

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 357
Week 30
27.07.09
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 18.07.09 until 24.07.09 (both dates inclusive) and covers the revolutions 825, 826 and 827.

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).

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 18/07/2009 and 24/07/2009 was 0.0896 Kg. The remaining propellant is in the order of 133.2501 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

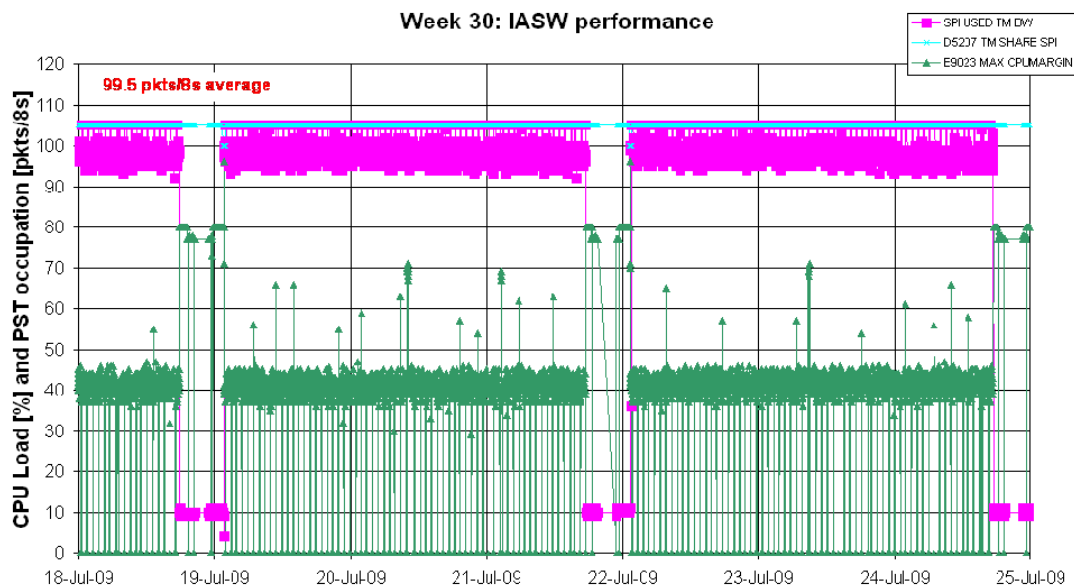
3.2.1 SPI

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.

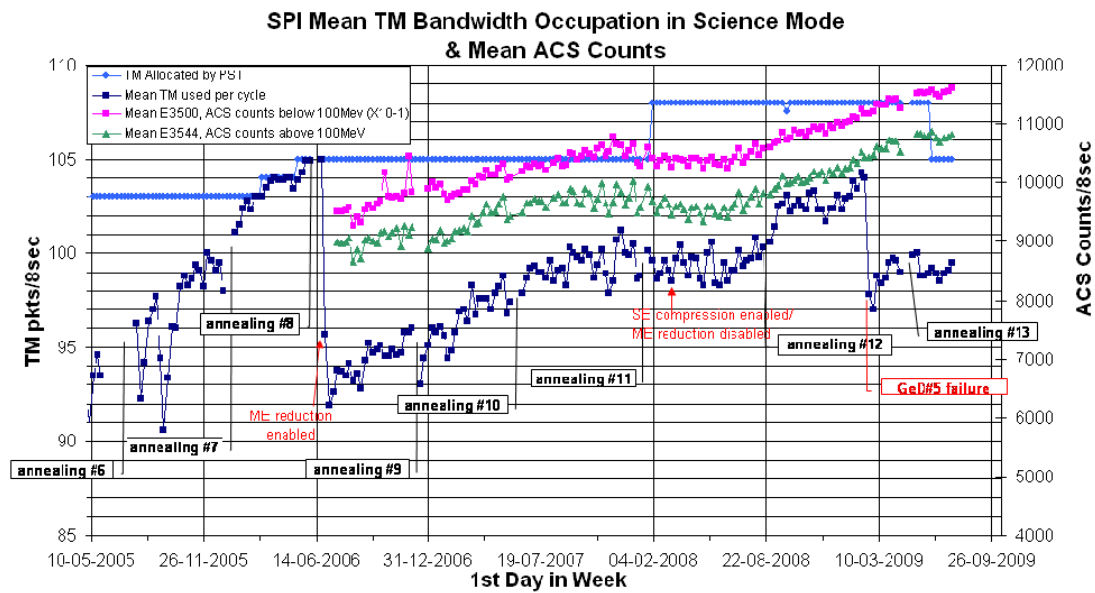
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 105 packets/cycle and the average telemetry occupation was 99.5 packets/cycle.

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.

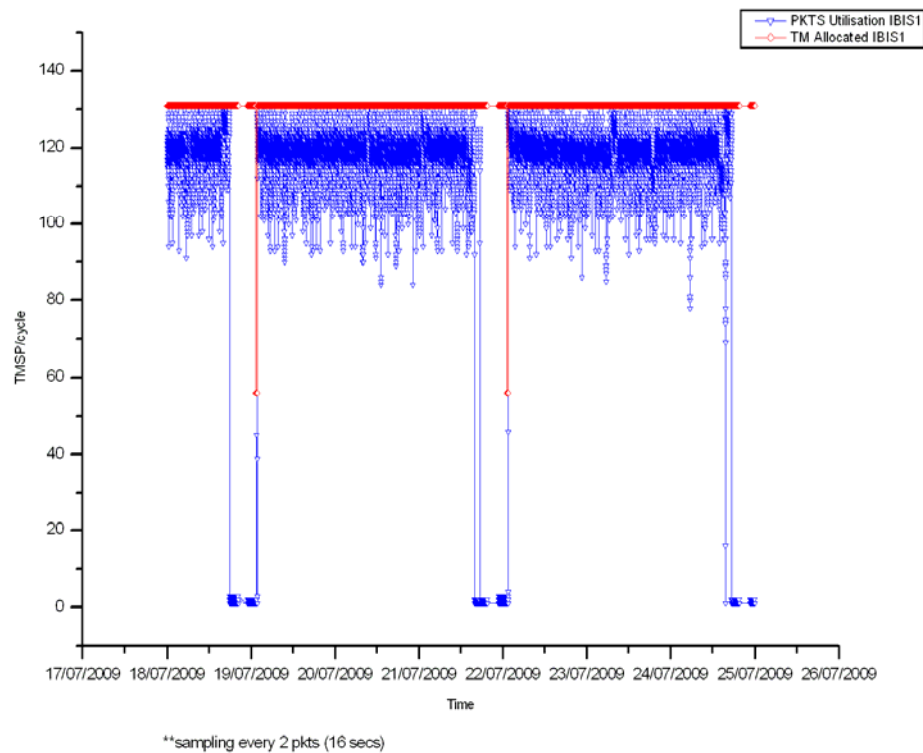
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 131 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 118.69 packets/cycle (down 0.27 on previous week)
- Percentage of TM cycles for which bandwidth usage was 131 packets/cycle: 1.16%

