

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 359
Week 32
10.08.09
Routine Phase

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1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC.

It addresses the activities from 01.08.09 until 07.08.09 (both dates inclusive) and covers the revolutions 830 and 831.

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 gamma-ray blazar 3C 279 (RA 12:56:11.17, -05:47:21.5) and a raster dither of the Perseus Arm region (RA 04:46:58.46, +45:14:46.4).

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 01/08/2009 and 07/08/2009 was 0.1156 Kg. The remaining propellant is in the order of 133.0101 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

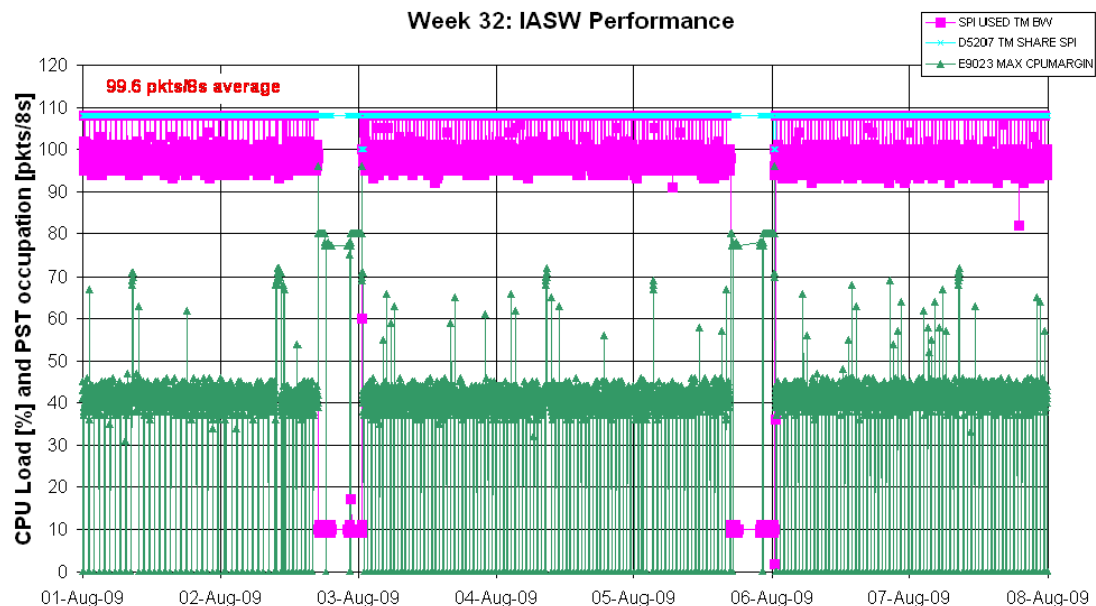
3.2.1 SPI

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.

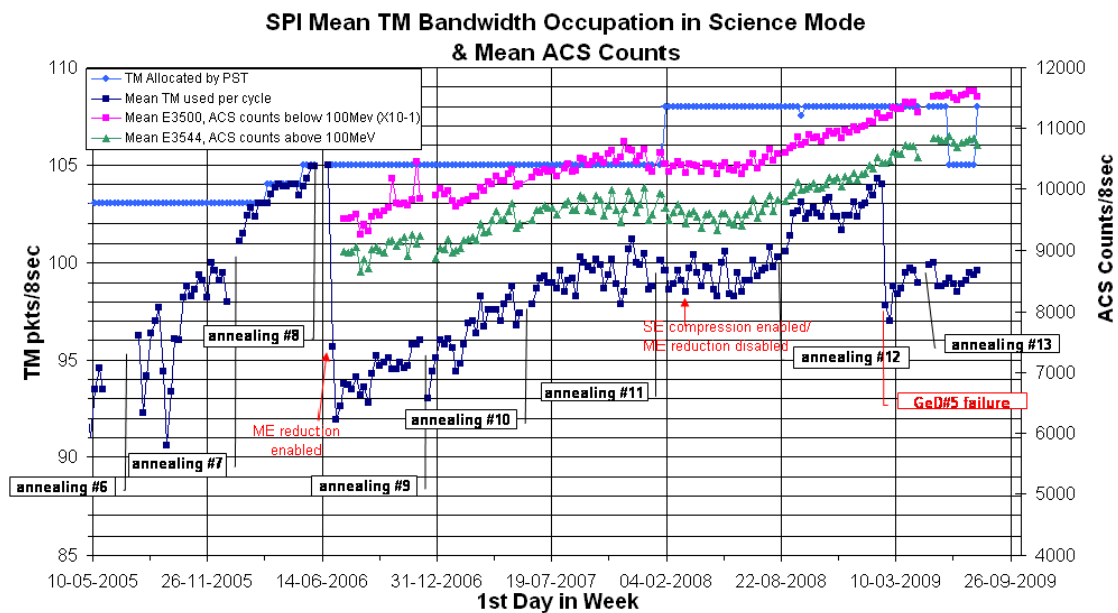
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 108 packets/cycle and the average telemetry occupation during science observations was 99.6 packets/cycle.

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



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.

¹ Data sampled every 8th packet (64sec)



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.

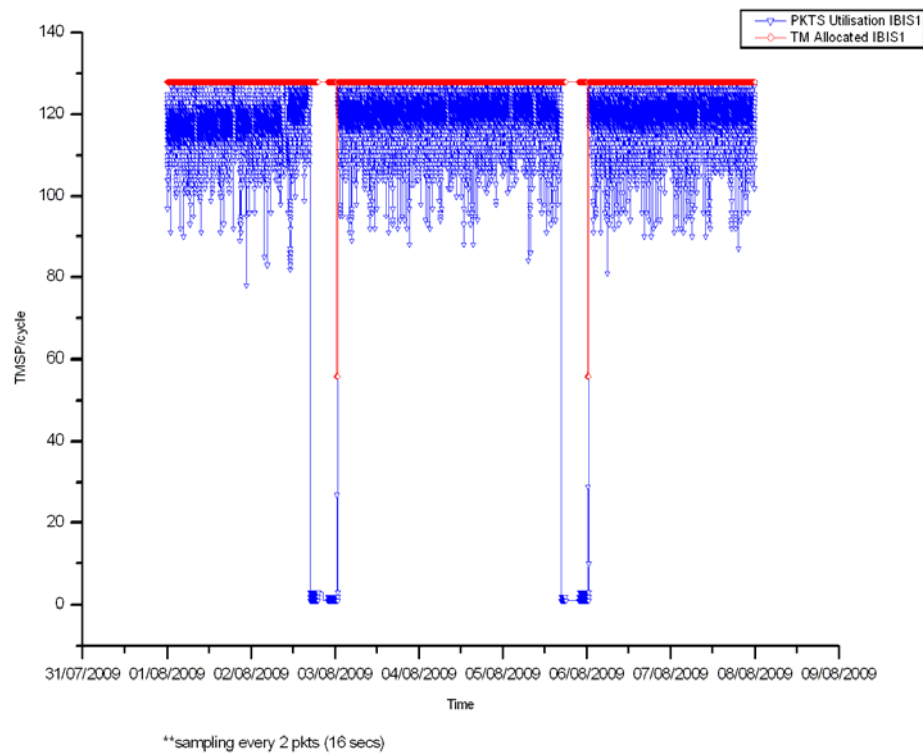
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 119.52 packets/cycle (up 1.7 on previous week)
- Percentage of TM cycles in science mode for which full bandwidth was used: 5.7%

