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

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-OPS-OF

No. 241
Week 18

07.05.07

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 28.04.07 until 04.05.07 (both dates inclusive) and covers the revolutions 555 and 556.

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 entirely of a raster dither of the object SS 433 (RA 19:11:49.56, DEC +04:58:57.6).

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.

The Eclipse season continued with the 5th and 6th eclipse passages. The eclipse passages were nominal from an AOCS point of view.

As part of the AOCS monitoring for the summer eclipse season, were verified the load of the TT sequence to re-enable the IMU Auto Switch-Off function in the ACC and the Eclipse ACC\FDE\FCE timers.

Four slews were missed from TL during the observation period due to problem on IMCS, ground station, FD system and on-board Search/Track process.

The fuel consumption over the period between 26/04/2007 and 03/05/2007 was 0.1831 Kg. The remaining propellant is in the order of 146.7091 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.

The 5th and 6th eclipses of eclipse season #10 took place on 30th April and 3rd May, the relevant details are given below

Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Total Eclipse Duration	Umbra duration Only	Observed DOD 1 (Ah)	Observed DOD 2 (Ah)	Recharge Duration Battery 1	Recharge Duration Battery 2
30/04/2007	02:58:13	02:59:56	03:58:41	03:59:58	1:01:45	0:58:45	5.66	5.6	3:22:30	3:20:22
03/05/2007	02:52:25	02:54:11	03:47:19	03:48:38	0:56:13	0:53:08	5.27	5.21	3:09:02	3:07:10

From the EPS point of view the eclipse passage was entirely nominal.

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

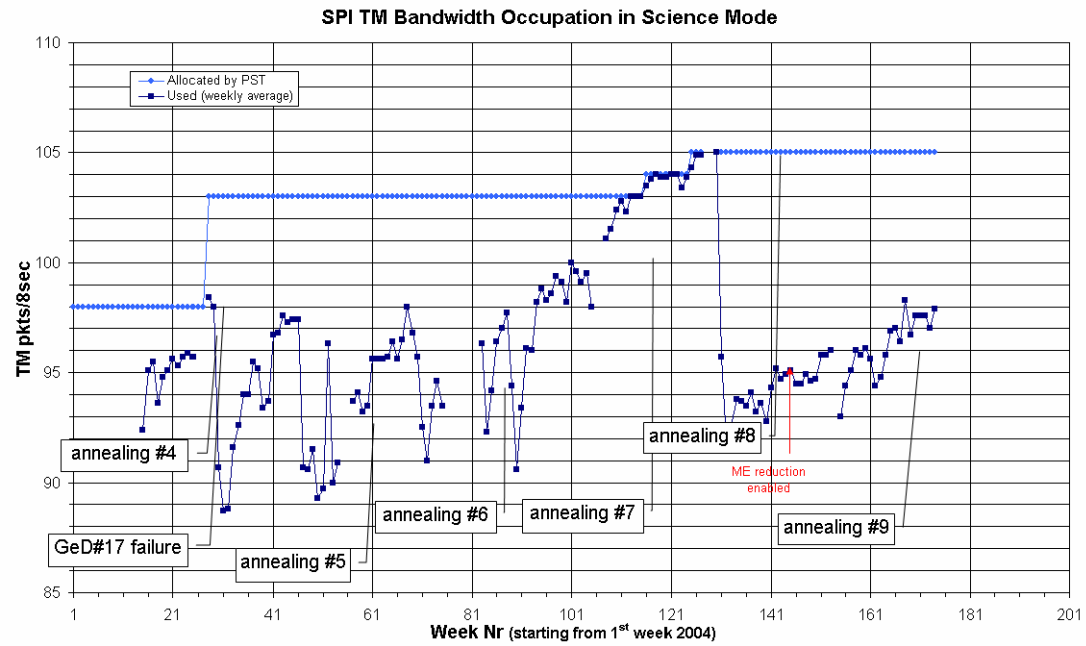
Following the 9th annealing, which ended on 22nd December, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). The energy resolution of GeD#4 was recovered with this annealing. 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. The stroke of all four compressors has been set to 40 since 03.02.2007 at 13:16Z.

SPI eclipse operations during this period continued to be executed nominally.

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 105 packets/cycle and the average telemetry occupation when the TM allocation was 105 packets/cycle was 97.9 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.

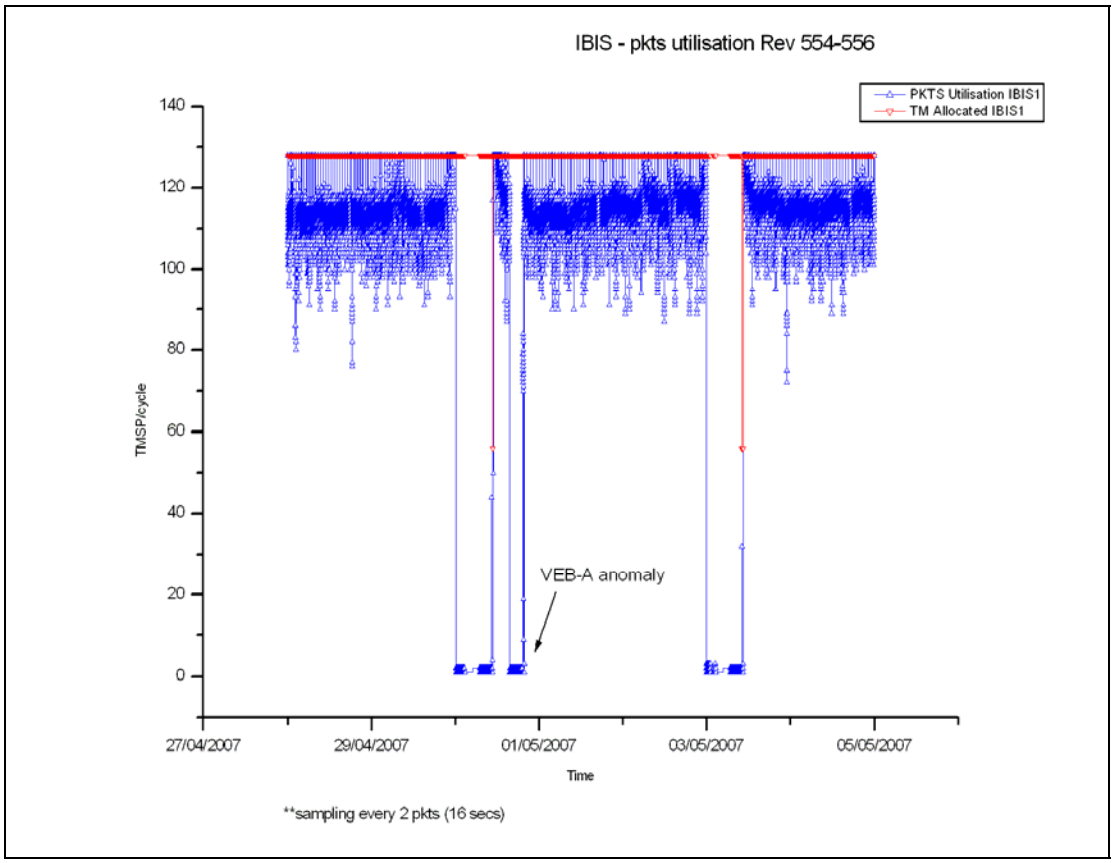
3.2.2 IBIS

The overall status of the unit is nominal.

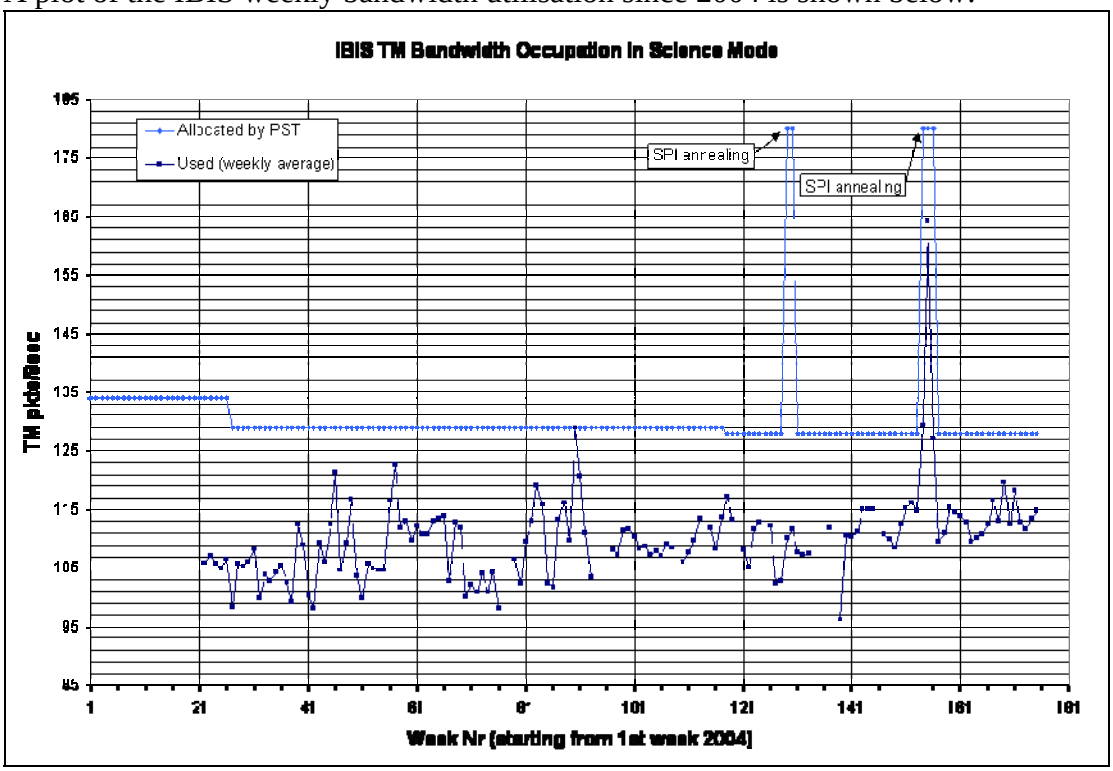
During this week, 2 eclipses occurred. Every time, the reconfiguration of IBIS was smoothly performed as per timeline.
However on 30/04/2007, at belts exit, after eclipse reconfiguration, VETO (VEB-A) flagged an anomaly with wrong parameter values for all VDM and CDM High Voltages (see appendix for details).

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period (when IBIS was in Science mode) was 114.7 TMPS/cycle, up 1.27 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 8 packets/cycle during science observations. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

On 2007-04-30, during the post-eclipse re-activation of JEM-X1 following the 5th eclipse of this season, a DFEE CRC anomaly occurred. Details are given below and recorded in INT_SC-187. Other than this, eclipse operations for JEM-X during this period continued to be executed nominally.

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, 166 of the 169 planned science pointings for OMC were executed nominally, 1 was lost and 2 were delayed.

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

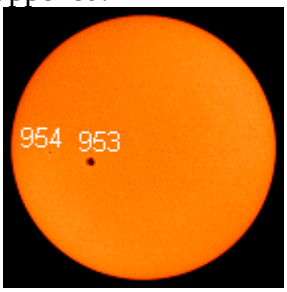
3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity.

During the whole observation period sunspot 953 posed a threat of M-class solar flare. On 30/04/2007 (see picture below) and 01/05/2007 it even harboured energy for X-class flares. However nothing happened.



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 slews were lost, and two delayed due to ground problems. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. However, one slew was lost when the HFA task crashed. Two further slews were delayed due to problems finding a suitable guide star. The overall performance was, however, still well over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There was, however, 1 occasion of a data drop from Redu, without impact, and 1 from DSS-27, which caused the loss of a pointing. There was also 1 occasion where the links with the isds dropped, which had no impact. The overall performance was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs are available up to revolution 563. Observations have been planned and send to MOC up to revolution 559, but for 559 the FSS/STR Misalignment + SAS calibration still has to be included.

Revolution 558 was replanned to include a dummy pointing avoiding a slew constraint found by flight dynamics.

TSF's up to revolution 557 have been received.

2. Observation status

No new ECS files have been received this week, the last is still 546.

3. ISOC Science Data Archive

ISDA version 2.7 has been released with several fixes, especially in the handling of large datasets.

4. ISOC system

Still using ISOC system V14.5.1.

5. Problems

The reason why the slew constraint mentioned above was not detected at ISOC still is being investigated.

4.3.2 ISDC

Status of ISDC observation processing on 07/05/2007:

- Latest Standard Analysis completed: observation 04200620001 (Sgr A*, Revolution 545 & 546) on 06/05/2007.

- Latest products archived: observation 04200620001 (Sgr A*, Revolution 545 & 546) on 07/05/2007.

- Latest observation products sent to the observer: observation 04200340018 (GRS 1915+105, Revolution 546) on 07/05/2007.

5 Special Events

6 Anomalies

The following problems were reported that impacted operations:

- On DoY 120, at 12:29, a lost guide star delayed the start of pointing 05550003 by about half an hour.
- On DoY 121, at 17:30, the update for Closed Loop Slew 05550035 failed. A manual recovery was performed using an Open Loop Slew. The impact was a 12 minute delay in the start of pointing 05550035.
- On DoY 122, at 13:36, a short TM drop from DSS-27, caused an AOCS command to fail release. The Timeline was suspended and a recovery was performed, which was completed at 14:09. The impact was the loss of pointing 05550057.
- On DoY 123, at 00:43, the HFA task on imca crashed. Problems restarting the task forced a switch to the b-chain. A recovery was performed, which was completed at 02:16. The impact was the loss of slew 05550069 (not a science pointing).

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

AR id	Date Created	Subject	Segment	Status
INT_SC-187	30/04/2007	JEM-X1 DFEE CRC Anomaly following eclipse on 2007-04-30	Payload	Open
INT_SC-188	02/05/2007	IBIS: VEB-A SW reported problem during reconfiguration after eclipse	Payload	Open

7 Future Milestones

The following activities are foreseen in the next few weeks.

