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

INTEGRAL
Mission Report

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

No. 258
Week 35

03.09.07

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 25.08.07 until 31.08.07 (both dates inclusive) and covers the revolutions 595 and 596.

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 three hexagonal dithers of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0) and two raster dithers of the Galactic centre (RA 17:45:40.00, DEC -29:00:29.0).

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.

2 slews were missed from TL, during the observation period, due to problem with the FDS.

The fuel consumption over the period between 25/08/2007 and 30/08/2007 was 0.0554 Kg. The remaining propellant is in the order of 144.746000 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.

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

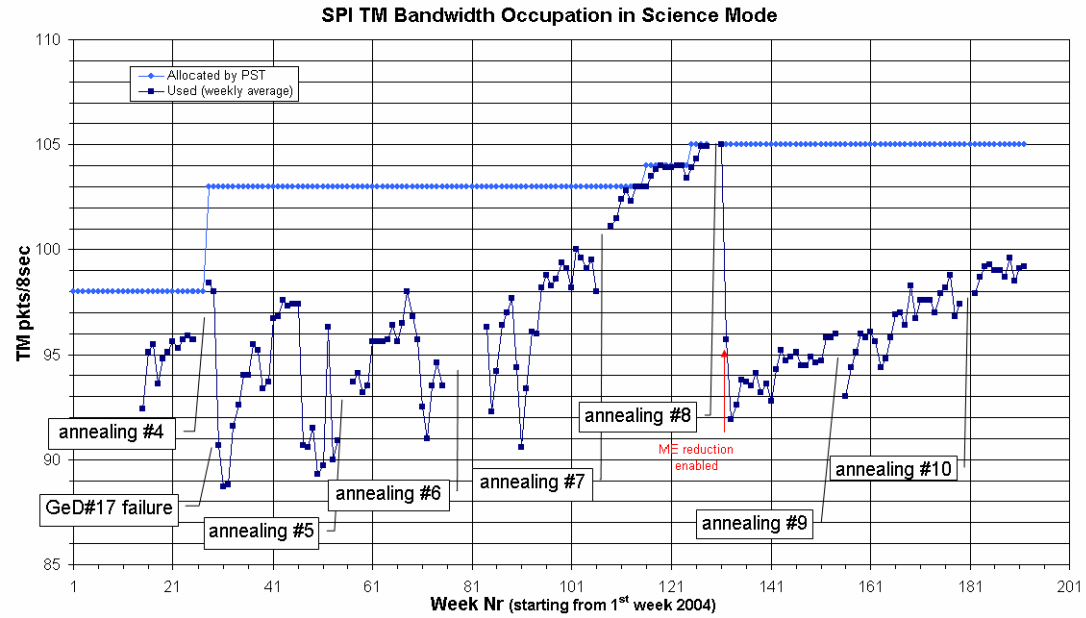
3.2.1 SPI

Following the 10th annealing, which ended on 17th June, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution 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 105 packets/cycle, except from 2007-08-26T10:03:14Z to 2007-08-26T14:25:06Z, when the TM allocation was 85 packets/cycle due to an OMC Flat Field Calibration. The average telemetry occupation when the TM allocation was 105 packets/cycle was 99.2 packets/cycle.

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



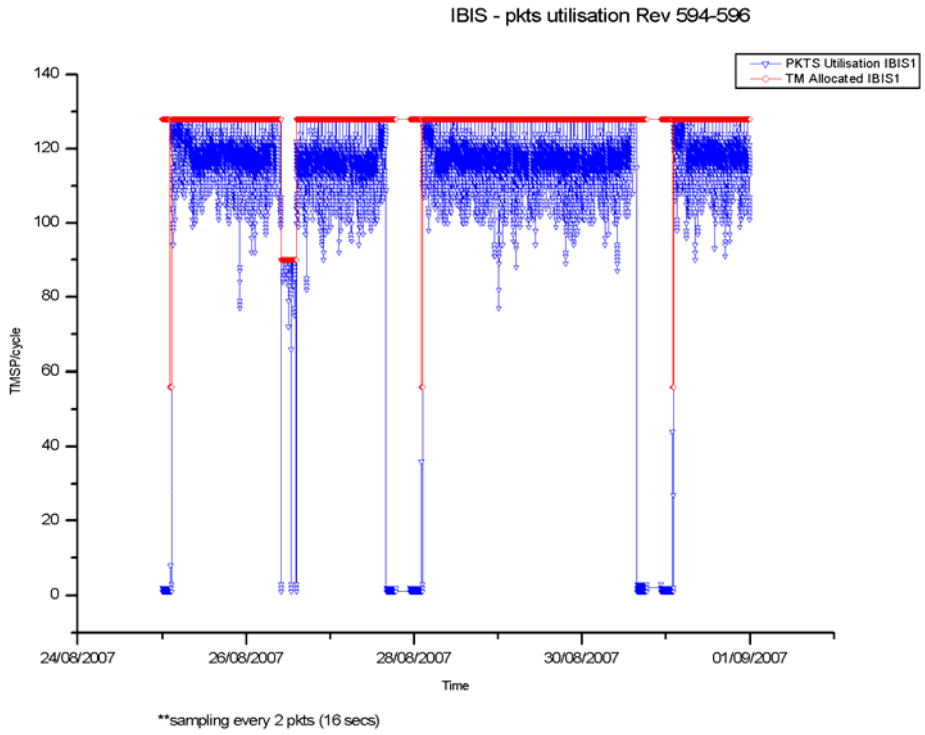
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

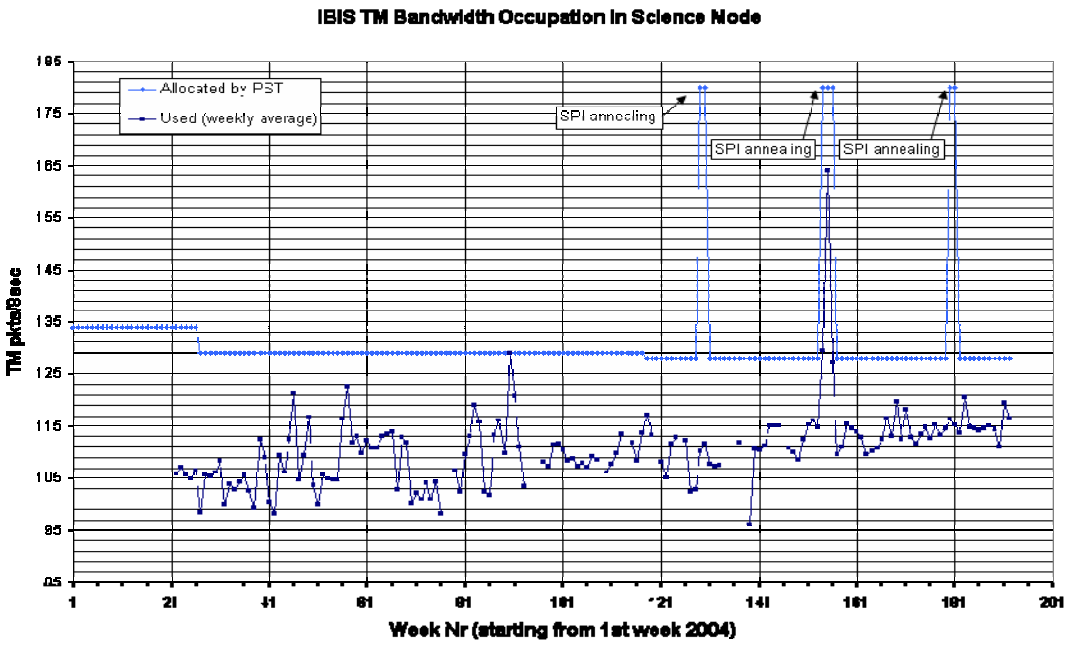
The overall status of the unit is nominal.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle except from 2007-08-26T10:03:14Z to 2007-08-26T14:25:06Z, when the TM allocation was 90 TMPS/cycle due to an OMC Flat Field Calibration. The IBIS mean bandwidth utilisation during the observation period (when IBIS was in Science mode) was 116.58 TMPS/cycle, down 2.93 on last week.

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 10:03:14 to 14:25:06 on DoY 238 when it was 63 packets/cycle.

During this reporting period, 144 of the 145 planned science pointings for OMC were executed nominally, 1 was executed, but at an incorrect attitude. A Flat-Field calibration exercise was also performed nominally.

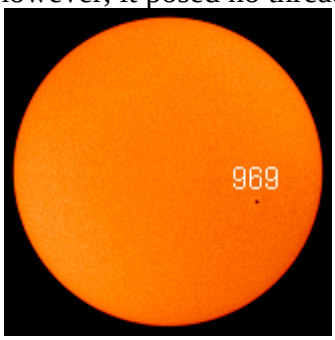
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity. Sunspot 969 was present throughout the week, however, it posed no threat of strong 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 excellent this week. One pointing was lost due to ground problems. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. A pointing was lost due to FD problems, and a further 7 slews were performed manually by the SPACON to maintain the Timeline. The overall performance was well over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were, however, 4 occasions of TM drops from Redu, with no impact reported. The overall performance was nearly 100%.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs are available up to revolution 605.
Observations have been planned up to revolution 605;
Crab calibrations are now foreseen in revolution 606.
POSs were sent up to revolution 605.
TSFs have been received up to revolution 600.

2. Observation status

Again no new ECS files have been received this week. The last is still for revolution 583.

3. ISOC Science Data Archive

No news.

4. ISOC system

Version 16.0 is expected to be released for testing on Monday, September 3.

5. Problems

The HEX Centre of Pattern move is not carried out at the moment; problem is under investigation.

4.3.2 ISDC

Status of ISDC observation processing on 03/09/2007:

- Latest Standard Analysis completed: observation 04200730033 (Galactic disk latitude scans, Revolution 580) on 10/08/2007.

- Latest products archived: observation 04200730033 (Galactic disk latitude scans, Revolution 580) on 10/08/2007.

- Latest observation products sent to the observer: observation 04200730033 (Galactic disk latitude scans, Revolution 580) on 02/09/2007.

5 Special Events

6 Anomalies

The following problem was reported that impacted operations:

- On DoY 240, at 02:27, due to the FD job scheduler not running, pointing 05950002 was lost. After the recovery, pointings 05950004 – 05950010 were executed manually by the SPACON.

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

7 Future Milestones

The following activities are foreseen in the next few weeks.

- Lunar eclipse on 11th September 2007, at the end of revolution 599.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 595

The observations in revolution 595 began with a hexagonal dither of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. They continued with a raster dither of the Galactic centre (RA 17:45:40.00, DEC -29:00:29.0), lasting ~54.1 hours until the end of the revolution.

