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

INTEGRAL
Mission Report

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

No. 269
Week 46

19.11.07

Routine Phase

Prepared by: M.J.H. Walker (OPS-OAI) and INTEGRAL FCT

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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 10.11.07 until 16.11.07 (both dates inclusive) and covers the revolutions 620, 621 and 622..

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 four raster dithers of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), and a raster dither of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4).

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

The AOCS operations were performed from the timeline during this period.

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

The fuel consumption over the period between 10/11/2007 and 16/11/2007 was 0.0837 Kg. The remaining propellant is in the order of 143.7260 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

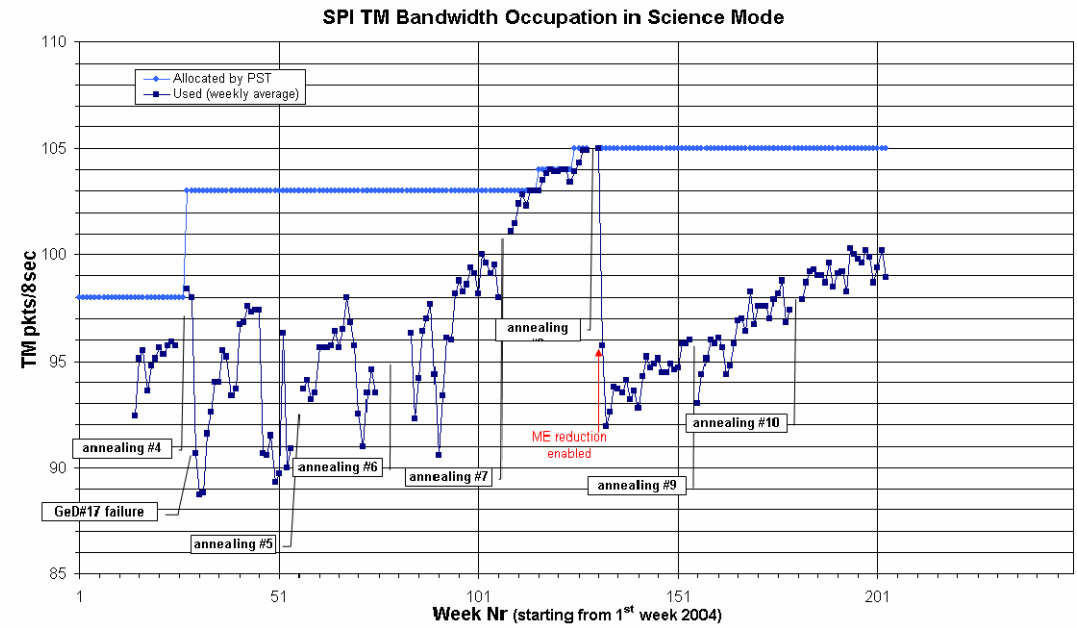
3.2.1 SPI

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. The average telemetry occupation when the TM allocation was 105 packets/cycle was 98.9 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.

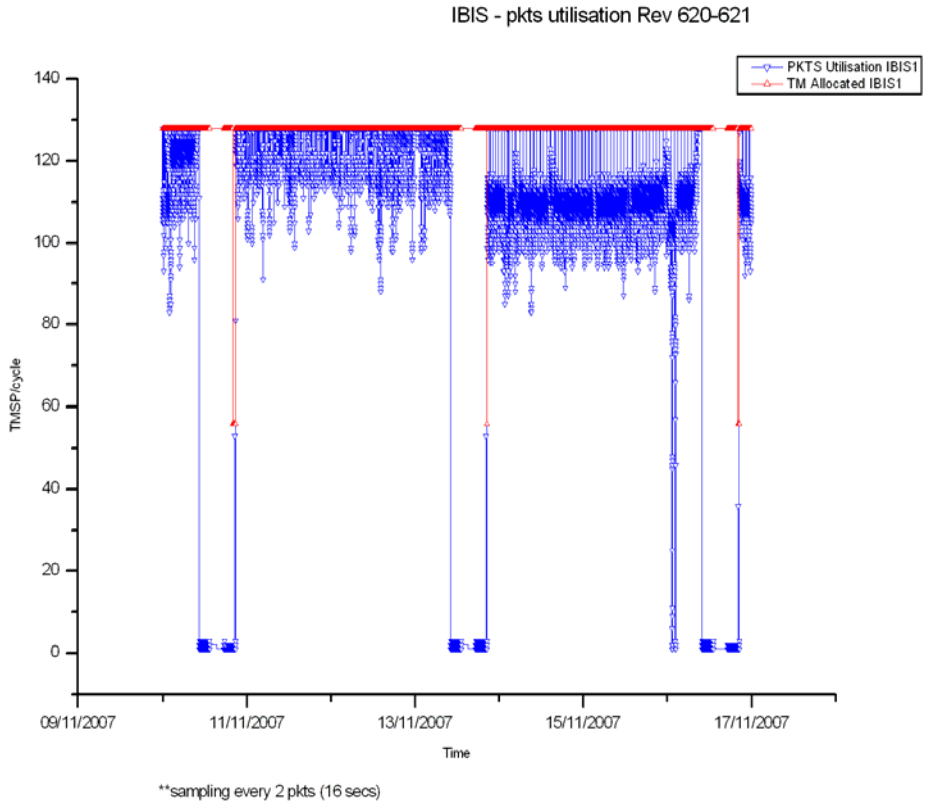
3.2.2 IBIS

The overall status of the unit is nominal.

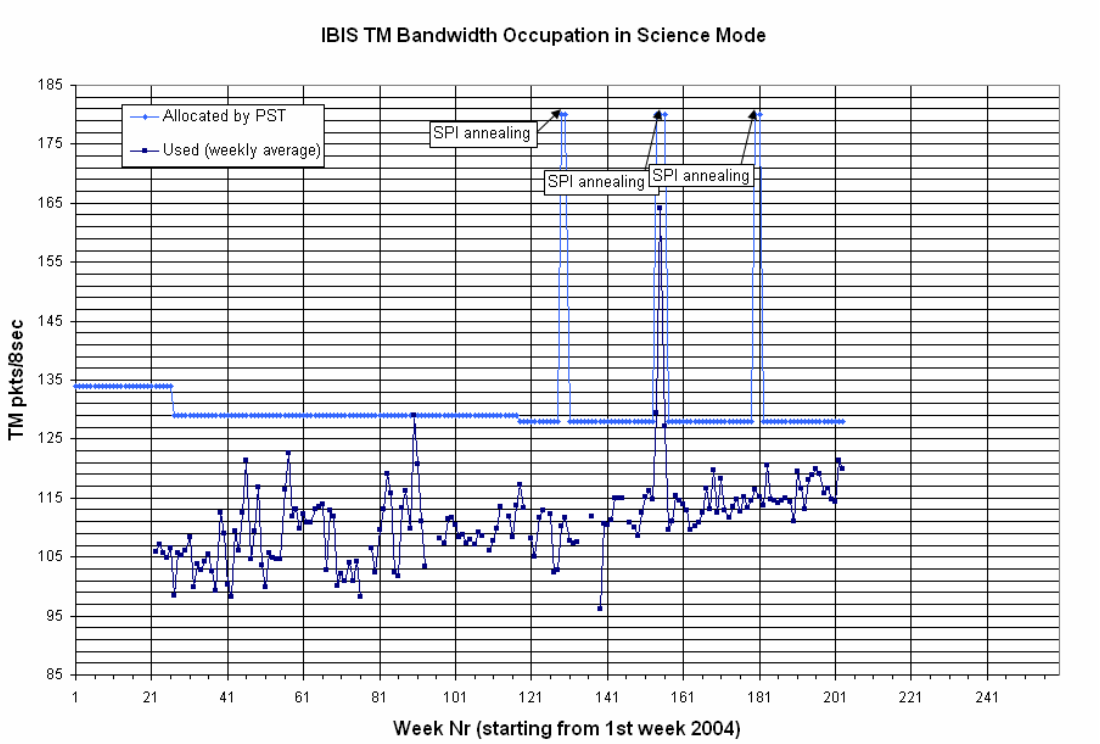
During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period (when IBIS was in Science mode) was 120.00 TMPS/cycle, down 1.41 on last week.

During the reporting period IBIS operations continued to be executed nominally.

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, 130 of the 131 planned science pointings for OMC were executed nominally, 1 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, except for Friday 16th November, when a new small sun spot appeared. The risk of solar flares was very low.

Reference: www.spaceweather.com

Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

4 Ground Facilities

The Operational ground facilities performance was very good this week. There were no ground problems reported, that led to loss of data. 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 imca had to be re-started twice during the AOS of revolution 620, to get TM showing green on the manual and auto-stacks, there was no impact. The overall performance was well over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were, however, 2 occasions of small TM drops from Redu, and 2 from DSS27, all without impact. The overall performance was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

A new PSF was received for revolution 628.

Planning was done for revolutions 623 to 627 including the latest stepping down of the JEM-X high voltage and introducing the new roll-angle stepping. All of these revolutions had to be re-planned though due to a TOO on the flaring blazer 3C 454.3 in revolution 623.

The TSFs for revolutions 620 to 623 have been received.

2. Observation status

No new ECS have been received.

3. ISOC Science Data Archive

An ISDA status meeting was held on 12 November where the results of last week's brainstorming meeting were discussed with the developers.

4. ISOC system

V 16.0.1 has been installed on the operational system on 12 November.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 19/11/2007:

- Latest Standard Analysis completed: observation 05200710004 (Galactic disk, Revolution 610) on 14/11/2007.

- Latest products archived: observation 05200710004 (Galactic disk, Revolution 610) on 14/11/2007.

- Latest observation products sent to the observer: observation 04200340030 (Gamma Ray Source 1915+105, Revolution 610) on 19/11/2007.

5 Special Events

6 Anomalies

There were no problems reported that impacted operations this week.

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.

- A new imcs database is foreseen to be installed during the perigee outage on Monday 19th November 2007.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 620

The observations in revolution 620 consisted entirely of a raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~55.9 hours.

Revolution 621

The observations in revolution 621 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. This was followed by a raster dither of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4), lasting ~50.9 hours, until the end of the revolution.

Revolution 622

The observations in revolution 622 consisted entirely of a raster dither of the mid-latitude 2 region (RA 19:42:44.23, DEC -15:04:03.4), lasting ~57.4 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 105; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2007-10-26T20:31:23.000Z     144.0472    F   Automatic TM processing.
2007-10-28T04:51:03.000Z     143.9682    F   Automatic TM processing.
2007-10-29T20:14:19.000Z     143.9563    F   Automatic TM processing.
2007-10-31T05:08:30.000Z     143.9325    F   Automatic TM processing.
2007-11-01T19:37:54.000Z     143.9215    F   Automatic TM processing.
2007-11-02T03:29:15.000Z     143.8929    F   Automatic TM processing.
2007-11-04T18:30:57.000Z     143.8819    F   Automatic TM processing.
2007-11-06T03:51:50.000Z     143.8658    F   Automatic TM processing.
2007-11-07T18:22:02.000Z     143.8490    F   Automatic TM processing.
2007-11-09T03:39:34.000Z     143.8253    F   Automatic TM processing.
2007-11-09T22:45:52.000Z     143.8097    F   Automatic TM processing.
2007-11-10T18:17:54.000Z     143.7986    F   Automatic TM processing.
2007-11-12T03:30:06.000Z     143.7714    F   Automatic TM processing.
2007-11-13T17:52:50.000Z     143.7629    F   Automatic TM processing.
2007-11-15T03:41:58.000Z     143.7418    F   Automatic TM processing.

