

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 358
Week 31
03.08.09
Routine Phase

Prepared by: F. Schmidt (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 25.07.09 until 31.07.09 (both dates inclusive) and covers the revolutions 828 and 829.

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 North Ecliptic Pole (RA 18:00:00.00, +66:33:39.0) and a raster dither of the gamma-ray blazar 3C 279 (RA 12:56:11.17, -05:47:21.5).

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 25/07/2009 and 31/07/2009 was 0.1244 Kg. The remaining propellant is in the order of 133.1257 Kg.

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

3.1.2 Power

All the other units of EPS are 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.

The PST was over-subscribed by 3 packets, which were allocated to SPI during the Instrument window for the entire reporting period.

3.1.5 RFS

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

Following the 13th SPI annealing, which ended on 11/05/2009, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004) and detector #5 (failed since 19/02/2009).

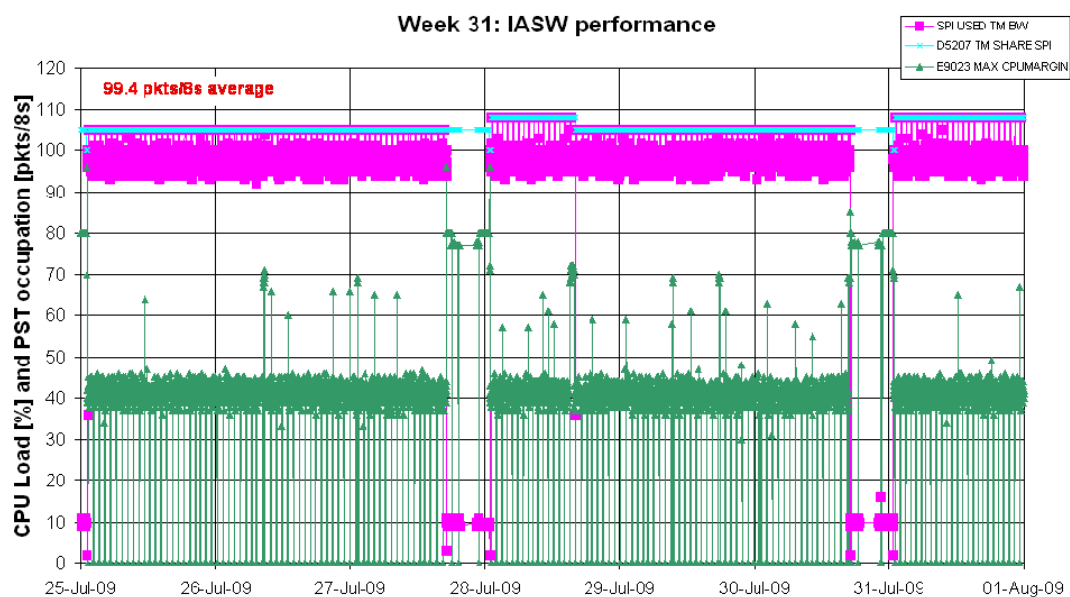
The Stirling compressors are working nominally. The Germanium detectors' temperature was kept in the range 80K $\pm$ 1K.

SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was:

- Revolutions 828-829 (except 2009-07-28T01:10:25Z - 2009-07-28T16:04:25Z): 105 packets/cycle
- 2009-07-28T01:10:25Z - 2009-07-28T16:04:25Z and revolution 830: 108 packets/cycle

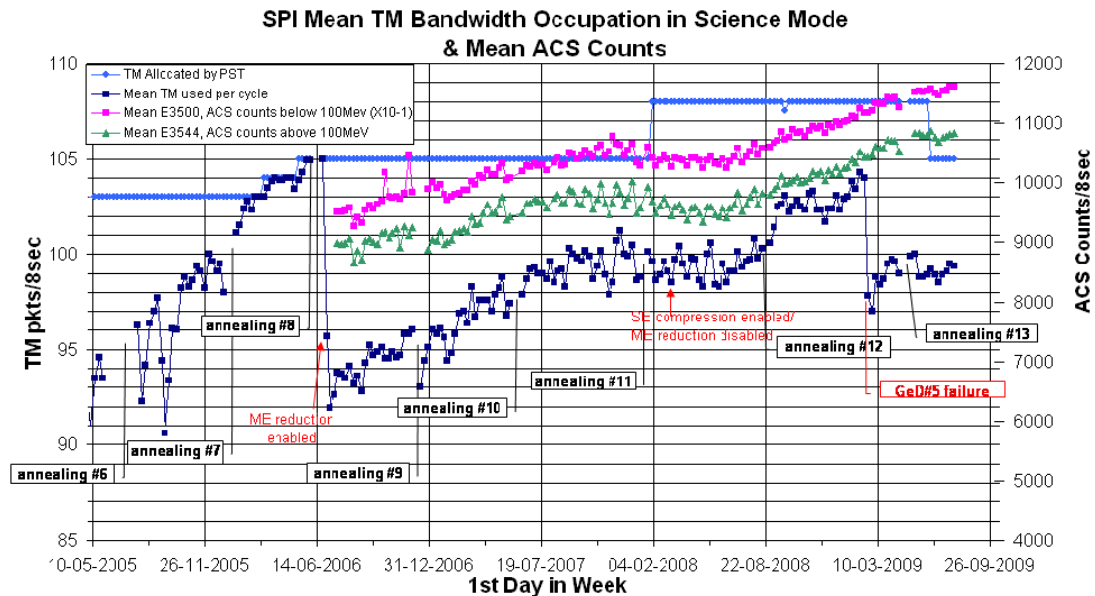
The average telemetry occupation during science observations was 99.4 packets/cycle.

The following plot shows the TM bandwidth allocation, occupation and DPE CPU load during the reporting period¹:



¹ Data sampled every 8th packet (64sec)

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005 along with the mean ACS count rate evolution (since July 2006). As can be seen, there is a strong correlation between the evolution of the background as measured by the ACS and the overall TM bandwidth usage.



Note: Some more information concerning the SPI operations is provided in the Appendix 8.3.2.

3.2.2 IBIS

The overall status of IBIS is nominal.

