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

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 238
Week 15
16.04.07
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 07.04.07 until 13.04.07 (both dates inclusive) and covers the revolutions 548 and 549.

2 Summary of Activities

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

The targets of these revolutions consisted of a raster dither of Orion OB1 (RA 05:17:00.30, DEC +01:47:17.7), a hexagonal dither of the Galactic Bulge Region (RA 17:45:36.00, DEC -28:56:00.0), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), and a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9).

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.

One slew was missed from TL during the observation period due to problem REDU station.

The fuel consumption over the period between 05/03/2007 and 12/04/2007 was 0.1705 Kg. The remaining propellant is in the order of 147.2626 Kg.

In preparation for the Summer 2007 eclipse season, the IMU 1-2-3-4 were health checked, the ACC IMUs drifts evaluated and the RMU-B health checked during rev 548.

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

3.1.2 Power

The EPS is working nominally, available power from the arrays is of the order of 2100W.

3.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

3.1.4 OBDH

The OBDH subsystem is working flawlessly. No on-board communications problem has been identified.

3.1.5 RFS

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

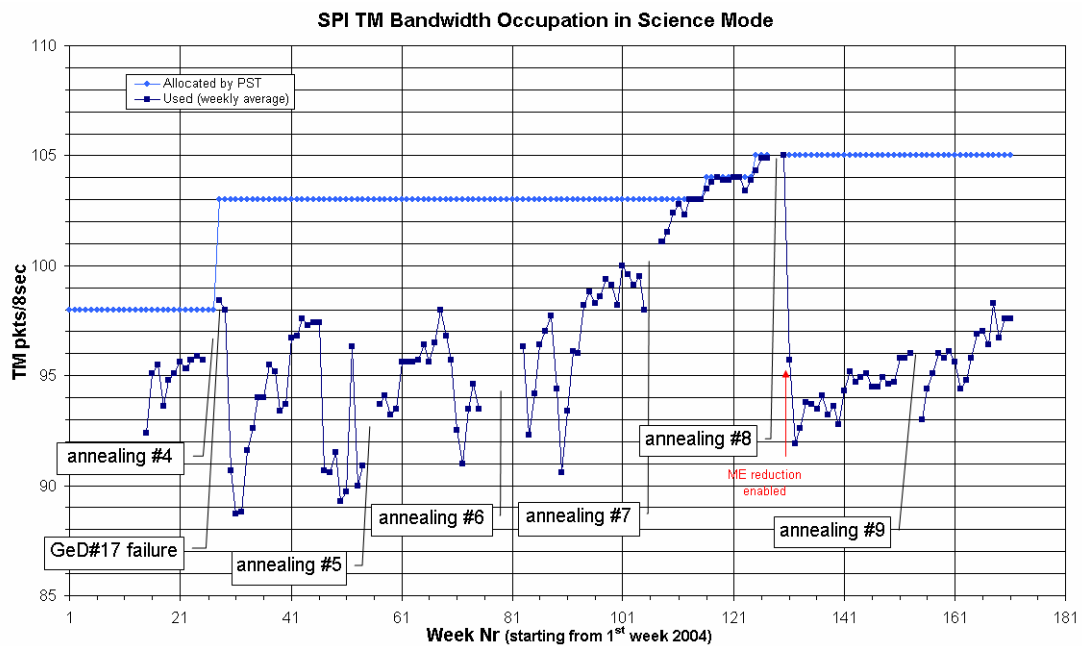
Following the 9th annealing, which ended on 22nd December, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). The energy resolution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

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 97.6 packets/cycle.

On 2007-04-12, during the radiation belt passage of revolution 548-549, OCR-225 was implemented to apply patch 1 to IASW 433 to correct the anomaly INT_SC-180.

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



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

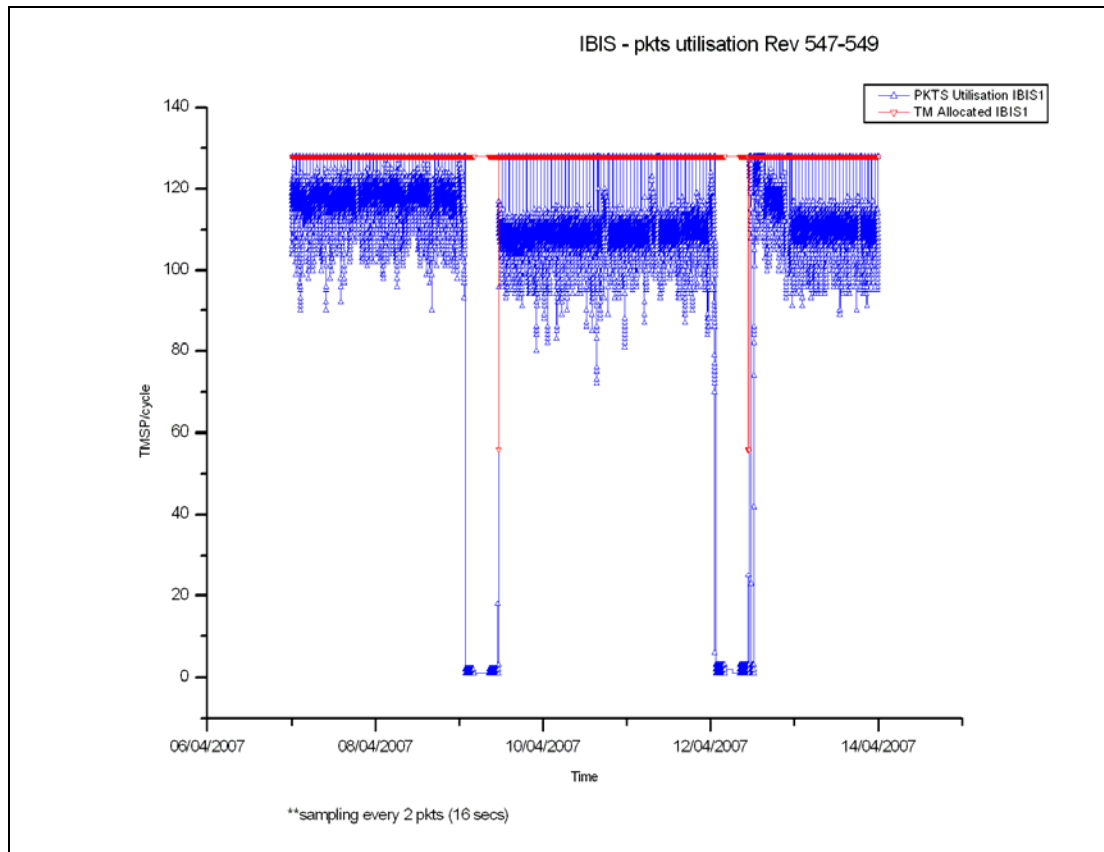
3.2.2 IBIS

The overall status of the unit is nominal.

On 12/04/2007 (DoY 2007.102) at 11:48Z, at the beginning of revolution 549, the 46th IREM reset forced IBIS into Stand-By mode. The unit was recovered manually by the operator and IBIS was back in Scientific Standard mode at 12:35Z.

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 112.83 TMPS/cycle, down 6.5 on last week

A plot of the IBIS TM utilisation during the observation period 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.

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, 144 of the 147 planned science pointings for OMC were executed nominally, 1 was interrupted and 2 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 12/04/2007 at 11:48Z, the IREM SEU #46 occurred. The unit was recovered as per procedures and was back into INTEGRAL mode at 14:06Z.

Solar Activity

The observation period was characterised by low solar activity.

The sun was blank during the whole observation period. Hence no threat of strong solar flare was reported.

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. One pointing was lost, with the OMC and IBIS data interrupted and then lost from two further pointings. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week, although there were repeated errors on one occasion sending data to the ISDS, and there was an occasion of FD having difficulties updating the Slew commands. There was no impact on either occasion. The overall performance was well over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were, however, 3 occasions of data drops from Redu, 1 from DSS-24 and 3 from DSS-27, the impact was one lost pointing. The overall performance was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs are available and observations have been planned up to revolution 554.

It has been decided to delay generation of further PSFs until 18 April to allow delaying instrument activation after the perigee passage by ~1h

A TOO request has been received for AXP 1E 1048.1-5937, but since this source will only become visible in early May, it can be handled by routine planning.

TSF's up to revolution 551 have been received.

2. Observation status

No ECS files have been received this week.

3. ISOC Science Data Archive

Version 2.7 still in beta-testing. Ideas are being developed for a better visibility of the INVITE tool.

4. ISOC system

A new analysis server has been set up that will be used for the data analysis of the ISOC scientists and possibly in the future for Archive-related processing.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 16/04/2007:

- Latest Standard Analysis completed: observation 04200560171 (GX 339-4, Revolution 536) on 02/04/2007.
- Latest products archived: observation 04200560171 (GX 339-4, Revolution 536) on 02/04/2007.
- Latest observation products sent to the observer: observation 04200560171 (GX 339-4, Revolution 536) on 03/04/2007.

5 Special Events

6 Anomalies

The following problems were reported that impacted operations:

- On DoY 100, at 15:30, a problem with TM link from Redu caused an AOCS command to fail PTV. This caused the suspension of the timeline. A recovery was performed and the timeline rejoined at 16:02. The impact was the loss of pointing 05480029.
- On DoY 102, at 11:47:57, an IREM reset (#46) forced IBIS to Stand-by, and OMC to Safe Mode. A recovery was performed. The impact was the interruption of pointing 05490003 after 409 from a scheduled 1800 seconds and the loss of pointing 05490004 for those instruments.

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

AR id	Date Created	Subject	Segment	Status
INT_SC-186	12/04/2007	IREM Anomaly: Reset of IREM_CSCI S/W #46, 12/04/2007	Payload	Open
INT-2911	13/04/2007	FDS: jump back in time detected in the AHF file for rev 544 PID 7	FDS	Pending
INT-2912	13/04/2007	FDS: ED AEPON (PP filter ON) inserted after every slew during sunlight rev	FDS	Pending

7 Future Milestones

The following activities are foreseen in the next few weeks.

- Summer eclipse season starts 18/04/2007 Rev. 550
- 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 548

The observations in revolution 548 consisted entirely of a raster dither of Orion OB1 (RA 05:17:00.30, DEC +01:47:17.7), lasting ~58.4 hours.

Revolution 549

The observations in revolution 549 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 the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 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 ~46.3 hours was performed.

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

2007-03-25T10:17:03.000Z	147.5925	F	Automatic TM processing.
2007-03-25T16:50:08.000Z	147.5701	F	Automatic TM processing.
2007-03-26T20:29:08.000Z	147.5498	F	Automatic TM processing.
2007-03-28T10:04:56.000Z	147.5418	F	Automatic TM processing.
2007-03-28T15:59:52.000Z	147.5267	F	Automatic TM processing.
2007-03-31T09:53:19.000Z	147.5133	F	Automatic TM processing.
2007-03-31T15:48:24.000Z	147.4916	F	Automatic TM processing.
2007-04-03T09:40:39.000Z	147.4792	F	Automatic TM processing.
2007-04-04T19:19:31.000Z	147.4331	F	Automatic TM processing.
2007-04-06T09:27:43.000Z	147.4146	F	Automatic TM processing.
2007-04-07T19:09:06.000Z	147.3902	F	Automatic TM processing.
2007-04-09T09:14:06.000Z	147.3700	F	Automatic TM processing.
2007-04-10T18:48:26.000Z	147.3005	F	Automatic TM processing.
2007-04-12T09:02:38.000Z	147.2869	F	Automatic TM processing.
2007-04-12T14:57:34.000Z	147.2626	F	Automatic TM processing.

This report was generated Fri Apr 13 08:00:17 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, 07/04/2007 –13/04/2007

AOCs operations were executed from the Automatic Timeline.

During this period, 66 Open Loop Slews, 95 Closed Loop Slews and 6 Momentum Biases were executed.

1 slew (OSL) was missed from TL during the observation period due to problem on the TM links on REDU station.

