

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 353
Week 26
29.06.09
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 20.06.09 until 26.06.09 (both dates inclusive) and covers the revolutions 816 and 817.

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 47 Tuc and SMC (RA 00:53:55.20, DEC -72:26:42.0) and a raster dither of the Virgo Cluster (RA 12:26:32.10, +12:43:24.0).

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 20/06/2009 and 26/06/2009 was 0.1216 Kg. The remaining propellant is in the order of 133.5678 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

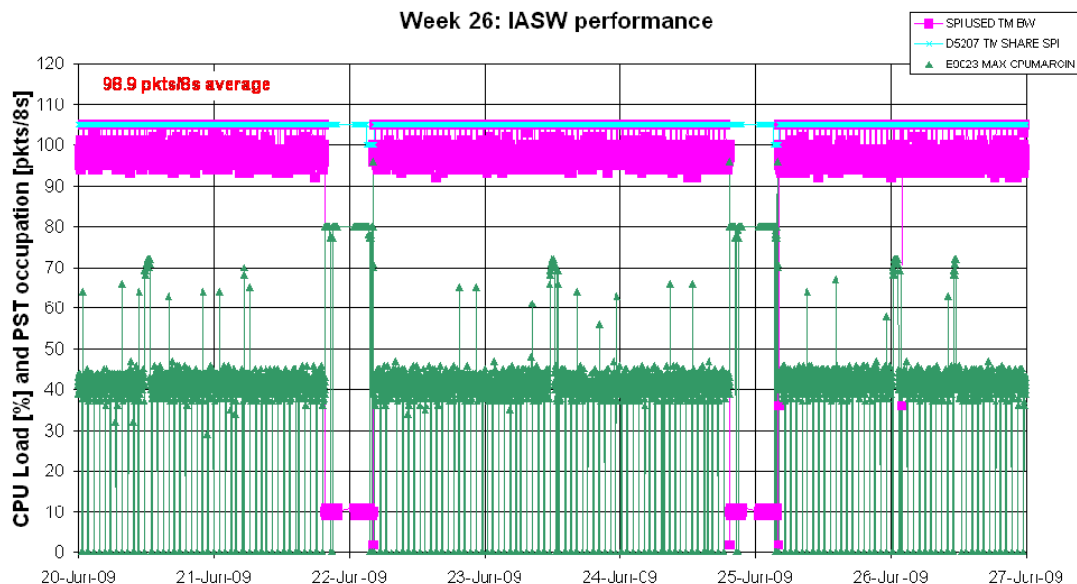
3.2.1 SPI

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.

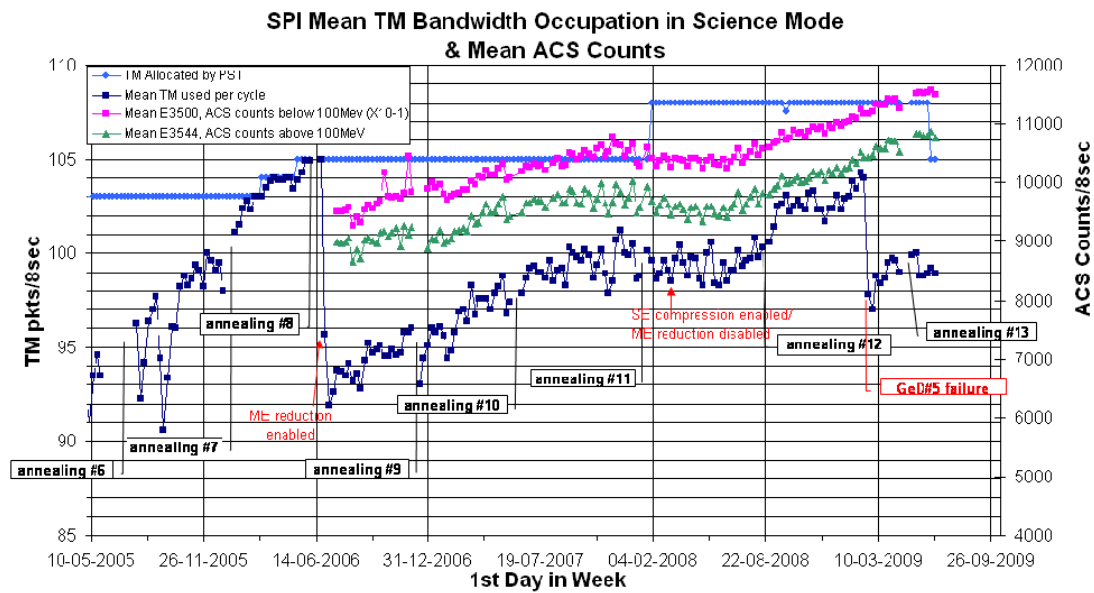
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 105 and the average telemetry occupation was 98.9 packets/cycle.

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.

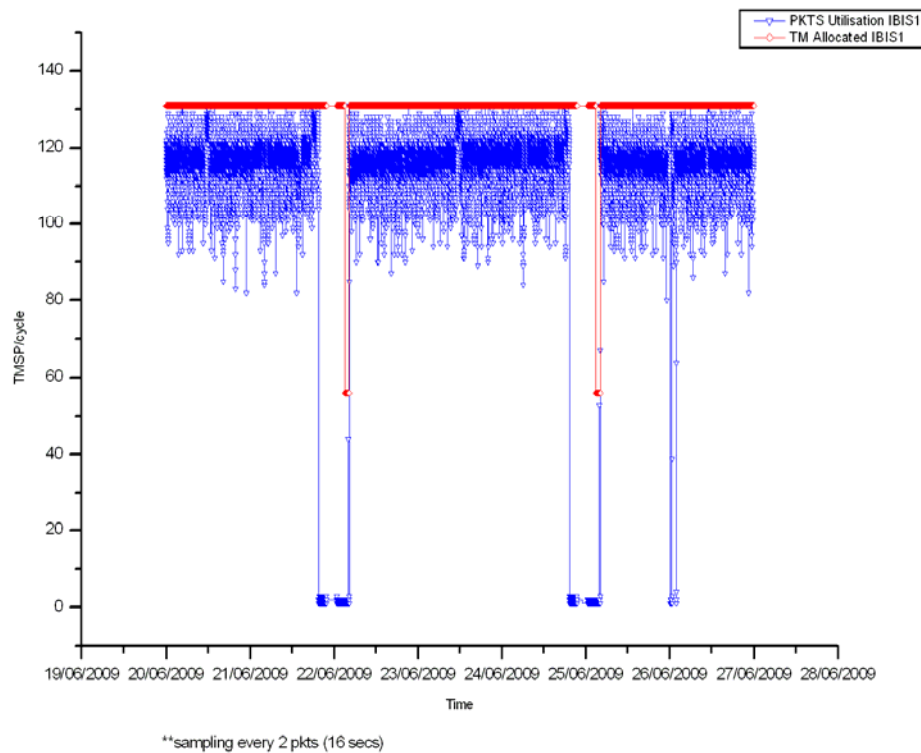
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 131 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 116.4 packets/cycle (down 0.18 on previous week)
- Percentage of TM cycles for which bandwidth usage was 131 packets/cycle: 0.26%