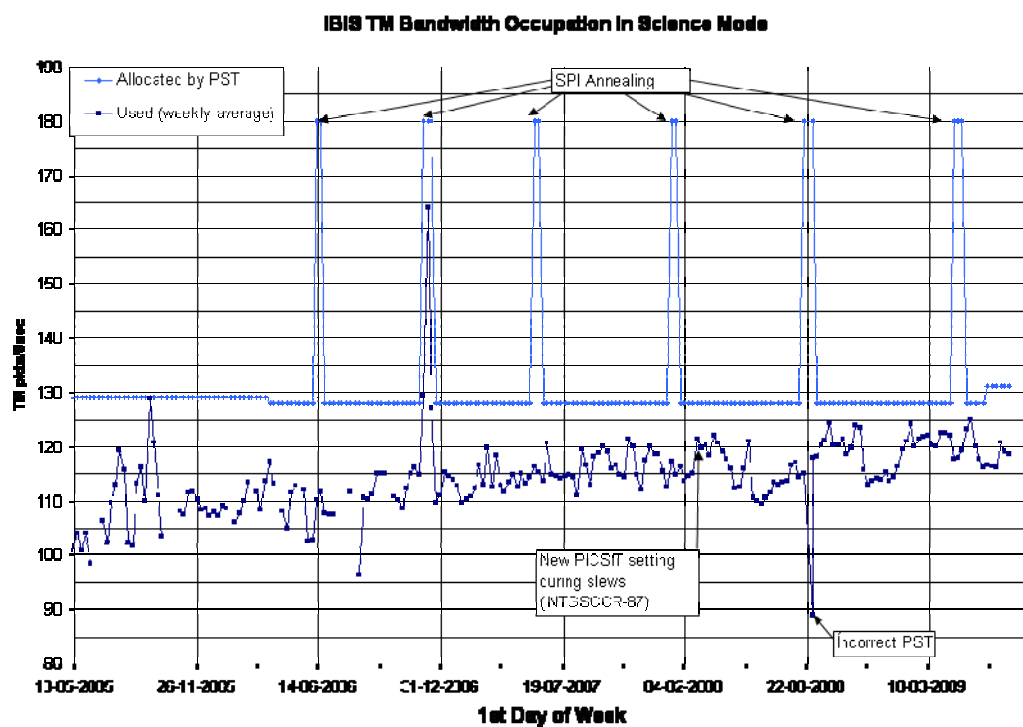
The plot below shows the IBIS TM utilisation during the reporting period² :

² Data sampled every 2nd packet (16sec)

IBIS - TM Bandwidth Utilisation Rev 825-827



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 139 planned science pointings were executed nominally.

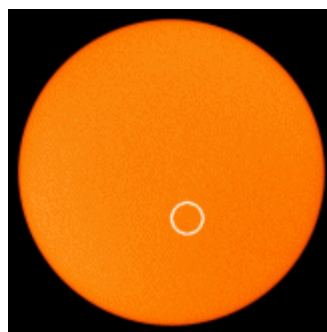
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity. The week began with a blank sun. On Friday 24th July a new spot began to form. The risk of solar flares was very low.

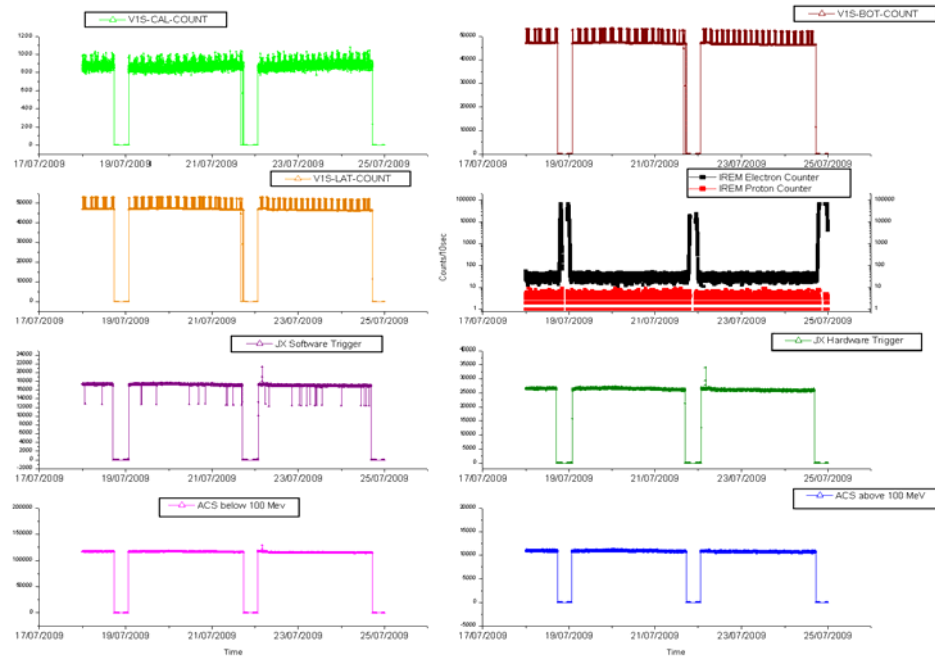


Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

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 :

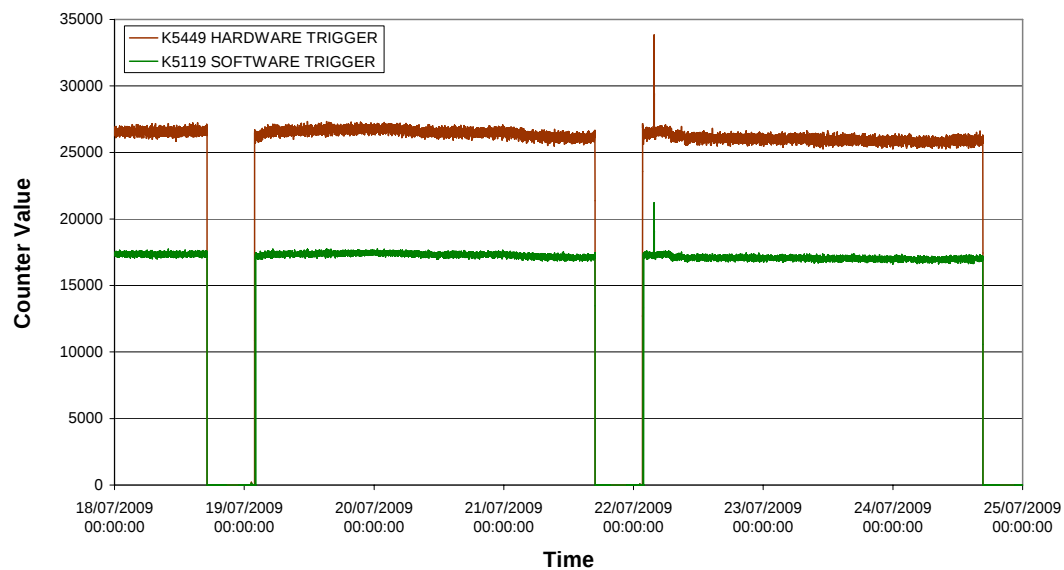
Radiation Background: Instrument Count Rates Rev 825-827



