

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 348
Week 21
25.05.09
Routine Phase

Prepared by: MJH. Walker (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 16.05.09 until 22.05.09 (both dates inclusive) and covers the revolutions 805 and 806.

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 3C 454.3 (RA 22:53:57.74, DEC +16:08:53.5), and 2 raster dithers of the Cygnus Region (RA 20:35:53.00, DEC +40:39:49.0).

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 16/05/2009 and 22/05/2009 was 0.0837 Kg. The remaining propellant is in the order of 134.2053 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

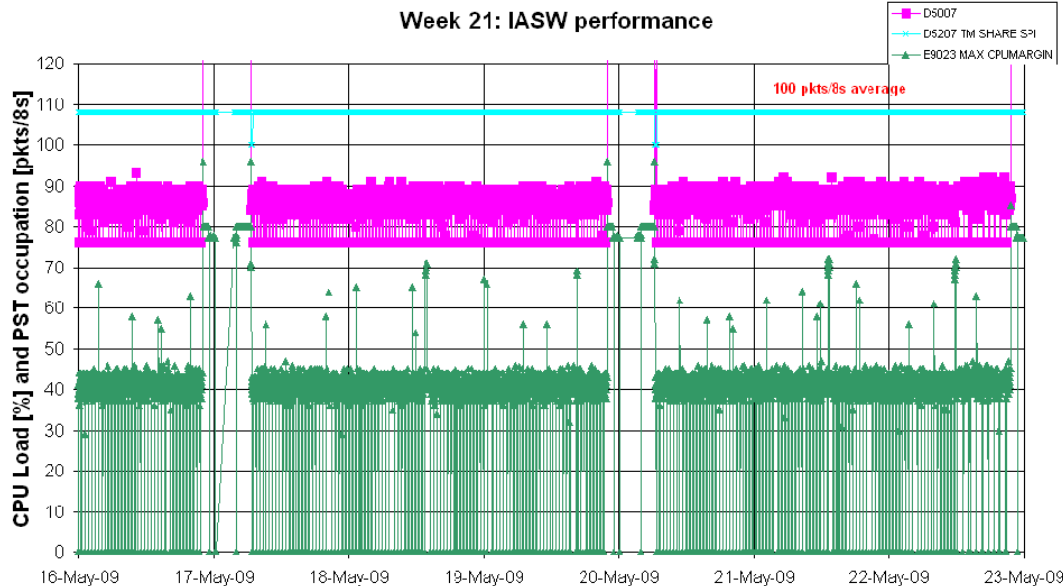
3.2.1 SPI

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).

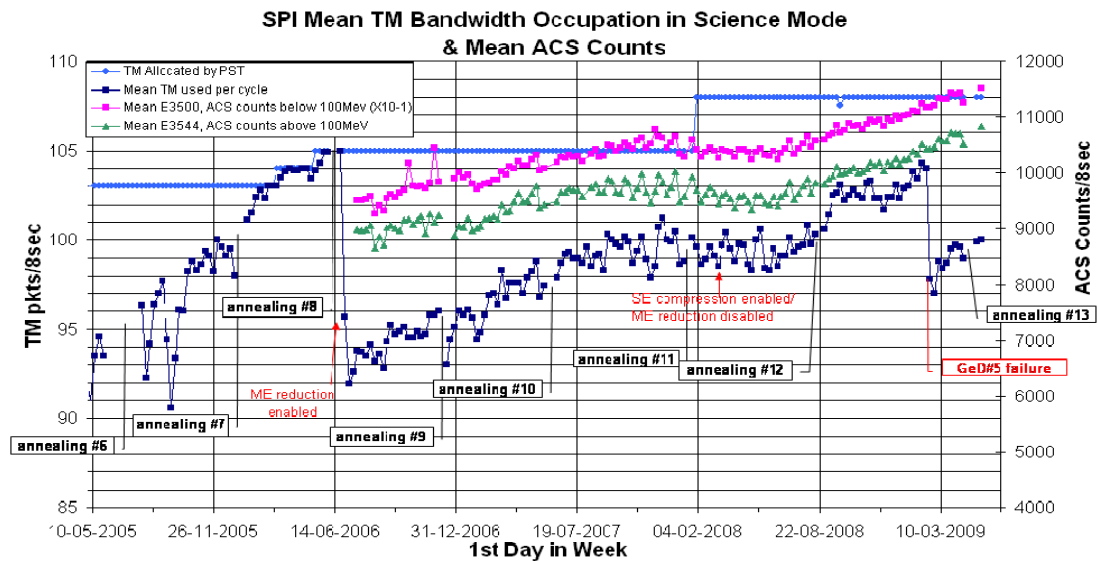
The Stirling compressors are working nominally. The Germanium detectors' temperature was kept in the range 80K+/-1K.

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 108 packets/cycle and the average telemetry occupation was 100 packets/cycle.

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



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.

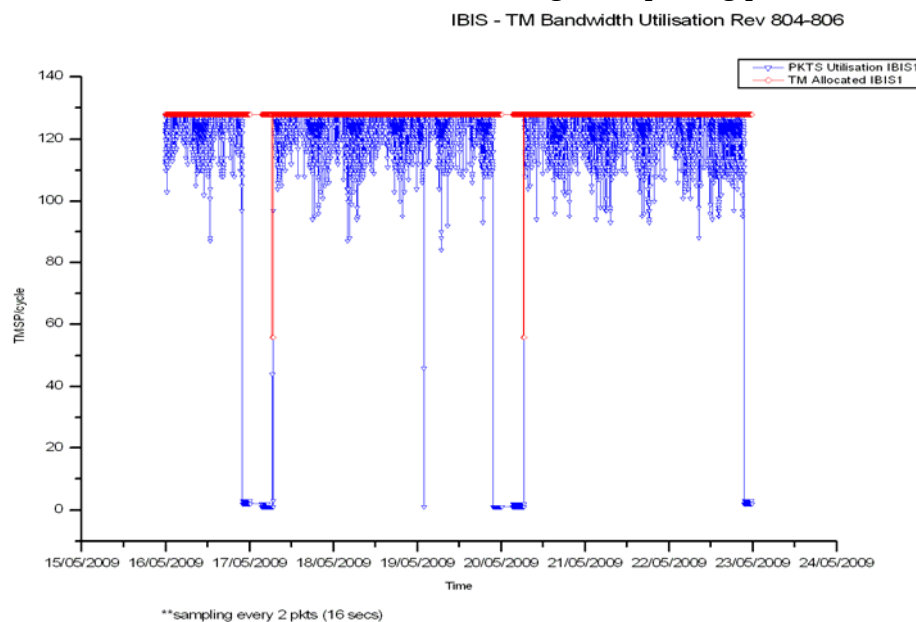
3.2.2 IBIS

The overall status of IBIS is nominal.

