

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 247
Week 24
18.06.07
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 09.06.07 until 15.06.07 (both dates inclusive) and covers the revolutions 569 and 570.

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 Galactic Plane Region 4 (RA 21:44:04.54, DEC +53:09:58.7), a hexagonal dither of the object MCG -05-23-016 (RA 09:47:40.10, DEC -30:56:56.0) and a raster dither, part of the XMM Large Scale Structure Survey (RA 02:18:00.00, DEC -07:00:00.0).

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, except...

On DoY 165 at 12:09, a SEU on the LCL for Reaction Wheel #4 caused the spacecraft to enter ESAM mode. A recovery was performed, and the spacecraft was back in nominal operations at 23:58. There seems to have been no further impact on spacecraft hardware or software.

3.1.1 AOCS

The AOCS operations were performed from the timeline during this period.

The Emergency Safe Attitude Mode (ESAM) was experienced, for the second time in the mission history, on the 14/06/2007.

The ESAM entry was caused by a violation of the SAS1 roll angle criteria: this was a direct consequence of a SEU affecting the LCL for the Reaction Wheel #4.

Sixteen slews were missed from TL during the observation period, due the ESAM entry/recovery and FDS failing update generation.

The fuel consumption over the period between 09/06/2007 and 15/06/2007 was 0.4635 Kg. The remaining propellant is in the order of 145.6940 Kg.

The ESAM entry/recovery fuel consumption was 0.3429 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.

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

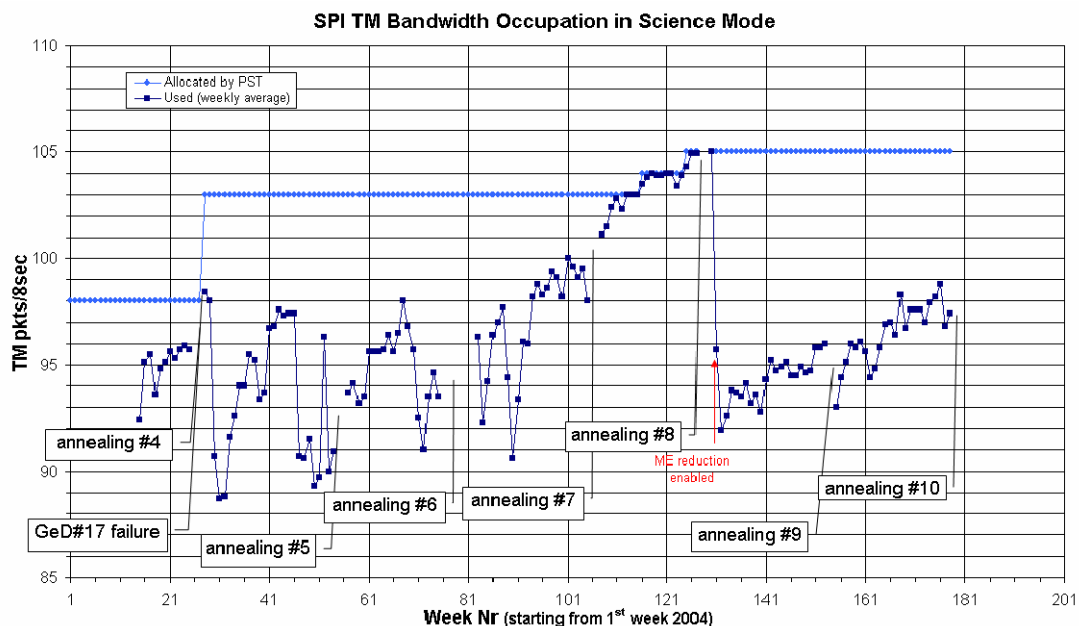
The overall status of the gamma-ray spectrometer is nominal. The 10th annealing started on 29th May and this annealing is progressing nominally. The following table reports the major events/steps performed so far (up to 15th June) since the start of the annealing:

Date/Time	Activity
29/05/2007 22:16Z	Configure SPI for start of Annealing and stop SPI active cooling
29/05/2007 23:30Z	Annealing Heater Main ON
30/05/2007 01:30Z	Annealing Heater Redundant ON
31/05/2007 10:39Z	Cold plate temperature reached 373K (100degC)
08/06/2007 20:39Z	Stop SPI Annealing: Annealing Heater Main and Redundant OFF; Heat Pipe Heater Main and Redundant OFF; Antifreeze Heater 1A ON
11/06/2007 08:44Z	ACS switch-on and calibration start (FEE#57 and FEE#81 ON)
11/06/2007 12:26Z	Thermal braids temperature TM EU0398A reached 308K
11/06/2007 12:47Z	Start of cryocooler switch-on
11/06/2007 13:57Z	Cyrocooler switch-on complete and stroke set to 4x45
13/06/2007 03:08Z	End of ACS Calibration
14/06/2007 21:08Z	Cold plate temperature TM EU0392A reached 127K
14/06/2007 21:34Z	Selected narrow range cyro temps and restored PSD nominal threshold
15/06/2007 16:36Z	Cold plate temperature TM EU0392 reached 100K
15/06/2007 16:42Z	Camera switch-on start
15/06/2007 19:08Z	Camera switch-on end: SPI in PHOTON mode with all GeD HV at 4kV except for GeD#2 (0.5kV) GeD#17(0.5kV) and GeD#12 (2.5kV)

15/06/2007 19:24Z	Thermal braid temperature TM E0398 reached 86K
15/06/2007 20:00Z	Start of reduction of cryocooler stroke for 80K target (FCP_SPI1_0072)

The assigned TM bandwidth was 46 packets/cycle until the start of revolution 570, when the TM allocation was 105 packets/cycle. SPI was in CONF mode due to the annealing until 15/06/2007 at 17:35Z, when it was first returned to PHOTON mode during the camera switch-on.

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.

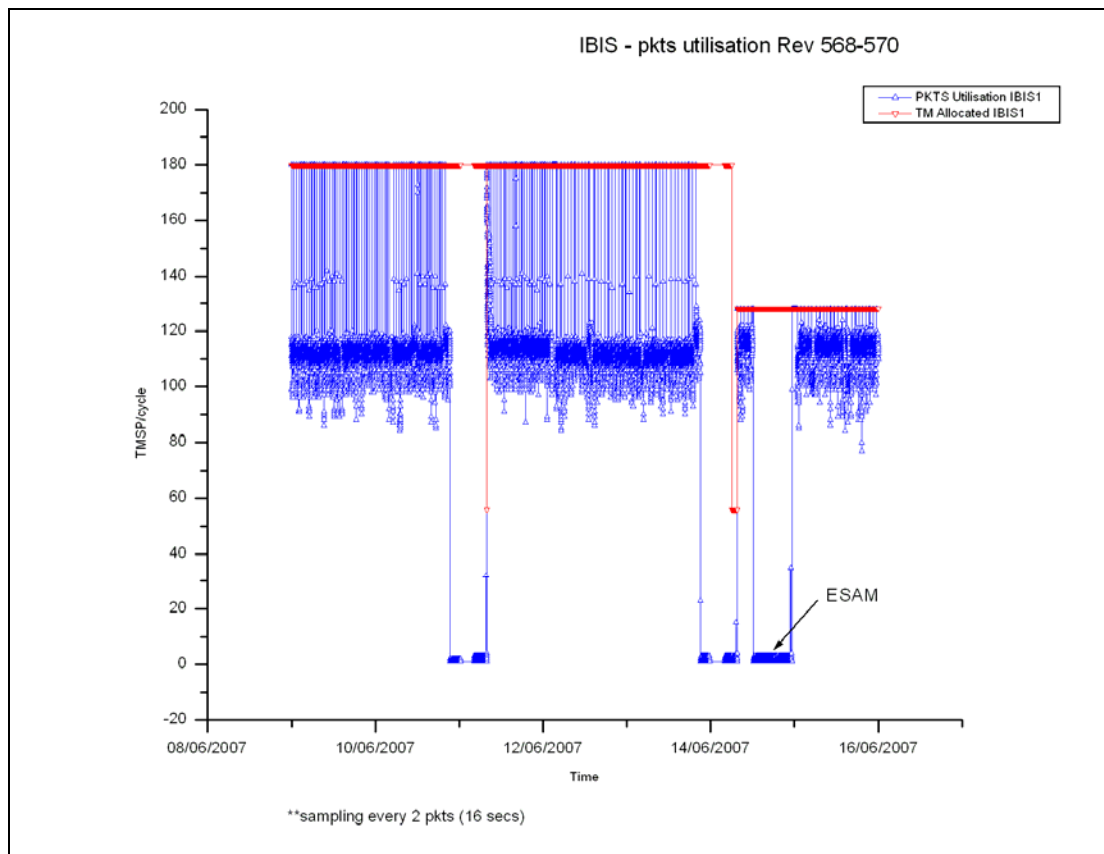
3.2.2 IBIS

The overall status of the unit is nominal.

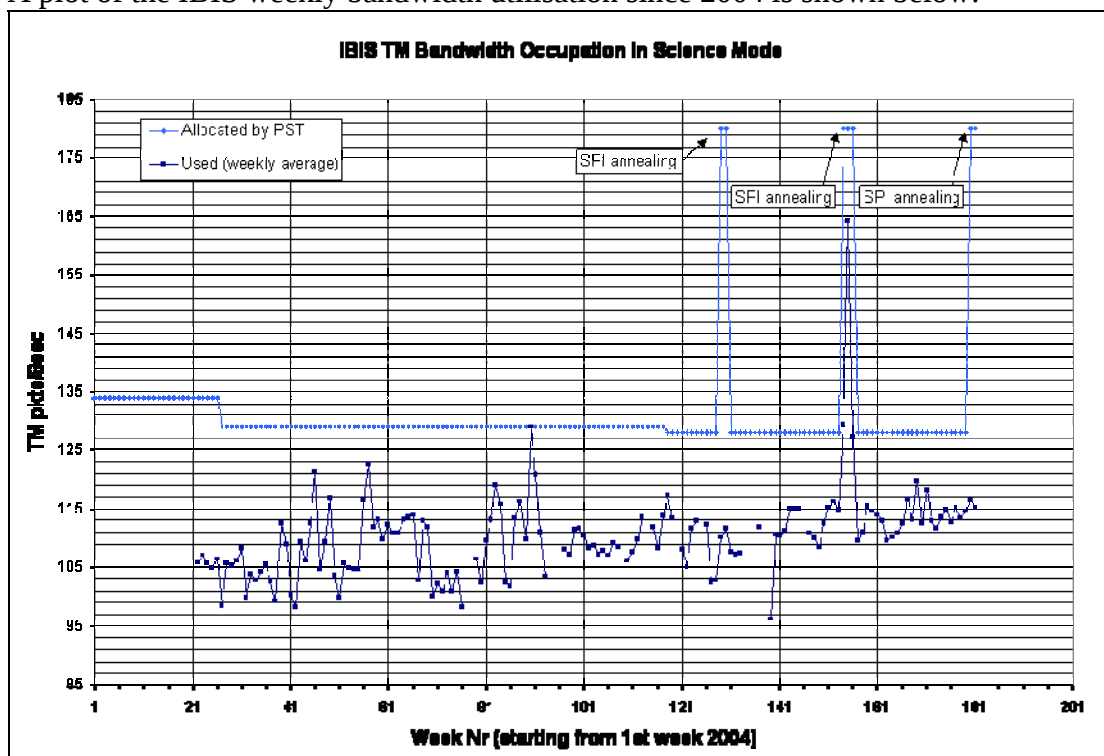
On 14/06/2007 (DoY 2007.165) at 12:20, the satellite went to the Emergency Safe Attitude Mode (ESAM) due to an SEU on the Reaction Wheel Electronics #4. This caused an automatic reaction of the payload (via Broadcast Packet) and switched IBIS to Safe configuration. The unit was recovered as per procedure at 23:25Z.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. From beginning of revolution 565 on 30/05/2007, it was 180 TMPS/cycle due to SPI annealing. The IBIS mean bandwidth utilisation during the observation period (when IBIS was in Science mode) was 115.23 TMPS/cycle, down 1.25 on last week.

A plot of the IBIS TM utilisation during the observation period is shown below:



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 15 packets/cycle in revolution 568 and 569 and 8 packets/cycle in revolution 570. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

On 2007-06-14 at 12:20Z an ESAM occurred, putting JEM-X1 into Safe mode. JEM-X1 was recovered back to Data Taking at 21:50Z

Further information on the JEM-X operations can be found 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, 149 of the 164 planned science pointings for OMC were executed nominally, 1 was interrupted and 14 were lost.

Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

3.2.5 IREM

The overall status of the unit is nominal.

At 15:06:45Z, the IREM SEU #49 occurred. This was during ESAM recovery, therefore the recovery of IREM was postponed to 23:51Z.

Solar Activity

The observation period was characterised by low solar activity.

Sunspot 960 was decaying this week. On 09/06/2007 and 10/06/2007 it still posed threat for strong solar flares. From 11/06/2007 it posed no more threat. On 15/06/2007 the sun was blank.

Reference: www.spaceweather.com

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 good this week. Two pointings were 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. Two FD problems led to the loss of 2 pointings, but that was all. The overall performance was still over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were 3 occasions of a data drops from Redu and 1 from DSS-24, plus a 4 minute delay in a H/O from Redu to DSS-24, all without impact. The overall performance was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Received PSFs for revolutions 575, 577 & 578.

Planning was done for 573-576. Replanning was done for revolutions 570 & 571, to move the OMC flat field observation from the end of 570 to end of 571 (because of SPI annealing in 570 and inconsistent TM settings, see below).

POSSes were sent up to revolution 575.

TSFs received up to revolution 572.

2. Observation status

ECS files have been received and processed up to revolution 561.

3. ISOC Science Data Archive

No news.

4. ISOC system

Version 15.0 is still in use. Work is ongoing on version 15.1; expected to be released next week.

