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

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-OPS-OF

No. 250
Week 76

09.07.07

Routine Phase

Prepared by: O. Bergogne (OPS-OAI)

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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 30.06.07 until 06.07.07 (both dates inclusive) and covers the revolutions 576 and 577.

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 raster dither of the Galactic Plane Region 2 (RA 14:08:36.11, DEC -61:30:20.6), and series of Galactic Disk Latitude Scans at (RA 14:07:43.20, DEC -59:27:00.0), (RA 14:39:38.40, DEC -62:16:48.0), (RA 14:37:57.60, DEC -58:00:00.0), and (RA 14:57:50.40, DEC -61:13:48.0), (RA 14:51:07.20, DEC -61:38:24.0), (RA 14:13:14.40, DEC -59:13:12.0).

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.

One slew was missed from TL during the observation period, due to problem on FDS.

The fuel consumption over the period between 30/06/2007 and 05/07/2007 was 0.0618 Kg. The remaining propellant is in the order of 145.4772 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

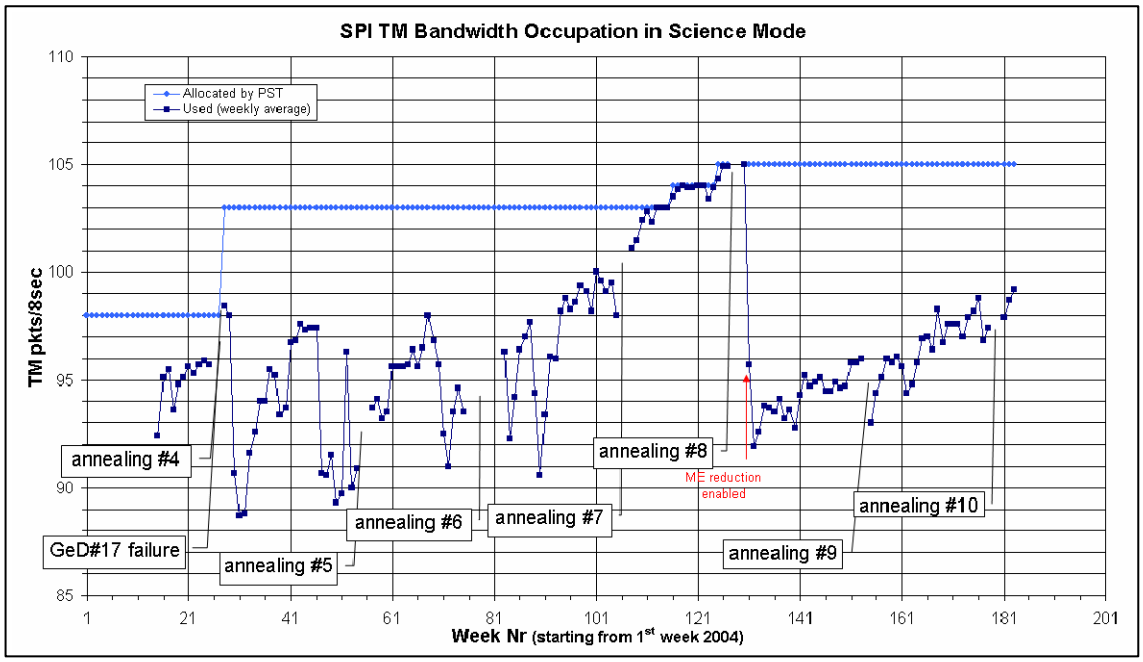
3.2.1 SPI

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 and 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.



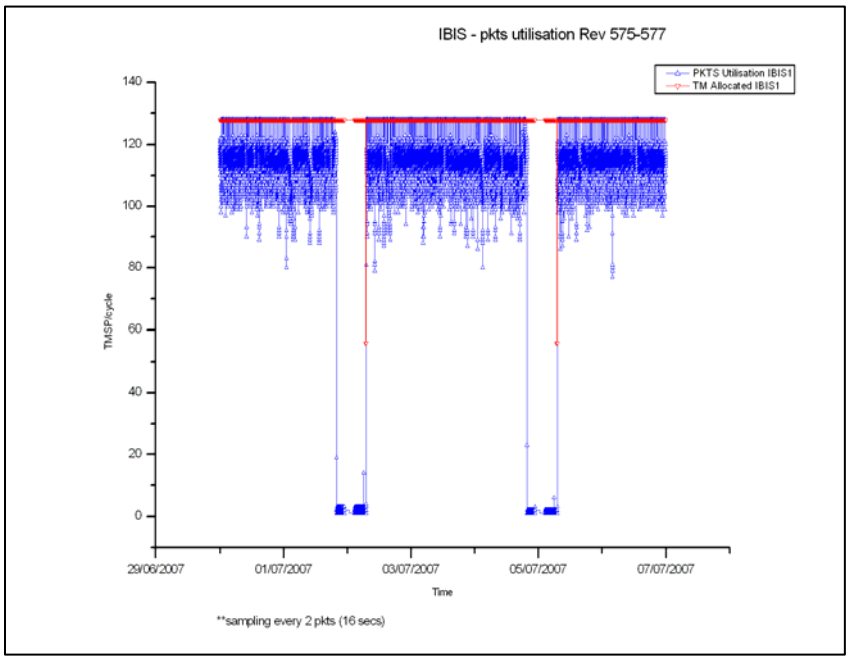
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

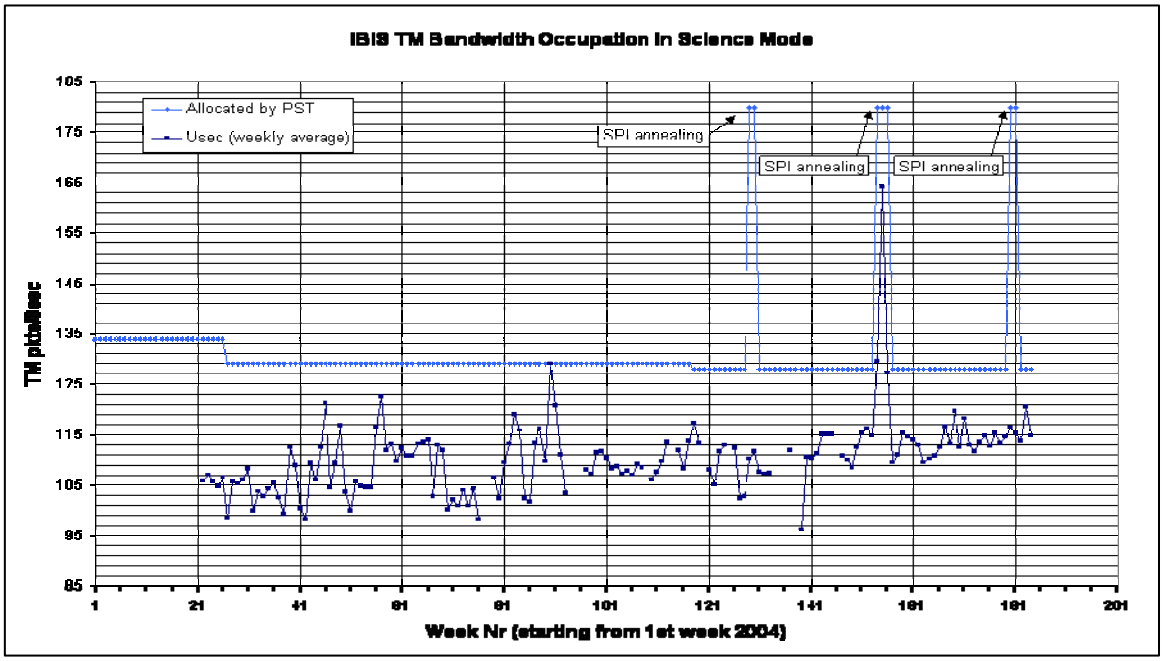
The overall status of the unit is nominal.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period (when IBIS was in Science mode) was 114.80 TMPS/cycle, down 5.75 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.

During this reporting period, 231 of the 232 planned science pointings for OMC were executed nominally. One slew (PID 05770004) failed from the Timeline due to a problem with the Flight Dynamics system and therefore, although OMC was in Science mode with the correct Imaging EDs for this pointing, the attitude was not stable.

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.

Sunspots 961 and 962 were crossing the surface of the sun during the observation period. None of them posed a threat for strong solar flare.

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. 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 very good this week.
The FDS was reported having problem in receiving TM, This caused one slew to be missed. The INCTRB was down for Hardware maintenance, but this had no impact on the operational A-chain. 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 was however one occasion of a data drop from Redu, and a glitch on the link to ISDC. Besides SLE tests were performed with the Ground Station VIL2, but they had no impact on the operations. The overall performance was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning
PSFs are available up to revolution 587. Observations were planned up to 584 with continuing difficulties in planning the Galactic Latitude Scans.

TSFs received up to revolution 582.

2. Observation status
ECS files have been received up to revolution 569 and processed up to revolution 567.

3. ISOC Science Data Archive
A new version of INVITE is ready for testing. The ability to display also data from the Galactic Bulge Monitoring program has been included in the User Requirements for future versions.

4. ISOC system
Work is ongoing on V15.2 which is expected to be ready for testing end of next week.

5. Problems
The automatic backup of the operational Oracle data base did not work for a while as a disk was not correctly remounted after last week's power cut. Another backup exists, but the procedure will be modified.

4.3.2 ISDC

Status of ISDC observation processing on 09/07/2007:

- Latest Standard Analysis completed: observation 04200770002 (NGC 4151, Revolution 561) on 30/06/2007.

- Latest products archived: observations 04200320002 (EXO 0748-676, revolution 566) and 04200770002 (NGC 4151, Revolution 561) on 30/06/2007.

- Latest observation products sent to the observer: observation 04700020002 (1E 1048.1-5937, Revolution 560) on 14/06/2007.

5 Special Events

6 Anomalies

The following problems were reported that impacted operations:

- On DoY 2007.186 (05/07/2007) at 07:59Z, due to problem with TM reception on FDS, the updating TPF for slew #0004 failed to be generated. This caused the slew to be missed from the timeline
- On DoY 2007.186 (05/07/2007) at 08:37Z INCTR-B was down for hardware substitution. Problems occurred in configuring the new hardware, and it was decided to roll back to previous hardware. Then, problems in re-establishing the TM links between INCTRS-B and MCS were reported. Therefore the whole B-chain was restarted. The B-chain was finally back operational at 13:56Z.

No anomaly report was entered into the ARTS system this week.

7 Future Milestones

The following activities are foreseen in the next few weeks.

- Periodic Thruster Torque rescaling 24th July 2007 in Rev. 583
- On Board Clock wrap around due 30th July 2007 in Rev. 585.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 576

The observations in revolution 576 began with a series of Galactic Disk Latitude Scans (RA 14:07:43.20, DEC -59:27:00.0), for ~8.3 hours, then (RA 14:39:38.40, DEC -62:16:48.0), for ~8.8 hours, then (RA 14:37:57.60, DEC -58:00:00.0), for ~17.1 hours, then back to (RA 14:39:38.40, DEC -62:16:48.0), for a further ~8.3 hours, then back to (RA 14:07:43.20, DEC -59:27:00.0), for a further ~8.8 hours. Finally, a raster dither of the Galactic Plane Region 2 (RA 14:08:36.11, DEC -61:30:20.6), which lasted ~2.1 hours was performed, until the end of the revolution.

