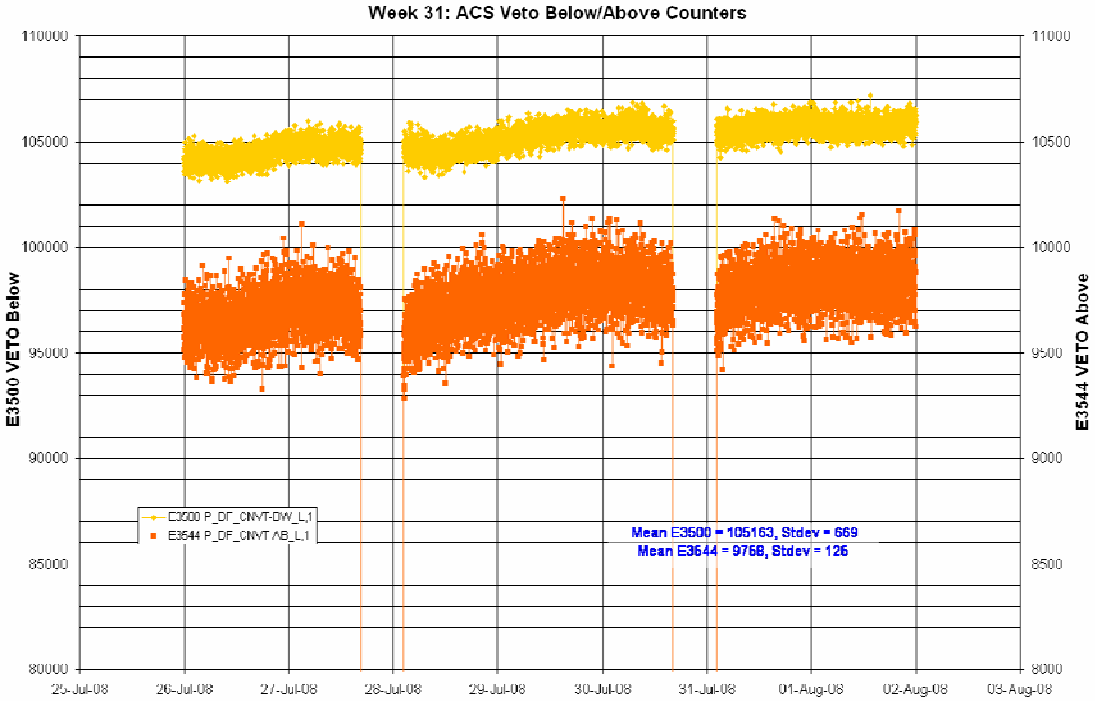
The average TM bandwidth occupation of SPI was 99.7 packets/cycle over the science window when the TM allocation was 108 packets/cycle.