- The FSS/STR misalignment calibration has been postponed to 21st May 2007, in Rev. 562
- Periodic Thruster Torque rescaling 24th July 2007 Rev. 583
- On Board Clock wrap around due in Rev. 585.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 555

The observations in revolution 555 consisted entirely of a raster dither of the object SS 433 (RA 19:11:49.56, DEC +04:58:57.6), lasting ~57.8 hours.

Revolution 556

The observations in revolution 556 consisted entirely of a raster dither of the object SS 433 (RA 19:11:49.56, DEC +04:58:57.6), lasting ~57.8 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.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2007-04-18T14:58:38.000Z     147.1040    F   Automatic TM processing.
2007-04-18T21:40:47.000Z     147.0830    F   Automatic TM processing.
2007-04-18T23:48:55.000Z     147.0570    F   Automatic TM processing.
2007-04-19T02:13:28.000Z     147.0310    F   Automatic TM processing.
2007-04-21T02:01:48.000Z     147.0072    F   Automatic TM processing.
2007-04-21T09:09:25.000Z     146.9905    F   Automatic TM processing.
2007-04-22T05:23:51.000Z     146.9652    F   Automatic TM processing.
2007-04-24T01:51:32.000Z     146.9230    F   Automatic TM processing.
2007-04-24T08:57:16.000Z     146.9079    F   Automatic TM processing.
2007-04-25T18:42:00.000Z     146.8922    F   Automatic TM processing.
2007-04-27T08:48:52.000Z     146.8518    F   Automatic TM processing.
2007-04-28T18:05:43.000Z     146.7980    F   Automatic TM processing.
2007-04-30T08:26:51.000Z     146.7868    F   Automatic TM processing.
2007-05-01T17:20:47.000Z     146.7659    F   Automatic TM processing.
2007-05-03T08:18:04.000Z     146.7091    F   Automatic TM processing.

