

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 215
Week 44
06.11.06
Routine Phase

Prepared by: M. Walker (OPS-OFO)

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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 28.10.06 until 03.11.06 (both dates inclusive) and covers the revolutions 494 and 495.

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 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 hexagonal dither of Ginga 1826-24 (RA 18:29:28.20, DEC -23:47:49.0), and a raster dither of the Region at l=0, b=-25 (RA 19:36:28.82, DEC -39:08:24.8).

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 second (29/10/2006) and third (01/11/2006) eclipse passages. The eclipse passages were nominal from an AOCS point of view.

As part of the AOCS preparation 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.

No slews were missed during the observation period.

The fuel consumption over the period between 27/10/2006 and 01/11/2006 was 0.1580 Kg. The remaining propellant is in the order of 150.1524 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.

SEU on BCRs:

On 29th October (DoY 302) at 09.24z, the following parameters changed status from ON (1) to OFF (0):

- P3004 BCR1 ON/OFF STATUS
- P3005 BCR2 ON/OFF STATUS

At the same time the battery charge current fell from its nominal value of 0.1A to 0.0A. As Integral is currently in eclipse season and the next eclipse was scheduled for the same day priority was given to restoring the correct BCR functionality (there was also a SPI problem at the same time - FEE HV #81). After checking the EPS status with the on-call SOE the SPACON switched the BCRs back on. BCR1 at 10.11z and BCR2 at 10.13z. Following this the battery trickle charge current returned to its nominal value of 0.1A for each battery.

For further details see INT-SC-163.

Eclipse Passage:

During the reporting period Integral passed through eclipses #2 (29/10/2006) and #3 (01/11/2006) of eclipse season #9, details are in the table below:

Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Total Duration	Umbra duration	Observed DOD B1	Observed DOD B2	Mean discharge Current in Umbra B1	Mean discharge Current in Umbra B2	Recharge Duration Battery1	Recharge Duration Battery2
19:28:20	19:30:02	20:10:57	20:13:04	00:44:44	00:40:55	4.05Ah	4.01Ah	5.81A	5.77A	2:24:58	2:23:49
19:16:38	19:18:01	20:10:19	20:12:07	00:55:29	00:52:18	5.05Ah	5.00Ah	5.62A	5.56A	3:02:03	3:00:03

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

During eclipse #3 the battery voltages were flagged as out of limits low. Investigation showed that at the time the battery temperatures were between +7 and +9degC, normally during eclipse battery temperatures are between -6 and +2degC. At these high temperatures (>+5degC) another limit set becomes applicable which has never been used before in eclipse, the values in this limit set are being reviewed and it is likely that they will be made less stringent.

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 8th annealing, which ended on 26th June, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was

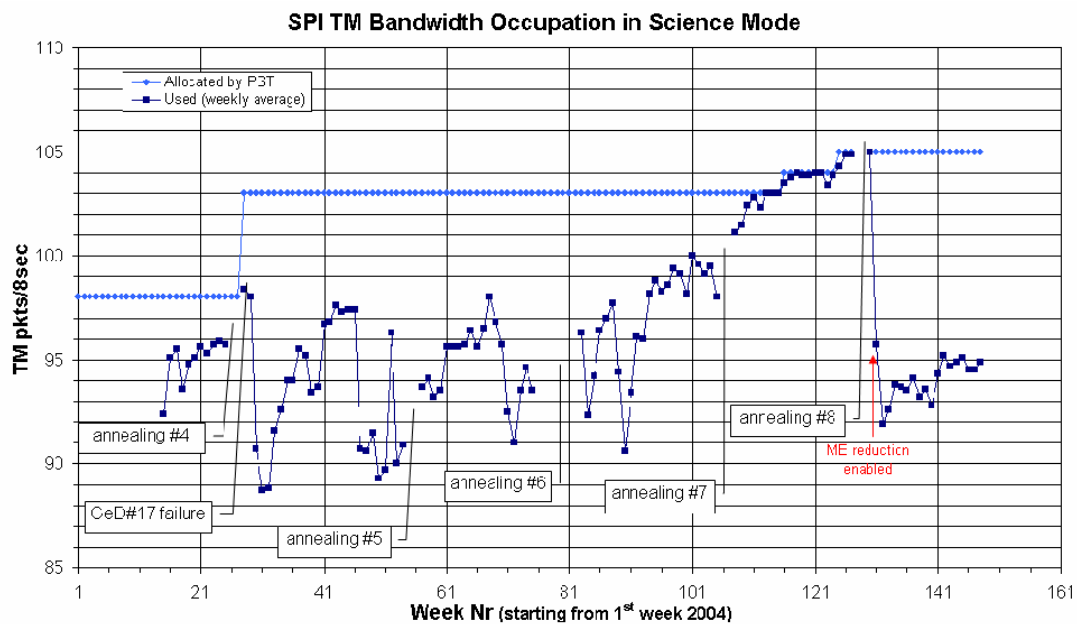
recovered with this annealing. Detector #2 is failed since 06.12.2003 and detector #17 since 17.07.2004.

The Stirling compressors are working nominally, maintaining the Germanium detectors at 80 +/-1K. On 2006-10-30 the RACP TCs associated to the On Board Monitoring entries for the CDE LCL currents were removed following agreement from Alenia.

On 2006-10-29 at 03:04Z an anomaly occurred on ACS FEE 81. As part of the recovery actions, three ACS resets were performed on 2006-10-29 and the HV of FEE 81 was reduced to the minimum value on 2006-10-31. Further details are provided in the ACS section of the SPI detailed report below (Section 8.3.2) and in Anomaly Report INT_SC-162.

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 allocation was 105 packets/cycle was 94.9 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

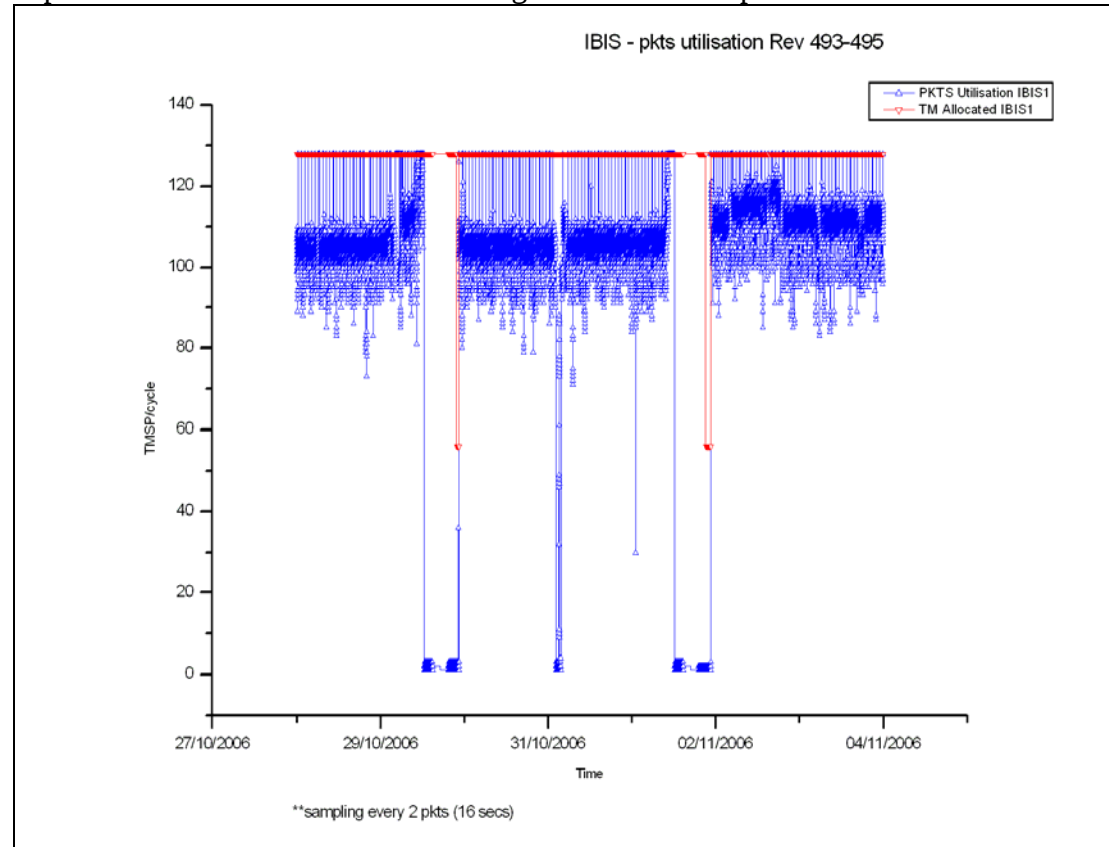
The overall status of the unit is nominal.

The Eclipse season started on 26/10/2006. From the unit point of view, the eclipse passages were nominal this week. However, on the 01/11/2006 at 20:29Z, the Event Designator GEVESP01 (VETO patch) failed. It was recovered by the operator following the guideline at 20:42Z.

On 31/10/2006 at 02:18Z, the 37th IREM SEU occurred. It forced IBIS into Stand-By mode. The unit was recovered by the operator, and IBIS was back into Scientific Standard mode at 03:54Z.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 108.46 TMPS/cycle, down 1.61 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.

JEM-X1 made two autonomous transitions to Safe mode, triggered by the Software Ratemeter, during the reporting period. These were ~20 minutes before the planned transition to Safe mode before radiation belt entry of revolutions 493 and 494.

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.

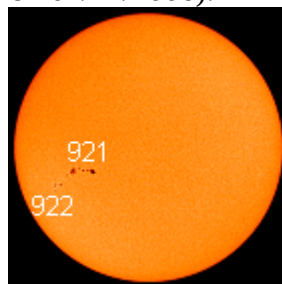
On 31/10/2006, at 02:18Z, the IREM CSCI SW reset #37 occurred during the science observations of revolution 494, which were interrupted as a result for IBIS and OMC (see INT_SC-164). For the first time this reset was not due to a Checksum Failure but a Watchdog Elapsed.

Solar Activity

The observation period was characterised by low solar activity.

At the beginning of the observation period, 2 small sunspots (919 and 920) were reported. They posed no threat for strong solar flares.

From 30/10/2006 until the end of the week, fast growing sunspot 921 posed threat for M-class solar flares (see picture on 02/11/2006).



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 excellent this week. No slews were lost, and no science lost to ground problems. The overall performance was nearly 100%.

4.1 Mission Operations Centre

The performance of the MOC was good this week. The main problem reported was the TC History task crashing. The overall performance was nearly 100%.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There was, however, a hit on the line, a drop on the line, three bad frames and Reed Solomon errors, all from Redu, none of which had any impact. The overall performance was nearly 100%.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs have been received up to revolution 502. Observations have been planned up to revolution 500. The following revolutions will be planned once the star-tracker and inertia calibrations have been settled.

TSF's up to revolution 497 have been received.

2. Observation status

ECS have been received up to revolution 485. Processing has been done up to revolution 483, further processing is waiting for ISDC.

3. ISOC Science Data Archive

The INTEGRAL Visualisation Tool has been integrated into ISDA V2.6 beta 2

A beta version of the statistics tool has been released.

The hardware problem with archive files system has been solved, enlargement of disk space can now proceed.

4. ISOC system

Version 13.1.1 is being used. Work is continuing on version 14.0, which will be released after the end of the Key Programme special AO.

The Oracle DB is being updated to the latest patch version 9.2.0.8.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 06/11/2006:

- Latest Standard Analysis completed: observation 04200010010 (Galactic Bulge region, Revolution 478) on 21/10/2006.

- Latest products archived: observation 04200010010 (Galactic Bulge region, Revolution 478) on 22/10/2006.

- Latest observation products sent to the observer: observation 04200010010 (Galactic Bulge region, Revolution 478) on 22/10/2006.

5 Special Events

6 Anomalies

The following problems that impacted operations were reported:

- On DoY 304, at 02:18, an IREM SEU (#37) caused OMC & IBIS to switch to SAFE mode. A recovery was performed, and completed at 03:54. The impact was an interruption of pointing 04940030, and the loss of pointings 04940031 & 04940032 for those two instruments.

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

AR id	Date Created	Subject	Segment	Status
INT-2892	2006-11-07	Dynamic default parameters late update	IMCS	Open
INT_SC-162	2006-10-30	SPI FEE HV status #81 Out of Specification	Payload	Pending
INT_SC-163	2006-10-30	BCR1 and 2 switch-off	Spacecraft	Pending
INT_SC-164	2006-11-01	IREM Anomaly: Reset of IREM_CSCI S/W #37, 31/10/2006	Payload	Open

7 Future Milestones

The current eclipse season started on 26/10/2006, it consists of 8 eclipses. The maximum duration will be just over one hour on 7th November.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 494

The observations in revolution 494 consisted entirely of a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9), lasting ~58.3 hours.

Revolution 495

The observations in revolution 495 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. It continued with another hexagonal dither, this time of Ginga 1826-24 (RA 18:29:28.20, DEC -23:47:49.0), lasting ~13.9 hours. Finally, a raster dither of the Region at l=0, b=-25 (RA 19:36:28.82, DEC -39:08:24.8), lasting ~37.3 hours, was performed, until the end of the revolution.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2, which is switched off. The TM allocation was IBIS 128; SPI 105; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-10-17T20:57:48.000Z	150.8080	F	Automatic TM processing.
2006-10-20T12:44:10.000Z	150.7216	F	Automatic TM processing.
2006-10-20T20:43:23.000Z	150.6586	F	Automatic TM processing.
2006-10-23T12:59:07.000Z	150.5763	F	Automatic TM processing.
2006-10-23T15:00:35.000Z	150.5118	F	Automatic TM processing.
2006-10-23T20:43:56.000Z	150.4821	F	Automatic TM processing.
2006-10-25T06:07:03.000Z	150.4710	F	Automatic TM processing.
2006-10-26T12:47:23.000Z	150.3839	F	Automatic TM processing.
2006-10-26T14:45:47.000Z	150.3104	F	Automatic TM processing.
2006-10-28T06:18:39.000Z	150.2962	F	Automatic TM processing.
2006-10-29T04:24:57.000Z	150.2592	F	Automatic TM processing.
2006-10-29T12:17:06.000Z	150.2379	F	Automatic TM processing.
2006-10-29T20:59:15.000Z	150.2189	F	Automatic TM processing.
2006-11-01T12:55:14.000Z	150.2028	F	Automatic TM processing.
2006-11-01T20:57:39.000Z	150.1524	F	Automatic TM processing.