Revolution 577

The observations in revolution 577 began with a series of Galactic Disk Latitude Scans (RA 14:57:50.40, DEC -61:13:48.0), for ~8.8 hours, then (RA 14:51:07.20, DEC -61:38:24.0), for ~8.8 hours, then (RA 14:13:14.40, DEC -59:13:12.0), for ~17.1 hours, then back to (RA 14:51:07.20, DEC -61:38:24.0), for a further ~8.3 hours, then back to (RA 14:57:50.40, DEC -61:13:48.0), for a further ~8.3 hours. Finally, a raster dither of the Galactic Plane Region 2 (RA 14:08:36.11, DEC -61:30:20.6), which lasted ~2.1 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

```
2007-06-14T23:06:24.000Z     145.7000    F   Automatic TM processing.
2007-06-15T14:39:05.000Z     145.6940    F   Automatic TM processing.
2007-06-17T04:30:05.000Z     145.6840    F   Automatic TM processing.
2007-06-18T14:03:53.000Z     145.6596    F   Automatic TM processing.
2007-06-20T04:17:40.000Z     145.6431    F   Automatic TM processing.
2007-06-21T13:50:00.000Z     145.6263    F   Automatic TM processing.
2007-06-23T04:05:24.000Z     145.6173    F   Automatic TM processing.
2007-06-24T13:39:03.000Z     145.5785    F   Automatic TM processing.
2007-06-26T03:58:27.000Z     145.5648    F   Automatic TM processing.
2007-06-27T14:50:55.000Z     145.5460    F   Automatic TM processing.
2007-06-29T03:45:16.000Z     145.5390    F   Automatic TM processing.
2007-06-30T13:24:31.000Z     145.5236    F   Automatic TM processing.
2007-07-02T03:32:19.000Z     145.5176    F   Automatic TM processing.
2007-07-03T13:08:55.000Z     145.4912    F   Automatic TM processing.