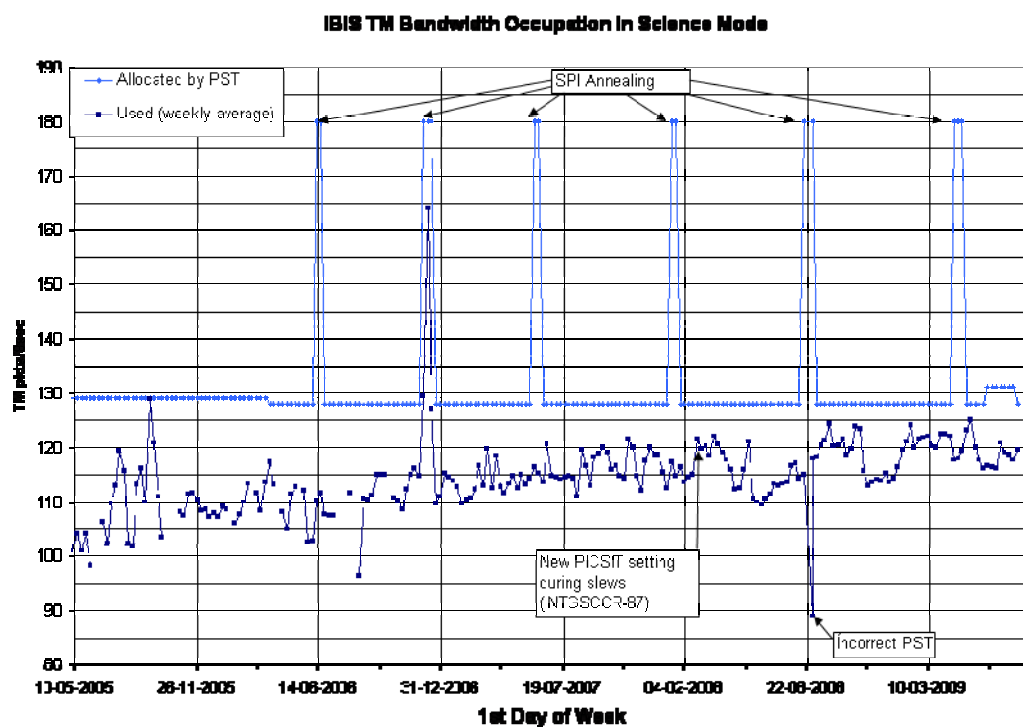
The plot below shows the IBIS TM utilisation during the reporting period² :

² Data sampled every 2nd packet (16sec)

IBIS - TM Bandwidth Utilisation Rev 830-832



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 210 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.

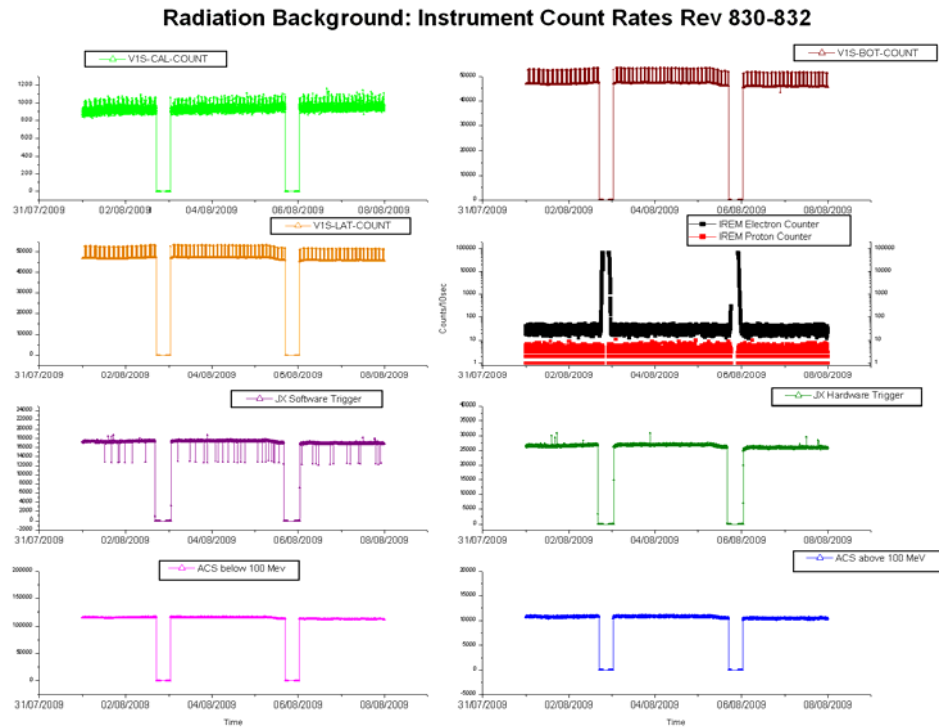
Solar Activity

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.

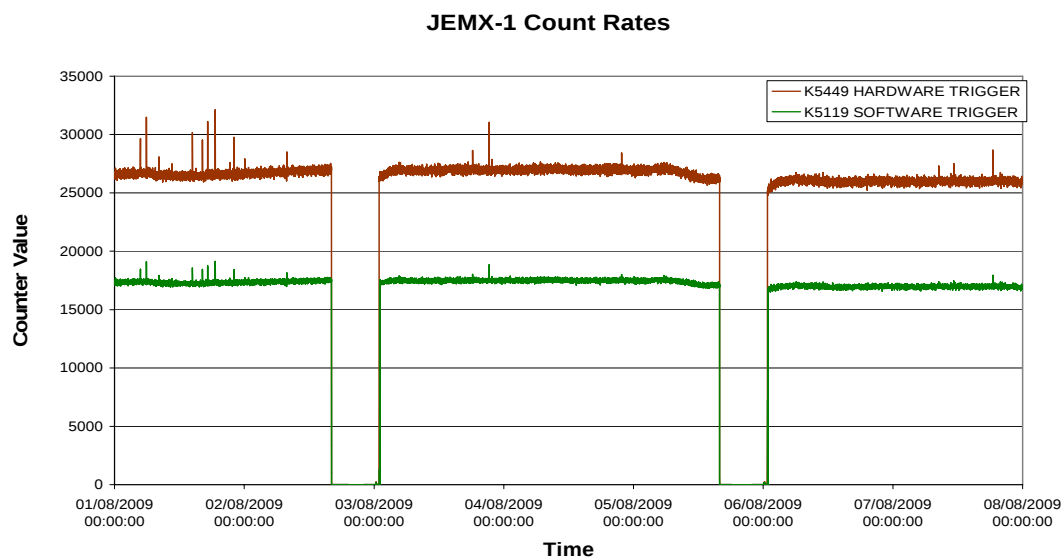
3.2.6 Radiation Background

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.