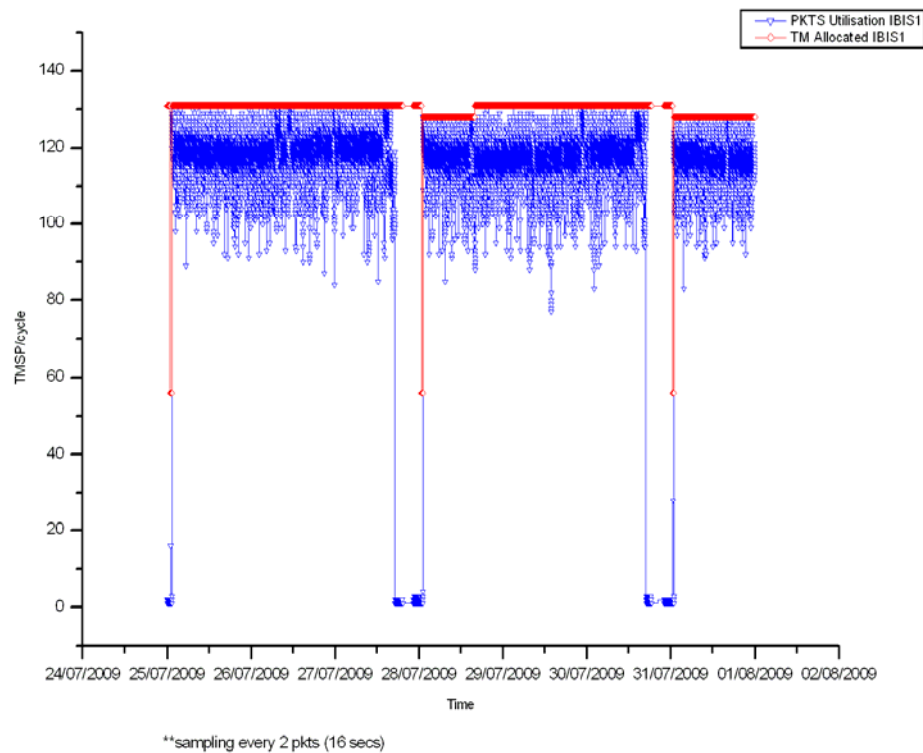
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts:
 - Revolutions 828-829 (except 2009-07-28T01:10:25Z - 2009-07-28T16:04:25Z): 131 packets/cycle
 - 2009-07-28T01:10:25Z - 2009-07-28T16:04:25Z and revolution 830: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 117.79 packets/cycle (down 0.9 on previous week)
- Percentage of TM cycles in science mode for which full bandwidth was used: 1.31%

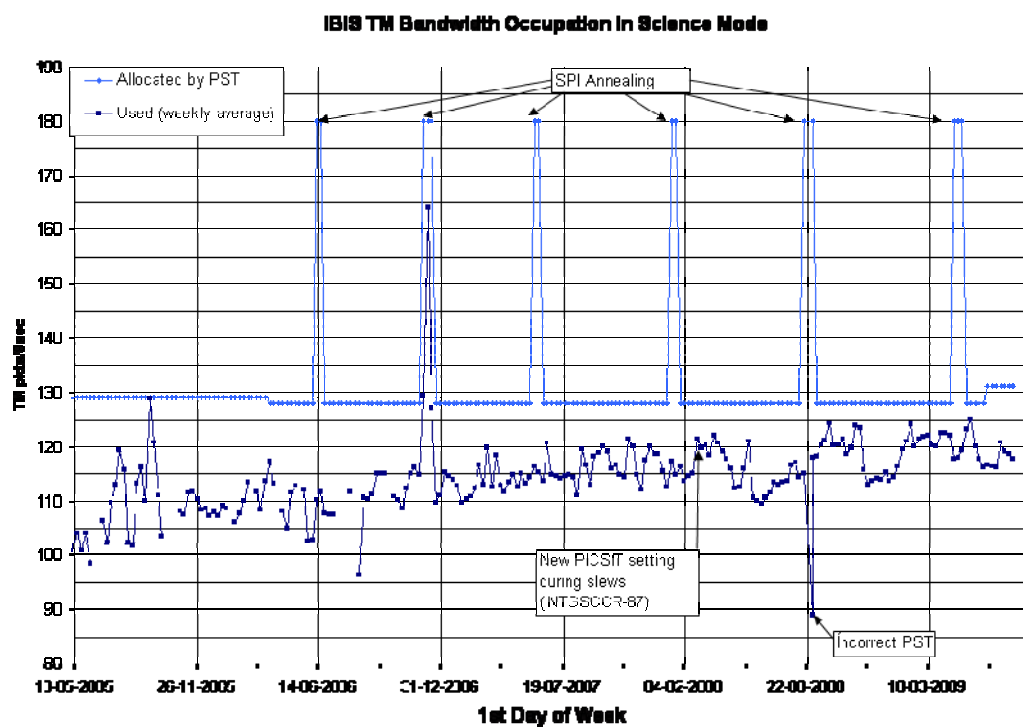
The plot below shows the IBIS TM utilisation during the reporting period² :

² Data sampled every 2nd packet (16sec)

IBIS - TM Bandwidth Utilisation Rev 828-830



A plot of the IBIS weekly bandwidth utilisation since May 2005 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 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 147 planned science pointings were executed 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.

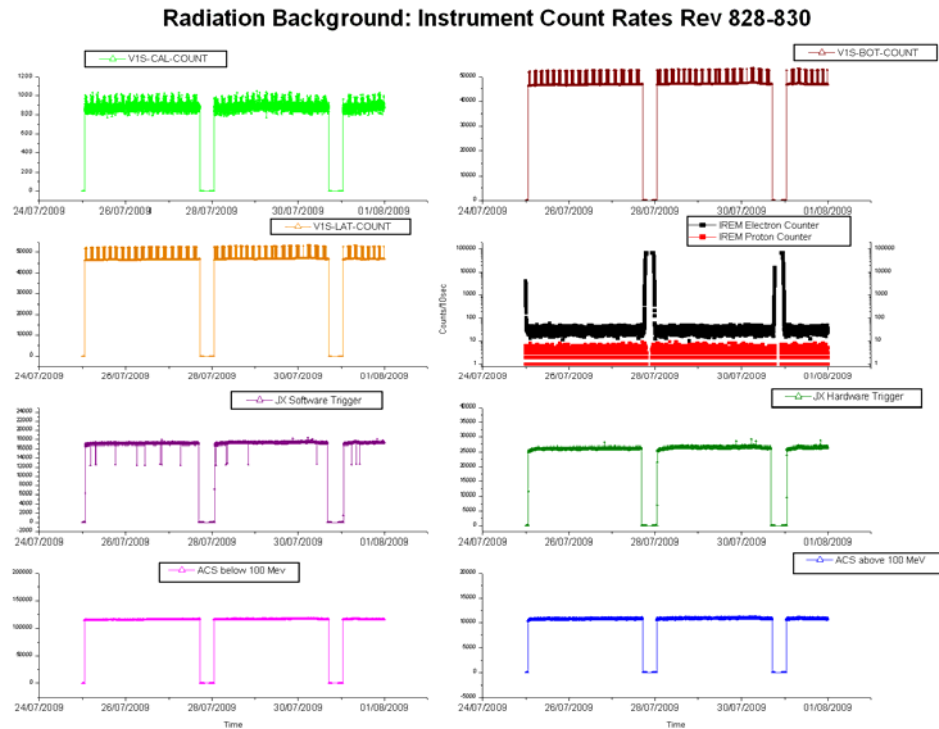
Solar Activity

The observation period was characterised by low solar activity. The sun was blank all week. The risk of solar flares was very low.