5. Problems

The problem with the file transfer from/to MOC has apparently been solved; it was due to a firewall setting that would sometimes block the connection. IFTS has been running stable for a couple of days now.

An OMC flat-field (FF) observation was planned by ISOC at the end of revolution 570. However, this revolution constituted the end of SPI annealing, in which the SPI detectors were switched on again and performance verifications were carried out. The TM settings for SPI during the OMC FF was lower than that needed for the performance verification ($85 < 105$); this would mean that the number of photons for the camera performance measurement would be reduced by 20% and no on-board spectra would be obtained during that time. Therefore MOC requested the FF to be moved to revolution 571.

4.3.2 ISDC

Status of ISDC observation processing on 18/06/2007:

- Latest Standard Analysis completed: observation 04700020002 (1E 1048.1-5937, Revolution 560) on 13/06/2007.
- Latest products archived: observation 04700020002 (1E 1048.1-5937, Revolution 560) on 13/06/2007.
- Latest observation products sent to the observer: 04700020002 (1E 1048.1-5937, Revolution 560) on 14/06/2007.

5 Special Events

6 Anomalies

The following problems were reported that impacted operations:

- On DoY 162 at 12:20, the lack of a suitable star caused the Star Mapping and subsequent manoeuvre update to fail. A recovery was performed, and the Timeline rejoined at 13:20. The impact was the loss of slew 05690008.
- At 15:13, due to problems with the FD SODA server, the TPFs for slew 05690012 failed to arrive in the control system. These were restarted, and a recovery performed. The impact was the loss of slew 05690012.
- On DoY 165 at 12:09, a SEU on the LCL for Reaction Wheel #4 caused the s/c to drift off nominal position. At 12:20:24 ESAM mode was triggered. A recovery was subsequently performed, and the Timeline rejoined at 23:58. The impact was the interruption after 2021 from a scheduled 3530 seconds of pointing 05700008, and the loss of pointings 05700009 to 05700020 inclusive (12 pointings).

The following anomaly reports were entered into the ARTS system this week:

AR id	Date Created	Subject	Segment	Status
INT_SC-191	14/06/2007	ESAM Entry #2	Spacecraft	Pending
INT_SC-192	20/06/2007	IREM Anomaly: Reset of IREM_CSCI S/W #49, 14/06/2007	Payload	Open

7 Future Milestones

The following activities are foreseen in the next few weeks.

- The 10th SPI annealing started on 29th May at radiation belt entry of revolution 564. A summary of the timeline of the planned annealing activities is given below:

10th SPI ANNEALING - revs 564-571																																
ID	Task Name	Duration	Start	Resource	28 May '07 04 Jun '07 11 Jun '07 18 Jun '07																											
				Names	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr
2	Start SPI Annealing - Warm-up Phase	36.5 hrs	29 May 22:09	PST[20 pkts]	May 22:09																											
16	Annealing at 104degC	202 hrs	31 May 10:39	PST[20 pkts]	31 May 10:39																											
28	Stop SPI Annealing - Passive Cooling Phase	64.02 hrs	08 Jun 20:39	PST[20 pkts]																												
36	ACS Calibration	40.4 hrs	11 Jun 08:39	PST[20 pkts]																												
44	Start Cryocoolers - Active Cooling Phase	139 hrs	11 Jun 12:40	PST[20 pkts]																												
57	Camera Switch on & Performance Tests	11.3 hrs?	15 Jun 17:40	PST[105 pkts]																												
74	Test of OEM 243 generation and Single Event Filtering	11.2 hrs	16 Jun 04:58	PST[105 pkts]																												
96	Active Cooling Fine Tuning	61 hrs	17 Jun 07:40	PST[105 pkts]																												
99	Resume SPI POS Observations	61 hrs	17 Jun 07:22	PST[105 pkts]																												

- Periodic Thruster Torque rescaling 24th July 2007 in Rev. 583
- On Board Clock wrap around due 30th July 2007 in Rev. 585.

Appendix

The appendix includes various detailed information.

7.1 Overview of Revolutions

Revolution 569

The observations in revolution 569 began with a raster dither of the Galactic Plane Region 4 (RA 21:44:04.54, DEC +53:09:58.7), lasting ~17.9 hours. It continued with a hexagonal dither of the object MCG -05-23-016 (RA 09:47:40.10, DEC -30:56:56.0), lasting ~37.8 hours, until the end of the revolution.

Revolution 570

The observations in revolution 570 consisted entirely of a raster dither, part of the XMM Large Scale Structure Survey (RA 02:18:00.00, DEC -07:00:00.0), lasting ~55.9 hours.

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 105; JEM-X1 8; JEM-X2 0; OMC 5.

7.2 Consumables

7.2.1 Detailed Fuel Book-keeping

2007-05-31T15:29:01.000Z	146.2420	F	Automatic TM processing.
2007-06-02T05:27:53.000Z	146.2320	F	Automatic TM processing.
2007-06-03T15:21:00.000Z	146.1950	F	Automatic TM processing.
2007-06-05T05:17:20.000Z	146.1800	F	Automatic TM processing.
2007-06-06T14:48:12.000Z	146.1635	F	Automatic TM processing.
2007-06-08T05:07:44.000Z	146.1569	F	Automatic TM processing.
2007-06-09T14:38:27.000Z	146.1357	F	Automatic TM processing.
2007-06-11T04:57:36.000Z	146.1243	F	Automatic TM processing.
2007-06-12T02:48:58.000Z	146.0915	F	Automatic TM processing.
2007-06-13T23:26:55.000Z	146.0540	F	Automatic TM processing.
2007-06-14T04:41:52.000Z	146.0429	F	Automatic TM processing.
2007-06-14T16:56:38.000Z	145.8719	F	ESAM monitoring
2007-06-14T19:17:52.000Z	145.7620	F	Post ESAM SSA to STA
2007-06-14T21:49:04.000Z	145.7480	F	Automatic TM processing.
2007-06-14T23:06:24.000Z	145.7000	F	Automatic TM processing.

This report was generated Fri Jun 15 09:17:23 GMT 2007

7.3 Detailed Satellite Information

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

7.3.1 AOCs SUMMARY OPERATIONS REPORT, 09/06/2007 –15/06/2007

AOCs operations were executed from the Automatic Timeline.

During this period, 76 Open Loop Slews, 82 Closed Loop Slews and 8 Momentum Biases were executed.

The Emergency Safe Attitude Mode (ESAM) was experienced on the 14/06/2007. The ESAM entry was caused by a violation of the SAS1A X criteria (TM A9096): this was a direct consequence of a SEU affecting the LCL for the RWDE4 and causing the switch-off and run down of RW-4.

16 (11 OSL, 5 CSL) slews were missed from TL, during the observation period, due to ESAM entry and FDS failing update generation.

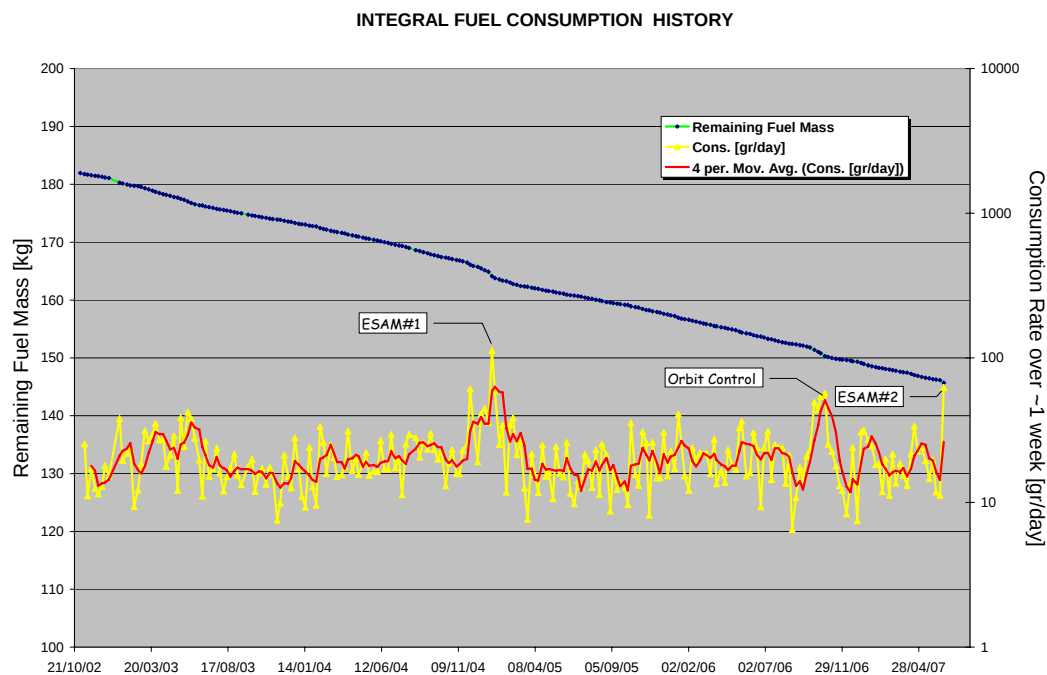
This is equivalent to ~9.4 % of the total number of slews planned (169).

Orbit Control

No update.

Fuel consumption

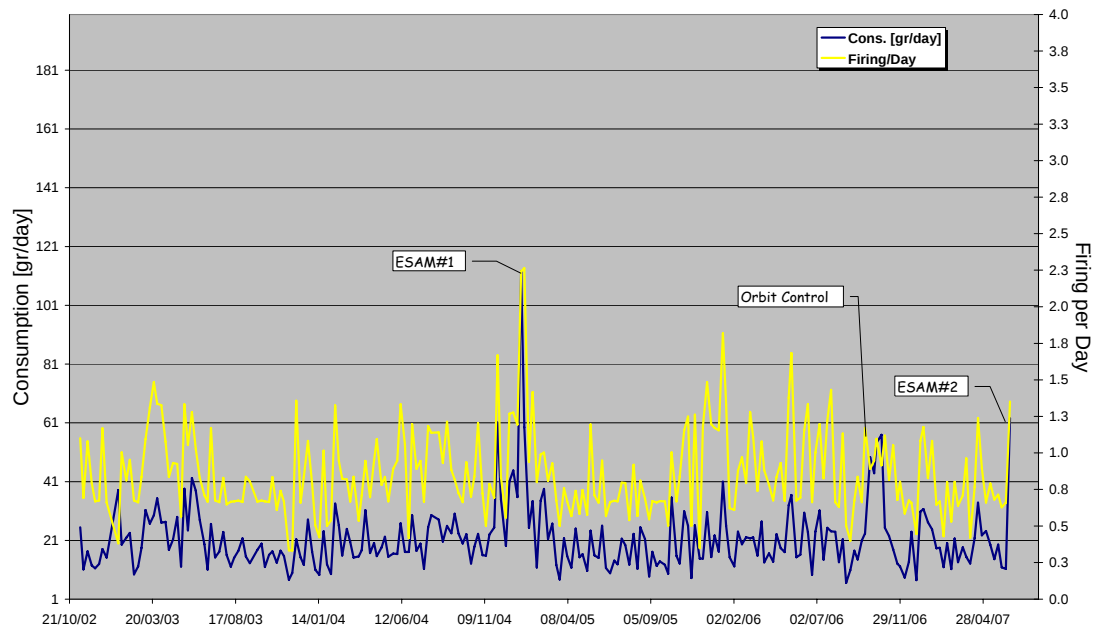
The fuel consumption (total, grams per day) over the period between 01/11/2002 and 15/06/2007 is reported in the plot below.



The plot above has been corrected to consider the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 15/06/2007 is reported in the plot below.

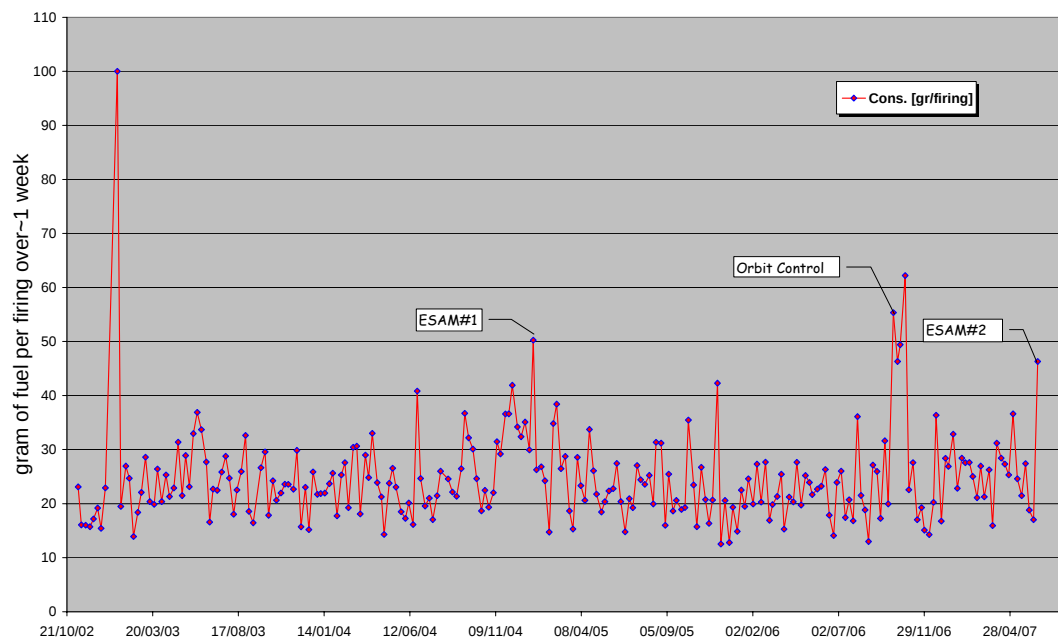
INTEGRAL FIRING PER DAY HISTORY



The plot above has been corrected to consider the ESAM fuel consumption spread over period of ~1 week.