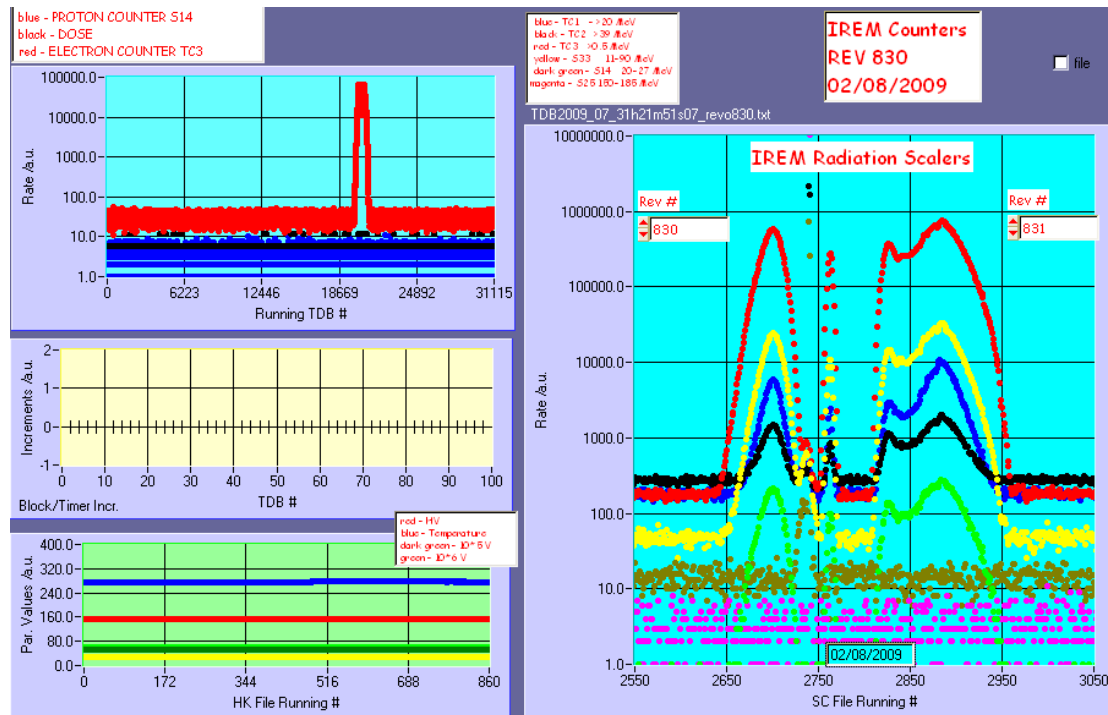


³ Data sampled every 6th packet (48sec)

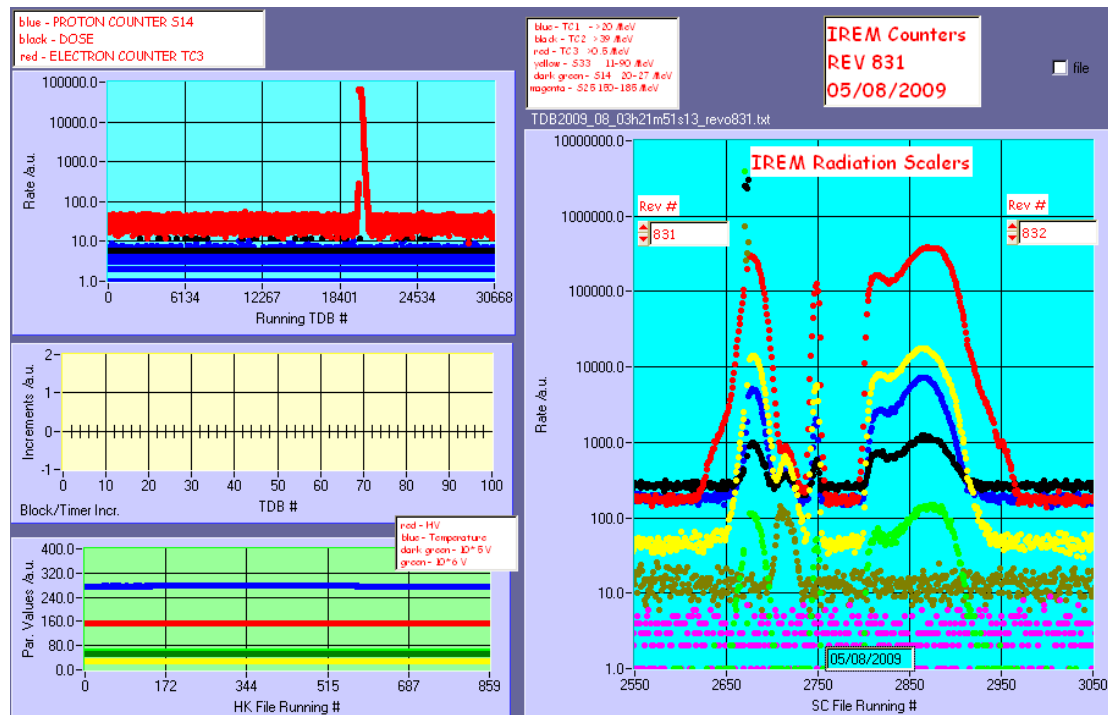
⁴ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

IREM radiation counters:

Revolution 830



Revolution 831



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 two 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 one occasion of bad frames, 2 occasions of a TM drop VC0 and VC7 from Redu and two occasions of a TM drop VC0 and VC7 from DSS-27.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 835-839. New observations have been planned for revolution 834. The first planning was changed after the first to include TOO observations on A0535+26. Due to the uncertainty of the further evolution of the source and TOO, no further revolutions have been planned. The planning files for revolution 833 were updated to correct telemetry allocation settings.

New TSFs have been received for revolutions 832+833.

2. Observation status

New ECS files have been received and processed for revolutions 817-821.

3. ISOC Science Data Archive

Ingestion of data from ISDC is working and data has been ingested up to revolution 810. A date for the next ISDA release will be discussed in September. Testing of some foreseen changes is waiting for ISDC to start processing rev_3 data.

4. ISOC system

No news.

5. Problems

None.

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Date : 10/08/09

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Rev. : 0
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5 Special Events

6 Anomalies

The following anomalies occurred this week:

AR id	Date Created	Subject	Segment	Status
INT-3069	2009-08-03	TDRS retrieval problem	IMCS	Pending

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, 01/08/2009 – 07/08/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 143 Open Loop Slews, 76 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

No slews were missed from the TL.