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

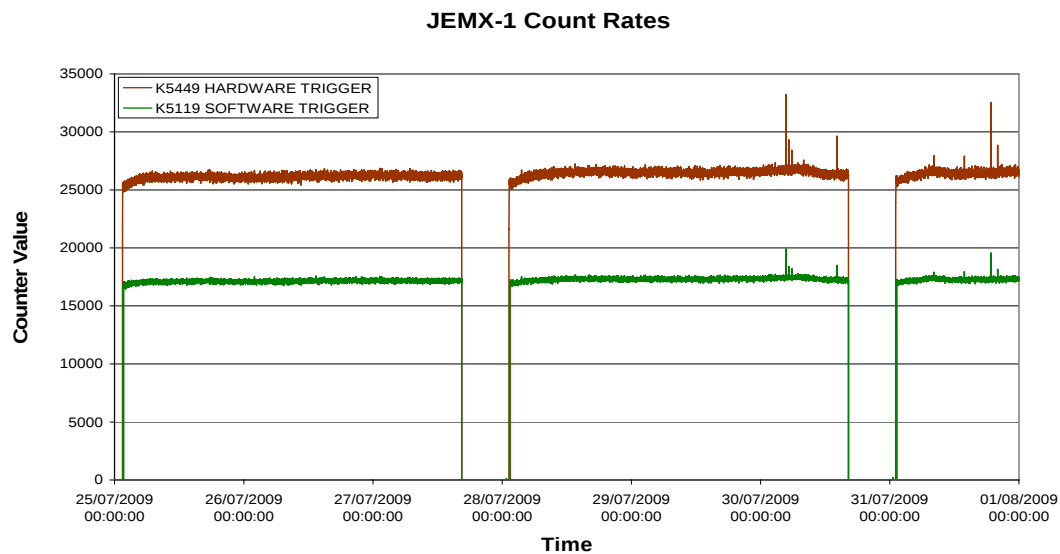
3.2.6 Radiation Background

The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the week³ :



JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph⁴.

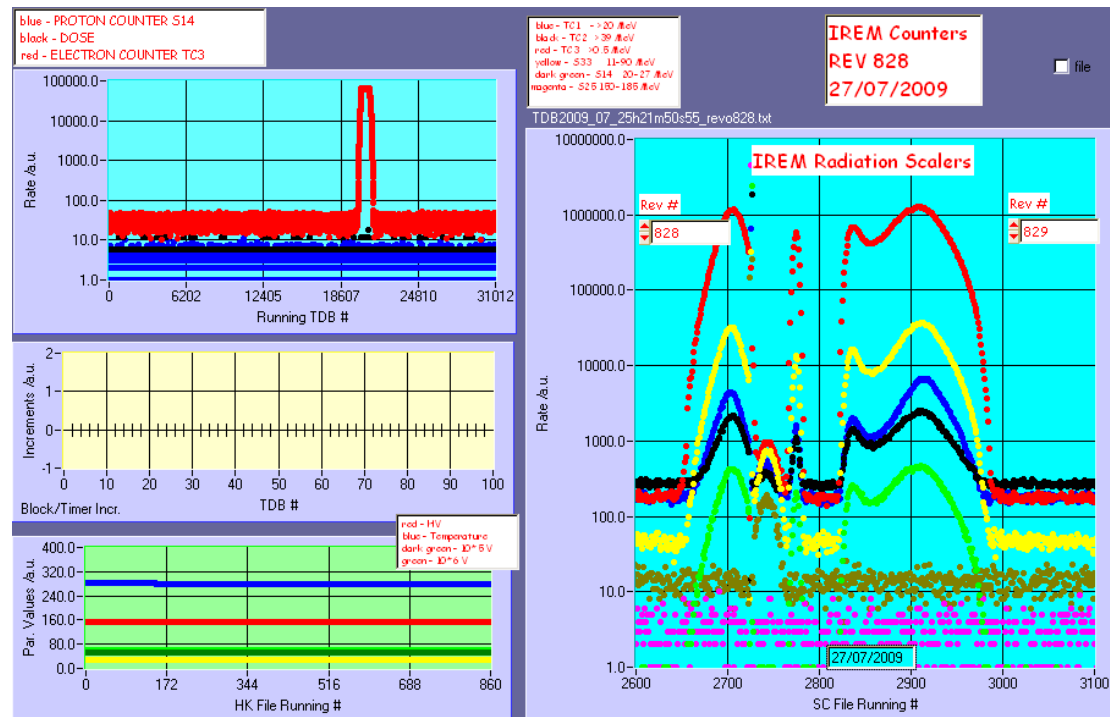


³ Data sampled every 6th packet (48sec)

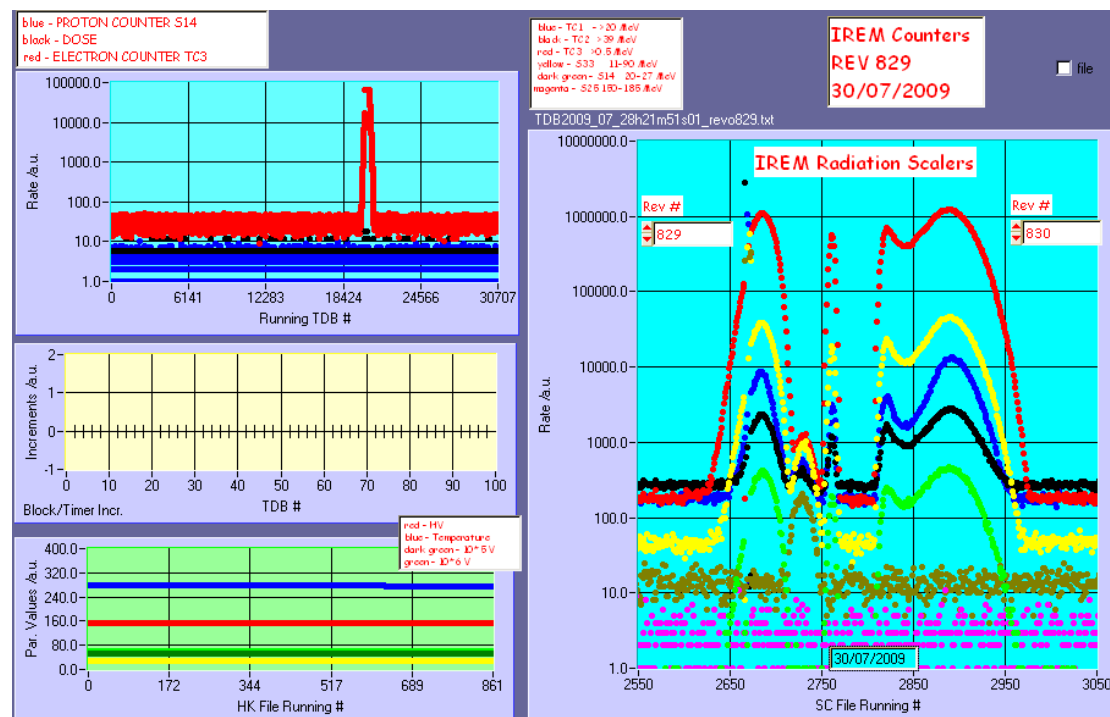
⁴ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

IREM radiation counters:

Revolution 828



Revolution 829



4 Ground Facilities

The Operational ground facilities performance was good this week. The overall performance was over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week, there were three occasion when the links with ISDC dropped, necessitating a restart of the isds & ifrd, there was no impact.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week, there were 2 occasions of bad frames, 2 occasions of a TM drop VC0 and VC7 from Redu. On DoY 211 at 00:00Z after the ground station handover to DSS-27 was performed, there were several occasions of a TM drop VC0 occurring every 14 minutes. At 02:58 the operations were moved back to Redu. There was no impact on T/L operations.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

No new PSFs have been received (the last was for revolution 834). No new observations have been planned.