This report was generated  Fri May 4 08:00:21 GMT 2007
```

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, 28/04/2007 –04/05/2007

AOCS operations were executed from the Automatic Timeline.

During this period, 85 Open Loop Slews, 91 Closed Loop Slews and 5 Momentum Biases were executed.

4 slew (CSL) were missed from TL, during the observation period, due to problem on the HFA TM task on IMCS-A, drop of TM link on DSS-27, FDS failing slew update and star not found during the on-board S/T process.

The OTF was reported flickering during the execution of PID 05540022.

This is equivalent to ~ 2.2 % of the total number of slews planned (176).

The AOCS eclipse operations were nominal. For the 5th and 6th eclipse passages, the ACC\FDE\FCE Eclipse Timers and the Time-Tagged sequence to re-enable the IMU Auto Switch-Off function of the ACC were loaded from the Timeline and the pre-eclipse IMU health checks was performed at the planned times. Some information regarding the eclipse times and IMU usage up to this stage of the eclipse season are provided below:

AOCS Eclipse Times — Summer 2007

Date	LOS	AOS	ACC Eclipse Imminent	Eclipse Start						Eclipse End					Eclipse Duration
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE	ACC	
2007-04-18	03:47:00	07:59:00	02:53:42	03:35:52	03:47:16	03:48:00	03:53:22	03:56:08	18/04/200	04:27:00	04:27:38	04:30:04	04:36:36	04:39:56	0:36:42
2007-04-21	03:32:00	07:45:00	02:32:54	03:15:12	03:24:07	03:24:51	03:32:34	03:34:25	03:34:49	04:24:55	04:25:15	04:26:43	04:31:03	04:36:44	0:54:09
2007-04-24	03:21:00	07:30:00	02:18:50	03:01:26	03:10:14	03:10:58	03:18:30	03:20:03	03:20:23	04:18:55	04:19:08	04:20:20	04:24:30	04:30:38	1:01:50
2007-04-27	03:07:00	07:18:00	02:07:30	02:49:55	02:58:49	02:59:33	03:07:10	03:08:37	03:08:55	04:09:43	04:09:56	04:11:00	04:15:17	04:21:09	1:03:50
2007-04-30	02:53:00	07:05:00	01:58:40	02:40:34	02:51:42	02:52:26	02:58:20	02:59:49	03:00:03	03:58:48	03:59:03	04:00:05	04:05:58	04:09:41	1:01:45
2007-05-03	02:44:00	06:53:00	01:53:10	02:35:02	02:43:44	02:44:28	02:52:50	02:54:14	02:54:36	03:47:42	03:47:54	03:49:01	03:52:52	03:58:35	0:56:11

IMU Usage during Eclipse Season — Summer 2007

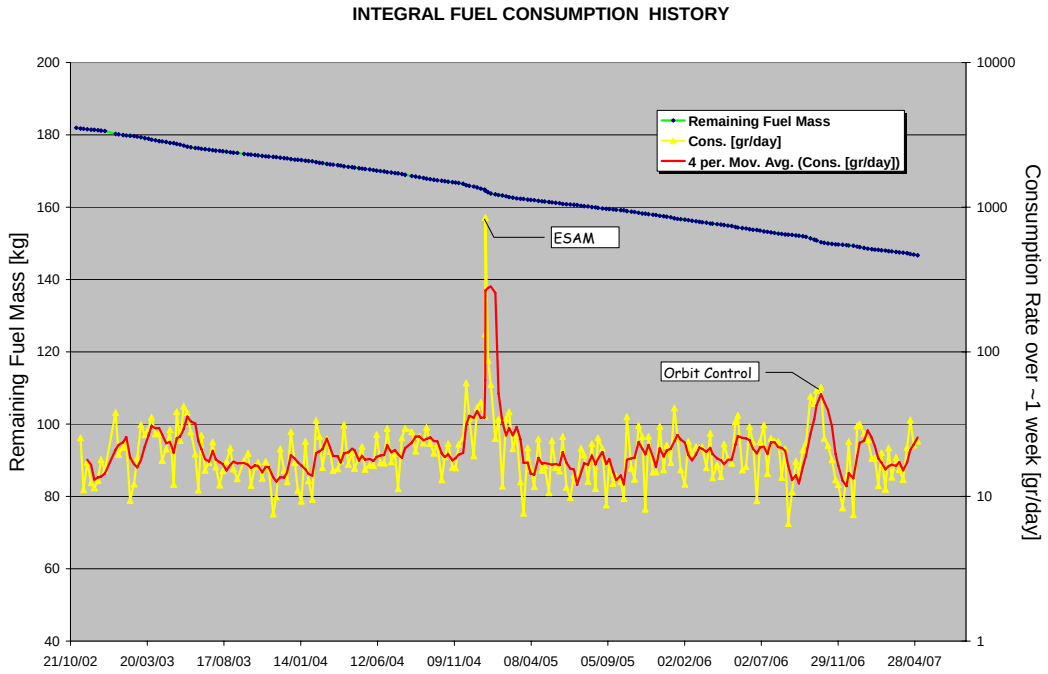
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]		
2007-04-18 00:41:01	2007-04-18 04:39:59	0.2048	0.3010	0.2788	3:58:58	3:58:58
2007-04-21 00:18:31	2007-04-21 04:39:06	0.2056	0.2173	0.2138	4:20:35	8:19:33
2007-04-24 00:06:42	2007-04-24 04:32:51	0.1850	0.1800	0.1580	4:26:09	12:45:42
2007-04-27 00:07:49	2007-04-27 04:23:27	0.2056	0.2600	0.2978	4:15:38	17:01:20
2007-04-30 00:21:16	2007-04-30 04:12:02	0.2086	0.2842	0.2974	3:50:46	20:52:06
2007-05-02 23:35:39	2007-05-03 04:00:54	0.1867	0.2699	autocal aborted due to CSL recovery	4:25:15	25:17:21

Orbit Control

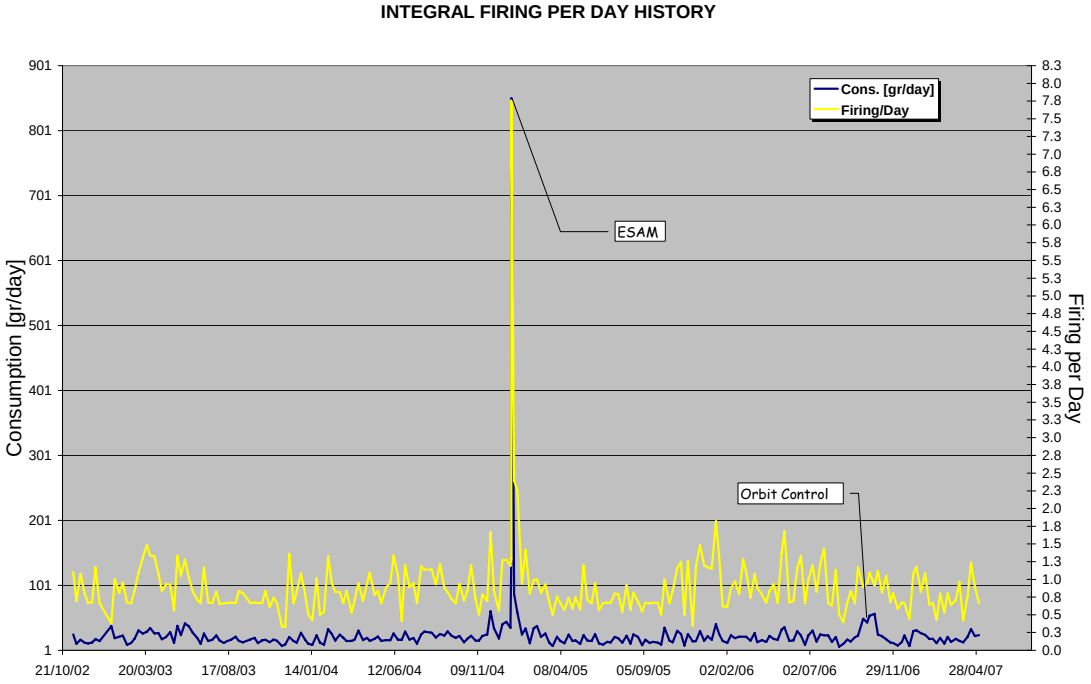
No update.

Fuel consumption

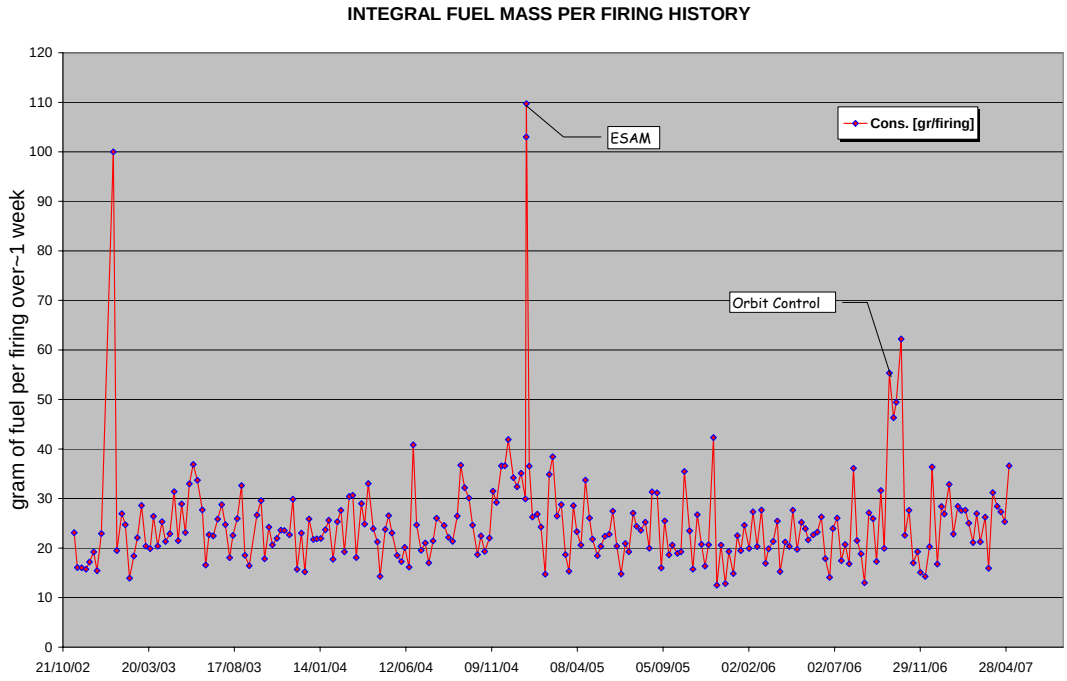
The fuel consumption (total, grams per day) over the period between 01/11/2002 and 03/05/2007 is reported in the plot below.



The firing per day over the period between 01/11/2002 and 03/05/2007 is shown in the plot below.

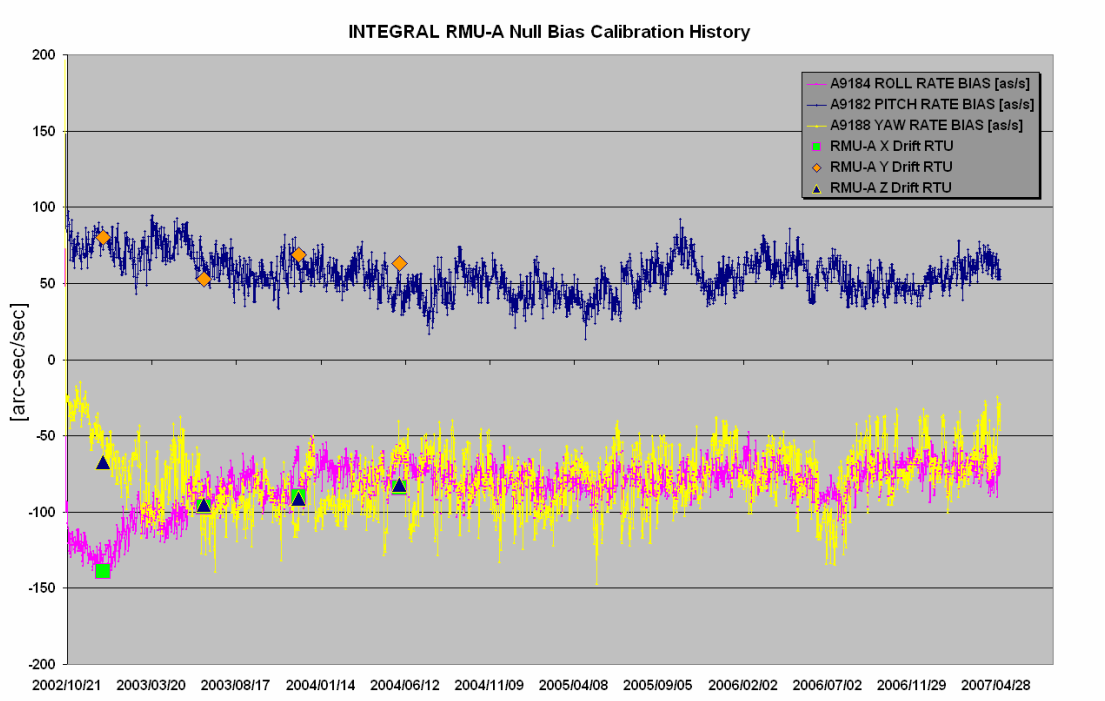


The fuel per firing over the period between 01/11/2002 and 03/05/2007 is shown in the plot below.

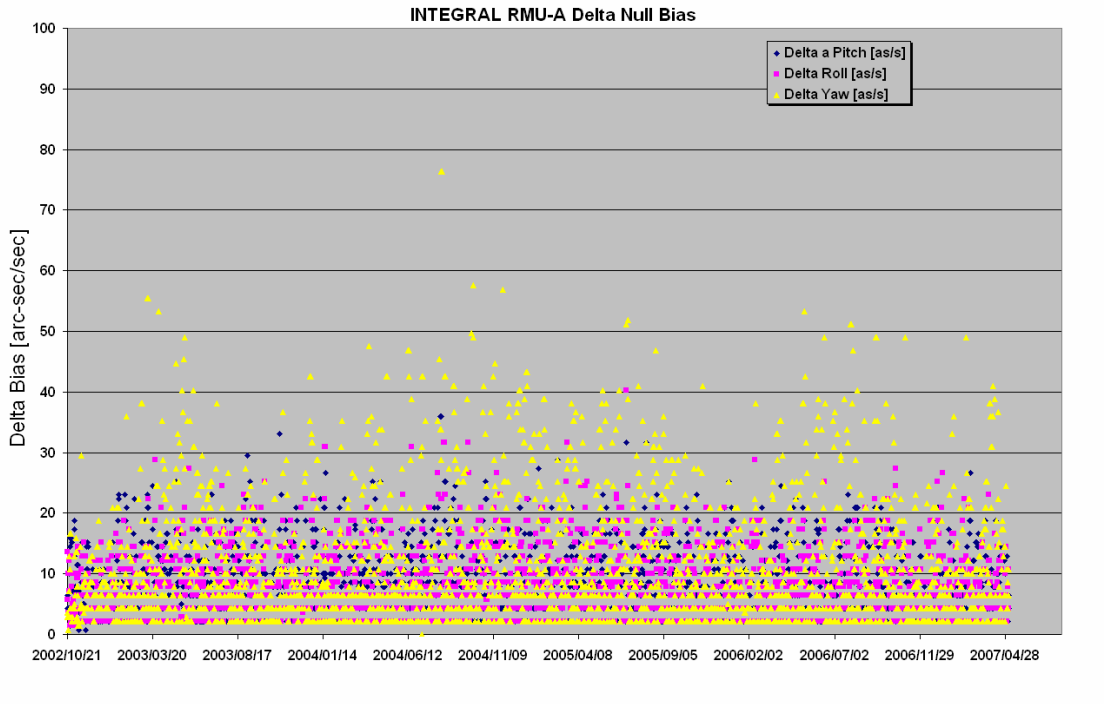


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 04/05/2007 is reported in the plot below.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 04/05/2007 is shown in the plot below



28/04/2007 (Day of Year 118, Revolution 554)

ACC Yaw Error OOL: reported at 00:56z, during the execution of PID 05540022, several occurrences of the OEM ID 50 APID 640 <<ACC YAW ERROR OOL>>.

The guide star, during PID 05540022, was Mi 8.5 @ CCD location [-317, -11268].
It was observed an oscillation in the Yccd position of the guide star (equivalent to the Yaw axis of the S/C) in average about 100 ccd units (=0.6 pixel).

This caused likely the OTF threshold, defined on-board for the yaw axis, to be exceeded with consequent generation of OEM ID 50.

No impact on TL, except a small actuation on the RWs and a flickering of the OTF during PID 05540022.

The problem was fixed at the execution of the following slew ID 05540023.

29/04/2007 (Day of Year 119, Revolution 554)

Nothing to report.

30/04/2007 (Day of Year 120, Revolution 554-555)

The 5th eclipse operations were nominal from the AOCS point of view. A summary of the eclipse passage during rev 554 is given below:

AOCS ECLIPSE MONITORING
Summer 2007

Revolution: 554