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

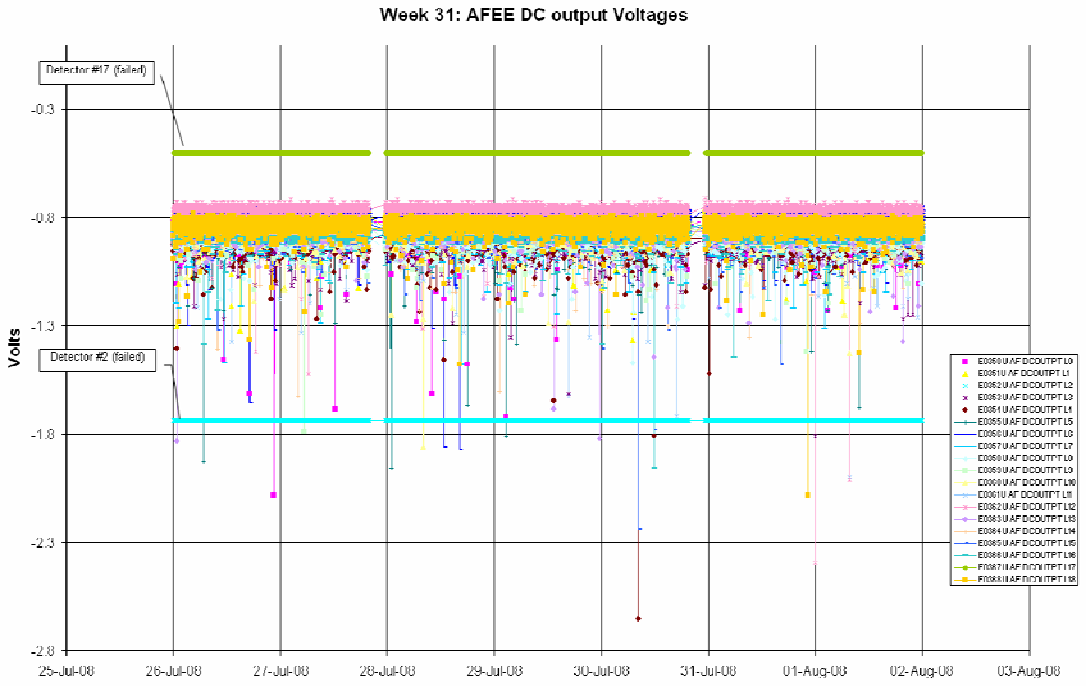


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

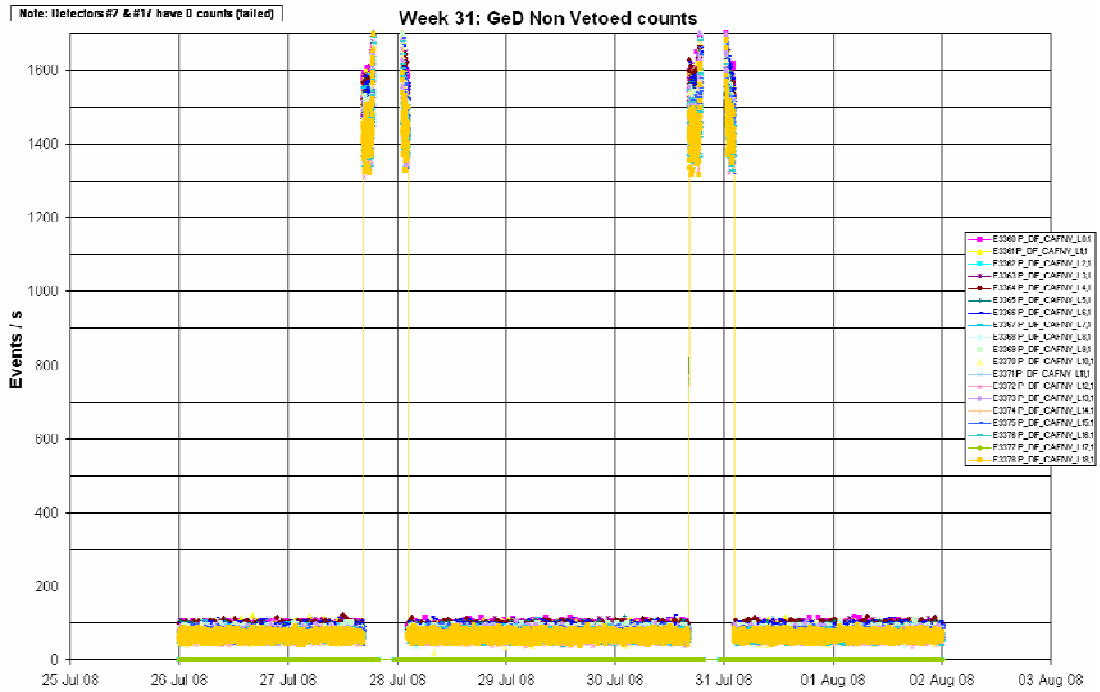
The following plot shows the ACS overall count rate evolution during the reporting period:

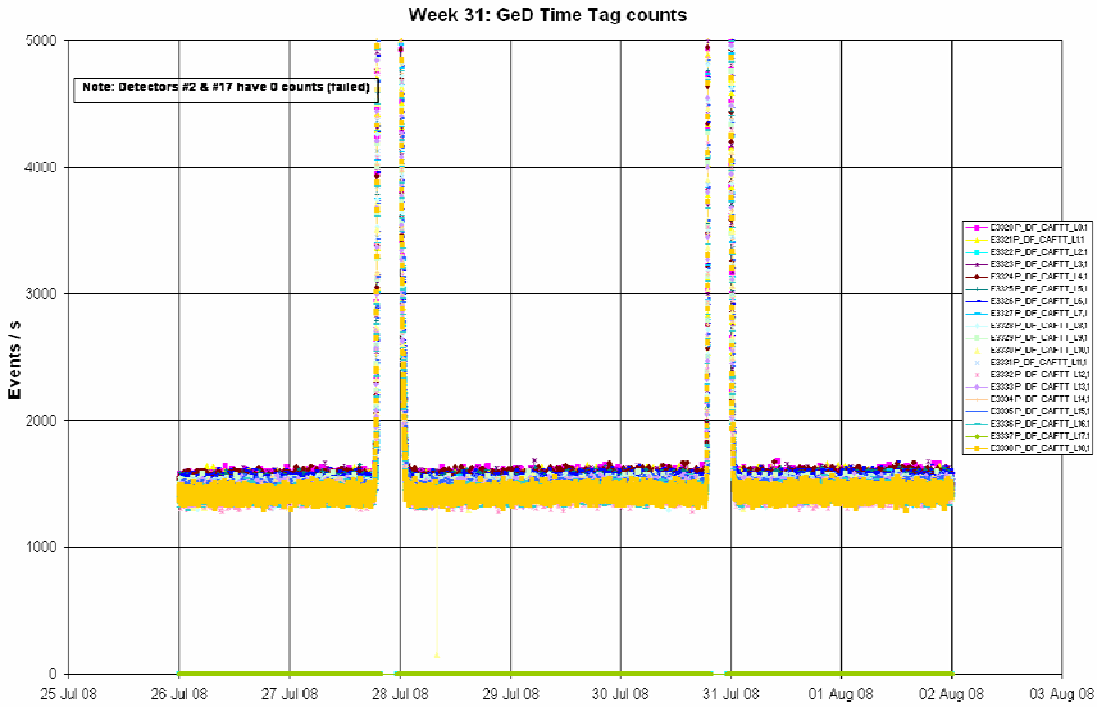


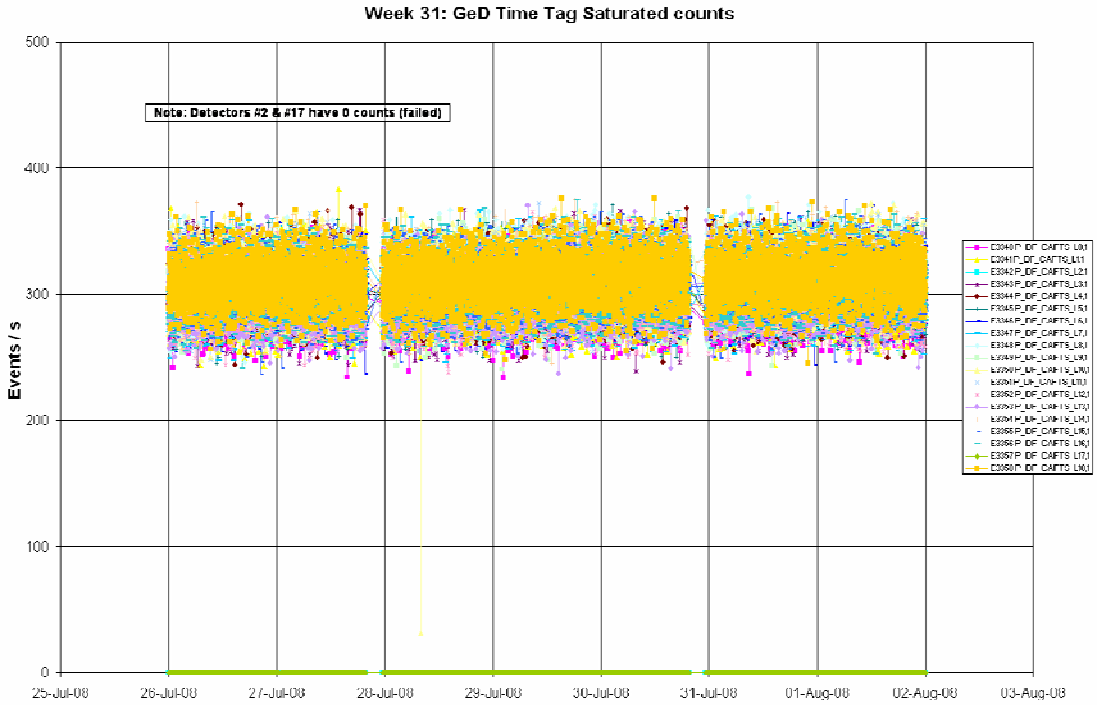
AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.



