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

INTEGRAL
Mission Report

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

No. 240
Week 17

30.04.07

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 21.04.07 until 27.04.07 (both dates inclusive) and covers the revolutions 552, 553 and 554.

2 Summary of Activities

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

The targets of these revolutions consisted of a hexagonal dither of the Galactic Bulge Region (RA 17:45:36.00, DEC -28:56:00.0), a hexagonal dither of Ginga 1826-24 (RA 18:29:28.20, DEC -23:47:49.0), a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), a raster dither of the Galactic Plane Region 3 (RA 19:43:54.33, DEC +23:53:25.4), a raster dither of Galactic Plane Region 4 (RA 21:44:04.54, DEC +53:09:58.7) and a raster dither of the object 1E 1048.1-5937 (RA 10:50:08.93, DEC -59:53:20.0), which was a Target of Opportunity.

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 2nd, 3rd and 4th 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.

Two slews were missed from TL during the observation period due to problem on IMCS.

The fuel consumption over the period between 20/04/2007 and 25/04/2007 was 0.1518 Kg. The remaining propellant is in the order of 146.8922 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 3rd and 4th eclipses of eclipse season #10 took place on 24th and 27th April, 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
24/04/07	03:18:29	03:20:23	04:18:54	04:20:22	1:01:53	0:58:31	5.9	5.83	3:30:29	3:28:29
27/04/07	03:07:11	03:08:55	04:09:43	04:11:03	1:03:52	1:00:48	6.18	6.11	3:40:52	3:38:44

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

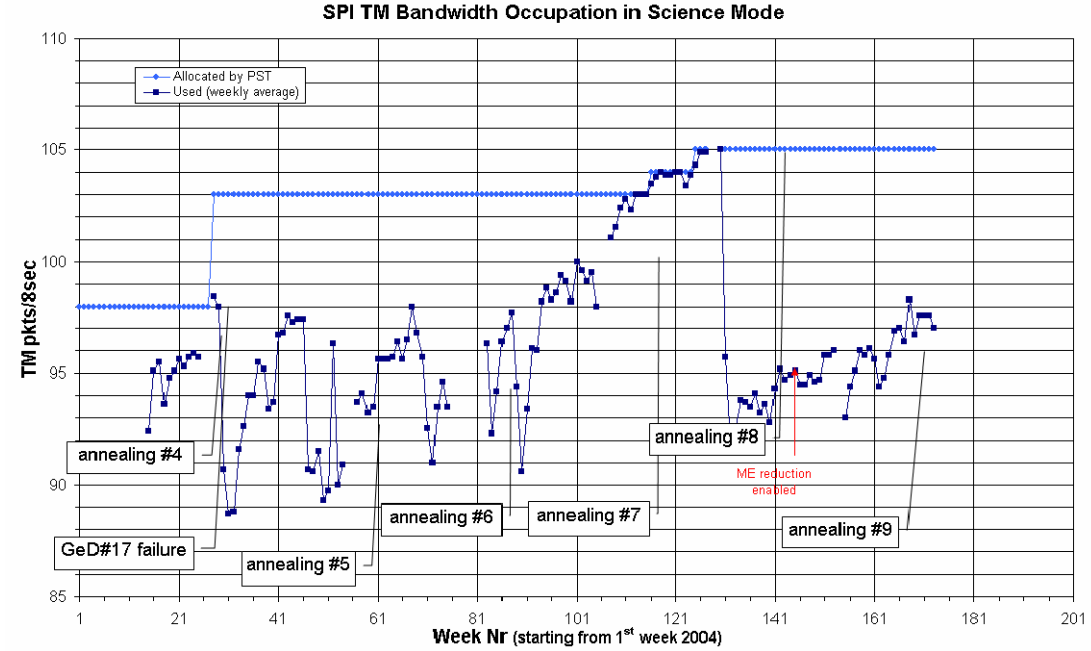
Following the 9th annealing, which ended on 22nd December, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). The energy resolution 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 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.

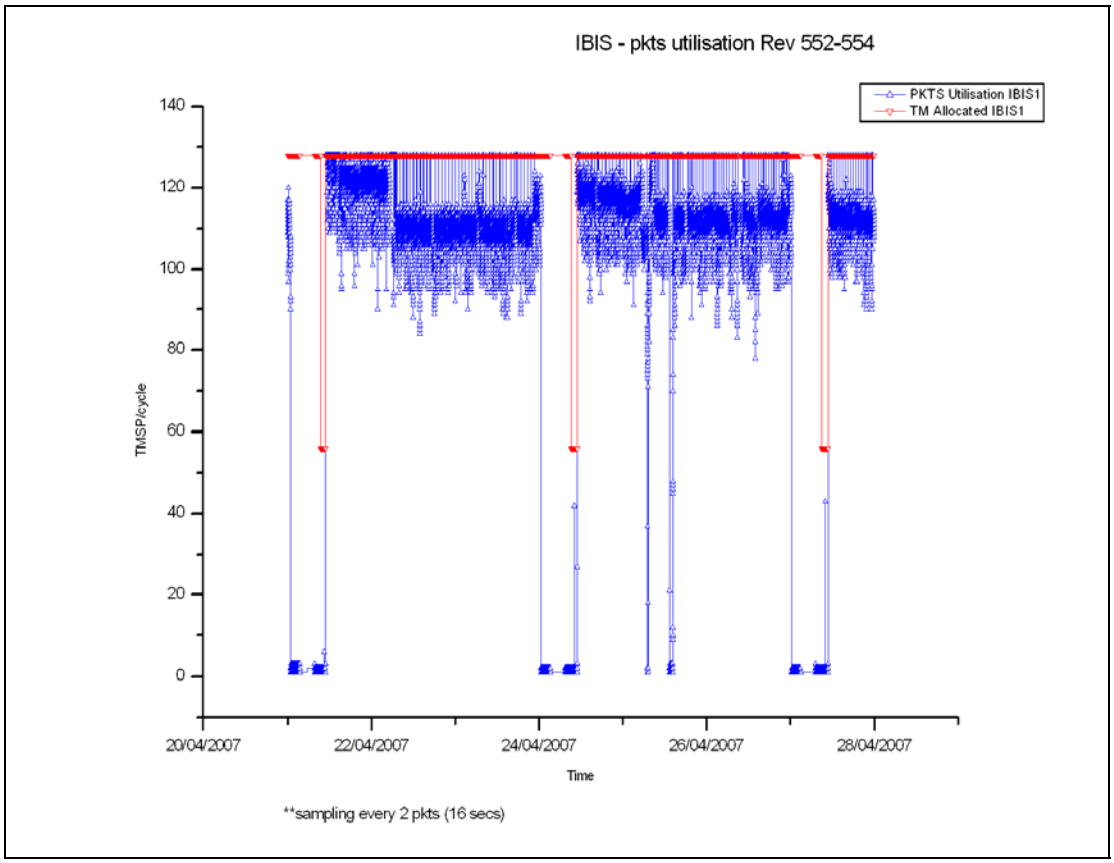
3.2.2 IBIS

The overall status of the unit is nominal.

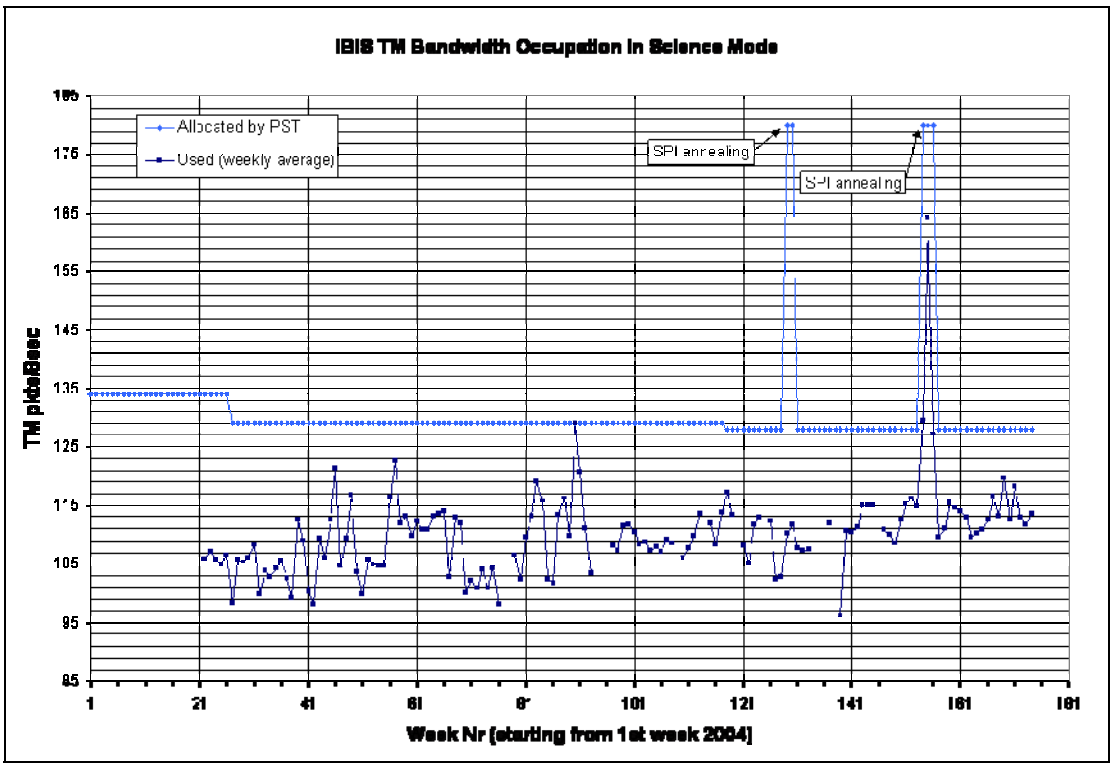
During this week, 3 eclipses occurred. Every time, the reconfiguration of IBIS was smoothly performed as per timeline.

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 113.43 TMPS/cycle, up 1.81 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.

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, 149 of the 153 planned science pointings for OMC were executed nominally, 1 was interrupted and 3 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.

On 25th April 2007 at 13:30Z the IREM reset #47 occurred.

Solar Activity
The observation period was characterised by low solar activity.

The sun was blank up to 26/04/2007 when a large sunspot, 953, appeared on the surface of the sun. It posed a slight threat of M-class solar flares but remained quiet until the end of the observation period.

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 to ground problems. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was not so good this week. Two slews were lost on one of two occasions when the HFA task crashed. The TC History and Command Verifier tasks also crashed, without further impact. 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 were, however, 4 occasions of data drops from Redu, 4 from DSS-24, and 1 from DSS-27, all without 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 561. Observations have been planned and send to MOC up to revolution 559. Revolution 559 was planned in order for MOC to process revolution 558. At the moment revolution 559 does not contain yet the FSS/STR Misalignment + SAS calibration (see below). The correct planning of 559 will be done in week 18 or early week 19.

The FSS/STR Misalignment + SAS calibration planned for revolution 558
has been moved to the end of revolution 559 due to software problem at ISOC.

The TOO request on AXP 1E 1048.1-5937, which was cancelled last week, was reinstated by the PI due to miscommunication with his co-Is. This resulted in a prompt replan of revolution 554 and 557.

TSF's up to revolution 555 have been received.

2. Observation status

ECS files have been received and processed up to revolutions 546. No extra time has been credited.

3. ISOC Science Data Archive

New ISDA, version 2.7, has been approved and expected to be released in week 18.

4. ISOC system

Still at ISOC V14.5.1. Scheduling of Custom pointings were incorrectly handled by OSS, see below.

5. Problems

The roll angles read from file for Custom pointings were not used correctly, and therefore the position angles for these cases ended up wrongly in the POS file. For

this reason the expected FSS/STR Misalignment + SAS calibration to be done in revolution 558 had to be moved forward to the next revolution (see also above), mainly because of the upcoming holidays at ESAC and ESOC.

4.3.2 ISDC

Status of ISDC observation processing on 30/04/2007:

- Latest Standard Analysis completed: observation 04200080003 (Orion OB1, Revolution 487, 530, 532, 538, 543) on 29/04/2007.

- Latest products archived: observation 04200080003 (Orion OB1, Revolution 487, 530, 532, 538, 543) on 29/04/2007.

- Latest observation products sent to the observer: observation 04200340017 (GRS 1915+105, Revolution 544) on 26/04/2007.

5 Special Events

6 Anomalies

The following problems were reported that impacted operations:

- On DoY 115, at 13:30:05, an IREM reset (#47) forced OMC to Safe Mode and IBIS to Stand-by. A recovery was promptly performed. The impact was the interruption of pointing 05530033 after 1629 from a scheduled 2476 seconds and the loss of pointing 05530034 for those instruments.
- On DoY 116, at 09:30, the TM on IMCA was lost when the HFA task crashed. The task was restarted, but errors were still reported storing packets. At 10:00, the entire IMCA chain was restarted, which was completed at 10:20. An attitude recovery was then performed, which was completed at 10:57. The impact was the loss of pointings 05530060 & 05530061.

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

AR id	Date Created	Subject	Segment	Status
INT-2916	18/04/2007	SPI: Incorrect setting for spectra scaling factor rev 551-553	Payload	Pending
INT-2917	26/04/2007	HFA task crashed.	IMCS	Open
INT_SC-189	03/05/2007	IREM Anomaly: Reset of IREM_CSCI S/W #47, 25/04/2007	Payload	Open

7 Future Milestones

The following activities are foreseen in the next few weeks.

- FSS/STR misalignment calibration on 14th May 2007 in Rev. 559
- Periodic Thruster Torque rescaling 24/07/2007 Rev. 583
- Planned altitude change for instrument activation.
- On Board Clock wrap around due in Rev. 585.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 552

The observations in revolution 552 began with a hexagonal dither of the Galactic Bulge Region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. This was followed by a hexagonal dither of Ginga 1826-24 (RA 18:29:28.20, DEC -23:47:49.0), lasting ~13.9 hours. For the remainder of the revolution, a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9), lasting ~38.0 hours was performed.