JEM-X Count Rates

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

JEMX-1 Count Rates

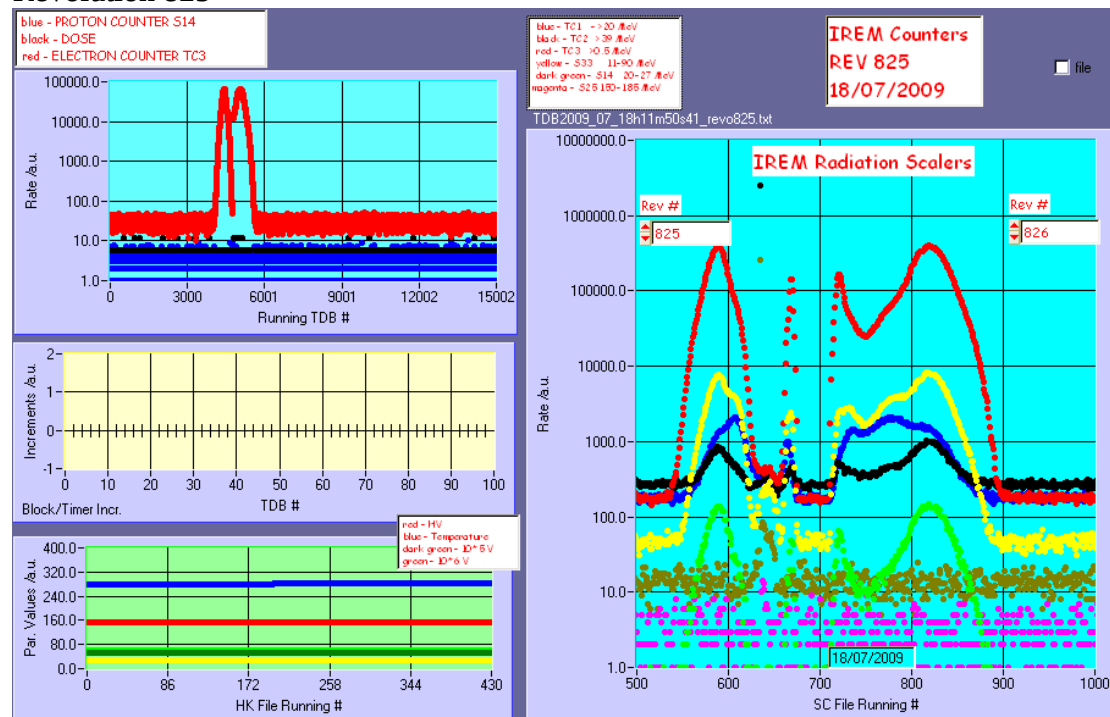


³ Data sampled every 6th packet (48sec)

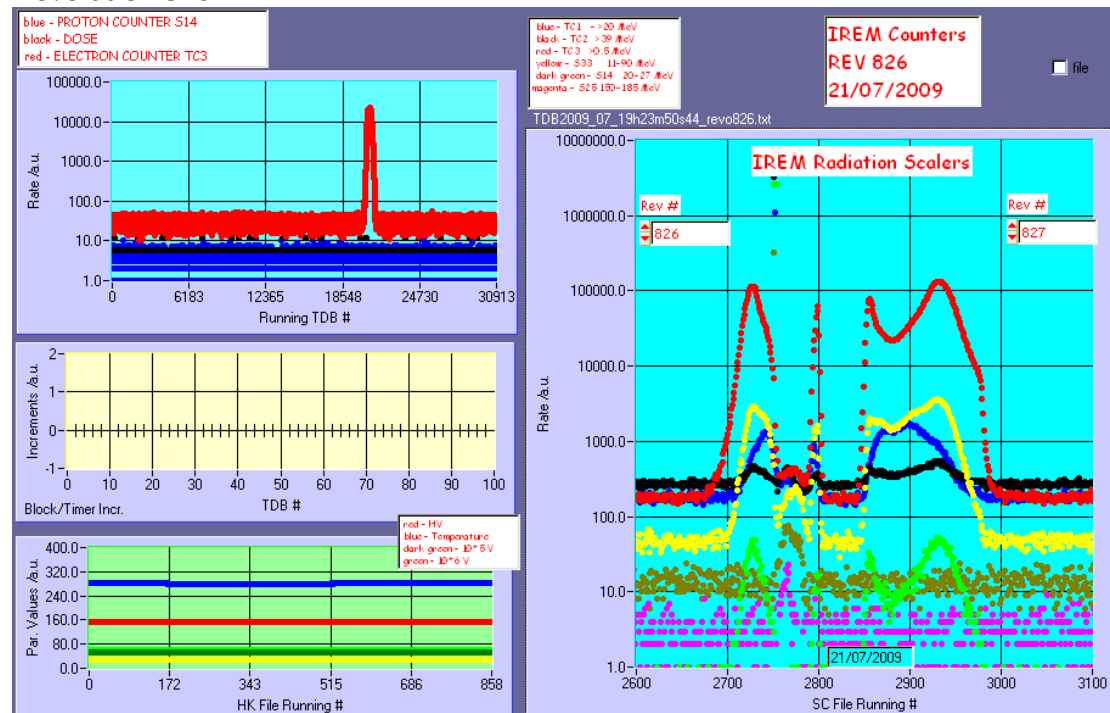
⁴ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

IREM radiation counters:

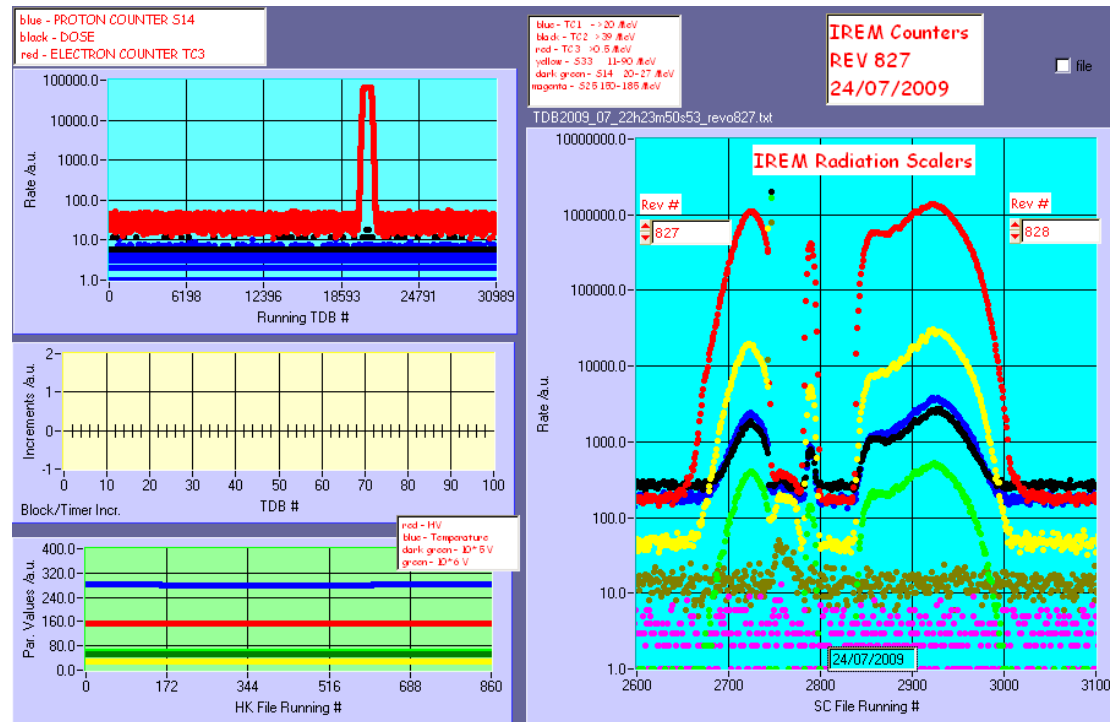
Revolution 825



Revolution 826



Revolution 827



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 was one 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, 5 occasions of a TM drop VC0 and VC7 from 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). New observations have been planned for revolution 833.