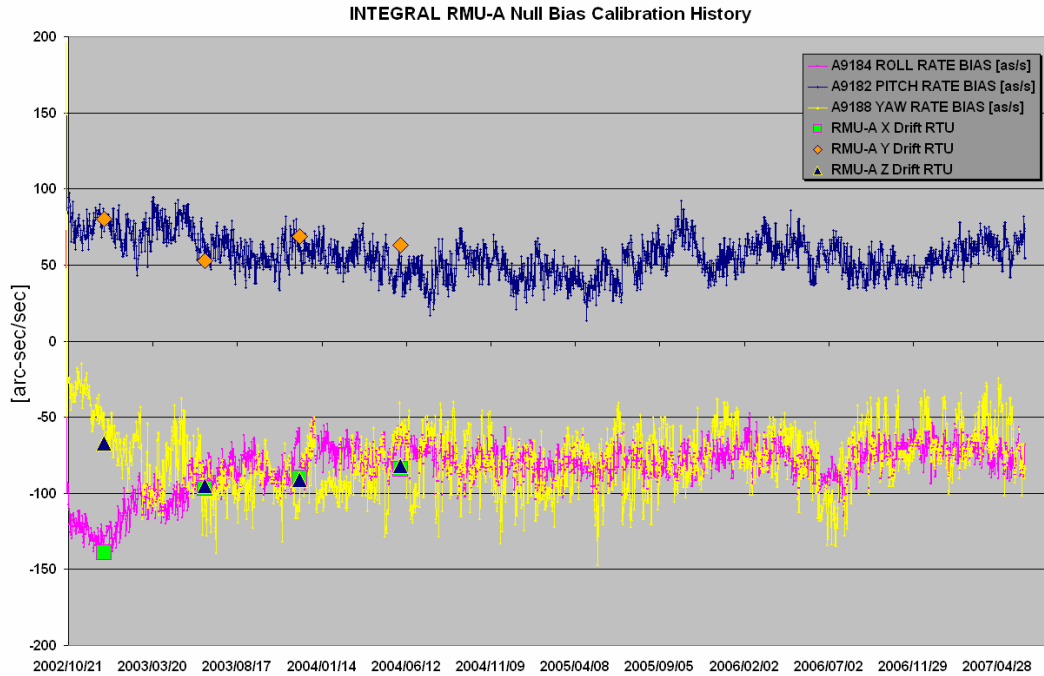
The fuel per firing over the period between 01/11/2002 and 15/06/2007 is reported in the plot below.

INTEGRAL FUEL MASS PER FIRING HISTORY

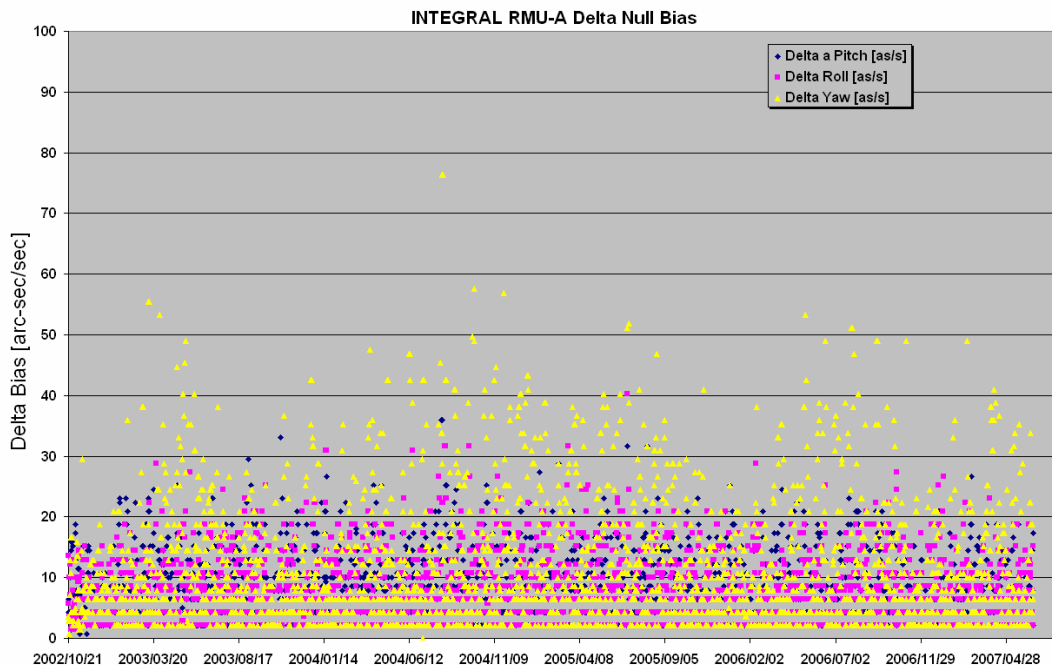


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 15/06/2007 is reported in the plot below.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 15/06/2007 is reported in the plot below.



09/06/2007 (Day of Year 160, Revolution 568)

Nothing to report.

10/06/2007 (Day of Year 161, Revolution 568)

Nothing to report.

11/06/2007 (Day of Year 162, Revolution 568-569)

FDS failed slew update: at 12:20z the FDS failed the update of slew ID 05690008. FDS reported an error during the update process: no suitable guide star was found for the attitude determination process and update generation.

A manual recovery of slew 05690008 was performed at 13:06z and the next slew (05690009) manually updated in TL.

The following slew was missed in TL: 05690008(OSL)

FDS failed slew update: at 15:15z the FDS failed the update of slew ID 05690012. FDS reported an error during the update process: no suitable guide star was found for the attitude determination process and update generation.

A manual recovery was performed at 16:12z to the attitude of PID 05690013 and the next slew (05690014) manually updated in TL.

The following slew was missed in TL: 05690012(OSL)

12/06/2007 (Day of Year 163, Revolution 569)

Nothing to report.

13/06/2007 (Day of Year 164, Revolution 569)

Nothing to report.

14/06/2007 (Day of Year 165, Revolution 569-570)

Emergency Safe Attitude Mode #2: at 12:20:12Z the ESAM mode was experienced, for the second time in the mission history.

The sequence of the events was the following:

At 12:09:18z the parameter P1136 LCL status for RW#4 reported SCC fail (=OPEN)
At 12:09:18z the ACC MACS reported exception failing transaction to WDE/4
At 12:16:04z the IMU1 was automatically switched ON by ACC compensating the lost of guide star reported by the STR, while RW2 and RW3 compensating the momentum transfer from RW4

At 12:19:43z the FSS beta angle reported a value in OOL (ALARM) equivalent to -42.47 deg

At 12:19:43z the FSS alpha angle reported a value in OOL (ALARM) equivalent to 5.87 deg

At 12:20:21z the FDE SAS 1A X criteria was detected.

At 12:20:21z the FCE triggered an on-board Automatic Reconfiguration (ARO).

The ESAM entry time is therefore 12:20:21z. Once in ESAM the S/C is controlled maintaining a zero Sun aspect angle (SAA) and a null rate about the sun vector.

The initial checks indicated a correct entry into ESAM, no manual intervention was necessary.

The ESAM recovery was performed with following main events:

- Sun Sensor Acquisition (SSA) at 13:25z
- Reaction Wheel Spin-Up and Star Tracker Acquisition (STA) at 17:15
- Inertial Pointing and Slew (IPS) at 20:09z
- AOCS enabled in TL at 00:55z on DoY 166

The ESAM entry was caused by a violation of the SAS1A X criteria (TM A9096): this was a direct consequence of a SEU affecting the LCL for the RWDE4 and causing the switch-off and run down of RW-4.

The ESAM entry was required because the FDE electronics, monitoring the SAS output on the roll angle, detected a violation of the X threshold at about 6.42 degrees.

The conclusion is that the ESAM triggering was not caused by any ground error, or on-board permanent unit failure and the S/C reacted correctly.

The following slews were missed in TL: 0570008-21

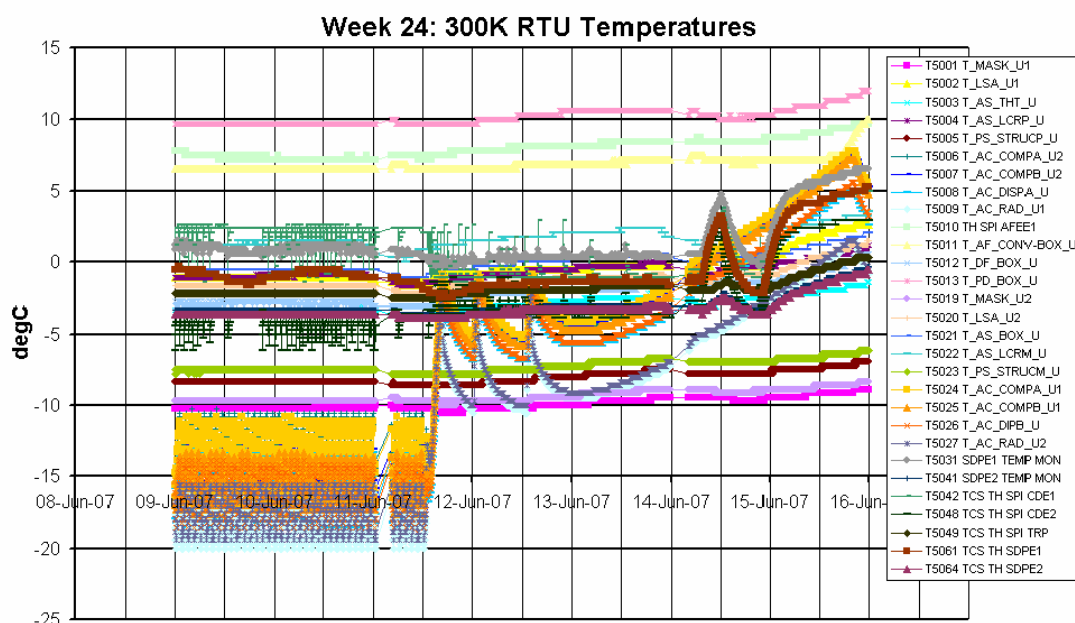
A detailed report/analysis on the ESAM #2 will be issued in a separate document, in the following weeks.

15/06/2007 (Day of Year 166, Revolution 570)

Nothing to report.

7.3.2 SPI Operations

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

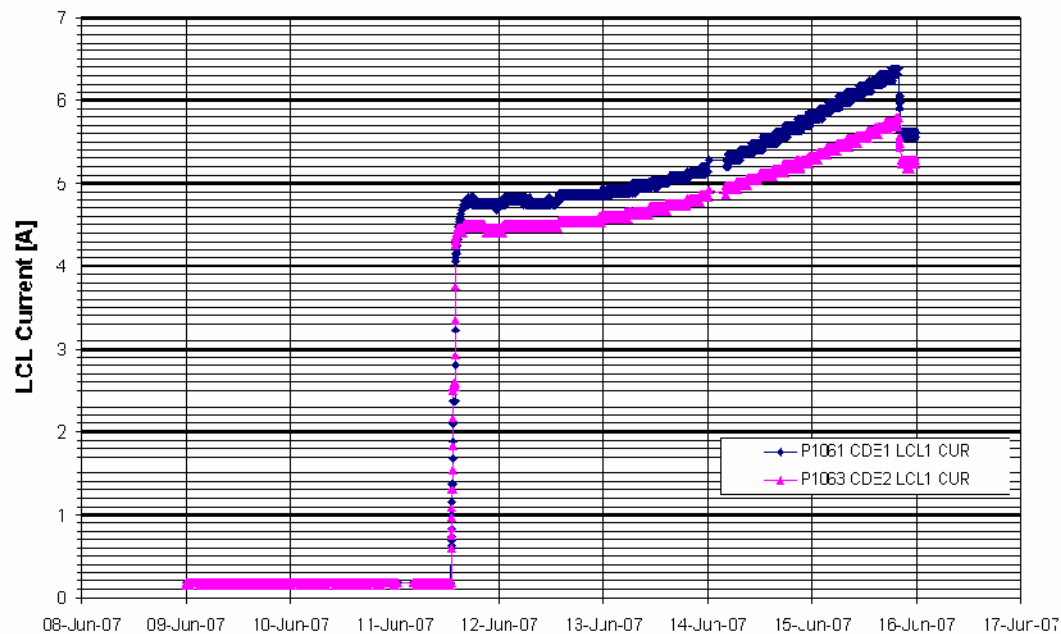


Stirling Compressors and Cryostat: The performance of the compressors is nominal. Due to the ongoing annealing operations, the cryocooler was in Standby mode until the start of active cooling on 11/06/2007 at 12:47Z. The switch-on was completed on 11/06/2007 at 13:57Z after which the compressors were run at full stroke (45) until 15/06/2007 at 20:00Z, when the reduction of the compressor strokes was started to reach a cold plate temperature of 80K. The stroke changes performed were as follows:

Time (Z)	Stroke Change
2007-06-15 20:00:00	CDE1 to 44
2007-06-15 20:00:30	CDE2 to 44
2007-06-15 20:30:30	CDE1 to 43
2007-06-15 20:31:00	CDE2 to 43
2007-06-16 11:31:00	CDE1 to 42
2007-06-16 11:31:30	CDE2 to 42
2007-06-16 12:16:30	CDE1 to 41
2007-06-16 12:17:00	CDE2 to 41
2007-06-16 13:02:00	CDE1 to 40
2007-06-16 13:02:30	CDE2 to 40
2007-06-16 13:47:30	CDE1 to 39
2007-06-16 13:48:00	CDE2 to 39
2007-06-16 14:48:00	CDE1 to 38
2007-06-16 14:48:30	CDE2 to 38
2007-06-16 15:48:30	CDE1 to 37
2007-06-16 15:49:00	CDE2 to 37