Revolution 553

The observations in revolution 553 began with a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours. This was followed by a raster dither of the Galactic Plane Region 3 (RA 19:43:54.33, DEC +23:53:25.4), lasting ~14.7 hours. For the remainder of the revolution, a raster dither of Galactic Plane Region 4 (RA 21:44:04.54, DEC +53:09:58.7), lasting ~35.8 hours was performed.

Revolution 554

The observations in revolution 554 consisted entirely of a Target of Opportunity, which was a raster dither of the object 1E 1048.1-5937 (RA 10:50:08.93, DEC -59:53:20.0), lasting ~55.6 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

```
2007-04-13T18:52:01.000Z     147.2368    F   Automatic TM processing.
2007-04-15T09:05:10.000Z     147.2260    F   Automatic TM processing.
2007-04-15T14:51:59.000Z     147.1498    F   Automatic TM processing.
2007-04-18T02:22:29.000Z     147.1280    F   Automatic TM processing.
2007-04-18T09:23:18.000Z     147.1130    F   Automatic TM processing.
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.

This report was generated  Fri Apr 27 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, 21/04/2007 –27/04/2007

AOCS operations were executed from the Automatic Timeline.

During this period, 78 Open Loop Slews, 93 Closed Loop Slews and 7 Momentum Biases were executed.

2 slews (OSL, CSL) were missed from TL, during the observation period, due to problem on the HFA TM task on IMCS-A.

The OTF was not reached during PID 05520063.

This is equivalent to ~1.1% of the total number of slews planned (172).

The AOCS eclipse operations were nominal. For the 2nd, 3rd and 4th 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

IMU Usage during Eclipse Season — Summer 2007

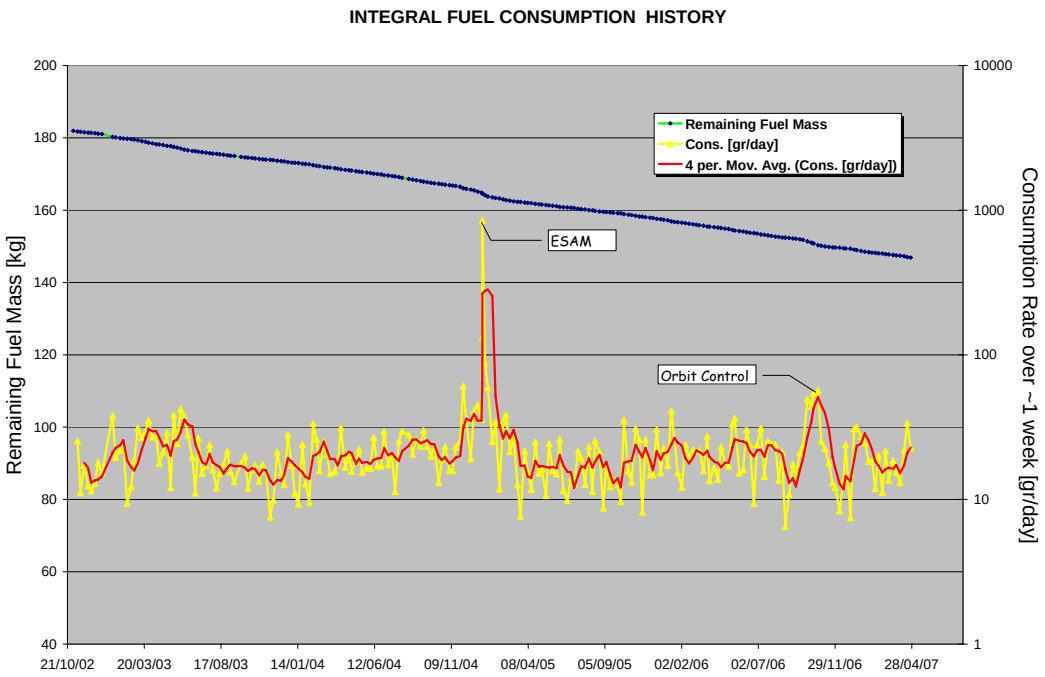
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]		
2007-04-18 00:41:01	2007-04-18 04:39:59	0.2048	0.3010	0.2788	3:58:58	3:58:58
2007-04-21 00:18:31	2007-04-21 04:39:06	0.2056	0.2173	0.2138	4:20:35	8:19:33
2007-04-24 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

Orbit Control

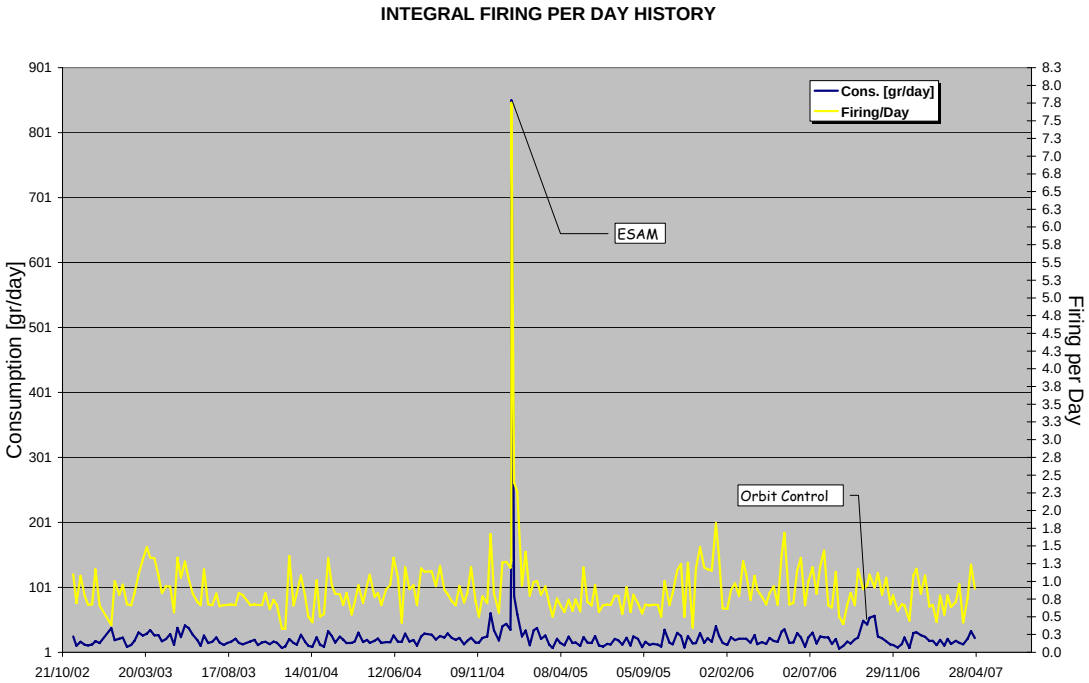
No update.

Fuel consumption

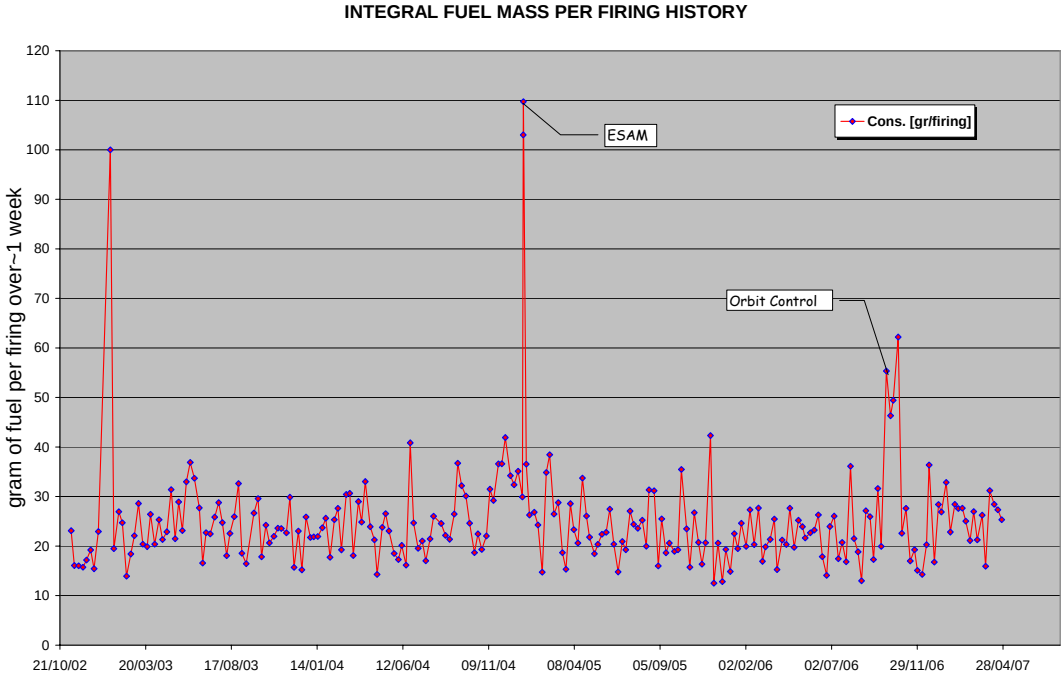
The fuel consumption (total, grams per day) over the period between 01/11/2002 and 25/04/2007 is reported in the plot below.



The firing per day over the period between 01/11/2002 and 25/04/2007 is reported in the plot below.

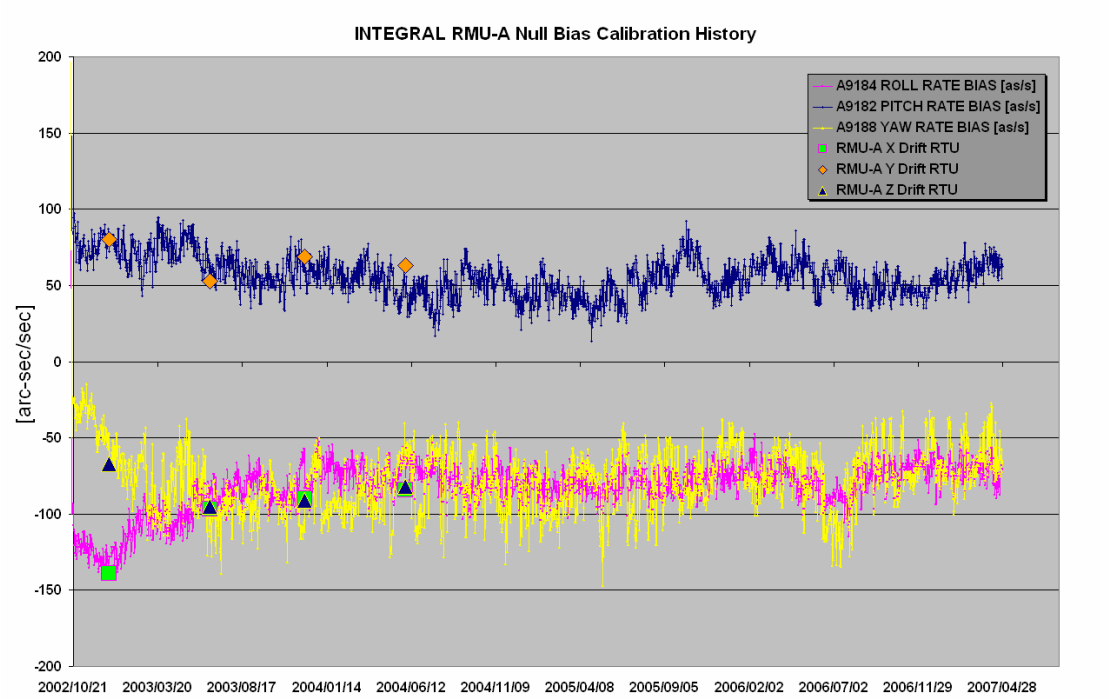


The fuel per firing over the period between 01/11/2002 and 25/04/2007 is reported in the plot below.

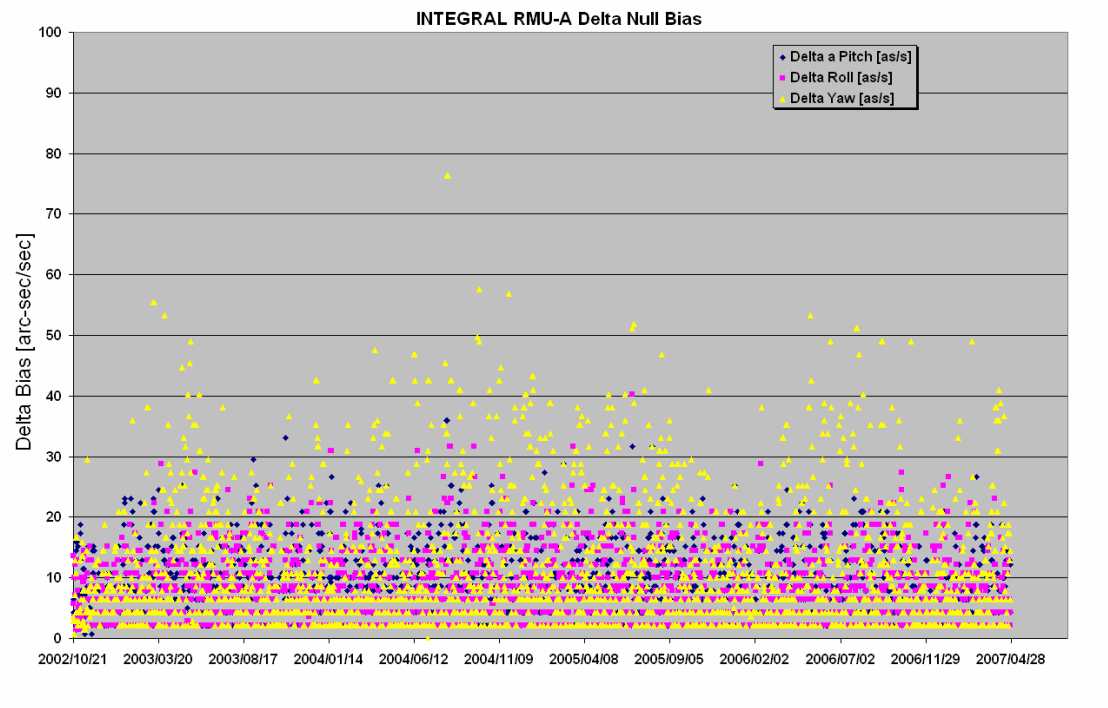


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 27/04/2007 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 27/04/2007 is reported in the plot below



21/04/2007 (Day of Year 111, Revolution 551-552)

The 2nd eclipse operations were nominal from the AOCS point of view. A summary of the eclipse passage during rev 551 is given below:

AOCS ECLIPSE MONITORING
Summer 2007

Revolution:	**551**
Date:	**21/04/2007**
DoY:	**111**

Penumbra Start:	21/04/2007 03:32:34	**LOS:**	21/04/2007 03:32:00	antenna swap
Umbra Start:	21/04/2007 03:34:49	**AOS:**	21/04/2007 07:45:00	
Umbra End:	21/04/2007 04:24:55			
Penumbra End:	21/04/2007 04:26:43			
Eclipse Duration:	0:54:09			
Eclipse Duration [sec]:	3249			

IMU Health Check Start	21/04/2007 00:15:00
Eclipse Imminent Flag	21/04/2007 02:32:54
ACC IMU AutoCal Start	21/04/2007 02:47:20
ACC IMU AutoCal End	21/04/2007 03:07:20

Sun out of FSS FoV	21/04/2007 03:34:25
