

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 300
Week 25
23.06.08
Routine Phase

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LIST OF CONTENTS

1	General.....	3
2	Summary of Activities.....	3
3	Satellite Status.....	3
3.1	Platform.....	3
3.1.1	AOCS.....	3
3.1.2	Power.....	3
3.1.3	Thermal.....	3
3.1.4	OBDH.....	3
3.1.5	RFS.....	4
3.2	Payload.....	4
3.2.1	SPI.....	4
3.2.2	IBIS.....	5
3.2.3	JEM-X.....	6
3.2.4	OMC.....	6
3.2.5	IREM.....	7
4	Ground Facilities.....	7
4.1	Mission Operations Centre.....	7
4.2	Ground Stations & Network.....	7
4.3	Science Ground Segment.....	7
4.3.1	ISOC.....	7
4.3.2	ISDC.....	8
5	Special Events.....	8
6	Anomalies.....	8
7	Future Milestones.....	8
8	Appendix.....	8
8.1	Overview of Revolutions.....	8
8.2	Consumables.....	8
8.2.1	Detailed Fuel Book-keeping.....	8
8.3	Detailed Satellite Information.....	9
8.3.1	AOCS SUMMARY OPERATIONS REPORT, 14/06/2008 – 20/06/2008.....	9
8.3.2	SPI Operations.....	14
8.3.3	IBIS Operations.....	20
8.3.4	JEM-X Operations.....	26
8.3.5	OMC Operations.....	27
8.3.6	IREM Operations.....	27

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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 14.06.08 until 20.06.08 (both dates inclusive) and covers the revolutions 692, 693 and 694.

2 Summary of Activities

The operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

The target of these revolutions was a raster dither around the Loop I-Loop IV Superbubble (RA 13:57:10.00, DEC +07:34:37.0).

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.

Two slews were missed from TL, during the observation period due to problem on FDS and DSS station.

The fuel consumption over the period between 14/06/2008 and 19/06/2008 was 0.0606 Kg. The remaining propellant is in the order of 140.0320 Kg.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix.

3.1.2 Power

The EPS is 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

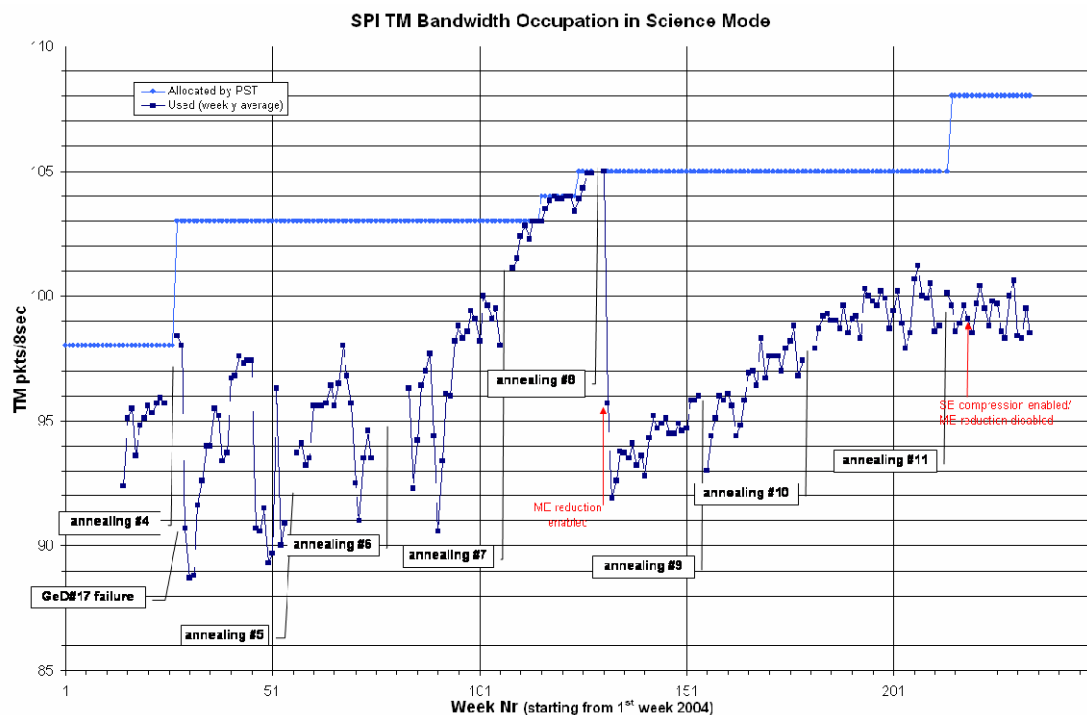
3.2.1 SPI

Following the 11th annealing, which ended on 30th January, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which, although its energy resolution improved since the previous annealing, is still showing a slightly degraded energy resolution compared to the other detectors and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). Detector #2 is failed since 06/12/2003 and detector #17 since 17/07/2004.

The Stirling compressors are working nominally, maintaining the Germanium detectors at 80 +/-1K.

During science operations, the instrument was kept in photon-by-photon mode with spectra TM enabled. The assigned TM bandwidth in the science observation windows was 108 packets/cycle and the average telemetry occupation in the science window was 98.5 packets/cycle.

The following plot shows the assigned and the average occupation of the SPI TM bandwidth.



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

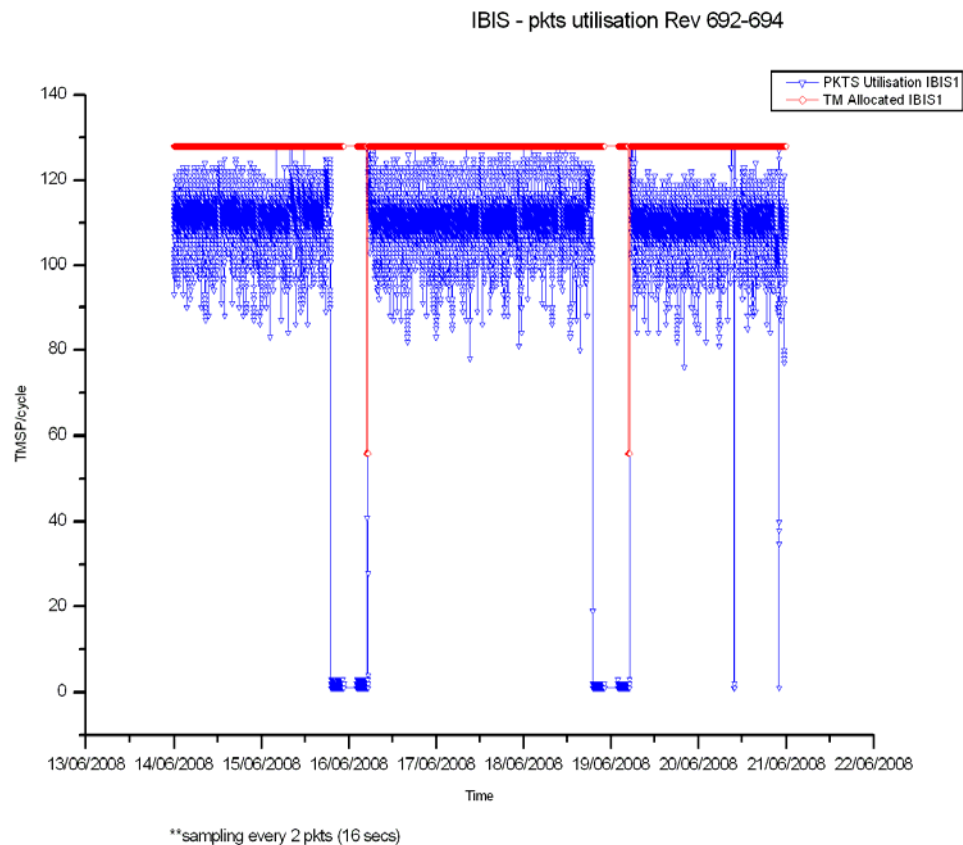
3.2.2 IBIS

The overall status of the unit is nominal.

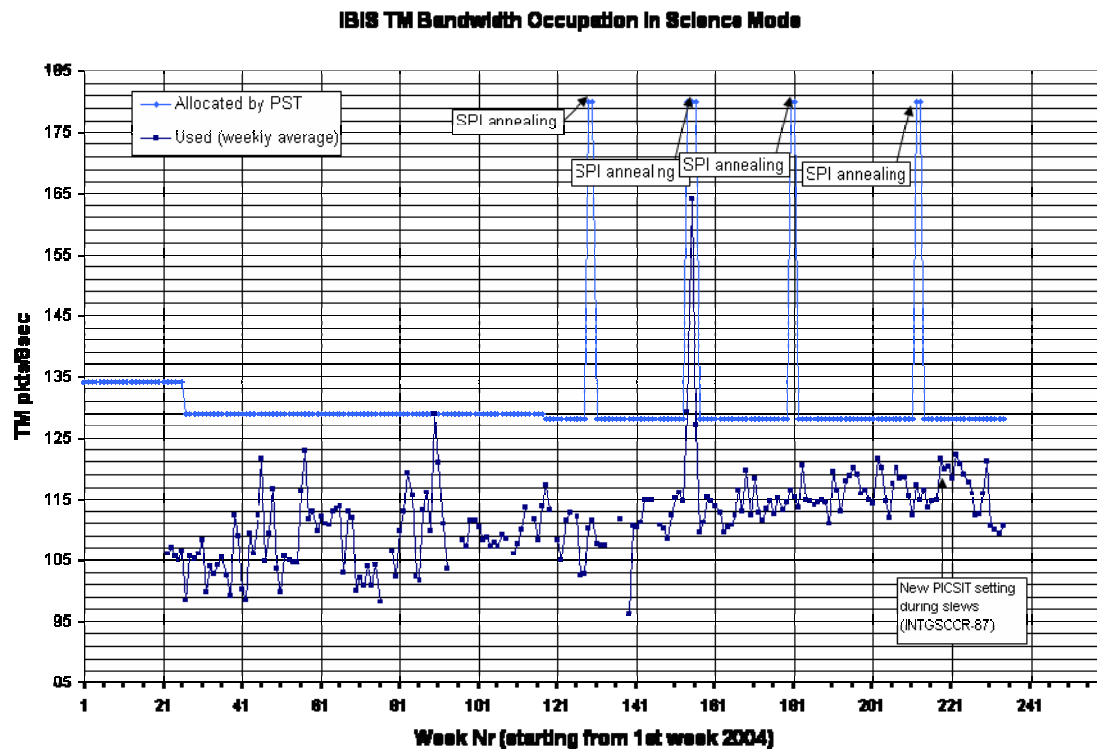
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 110.63 packets/cycle (up 1.27 on last week)
- Percentage of TM cycles in which full bandwidth was used: 1.20%

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



A plot of the IBIS weekly bandwidth utilisation since 2004 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.

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, 142 of the 143 planned science pointings were executed nominally, 1 pointing was lost due to a ground station problem.