Revolution 596

The observations in revolution 596 began with a hexagonal dither of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. They continued with a raster dither of the Galactic centre (RA 17:45:40.00, DEC -29:00:29.0), lasting ~50.3 hours, and finally another hexagonal dither of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 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 105; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2007-08-10T00:46:01.000Z     144.9782    F   Automatic TM processing.
2007-08-11T11:03:17.000Z     144.9673    F   Automatic TM processing.
2007-08-13T00:34:17.000Z     144.9600    F   Automatic TM processing.
2007-08-14T10:51:56.000Z     144.9388    F   Automatic TM processing.
2007-08-16T00:19:20.000Z     144.9293    F   Automatic TM processing.
2007-08-17T10:39:55.000Z     144.8650    F   Automatic TM processing.
2007-08-19T00:07:11.000Z     144.8560    F   Automatic TM processing.
2007-08-20T09:38:35.000Z     144.8440    F   Automatic TM processing.
2007-08-21T23:55:52.000Z     144.8257    F   Automatic TM processing.
2007-08-23T09:56:35.000Z     144.8116    F   Automatic TM processing.
2007-08-24T23:43:36.000Z     144.8014    F   Automatic TM processing.
2007-08-26T09:14:27.000Z     144.7798    F   Automatic TM processing.
2007-08-27T23:33:27.000Z     144.7710    F   Automatic TM processing.
2007-08-29T09:32:35.000Z     144.7580    F   Automatic TM processing.
2007-08-30T23:22:23.000Z     144.7460    F   Automatic TM processing.