No new TSFs have been received, the last available is for revolution 831.

2. Observation status

New ECS files have been received and processed for revolutions 814-816.

3. ISOC Science Data Archive

The main archive server (ISDA) will be upgraded and different options are being explored.

4. ISOC system

No news.

5. Problems

None.

5 Special Events

6 Anomalies

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

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Consumables

8.2 Detailed Satellite Information

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

8.2.1 AOCS SUMMARY OPERATIONS REPORT, 25/07/2009 – 31/07/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 84 Open Loop Slews, 72 Closed Loop Slews and 4 Momentum Biases were executed (as reported by ACC OEM).

No slews were missed from the TL.

OTF was not reached for PID 08280035, 08290049 and 08300018.

Orbit Control

No update.

Fuel consumption

No update

The RMU-A null bias calibration

No update

25/07/2009 (Day of Year 206 , Revolution 827 to 828)

Nothing to report

26/07/2009 (Day of Year 207 , Revolution 828)

- On Target Flag was not reached for PID 08280035 (11:40:00). The reason why that happened was the following: after slew 08280035 was completed, a guide star was automatically selected. Then, only 40 seconds after SLEW END the star was lost. IMU1 didn't switch on, an automatic mapping occurred and another star was selected instead. The SSL got then disabled.

OTF was not reached for PID 08280035.

27/07/2009 (Day of Year 208 , Revolution 828)

Nothing to report.

28/07/2009 (Day of Year 209 , Revolution 828 to 829)

Nothing to report.

29/07/2009 (Day of Year 210 , Revolution 829)

- IMU1 switched ON during the stable pointing of PID 08290049 (22:56:00Z). A manual mapping was commanded and the parameters for slew 08290050 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08290049.

30/07/2009 (Day of Year 211 , Revolution 829)

- Flight Dynamics Job Scheduler crashed. Slews 08290063 and 08290064 went from the Timeline without a real time update. After noticing this, a manual mapping was commanded and the parameters for slew 08290065 manually updated (spacontool).

No impact on the Timeline execution.

31/07/2009 (Day of Year 212 , Revolution 829 to 830)

- IMU1 switched ON during the stable pointing of PID 08300018 (16:16:00Z). A manual mapping was commanded and the parameters for slew 08300019 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08300018.

- Flight Dynamics Job Scheduler crashed. Slews 08300020, 08300021 and 08300022 went from the Timeline without a real time update. After noticing this, a manual mapping was commanded and the parameters for slew 08300023 manually updated (spacontool).

Since, by the time of the automatic update for the parameters of slew 08300024, FD had still not re-started the Job Scheduler, a manual mapping was commanded and the parameters for slew 08300024 manually updated (spacontool). The same approach had to be done also for slew 08300025.

Then the FD Job Scheduler was re-started and the updates resume.

No impact on the Timeline execution.

8.2.2 SPI Operations

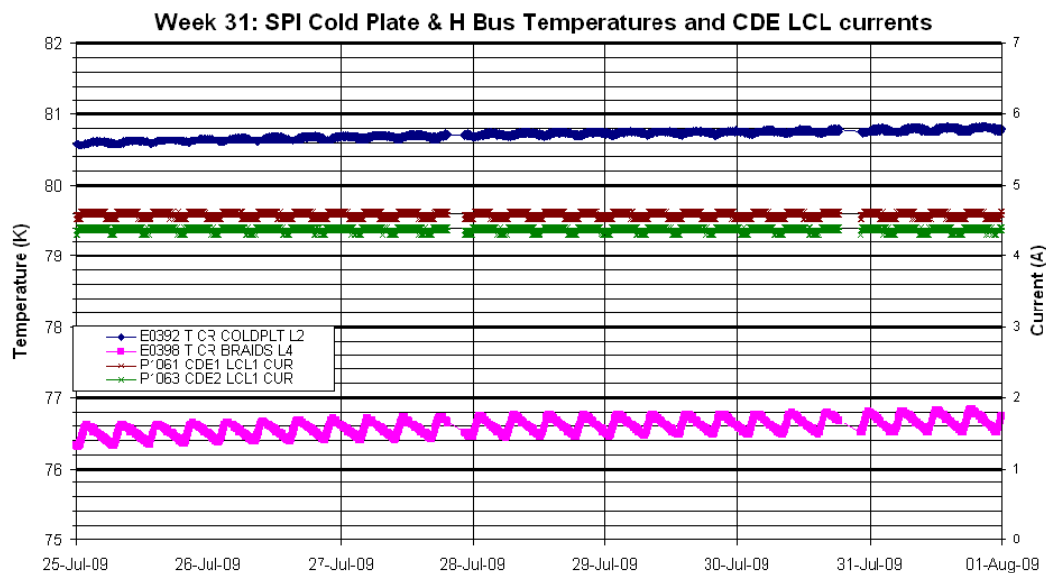
Unit Temperatures: All the equipment temperatures are inside the operational limits.