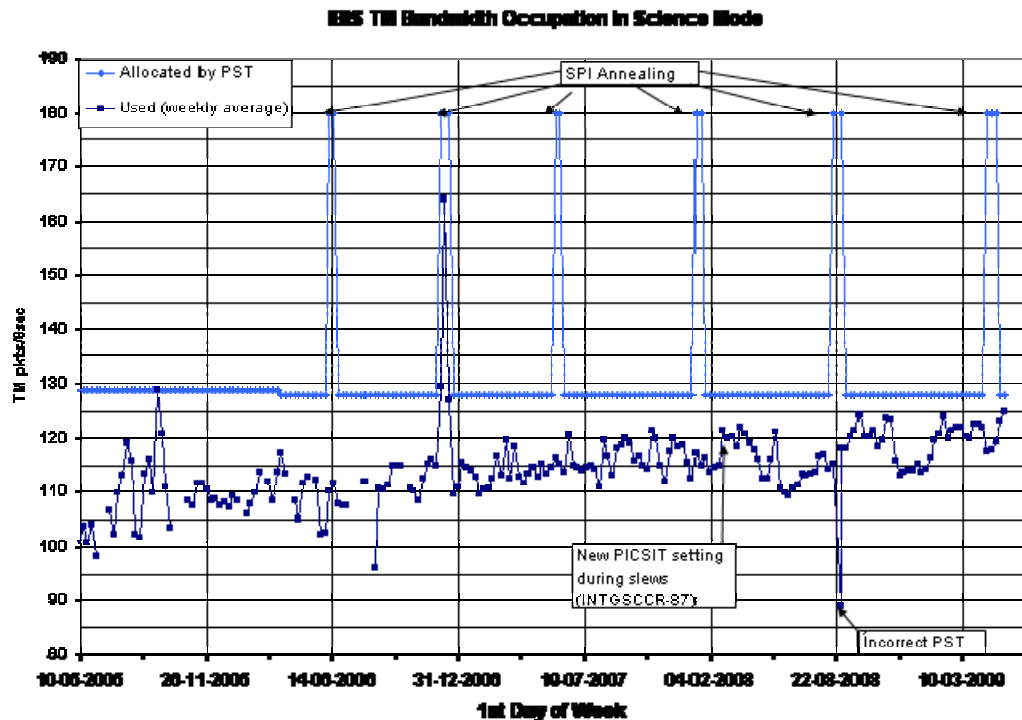
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 124.98 packets/cycle (up 1.61 on previous week)
- Percentage of TM cycles for which bandwidth usage was 128 packets/cycle: 58%

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



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 235 planned science pointings were executed nominally.

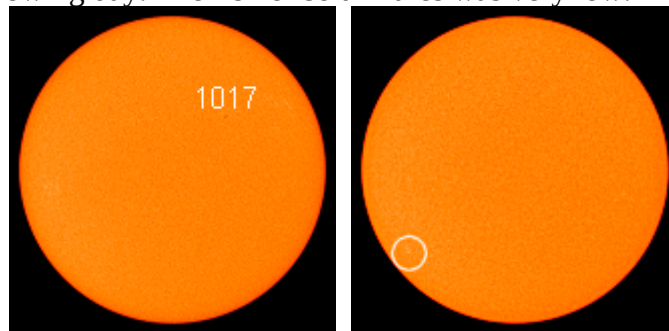
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

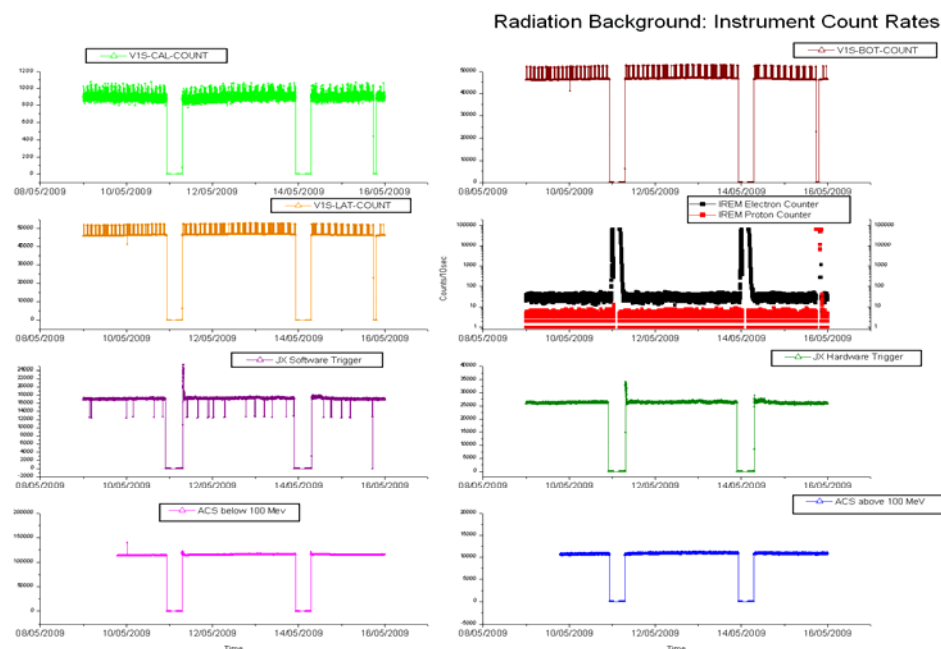
The observation period was characterised by low solar activity. Sun-spot #1017 was present at the start of the week, which remained until the 20th May, a small new spot appeared the following day. The risk of solar flares was very low.



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

3.2.6 Radiation Background

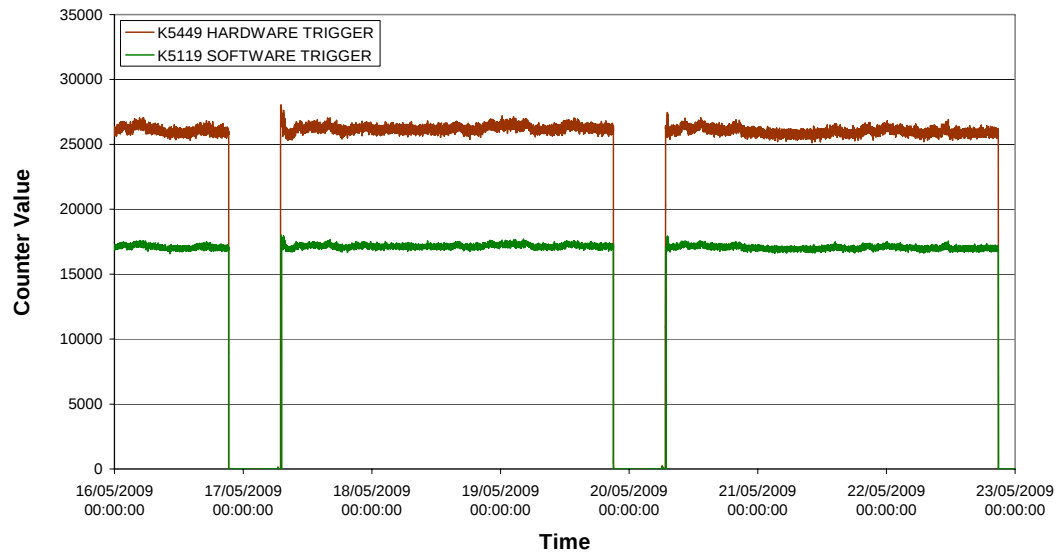
The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the week:



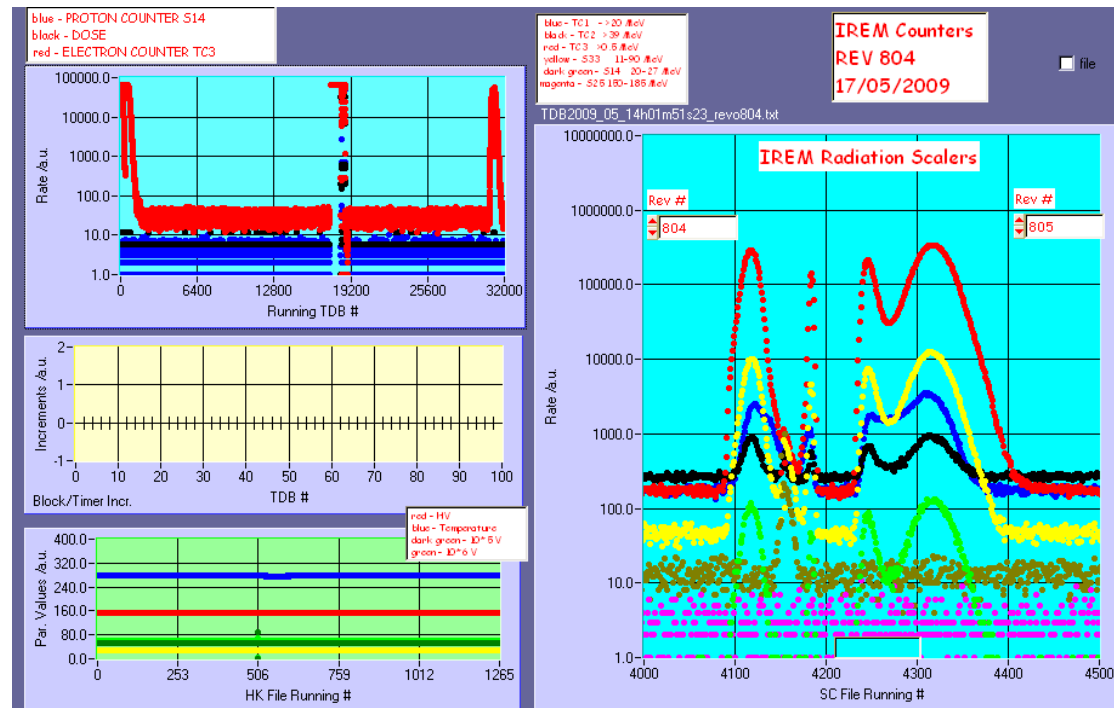
JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph¹.

JEMX-1 Count Rates



IREM radiation counters:



The IREM radiation counter plot for revolution 805 is not available.

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

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 were 3 occasions 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 much better this week, there were 3 occurrences of bad TM from VIL2, all without impact.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 810 to 813.

New observations have been planned for revolutions 807 to 809, including AOCS calibrations in revolution 808.

New TSFs have been received for revolutions 806 and 807.

2. Observation status

A new ECS files has been received for revolution 797. The files for revolution 795 and 796 are being awaited.

3. ISOC Science Data Archive

No news.

4. ISOC system

ISOC system V22 has been released on 19 May, preparing the opening of the second phase of AO-7.

5. Problems

No new problems.

5 Special Events

6 Anomalies

The following anomaly report was entered into the ARTS system this week.

AR id	Date Created	Subject	Segment	Status
INT-3065	2009-05-15	IMCA: Verifier crashed (DOY 135)	IMCS	Closed

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, 16/05/2009 – 22/05/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 139 Open Loop Slews, 105 Closed Loop Slews and 4 Momentum Biases were executed (as reported by ACC OEM).

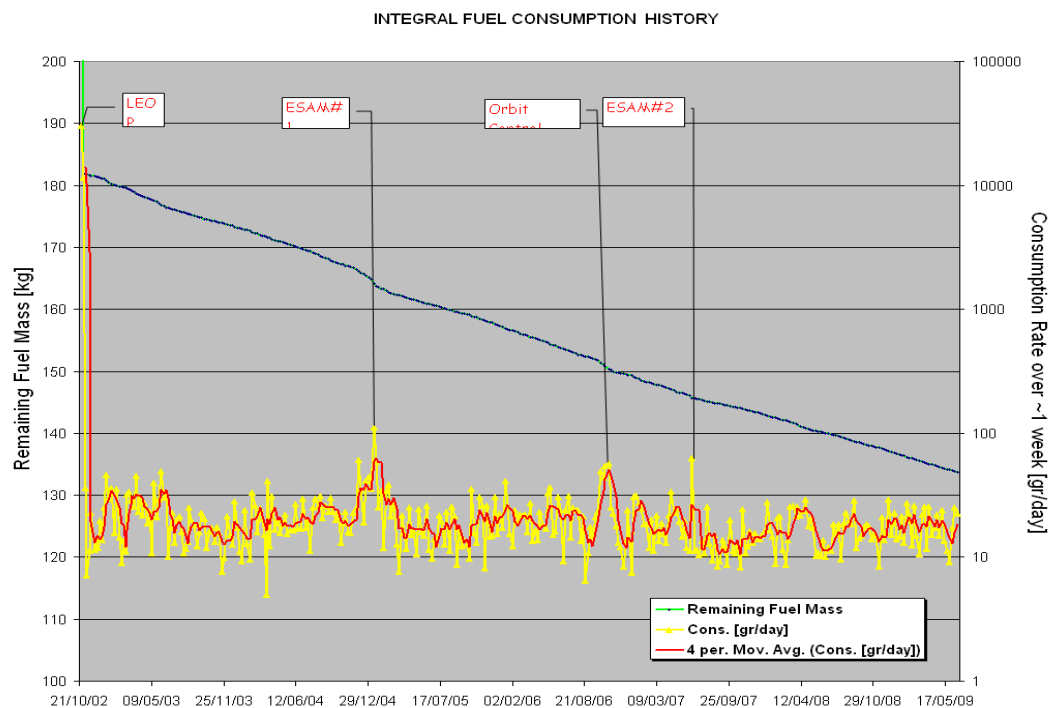
No slews were missed from TL, during the observation period.

Orbit Control

No update.

Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 22/05/2009 is reported in the plot below.