Date: 30/04/2007
DoY: 120

Penumbra Start:	30/04/2007 02:58:20	**LOS:**	30/04/2007 02:53:00	antenna swap
Umbra Start:	30/04/2007 03:00:03	**AOS:**	30/04/2007 07:05:00	
Umbra End:	30/04/2007 03:58:48			
Penumbra End:	30/04/2007 04:00:05			
Eclipse Duration:	1:01:45			
Eclipse Duration [sec]:	3705			

IMU Health Check Start	30/04/2007 00:19:00
Eclipse Imminent Flag	30/04/2007 01:58:40
ACC IMU AutoCal Start	30/04/2007 02:13:06
ACC IMU AutoCal End	30/04/2007 02:33:06

Sun out of FSS FoV	30/04/2007 02:59:49
Sun back in FSS FoV	30/04/2007 03:59:03

Eclipse Timers	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	**WRT Pen. Start [sec]**	**Absolute**	**WRT Pen. Start [sec]**		
ACC Eclipse Start	30/04/2007 02:40:34	-1066.00	30/04/2007 02:40:40	-1060.00	**-1064**	
FDE Eclipse Start	30/04/2007 02:51:42	-398.00	30/04/2007 02:52:03	-377.00	**-404**	**176**
FCE Eclipse Start	30/04/2007 02:52:26	-354.00	30/04/2007 02:52:51	-329.00	**-360**	**176**

	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	**WRT Pen. End [sec]**	**Absolute**	**WRT Pen. End [sec]**		
FCE Eclipse End	30/04/2007 04:05:58	353			**360**	**176**
FDE Eclipse End	30/04/2007 04:05:58	353			**360**	**176**
ACC Eclipse End	30/04/2007 04:09:41	576	30/04/2007 04:09:48	583.00	**578**	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	27/04/2007 08:28:37	30/04/2007 04:12:01	716
IMU On	30/04/2007 00:21:16	**IMU H/C Noise Roll [as/s]**	0.2086
IMU Off	30/04/2007 04:12:02	**IMU H/C Drift Roll [as/s]**	0.2842
IMU On Time	3:50:46	**IMU Auto Cal Drift Roll [as/s]**	0.2974

Search/Track process failed, start guide star failed PTV: at 12:29z, the sequence for slew ID 05550003 failed release due to static PTV. The expected slew star was not found in slot #2, during the S/T process, and the static PTV blocked the sequence execution.

The guide star selected for the S/T was ID 1055-4669. This star was reported in the mission catalogue and found in the mapping of the STR FOV at CCD location [-14120, -19261] and Mi 8.43.

A second object, very close to the slew star, was found in the mapping, as reported (by TM) in the log file produced during the attitude determination process. An investigation on a different star catalogue resulted in a dim star (ID 1055-5137, Mi 10.51) at ~5arcmin from the slew star and several variable stars reported in the STR FOV at the same time. This did not clarify the event therefore the reason of the S/T process failed is still to be identified. At moment the slew star ID 1055-4669 is classified and monitored to verify its validity to the next occasion.

A new mapping was manually commanded and a manual recovery performed from the attitude of PID 05550002 to the attitude of PID 05550003.

The next slew ID 05550004 was manually updated at 13:07z.

The following slew was missed in TL: 05550003(CSL)

01/05/2007 (Day of Year 121, Revolution 555)

FDS failed slew update: at 17:30z the FDS failed the update of slew ID 05550035. FDS reported an error during the update process: no guide star was found for the CSL generation. The suitable guide stars in the STR FOV overlap failed the blemish pixel check.

A new mapping was manually commanded and a slew recovery (as open loop slew) performed from the attitude of PID 05550034 to the attitude of PID 05550035.

The next slew ID 05550036 was manually updated at 18:01z.

The following slew was missed in TL: 05550035(CSL)

02/05/2007 (Day of Year 122, Revolution 555)

Problem at DSS-27 station: at 13:36z, due to a drop of TM links at DSS-27 station, the command sequence for slew 05550057 failed release.

A new mapping was manually commanded and a slew recovery performed from the attitude of PID 05550056 to the attitude of PID 05550057 as open loop slew.

The next slew ID 05550058 was manually updated at 14:09z.

The following slew was missed in TL: 05550057(CSL)

03/05/2007 (Day of Year 123, Revolution 555-556)

The 6th eclipse operations were nominal from the AOCS point of view. Hereafter is reported summary of the eclipse passage during rev 555:

AOCS ECLIPSE MONITORING
Summer 2007

Revolution:	**555**		
Date:	**03/05/2007 123**		
DoY:	**123**		

Penumbra Start:	03/05/2007 02:52:50	**LOS:**	03/05/2007 02:44:00	antenna swap
Umbra Start:	03/05/2007 02:54:36	**AOS:**	03/05/2007 06:53:00	
Umbra End:	03/05/2007 03:47:42			
Penumbra End:	03/05/2007 03:49:01			
Eclipse Duration:	0:56:11			
Eclipse Duration [sec]:	3371			

IMU Health Check Start	02/05/2007 23:32:00
Eclipse Imminent Flag	03/05/2007 01:53:10
ACC IMU AutoCal Start	03/05/2007 02:07:36
