

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 365
Week 38
21.09.09
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 12.09.09 until 18.09.09 (both dates inclusive) and covers the revolutions 844 and 845.

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 hexagonal dither of Galactic Bulge region (RA 17:45:36.00, -28:56:00.0), a raster dither of the Galactic disk, l=+25 (RA 18:36:53.70, -07:03:19.4) and a raster dither of the Galactic disk, l=-25 (RA 16:27:14.74, -48:57:19.9).

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.

Slews 08450072, 08450073, 08450074, 08450075, 08450076, 08450077, 08450100, 08450101, 08450102, 08450103, 08450104 and 08450105 were missed from the timeline.

The fuel consumption over the period between 12/09/2009 and 18/09/2009 was 0.1094 Kg. The remaining propellant is in the order of 132.4410 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

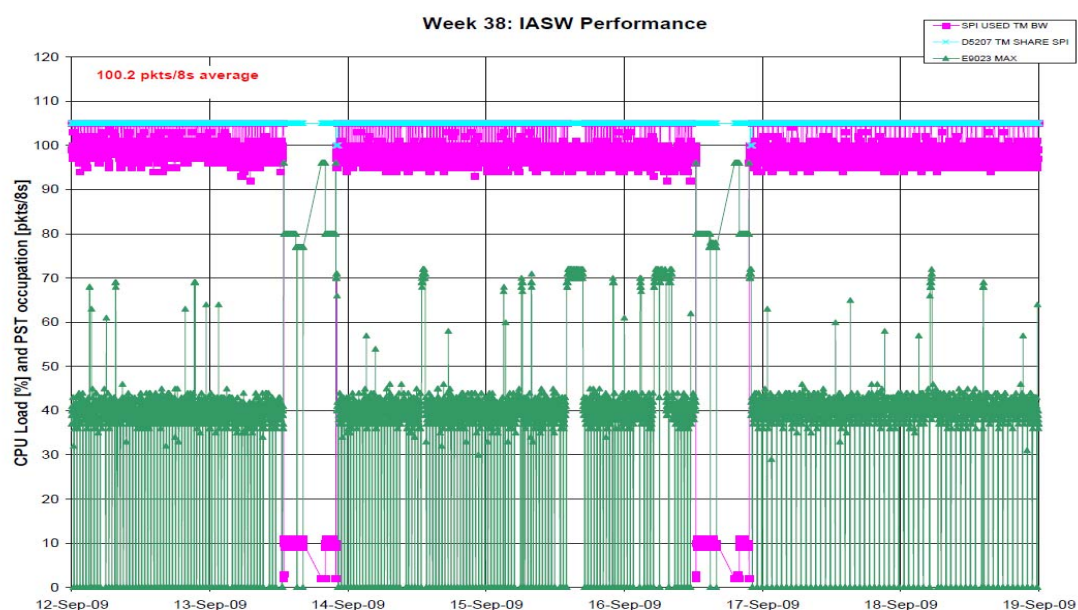
Following the 13th SPI annealing, which ended on 11/05/2009, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004) and detector #5 (failed since 19/02/2009).

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

Eclipse operations for SPI continued nominally during the reporting period.

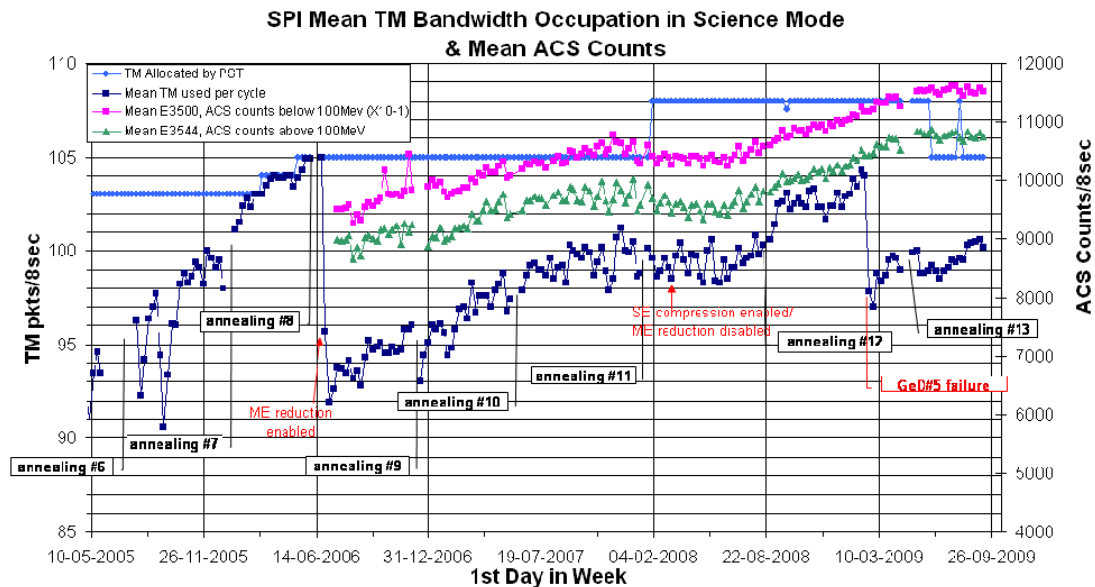
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 105 packets/cycle the average telemetry occupation was 100.2 packets/cycle.

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.

3.2.2 IBIS

The overall status of IBIS is nominal.

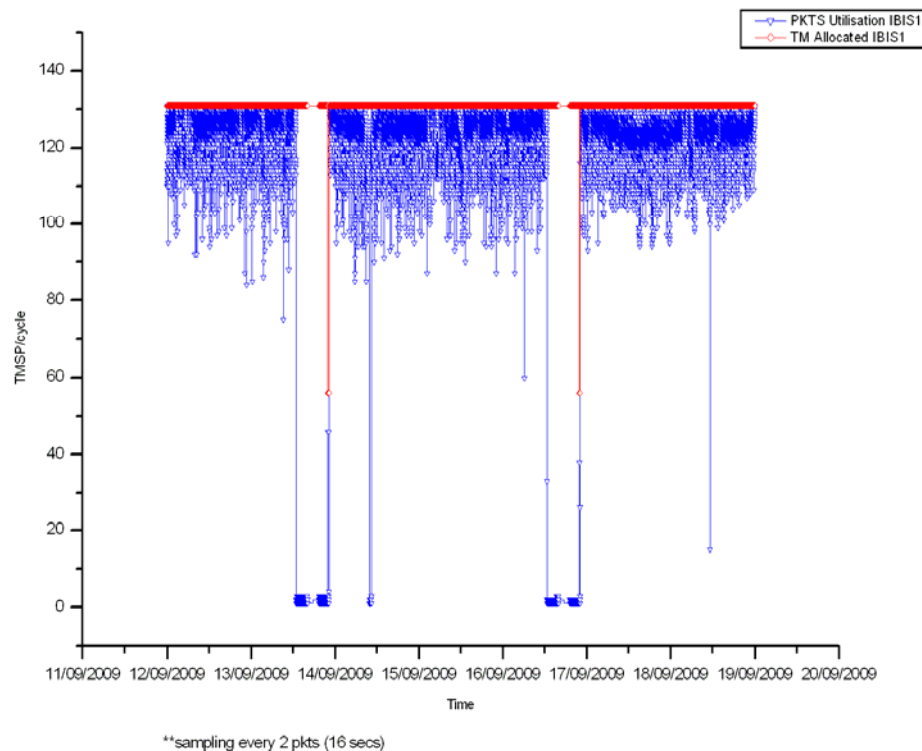
Eclipse operations for IBIS are progressing nominally.