2007-07-05T03:21:55.000Z     145.4772    F   Automatic TM processing.

This report was generated Fri Jul 6 08:00:23 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, 30/06/2007 – 06/07/2007

AOCS operations were executed from the Automatic Timeline.

During this period, 80 Open Loop Slews, 170 Closed Loop Slews and 5 Momentum Biases were executed.

1 slew (CSL) was missed from TL, during the observation period, due to FDS failing update generation (GTPs processors not working).

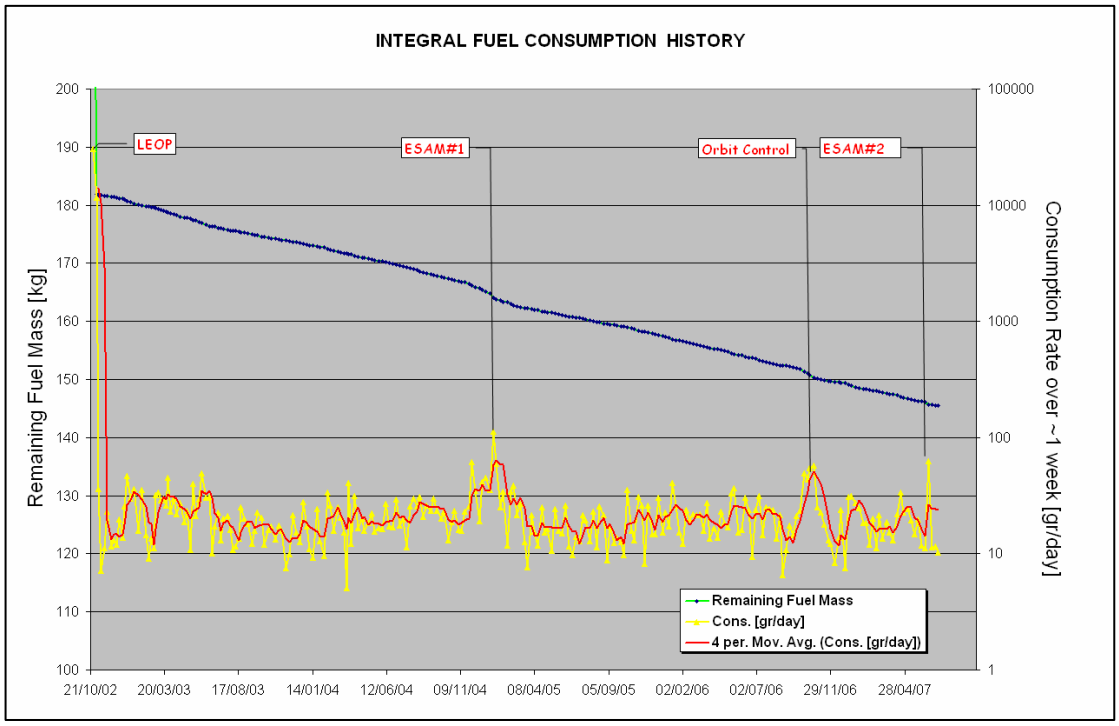
This is equivalent to ~0.4 % of the total number of slews planned (250).

Orbit Control

No update.

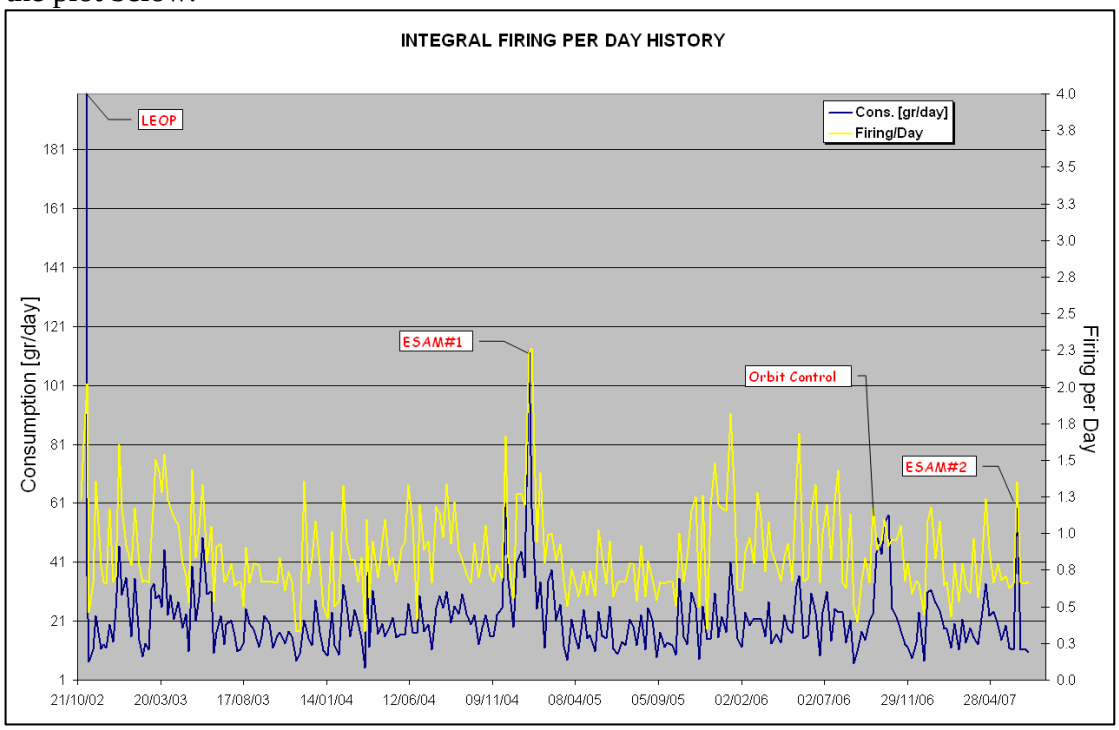
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 05/07/2007 is reported in the plot below.



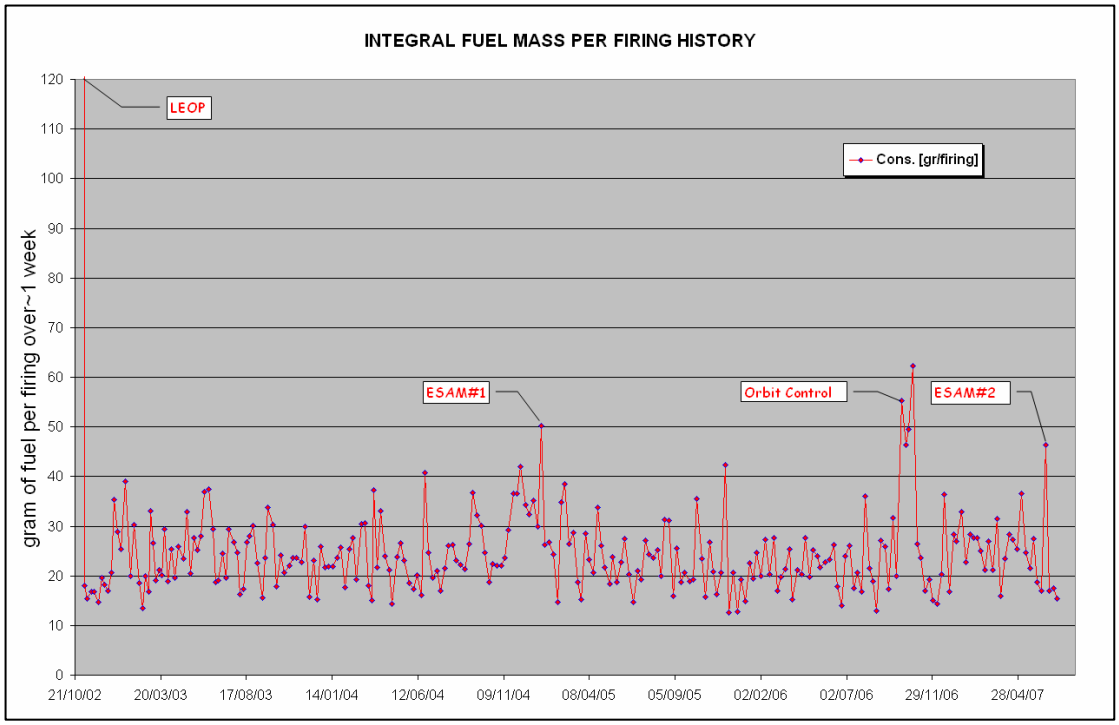
The plot above has been corrected to consider the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 05/07/2007 is reported in the plot below.



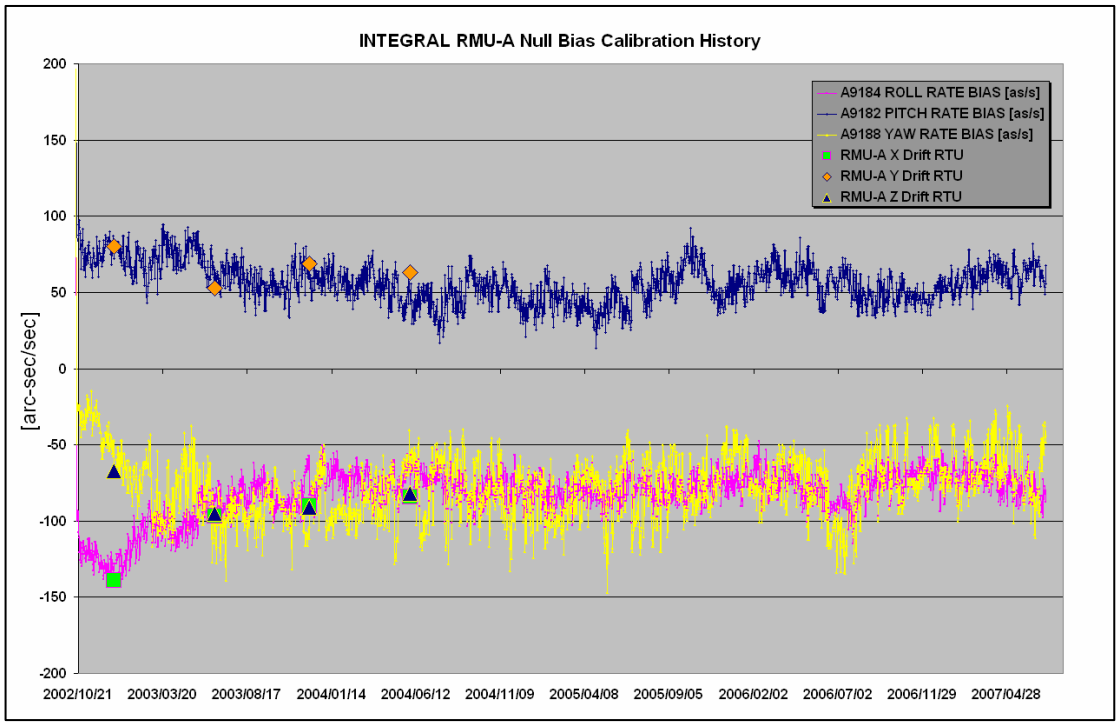
The plot above has been corrected to consider the ESAM fuel consumption spread over period of ~1 week.

The fuel per firing over the period between 01/11/2002 and 05/07/2007 is reported in the plot below.

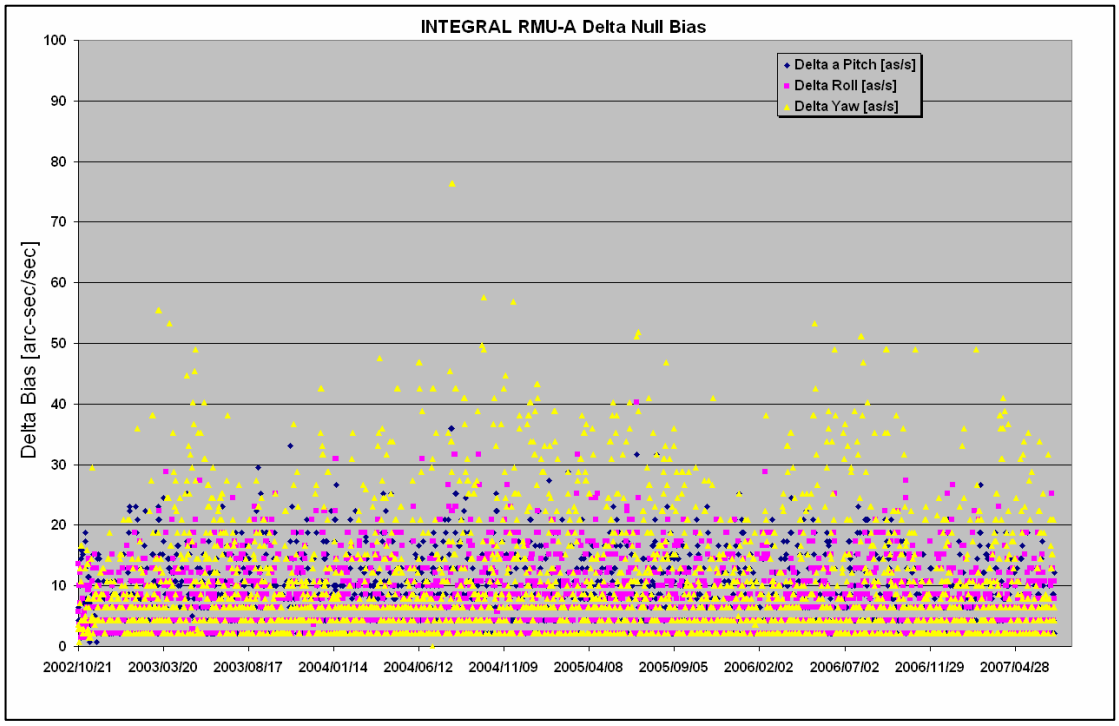


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 06/07/2007 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 06/07/2007 is reported in the plot below.



30/06/2007 (Day of Year 181, Revolution 575)

Nothing to report.

01/07/2007 (Day of Year 182, Revolution 575)

Nothing to report.

02/07/2007 (Day of Year 183, Revolution 575-576)