This report was generated  Fri Nov 16 08:00:21 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, 10/11/2007 – 16/11/2007

The AOCS operations were executed from the Automatic Timeline.

During this period, 70 Open Loop Slews, 74 Closed Loop Slews and 5 Momentum Biases were executed.

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

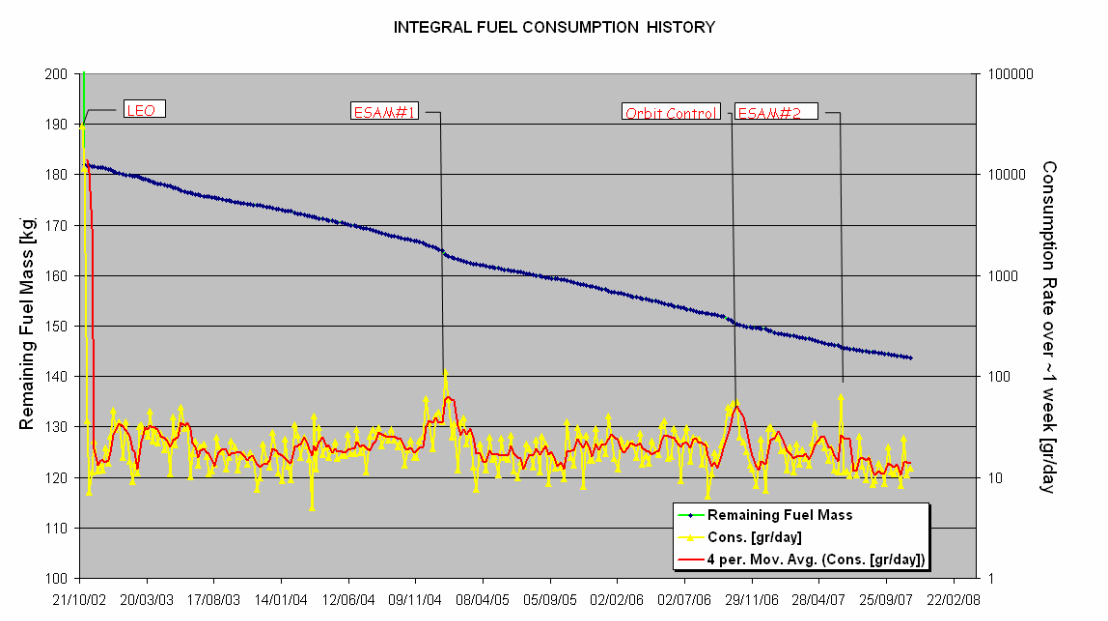
The OTF was not reached during PIDs 06200013, 06200050.

Orbit Control

No update.

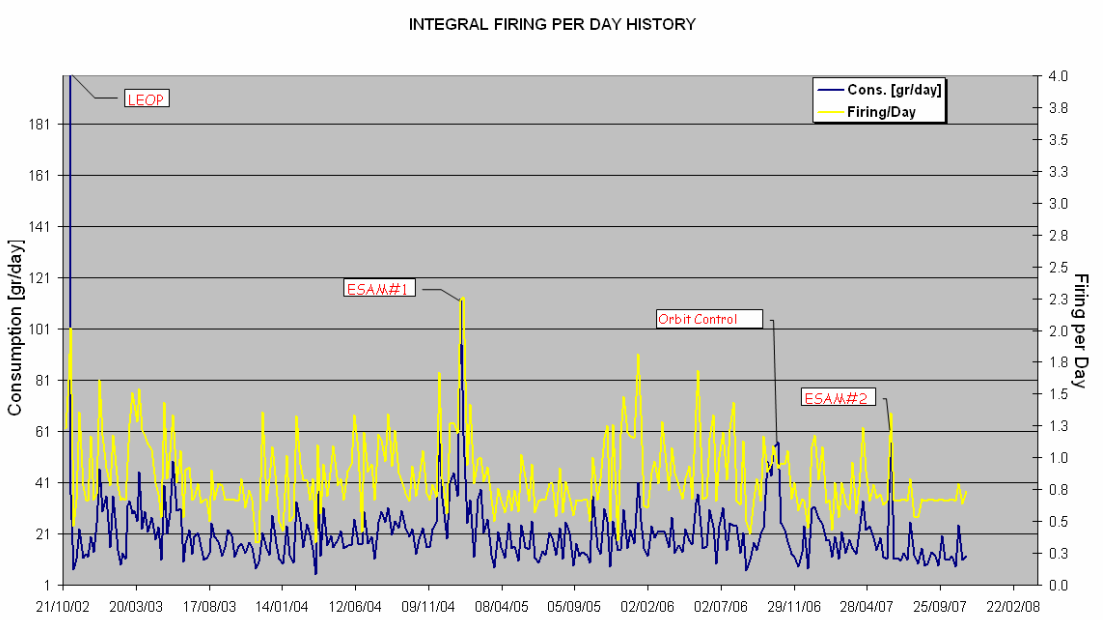
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 16/11/2007 is reported in the plot below.



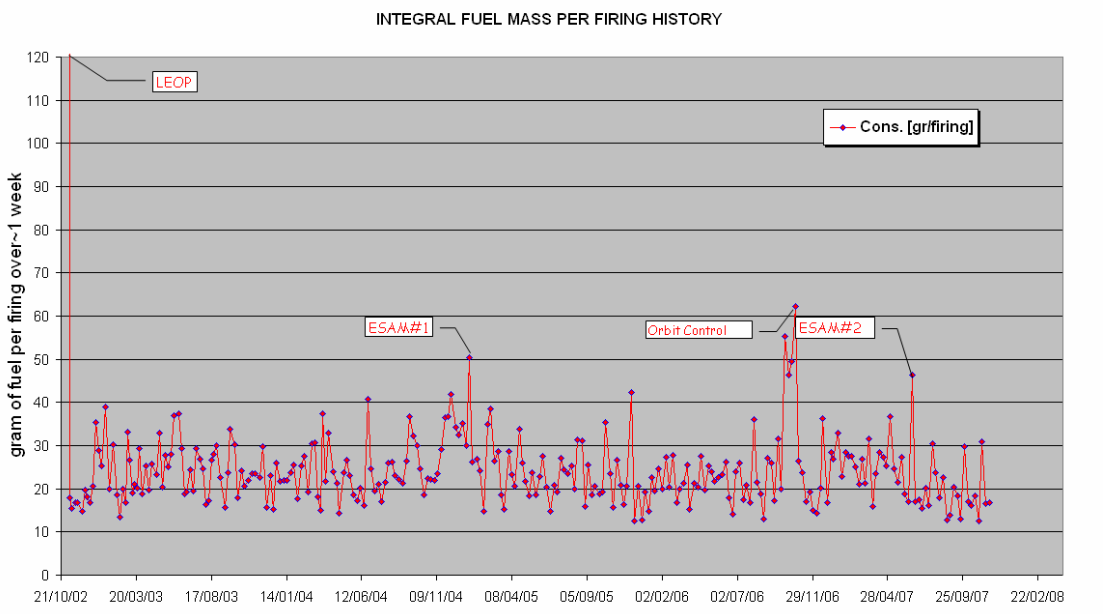
The plot above consider the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 16/11/2007 is reported in the plot below.



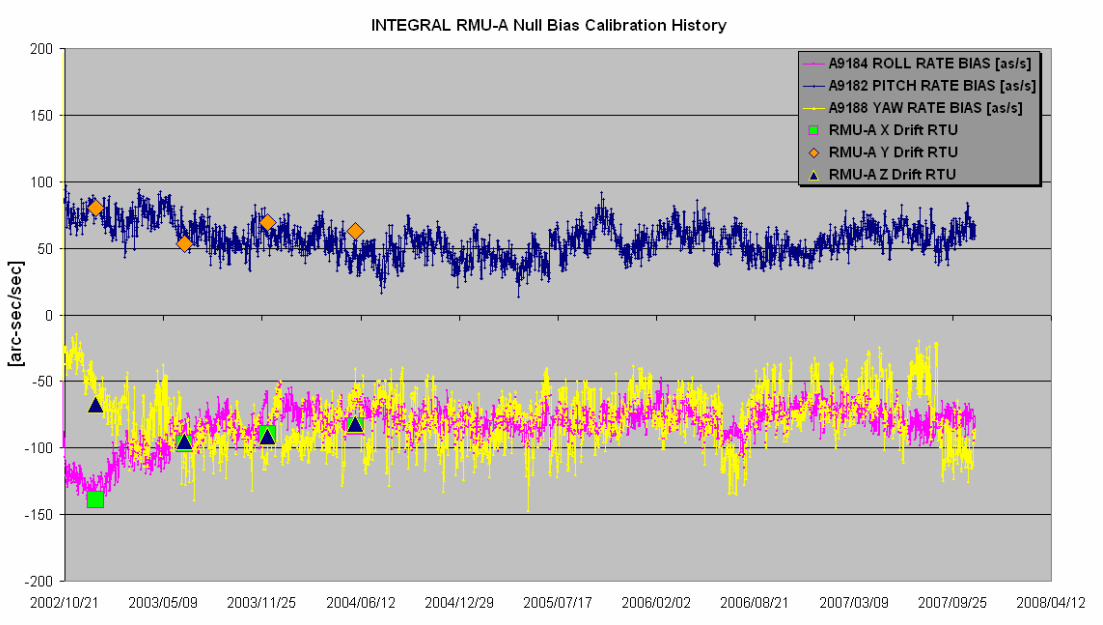
The plot above considers the ESAM fuel consumption spread over period of ~1 week.

The fuel per firing over the period between 01/11/2002 and 16/11/2007 is reported in the plot below.