New TSFs have been received for revolutions 830 and 831.

2. Observation status

No new ECS files have been received, the last is for revolutions 813.

3. ISOC Science Data Archive

ISDA v3.0 with various improvements has been released on the operational system.

A test database is being set up for the SAT.

Further data ingestion is on hold until the test database is correctly populated to avoid having two sets of daemons running.

4. ISOC system

The Helpdesk has been moved to a version of Kayako supplied by computer support instead of the Integral project, this should be transparent to the users.

The switch to the new webserver is waiting for firewall exceptions to be granted.

5. Problems

None.

5 Special Events

6 Anomalies

The following anomalies occurred this week:

AR id	Date Created	Subject	Segment	Status
INT_SC-263	2009-07-31	IBIS VETO VDM8 HV Breakdown	Payload	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, 18/07/2009 – 24/07/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 90 Open Loop Slews, 57 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

No slews were missed from the TL.

Orbit Control

No update.

Fuel consumption

No update.

The RMU-A null bias calibration

No update.

18/07/2009 (Day of Year 199 , Revolution 825)

Nothing to report.

19/07/2009 (Day of Year 200 , Revolution 825 to 826)

Nothing to report.

20/07/2009 (Day of Year 201 , Revolution 826)

Nothing to report.

21/07/2009 (Day of Year 202 , Revolution 826)

Nothing to report.

22/07/2009 (Day of Year 203 , Revolution 826 to 827)

Nothing to report.

23/07/2009 (Day of Year 204 , Revolution 827)

Nothing to report.

24/07/2009 (Day of Year 205 , Revolution 827)

Nothing to report.

8.2.2 SPI Operations

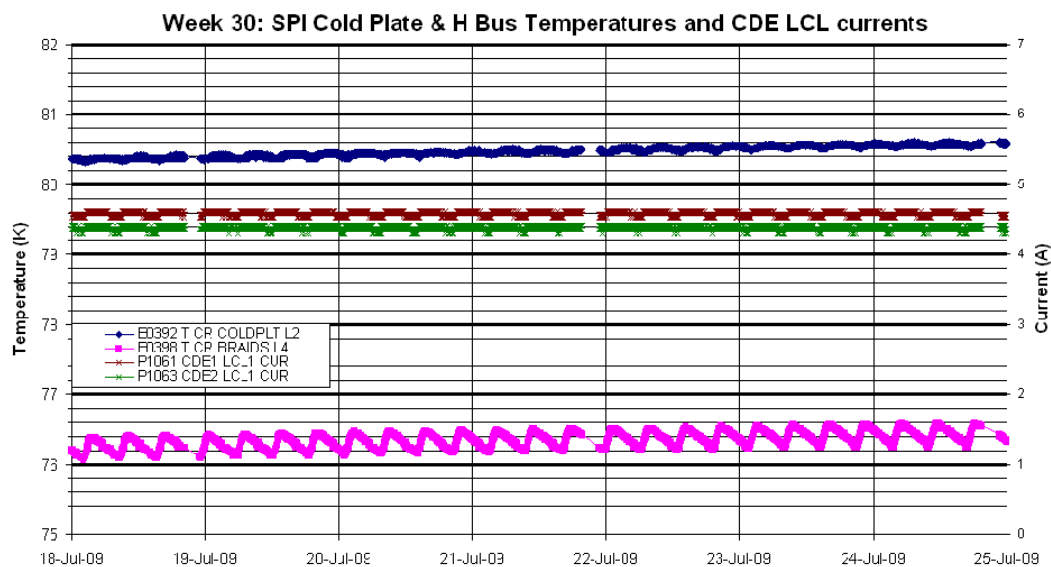
Unit Temperatures: All the equipment temperatures are inside the operational limits.

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 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:

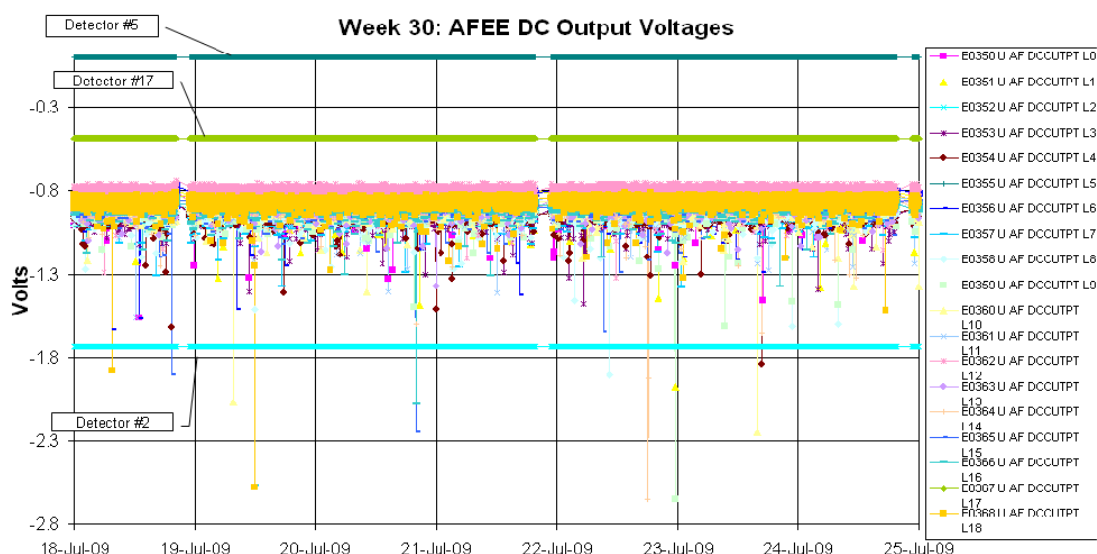


DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

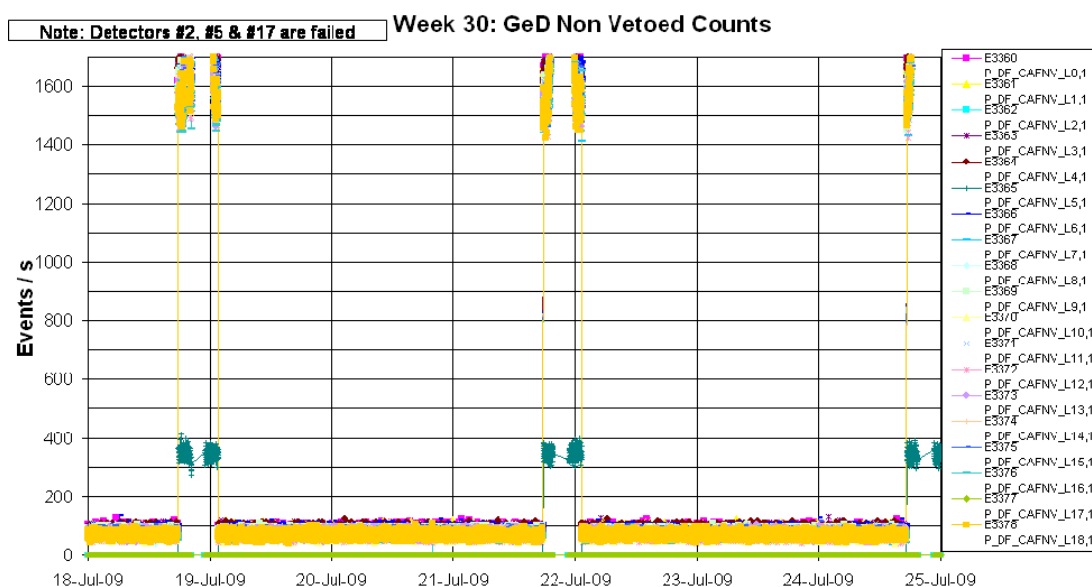
⁵ Data sampled every 8th packet (64sec)

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.