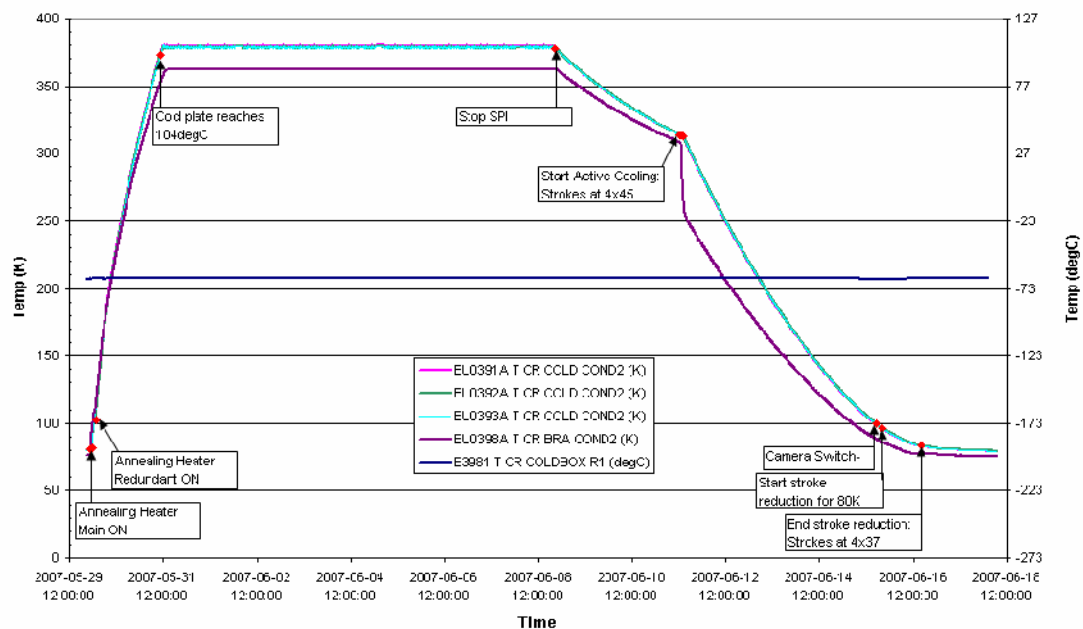
The following plot shows the evolution of the CDE currents during the reporting period.

Week 24: SPI CDE1 and CDE2 LCL Currents

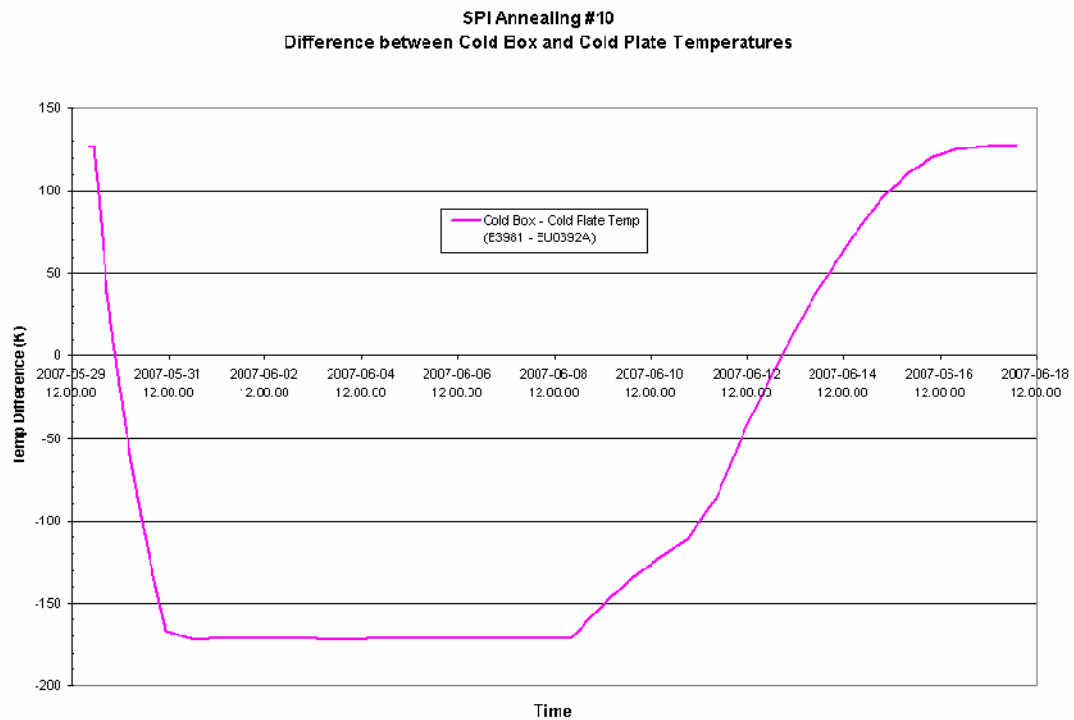


The following plot shows the evolution of the cold plate, H bar and cold box temperatures since the start of annealing.

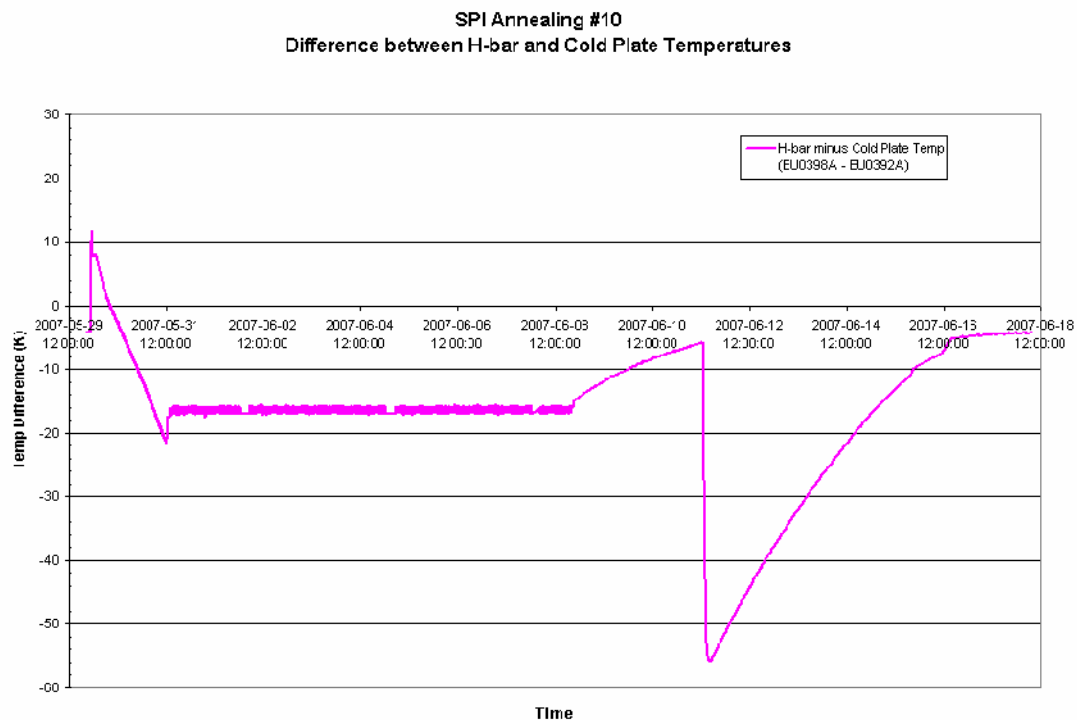
**SPI Annealing #10
 Cold Plate, H-Bar and Cold Box Temperatures**



The following plot shows the difference between the cold box and cold plate temperatures since the start of annealing.



The following plot shows the difference between the H-bar and cold plate temperatures since the start of annealing.



DPE & IASW: The DPE health and IASW performance is nominal. The IASW version installed is v433 patch #1 with the spectra scaling factor set to 9/19 SE. Due to the ongoing annealing operations, started on 29th May, the TM allocation was 46 packets/cycle until the start of revolution 570, after which it reverted to the nominal 105 packets/cycle during the INSTRUMENT window. The IASW was in CONF mode until the camera switch-on, which started on 15/06/2007 at 16:42Z.

Following the camera switch-on, a test of OEM 243 generation and Single Event Filtering were performed, as follows:

- 2007-06-15T20:53:17Z Transition to Conf, uplink TPF ES1700_IASW-PAR_fmconfig_0013.TPF with spectra scaling factor set to 19/19 SE; and the spectra accumulation duration (TC parameter E8976) to 300secs and transition back to Photon. As expected, a single OEM 243 was generated at the start of each spectra building (~every 5 minutes).
- 2007-06-15T21:44:15Z Transition to CONF, uplink image IIMG_P_SPI_0129_00002_T_V_430_001_5.INT for the 5-line Single Event filtering energies, uplink TPF ES1700_IASW-PAR_fmconfig_0013.TPF with the filtering (TC parameter E8979) set to SEonly and transition back to Photon. The PI verified that the Single Event filtering was working as expected. Before the start of spectra accumulation, the CPU margin was ~66% and no anomaly OEMs were generated. At the start of the next pointing (PID 05700041), when the spectra accumulation started (spectra scaling factor 9/19SE), the CPU margin (max) decreased to ~31%. One OEM 243 was generated at the start of the pointing and then no further OEMs were generated until about 20 minutes into the pointing, when the following series of OEMs were received:

2007.166.22.51.11.421	2007.166.22.51.22.418	1024	RealTime	10	ANOMALY
SPI1 PERIODIC TASK OVERRUN					
E9074	TASK ID 16	6			
FIX16		0			
2007.166.22.51.00.921	2007.166.22.51.05.599	1024	RealTime	229	EXCEPTION
SPI1 PARTIAL FLAG OVERFLOW					
E9783	SUBBLOCK ID	SP12			
FIX16		0			
2007.166.22.51.00.796	2007.166.22.51.05.596	1024	RealTime	229	EXCEPTION
SPI1 PARTIAL FLAG OVERFLOW					
E9783	SUBBLOCK ID	SP13			
FIX16		0			
2007.166.22.51.00.796	2007.166.22.51.05.594	1024	RealTime	224	EXCEPTION
SPI1 SW ERROR					
E9777	FAULTY TASK ID	6			
FIX16		0			
2007.166.22.51.00.796	2007.166.22.51.05.591	1024	RealTime	7	EXCEPTION
SPI1 CONSTRAINT DPE CULPR					
E9076	OUT RANGE VALUE	36869			
E9067	LOGICAL ADDRESS	9643			
2007.166.22.51.00.796	2007.166.22.51.05.567	1024	RealTime	10	ANOMALY
SPI1 PERIODIC TASK OVERRUN					
E9074	TASK ID 16	6			
FIX16		0			
2007.166.22.51.00.671	2007.166.22.51.05.532	1024	RealTime	229	EXCEPTION
SPI1 PARTIAL FLAG OVERFLOW					
E9783	SUBBLOCK ID	ME			
FIX16		0			

These OEMs stopped of their own accord.

- 2007-06-15T22:54:43Z Transition to CONF, uplink TPF ES1700_IASW-PAR_fmconfig_0013.TPF with the filtering (TC parameter E8979) set to SEandME and transition back to Photon. Before the start of spectra accumulation, the CPU margin was ~66% (similar to the case of SE filtering only) and no anomaly OEMs were generated. At the start of the next pointing (PID 05700042), when the spectra accumulation started (spectra scaling factor 9/19SE), the CPU margin (max) decreased to ~28-31%. Again one OEM 243 was generated at the start of the pointing and then no further OEMs were generated until about 20 minutes into the pointing, when the following series of OEMs were received:

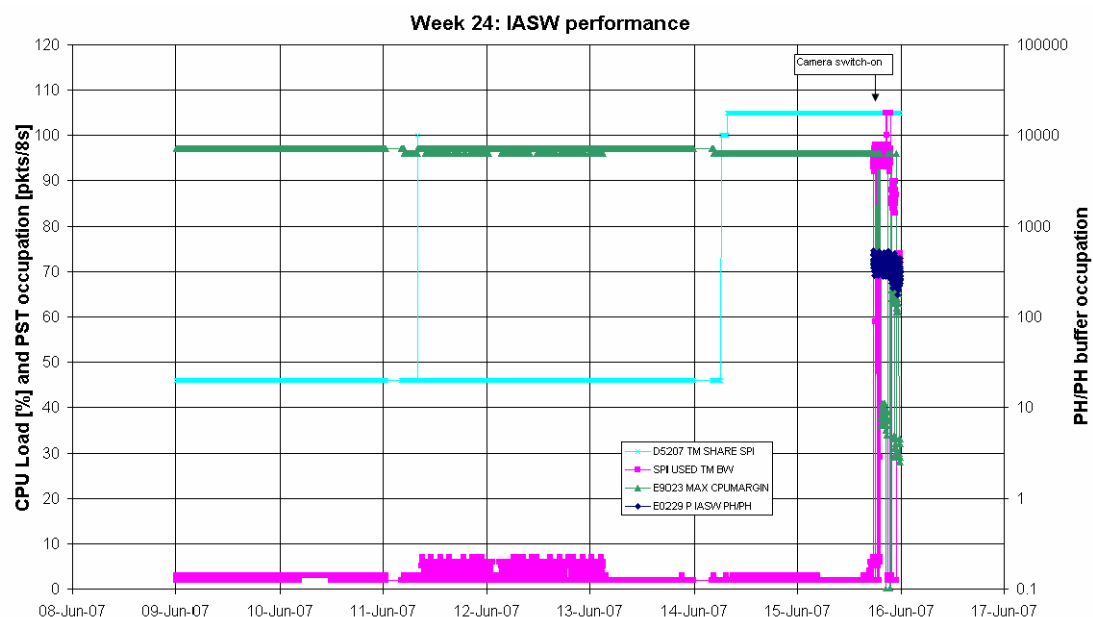
2007.166.23.54.51.548	2007.166.23.54.58.403	1024	RealTime	224	EXCEPTION
SPI1 SW ERROR					
E9777	FAULTY TASK ID	6			
FIX16		0			
2007.166.23.54.51.548	2007.166.23.54.58.400	1024	RealTime	7	EXCEPTION
SPI1 CONSTRAINT DPE CULPR					
E9076	OUT RANGE VALUE	36869			
E9067	LOGICAL ADDRESS	9643			
2007.166.23.54.51.548	2007.166.23.54.58.388	1024	RealTime	10	ANOMALY
SPI1 PERIODIC TASK OVERRUN					
E9074	TASK ID 16	6			
FIX16		0			
2007.166.23.54.51.423	2007.166.23.54.58.334	1024	RealTime	229	EXCEPTION
SPI1 PARTIAL FLAG OVERFLOW					
E9783	SUBBLOCK ID	SP11			
FIX16		0			

The OEMs stopped of their own accord.

