

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 207
Week 36
11.09.06
Routine Phase

Prepared by: M. Walker (OPS-OFO)

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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 02.09.06 until 08.09.06 (both dates inclusive) and covers the revolutions 475 and 476.

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 2 hexagonal dithers of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), a 2 raster dithers of the Galactic Centre (RA 17:45:40.00, DEC -29:00:28.0), a raster dither of the Galactic Plane Region 1 (RA 18:33:10.67, DEC -08:49:48.0), and a hexagonal dither of Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0).

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.

1 slew was missed during the observation period due problem during the handover REDU to DSS27 station.

The fuel consumption over the period between 01/09/2006 and 07/09/2006 was 0.1297 Kg. The remaining propellant is in the order of 152.2056 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

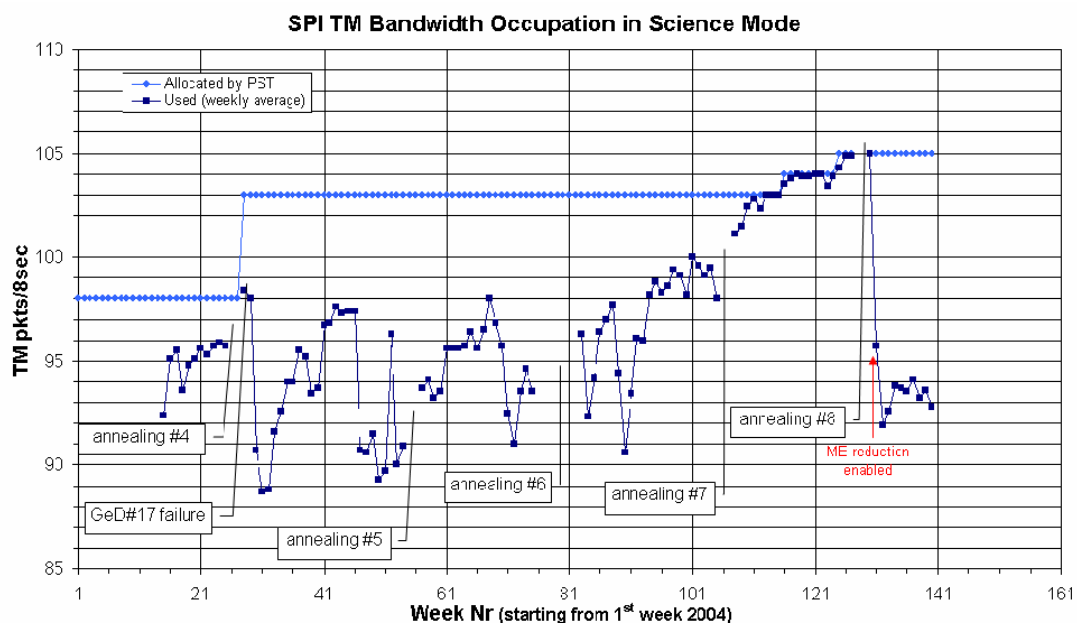
3.2.1 SPI

Following the 8th annealing, which ended on 26th June, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with this annealing. 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 82 +/-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 pkts/cycle. The average telemetry occupation in the science window was 92.8 packets/cycle.

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



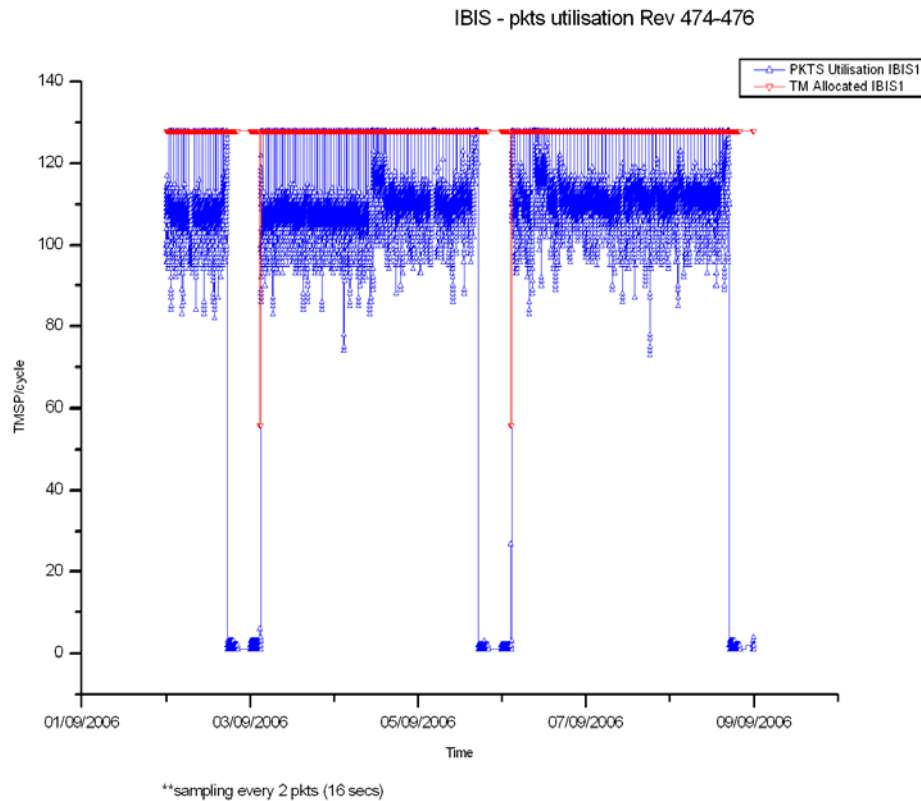
Note: Some more information concerning the SPI operations is provided in the Appendix.

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 was 99.5 TMPS/cycle, down 11 on last week.

A plot of the IBIS TM utilisation during the observation period 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 during science observations. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

Further information on the JEM-X operations can be found in the Appendix Section 8.3.4.

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, all of the 164 planned science pointings for OMC were executed nominally, none were lost.

Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

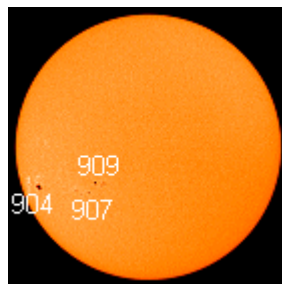
3.2.5 IREM

The overall status of the unit is nominal. IREM CSCI SW reset #32 occurred during rev 476.

Solar Activity

The observation period was characterised by low solar activity.

From 07/09/2006 to 08/09/2006, Sunspot 909 grew rapidly, but did pose a threat of solar flares.



Reference: www.spaceweather.com

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

4 Ground Facilities

The Operational ground facilities performance was much better this week. The slew to the perigee attitude for revolution 476 was lost from the timeline after a problem establishing the links with DSS-27 after a handover, but this was manually executed without loss. The overall performance was well above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was again good this week. There were only minor problems reported, such as the manual stack freezing, and the connection to the MISCdynamic server dropping, neither of which had any impact. The overall performance was well above the 95% requirement. The server which forwards data to ISDC has been reconfigured, the redundant server is now in use. Testing is on-going with the prime server to try to discover the cause of the problems experienced during recent months with the data connection to ISDC. The behaviour of the redundant server is nominal up to now.

4.2 Ground Stations & Network

The performance of the ground stations and Network was again good this week. There were, however, repeated instances of Reed-Solomon errors, bad frames, hits on the line and data drops from Redu & Vil2, none of which caused any problems. The overall performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs have been received up to revolution 482. Up to revolution 481 has been planned and sent to MOC. TSF for rev 476 was received.

2. Observation status

ECS's for revolutions 462 to 464 have been received and processed. No extra time is credited

3. ISOC science Data Archive

Ingest now running reliably.

ISDA contains all available raw data, but there is still a backlog of products to be copied

ISDA 2.5.2 expected October, will include:

VO interface

Products at observation level as well as observation group level IVT (Visualisation tool) prototype almost ready. The only remaining task is integration into the development version of the ISDA.

4. ISOC system

ISOC version 13.0 has been released for operational use.

5. AO-4

Amalgamation is now complete. The "latitude scan" observations (PI: Sunayev) still needs to be set up. It requires quite some manual work. Support by use of scripts is investigated.

7. Problems

Since a switch over at MOC to IFTS chain B the communication links to ESAC have experienced problems. No data is lost but data hangs from time to time. Investigation is in progress.

4.3.2 ISDC

Status of ISDC observation processing on 11/09/2006:

- Latest Standard Analysis completed: observation 03201080014 (Field_14, Revolution 453, 455 & 459) on 29/08/2006.

- Latest products archived: observation 03201080014 (Field_14, Revolution 453, 455 & 459) on 04/09/2006.

- Latest observation products sent to the observer: observation 03201080014 (Field_14, Revolution 453, 455 & 459) on 06/09/2006.

5 Special Events

6 Anomalies

The following problem that impacted operations was reported:

- On DoY 250, at 18:37, during the handover from Redu to DSS-27, an incorrect start time was given, and the links failed to open. The handover was attempted again, and achieved at 18:38. The result was slew 04760067 to the perigee attitude was lost and had to be performed manually. There was no impact or loss of science data.
- On DoY 251, at 19:59, the 33rd reset of the IREM S/W occurred. This was just before LOS DSS27 during rev 476. There was no impact on the Payload as the instruments were already in Safe Mode for the Radiation Belt Passage.

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

AR id	Date Created	Subject	Segment	Status
INT-2873	11/09/2006	FDS: no CGS defined for RWB in rev 477	FDS	Pending

:

7 Future Milestones

Battery 1 re-conditioning will start on the 12th September 2006.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 475

The observations in revolution 475 began with a raster dither of the Galactic Plane Region 1 (RA 18:33:10.67, DEC -08:49:48.0), lasting ~30.0 hours. This was followed by a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. Finally a raster dither of the Galactic Centre (RA 17:45:40.00, DEC -29:00:28.0), lasting ~25.1 hours, was executed, until the end of the revolution.