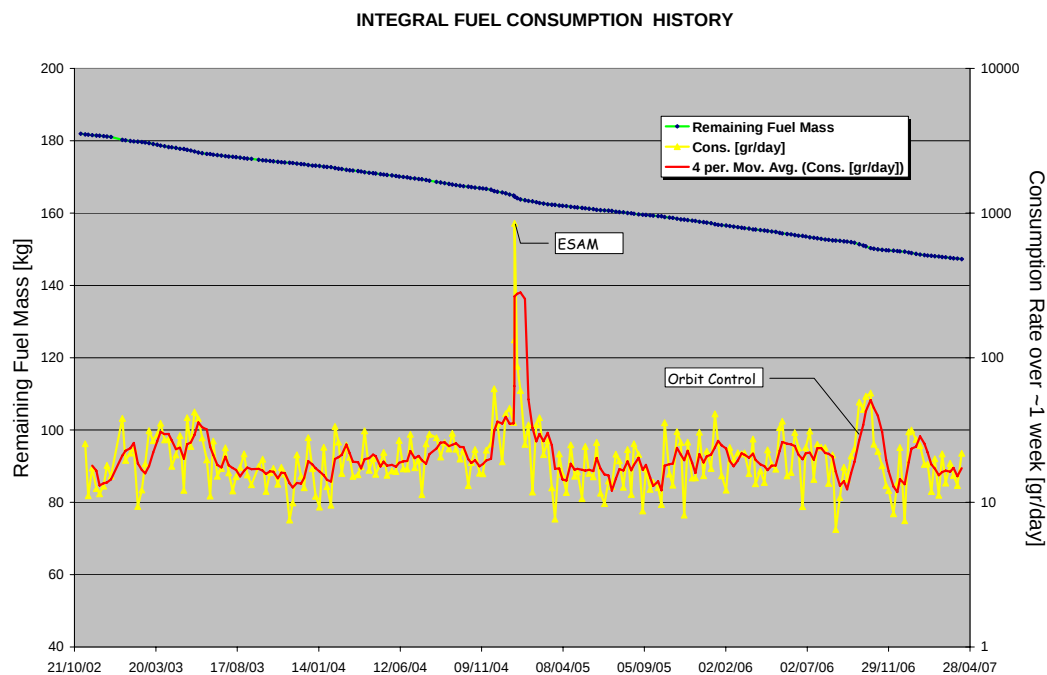
This is equivalent to $\sim 0.6\%$ of the total number of slews planned (161).

Orbit Control

No update.

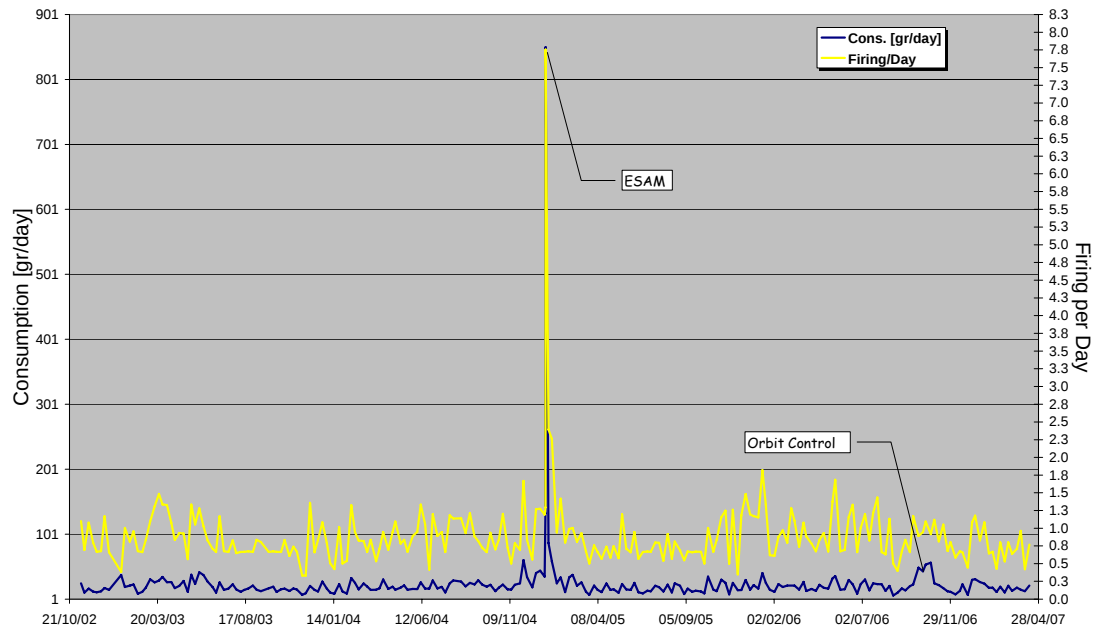
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 12/04/2007 is reported in the plot below.



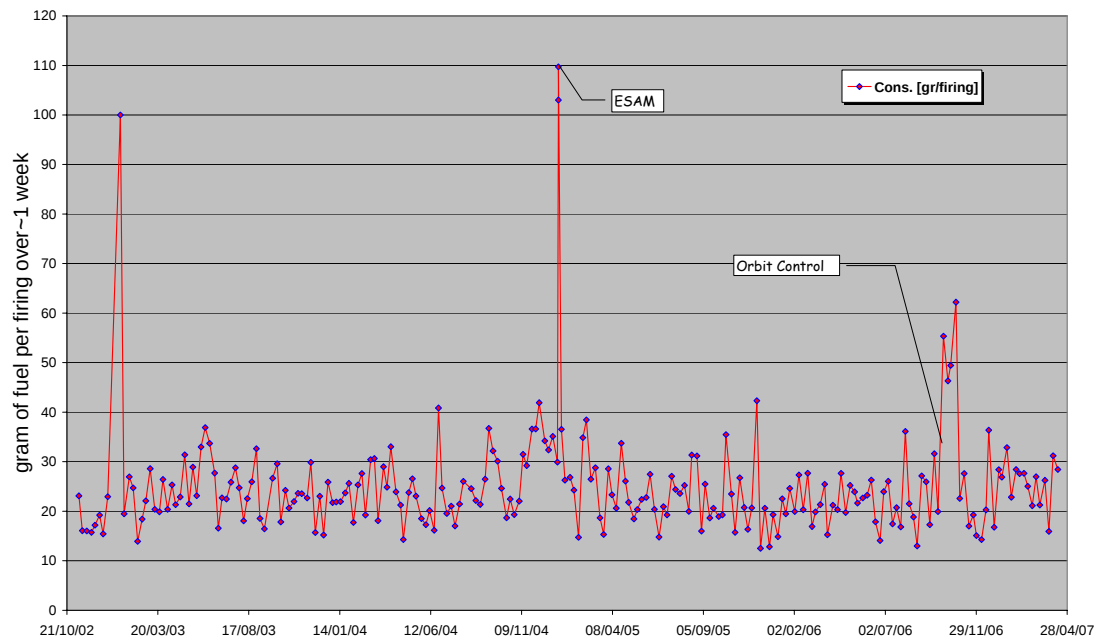
The firing per day over the period between 01/11/2002 and 12/04/2007 is reported in the plot below.

INTEGRAL FIRING PER DAY HISTORY



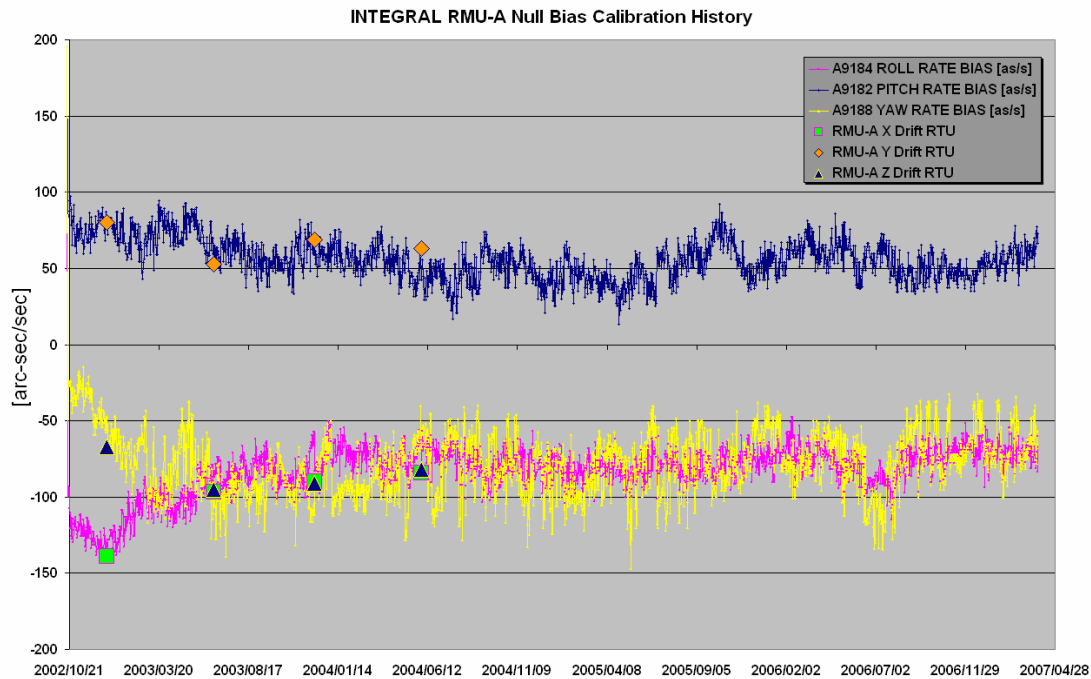
The fuel per firing over the period between 01/11/2002 and 12/04/2007 is reported in the plot below.

INTEGRAL FUEL MASS PER FIRING HISTORY

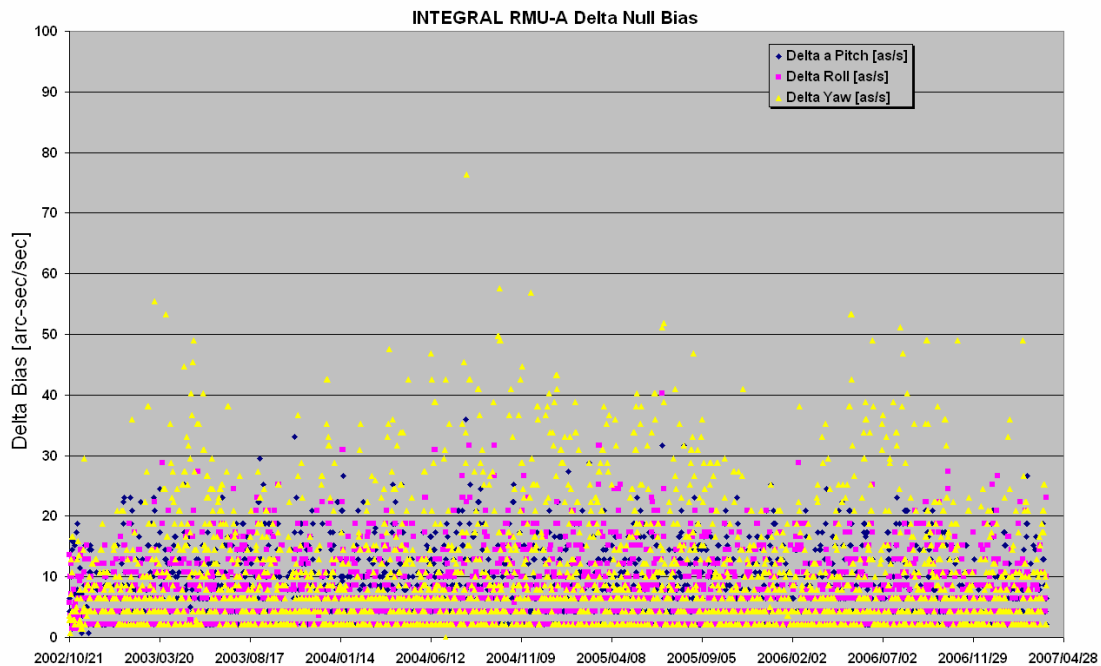


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 06/04/2007 (not updated this week) 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 06/04/2007 (not updated this week) is reported in the plot below



07/04/2007 (Day of Year 097, Revolution 547)

Nothing to report.

08/04/2007 (Day of Year 098, Revolution 547)

Nothing to report.

09/04/2007 (Day of Year 099, Revolution 547-548)

STR SEU threshold exceeded: at 08:29:16z, at AOS after perigee passage of rev 547, the STR SEU threshold was exceeded due to repeated false events, the guide star lost and the IMU1 was switched ON by the ACC.

The guide star (ID 4755-1677) at the occurrence of the event, was Mi 6.3 @ CCD location [-7814, -9531].

A new mapping was automatic initiated by the ACC and a new guide star (ID 4755-1678) Mi 6.1 @ CCD location [-5920, -6324], found.

No impact on TL except the OTF was not reached during non-scientific pointing.

FDS failed update: at 09:54z the FDS did not perform the update of the planned first slews of the rev 0548. The Job scheduler was found not running on INTATT (last run found at 09:12z). As consequence the TPF update process failed twice for slew update 05480001-2.

The scheduler was restarted and the update for slew 05480001 and 05480002 manually performed.