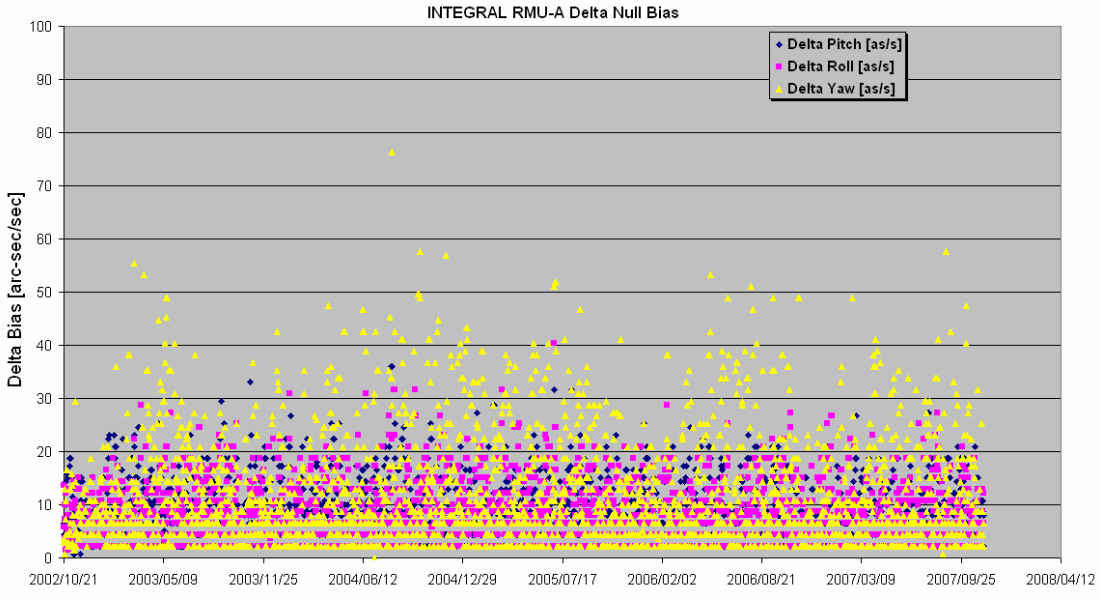
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 09/11/2007 is reported in the plot below.



The evolution of the drift on yaw channel is under constant monitoring.

The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 09/11/2007 is reported in the plot below.



10/11/2007 (Day of Year 314, Revolution 619-620)

Nothing to report.

11/11/2007 (Day of Year 315, Revolution 620)

Loss of guide star: at 09:17:16z a loss of the selected guide star occurred during the execution of PID 06200013.

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.

The OTF was not reached during PID 06200013.

12/11/2007 (Day of Year 316, Revolution 620)

Nothing to report.

13/11/2007 (Day of Year 317, Revolution 620-621)

Loss of guide star: at 00:00:14z a loss of the selected guide star occurred during the execution of slew ID 06200050 (OSL).

As foreseen by the IPS logic, the ACC did not switch the IMU 1 because the event occurred <1 min after the end of the slew execution.

A manual recovery was performed at 00:10z from attitude of PID 06200050 to the attitude of PID 06200051.

The OTF was not reached during PID 06200050.

14/11/2007 (Day of Year 318, Revolution 621)

Nothing to report.

15/11/2007 (Day of Year 319, Revolution 621)

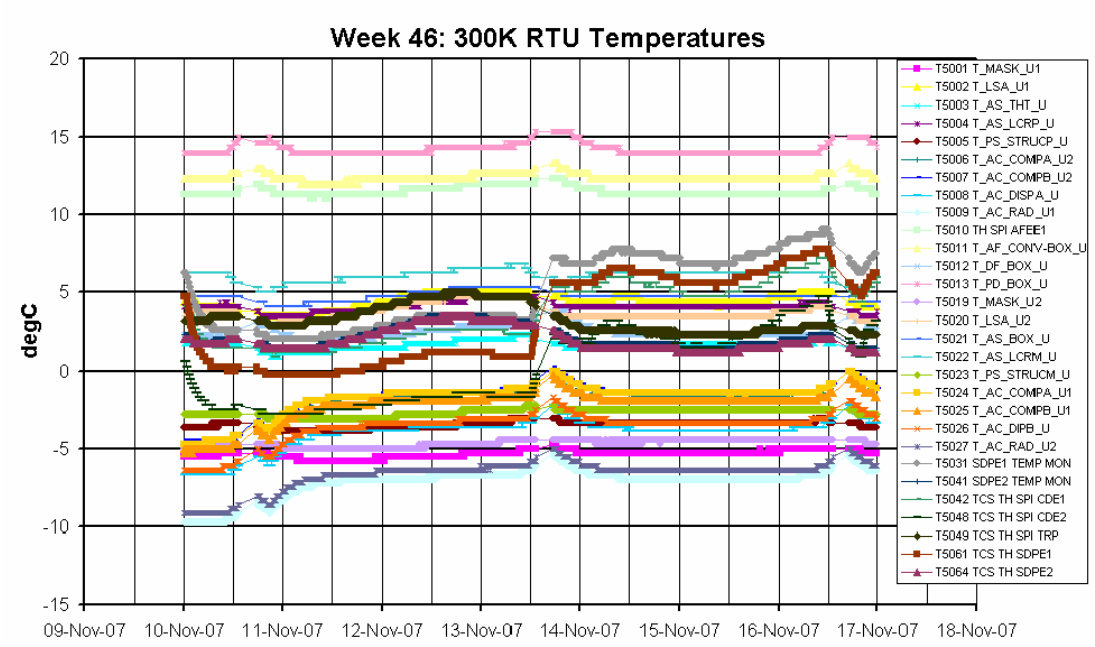
Nothing to report.

16/11/2007 (Day of Year 320, Revolution 621-622)

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.

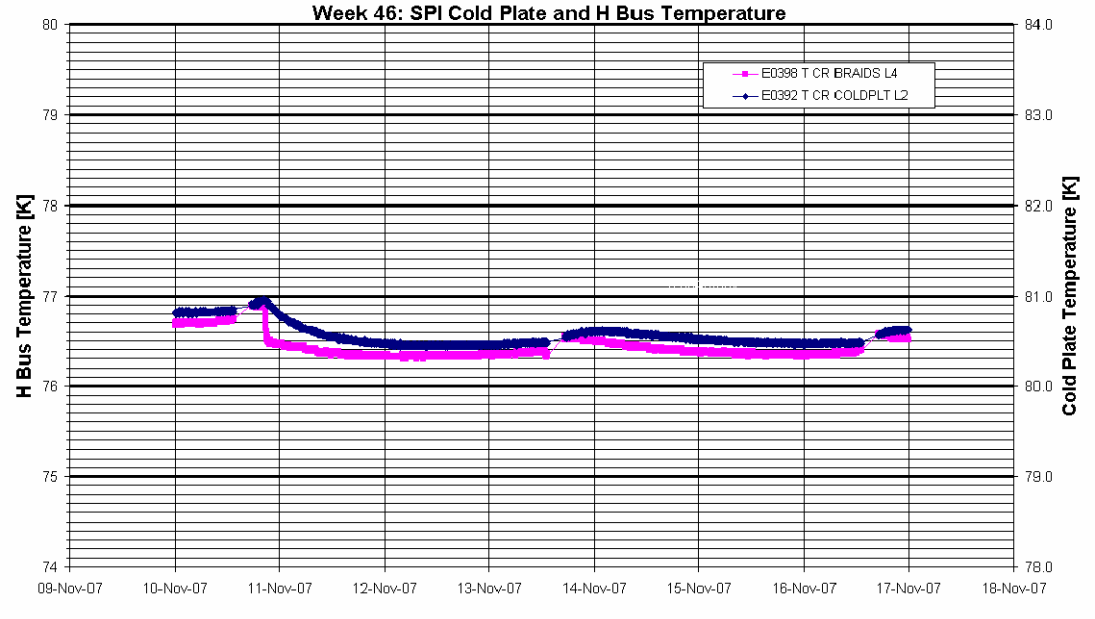


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

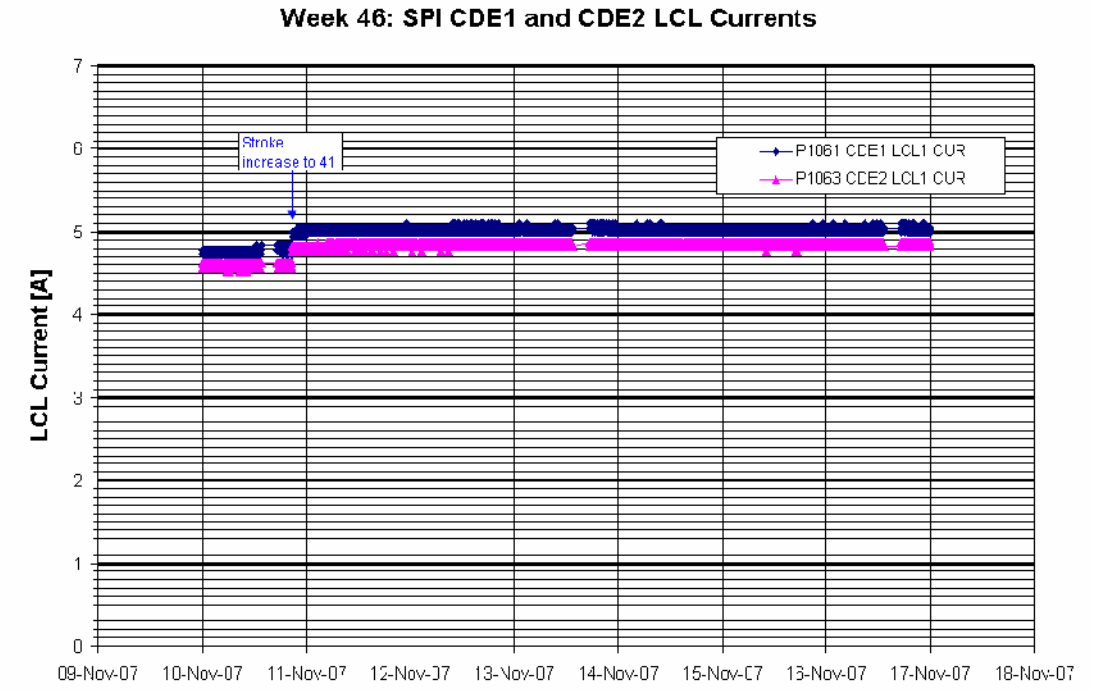
The stroke of all four compressors was set to 40 until 20:48Z on 10/11/2007, when it was increased to 41 on all four compressors as the cold plate temperature had reached 80.9K. The average CDE LCL currents over the week were as follows:

- CDE1 LCL Current = 5.00A
- CDE2 LCL Current = 4.80A

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

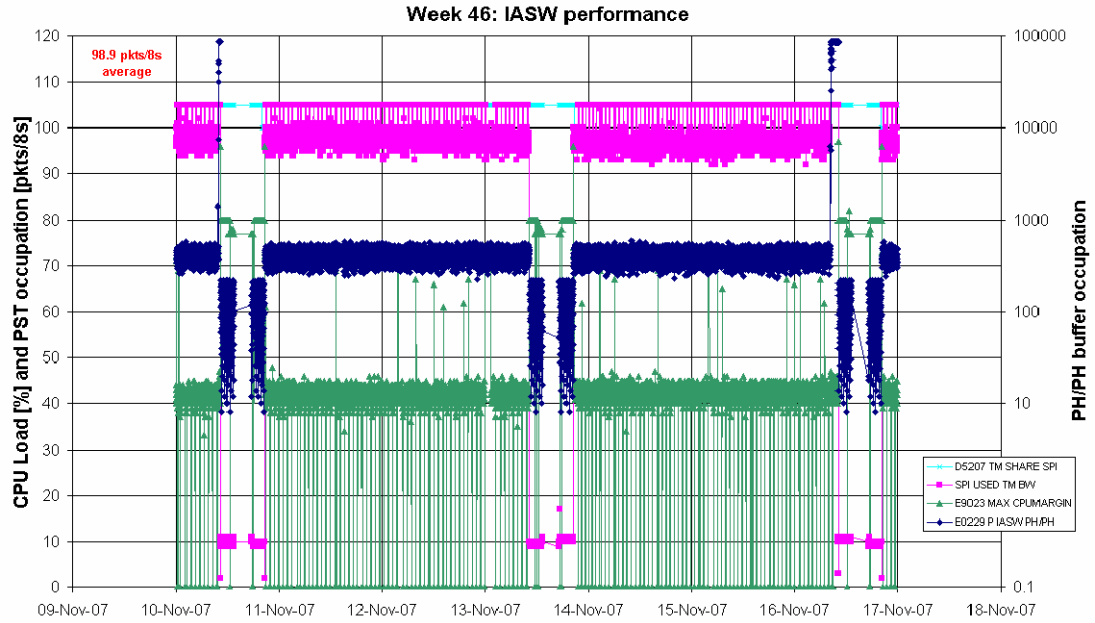


The following plot shows the evolution of the CDE currents during the reporting period.