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 39 throughout the week and the average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.58A
- CDE2 LCL Current = 4.37A

The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period⁵:



DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

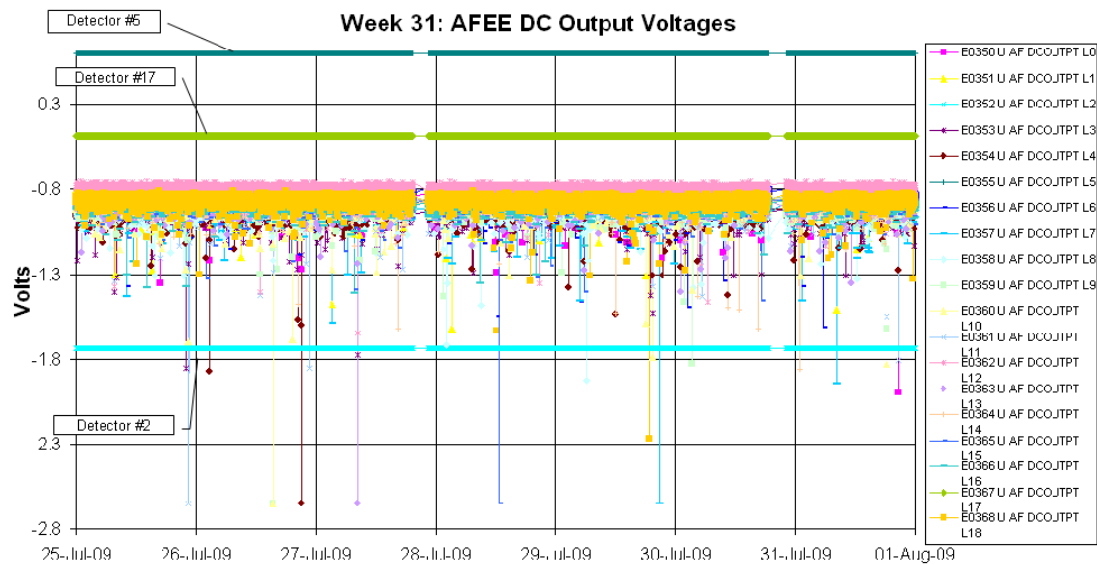
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). A plot of the ACS counts is given in Section 3.2.6.

AFEE: The health of the AFEE is nominal. The following plot shows the dc output voltage of the detector channels during the reporting period⁶. The values are nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004 and

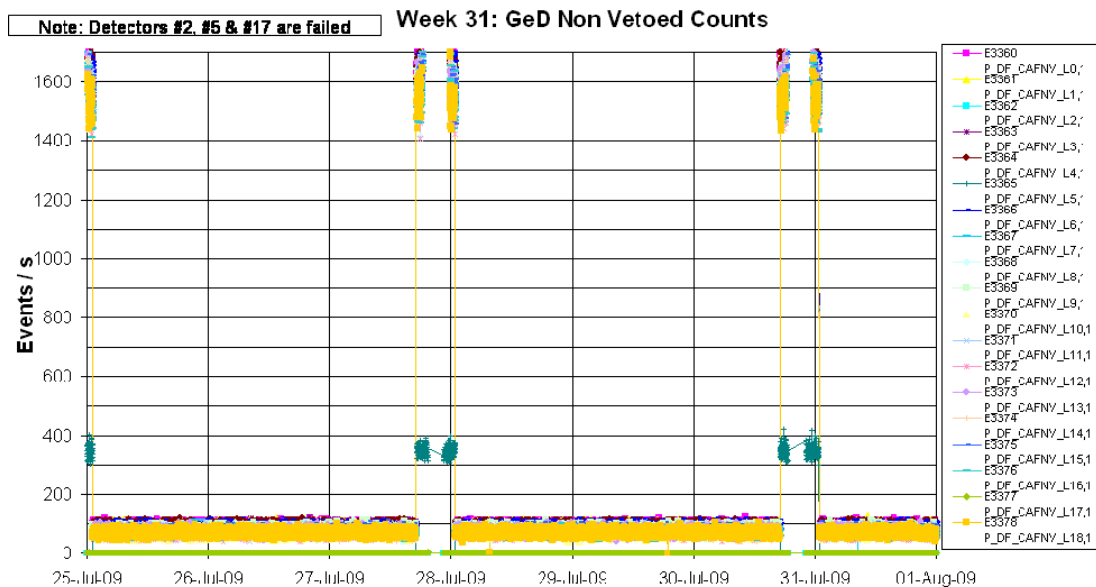
⁵ Data sampled every 8th packet (64sec)

⁶ Data sampled every 8th packet (64sec)

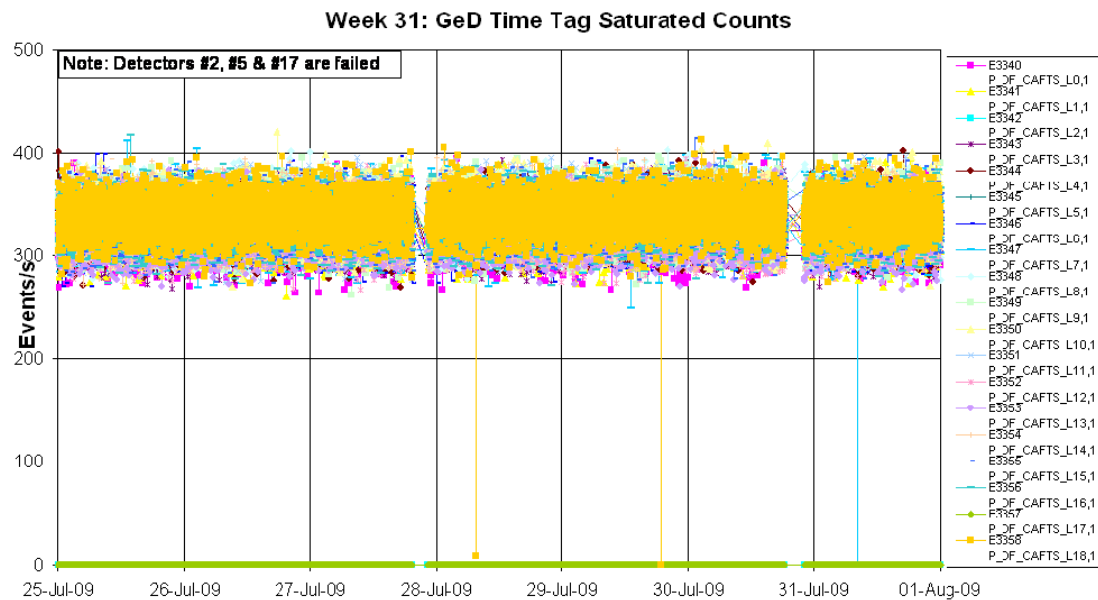
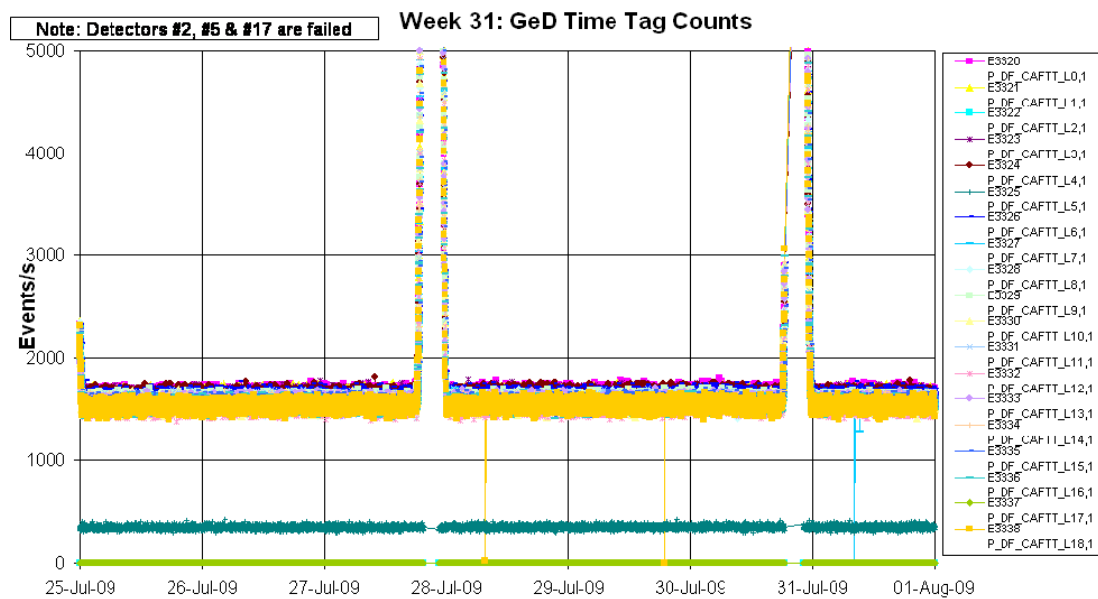
detector #5 is failed since 19/02/2009. The HV of the failed detectors are nominally set to 0.5kV.