This report was generated Fri Nov 3 08:00:51 GMT 2006

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, 28/10/2006 – 03/11/2006

AOCs operations were executed from the Automatic Timeline.

During this period, 75 Open Loop Slews, 87 Closed Loop Slews and 6 Momentum Biases were executed.

No slews were missed during the observation period.

The AOCS eclipse operations were nominal. 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:

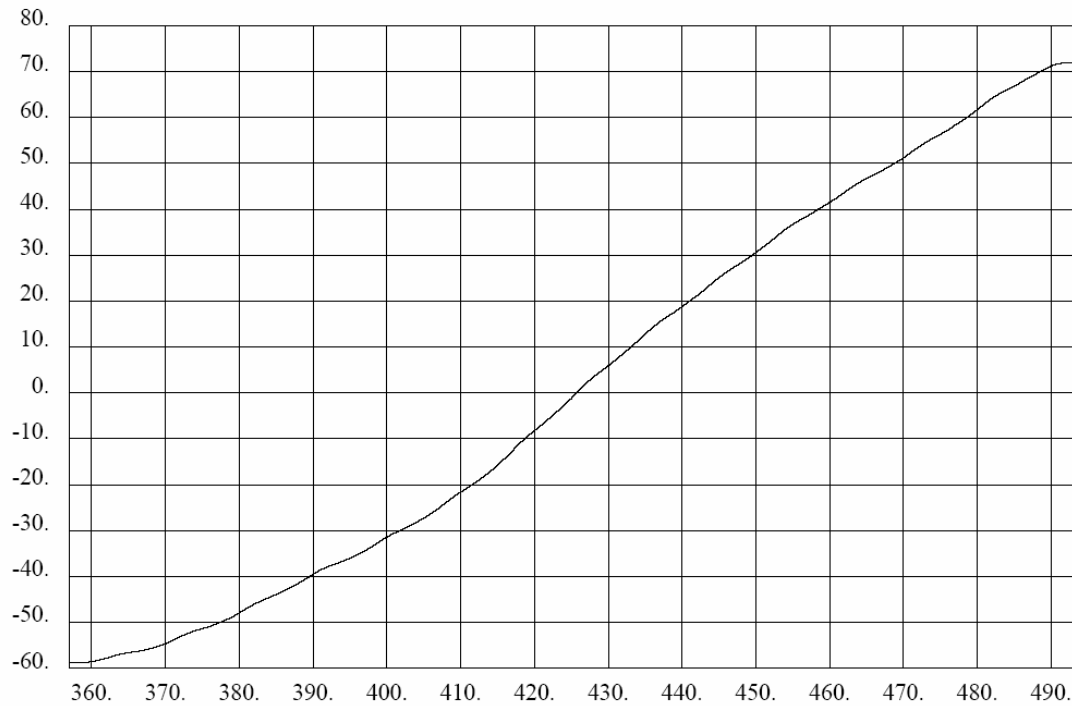
AOCS Eclipse Times															Summer 2006	
Date	LOS	AOS	ACC Eclipse Imminent	Eclipse Start						Eclipse End						Eclipse Duration
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE	ACC		
2006-10-26	15:14:26	19:36:00	18:45:14	19:25:54	19:35:23	19:36:07	19:44:54	19:47:25	19:48:05	20:07:25	20:08:18	20:10:59	20:14:27	20:19:21	0:26:05	
2006-10-29	15:02:00	19:25:00	18:28:40	19:10:41	19:19:53	19:20:37	19:28:20	19:30:22	19:30:02	20:10:57	20:12:01	20:13:04	20:17:17	20:22:47	0:44:44	
2006-11-01	14:54:00	19:14:00	18:16:58	18:58:59	19:08:09	19:08:53	19:16:38	19:19:12	19:18:01	20:10:19	20:12:00	20:12:07	20:16:33	20:21:50	0:55:29	

IMU Usage during Eclipse Season						Summer 2006
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]		
2006-10-26 12:00:41	2006-10-26 20:21:37	0.2423	0.2417	0.2313	8:20:56	8:20:56
2006-10-29 11:39:32	2006-10-29 20:25:04	0.2136	0.2138	0.2370	8:45:32	17:06:28
2006-11-01 12:15:34	2006-11-01 20:24:06	0.1956	0.2434	0.2549	8:08:32	25:15:00

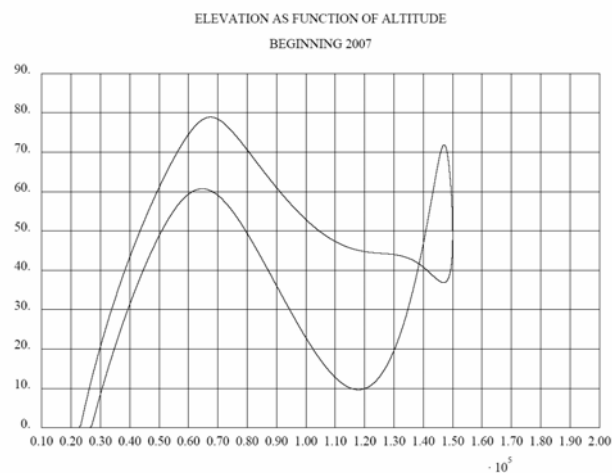
Orbit Control

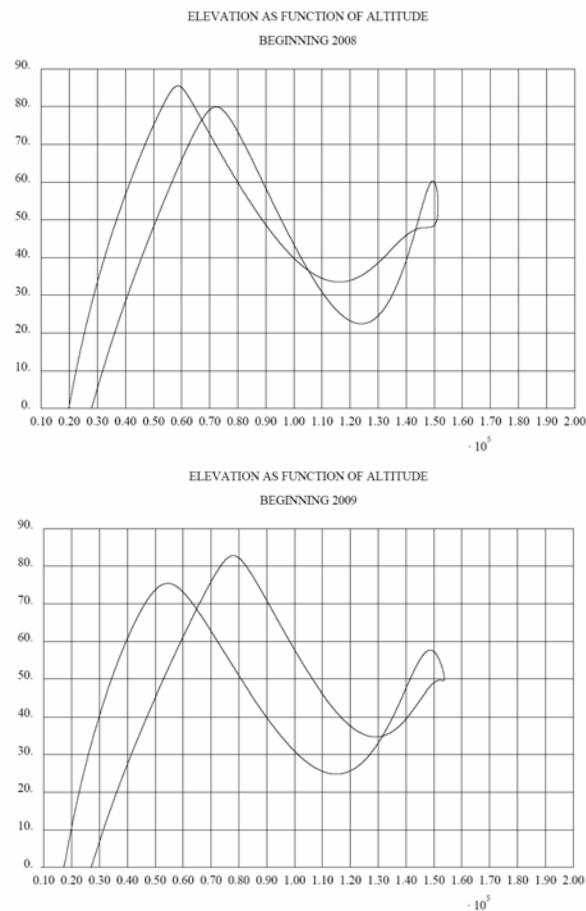
The attached plot shows the apogee longitude of Integral as a function of the orbit. The attached plot shows the apogee longitude of Integral (in deg East) as a function of the orbit number for the period September 2005 - October 2006. At present time the drift rate is close to zero and there is REDU coverage starting 1h53m before ascending through altitude 40000 km after a perigee passage and ending 51m after descending through altitude 40000 km before a perigee passage.

APOGEE LONGITUDES OF INTEGRAL 16.9.2005 - 31.10.2006



The target is to maximise the coverage, before ascending through 40000 km altitude, after a perigee passage, subject to the constraint of having 1 hour of coverage, after having descended through altitude 40000 km, before a perigee passage. The resulting coverage (elevation in deg as a function of the altitude in km) is displayed in the following 3 plots:





With 1 hour coverage after having descended through altitude 40000 km the coverage before ascending through 40000 km altitude will be:

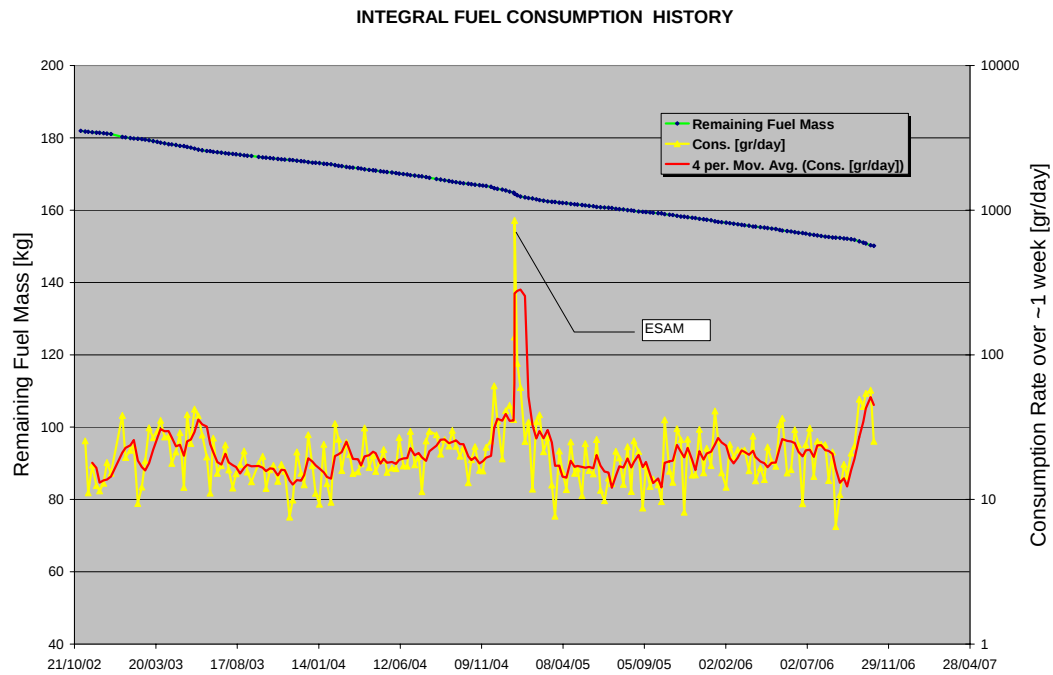
	Coverage before ascending through altitude 40000 km
Beginning 2007	1h45m
Beginning 2008	1h54m
Beginning 2009	1h59m

There is therefore no need for a second ground station.

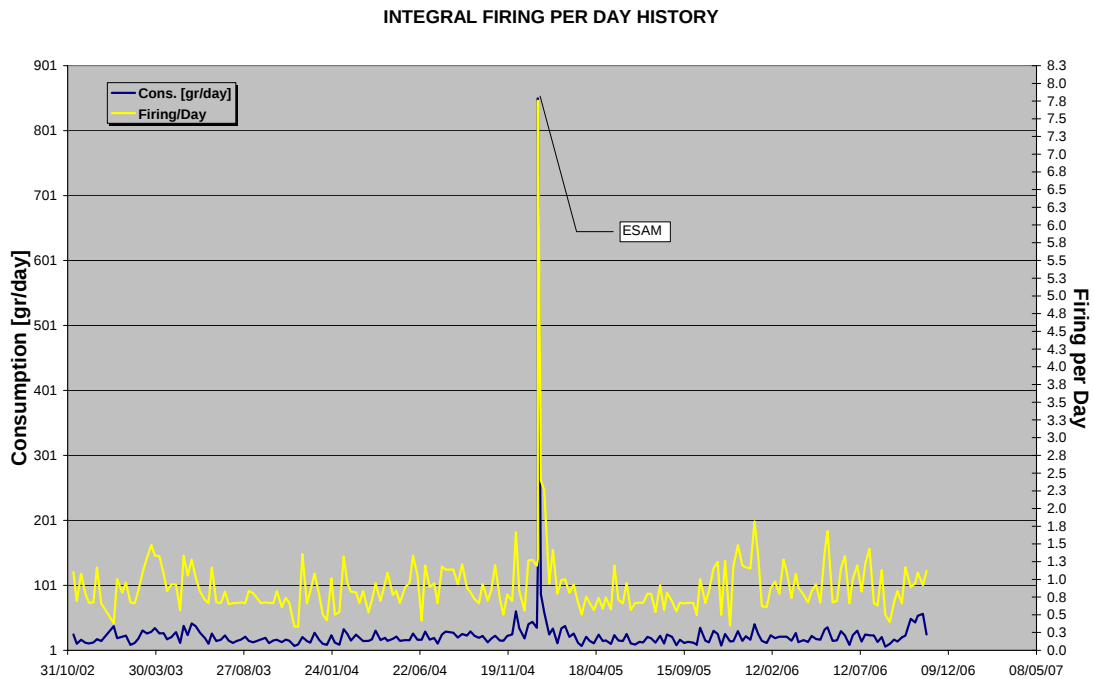
Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 01/11/2006 is reported in the plot below.

The large fuel consumption observed in the last weeks is due to the combination of the new strategy to perform artificial large momentum dump manoeuvres when the pointing is suitable for orbit control and the starting of the eclipse season.