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

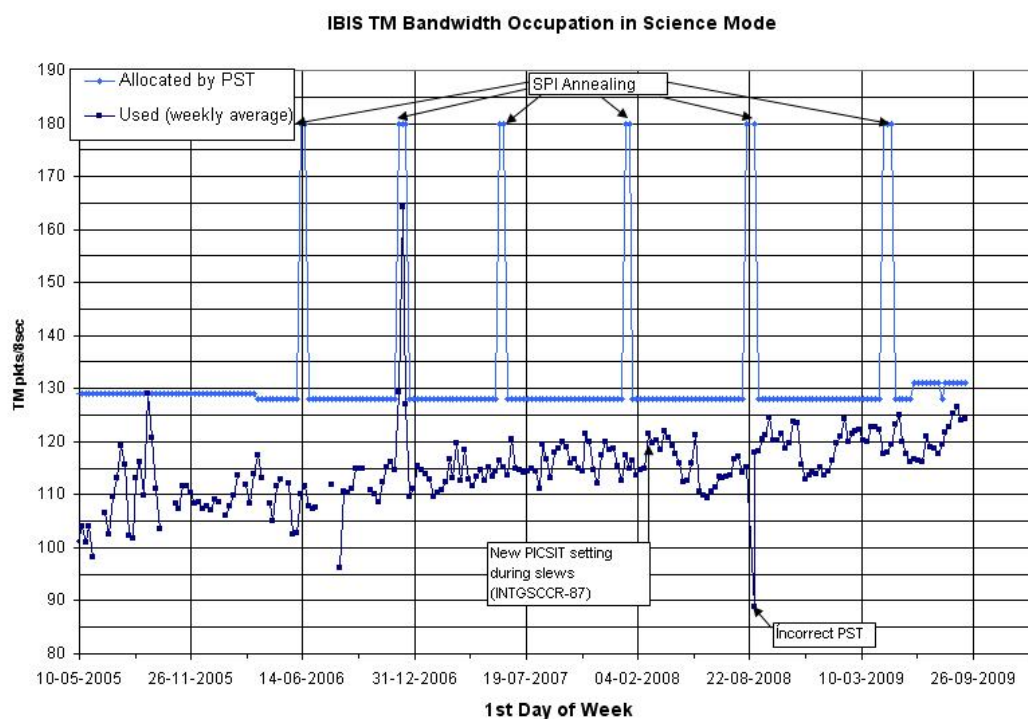
- PST allocation to IBIS above radiation belts: 131 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 124.35 packets/cycle (up 0.24 on previous week)
- Percentage of TM cycles for which full bandwidth was used: 13.9%

The plot below shows the IBIS TM utilisation during the reporting period.

IBIS - TM Bandwidth Utilisation Rev 844-846



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.

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, 213 of the 226 planned science pointings were executed nominally, 2 were cut short, and 11 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.

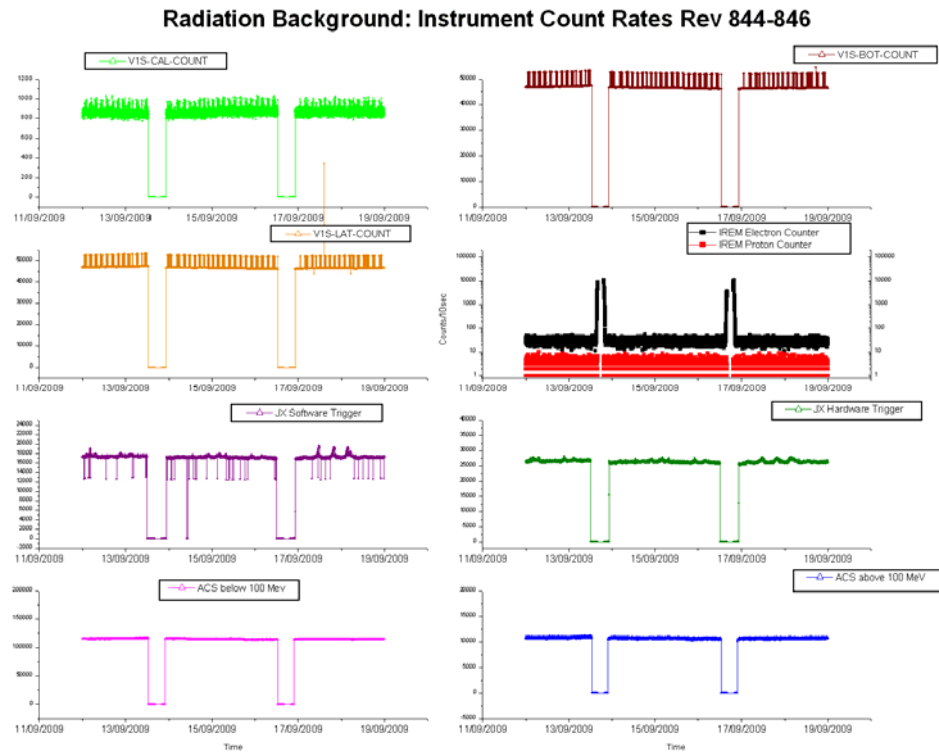
Solar Activity

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

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

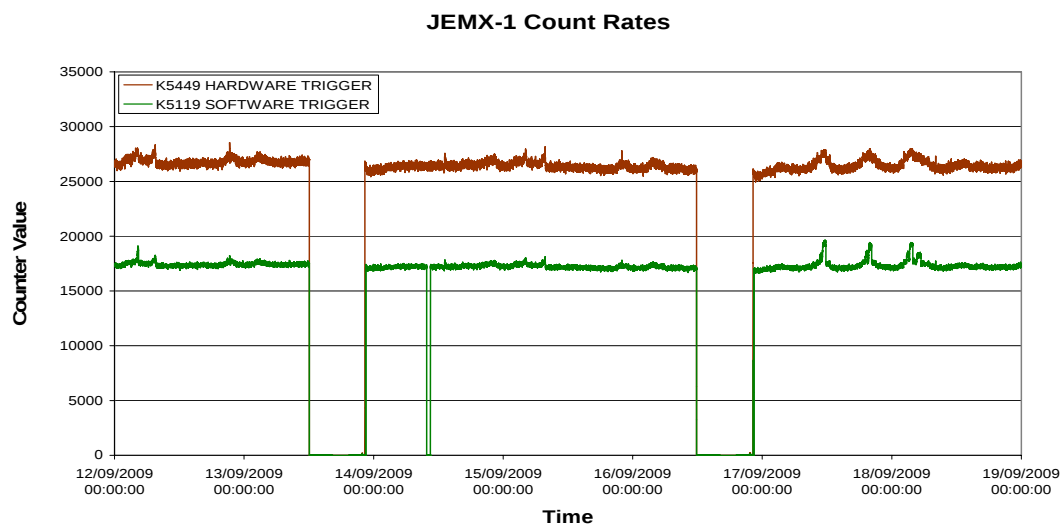
3.2.6 Radiation Background

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 week²:



JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph³.

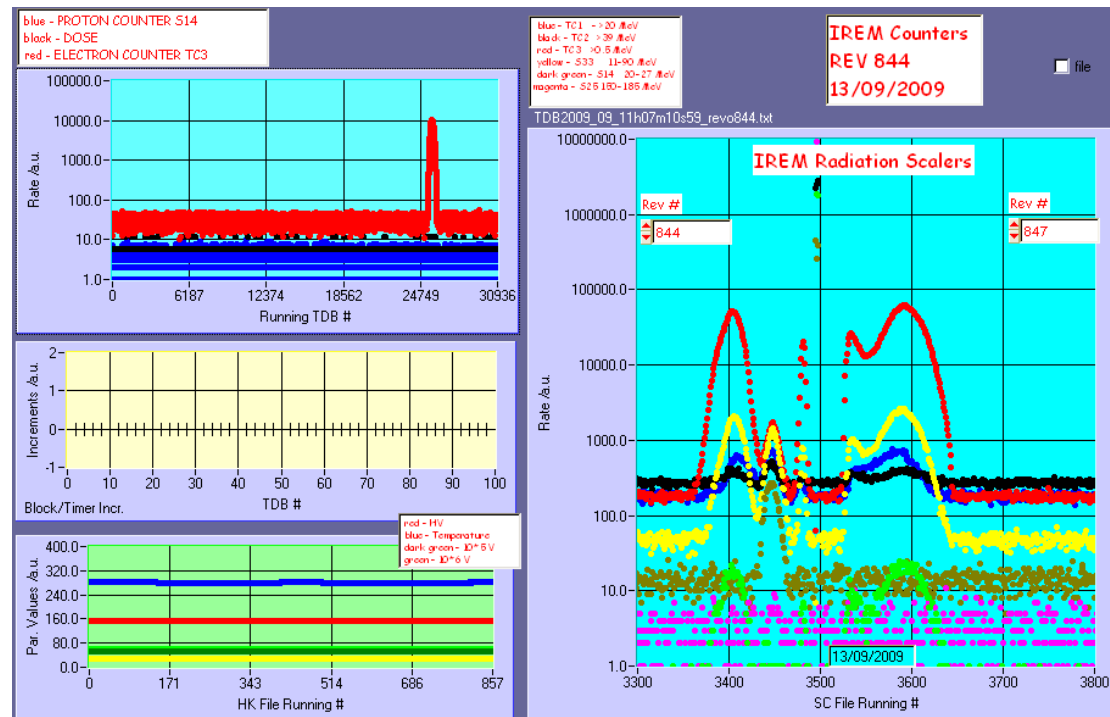


² Data sampled every 6th packet (48sec)

