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

INTEGRAL
Mission Report

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

No. 214
Week 43

30.10.06

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 21.10.06 until 27.10.06 (both dates inclusive) and covers the revolutions 492 and 493.

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 dithers of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), a raster dither of the Region at l=0, b=-25 (RA 19:36:28.82, DEC -39:08:24.8), a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9), and a hexagonal dither of the Galactic Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0).

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

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

The Eclipse season started with the first eclipse passage on 26/10/2006.The first eclipse passage was nominal from an AOCS point of view.

As results of the periodic IMUs (1-2) calibration (together with RMU-B health-check) performed on 19/10/2006, the IMUs drift corrections were updated during rev 492.

As part of the AOCS preparation for the summer eclipse season, the onboard AMD thresholds were set to their eclipse season values at the beginning of rev 492. In the same time frame were verified the AMD dead band value, the IMU timers, the load of the TT sequence to re-enable the IMU Auto Switch-Off function in the ACC and the Eclipse ACC\FDE\FCE timers.

Four slews were missed during the observation period due to problems on IMCS, NCTRS and guide star not found during the Search/Track process.

The fuel consumption over the period between 18/10/2006 and 26/10/2006 was 0.4976 Kg. The remaining propellant is in the order of 150.3104 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 first eclipse of Eclipse Season #9 took place on 26/10/2006, the relevant details are given 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
19:44:54	19:48:05	20:07:25	20:10:59	00:26:05	00:19:20	2.01Ah	1.99Ah	5.49A	5.44A	1:09:43	1:09:03

From the EPS point of view the eclipse passage was 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.

Eclipse Season Preparation:
On 25/10/2006 at 13.29z the On-board Monitoring tables were updated with the entries for the eclipse season.

In relation to this and the simultaneous reduction in SPI Detector temperature (increase in CDE current) there was some discussion regarding the On-board monitoring entries for SPI Compressor Current monitoring. In the OBM table for **eclipse season** we have the following 2 OBM entries to monitor the SPI Compressor PDU currents:

OBM Entries
0A < P1061 (CDE1 LCL1 CUR) < 6.18A, triggering RACP 35 and 39
0A < P1063 (CDE2 LCL1 CUR) < 5.95A, triggering RACP 36 and 40

RACP Entries
35 : P3030 CDE1 LCL1 OFF
39 : P3030 CDE1 LCL1 OFF
36 : P3030 CDE2 LCL1 OFF
40 : P3030 CDE2 LCL1 OFF

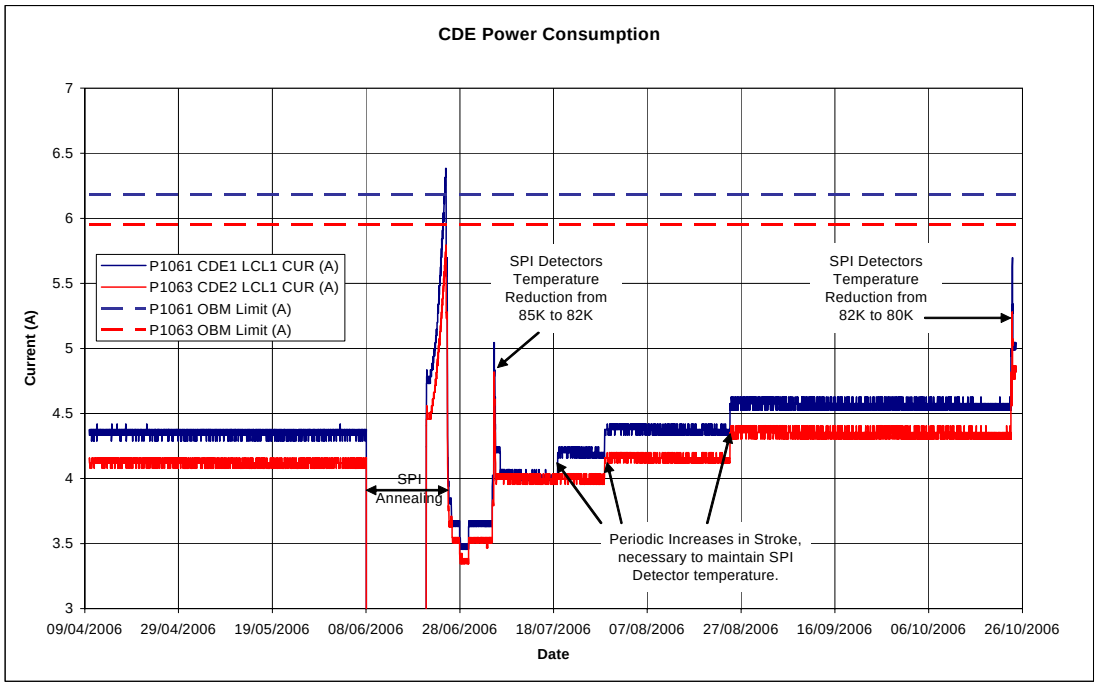
In case either of the limits are exceeded, the related RACP commands are issued, switching off the affected CDE.