ACC IMU AutoCal End	03/05/2007 02:27:36
Sun out of FSS FoV	03/05/2007 02:54:14
Sun back in FSS FoV	03/05/2007 03:47:54

Eclipse Timers	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	WRT Pen. Start [sec]	Absolute	WRT Pen. Start [sec]		
ACC Eclipse Start	03/05/2007 02:35:02	-1068.00	03/05/2007 02:35:07	-1063.00	**-1064**	
FDE Eclipse Start	03/05/2007 02:43:44	-546.00			**-404**	**176**
FCE Eclipse Start	03/05/2007 02:44:28	-502.00			**-360**	**176**

	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	WRT Pen. End [sec]	Absolute	WRT Pen. End [sec]		
FCE Eclipse End	03/05/2007 03:52:52	231			**360**	**176**
FDE Eclipse End	03/05/2007 03:52:52	231			**360**	**176**
ACC Eclipse End	03/05/2007 03:58:35	574	03/05/2007 03:58:40	579.00	**578**	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	30/04/2007 08:08:36	03/05/2007 04:00:54	713
IMU On	02/05/2007 23:35:39	**IMU H/C Noise Roll [as/s]**	0.1867
IMU Off	03/05/2007 04:00:54	**IMU H/C Drift Roll [as/s]**	0.2699
IMU On Time	4:25:15	**IMU Auto Cal Drift Roll [as/s]**	aborted due to CSL recovery

IMCS HFA TM task problem: at 00:43z due to problem on HFA TM task on IMCS-A, the update for slew ID 05550069 failed.

The complexity of the ground recovery (implying also an IMCS-A reboot) and the imminent eclipse passage forced to swap on the Backup chain, to continue safe operations.

Once the backup system was configured (IMCS-B + FDS), a mapping was then manually executed and the corrective slew to the attitude of PID 05550069 performed at 02:06z. No manual CGS for the imminent eclipse passage was required by FD.

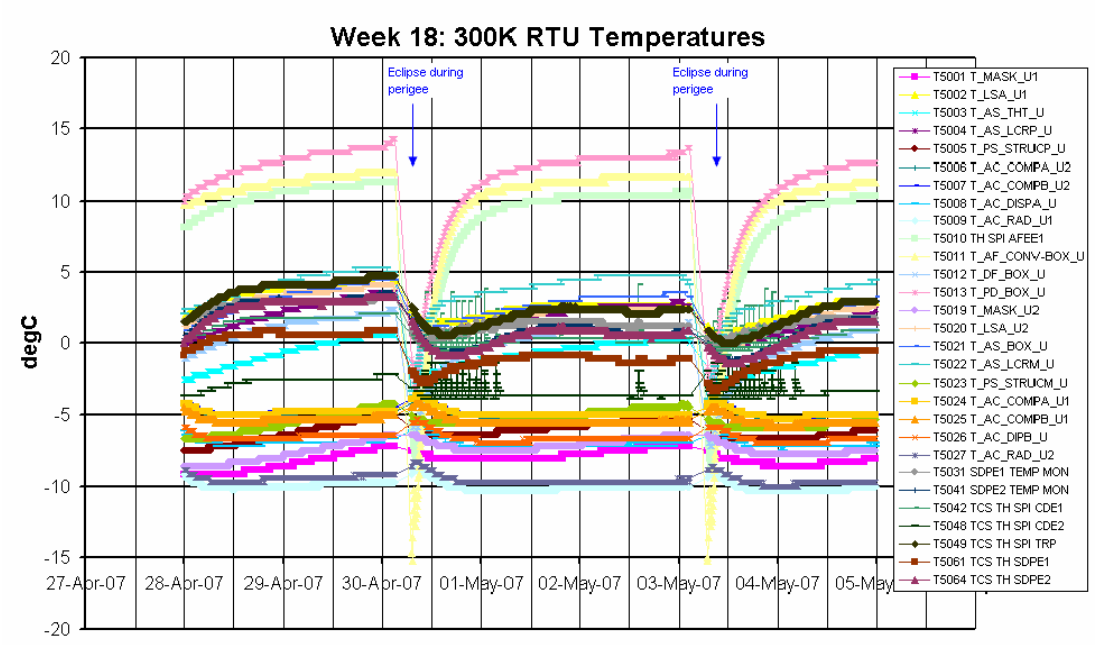
The following slew was missed in TL: 05550069(CSL).

04/05/2007 (Day of Year 124, Revolution 556)

Nothing to report.

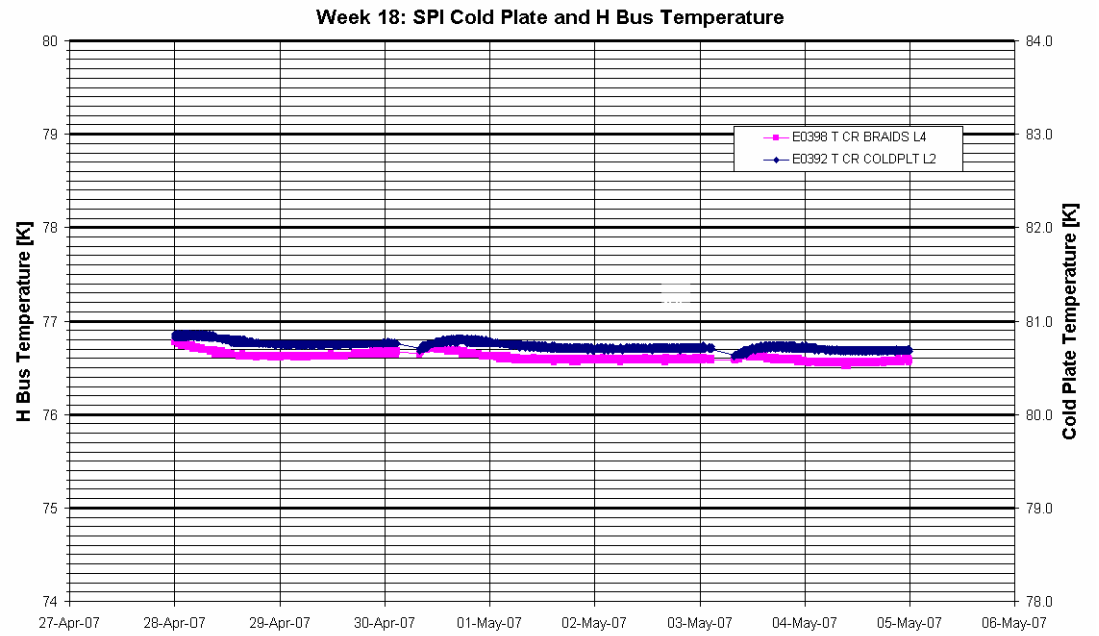
8.3.2 SPI Operations

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

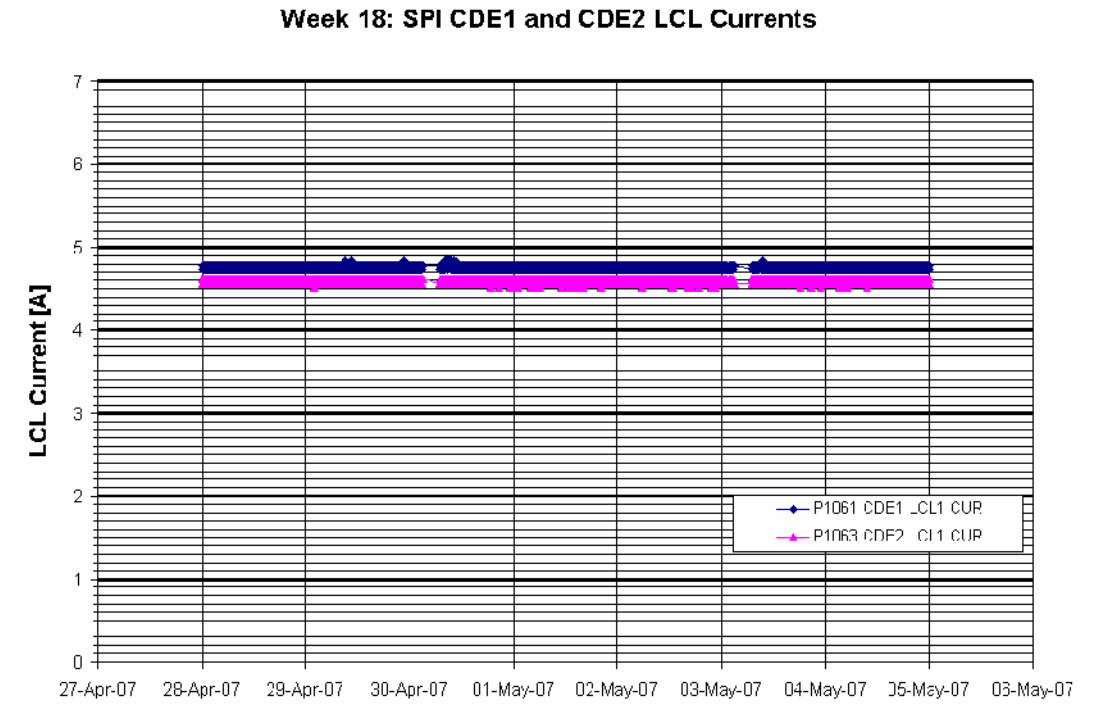


The stroke of all four compressors has been 40 since 03-02-2007 at 13:16Z.

The average LCL currents of the CDEs over the week were:

- Average CDE1 LCL Current = 4.76A
- Average CDE2 LCL Current = 4.57A

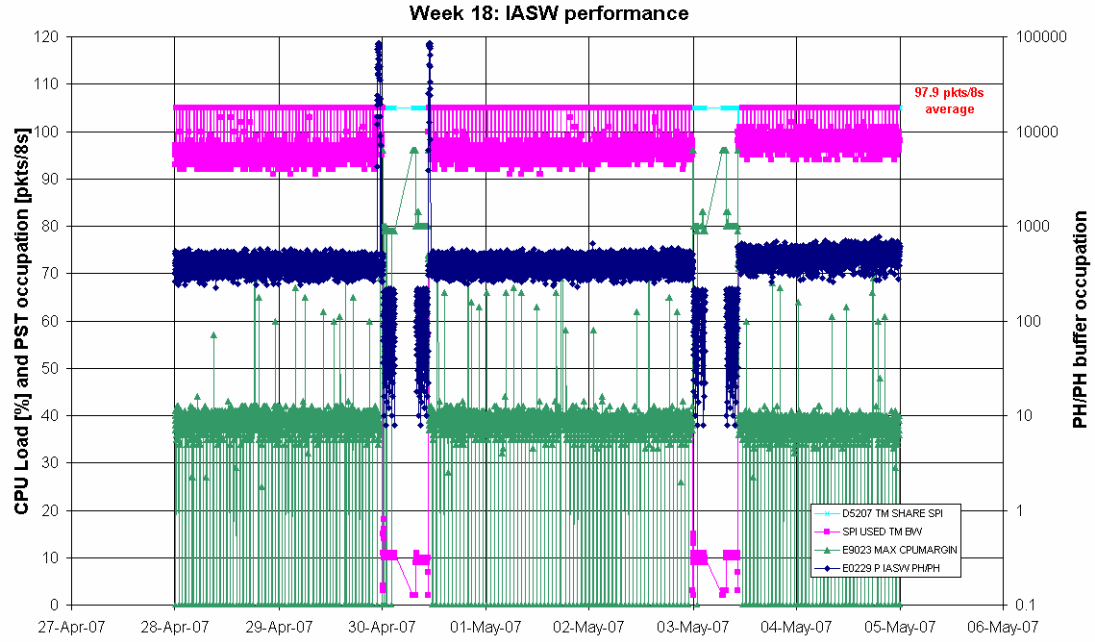
The following plot shows the evolution of the CDE currents during the reporting period.



DPE & IASW: The DPE health and IASW performance is nominal. The IASW version installed is v433 patch #1. The spectra scaling factor was set to 9/19 SE

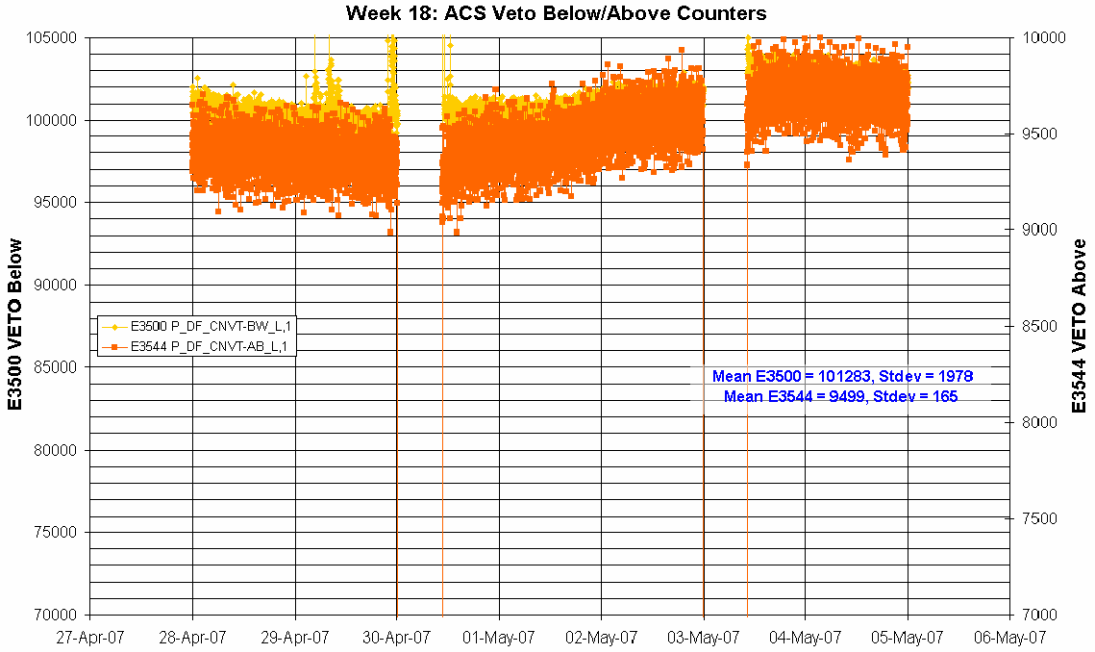
throughout the week (being reset manually after each radiation belt exit in line with INT_OPS_0286).

The average TM bandwidth occupation of SPI was 97.9 packets/cycle over the science window, when the TM allocation was 105 packets/cycle. 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).

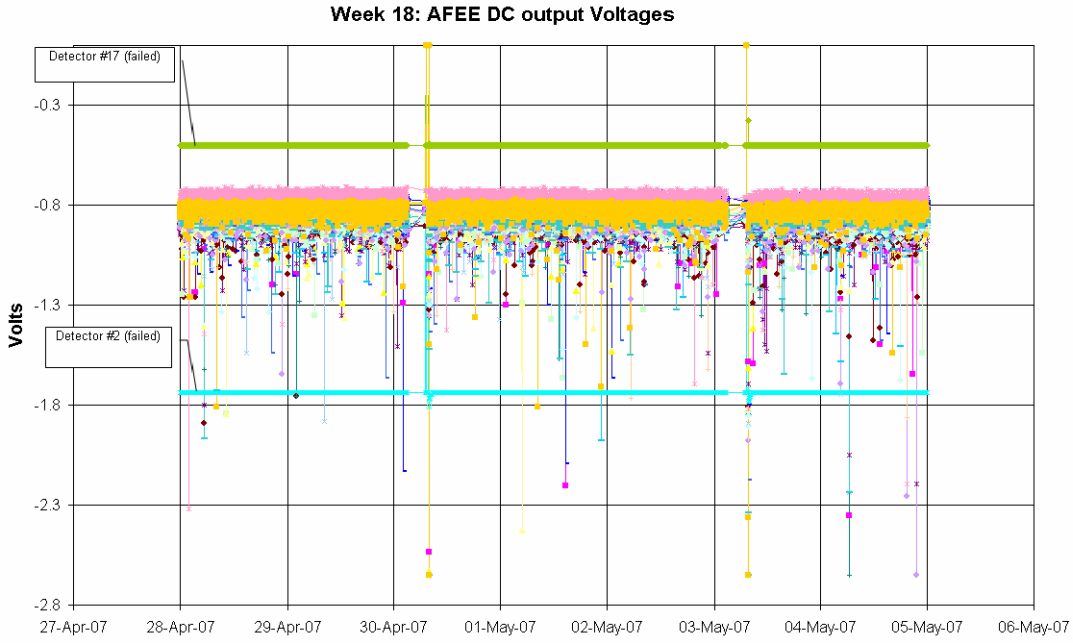
The following plot shows the ACS overall count rate evolution during the reporting period:



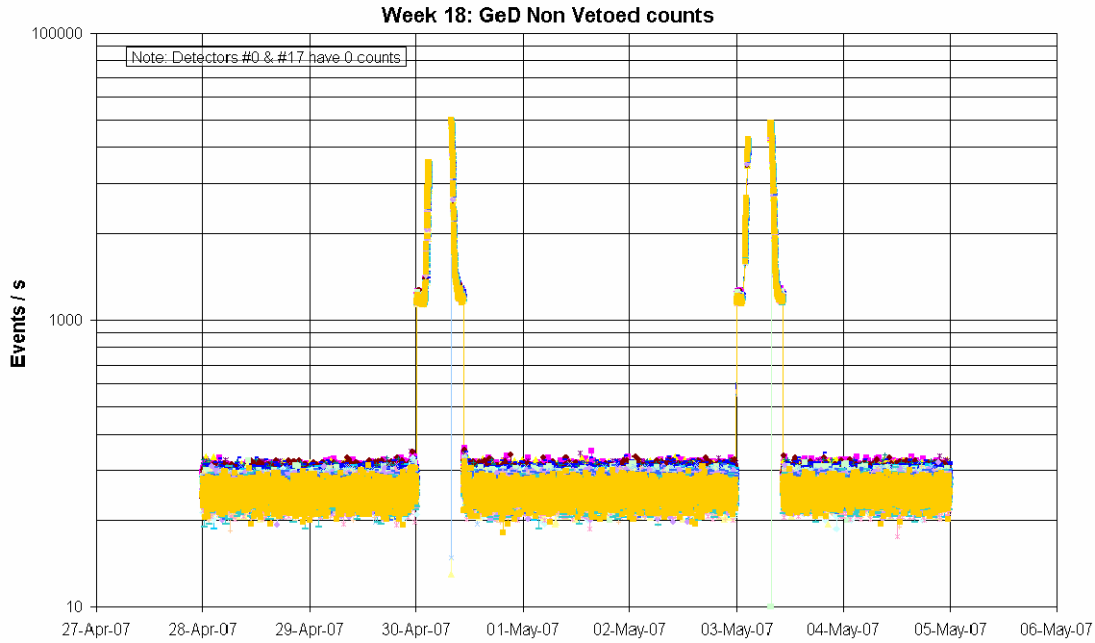
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution. The energy resolution of GeD#4 was recovered with the last annealing.

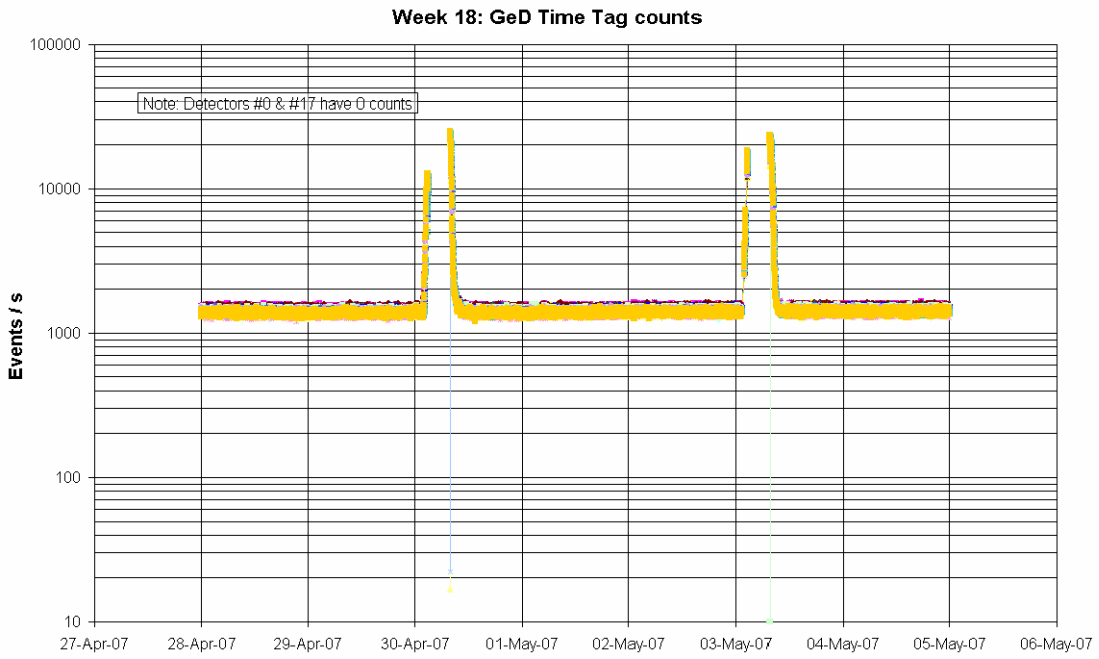
The GeD#12 HV remained at 3.5kV throughout the reporting period.

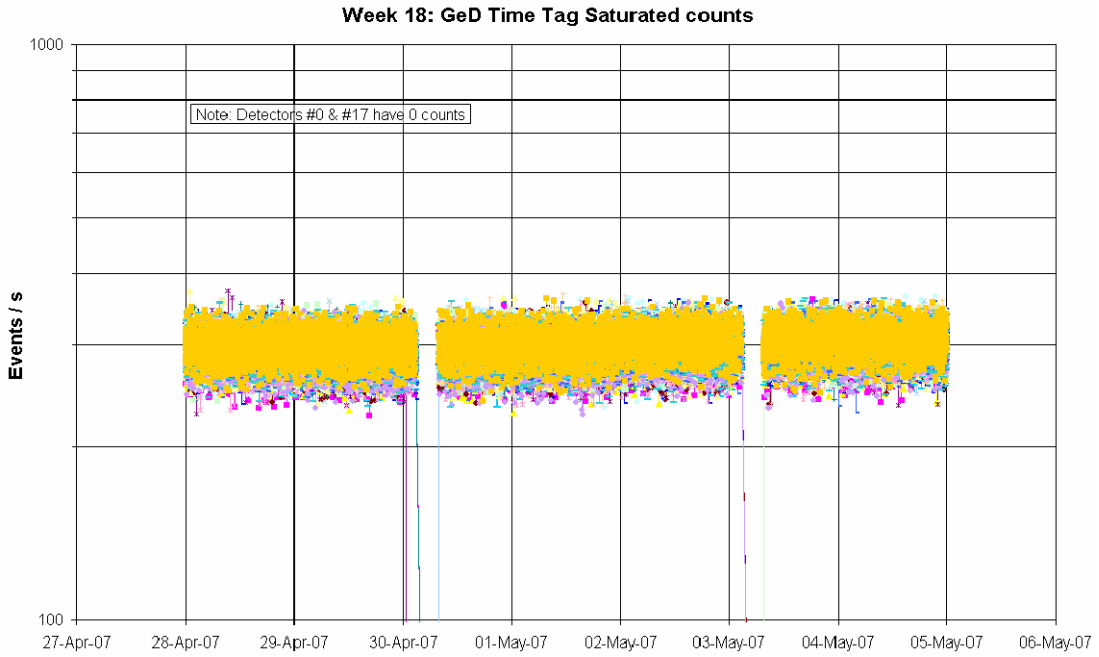
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



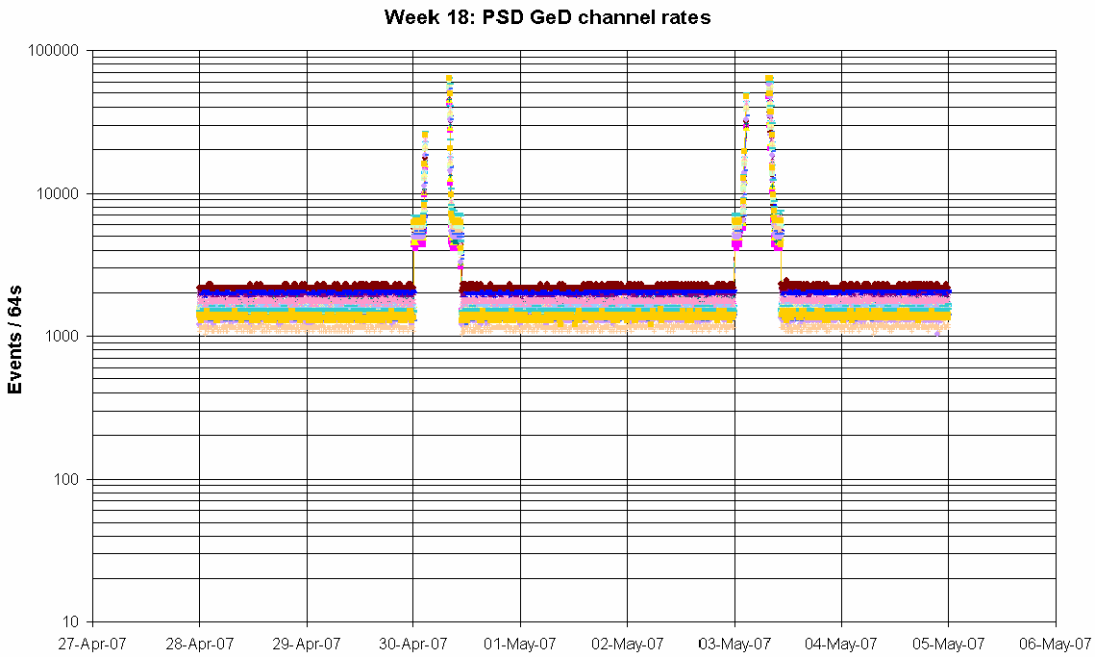
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.







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



Event Log:

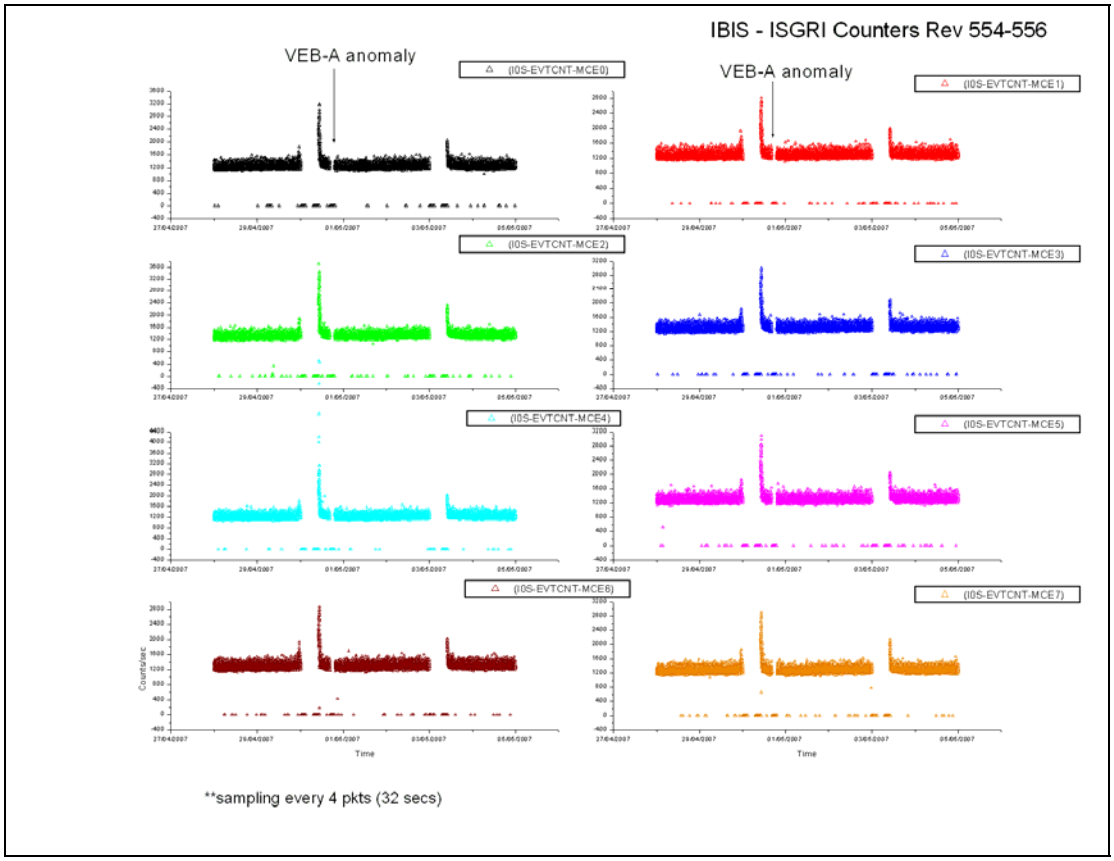
The following non-nominal events occurred on SPI during the reporting period:

- On 2007-04-28 at 08:58:01Z TM parameter E2115 Plastic scintillator temperatures started fluctuating in and out of limits Warning Low (value = -15.38degC). It returned stable within limits at 10:23:21Z.
- On 2007-04-29 at 07:00:07Z and 11.07.59Z and on 2007-05-04 at 12:31:19Z OEM APID 1024 ID 243 EVENT SPI1 SPECTRA BUILDING NOT COMPLETED was received. As these were single occurrences and remain rare, the spectra scaling factor has not been adjusted.
- On 2007-04-29 at 22:50:08Z the TM parameter E3500 P_DF_CNVT-BW_L went briefly OOL High, returning within limits at 22:50:24Z. This was just before radiation belt entry of revolution 554 and therefore no action was taken.
- On 2007-04-30 at 07:53:07Z and again on 2007-05-03 at 07:40:51Z the TM parameter E4009 S DF HSLERR L went OOL High for a couple of TM cycles, indicating an error on the HSL. This was a few minutes after the end of the execution of the post-eclipse activation ED EECLEX02 from the Timeline at the start of revolutions 555 and 556 respectively.