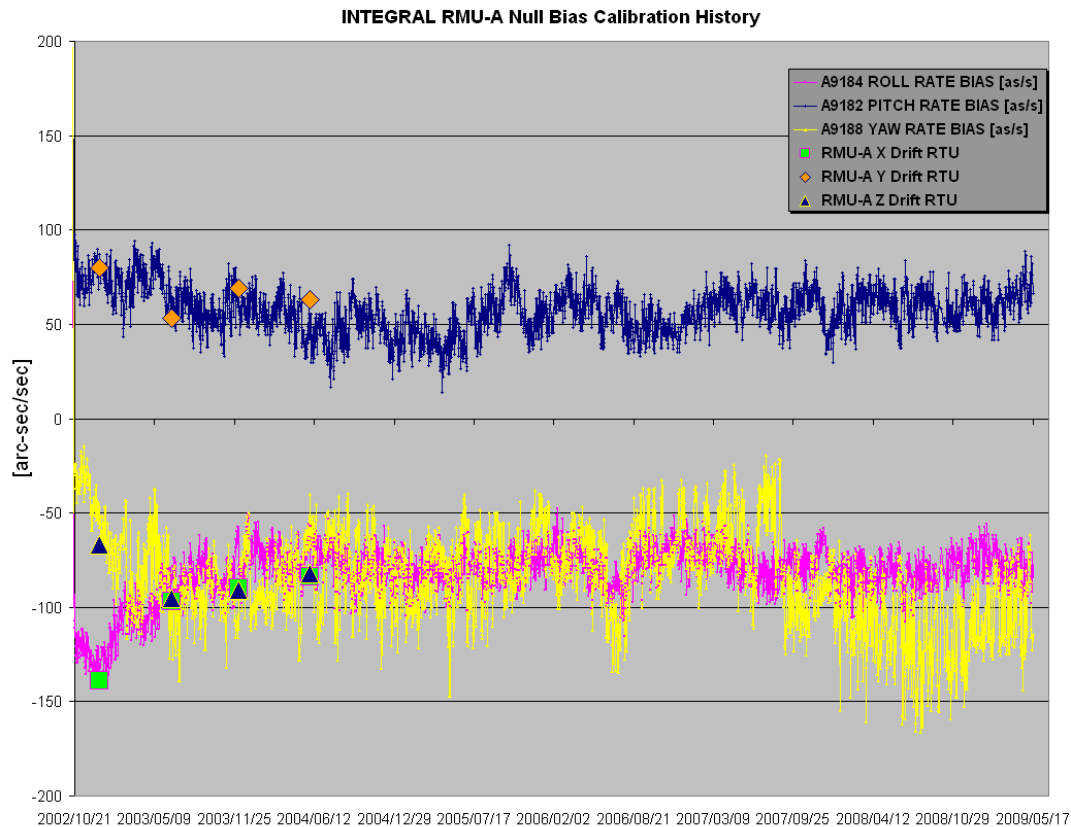


The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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 22/05/2009 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.



16/05/2009 (Day of Year 136, Revolution 804)

Nothing to report.

17/05/2009 (Day of Year 137, Revolution 804-805)

Nothing to report.

18/05/2009 (Day of Year 138, Revolution 805)

Nothing to report.

19/05/2009 (Day of Year 139, Revolution 805)

Problem at VILSPA station: at 20:03z the last part of the AESAM sequence failed release. A TM and TC drop in VILSPA station caused the sequence to fail.

A manual recovery was performed and the next slew 08050104 was manually updated in TL.

No impact on TL.

20/05/2009 (Day of Year 140, Revolution 805-806)

Nothing to report.

21/05/2009 (Day of Year 141, Revolution 806)

Nothing to report.

22/05/2009 (Day of Year 142, Revolution 806)

Nothing to report.

8.2.2 SPI Operations

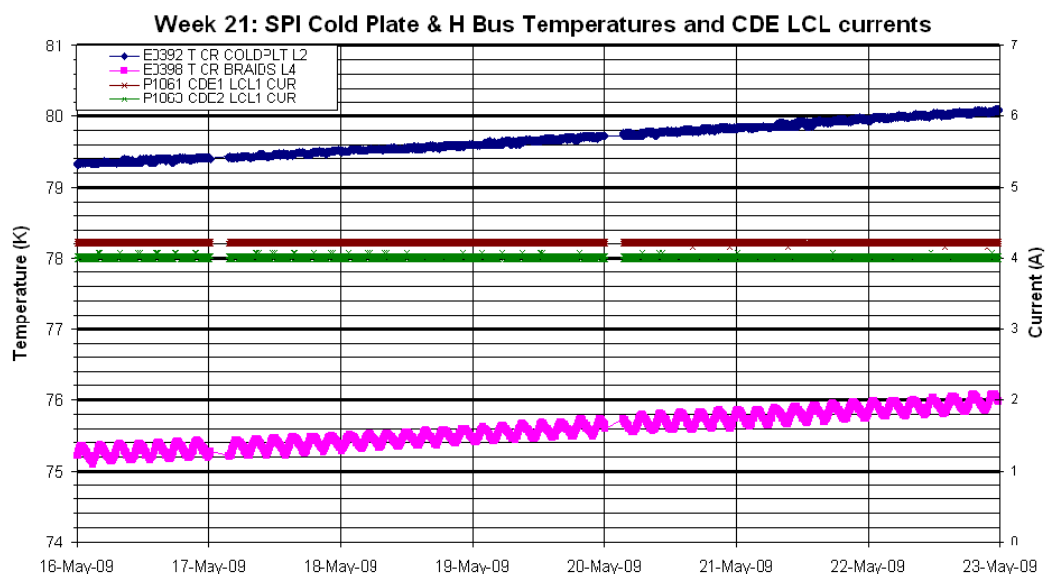
Unit Temperatures: All the equipment temperatures are inside the operational limits.

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

- CDE1 LCL Current = 4.22A
- CDE2 LCL Current = 4.02A

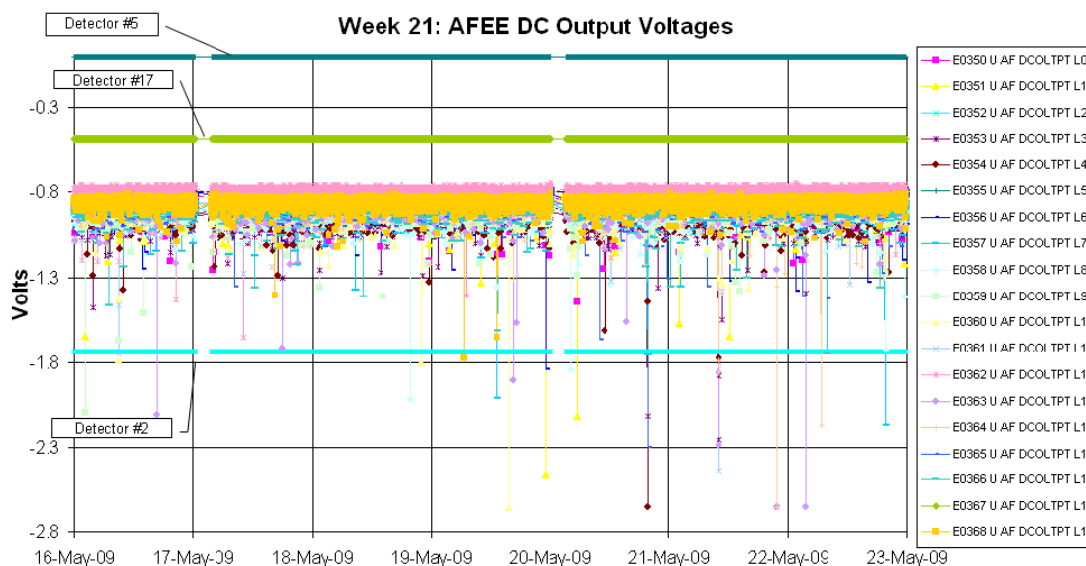
The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period:



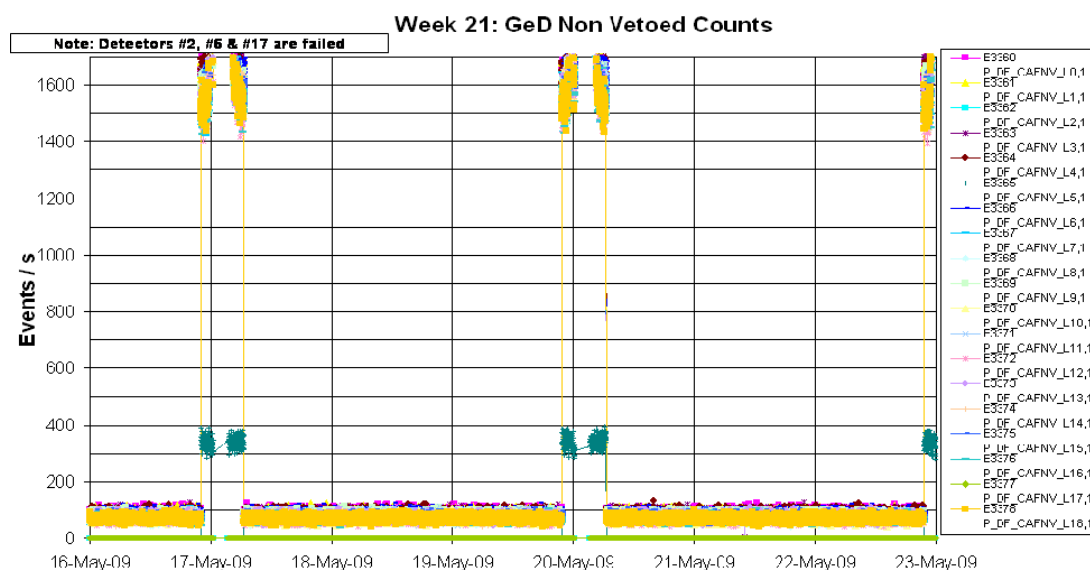
DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

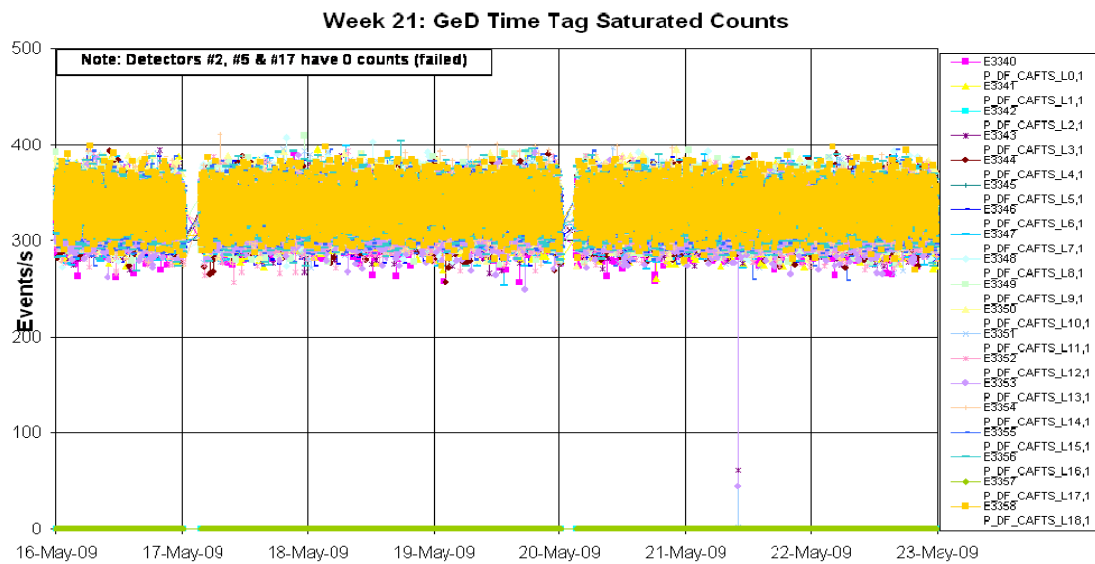
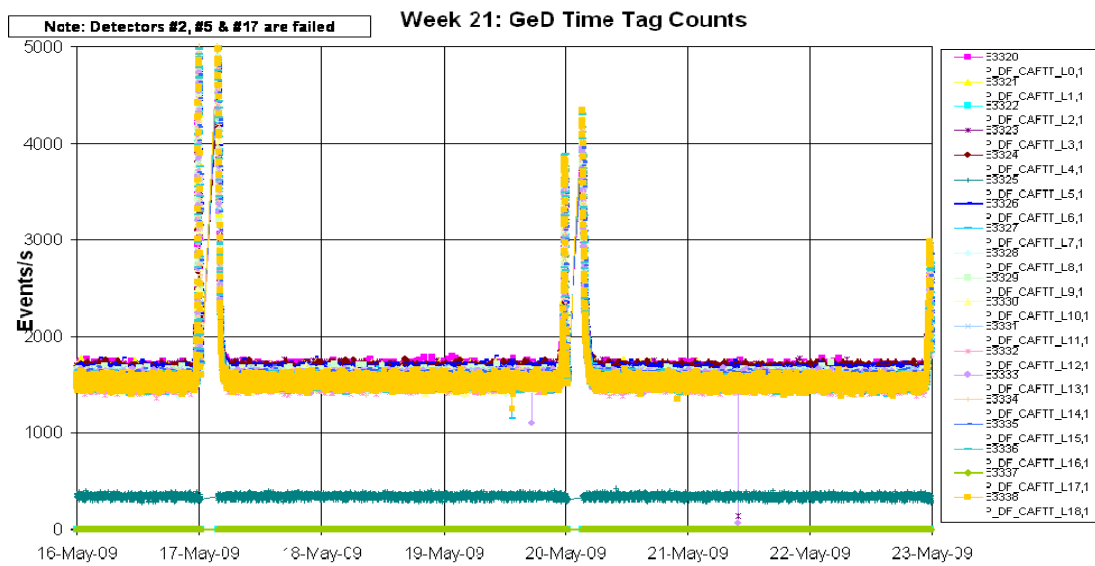
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). A plot of the ACS counts is given in Section 3.2.6.