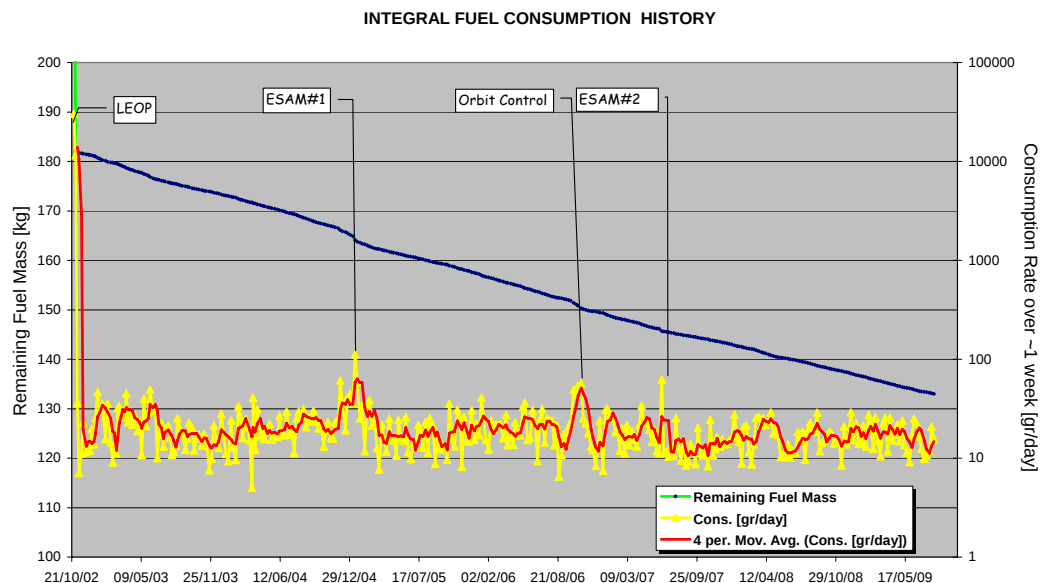
OTF was not reached for PID 08300047, 08300072 and 08310086.

Orbit Control

No update.

Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 07/08/2009 is reported in the plot below.

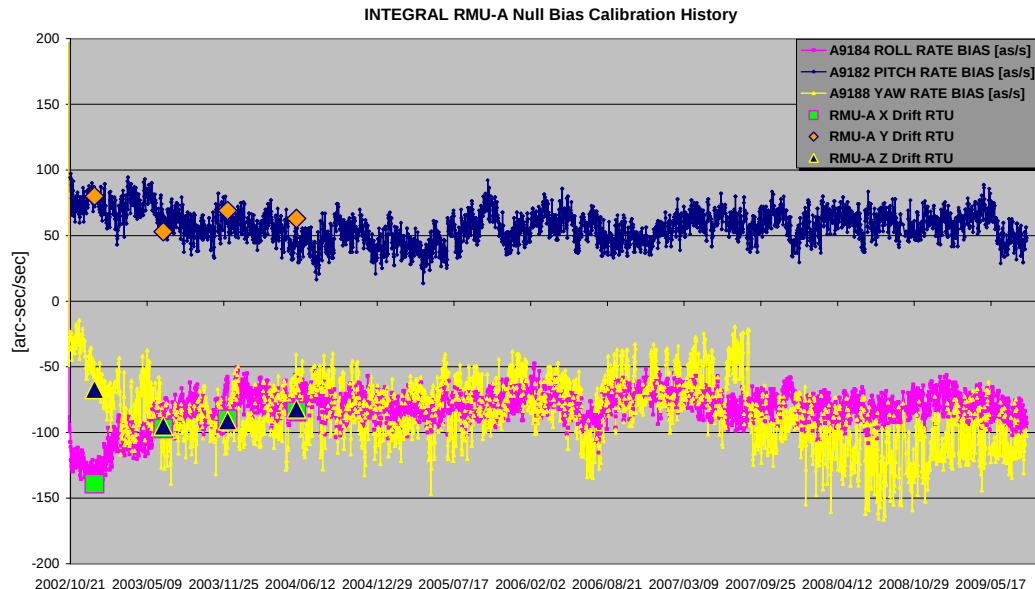


The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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 07/08/2009 is reported in the plot below.

The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs. At moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.



01/08/2009 (Day of Year 213, Revolution 830)

- IMU1 switched ON during the stable pointing of PID 08300047 (19:14:20Z). A manual mapping was commanded and the parameters for slew 08300048 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08300047.

02/08/2009 (Day of Year 214, Revolution 830)

- IMU1 switched ON during the stable pointing of PID 08300072 (16:58:37Z). A manual mapping was commanded and the parameters for slew 08300073 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08300072.

03/08/2009 (Day of Year 215, Revolution 830 to 831)

Nothing to report

04/08/2009 (Day of Year 216, Revolution 831)

Nothing to report

05/08/2009 (Day of Year 217, Revolution 831)

- IMU1 switched ON during the stable pointing of PID 08310086 (09:20:52Z). A manual mapping was commanded and the parameters for slew 08310087 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08310086.

06/08/2009 (Day of Year 218, Revolution 831 to 832)

- Flight Dynamics System failed to generate an update for slew 08320024 (14:40:00Z).
A manual mapping was commanded and the update generated via spacontool (0832_0500_A.CSL).

No impact on the Timeline.

07/08/2009 (Day of Year 219, Revolution 832)

Nothing to report

8.2.2 SPI Operations

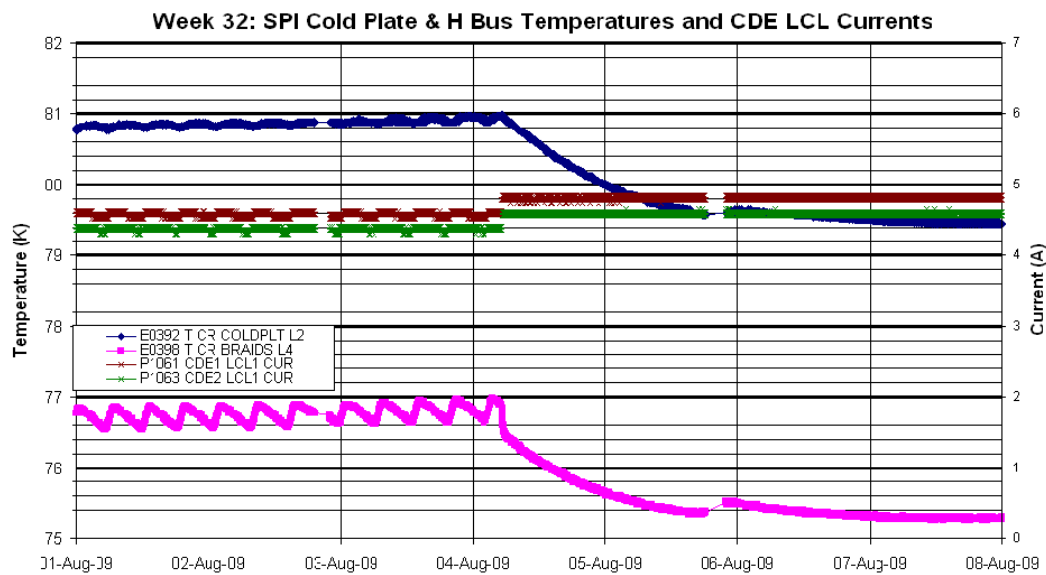
Unit Temperatures: All the equipment temperatures are inside the operational limits.

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 until 2009-08-04 at 05:18:23Z, when it was increased to 40 on all compressors as the Cold Plate temperature (TM parameter E0392) had reached 80.9K.