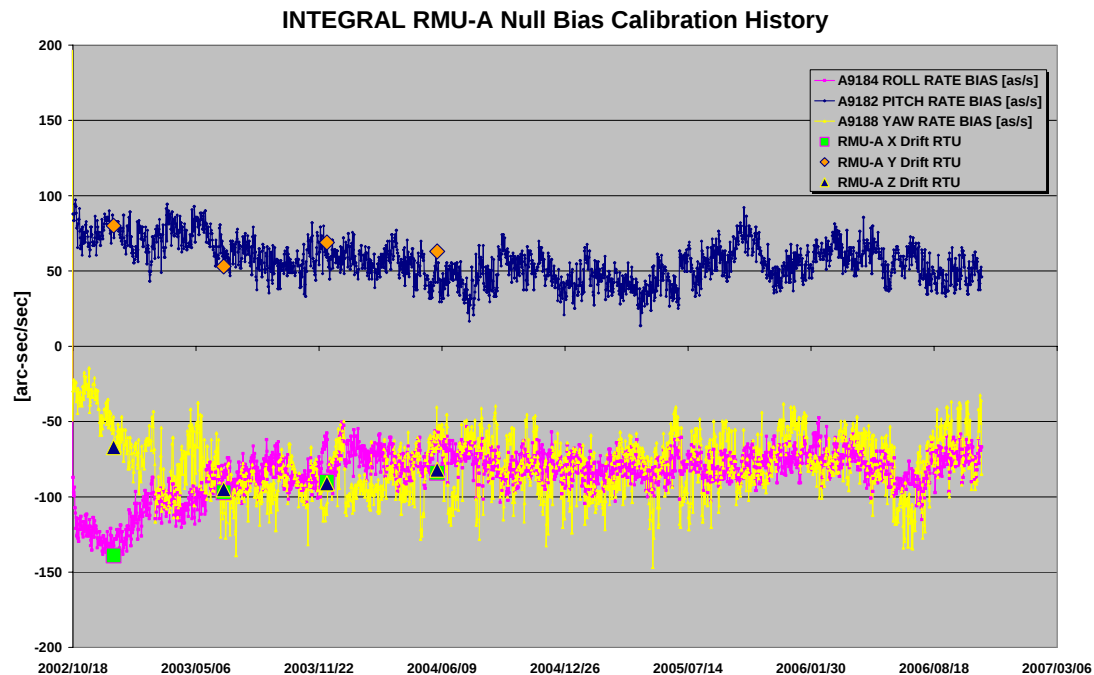


The firing\day over the period between 01/11/2002 and 01/11/2006 is reported in the plot below.

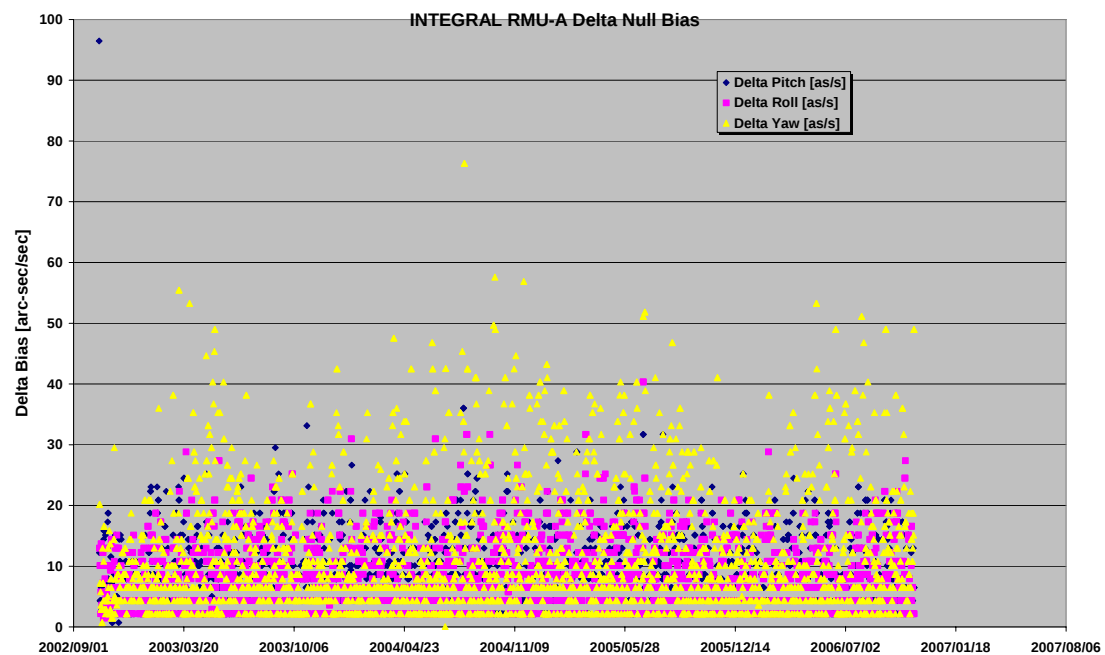


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 03/11/2006 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 03/11/2006 is reported in the plot below



28/10/06 (Day of Year 301, Revolution 493)

Nothing to report.

29/10/06 (Day of Year 302, Revolution 493-494)

The eclipse operations were nominal from the AOCS point of view. A summary of the second eclipse passage during rev 494 is given below:

Doc. Title : INTEGRAL Mission Report #215
 Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
 Date : 06/11/06

Issue : 1
 Rev. : 0
 Page : 16

AOCS ECLIPSE MONITORING

Winter 2006

Revolution: 494

Date: 29/10/2006

DoY: 302

Penumbra Start: 29/10/2006 19:28:20

Umbra Start: 29/10/2006 19:30:02

Umbra End: 29/10/2006 20:10:57

Penumbra End: 29/10/2006 20:13:04

Eclipse Duration: 0:44:44

Eclipse Duration [sec]: 2684

IMU Health Check Start 29/10/2006 11:56:00

Eclipse Imminent Flag 29/10/2006 18:28:40

ACC IMU AutoCal Start 29/10/2006 18:43:06

ACC IMU AutoCal End 29/10/2006 19:03:06

Sun out of FSS FoV 29/10/2006 19:30:22

Sun back in FSS FoV 29/10/2006 20:12:01

Eclipse Timers

Absolute

WRT Pen. Start [sec]

Absolute

WRT Pen. Start [sec]

UM [sec]

LSB [sec]

ACC Eclipse Start

29/10/2006 19:10:41

-1059.00

29/10/2006 19:10:44

-1056.00

-1064

176

FDE Eclipse Start

29/10/2006 19:19:53

-507.00

-404

176

FCE Eclipse Start

29/10/2006 19:20:37

-463.00

-360

176

Absolute

WRT Pen. End [sec]

Absolute

WRT Pen. End [sec]

UM [sec]

LSB [sec]

FCE Eclipse End

29/10/2006 20:17:17

253

29/10/2006 20:19:21

377.00

360

176

FDE Eclipse End

29/10/2006 20:17:17

253

29/10/2006 20:19:13

369.00

360

176

ACC Eclipse End

29/10/2006 20:22:47

583

29/10/2006 20:22:50

586.00

578

IMU

Uplink

Execution

WRT Penumbra End [sec]

IMU Auto Off Enable

26/10/2006 20:37:52

29/10/2006 20:24:43

699

IMU On

29/10/2006 11:39:32

IMU H/C Noise Roll [as/s]

0.2136

IMU Off

29/10/2006 20:25:04

IMU H/C Drift Roll [as/s]

0.2138

IMU On Time

8:45:32

IMU Auto Cal Drift Roll [as/s]

0.2370

30/10/06 (Day of Year 303, Revolution 494)

Nothing to report.

31/10/06 (Day of Year 304, Revolution 494)

FDS failed update: at 10:49z the update of slew ID 04940040 failed.

FDS reported an error during the update process: the only suitable guide star for the execution of the next CSL was excluded since it would have passed around a blemish pixel. This caused the CSL update to fail. The AOCS was disabled in TL at 11:03z.

Under the supervision of the FD on call , was decided to let the next slew running without update (i.e. using the original slew parameters in TL) by considering that the error in attitude was ~ 1 CCD pixel = 40 arcsec

Reached Attitude ID 04940039

RA= 05:45:27

DEC= -28:40:46

POS= 123:55:02

Planned Attitude ID 04940039

RA= 05:45:26

DEC= -28:40:59

POS= 123:55:28

with the planned S/T star was well inside the STR FOV.

No further corrections were requested and the AOCS was enabled in TL at 11:13z.

Doc. Title : INTEGRAL Mission Report #215
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 06/11/06

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No impact on TL.

01/11/06 (Day of Year 305, Revolution 494-495)

The eclipse operations were nominal from the AOCS point of view. Hereafter is reported summary of the second eclipse passage during rev 495:

AOCS ECLIPSE MONITORING

Winter 2006

Revolution: 495

Date: 01/11/2006

DoY: 305

Penumbra Start: 01/11/2006 19:16:38

Umbra Start: 01/11/2006 19:18:01

Umbra End: 01/11/2006 20:10:19

Penumbra End: 01/11/2006 20:12:07

Eclipse Duration: 0:55:29

Eclipse Duration [sec]: 3329

IMU Health Check Start 01/11/2006 11:47:20

Eclipse Imminent Flag 01/11/2006 18:16:58

ACC IMU AutoCal Start 01/11/2006 18:31:24

ACC IMU AutoCal End 01/11/2006 18:51:24

Sun out of FSS FoV 01/11/2006 19:19:12

Sun back in FSS FoV 01/11/2006 20:12:00

Eclipse Timers

From Loaded Timers

Absolute

WRT Pen. Start [sec]

Actual From Telemetry

Absolute

WRT Pen. Start [sec]

UM [sec]

LSB [sec]

ACC Eclipse Start

01/11/2006 18:58:59

-1059.00

01/11/2006 18:59:02

-1056.00

-1064

FDE Eclipse Start

01/11/2006 19:08:09

-509.00

-404

176

FCE Eclipse Start

01/11/2006 19:08:53

-465.00

-360

176

From Loaded Timers

Absolute

WRT Pen. End [sec]

Actual From Telemetry

Absolute

WRT Pen. End [sec]

UM [sec]

LSB [sec]

FCE Eclipse End

01/11/2006 20:16:33

266

01/11/2006 20:18:33

386.00

360

176

FDE Eclipse End

01/11/2006 20:16:33

266

01/11/2006 20:18:33

386.00

360

176

ACC Eclipse End

01/11/2006 20:21:50

583

01/11/2006 20:21:53

586.00

578

IMU

Uplink

Execution

WRT Penumbra End [sec]

IMU Auto Off Enable

29/10/2006 20:40:27

01/11/2006 20:23:46

699

IMU On

01/11/2006 12:15:34

IMU H/C Noise Roll [as/s]

0.1956

IMU Off

01/11/2006 20:24:06

IMU H/C Drift Roll [as/s]

0.2434

IMU On Time

8:08:32

IMU Auto Cal Drift Roll [as/s]

0.2549

02/10/06 (Day of Year 306, Revolution 495)

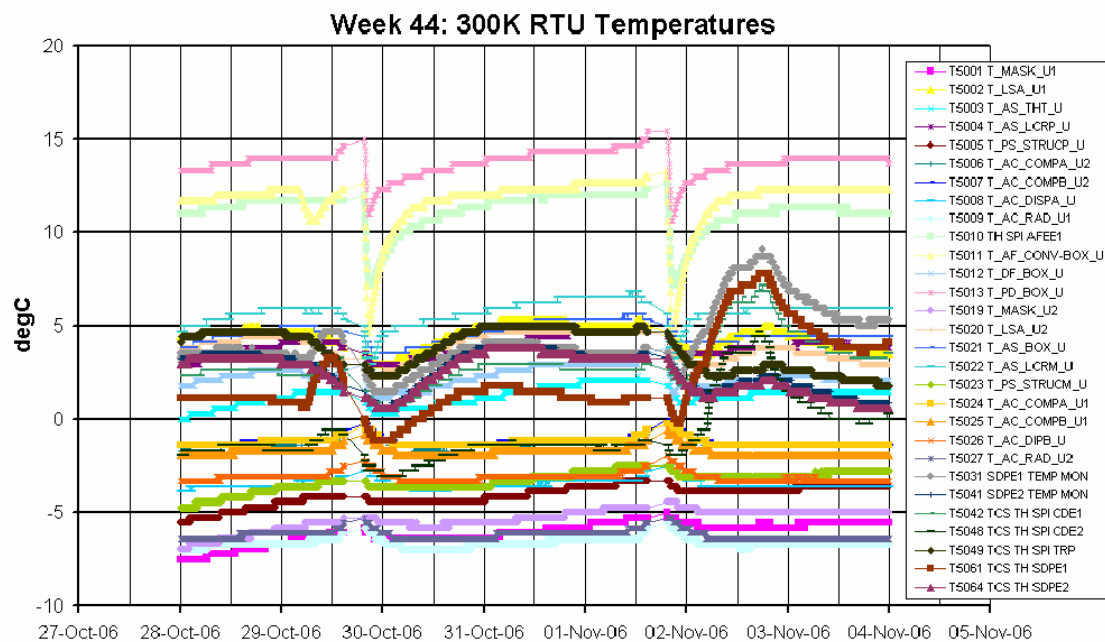
Nothing to report.

03/11/06 (Day of Year 307, Revolution 495)

Nothing to report.

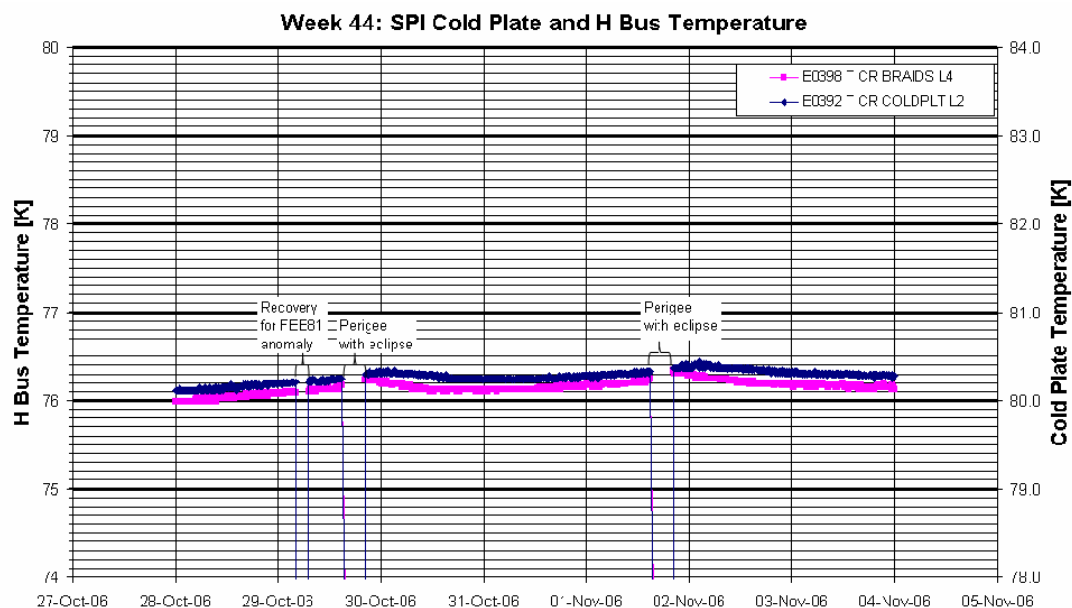
8.3.2 SPI Operations

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 to 80K +/-1K with a variable drift (see plot below).