Revolution 476

The observations in revolution 476 began with a hexagonal dither of Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours. It continued with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. Finally a raster dither of the Galactic Centre (RA 17:45:40.00, DEC -29:00:28.0), lasting ~48.3 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

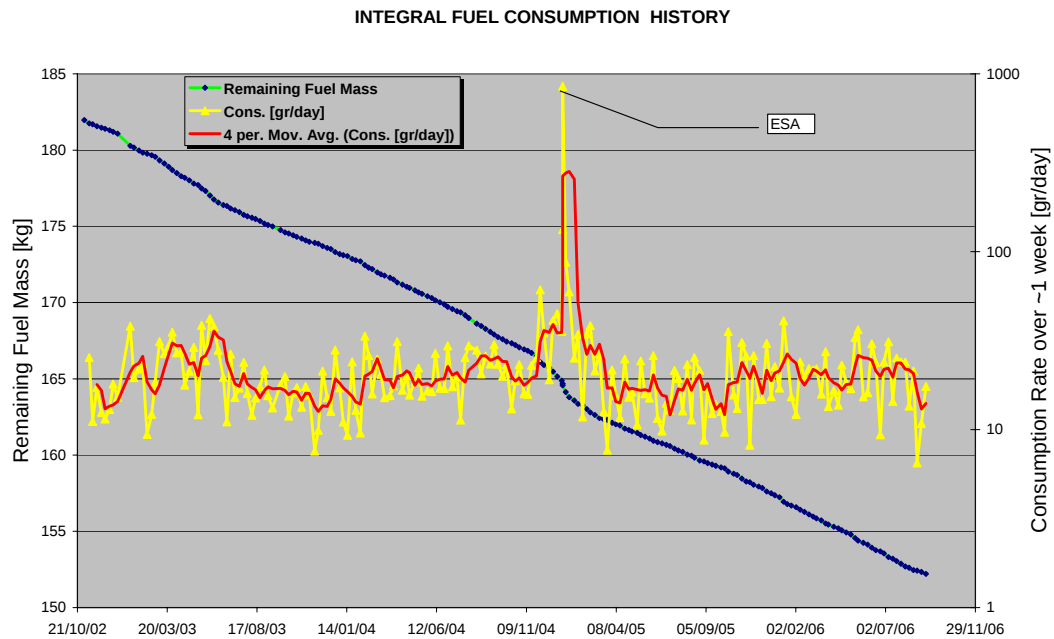
8.2.1 Detailed Fuel Book-keeping

2006-08-13T17:41:30.000Z	152.5093	F	Automatic TM processing.
2006-08-14T12:53:00.000Z	152.4909	F	Automatic TM processing.
2006-08-16T02:12:08.000Z	152.4724	F	Automatic TM processing.
2006-08-17T12:55:00.000Z	152.4560	F	Automatic TM processing.
2006-08-19T08:14:24.000Z	152.4392	F	Automatic TM processing.
2006-08-22T02:38:55.000Z	152.4350	F	Automatic TM processing.
2006-08-23T12:21:39.000Z	152.4171	F	Automatic TM processing.
2006-08-26T11:20:10.000Z	152.4032	F	Automatic TM processing.
2006-08-28T01:10:00.000Z	152.3791	F	Automatic TM processing.
2006-08-31T00:54:07.000Z	152.3357	F	Automatic TM processing.
2006-09-01T10:49:31.000Z	152.3113	F	Automatic TM processing.
2006-09-03T00:40:15.000Z	152.2875	F	Automatic TM processing.
2006-09-04T10:44:11.000Z	152.2472	F	Automatic TM processing.
2006-09-06T08:56:08.000Z	152.2273	F	Automatic TM processing.
2006-09-07T10:49:23.000Z	152.2060	F	Automatic TM processing.

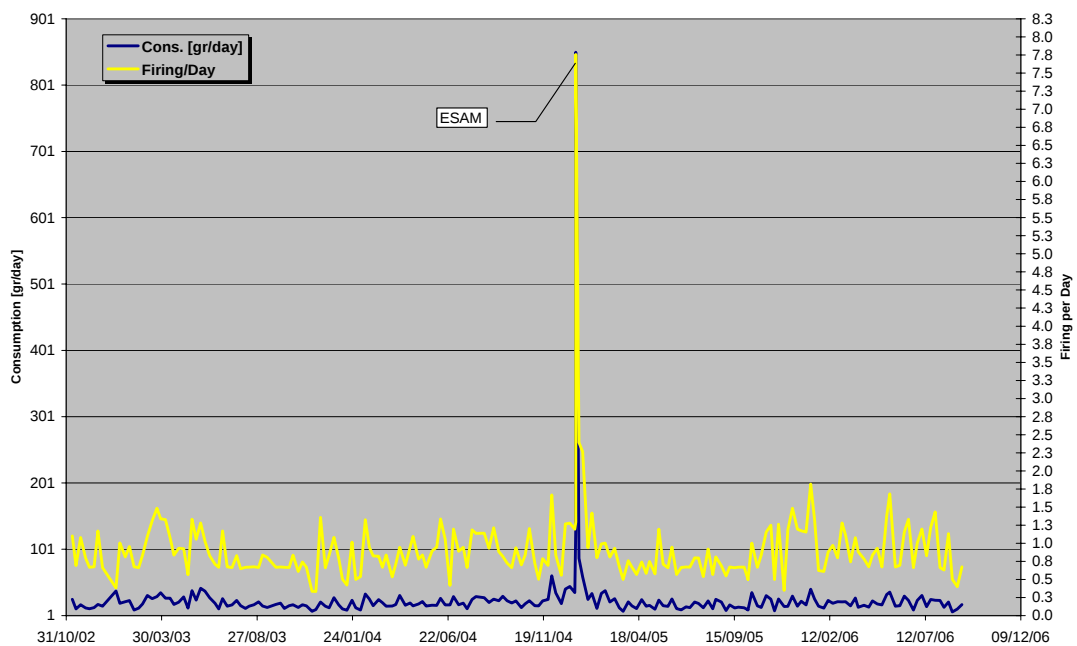
This report was generated Fri Sep 8 08:00:31 GMT 2006

8.3 Detailed Satellite Information

This section contains some detailed information concerning the various subsystems of the satellite and instruments.

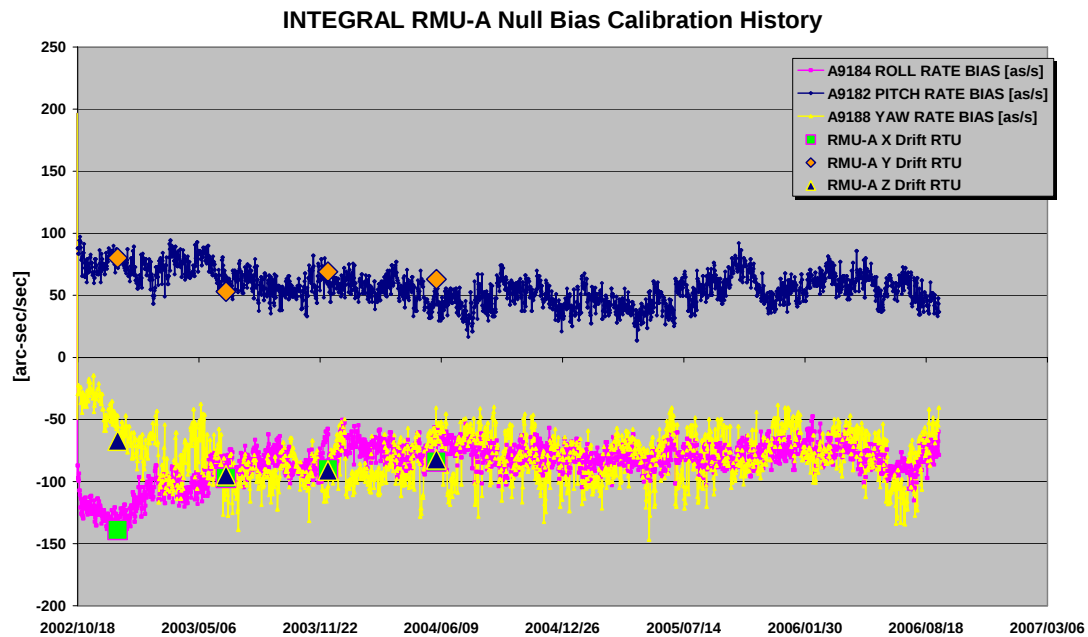


The firing\day over the period between 01/11/2002 and 07/09/2006 is reported in the plot below.

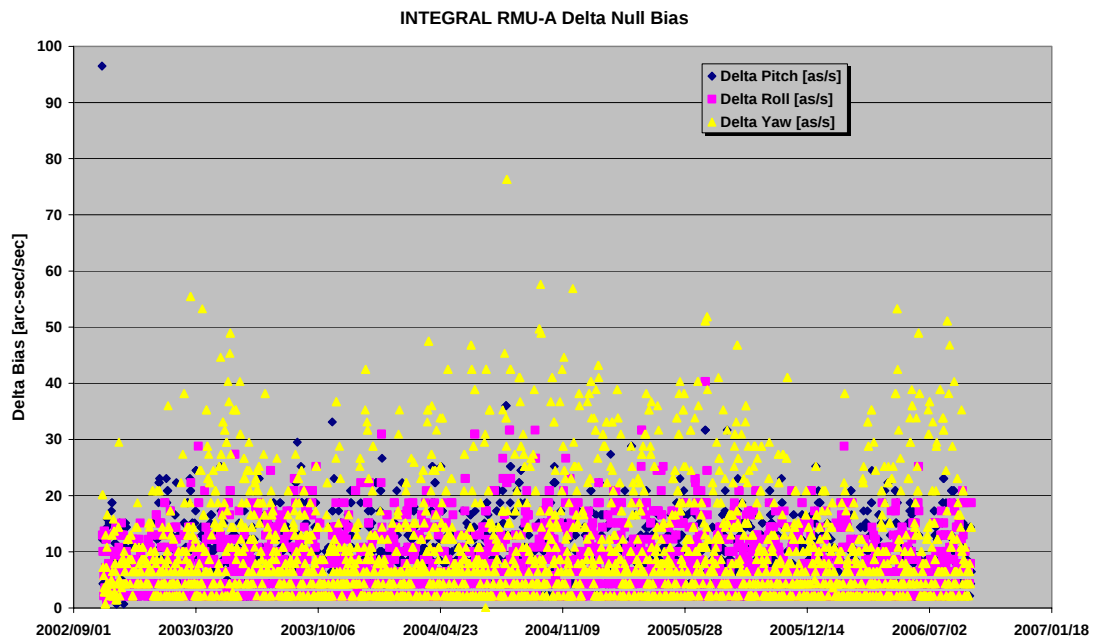


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 08/09/2006 is reported in the plot below.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 08/09/2006 is reported in the plot below.



02/09/06 (Day of Year 244, Revolution 474)

Nothing to report.

03/09/06 (Day of Year 245, Revolution 474-475)

Nothing to report.

04/09/06 (Day of Year 246, Revolution 475)

Nothing to report.