Current database limits are: 0.01A to 6A for both parameters, and the LCL Class is 7A

According to the users manual:
"This OBM entry is used to record a Trip -OFF current being exceeded in the CDE-1 LCL 1. In nominal operation the CDE-1 LCL 1 is closed. The OBM entry is necessary

only in the case of a failure during orbits with eclipses, since smart short circuit occurrence is more critical. RACP #35, nominal command, and RACP #39, redundant command, switch the LCL OFF in case of upper limit transgression."

During the recent reduction in SPI Detector Temperature, the limits were approached (after annealing they were regularly exceeded) - see plot below:



Together with ALENIA it was decided to avoid an accidental or unnecessary hard switch-off of either of the (sensitive) CDEs by the OBM task at all costs, therefore the RACP commands from the OBM entries were removed, with the limits left unchanged to record any transgressions without action being taken.

Using this approach in case of a real short circuit the LCL reacts limiting the current to about 8.15 A (7 A + 15% plus margin) and opening the circuit after 10ms.

In case of a "smart short circuit" the current reaches the values in worst case of 8.14 A (i.e. slightly below the threshold at which the LCL opens). In the worst case this consumption would be maintained for the whole eclipse duration. Considering the good health status of the batteries, the maximum eclipse duration and the available power budget, this scenario is fully sustainable by the system. Here, the OBM detects the problem even outside-visibility.

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.

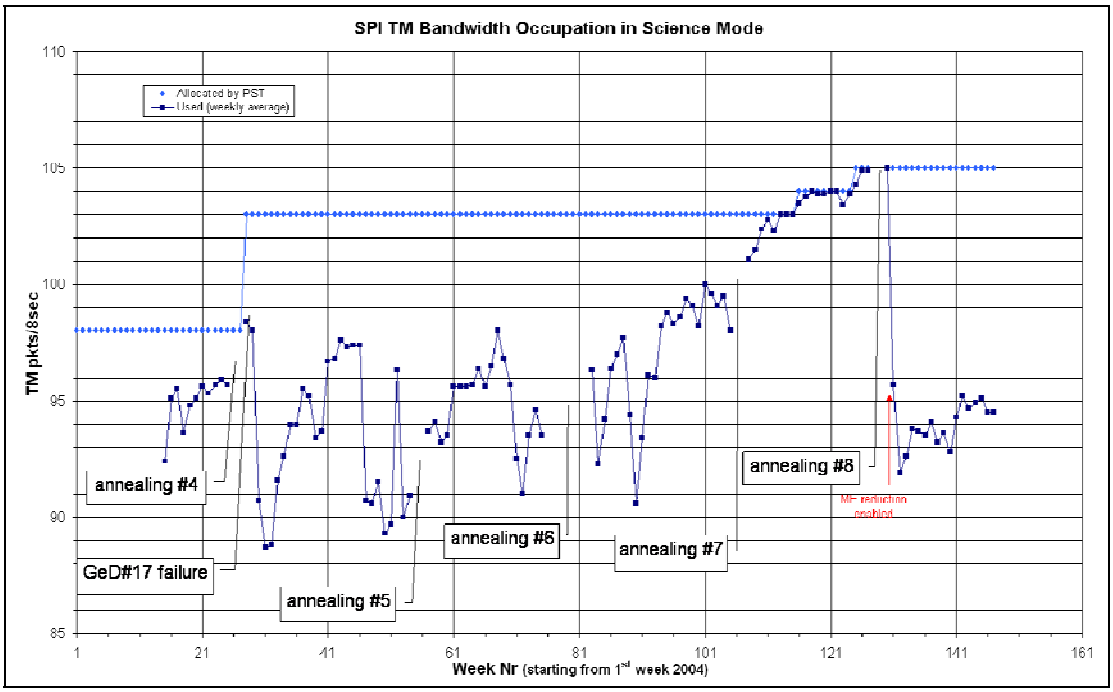
The Stirling compressors are working nominally, maintaining the Germanium detectors at 82 +/-1K.

On 23/10/2006 was implemented successfully the OCR-220 to reduce SPI detectors temperature from 82K to 80K.

On 26/10/2006, the first eclipse of the season occurred. For SPI, the eclipse activities were performed nominally except for ED EEXIT-02 which failed probably due to an issue on ground with dynamic default parameter updates. The ED was recovered by the operator with minor delays.

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. The average telemetry occupation in the science window was 94.5 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.