Sun back in FSS FoV	21/04/2007 04:25:15

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	21/04/2007 03:15:12	-1042.00	21/04/2007 03:15:19	-1035.00	**-1064**	
FDE Eclipse Start	21/04/2007 03:24:07	-507.00	21/04/2007 03:26:50	-344.00	**-404**	**176**
FCE Eclipse Start	21/04/2007 03:24:51	-463.00	21/04/2007 03:27:30	-304.00	**-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	21/04/2007 04:31:03	260			**360**	**176**
FDE Eclipse End	21/04/2007 04:31:03	260			**360**	**176**
ACC Eclipse End	21/04/2007 04:36:44	601	21/04/2007 04:36:51	608.00	**578**	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	18/04/2007 09:06:01	21/04/2007 04:38:45	722
IMU On	21/04/2007 00:18:31	**IMU H/C Noise Roll [as/s]**	0.2056
IMU Off	21/04/2007 04:39:06	**IMU H/C Drift Roll [as/s]**	0.2173
IMU On Time	4:20:35	**IMU Auto Cal Drift Roll [as/s]**	0.2138

FDS failed slew update: at 16:02z the update of slew ID 05520014 failed. FDS reported an error during the update process: were found only two stars of full accuracy in the STR mapping TM. These stars could not be match with mission catalogue stars. The attitude determination task was aborted which consequently interrupted the TPF generation.

The slew was manually updated on at 16:12z.

No impact on TL.

22/04/2007 (Day of Year 105, Revolution 552)

Nothing to report.

23/04/2007 (Day of Year 106, Revolution 552)

STR loss of guide star: at 17:30:18z, the STR reported lost of guide star and the IMU1 was automatically switched ON by the ACC.

The guide star (ID 7055-202) at the occurrence of the event, was Mi 6.85 @ CCD location [-8111 , -22110].

A new mapping was automatic initiated by the ACC and a new guide star Mi 7.95 @ CCD location [3727 , 341] , found.

The next slew ID 05520064 was manually updated at 17:37z.

The reason of the loss of guide star is likely due to the several extended objects (cluster of galaxies) present in the STR FOV for that pointing.

No impact on TL except the OTF not reached during PID 05520063.

24/04/2007 (Day of Year 107, Revolution 552-553)

The 3rd eclipse operations were nominal from the AOCS point of view. A summary of the eclipse passage during rev 552 is given below:

AOCS ECLIPSE MONITORING
Summer 2007

Revolution: 552
Date: 24/04/2007
DoY: 114

Penumbra Start:	24/04/2007 03:18:30	**LOS:**	24/04/2007 03:21:00
Umbra Start:	24/04/2007 03:20:23	**AOS:**	24/04/2007 07:30:00
Umbra End:	24/04/2007 04:18:55		
Penumbra End:	24/04/2007 04:20:20		
Eclipse Duration:	1:01:50		
Eclipse Duration [sec]:	3710		

IMU Health Check Start	24/04/2007 00:04:13
Eclipse Imminent Flag	24/04/2007 02:18:50
ACC IMU AutoCal Start	24/04/2007 02:33:16
ACC IMU AutoCal End	24/04/2007 02:53:16

Sun out of FSS FoV	24/04/2007 03:20:03
Sun back in FSS FoV	24/04/2007 04:19:08

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	24/04/2007 03:01:26	-1024.00	24/04/2007 03:01:26	-1024.00	**-1064**	
FDE Eclipse Start	24/04/2007 03:10:14	-496.00	24/04/2007 03:13:00	-330.00	**-404**	**176**
FCE Eclipse Start	24/04/2007 03:10:58	-452.00	24/04/2007 03:13:31	-299.00	**-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	24/04/2007 04:24:30	250			**360**	**176**
FDE Eclipse End	24/04/2007 04:24:30	250			**360**	**176**
ACC Eclipse End	24/04/2007 04:30:38	618	24/04/2007 04:30:38	618.00	**578**	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	24/04/2007 08:52:05	24/04/2007 04:32:31	731
IMU On	24/04/2007 00:06:42	**IMU H/C Noise Roll [as/s]**	0.1850
IMU Off	24/04/2007 04:32:51	**IMU H/C Drift Roll [as/s]**	0.1800