05/09/06 (Day of Year 247, Revolution 475)

ACC STR threshold exceeded: at 04:08:11z the STR SEU threshold was exceeded, just after the execution of SID 04750068(OSL). The guide star was Mi 8.2 at CCD location [2171, -2460].

Once the open loop slew executed, with IPS settle (DCA\RGAs=1\6), but manoeuvre timer still with 300 sec to run, were reported several OEM APID 640 <<STR THR EXCEEDED>>. This caused the loss of the guide star and the automatic switch ON of the IMU at 04:08:59z.

As consequence, FDS failed to update the PID 04750069 because the slew 04750068 was completed but the manoeuvre timer still running. The autonomous mapping after the OSL was affected by the IMU switch on and hence aborted. The update job for slew 04750069 could not find the appropriate mapping.

A manual recovery was executed at 04:20z and the next slew ID 04750069(CSL) manually updated in TL.

No impact on TL, except the OTF not reached during PID 04750069.

06/09/06 (Day of Year 248, Revolution 475-476)

Nothing to report.

07/09/06 (Day of Year 249, Revolution 476)

Nothing to report.

08/09/06 (Day of Year 250, Revolution 476)

Problem on TM link configuration during Handover Redu-DSS27 station: at 18:37z due to problems on TM link configuration before the handover from REDU to DSS27 station (see anomaly report section), the AOCS s/s was disabled at 18:37z. The sequence for slew ID 04760067 failed release.

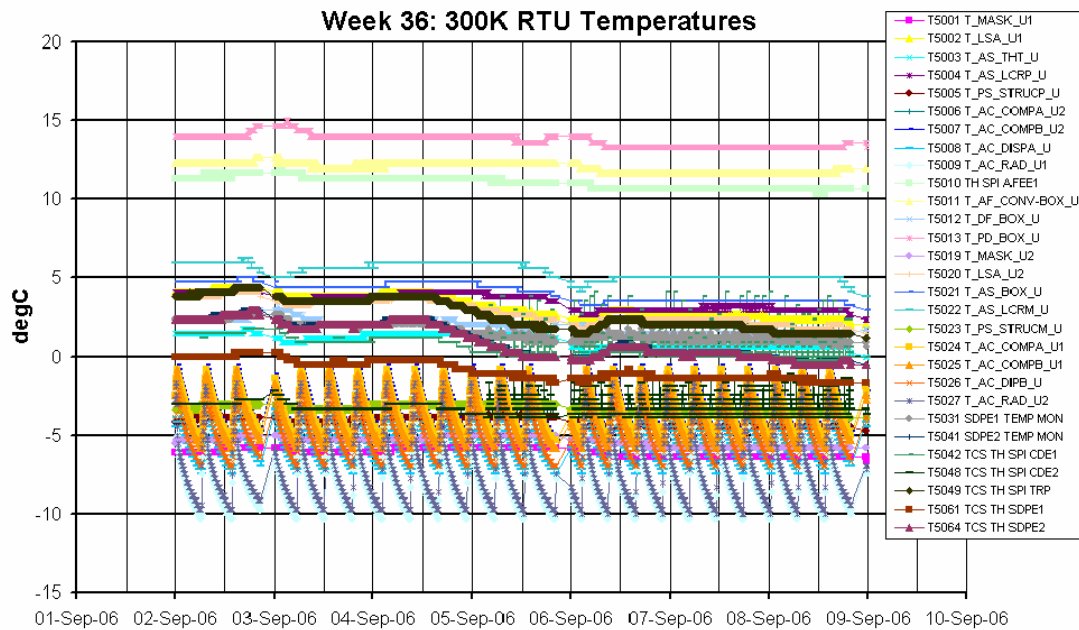
A manual recovery was then started from attitude of PID 04760066 to the attitude of PID 04760067 (perigee attitude).

The following slew was not executed from TL: ID 04760067(OSL).

8.3.2 SPI Operations

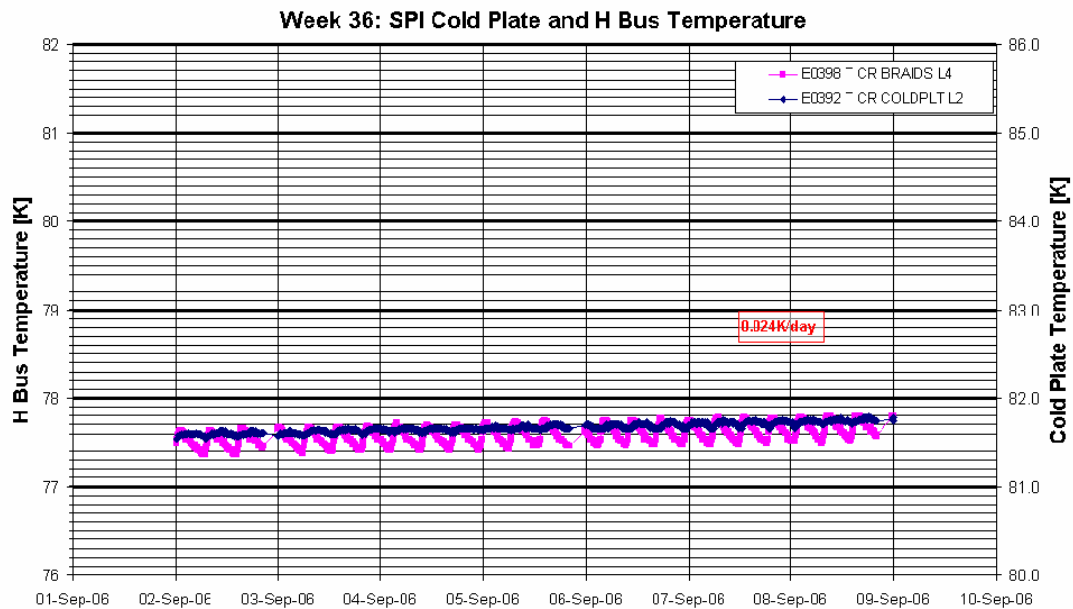
Unit Temperatures:

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 to 82K +/-1K with a positive drift of 0.024deg/day. The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.

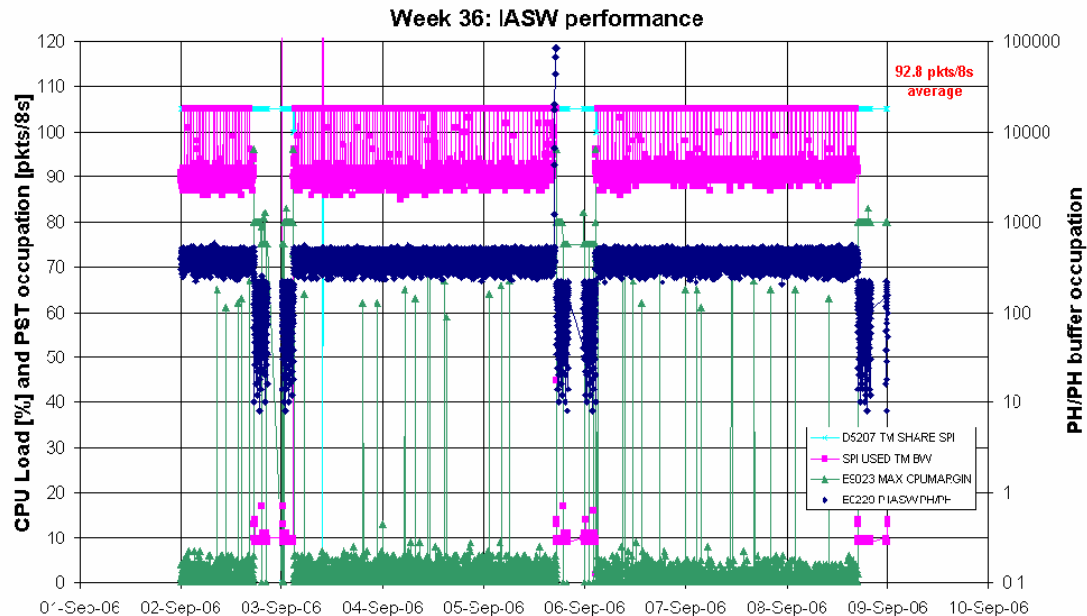


DPE & IASW:

The DPE health and IASW performance is nominal. The current IASW version installed is 432.

The average TM bandwidth occupation of SPI was 92.8 packets/cycle over the science window, when the TM allocation was 105 packets/cycle.

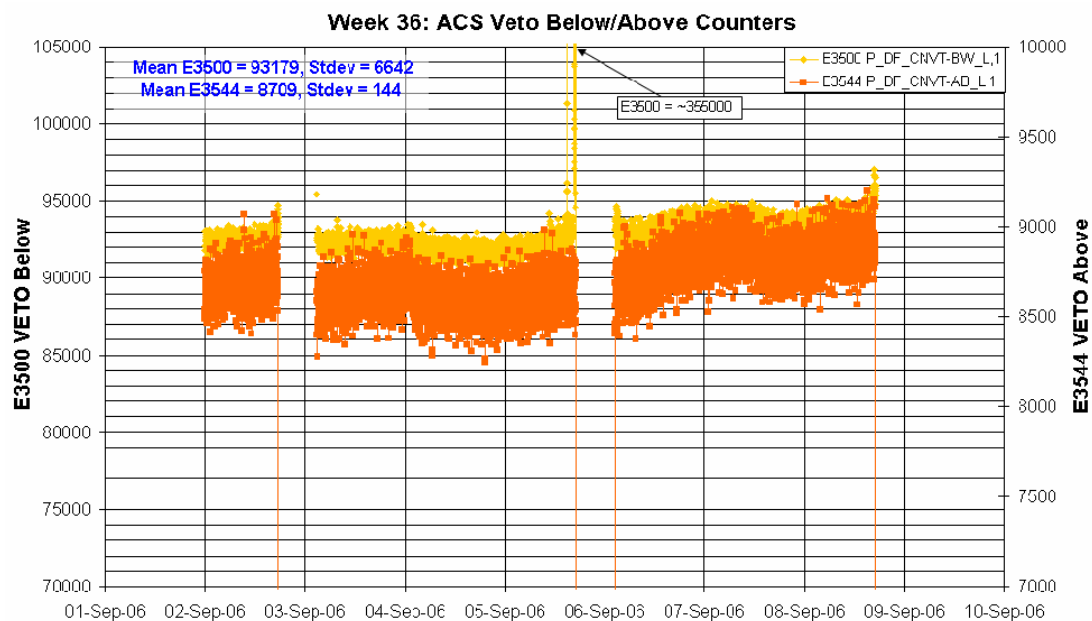
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