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

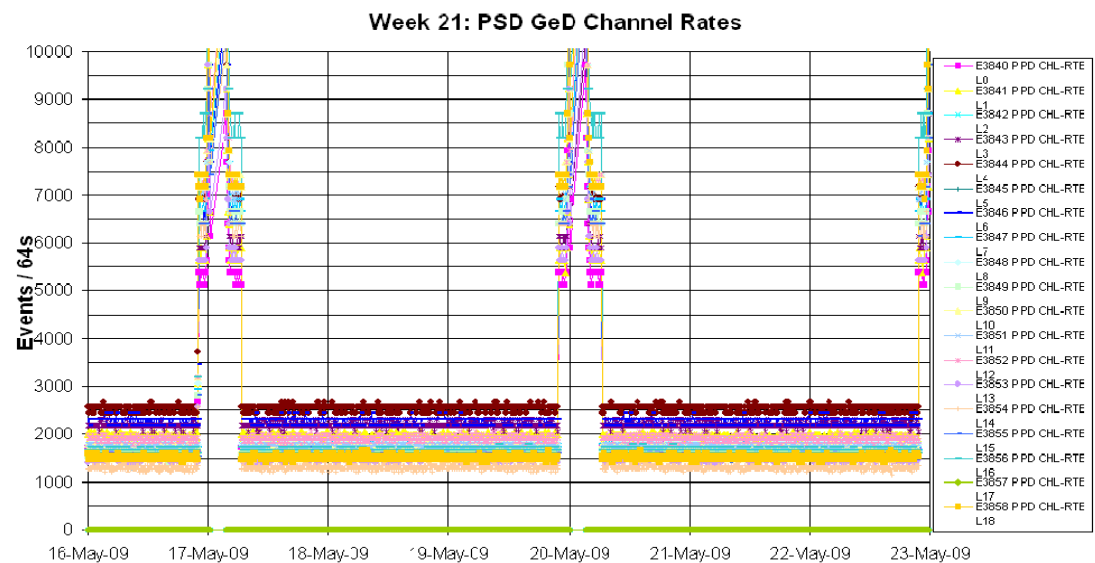


DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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



Event Log:

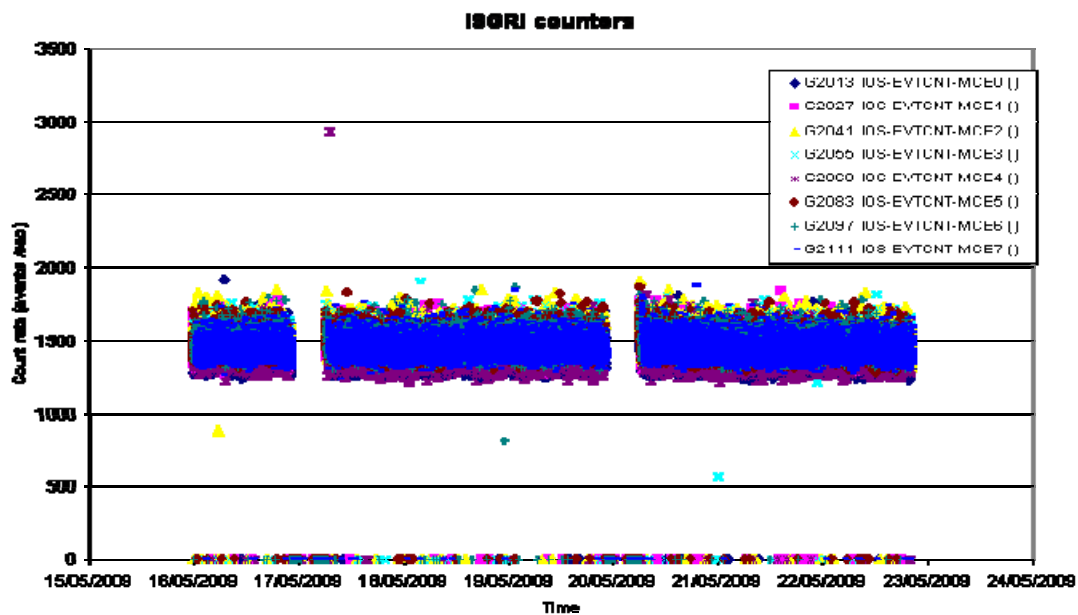
- No non-nominal events occurred with SPI over the reporting period.