IMCS command verifier task problem: at 07:17z the Command Verifier Task on IMCS-A crashed (lost connection to the TM cache), causing the last two commands for the mapping sequence , after slew ID 05760002, to fail release.

A mapping was then manually executed and the next slew 05760003 updated at 07:28z in TL.

No impact on TL.

03/07/2007 (Day of Year 184, Revolution 576)

FDS failed slew update: at 01:53z the FDS failed the update of slew ID 05760036. FDS reported an error during the update process: the slew for PID 05760035 was a CSL with component only on the roll ($X_{s/c}$) axis, but size >6 deg (nominally CSL are defined <6 deg). Therefore the duration of the slew was exceeding the nominal expected CSL duration. The update TPF job which runs after each slew is kicked off relatively to the slew end of the previous slew. In order to read the current wheel speeds the software accesses the TM at a time which is, however, relative to the slew start of the previous slew (in this case a CSL). It happened that the previous CSL took longer than 3 minutes which caused the TPF update software to read RWs speeds TM during the slew. These wheel speeds, however, were not suitable to perform the slew and the TPF generation was aborted.

A manual recovery was performed and the next slew (05760036) updated in TL.

No impact on TL.

04/07/2007 (Day of Year 185, Revolution 576)

Nothing to report.

05/07/2007 (Day of Year 186, Revolution 576-577)