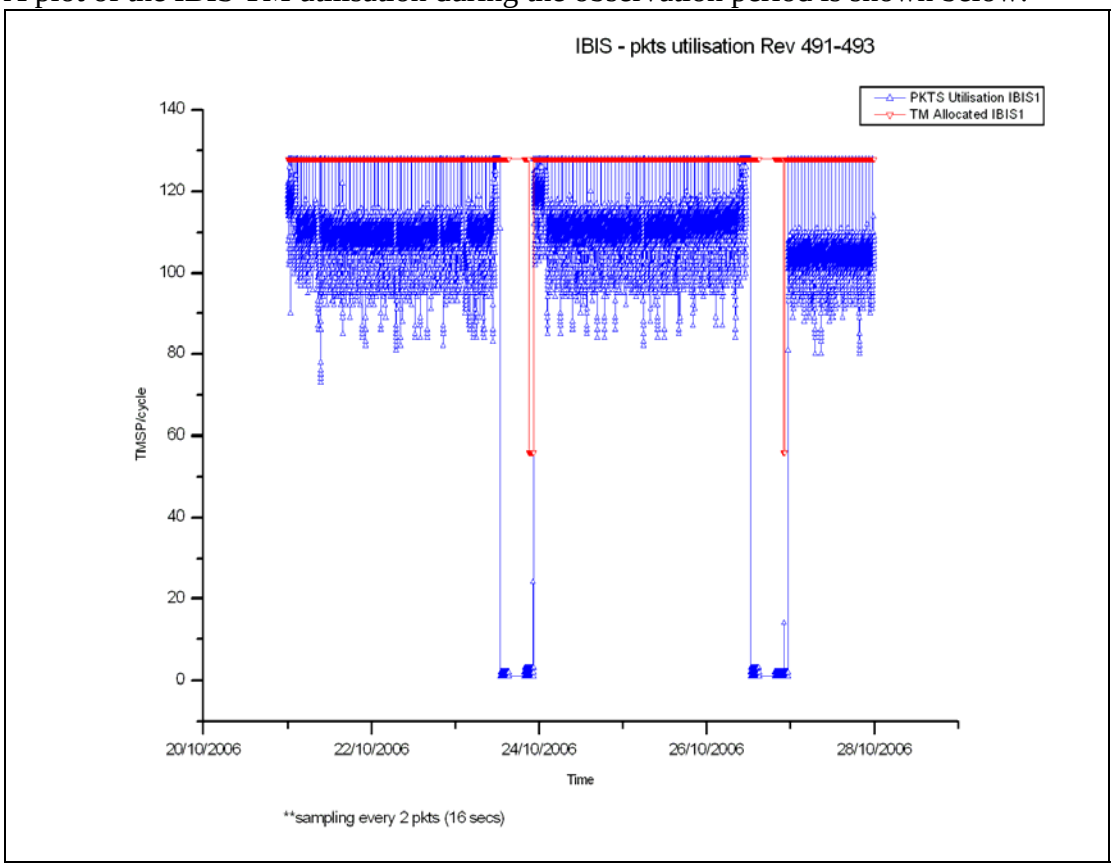
3.2.2 IBIS

The overall status of the unit is nominal.

The Eclipse season started on 26/10/2006. From the unit point of view, the eclipse passage was nominal.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 110.07 TMPS/cycle, down 0.7 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.

On 2006-10-26 at 20:23Z, during the post-eclipse reconfiguration of JEM-X1 following the 1st eclipse of this season, another DFEE anomaly occurred similar to those observed during previous eclipse seasons. This anomaly is recorded as INT_SC-

161. JEM-X1 was recovered and re-enabled in the Timeline at 21:39, without loss of data.

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, 147 of the 150 planned science pointings for OMC were executed nominally, 1 was delayed and 2 were lost.

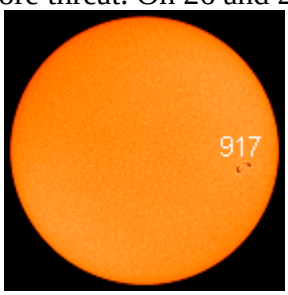
Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

3.2.5 IREM

The overall status of the unit is nominal.

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

From 21/10/2006 to 25/10/2006, new sunspot 917 crossed the sun. The threat for strong solar flares grew until 23/10/2006 (see picture), then the sunspot started decaying and hence posed no more threat. On 26 and 27/10/2006, the sun was blank.



Reference: www.spaceweather.com
Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

4 Ground Facilities

The Operational ground facilities performance was excellent this week. Two slews were lost, and one delayed. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. The main problems reported were with the Command Verifier task, which delayed a pointing, the FD system struggling

to find guide stars, which caused the loss of a pointing, the FD GTP task crashing, which had no impact. The overall performance was well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There was, however, a drop on the line from Redu twice, one of which caused the loss of a pointing, two occasions of missing source packets, and an error sending data to the isds. The overall performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs have been received up to revolution 498. No new observations have been planned this week. The planning is still up to revolution 497.
TSF's up to revolution 493 have been received.

2. Observation status

ECS have been received and processed up to revolution 483.

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

No changes. Work is continuing on version 14.0.
To ensure commonality within ESAC, ISOC machines running under Linux will be slowly migrated to Red Hat instead of Suse Linux.

5. Problems

Connectivity problems between ESAC and the RSSD servers at ESTEC meant that the ISOC Web pages were not available for a few hours on Wed, 25 Oct 2006.

4.3.2 ISDC

Status of ISDC observation processing on 30/10/2006:

- 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 295, at 19:35, a problem with the imcs Verifier task caused the Timeline to be interrupted. A manual recovery was executed, and the Timeline rejoined at 20:20. The impact was a half hour delay in the start of pointing 04910053.
- On DoY 298, at 23:40, the AOCS command A3189 (Start Guide Star) failed release due to the chosen star being too faint for the threshold set. A recovery was performed, and the Timeline recovered at 00:54 the following day. The impact was the loss of pointing 04920056.
- On DoY 299, at 22:15:05, a problem with the command link caused the commands for the slew to attitude 04930002 to fail. The impact was the loss of this pointing.