8.2.3 IBIS Operations

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

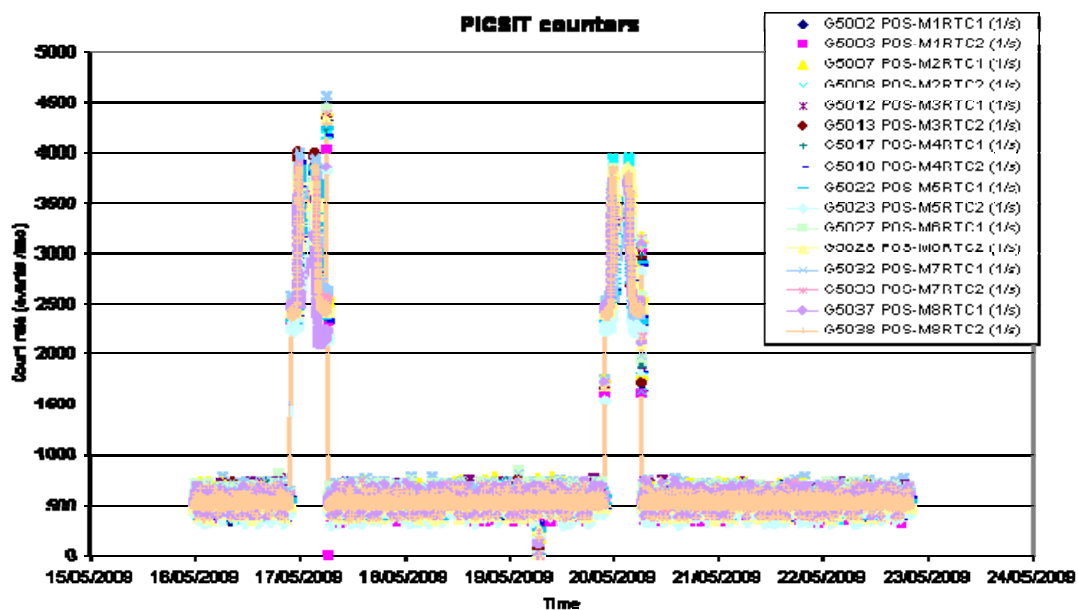
ISGRI

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



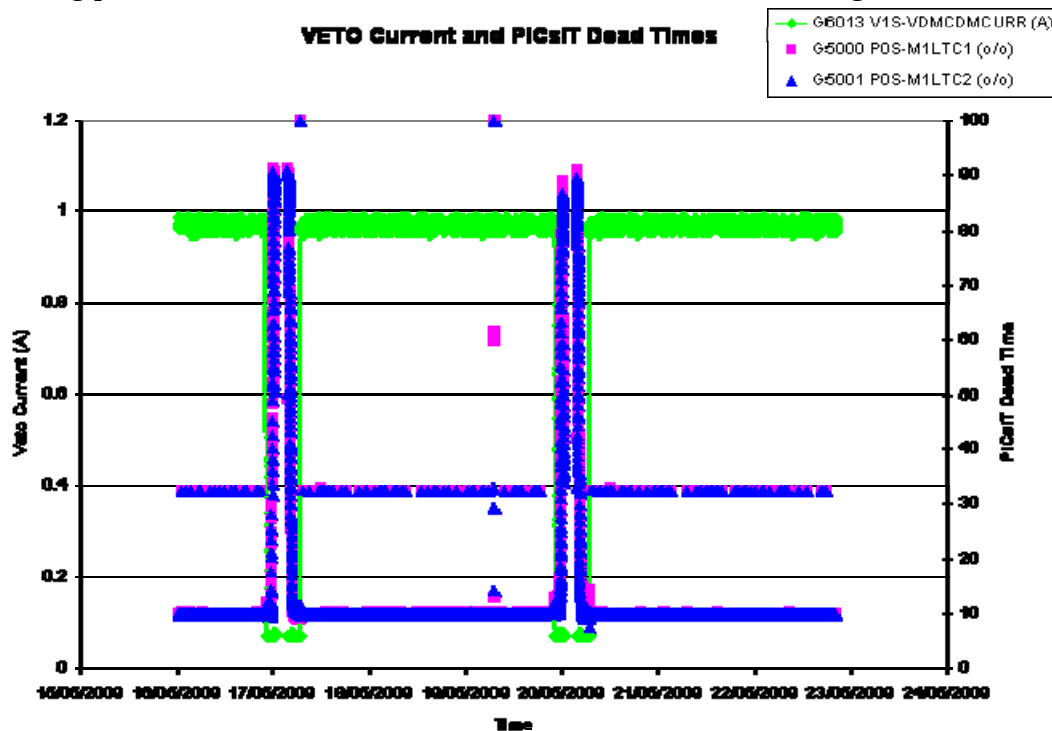
PICsIT

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



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:



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.

TM parameter G6061 went OOL Warning Low several times during the week. This is the VETO calibration counter. As in each case it returned within limits of its own accord at the next TM cycle, 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.

2009-05-16 (DOY 136, Rev 804) to 2009-05-18 (DOY 138, Rev 805)

IBIS operations executed nominally.

2009-05-19 (DOY 139, Rev 805)

At 01:07Z, 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:

- 01:57:34Z FCP_IBIS1_0312
 - 01:58:45Z TC G0129 uplinked to return IBIS to Science Standard mode.
- IBIS operations continued nominally.

At 06:57:12Z a few parameters of the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 06:57:47Z the TM parameter families G5002 and G5003 for the PDM semi-module counters went OOL Low. As they had all returned within limits of their own accord by 06:58:27Z, no action was taken.

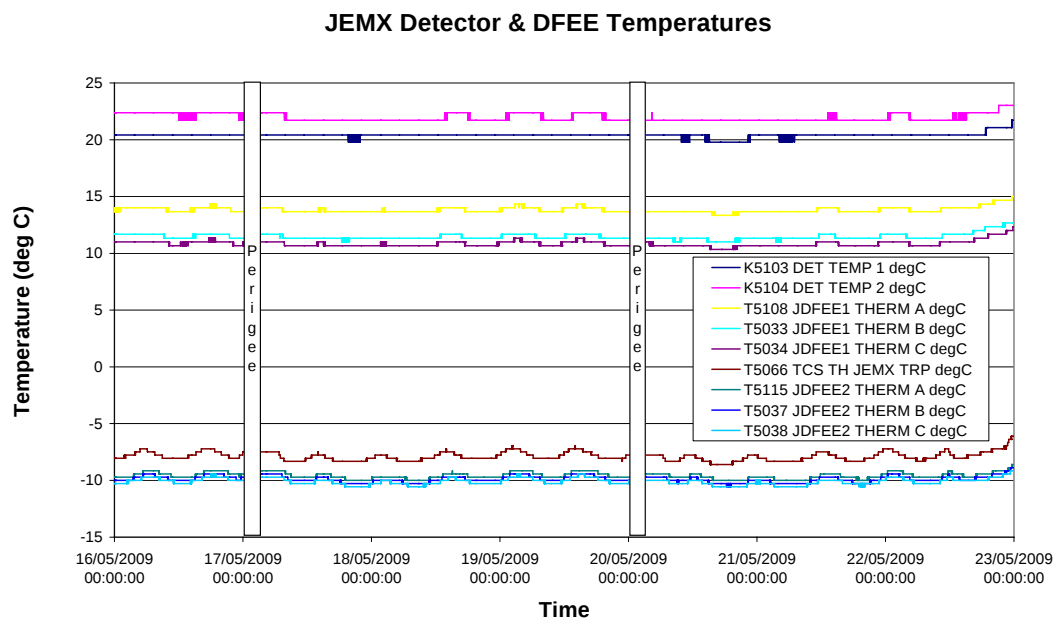
2009-05-20 (DOY 140, Rev 805-806) to 2009-05-22 (DOY 142, Rev 806)

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 graph².



JEM-X Daily Report

2009-05-16 (DoY 136 Rev 804) to 2009-05-22 (DoY 142 Rev 806)

JEM-X 1 operations executed nominally.

8.2.5 OMC Operations

2009-05-16 (DoY 136, Rev 804) to 2009-05-22 (DoY 142, Rev 806)

Nothing to report.

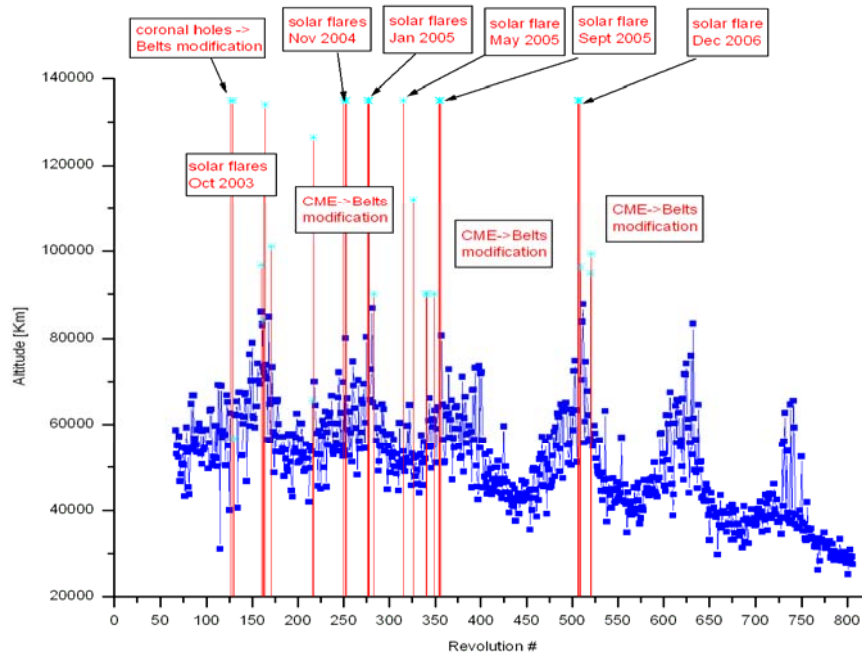
² Data sampled (1 frame in 8)