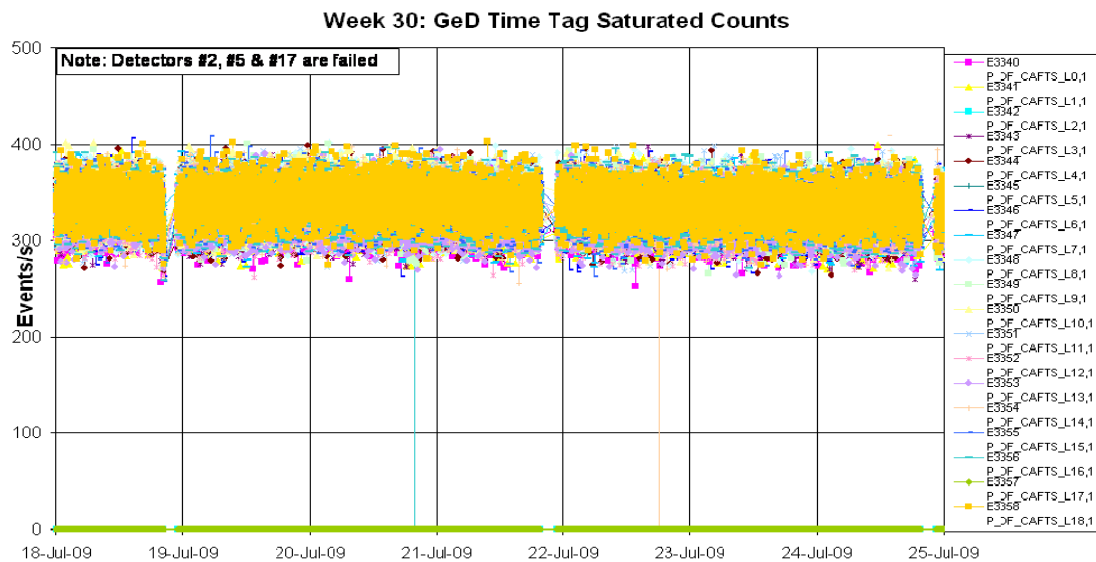
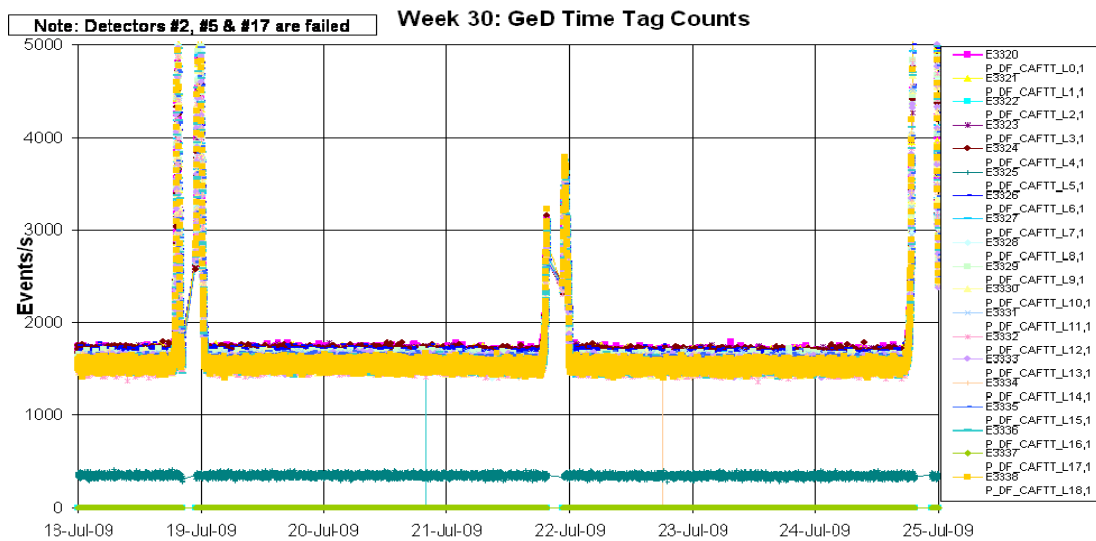


DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁷.

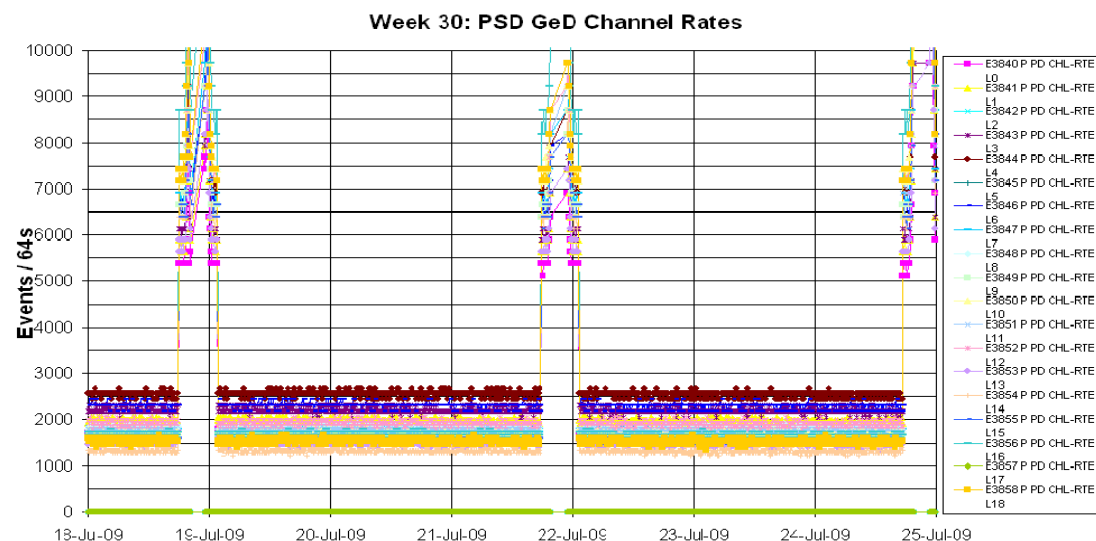


⁶ Data sampled every 8th packet (64sec)

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:

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

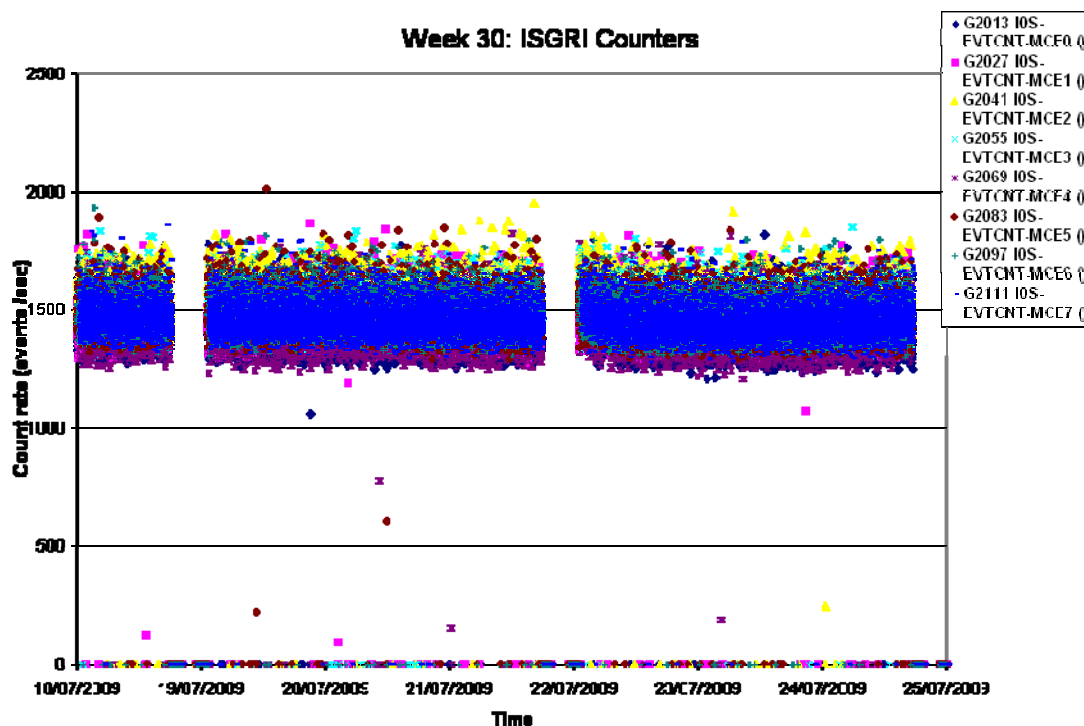
- On 2009-07-19 at 06.52.12Z TM parameter E2398 went OOL (value = PARAM > SPEC). This is the ACS FEE analogue status -5V #48. As it returned within limits of its own accord when the next packet was received at 07.02.52Z, no action was taken.

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:

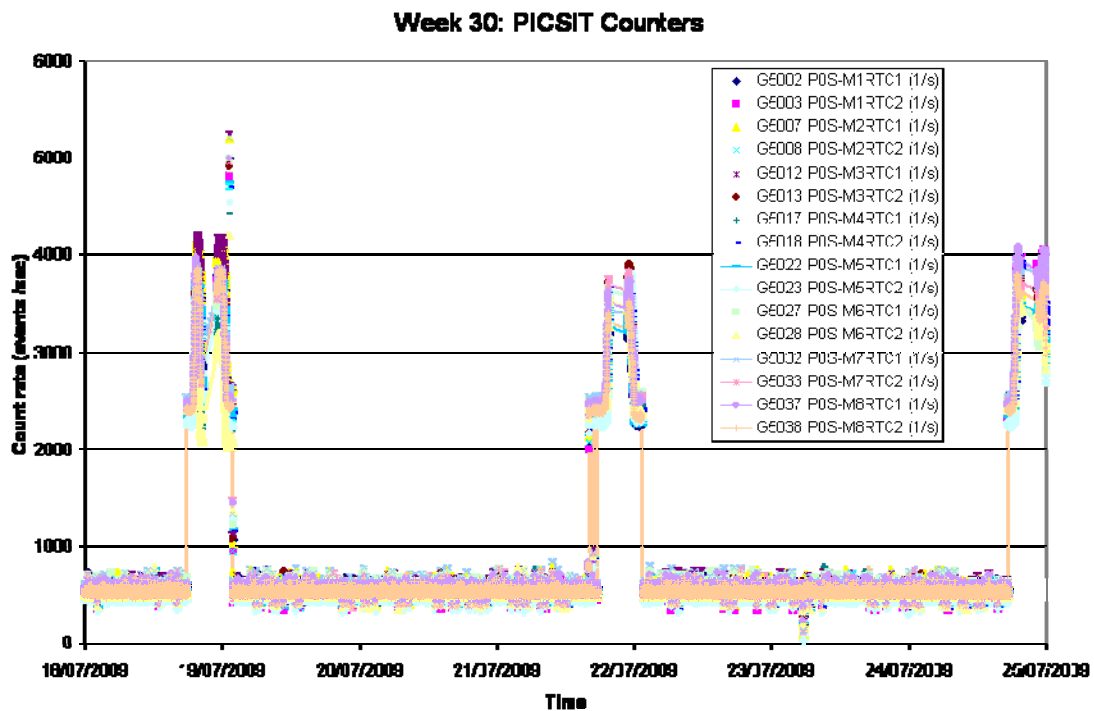


PICsIT

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

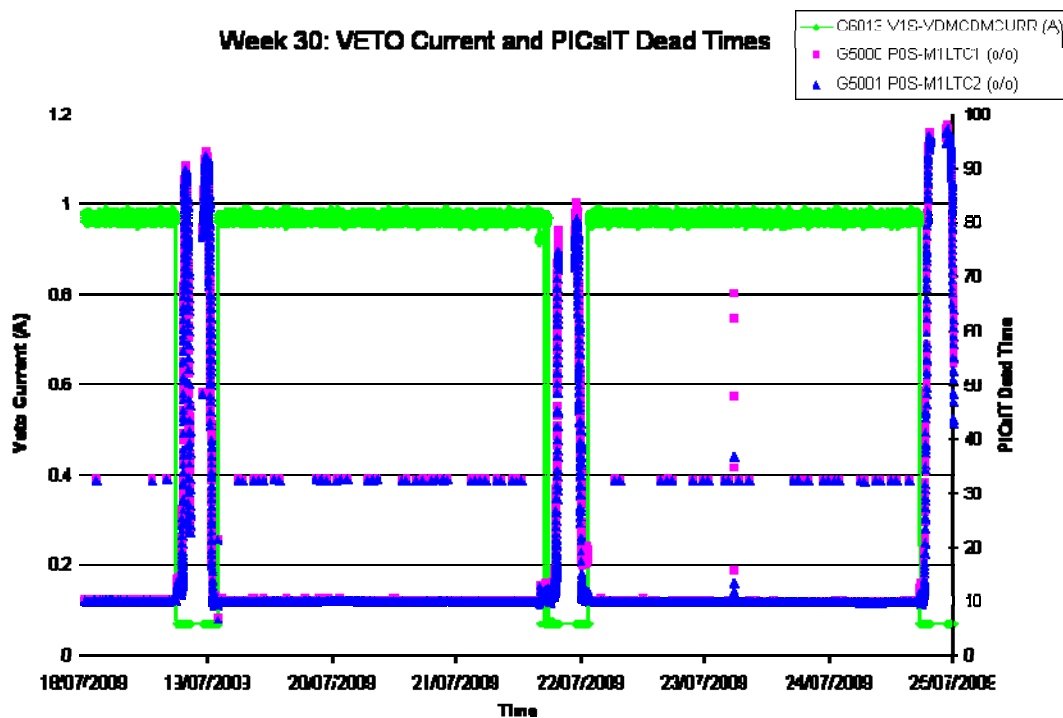
⁹ Data sampled every 4th packet (32sec)

¹⁰ Data sampled every 4th packet (32sec)



VETO

The health and performance of VETO was nominal during the reporting period, except for a VDM8 High Voltage breakdown which occurred on 21/07/2009. The following plot shows the VETO current and PICSIT dead-times during the week¹¹ :



¹¹ Data sampled every 4th packet (32sec)

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.