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.

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

4 Ground Facilities

The Operational ground facilities performance was very good this week. 1 pointings was lost to ground problems. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were a few instances of TM drops from DSS-24 and bad frames from Redu but with no impact. One pointing was lost as mentioned above due to a loss of the TC link from DSS-24.

The TM link to ISDC experienced occasional problems requiring the ISDS task to be restarted.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 699 to 706.
Observations have been planned for revolutions 699 to 703.
New TSFs have been received for revolutions 694 to 699.

2. Observation status

New ECS files have been received for revolution 684 to 687.

3. ISOC Science Data Archive

Ingestion has been halted for the installation of new disk arrays and rearrangement of some disks.

4. ISOC system

Work is ongoing on ISOC system V19.3, expected for delivery early in July.

5. Problems

None.

4.3.2 ISDC

Update not available this week. Status of ISDC observation processing on 16/06/2008:

- Latest Standard Analysis completed: observation 05200260004 (mid-latitude 2, Revolutions 680 & 681) on 16/06/2008.
- Latest products archived: observation 05200510008 (Mrk 421, Revolutions 679) on 14/06/2008.
- Latest observation products sent to the observer: observation 05200510009 (Mrk 421, Revolutions 679) on 16/06/2008.

5 Special Events

6 Anomalies

The following anomalies occurred this week.

AR id	Date Created	Subject	Segment	Status
INT_SC-231	2008-07-09	VETO VDM16 High Voltage Breakdown	Payload	Pending

7 Future Milestones

Nothing to report.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 692-694

The observations in these revolutions consisted entirely of a raster dither of Loop I-Loop IV Superbubble (RA 13:57:10.00, DEC +07:34:37.0), lasting ~61 hours in each revolution.

Throughout these observations, all instruments were in their nominal science modes, except JEM-X2, which is switched off. The TM allocation was IBIS 128; SPI 108; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2008-05-29T04:07:12.000Z	140.2729	F	Automatic TM processing.
2008-05-30T13:42:28.000Z	140.2506	F	Automatic TM processing.
2008-06-01T03:53:52.000Z	140.2439	F	Automatic TM processing.

Doc. Title : INTEGRAL Mission Report #299
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
Date : 16/06/08

Issue : 1
Rev. : 0
Page : 9

2008-06-02T13:32:27.000Z	140.2257	F	Automatic TM processing.
2008-06-04T03:41:03.000Z	140.2180	F	Automatic TM processing.
2008-06-05T13:17:55.000Z	140.1970	F	Automatic TM processing.
2008-06-07T03:29:11.000Z	140.1850	F	Automatic TM processing.
2008-06-08T04:13:45.000Z	140.1610	F	Automatic TM processing.
2008-06-10T03:15:19.000Z	140.1206	F	Automatic TM processing.
2008-06-11T12:24:18.000Z	140.1081	F	Automatic TM processing.
2008-06-13T03:03:10.000Z	140.0926	F	Automatic TM processing.
2008-06-14T12:39:22.000Z	140.0722	F	Automatic TM processing.
2008-06-16T02:52:15.000Z	140.0621	F	Automatic TM processing.
2008-06-17T12:26:27.000Z	140.0394	F	Automatic TM processing.
2008-06-19T02:41:35.000Z	140.0320	F	Automatic TM processing.

This report was generated Fri Jun 20 08:00:24 GMT 2008

8.3 Detailed Satellite Information

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

8.3.1 AOCS SUMMARY OPERATIONS REPORT, 14/06/2008 – 20/06/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 98 Open Loop Slews, 51 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC).

2 slews (CSL) were missed from TL, during the observation period due to problem on FDS (failed update) and problem on the TC link with DSS station.

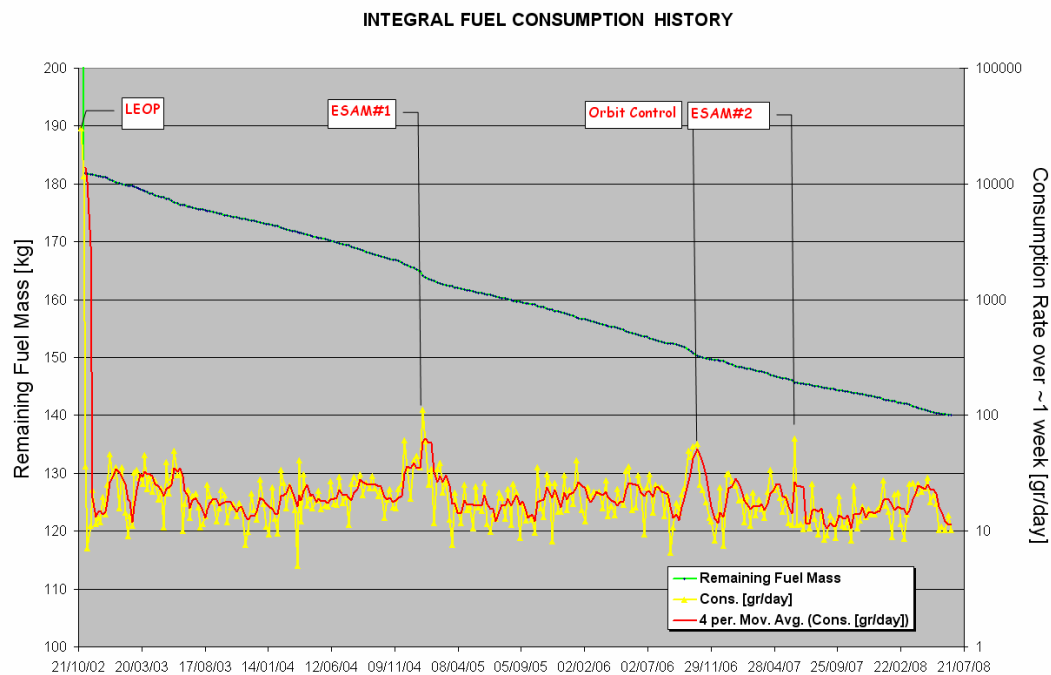
This is equivalent to ~ 1.3 % of the total number of slews planned (149)

Orbit Control

No update

Fuel consumption

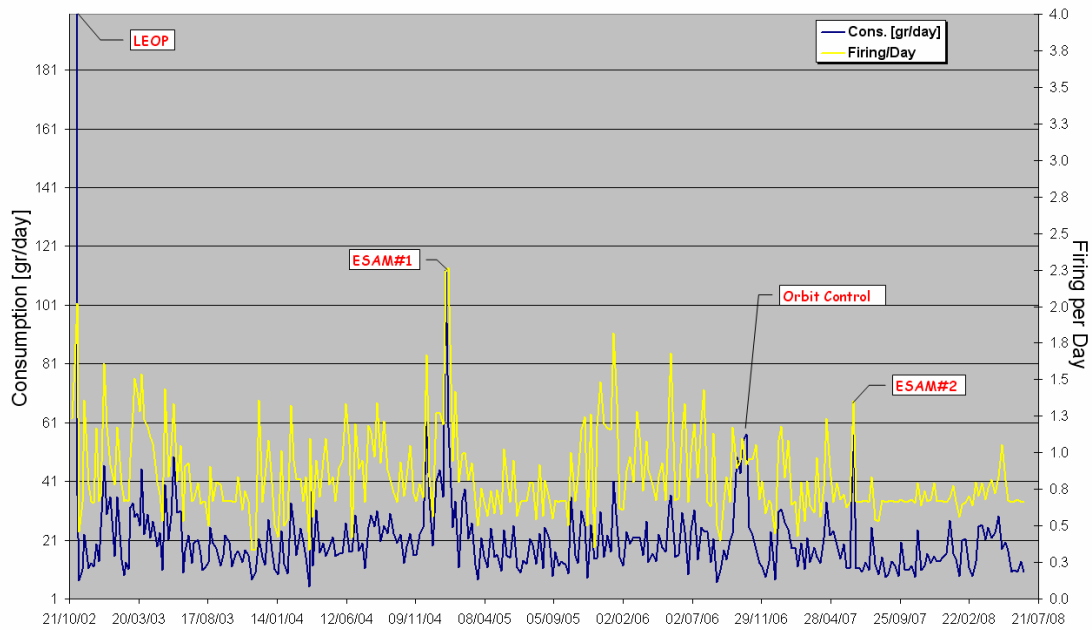
The fuel consumption (total, grams per day) over the period between 01/11/2002 and 19/06/2008 is reported in the plot below.



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

The firing per day over the period between 01/11/2002 and 19/06/2008 is reported in the plot below.

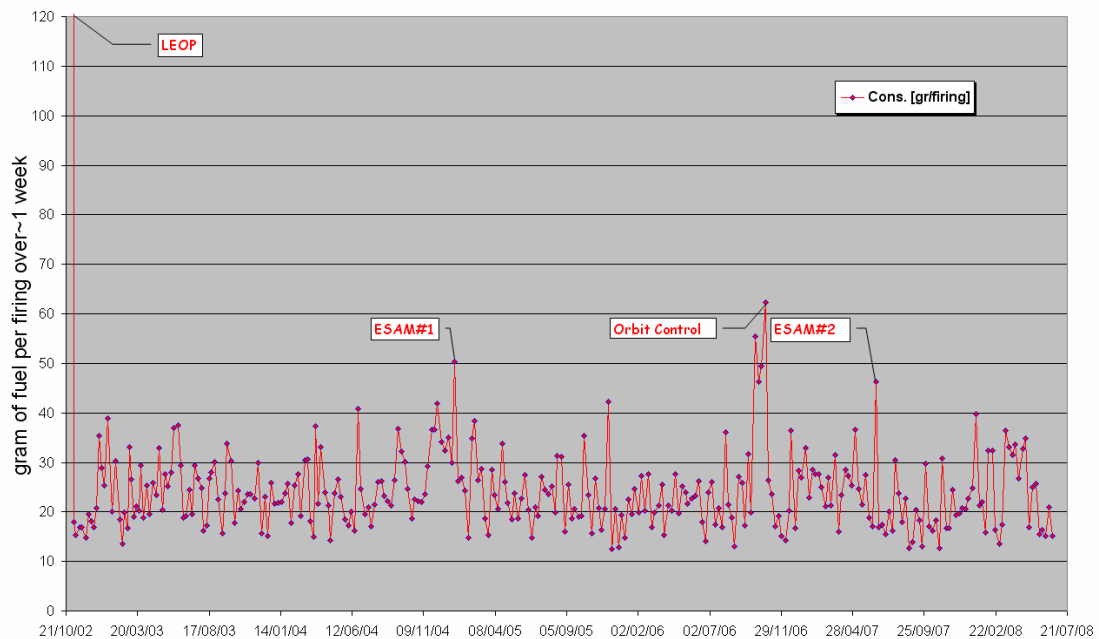
INTEGRAL FIRING PER DAY HISTORY



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

The fuel per firing over the period between 01/11/2002 and 19/06/2008 is shown in the plot below.