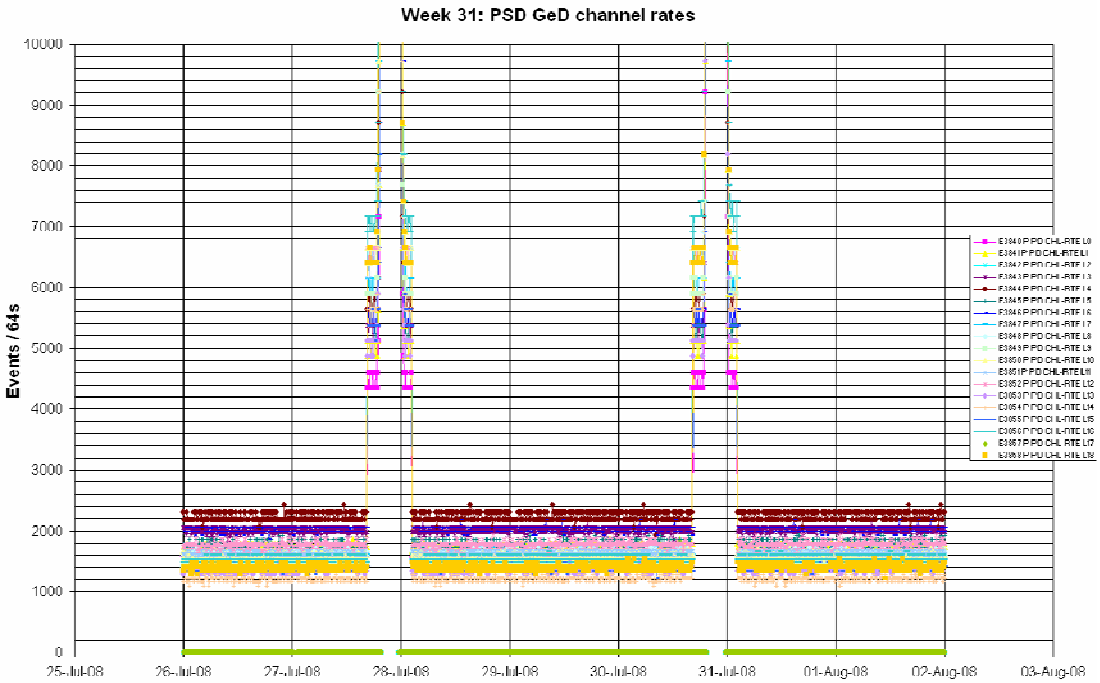
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.







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



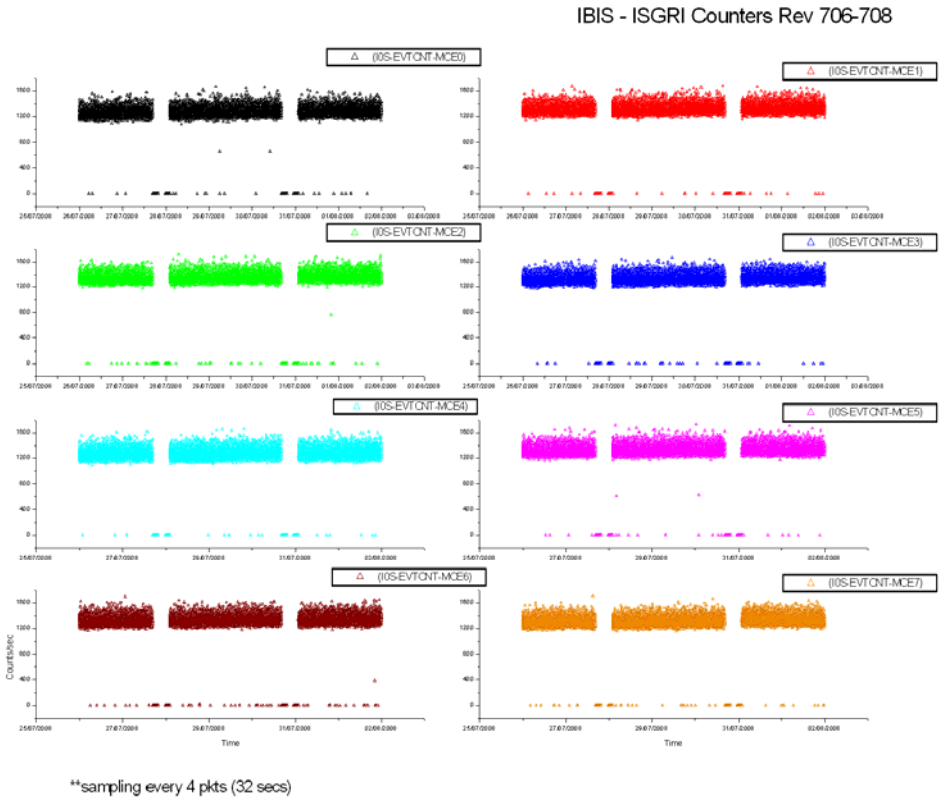
Event Log:

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

8.3.3 IBIS Operations

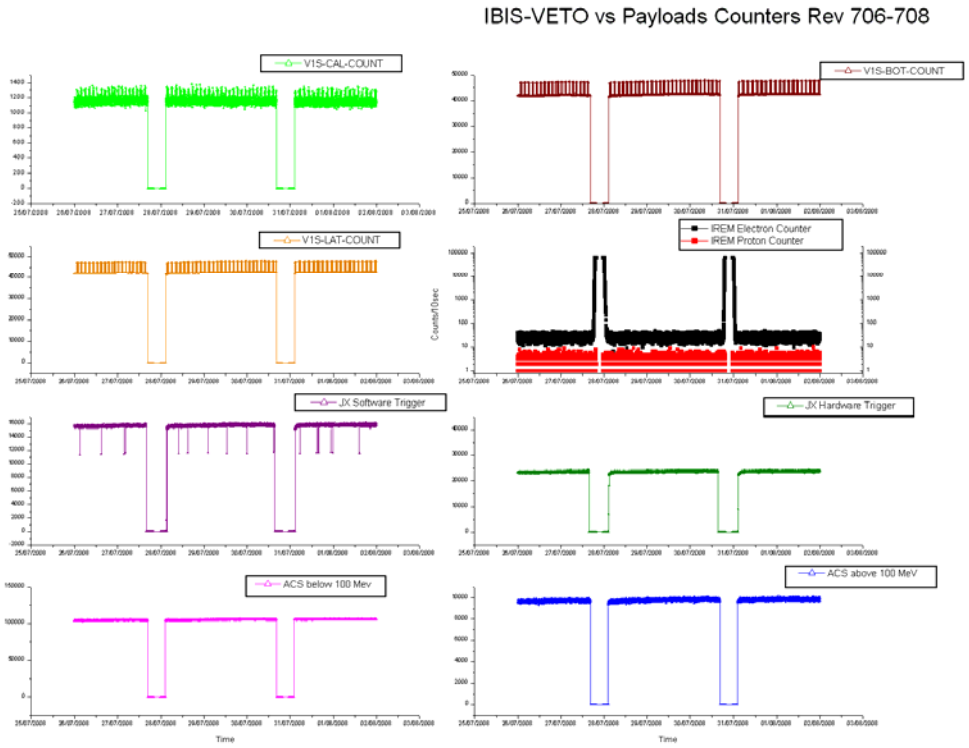
IBIS Event Counters Plots

ISGRI Counters:



**sampling every 4 pkts (32 secs)

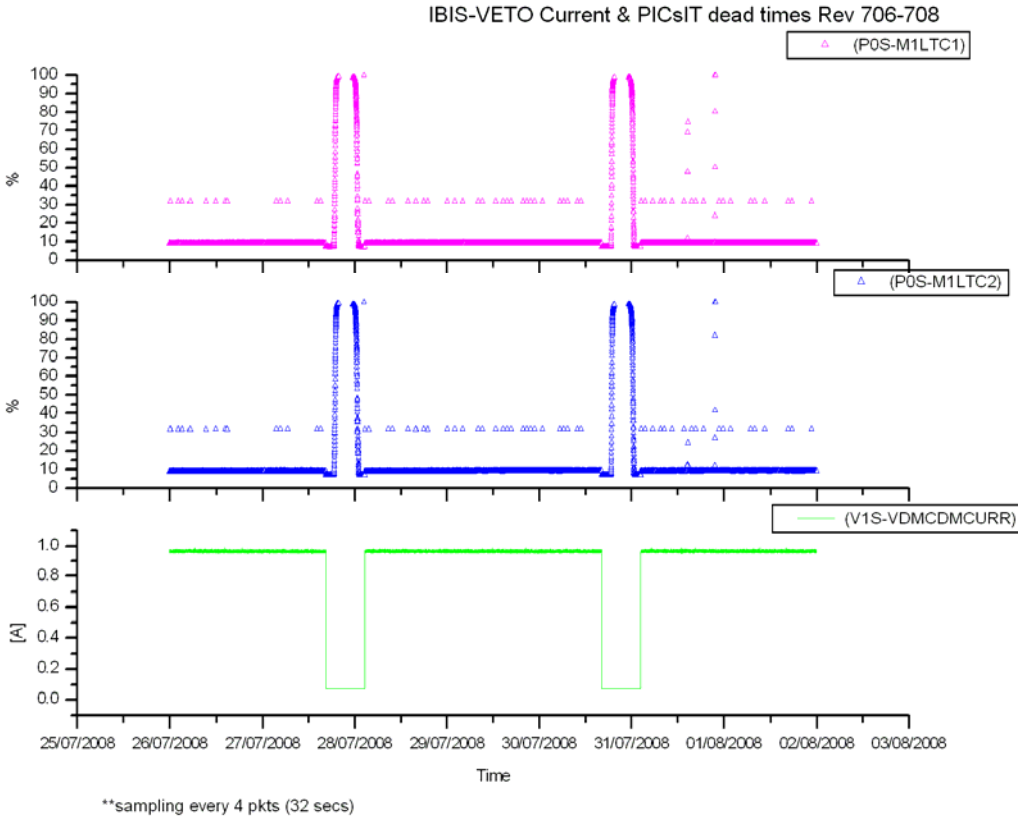
VETO vs Payload Counters:



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

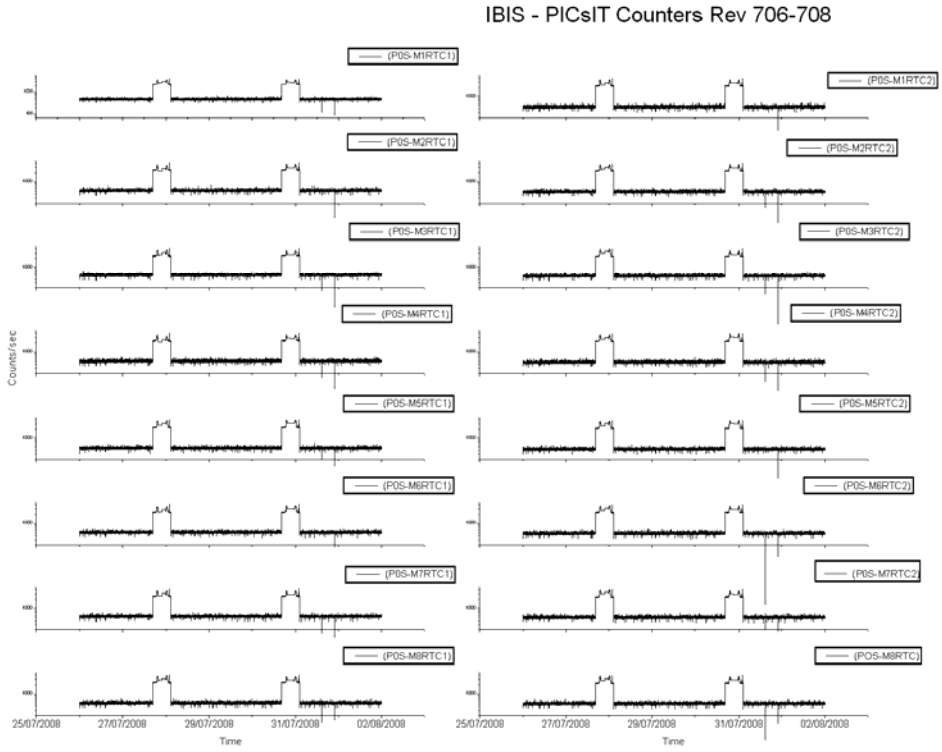
The week was characterised by low radiation as reported by the payload.