This report was generated  Fri Aug 31 09:13:06 GMT 2007
```

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, 25/08/2007 – 31/08/2007

The AOCS operations were executed from the Automatic Timeline.

During this period, 122 Open Loop Slews, 34 Closed Loop Slews and 4 Momentum Biases were executed.

2 slews (1 CSL, 1 OSL) were missed from TL, during the observation period, due to problem with the FDS job scheduler.

The OTF was not reached during PID 05940054.

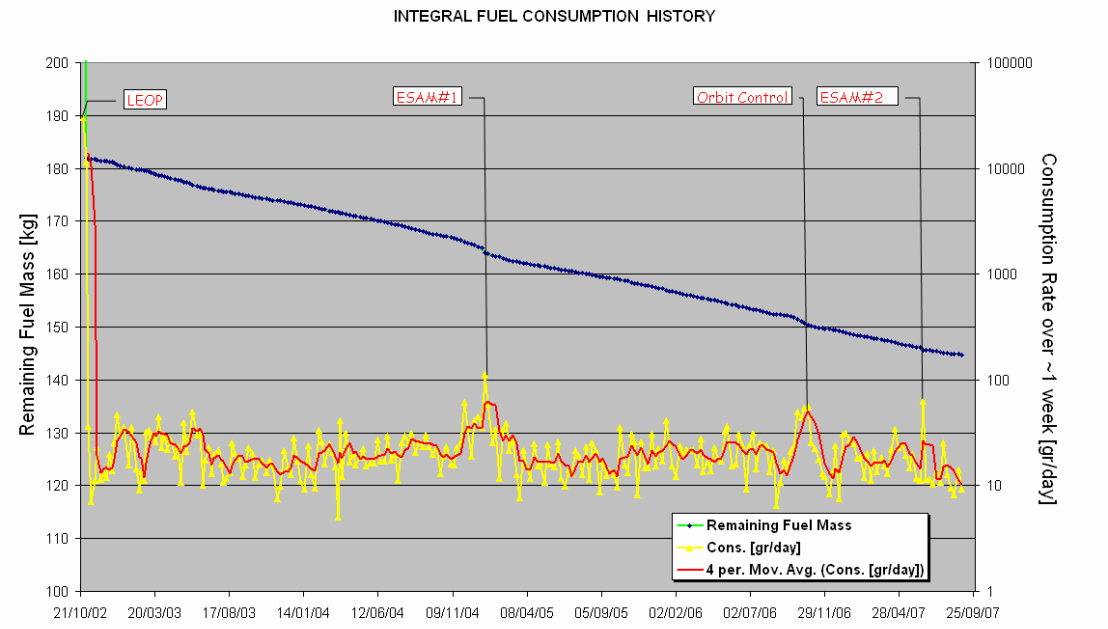
This is equivalent to ~ 1.3 % of the total number of slews planned (157).

Orbit Control

No update.

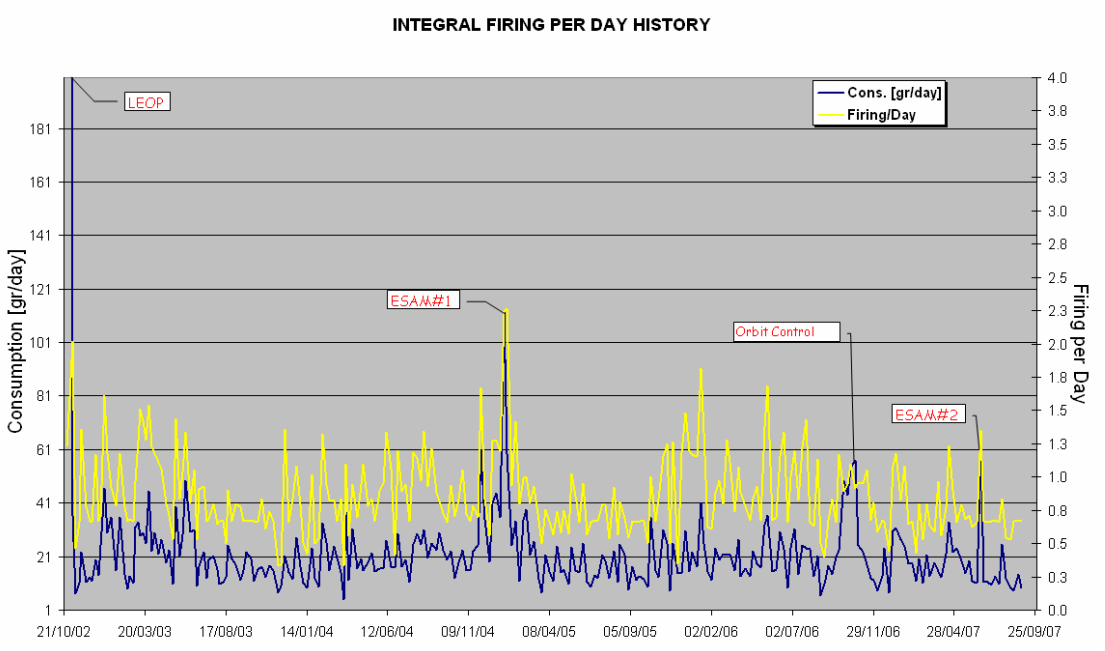
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 30/08/2007 is reported in the plot below.



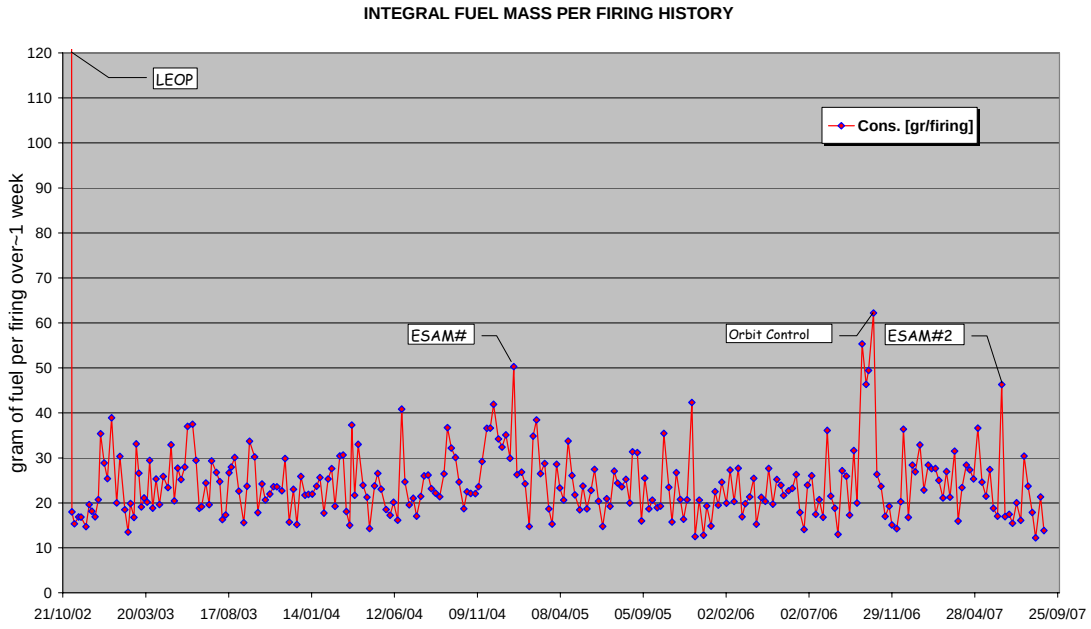
The plot above consider the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 30/08/2007 is reported in the plot below.



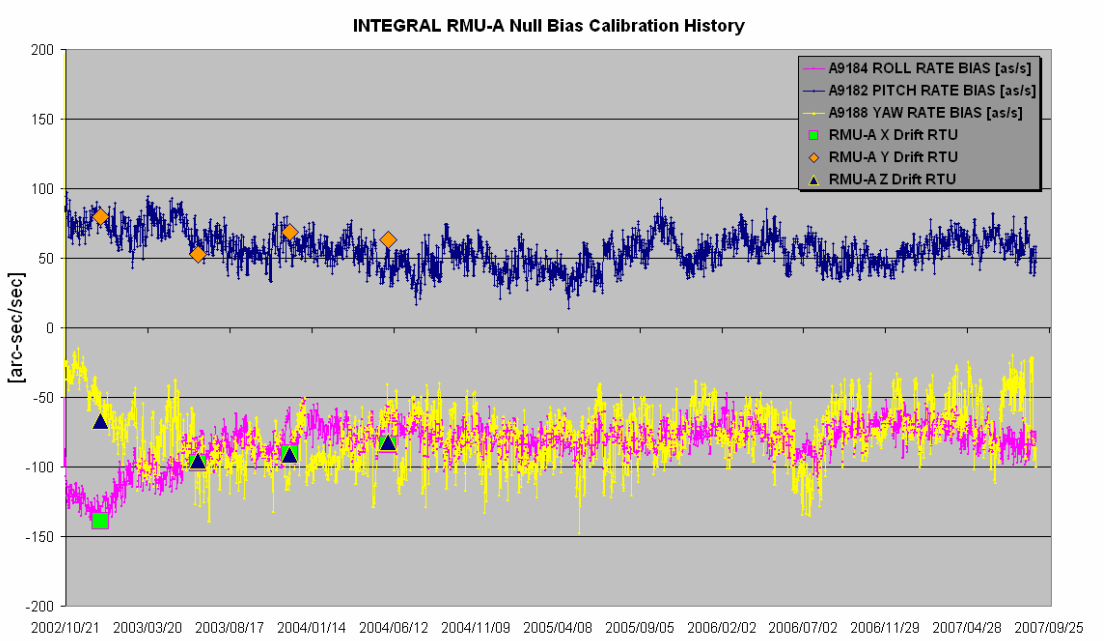
The plot above consider the ESAM fuel consumption spread over period of ~1 week.

The fuel per firing over the period between 01/11/2002 and 30/08/2007 is reported in the plot below.

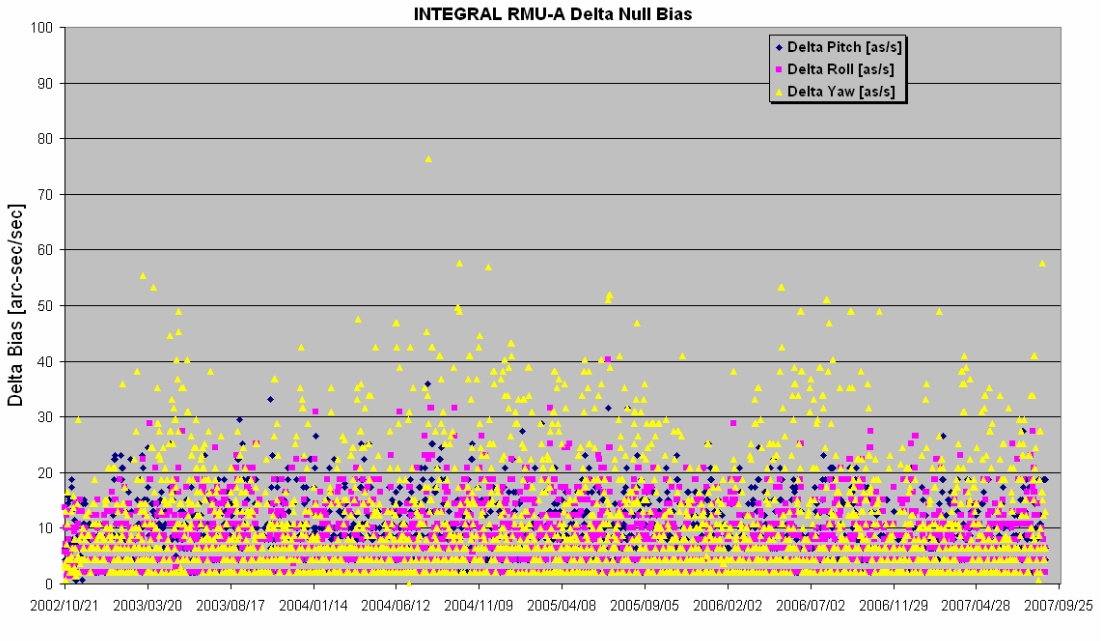


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 31/08/2007 is reported in the plot below.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 31/08/2007 is reported in the plot below.



25/08/2007 (Day of Year 237, Revolution 594)

Nothing to report.

26/08/2007 (Day of Year 238, Revolution 594)

Nothing to report.

27/08/2007 (Day of Year 239, Revolution 594-595)

Loss of guide star: at 05:26z a loss of the selected guide star occurred during the execution of PID 05940054.