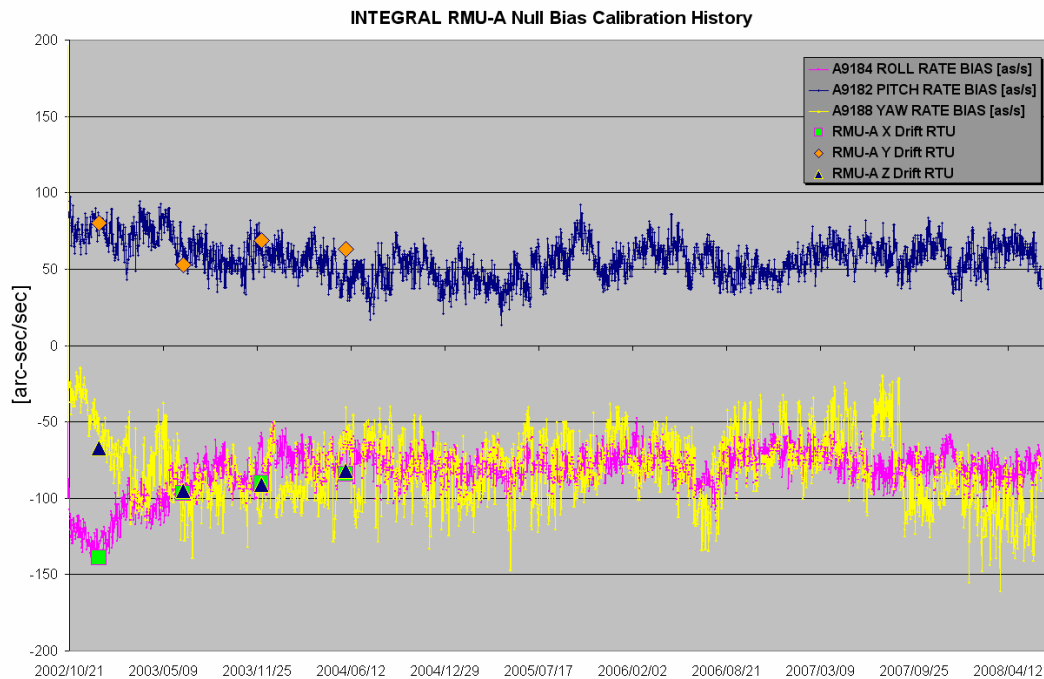
INTEGRAL FUEL MASS PER FIRING HISTORY



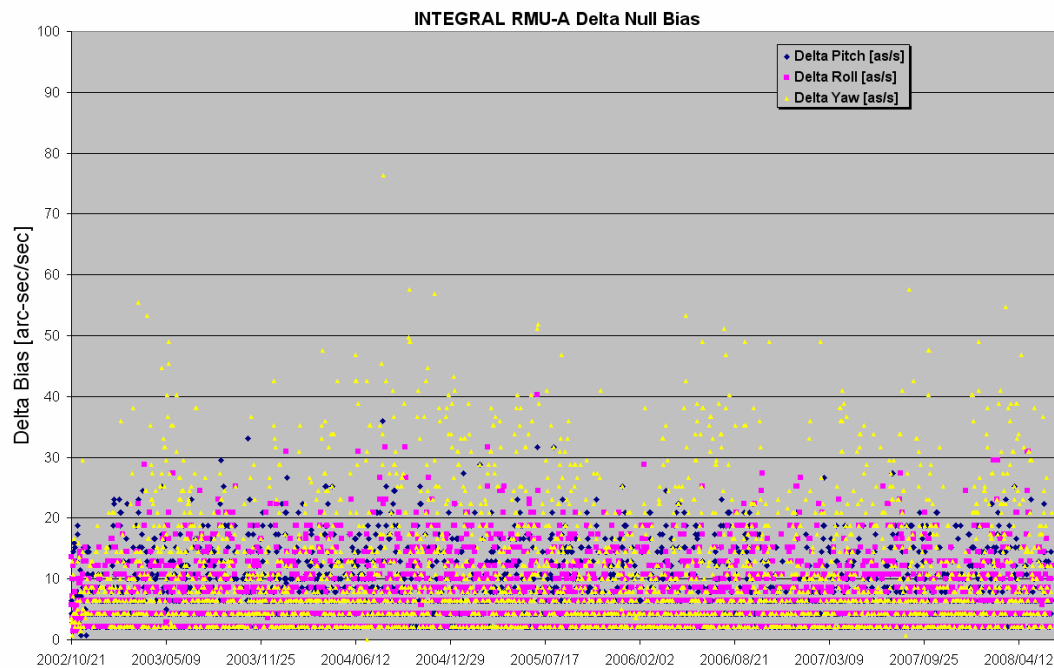
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 20/06/2008 is reported in the plot below.

Problems have been reported during the last period on FDS when generating the drift update for the RMU-A Yaw channel: the limits set on FDS have been violated few times. 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.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 20/06/2008 is reported in the plot below.



14/06/2008 (Day of Year 166, Revolution 692)

Nothing to report.

15/06/2008 (Day of Year 167, Revolution 692)

FDS failed slew update: at 04:31z the FDS failed the update of slew ID 06920049. FDS reported an error during the update process: the following manoeuvre could not be executed as a close loop slew but as an open loop slew.

A manual recovery was performed at 05:19z by generating a manual OSL. At 05:37z the slew ID 06920050 was manually updated in TL.

The following slew was missed in TL: 06920049 (CSL).

Problem on the link with DSS station: at 07:10z a problem on the TC link between ESOC and DSS station caused the slew 06920051 to fail release.

At 07:29z, once a stable TC link was set with DSS station, the operator started a manual recovery from attitude of PID 06920050 to the attitude of PID 06920051. The next slew in TL 06920052 was manually updated at 08:04z.

The following slew was missed in TL: 06920051(CSL).

16/06/2008 (Day of Year 168, Revolution 692-693)

Nothing to report.

17/06/2008 (Day of Year 169, Revolution 693)

Nothing to report.

18/06/2008 (Day of Year 170, Revolution 693)

Nothing to report.

19/06/2008 (Day of Year 171, Revolution 693-694)

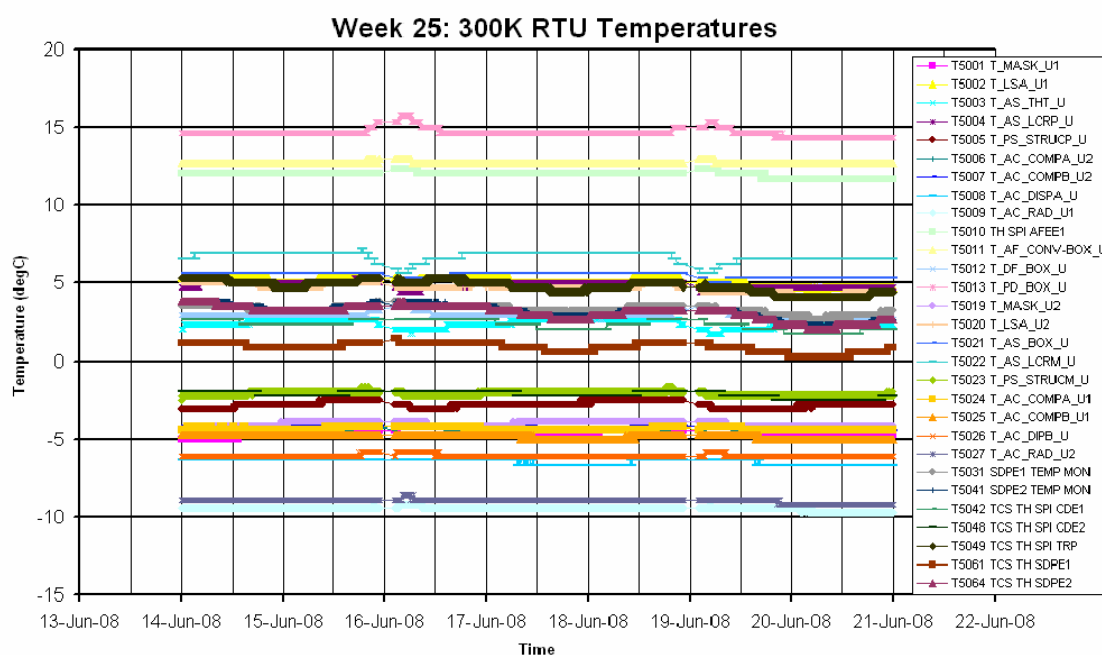
Nothing to report.

20/06/2008 (Day of Year 172, Revolution 694)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period.