These tests indicate that the Single Event filtering works, however the CPU resources are marginal when spectra are enabled at the same time. A further test with the spectra scaling factor set to 1/19SE was planned for the following day and will be reported in next week's report.

- At 2007-06-16T00:02:21Z the nominal event filtering configuration was restored (event filtering TC parameter E8979 set to MEonly), along with the nominal ACS HV configuration with FEE#57 and FEE#81 OFF, and SPI was returned to Photon mode at 2007-06-16T00:16:04Z.

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



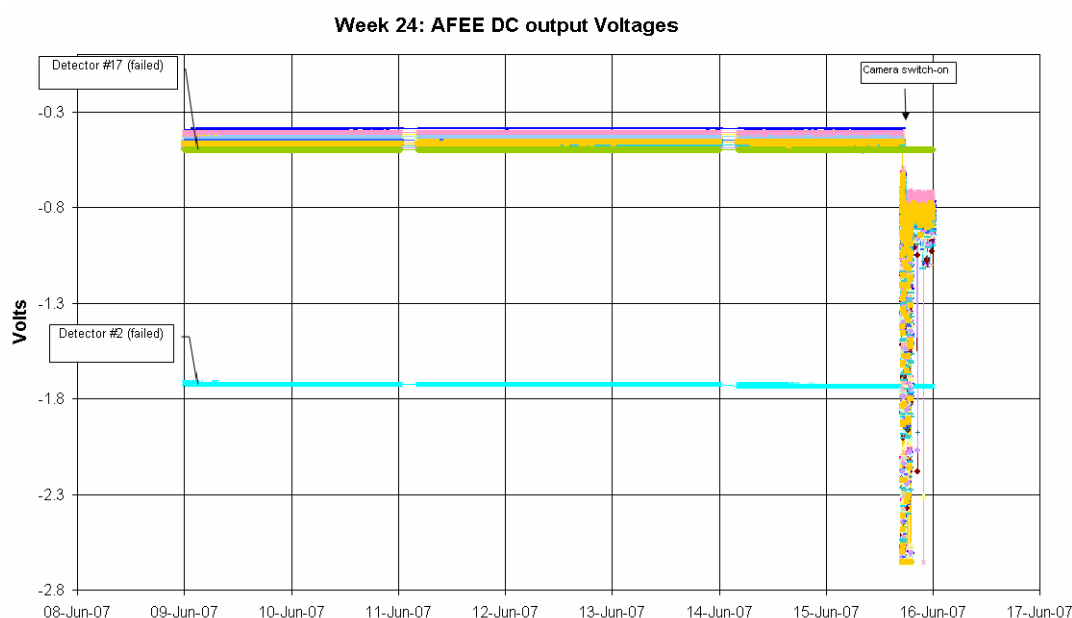
ACS: The performance of the ACS is nominal, except for FEE #81 which remains switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is still OFF due to the anomaly on 5/8/2003 (INT_SC-61).

Due to the ongoing annealing operations, started on 29th May, the ACS HVPSs have been set to the minimum voltage (~980V) and the ACS was in CONF mode until 11/06/2007 at 08:44Z, when the ACS switch-on and calibration was started. For this, FEE#57 and FEE#81 were switched ON again. The ACS calibration was completed

on 13/06/2007 at 03:08Z. FEE#57 and FEE#81 were switched OFF again on 16/06/2007 at 00:06Z, following the camera switch-on and performance tests.

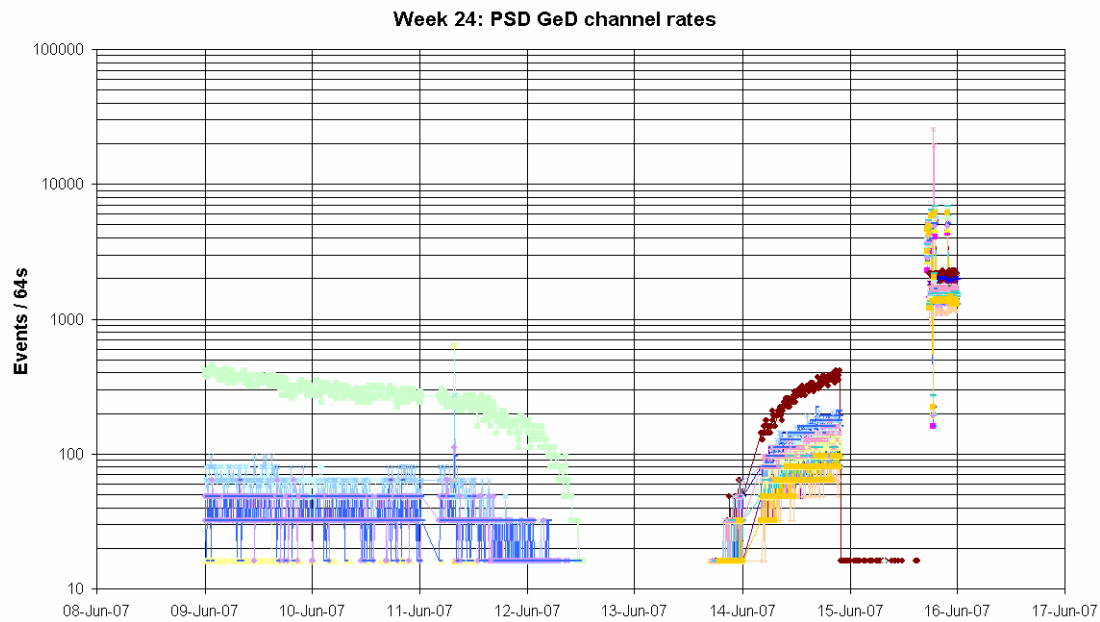
AFEE: The health of the AFEE is nominal. For the 10th annealing operations, started on 29th May, all detector HVPSs were switched off and only the LVPSs were left on until the camera switch-on, which started on 15/06/2007 at 16:42Z. Following the camera switch-on, ending on 15/06/2007 at 19:08Z, the HV of GeD#12 was left at 2.5kV (instead of the nominal 4kV) due to the observed degradation in the energy resolution of this detector. On 16/06/2007 the HV of GeD#12 was ramped up to 4kV, to determine the energy resolution of this detector at the different HV settings, once the cold plate temperature had lowered. Following these tests, the HV of GeD#12 was set at 3.5kV, as was the case prior to this annealing cycle.

The following plot shows the dc voltage offset of the detector channels during the reporting period. 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. Due to the ongoing annealing operations, started on 29th May, the DFEE was in CONF mode until the camera switch-on, which started on 15/06/2007 at 16:42Z.

PSD: The health of the unit is nominal. Due to the ongoing annealing operations, started on 29th May, the PSD was in CONF mode until the camera switch-on, which started on 15/06/2007 at 16:42Z. The following plot shows the PSD channel rates during the reporting period.



Event Log:

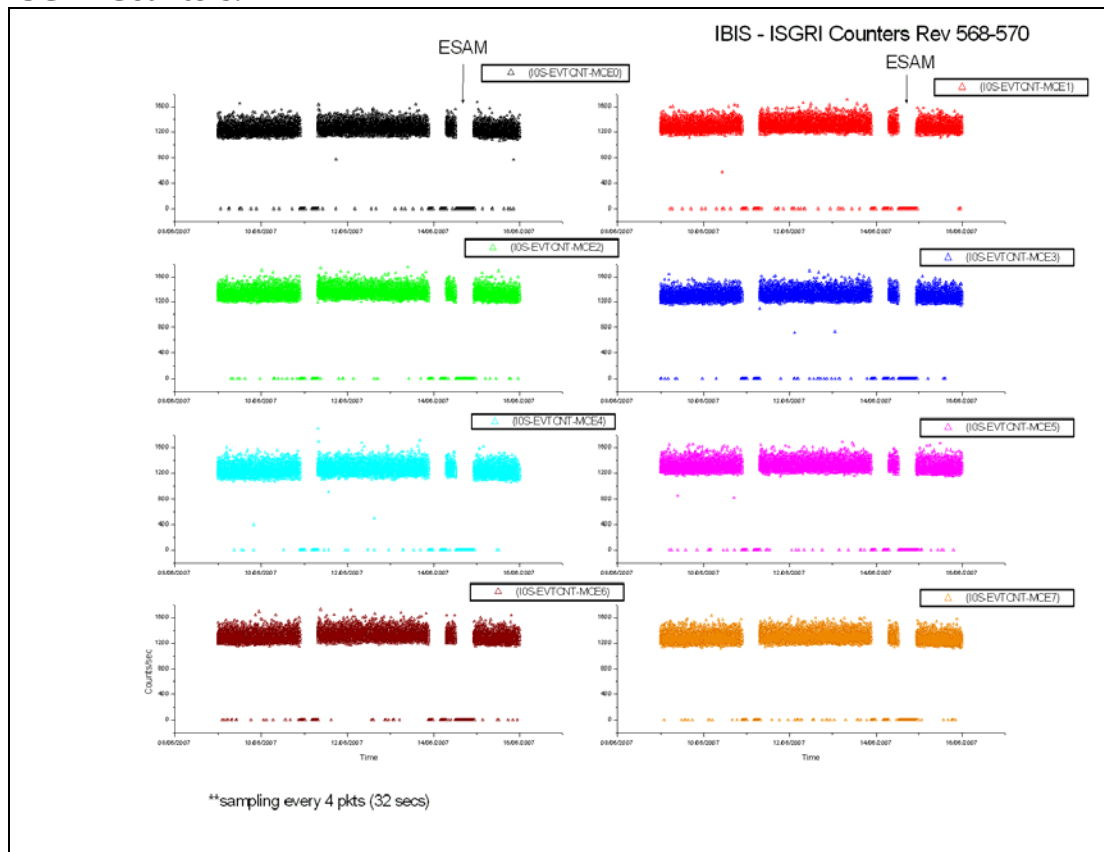
The following non-nominal events occurred on SPI during the reporting period:

- On 2007-06-10 at 16:36:43Z TM parameter E3126 S AS AN-5V L55 went OOL (value = PARAM > SPEC). This is the FEE analogue status -5 V #55. It returned within limits when the next packet was received at 16:47:23Z.
- On 2007-06-11 at 04:52:43Z the TM parameter E2101 (ACS UCR temperature n.0) started fluctuating in and out of limits warning low until 16:15:23Z.
- The TM parameter E2115 PSAC temperature toggled OOL Warning Low several times during the reporting period. It returned within limits of its own accord and no action was taken.
- On 2007-06-14 at 12:20Z an ESAM occurred (see AOCS section). For SPI, the ESAM had no impact as the instrument was in CONF mode due to the ongoing annealing activities. The status changed to PROTEGE but the ACS HV remained ON. This was confirmed with the PI to be no problem. Upon the transition of the AOCS to SSA (exit from ESAM) at 16:56Z, the SPI status changed automatically back to COMMANDE.

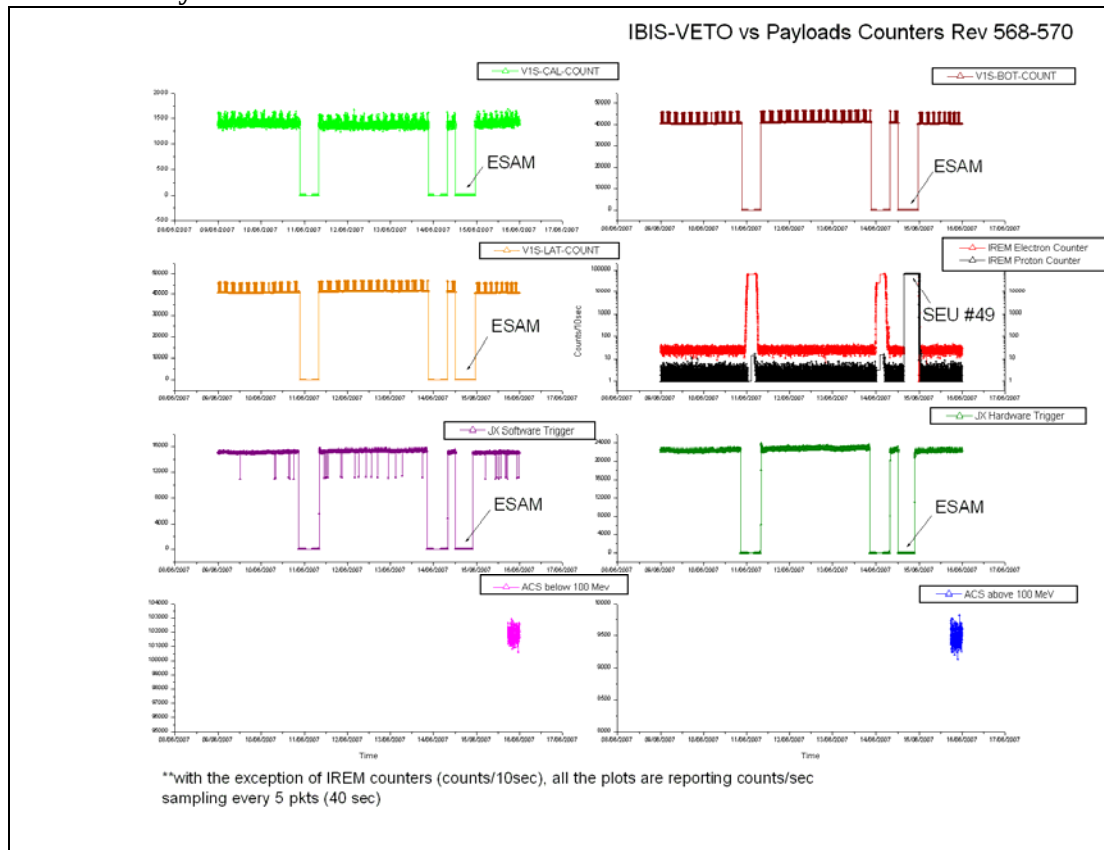
7.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