VETO Current:



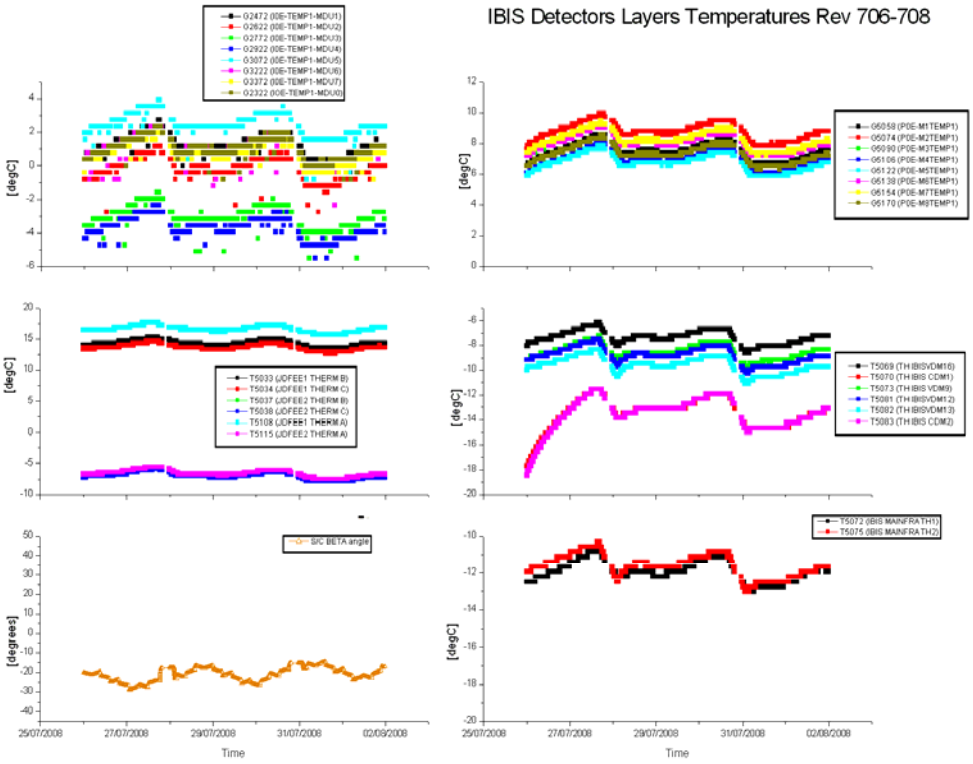
**sampling every 4 pkts (32 secs)

PICsIT Counters:



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:



**sampling every 8 pkts (64 secs)

IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), G5002 (P0S-Mi_RTC1) and G5003 (P0S-Mi_RTC2) families and G2000 family (I0E-OVFWPXADD-Mi) were received during the radiation belt passages.

2008-07-26 (DOY 208, Rev 706) to 2008-07-30 (DOY 212, Rev 707-708)

IBIS operations executed nominally.

2008-07-31 (DOY 213, Rev 708)

At 01:58:28Z, during the execution of the ED GEISCL03, TM parameter G2111 went OOL Low (value = 0). This is the number of events triggering the MCE7 per second. As it returned within limits of its own accord at 02:00:04Z, no action was taken.

At 14:38:17Z several parameters in the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 14:39:00Z TM parameter G5028 (PDM6 semimodule #2 counter) also went OOL Low. As these parameters had all returned within limits of their own accord by 14:40:57Z, no action was taken.

At 21:47:05Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 21:47:56Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 21:51:26Z 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.

2008-08-01 (DOY 214, Rev 708)

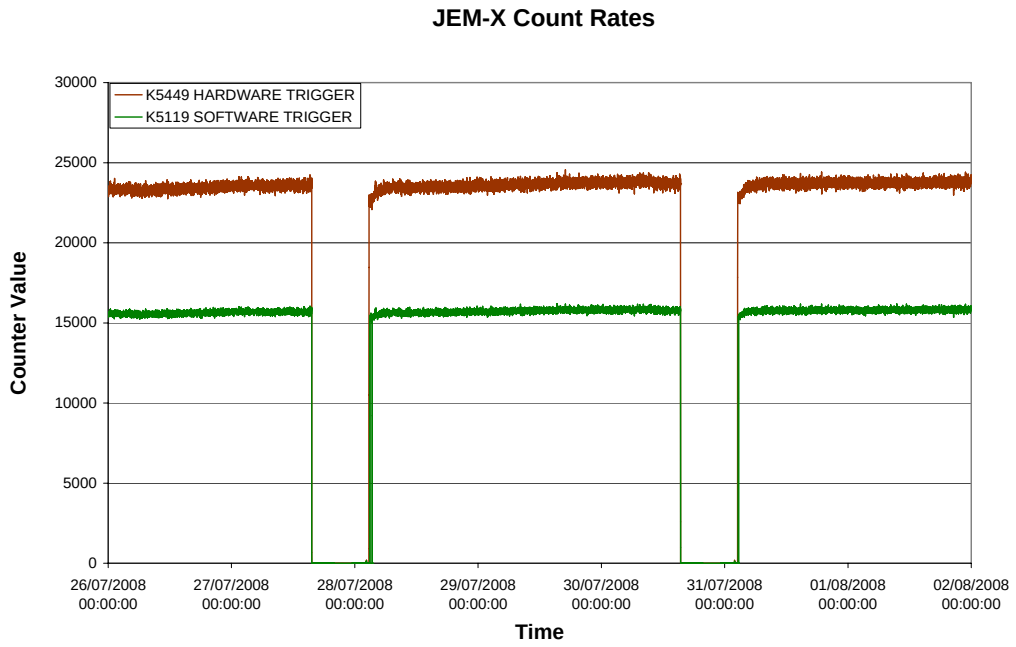
IBIS operations executed nominally.