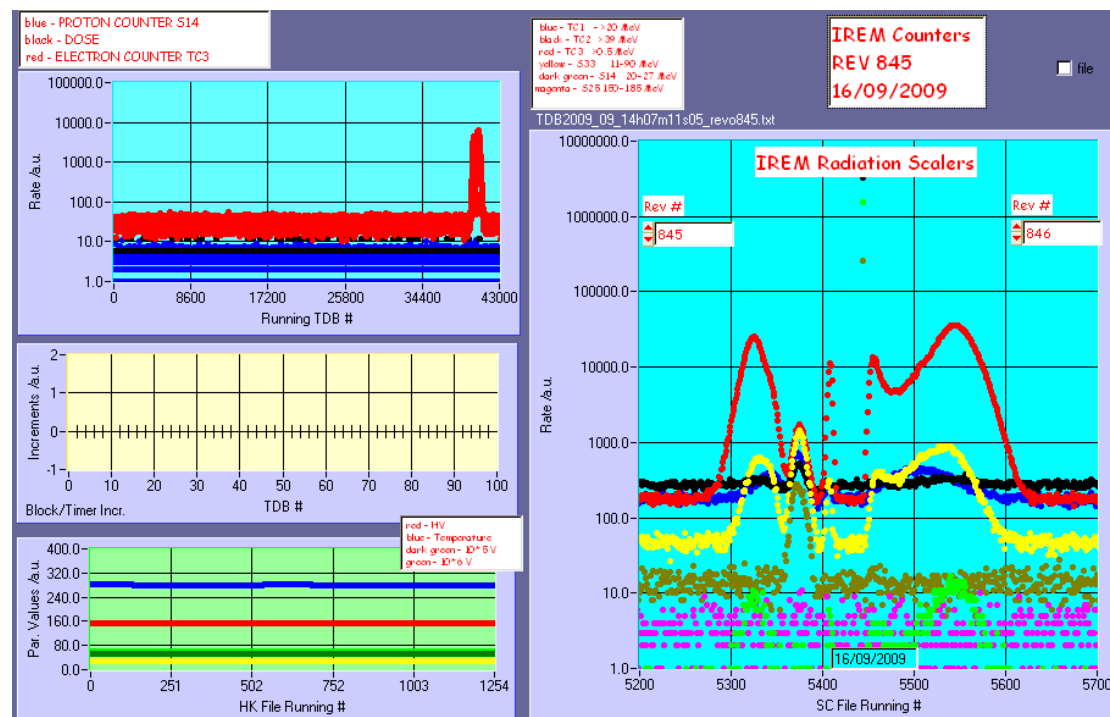
³ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

IREM radiation counters:

Revolution 844



Revolution 845



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 very good this week. There was one occasion when the links with ISDC dropped, necessitating a restart of the isds & ifrd, there was no impact. The DENEb data centre, PISA area and DENEb LAN Switch-off took place on 16/9/2009, all operations were moved to servers in Halley data centre and clients on Halley LAN. 12 pointings were lost due to problems with the FD server.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were two occasions of a TM drop VC0 and VC7 from VIL2 and one TM drop VC0 and VC7 from DSS27. On DOY 262 at 15:24, Redu-1 was unavailable for the scheduled support (BOT 18:55), due to a power outage at Redu. Communication had been lost, but was recovered at 16:00, so the support from Redu-1 went ahead as scheduled.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 853 and 854.

TOO observations of a new source found by Integral, IGR J17511-3057, have been planned for revolution 846. Further observations have been planned for revolutions 850 & 851.

New TSFs have been received for revolutions 846 to 848.

2. Observation status

A new ECS file has been received for revolution 830.

3. ISOC Science Data Archive

No news.

4. ISOC system

ISOC software version V23.1 is planned to be released for testing on 21 September.

5. Problems

No new problems.

5 Special Events

DPEs LOBT Wraparound

Power down of DENEb on 16/9/2009

6 Anomalies

The following anomaly occurred this week:

AR id	Date Created	Subject	Segment	Status
INT-3075	2009-09-15	FDS Problems during DENEb Downtime 20090916	FDS	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Detailed Satellite Information

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

8.1.1 AOCS SUMMARY OPERATIONS REPORT, 12/09/2009 – 18/09/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 157 Open Loop Slews, 76 Closed Loop Slews and 4 Momentum Biases were executed (as reported by ACC OEM).

Slews 08450072, 08450073, 08450074, 08450075, 08450076, 08450077, 08450100, 08450101, 08450102, 08450103, 08450104 and 08450105 were missed from the timeline.

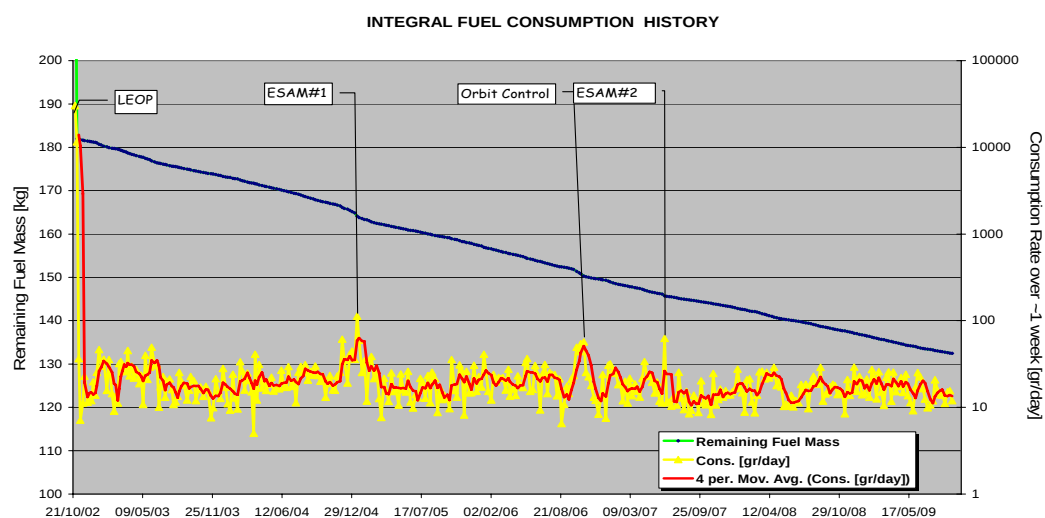
The OTF was not reached for PID 08450024, 08450072, 08450073, 08450074, 08450075, 08450076, 08450077, 08450100, 08450101, 08450102, 08450103, 08450104 and 08450105.

Orbit Control

No update.

Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 18/09/2009 is reported in the plot below.