As foreseen by the IPS logic, the ACC switched ON the IMU 1, a new automatic mapping was commanded and a new guide star picked.

No impact on TL. The OTF was not reached during PID 05940054.

28/08/2007 (Day of Year 240, Revolution 595)

FDS failed update: at 02:27z the FDS did not perform the update of the planned first slews of the rev 0595. The job scheduler was found not running after perigee passage and was only back at around 07:32:03, after FD on call action, to kick off the update for CSL 05950012. Slews 05950001, 05950002 and 05950005 were uplinked without update before the problem was recognized (search and track process failed due to star not found in slot#2 and consequent PTV failure) and isolated.

A manual recovery was performed from attitude from PID 05950001 to the attitude of PID 05950003.

The update for slew 05950004-6-7-8-9-10-11 was manually performed.

An AR (INT_2914) was already open on 04/2007 concerning this same problem and an action assigned to FD Team.

The following slews were missed in TL: 05950002 (CSL)-05950003(OSL)

29/08/2007 (Day of Year 241, Revolution 595)

Nothing to report.

30/08/2007 (Day of Year 242, Revolution 595-596)

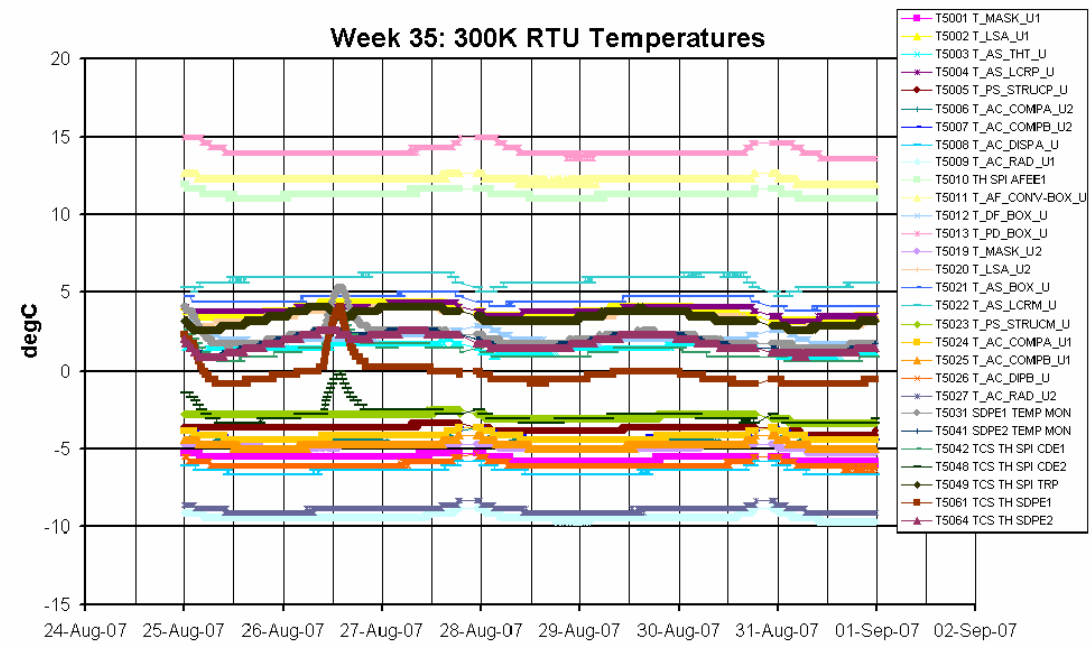
Nothing to report.

31/08/2007 (Day of Year 243, Revolution 596)

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.

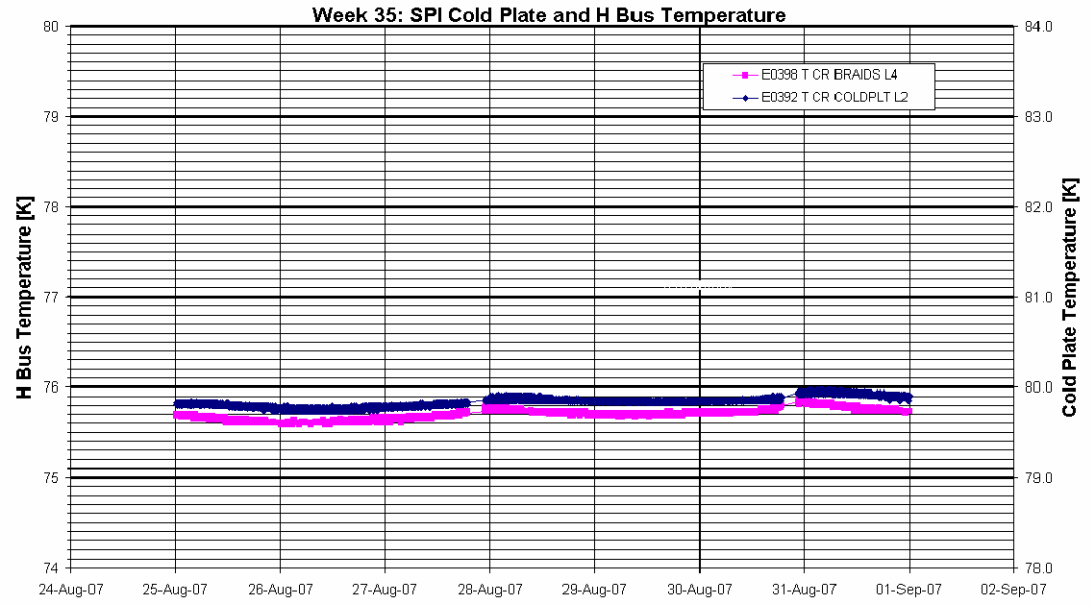


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

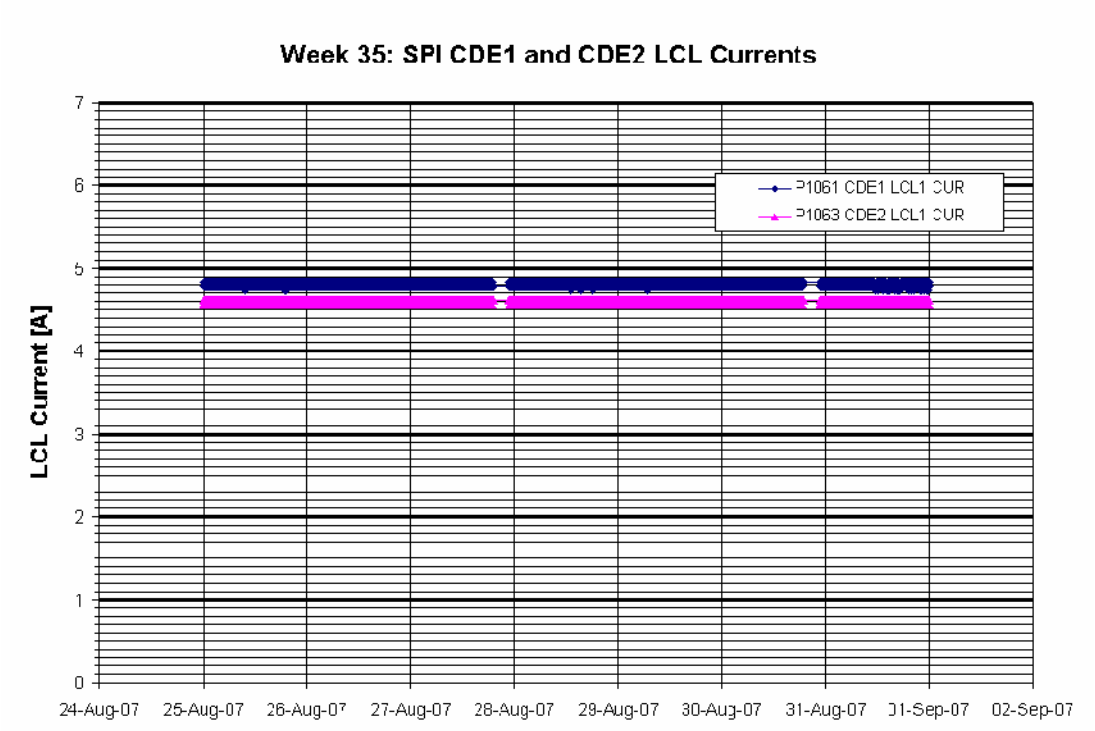
The stroke of all four compressors was set 40 throughout the week with the average CDE LCL currents as follows:

- CDE1 LCL Current = 4.80A
- CDE2 LCL Current = 4.59A