The problem is under investigation by FD SWS.

No impact on TL.

10/04/2007 (Day of Year 100, Revolution 548)

Problem at Redu station: at 12:32z due to a problem on REDU station, TM link dropped, the slew sequence 05480029 failed release due to dynamic PTV (pre-transmission verification).

A manual recovery was then performed from attitude of PID 05480028 to the attitude of PID 05480029. The next slew ID 05480030 was manually updated and the AOCS s/s enabled in TL.

The following slew was not executed from TL: 05480029 (OSL)

11/04/2007 (Day of Year 101, Revolution 548)

Summer 2007 Eclipse Season preparation: in preparation for the summer 2007 eclipse season the ACC IMU 1-2-3-4 drifts were evaluated and the RMU-B health checked during rev 548.

The calculated FD drifts (**below in red**) resulted consistent with the quick evaluation performed in parallel by FCT (**below in blue**) and with the drifts history.

Time z	Complete IMU Health-Check / Calibration and RMU-B Health Check 11/04/2007 (DoY 101)		
07:18	Verify the end of AOCS TL commanding Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051 <i>Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=INHIBIT, A1380=ENABLE, A1381=ENABLE</i> Load GRD to visualize the IMUs temperatures		Step 1, IMU1 and IMU3 PID 05480044 Start at 07:13:21Z End at 08:11:44Z (exposure end before HO) Altitude >137TKm
07:21:06	IMU1 Switch On, FCP-AOC-1600 <i>Remark for procedure AOC_1600: Step 4.2 for the SOE: remember to log the IMU time of activation in the IMU lifetime log</i>		T6009=7.19 degC T6010=6.25 degC T6011=26.0 degC T0052=6.56 degC T0028=8.12 degC
07:25:01	IMU3 Switch On, FCP-AOC-1604 <i>Remark for procedure AOC_1604: Step 4.2 for the SOE: remember to log the IMU time of activation in the IMU lifetime log</i>		
07:28:00	RMU-B switch On, FCP-AOC-1902		
	IMUs warm-up time (>30 minutes)		
07:52:00 07:58:00	Set IMU Selection ACC: Set IMU1 on Roll, IMU1 on Yaw, FCP-AOC-1050 FDE: Set IMU1-X on Roll(X), IMU3-Y on Pitch(Y), IMU3-Z on Yaw(Z), FCP-AOC-1218		HO REDU-GOLDST HO_PERIOD_START 08:16:58Z HANDOVER_STOP 08:26:58Z (AOCS TL commanding start)
08:33:39 08:35:25	Verify the end of AOCS TL commanding Reset IAAD Accumulators, FCP-AOC-1210 Reset FCE RMU Integrators, FCP-AOC-1254 Perform IMU-1 Drift and Noise evaluation, FCP-AOC-1623		PID 05480045 Start at 08:32:23Z End at 09:27:24Z (AOCS TL commanding start)
08:33:39 to 09:27:24	>30 minutes of data collection From TM: IMU1 Noise Roll = 0.1101 as/s IMU1 Drift Roll = 0.1771 as/s IMU1 Noise Yaw = 0.0757 as/s IMU1 Drift Yaw = 0.1928 as/s	Calculated by FD: => 0.1845 as/s => 0.1919 as/s	Stable pointing: PID 05480045 T6009=16.15 degC T6010=14.33 degC T6011=26.0 degC T0052=13.0 degC T0028=20.42 degC Altitude >134TKm
09:37	Verify the end of AOCS TL commanding Set IMU Selection ACC: Set IMU1 on Roll, IMU3 on Yaw, FCP-AOC-		PID 05480046 Start at 09:32:42Z End at 10:26:46Z

09:40	1050 FDE: Set IMU1-X on Roll(X), IMU3-Y on Pitch(Y), IMU1-Z on Yaw(Z), FCPAOC-1218	(AOCS TL commanding start)
09:42:07 09:43:52	Reset IAAD Accumulators, FCP-AOC-1210 Reset FCE RMU Integrators, FCP-AOC-1254 Perform IMU-3 Drift and Noise evaluation, FCP-AOC-1623 <i>Remark for the SOE: compare with values of the previous IMU drift reported in the specific IMU drift file</i>	
09:42:07 to 10:26:46	>30 minutes of data collection From TM: IMU1 Noise Roll = 0.2136 as/s IMU1 Drift Roll = 0.2008 as/s IMU3 Noise Yaw = 0.0518 as/s IMU3 Drift Yaw = 0.0542 as/s Calculated by FD: => 0.1976 as/s => 0.0556 as/s	Stable pointing: PID 05480046 Altitude >131TKm
10:37	8.3.1.1 Verify the end of AOCS TL commanding Deselect IMU1 and IMU3 from ACC Word B, FCP-AOC-1050	PID 05480047 Start at 10:33:17z End at 11:28:18Z (AOCS TL commanding start)
10:41	Deselect IMU1 and IMU3 from FDE, FCP-AOC-1218	
10:44:31	Switch Off IMU1, FCP-AOC-1601 <i>Remark: report the IMU1 on-time in the log</i>	T6009=17.69 degC T6010=15.77 degC T6011=30.0 degC
10:47:01	Switch Off IMU3, FCP-AOC-1605 <i>Remark: report the IMU3 on-time in the log</i>	
10:50	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-0526 <i>Remark for procedure AOC-0526 Step 4.1 use AND A1004 (not A1005)</i>	
10:53:44	RMU-B switch Off, FCP-AOC-1903	T0052=21.25 degC T0028=13.67 degC
Thermal stabilisation after IMU1 and IMU3 Switch Off (> 2 hours) PID 05480048-PID 05480049 11:33:41 – 13:13:00		
13:13	<i>Verify the end of AOCS TL commanding</i> Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051 <i>Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=INHIBIT, A1380=ENABLE, A1381=ENABLE</i>	Step 2, IMU2 and IMU4 PID 05480050 Start at 13:34:38Z End at 14:28:42Z
13:20:12	IMU2 Switch On, FCP-AOC-1602 <i>Remark for procedure AOC-1602: Step 2.2.1 do not requested to check if IMU1 is selected for YAW. If for any reason during the calibration, the guide star is lost the controller will switch ON the IMU1: the contingency reaction foresees to switch OFF the IMU2 to avoid thermal problem Step 4.2 remember to log the IMU time of activation in the IMU lifetime log</i>	T6009=11.67 degC T6010=10.33 degC T6011=29.0 degC
13:23:43	IMU4 Switch On, FCP-AOC-1606	

	<i>Remark for procedure AOC-1606: Step 4.2 remember to log the IMU time of activation in the IMU lifetime log</i>		
13:44	Set IMU Selection		
	ACC: Set IMU2 on Roll, IMU2 on Yaw, FCP-AOC-1050		
13:48	FDE: Set IMU2-X on Roll(X), IMU4-Y on Pitch(Y), IMU2-Z on Yaw(Z), FCP-AOC-1218		(AOCS TL commanding start at 14:28:42Z)
	IMUs warm-up time (>30 minutes)		
14:40:47	Reset IAAD Accumulators, FCP-AOC-1210 Perform IMU-2 Drift and Noise evaluation, FCP-AOC-1623 <i>Remark: compare with values of the previous IMU drift reported in the specific IMU drift file</i>		PID 05480051 Start at 14:35:12Z End at 15:30:13Z (AOCS TL commanding start)
14:40:47 to 15:30:13	~30 minutes of data collection From TM: IMU2 Noise Roll = 0.2003 as/s IMU2 Drift Roll = 0.1431 as/s IMU2 Noise Yaw = 0.1051 as/s IMU2 Drift Yaw = 0.0355 as/s	Calculated by FD: => 0.1456 as/s => 0.0369 as/s	Stable pointing: PID 05480051 HO GOLDST-REDU HO_PERIOD_START 15:44:00Z HANDOVER_STOP 15:54:00Z T6009=16.92 degC T6010=15.38 degC T6011=26.0 degC Altitude >117TKm
15:54	<i>Verify the end of AOCS TL commanding</i> Set IMU Selection ACC: Set IMU4 on Roll, IMU2 on Yaw, FCP-AOC-1050		PID 05480052
15:57	FDE: Set IMU4-X on Roll(X), IMU4-Y on Pitch(Y), IMU2-Z on Yaw(Z), FCP-AOC-1218		Start at 15:54:00Z End at 16:49:01Z (AOCS TL commanding start)
15:58:52	Reset IAAD Accumulators, FCP-AOC-1210 Perform IMU-4 Drift and Noise evaluation, FCP-AOC-1623 <i>Remark: compare with values of the previous IMU drift reported in the specific IMU drift file</i>		
15:58:52 to 16:49:01	>30 minutes of data collection From TM: IMU4 Noise Roll = 0.1827 as/s IMU4 Drift Roll = 0.0325 as/s IMU2 Noise Yaw = 0.0484 as/s IMU2 Drift Yaw = 0.0596 as/s	Calculated by FD: => - 0.0378 as/s => 0.0563 as/s	Stable pointing: PID 05480052 T6009=19.62 degC T6010=18.08 degC T6011=28.0 degC Altitude >109TKm
16:59	Deselect IMU2 and IMU4 from ACC Word B, FCP-AOC-1050		PID 05480053 Start at 16:54:22Z End at 17:48:26Z
17:03	Deselect IMU2 and IMU4 from FDE, FCP-AOC-1218		
17:05:57	Switch Off IMU2, FCP-AOC-1603		T6009=20.83 degC T6010=18.85 degC T6011=27.50 degC
	<i>Remark for the SOE: report the IMU2 on-time in the log</i>		

17:07:49	Switch Off IMU4, FCP-AOC-1607 <i>Remark for the SOE: report the IMU4 on-time in the log</i>	
17:10	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-0526 <i>Remark for procedure AOC-0526 Step 4.1 use AND A1004 (not A1005)</i>	

12/04/2007 (Day of Year 102, Revolution 548-549)

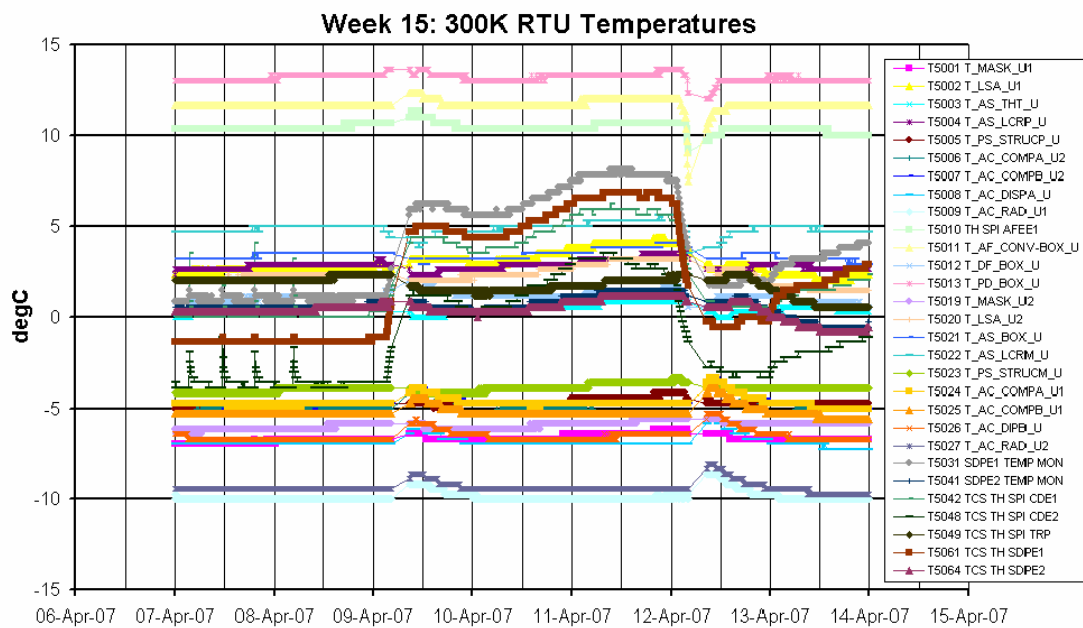
Nothing to report.

13/04/2007 (Day of Year 103, Revolution 549)

Nothing to report.