On DoY 136 at 22:03:01, DoY 139 at 21:50:05 and DoY 142 at 21:36:45 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]
804	RAD_ENTR R 2009-05-16T22:02:53Z	16/05/2009 23:33:08	27848.0	16-May-2009 23:03:50	32035.53
805	RAD_EXIT R 2009-05-17T06:37:21Z	17/05/2009 05:02:44	>>36142.8	17-May-2009 05:23:50	46543.73
805	RAD_ENTR R 2009-05-19T21:50:01Z	19/05/2009 23:11:00	29321.3	19-May-2009 22:46:59	32848.21
806	RAD_EXIT R 2009-05-20T06:24:36Z	20/05/2009 04:51:08	>>36136.0	20-May-2009 05:16:59	47384.64
806	RAD_ENTR R 2009-05-22T21:36:44Z	22/05/2009 23:00:28	27515.6	22-May-2009 22:36:59	32562.51

Reference

High radiation

Very small error vs reference (less than 10 minutes)

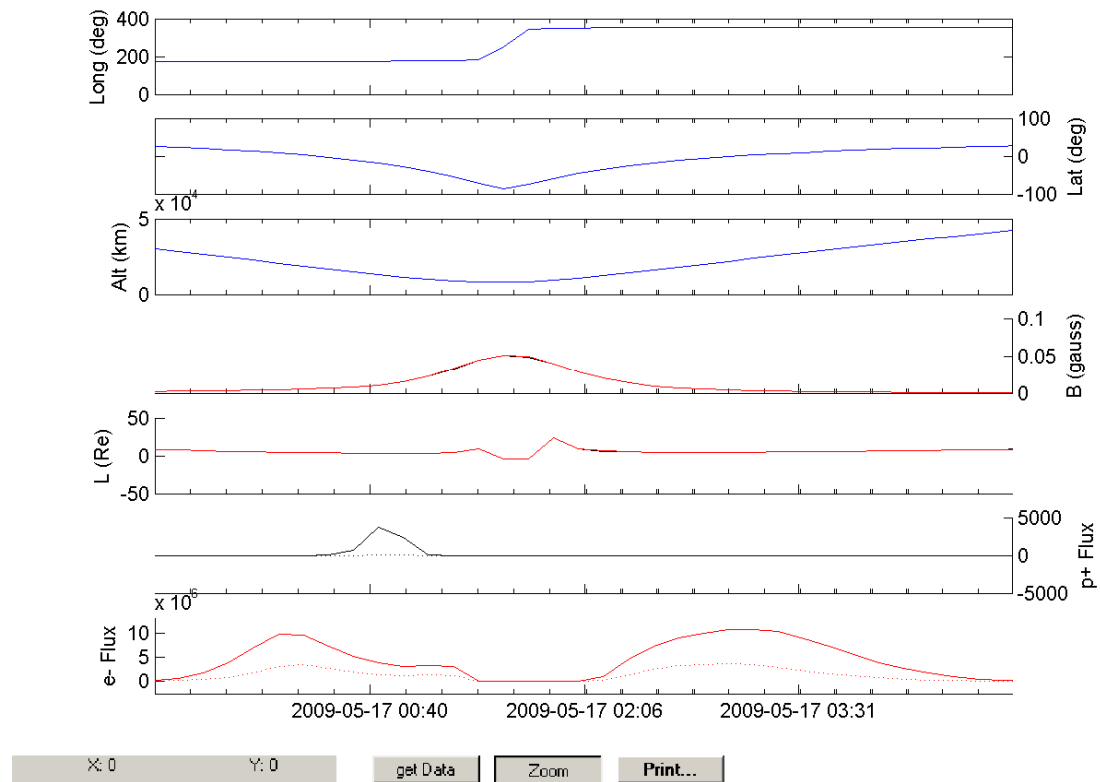
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

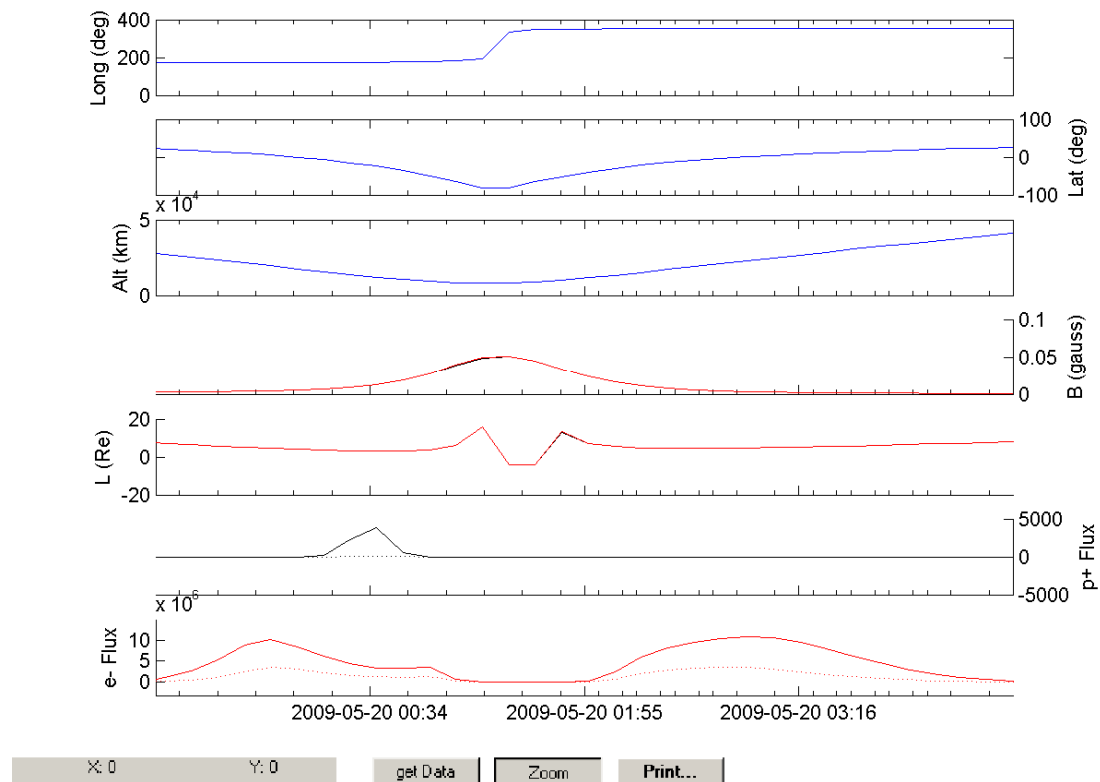
Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM Predicted Radiation Belt Passages

Rev 804



Rev 805



Rev 806