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

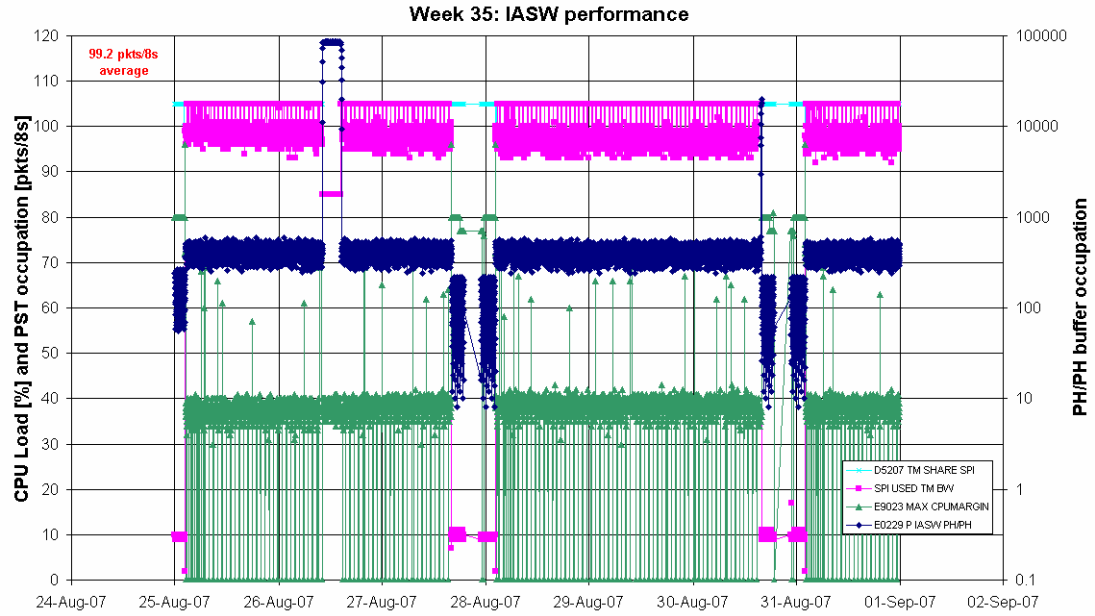


The following plot shows the evolution of the CDE currents during the reporting period.



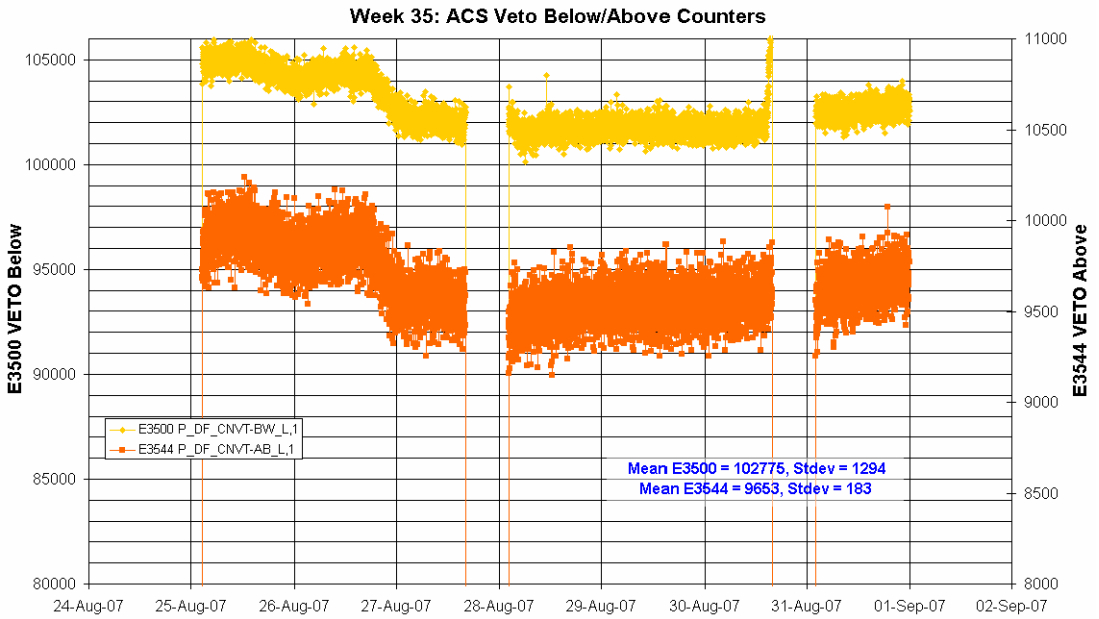
DPE & IASW: The DPE health and IASW performance is nominal. The IASW version installed is v433 patch #1 with the spectra scaling factor set to 9/19 SE. The average TM bandwidth occupation of SPI was 99.2 packets/cycle over the science window, when the TM allocation was 105 packets/cycle.

The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period. Note that from 2007-08-26T10:03:14Z to 2007-08-26T14:25:06Z the TM allocation was 85 packets/cycle due to an OMC Flat Field Calibration.



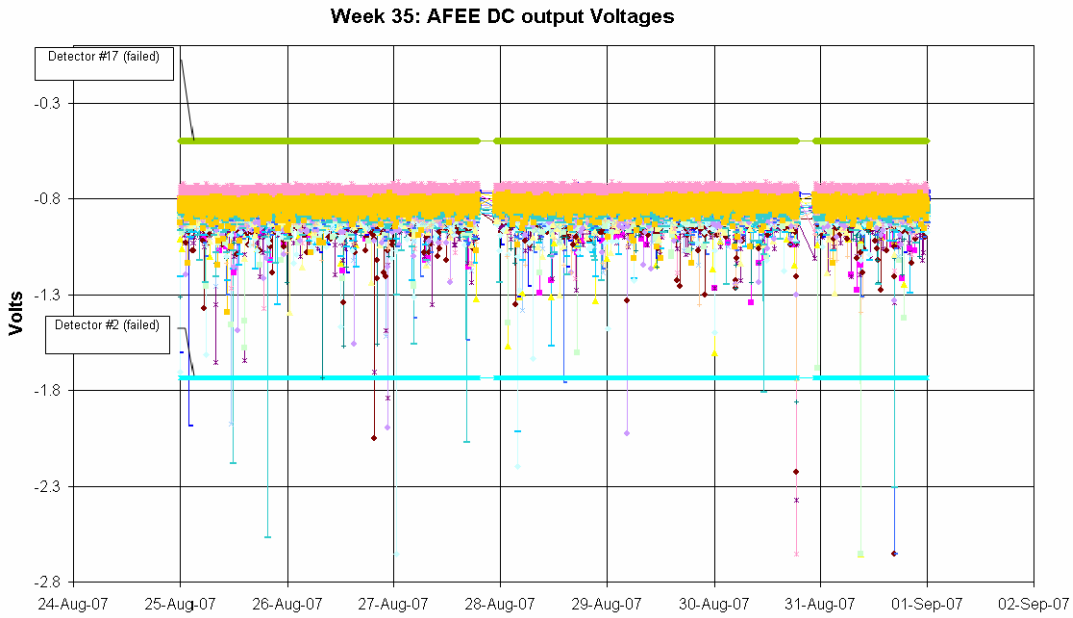
ACS: The performance of the ACS is nominal, except for FEE #81 which remains switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is still OFF due to the anomaly on 5/8/2003 (INT_SC-61).

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

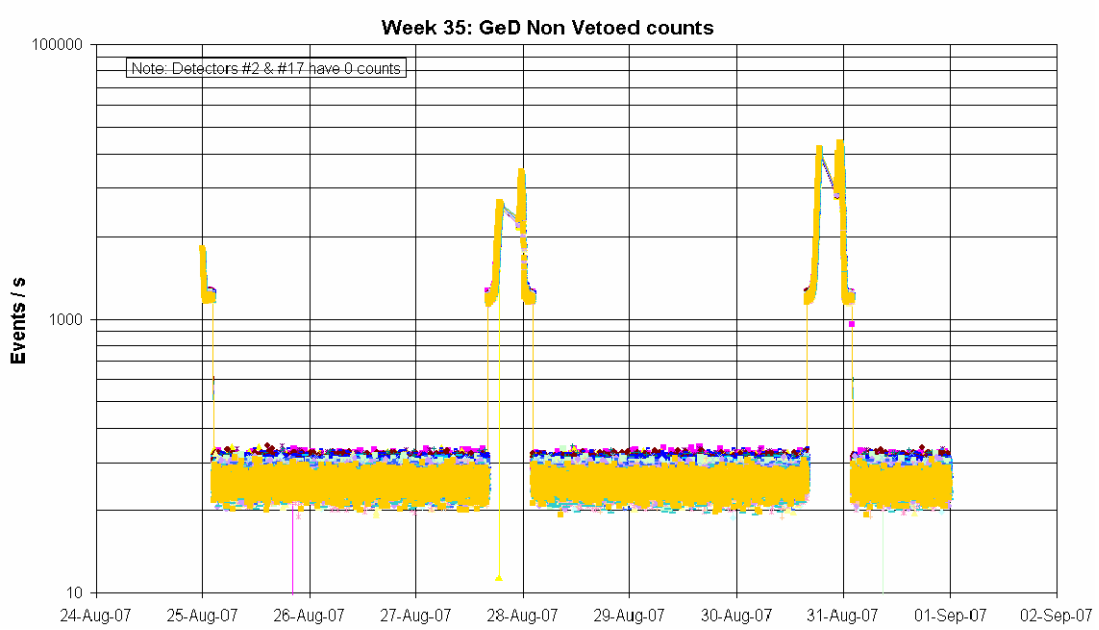


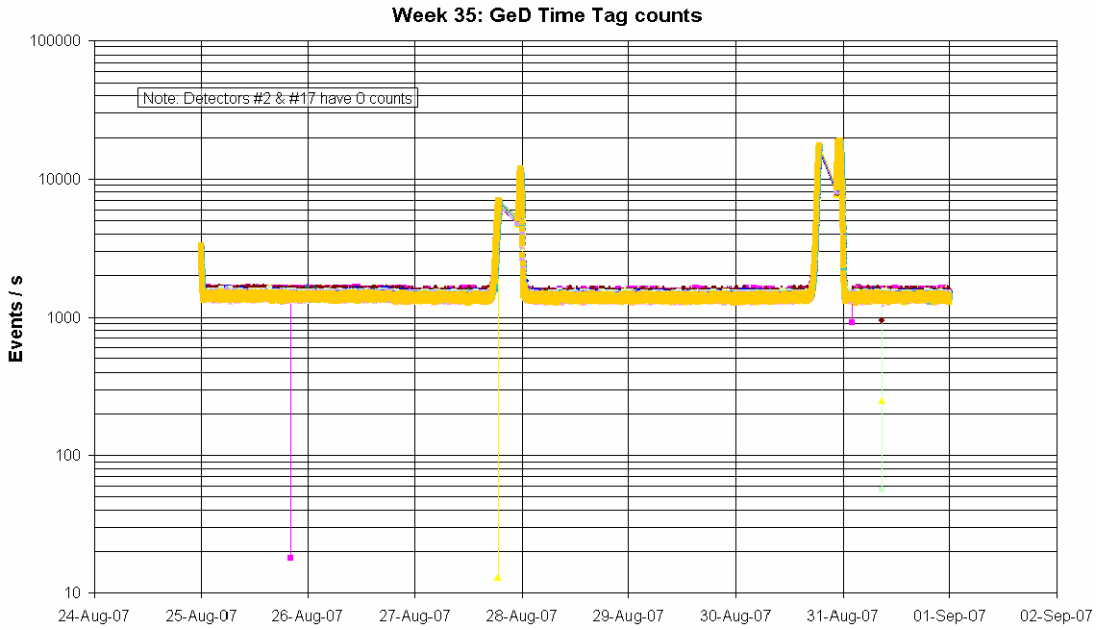
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operated at a lower HV setting of 3.5kV (instead of 4kV).

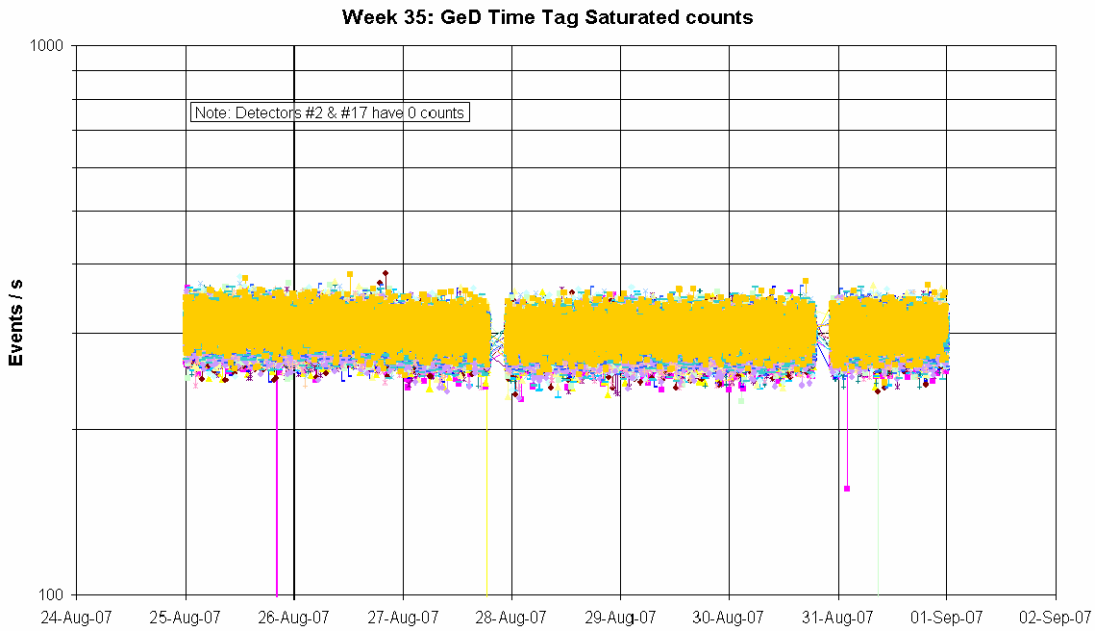
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



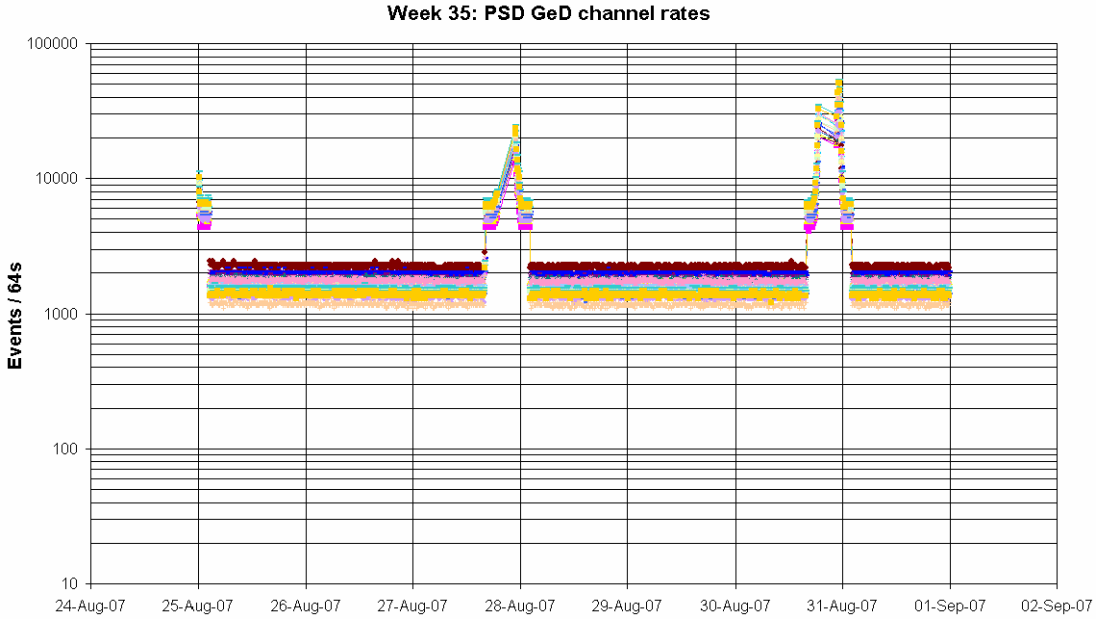
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.







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 during the reporting period:

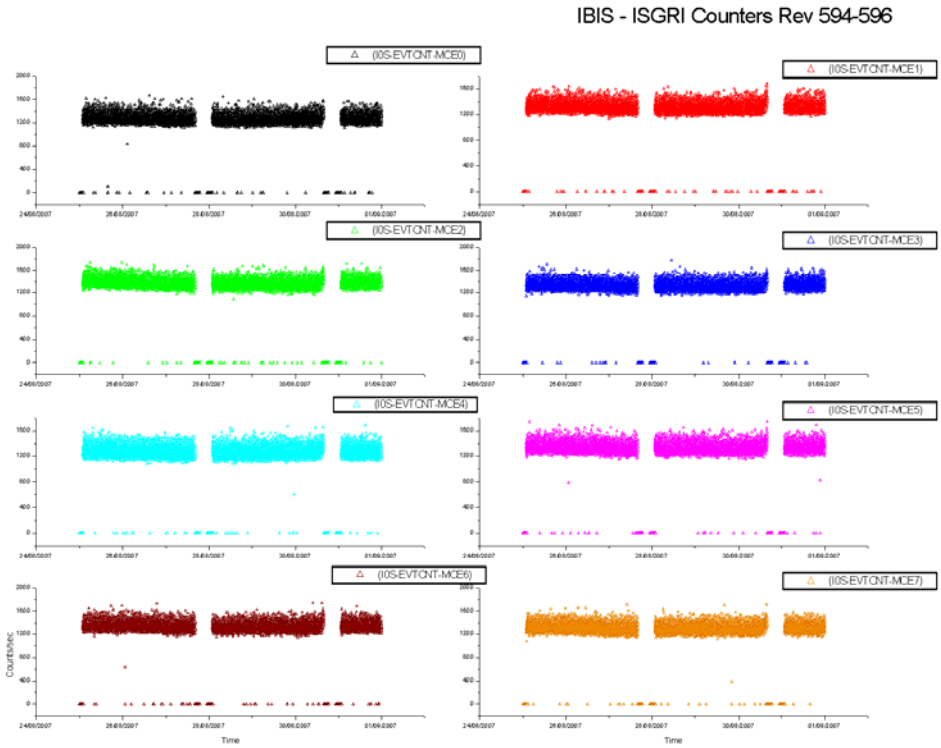