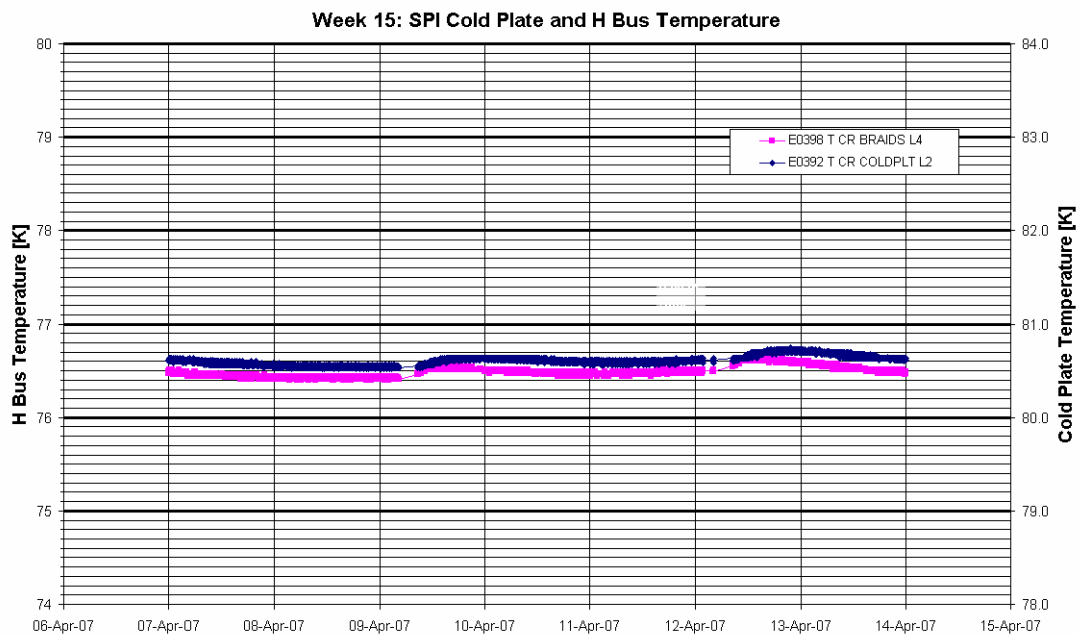
8.3.2 SPI Operations

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.

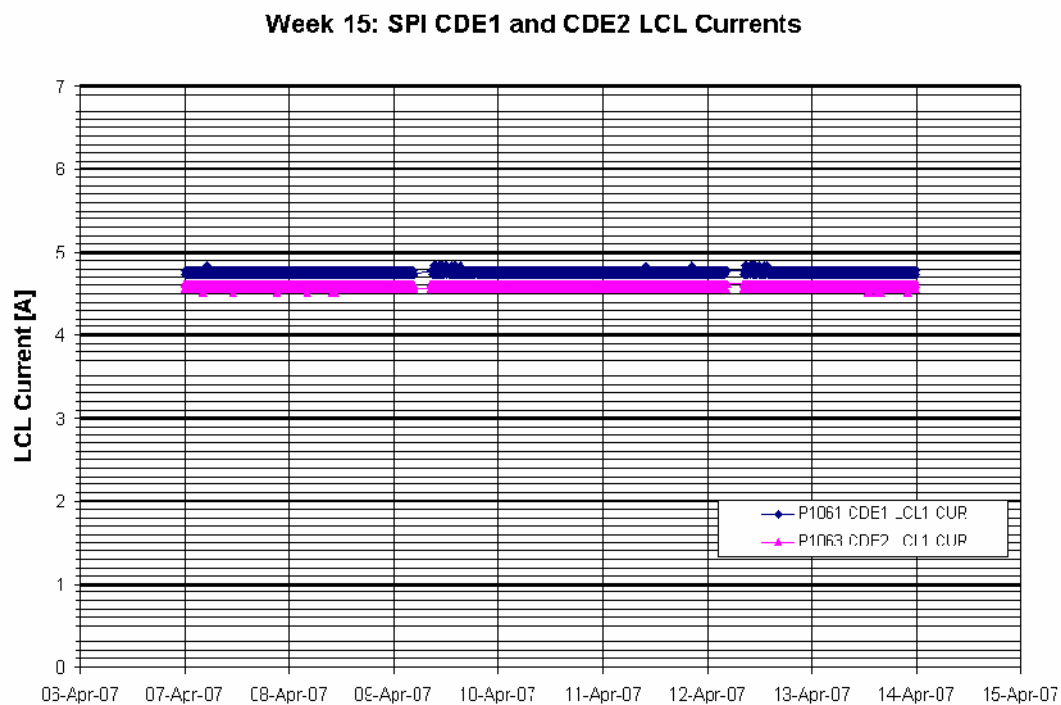


The stroke of all four compressors has been 40 since 03-02-2007 at 13:16Z.

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

- Average CDE1 LCL Current = 4.77A
- Average CDE2 LCL Current = 4.58A

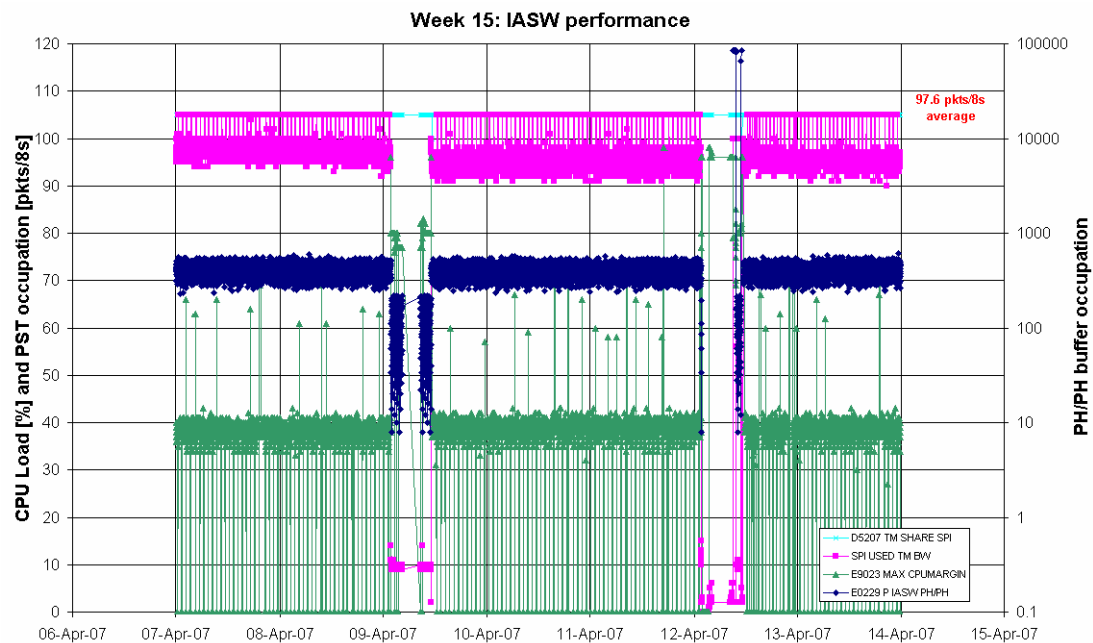
The following plot shows the evolution of the CDE currents during the reporting period.



DPE & IASW: The DPE health and IASW performance is nominal. The IASW version installed is 433. The spectra scaling parameter was set to 9/19 SE.

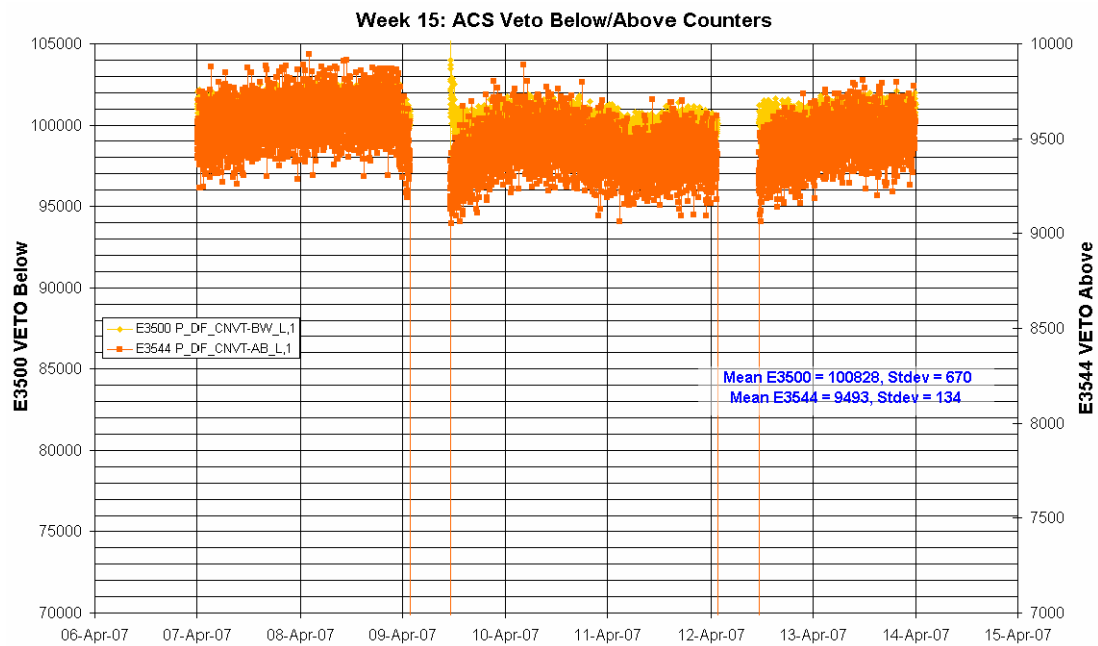
On 2007-04-12, during the radiation belt passage of revolution 548-549, OCR-225 was implemented to patch IASW 433 in order to correct the anomaly INT_SC-180 (SPI IASW 433: Problems in acquiring data blocks in long HK TM packets at mode/state change). The operations were performed according to INT_OPS_285, starting at 01:35Z and ending at 11:20Z). The operations were nominal and the performance of SPI with this new version of the IASW (Version 433 Patch #1) is nominal so far. In particular, the anomaly INT_SC-180 appears to have been fixed with this patch. A test of the science mode inside the belts is still to be performed, to verify the additional functionality introduced with the patch regarding the filtering of OEM 243. This will be done at a convenient time during an upcoming radiation belt passage.

The average TM bandwidth occupation of SPI was 97.6 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). FEE #57 is also still OFF due to the anomaly on 5/8/2003 (INT_SC-61).

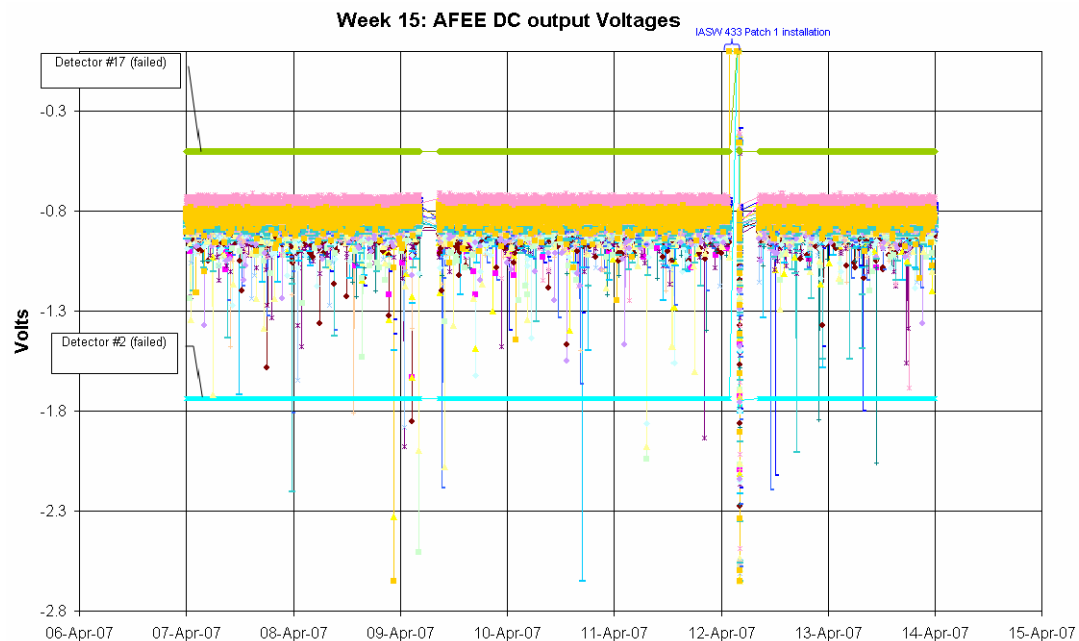
The following plot shows the ACS overall count rate evolution during the reporting period:



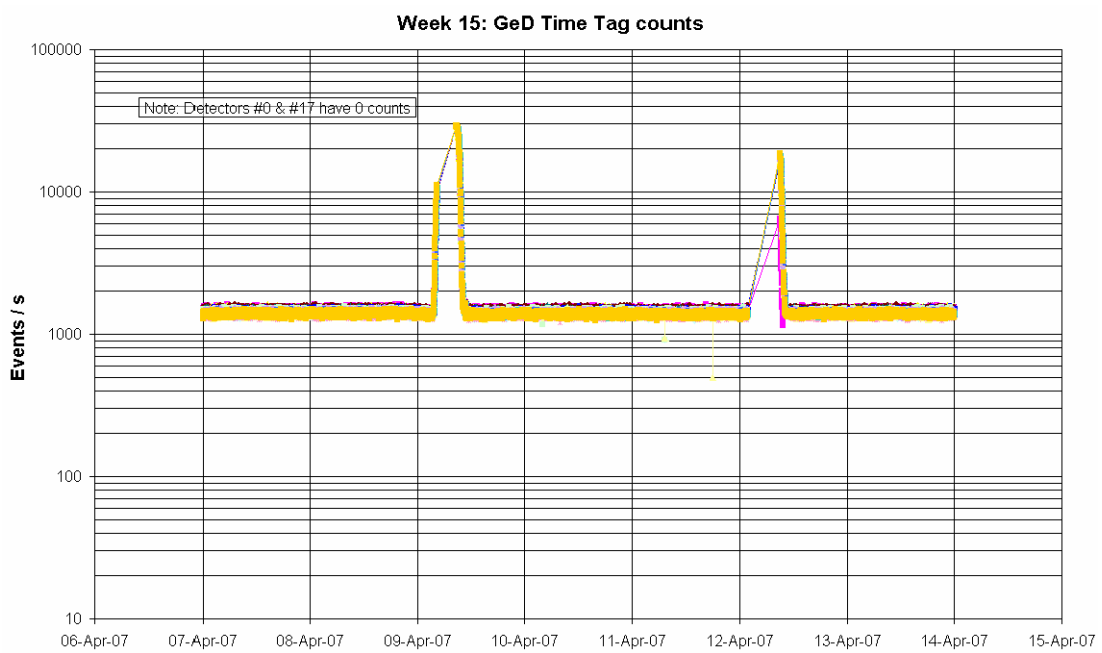
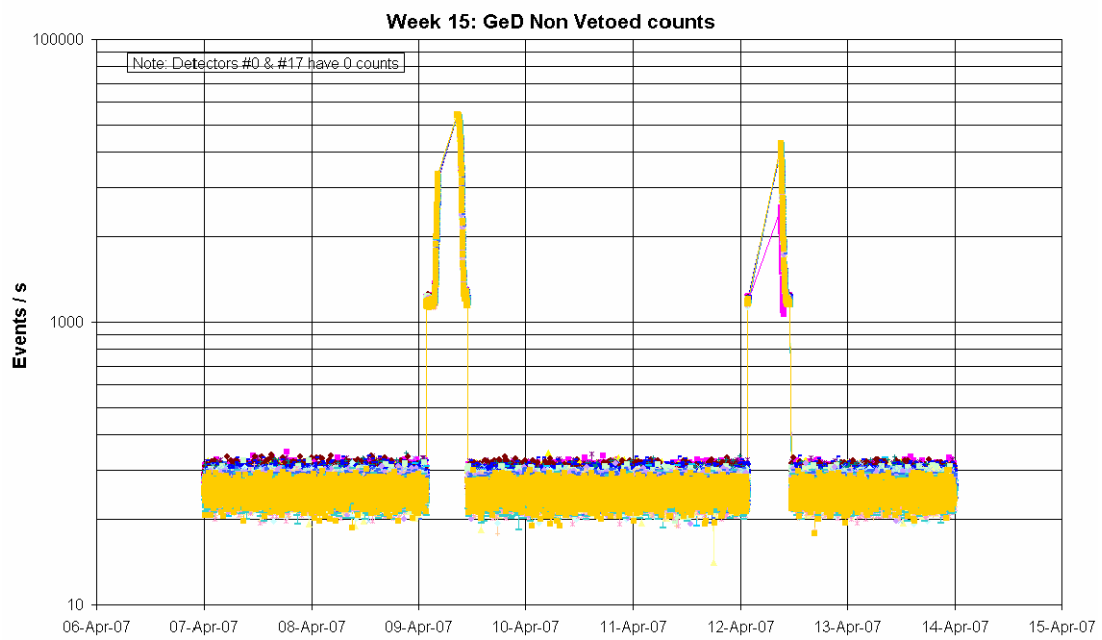
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detector #12 which is showing a slightly degraded energy resolution. The energy resolution of GeD#4 was recovered with the last annealing.

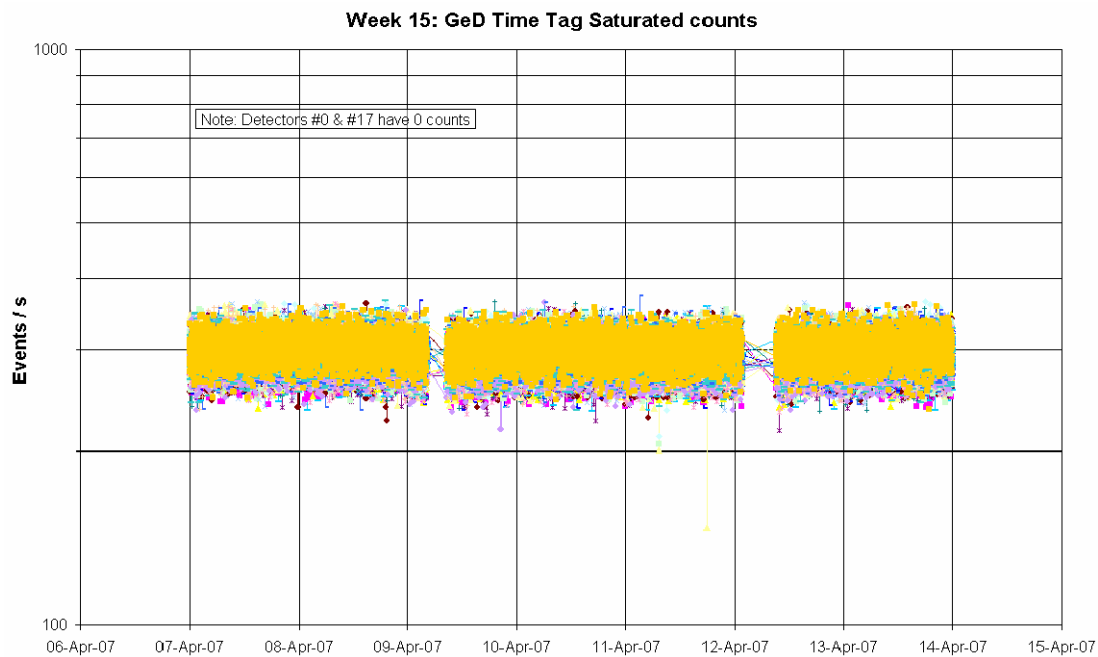
The GeD#12 HV remained at 3.5kV throughout the reporting period.

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.

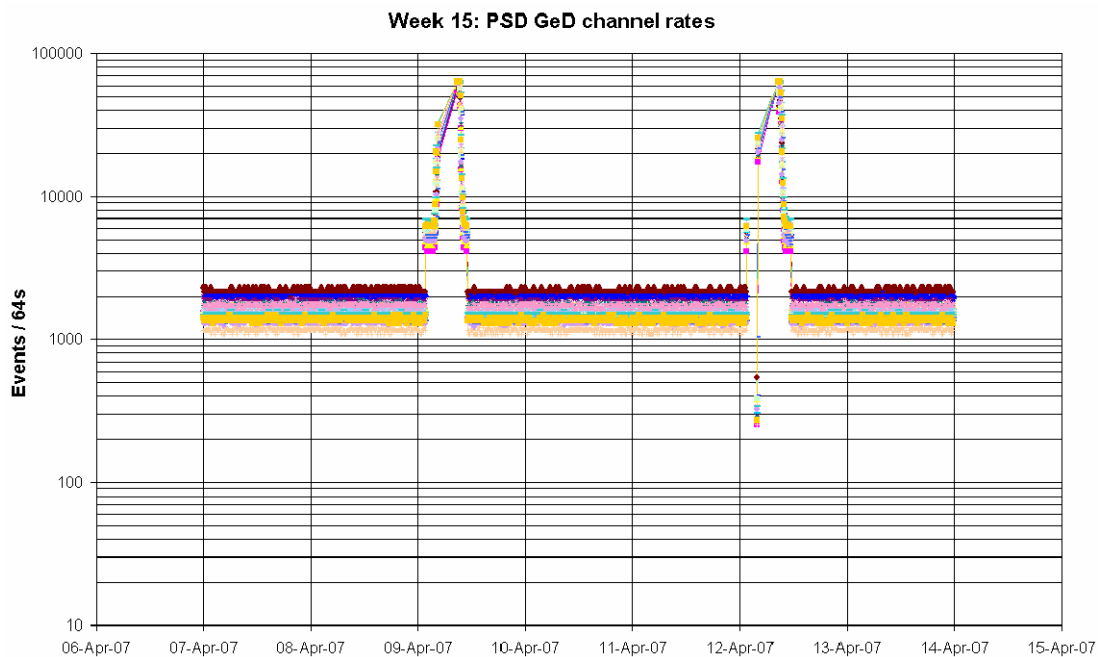


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.





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:

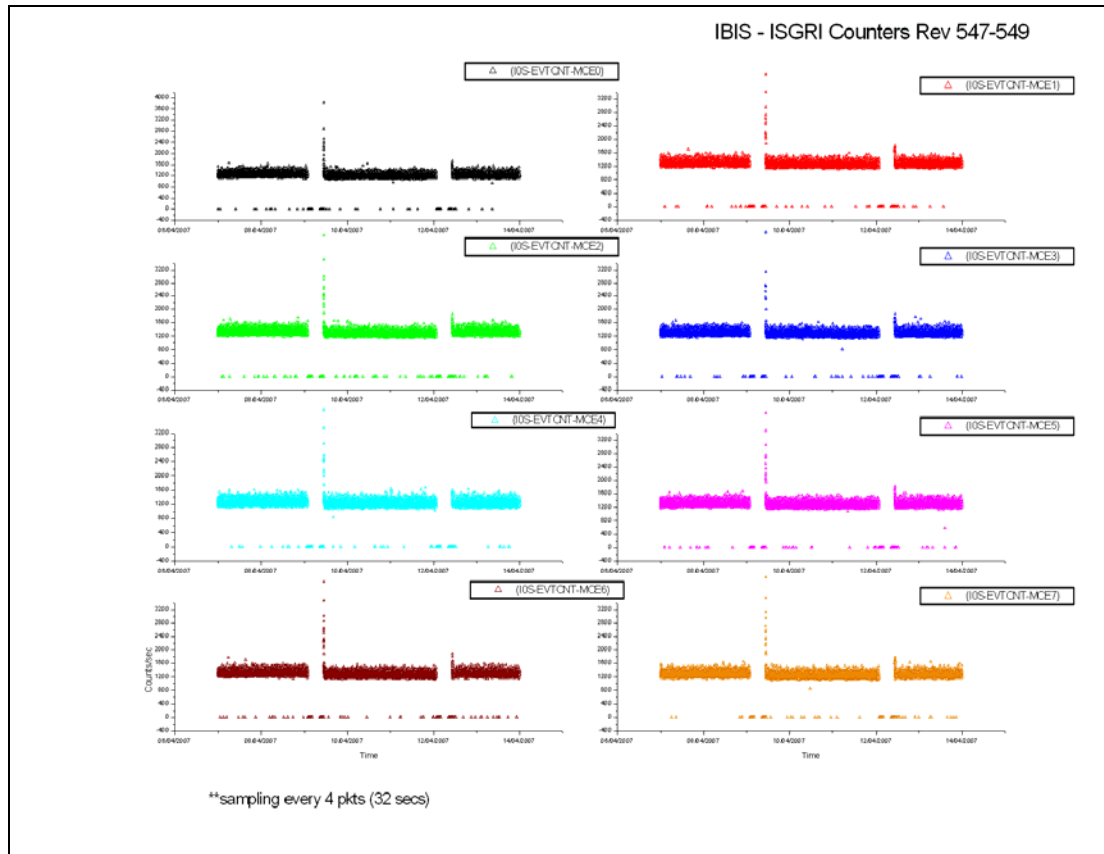
- On 2007-04-09 at 08:35:39Z the TM parameter E4009 S DF HSLERR L started toggling OOL, indicating errors on the High Speed Line. This was after AOS of revolution 548. It returned stably within limits at 09:02:50Z and therefore no action was taken.
- On 2007-04-09 at 23:38:54Z and again on 2007-04-11 at 15:50:53Z OEM 1024 ID 243 EVENT SPI1 SPECTRA BUILDING NOT COMPLETED was received. This was during pointing IDs 05480013 and 05480052

respectively. As these were each single occurrences and are not often received, the spectra scaling parameter has been maintained at 9/19SE.