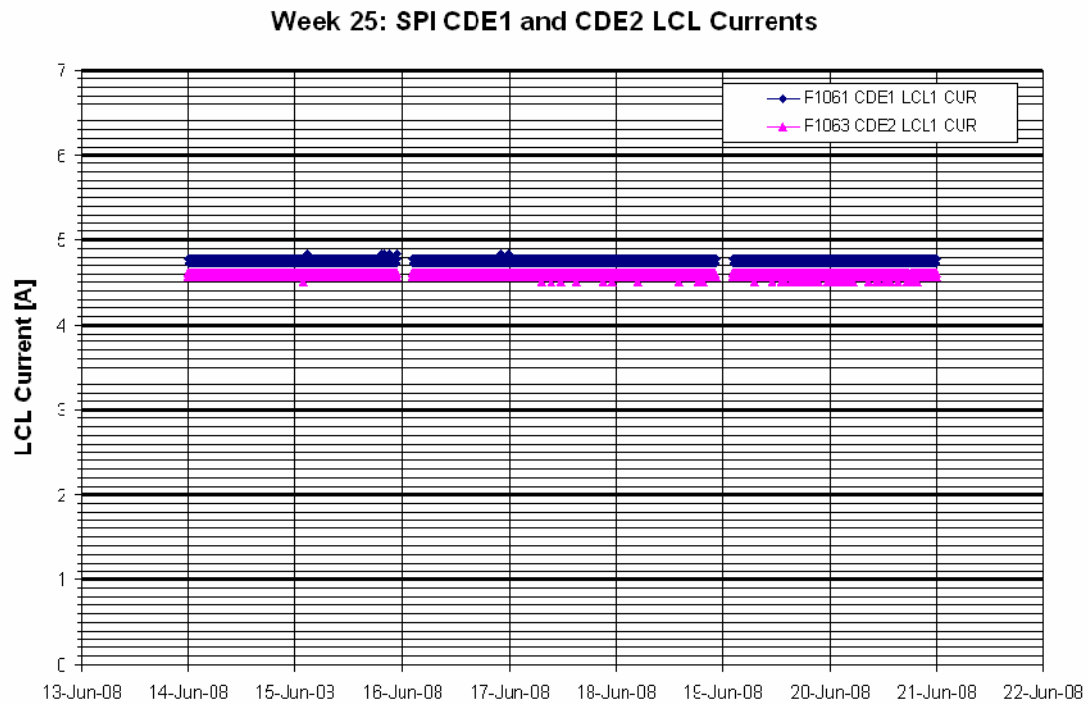


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

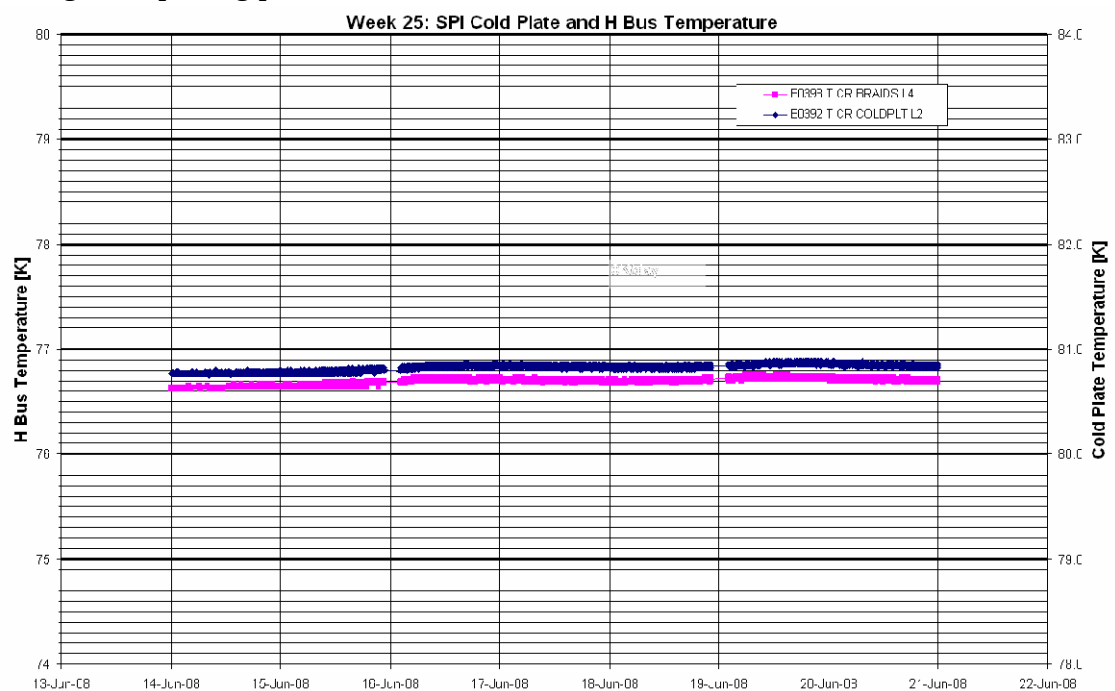
The stroke of all four compressors was set to 40 throughout the week. The average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.77A
- CDE2 LCL Current = 4.57A

The following plot shows the evolution of the CDE LCL currents during the reporting period.



The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.

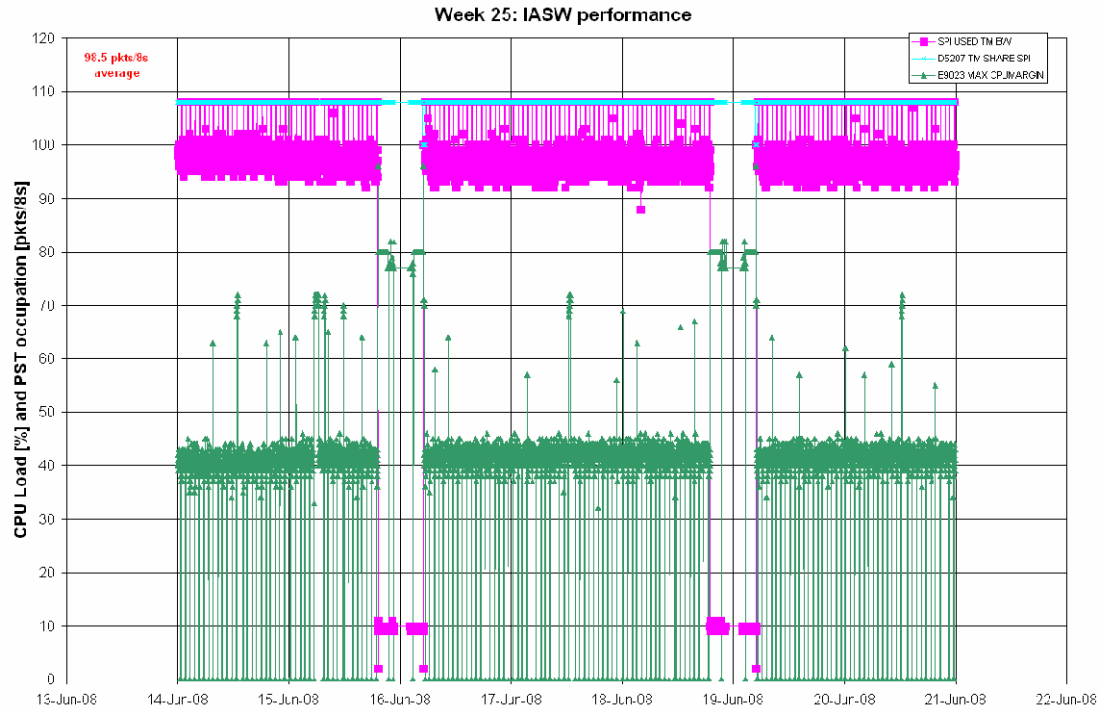


DPE & IASW: The DPE health and IASW performance is nominal.

The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE.

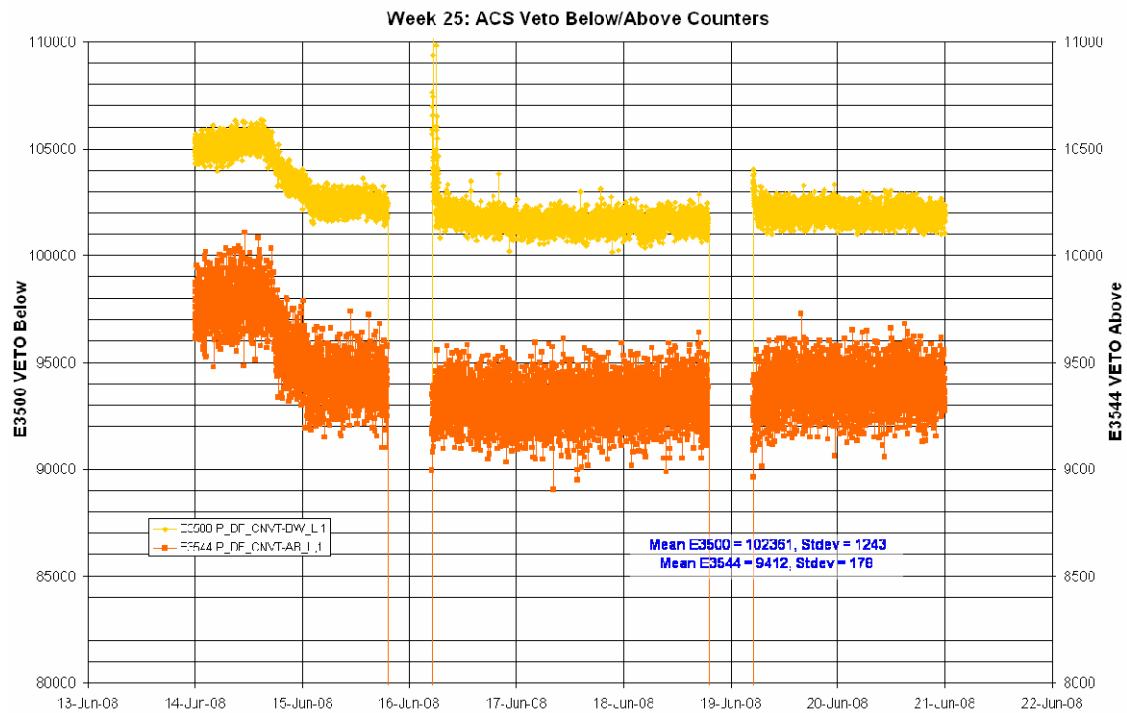
The average TM bandwidth occupation of SPI was 98.5 packets/cycle over the science window. The TM allocation in the science window was 108 packets/cycle.

The following plot shows the IASW performance in terms of TM bandwidth occupation and DPE CPU load during the reporting period.