FDS failed slew update: at 07:59z the FDS failed the update of slew ID 05770004. FDS reported an error during the update process: GTPs (TM processors) were frozen and did not receive TM. The update TPF update for slews 05770004 and 05770005 could not find the mapping taken after the previous slew but rather found the mapping after slew 05770002 as last mapping instead.

A manual recovery was performed at 08:10z to the attitude of PID 05770004 and the next slew (05770005) manually updated in TL.

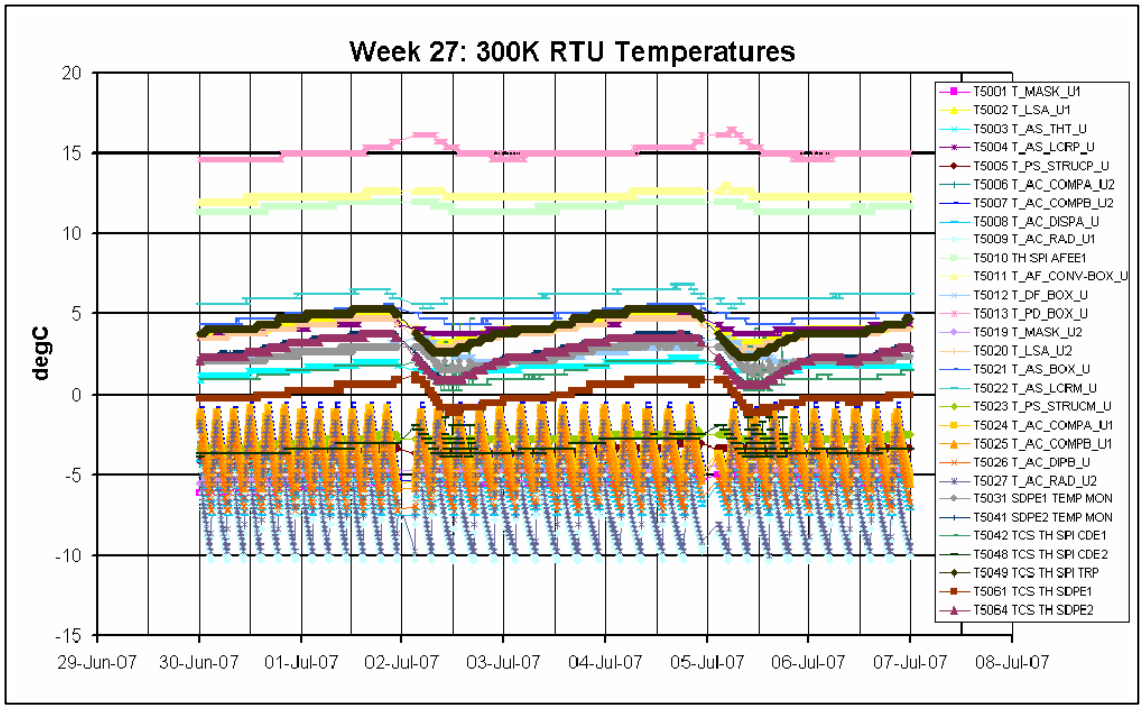
The following slew was missed in TL: 05770004(CSL)

06/07/2007 (Day of Year 187, Revolution 577)

Nothing to report.

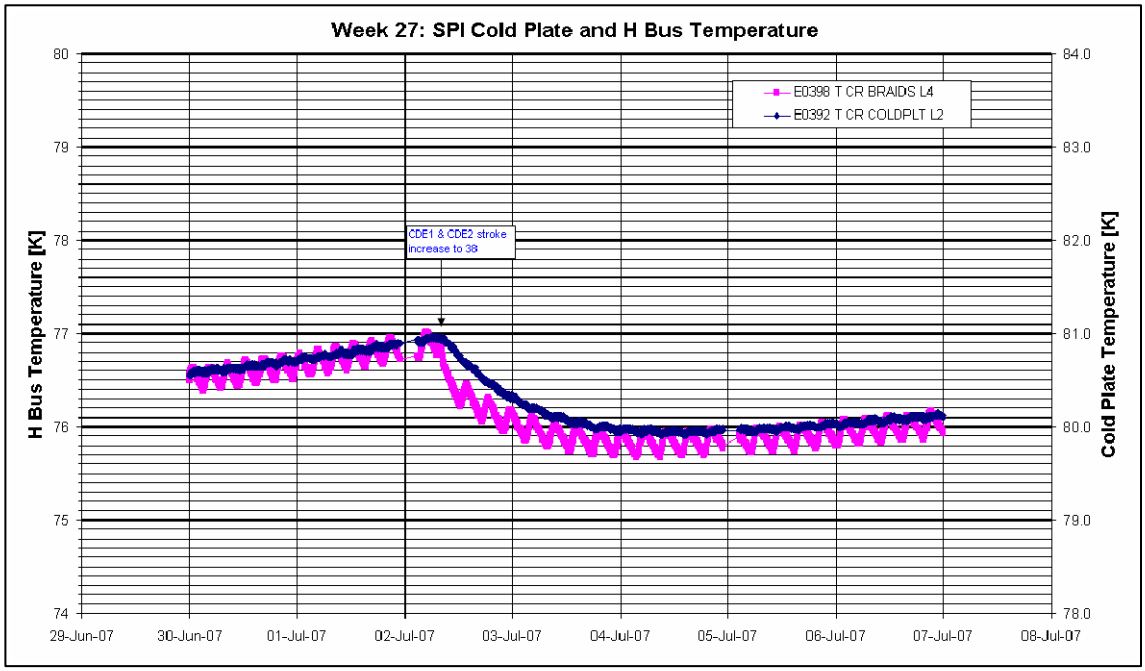
8.3.2 SPI Operations

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

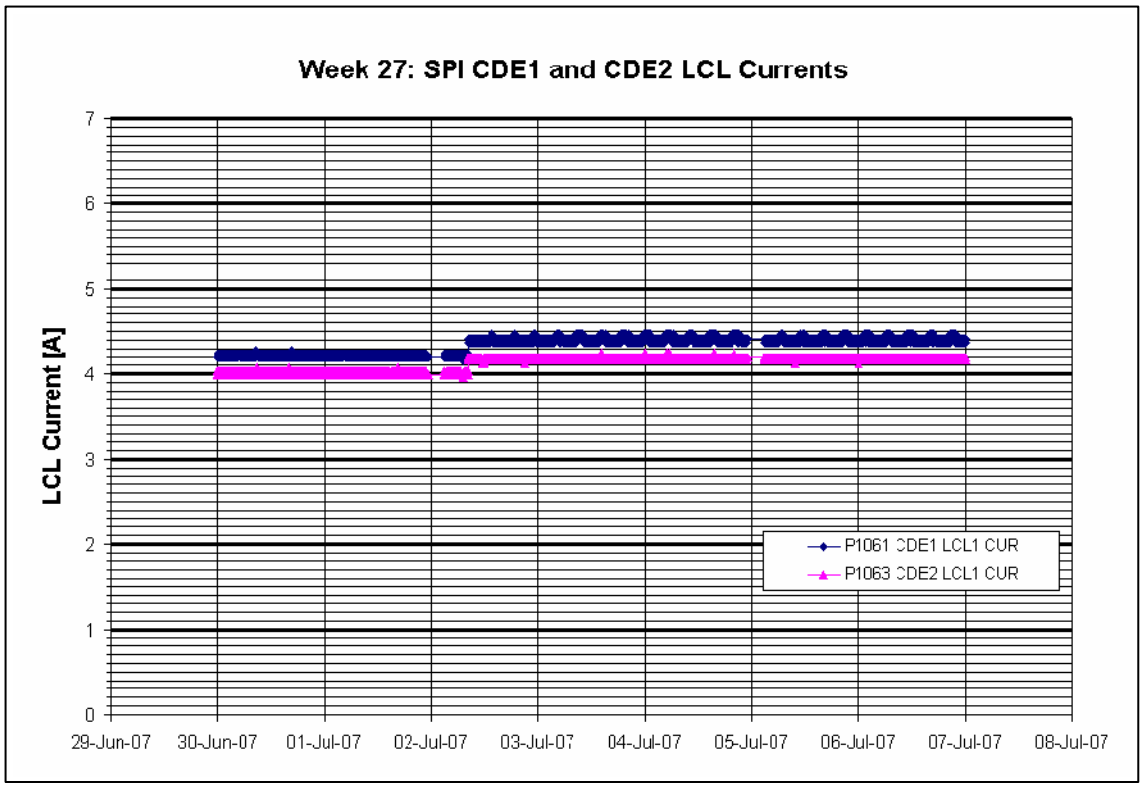


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K. On 02/07/2007 at 08:19Z, the stroke of all four compressors was increased to 38, after which it remained at 38 for the rest of the reporting period.

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

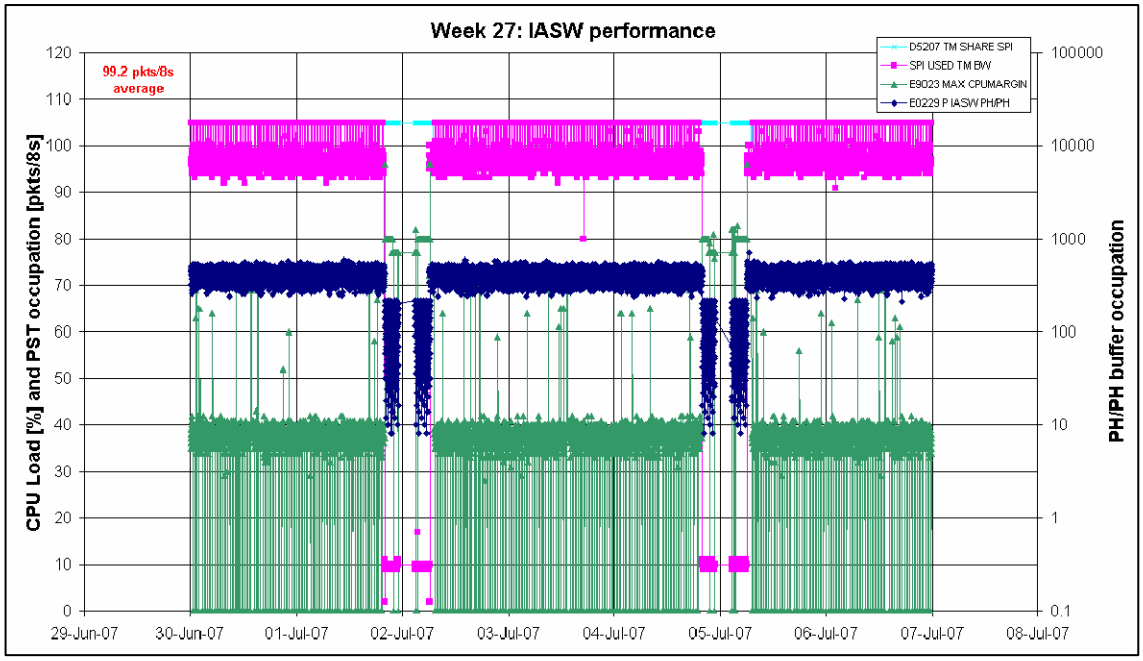


period.

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

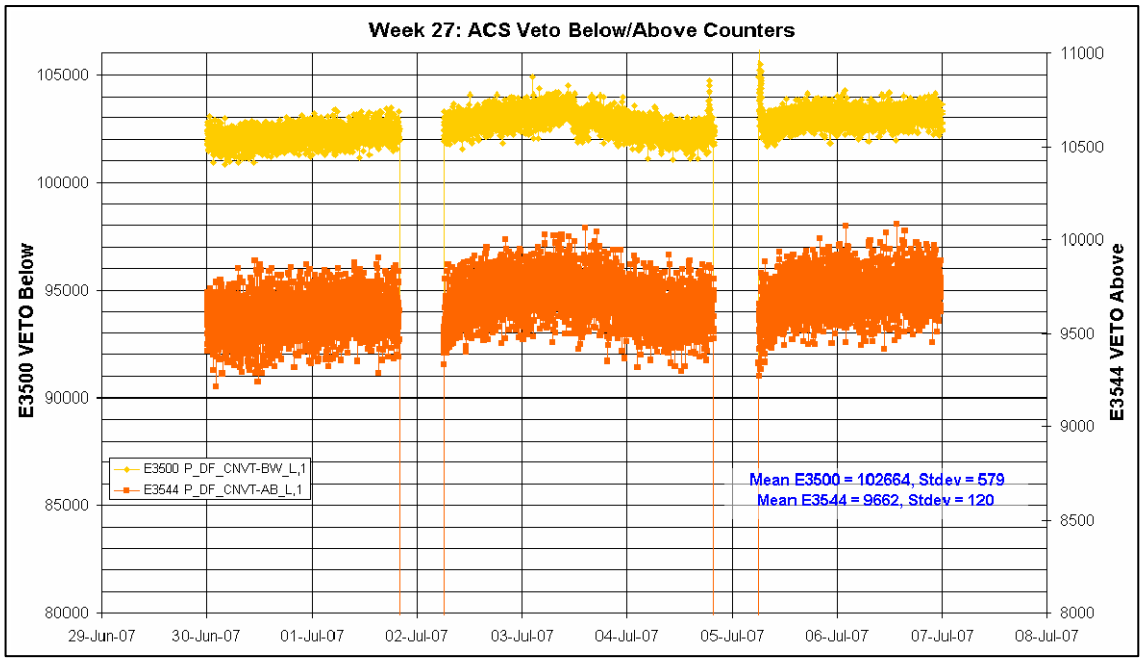
average TM bandwidth occupation of SPI was 99.2 packets/cycle over the science window, when the TM allocation was 105 packets/cycle.

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



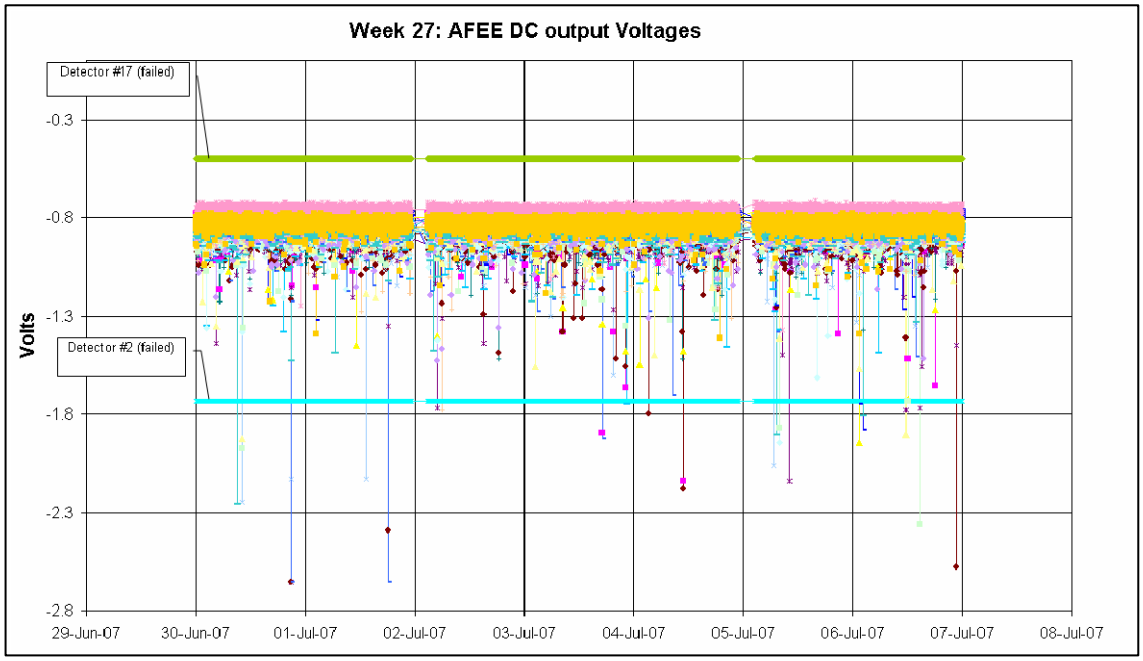
ACS: The performance of the ACS is nominal, except for FEE 81 which remains switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is still OFF due to the anomaly on 5/8/2003 (INT_SC-61).

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