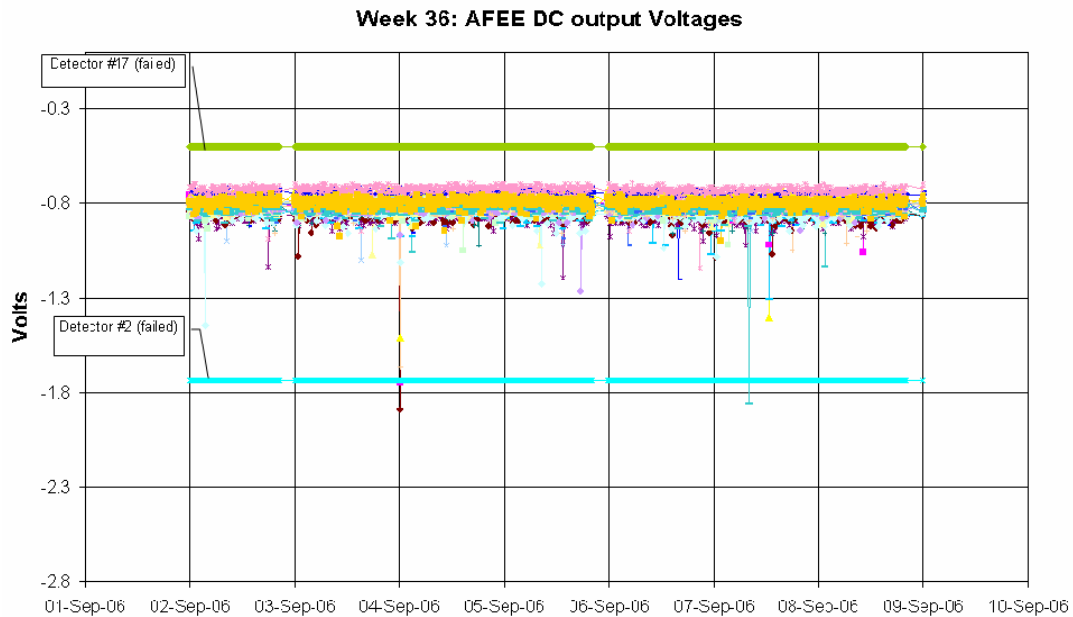
The following plot shows the ACS overall count rate evolution during the reporting period:



AFEE:

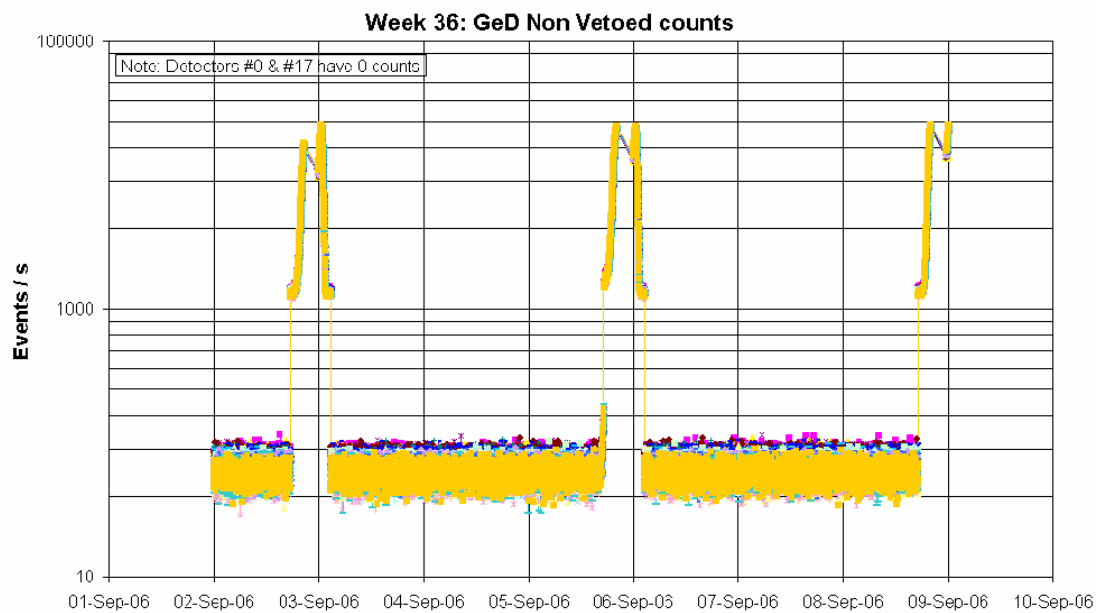
The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with the last annealing.

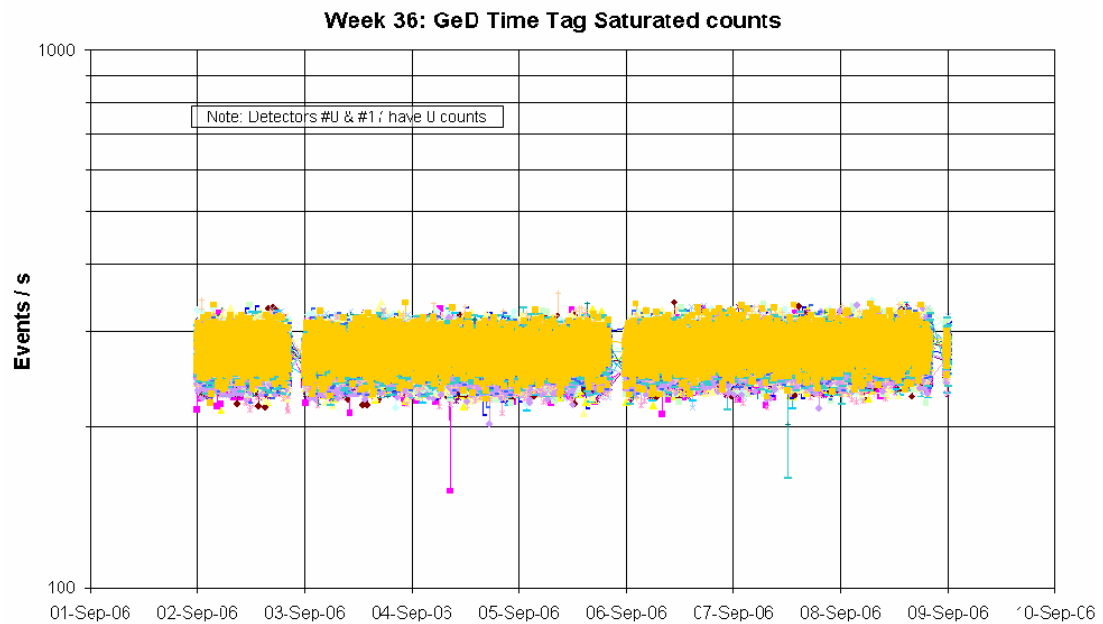
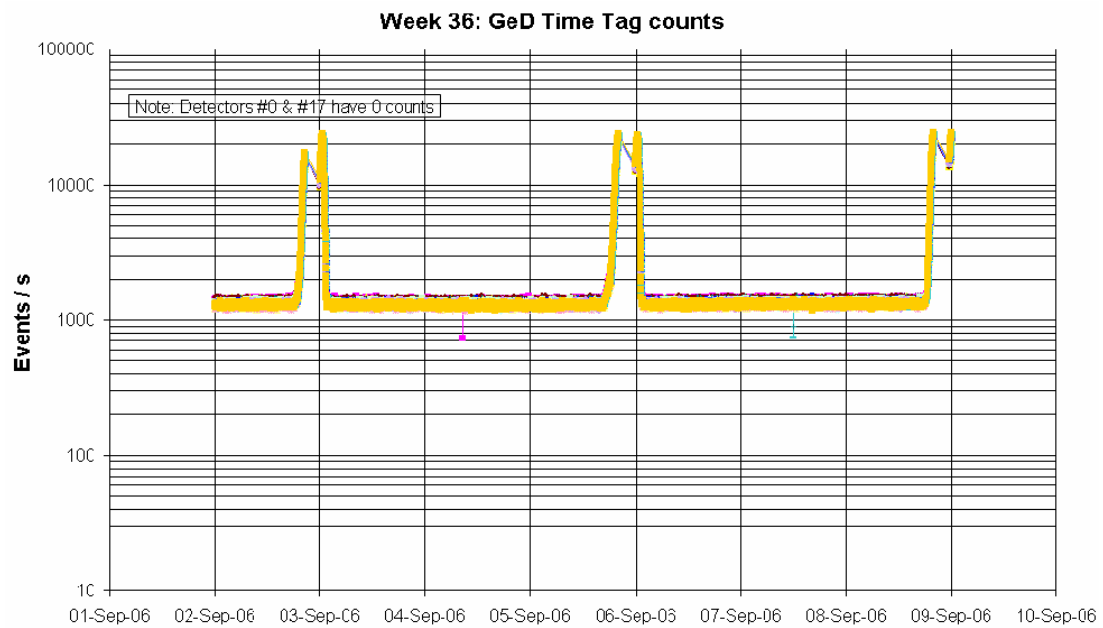
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004



DFEE:

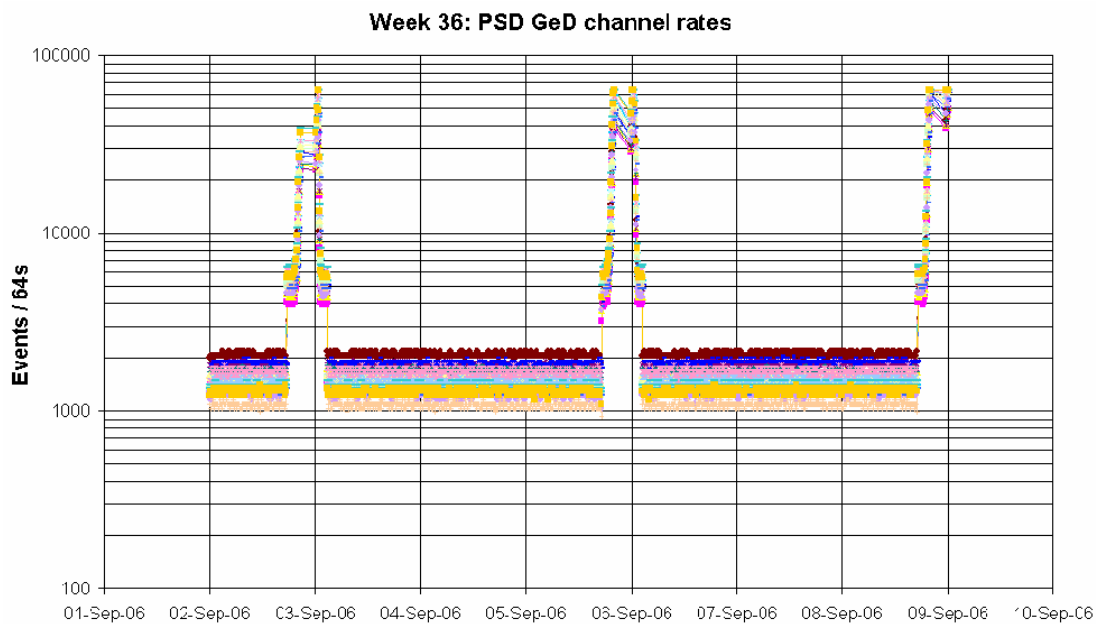
The performance of the unit is nominal. The following plots show the Non Vetoeed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.