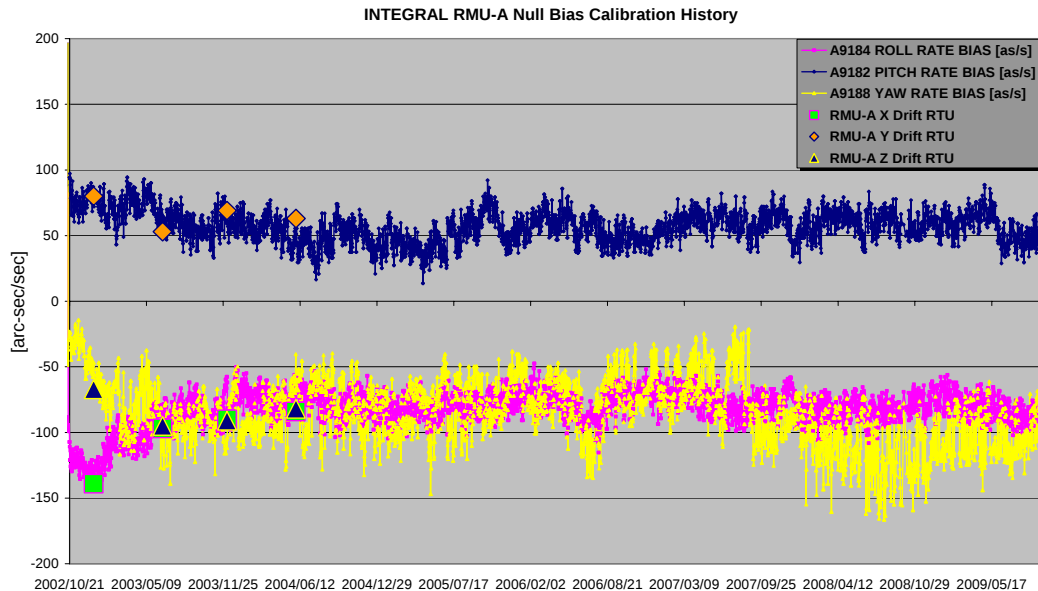


The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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 18/09/2009 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.



Daily events Log:

Week 365

12/09/2009 (Day of Year 255, Revolution 844)

Nothing to report

13/09/2009 (Day of Year 256, Revolution 844 to 845)

Nothing to report

14/09/2009 (Day of Year 257, Revolution 845)

- IMU1 switched ON during the stable pointing of PID 08450024 (11:16:00Z). An automatic mapping was used to manually update the parameters for slew 08450025 (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08450024.

15/09/2009 (Day of Year 258, Revolution 845)

- FDS failed to update slew 08450072 (13:28:00Z). This happened directly after FD server in DENEb was stopped. Slews 08450072 to 08450076 were missed during the troubleshooting.

After FDS recovered, a manual slew was performed from PID 08450071 to 08450077 (plus a corrective one from 08450077 to 08450077).

Slews 08450072 to 08450077 were not performed via Timeline, neither the OTF was reached for their corresponding PIDs.

16/09/2009 (Day of Year 259, Revolution 845 to 846)

- FDS failed to update slew 08450100 (04:34:00Z). This happened directly after the power down of DENEb. FD was called in.

A manual recovery was performed (06:15:00Z) to slew from attitude of PID 08450099 to 08450102, but the update of PREQ 08450103 fails. AOCS on hold.

A second recovery (07:08:00Z) is performed, from attitude of PID 08450102 to 08450105. The parameters for PREQ 08450106 are successfully updated afterwards.

Slews 08450100 to 08450105 were not performed via Timeline, neither the OTF was reached for their corresponding PIDs.

17/09/2009 (Day of Year 260, Revolution 846)

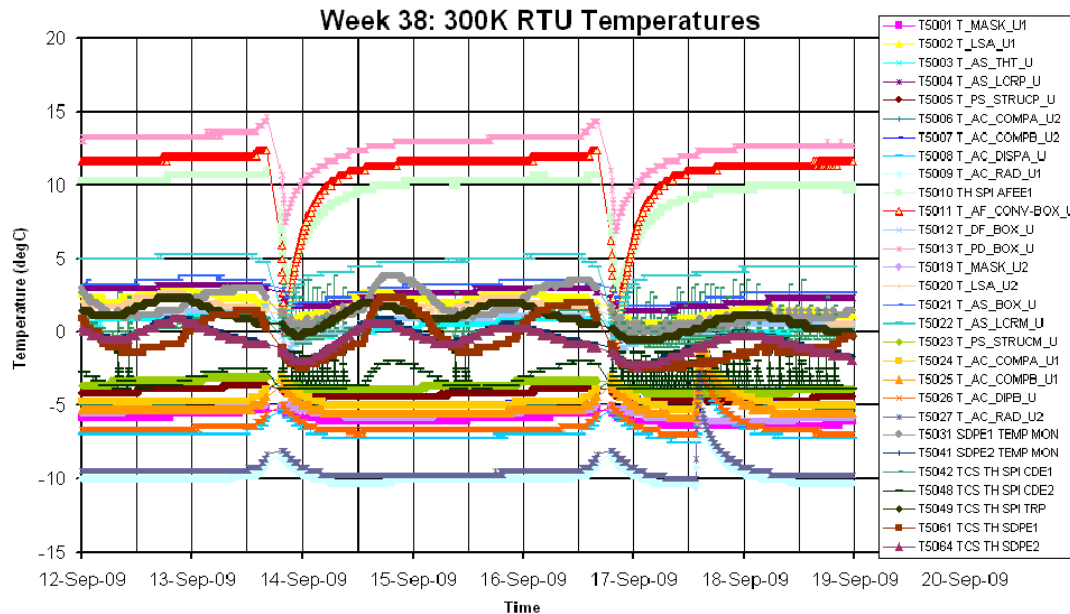
Nothing to report

18/09/2009 (Day of Year 261, Revolution 846)

Nothing to report

8.1.2 SPI Operations

Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period. The temperature recovery after eclipse was nominal:



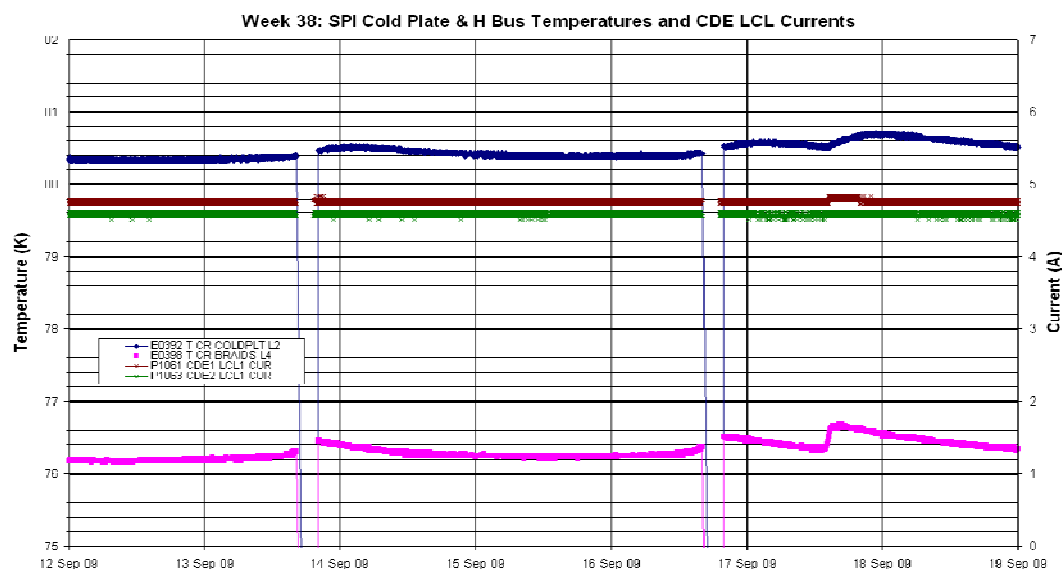
Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

The stroke of all four compressors was set to 40 throughout the week and the average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.76A
- CDE2 LCL Current = 4.57A

The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period⁴:

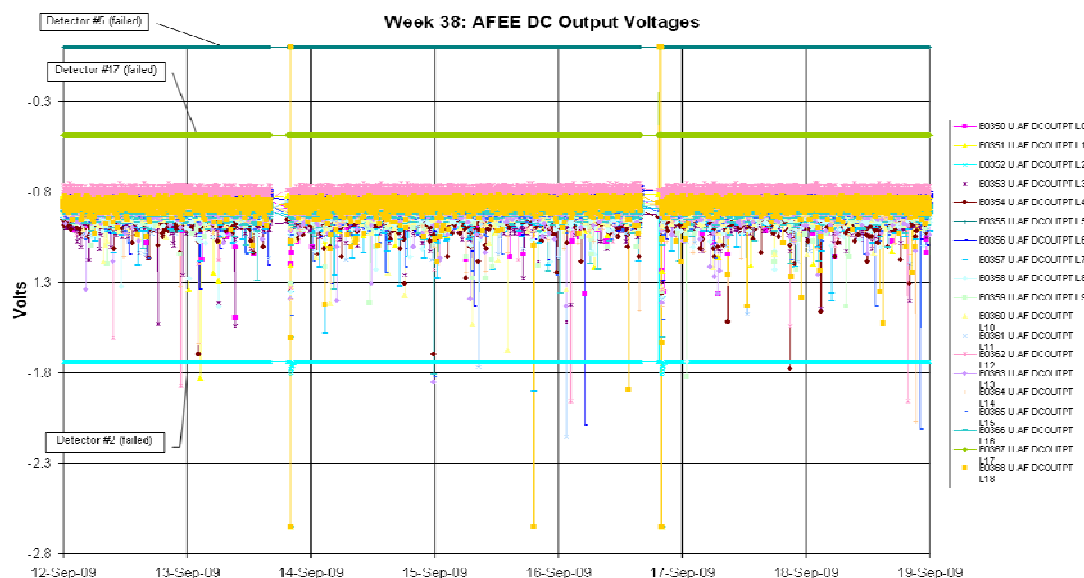
⁴ Data sampled every 8th packet (64sec)



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).

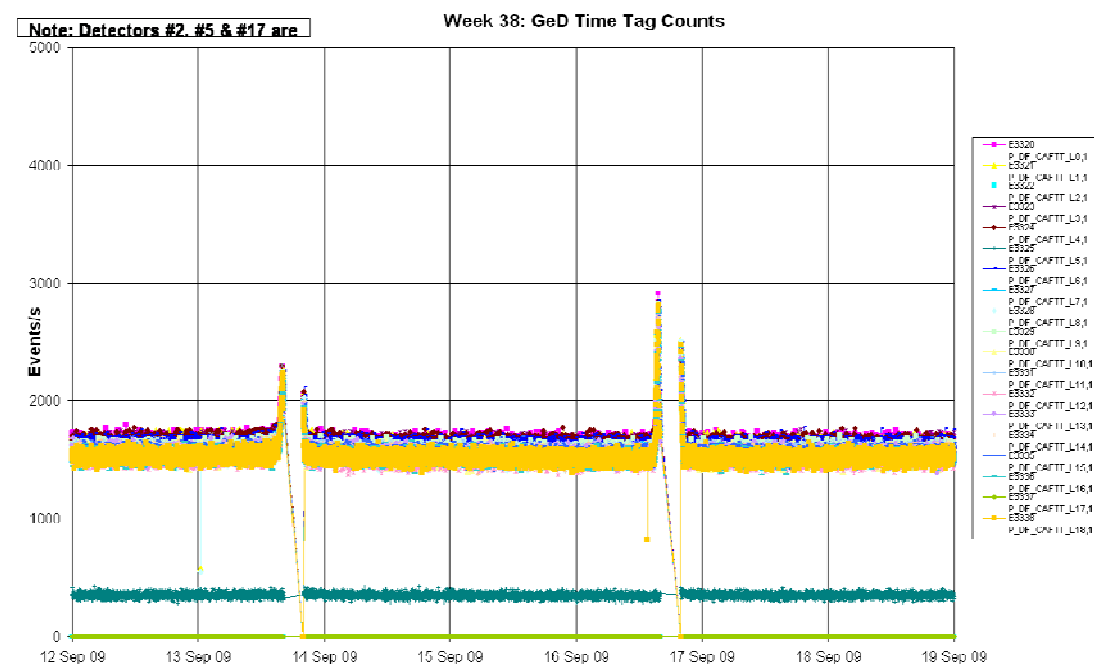
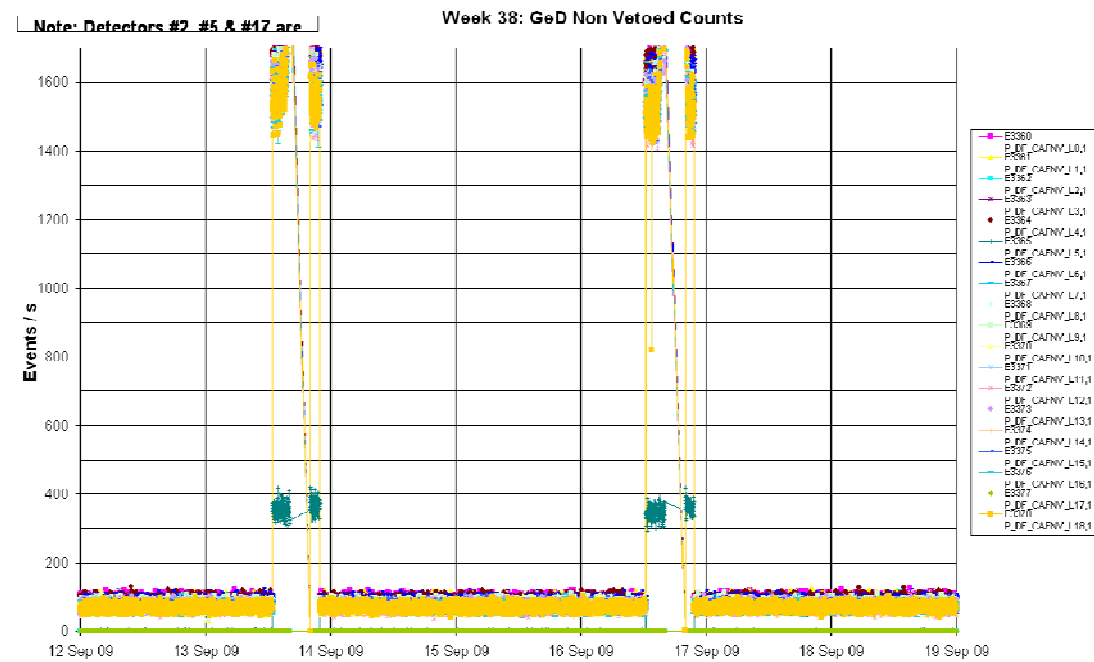
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

AFEE: The health of the AFEE is nominal. The following plot shows the dc output voltage of the detector channels during the reporting period⁵. 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.

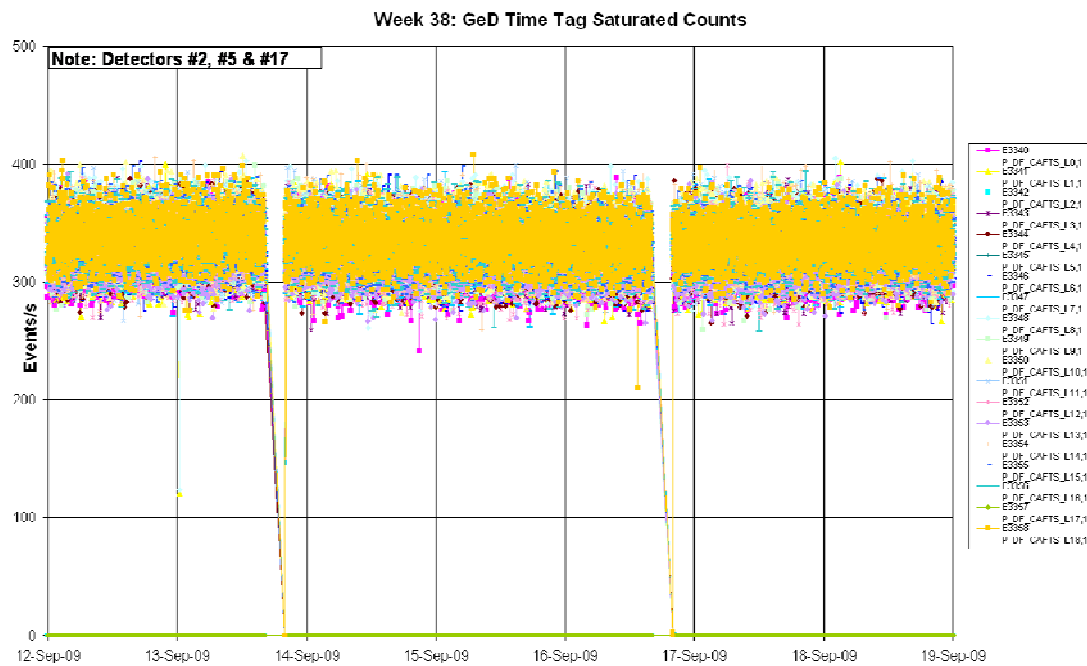


⁵ Data sampled every 8th packet (64sec)