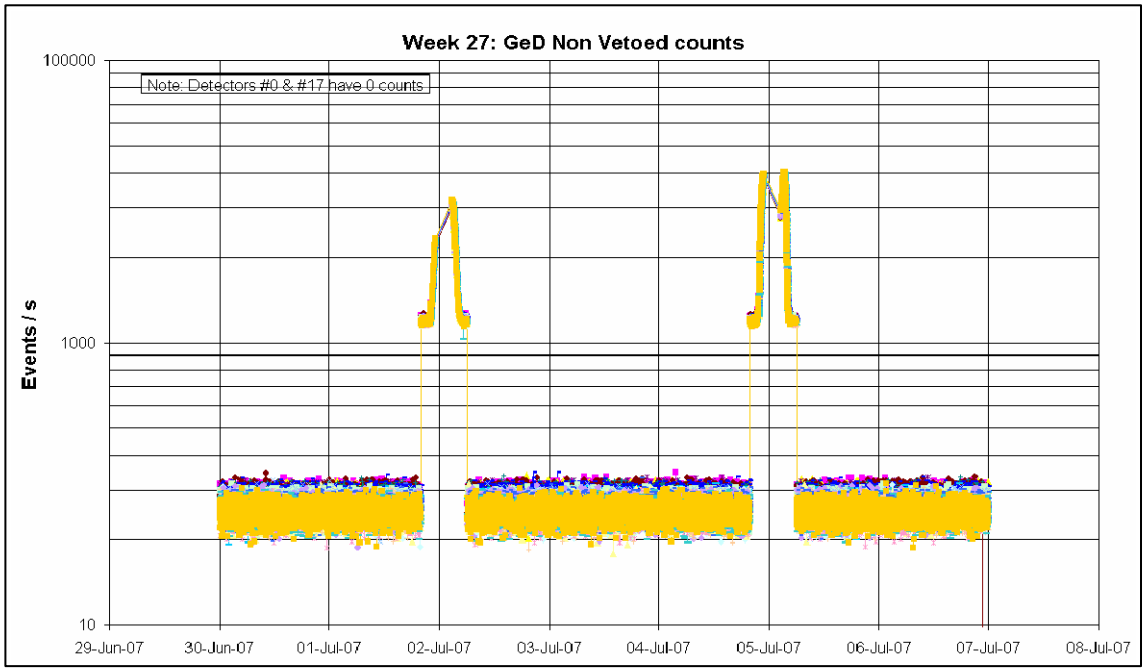


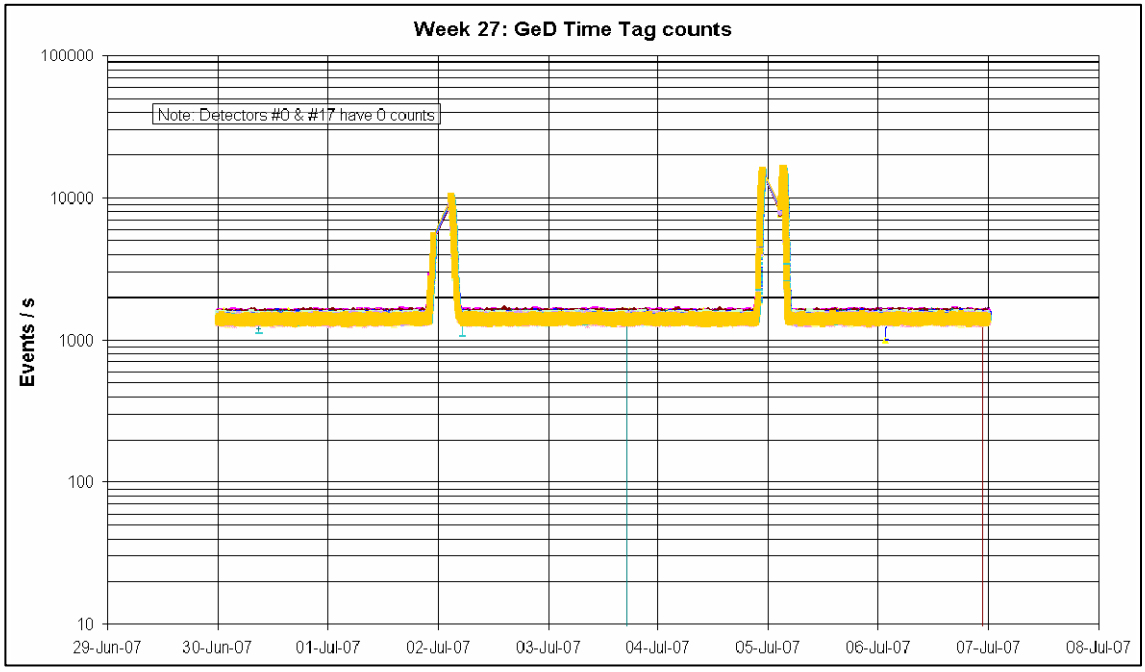
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operated at a lower HV setting of 3.5kV (instead of 4kV).

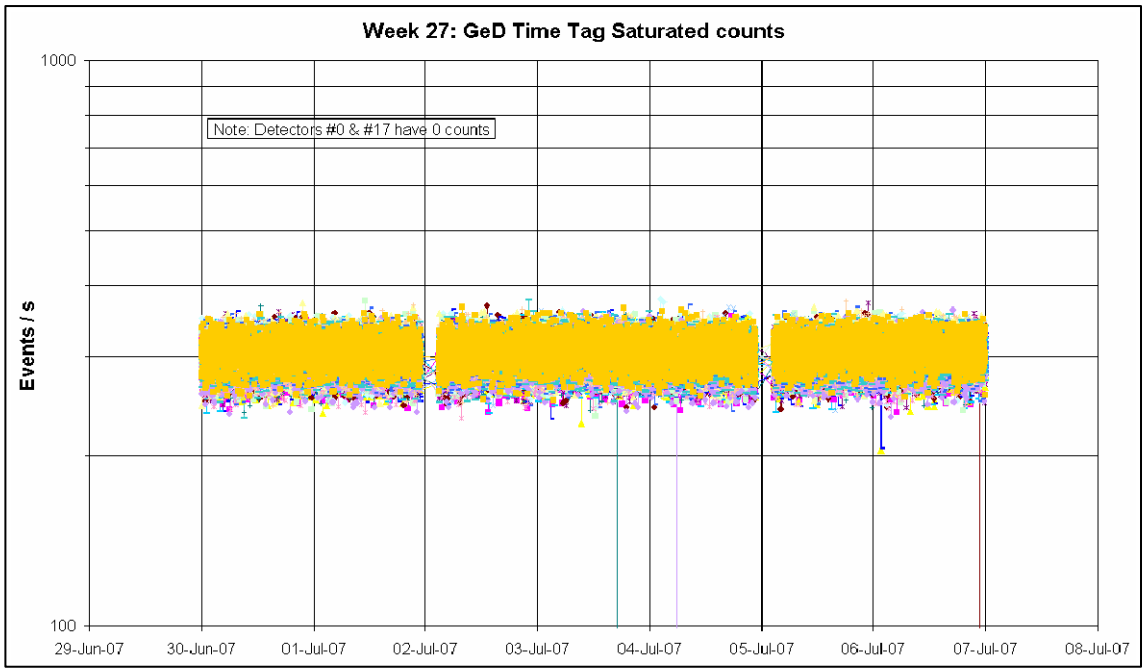
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



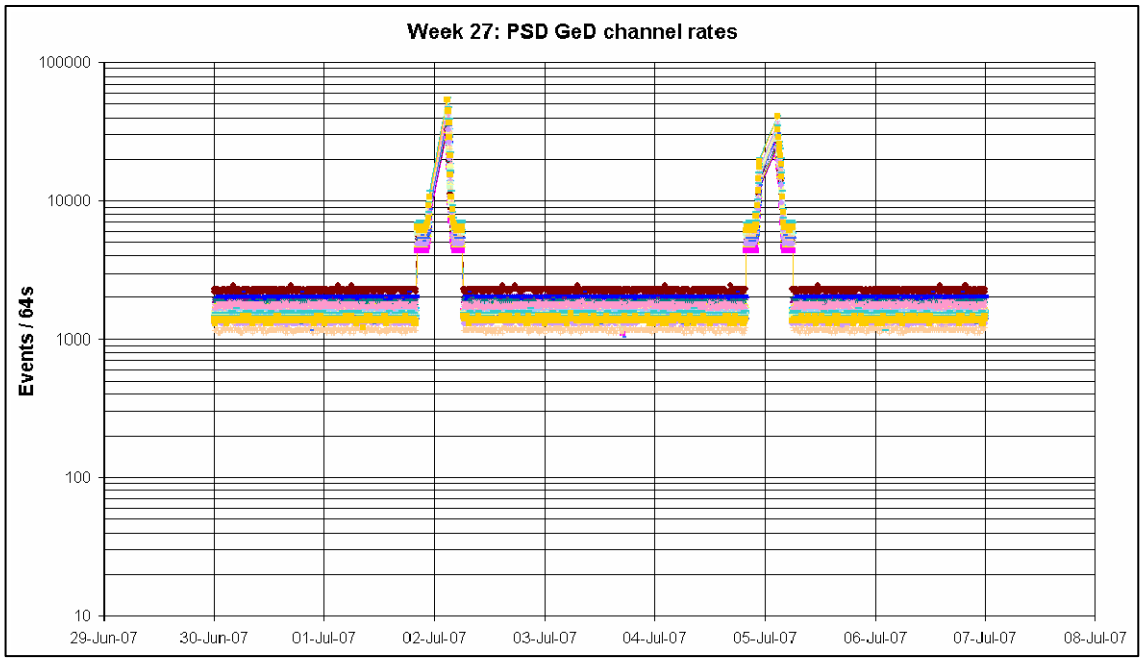
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.







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



Event Log:

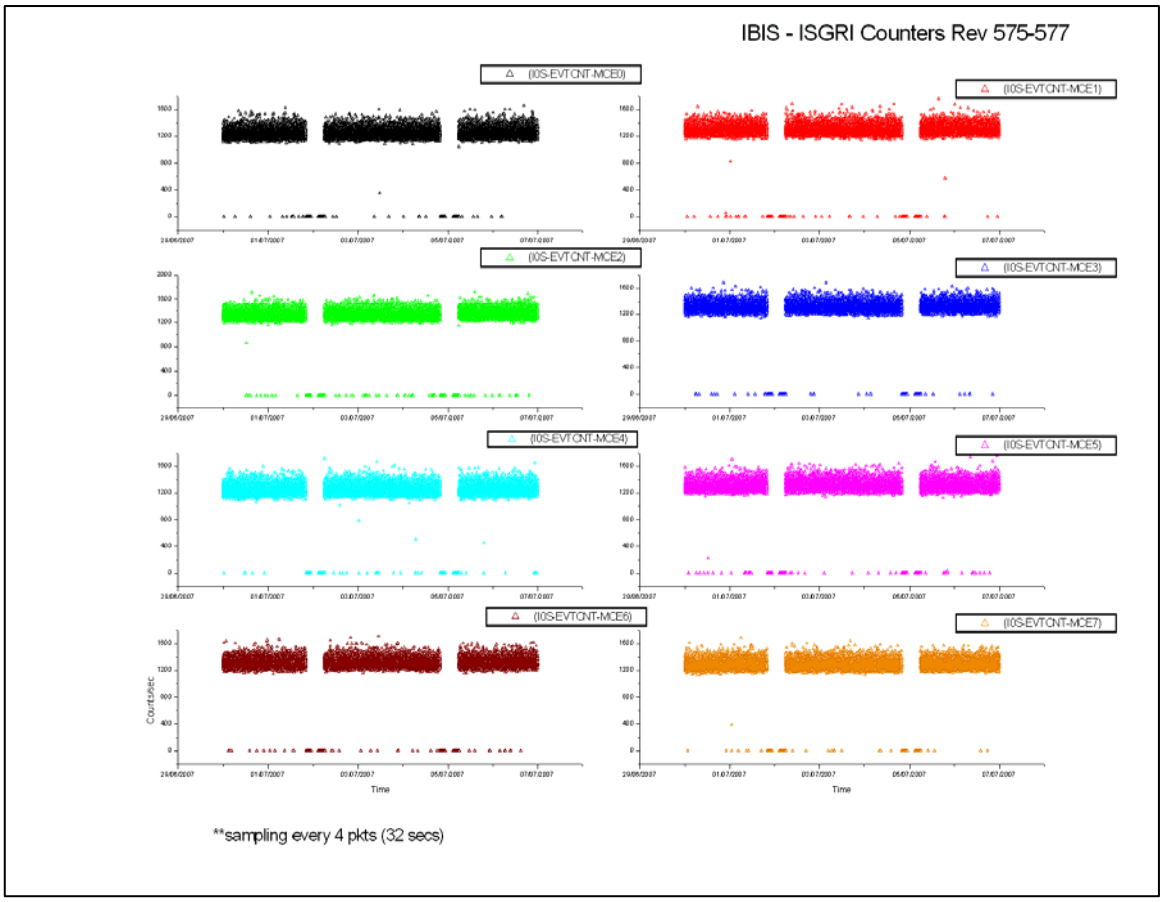
The following non-nominal events occurred on SPI during the reporting period:

- On 2007-07-02 at 12:50:19Z OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED was received. This was during Pointing ID 05760011. As it was a single occurrence, no action was taken.
- On 2007-07-04 at 11:48:44Z TM parameter E2391 (ACS FEE analogue status -5 V #41) went OOL (value = PARAM > SPEC). It returned within limits when the next packet was received at 11:59:24Z.
- On 2007-07-05 at 03:07:30Z OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. This was during the AOS_CHK window of revolution 577, when the time verification TC was sent. This OEM is sometimes received when this TC is sent and no action was taken.
- On 2007-07-05 at 06:01:59Z, during the reconfiguration of SPI at radiation belt exit, the TM parameters E3825; E3826 and E3828-E3831 went OOL with value = 0 raw. These are the PSD +/-5V analogue voltages and some PSD board temperatures. They returned within limits when the next packet was received at 06:03:03Z.

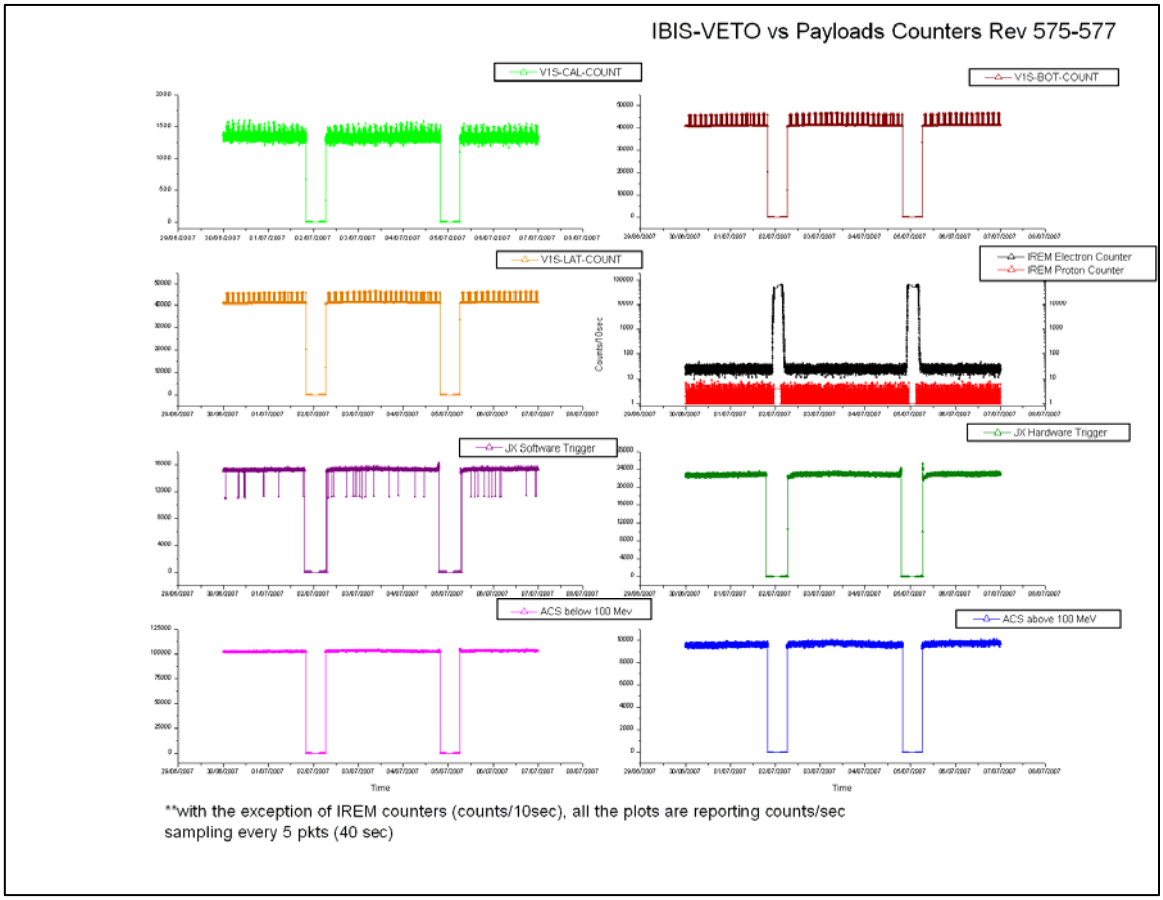
8.3.3 IBIS Operations