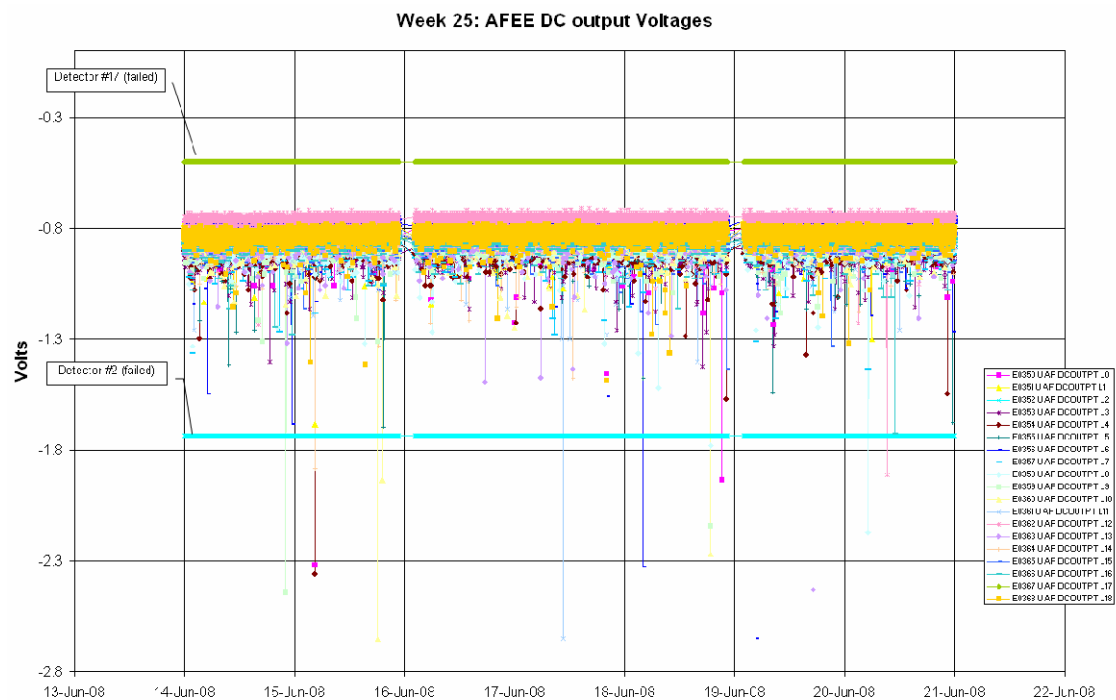


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

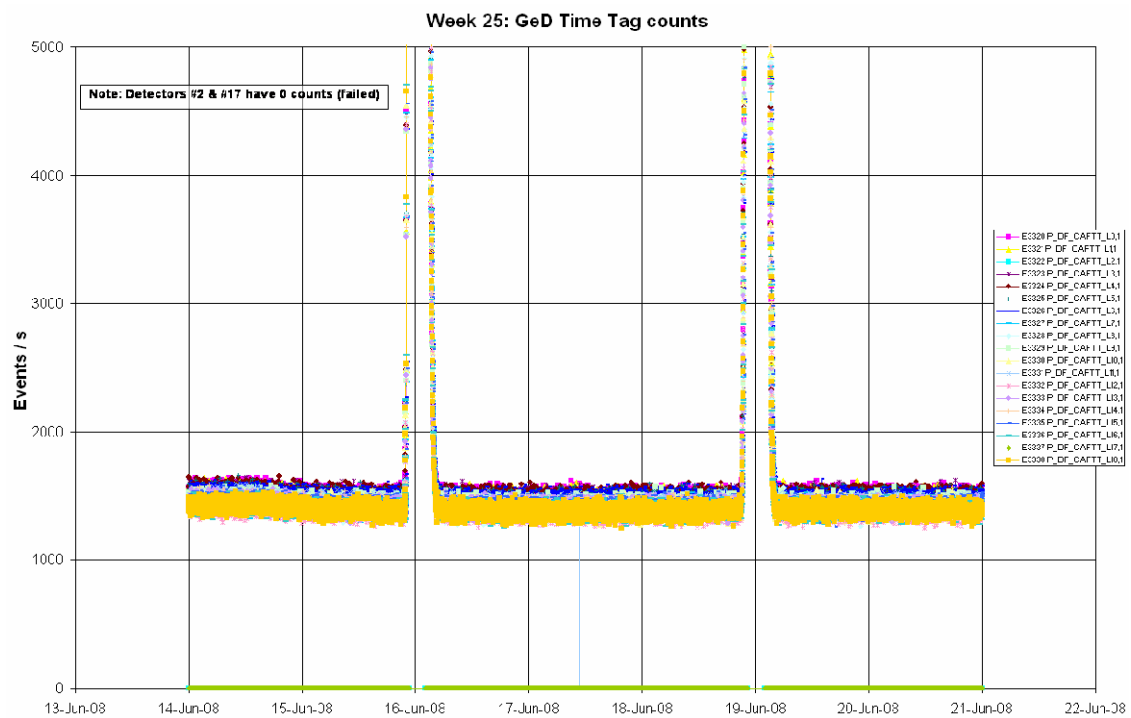
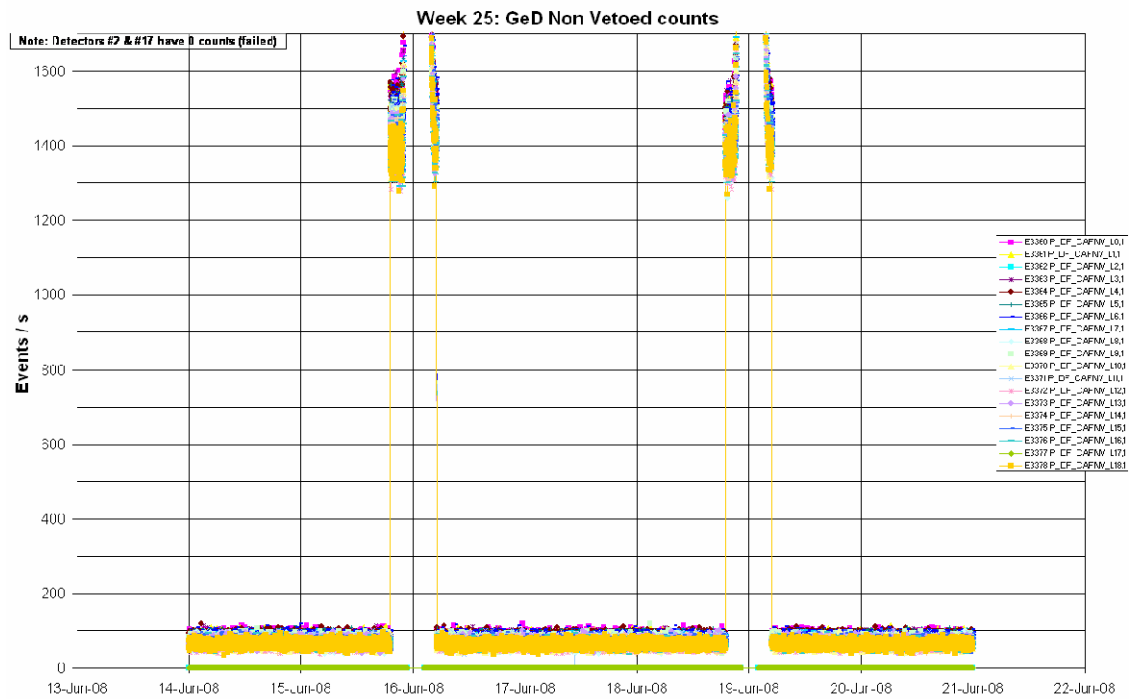
The following plot shows the ACS overall count rate evolution during the reporting period:

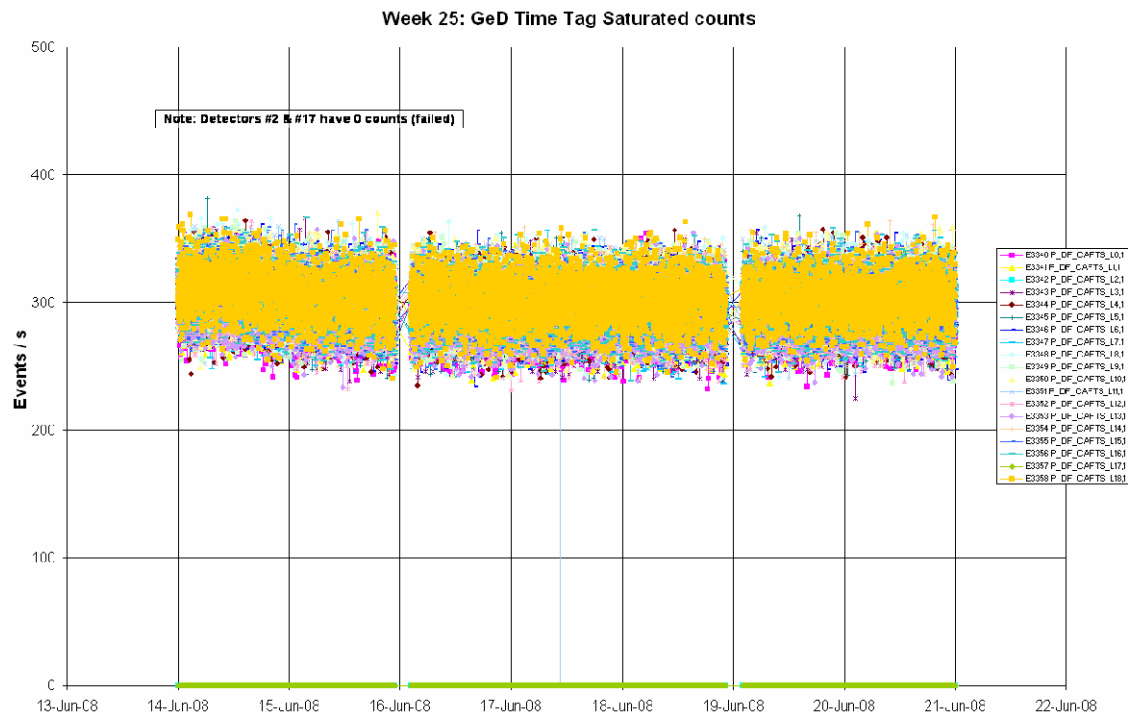


AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

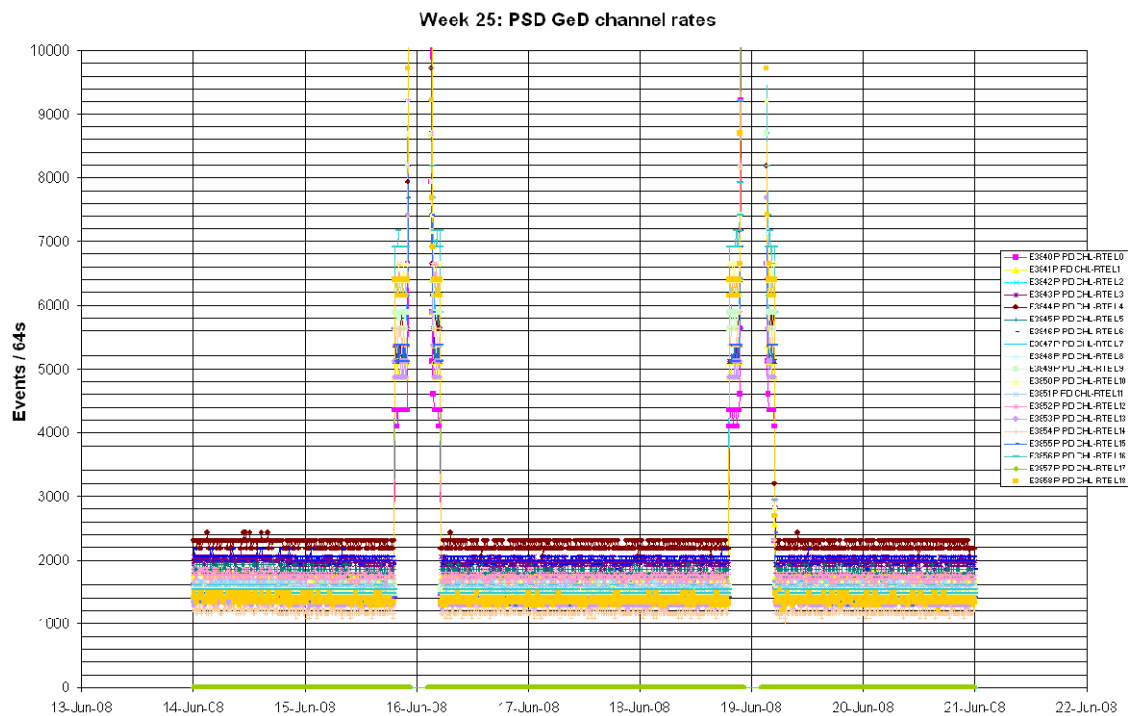


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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