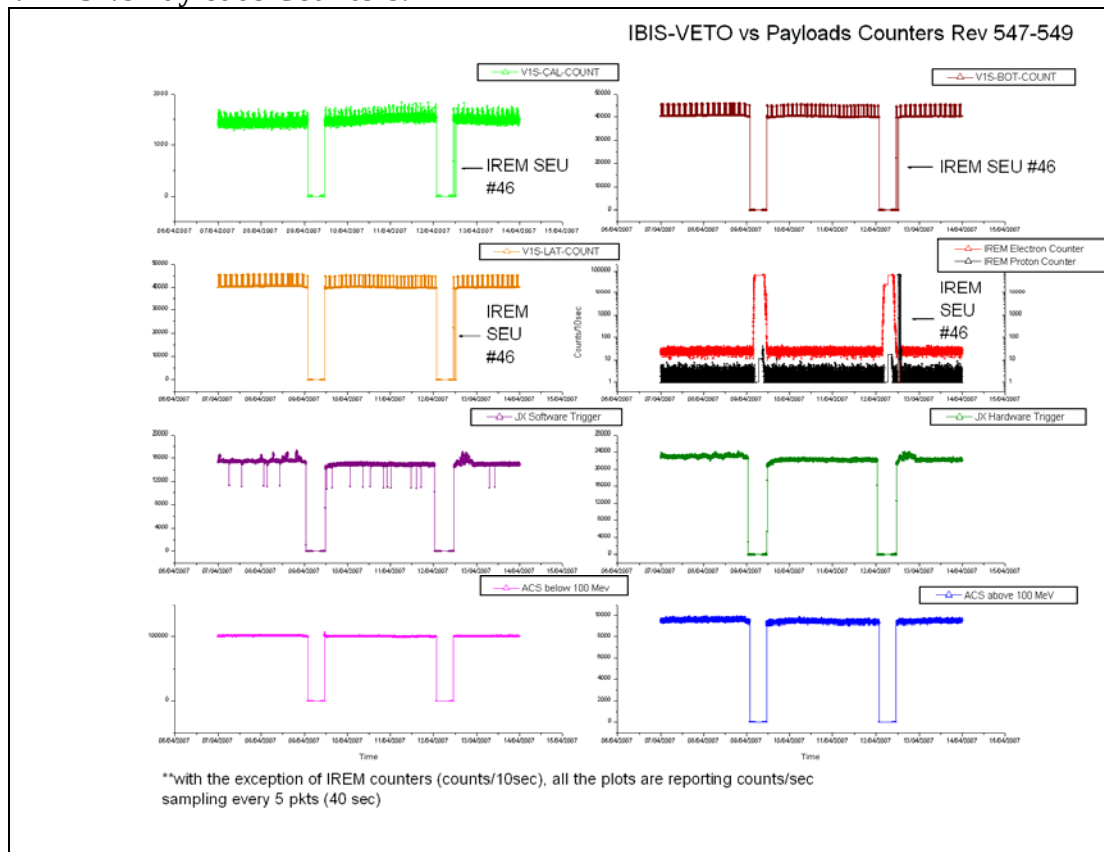
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

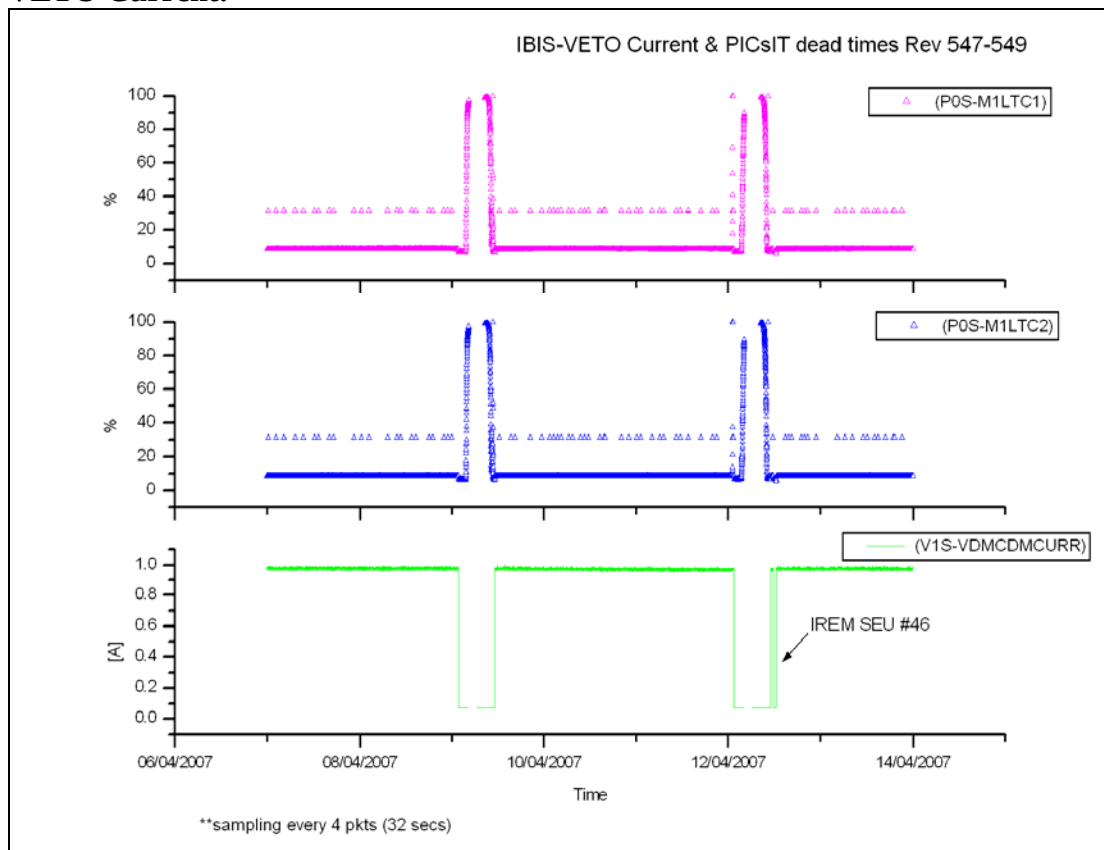


VETO vs Payloads Counters:

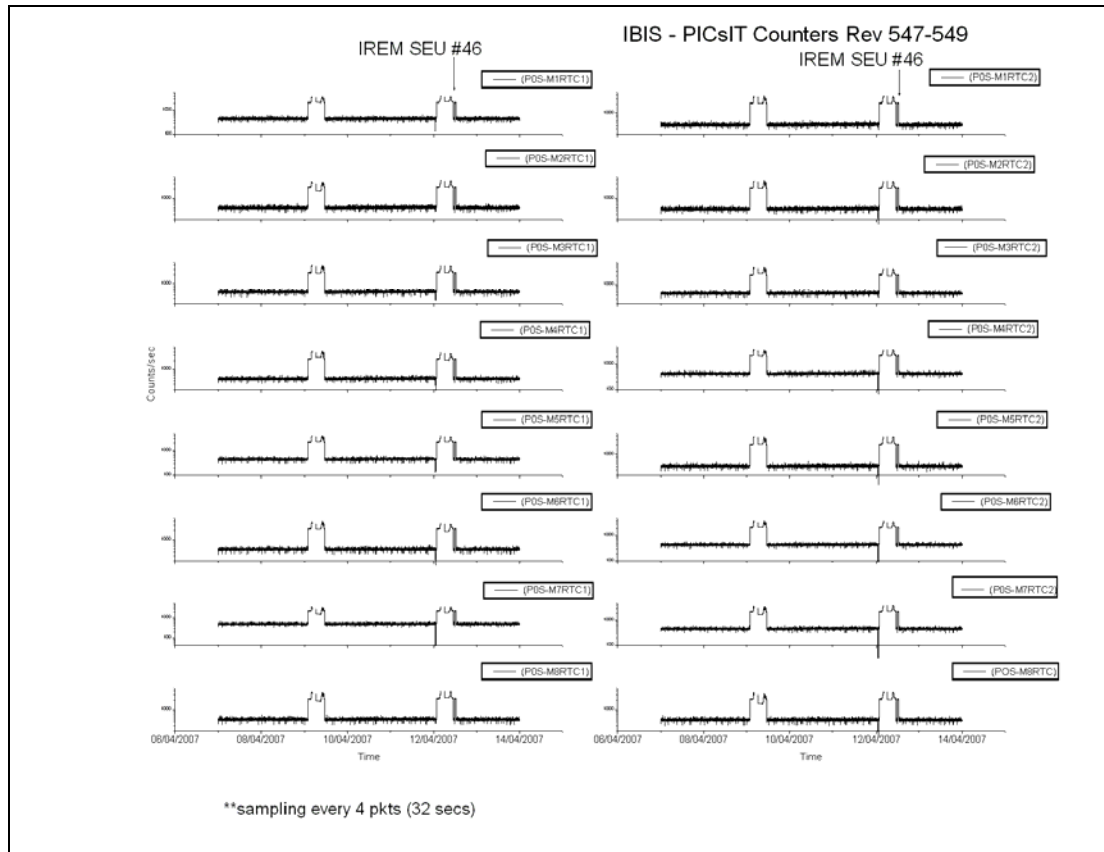


The week was characterised by low radiation.

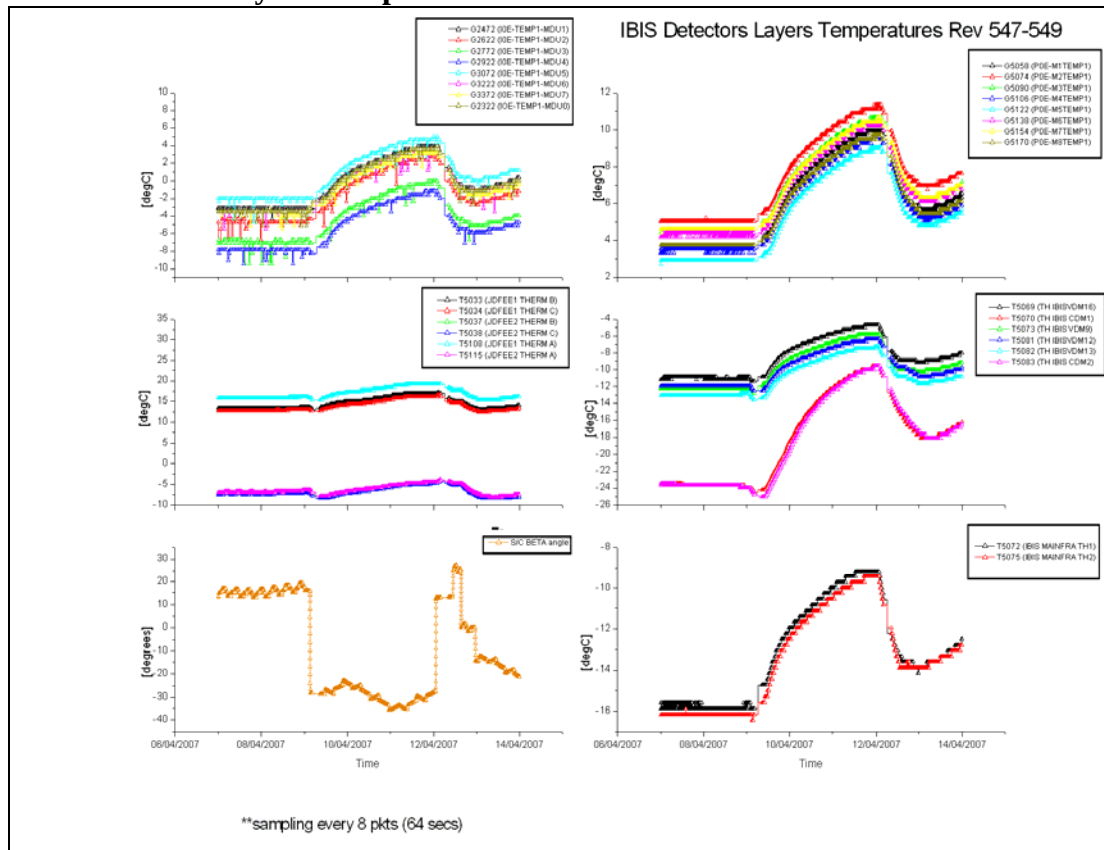
VETO Current:



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 2007.093 (03/04/2007): High radiation at belts exit

Between 10:39Z and 10:48Z, close to Belts exit time, the IREM counters were reporting higher radiation level than IBIS thresholds while ISGRI was already in NOMINAL mode.