IBIS Event Counters Plots:

ISGRI Counters:

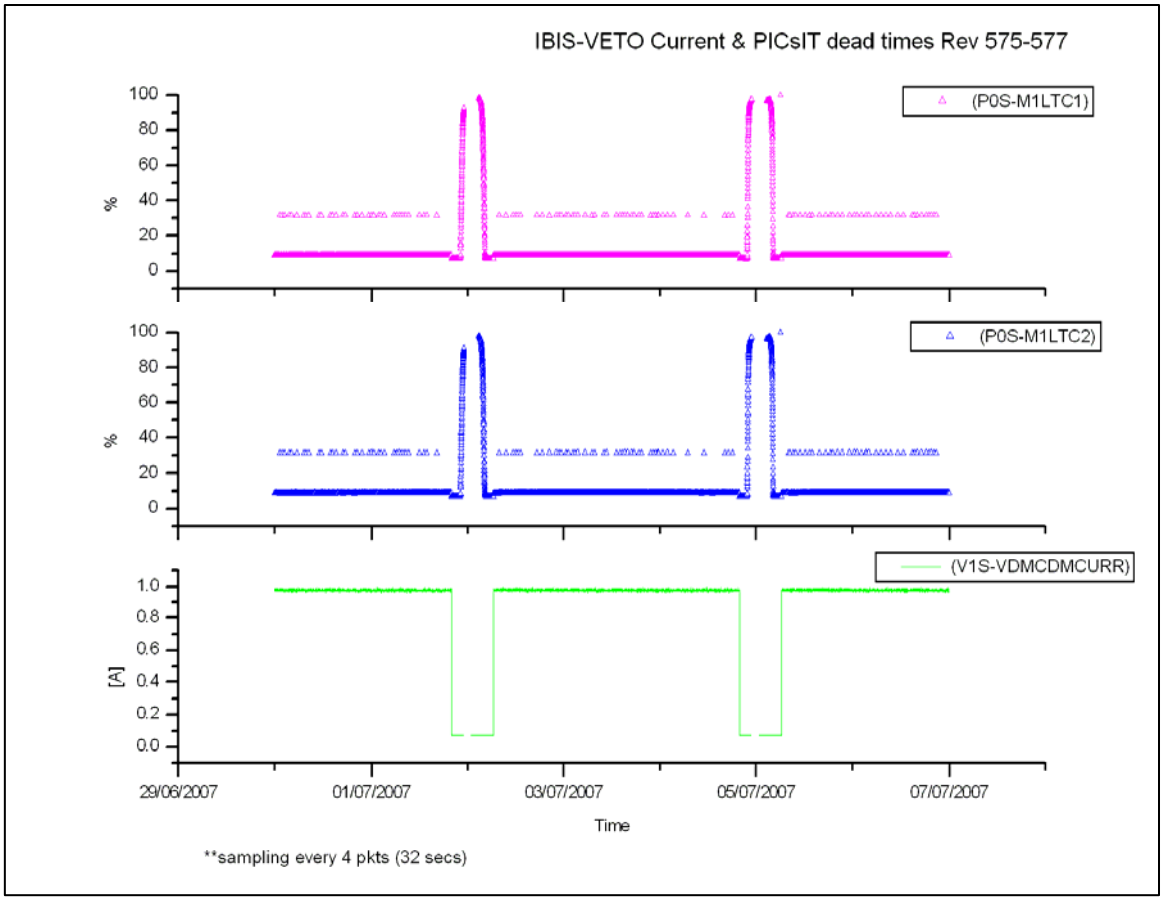


VETO vs Payloads Counters:

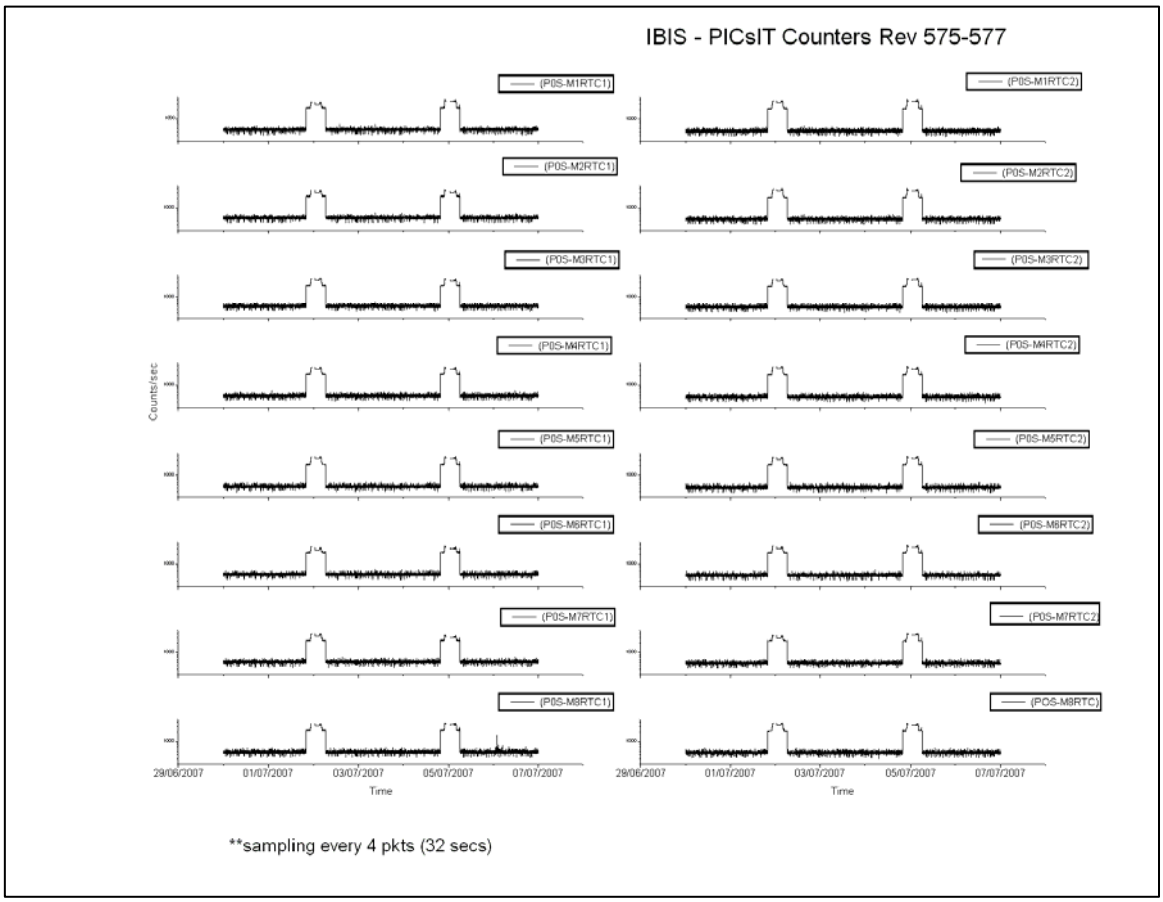


The week was characterised by low radiation as reported by the payload.

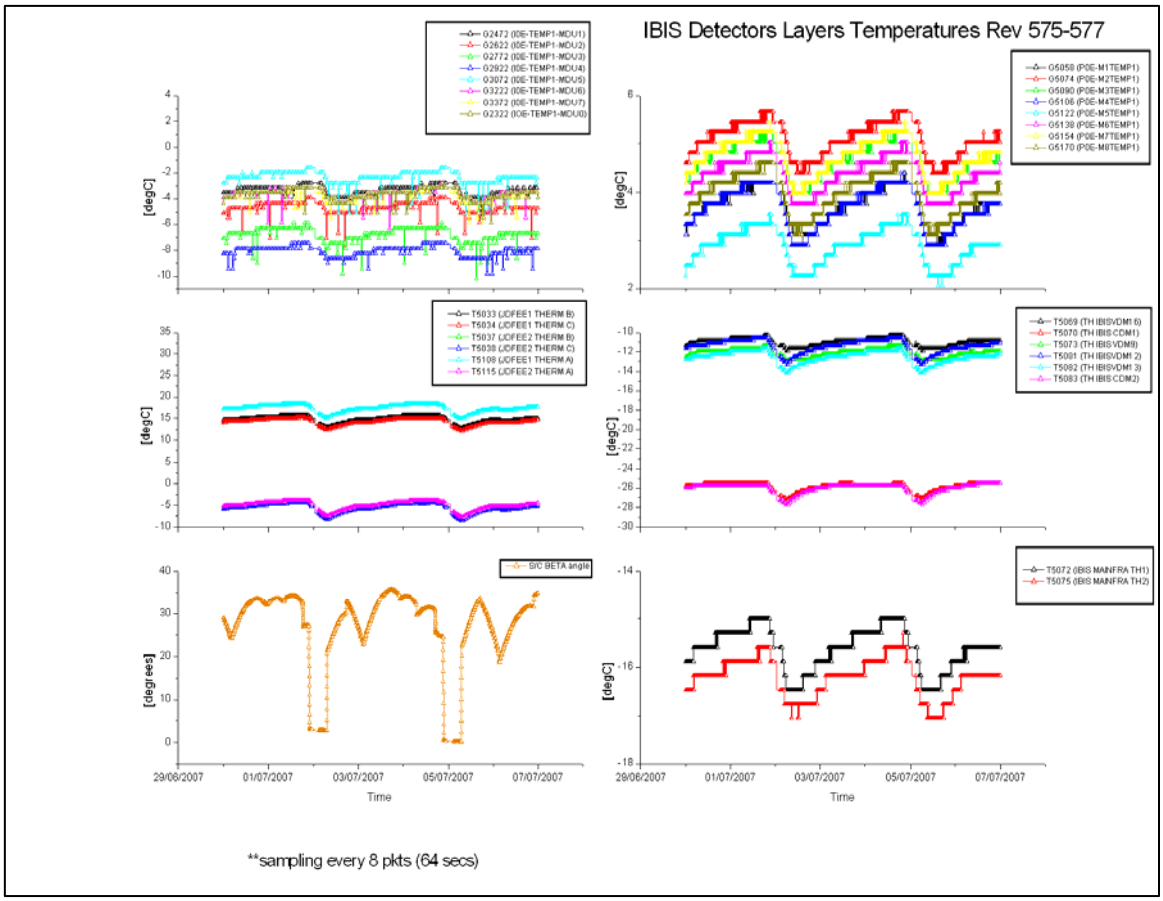
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



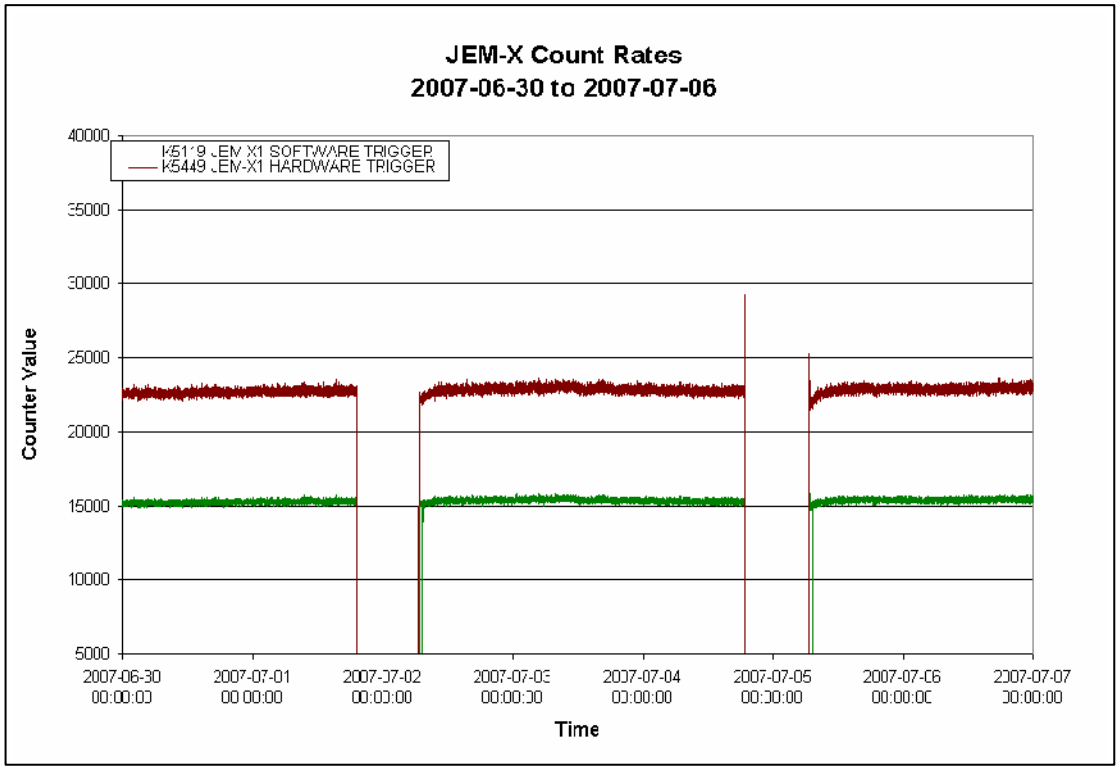
IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), families G5002 (P0S-Mi_RTC1) and G5003 (P0S-Mi_RTC2), families G2014 (I0E-OVFWPXADD-Mi) were reported at Radiation Belts passage.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

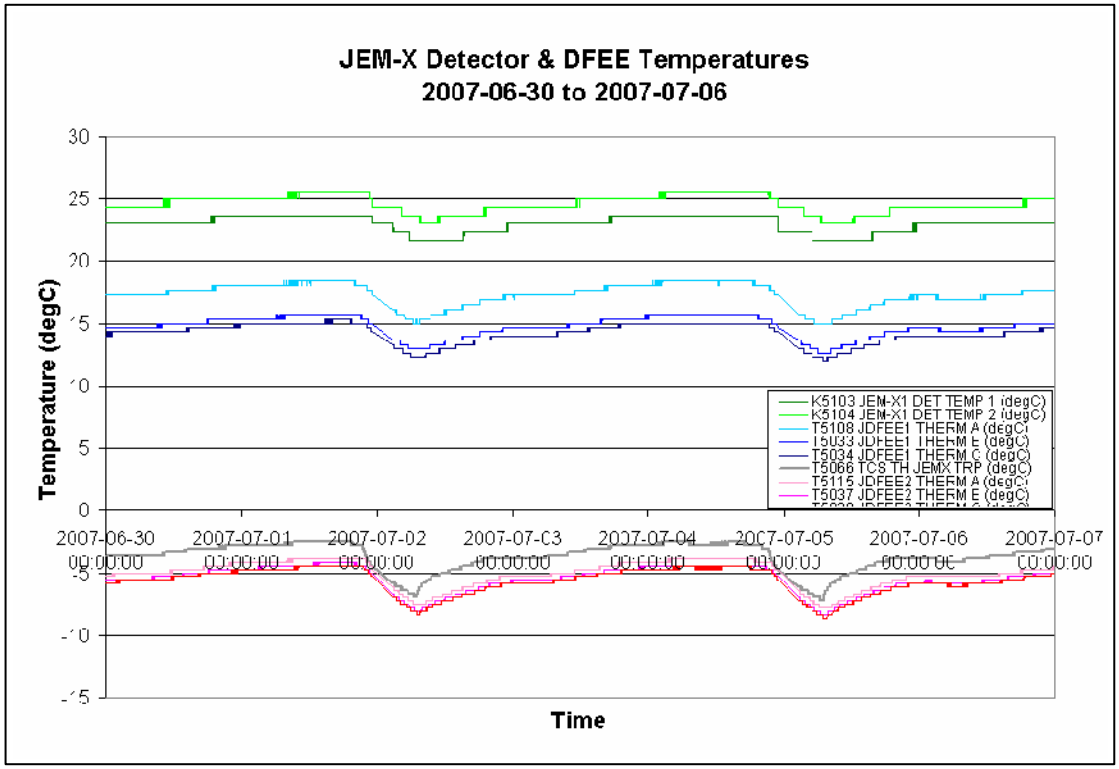
JEM-X count rates over the reporting period are displayed in the following graph[1].



8.3.4.2 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].

[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)



8.3.4.3 JEM-X Daily Report

2007-06-30 (DOY 181, Rev 575) to 2007-07-03 (DOY 184, Rev 576)

JEM-X1 operations executed nominally.

2007-07-04 (DOY 185, Rev 576)

At 18:55:02Z TM parameter K5136 BUFFER LOSS went OOL High (value = 144), however it returned within limits at the next TM cycle.

2007-07-05 (DOY 186, Rev 576-577) to 2007-07-06 (DOY 187, Rev 577)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2007-06-30 (DOY 181, Rev 575) to 2007-07-04 (DOY 185, Rev 576)

OMC operations executed nominally.

2007-07-05 (DOY 186, Rev 576-577)

Due to a problem with the Flight Dynamics System, the update for the corrective Closed Loop Slew PID 05770004 failed and therefore the AOCS was disabled and this slew, scheduled at 08:06:16Z, was not executed from the Timeline. However, the Broadcast Packet Commands and OMC Imaging EDs for this pointing were executed