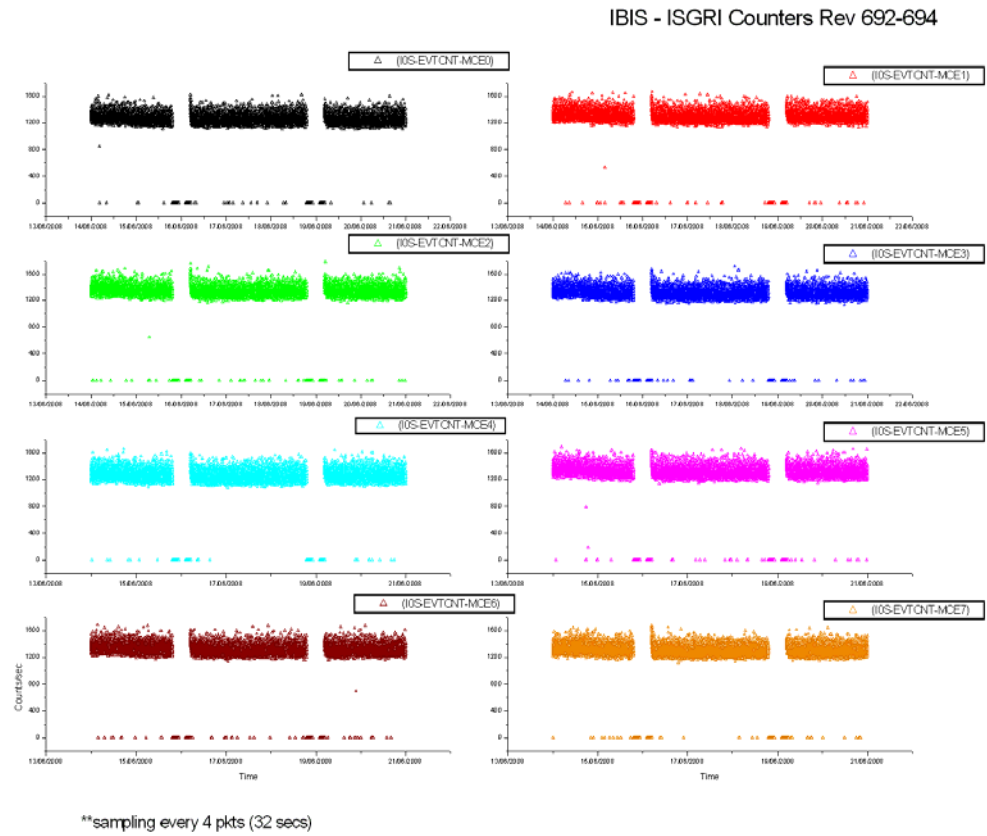
Event Log:

No non-nominal events occurred in this reporting period.

8.3.3 IBIS Operations

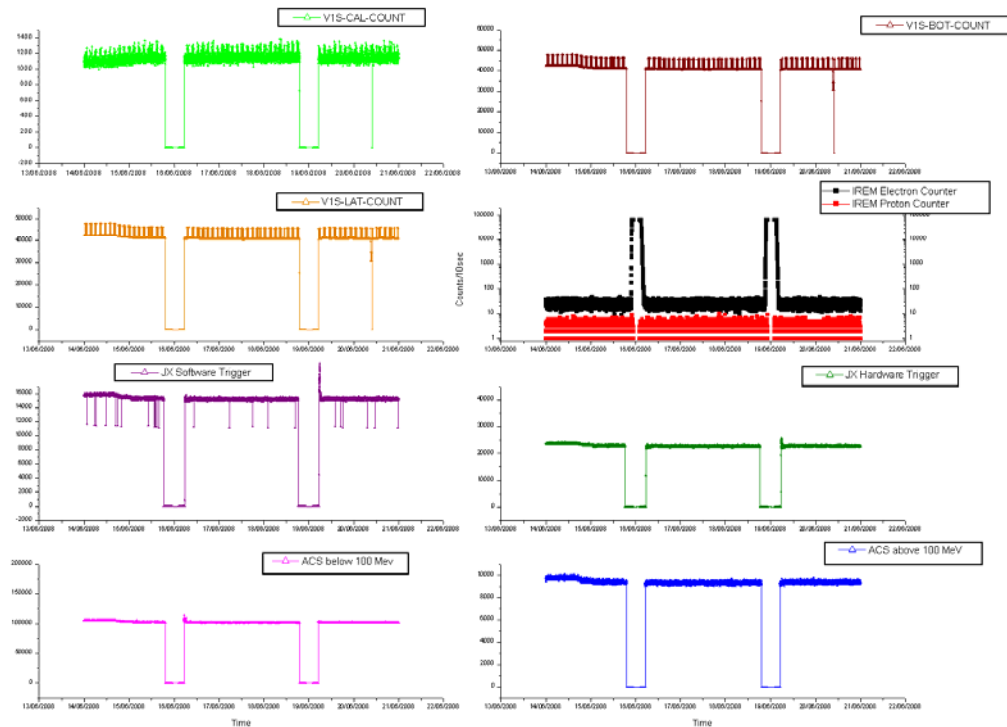
IBIS Event Counters Plots

ISGRI Counters:



VETO vs Payload Counters:

IBIS-VETO vs Payloads Counters Rev 692-694

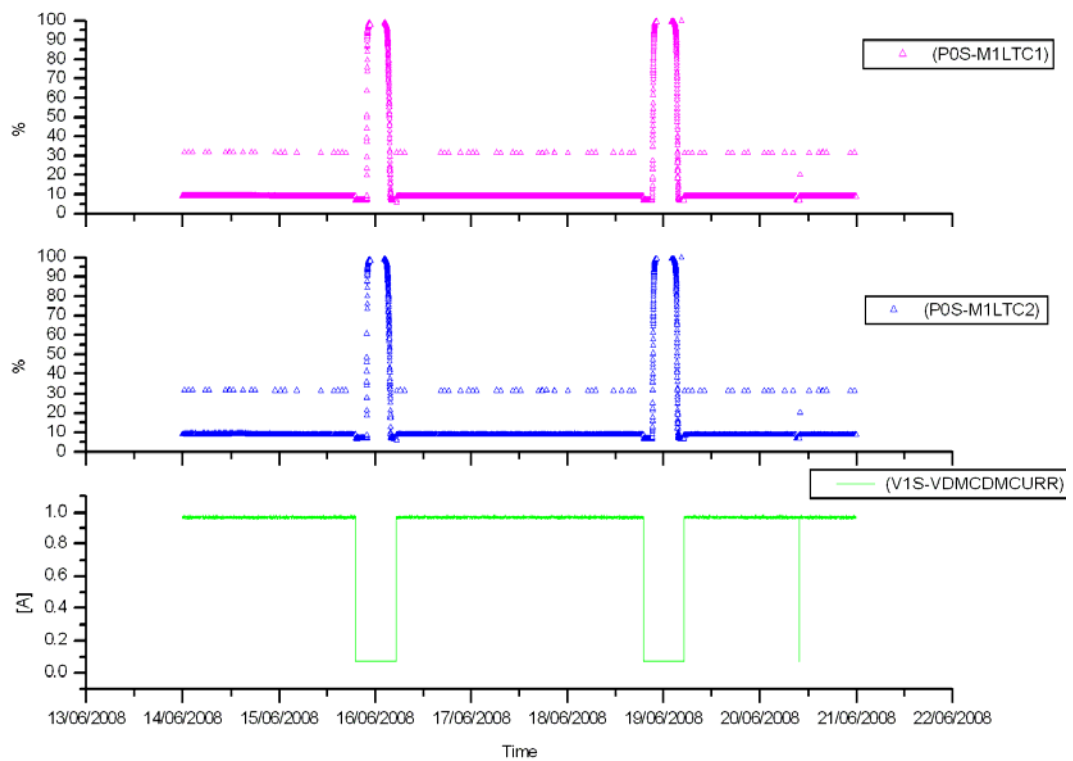


**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

The week was characterised by low radiation as reported by the payload.

VETO Current:

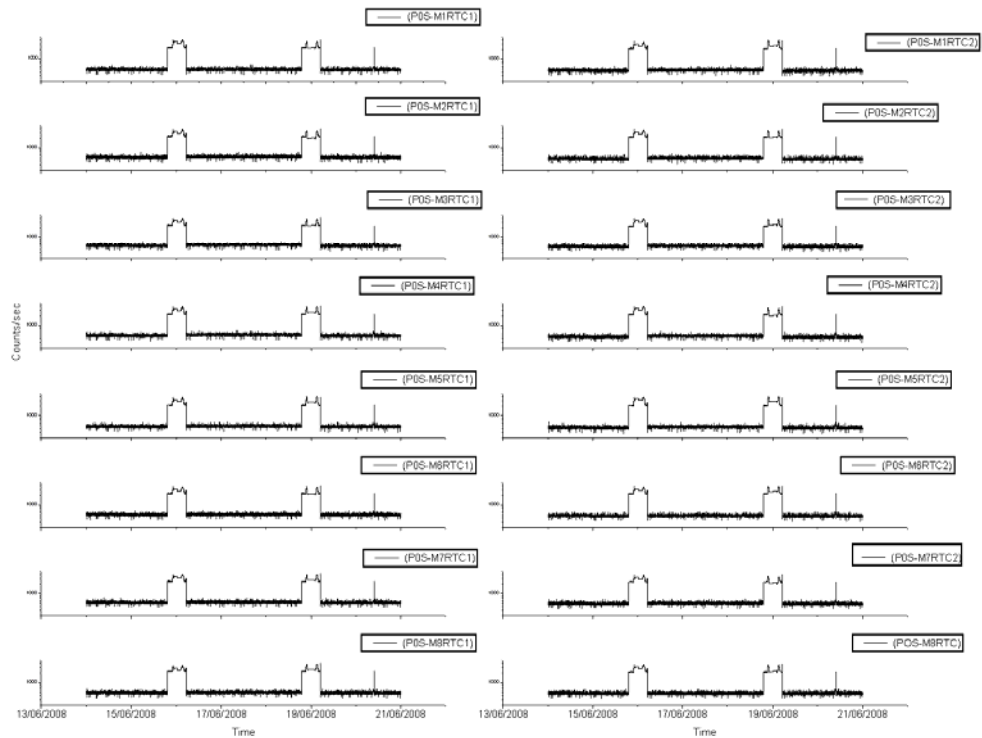
IBIS-VETO Current & PICsIT dead times Rev 692-694