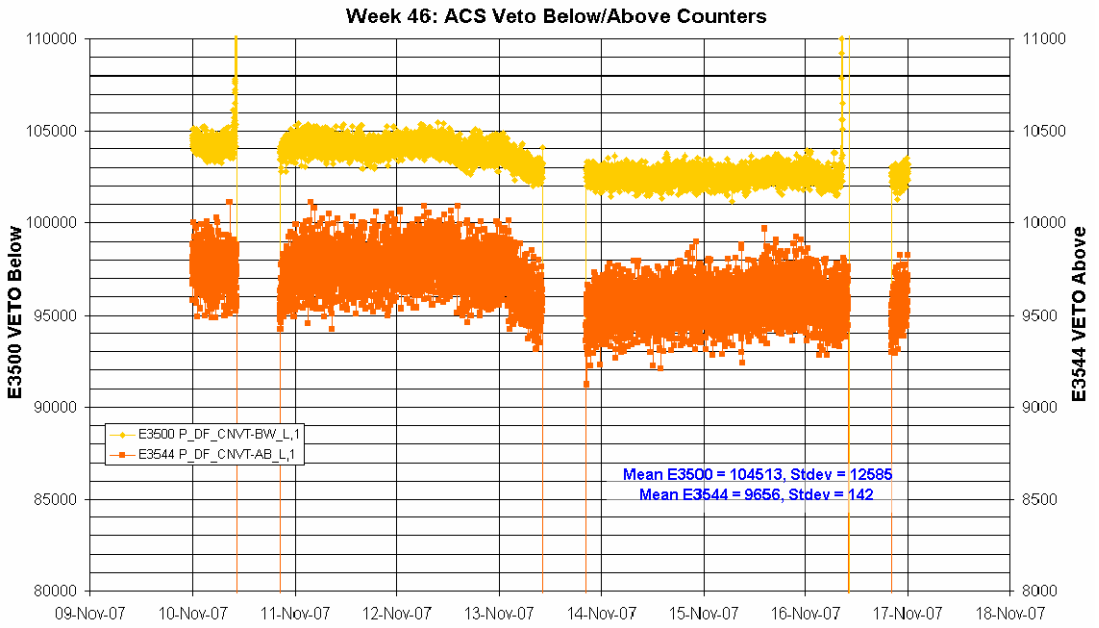
DPE & IASW: The DPE health and IASW performance is nominal. The IASW version installed is v433 patch #1 with the spectra scaling factor set to 8/19 SE. The average TM bandwidth occupation of SPI was 98.9 packets/cycle over the science window, when the TM allocation was 105 packets/cycle.

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



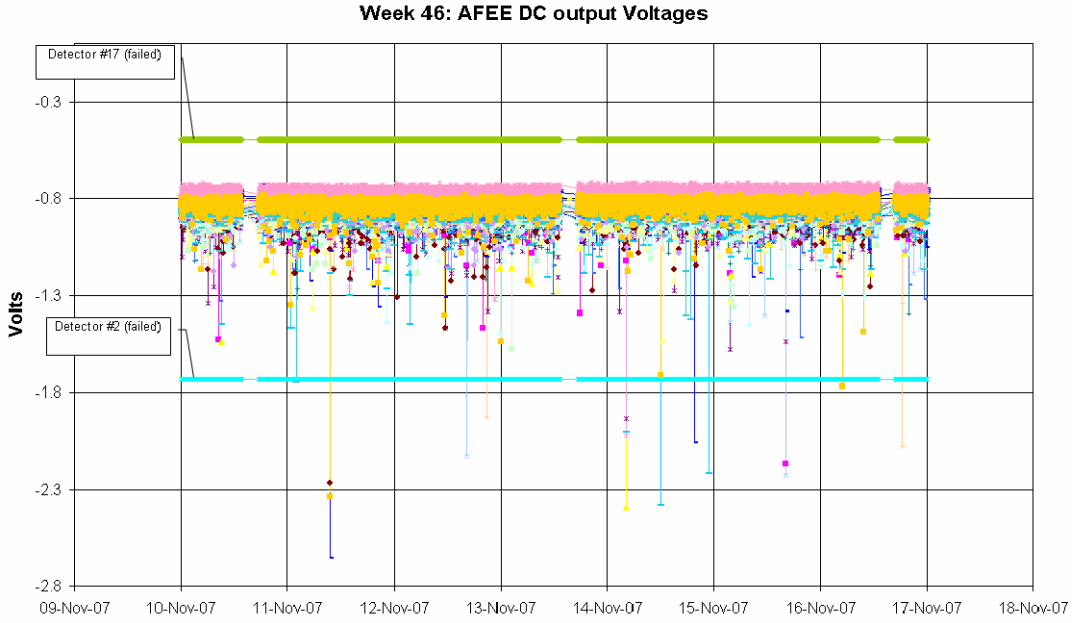
ACS: The performance of the ACS is nominal, except for FEE #81 which remains switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is still OFF due to the anomaly on 5/8/2003 (INT_SC-61).

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

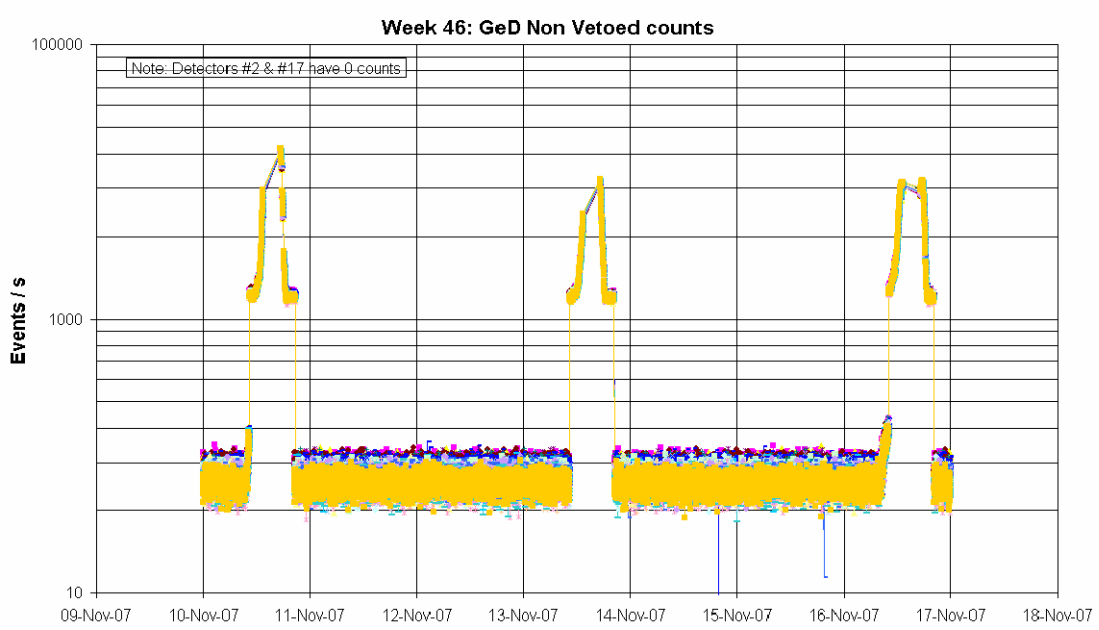


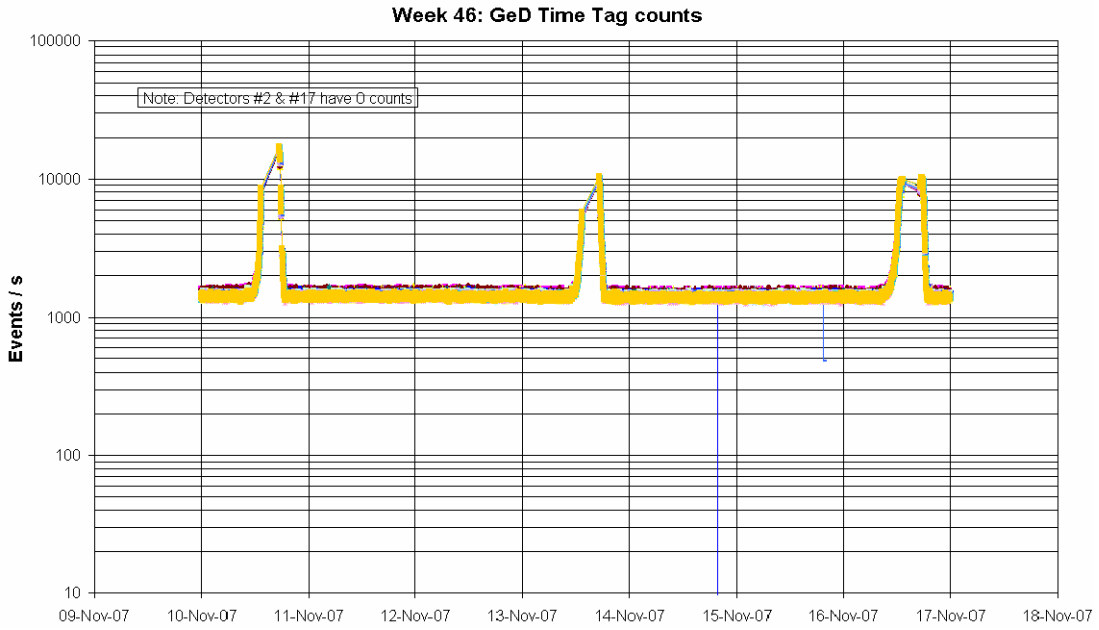
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operated at a lower HV setting of 3.5kV (instead of 4kV).