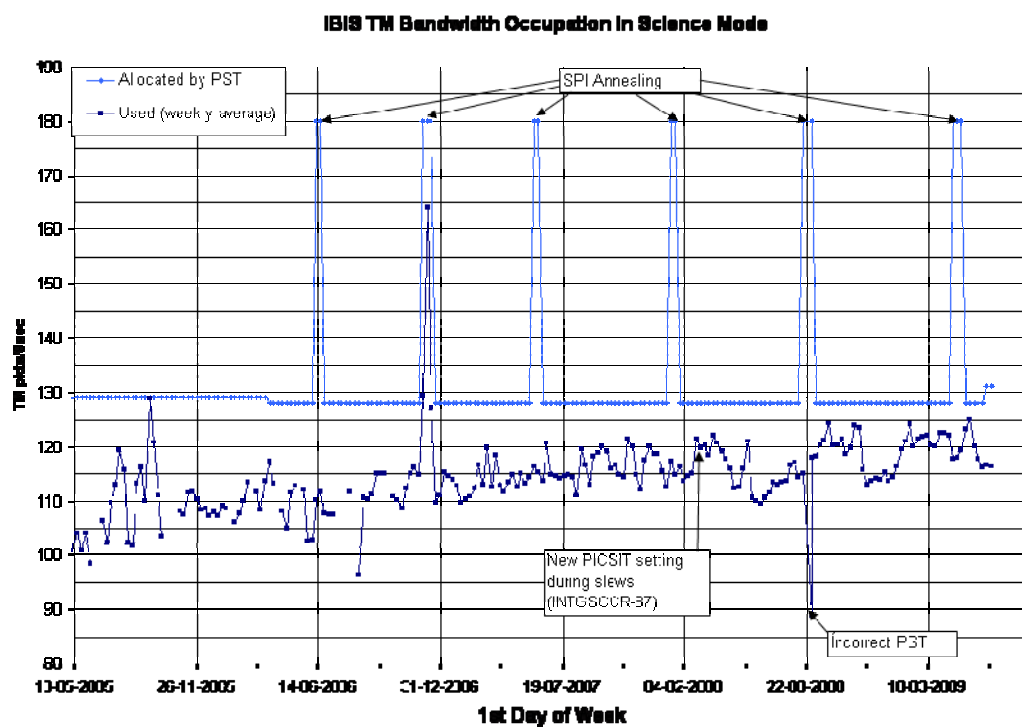
The plot below shows the IBIS TM utilisation during the reporting period²:

² Data sampled every 2nd packet (16sec)

IBIS - TM Bandwidth Utilisation Rev 816-818



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 142 planned science pointings were executed nominally.

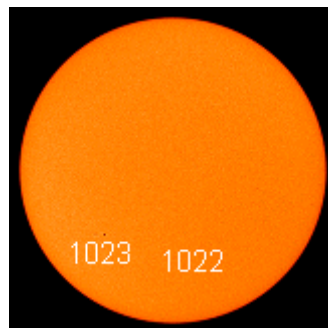
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

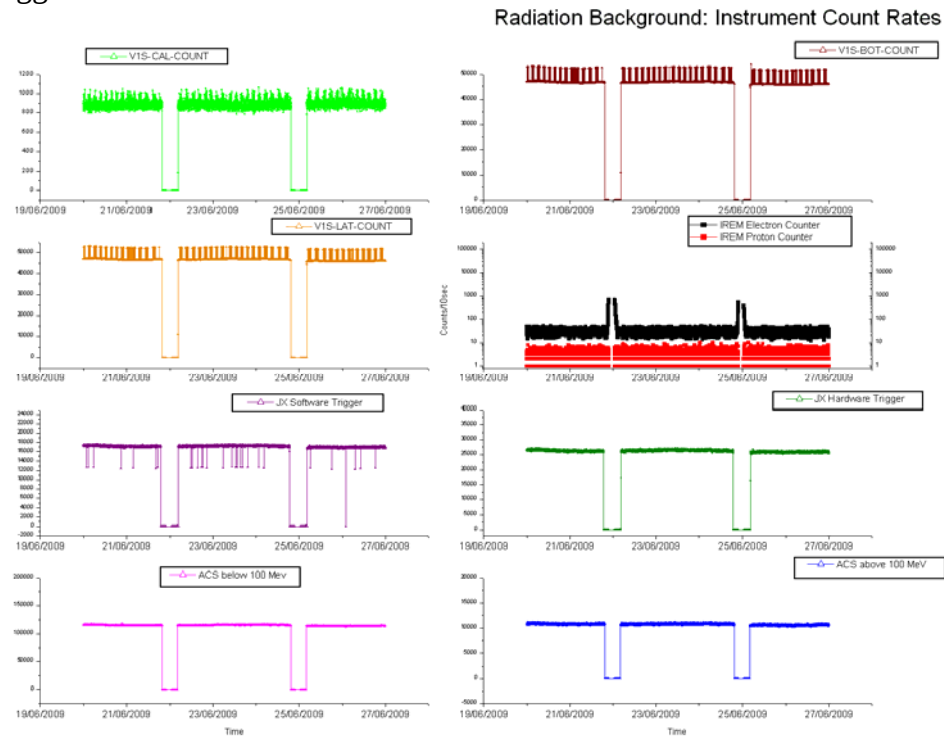
The observation period was characterised by low solar activity. At the start of the week, the sun was blank. Two small sun-spots emerged on the 22nd June. Sun-spot #1022 had disappeared by the 24th, and #1023 by the 26th (Friday). The risk of solar flares was very low.