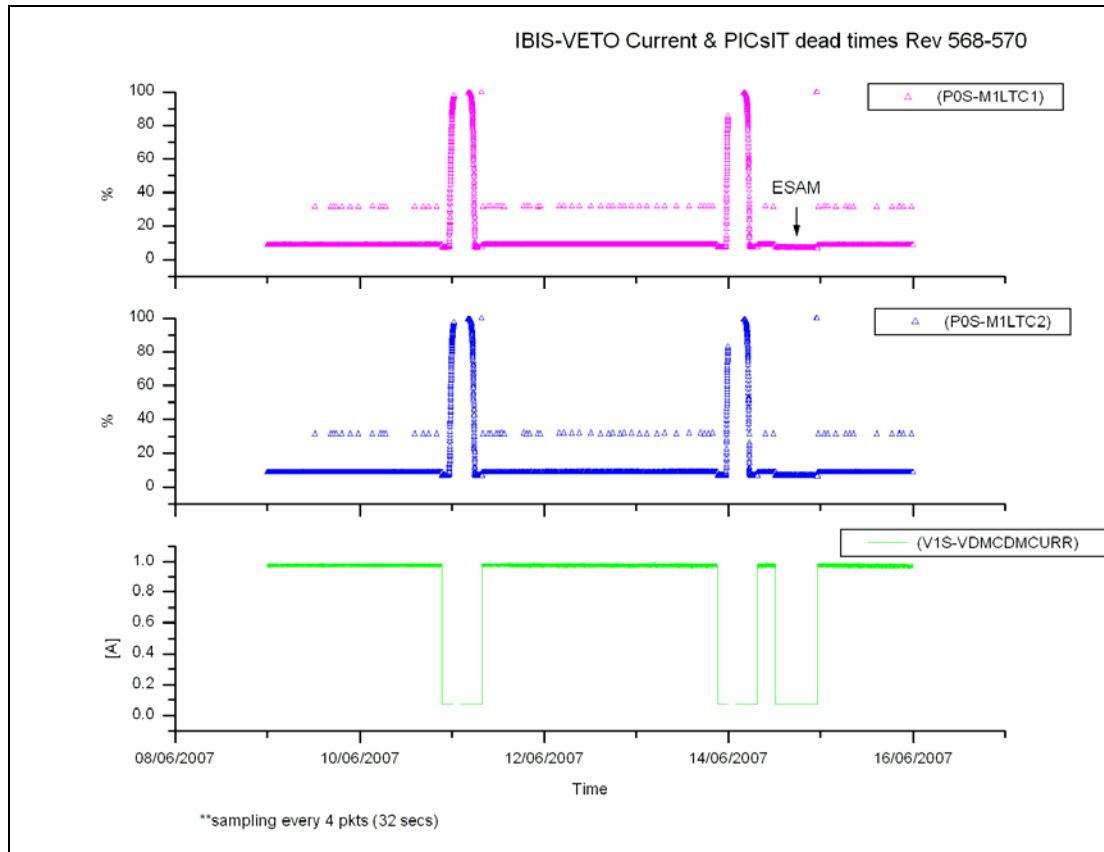


VETO vs Payloads Counters:

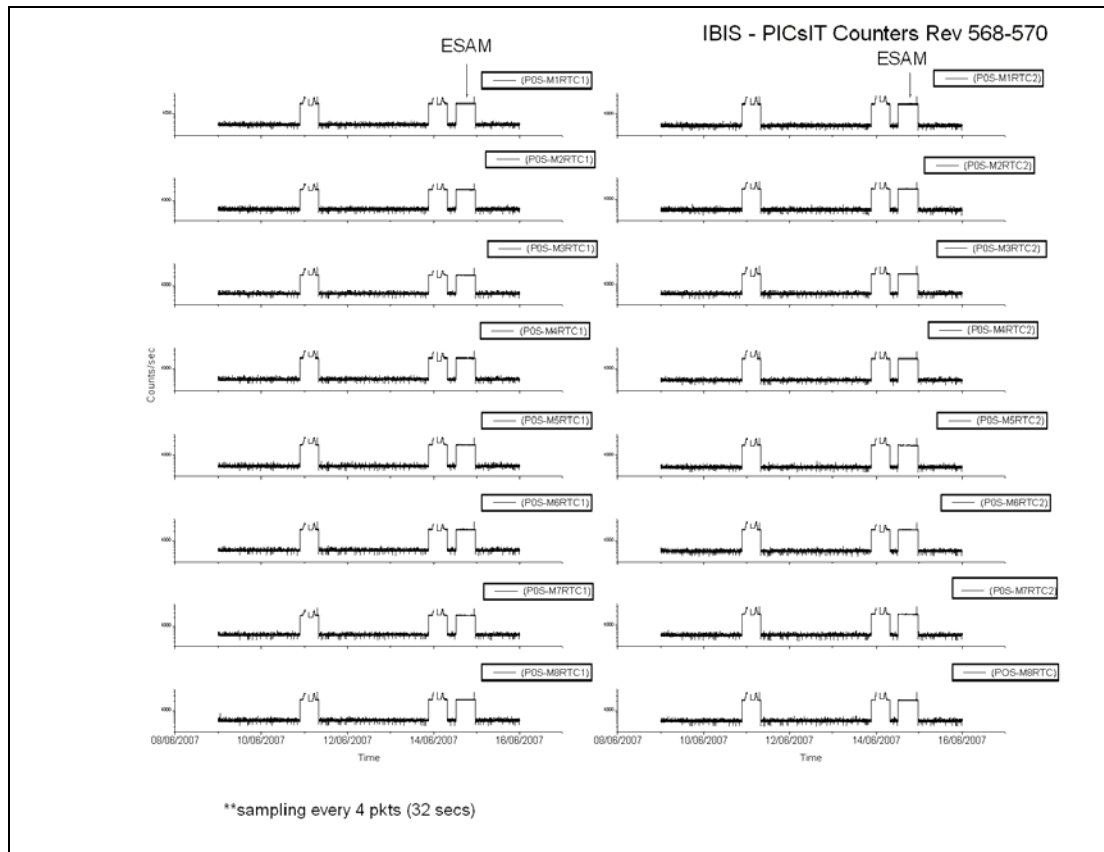


The week was characterised by low radiation as reported by the payload.

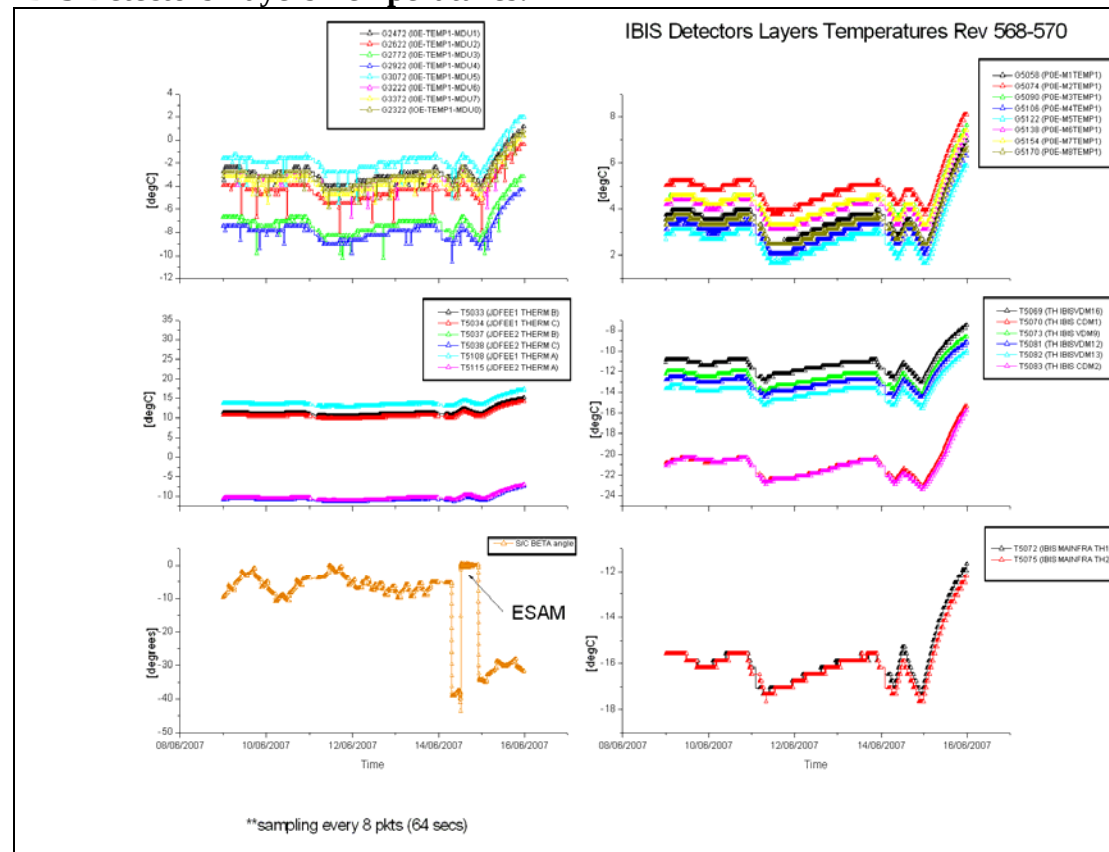
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), families G5002 (P0S-Mi_RTC1) and G5003 (P0S-Mi_RTC2), families G2014 (I0E-OVFWPXADD-Mi) were reported at Radiation Belts passage.

DoY 2007.165 (14/06/2007): ESAM

At 12:20, the satellite went to the Emergency Safe Attitude Mode (ESAM) due to an SEU on the Reaction Wheel Electronics #4. This caused an automatic reaction of the payload (via Broadcast Packet) and switched IBIS to Safe configuration with IASW, ISGRI and VETO in Stand-By, and PICsIT in Nominal.

The instrument recovery occurred once the AOCS unit was back to nominal IPS mode, meaning at about 22:30Z.

The operator followed CRP_IBIS1_5110 (IBIS recovery from ESAM condition):

- at 22:36Z, an ISGRI calibration (ED GEISCL03) was performed,
- at 23:05Z, the PICsIT CTX table was restored (FCP_IBIS1_0228),
- at 23:11Z, the VETO CTX table was restored (FCP_IBIS1_0199 and FCP_IBIS1_0201),
- at 23:24Z, the ED GESTAN02 was uplinked to put back IBIS into Scientific Standard mode.

During the ESAM and instrument recovery, the temperatures of IBIS detectors and electronics were carefully monitored. No anomaly was reported.

DoY 2007.165 (14/06/2007): MCE6 Time-Out

At 23:34Z, the following OEM APID 1280 ID 133 CLASS 2 was reported:

"IBIS1 IASW LSL TRANSFER FAILED (LOW LEVEL)"

together with OEM APID 1280 ID 131 CLASS 2:

"IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET".

These 2 OEMs were followed after few seconds by OEM APID1280 ID 246 CLASS 3:

"IBIS1 MCE6 TIME OUT",

the numbering system in the OEM goes from 0 to 7, this OEM indeed concerns HW MCE7.

This anomaly is similar to the previous ones that flagged a Time-Out in several peripherals and that refer to the anomaly report INT_SC-113. This time, according to G1581 (parameter of OEM ID 131), the anomaly occurred with ISGRI MCE6.

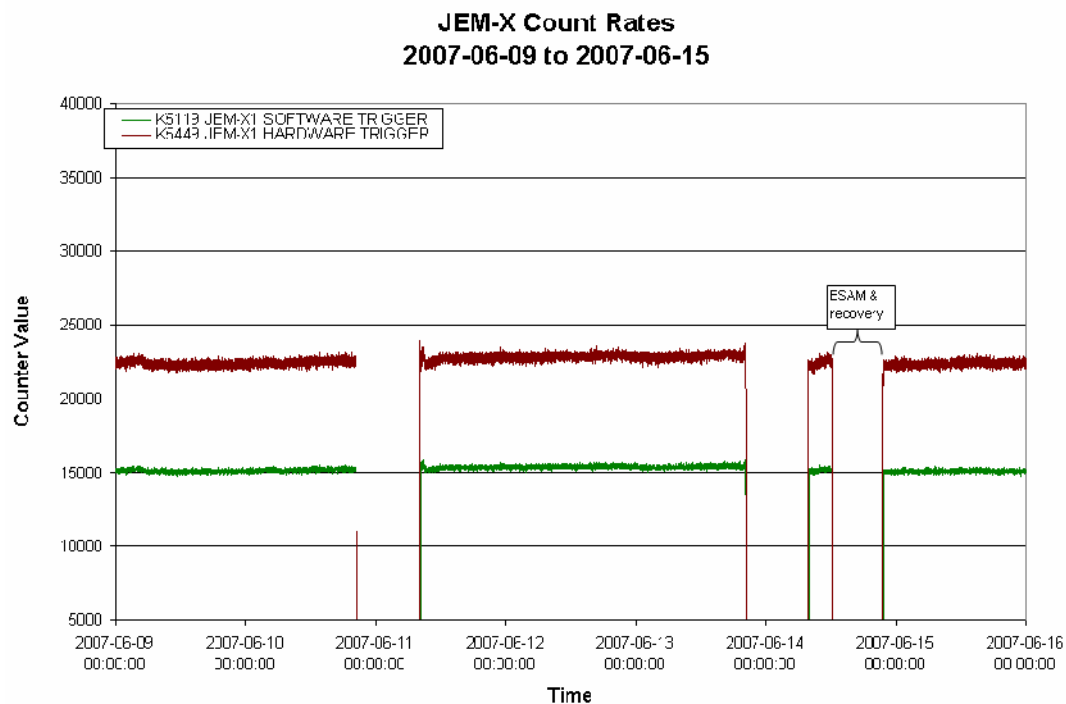
Summarising, IBIS incurred a timing problem on the Low Speed Line that affected the communication with the peripheral. During this time, a request for HK3 was sent to the MCE6 without any answer due to a black out in communication between the peripheral and the DPE. The IASW flagged the non-generation of HK3 from MCE6 as an on-board rejection (time-out) of the internal TC indicated in the OEM body. During this time no valid HK was collected from MCE6 therefore, what was reported in the HK3 was simply the IASW default (i.e all 0000...). This is confirmed by the reading of some TM parameters reporting the raw value 0. The unit solved autonomously the internal conflict on the LSL and reported the valid HK3 for MCE6 in the next cycle. No further action was requested as per recovery action I-REJ-1.