- 96 occurrences of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received throughout the week. As they were each single occurrences, no action was taken. However, as the occurrence of this OEM is becoming more frequent, the SPI PI has been consulted to check whether a modification of the spectra scaling factor may be required.
- On 2007-08-26 from 14:44:52Z to 14:49:48Z, 17 occurrences of OEM APID 1024 ID 245 EXCEPTION SPI1 SPECTRA COMPRESSION OVERFLOW were received followed at 14:49:48Z by OEM APID 1024 ID

244 EXCEPTION SPI1 SPECTRA COMPRESSION NOT COMPLETED. This was following the OMC Flat Field Calibration, about 20 minutes after the TM allocation to SPI had been changed back from 85 packets/cycle to 105 packets/cycle. These were also received following previous OMC Flat Field Calibrations with IASW 433. These OEMs indicate a problem with the spectra compression due to insufficient bandwidth and can be considered nominal behaviour when insufficient bandwidth has been allocated to SPI to allow the spectra compression. They stopped of their own accord and therefore no action was taken.

- On 2007-08-27 at 23:19:09Z OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. This was during the AOS_CHK window of revolution 595, when the time verification TC was sent. This OEM is sometimes received when this TC is sent and no action was taken.
- On 2007-08-30 at 15:22:39Z TM parameter E3500 (ACS Veto Below Counter) went OOL High. As this was ~30 minutes before radiation belt entry of revolution 595, no action was taken. This parameter toggled OOL High until radiation belt entry, at 15:52:45Z.

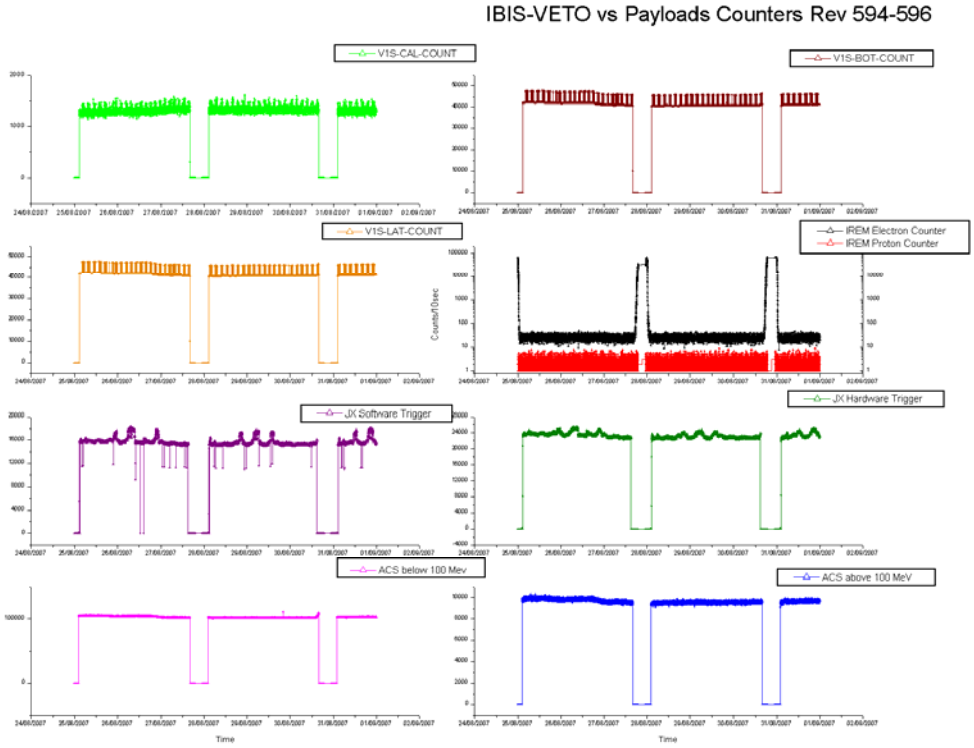
8.3.3 IBIS Operations

IBIS Event Counters Plots
ISGRI Counters:



**sampling every 4 pkts (32 secs)

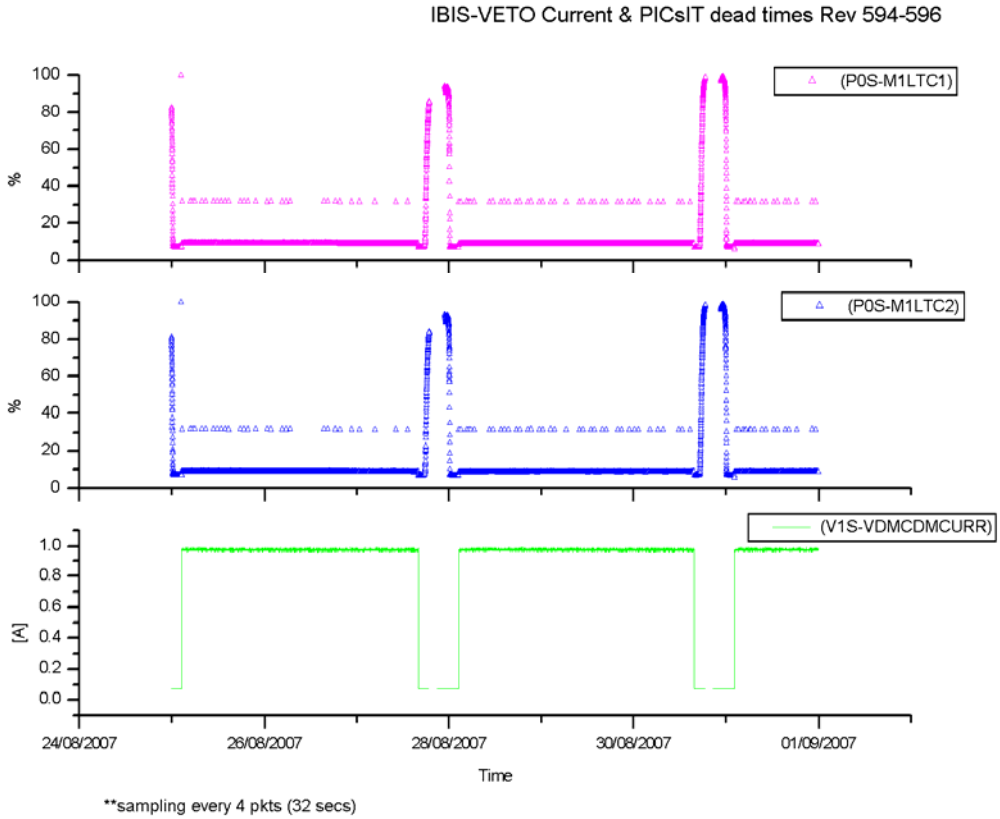