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

AR id	Date Created	Subject	Segment	Status
INT-2891	2006-10-27	Timeline commanding failed - Uplink status set to blocked	IMCS	Pending
INT_SC-161	2006-10-27	JEM-X1 DFEE CRC Anomaly following eclipse on 2006-10-26	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 492

The observations in revolution 492 began with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. It continued with a raster dither of the Region at l=0, b=-25 (RA 19:36:28.82, DEC -39:08:24.8), lasting ~54.9 hours, which lasted until the end of the revolution.

Revolution 493

The observations in revolution 493 began with a raster dither of PKS 0537-286 (RA 05:39:54.28, DEC -28:39:55.9), lasting ~50.9 hours. It continued with a hexagonal dither of the Galactic Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours, 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

```
2006-10-11T21:23:32.000Z     151.0713    F   Automatic TM processing.
2006-10-13T07:27:28.000Z     151.0551    F   Automatic TM processing.
2006-10-14T13:42:11.000Z     150.9867    F   Automatic TM processing.
2006-10-14T15:42:19.000Z     150.9224    F   Automatic TM processing.
2006-10-14T21:07:00.000Z     150.9105    F   Automatic TM processing.
2006-10-16T06:52:48.000Z     150.8751    F   Automatic TM processing.
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.

This report was generated  Fri Oct 27 08:00:52 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, 21/10/2006 – 27/10/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 79 Open Loop Slews, 85 Closed Loop Slews and 6 Momentum Biases were executed.

4 slews (CSL) were missed during the observation period due to problems on IMCS, NCTRS and star not found during the Search/Track process. In addition the OTF was not reached for PID 04910059.

This is equivalent to a ~2 % of the total number of slews planned (165).

