EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-OPS-OAI

No. 355
Week 28

13.07.09

Routine Phase

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LIST OF CONTENTS

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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 04.07.09 until 10.07.09 (both dates inclusive) and covers the revolutions 821 and 822.

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 the Coma Cluster (RA 12:59:48.70, +27:58:50.0) and an staring OMC FF #37 calibration (RA 13:11:12.00, -00:30:00.0).

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.

Slews 08220060, 08230011 and 08230019 were missed from the TL, during the observation period.

The fuel consumption over the period between 04/07/2009 and 10/07/2009 was 0.0641 Kg. The remaining propellant is in the order of 133.4186 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

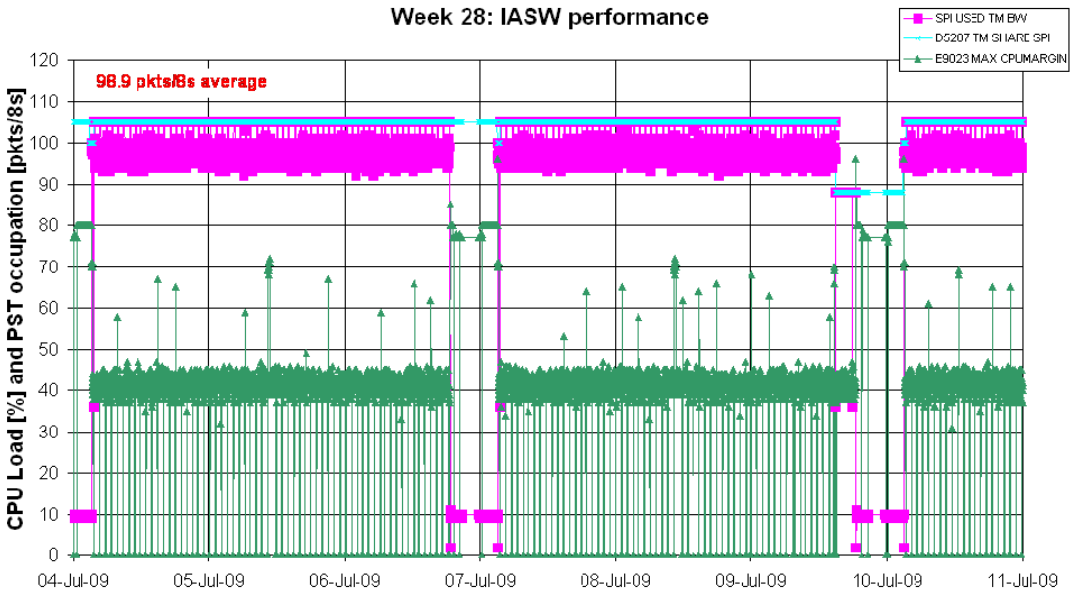
3.2.1 SPI

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+/-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 except from 2009-07-09T14:58:36Z until the end of revolution 822, when it was 88 packets/cycle due to an OMC Flat Field Calibration. The average telemetry occupation when the allocation was 105 packets/cycle was 98.9 packets/cycle.

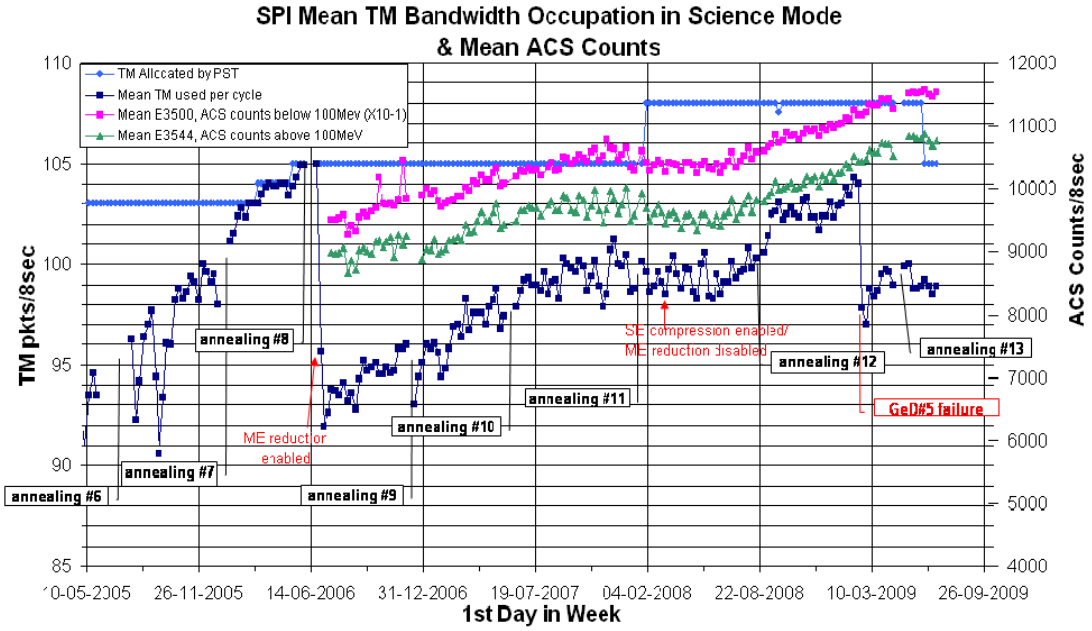
The following plot shows the TM bandwidth allocation, occupation and DPE CPU load during the reporting period[1]:



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

[1] Data sampled every 8th packet (64sec)