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

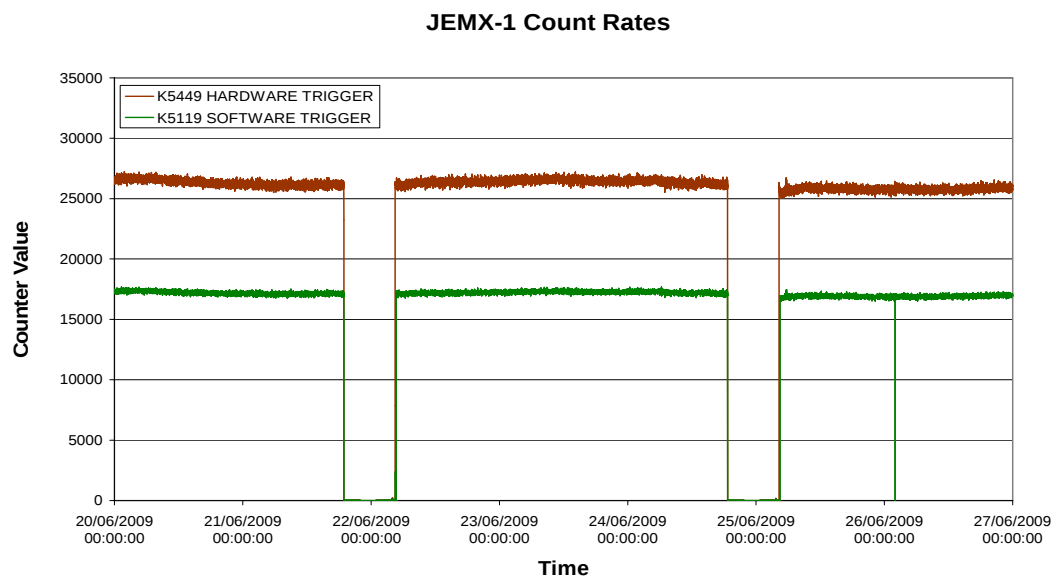
3.2.6 Radiation Background

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

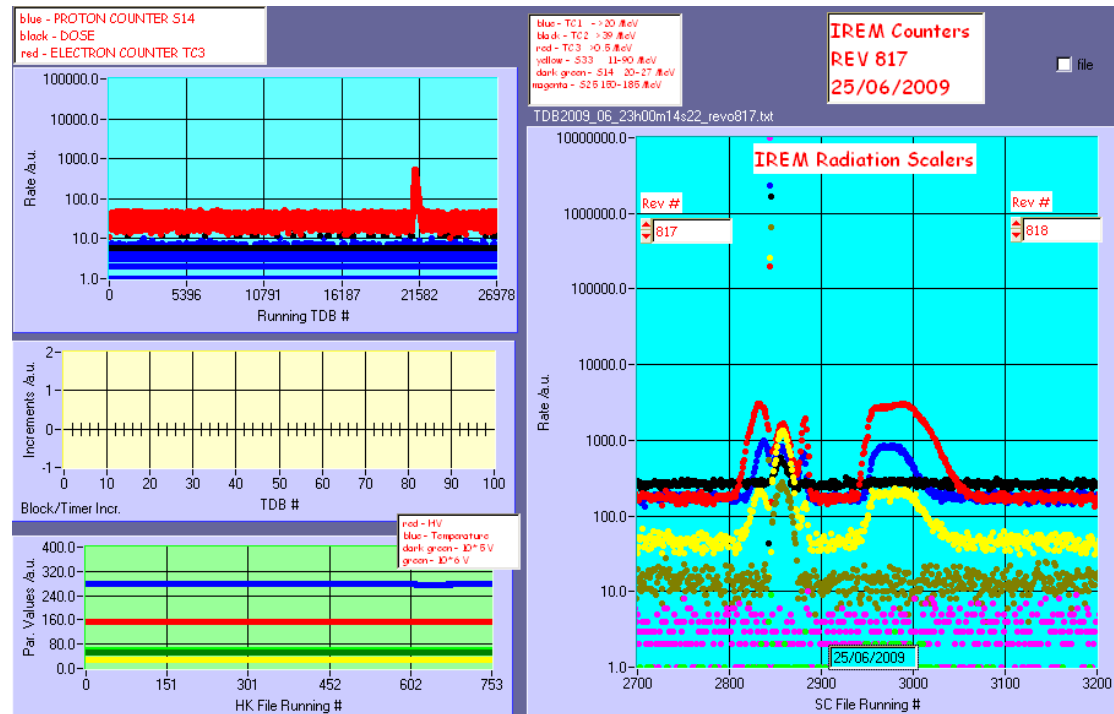
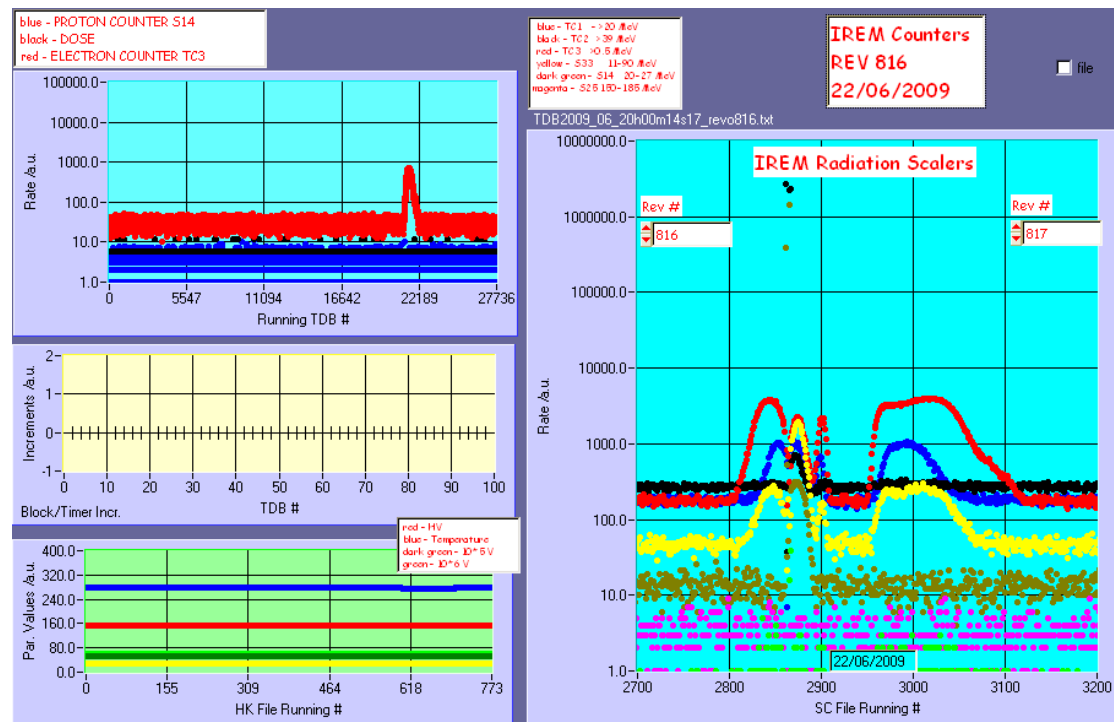
JEM-X count rates over the reporting period are displayed in the following graph⁴.



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:



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 1 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 8 occasions of bad frames from Redu. The only impact was that two commands from ED JEDMP100 failed release from T/L. They were resent manually.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs were received for revolutions 824-827. The Radiation Belt exit times are changed from revolution 825 onwards, from 57000km to 50000km. New planning was done for revolutions 820-824.

New TSFs have been received for revolutions 818-820.

A new updated long-term plan was released.

2. Observation status

No new ECS files have been received.

3. ISOC Science Data Archive

Extensive testing of the beta release of ISDA 3.0 has been done, and results have been reported.

ISDC wants to suppress RW account at the ISDC. However, some more tests need to be done to see if everything related to the Archive can be done without that account. ISOC has asked to keep the account open a little bit longer.

4. ISOC system

Still at V22.0.

Work is ongoing on the installation of the new (virtual) webserver.