The IMUs drift corrections were updated during rev 492 accordingly to the following values:

IMU-1-X=0.1894 arcsec/sec
IMU-1-Z=0.1843 arcsec/sec

IMU-2-X= 0.1090 arcsec/sec
IMU-2-Z=0.0046 arcsec/sec

IMU-3-Z=-0.0421 arcsec/sec (unchanged)

IMU-4-X=-0.0563 arcsec/sec (unchanged)

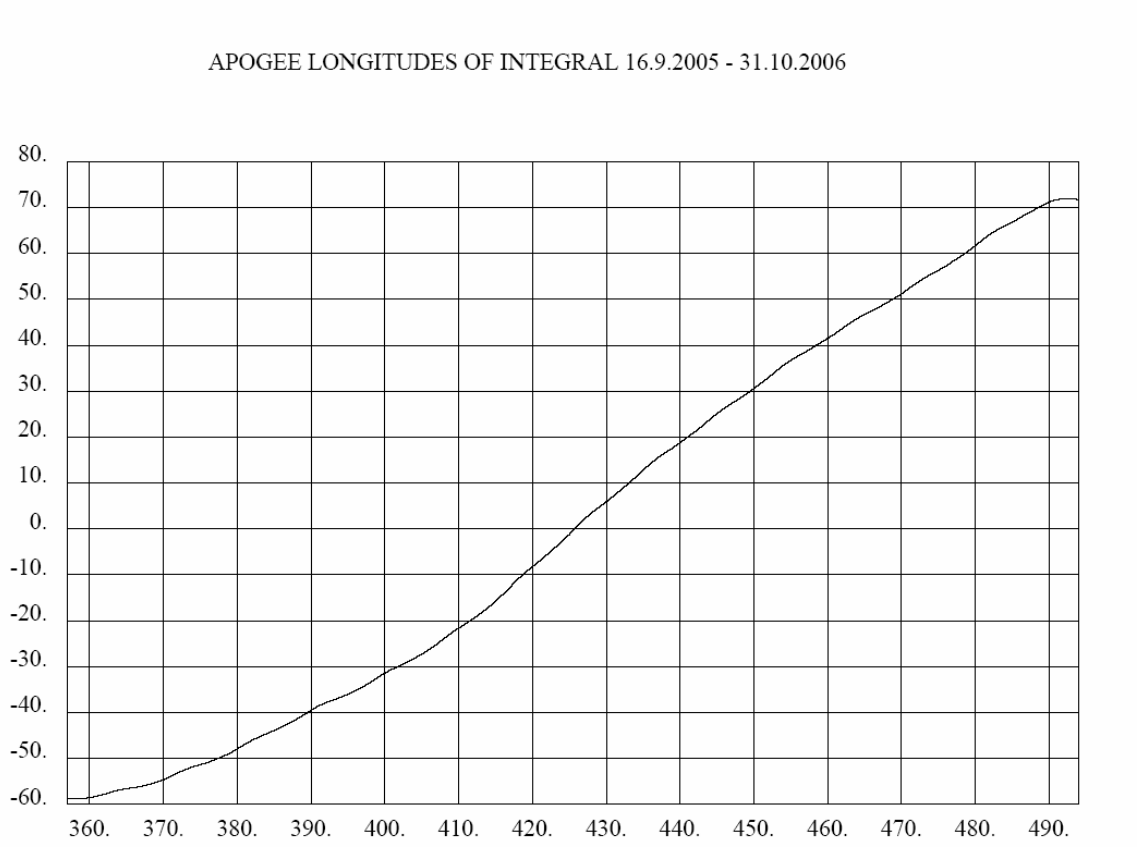
The AOCS eclipse operations were nominal. For the first eclipse passage, the ACC\FDE\FCE Eclipse Timers and the Time-Tagged sequence to re-enable the IMU Auto Switch-Off function of the ACC were loaded from the Timeline and the pre-eclipse IMU health checks was performed at the planned times. Some information 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

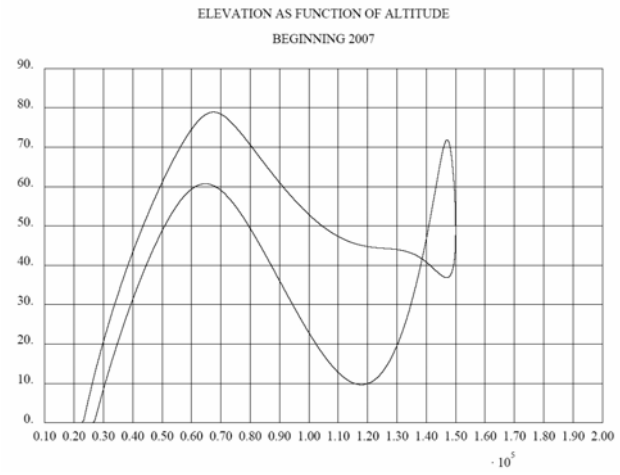
IMU Usage during Eclipse Season						Summer 2006
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]		
2006-10-26 12:00:41	2006-10-26 20:21:37	0.2423	0.2417	0.2313	8:20:56	8:20:56

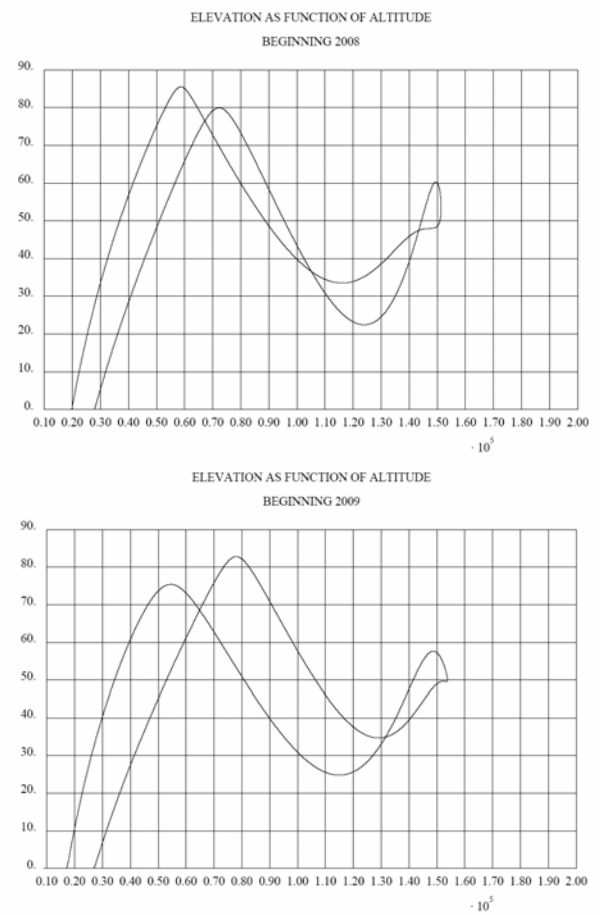
Orbit Control

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.



The target is to maximise the coverage, before ascending through altitude 40000 km, 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:





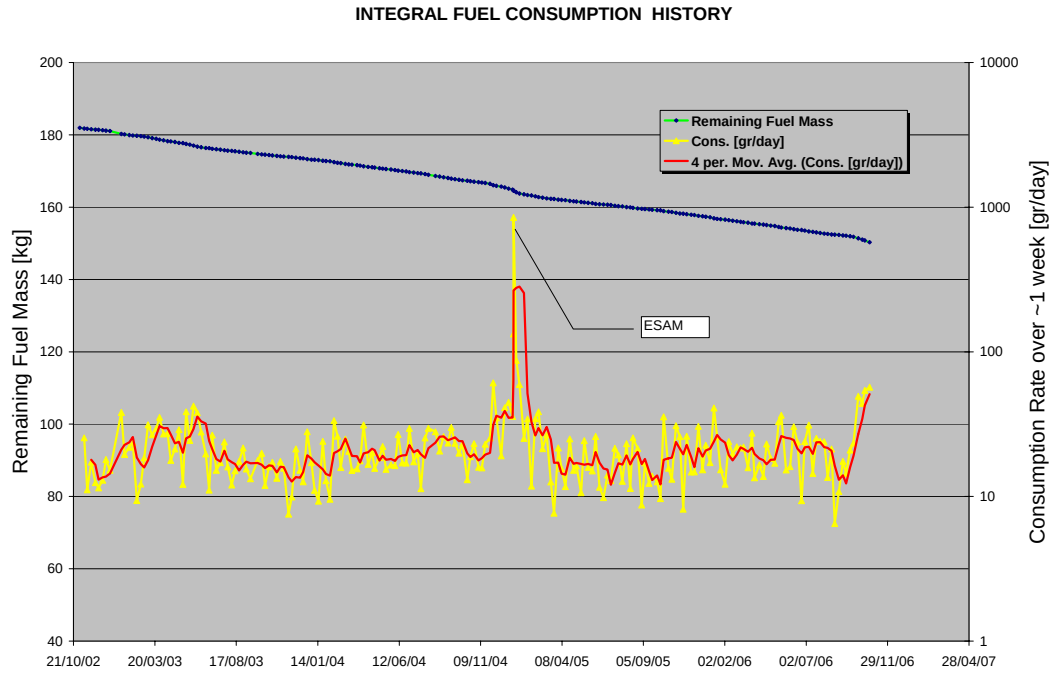
With 1 hour coverage after having descended through altitude 40000 km the coverage before ascending through altitude 40000 km will be:

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

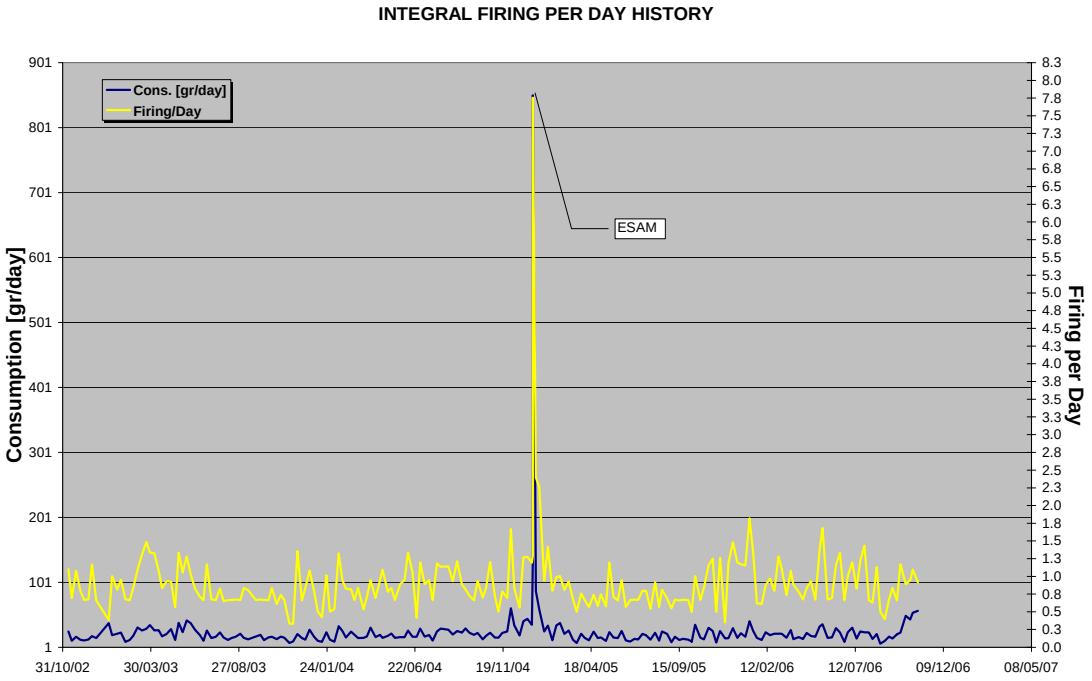
There is therefore no need for a second ground station.

Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 26/10/2006 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.

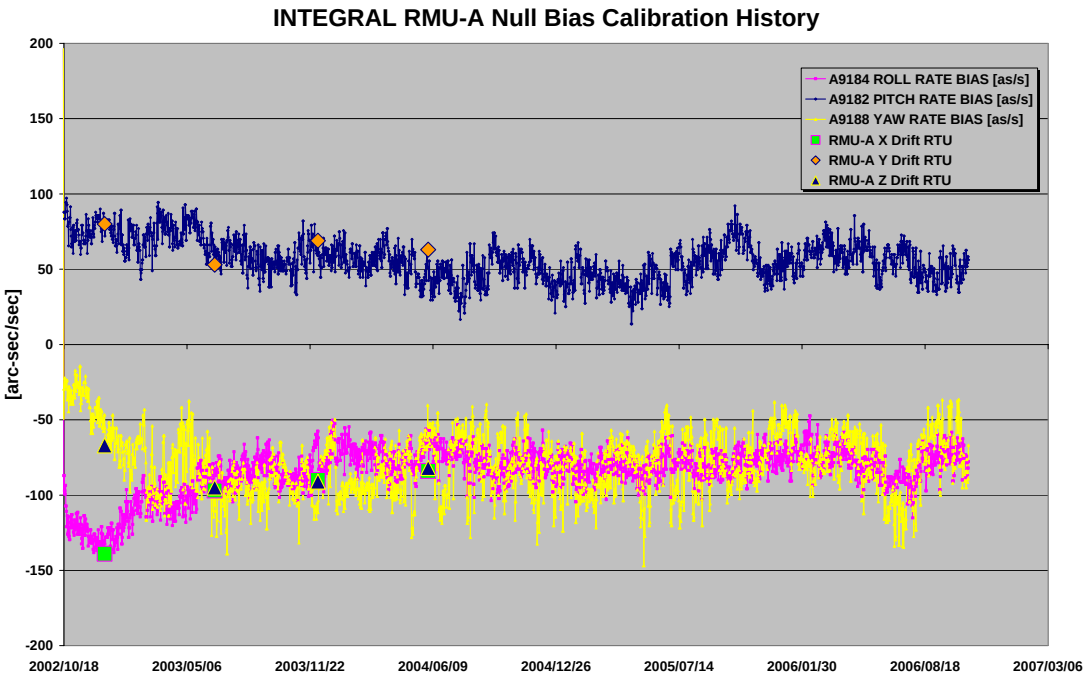


The firing\day over the period between 01/11/2002 and 26/10/2006 is reported in the plot below.

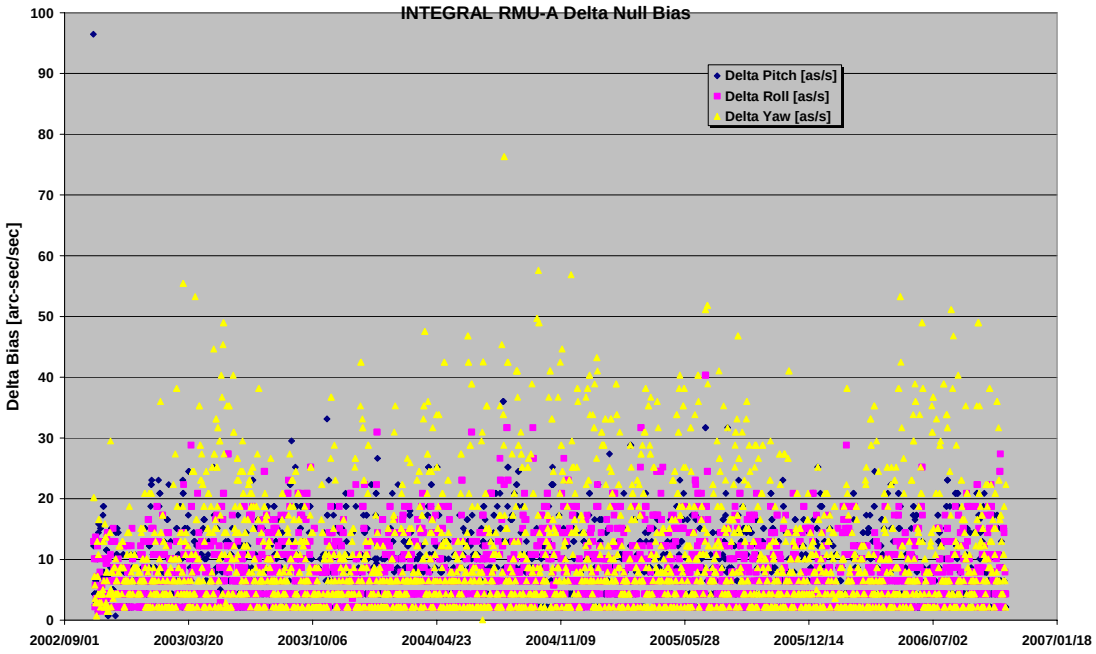


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 27/10/2006 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 27/10/2006 is reported in the plot below