(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

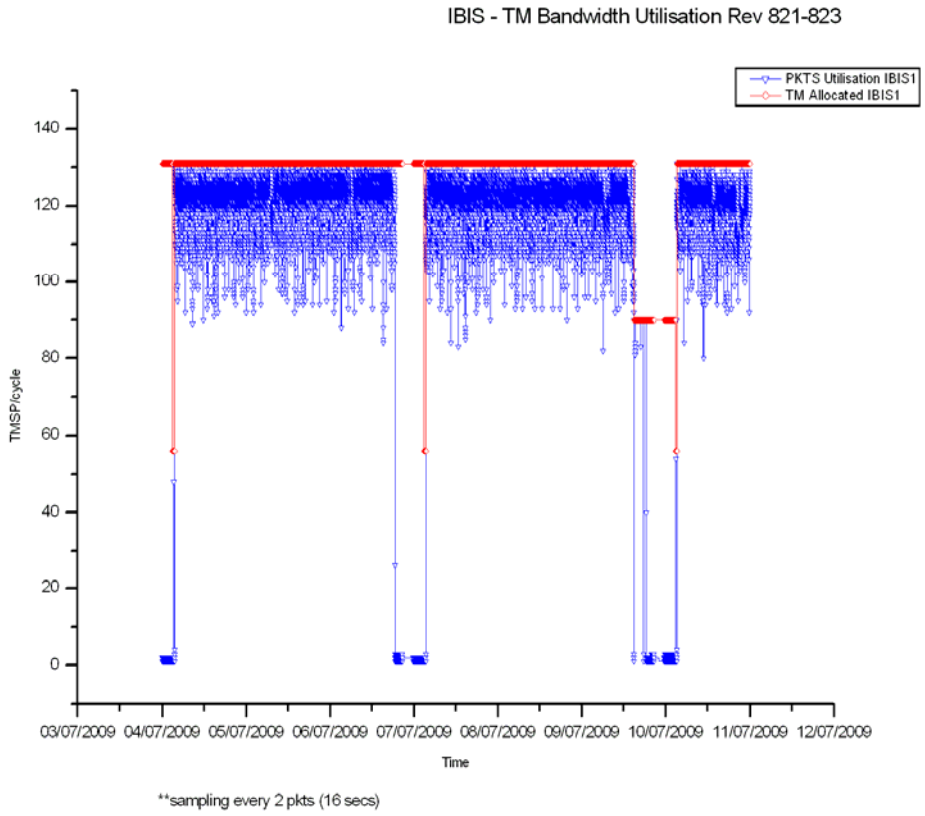
The overall status of IBIS is nominal.

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

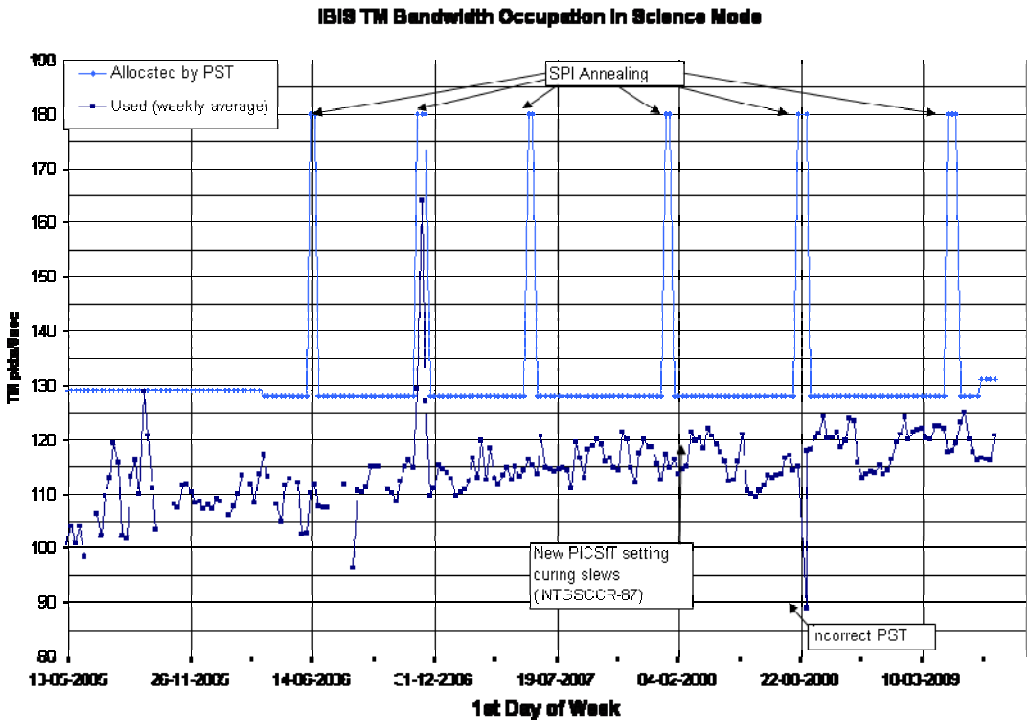
- PST allocation to IBIS above radiation belts: 131 packets/cycle except from 2009-07-09T14:58:36Z until the end of revolution 822, when it was 90 packets/cycle due to an OMC Flat Field Calibration.
- IBIS mean bandwidth utilisation in science mode: 120.85 packets/cycle (up 4.77 on previous week)
- Percentage of TM cycles for which bandwidth usage was 131 packets/cycle: 0.67%

The plot below shows the IBIS TM utilisation during the reporting period[2] :

[2] Data sampled every 2nd packet (16sec)



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, except from 2009-07-09T14:59:19Z to the end of the revolution at 2009-07-09T18:30:31Z during the Flat-field calibration when it was 63 packets/cycle.

During this reporting period, 135 of the 137 planned science pointings were executed nominally, one pointing was cut short, and another lost.

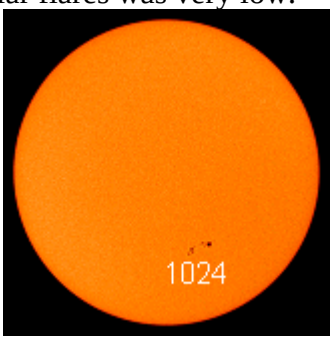
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

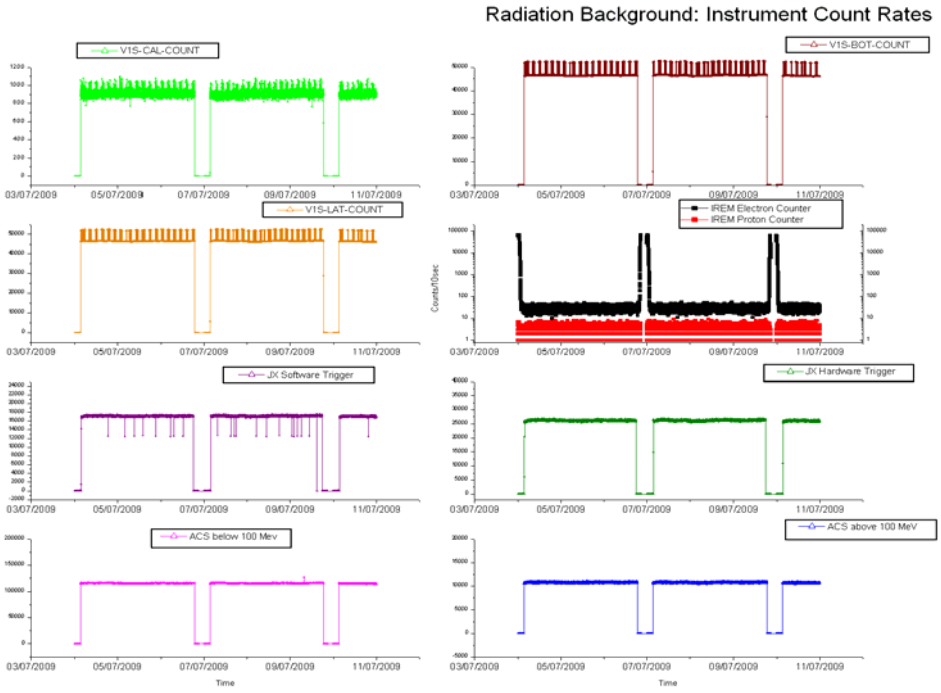
The observation period was characterised by low solar activity. Sun-spot #1024 was present all week The risk of solar flares was very low.