7.3.4 JEM-X Operations

JEM-X Count Rates

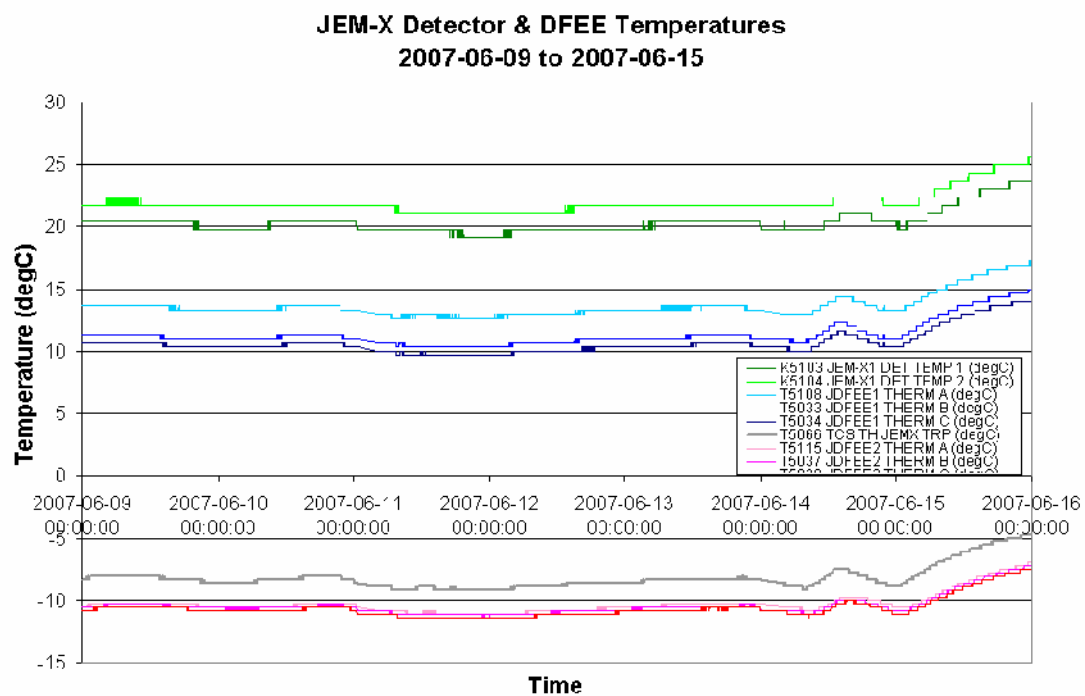
JEM-X count rates over the reporting period are displayed in the following graph¹.

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



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.



² Data sampled (1 frame in 8)

JEM-X Daily Report

2007-06-09 (DOY 160, Rev 568) to 2007-06-13 (DOY 164, Rev 569)

JEM-X1 operations executed nominally.

2007-06-14 (DOY 165, Rev 569-570)

At 12:20:21Z the spacecraft entered ESAM mode, triggered by an SEU switching off the LCL of Reaction Wheel Drive Electronics 4 (see AOCS section). JEM-X1 reacted as expected to the ESAM, going to Safe mode at this time, with OEM 231 JEM-X1 AUTO EVENT 1. Following the recovery of the AOCS, JEM-X1 was recovered as follows, following CRP_JEM1_5100:

- 21:16:01Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE. This was executed in order to reset both shutdown levels to NORMAL, as the ACT SHUTDOWN LEV K5381 had remained GOTOSAFE after the AOCS had exited ESAM. (The first attempt to command JEM-X1 to Setup mode, as indicated in CRP_JEM1_5100 failed with TC rejected OEM 136 JEM-X1 TC REJECTED 9 and this CRP will be updated to include the Safe command before commanding the transition to Setup mode.)
- 21:16:22Z FCP_JEM1_0041 JEMX1 TRANSITION TO SETUP
- 21:20:48Z FCP_JEM1_1010 JEMX1 CONFIGURATION FOR SCIENCE OPS
- 21:50:54Z ED KEDATA02 re-uplinked with the planned observation parameters.

JEM-X1 operations continued nominally.

2007-06-15 (DOY 166, Rev 570)

JEM-X1 operations executed nominally.

7.3.5 OMC Operations

2007-06-09 (DOY 160, Rev 568) to 2007-06-10 (DOY 161, Rev 568)

Nothing to report.

2007-06-11 (DOY 162, Rev 569)

At 12:20, due to FD problems, slew 05690008 failed to uplink. A recovery was subsequently performed and the Timeline rejoined at 13:20. The impact was the loss of that pointing.

At 15:13, further FD problems prevented slew 05690012 from executing. At 16:39, a recovery was performed, and the Timeline rejoined. The impact was the loss of that pointing.

2007-06-12 (DOY 163, Rev 569) to 2007-06-13 (DOY 164, Rev 569)

Nothing to report.

2007-06-14 (DOY 165, Rev 570)

At 12:20:24, due to a SEU within the AOCS system, ESAM was triggered. This caused, (amongst a few other things) OMC to go to SAFE mode. A recovery was performed and the unit eventually returned to Stand-by at 21.47.12, and subsequently to Normal mode at 00:59:43 the following day. The impact was the interruption after 2021 from a scheduled 3530 seconds of pointing 05700008, and the loss of pointings 05700009 to 05700020 inclusive (12 pointings).

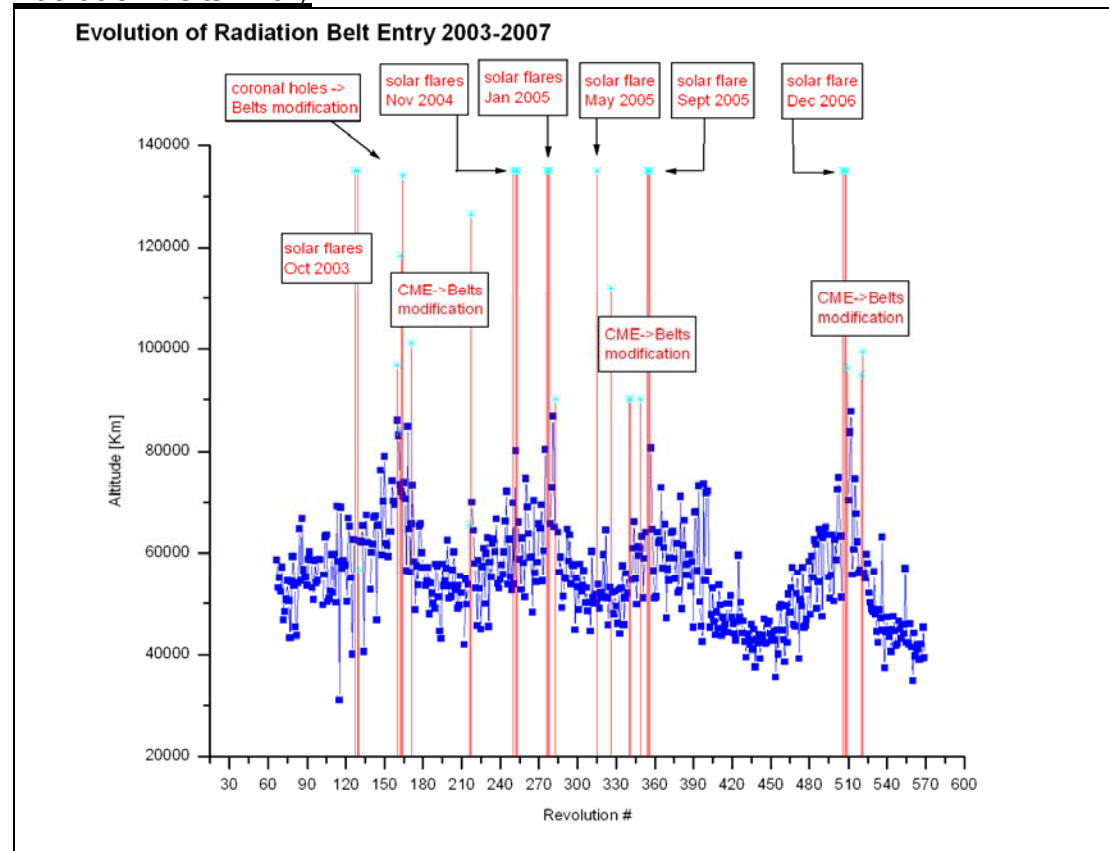
2007-06-15 (DOY 166, Rev 570)

Nothing to report

On DoY 161 at 21:26:56 and DoY 164 at 21:13:36 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

7.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

DoY 2007.165 (14/06/2007):

At 15:06:45Z, the IREM SEU #49 occurred. This was during ESAM recovery, therefore the recovery of IREM was postponed to 23:51Z.

The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal
- 2) The LCL current was nominal
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits
- 4) The anomaly occurred at 2007.165.15.06Z at 101015.8km. The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit
- 5) The recovery of the unit started at 23:51Z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e the Checksum Failure flag shows YES. The unit was still reporting the status as if it was in Integral mode with counting ON, accumulation ON and checksum failure flag ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.
- 6) A dump of all the registers gave a status word BC80 HEX = 48256 DEC = 1011110010000000, ie. the unit was still reporting the status as if it was in Integral mode but the Checksum Failure flag was this time OFF and the checksum counter in the register number 3 incremented by 1 unit.
- 7) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 01:01Z on 15/06/2007.

The IREM automatic transition to Standard Mode did not affect the instruments that were already in Safe configuration due to the ESAM flag propagated in the Broadcast Packet.

The cause of these S/W resets is still under investigation, but it is apparently due to the unit's memory device that is sensitive to radiation.

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]
568	RAD_ENTR R 2007-06-10T21:26:52Z	45293.2	2007-06-10 22:46:37	2007-06-10 22:39:39	45718
569	RAD_EXIT R 2007-06-11T07:40:33Z	>>29769.8	2007-06-11 05:50:45	2007-06-11 06:29:39	43168
569	RAD_ENTR R 2007-06-13T21:13:32Z	39387.6	2007-06-13 23:07:33	2007-06-13 22:21:10	46605
570	RAD_EXIT R 2007-06-14T07:26:55Z	45325.4	2007-06-14 06:31:41	2007-06-14 06:11:10	42315

Reference

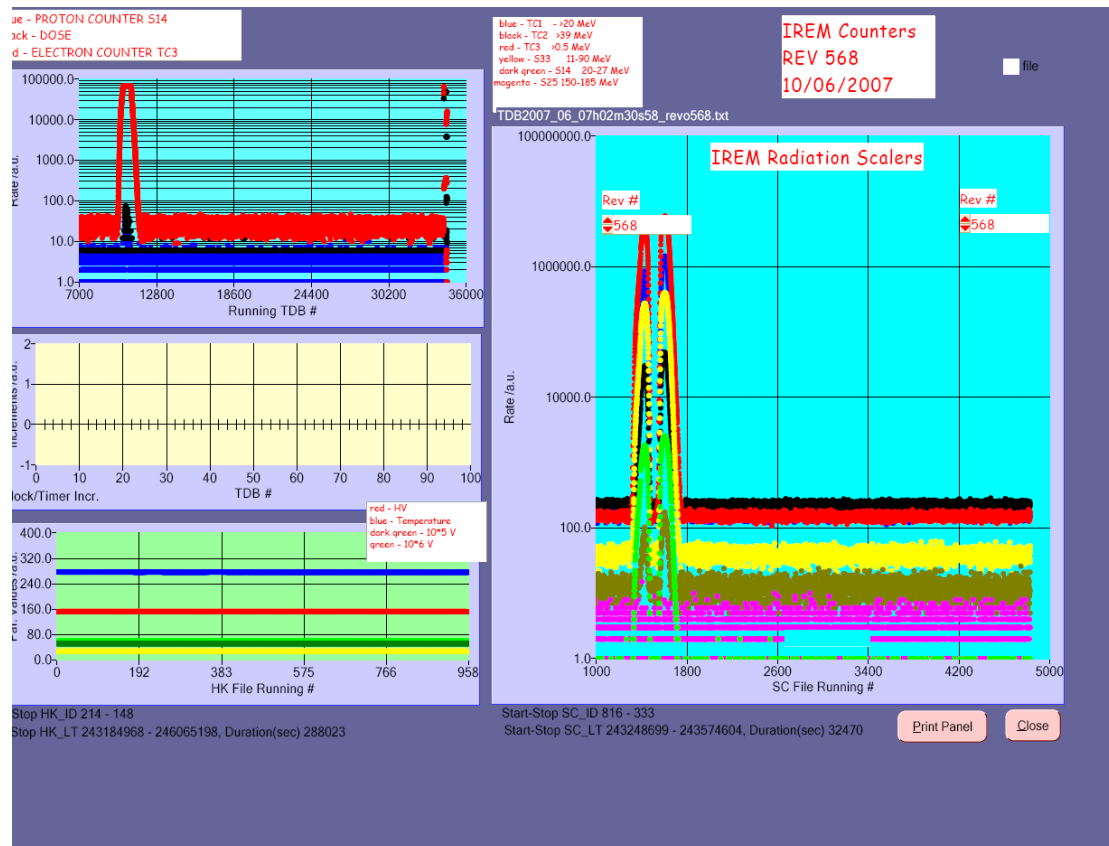
High radiation

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)