DFEE: The health of the unit is nominal. The following plots show the Non Vetoeed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁷.

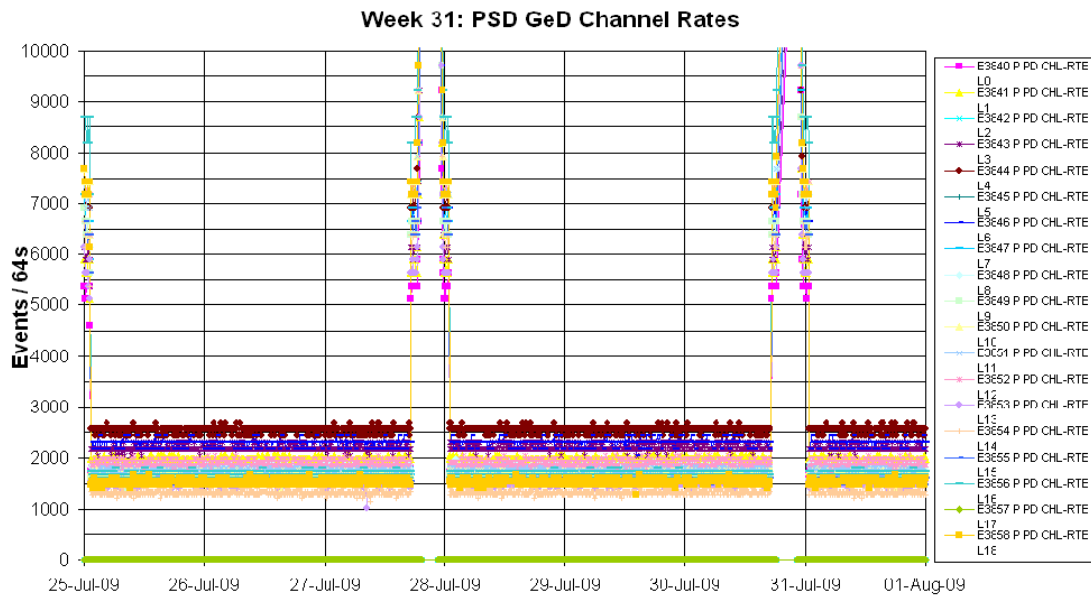


⁷ Data sampled every 8th packet (64sec)



PSD: The overall health of the unit is nominal. The following plot shows the PSD channel rates over the reporting period⁸:

⁸ Data sampled every 8th packet (64sec)



Event Log:

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

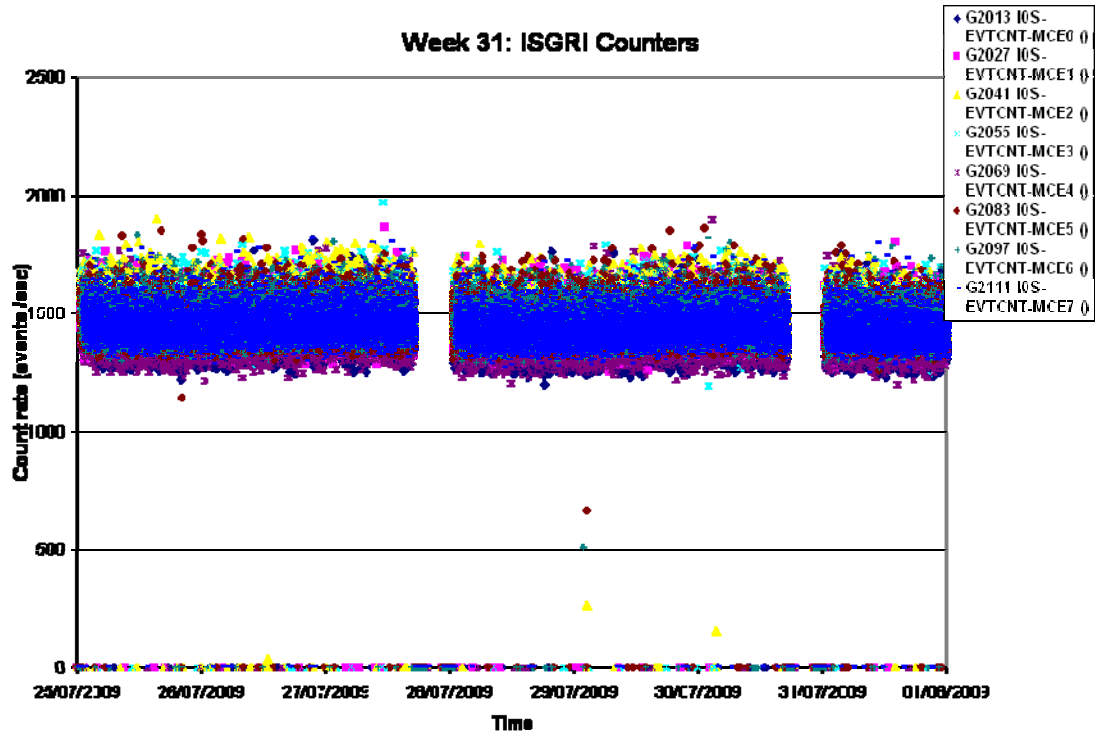
8.2.3 IBIS Operations

Unit Temperatures: All the equipment temperatures were inside the operational limits throughout the week.