TM parameter G6061 went OOL Warning Low several times during the week. This is the VETO calibration counter. As in each case it shortly returned within limits of its own accord, no action was taken. These frequent OOLs are due to a reduction in calibration counts as a result of the natural decay of the radioactive calibration source. The lower limit for this parameter will therefore be updated in the next database release.

2009-07-18 (DOY 199, Rev 825-826) to 2009-07-19 (DOY 200, Rev 826)

IBIS operations executed nominally.

2009-07-20 (DOY 201, Rev 826)

At 08:03:34Z TM parameter G2055 (number of events triggering the MCE3 per second) went OOL Low (value = 0). As it returned within limits of its own accord at 08:05:10Z, no action was taken.

2009-07-21 (DOY 202, Rev 826-827)

At 15:56:06Z, the VETO VDM8 HV went OOL Alarm Low:
G6042 (V1S-VDM08HV) = -35.7 V [0 Raw]

At the same time several OEM APID 1280 ID 186 ANOMALY IBIS1 VETO PMTXX IS ON AND CORRESPONDING HV MONIT IS ABOUT ZERO began to be received (8 OEMs every 8 second cycle).

No other alarms were generated and no change was observed in the VETO counters or current. The VDM8 HV remained at zero until the following recovery procedure was executed:

- 16:02:11Z Set IBIS-IASW in Stand-By (TC G0125).
- 16:04:14Z Set IBIS-VETO in Stand-By (TC G0601). At this point all the VETO HVs went to zero as expected and the OEMs APID 1280 ID 186 Class 2 stopped.
- 16:11:33Z Set VETO in Maintenance (TC G0634 TC-V-MAINT) and VETO HVs and counters monitored for 45 minutes.
- 16:57:43Z (and again at 17:02:42Z) attempt to return VETO to nominal with TC G0600 failed with OEM APID 1280 ID 176 EVENT IBIS1 VETO RECEIVED COMMAND CANNOT BE PROCESSED IN CURRENT MODE as VETO cannot be commanded to Nominal from Maintenance Mode.
- 17:04:22Z Set VETO in Stand-By (TC G0601).
- 17:28:29Z Set VETO in Nominal (TC G0600).
- 17:31:10Z Set IBIS-IASW in Science Standard (TC G0129).

Following the recovery the performance of VETO and all VETO parameters were nominal. This is recorded as Anomaly Report INT_SC-263.

IBIS operations continued nominally.

2009-07-22 (DOY 203, Rev 827)

IBIS operations executed nominally.

2009-07-23 (DOY 204, Rev 827)

Starting at 05:36:11Z several parameters of the TM parameter families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. As they had all returned within limits by 05:38:19Z, no action was taken.

2009-07-24 (DOY 205, Rev 827-828)

At 14:32Z, following a ground station handover, TM parameter X7500 went OOL, indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

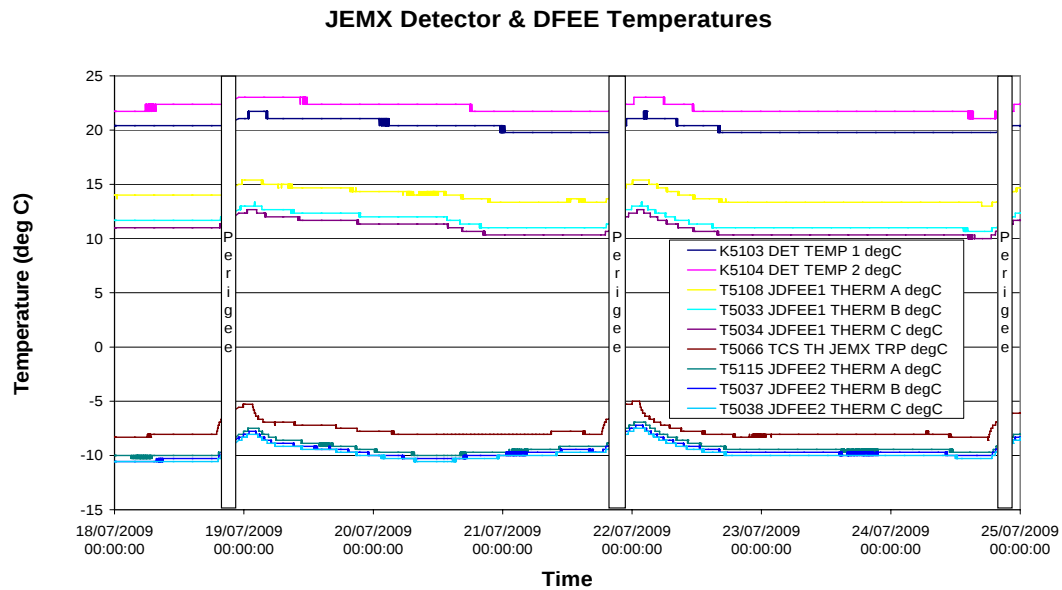
- 15:36:04Z FCP_IBIS1_0312
 - 15:38:43Z TC G0129 uplinked to return IBIS to Science Standard mode.
- IBIS operations continued nominally.

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.

¹² Data sampled (1 frame in 8)



JEM-X Daily Report

2009-07-18 (DoY 199 Rev 825) to 2009-07-21 (DoY 202 Rev 827)

JEM-X 1 operations executed nominally.

2009-07-22 (DoY 203 Rev 827)

At 03:49:31, TM parameter K5449 briefly exceeded soft limits, no action was taken, and there was no impact.

2009-07-23 (DoY 204 Rev 827) to 2009-07-24 (DoY 205 Rev 828)

JEM-X 1 operations executed nominally.

8.2.5 OMC Operations

2009-07-18 (DoY 199, Rev 825) to 2009-07-24 (DoY 205, Rev 827)

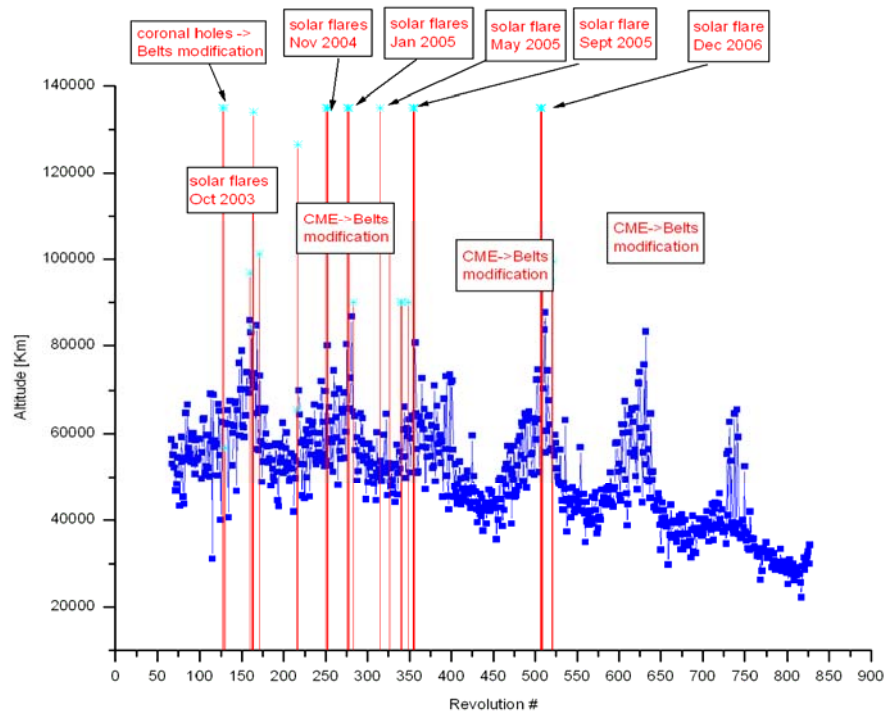
Nothing to report.