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:

⁵ Data sampled every 8th packet (64sec)

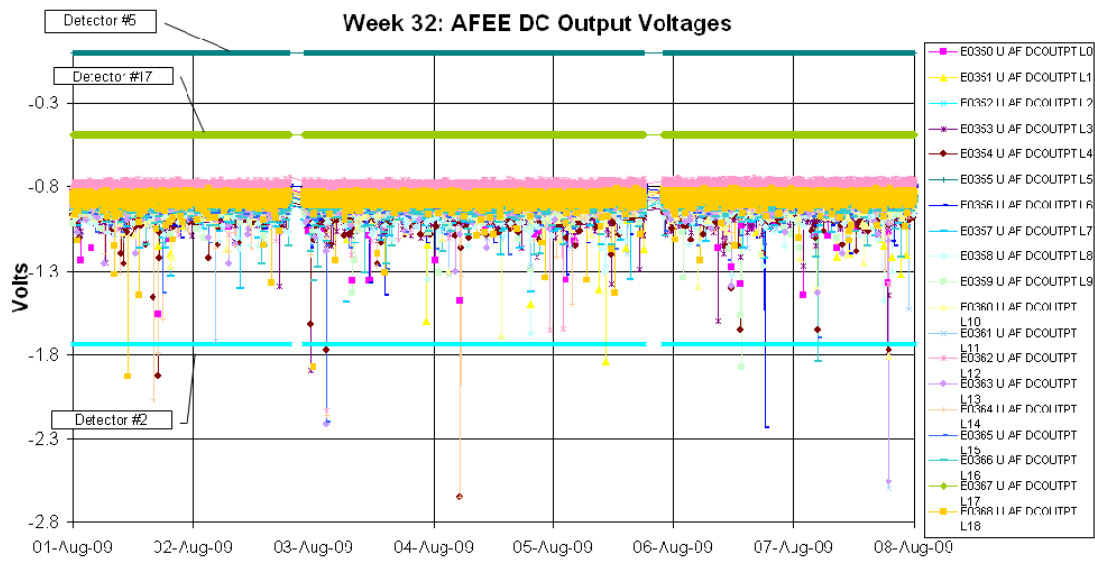


DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

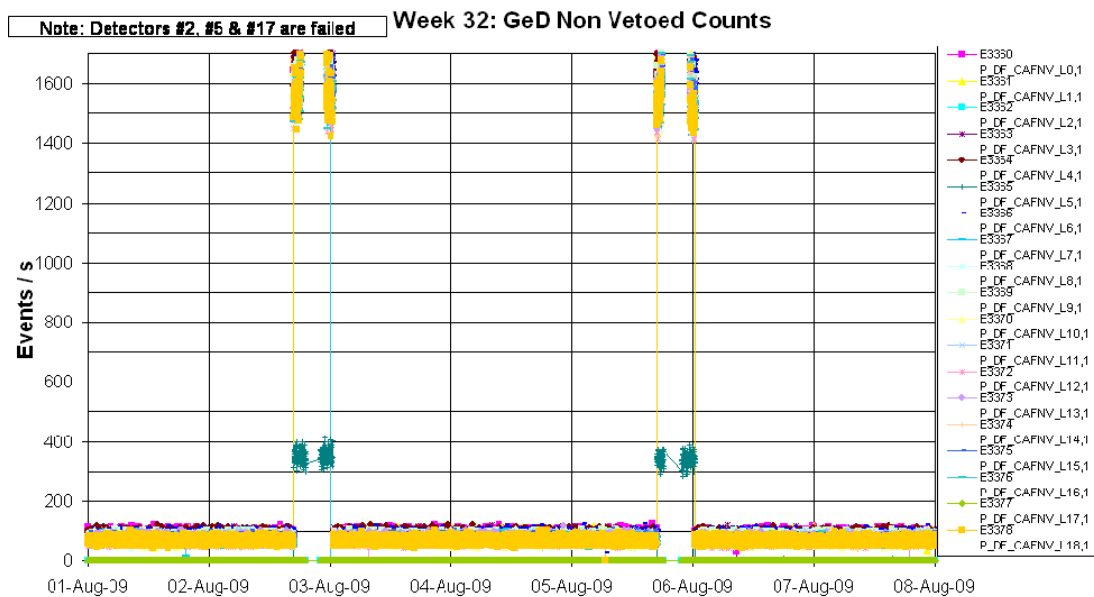
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). A plot of the ACS counts is given in Section 3.2.6.

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

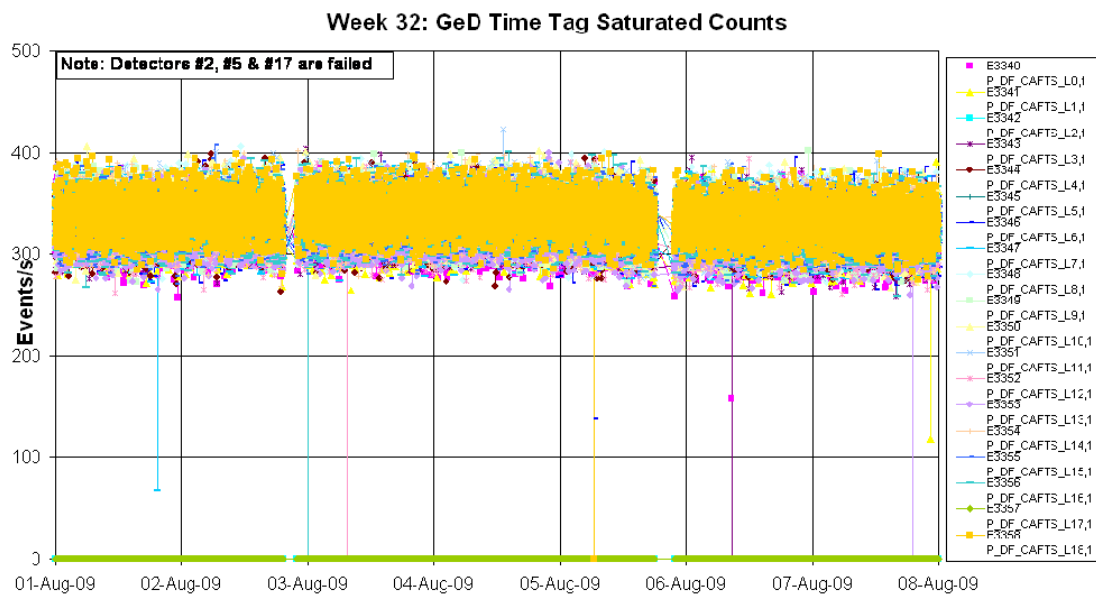
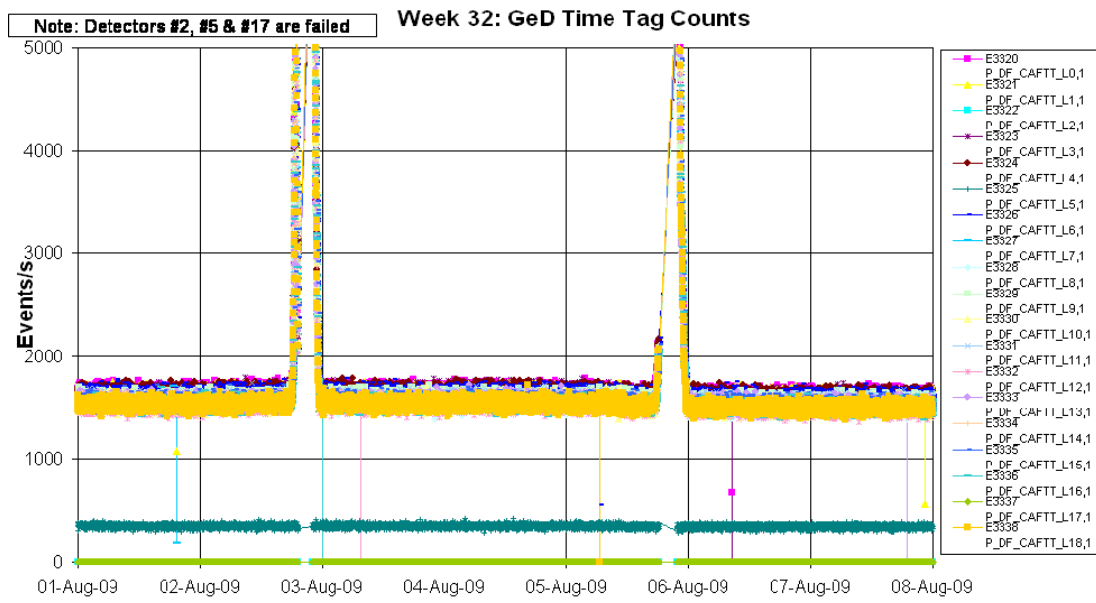
⁶ Data sampled every 8th packet (64sec)