VETO vs Payloads Counters:



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

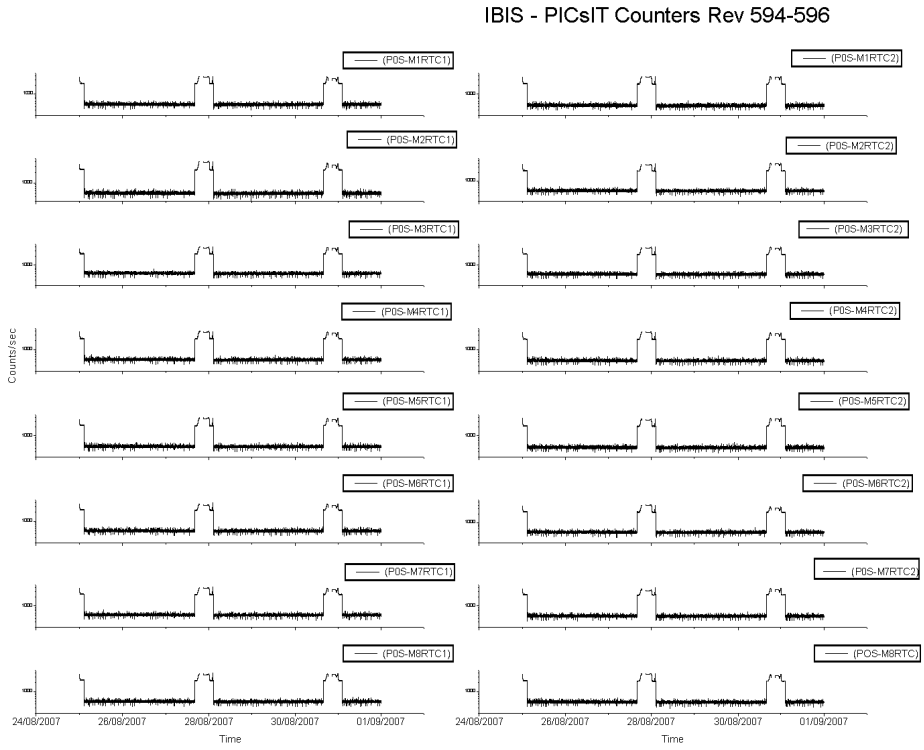
The week was characterised by low radiation as reported by the payload.

VETO Current:



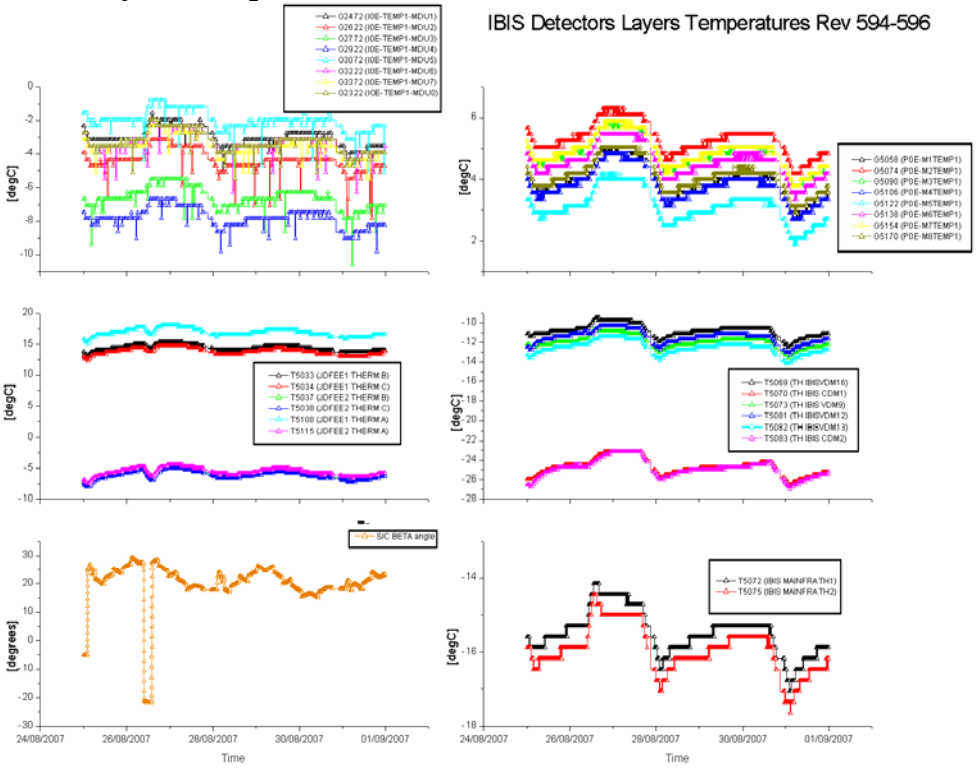
**sampling every 4 pkts (32 secs)

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.

2007-08-25 (DOY 237, Rev 594)

From 03.20.33Z to 13:18:25Z TM parameter G6061 (Veto calibration source counter) toggled OOL Warning Low. If this parameter increasingly continues to toggle OOL, due to the nominal radioactive decay of the calibration source, the limits for this parameter will be updated in the next IODB release.

2007-08-26 (DOY 238, Rev 594)

IBIS operations executed nominally.

2007-08-27 (DOY 239, Rev 594-595)

At 08:26:57Z TM parameter G2014 went OOL (value =1), indicating an overflow of the noisy pixel address buffer in MCE1. It returned within limits at 08:27:05Z and no action was taken.

2007-08-28 (DOY 240, Rev 595) to 2007-08-31 (DOY 243, Rev 596)

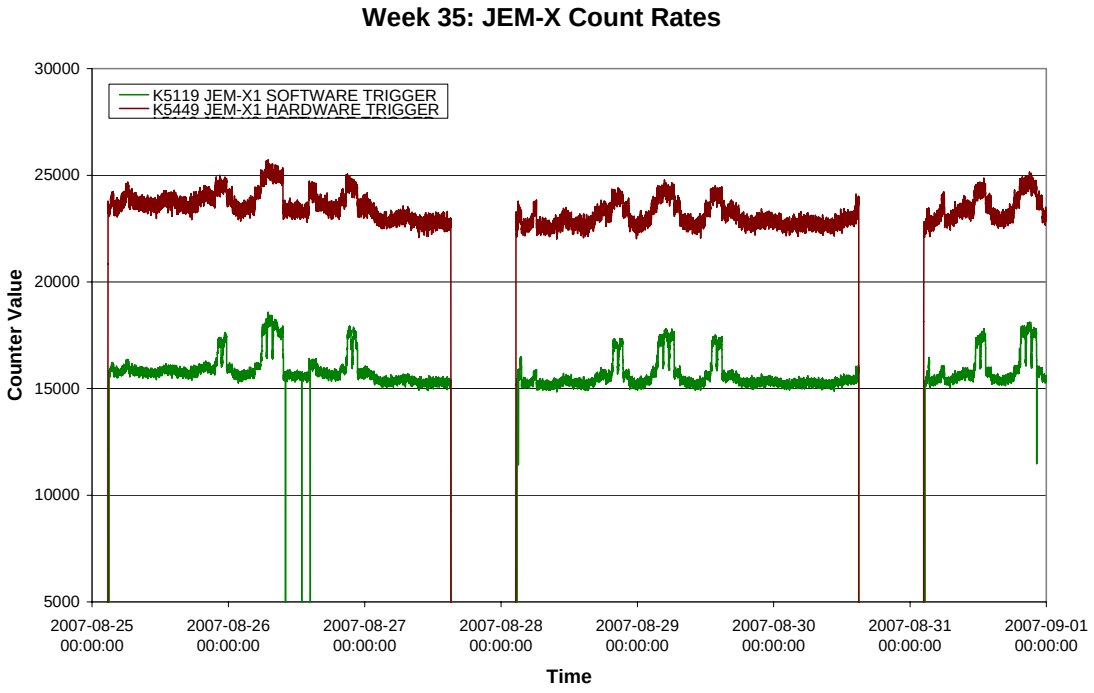
IBIS operations executed nominally.

8.3.4 JEM-X Operations

JEM-X Count Rates

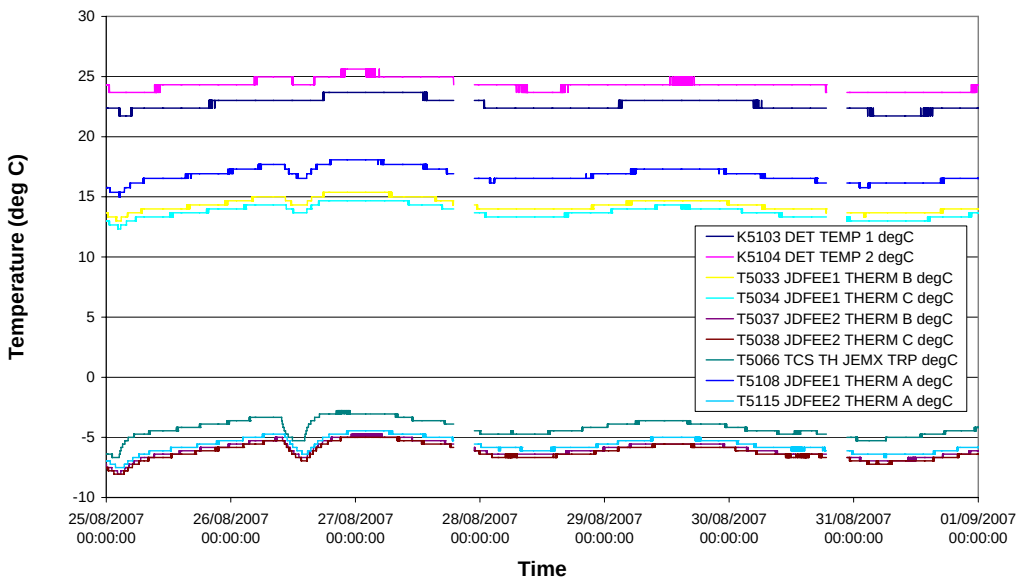
JEM-X count rates over the reporting period are displayed in the following graph[1].

[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

2007-08-25 (DoY 237, Rev 594) to 2007-08-31 (DoY 243, Rev 596)

[2] Data sampled (1 frame in 8)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2007-08-25 (DoY 237, Rev 594)

Nothing to report.

2007-08-26 (DoY 238, Rev 594)