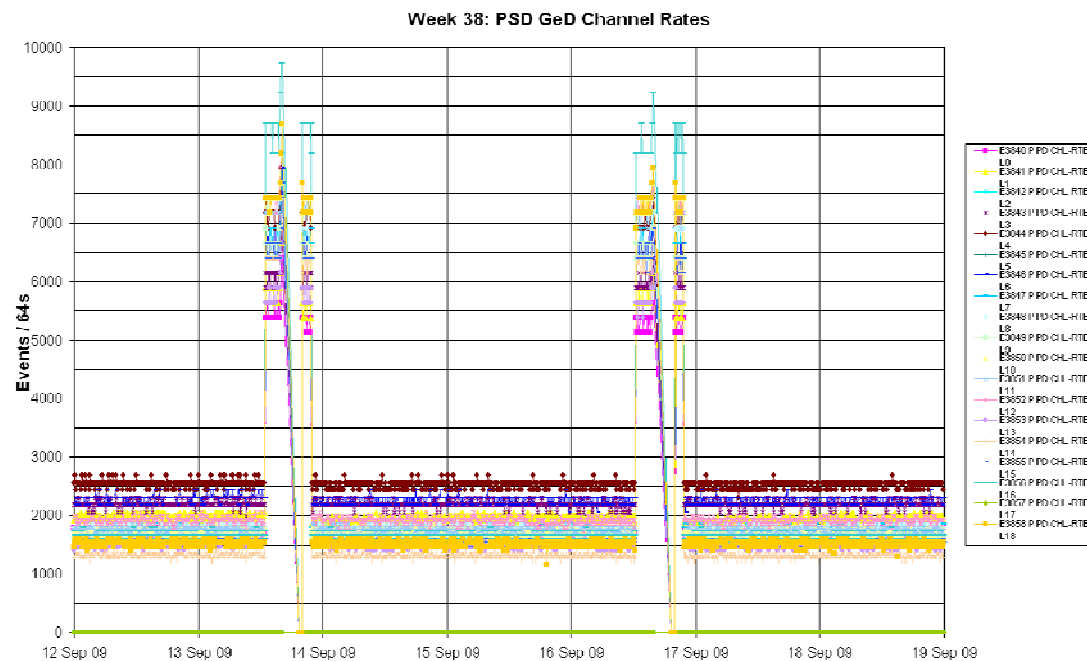
DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁶.



⁶ 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 period⁷:



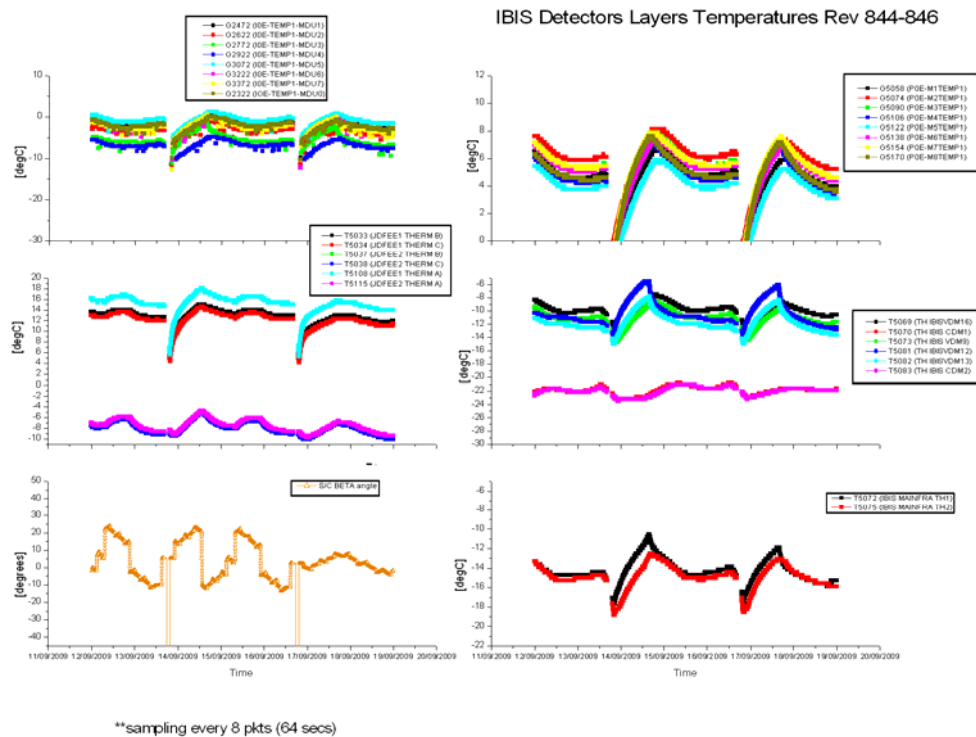
Event Log:

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

⁷ Data sampled every 8th packet (64sec)

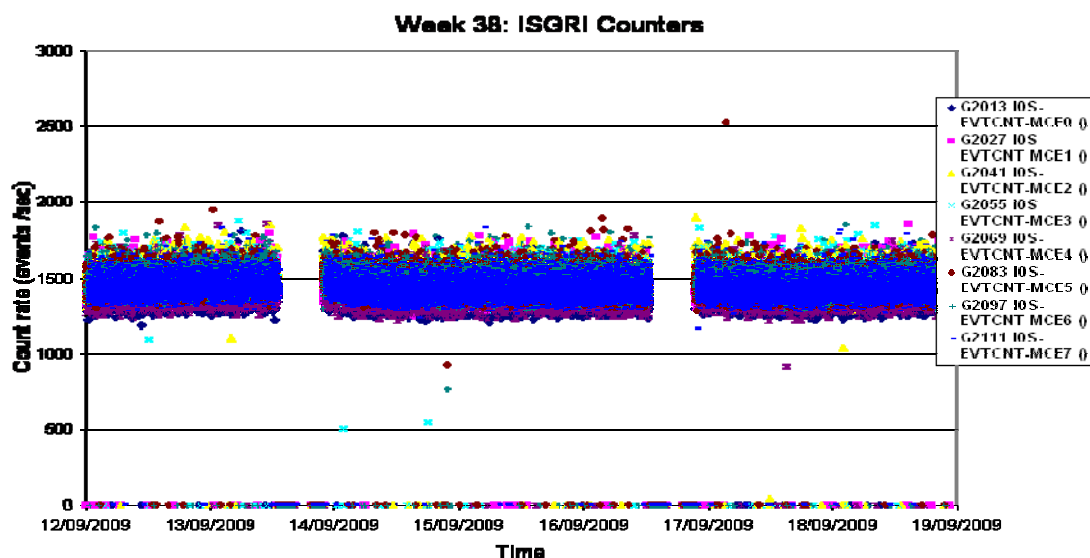
8.1.3 IBIS Operations

Unit Temperatures: All the equipment temperatures were inside the operational limits throughout the week. The following plot shows selected IBIS temperatures, along with those of the JEM-X DFEF and the S/C beta angle for comparison. The temperature recovery of the units after eclipse was nominal.