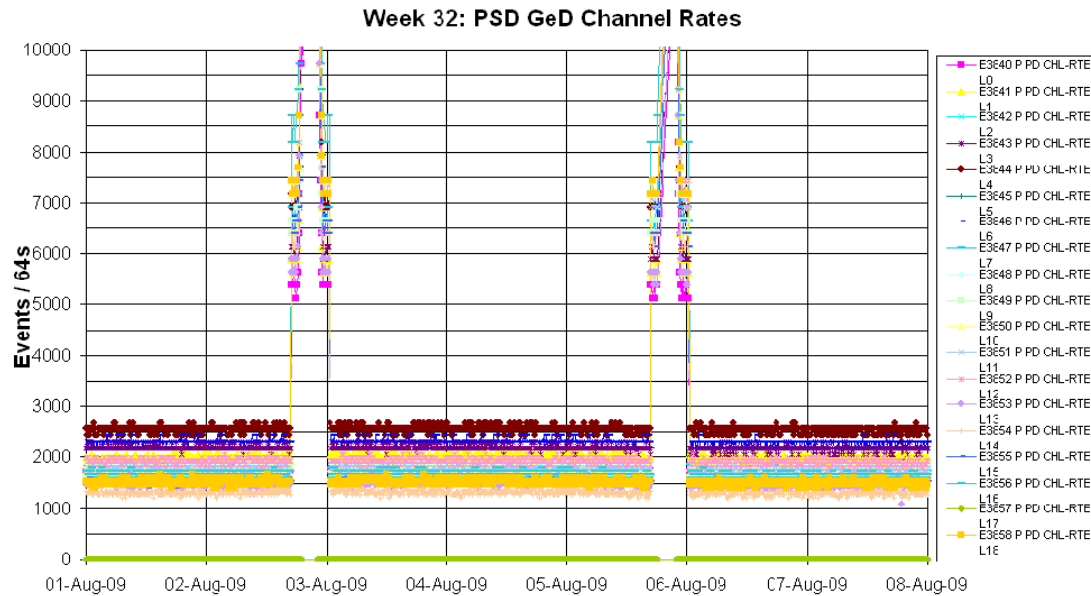
DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁷.



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:



Event Log:

The following non-nominal events occurred with SPI over the reporting period:

- On 2009-08-01 at 09.21.32Z TM parameter E3215 went OOL (value = PARAM > SPEC). This is the ACS FEE#51 temperature status. As it returned within limits of its own accord when the next packet was received at 09.32.12Z, no action was taken.
- On 2009-08-05 at 04.54.53Z TM parameter E2265 went OOL (value = PARAM < SPEC). This is the ACS FEE#15 analogue status 5 V. As it returned within limits of its own accord when the next packet was received at 05.05.33Z, no action was taken.

8.2.3 IBIS Operations

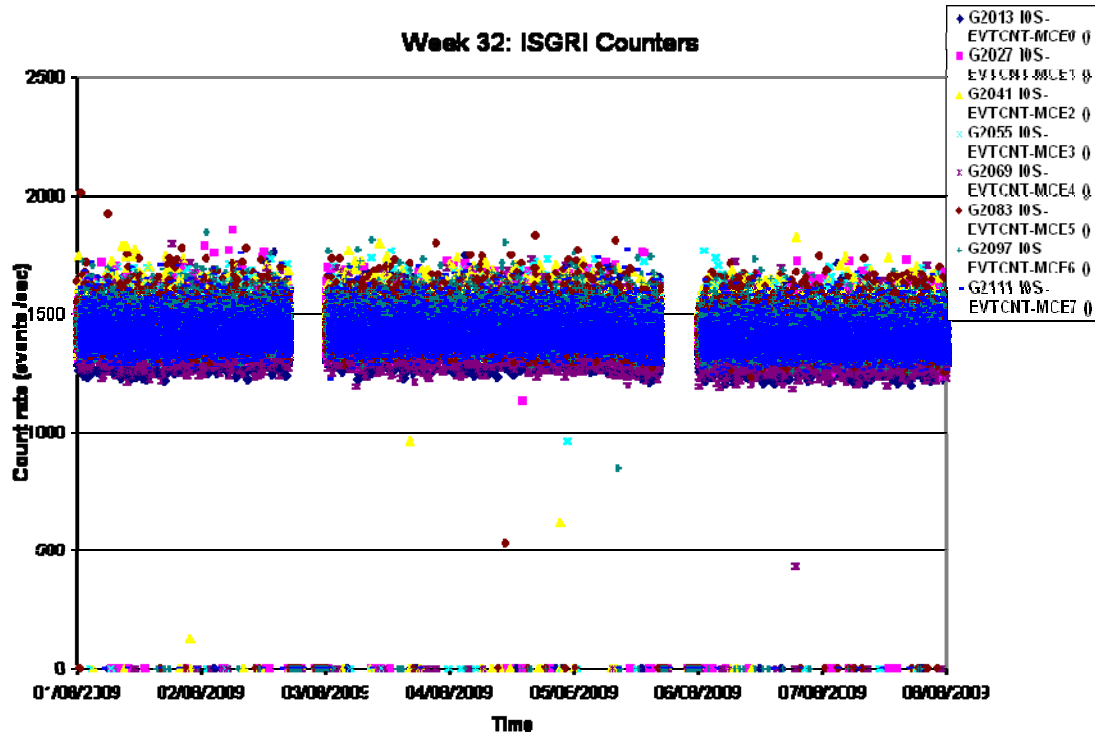
Unit Temperatures: All the equipment temperatures were inside the operational limits throughout the week.