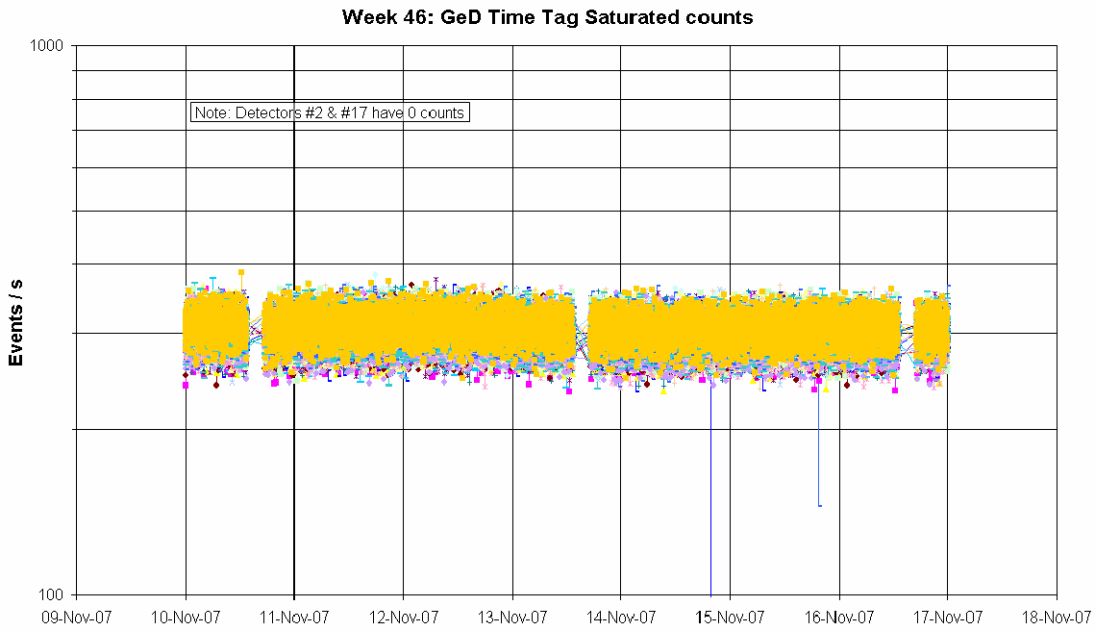
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



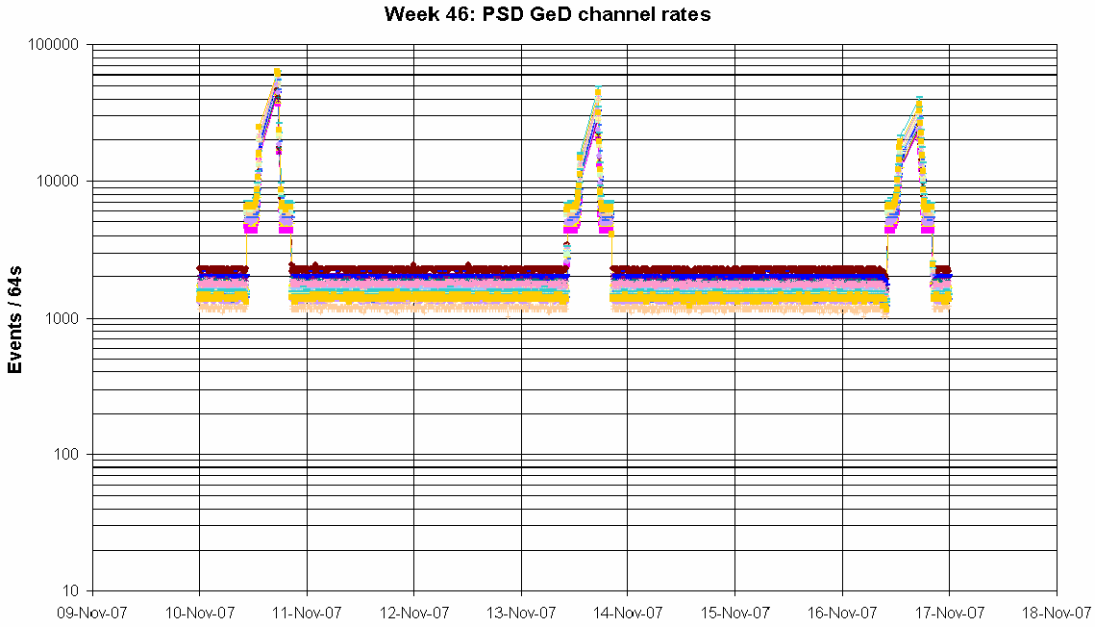
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.







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:

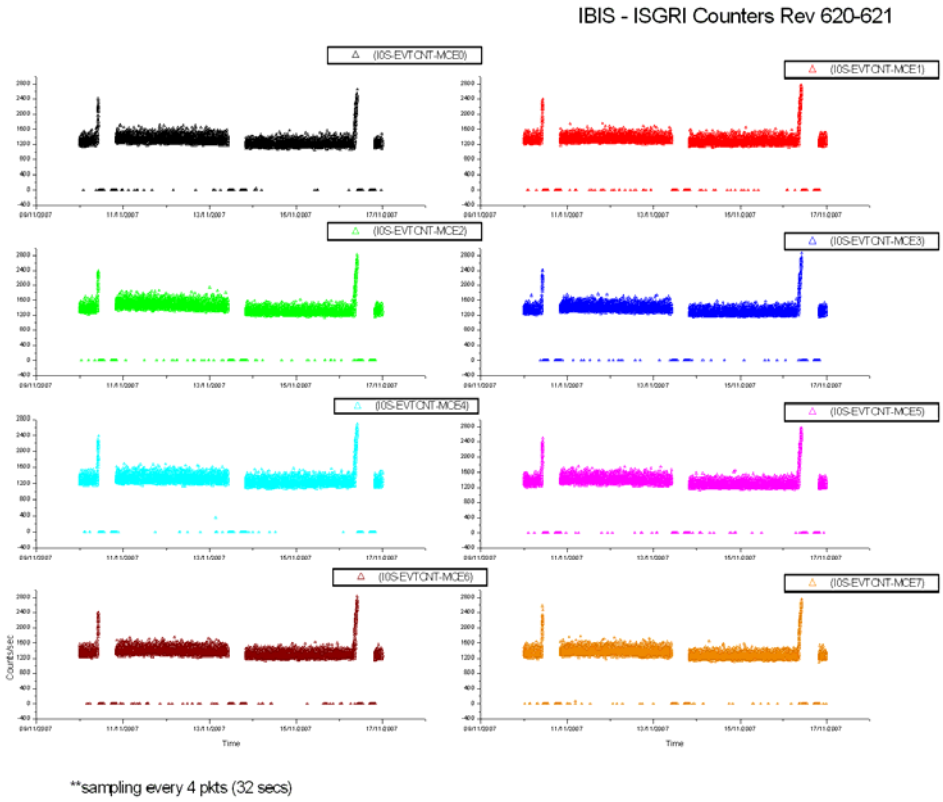
- 9 occurrences of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received during the week. As they were all single occurrences, no action was taken.
- On 2007-11-10 TM parameter E0392 for the cold plate temperature fluctuated OOL Warning High until the compressor stroke was increased at 20:48Z.
- On 2007-11-10 at 05:28:27Z TM parameter E3204 (ACS FEE temperature status #40) went OOL (value = PARAM > SPEC). As it returned within limits when the next packet was received at 05:39:07Z no action was taken.

- Due to high background radiation conditions before the expected radiation belt entry of revolution 619, on 2007-11-10 at 10:08:50Z TM parameter E3500 went OOL High and remained OOL until radiation belt entry, at 10:27:36Z.
- On 2007-11-13 at 20:24:28Z, during the reconfiguration of SPI at radiation belt exit of revolution 621, TM parameters E2101- E2116 and E2121-E2123 all went OOL with value 0. These are blocks 10 (ACS power supply voltage and current) and 11 (ACS veto shield temperatures) of TM packet 60601. This was a periodic TM packet and the building of this packet started 45 secs before the reconfiguration of the ACS at belt exit (at 20:25:13Z) and so the ACS parameters being zero was likely due to the acquisition of these blocks being exactly at the time the ACS switch-on was occurring. These parameters returned within limits when the next (mode change) packet was received at 20:27:00Z. This is recorded as Anomaly Report INT_SC-211.
- Due to high background radiation conditions before the expected radiation belt entry of revolution 621, on 2007-11-16 at 08:43:55Z TM parameter E3500 went OOL High, fluctuating OOL until radiation belt entry, at 10:05:05Z.
- On 2007-11-16 at 20:13:43Z, during the reconfiguration of SPI at radiation belt exit of revolution 622, TM parameters E3825; E3826 and E3828- E3831 all went OOL with value 0. These are the PSD +/-5V analogue and some PSD board temperatures and are in SPID 60060. They returned within limits when the next packet was received at 20:14:47Z. This is recorded as Anomaly Report INT_SC-212.

8.3.3 IBIS Operations

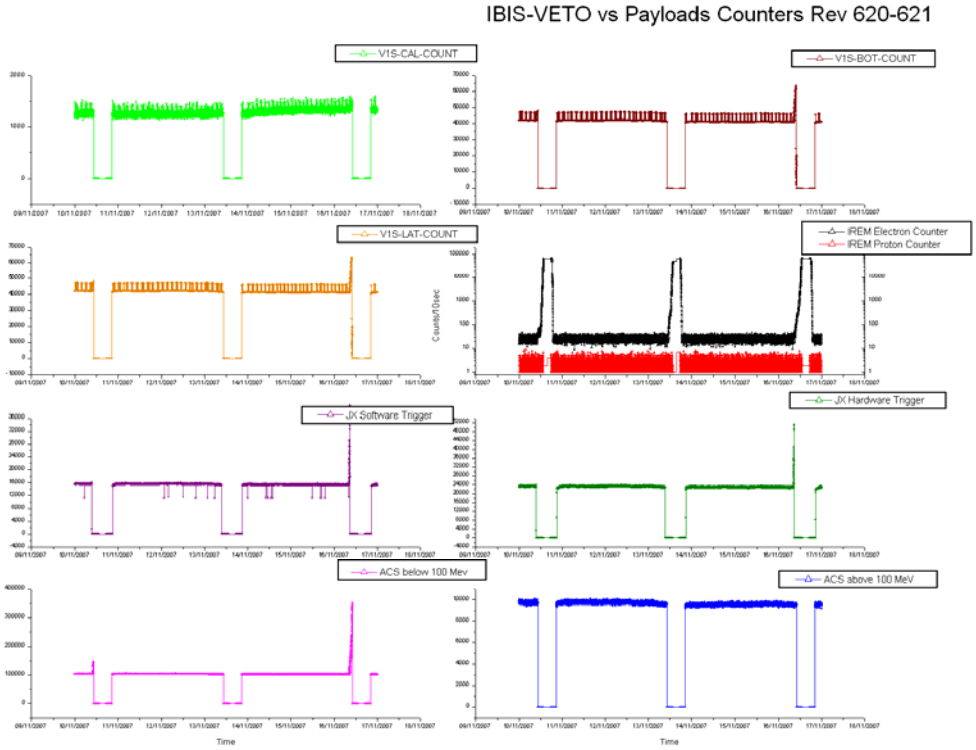
IBIS Event Counters Plots

ISGRI Counters:



**sampling every 4 pkts (32 secs)

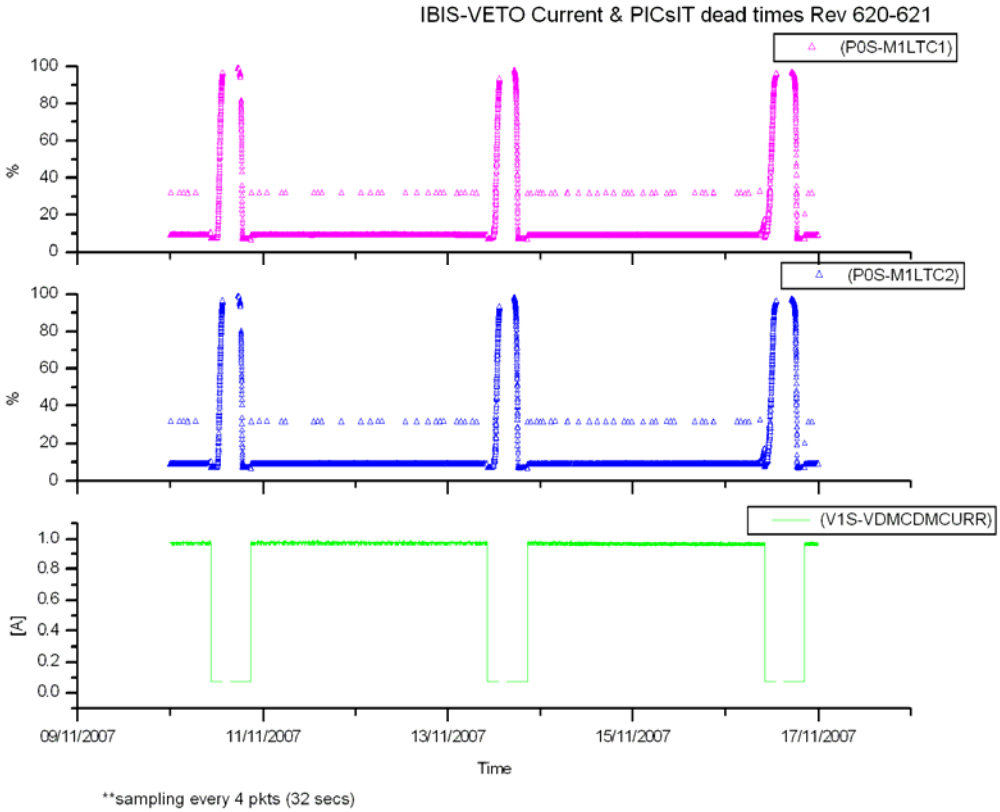
VETO vs Payloads Counters:



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

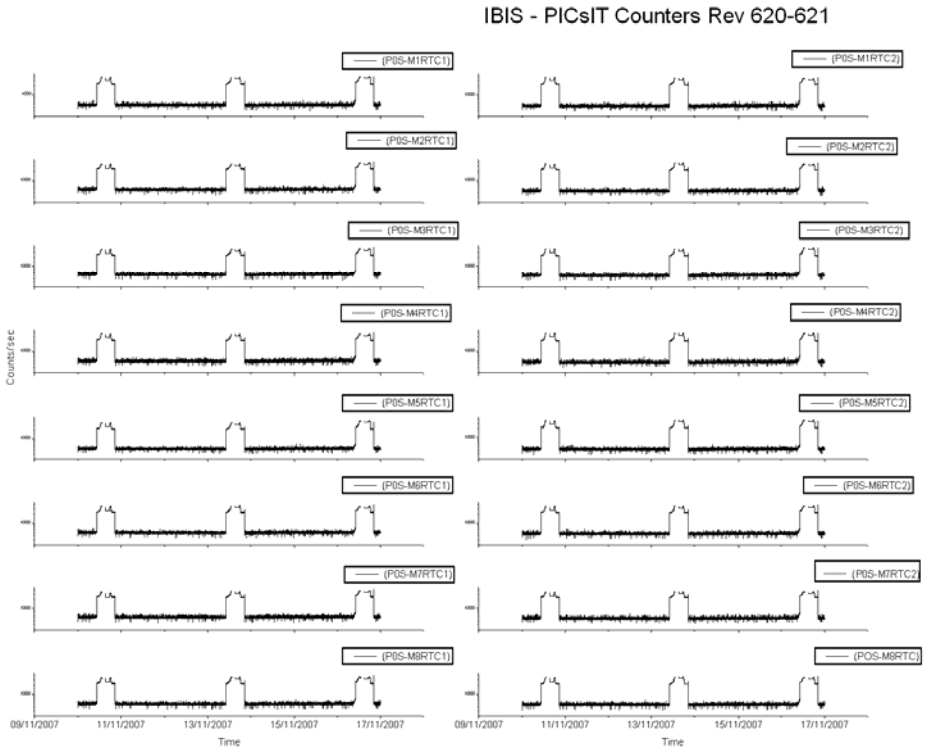
Note that the ACS plot above 100MeV has a smaller scale than usual.

VETO Current:



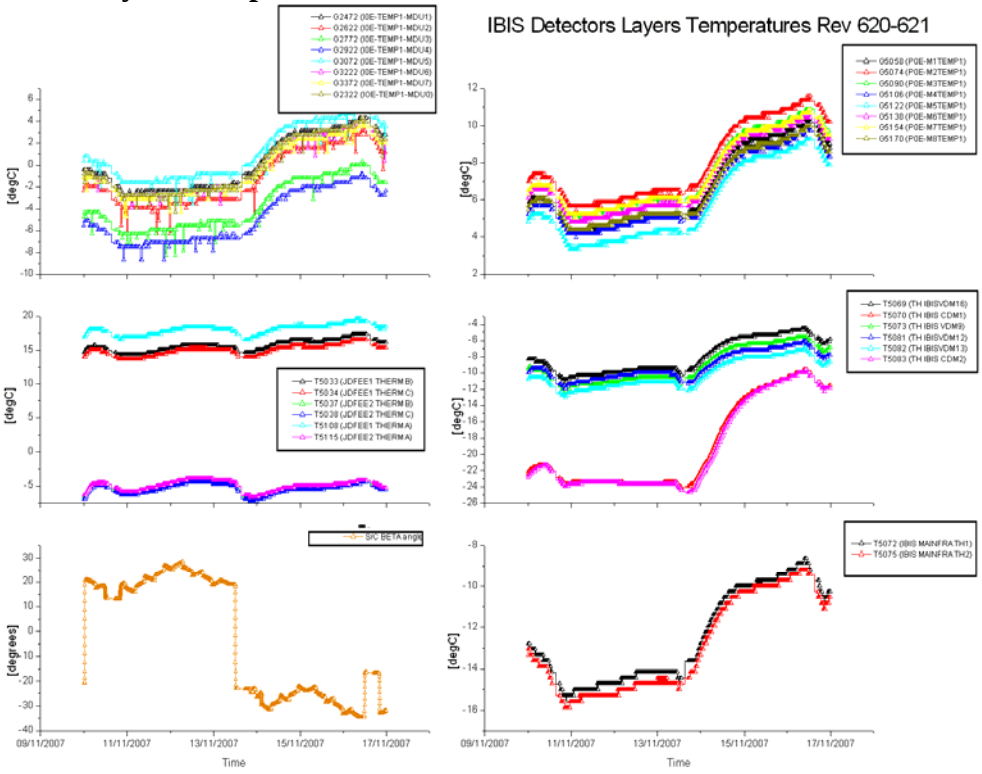
**sampling every 4 pkts (32 secs)

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.

In addition, throughout the week, TM parameter G8080 went OOL Warning High several times. This is the valid event rate on HBRA. As at each occurrence it remained OOL for only 1 TM cycle, no action was taken. This indicates an overflow in the counters and affects only the scientific data but not the safety of the instrument.

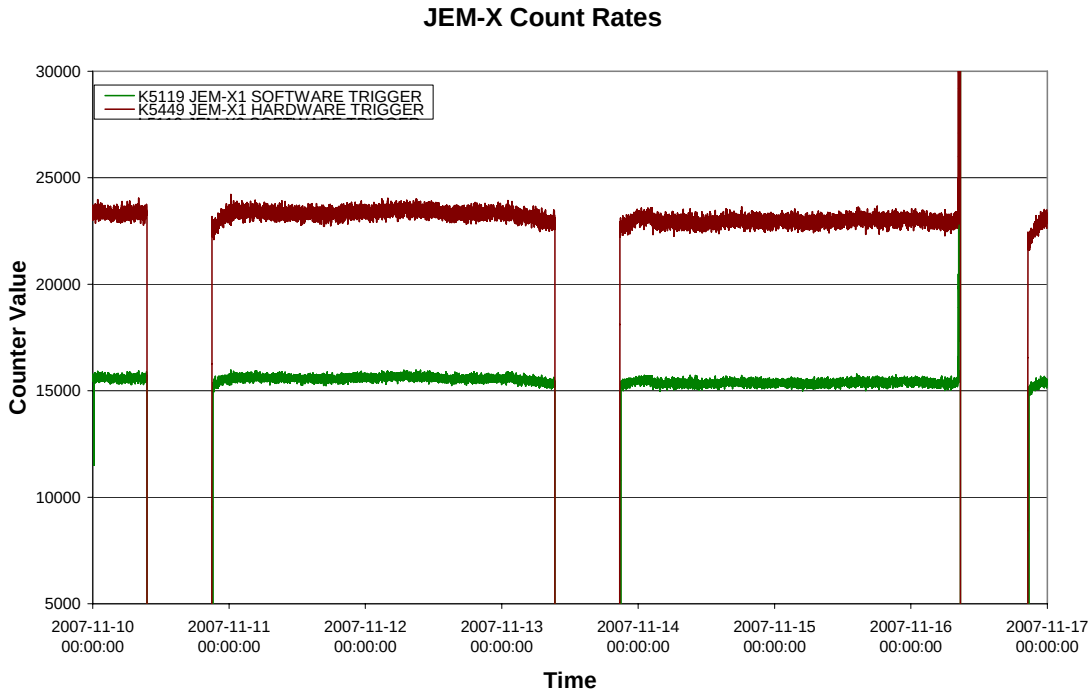
2007-11-10 (DOY 314, Rev 619-620) to 2007-11-16 (DOY 320, Rev 621-622)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

JEM-X Count Rates

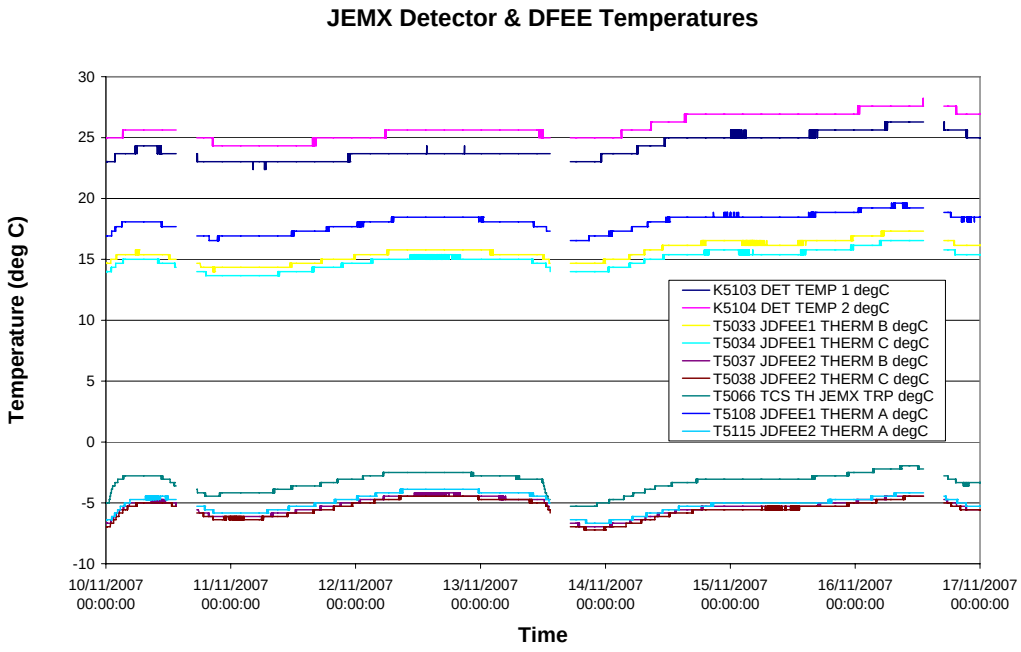
JEM-X count rates over the reporting period are displayed in the following graph[1].