IMU On Time	4:26:09	**IMU Auto Cal Drift Roll [as/s]**	0.1580

FDS failed slew update: at 10:28z the update of slew ID 05530003 failed. FDS reported an error during the update process (reason still TBI). The attitude determination task was aborted which consequently interrupted the TPF generation.

The slew was manually updated and no impact on TL reported.

IMCS command verifier task problem: at 11:02z the Command Verifier Task on IMCS-A crashed, causing the command sequence for the mapping , after slew ID 05530003, to fail release.

A mapping was then manually executed and the slew 05530004 updated at 11:09z.

No impact on TL.

25/04/2007 (Day of Year 108, Revolution 553)

Nothing to report.

26/04/2007 (Day of Year 109, Revolution 553)

IMCS HFA TM task problem: at 08:19z due to problem on HFA TM task on IMCS-A, the update for slew ID 05530059 failed.

A mapping was then manually executed and the slew 05530059 updated at 08:44z.

At 09:30z, the problem on the HFA TM task occurred again, causing the slews 05530060 and 05530061 to fail release.

A manual recovery was then started at 10:26z from attitude of PID 05530059 to the attitude of PID 05530061. The next slew 05530062 was manually updated at 10:57z.

The following slews were missed in TL: 05530060(CSL)-61(OSL).

27/04/2007 (Day of Year 110, Revolution 553-554)

The 4th eclipse operations were nominal from the AOCS point of view. A summary of the eclipse passage during rev 553is given below:

AOCS ECLIPSE MONITORING
Summer 2007

Revolution:	**553**
Date:	**27/04/2007**
DoY:	**117**

Penumbra Start:	27/04/2007 03:07:10	**LOS:**	27/04/2007 03:07:00
Umbra Start:	27/04/2007 03:08:55	**AOS:**	27/04/2007 07:18:00
Umbra End:	27/04/2007 04:09:43		
Penumbra End:	27/04/2007 04:11:00		
Eclipse Duration:	1:03:50		
Eclipse Duration [sec]:	3830		

IMU Health Check Start	26/04/2007 23:53:06
Eclipse Imminent Flag	27/04/2007 02:07:30
ACC IMU AutoCal Start	27/04/2007 02:21:56
ACC IMU AutoCal End	27/04/2007 02:41:56

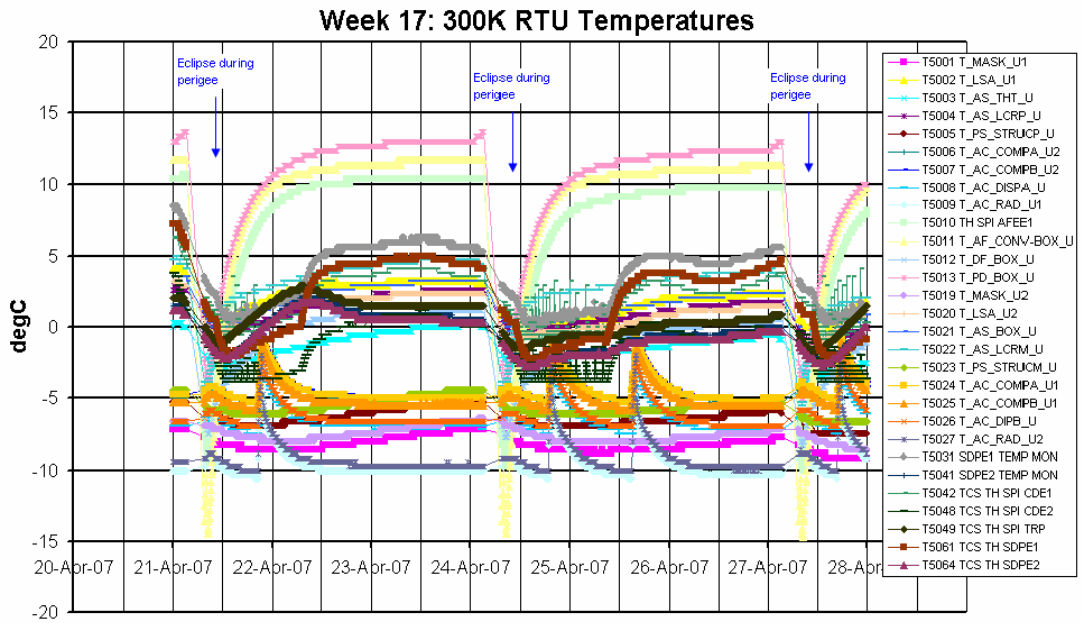
Sun out of FSS FoV	27/04/2007 03:08:37
Sun back in FSS FoV	27/04/2007 04:09:56

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	27/04/2007 02:49:55	-1035.00	27/04/2007 02:49:59	-1031.00	**-1064**	
FDE Eclipse Start	27/04/2007 02:58:49	-501.00	27/04/2007 03:01:39	-331.00	**-404**	**176**
FCE Eclipse Start	27/04/2007 02:59:33	-457.00	27/04/2007 03:02:03	-307.00	**-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	27/04/2007 04:15:17	257			**360**	**176**
FDE Eclipse End	27/04/2007 04:15:17	257			**360**	**176**
ACC Eclipse End	27/04/2007 04:21:09	609	27/04/2007 04:21:13	613.00	**578**	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	24/04/2007 08:40:05	27/04/2007 04:23:17	737
IMU On	27/04/2007 00:07:49	**IMU H/C Noise Roll [as/s]**	0.2056
IMU Off	27/04/2007 04:23:27	**IMU H/C Drift Roll [as/s]**	0.2600
IMU On Time	4:15:38	**IMU Auto Cal Drift Roll [as/s]**	0.2978

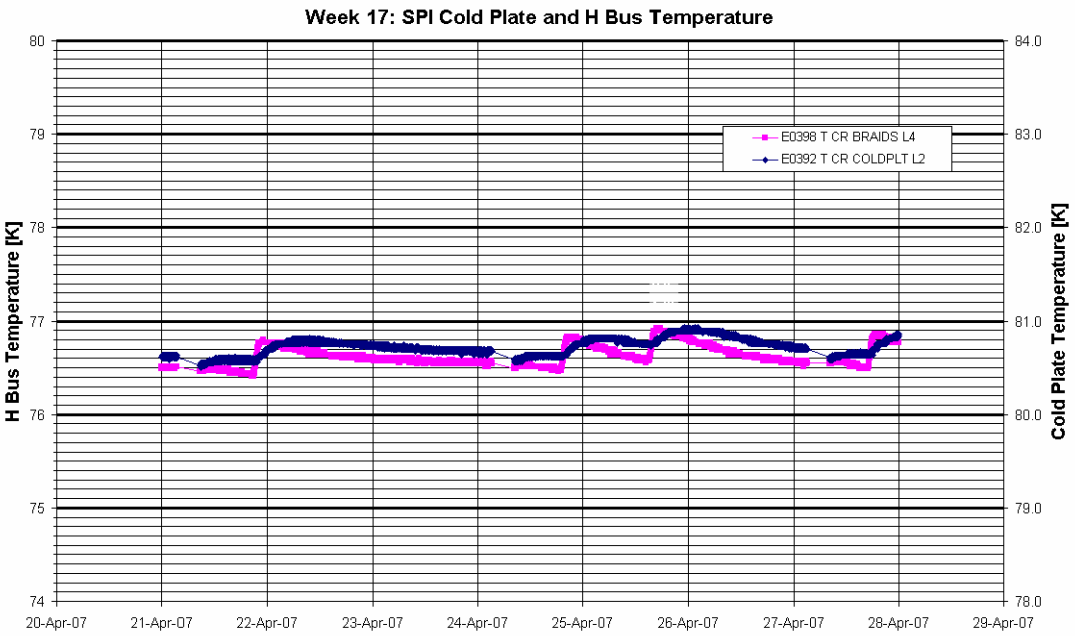
8.3.2 SPI Operations

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.

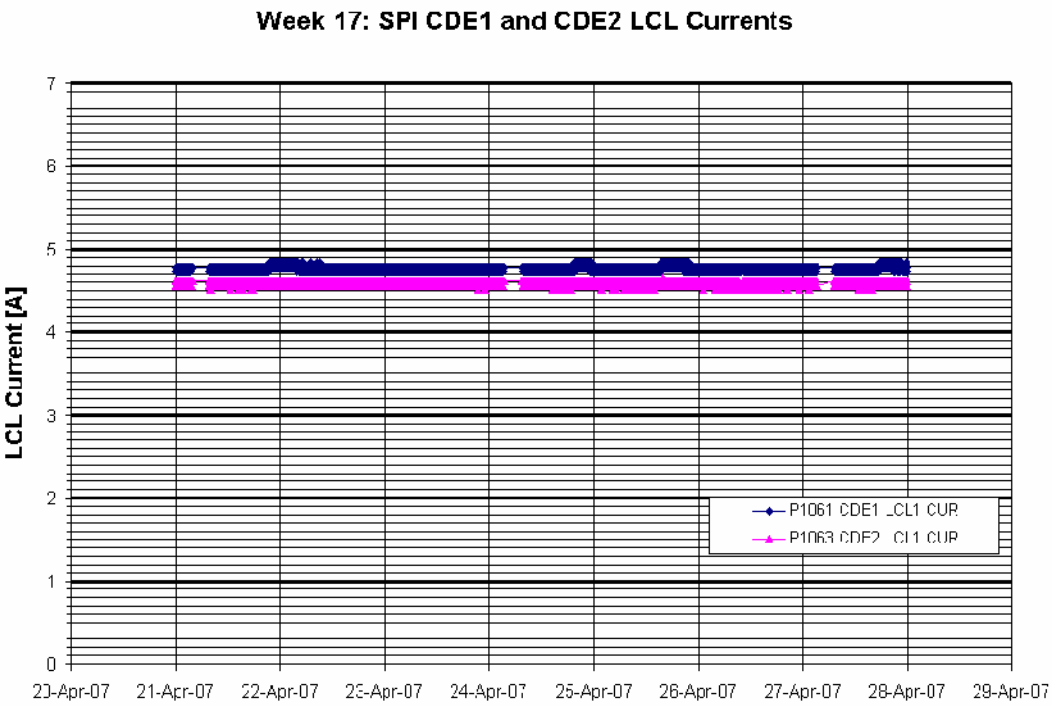


The stroke of all four compressors has been 40 since 03-02-2007 at 13:16Z.

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

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

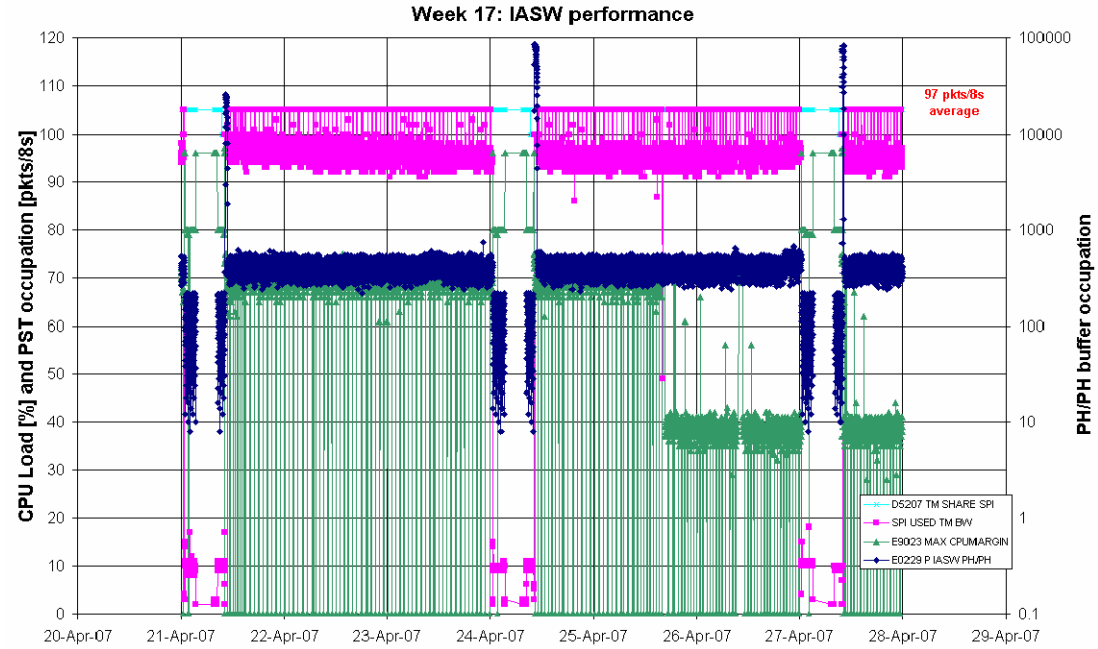
The following plot shows the evolution of the CDE currents during the reporting period.



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 an erroneous value of FF (hex) by the ED EEXIT-02 (see Anomaly Report INT-2916) until 2007-