Long-term planning tool eAIMS 2.1.1 has been tested. V2.2 will be released soon. Work is ongoing for V3.0.

5. Problems

A new integralogs mailing list (integralogs@sciops.esa.int) has been set up @ ISOC, because #integralOGS@esa.int did not work lately.

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-3067	2009-06-20	IMCS - AUX and ARCH tasks crash when producing CDs	IMCS	Pending
INT_SC-260	2009-06-26	IBIS PICSIT PDM01 LATCH UP	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, 20/06/2009 – 26/06/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 102 Open Loop Slews, 57 Closed Loop Slews and 8 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

20/06/2009 (Day of Year 171, Revolution 816)

Nothing to report

21/06/2009 (Day of Year 172, Revolution 816)

Nothing to report

22/06/2009 (Day of Year 173, Revolution 816 to 817)

Nothing to report

23/06/2009 (Day of Year 174, Revolution 817)

Nothing to report

24/06/2009 (Day of Year 175, Revolution 817)

Nothing to report

25/06/2009 (Day of Year 176, Revolution 817 to 818)

Nothing to report

26/06/2009 (Day of Year 177, Revolution 818)

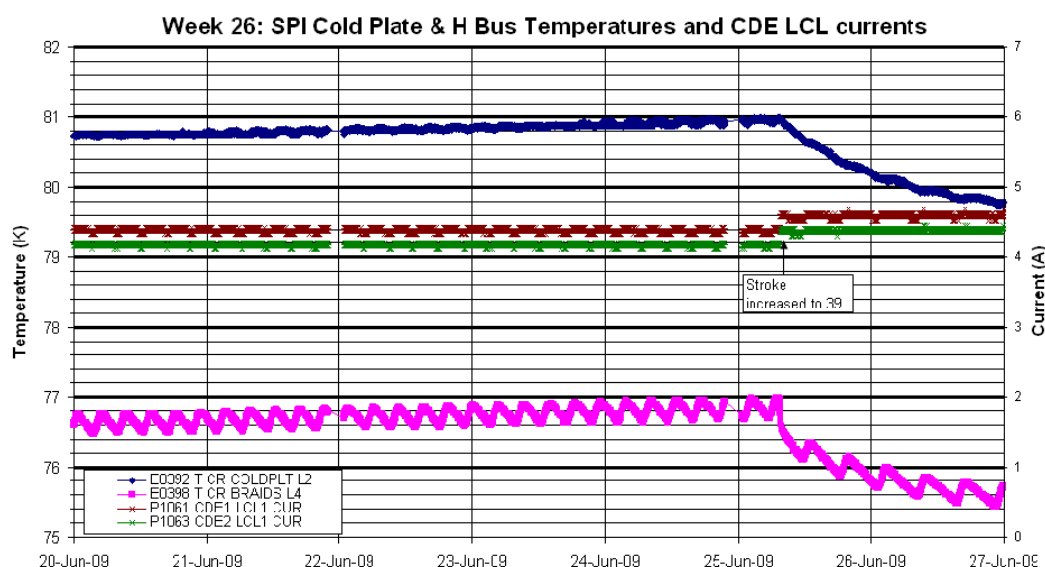
Nothing to report

8.2.2 SPI Operations

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 38 until 2009-06-25 at 07:31Z, when it was increased to 39 for both compressor pairs 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:

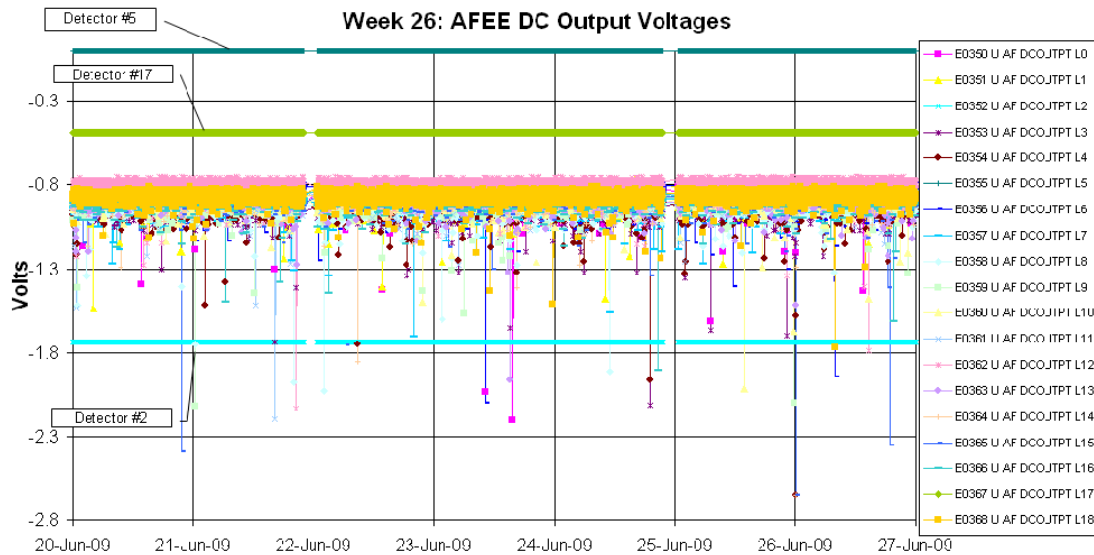


DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

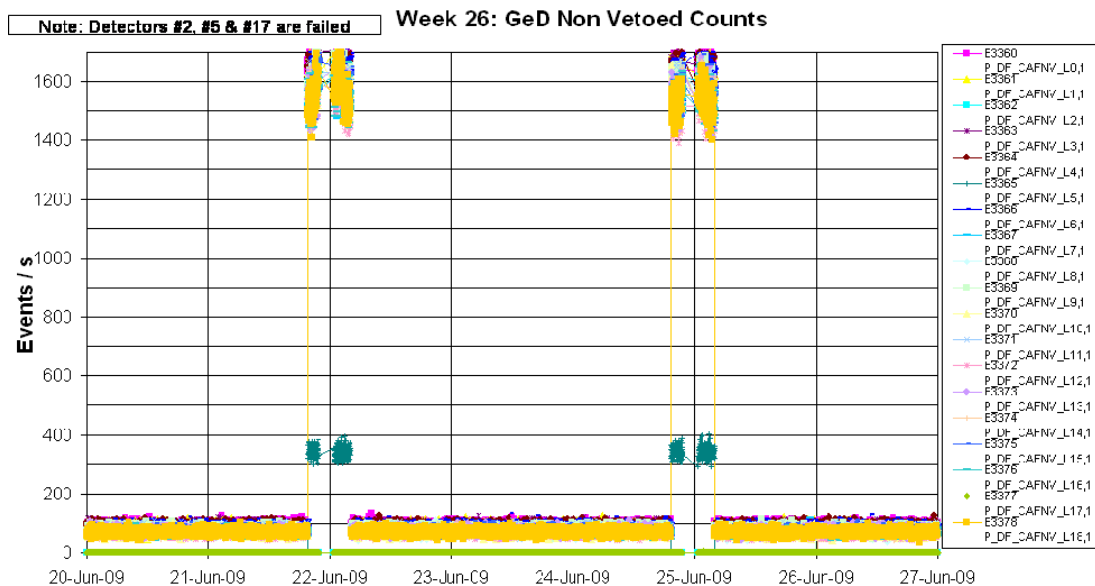
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). A plot of the ACS counts is given in Section 3.2.6.