On DoY 199 at 17:51:04, DoY 202 at 17:37:52 and DoY 205 at 17:23:45 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]
825	RAD_ENTR R 2009-07-18T17:50:56Z	18/07/2009 18:51:27	32671.6	18-Jul-2009 19:07:53	29640.09
826	RAD_EXIT R 2009-07-19T01:33:38Z	19/07/2009 00:54:15	>>32782.9	19-Jul-2009 01:17:53	47455.39
826	RAD_ENTR R 2009-07-21T17:37:45Z	21/07/2009 18:51:11	29930.4	21-Jul-2009 18:47:33	31059.03
827	RAD_EXIT R 2009-07-22T01:20:48Z	22/07/2009 00:04:55	>>32763.1	22-Jul-2009 01:07:33	47758.21
827	RAD_ENTR R 2009-07-24T17:23:37Z	24/07/2009 18:18:48	34273.5	24-Jul-2009 18:37:33	30265.74

Reference

High radiation

Very small error vs reference (less than 10 minutes)

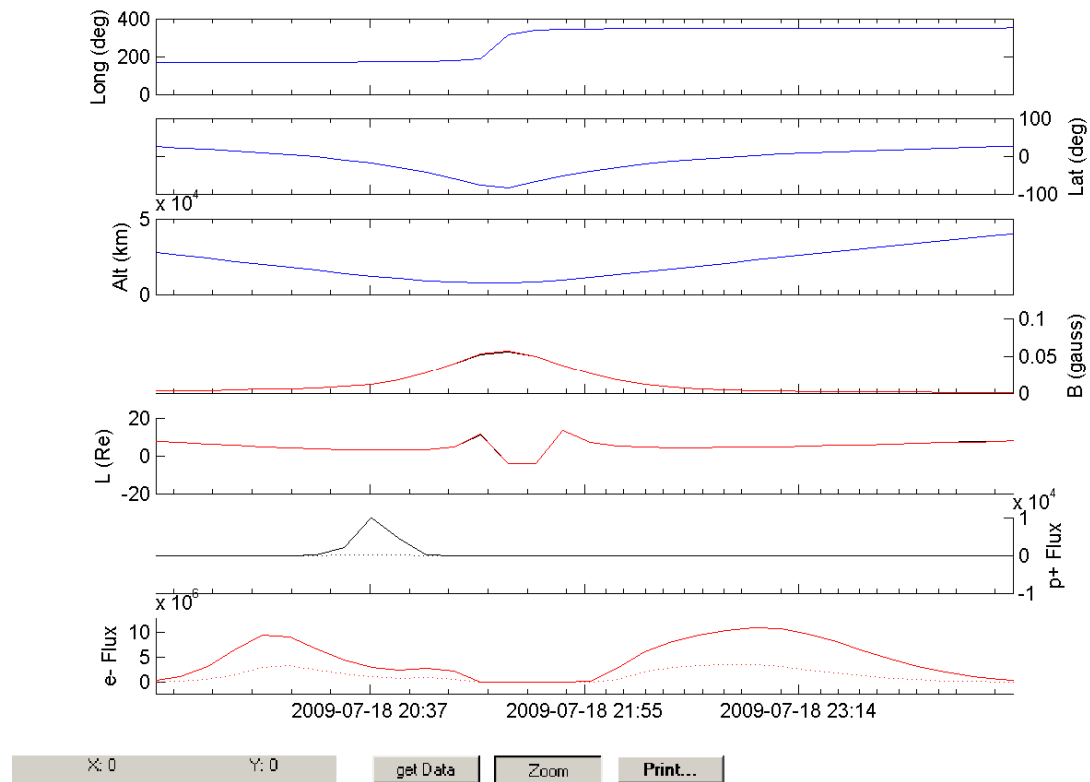
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

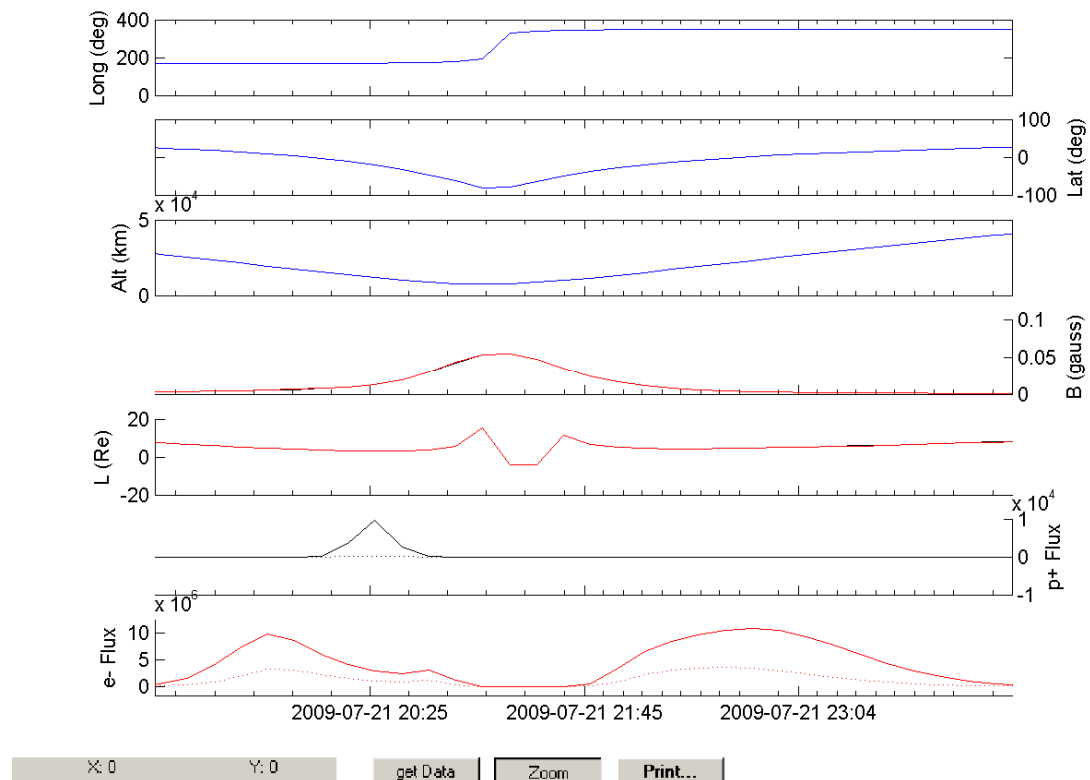
Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM Predicted Radiation Belt Passages

Rev 825



Rev 826



Rev 827