ISGRI

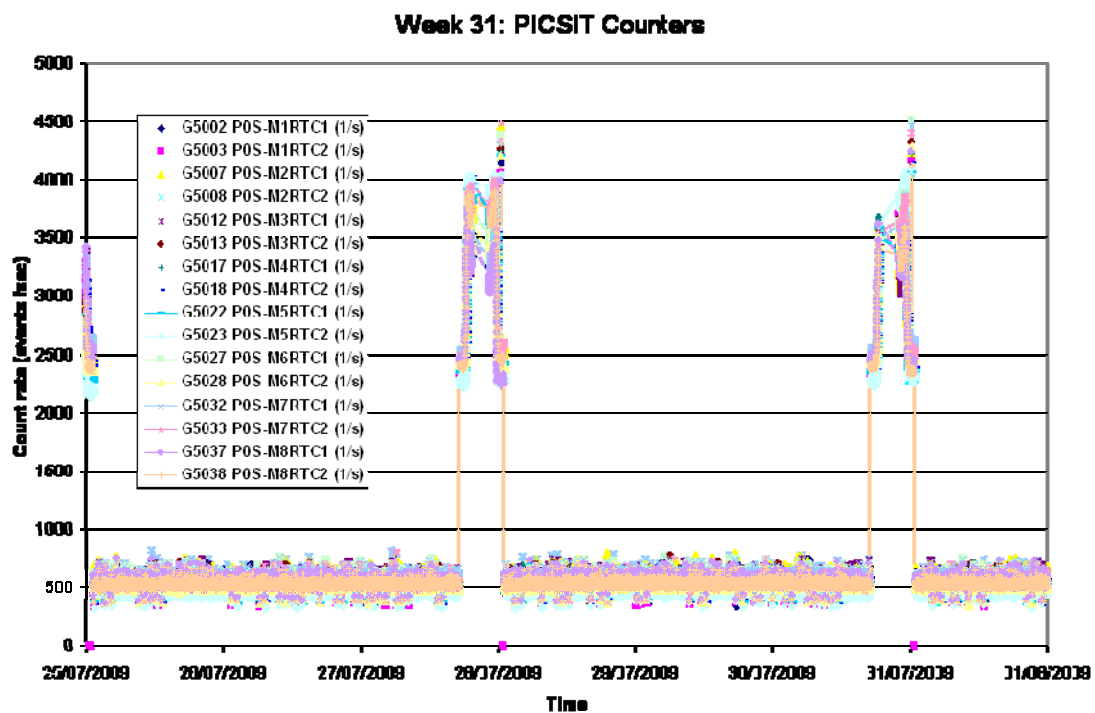
The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the week⁹:

⁹ Data sampled every 4th packet (32sec)



PICsIT

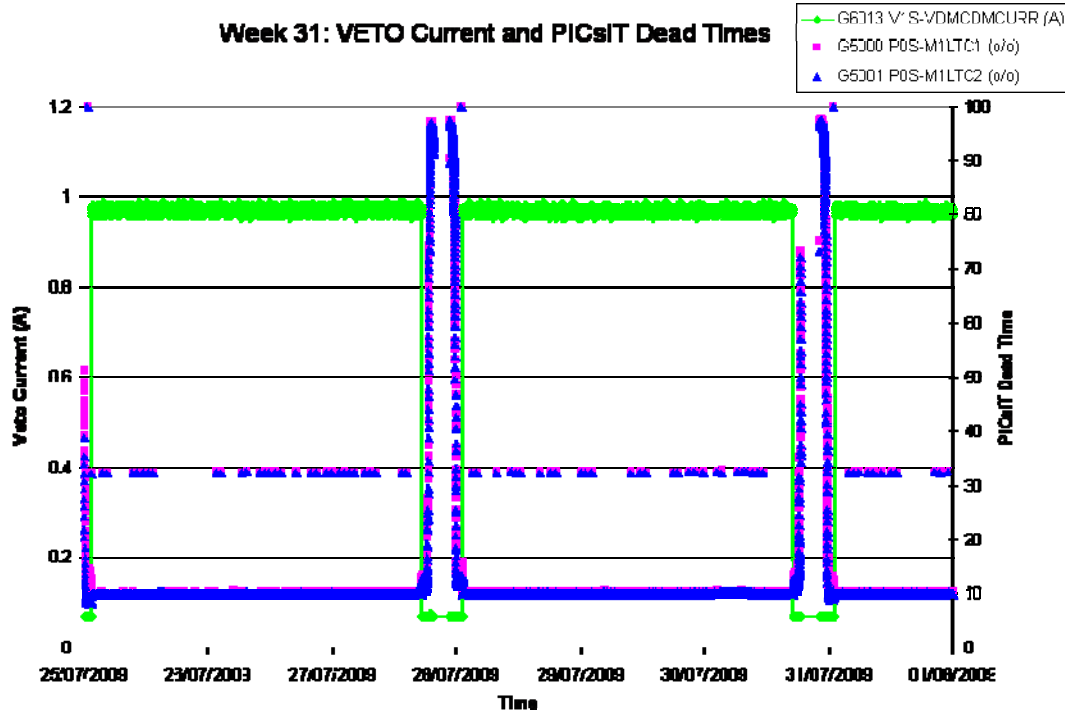
The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week¹⁰ :



¹⁰ Data sampled every 4th packet (32sec)

VETO

The health and performance of VETO was nominal during the reporting period. The following plot shows the VETO current and PICsIT dead-times during the week¹¹ :



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 (IOE-OVFWPXADD-Mi) were received during the radiation belt passages.

2009-07-25 (DOY 206, Rev 828) to 2009-07-31 (DOY 212, Rev 830)

IBIS operations executed nominally.

8.2.4 JEM-X Operations

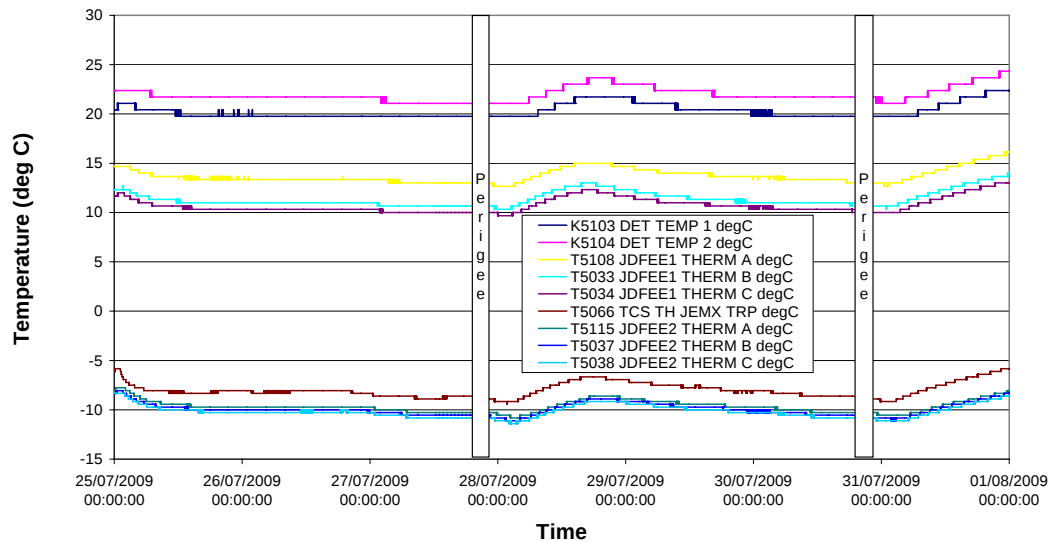
JEM-X Temperatures

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 graph¹².