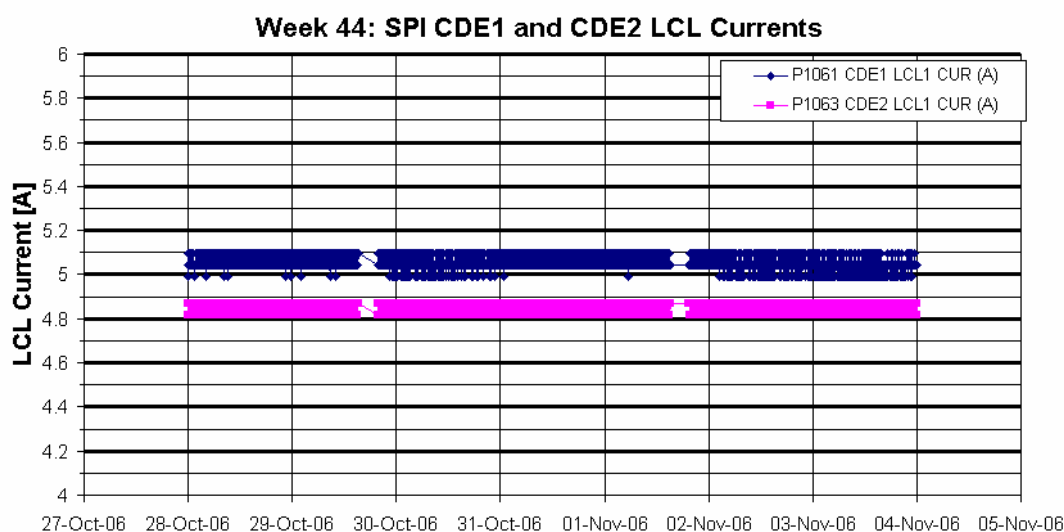
The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.



The stroke of all four compressors is currently set to 41. The average LCL currents of the CDEs over the week were:

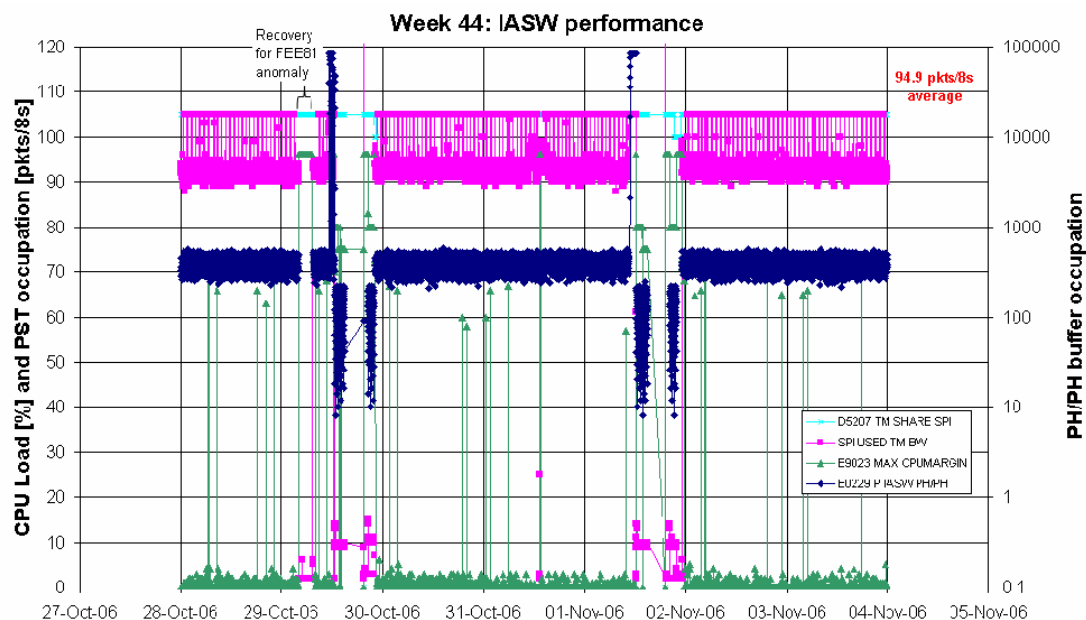
- Average CDE1 LCL Current = 5.05A
- Average CDE2 LCL Current = 4.85A

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



On 2006-10-30 the RACP TCs associated to the On Board Monitoring entries for the CDE LCL currents were removed following agreement from Alenia. Therefore, if the CDE LCL currents exceed the threshold in the future, an OEM will be received for the triggering of the OBM but no RACP TCs will be sent to open the CDE LCLs.

DPE & IASW: The DPE health and IASW performance is nominal. The current IASW version installed is 432. The average TM bandwidth occupation of SPI was 94.9 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, for which the HV status (TM parameter E3277) went OOL 'PARAM<SPEC' on 2006-10-29 at 03:04Z. To recover the anomaly, three ACS resets were executed as follows:

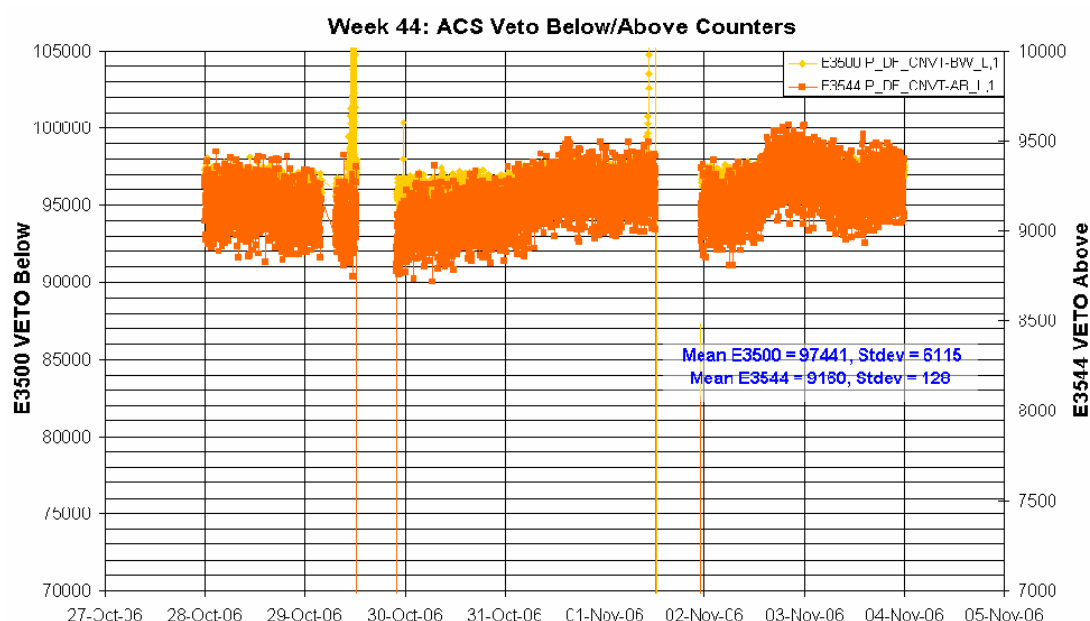
- From 03:57:17Z to 04:31:22Z and from 05:32:15Z to 06:01:06Z via ECP7.
- From 06:34:40Z to 07:26:23Z via the sequence of procedures FCP_SPI1_0160; CRP_SPI1_3070; EEORTM01 and FCP_SPI1_0130.

This cleared the OOL temporarily however it continued to re-appear periodically.

On 2006-10-31 it was decided to reduce the HV to the minimum possible (980V) in an attempt to preserve the FEE81 high voltage chains as the out of range could indicate an HV power supply problem. This was executed in line with INT_OR_0270 on 2006-10-31. SPI was put in CONF mode at 13:18:43Z and returned to Photon mode at 13:34:26Z. Despite the reduction, the count rate remained unstable and the HV still indicated out-of-range below 870V occasionally for the remainder of the reporting period.

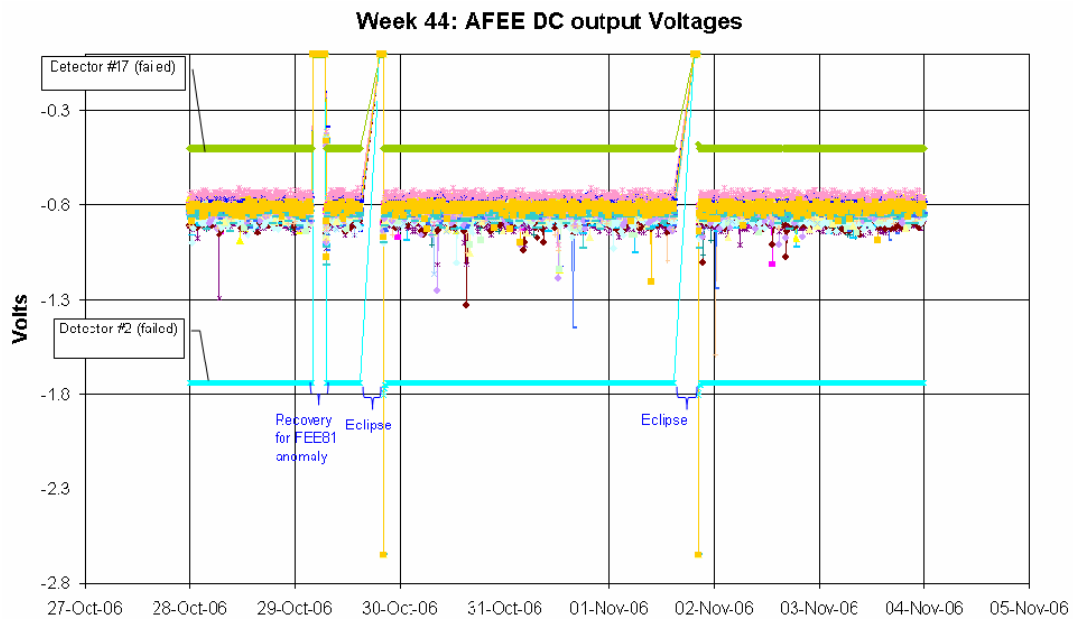
Further investigation revealed that the FEE 81 had been showing anomalous behaviour since 2006-10-26 at around 03:00Z, with an unexpected drop in the count rate and HV, although no OOL was flagged at this time. This anomaly is recorded as INT_SC-162 and further investigations are ongoing.