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 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.

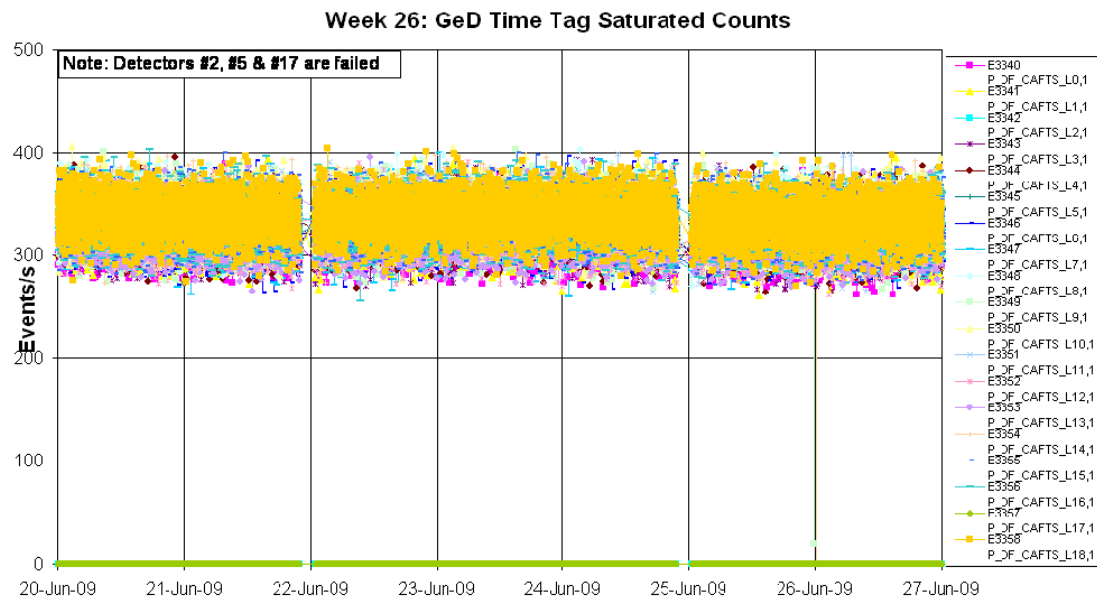
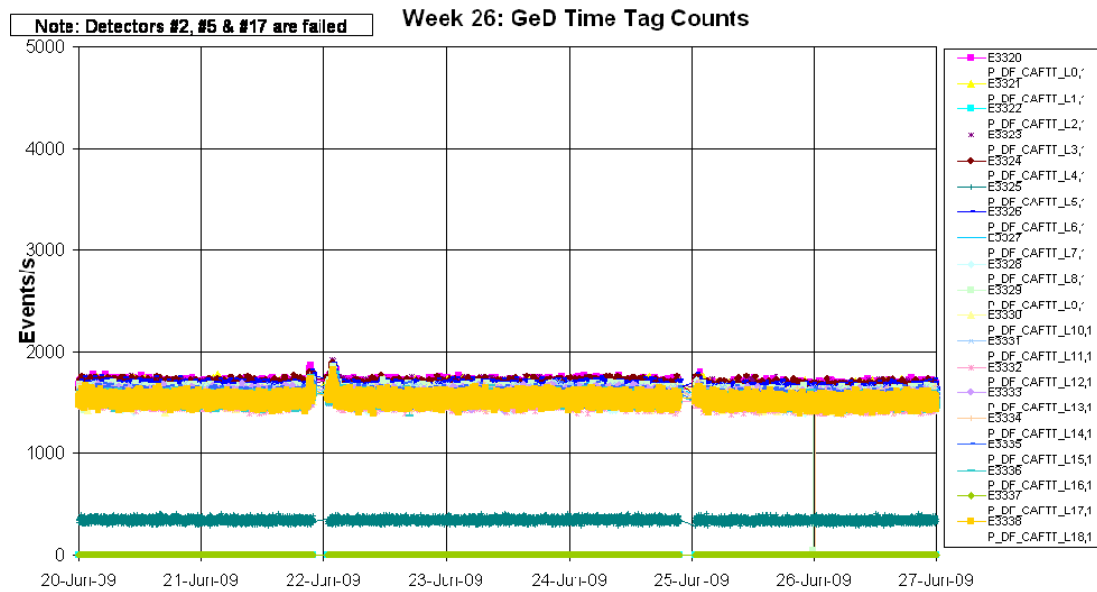


DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁷.



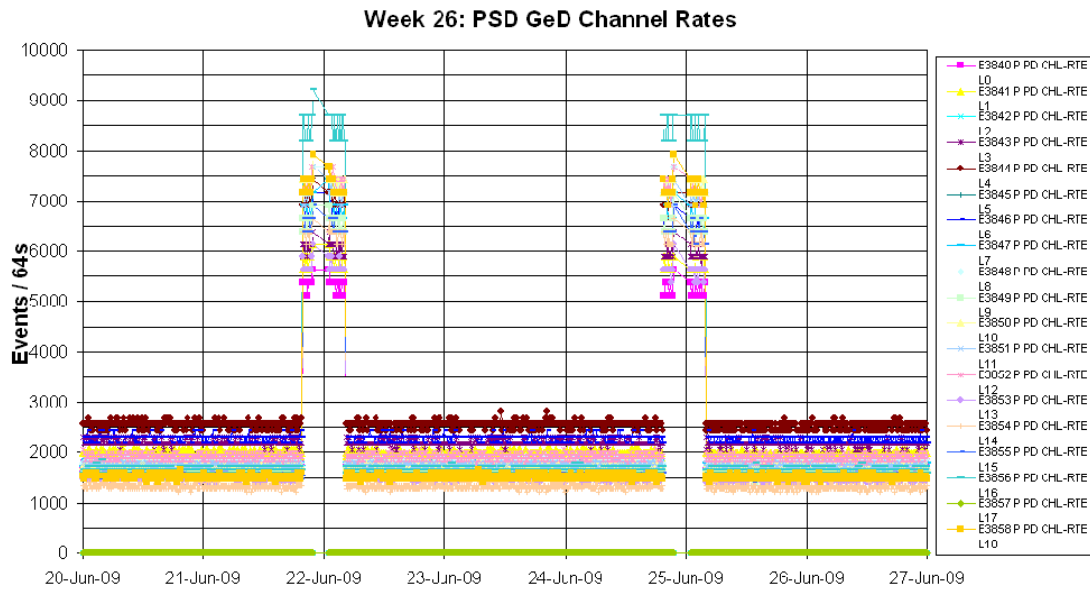
⁶ Data sampled every 8th packet (64sec)