- On 2007-05-03 at 07:44:53Z OEM APID 1024 ID 145 EXCEPTION SPI1 LSL ERROR was received with E9759 LSL ERROR TYPE = NACK; E9760 LSL CHANNEL = PSD and E9762 TYPE OF COMMAND = K, indicating a negative acknowledgement on the LSL for a HK acquisition request from the PSD. As this was a single occurrence, no action was taken.
- On 2007-04-30 at 10:45:45Z the TM parameter E3500 P_DF_CNVT-BW_L went OOL High. This was just after radiation belt exit of revolution 555. It returned within limits at 11:04:01Z..

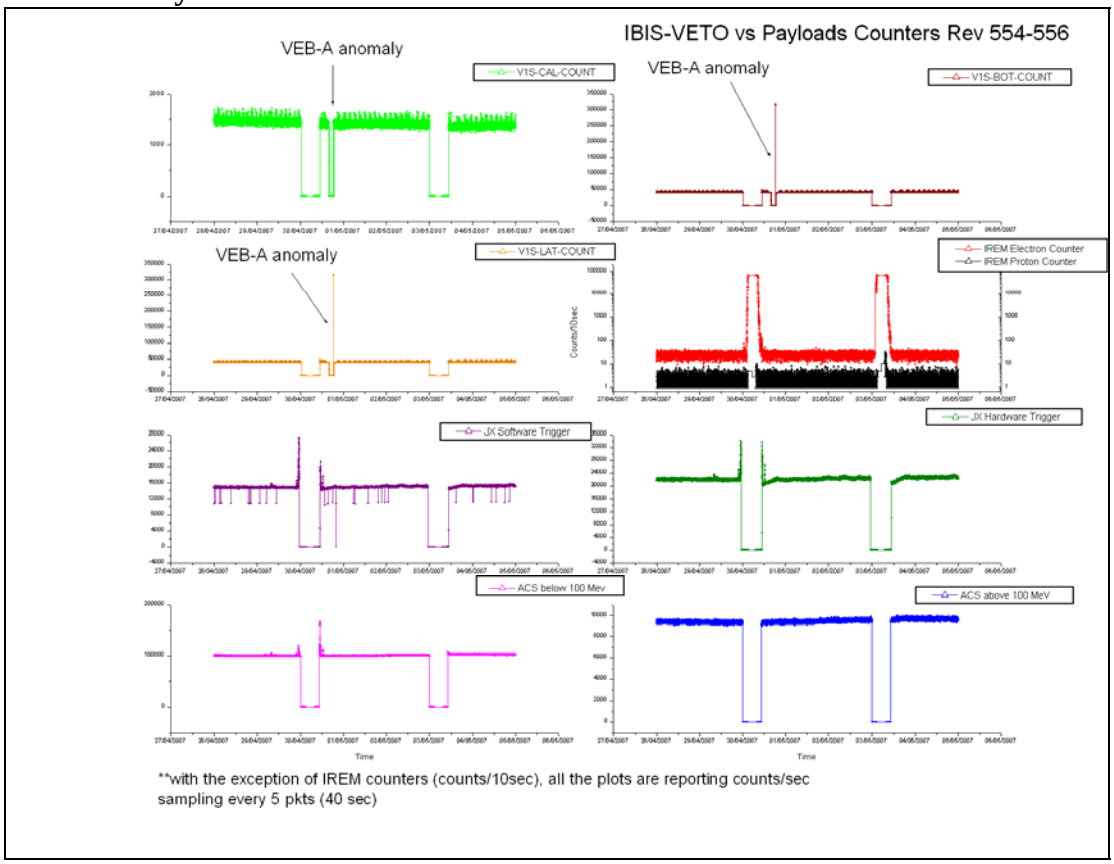
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

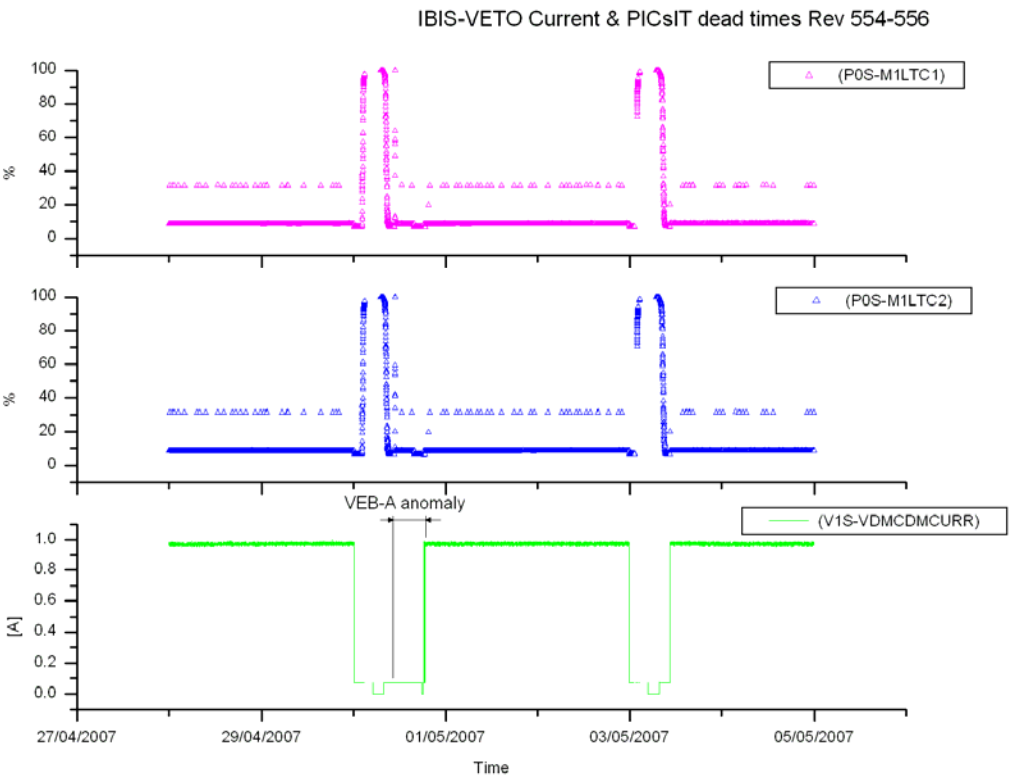


VETO vs Payloads Counters:

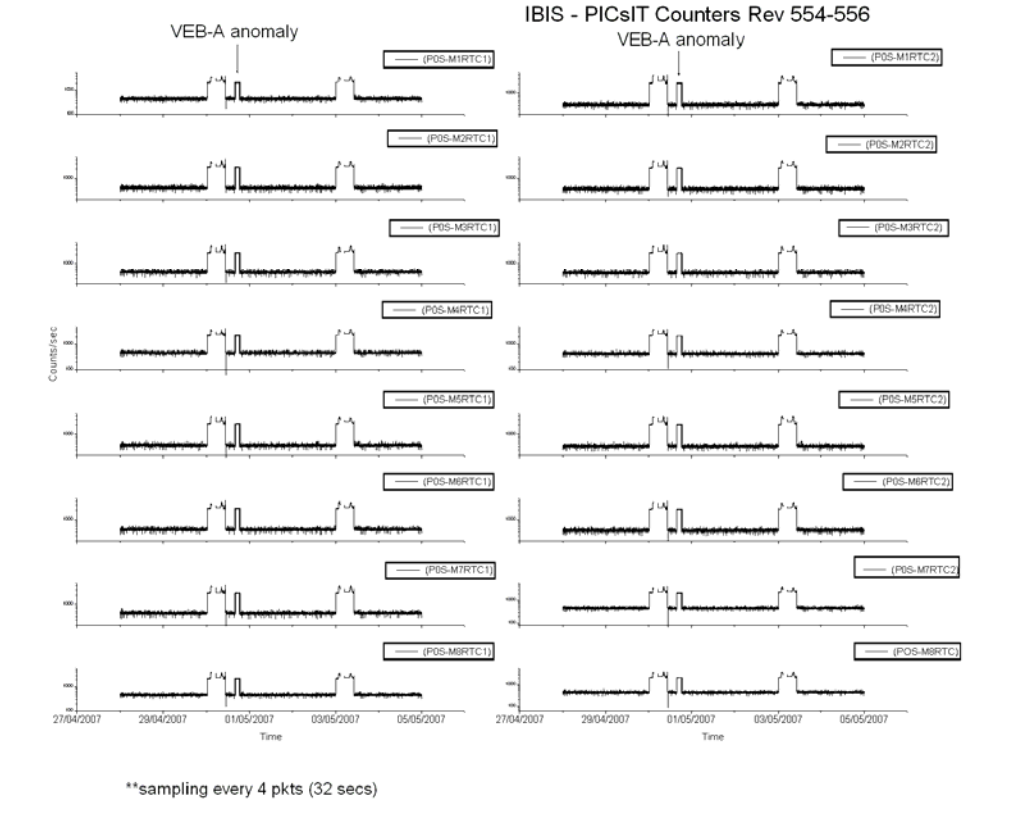


The week was characterised by low radiation.

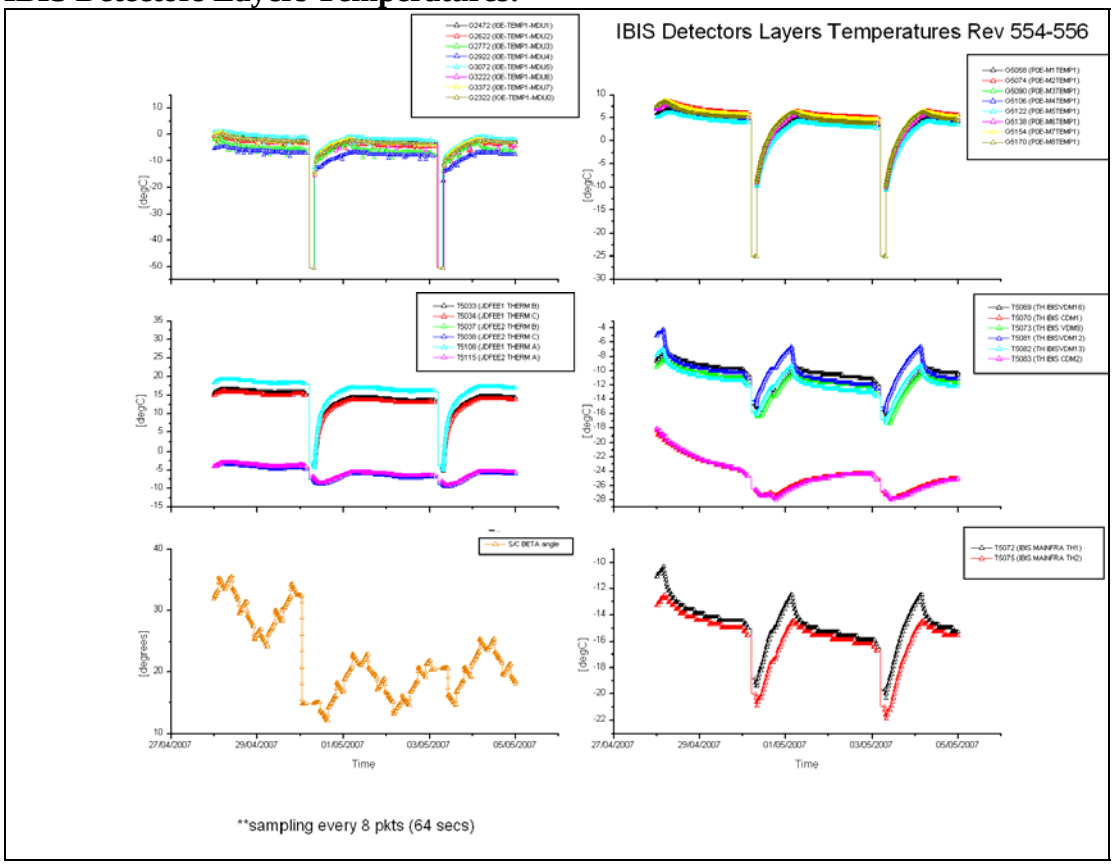
VETO Current:



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 2007.119 (29/04/2007):

Between 23:32Z and 00:13Z on next day (DoY 120), TM parameter G8080 (S1E-VS_HBRA-RT) was toggling OOL High. As this occurred when the spacecraft was approaching the radiation belts entry time, no action was taken following the FDIR.

DoY 2007.120 (30/04/2007):

At 10:17Z, TM family G2013 (I0S-EVTCNT-MCEi) was reported toggling OOL High until 10:33Z. This was due to high radiation background at belts exit. No action was requested.

DoY 2007.120 (30/04/2007): VEB-A anomaly (INT_SC-188)

At 10:42Z, at radiation belts exit, after post-eclipse reconfiguration, several VETO TM parameters were reported OOL.
At this time, HK4 parameters are expected to be OOL as the unit is filling up the packet with default values for ~4 cycles (due to eclipse operations). However, in addition of these, TM parameters from HK1 were also reported OOL, namely:

- all VETO modules (VDM and CDM) High Voltages were ~0V,
- CDM1 temperature was Raw 0.

During this time, ISGRI and PICsIT count rates were reporting nominal values indicating that the science may not have been disturbed by the VETO anomaly.

As explained in details in the Anomaly Report (INT_SC-188), the operator with support of the on-call SOE performed the following activities:

- at 15:40Z, VETO mode cycle (reaction indicated in FDIR to HV break-down anomaly) → not successful
- at 16:22Z, IBIS to Safe configuration (FCP_IBIS1_0801) during investigation
- at 17:44Z, in agreement with IBIS PI, VEB-A power cycle
- at 18:11Z, VETO Context Tables restoring
- at 18:18Z, VETO to Nominal, check of VETO modules HV→ successful
- at 18:29Z, VETO back to Stand-By and uplink of VEB-A patch (3.1 + 3.2)
- at 18:36Z, VETO in Nominal, check of VETO modules HV→ successful
- at 19:06Z, reconfiguration of IBIS to Scientific Standard Mode
- at 19:52Z, the unit rejoined the timeline.

This anomaly seems related to the uplink of the VEB patch during eclipse reconfiguration. Further investigations are on-going.

DoY 2007.120 (30/04/2007):

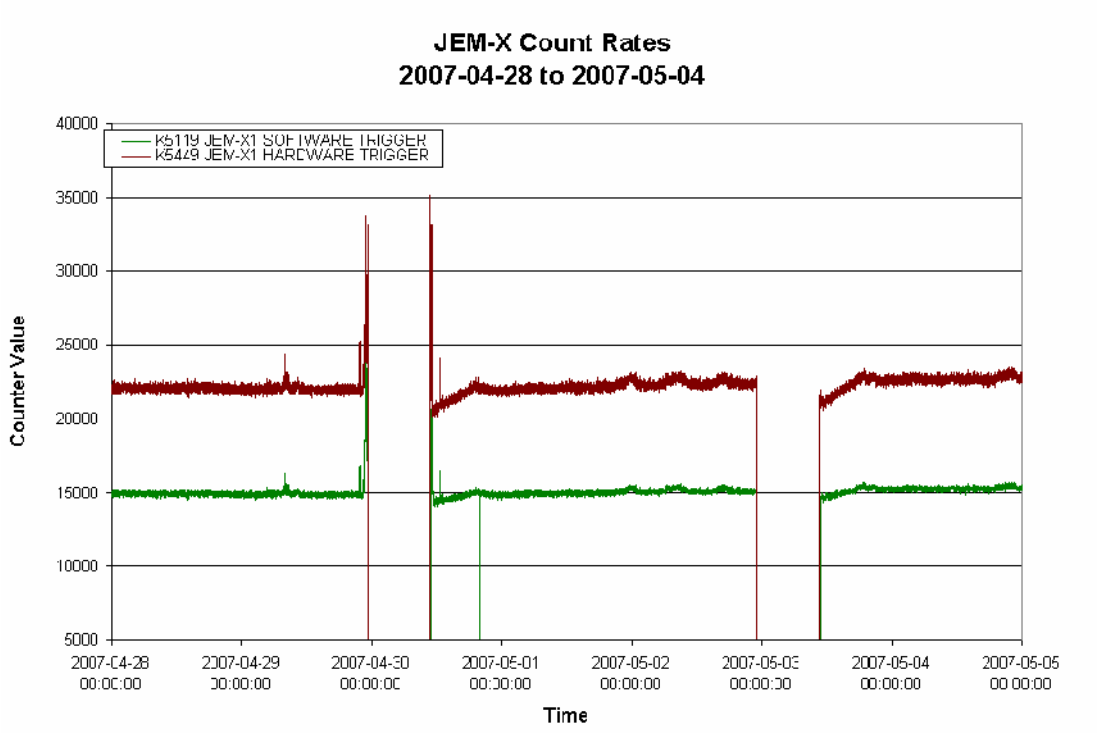
At 10:48Z, TM families G5068 and G5072 (P0S-MiF1 & 2 ERRF) failed SCC.
At 10:52Z, TM families G5002 and G5003 (P0S-MiRTC1 & 2) were reported OOL low-low.
At 10:55Z, the OEM APID 1280, class 0, ID 132, "IBIS1 IASW HEPI RESYNCHRONISED" was reported.
The coincidence of these 3 events flagged a synchronisation problem between the detectors and HEPI. The unit fixed it automatically and no action is required from the operator as indicated in FDIR.

8.3.4 JEM-X Operations

JEM-X Count Rates

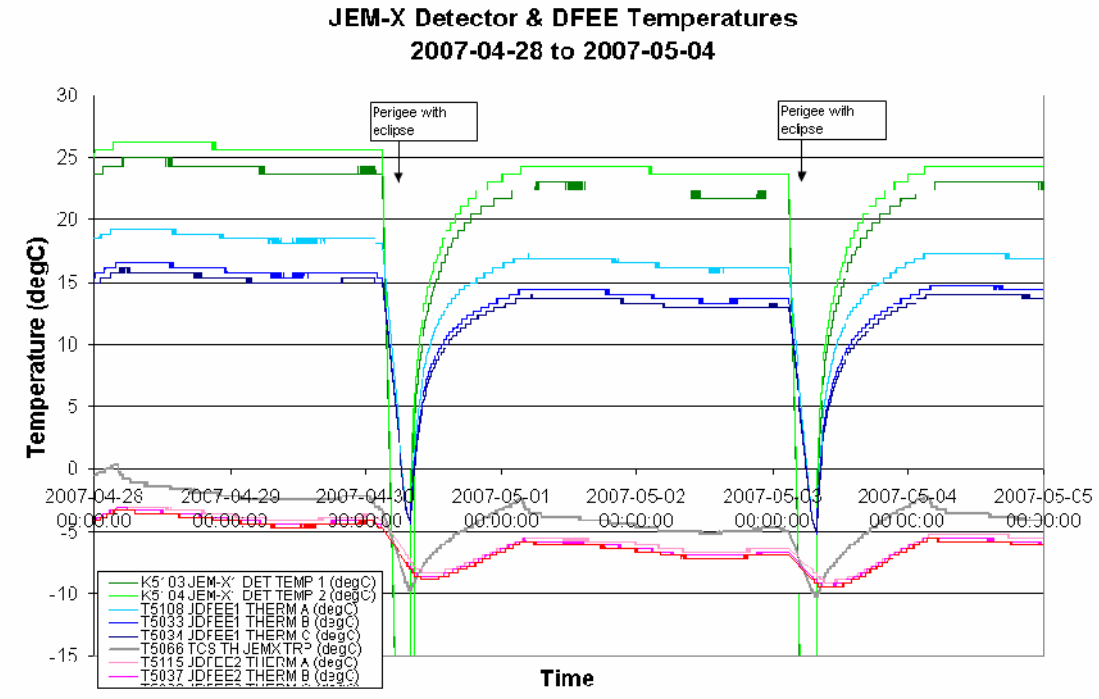
JEM-X count rates over the reporting period are displayed in the following graph[1].

[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 graph[2].



JEM-X Daily Report

[2] Data sampled (1 frame in 8)

2007-04-28 (DOY 118, Rev 554)

JEM-X1 operations executed nominally.

2007-04-29 (DOY 119, Rev 554)

At 22:52:59Z the TM parameter K5449 HARDWARE TRIGGER began to toggle OOL High, until JEM-X1 was commanded to Safe by the ED KESAFE01 in the Timeline at 23:17:03Z before radiation belt entry of revolution 554.

2007-04-30 (DOY 120, Rev 554-555)

During the post-eclipse reconfiguration of JEM-X1 following the 5th eclipse of this season, another DFEE anomaly occurred like those observed on 2004-06-20, 2004-06-23, 2004-12-08; 2005-05-18; 2005-11-14 and 2006-10-26 (ref: Anomaly Reports INT_SC-84; INT_SC-104; INT_SC-119; INT_SC-131 and INT_SC-161).

The symptoms were as follows:
1) The following OEMs were received after the JEM-X1 DFEE was switched on by the ED KECLEX01 in the Timeline (uplinked at 2007-04-30T07:53:32Z):