PSD:

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



Event Log:

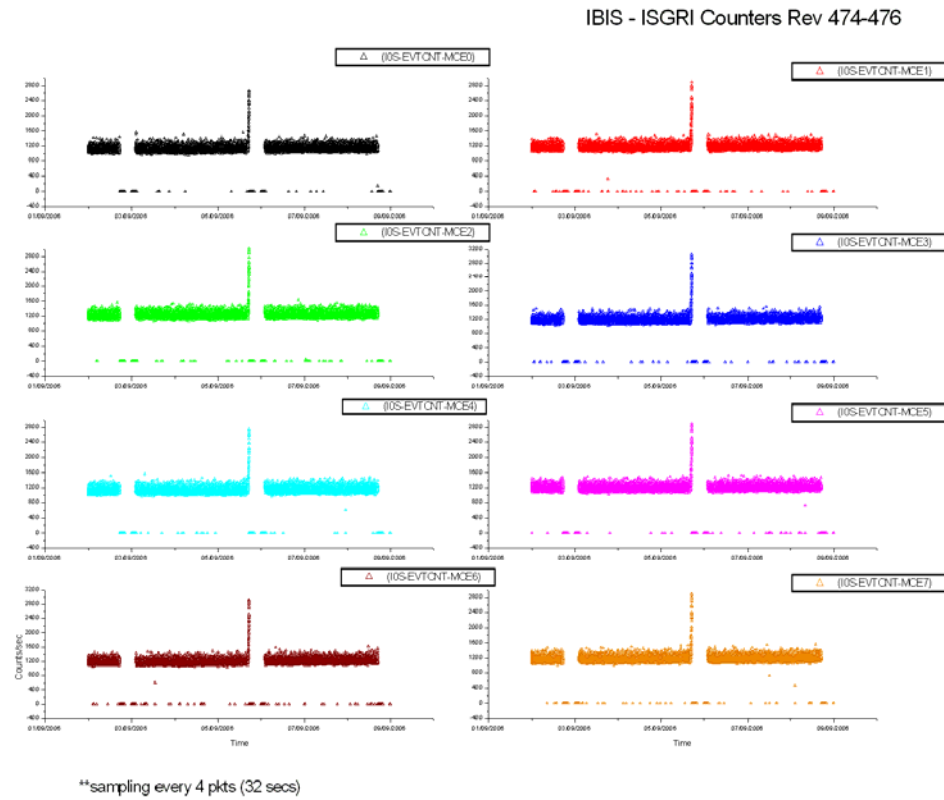
The following non-nominal OOLs and OEMs were received from SPI during the reporting period:

- On 2006-09-05 at 16:55:56Z TM parameter E3500 Cnt Veto Below went OOL High (value = 129730). As this was ~20 minutes before radiation belt entry of revolution 475, no action was taken.
- On 2006-09-05 at 23:48:31Z TM parameter E4009 S DF HSLERR L went OOL High (value = 1), indicating that the number of erroneous HSL transfers in the previous second exceeded the threshold. It returned within limits at the next TM cycle. This was at AOS of revolution 476.
- On 2006-09-07 at 13:36:48Z TM parameter E3825 (PSD + 5V analogue) exceeded the Soft OOL High (value= 5.2038V) but returned within limits when the next packet was received at 13:37:52Z.
- On 2006-09-08 at 19:36:59Z OEM 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. This was during the LOS_CHK window of revolution 477, when the SPI1 DPE time verification TC was sent. This OEM is sometimes received when this TC is sent and no action was taken.

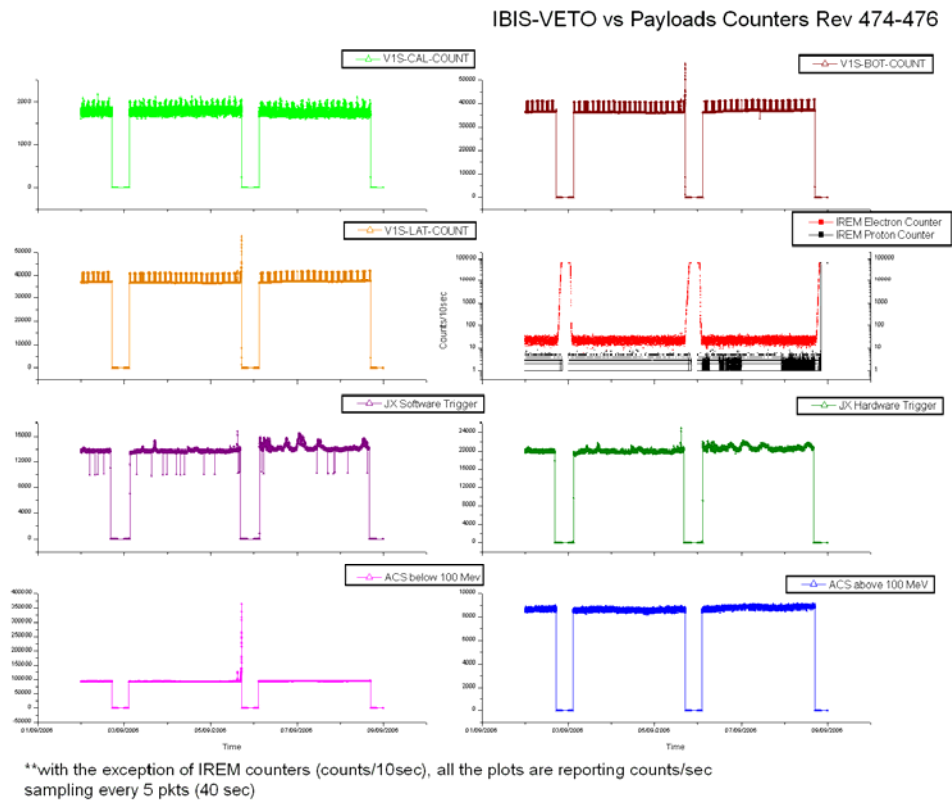
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

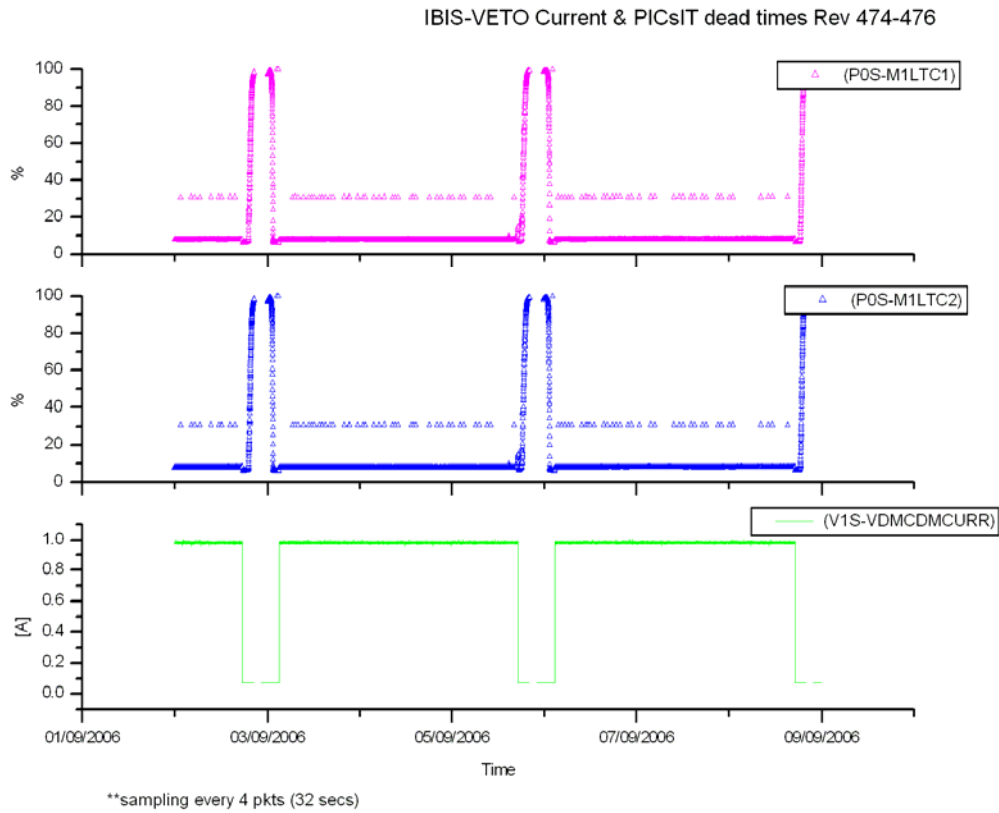


VETO vs Payloads Counters:

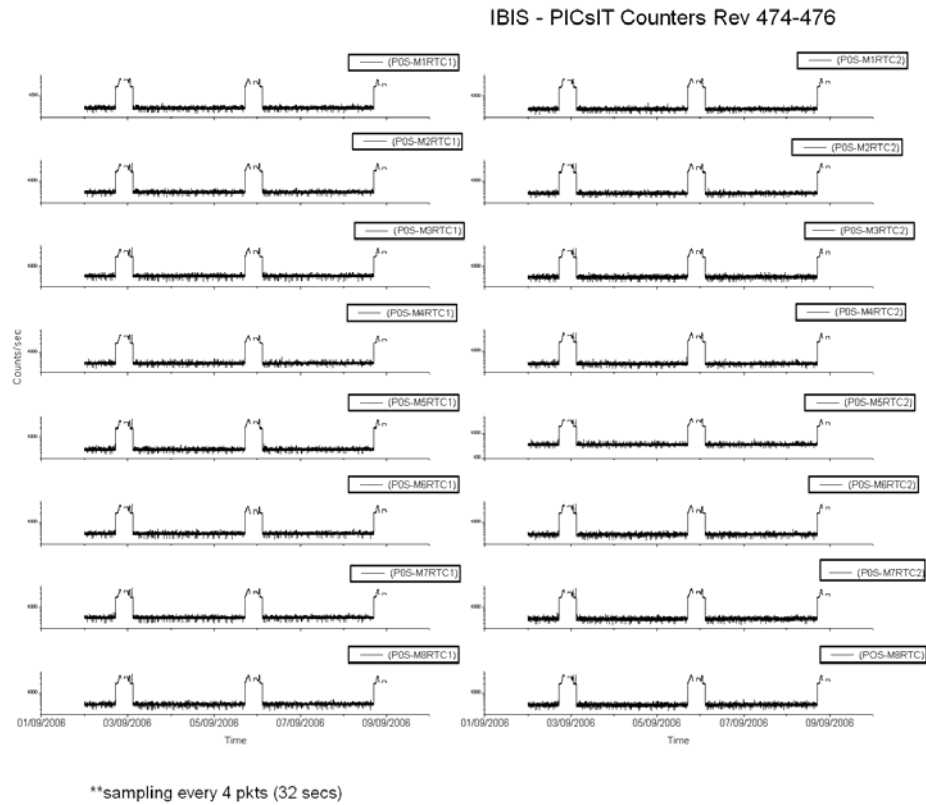


The week was characterised by low radiation.