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

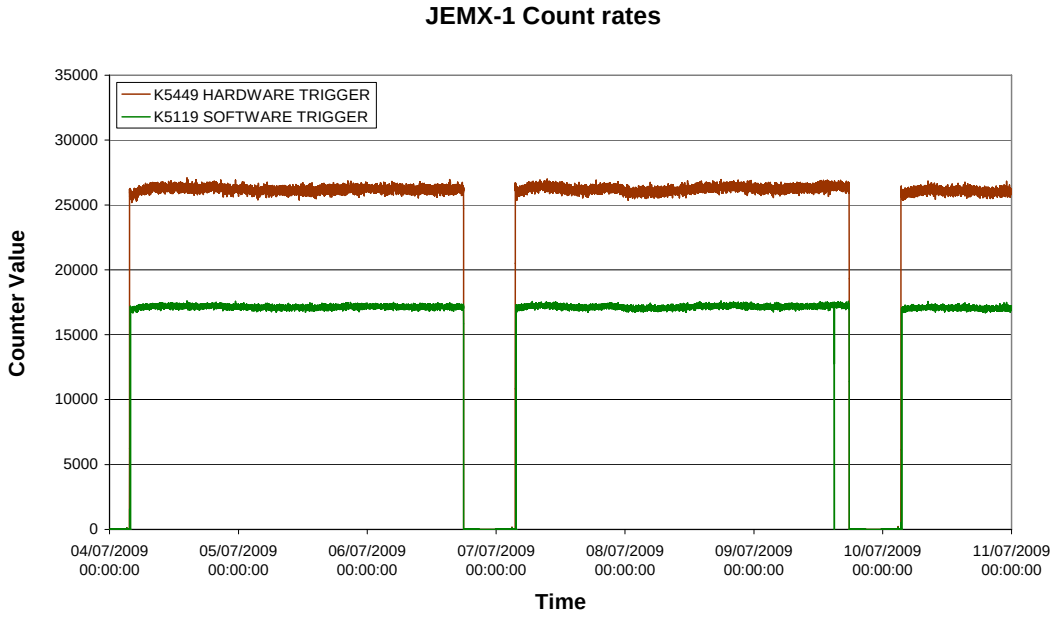
3.2.6 Radiation Backround

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 week[3] :



JEM-X Count Rates

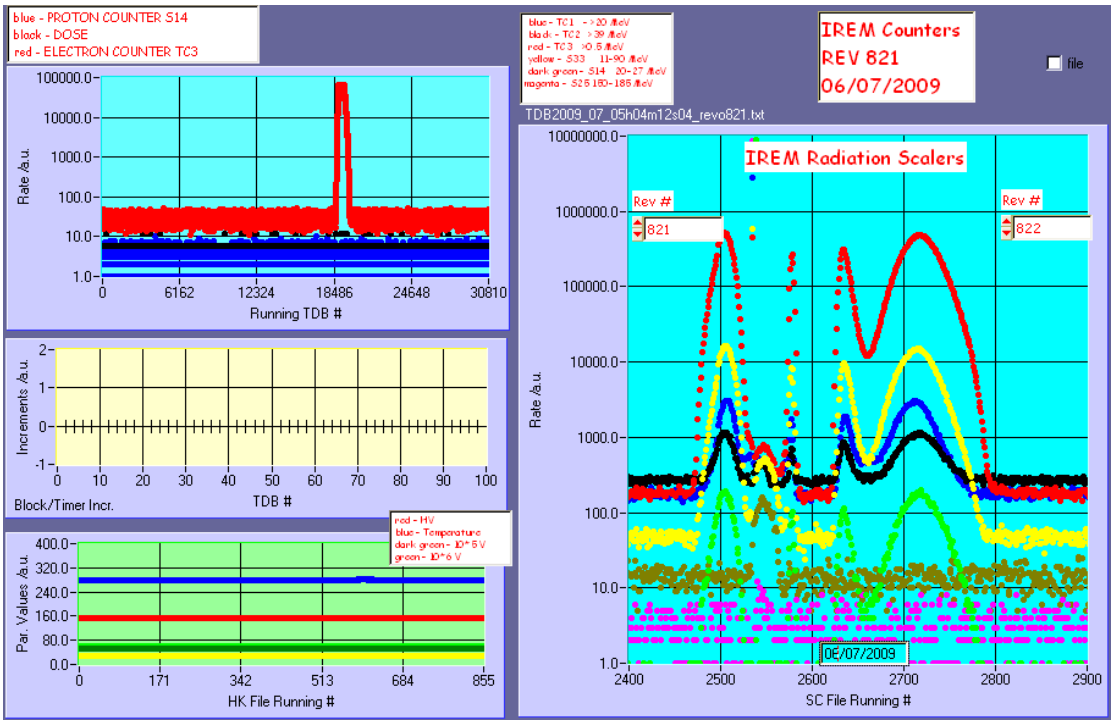
JEM-X count rates over the reporting period are displayed in the following graph[4].



[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 821



Revolution 822 is not available

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 on DOY 187 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 5 occasions of bad frames, 19 occasions of a TM drop VC0 and VC7 from Redu and 2 occasions of a TM drop VC0 and VC7 from DSS27. There was no impact on T/L operations.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received and observations have been planned for revolution 829-832.

New TSFs have been received for revolutions 824-829.

2. Observation status

New ECS files have been received for revolutions 807 and 808.

3. ISOC Science Data Archive

The results of the ISDA 3.0 beta test and the overall interaction between ISOC and the SAT have been discussed. Work is ongoing to finish ISSA 3.0.

4. ISOC system

No news.

5. Problems

Side effects of last week's power failure have led to various smaller disturbances for ISOC.