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

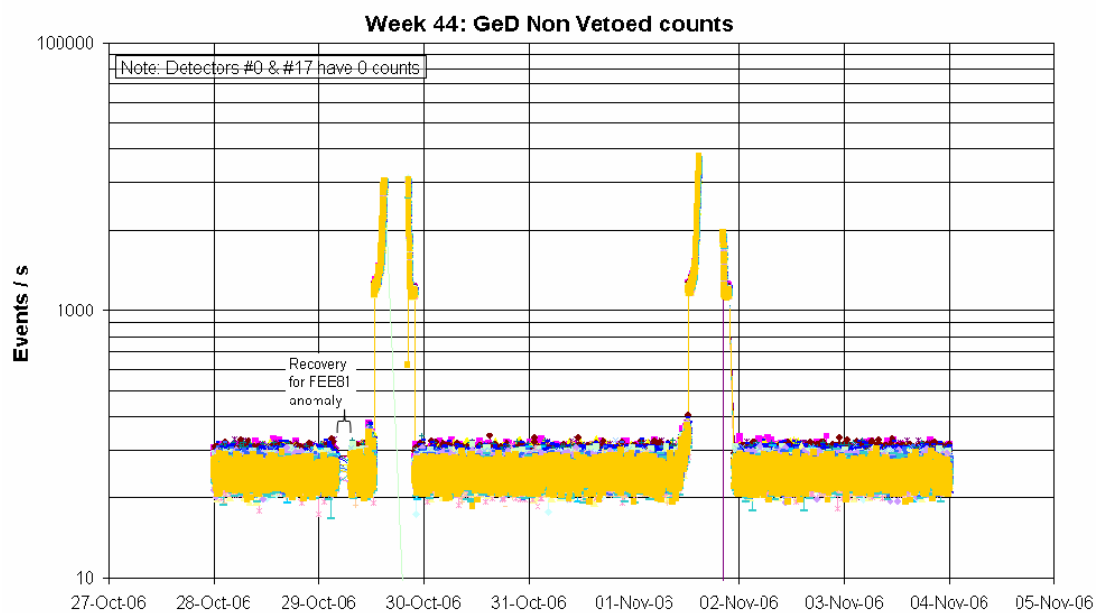


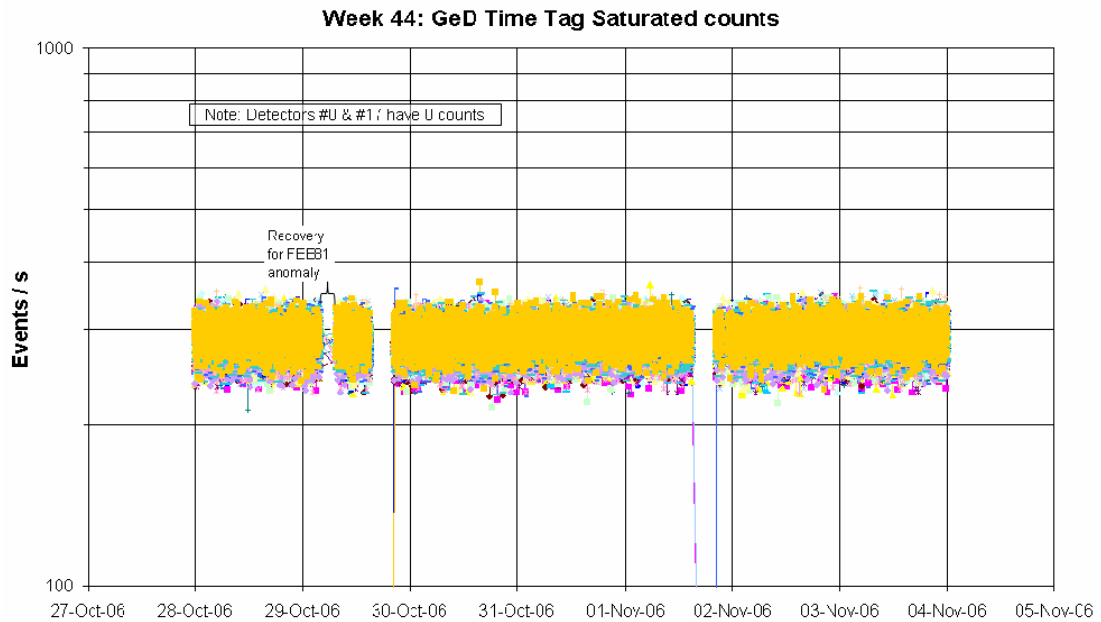
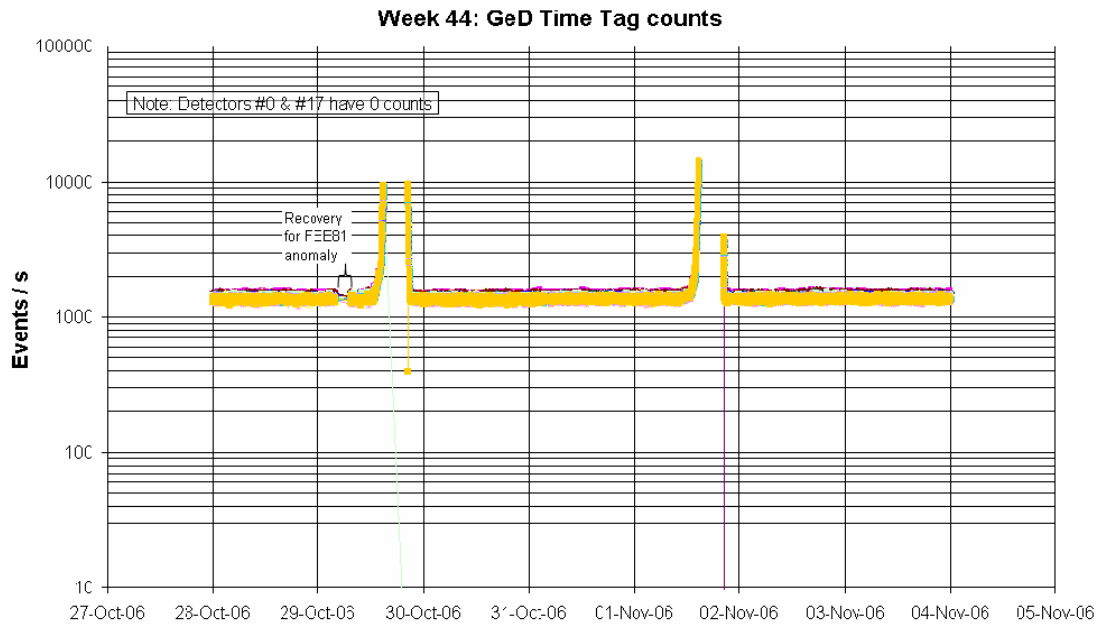
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with the last annealing.

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

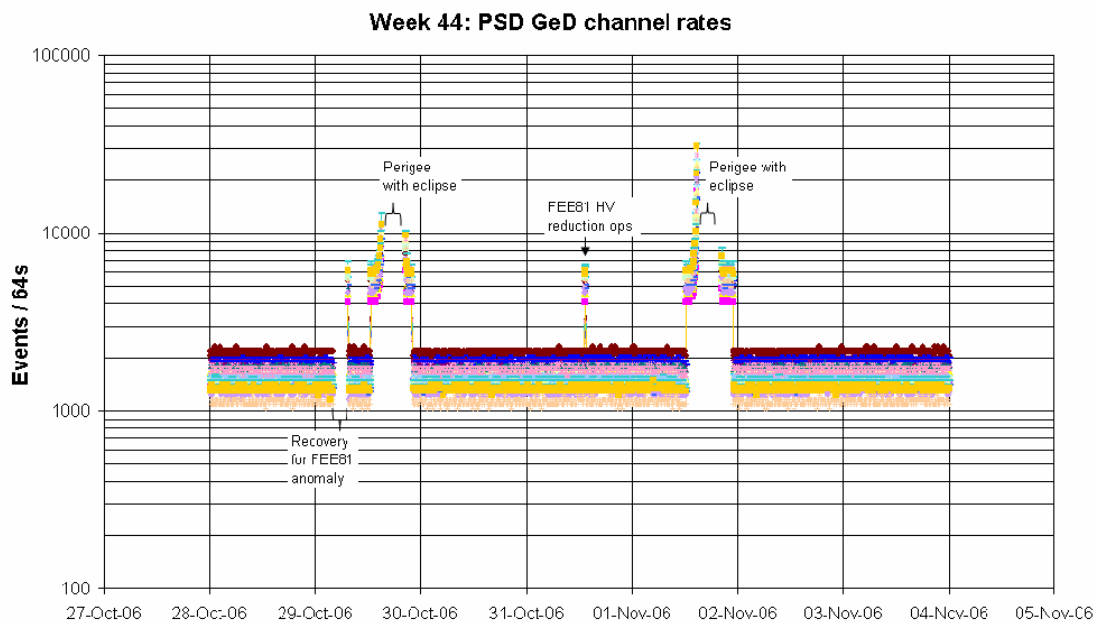


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.





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



Event Log:

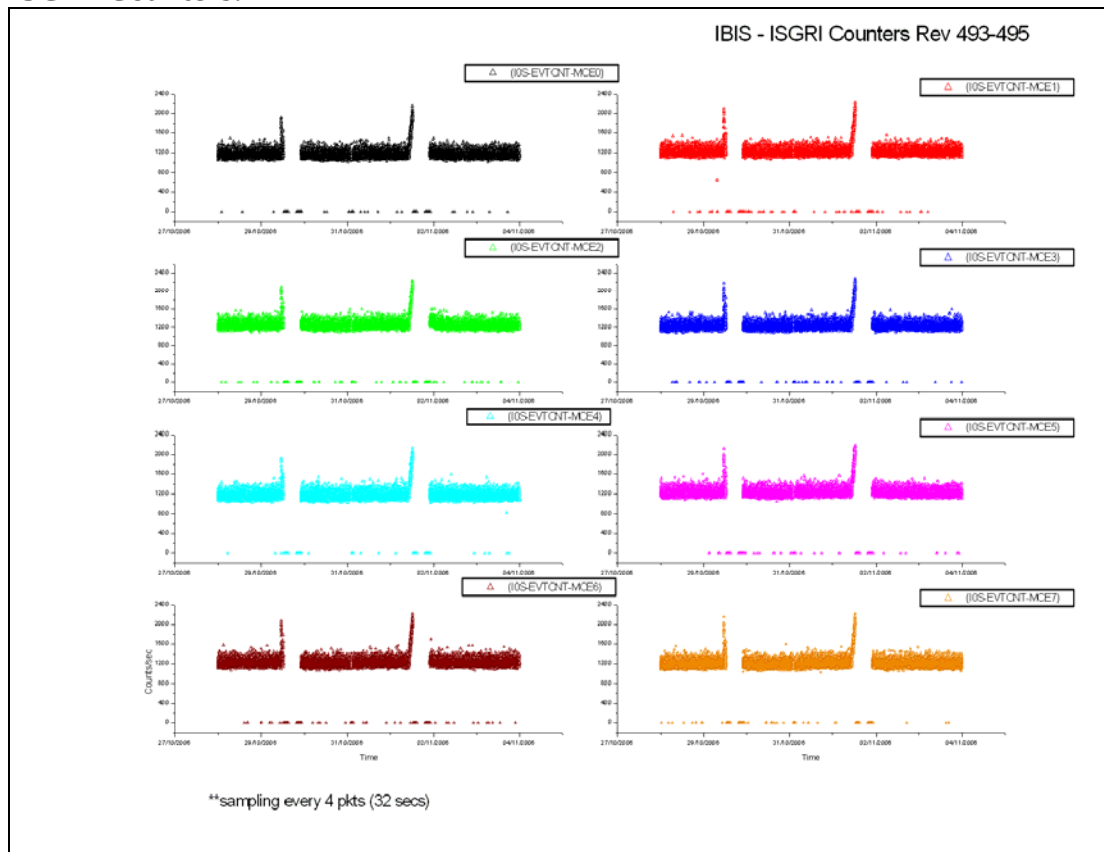
The following non-nominal events occurred on SPI during the reporting period:

- On 2006-10-29 at 11:25Z the TM parameter E3500 P_DF_CNVT-BW_L starting going OOL High. This was ~1 hour before radiation belt entry of revolution 493 and therefore no action was taken.
- On 2006-11-01 at 10:42Z the TM parameter E3500 P_DF_CNVT-BW_L starting going OOL High. This was ~1.5 hours before radiation belt entry of revolution 494 and therefore no action was taken.
- On 2006-11-01 at 21:52:01Z TC EU0201D of the ED EEXIT-02 failed release as the dynamic PTV failed due to the dynamic default parameters of this TC not having been updated. As SPI had already transitioned to CONF mode due to the partial execution of the ED EEXIT-02, this ED was re-uplinked at 23:02:43Z without the first TC, E0502, to go to CONF. This was executed successfully, putting SPI in Photon mode at 23:05:29Z. The ED EEORTM01 (which was missed due to commanding from the Timeline to SPI being disabled during the recovery) was re-uplinked at 23:08:19Z and SPI commanding from the Timeline was re-enabled at 23:27Z.
- TM parameter E2116 T AS PSAC L2 (Plastic Scintillator temperature) went OOL Low several times during the week. No action was taken as this is a known and recurring problem due to this thermistor being unreliable.

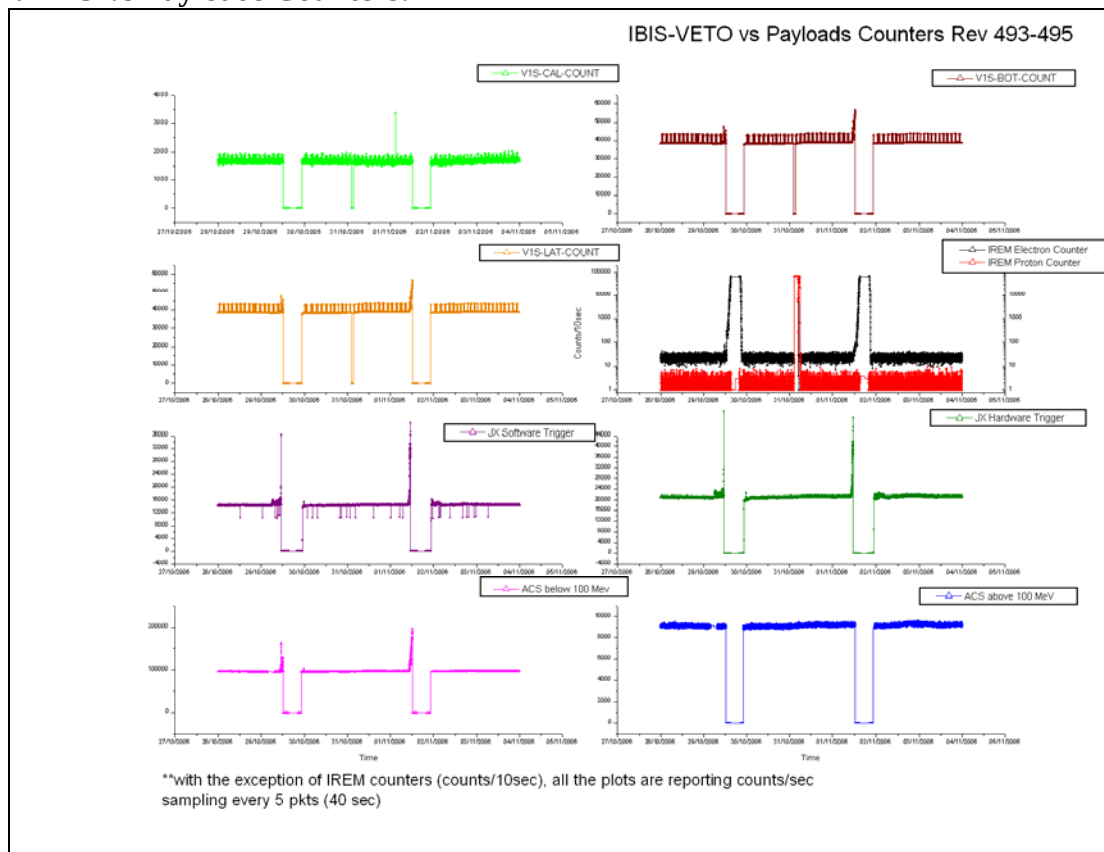
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