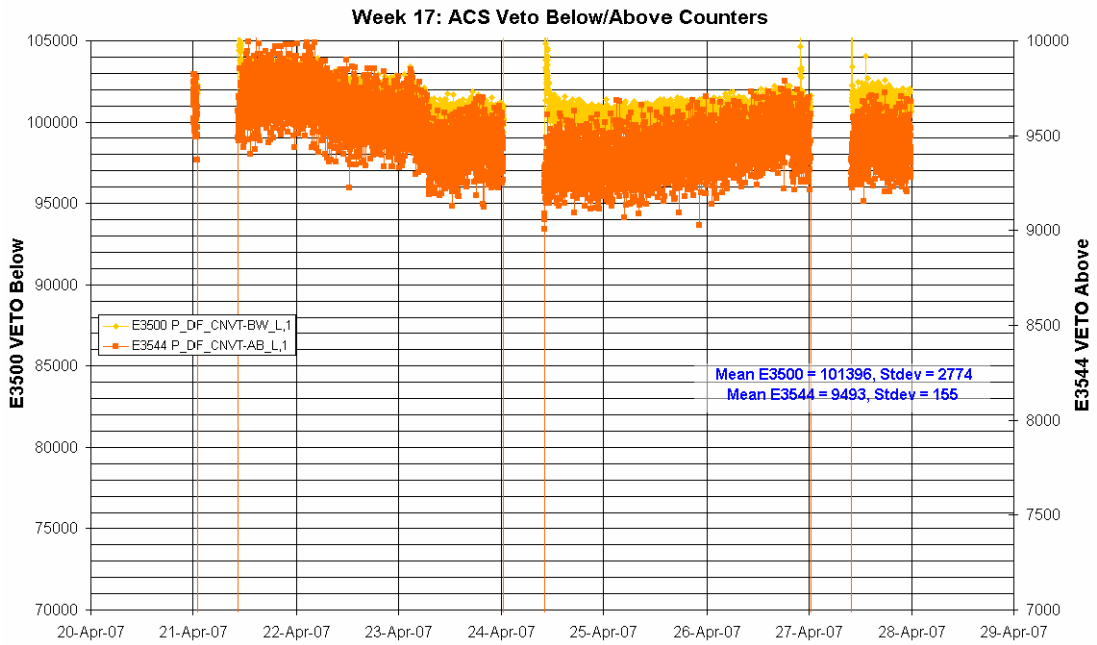
04-25 at 16:02Z, when the operations to reset the scaling factor to 9/19 SE were completed (SPI back to PHOTON mode). The higher than usual CPU margin which can be seen in the following plot until 25/04/2007 at 16:40Z (end of the next slew and start of the next spectra building) is due to this. Following analysis by the SPI PI, it has been determined that this setting of the spectra scaling factor equates to a scaling factor of 1/19 SE. From revolution 554 onwards, the spectra scaling factor was reset to 9/19 SE manually after each radiation belt exit in line with INT_OPS_0286.

The average TM bandwidth occupation of SPI was 97 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).

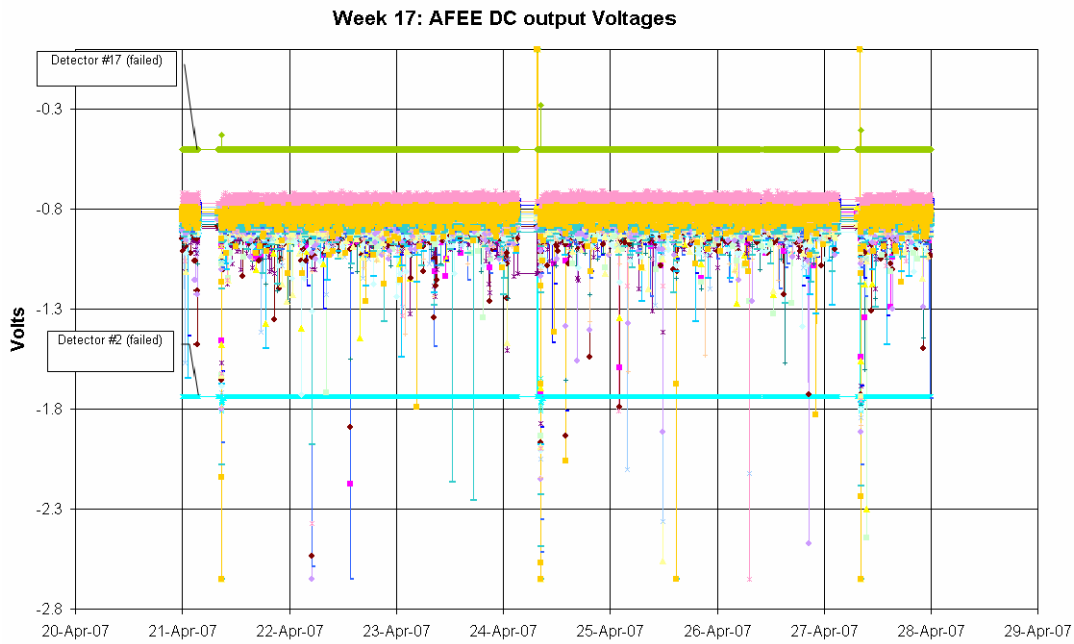
The following plot shows the ACS overall count rate evolution during the reporting period:



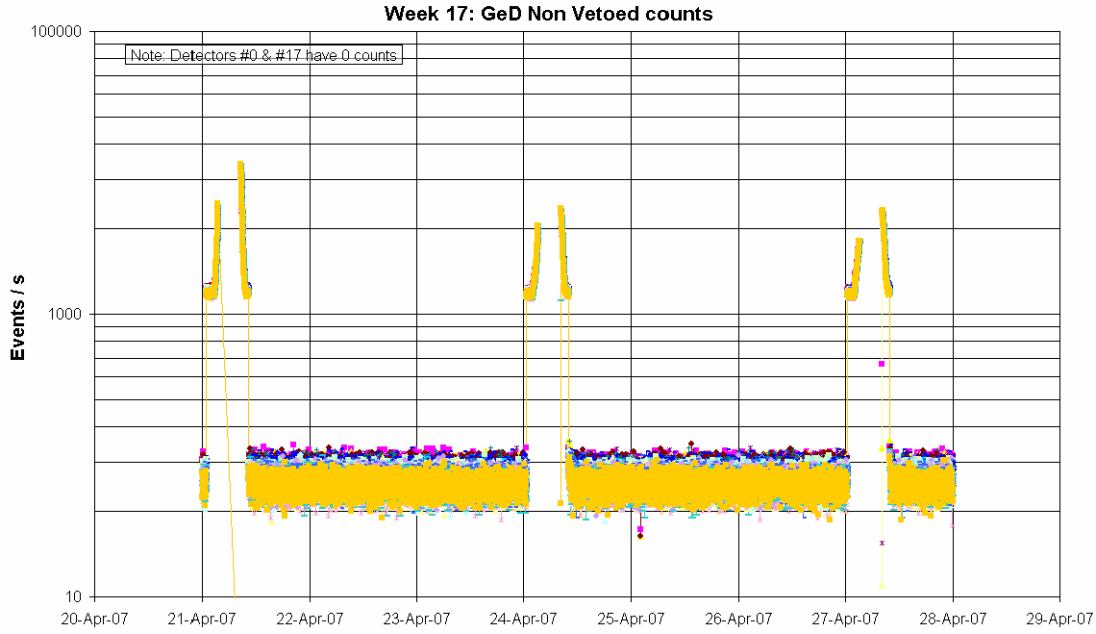
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution. The energy resolution of GeD#4 was recovered with the last annealing.

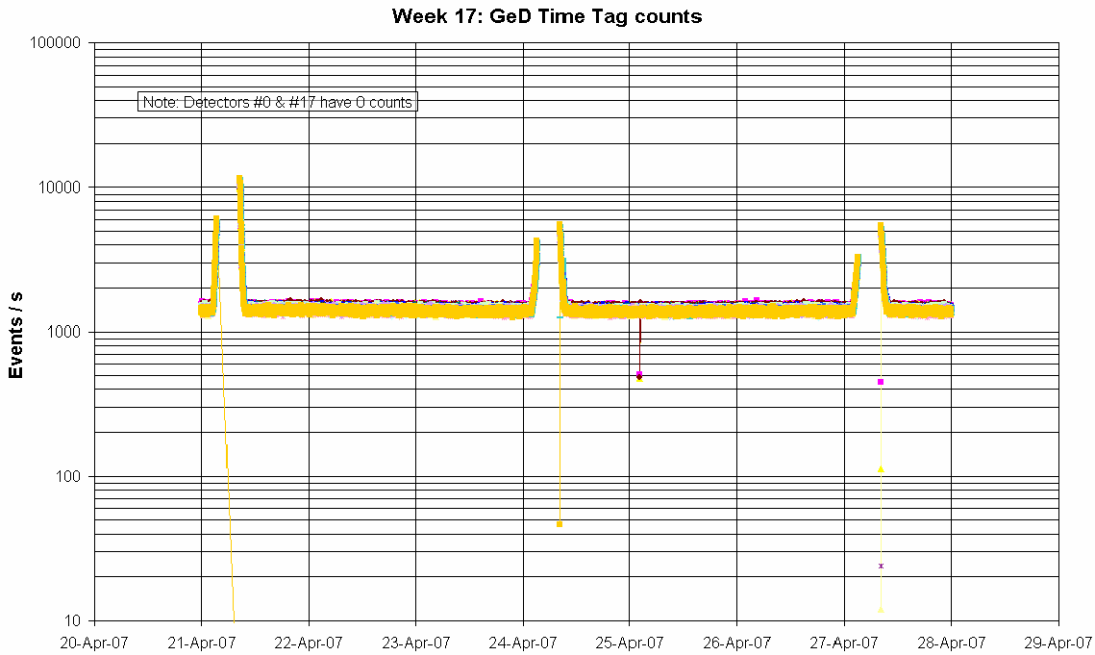
The GeD#12 HV remained at 3.5kV throughout the reporting period.

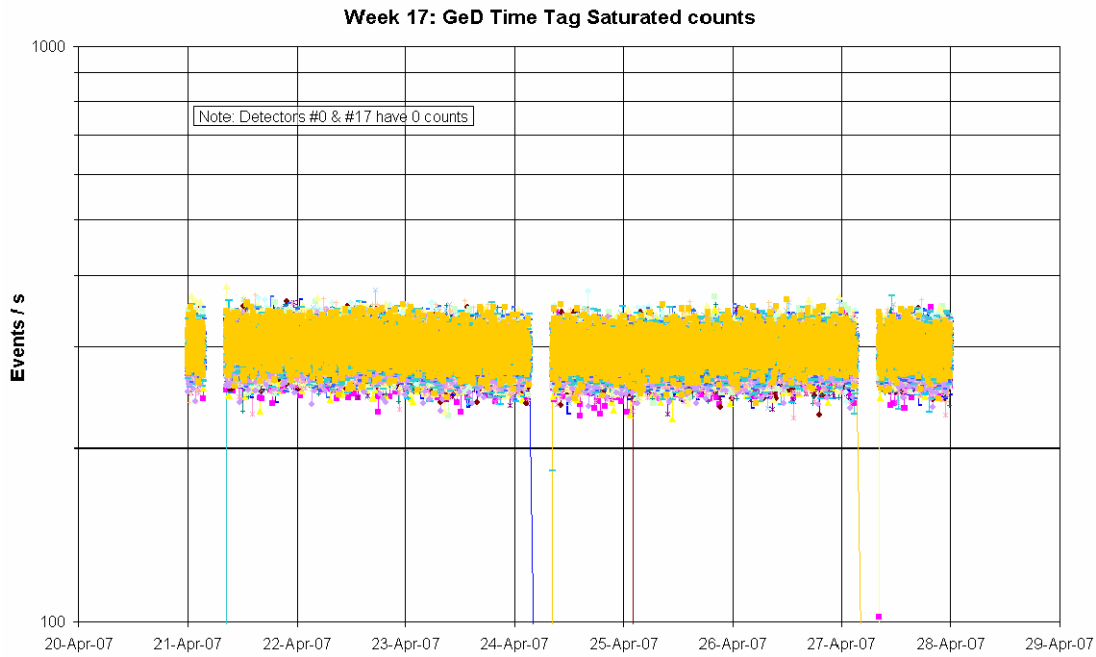
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



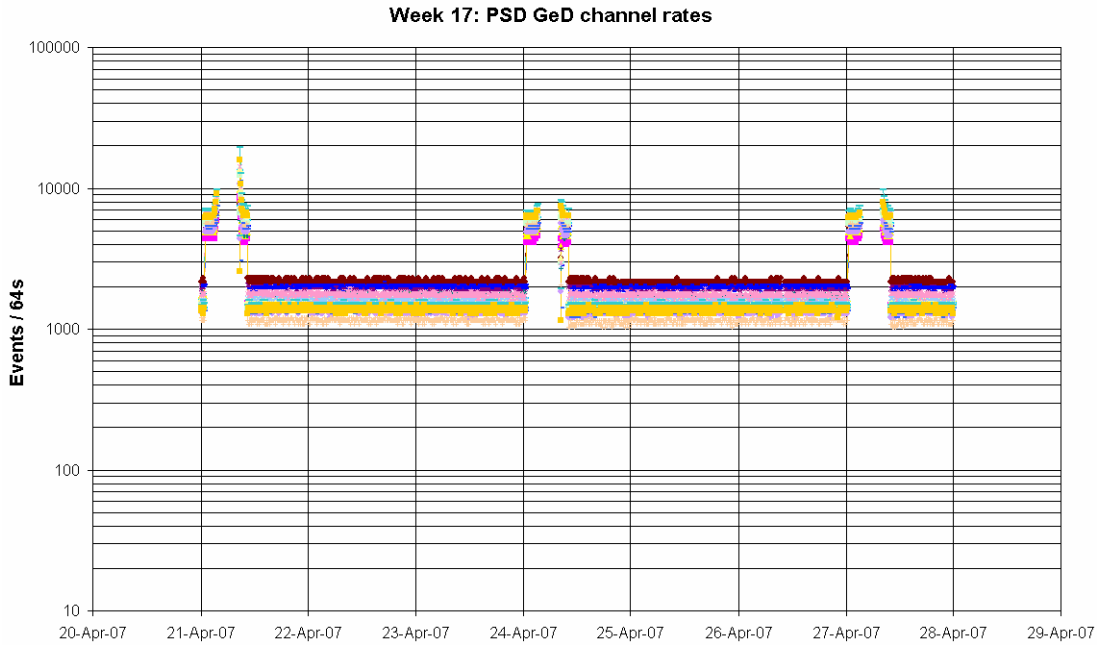
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.


Week 17: GeD Non Vetoed counts
Note: Detectors #0 & #17 have 0 counts
Events / s
100000
1000
10
20-Apr-07
21-Apr-07
22-Apr-07
23-Apr-07
24-Apr-07
25-Apr-07
26-Apr-07
27-Apr-07
28-Apr-07
29-Apr-07


Week 17: GeD Time Tag counts
Note: Detectors #0 & #17 have 0 counts
Events / s
100000
10000
1000
100
10
20-Apr-07
21-Apr-07
22-Apr-07
23-Apr-07
24-Apr-07
25-Apr-07
26-Apr-07
27-Apr-07
28-Apr-07
29-Apr-07



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 2007-04-21 at 08:10:05Z OEM APID 1024 ID 1 EXCEPTION SPI1 FIXED POINT OVERFLOW was received. This was just after AOS of revolution 552, when the time verification TC was sent. This OEM is sometimes received when this TC is sent and no action was taken.
- On 2007-04-21 at 08:59:19Z and on 2007-04-27 at 09:30:14Z 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

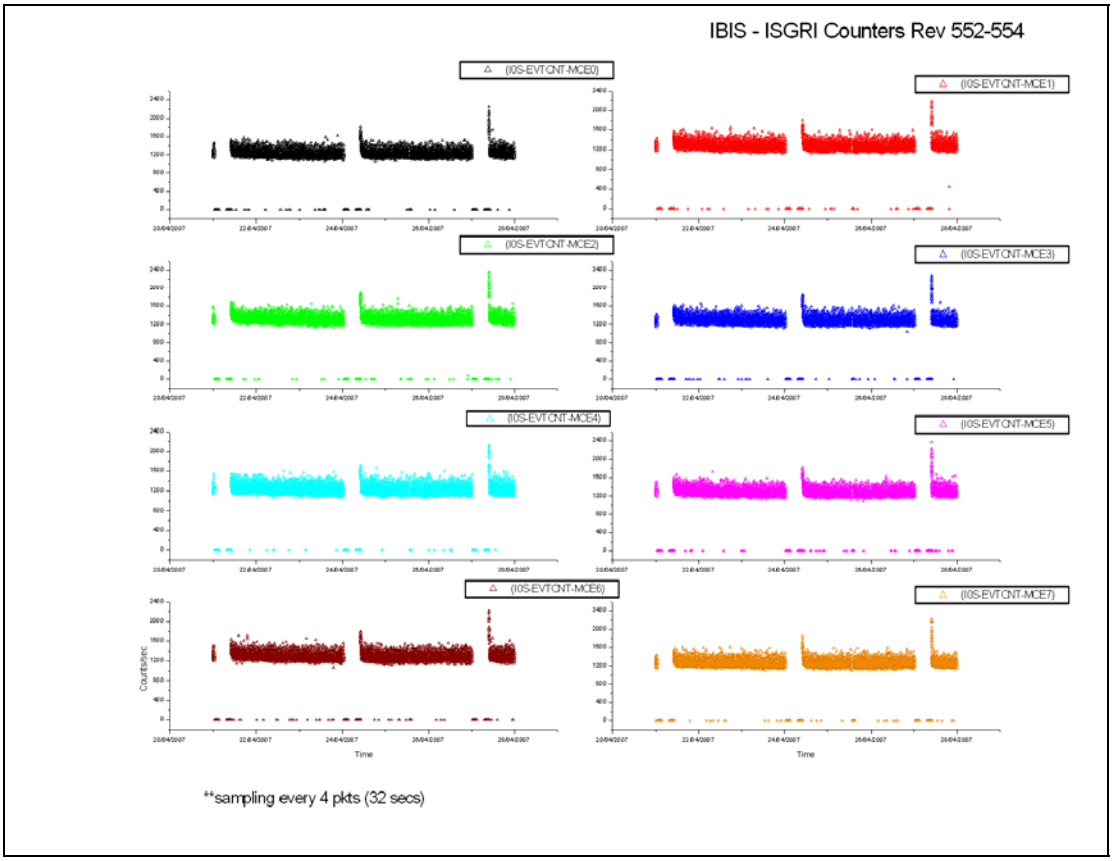
LSL for a HK acquisition request from the PSD. As these were single occurrences, no action was taken.

- On 2007-04-21 at 10:25:23Z the TM parameter E3500 P_DF_CNVT-BW_L went OOL High. This was just after radiation belt exit of revolution 552. It returned within limits at 10:28:51Z.
- On 2007-04-24 at 10:11:39Z the TM parameter E3500 P_DF_CNVT-BW_L went OOL High. This was just after radiation belt exit of revolution 553. It returned within limits at 10:25:31Z.
- On 2007-04-24 at 13:35:21Z TM parameter E0334 went OOL Low (value = 287.8K) and at 13:36:33Z TM parameters E0343 - E0345 and E0347 also went OOL Low. These are the temperatures for AFEE Analogue Digital Converter #4; #13; #14; #15 and #18. Their temperatures were lower than usual following eclipse. They had all returned within limits by 14:19Z.
- On 2007-04-25 at 22:41:09Z and on 2007-04-26 at 00:52:21Z and 01:39:25Z the TM parameter E0392 (Cold plate temperature) went OOL Warning High (value = 80.9K). As it returned within limits after 1 or 2 TM cycles in each case, no action was taken. These peaks are due to the cycling of the radiator compensation heater after eclipse. If the cold plate temperature exceeds 80.9K for a longer duration (~30minutes) the compressors' stroke will be increased.