⁷ Data sampled every 8th packet (64sec)



PSD: The 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:

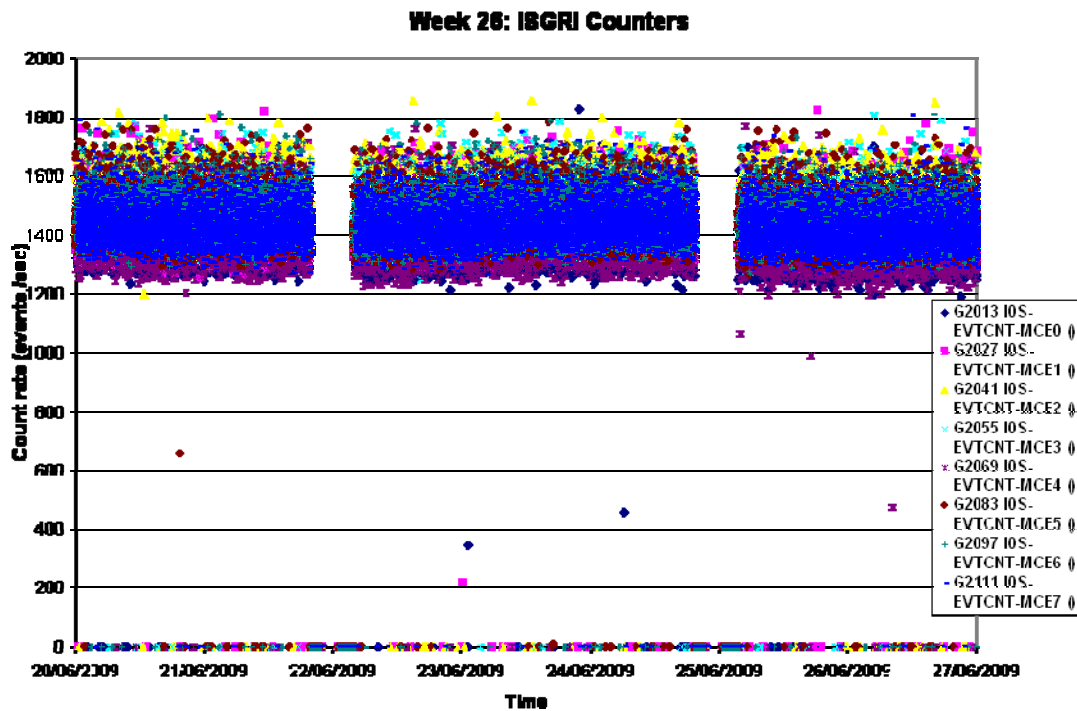
- On 2009-06-21 at 08:49:30Z TM parameter E3258 S AS HV-ST L62 went OOL (value = PARAM < SPEC). This is the ACS FEE HV status #62. TC sequence ES1831 was then sent to report the ACS HK parameters at 08:56:57Z, after which this parameter returned within limits.
- On 2009-06-21 at 17:21:24Z OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED was received with parameter E9780 (DETECTOR ID) = 15. As this was a single occurrence, 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:

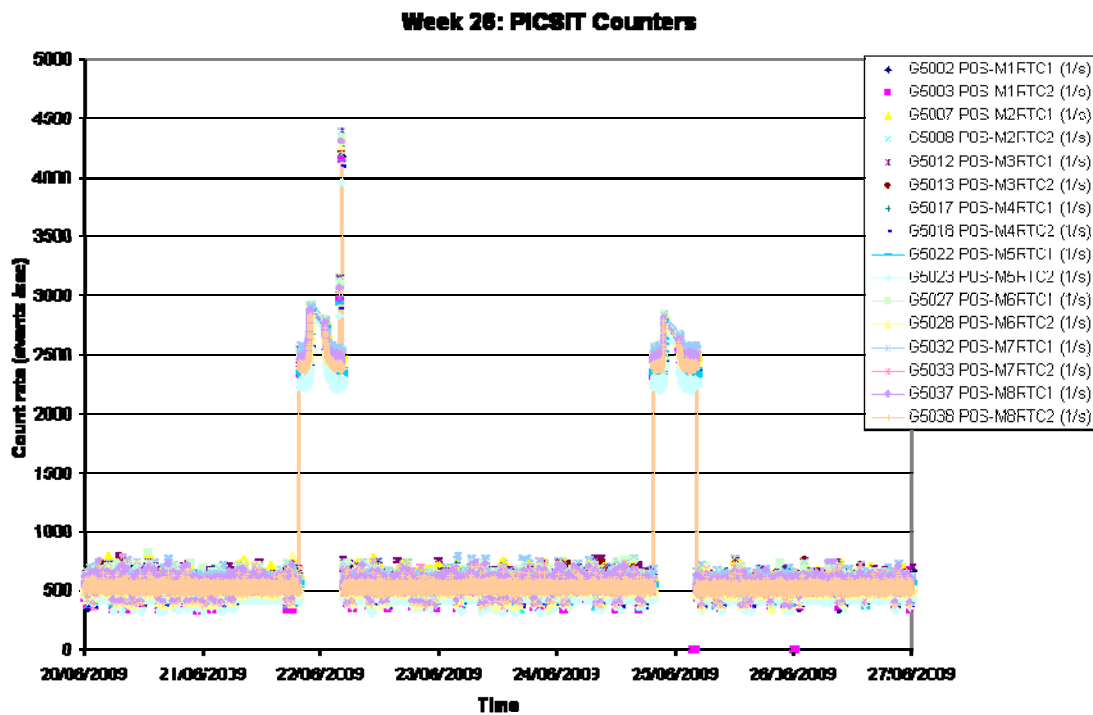


PICsIT

The health and performance of PICsIT was nominal during the reporting period, with the exception of a PDM Latch-up which occurred on 2009-06-26 (details in Daily Report section). The following plot shows the PICsIT semi-module counters during the week¹⁰:

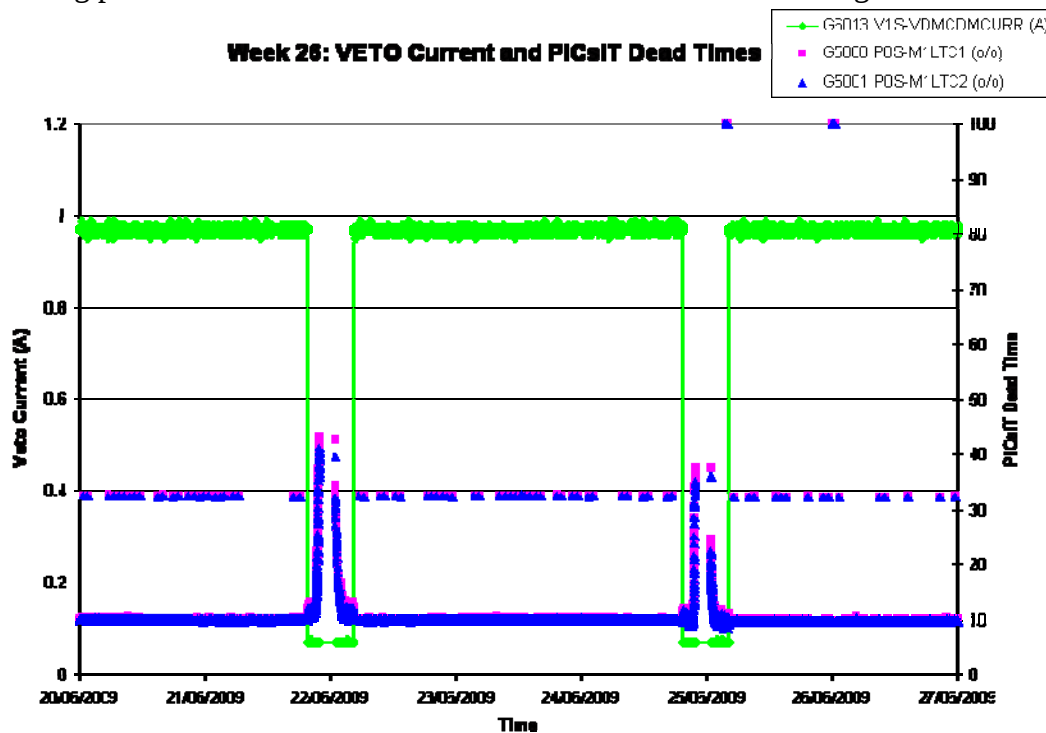
⁹ Data sampled every 4th packet (32sec)

¹⁰ Data sampled every 4th packet (32sec)



VETO

The health and performance of VETO was nominal during the reporting period. 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 (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 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.

2009-06-20 (DOY 171, Rev 816) to 2009-06-25 (DOY 176, Rev 818)

IBIS operations executed nominally.

2009-06-26 (DOY 177, Rev 818)

At 00:00:13Z TM parameter G5047 (PDM1: on/off status) went OOL (value = OFF), indicating that PICsIT PDM01 had switched OFF.

At the same time, OEM APID 1280 ID 170 EXCEPTION IBIS1 PICSIT LATCHED UP MODULE NOTIFICATION was received. In order to recover, a restart of PDM01 was performed as follows:

- 00:19:20Z FCP_IBIS1_0313 IBIS1 Stand-By Mode
- 00:22:25Z FCP_IBIS1_0315 PICsIT PDM1 OFF
- 00:24:13Z FCP_IBIS1_0103 PICsIT PDM1 Activation (step 3.3 only, i.e. heater configuration remained unchanged)
- 00:28:32Z FCP_IBIS1_0083 PICsIT (PDMs) Status Enabling by Dynamic Default
- 00:42:19Z ED GESTAN02 uplinked using parameters from TC-History to return IBIS to Science Standard mode
- 00:43Z CCCF enabled

IBIS operations continued nominally. This is recorded as Anomaly Report INT_SC-260.

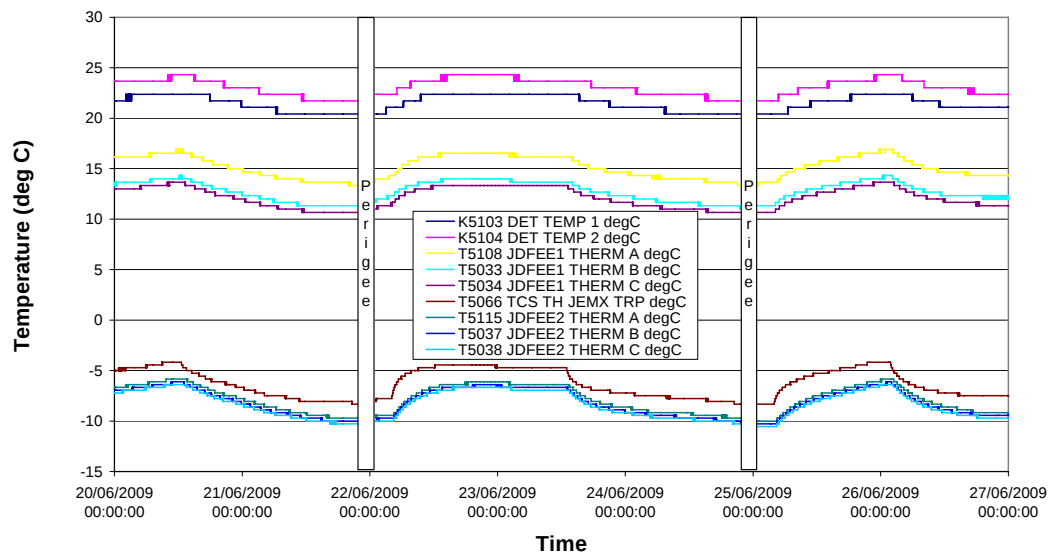
8.2.4 JEM-X Operations

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)

JEMX Detector & DFEE Temperatures



JEM-X Daily Report

2009-06-20 (DoY 171 Rev 816)

JEM-X 1 operations executed nominally.

2009-06-21 (DoY 172 Rev 816)

At the indicated times, the following OEMs were received:

Time	Source	Event	Class	ID	Start	End	Exception
2009.172.05.14.27.750	JEM-X1	EXC IACS INTERF EXID	0	0	65535	PR	N
2009.172.05.14.32.203	JEM-X1	EXC IACS INTERF EXID	0	0	65535	PR	N
2009.172.05.14.27.750	JEM-X1	EXC IACS INTERF CULP	0	0	65535	PR	N
2009.172.05.14.32.263	JEM-X1	EXC IACS INTERF CULP	0	0	65535	PR	N

No action was taken, and there was no impact.

2009-06-22 (DoY 173 Rev 817) to 2009-06-24 (DoY 175 Rev 817)

JEM-X 1 operations executed nominally.

2009-06-25 (DoY 176 Rev 818)

At 03:41:27, TC K0021 terminated with status UNCERTAIN_FAILED.

At 06:13:01, TC K0021 terminated with status UNCERTAIN_FAILED

No action was taken and there was no impact.

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2009-06-26 (DoY 177 Rev 818)

At the indicated times, the following OEMs were received:

2009.177.06.20.28.021	2009.177.06.20.35.832	1536	RealTime	5		EXCEPTION
JEM-X1 EXC IACS INTERF EXID			0	0	65535	PR N
E E						
FIX6		0				
K9079	MESS CLASS	1				
K9080	MESS ID	5				
K9065	CSSW OPERAT ID	START				
K9066	TASK ID 8	IASW				
K9067	LOGICAL ADDRESS					4989
2009.177.06.20.28.021	2009.177.06.20.35.867	1536	RealTime	6		EXCEPTION
JEM-X1 EXC IACS INTERF CULP			0	0	65535	PR N
E E						
FIX6		0				
K9079	MESS CLASS	1				
K9080	MESS ID	6				
K9065	CSSW OPERAT ID	START				
K9066	TASK ID 8	IASW				
K9067	LOGICAL ADDRESS	19726				

No action was taken, and there was no impact.