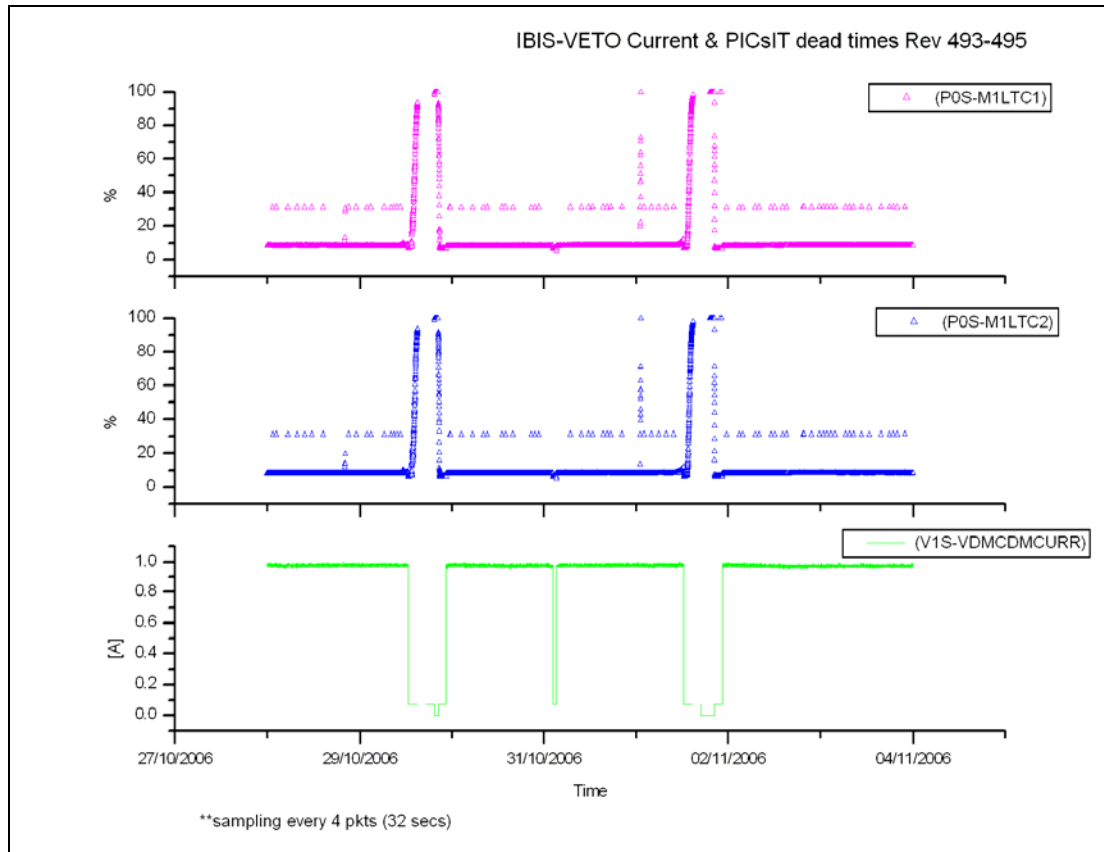


VETO vs Payloads Counters:

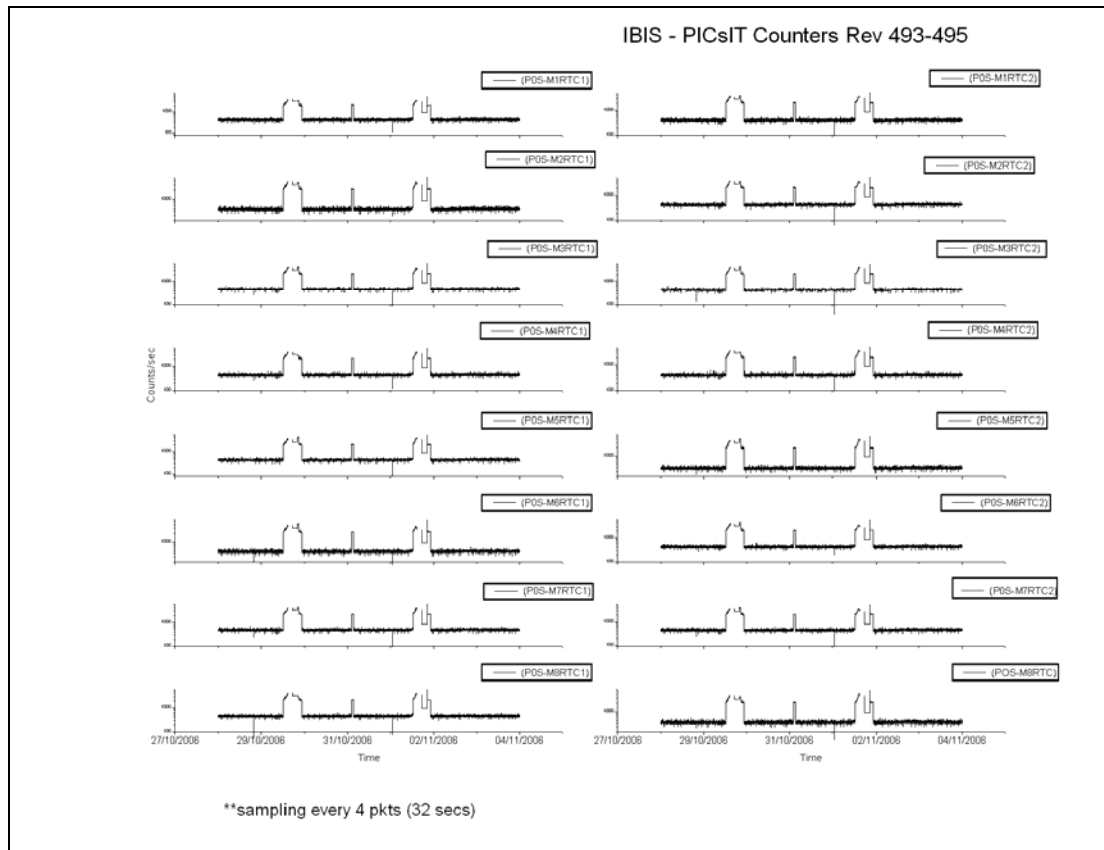


The week was characterised by low radiation.

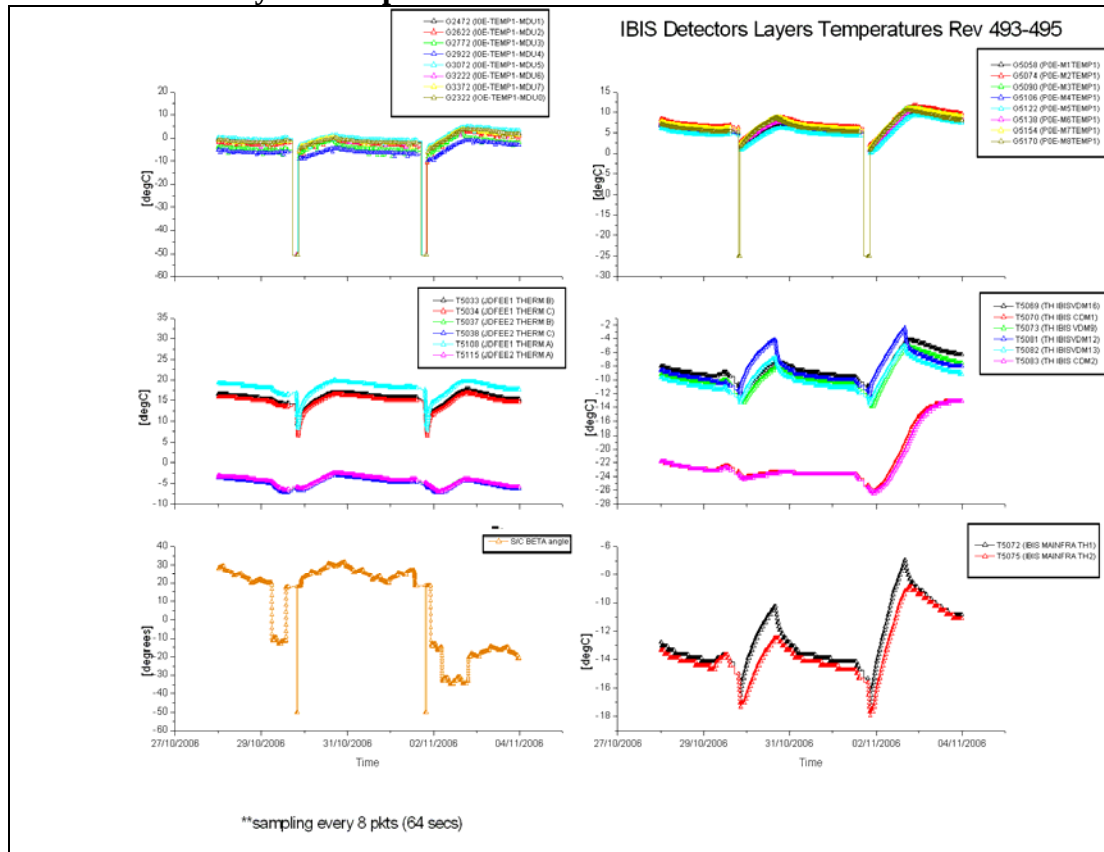
VETO Current:



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 2006.301 (28/10/2006):

At 20:07Z, TM families G5068 (P0S-MiF1ERRF) and G5072 (P0S-MiF2ERRF) failed SCC. According to FDIR action P-FIF-1, no action was taken.

DoY 2006.301 (28/10/2006):

At 12:22Z, TM parameter G8080 (S1E-VS_HBRA-RT) was reported toggling OOL High for 10 min. According to FDIR reaction H-OVF-2, no action was taken.

DoY 2006.304 (31/10/2006): IREM SEU #37

At 02:18Z, IREM crash #37 occurred. IBIS went into Stand-By mode. The unit was manually recovered via FCP_IBIS1_0803 (Exit Safe mode) and ED GESTAN02. It was re-enabled in the timeline at 03:54Z.

DoY 2006.305 (01/11/2006): HEPI resynchronisation

At 01:08Z, TM families G5068 (P0S-MiF1ERRF) and G5072 (P0S-MiF2ERRF) failed SCC.

At 01:13Z, TM families G5002 (P0S-MiRTC1) and G5003 (P0S-MiRTC2) were reported OOL low-low.

At 01:16Z the OEM APID 1280, id 132, class 0, "IBIS1 IASW HEPI RESYNCHRONISED" was reported.

According to FDIR, the occurrence of these 3 anomalies reports a resynchronisation of HEPI and the detectors. No action was taken.

DoY 2006.305 (01/11/2006):

At 10:41Z TM parameter G8080 (S1E-VS_HBRA-RT) was reported OOL High. According to FDIR reaction H-OVF-2, no action was taken.

At 11:48Z TM parameters G6062 (V1S-BOT-COUNT) and G6063 (V1S-BOT-COUNT) started toggling OOL High as the S/C was approaching the Radiation Belts. According to FDIR reactions V-BOT-1 and V-LAT-1, no action was taken.

At 12:07Z, TM family G2013 (I0S-EVTCNT-MCEi) started toggling OOL High as the S/C was approaching the Radiation Belts. According to FDIR reaction I-CNT-1, no action was taken.

DoY 2006.305 (01/11/2006): GEVESP01 TC rejected

At 20:29Z, while sequence GEVESP01 was being uplinked, the following OEMs (APID 1280) were reported:

- Id 129, class 2, "IBIS1 IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FROM CSSW DURING AT LEAST ONE RTC)"
- Id 134, class 3, "IBIS1 IASW EXTERNAL TC REJECTED COULD NOT BE EXECUTED".

Consequently, the ED GEVESP01 failed. IBIS was disabled in the timeline by the operator at 20:30Z.

This VETO time-out had already happened in the past and is referenced in the ARTS system as INT_SC-130.

According to the IBIS ED recovery guideline, the operator restored the VETO CTX from DPE (TC G0102) and re-uplinked successfully the complete ED GEVESP01.

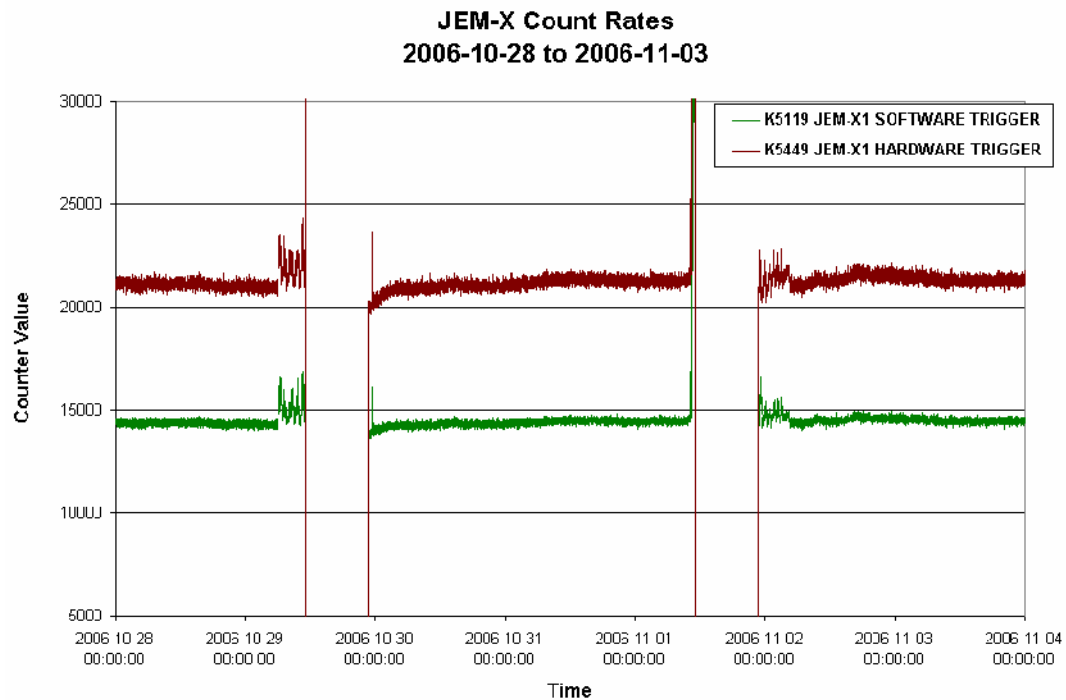
IBIS was re-enabled in the timeline at ~20:50Z and the rest of the post-eclipse activation was performed nominally.