21/10/06 (Day of Year 294, Revolution 491)

Nothing to report.

22/10/06 (Day of Year 295, Revolution 491)

Problem on IMCS Command Verifier Task: at 19:35z due to a problem on the IMCS Command Verifier task, the slew ID 04910053(CSL) failed release.
A manual recovery was then started at 19:40z from attitude of PID 04910052 to the attitude of PID 04910053. The next slew 04910054 was manually updated at 20:20z.

The following slew was missed in TL: 04910053(CSL).

23/10/06 (Day of Year 296, Revolution 491-492)

STR lost of guide star: at 02:08 z due to lost of guide star the IMU was switched ON by the ACC, during the execution of PID 04910059.

The guide star at moment of the false event was Mi 8.45 at CCD location [12210, 21836]. A new guide star was picked after the mapping commanded by the ACC autonomously.

A manual recovery was then started at 02:19z and the next slew in TL (04910060) manually updated at 02:27z.

No impact on TL, except the OTF not reached for PID 04910059.

FDS failed update change of guide star: at 15:17z the update of CGS (to be released at 15:24:10z) failed.

FDS reported an error during the update process: the only suitable guide star for the execution of the next RWB was already taken at the end of the previous slew and no other suitable stars were present in the STR FOV. This caused the CGS update to fail.

The AOCS s/s was disabled from TL at 15:20z. Being the current guide star, Mi 7.8 at CCD location [-5641, 11593], suitable for the next RWB execution was decided to proceed without CGS.

No further corrections were requested and the AOCS was enabled in TL at 15:25z.

No impact on TL.

Loading of the Eclipse Season AMD thresholds: In preparation for the winter eclipse season 2006 (according to FCP_AOC_0524), the on-board AMD thresholds were set to their eclipse season values, accordingly to the table below:

Thresholds from INT-MA-AI-0001, 5.3.2.4.2.2, and INT-PR-MMB-0005 page 5-9, modified as per new AMD Threshold agreement for the eclipse season.

01- Update of thresholds after uplink of new RW Inertias on 22/01/2004. 0155_0001_M.RWI

Wheel Inertia:

RW#1:	0.096000	Kgm**2
RW#2:	0.097650	Kgm**2
RW#3:	0.097272	Kgm**2
RW#4:	0.097649	Kgm**2

Eclipse Season:

	Subset 1		Subset 2			
WSMAX	39.5	Nms	35.9	Nms		
WSMIN	1.2	Nms	4.8	Nms		

WSMAX	To Uplink:				In rpm:	
	X1		X2		X1	X2
RW#1:	411.458333	rd/s	373.958333	rd/s	3929	3571
RW#2:	404.507960	rd/s	367.641411	rd/s	3863	3511
RW#3:	406.078637	rd/s	369.068939	rd/s	3878	3524
RW#4:	404.508374	rd/s	367.641788	rd/s	3863	3511

WSMIN	To Uplink:				In rpm:	
	X1		X2		X1	X2
RW#1:	12.500000	rd/s	50.000000	rd/s	119	477
RW#2:	12.288849	rd/s	49.155398	rd/s	117	469
RW#3:	12.336566	rd/s	49.346265	rd/s	118	471
RW#4:	12.288862	rd/s	49.155448	rd/s	117	469

The uplink was performed at 20:09z.

In the same time frame, were verified the AMD dead band value, the IMU timers, 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.

FDS GTPs did stop to receive real time TM: at 20:20z the FDS stopped to receive real time TM due to the crash of the GTP processors (likely caused by the crash of the IMCS HFA task).

The GTPs processors were re-started with the help of FD on call and a manual recovery was then started at 20:56z to update the first slew in TL (04920001).

No impact on TL.

24/10/06 (Day of Year 297, Revolution 492)

Nothing to report.

25/10/06 (Day of Year 298, Revolution 492)

Following the latest IMU 1-2 calibration, in preparation of the winter 2006 eclipse, the ACC IMUs drift corrections were updated at 11:44z during rev 492.

The calculated drifts from FD resulted consistent with the quick evaluation performed in parallel by FCT and with the drifts history. The IMUs drift corrections were updated accordingly to the following table (source FD, TPF 0492_0001_M.DRA):