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)



JEM-X Daily Report

2007-11-10 (DoY 314, Rev 619) to 2007-11-15 (DoY 319, Rev 621)

JEM-X1 operations executed nominally

2007-11-16 (DoY 320, Rev 621-622)

High radiation towards the end of the revolution forced the controller to manually switch JEMX to SAFE mode. The sequence of events was as follows:

At 08:21:54, a series of warnings and then errors were issued, as parameter K5449 (JEM-X1 Hardware Trigger) exceeded soft then hard limits.

At 08:42:26, parameter then K5119 (JEM-X1 Software Trigger) exceeded soft limits.

This was followed at 08:43:22 by K9104 (EM #1 IDENTIFIER).

At 08:45:22 KD5020D (EQ DFEE STATE) was briefly outside its nominal range (during the manual switch off below).

At 08:46, the procedure FCP_JEM1_0040 was executed to put the instrument to SAFE mode.

At 09:10:21, the commands for the ED KESAFE02 all failed their PTV check as JEMX was already in SAFE mode.

8.3.5 OMC Operations

2007-11-10 (DoY 314, Rev 619) to 2007-11-12 (DoY 316, Rev 620)

Nothing to Report.

2007-11-13 (DoY 317, Rev 620)

At 00:00:04, an AOCS problem caused the loss of pointing 06200050.

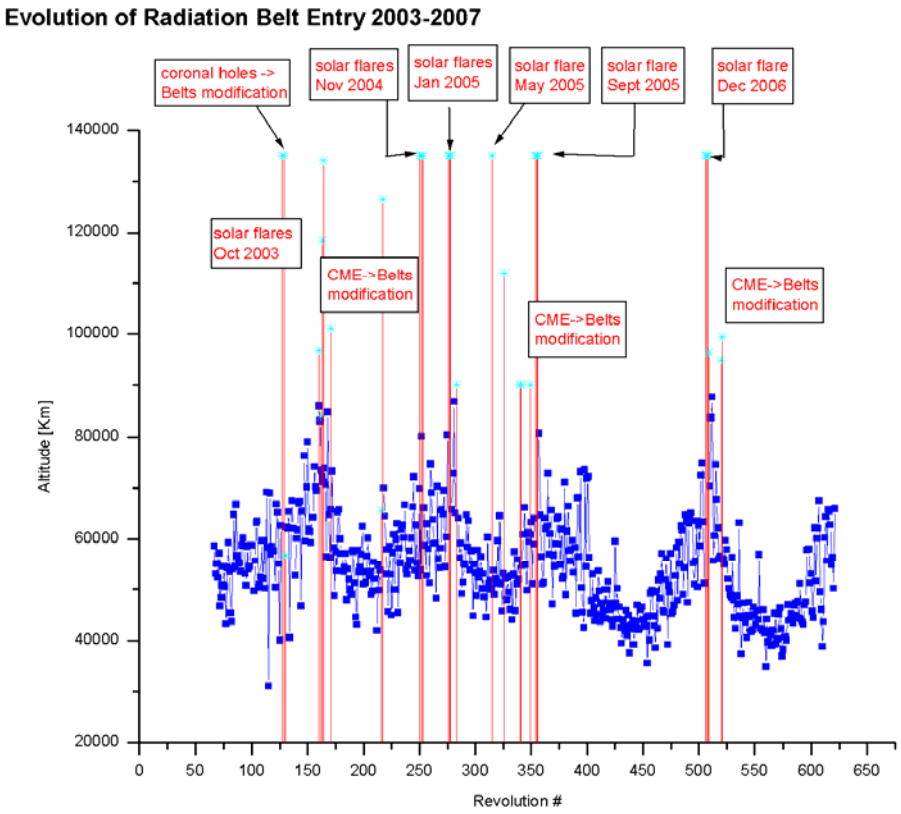
2007-11-14 (DoY 318, Rev 620) to 2007-11-16 (DoY 320, Rev 621)

Nothing to Report.

On DoY 314 at 10:27:44 and DoY 320 at 10:05:12 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet. The On-Event-Message for SAFE mode on DoY 317 is missing from the record due to an NCTRS swap at that moment.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

Nothing to report.

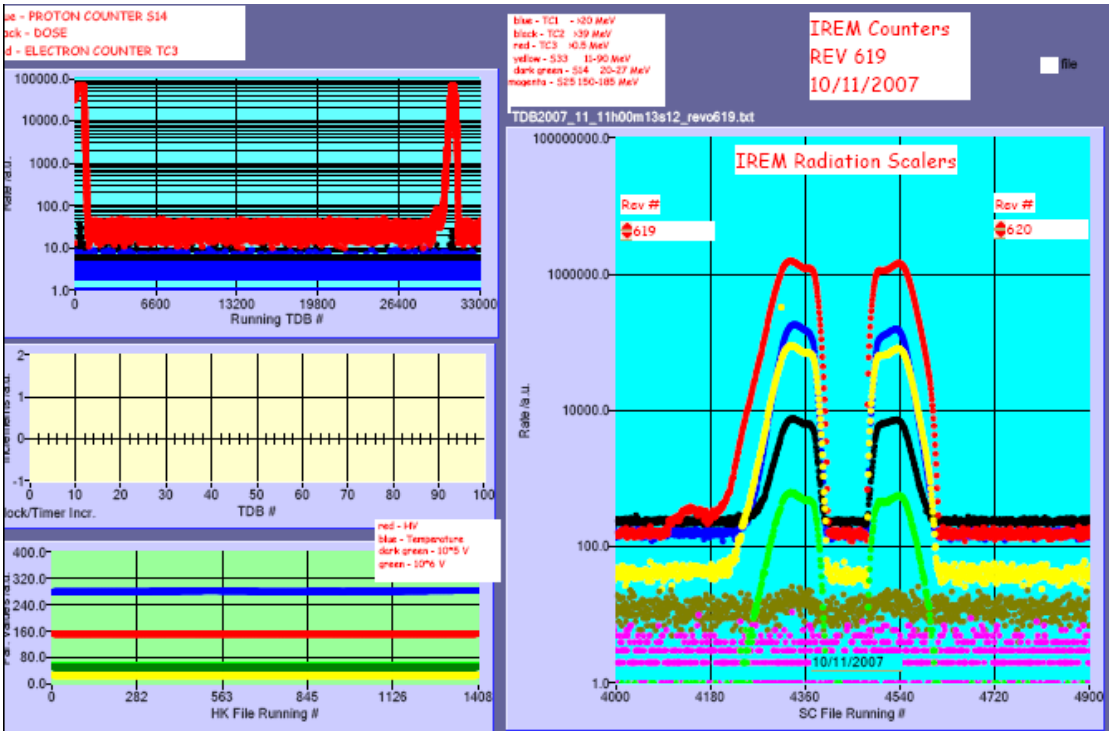
Electron Belts

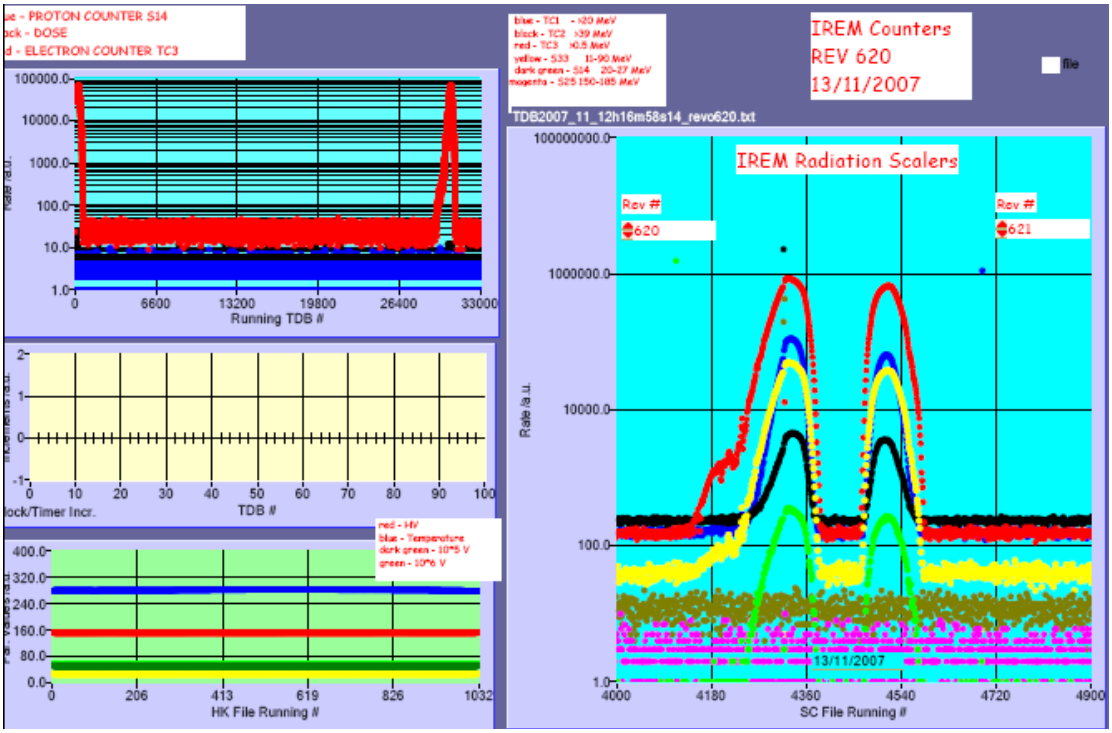
REV	S/C BCPKT (electron)	Electron CUT-OFF Observed	Observed Entry/Exit	Electron CUT-OFF Predicted	Predicted Entry/Exit