8.3.4 JEM-X Operations

JEM-X Count Rates

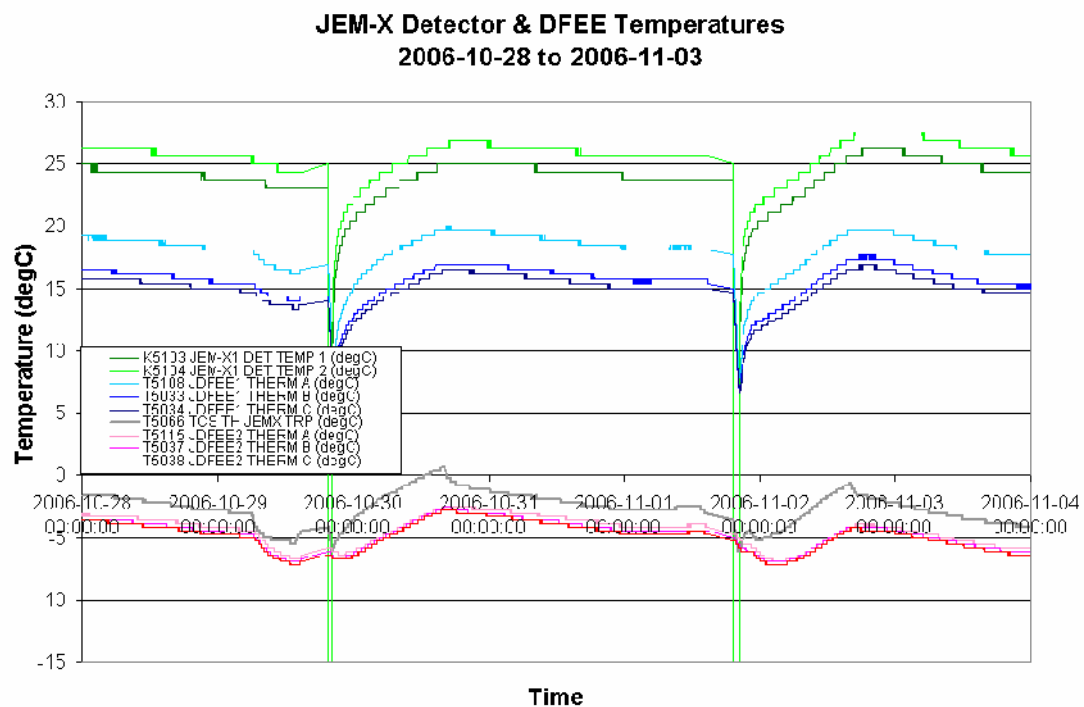
JEM-X count rates over the reporting period are displayed in the following graph¹.

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.



JEM-X Daily Report

² Data sampled (1 frame in 8)

2006-10-28 (DOY 301, Rev 493)

Nothing to report

2006-10-29 (DOY 302, Rev 493-494)

Due to high background radiation conditions before the expected radiation belt entry of revolution 493, at 11:10:58Z the TM parameter K5449 HARDWARE TRIGGER went Out of Limits High. At 11:16:58Z K5119 SOFTWARE TRIGGER also went OOL High and at 11:17:17Z JEM-X1 made an autonomous transition to Safe mode, triggered by the Software Ratemeter. OEM 189 JEM-X1 PROB DFEE 9 (Unexpected DFEE state reported in housekeeping) was received at this time, as the TM parameter K5462 DFEE STATE IASW was reporting state Setup while K5022 DFEE STATUS was Safe.

At 11:22:07Z FCP_JEM1_0040 was executed, setting K5462 DFEE STATE IASW to Safe as well and OEM 254 ERROR OFF was received.

JEM-X1 operations continued nominally.

2006-10-30 (DOY 303, Rev 494)

Nothing to report

2006-10-31 (DOY 304, Rev 494)

At 02:18:25Z an IREM reset occurred, causing the RMC parameters K5315-K5317 to all go OOL High (value = 65535), however this had no effect on JEM-X1 as the JEM-X1 reaction to the RMC parameters is disabled.

2006-11-01 (DOY 305, Rev 494-495)

Due to high background radiation conditions before the expected radiation belt entry of revolution 494, at 10:38:58Z the TM parameter K5449 HARDWARE TRIGGER went Out of Limits High. From 10:43:38Z to 10:45:22Z K5136 BUFFER LOSS also went OOL High. At 11:07:06Z K5119 SOFTWARE TRIGGER also went OOL High and at 11:09:10Z JEM-X1 made an autonomous transition to Safe mode, triggered by the Software Ratemeter. Two occurrences of OEM 189 JEM-X1 PROB DFEE 9 (Unexpected DFEE state reported in housekeeping) were received at this time, as the TM parameter K5462 DFEE STATE IASW was reporting state Setup while K5022 DFEE STATUS was Safe.

The ED KESAFE02 planned in the Timeline at 11:28:08Z failed release as commanding to JEM-X1 from the Timeline had been disabled. This ED was resent manually at 11:57:25Z and K5462 DFEE STATE IASW then also went to Safe and OEM 254 ERROR OFF was received.

JEM-X1 operations continued nominally.

2006-11-02 (DOY 306, Rev 495) to 2006-11-03 (DOY 307, Rev 495)

Nothing to report

8.3.5 OMC Operations

2006-10-28 (DOY 301, Rev 493)

Nothing to report

2006-10-29 (DOY 302, Rev 493)

At 22:39:25, the following On-Event messages were received:

2006.302.22.39.25.123	2006.302.22.39.33.751	1792	RealTime	7	EXCEPTION	
OMC CONSTRAINT D			0	0	65535 PR	N
E E						
2006.302.22.39.25.123	2006.302.22.39.33.798	1792	RealTime	5	ANOMALY	
OMC CSSW INT ER			0	0	65535 PR	N
E E						

These are often seen when observing a crowded area of the sky. No action was taken, and there was no impact.

2006-10-30 (DOY 303, Rev 494)

Nothing to report

2006-10-31 (DOY 304, Rev 494)

At 02:18:20, an IREM SEU (#37) occurred, which forced OMC to SAFE mode. A recovery was performed, and completed at 03:52:38, when OMC was returned to Stand-by. The impact was an interruption of pointing 04940030 after 2817 from a scheduled 3334 seconds, and the loss of pointings 04940031 & 04940032.

Two more pairs of the above mentioned On-Event messages were received, and as before no action was taken, and there was no further impact.

2006.304.13.37.33.107	2006.304.13.37.41.846	1792	RealTime	7	EXCEPTION	
OMC CONSTRAINT D			0	0	65535 PR	N
E E						
2006.304.13.37.33.107	2006.304.13.37.41.902	1792	RealTime	5	ANOMALY	
OMC CSSW INT ER			0	0	65535 PR	N
E E						
2006.304.22.15.42.256	2006.304.22.15.49.613	1792	RealTime	7	EXCEPTION	
OMC CONSTRAINT D			0	0	65535 PR	N
E E						
2006.304.22.15.42.256	2006.304.22.15.49.641	1792	RealTime	5	ANOMALY	
OMC CSSW INT ER			0	0	65535 PR	N
E E						

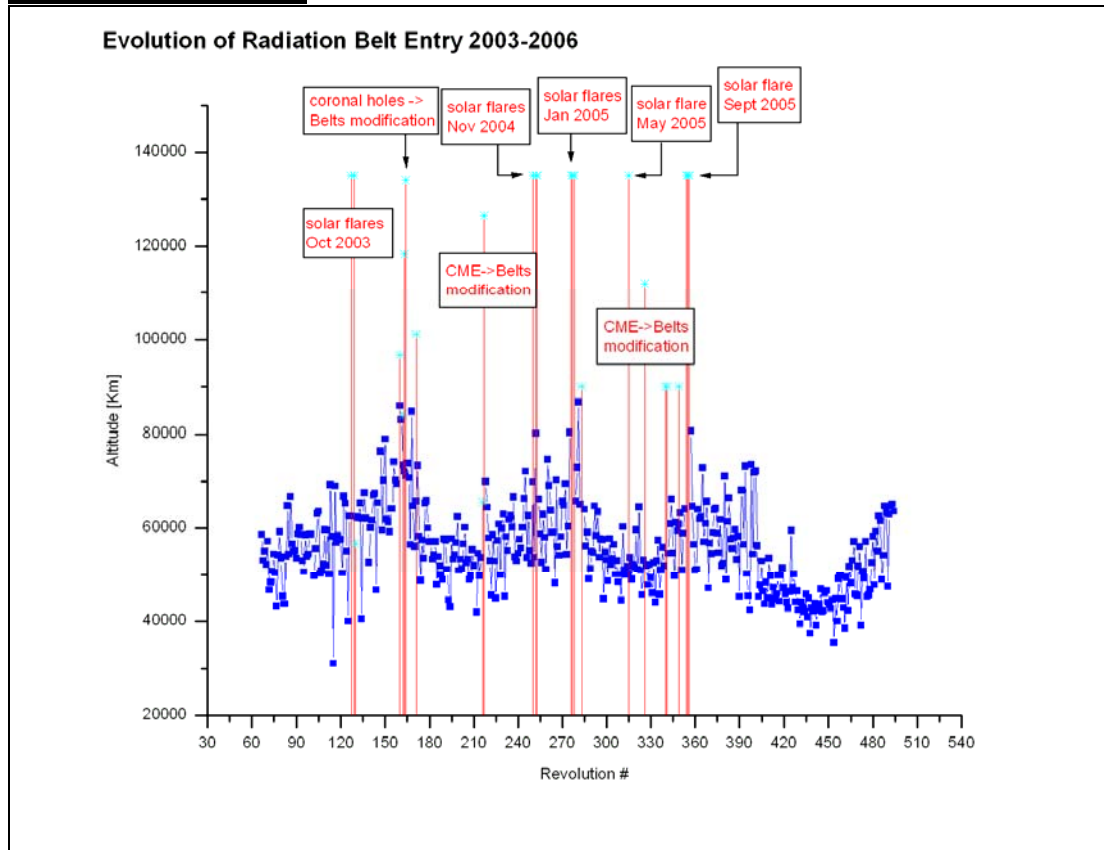
2006-11-01 (DOY 305, Rev 494) to 2006-11-03 (DOY 307, Rev 495)

Nothing to report

On DoY 302 at 12:35:32 and DoY 305 at 12:24:04 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

On 2006-10-31 at 02:18Z, a local reset of the IREM CSCI S/W (SEU #37) occurred: as previously (see anomalies on 16/12/2002, 01/01/2003, 03/06/2003, 11/07/2003, 19/07/2003, 05/08/2003, 24/08/2003, 26/12/2003, 13/05/2004, 16/05/2004, 09/06/2004, 12/06/2004, 10/09/2004, 14/09/2004, 28/10/2004, 06/11/2004, 01/12/2004, 11/12/2004, 30/01/2005, 11/02/2005, 04/03/2005, 11/05/2005, 17/05/2005, 15/06/2005, 30/07/2005, 07/09/2005, 20/09/2005, 21/11/2005, 09/04/2006, 30/04/2006, 10/06/2006, 16/08/2006, 08/09/2006, 10/09/2006, 18/09/2006, 29/09/2006) the status of the unit, before the anomaly, 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 2006.304.02.18Z at 148640.1km. 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 02:41Z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCA0 HEX = 48288 DEC = 1011110010100000, i.e the **Checksum Failure flag shows NO** and the **Watchdog Elapsed flag shows YES**. The unit was still reporting the status as if it

was in Integral mode with counting ON, accumulation ON and watchdog elapsed 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 Watchdog Elapsed flag was this time OFF and the **Watchdog 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 06:10Z.

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.

The recovery of the payload was performed with IBIS at 03:49Z and OMC re-enabled at 03:52Z.

The cause of this S/W reset 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]
493	RAD_ENTR R 2006-10-29T12:35:26Z	2006-10-29 11:24:10	<65159.3	2006-10-29 13:07:36	50171
494	RAD_EXIT R 2006-10-29T21:56:30Z	2006-10-29 20:58:02	35995.5	2006-10-29 21:17:36	40984
494	RAD_ENTR R 2006-11-01T12:23:59Z	2006-11-01 11:28:11	<63583.2	2006-11-01 12:54:16	50191
495	RAD_EXIT R 2006-11-01T21:45:19Z	2006-11-01 20:33:39	34438.3	2006-11-01 21:04:16	40889

Reference

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)

Radiation Spike

Issue : 1
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je - PROTON COUNTER S14
 xk - DOSE
 d - ELECTRON COUNTER TC3

Running TDB #

blue - TC1 - >20 MeV
 black - TC2 - >39 MeV
 red - TC3 - >0.5 MeV
 yellow - S33 - 11-90 MeV
 dark green - S14 - 20-27 MeV
 magenta - S25 150-185 MeV

TDB2006_10_25h12m06s14_revo493.txt

Rate (a.u.)

TDB #

lock/Timer Incr.

HK File Running #

Start HK_ID 85 - 76
 Stop HK_LT 49178648 - 54395336, Duration(sec) 521668

IREM Radiation Scalers

Rev # 493

Rate (a.u.)