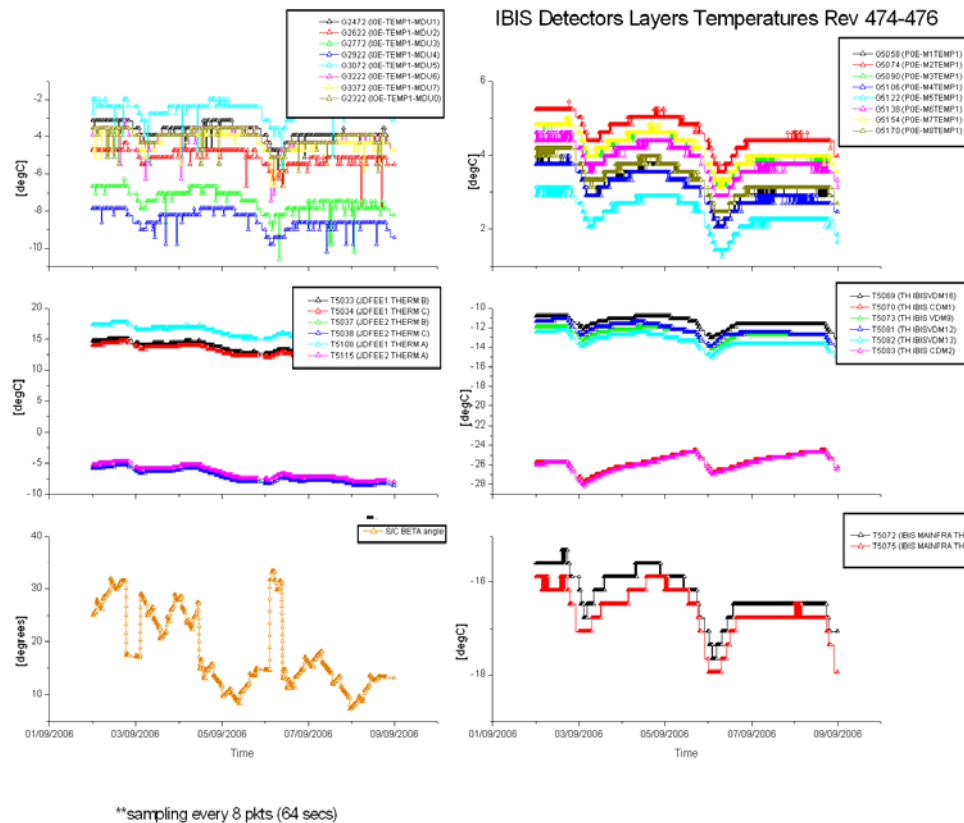
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 245 (02/09/2006):

During the day several TM parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 246 (03/09/2006):

At 03:01Z, TM parameter G8015 (S1E-A2 PMT V) went back inside limit, after the radiation belts passage, according to V-VLT-1 no action was taken before.

During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went OOL High and back. According to P-CNT-1, no action was taken.

At 02:26Z TM several parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 247 (04/09/2006):

During the day several TM parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 248 (05/09/2006):

At 17:17Z, TM parameter G8015 (S1E-A2 PMT V) was reported Out Of Limit high. It went back inside limit on DoY 249 at 02:47Z. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 no action was taken.

During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went OOL High and back. According to P-CNT-1, no action was taken.

During the day several TM parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 249 (06/09/2006):

At 02:11Z TM several parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 250 (08/09/2006):

During the day several TM parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 251 (08/09/2006):

At 17:02Z, TM parameter G8015 (S1E-A2 PMT V) was reported Out Of Limit high. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 no action was taken.

During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went OOL High and back. According to P-CNT-1, no action was taken.

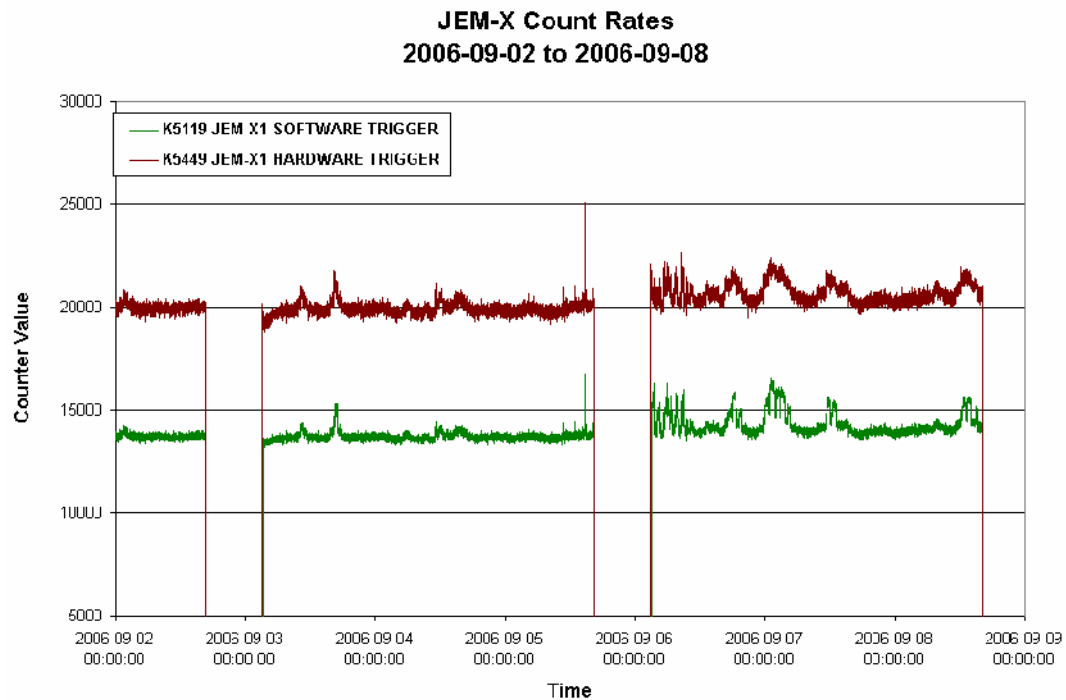
During the day several TM parameters from G2000 family (I0E-OVFWPXADD) failed SCC and back. According to I-OVF-1, no action was taken.

8.3.4 JEM-X Operations

JEM-X Count Rates

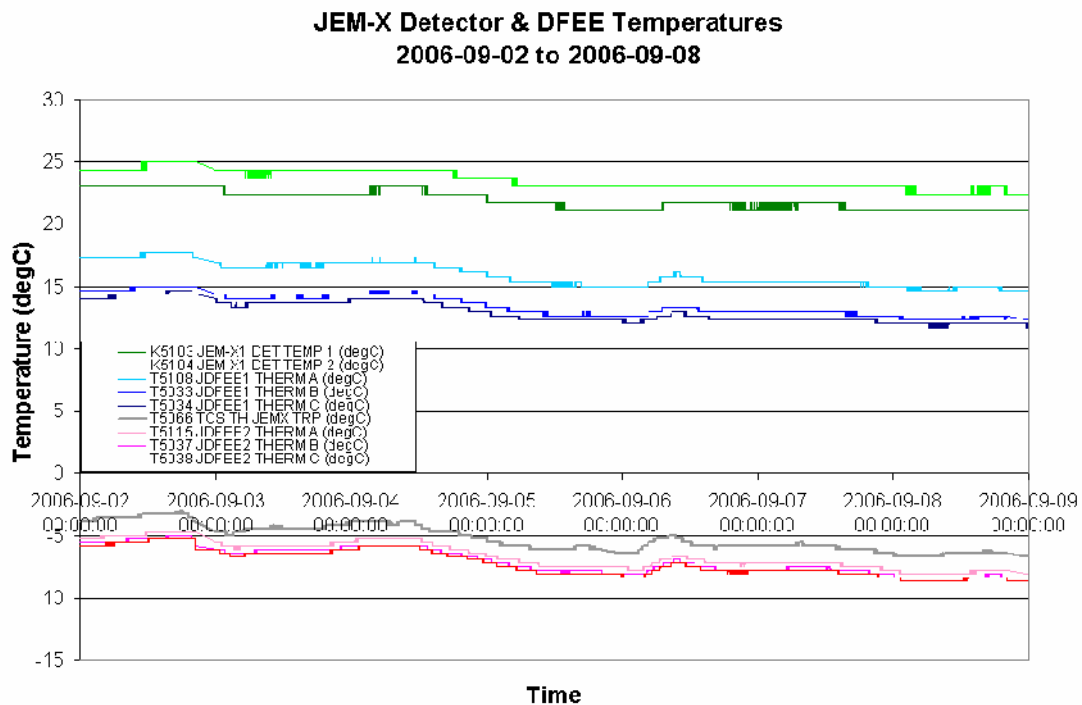
JEM-X count rates over the reporting period are displayed in the following graph¹.

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



JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph².



² Data sampled (1 frame in 8)

JEM-X Daily Report

2006-09-02 (DOY 245, Rev 474-475) to 2006-09-04 (DOY 247, Rev 475)

Nothing to report

2006-09-05 (DOY 248, Rev 475-476)

At 14:49:43Z the TM parameter K5317 RAD MONITOR 3 went OOL High (value = 78) but returned within limits at the next TM cycle. This had no impact on JEM-X1 as the reactions to the IREM RMC parameters are disabled.