At 10:02:47, according to the Timeline, a Flat Field calibration was commenced. This continued to 12.55.47, when a Dark Current calibration was started. This terminated at 13.28.21. Both calibrations were performed successfully.

2007-08-27 (DoY 239, Rev 594)

Nothing to report.

2007-08-28 (DoY 240, Rev 595)

At 02:27, due to FD problems, the slew to attitude 05050002 was not performed. The OMC pointing was, however, executed. Thus the attitude for this exposure will be incorrect.

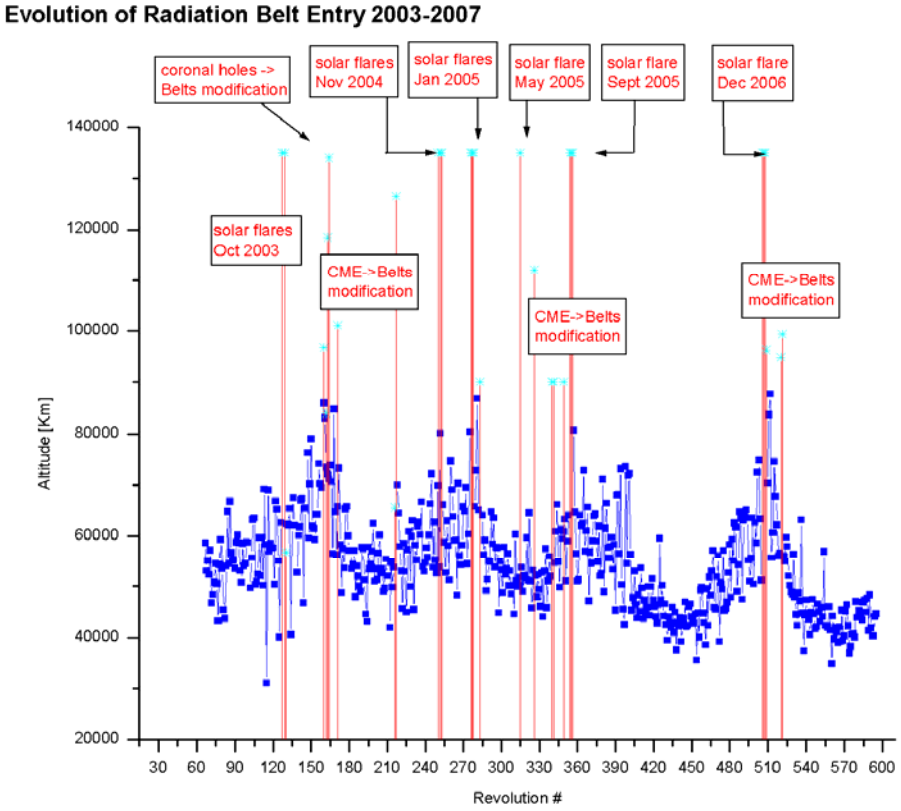
2007-08-29 (DoY 241, Rev 595) to 2007-08-31 (DoY 243, Rev 596)

Nothing to report.

On DoY 239 at 16:05:40 and DoY 242 at 15:52:44 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

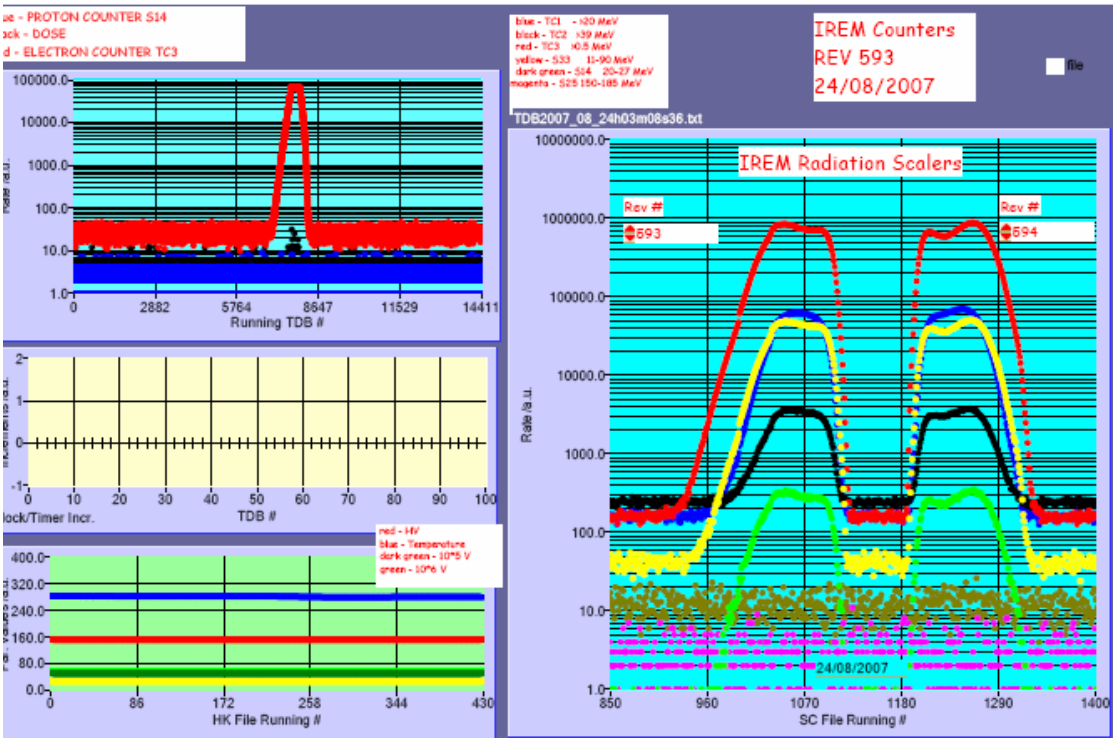
Nothing to report.

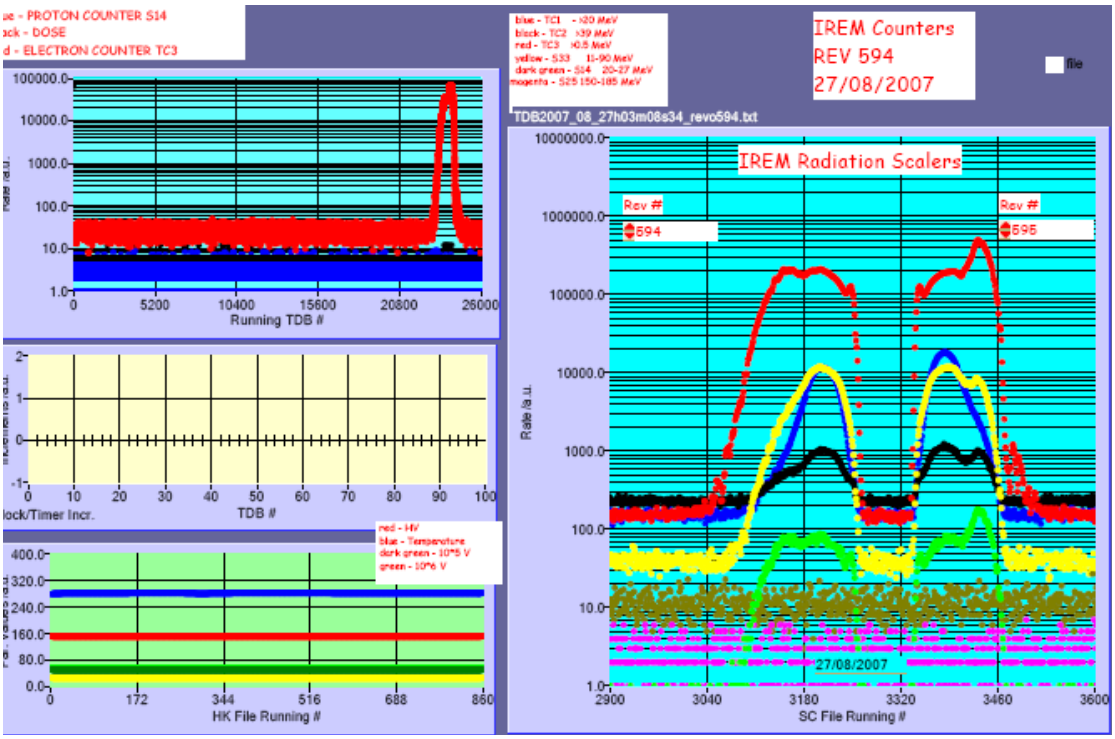
Electron Belts

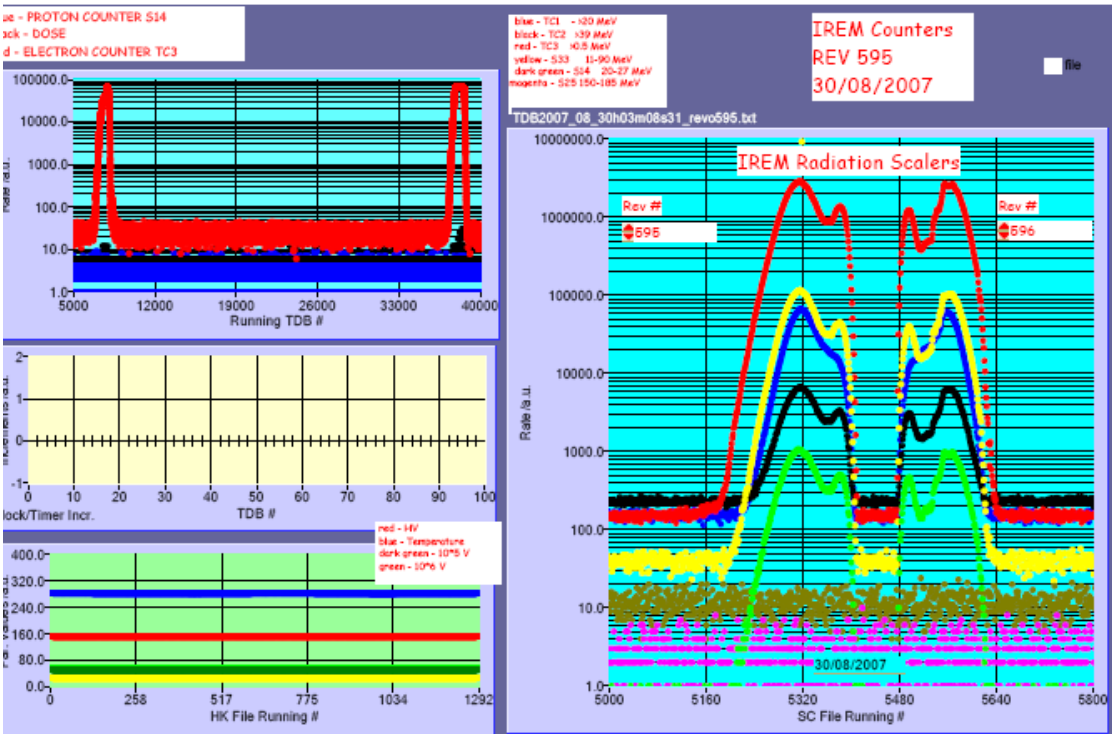
REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
594	RAD_EXIT R 2007-08-25T02:25:42Z	25/08/2007 00:45:08	>>29824.4	25-Aug-2007 01:18:42	43614.97
594	RAD_ENTR R 2007-08-27T16:05:33Z	27/08/2007 17:29:48	44002.7	27-Aug-2007 17:22:56	44815.6
595	RAD_EXIT R 2007-08-28T02:15:01Z	28/08/2007 01:07:16	>>29820.8	28-Aug-2007 01:02:56	43043.78
595	RAD_ENTR R 2007-08-30T15:52:37Z	30/08/2007 17:11:48	44629.4	30-Aug-2007 17:11:07	45043.68
596	RAD_EXIT R 2007-08-31T02:03:03Z	31/08/2007 00:41:40	>>31437.8	31-Aug-2007 00:51:07	42686.3

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)

IREM radiation counters:

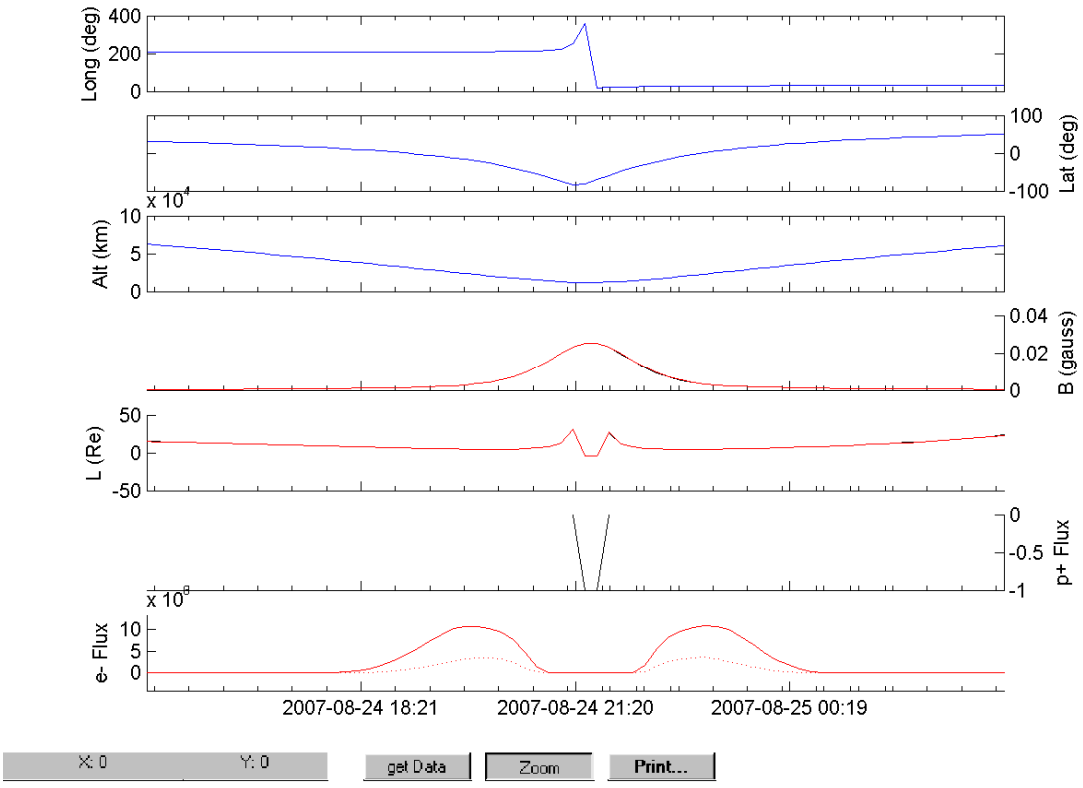




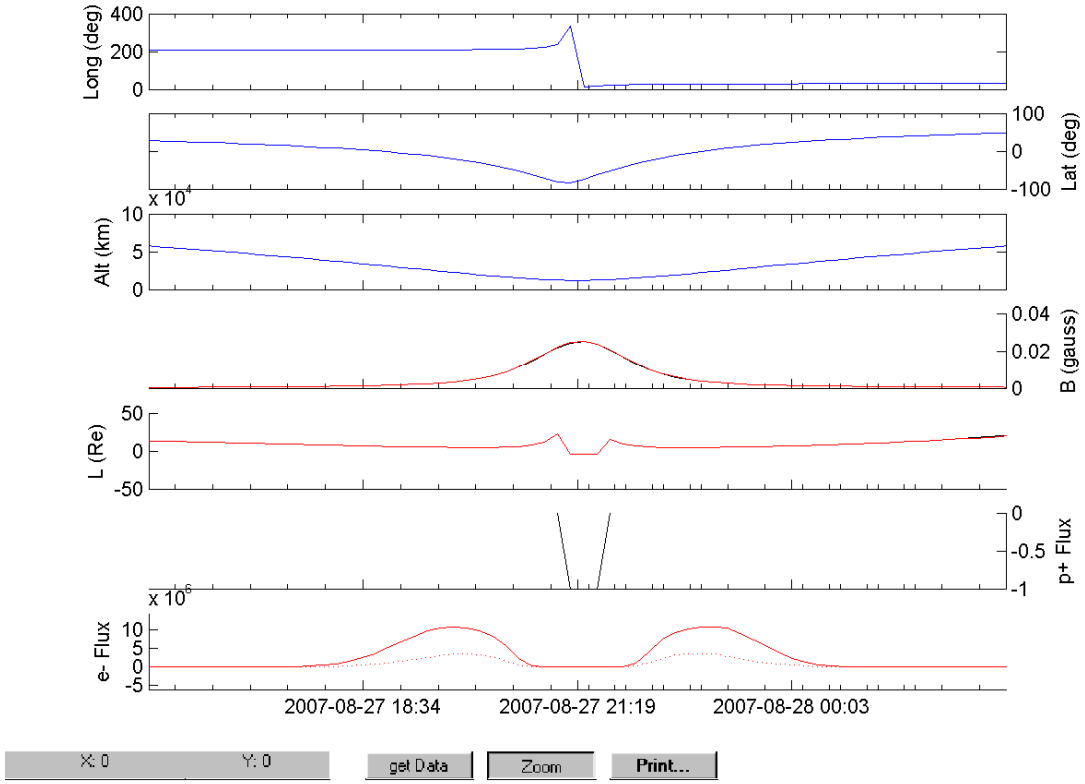


IREM Predicted Radiation Belt Passages

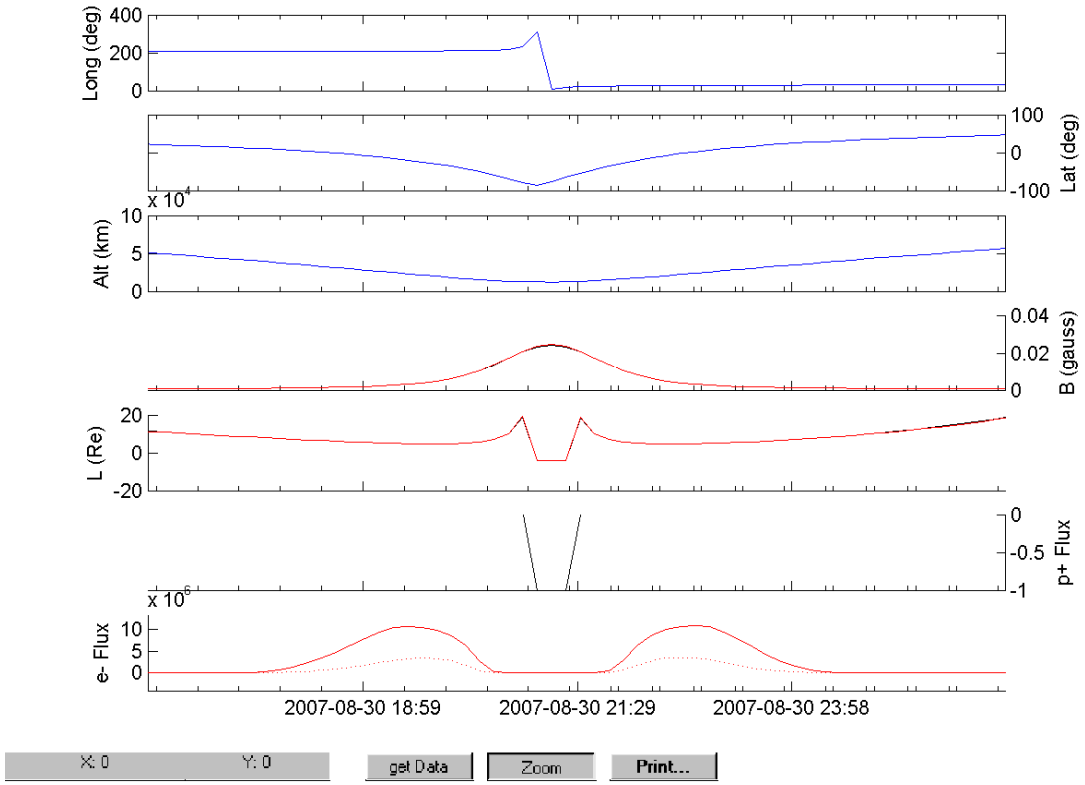
Rev 593



Rev 594



Rev 595



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.