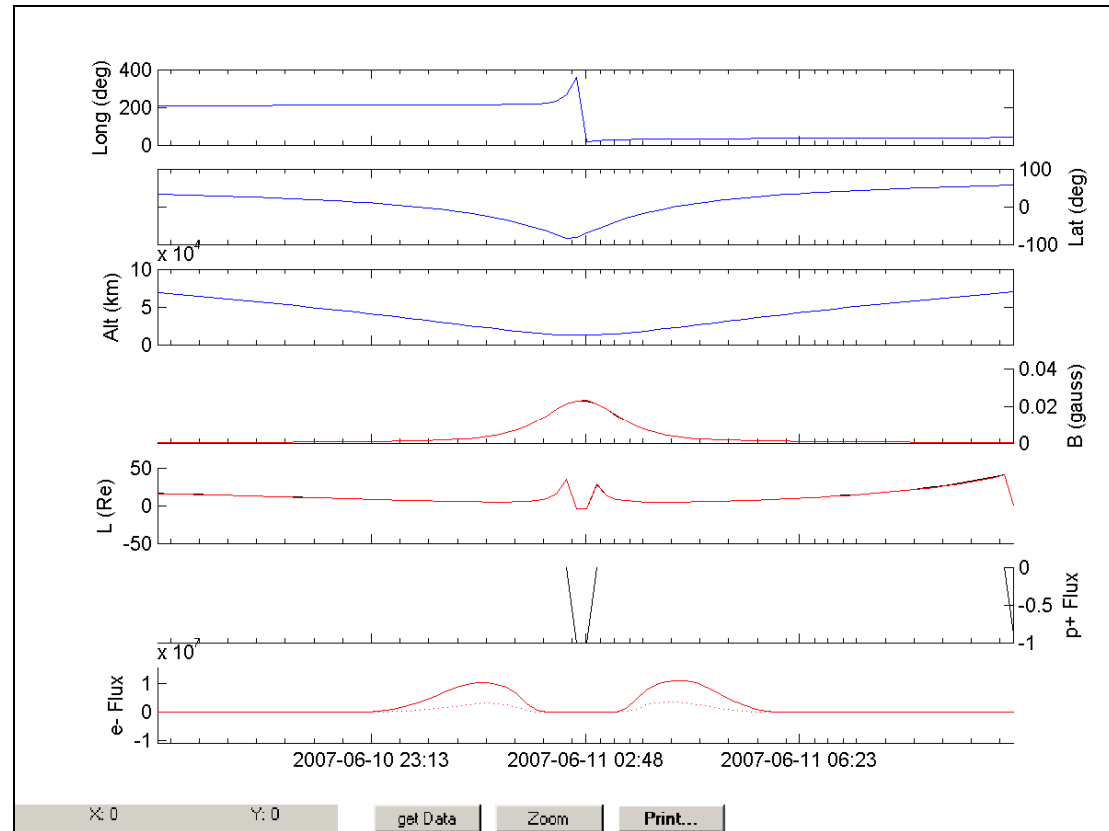
IREM radiation counters:



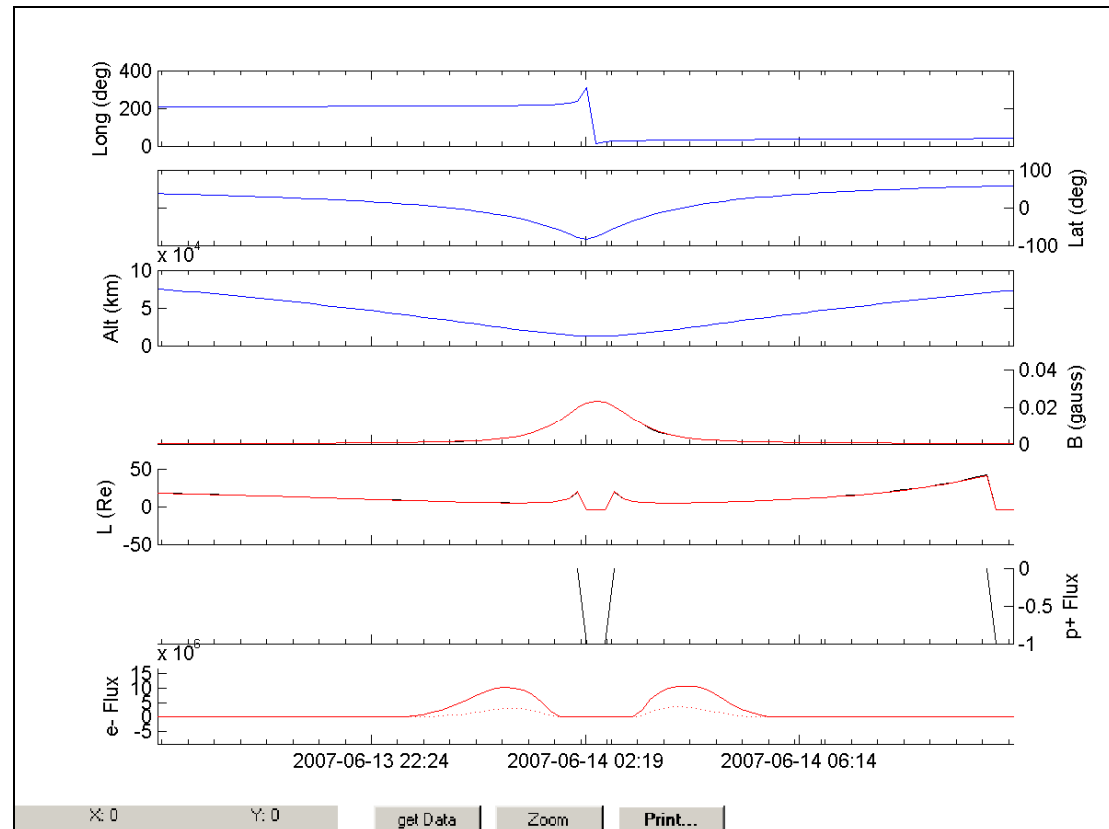
Due to a problem with the ECOE, the belts passage from revolution 568 to 569 is missing. In addition data for revolution 570 are corrupted hence not presented here.

IREM Predicted Radiation Belt Passages

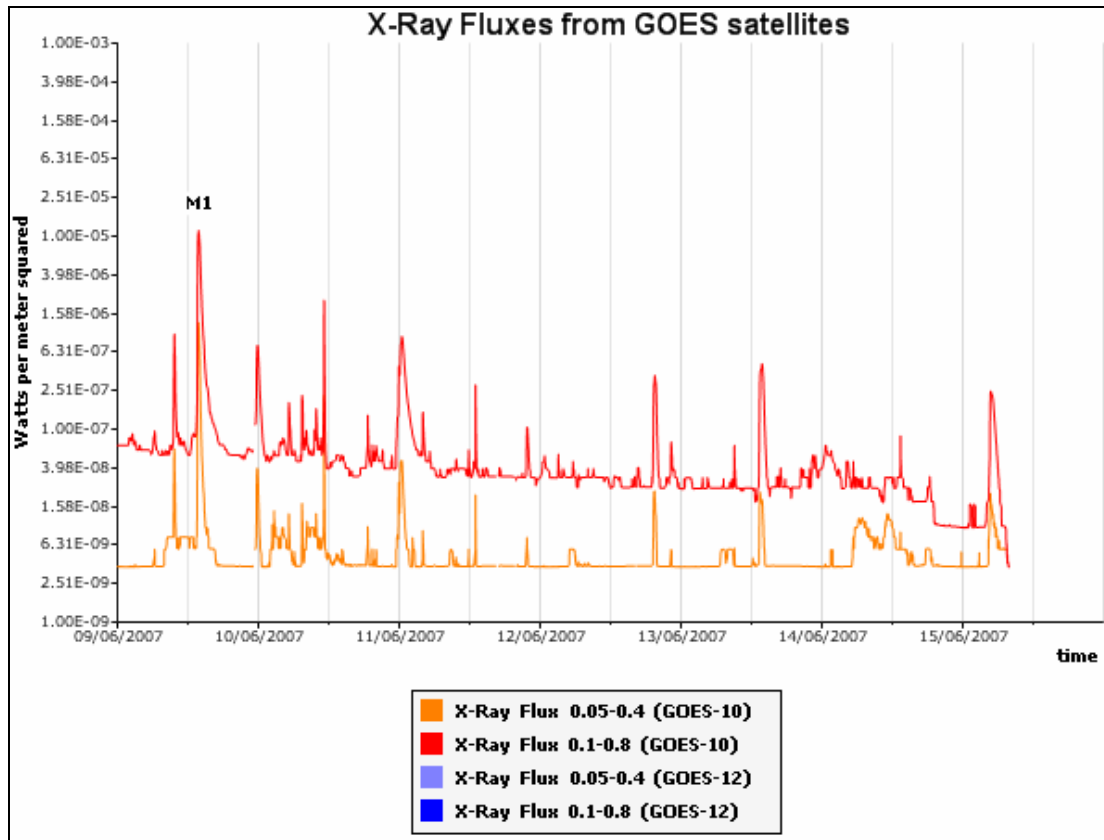
Rev 568



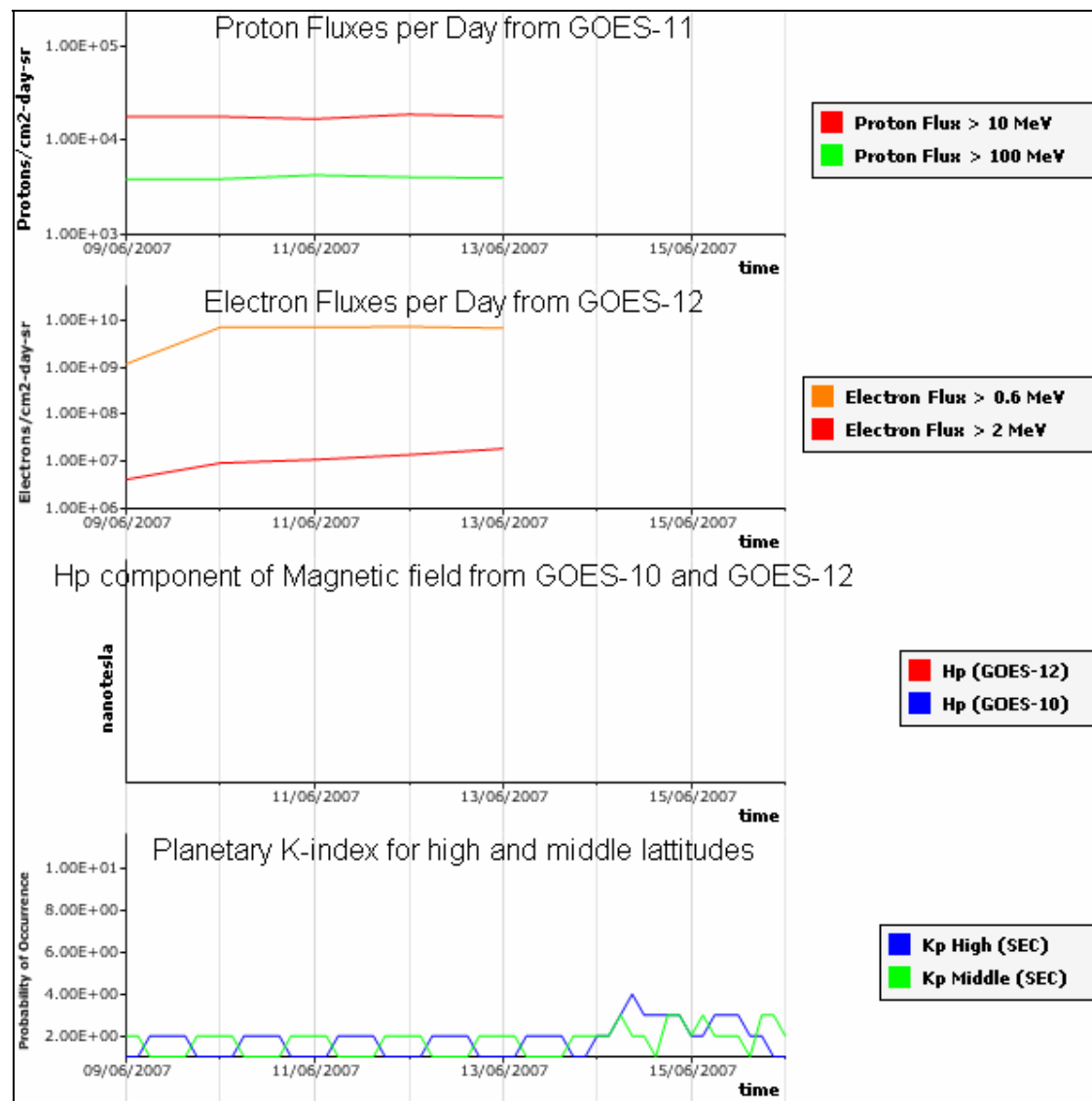
Rev 569



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. An M8-class solar flare on 04th of June is missing on the plot.



Proton and electron flux are reporting low radiation background this week. 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 features storm-level geomagnetic activity.