**sampling every 4 pkts (32 secs)

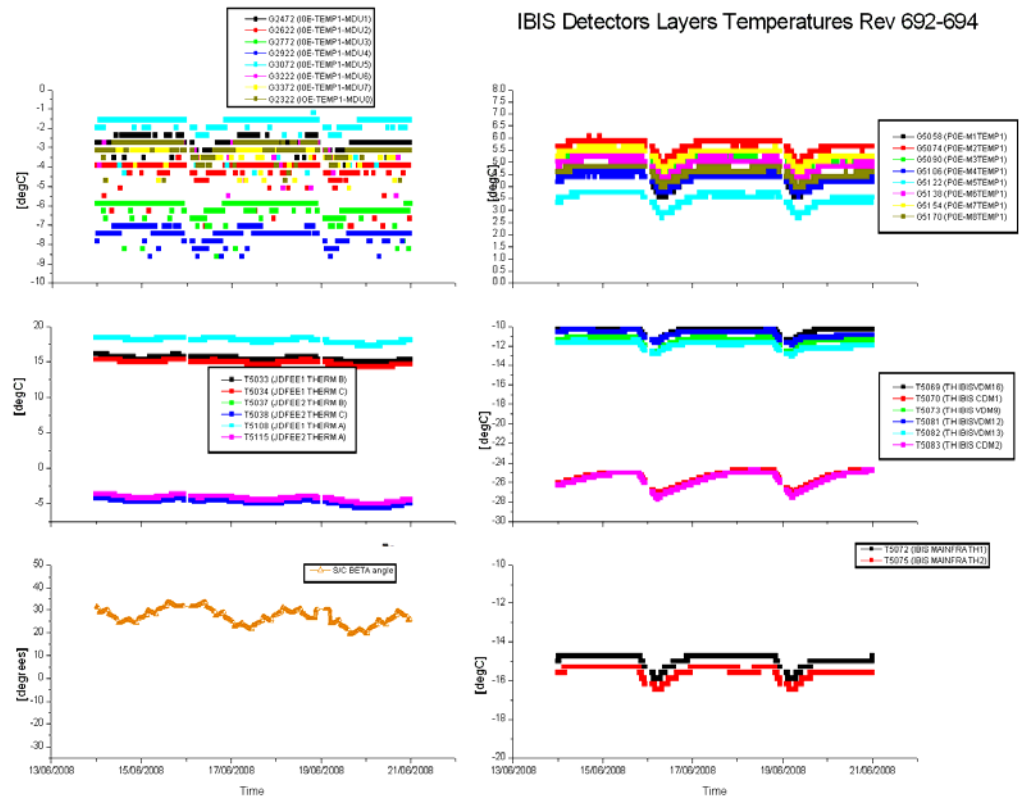
PICsIT Counters:

IBIS - PICsIT Counters Rev 692-694



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:



**sampling every 8 pkts (64 secs)

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.

2008-06-14 (DOY 166, Rev 692) to 2008-06-19 (DOY 171, Rev 693-694)

IBIS operations executed nominally.

2008-06-20 (DOY 172, Rev 694)

At 09:05:37Z TM parameter G6050 V1S-VDM16HV (High Voltage of VETO module VDM16) went OOL Alarm Low with value 414.3V.

No other OOLs were received and at 09:10:25Z the VDM16 HV recovered to its nominal value:

G6050 (V1S-VDM16HV) = 994.14V,

however the VETO count rates had dropped to lower values than nominal and remained at these lower values even after the VDM16 HV had recovered, e.g. at 09:11:53Z:

G6062 (VETO BOT counter) = 30736/s

G6063 (VETO LAT counter) = 30800/s

The current had remained nominal throughout, e.g. at 09:12:09Z:

G6013 (VETO VDM/CDM current) = 0.97A

As can be expected considering the reduced VETO count rates, the PICsIT counters were also higher than normal (approx. 500-600/s for each semi-module versus a nominal value of approx. 400-500/s). This however was also not high enough to generate an OOL.

The situation remained as such until the anomaly was recovered as follows:

1- At 09:45:41Z, set IBIS-IASW in Stand-By (TC G0125)

2- At 09:45:55Z, set IBIS-VETO in Stand-By (TC G0601)

3- At 09:48:58Z, set IBIS-VETO in Nominal (TC G0600)

4- At 10:01:44Z, set IBIS-IASW in Science Standard (TC G0129).

Following the recovery VETO was in Nominal and the main VETO parameters were nominal, e.g. at 10:03:05Z:

G6050 (V1S-VDM16HV) = 994.14V

G6062 (VETO BOT counter) = 40728/s

G6063 (VETO LAT counter) = 40720/s

G6013 (VETO VDM/CDM current) = 0.97A

The PICsIT counters also returned to nominal values.

This is recorded as AR INT_SC-231.

At 21:36Z, 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:

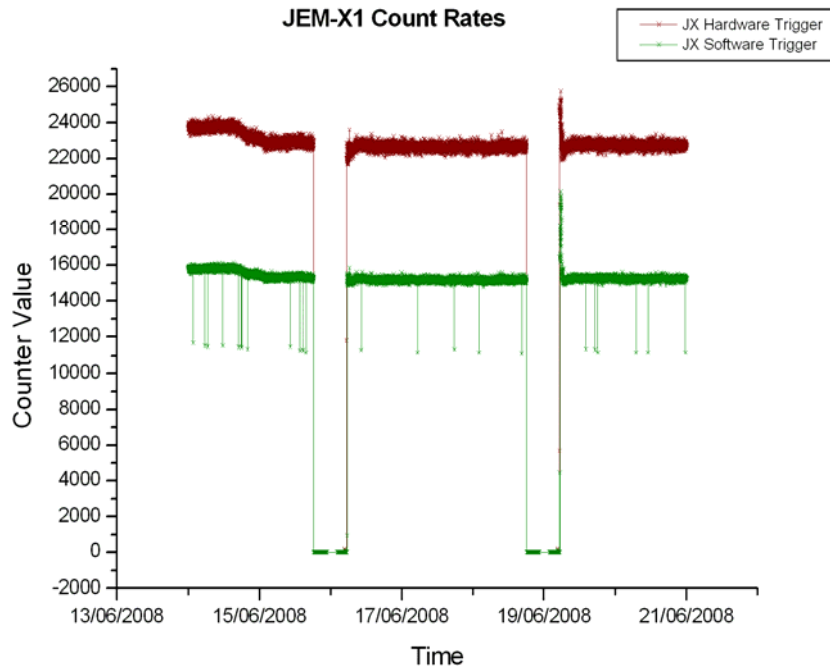
- 22:01:47Z FCP_IBIS1_0312;
- 22:02:40Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

8.3.4 JEM-X Operations

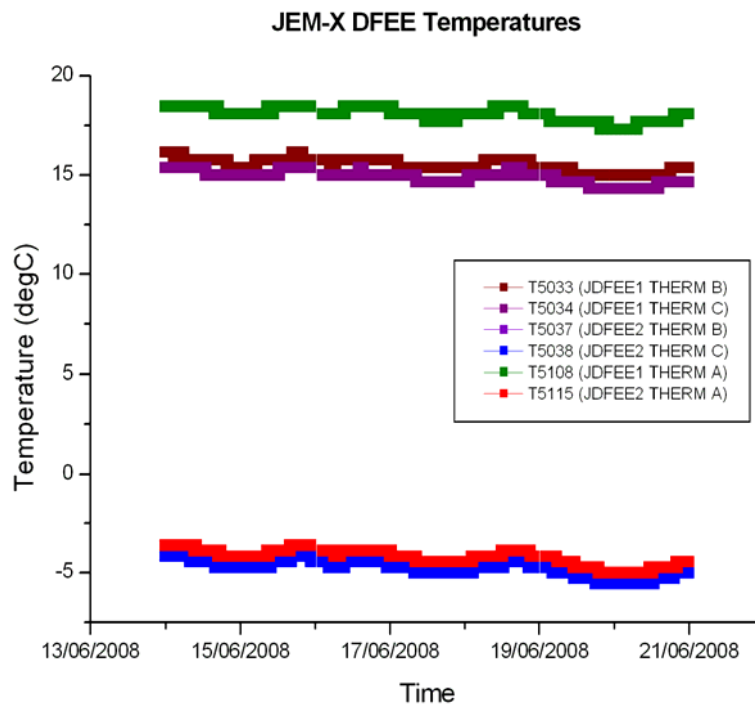
JEM-X Count Rates

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



JEM-X Temperatures

JEM-X DFEE temperatures over the reporting period are displayed in the following graph¹.



¹ Data sampled.

JEM-X Daily Report

2008-06-14 (DOY 166, Rev 692) to 2008-06-20 (DOY 172, Rev 694)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2008-06-14 (DOY 166, Rev 692)

OMC operations executed nominally.

2008-06-15 (DOY 167, Rev 692)

Due to a loss of TC from the ground station, slew ID 06920051 failed release and the OMC Imaging EDs for this pointing failed onboard acceptance as OMC was still in Science Normal mode, with the following OEMs being issued:

2008.167.07.25.49.436 1792 RealTime 131 TC REJECT REJECTED TC1

2008.167.07.25.49.359 1792 RealTime 131 TC REJECT REJECTED TC1

OMC transitioned to Standby at 07:51:32Z when the manual recovery slew was performed and operations continued nominally from Pointing ID 06920052 onwards.