8.2.5 OMC Operations

2009-06-20 (DoY 171, Rev 816) to 2009-06-21 (DoY 172, Rev 816)

Nothing to report.

2009-06-22 (DoY 173, Rev 817)

At the indicated times below, the following OEM's were received:

2009.173.10.28.26.679	2009.173.10.28.33.794	1792	RealTime	7		EXCEPTION
OMC CONSTRAINT D			0	0	65535	PR N
E E						
2009.173.10.28.26.679	2009.173.10.28.33.809	1792	RealTime	5		ANOMALY
OMC CSSW INT ER			0	0	65535	PR N
E E						

These occur from time to time, when the instrument is pointing at a crowded area of the sky, and are harmless. No action was taken and there was no impact.

2009-06-23 (DoY 174, Rev 817) to 2009-06-26 (DoY 177, Rev 818)

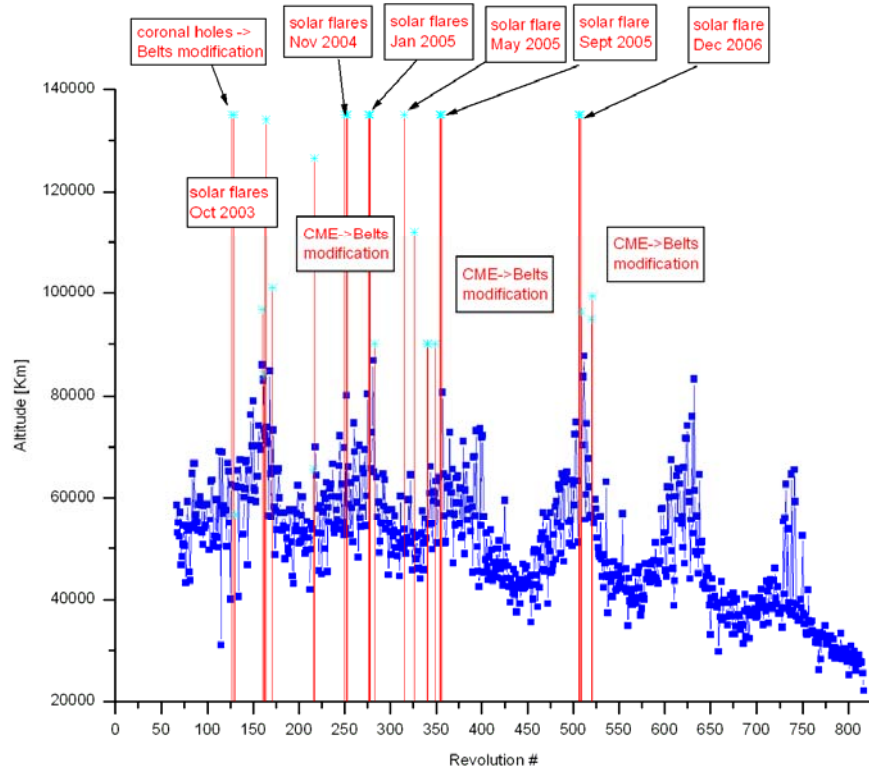
Nothing to report.

On DoY 172 at 19:38:15 and DoY 175 at 19:24:55 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]
816	RAD_ENTR R 2009-06-21T19:38:07Z	21/06/2009 21:13:26	25579.9	21-Jun-2009 20:50:17	30163.94
817	RAD_EXIT R 2009-06-22T04:09:00Z	22/06/2009 02:16:38	>>32767.9	22-Jun-2009 03:00:17	47017.56
817	RAD_ENTR R 2009-06-24T19:24:50Z	24/06/2009 21:17:34	22179.1	24-Jun-2009 20:36:21	30270.45
818	RAD_EXIT R 2009-06-25T03:56:02Z	25/06/2009 01:20:22	32752.9	25-Jun-2009 02:46:21	46839.97

Reference

High radiation

Very small error vs reference (less than 10 minutes)

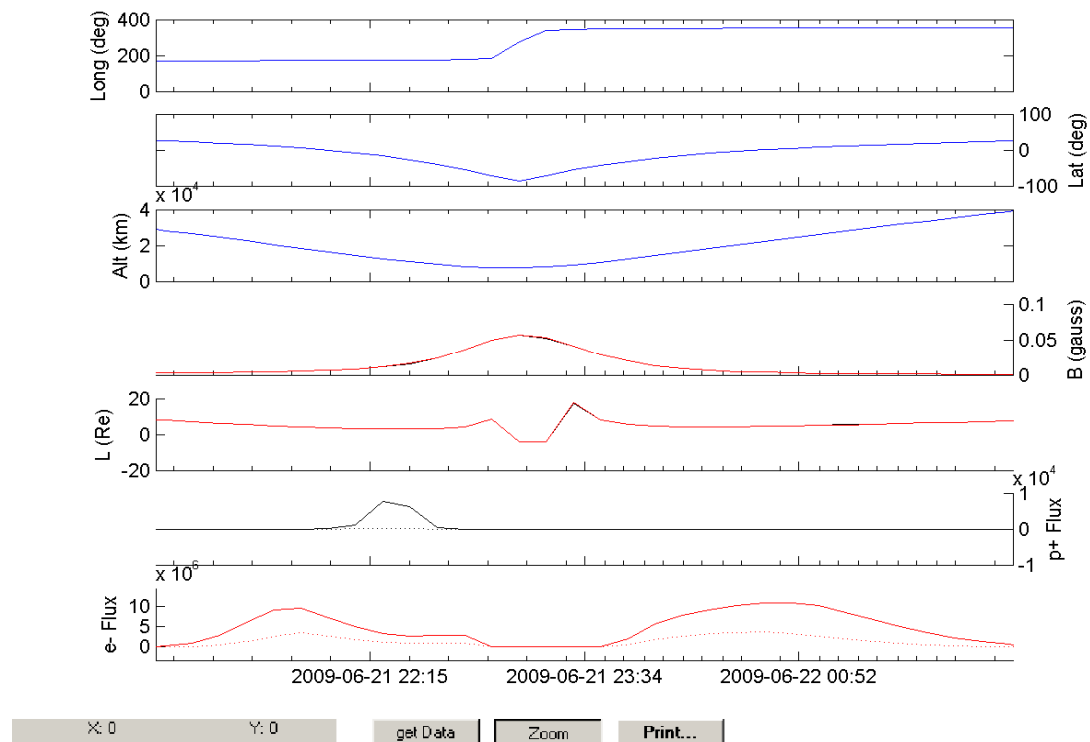
Small error vs reference (between 10 and 30 minutes)

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 816



Rev 817