ISGRI

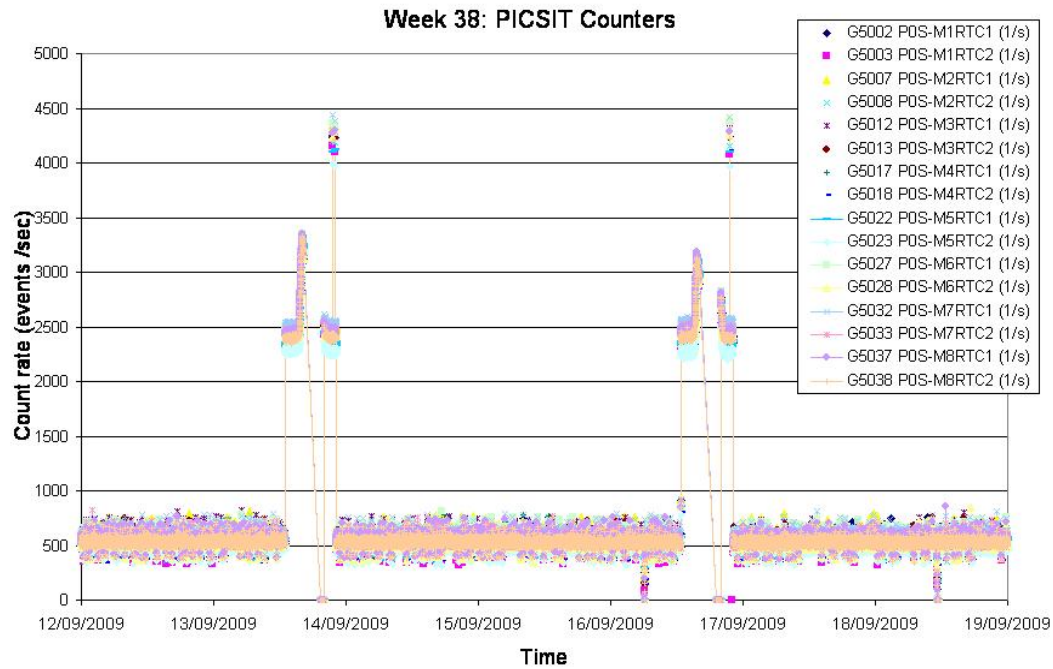
The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the week⁸:



⁸ Data sampled every 4th packet (32sec)

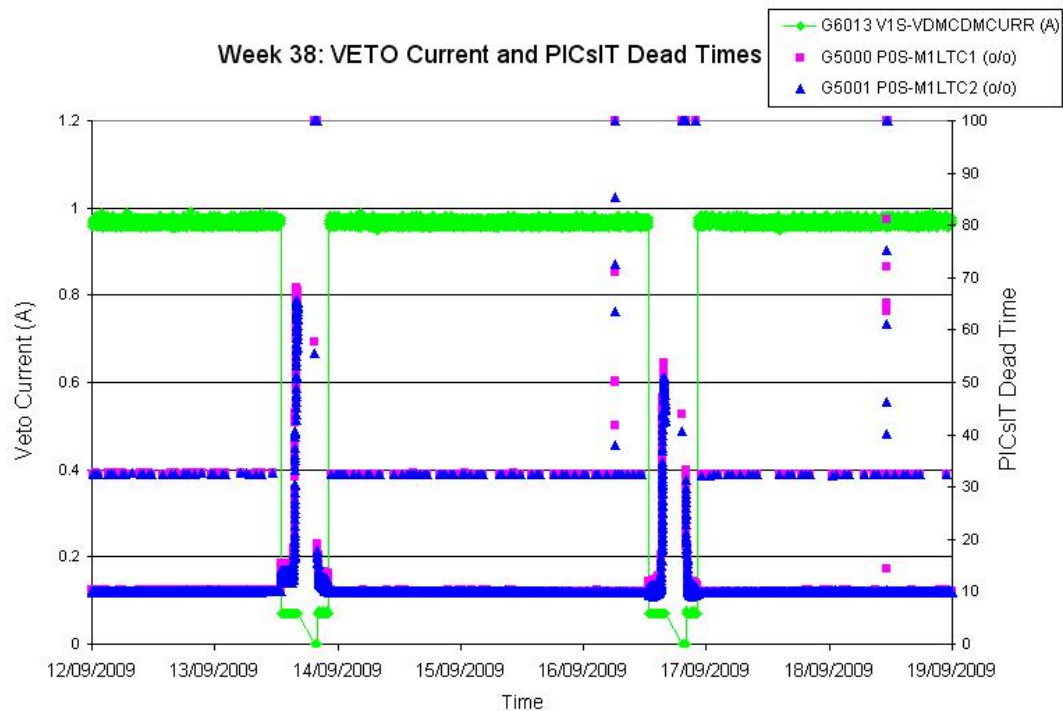
PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week⁹:



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 week¹⁰:



⁹ Data sampled every 4th packet (32sec)

¹⁰ Data sampled every 4th packet (32sec)

IBIS Daily Report

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), G5002 (POS-Mi_RTC1) and G5003 (POS-Mi_RTC2) families and G2000 family (IOE-OVFWPXADD-Mi) were received during the radiation belt passages.

2009-09-12 (DOY 255, Rev. 844)

At 03.00.27Z OEM APID 1280 ID 131 ANOMALY IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET and OEM APID 1280 ID 133 ANOMALY IBIS1 IASW LSL TRANSFER FAILED (LOW LEVEL) (TOGETHER WITH 11) were received. As these were single occurrences and no OOLs or other anomalous OEMs were received at the time, no action was taken.

2009-09-13 (DOY 256, Rev. 844-845)

IBIS operations executed nominally.

2009-09-14 (DOY 257, Rev. 845)

Due to the upcoming wraparound of the DPE LOBT, IBIS was commanded to Standby Mode at 09.51.20Z via FCP_IBIS1_0313. It was commanded back to Science Standard Mode via the CCCF_ED GESTAN02 in the Timeline at 10.29.29Z.

2009-09-15 (DOY 258, Rev. 845)

IBIS operations executed nominally.

2009-09-16 (DOY 259, Rev. 845-846)

At 06.07.10Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 06.07.37Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 06.12.00Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

2009-09-17 (DOY 260, Rev. 846)

IBIS operations executed nominally.

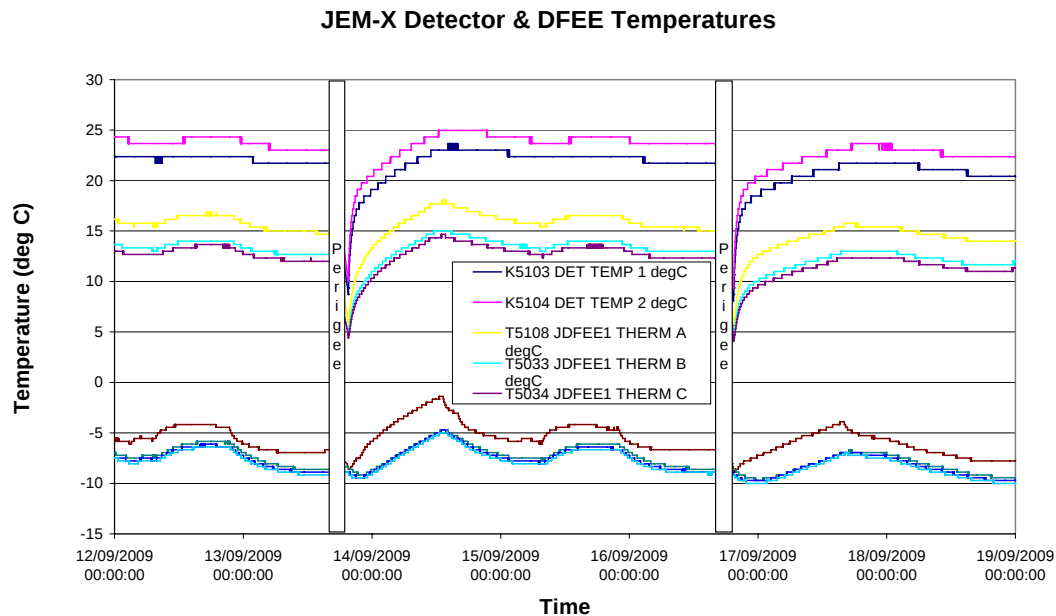
2009-09-18 (DOY 261, Rev. 846)

At 11.17.02Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 11.18.33Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 11.21.49Z by OEM

APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

8.1.4 JEM-X Operations

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 graph¹¹.



JEM-X Daily Report

2009-09-12 (DoY 255 Rev 844)

JEM-X 1 operations executed nominally.

2009-09-13 (DoY 256 Rev 844-845)

At 12:05:43, TC KU0014 terminated with status UNKNOWN.