- On 2007-04-27 at 15:43:21Z the TM parameter E3220 S AS TEMP L56 went OOL (value = PARAM > SPEC). This is the temperature status for ACS FEE #56. It returned within limits at when the next packet was received at 15:54:01Z.

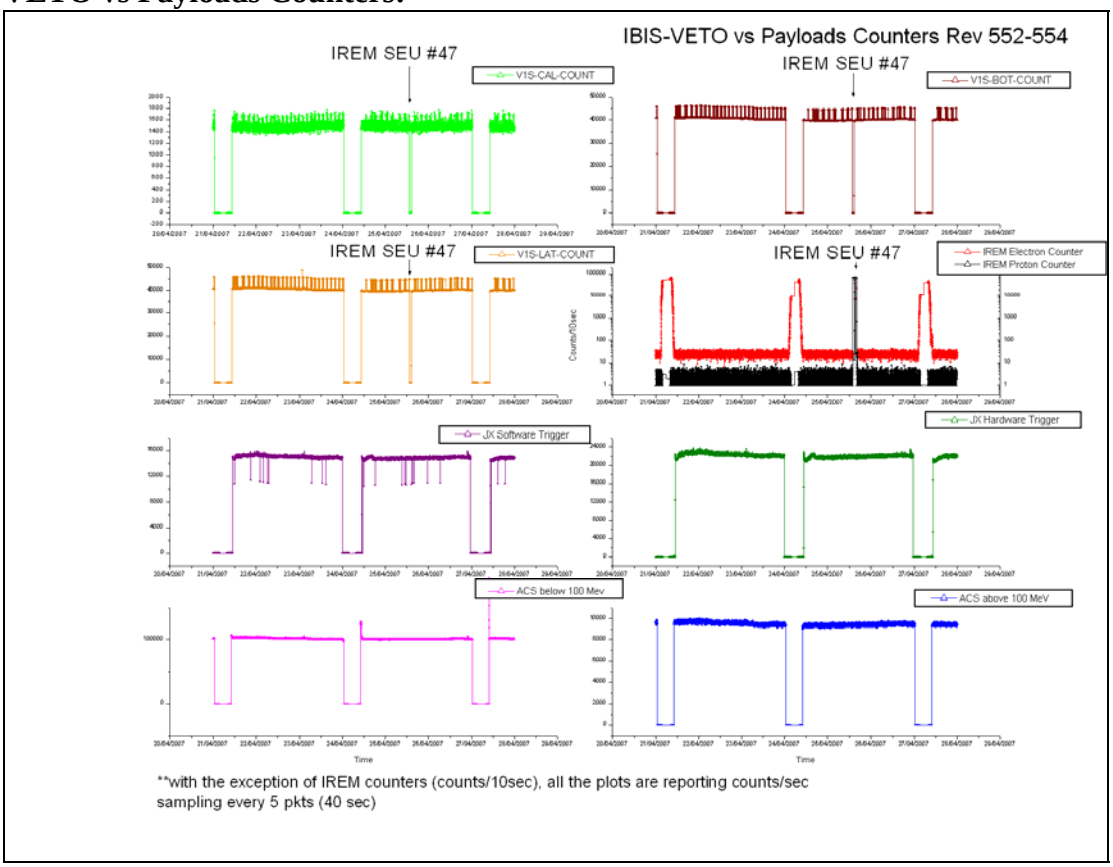
8.3.3 IBIS Operations

<u>IBIS Event Counters Plots.</u>

ISGRI Counters:

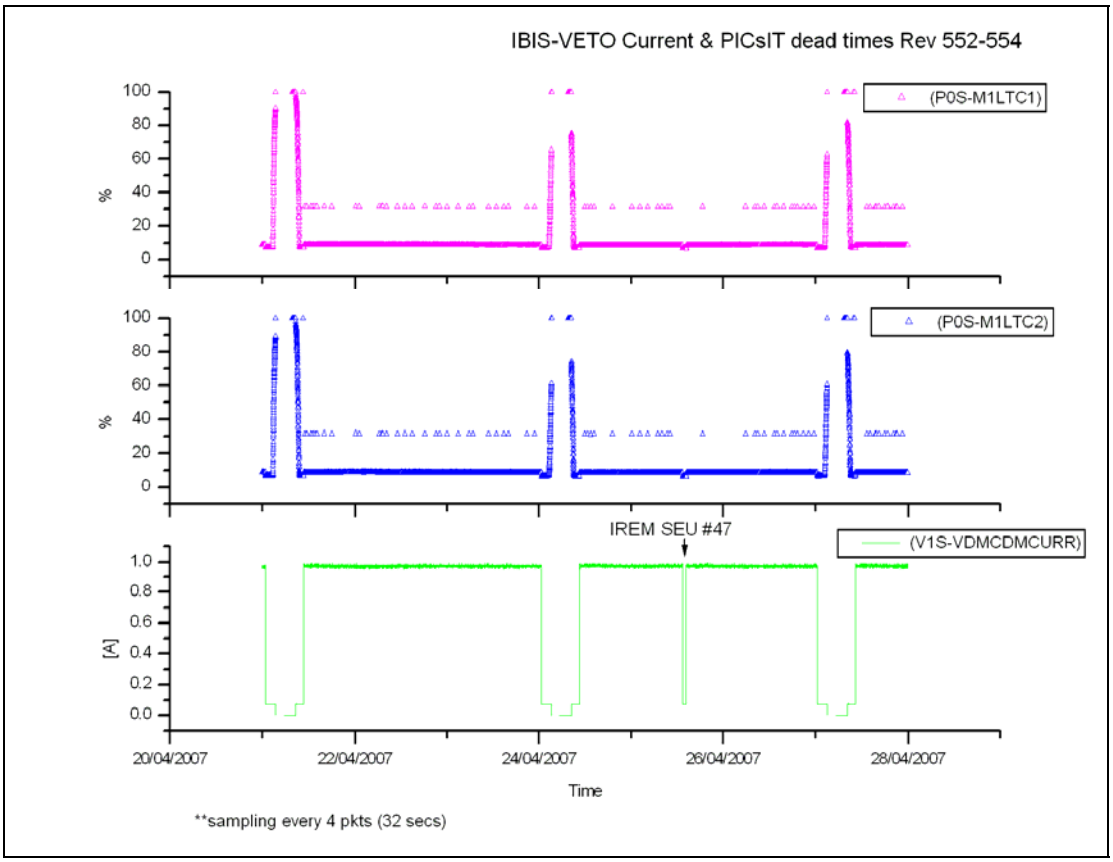


VETO vs Payloads Counters:

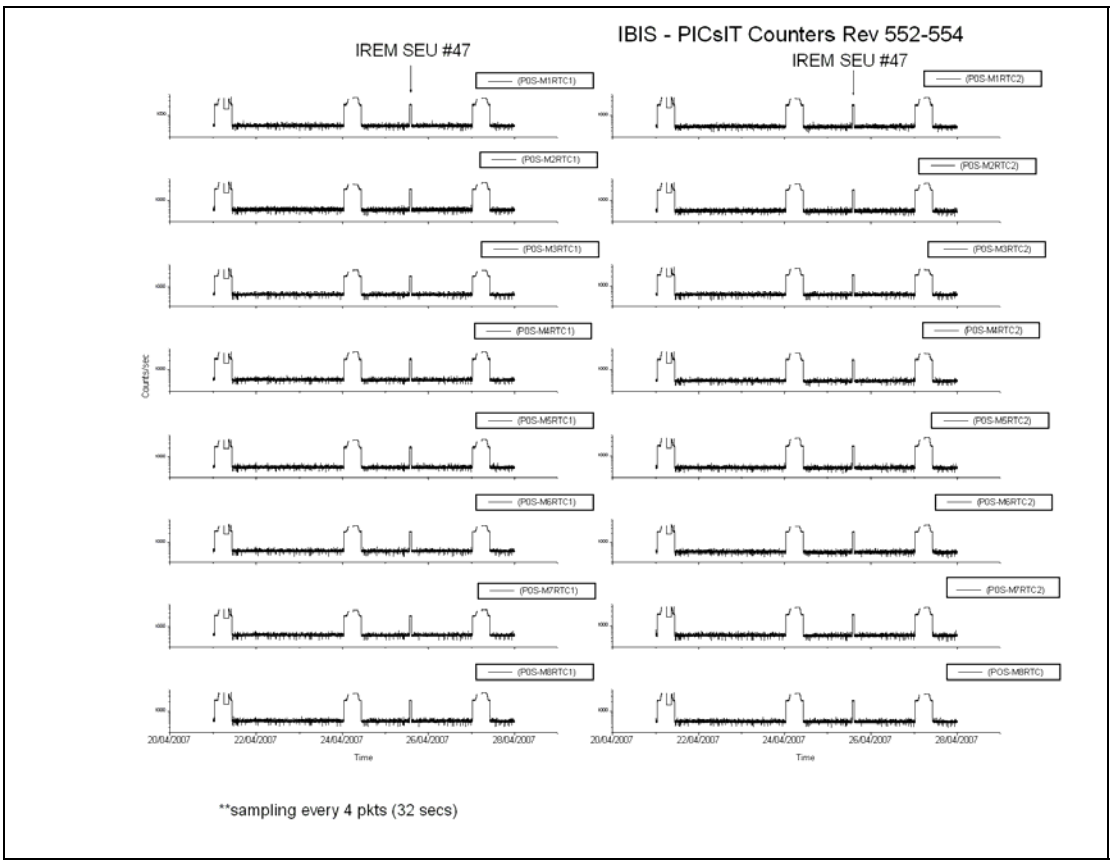


The week was characterised by low radiation.

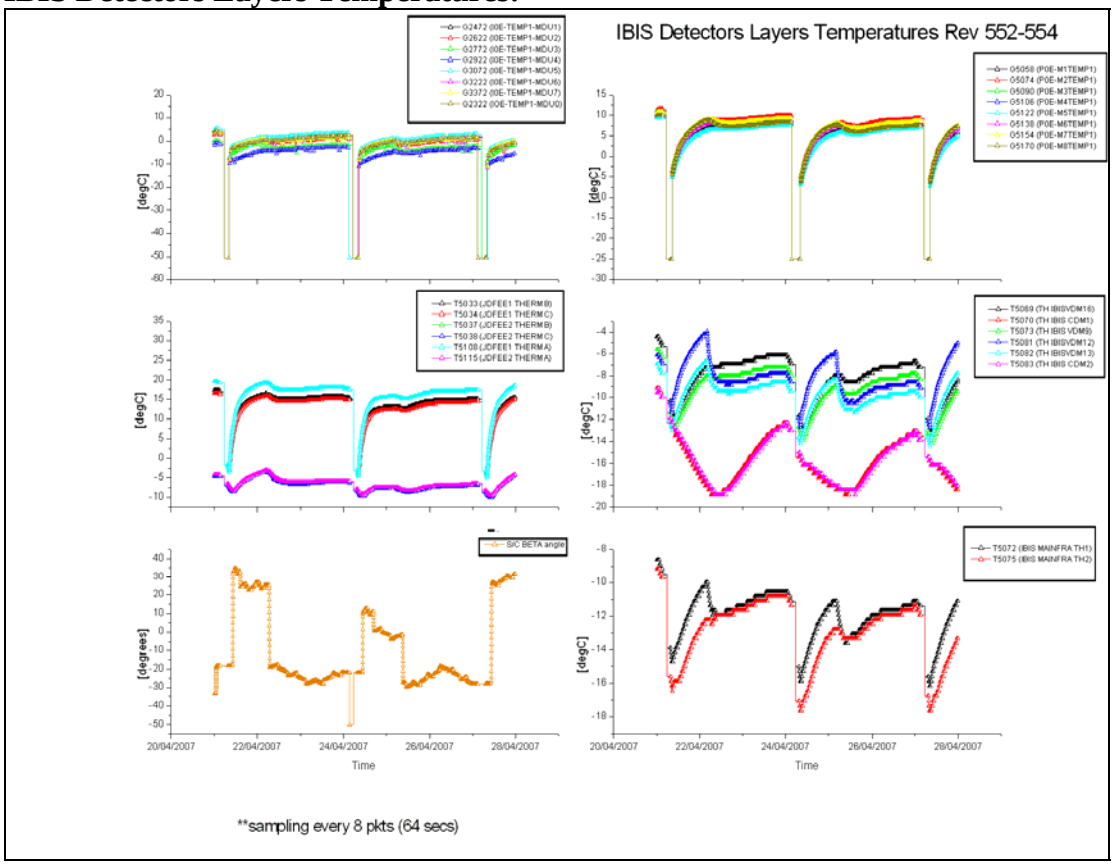
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



<u>IBIS daily report:</u>

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 2007.113 (23/04/2007): PICsIT Time-Out

At 01:48Z, 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".

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 PICsIT.

Summarising, IBIS incurred a timing problem on the Low Speed Line that affected the communication with the peripheral. During this time, a request for HK1 was sent to PICsIT without any answer due to a black out in communication between the peripheral and the DPE. The IASW flagged the non-generation of HK1 from PICsIT 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 PICsIT therefore, what was reported in the HK1 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 HK1 for PICsIT in the next cycle. No further action was requested as per recovery action I-REJ-1.

DoY 2007.115 (25/04/2007): Histograms problem

At 06:01Z, after Ground Station Hand-Over, TM parameter X7500 (IBIS HIST DWN LD) was reported OOL flagging a problem with IBIS histograms downloading.
Following the indication in the FDIR, the operator waited to see if the histograms would restart after the next slew. This did not occur, and at 07:05Z the operator forced the downlink of all remaining histograms with FCP_IBIS1_0312 as indicated in FDIR. IBIS was back in Scientific Standard mode at 07:18Z and during the next pointing it was verified that the histograms were downloaded nominally.

DoY 2007.115 (25/04/2007): IREM SEU #47

At 13:30Z, the IREM reset #47 occurred, forcing IBIS into Stand-By mode. The unit was recovered as per CRP_SYS_2570 and was back into Scientific Standard mode at 14:30Z.
The impact on the science was that pointings 05530033 and 05530034 were interrupted.

DoY 2007.117 (27/04/2007): High radiation at belts exit

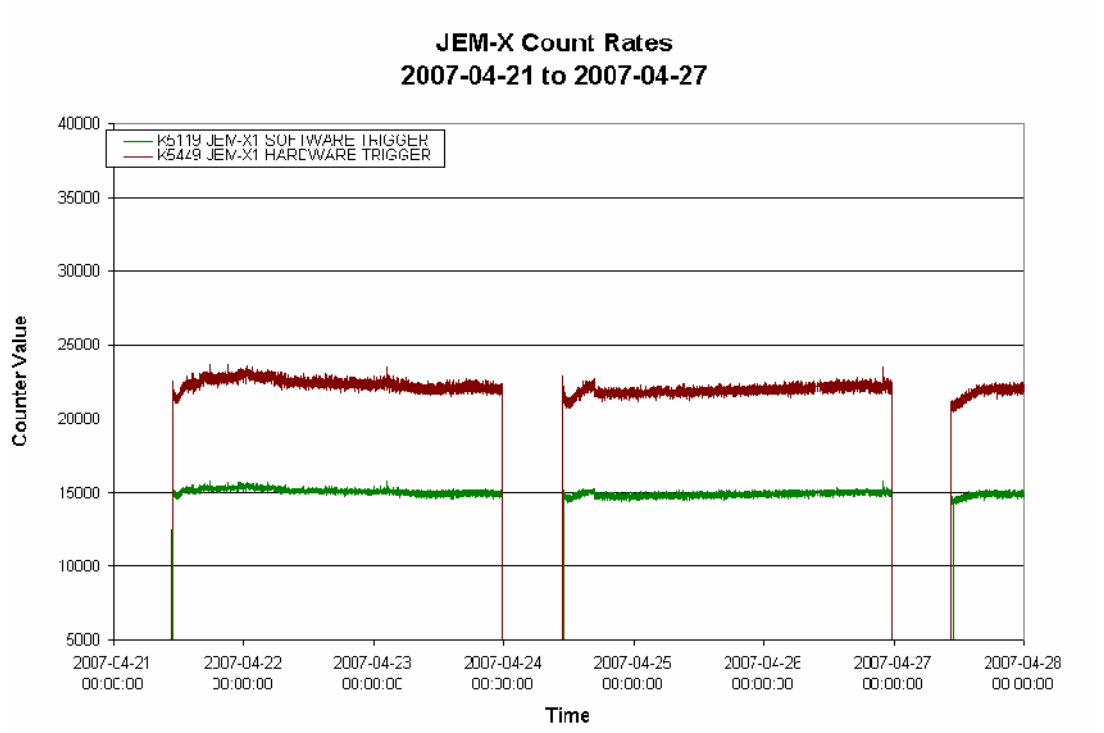
At beginning of revolution 554, the ISGRI counter rates (G2013 family) reported high values due to the high radiation environment at belts exit.
This should be fixed by the new belts exit critical altitude shifted from 45000km to 53000km from revolution 555 onwards.

8.3.4 JEM-X Operations

JEM-X Count Rates

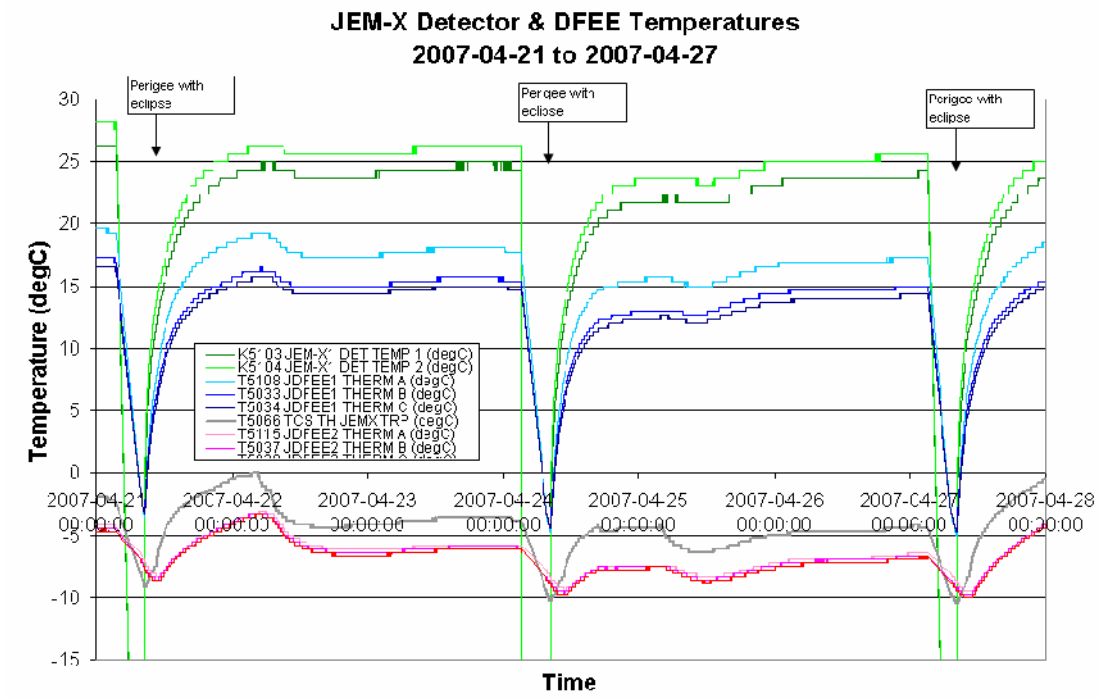
JEM-X count rates over the reporting period are displayed in the following graph[1].

[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)

2007-04-21 (DOY 111, Rev 551-552) to 2007-04-24 (DOY 114, Rev 552-553)

JEM-X1 operations executed nominally.

2007-04-25 (DOY 115, Rev 553)

At 13:30:11Z an IREM SW reset (see INT_SC-189) caused the IREM RMC parameters K5315-K5317 to go OOL high (value = 65535). This did not affect JEM-X1 as the JEM-X reactions to IREM are disabled.

2007-04-26 (DOY 116, Rev 553) to 2007-04-27 (DOY 117, Rev 553-554)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2007-04-21 (DOY 111, Rev 551)

Nothing to report.

2007-04-22 (DOY 112, Rev 552)

At 11:10:26 and 12:08:05, the following OEMs were received:

```
2007.112.11.10.25.914   2007.112.11.10.31.318   1792   RealTime   7       EXCEPTION
OMC CONSTRAINT D                                          0       0    65535   PR    N
E   E
2007.112.11.10.25.914   2007.112.11.10.31.340   1792   RealTime   5       ANOMALY
OMC CSSW INT ER                                           0       0    65535   PR    N
E   E
2007.112.12.08.05.042   2007.112.12.08.15.426   1792   RealTime   7       EXCEPTION
OMC CONSTRAINT D                                          0       0    65535   PR    N
E   E
2007.112.12.08.05.042   2007.112.12.08.15.451   1792   RealTime   5       ANOMALY
OMC CSSW INT ER                                           0       0    65535   PR    N
E   E
```

These are harmless, and occur frequently when pointing toward a crowded area of the sky. There was no impact.

2007-04-23 (DOY 113, Rev 552) to 2007-04-24 (DOY 114, Rev 553)

Nothing to report.

2007-04-25 (DOY 115, Rev 553)

At 13:30:05, an IREM reset (#47) forced OMC to Safe Mode. A recovery was performed, and the unit returned to Stand-by at 14:01:00. The impact was the interruption of pointing 05530033 after 1629 from a scheduled 2476 seconds and the loss of pointing 05530034.

2007-04-26 (DOY 116, Rev 553)

At 09:30, an IMCS problem caused the suspension of the Timeline. After a recovery was performed, the Timeline was rejoined at 10:57. The impact was the loss of pointings 05530060 & 05530061.

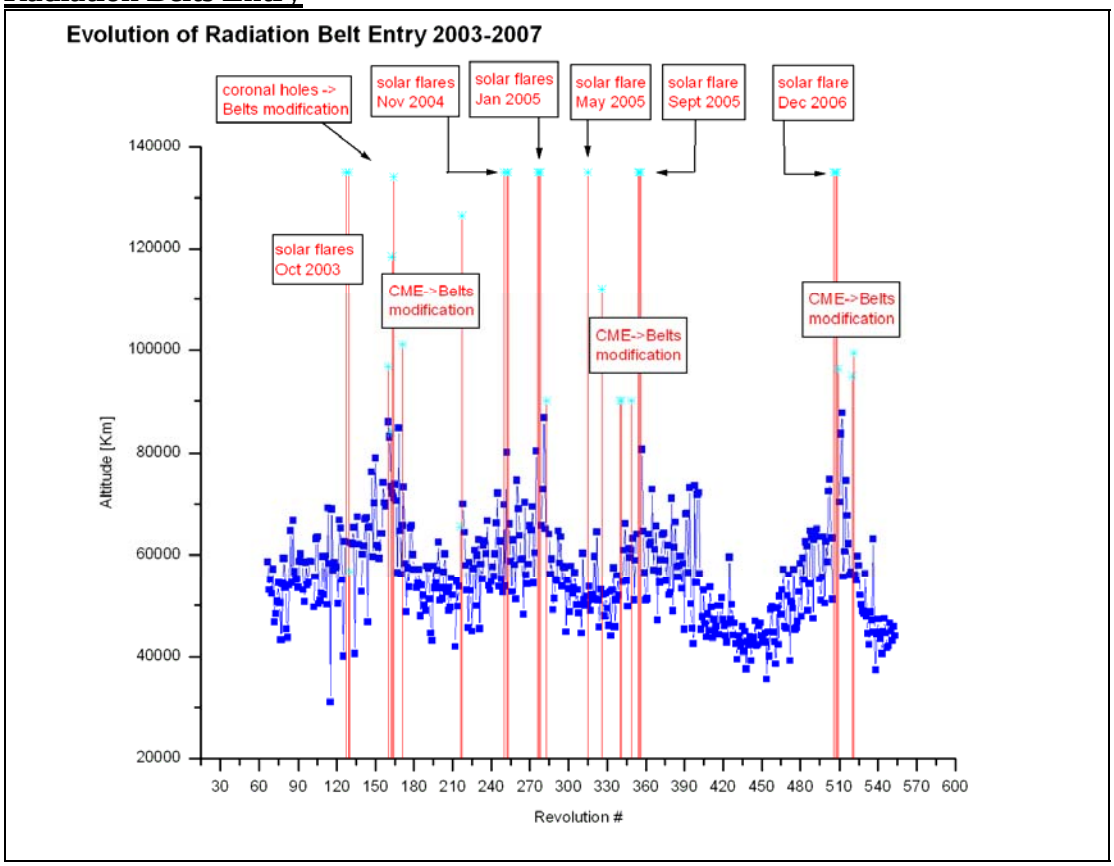
2007-04-27 (DOY 117, Rev 554)

Nothing to report.

On DoY 111 at 00:53:41, DoY 114 at 00:40:37 and DoY 117 at 00:26:53 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

DoY 2007.115 (25/04/2007):