2006-09-06 (DOY 249, Rev 476) to 2006-09-08 (DOY 251, Rev 476-477)

Nothing to report

8.3.5 OMC Operations

2006-09-02 (DOY 245, Rev 474) to 2006-09-07 (DOY 250, Rev 476)

Nothing to report

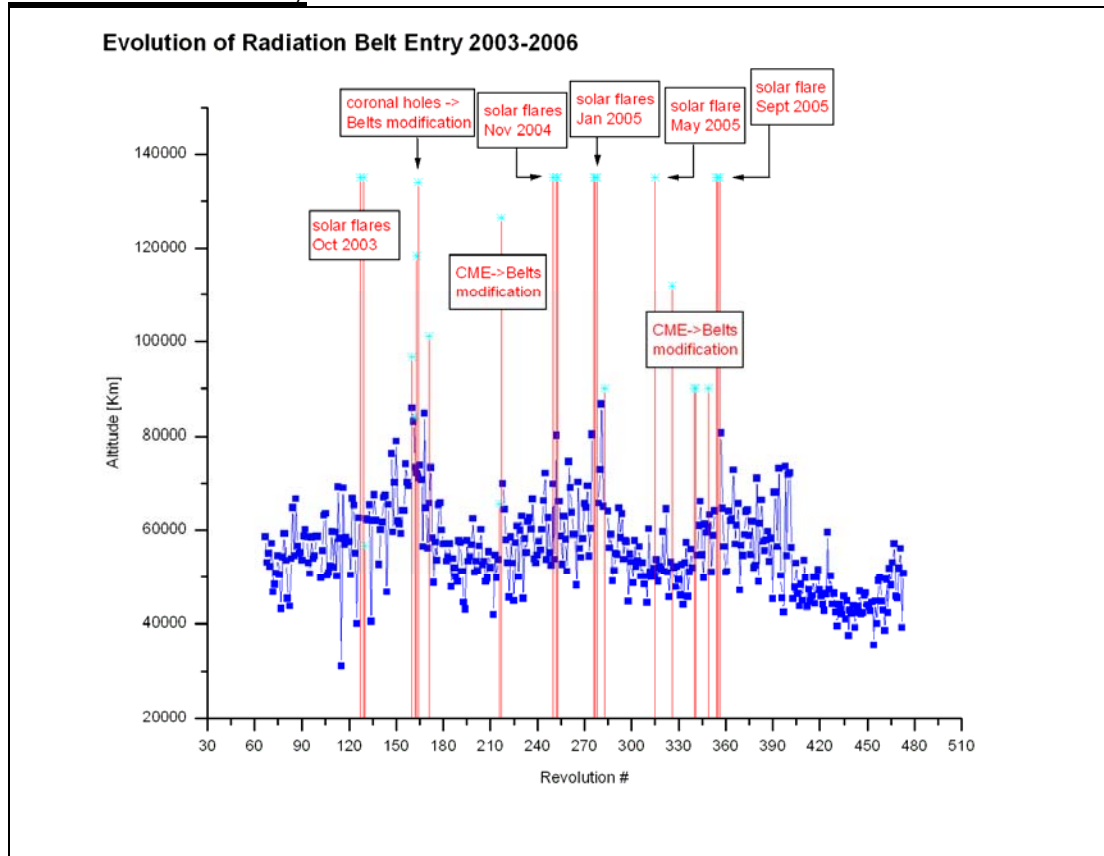
2006-09-08 (DOY 251, Rev 476)

At 17:30:29, a command was rejected by OMC. This was part of a ground test executed when the unit was in SAFE mode during the perigee passage, there was no impact.

On DoY 245 at 17:30:57, DoY 248 at 17:16:49 and DoY 251 at 17:02:01 OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

The 33rd reset of IREM S/W occurred on 08/09/2006(DoY 2006.251) at 19:59Z. This was just before LOS DSS27 during rev 476. No impact on the Payloads was reported as the instruments were already in Safe Mode for the Radiation Belt Passage.

The sequence of events was as follows:

On 08/09/2006

19:59Z IREM S/W reset;

On 09/09/2006

02:24Z DRMC flag set to DISREGARD

03:35Z Start IREM recovery following procedure CRP_SYS_2570

03:35Z OMC exit from Safe

07:20Z IREM patch procedure completed (FCP_RM_0081)

09:32Z DRMC flag set to REGARD; IREM enabled in Timeline.

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]
475	RAD_ENTR R 2006-09-05T17:16:42Z	2006-09-05 15:06:17	71816.0 (spike)	Na	Na
476	RAD_EXIT R 2006-09-06T02:34:50Z	2006-09-06 02:14:25	<44227.0	Na	Na
476	RAD_ENTR R 2006-09-08T17:01:56Z	2006-09-08 18:15:37	45292.3	Na	na

Reference

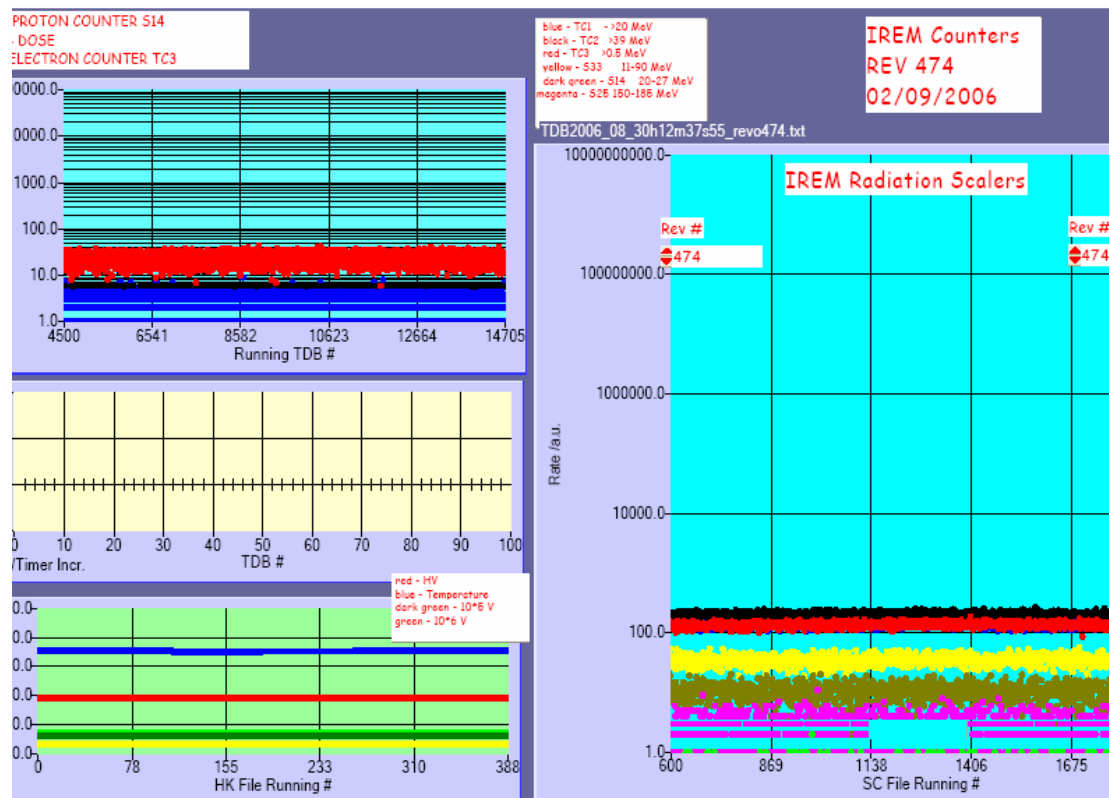
Very small error vs reference (less than 10 minutes)