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, 04/07/2009 – 10/07/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 81 Open Loop Slews, 66 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

Slews 08220060, 08230011 and 08230019 were missed from the TL.

The OTF was not reached for PID 08210028 and 08230010.

Orbit Control

No update.

Fuel consumption

No update.

The RMU-A null bias calibration

No update

04/07/2009 (Day of Year 185, Revolution 820 to 821)

Nothing to report.

05/07/2009 (Day of Year 186, Revolution 821)

- IMU switched ON during the stable pointing of PID 08210028 (06:47:00Z). A mapping was commanded and the parameters for the next slew updated in the Timeline.

No impact on the Timeline.

OTF not reached for PID 08210028.

06/07/2009 (Day of Year 187, Revolution 821)

Nothing to report.

07/07/2009 (Day of Year 188, Revolution 821 to 822)

Nothing to report.

08/07/2009 (Day of Year 189, Revolution 822)

Nothing to report

09/07/2009 (Day of Year 190, Revolution 822)

- CSL failure: during the commanding of CSL 08220060, a TM drop caused the command A3161 to fail the PTV. After TM link was recovered a manual slew was generated from PID 08220059 to 08220060 and after this slew was completed, the parameters for PREQ 08220061 were manually (spacontool) updated on the Timeline.

Slew 08220060 was missed from the Timeline.

10/07/2009 (Day of Year 191, Revolution 822 to 823)

- IMU switched ON during the stable pointing of PID 08230010 (12:22:00Z). Timeline was disabled and slew 08230011 missed.
A manual slew was generated (spacontool) from PID 08230010 to PID 08230011 and the parameters for PID 08230012 manually updated afterwards.

Slew 08230011 was missed from the Timeline.

OTF was not reached for PID 08230010.

- The commanding of CSL 08230019 failed (20:37Z). The reason was that, due to TC drops from Redu , the command A2551 'RP SRCH/TRK' failed release.
A mapping was commanded and the slew (from PID 08230018 to PID 08230019) performed manually (spacontool). Then, the parameters for the subsequent manoeuvre, PID 08230020, were updated (spacontool).

Slew 08230019 was missed from the Timeline.

8.2.2 SPI Operations

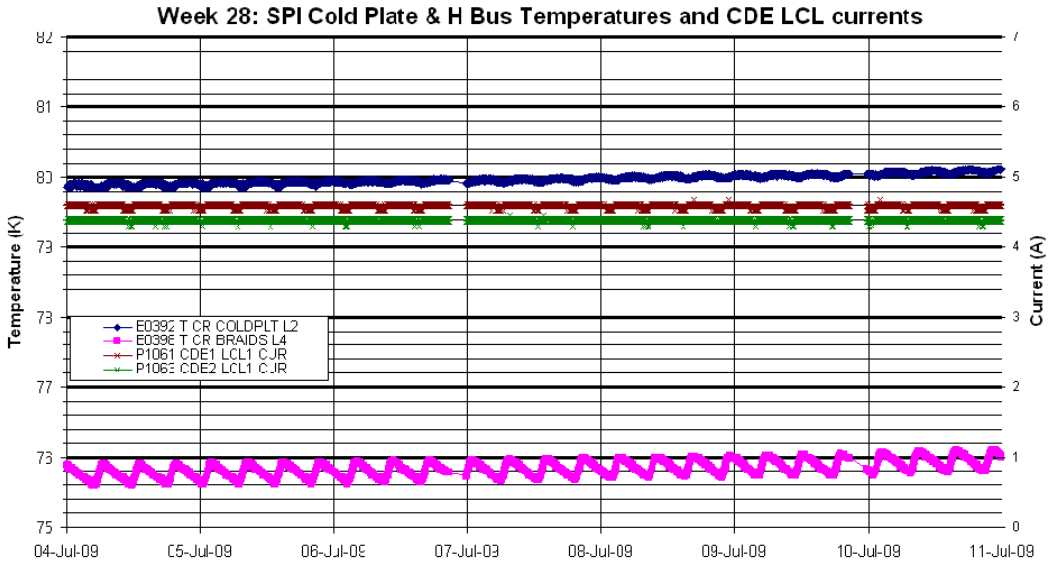
Unit Temperatures: All the equipment temperatures are inside the operational limits.

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 = 4.59A
- CDE2 LCL Current = 4.38A

The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period[5]:

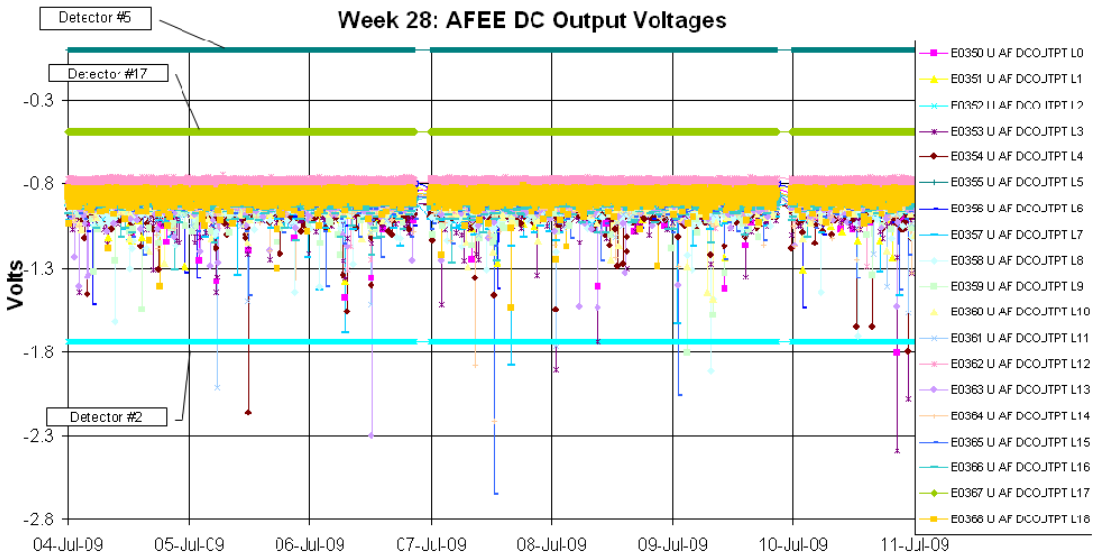


DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

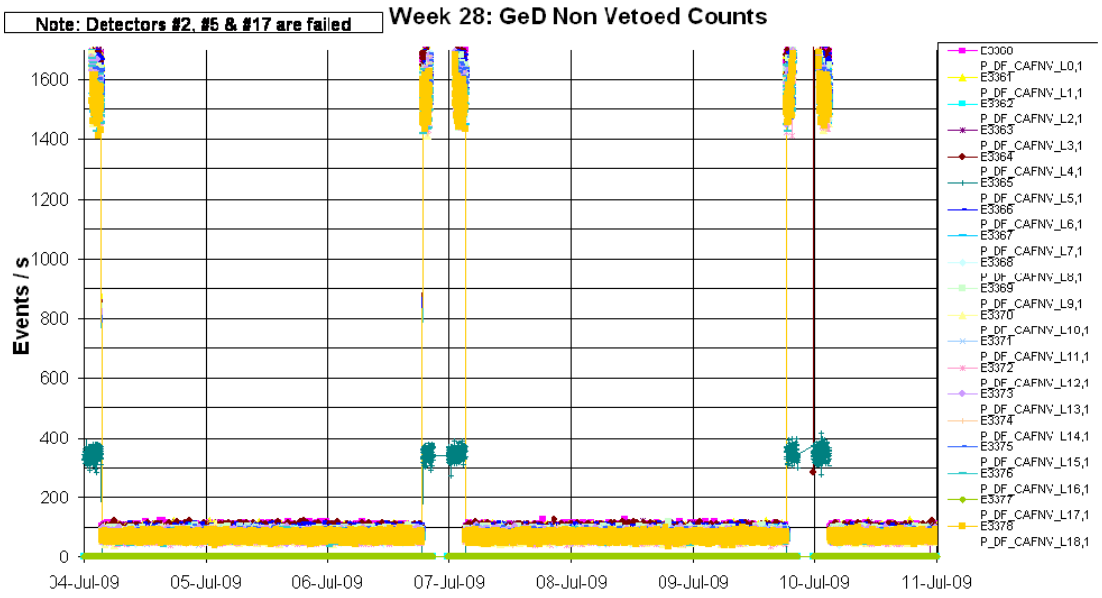
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). A plot of the ACS counts is given in Section 3.2.6.

[5] Data sampled every 8th packet (64sec)

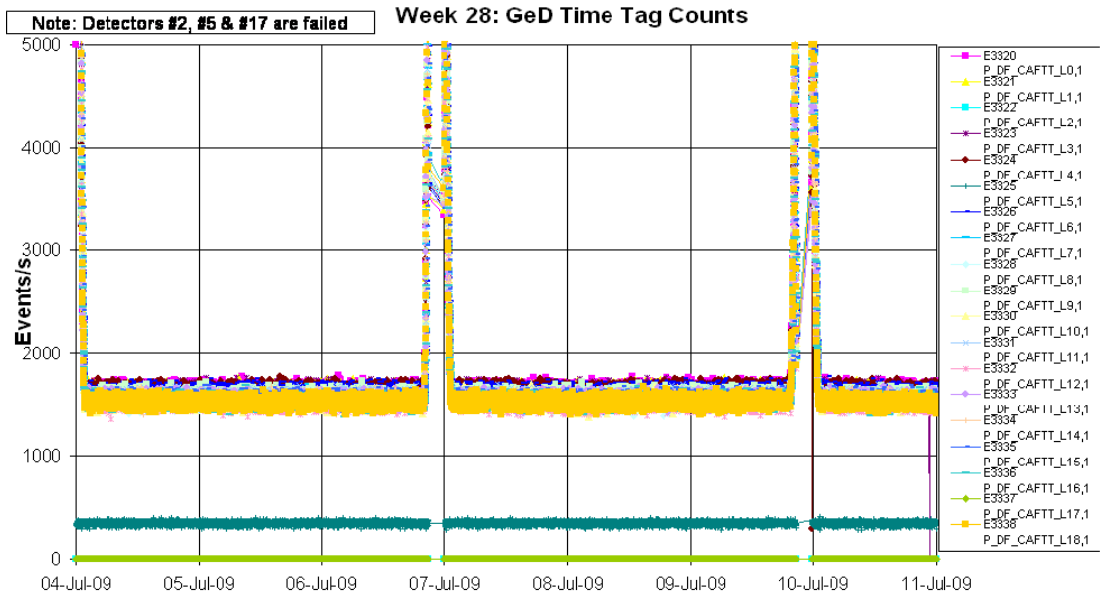
AFEE: The health of the AFEE is nominal. The following plot shows the dc output voltage of the detector channels during the reporting period[6]. The values are nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004 and detector #5 is failed since 19/02/2009. The HV of the failed detectors are nominally set to 0.5kV.

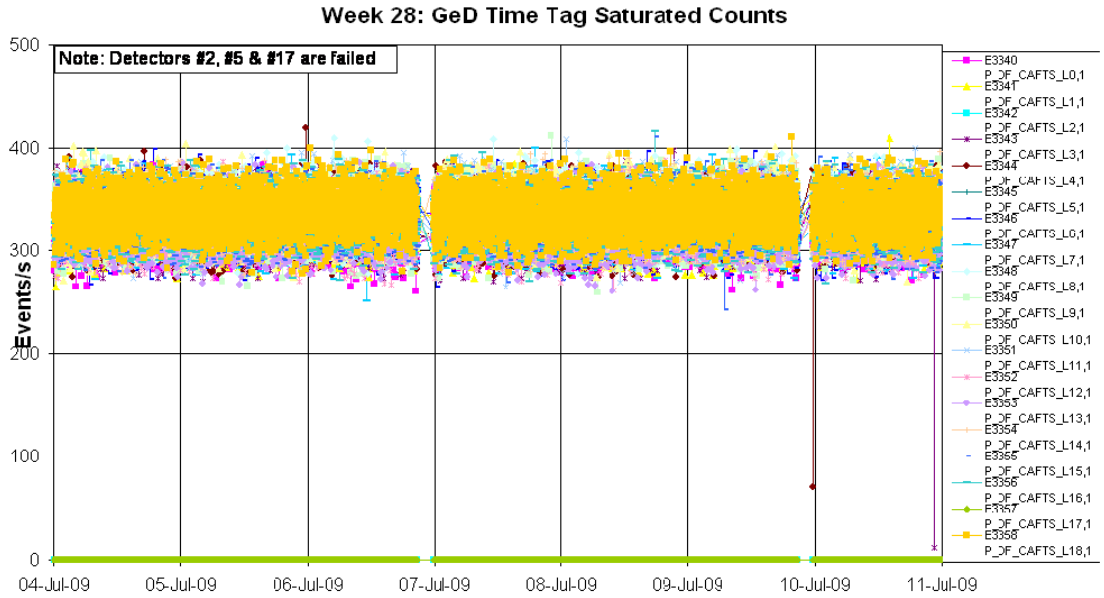


DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period[7]:



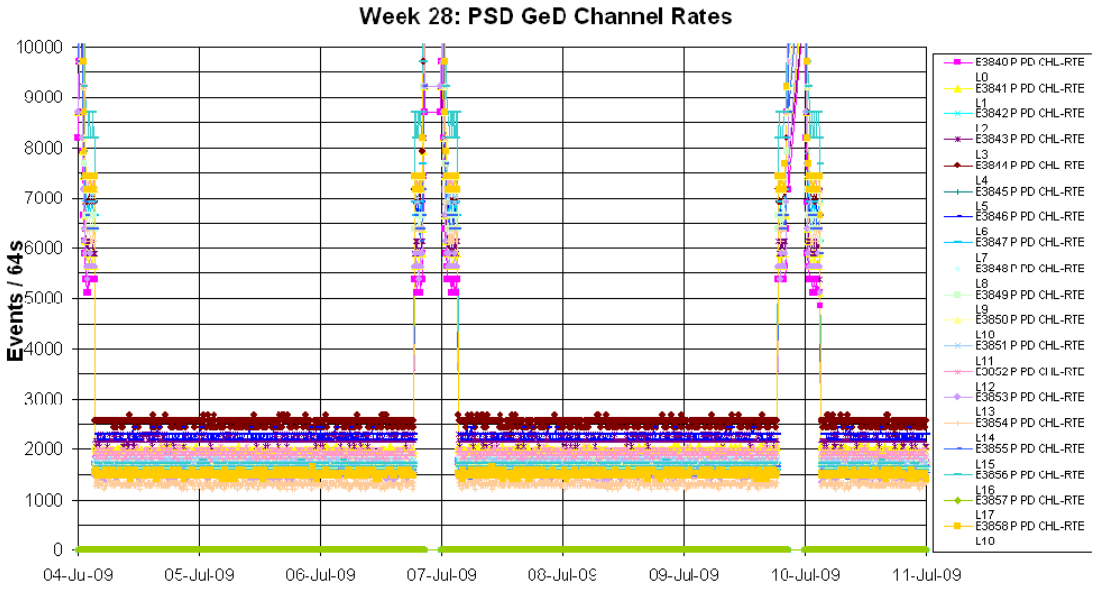
[6] Data sampled every 8th packet (64sec)
[7] Data sampled every 8th packet (64sec)





PSD: The overall health of the unit is nominal. The following plot shows the PSD channel rates over the reporting period[8]:

[8] Data sampled every 8th packet (64sec)

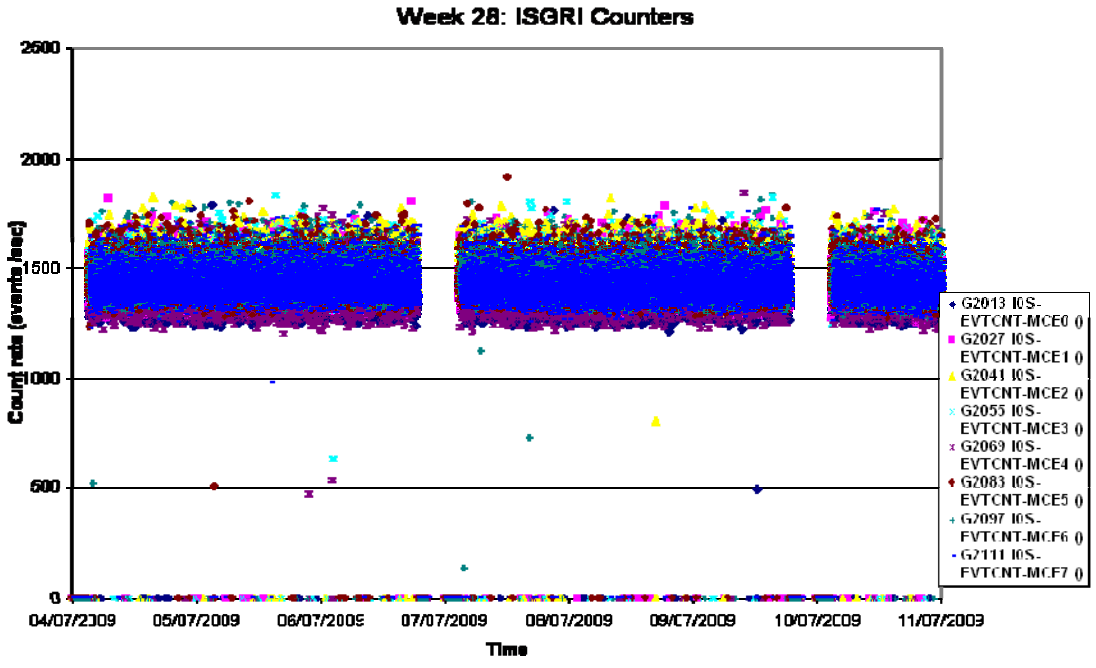


Event Log:
No non-nominal events occurred with SPI over the reporting period.

8.2.3 IBIS Operations

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

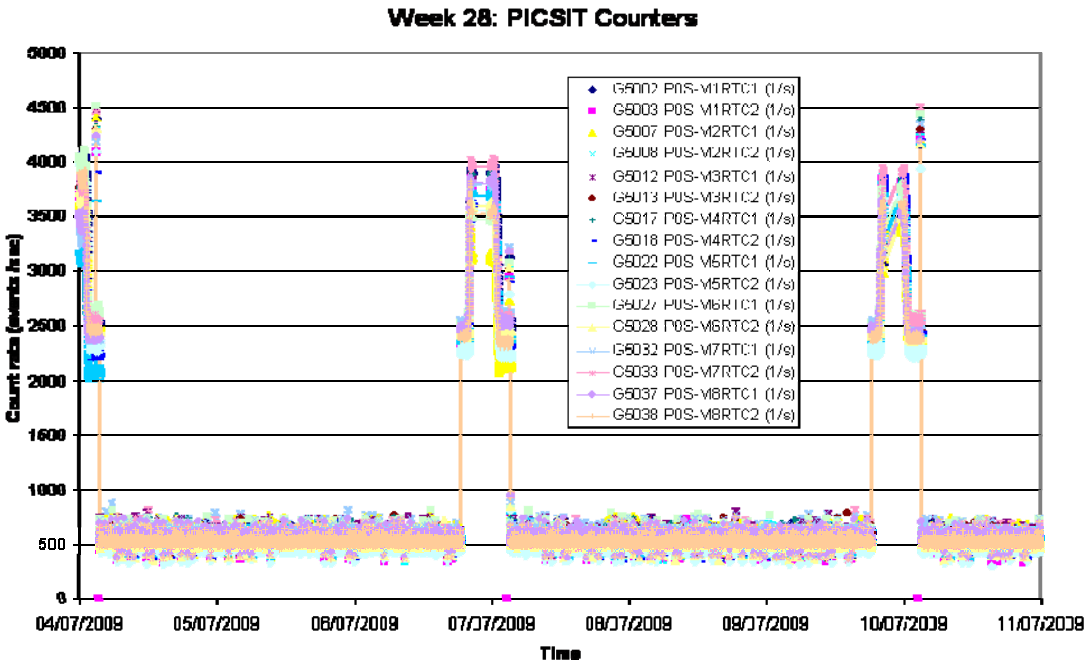
ISGRI
The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the week[9]:



[9] Data sampled every 4th packet (32sec)

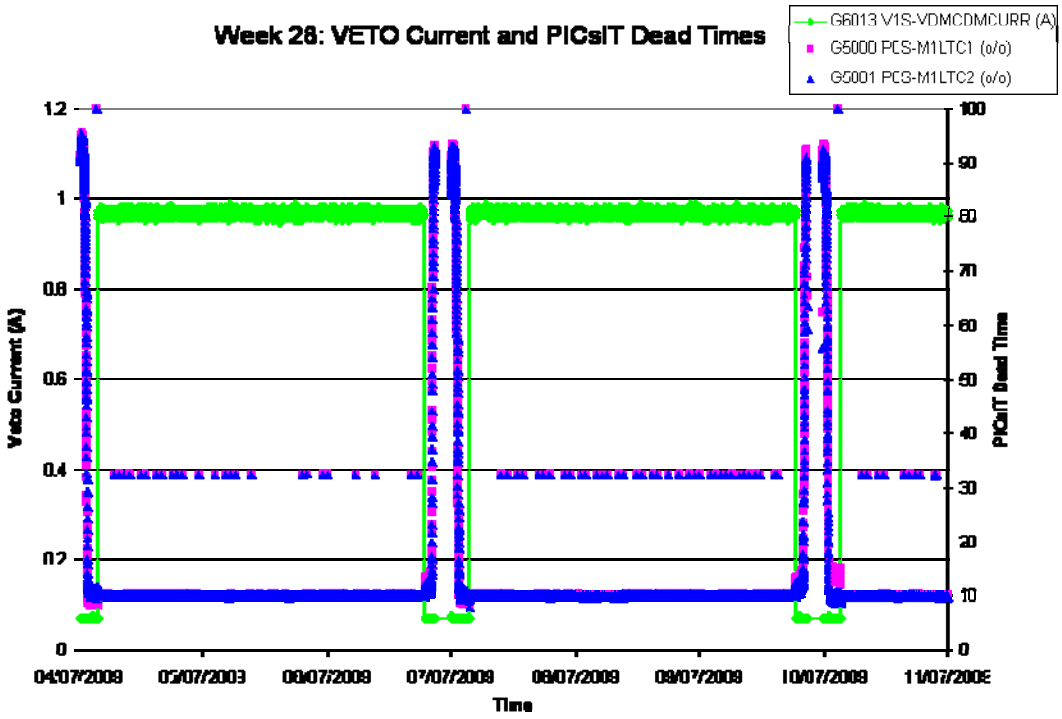
PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week[10] :



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 week[11] :



[10] Data sampled every 4th packet (32sec)
[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.

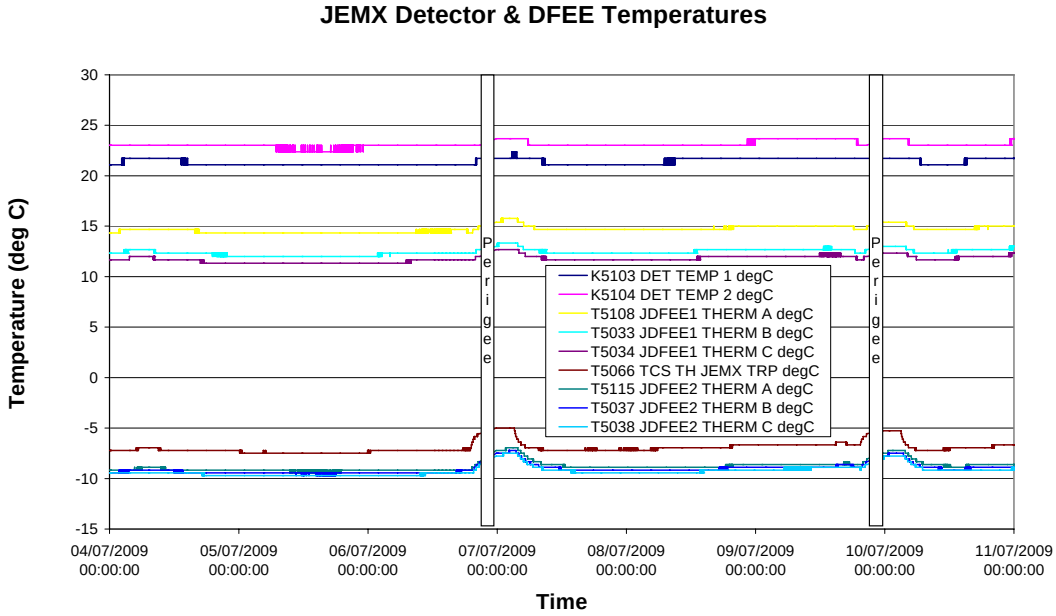
2009-07-04 (DOY 185, Rev 821) to 2009-07-10 (DOY 191, Rev 823)

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 graph[12].



JEM-X Daily Report

2009-07-04 (DoY 185 Rev 821) to 2009-07-10 (DoY 191 Rev 823)

JEM-X 1 operations executed nominally.

[12] Data sampled (1 frame in 8)

8.2.5 OMC Operations

2009-07-04 (DoY 185, Rev 821) to 2009-07-08 (DoY 189, Rev 822)

Nothing to report.

2009-07-09 (DoY 190, Rev 822)

At 17:46, a TM drop caused an AOCS command to fail its PTV. This led to a suspension of the Timeline. A recovery was performed, and the Timeline rejoined at 18:45. There was no impact, as this pointing 08220060 was dedicated to the Dark Current part of the OMC calibration.