8.3.4 JEM-X Operations

JEM-X Count Rates

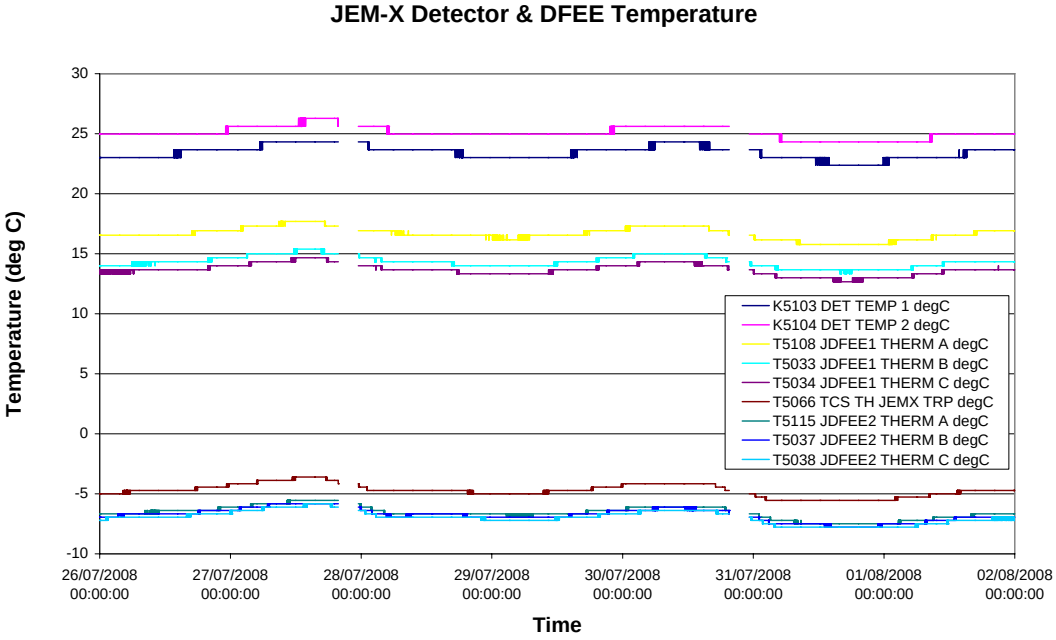
JEM-X count rates over the reporting period are displayed in the following graph[1].

[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 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 graph[2].



JEM-X Daily Report

2008-07-26 (DoY 208, Rev 706) to 2008-07-27 (DoY 209, Rev 706)

JEM-X1 operations executed nominally.

[2] Data sampled (1 frame in 8)

2008-07-28 (DoY 210, Rev 707)

At 02:56:28, TCs KU0014 & K0021 terminated with status unknown. 8 seconds later, the status of the K0021 command changed to uncertain_failed. As a precaution, at 03:21, the KEDATA02 ED was re-uplinked. This time the commands terminated correctly.

2008-07-29 (DoY 211, Rev 707) to 2008-08-01 (DoY 214, Rev 708)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2008-07-26 (DoY 208, Rev 706) to 2008-07-28 (DoY 210, Rev 707)

Nothing to report.

2008-07-29 (DoY 211, Rev 707)

At 18:40, a drop in TC to Redu caused the OMC pointing commands to fail uplink. The links returned at 18:46. The impact was the loss of pointing 07070041.

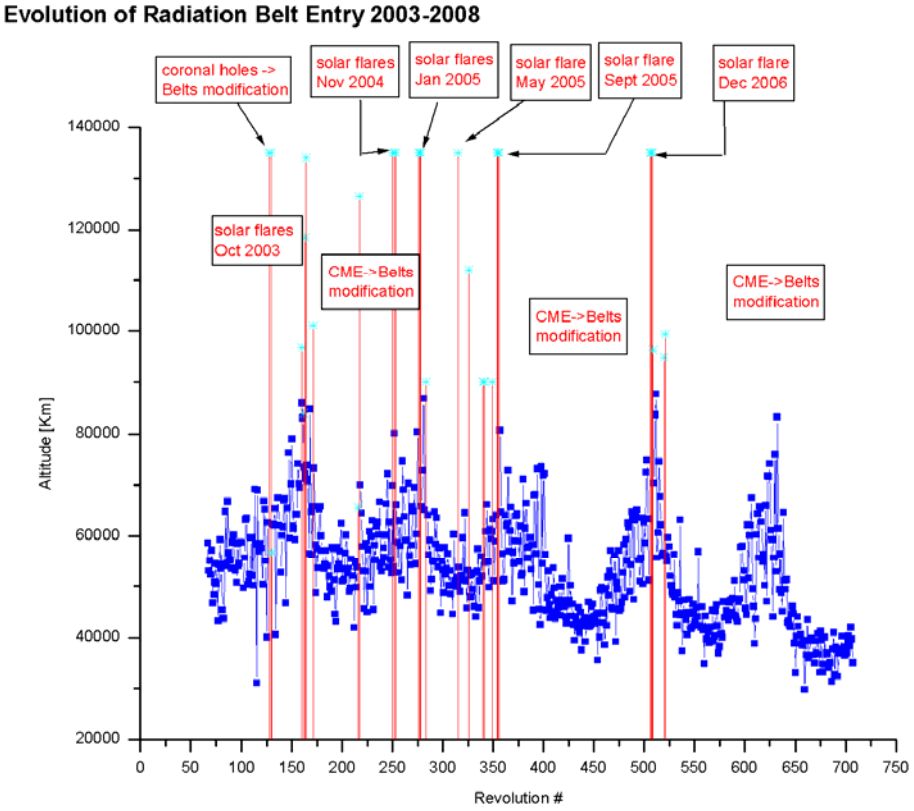
2008-07-30 (DoY 212, Rev 707) to 2008-08-01 (DoY 214, Rev 708)

Nothing to report.