At 10:44Z, parameters from TM family G2013 (I0S-EVTCNT) were reported OOL High.

Both these events were due to high radiation at Radiation Belts exit, and no action was taken as the radiation level dropped to safe environment rather fast.

DoY 2007.102 (12/04/2007):

At 01:08Z TM families G5068 and G5072 (P0S-MiF 1 & 2 ERRF) were reported failing Status Consistency Check.

At 01:11Z, TM families G5002 and G5003 (P0S-Mi_RTC 1 & 2) were reported OOL Low-Low with the value 0.

At 01:14Z, 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 HEPI board and the detector layers. The unit automatically fixed itself.

DoY 2007.102 (12/04/2007): IREM SEU #46

At 11:48Z, at the beginning of revolution 549, the 46th IREM reset forced IBIS into Stand-By mode. The unit was recovered manually by the operator via FCP_IBIS1_0803 (exit Safe mode) and ED GESTAN02. IBIS was back in Scientific Standard mode at 12:35Z.

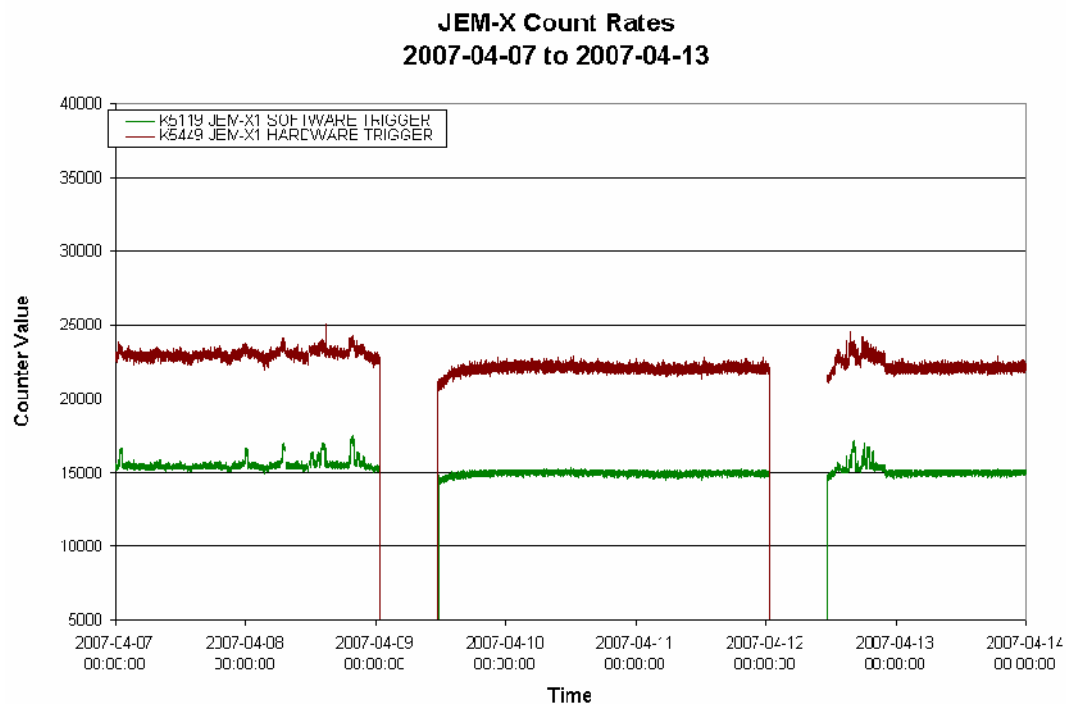
The impact was Pointing 0549003 was partially missed, and Pointing 05490004 was lost.

8.3.4 JEM-X Operations

JEM-X Count Rates

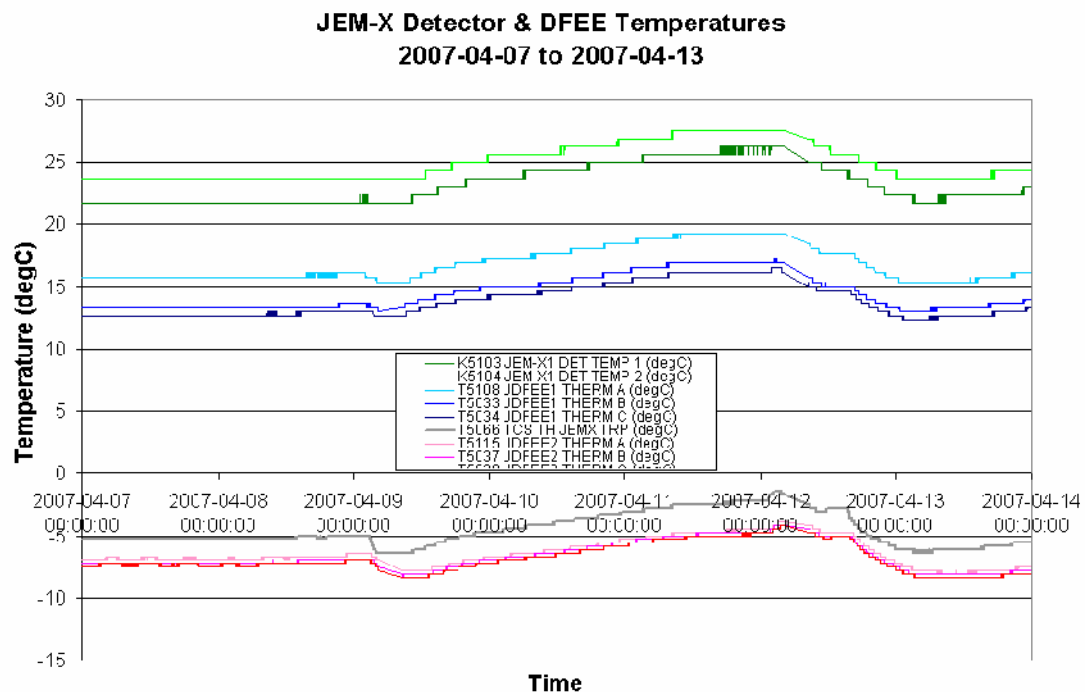
JEM-X count rates over the reporting period are displayed in the following graph¹.

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



JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph².



² Data sampled (1 frame in 8)

JEM-X Daily Report

2007-04-07 (DOY 097, Rev 547) to 2007-04-11 (DOY 101, Rev 548)

JEM-X1 operations executed nominally.

2007-04-12 (DOY 102, Rev 548-549)

At 11:48:02Z an IREM SW reset (see INT_SC-186) 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.

2007-04-13 (DOY 103, Rev 549)

JEM-X1 operations executed nominally.

8.3.5 OMC Operations

2007-04-07 (DOY 97, Rev 547) to 2007-04-09 (DOY 99, Rev 548)

Nothing to report.

2007-04-10 (DOY 100, Rev 548)

At 15:30, a problem at Redu caused an AOCS command to fail PTV. This caused the suspension of the timeline. A recovery was performed and the timeline rejoined at 16:02. The impact was the loss of pointing 05480029. It was at this time the following commands were rejected:

2007.100.15.33.33.058	2007.100.15.33.42.442	1792	RealTime	131	TC REJECT		
REJECTED TC1			0	0	65535	PR	N
E E							
2007.100.15.33.39.745	2007.100.15.33.50.337	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.

2007-04-11 (DOY 101, Rev 548)

Nothing to report.

2007-04-12 (DOY 102, Rev 548)

At 11:47:57, an IREM reset (#46) forced OMC to Safe Mode. A recovery was performed, and the unit returned to Stand-by at 12:35:32. The impact was the interruption of pointing 05490003 after 409 from a scheduled 1800 seconds and the loss of pointing 05490004.

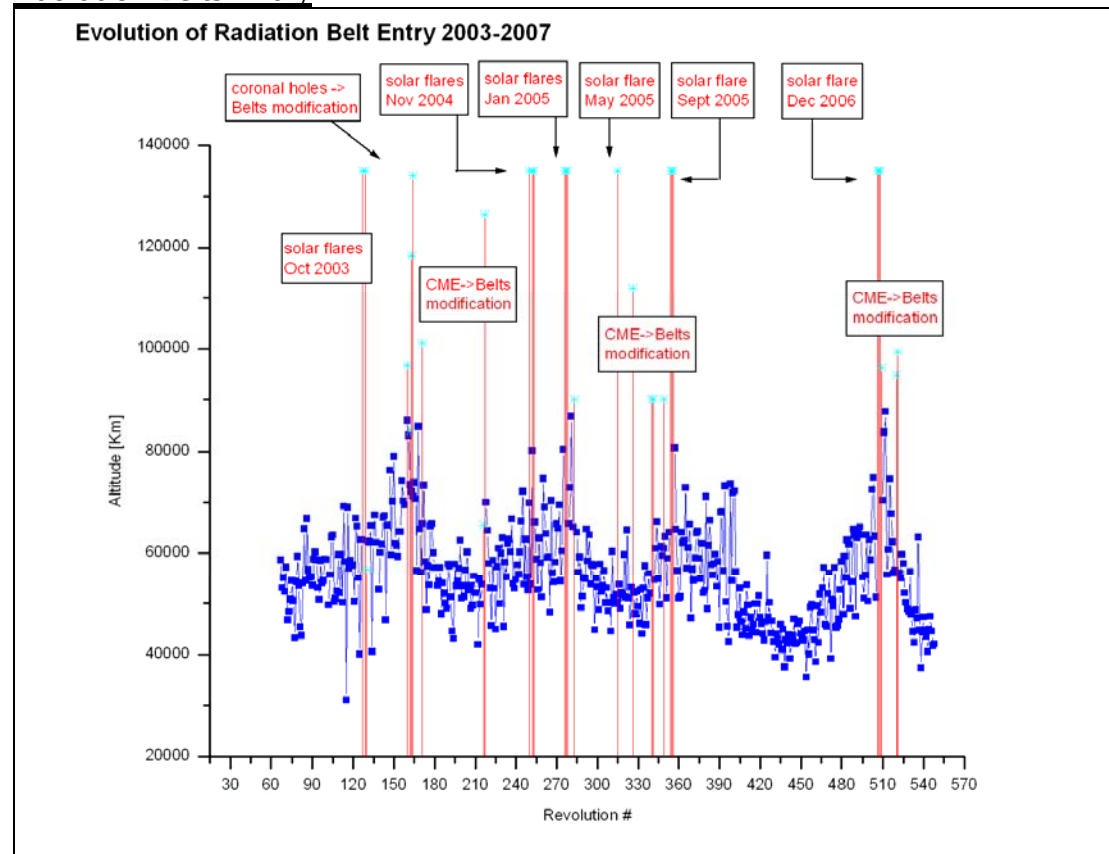
2007-04-13 (DOY 103, Rev 549)

Nothing to report.

On DoY 099 at 01:45:08 and DoY 102 at 01:34:04 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 2007.102 (12/04/2007):

At 11:48Z, a local reset of the IREM CSCI S/W (SEU #46) 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 2007.102.11.48.00Z at 53189.4km. 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 11:53Z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e the Checksum Failure flag shows YES. The unit was still reporting the status as if it was in Integral mode with counting ON, accumulation ON and checksum failure flag ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

6) A dump of all the registers gave a status word BC80 HEX = 48256 DEC = 1011110010000000, ie. the unit was still reporting the status as if it was in Integral mode but the Checksum Failure flag was this time OFF and the checksum counter in the register number 3 incremented by 1 unit.

7) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 13:58Z.

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 12:35Z, and OMC at 12:36Z.

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.

DoY 2007.099 (09/04/2007):

At 09:06Z, TC U4920 "INT GND LINK ON" was uplinked from the timeline but failed CEV due to a late update of the TM desktop. The execution of the command was nevertheless checked by the operator in AND U001, and no further action was required.

DoY 2007.102 (12/04/2007):

At 08:56Z, TC U4920 "INT GND LINK ON" was uplinked from the timeline but failed CEV due to a late update of the TM desktop. The execution of the command was nevertheless checked by the operator in AND U001, and no further action was required.