2009-07-10 (DoY 191, Rev 823)

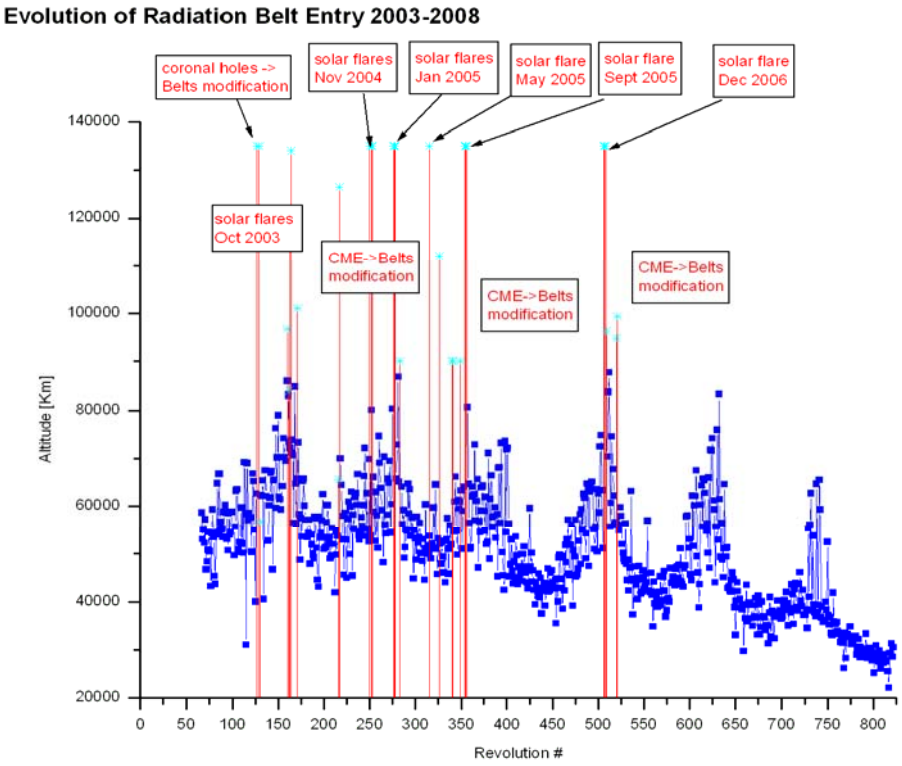
At 12:22, the IMU switched on, causing a delay in the start of pointing 08230011. The impact was that pointing was shortened from a planned 3572 to 3136 seconds.

At 20:37, an AOCS command timed out, forcing a suspension of the Timeline. A recovery was performed and the Timeline was recovered at 21:32. The impact was the loss of pointing 08230019.

On DoY 187 at 18:40:08 and DoY 190 at 18:29:36 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



IREM daily report

Nothing to report.

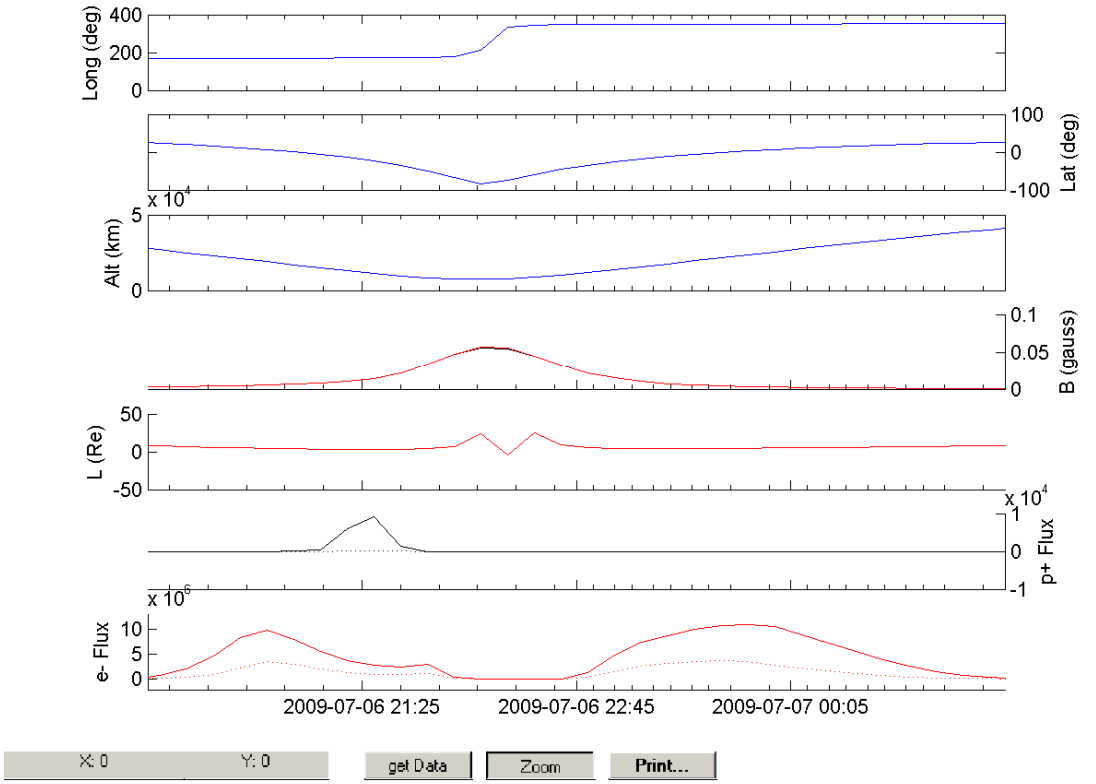
Electron Belts

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]
821	RAD_EXIT R 2009-07-04T03:20:08Z	04/07/2009 01:51:34	>>32808.1	04-Jul-2009 02:09:26	46595.05
821	RAD_ENTR R 2009-07-06T18:40:05Z	06/07/2009 20:02:31	28573.2	06-Jul-2009 19:49:26	30648.74
822	RAD_EXIT R 2009-07-07T03:10:11Z	07/07/2009 01:31:27	>>32805.7	07-Jul-2009 01:59:26	46647.64
822	RAD_ENTR R 2009-07-09T18:29:34Z	09/07/2009 19:47:51	30515.4	09-Jul-2009 17:23:26	32587.28
823	RAD_EXIT R 2009-07-10T03:00:12Z	10/07/2009 00:58:39	>>32777.4	09-Jul-2009 23:53:26	47610.02

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 821



Rev 822