On DoY 209 at 16:31:26 and DoY 212 at 16:18:22 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



IREM daily report

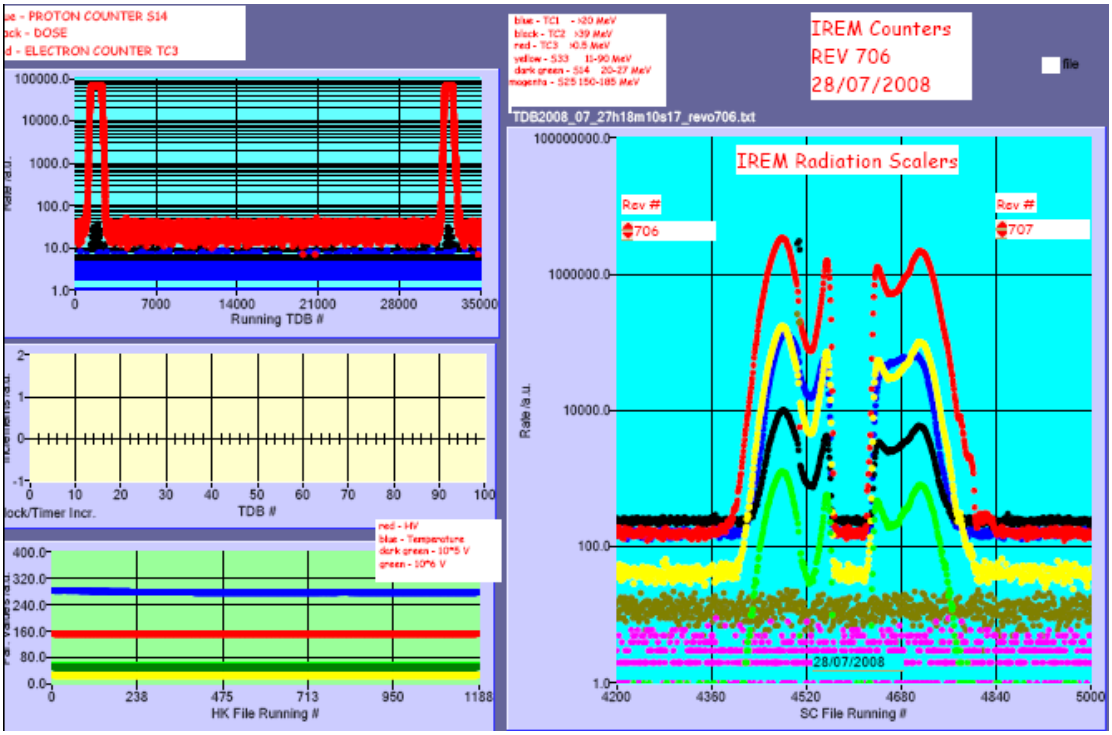
Nothing to report.

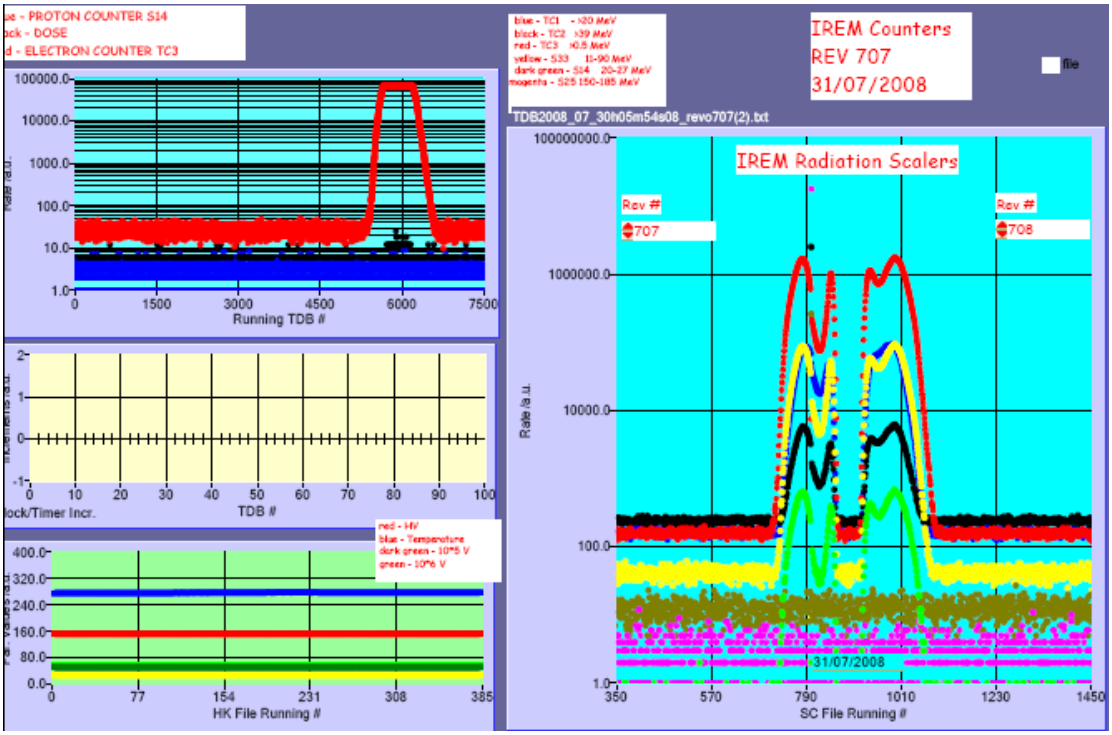
Electron Belts

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]
706	RAD_ENTR R 2008-07-27T16:31:18Z	27/07/2008 18:21:33	39639.0	27-Jul-2008 18:21:03	39465.2
707	RAD_EXIT R 2008-07-28T02:24:30Z	28/07/2008 01:39:41	>>33554.6	28-Jul-2008 01:31:03	45459.65
707	RAD_ENTR R 2008-07-30T16:18:21Z	30/07/2008 18:34:21	35074.7	30-Jul-2008 18:09:30	39276.78
708	RAD_EXIT R 2008-07-31T02:11:14Z	31/07/2008 00:51:25	>>33567.7	31-Jul-2008 01:19:30	45670.22

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.