and OMC went to Science Normal mode at 08:07:38Z. A manual corrective CSL was uplinked at 08:21Z, which was seen as an OTF flicker by OMC (OMC remaining in Science mode as there was no change in the BCP PID). Therefore the attitude during pointing 05770004 was not stable.

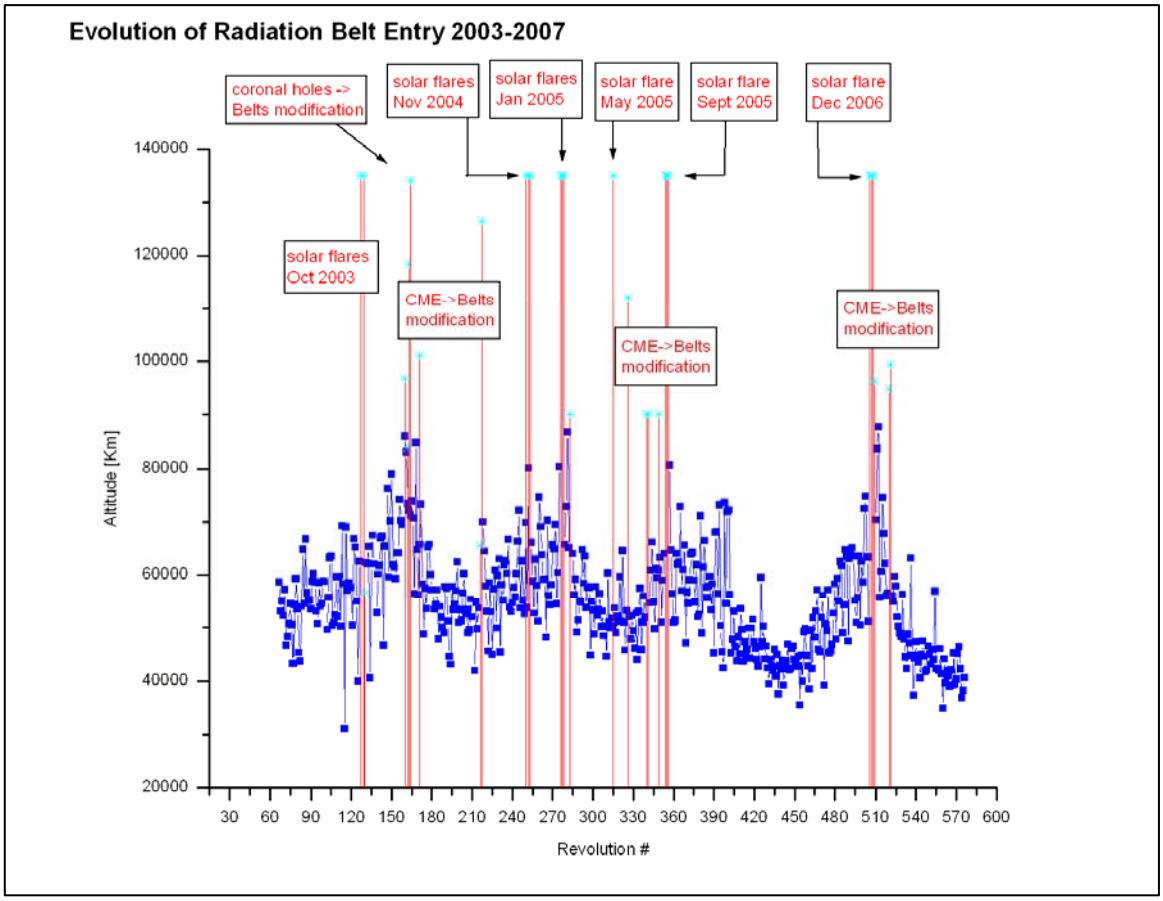
OMC operations continued nominally from PID 05770005 onwards.

2007-07-06 (DOY 187, Rev 577)

OMC operations executed nominally.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

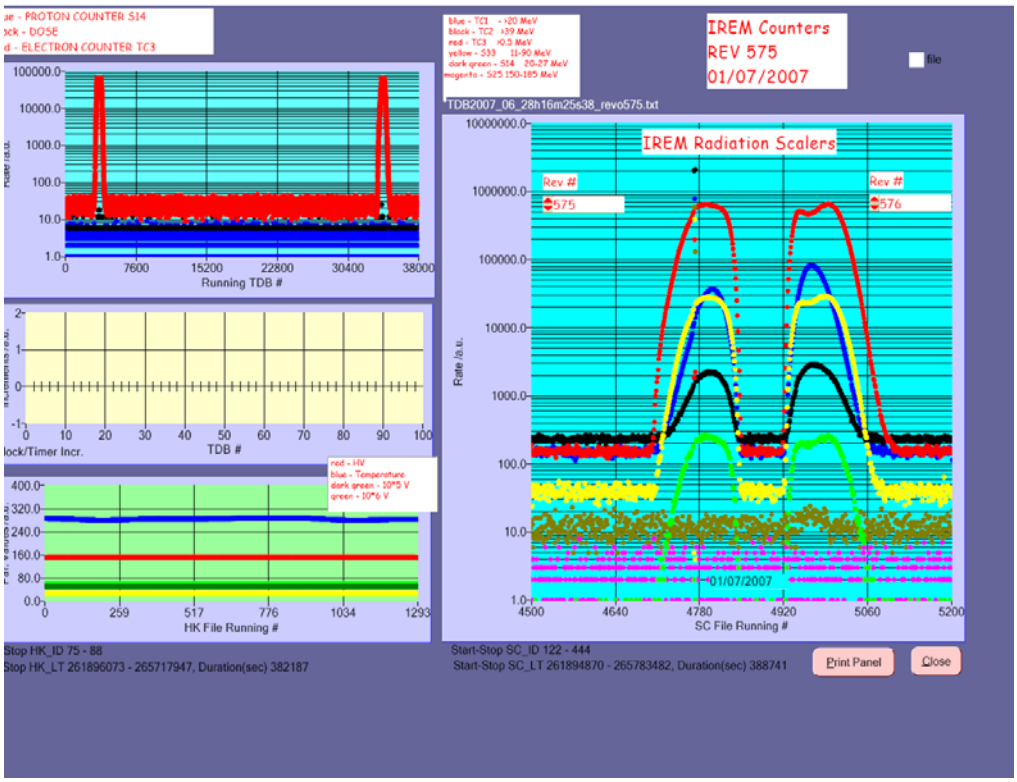
Nothing to report.

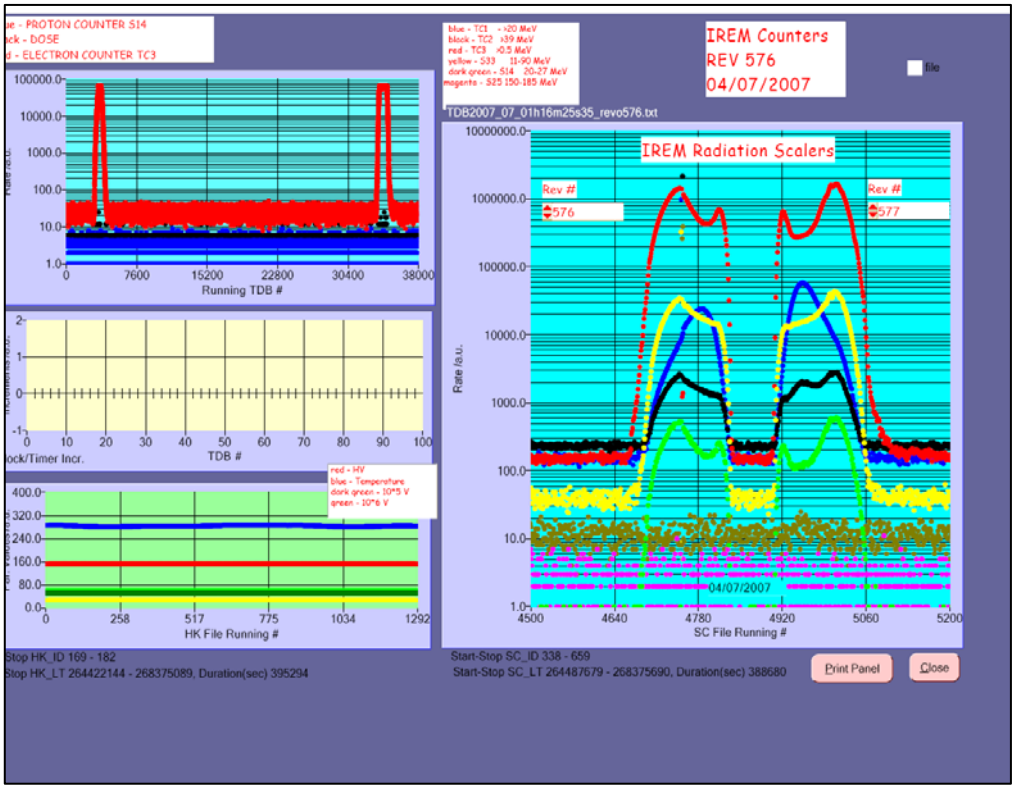
Electron Belts

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]
575	RAD_ENTR R 2007-07-01T20:01:50Z	2007-07-01 22:08:47	38205.0	2007-07-01 21:22:26	45173
576	RAD_EXIT R 2007-07-02T06:12:07Z	2007-07-02 04:41:11	>>31441.5	2007-07-02 05:02:26	42667
576	RAD_ENTR R 2007-07-04T19:51:20Z	2007-07-04 21:35:03	40681.5	2007-07-04 21:08:14	45698
577	RAD_EXIT R 2007-07-05T06:01:44Z	2007-07-05 04:48:55	>>31440.0	2007-07-05 04:48:14	42054

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)

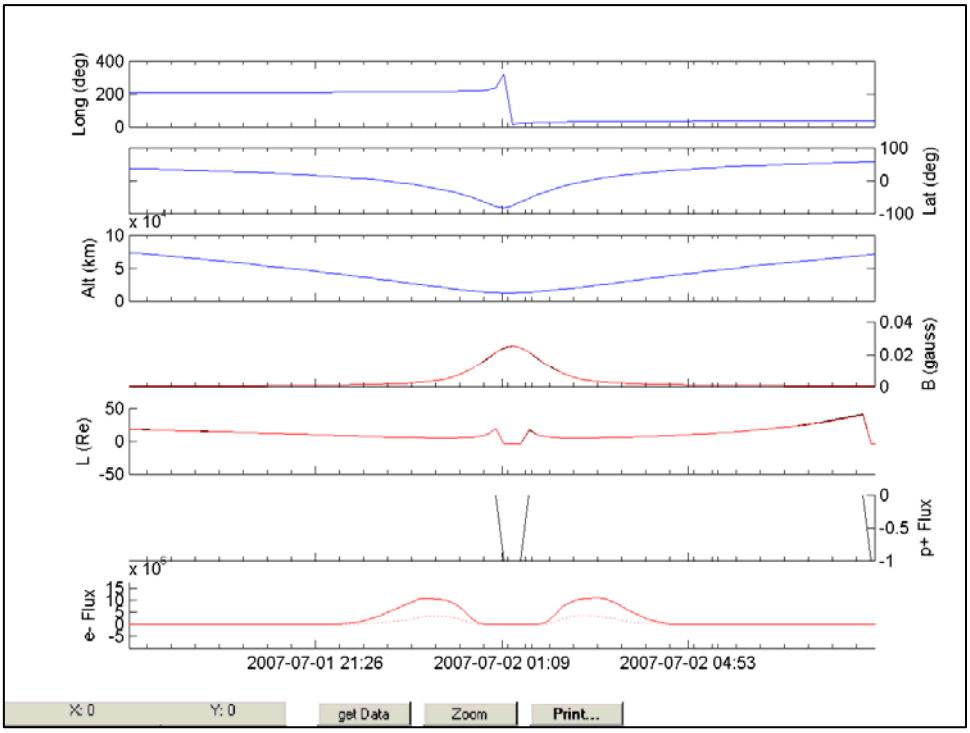
IREM radiation counters:



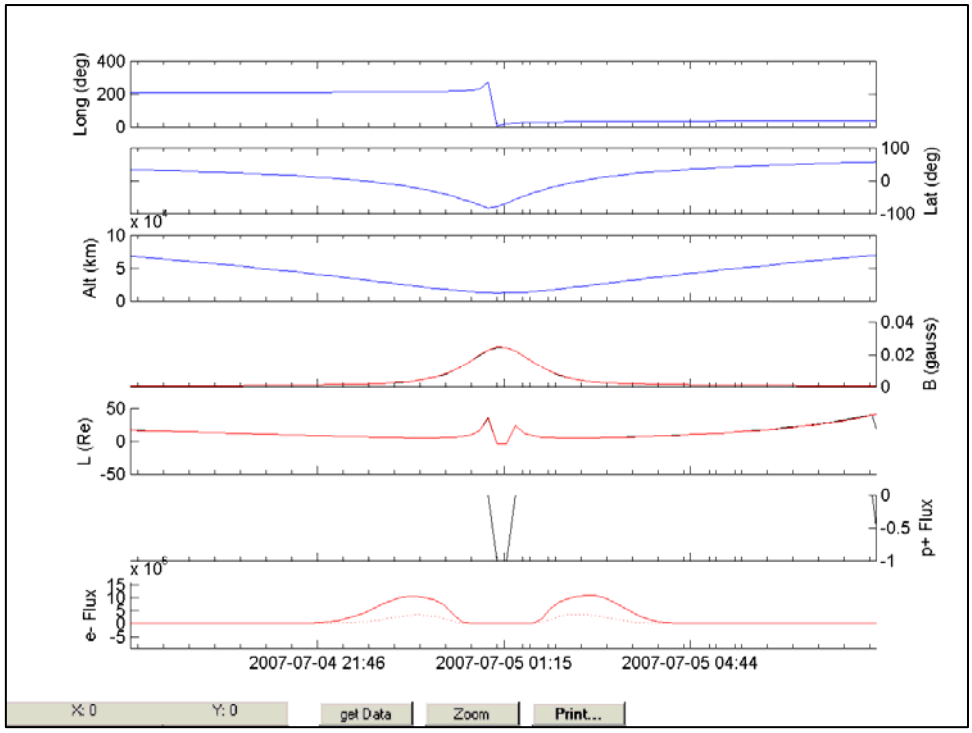


IREM Predicted Radiation Belt Passages

Rev 575



Rev 576



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

Due to problem with the SEIS server, no plots are available this week. However no radiation was reported this week.