At 13:30Z, a local reset of the IREM CSCI S/W (SEU #47) occurred as previously the status of the unit, before the anomalies, 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 2007.115.13.30Z at 148318.4km. 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 13:56Z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCC0 HEX = 48320 DEC = 10111100**1**000000, 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 = 10111100**1**000000, 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 16:08Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the PIs request.
IBIS was recovered and re-enabled in timeline at 14:30Z, and OMC at 14:01Z.

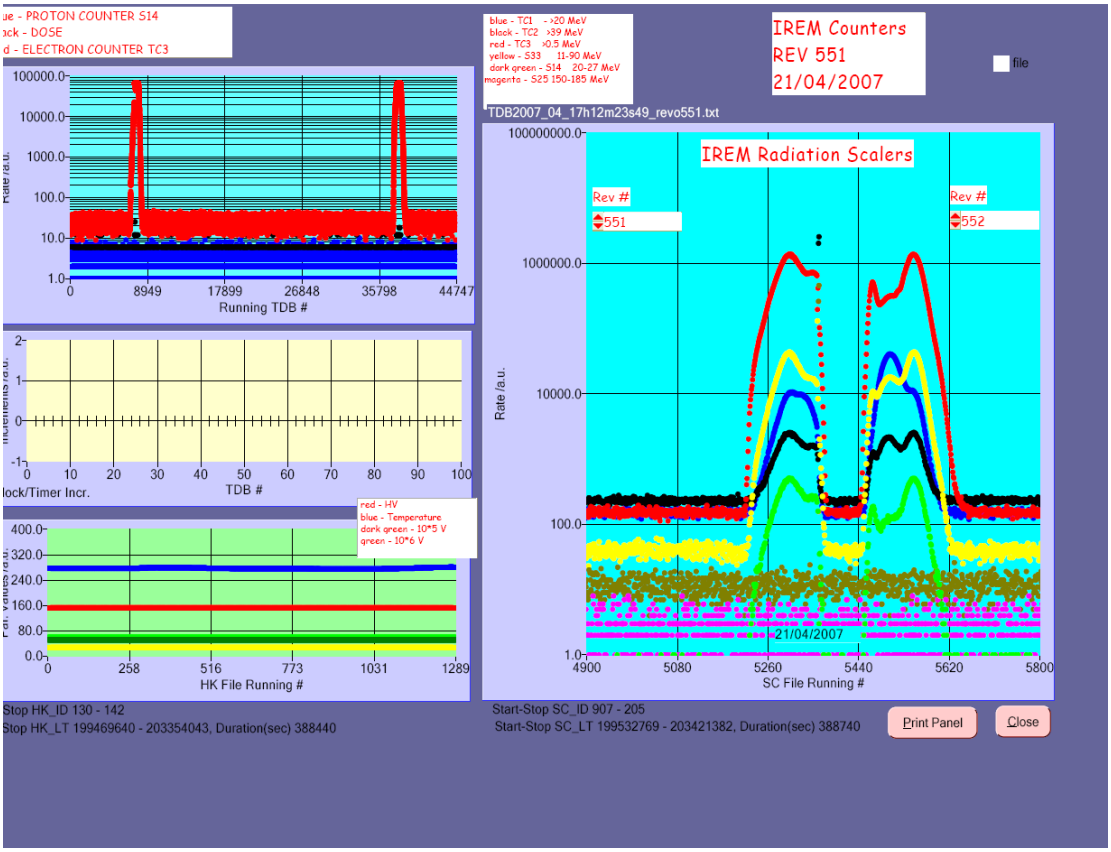
The cause of these S/W resets is still under investigation, but it is apparently due to the unit's memory device that is sensitive to radiation.

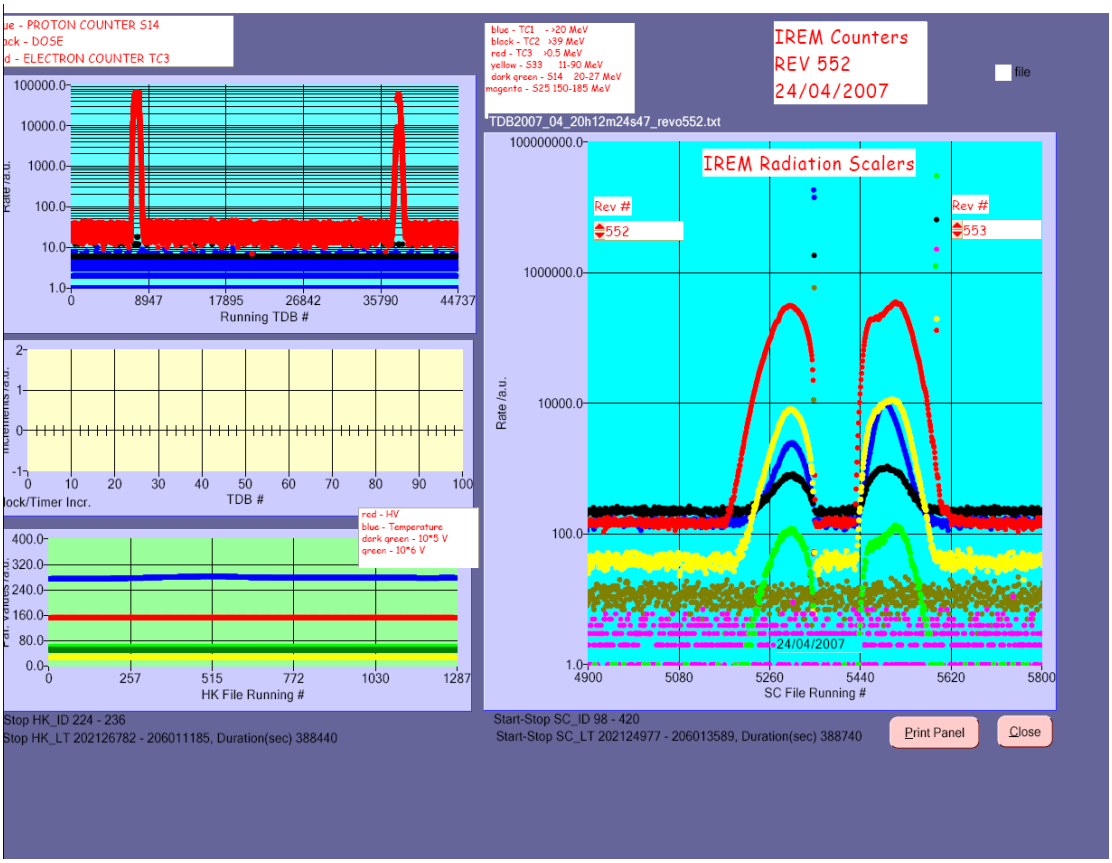
Electron Belts

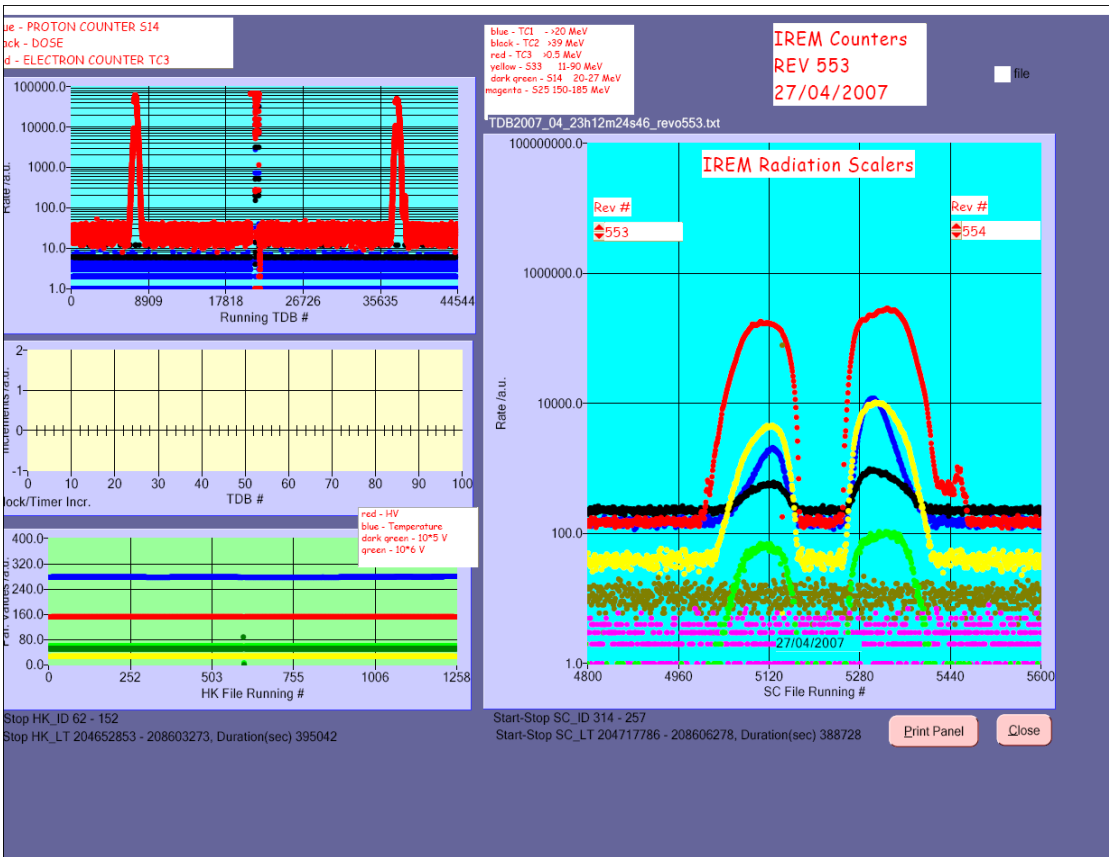
REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
552	RAD_ENTR R 2007-04-21T00:53:40Z	2007-04-21 02:26:58	43138.7	2007-04-21 02:03:25	46745
552	RAD_EXIT R 2007-04-21T10:13:18Z	2007-04-21 09:34:26	39178.6	2007-04-21 10:03:25	43281
553	RAD_ENTR R 2007-04-24T00:40:30Z	2007-04-24 01:59:07	45861.0	2007-04-24 01:51:05	46663
553	RAD_EXIT R 2007-04-24T09:59:46Z	2007-04-24 09:06:03	38597.5	2007-04-24 09:41:05	41938
554	RAD_ENTR R 2007-04-27T00:26:52Z	2007-04-27 01:53:31	44056.0	2007-04-27 01:31:05	47600
554	RAD_EXIT R 2007-04-27T09:46:21Z	2007-04-27 09:41:47	44386.8	2007-04-27 09:31:05	42416

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:

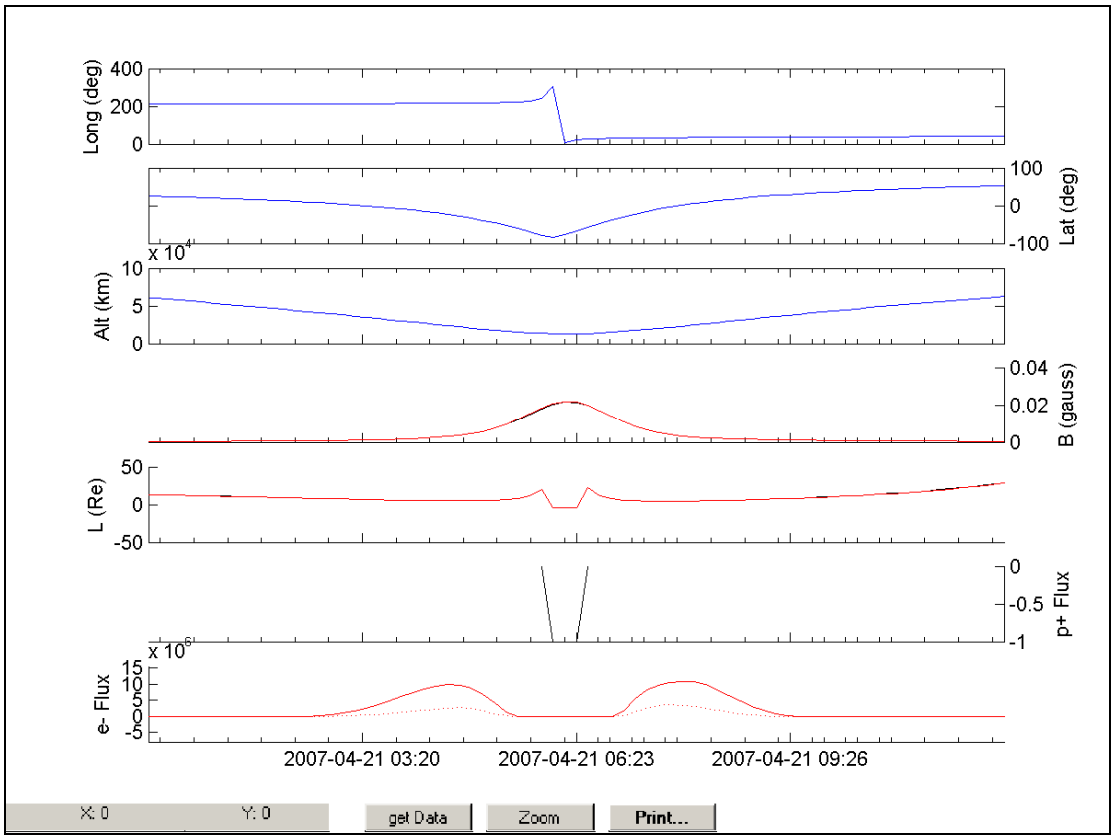




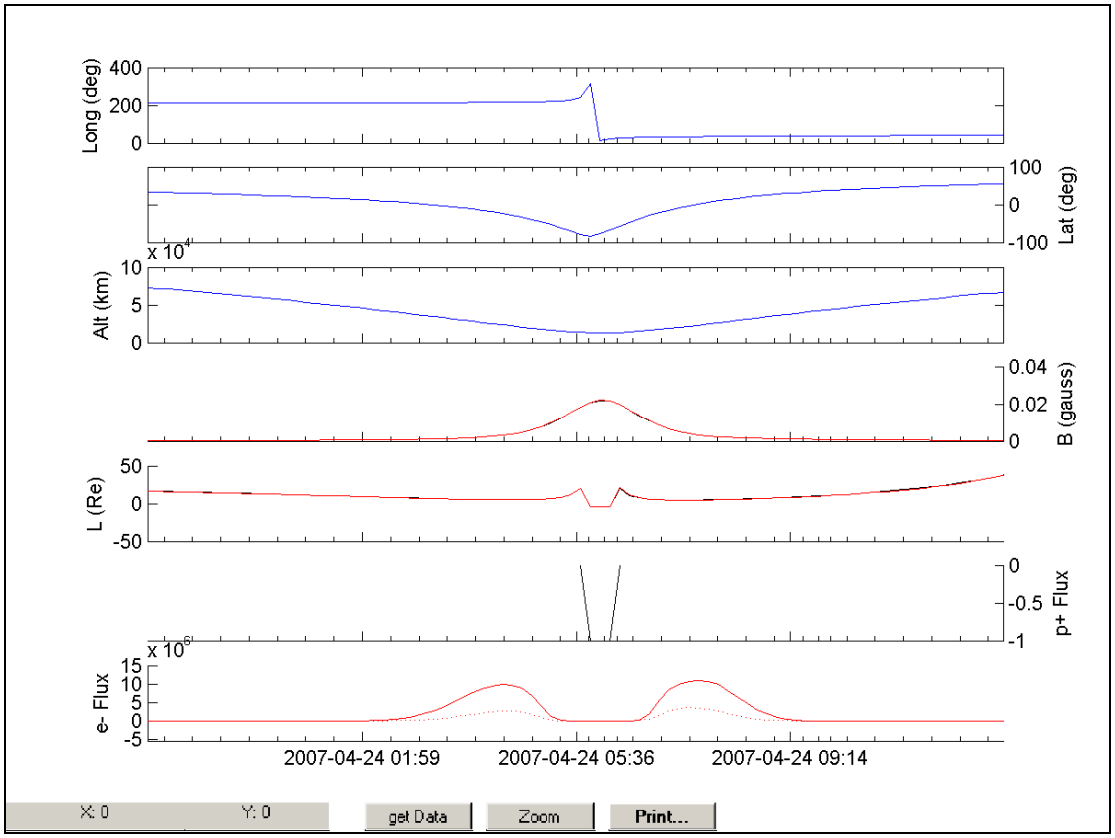


IREM Predicted Radiation Belt Passages

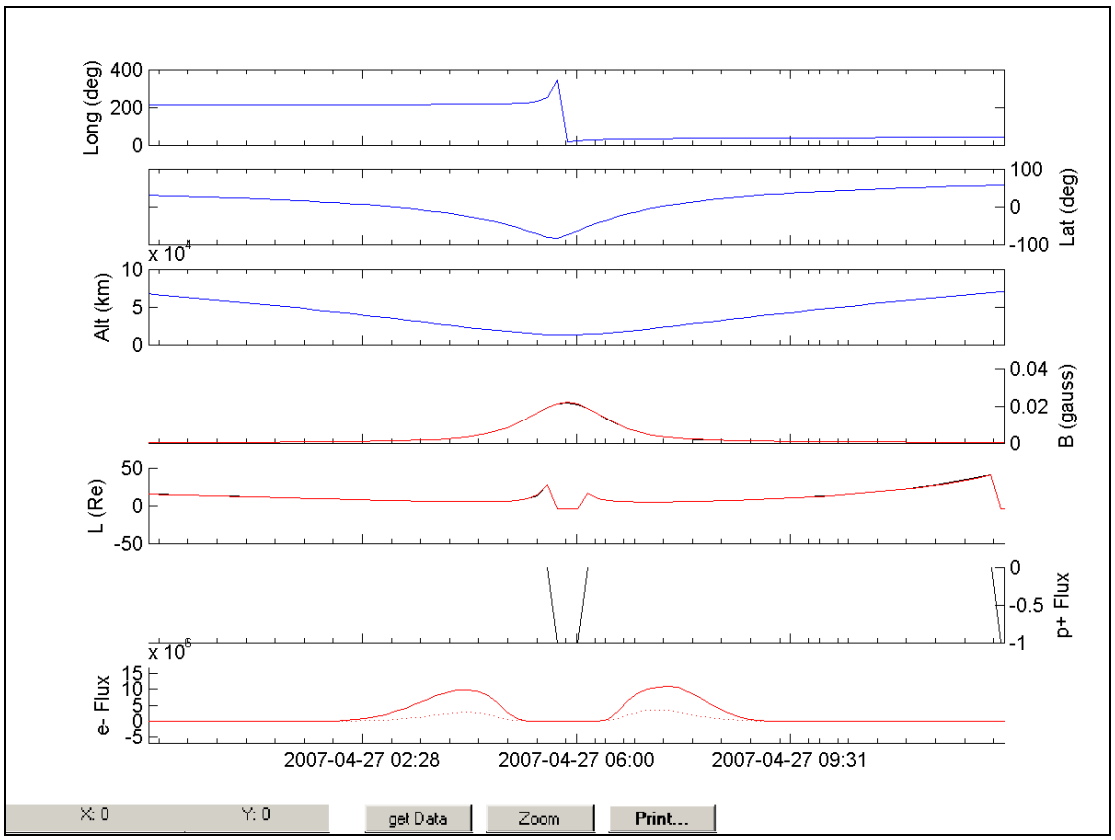
Rev 551



Rev 552



Rev 553



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