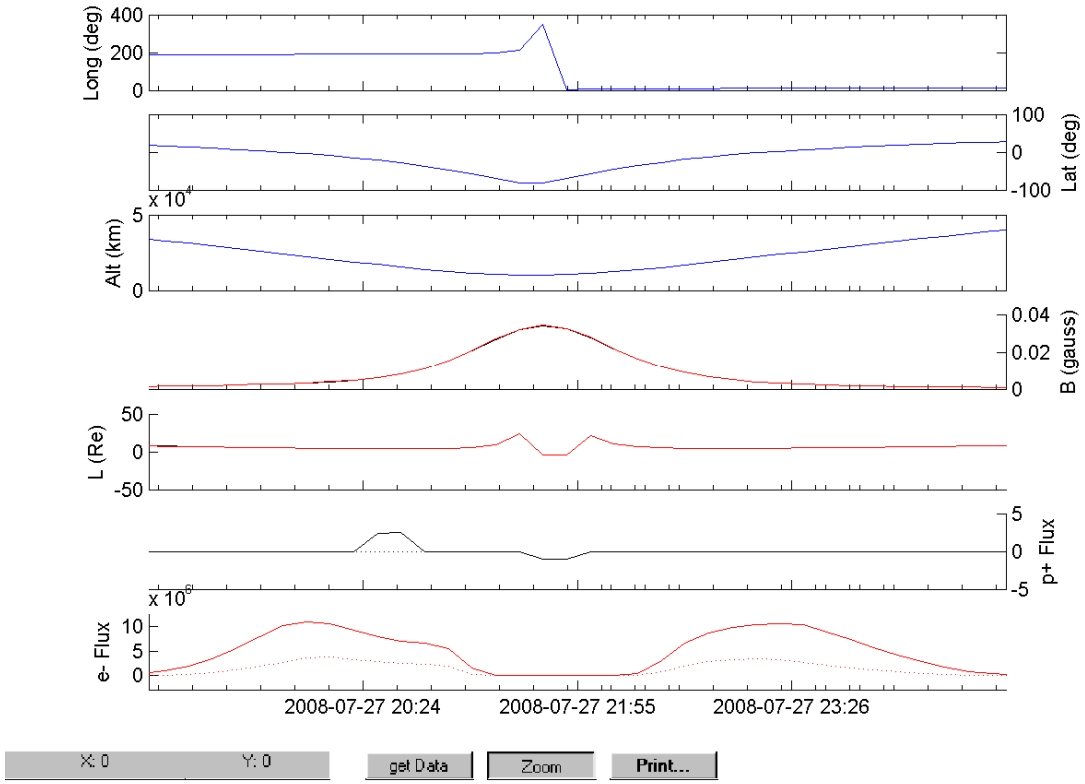
IREM radiation counters:



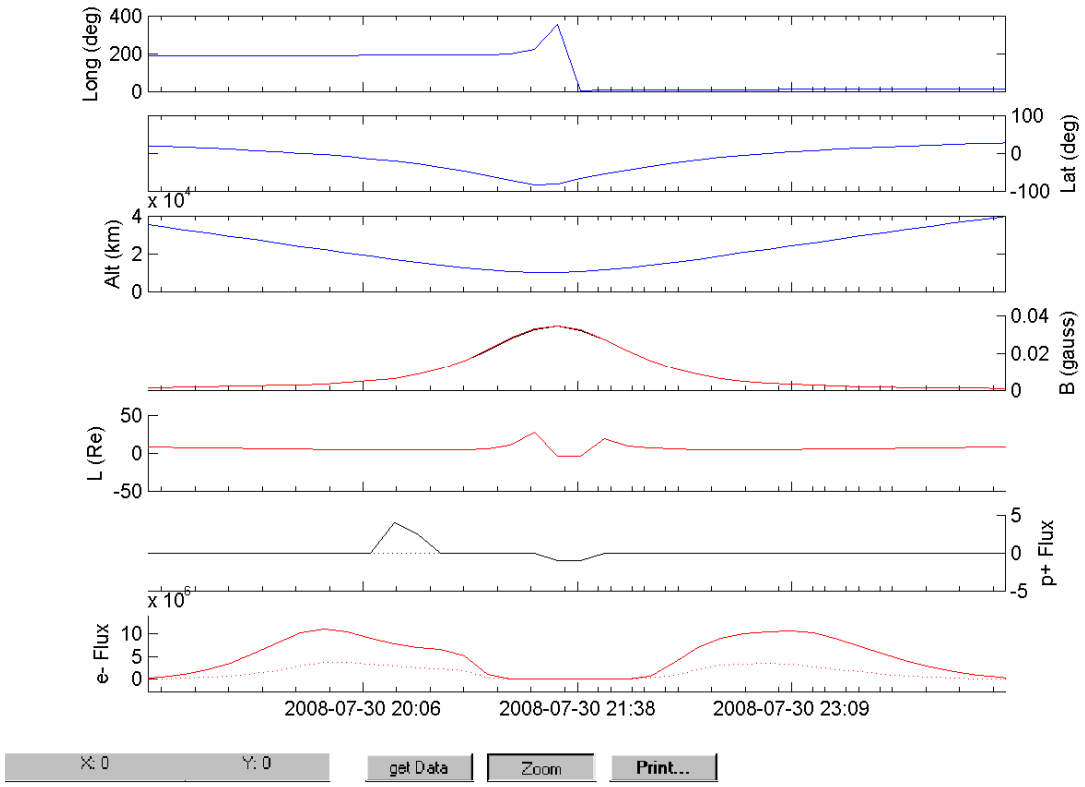


IREM Predicted Radiation Belt Passages

Rev 706



Rev 707



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

Due to a problem on the SEISOP server, no data are available this week. However, the week was very quiet and no radiation was reported.