¹¹ Data sampled every 4th packet (32sec)

¹² Data sampled (1 frame in 8)

JEMX Detector & DFEE Temperatures



JEM-X Daily Report

2009-07-25 (DoY 206 Rev 828) to 2009-07-30 (DoY 211 Rev 830)

JEM-X 1 operations executed nominally.

2009-07-31 (DoY 212 Rev 830)

At 13:50:57, TM parameter K5136 briefly exceeded soft limits, no action was taken, and there was no impact.

8.2.5 OMC Operations

2009-07-25 (DoY 206, Rev 828) to 2009-07-31 (DoY 212, Rev 830)

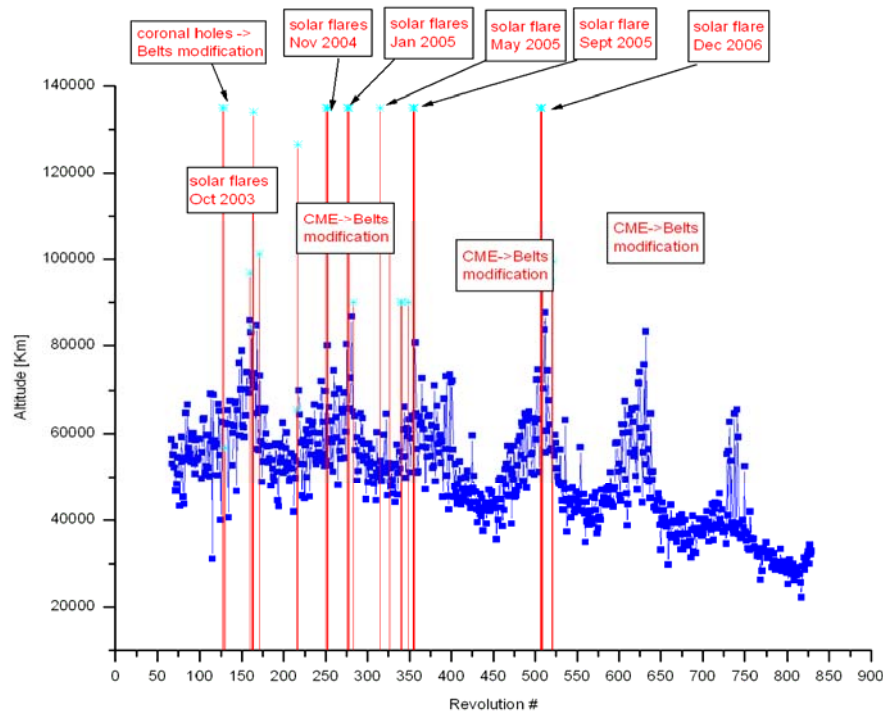
Nothing to report.

On DoY 208 at 17:12:33 and DoY 211 at 17:02:49 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.2.6 IREM Operations

Radiation Belts Entry

Evolution of Radiation Belt Entry 2003-2008



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]
828	RAD_EXIT R 2009-07-25T01:06:52Z	25/07/2009 00:25:36	>>32751.4	25-Jul-2009 00:47:54	46631.63
828	RAD_ENTR R 2009-07-27T17:12:28Z	27/07/2009 18:15:12	32167.0	27-Jul-2009 18:27:54	29461.35
829	RAD_EXIT R 2009-07-28T00:55:15Z	27/07/2009 23:59:52	>>32778.0	28-Jul-2009 00:37:54	47641.1
829	RAD_ENTR R 2009-07-30T17:02:43Z	30/07/2009 17:59:52	32874.0	30-Jul-2009 15:58:05	32293.27
830	RAD_EXIT R 2009-07-31T00:45:04Z	30/07/2009 23:51:36	>>32801.7	30-Jul-2009 22:28:05	47951.76

Reference

High radiation

Very small error vs reference (less than 10 minutes)

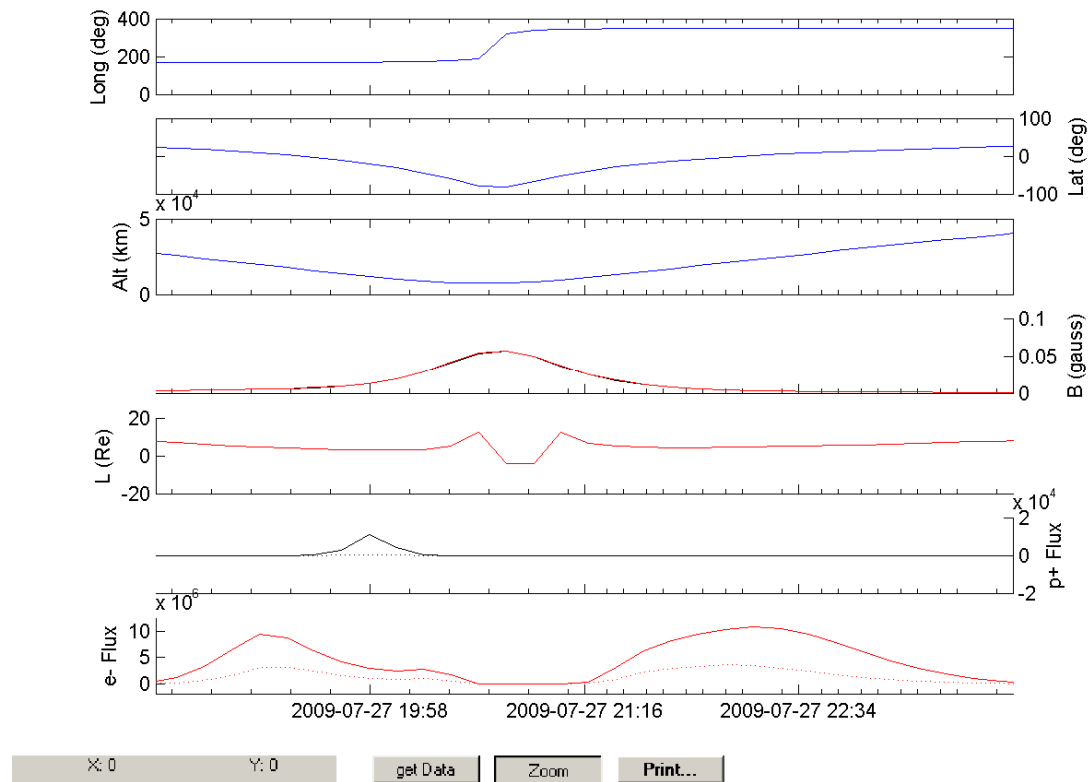
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM Predicted Radiation Belt Passages

Rev 828



Rev 829