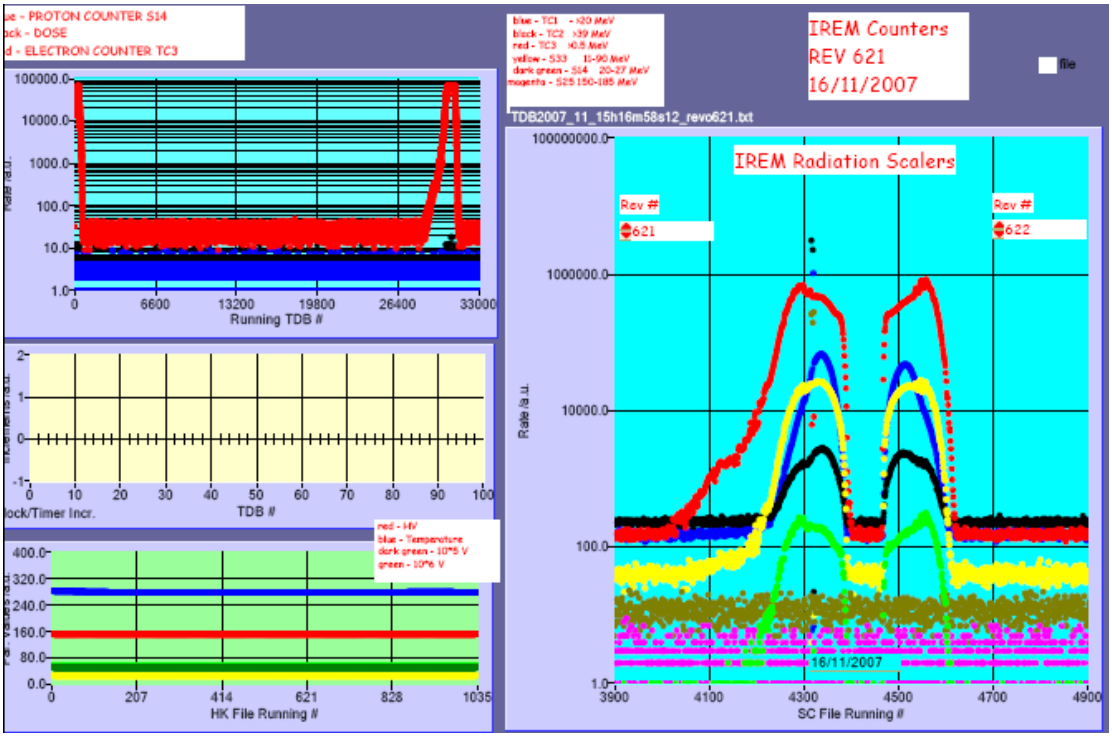
		Entry/Exit	Altitude [Km]	Entry/Exit	Altitude [Km]
619	RAD_ENTR R 2007-11-10T10:27:36Z	10/11/2007 10:32:55	56329.8	10-Nov-2007 11:51:22	44505.36
620	RAD_EXIT R 2007-11-10T20:37:07Z	10/11/2007 18:44:23	>>31454.2	10-Nov-2007 19:41:22	44864.43
620	RAD_ENTR R 2007-11-13T10:16:10Z	13/11/2007 10:58:55	50214.8	13-Nov-2007 11:42:19	44219.05
621	RAD_EXIT R 2007-11-13T20:24:50Z	13/11/2007 18:15:59	>>31471.8	13-Nov-2007 19:22:19	43794.38
621	RAD_ENTR R 2007-11-16T10:05:05Z	16/11/2007 08:49:27	65971.3	16-Nov-2007 11:32:19	44371.44
622	RAD_EXIT R 2007-11-16T20:13:21Z	16/11/2007 18:36:23	>>31478.0	16-Nov-2007 19:12:19	43679.31

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:

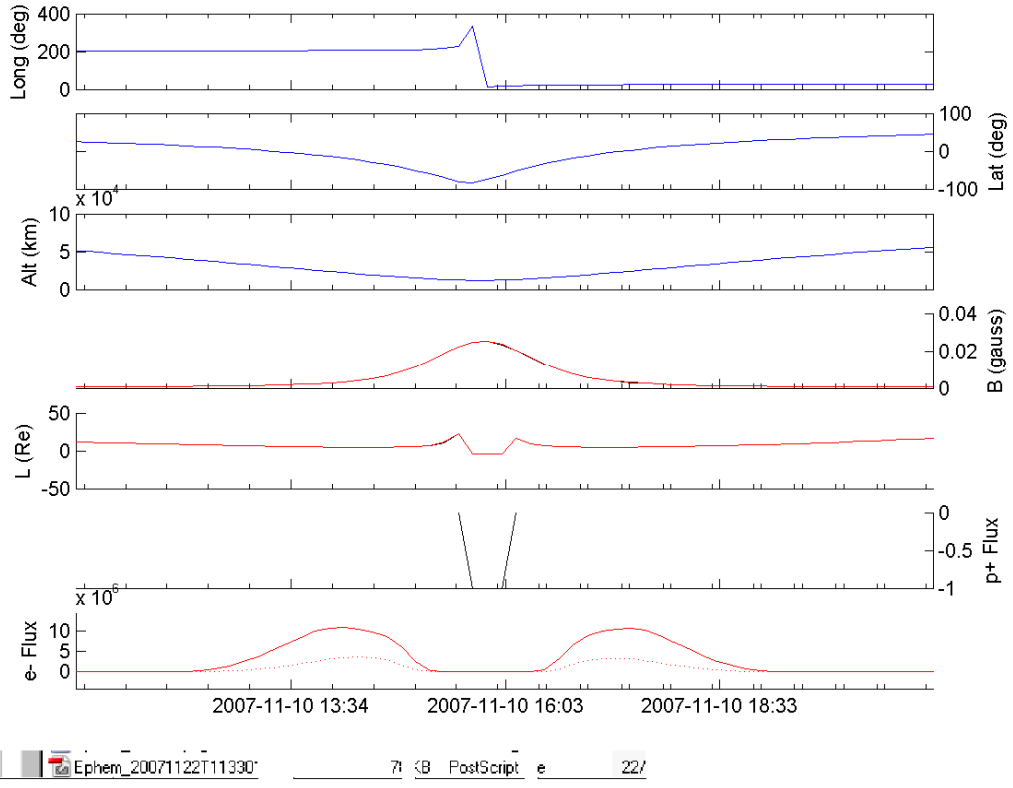




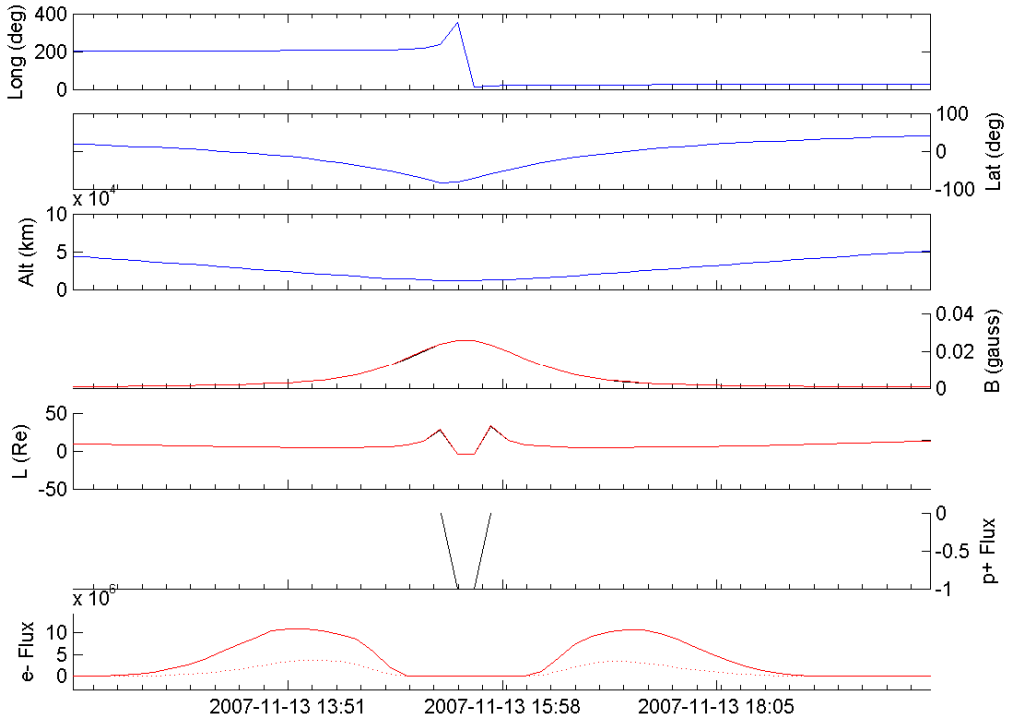


IREM Predicted Radiation Belt Passages

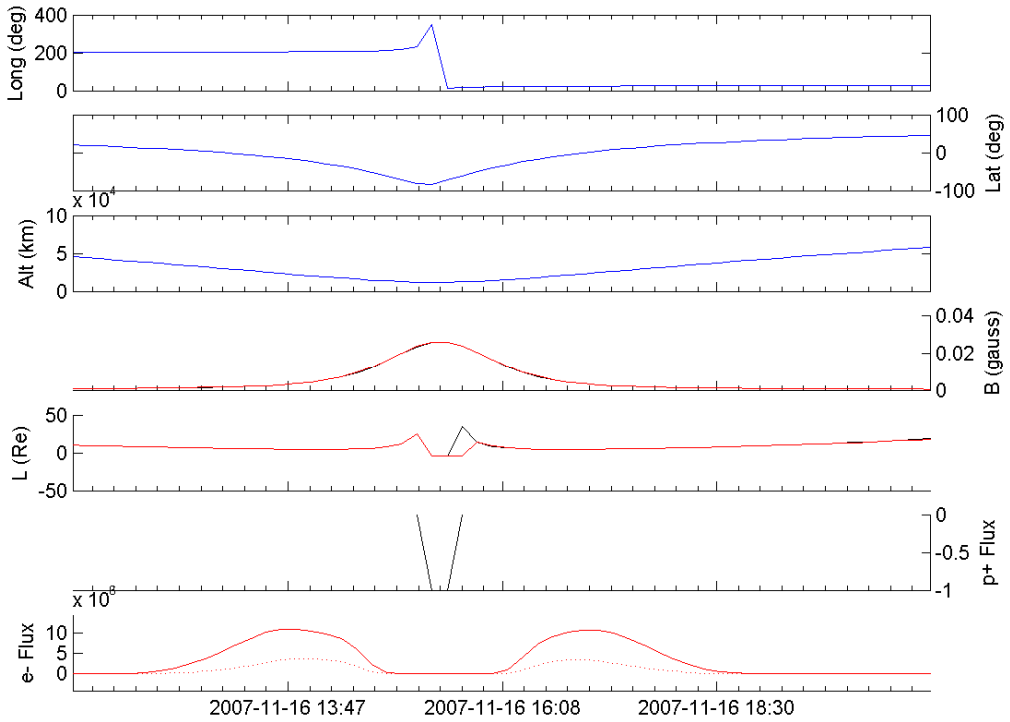
Rev 619



Rev 620



Rev 621



Ephem_20071122T113425

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.