From 19:34:59 to 19:35:23, TM parameter KD5380D indicated a false status.

At 22:32:24 TC KU0014 terminated with status AFFECTED then at 22:32:35 this changed to UNVERIFIED.

No action was taken on any of the above, and there was no impact.

2009-09-14 (DoY 257 Rev 845) to 2009-09-15 (DoY 258 Rev 845)

JEM-X 1 operations executed nominally.

2009-09-16 (DoY 259 Rev 845-846)

¹¹ Data sampled (1 frame in 8)

From 19:26:28 to 19:26:52, TM parameter KD5380D indicated a false status. No action was taken, and there was no impact.

2009-09-17 (DoY 260 Rev 846) to 2009-09-18 (DoY 261 Rev 846)

JEM-X 1 operations executed nominally.

8.1.5 OMC Operations

2009-09-12 (DoY 255, Rev 844) to 2009-09-14 (DoY 257, Rev 845)

Nothing to report.

2009-09-15 (DoY 258, Rev 845) to 2009-09-14 (DoY 255, Rev 845)

At 13:28:00 the expected TPFs from Flight Dynamics failed to arrive. This was triggered by the planned DENEb outage. The cause was that both the FD clients were connected to this LAN, and none to the HALLEY LAN. A recovery was subsequently performed, and the timeline resumed at 16:57. The impact was the loss of pointings 08450072 through to 08450076 inclusive, with pointing 08450077 cut short from a planned 1800 to 944 seconds.

2009-09-16 (DoY 259, Rev 845-846)

At 02:20, the ED DEBPG200 command failed release due to operator error. This was quickly corrected, and the OMC commands manually resent. The impact was pointing 08450095 was cut short from a planned 1800 to 1720 seconds. It was at this time the following OEM's were received.

2009.259.02.21.50.827	2009.259.14.16.06.672	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2009.259.02.21.56.952	2009.259.14.16.07.741	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

At 04:34, the FD update for pointing 08450100 failed to arrive. The timeline was suspended and a recovery performed. At 05:56 a manual slew was performed to the attitude of pointing 08450102. At 07:51:00, another manual slew was performed, this time to the attitude for pointing 08450106. The timeline was eventually rejoined at 07:52. The impact was the loss of pointings 08450100 through to 08450105 inclusive.

2009-09-17 (DoY 260, Rev 846) to 2009-09-18 (DoY 261, Rev 846)

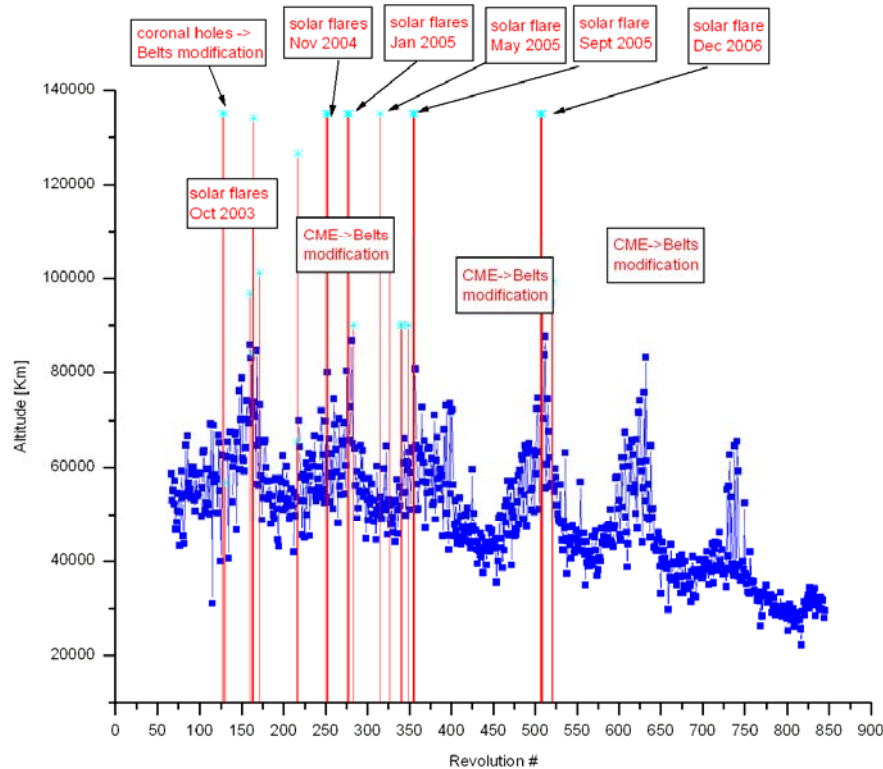
Nothing to report.

On DoY 256 at 12:54:27 and DoY 259 at 12:40:20 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.1.6 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]
844	RAD_ENTR R 2009-09-13T12:54:26Z	13/09/2009 15:28:50	27959.6	13-Sep-2009 15:24:12	28951.33
845	RAD_EXIT R 2009-09-13T21:47:38Z	13/09/2009 20:16:50	34624.3	13-Sep-2009 21:34:12	48091.45
845	RAD_ENTR R 2009-09-16T12:40:16Z	16/09/2009 15:08:50	29521.1	16-Sep-2009 15:05:16	30155.03
846	RAD_EXIT R 2009-09-16T21:33:37Z	16/09/2009 20:25:39	38132.4	16-Sep-2009 21:15:16	47063.88

Reference

High radiation

Very small error vs reference (less than 10 minutes)

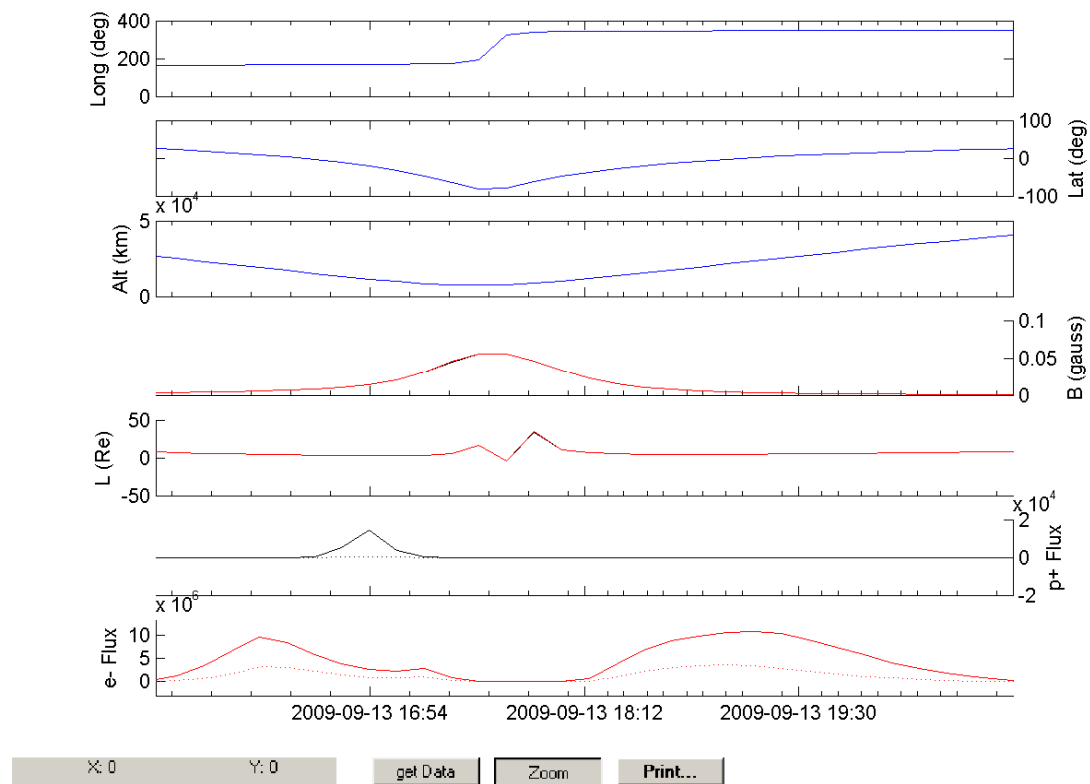
Small error vs reference (between 10 and 30 minutes)

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 844



Rev 845