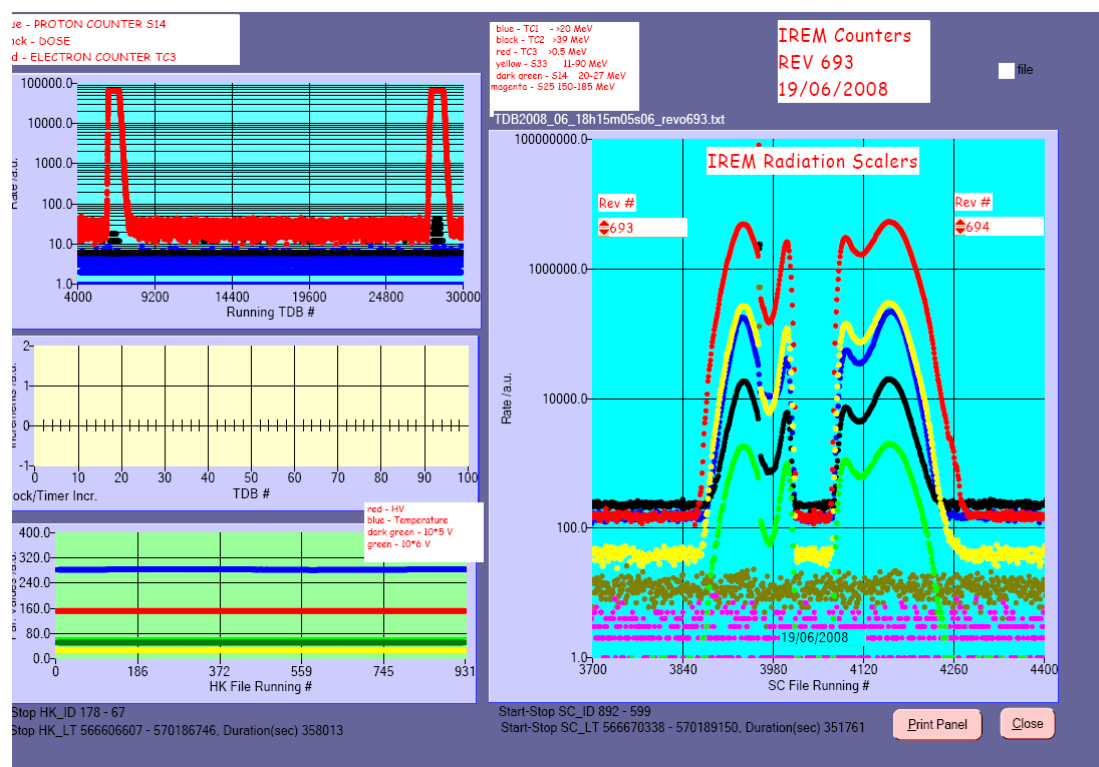
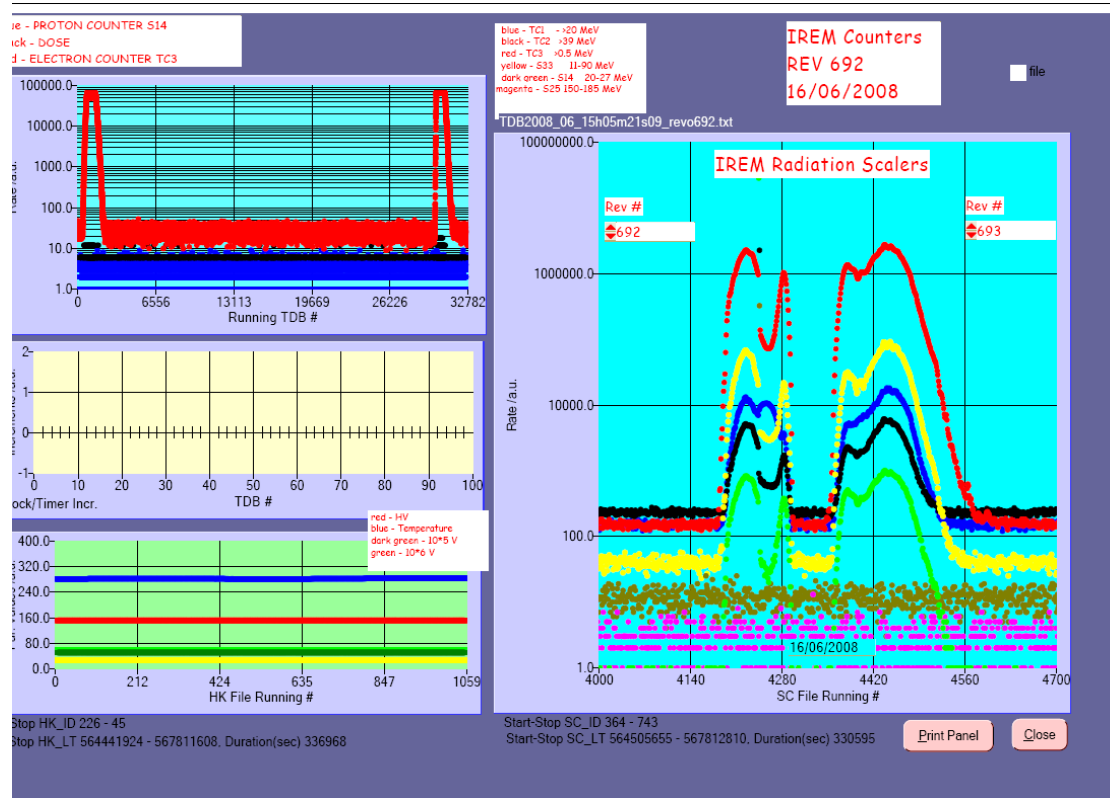
2008-06-16 (DOY 168, Rev 692-693) to 2008-06-20 (DOY 172, Rev 694)

OMC operations executed nominally.

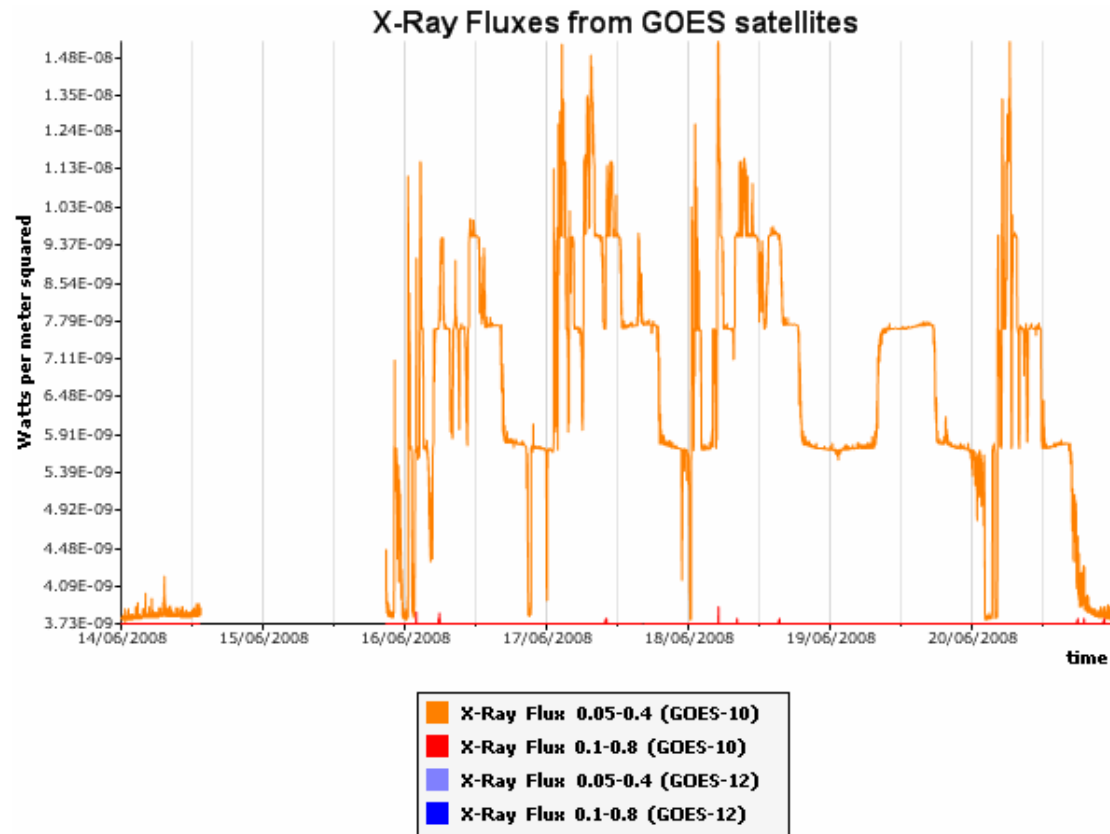
8.3.6 IREM Operations

IREM operations during the reporting period were nominal.

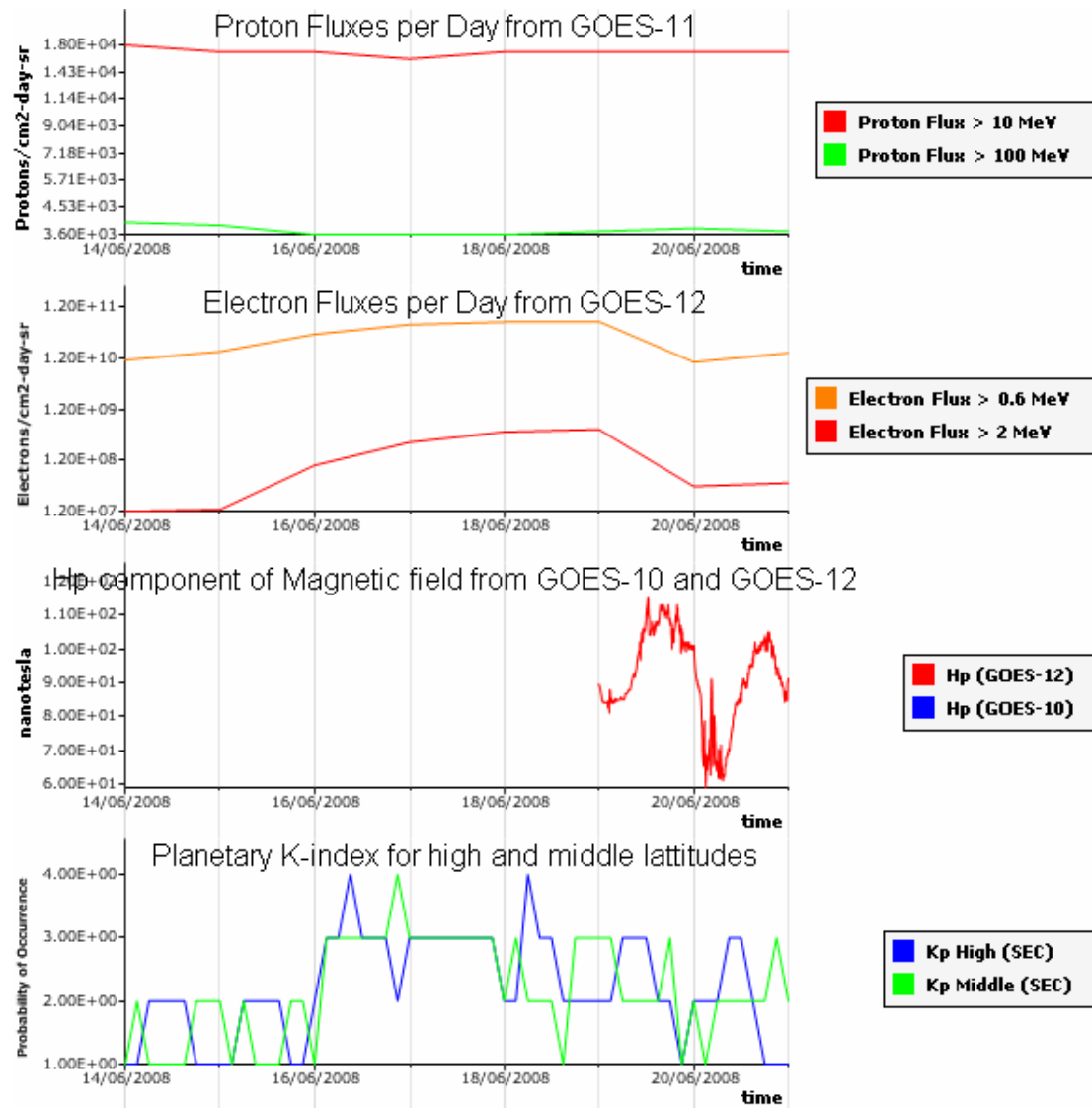
IREM radiation counters:



SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):



X-Ray fluxes start to be significant over 10^{-5} W/m^2 (corresponding to M-class flares). Above 10^{-4} W/m^2 , they correspond to strong X-class flares.



Proton and electron flux report low radiation background.

Hp component of the Geomagnetic Field is essentially parallel to the Earth's rotation axis. A drop near 0 nT is associated with a significant variation in the magnetic field.

Kp index is based on ground magnetometers. Kp ≥ 5 indicates storm-level geomagnetic activity.