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]
547	RAD_ENTR R 2007-04-09T01:45:01Z	2007-04-09 03:30:59	41764.4	2007-04-09 02:45:03	47846
548	RAD_EXIT R 2007-04-09T11:03:49Z	2007-04-09 11:00:43	<47152.0	2007-04-09 10:45:03	42286
548	RAD_ENTR R 2007-04-12T01:34:00Z	2007-04-12 03:14:19	42104.9	2007-04-12 02:41:18	46990
549	RAD_EXIT R 2007-04-12T10:52:38Z	2007-04-12 13:30:27	>65308.7	2007-04-12 10:31:18	41667

Reference

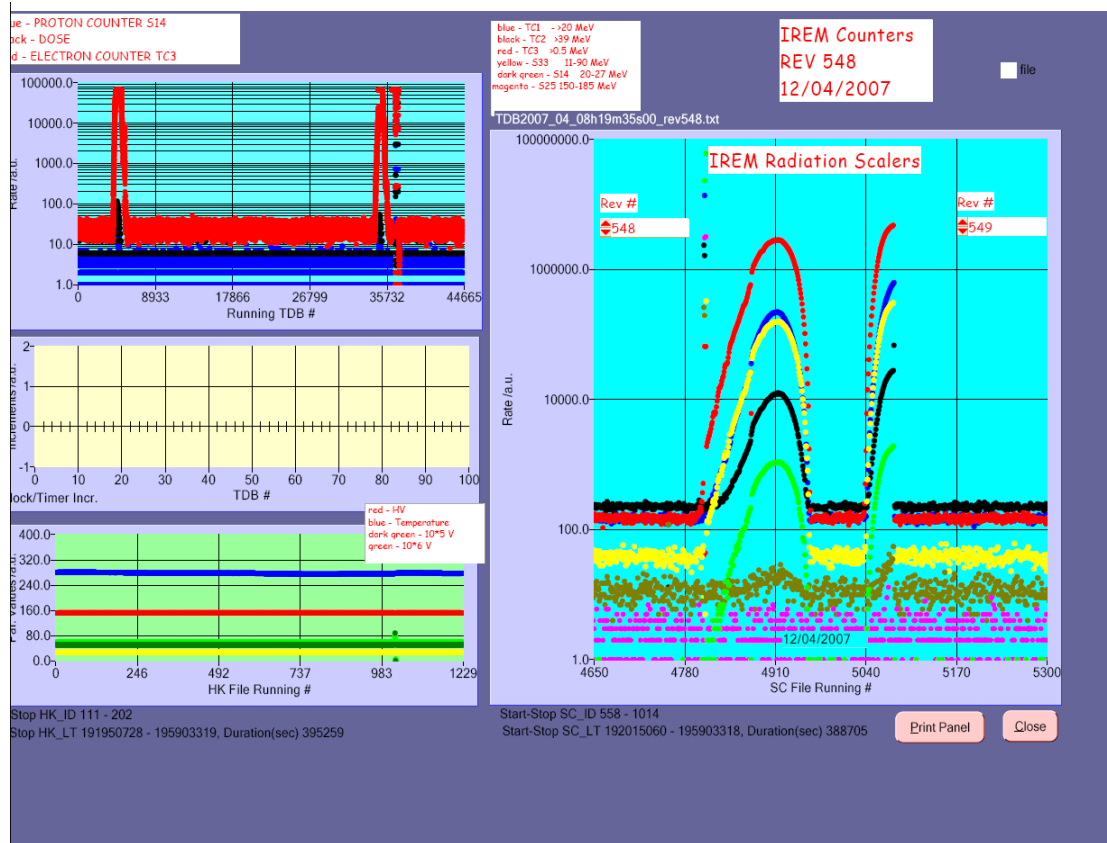
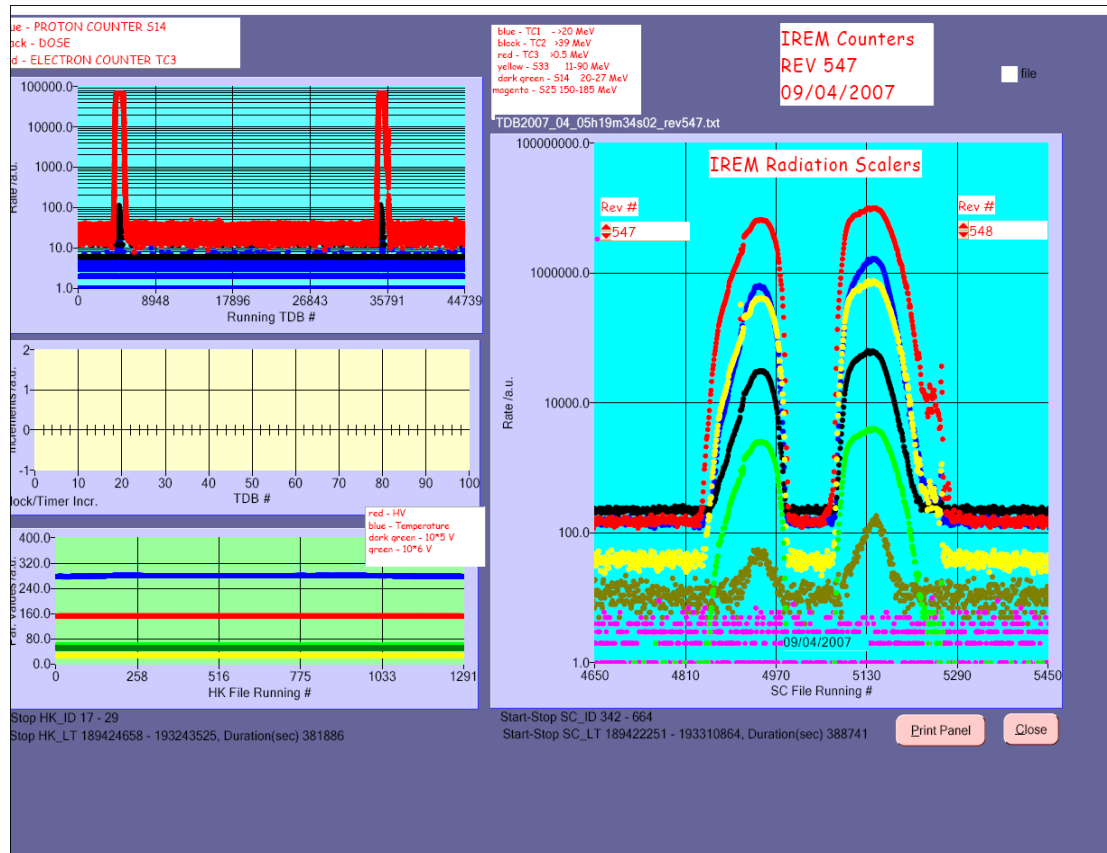
High radiation

Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

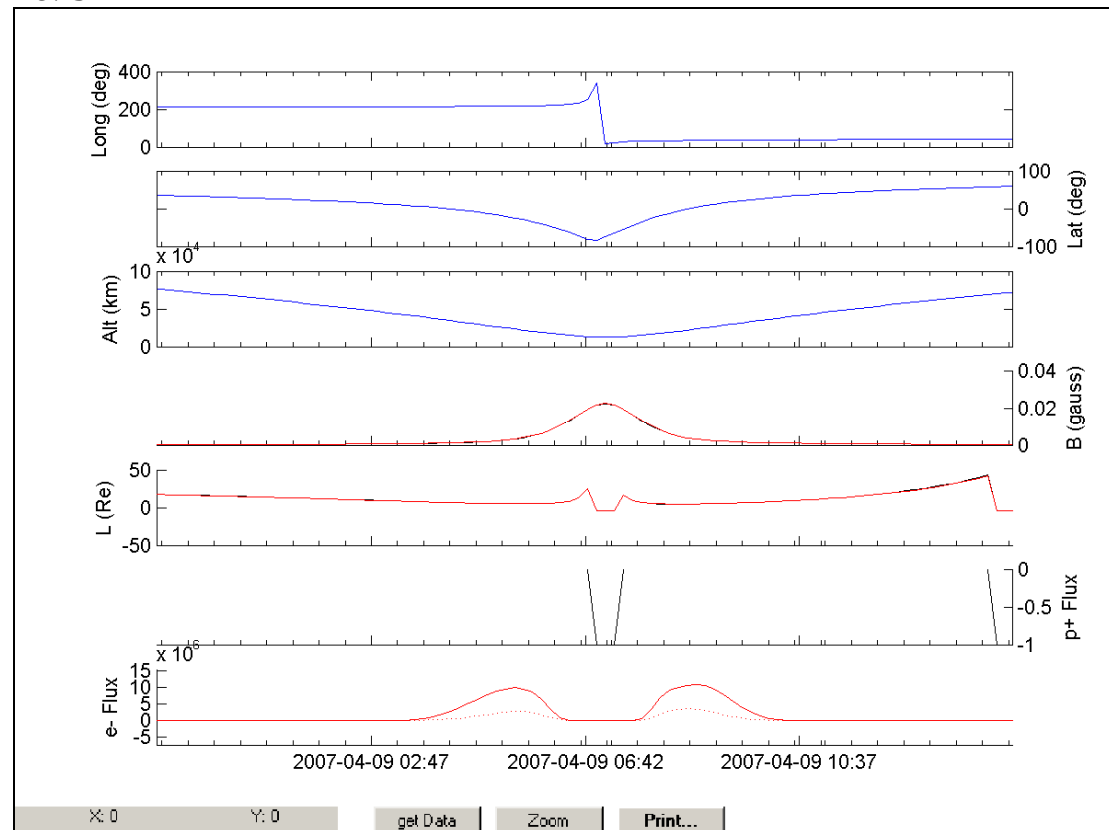
Large error vs reference (more than 30 minutes)

IREM radiation counters:

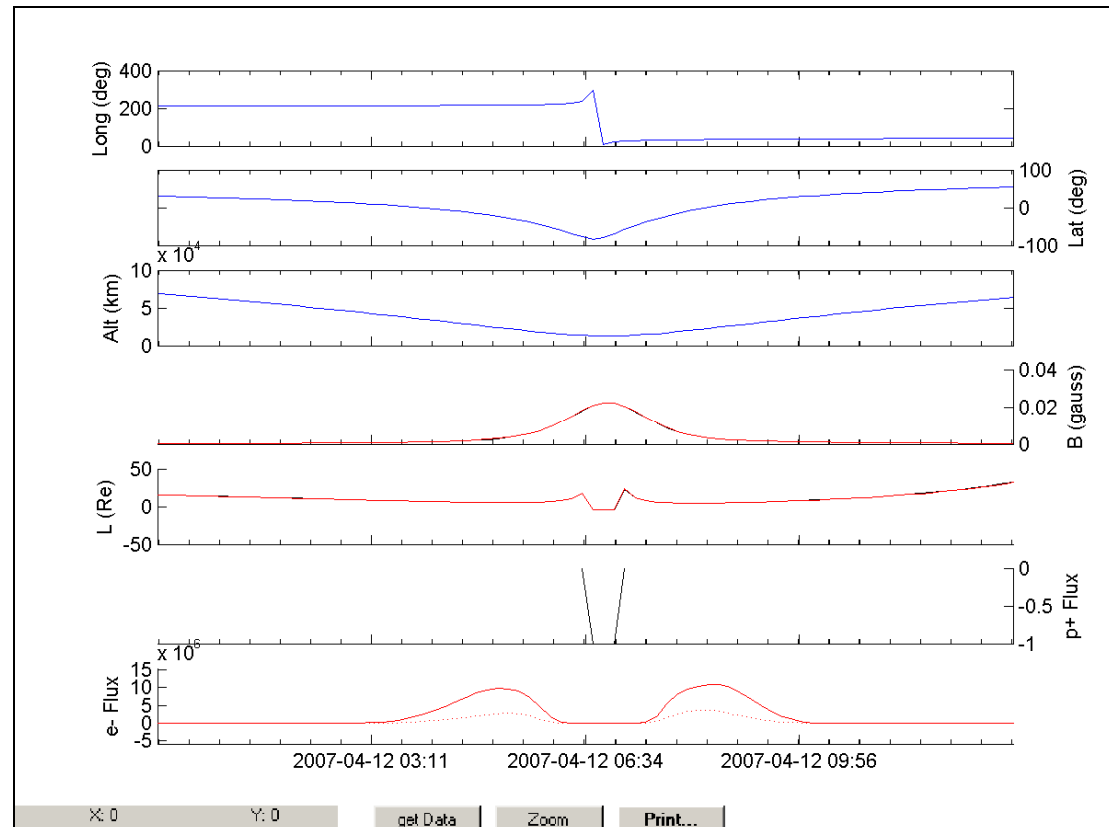


IREM Predicted Radiation Belt Passages

Rev 547



Rev 548



Doc. Title : INTEGRAL Mission Report #238
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 16/04/07

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Rev. : 0
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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