```
 2007.120.07.54.16.862   2007.120.07.54.21.769   1536   RealTime
191     EVENT       JEM-X1 PROB DFEE 11
    FIX6                          11
    K9079          MESS CLASS      0
    K9080          MESS ID        191
    FIX16                         8
    FIX16                         0
```

>> Indicating that the operation “Load DFEE context” was unsuccessful due to CRC failure of the area B000 (hex) to CFFF (hex).

```
2007.120.07.54.16.862   2007.120.07.54.21.793   1536   RealTime   234
EVENT       JEM-X1 AUTO EVENT 4
    FIX6                            4
    K9079          MESS CLASS       0
    K9080          MESS ID          234
    K5419          ACTUAL LEVEL    ECLIPSE
    K5420          TARGET LEVEL    RAD.
```

>>> Indicating failure of the automatic recovery from shutdown level ECLIPSE to shutdown level RAD. BELTS
2) Following the KECLEX01 ED, the JEM-X1 DFEE state (TM parameter K5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter K5381) remained ECLIPSE instead of RAD. BELTS.
3) The DFEE CPU speed, TM parameter K5583 CPU MODE, remained at a value of 8 MHz WAIT (as at start-up) rather than the nominal value of 16MHz.

In response to this, the following operations were performed:
1) For the purpose of later analysis, a dump of the relevant area of the DFEE memory was executed:

- 08:08:50Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE
- 08:14:46Z FCP_JEM1_0120 JEMX1 SET BCP OVERRIDES to disable the JEM-X1 reactions to the Broadcast Packet radiation belt times

- 08:15:29Z FCP_JEM1_0045 JEMX1 TRANSITION TO MEMORY MAINTENANCE
- 08:19:27Z FCP_JEM1_0051 JEMX1 DFEE MEMORY DUMP, with the following values for the parameters of TC K0018:
  K0017 START ADDR = B000 (hex)
  K0018 LENGTH OF MEM = 1FFF (hex)

No differences with respect to the reference image on-ground were observed.
2) In order to recover JEM-X1, a DFEE power cycle was then performed according to CRP_JEM1_5010 JEMX1 DFEE POWER CYCLE, consisting of:

- 08:27:43Z FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF
- 08:32:08Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION

3) At 08:39:12Z FCP_JEM1_0120 JEMX1 SET BCP OVERRIDES was executed to re-enable the JEM-X1 reactions to the Broadcast Packet radiation belt times.

The above recovery proceeded nominally and JEM-X1 operations then continued nominally from the Timeline with the ED KEACAL01 (anode calibration at radiation belt exit). This anomaly is recorded as INT_SC-187.

Due to high background radiation conditions after the expected radiation belt exit of revolution 555, at 10:51:47Z the TM parameter K5449 HARDWARE TRIGGER started toggling OOL High and at 10:54:11Z K5136 BUFFER LOSS also started toggling OOL High. Both parameters were stably back within limits by 11:09:55Z.

During the execution of the JEM-X1 activation ED KEHVAC01 from the Timeline, after the TC K0013 STATE DIAGNOSTIC was uplinked at 10:54:08Z, the following OEM was received:

10:54:31Z OEM 189 JEM-X1 PROB DFEE 9 (Unexpected DFEE state reported in HK)

as the TM parameter K5462 DFEE STATE IASW was reporting state DATA DUMP while K5022 DFEE STATUS was SETUP. This was because the DFEE output FIFO buffer was over half full at the time of termination of the diagnostic data collection (K5135 FIFO FULL LOSS = 2380 at 10:54:03Z) and thus the IASW did not recognise the autonomous transition of the DFEE back to SETUP (see JEM-X User Manual Section 3.7.5.2.3.6). The situation rectified itself when the next TC of the ED, TC K0009 STATE SETUP, was sent at 10:59:08Z, after which both TM parameters K5462 and K5022 reported SETUP and the following OEM was received:

10:59:18Z OEM 254 ERROR OFF.

JEM-X1 operations continued nominally.

2007-05-01 (DOY 121, Rev 555) to 2007-05-04 (DOY 124, Rev 556)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2007-04-28 (DOY 118, Rev 554) to 2007-04-29 (DOY 119, Rev 555)

Nothing to report.

2007-04-30 (DOY 120, Rev 555)

At 12:29, problems with guide stars caused a delay in the slew to the PID 05550003. A manual recovery was performed, and the pointing manually started at 13:05:09. It was at this time the following commands were rejected:

```
2007.120.12.32.54.862   2007.120.12.33.02.537   1792   RealTime   131     TC REJECT
REJECTED TC1                                             0       0    65535   PR    N
E   E
2007.120.12.33.00.987   2007.120.12.33.11.317   1792   RealTime   131     TC REJECT
REJECTED TC1                                             0       0    65535   PR    N
E   E
```

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 05550003.

2007-05-01 (DOY 121, Rev 555)

At 17:30, an FD problem caused a delay in the start of pointing 05550035. The impact was the start of this pointing was delayed from a planned 17:42 to 17:54:21.

2007-05-02 (DOY 122, Rev 555)

At 13:36, a TM gap caused the suspension of the Timeline, a recovery was performed, which was completed at 14:09. The impact was the loss of pointing 05550057. It was at this time the following commands were rejected:

```
2007.122.13.42.59.102   2007.122.13.43.03.616   1792   RealTime   131     TC REJECT
REJECTED TC1                                             0       0    65535   PR    N
E   E
2007.122.13.43.05.477   2007.122.13.43.11.512   1792   RealTime   131     TC REJECT
REJECTED TC1                                             0       0    65535   PR    N
E   E
```

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

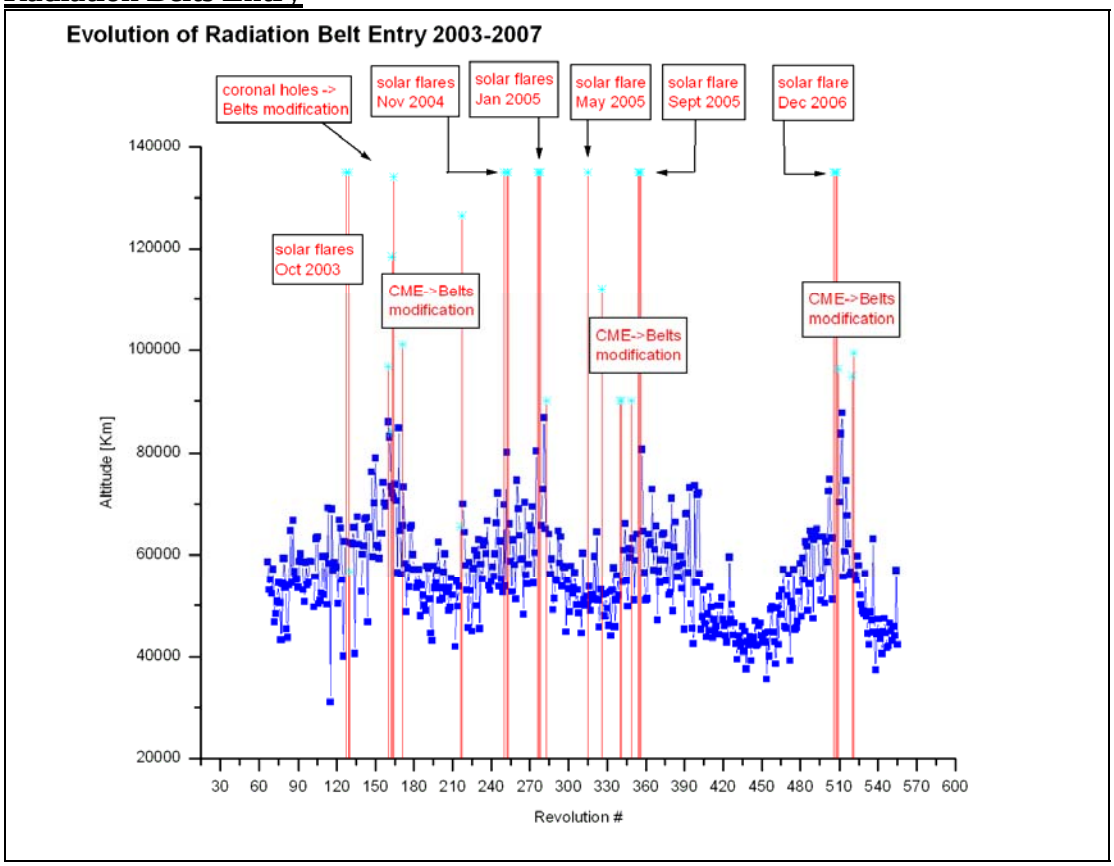
2007-05-03 (DOY 123, Rev 556) to 2007-05-04 (DOY 124, Rev 556)

Nothing to report.

On DoY 120 at 00:12:45 and DoY 122 at 23:59:58 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

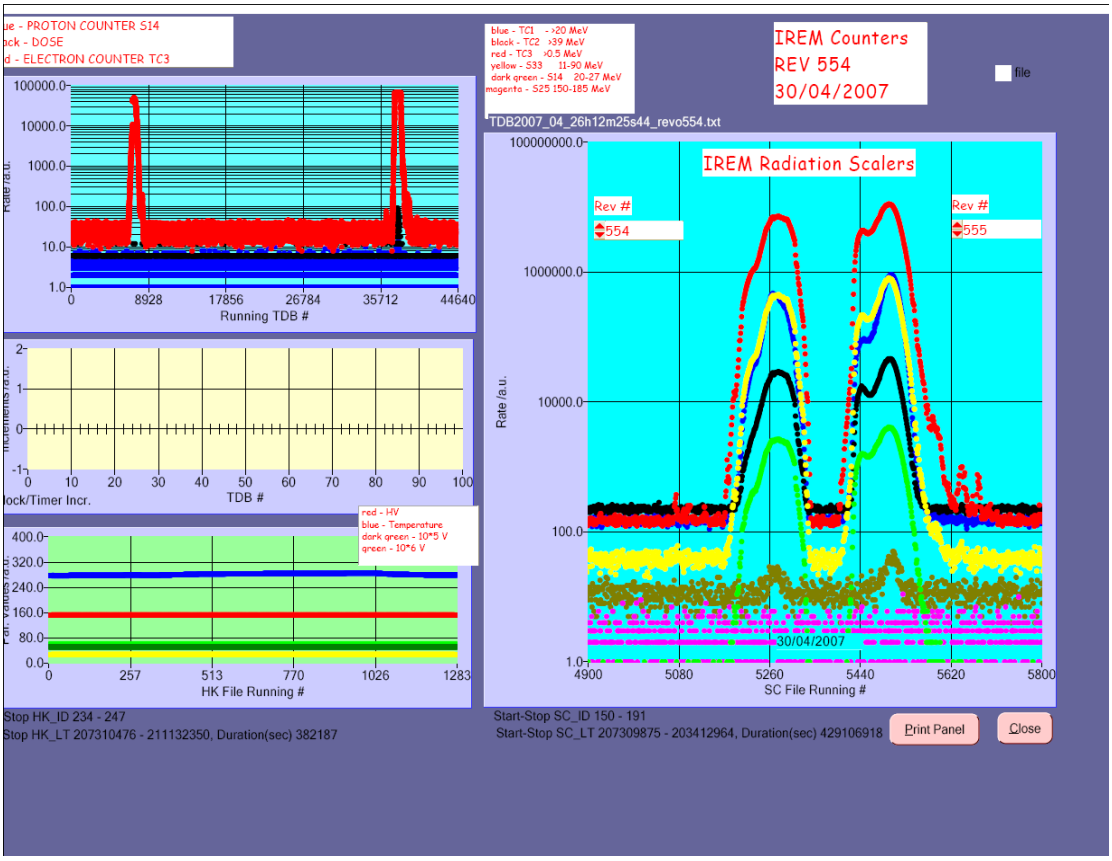
Nothing to report

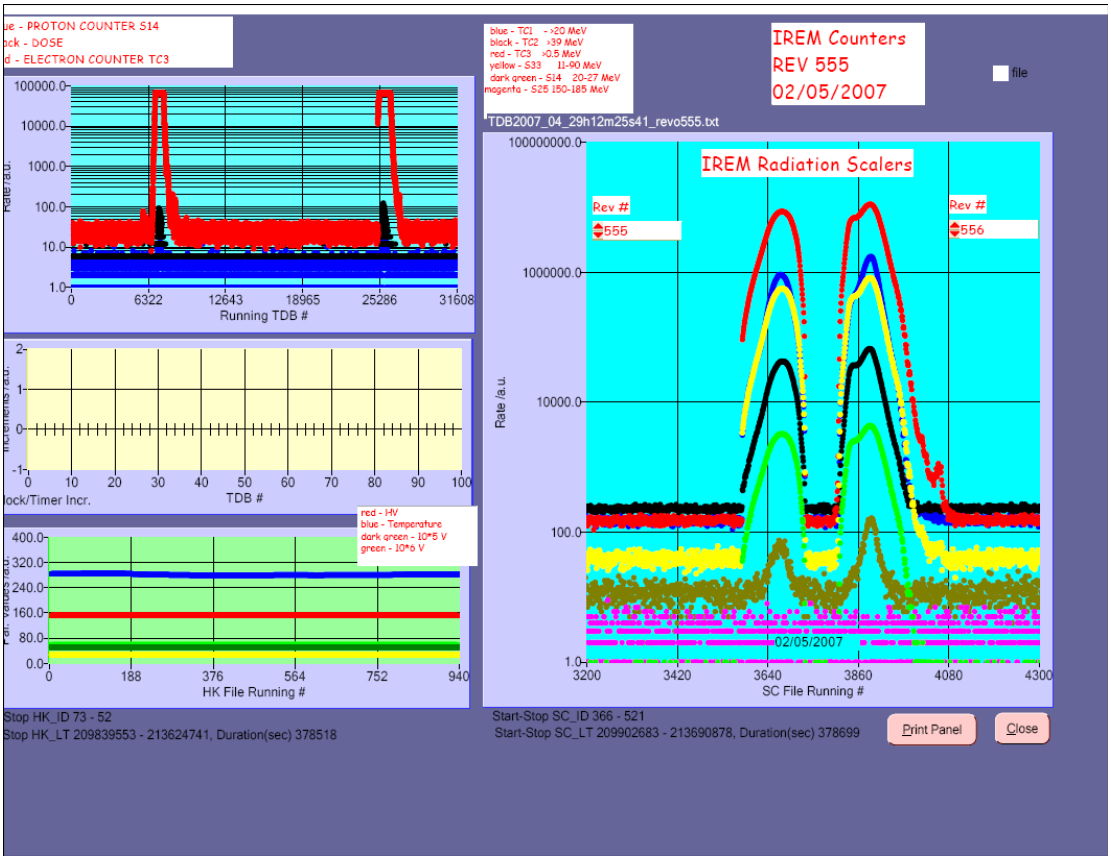
Electron Belts

REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
554	RAD_ENTR R 2007-04-30T00:12:41Z	2007-04-30 00:05:47	56960	2007-04-30 01:17:36	47447
555	RAD_EXIT R 2007-04-30T10:29:41Z	2007-04-30 10:15:31	<<55012	2007-04-30 09:17:36	42527
555	RAD_ENTR R 2007-05-02T23:59:51Z	2007-05-03 01:39:15	42336	2007-05-03 01:11:07	46786
556	RAD_EXIT R 2007-05-03T10:16:28Z	2007-05-03 09:52:43	<<53041	2007-05-03 09:11:07	43278

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)

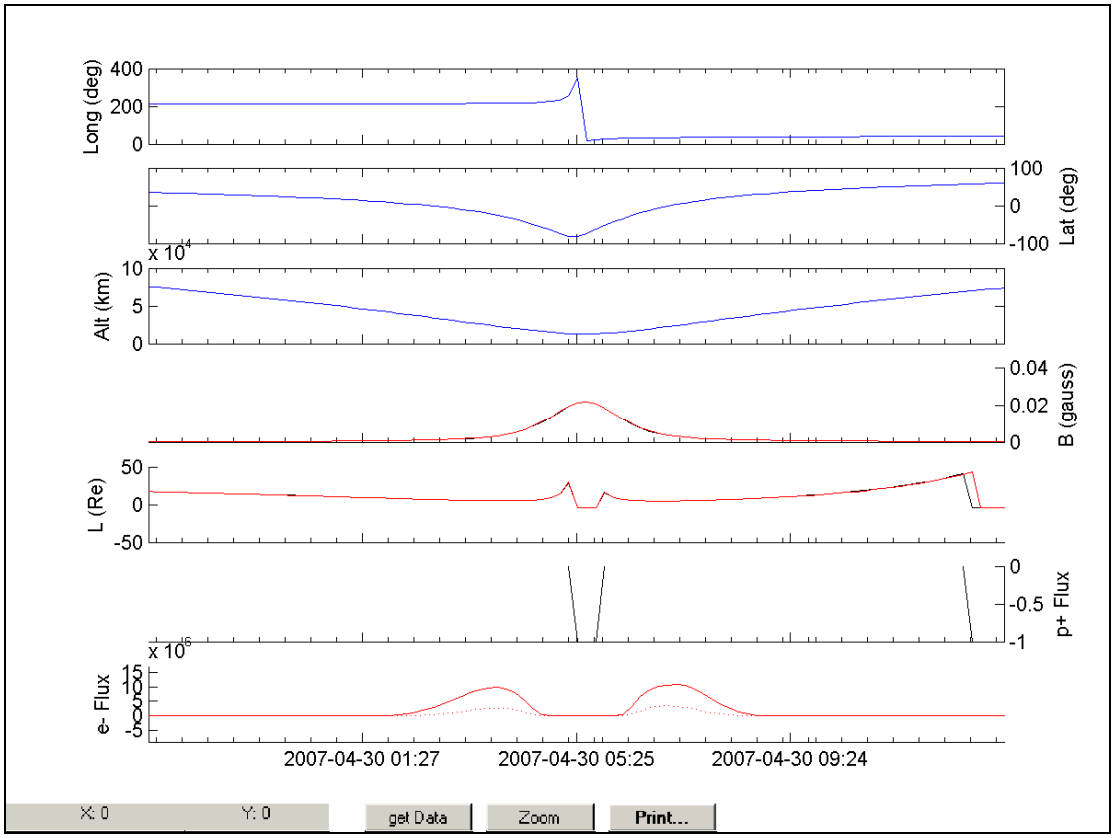
IREM radiation counters:



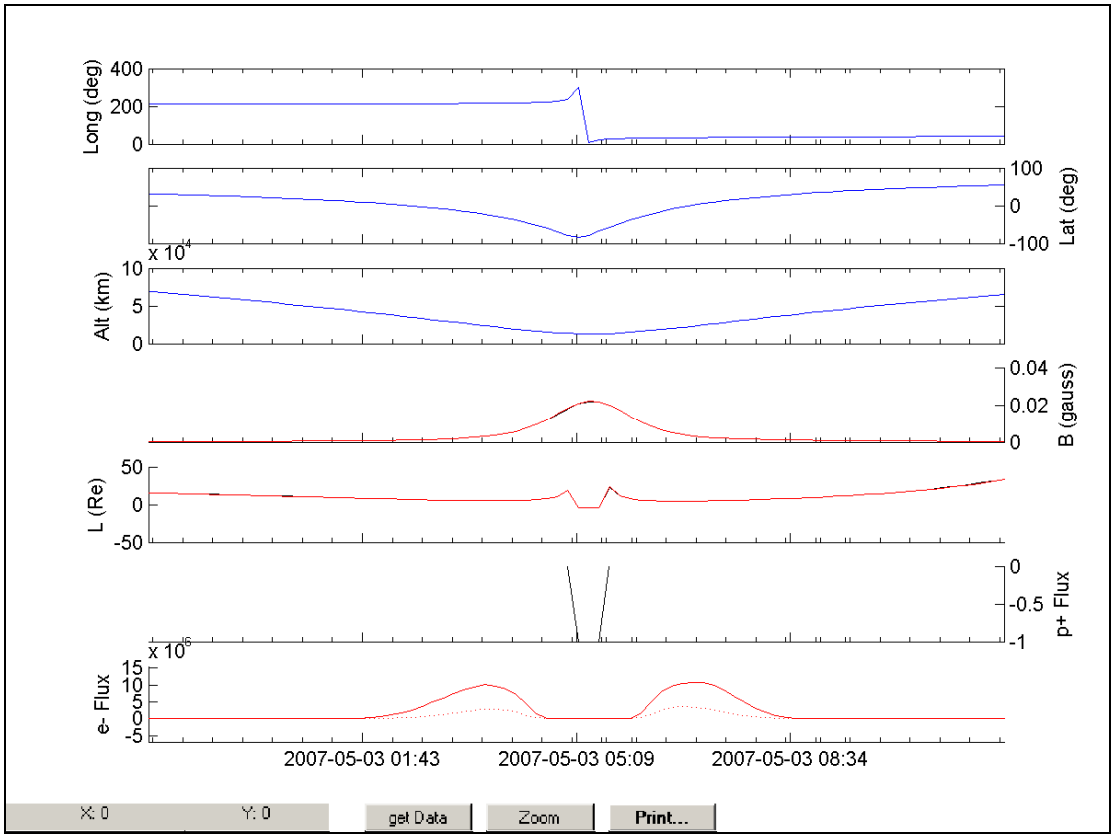


IREM Predicted Radiation Belt Passages

Rev 554



Rev 555



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

Note: no plots are available from the SEIS. However the radiation environment (X-Ray and particles flux) was quiet this week