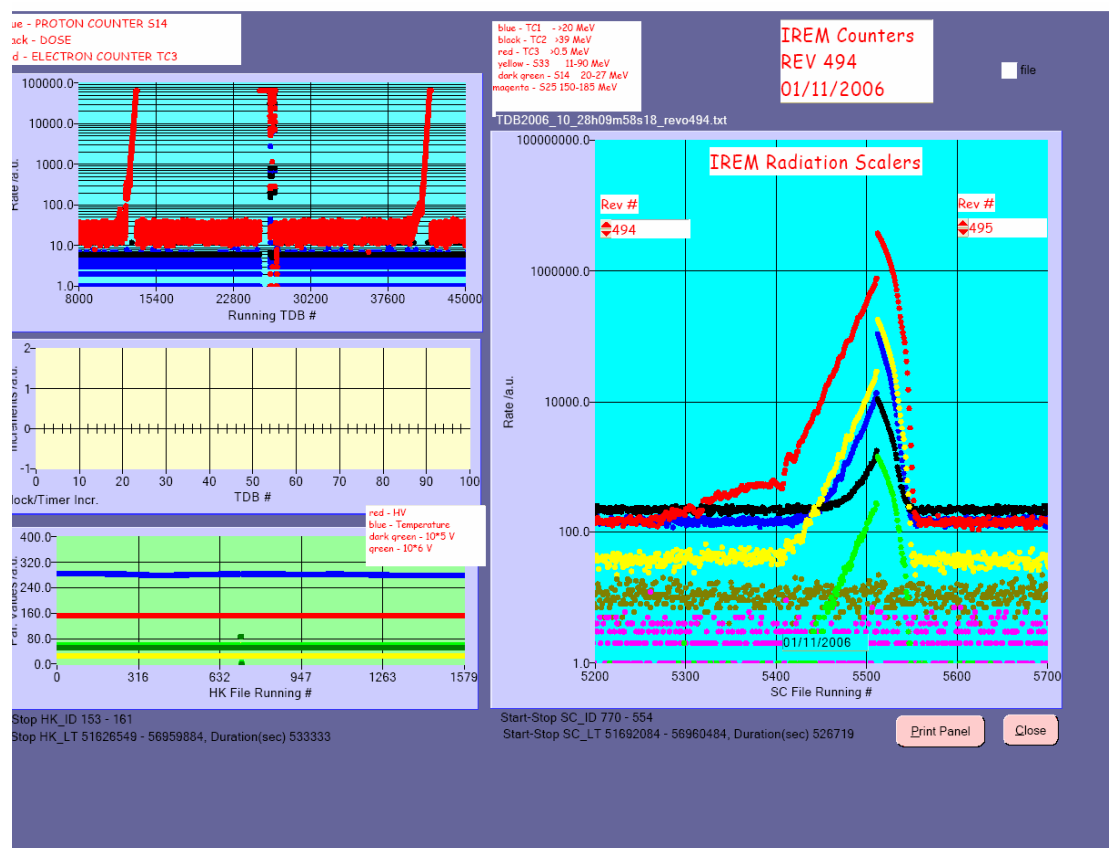
SC File Running #

29/10/2006

Start-Stop SC_ID 684 - 385
 Start-Stop SC_LT 49177445 - 54395936, Duration(sec) 521729

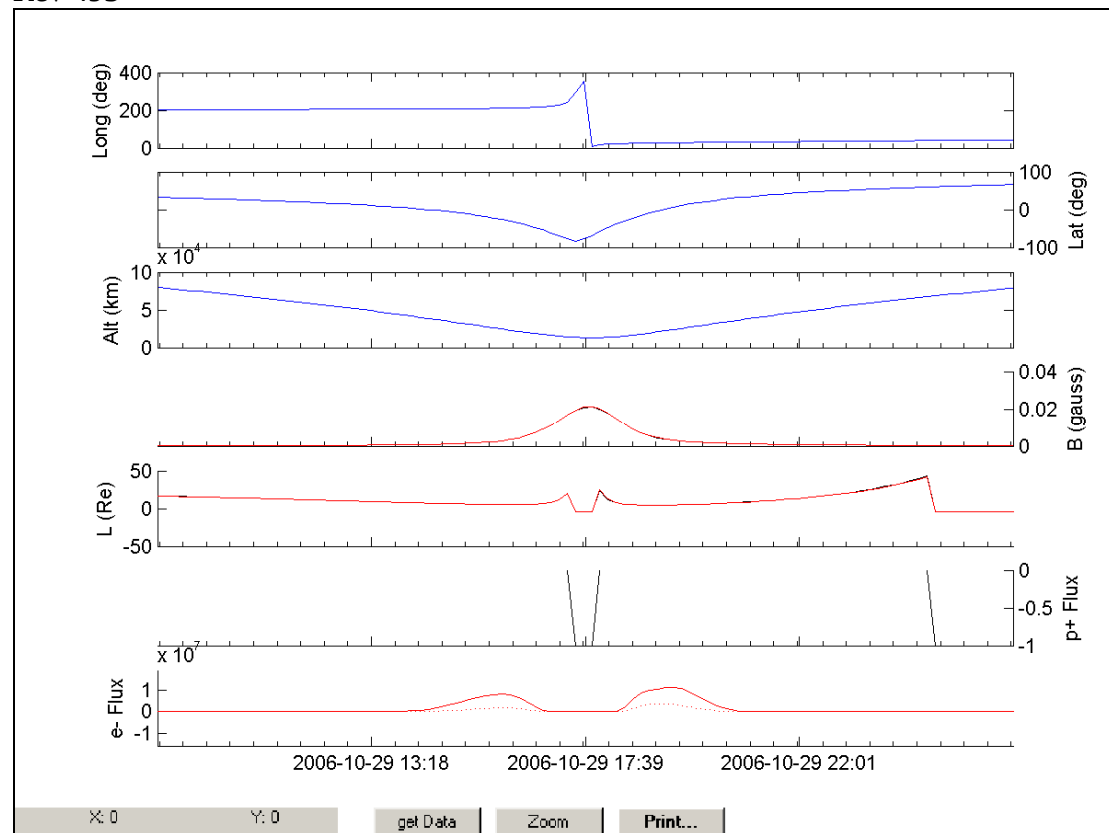
Print Panel

Close

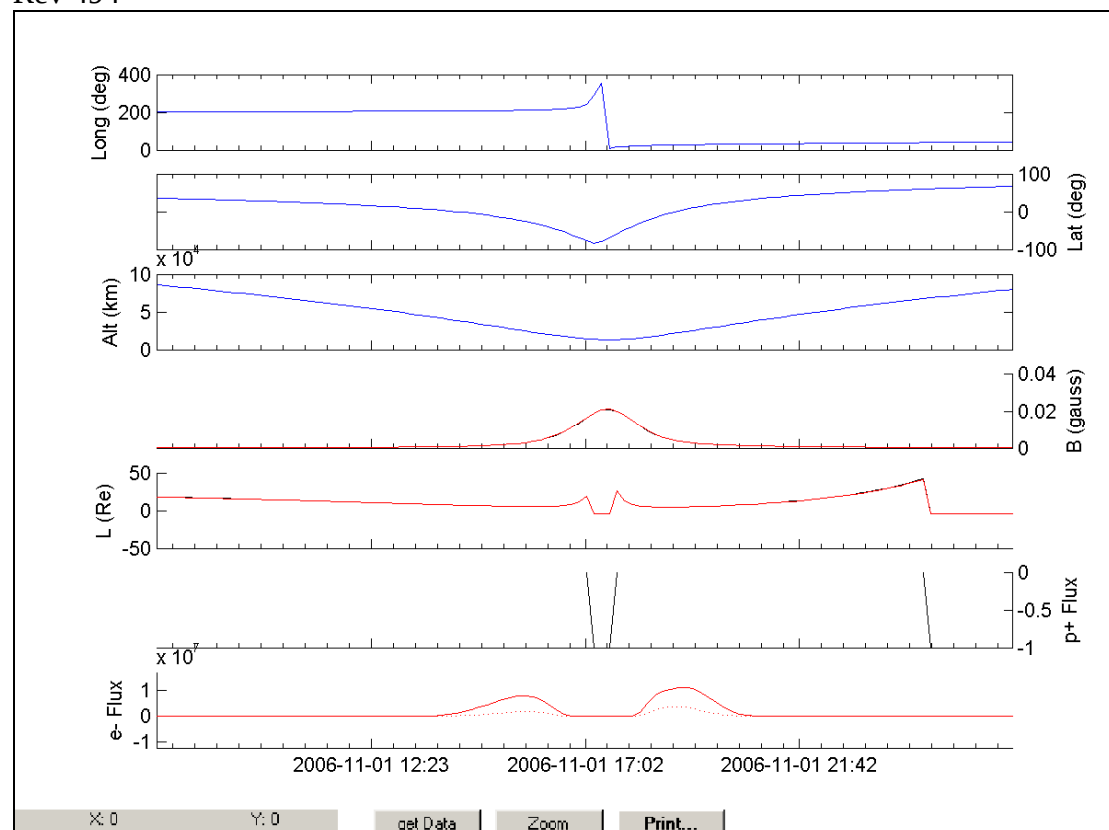


IREM Predicted Radiation Belt Passages

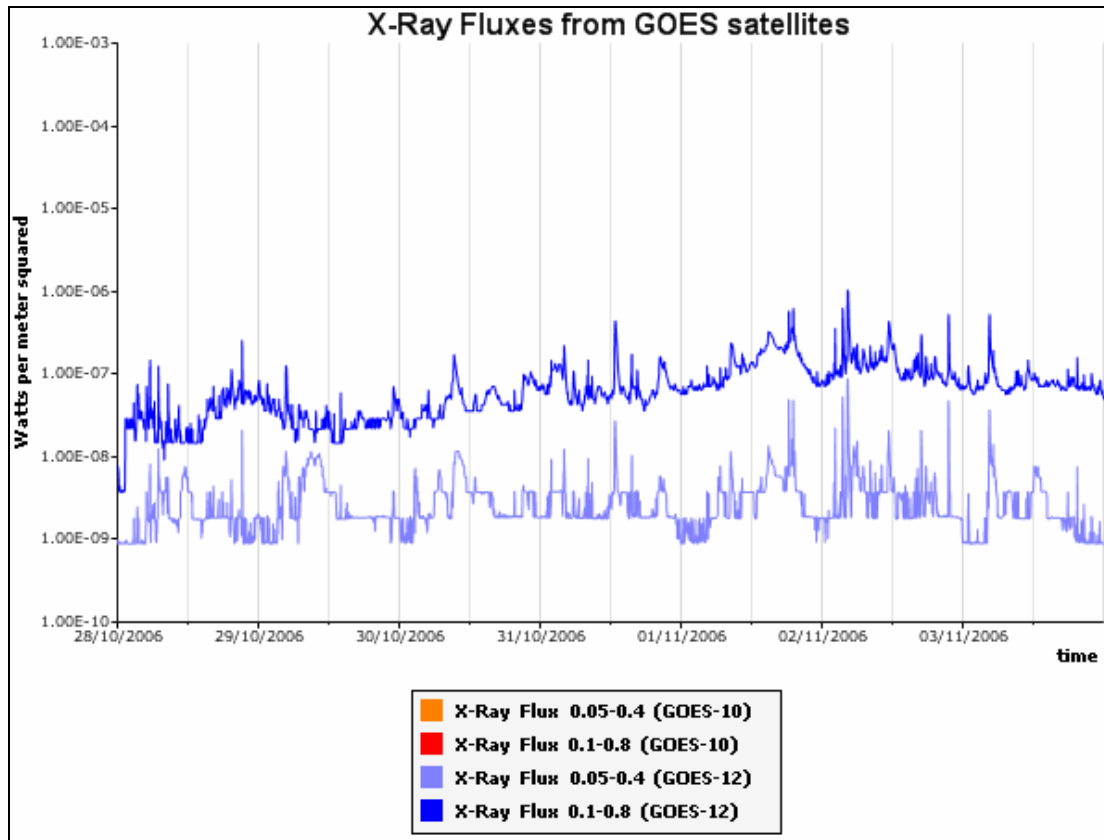
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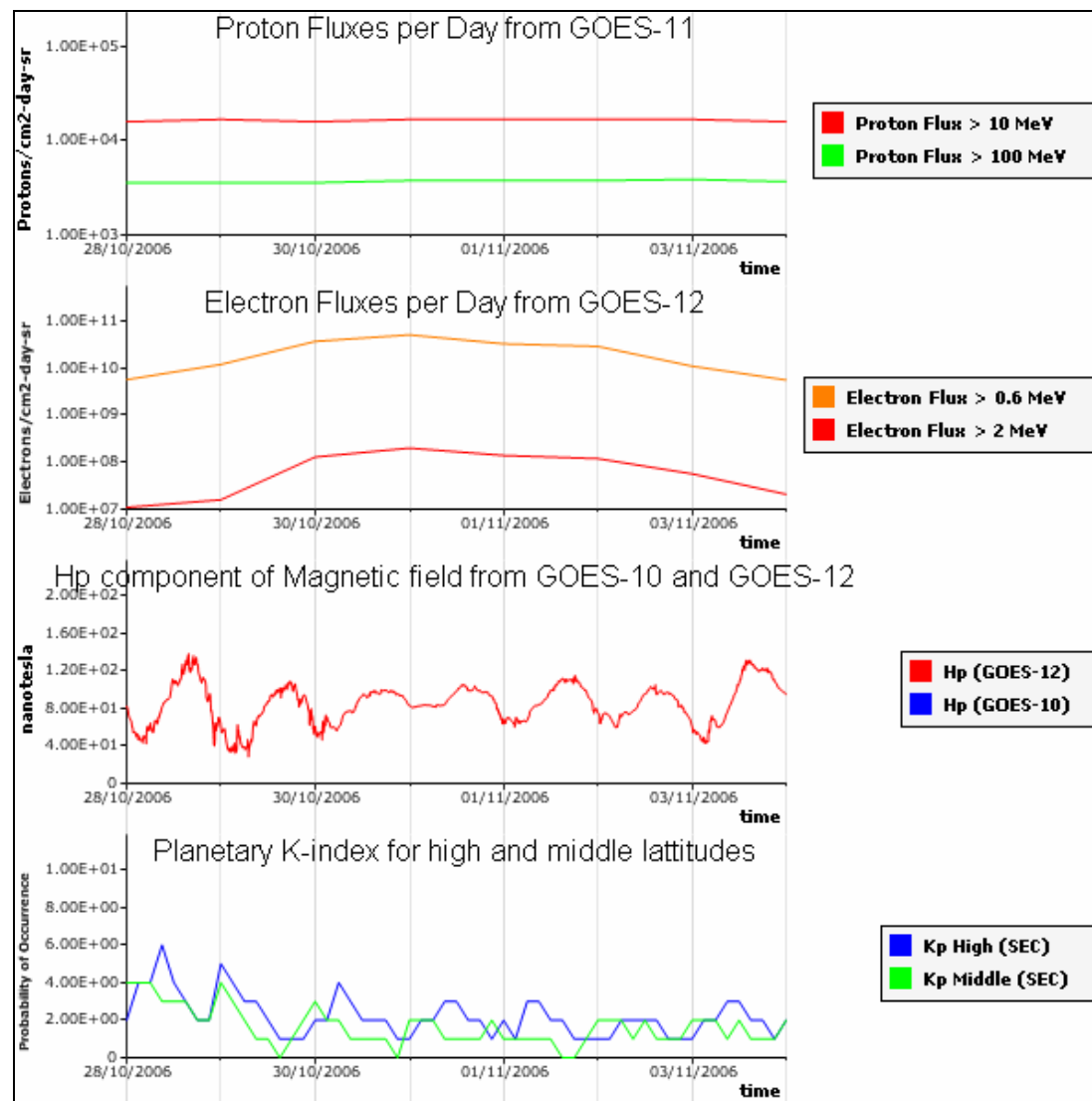
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SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):



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



Proton and electron flux report low radiation background.

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

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