ISGRI

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

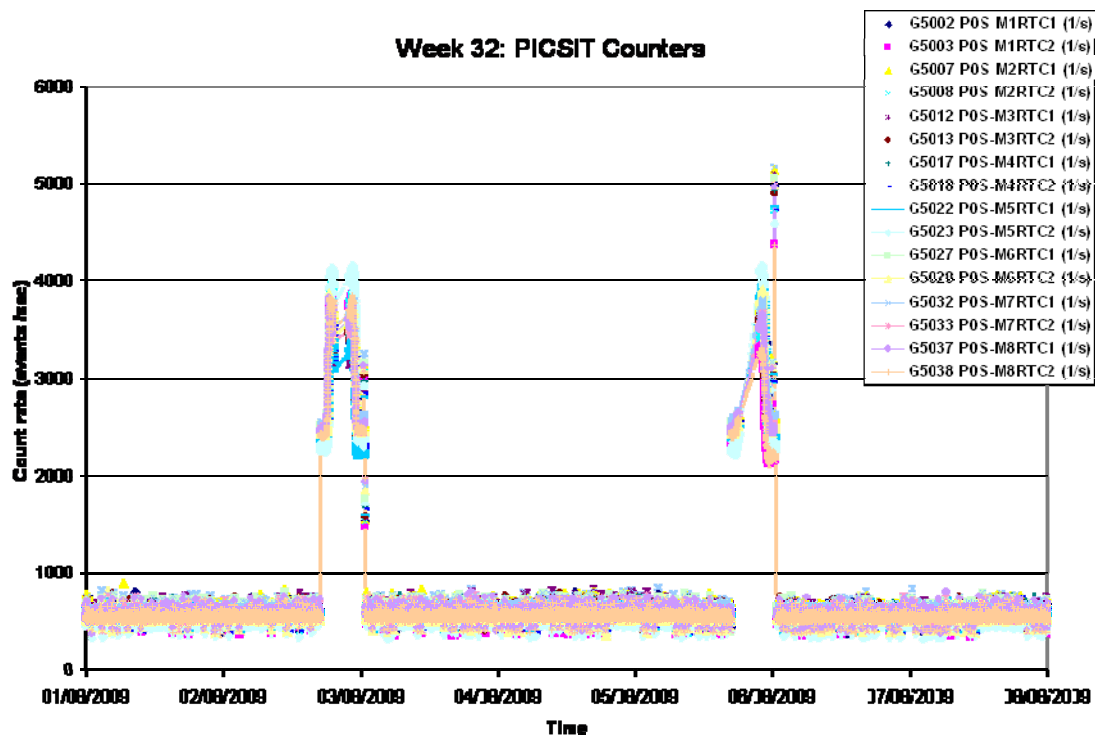
⁸ Data sampled every 8th packet (64sec)

⁹ Data sampled every 4th packet (32sec)



PICsIT

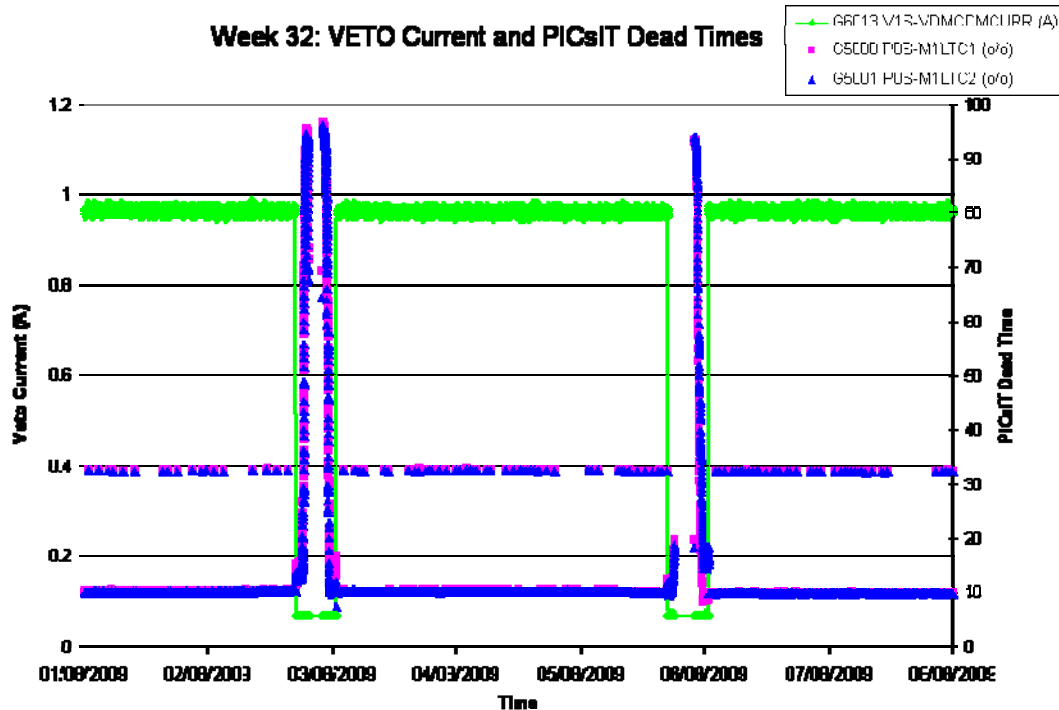
The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week¹⁰ :



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 (I0E-OVFWPXADD-Mi) were received during the radiation belt passages.

2009-08-01 (DOY 213, Rev 830) to 2009-08-07 (DOY 219, Rev 832)

IBIS operations executed nominally.

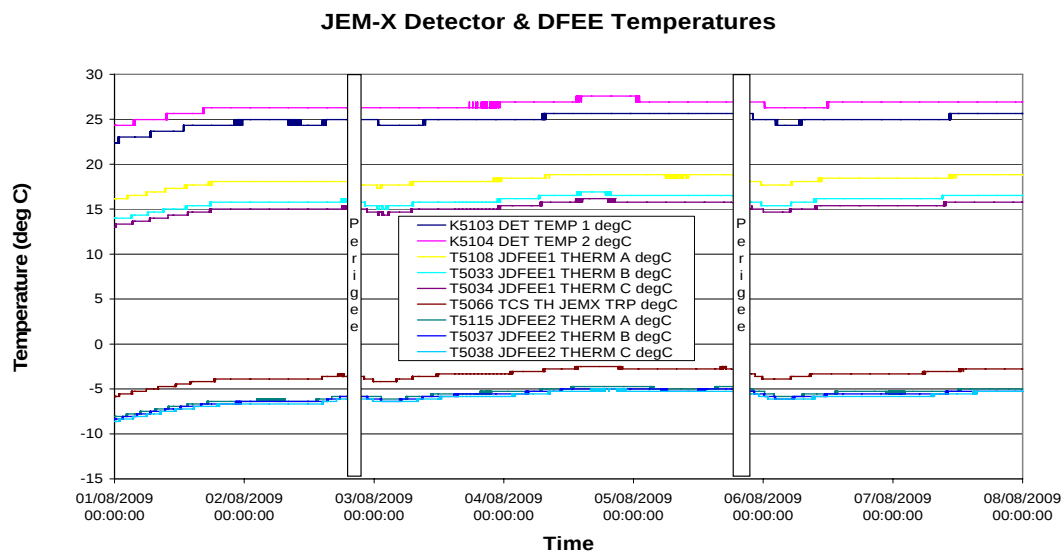
8.2.4 JEM-X Operations

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)



JEM-X Daily Report

2009-08-01 (DoY 213 Rev 830) to 2009-08-02 (DoY 214 Rev 831)

JEM-X 1 operations executed nominally.