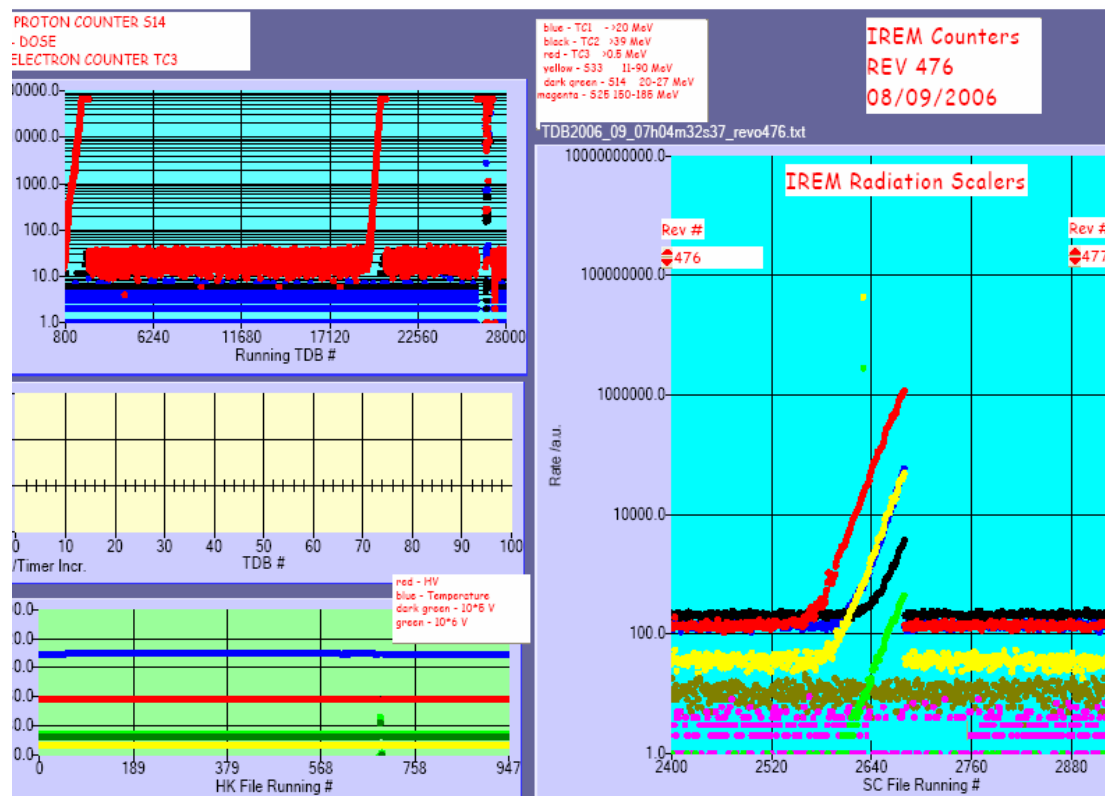
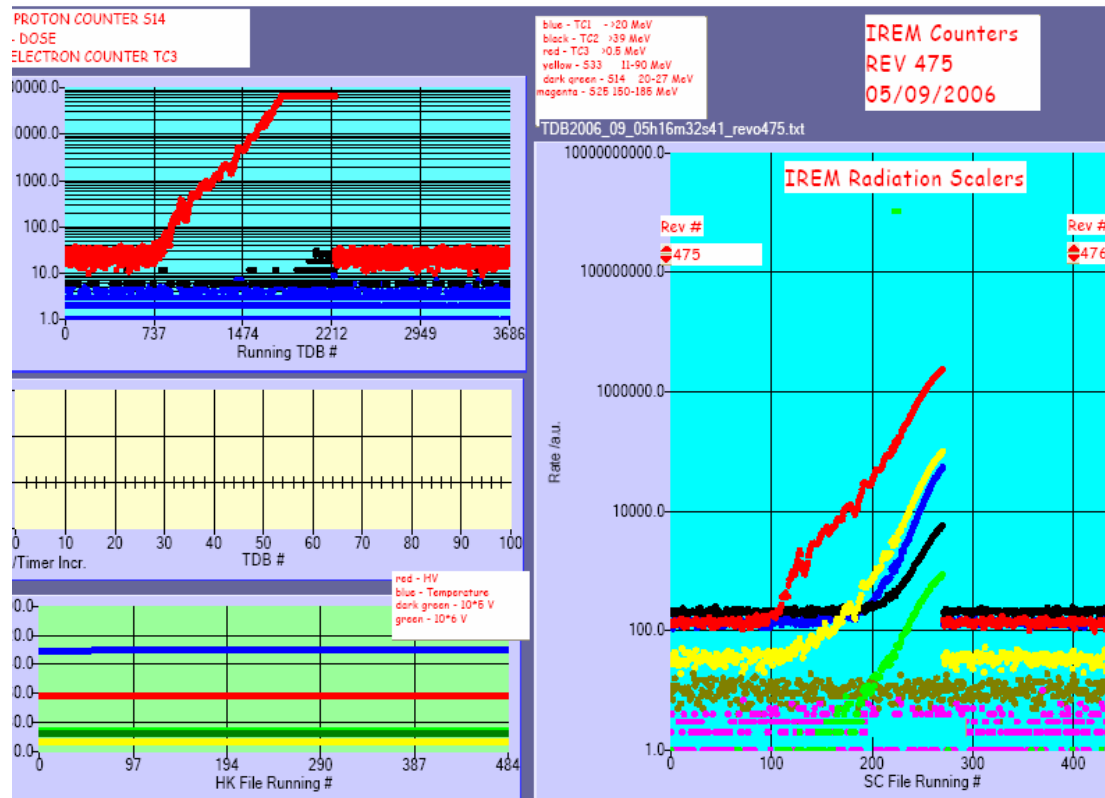
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

IREM radiation counters:

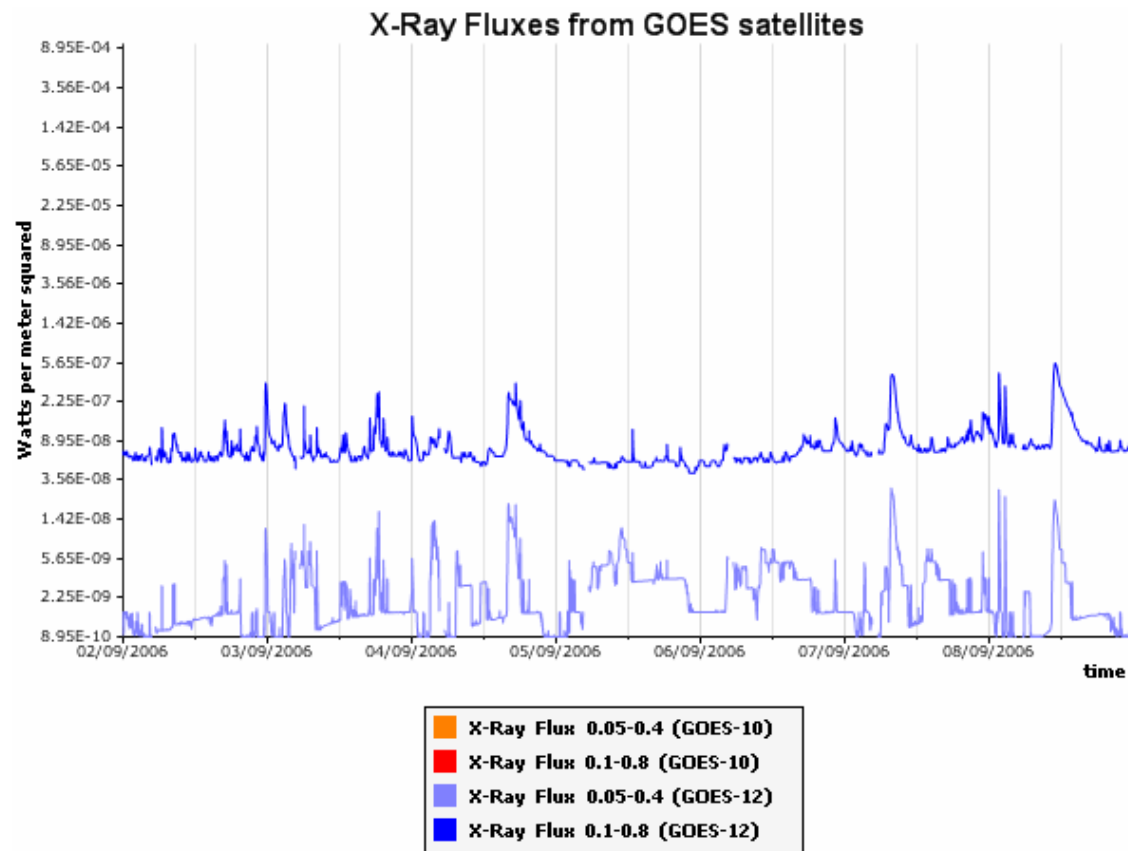




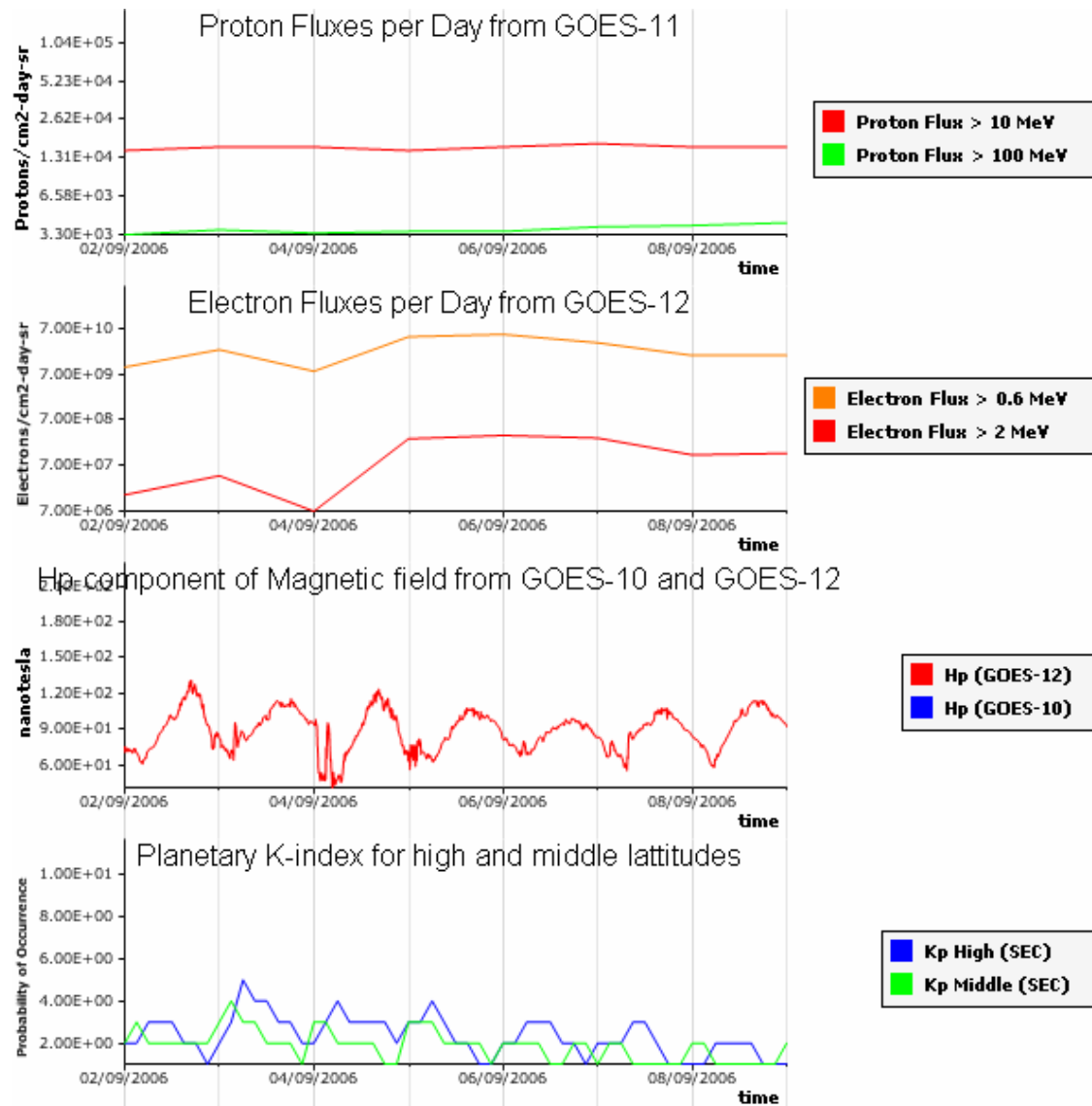
IREM Predicted Radiation Belt Passages:

Not available

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



X-Ray fluxes start to be significant over 10^{-5}W/m^2 (corresponding to M-class flares). Above 10^{-4}W/m^2 , they correspond to strong X-class flares.



Proton and electron flux report low radiation background.

Hp component of the Geomagnetic Field is essentially parallel to the Earth's rotation axis. A drop near 0 nT is associated with a significant variation in the magnetic field.

Kp index is based on ground magnetometers. Kp >=5 features storm-level geomagnetic activity.