2009-08-03 (DoY 215 Rev 831)

At 01:07:19, TCs KU0014 & K0021 terminated with status unknown.

At 05:30:31, TC K0021 terminated with status unknown-failed. On neither occasion was any action taken, there was no impact.

2009-08-04 (DoY 216 Rev 831)

JEM-X 1 operations executed nominally.

2009-08-05 (DoY 217 Rev 832)

At 15:58:33, TC KU0014 terminated with status Affected, this changed at 15:58:38 to Unverified, then immediately after to Passed, no action was taken.

2009-08-06 (DoY 218 Rev 832) to 2009-08-07 (DoY 219 Rev 832)

JEM-X 1 operations executed nominally.

8.2.5 OMC Operations

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

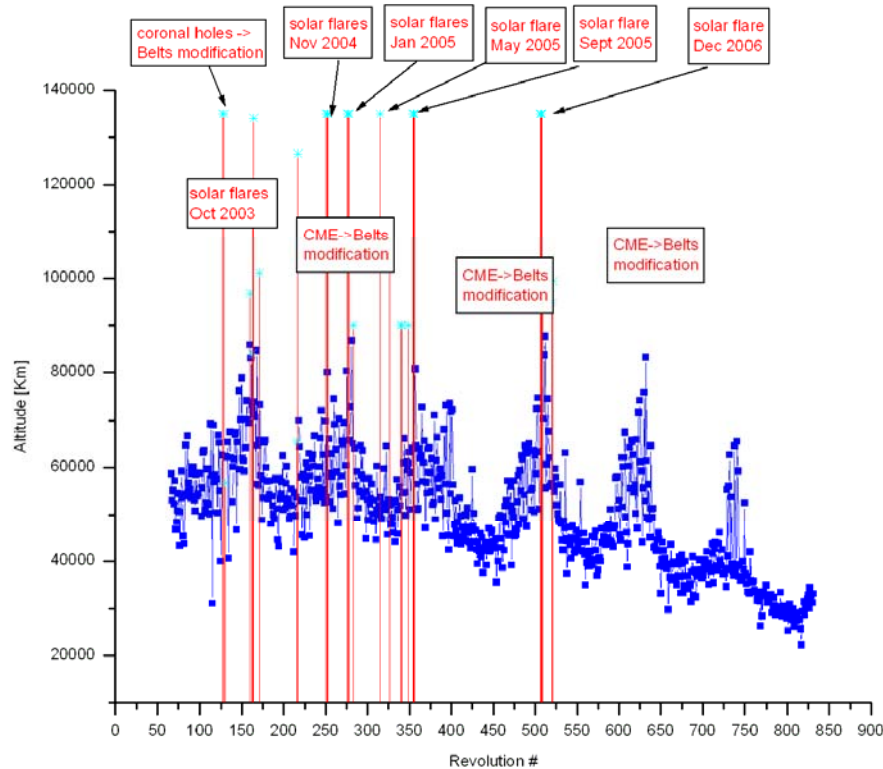
Nothing to report.

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]
830	RAD_ENTR R 2009-08-02T16:53:03Z	02/08/2009 18:00:48	31201.7	02-Aug-2009 18:13:31	29261.08
831	RAD_EXIT R 2009-08-03T00:35:29Z	02/08/2009 23:24:16	>>32794.9	03-Aug-2009 00:23:31	47790.51
831	RAD_ENTR R 2009-08-05T16:42:17Z	05/08/2009 17:46:00	33077.8	05-Aug-2009 17:57:12	30246
832	RAD_EXIT R 2009-08-06T00:25:15Z	05/08/2009 23:32:56	>>32766.0	06-Aug-2009 00:07:12	46872.28

Reference

High radiation

Very small error vs reference (less than 10 minutes)

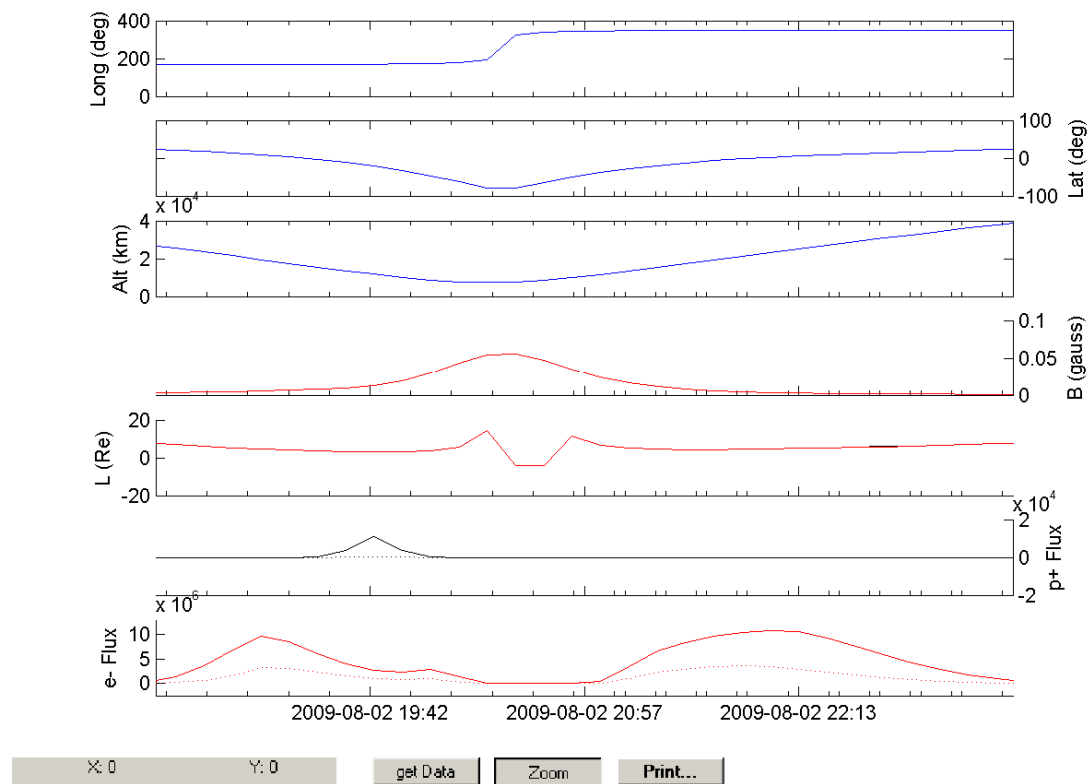
Small error vs reference (between 10 and 30 minutes)

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 830



Rev 831