```
IMU1_R_1 R 0.9182177E-06        r/s  D IMU 1 roll 1
IMU1_R_2 R 0.9182177E-06        r/s  D IMU 1 roll 2
IMU1_Y_1 R 0.8937007E-06        r/s  D IMU 1 yaw 1
IMU1_Y_2 R 0.8937007E-06        r/s  D IMU 1 yaw 2
IMU2_R_1 R 0.5286845E-06        r/s  D IMU 2 roll 1
IMU2_R_2 R 0.5286845E-06        r/s  D IMU 2 roll 2
IMU2_Y_1 R 0.2229173E-07        r/s  D IMU 2 yaw 1
IMU2_Y_2 R 0.2229173E-07        r/s  D IMU 2 yaw 2
IMU3_Y_1 R -0.2043005E-06       r/s  D IMU 3 yaw 1
IMU3_Y_2 R -0.2043005E-06       r/s  D IMU 3 yaw
IMU4_R_1 R -0.2728047E-06       r/s  D IMU 4 roll 1
IMU4_R_2 R -0.2728047E-06       r/s  D IMU 4 rol
```

Star not found during S/T: at 23:40z the TC A3189 (START GUIDE STAR) failed release due to static PTV NO GO during commanding for slew ID 04920056: the problem was due to star not found in SLOT # 2 during the S/T process at the beginning of the Close Loop Slew (CSL) commanding.

The AOCS s/s was disabled in TL at 23:40z and a manual recovery was then started at 23:46z from attitude of PID 04920055 to the attitude of PID 04920056 by executing a CSL.

Again no star was found in SLOT#2 during the S/T process and TC A3189 failed release due to static PTV.

A second manual recovery was then attempted from attitude of PID 04920055 to the attitude of PID 04920057 by performing a manual Open Loop Slew (OSL).

The next slew in TL (04920058) was manually updated and the AOCS enabled on DoY 2006.299 at 00:54z.

The following slews were missed: 04920056(CSL)-57(CSL).

26/10/06 (Day of Year 299, Revolution 492-493)

The first eclipse operations were nominal from the AOCS point of view. Hereafter is reported summary of the first eclipse passage during rev 493:

AOCS ECLIPSE MONITORING
Winter 2006

Revolution:	**493**		
Date:	**26/10/2006**		
DoY:	**299**		

Penumbra Start:	26/10/2006 19:44:54	**LOS:**	26/10/2006 15:14:26
Umbra Start:	26/10/2006 19:48:05	**AOS:**	26/10/2006 19:36:00
Umbra End:	26/10/2006 20:07:25		
Penumbra End:	26/10/2006 20:10:59		
Eclipse Duration:	0:26:05		
Eclipse Duration [sec]:	1565		

IMU Health Check Start	26/10/2006 12:09:30
Eclipse Imminent Flag	26/10/2006 18:45:14
ACC IMU AutoCal Start	26/10/2006 18:59:40
ACC IMU AutoCal End	26/10/2006 19:19:40

Sun out of FSS FoV	26/10/2006 19:47:25
Sun back in FSS FoV	26/10/2006 20:08:18

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	26/10/2006 19:25:54	-1140.00	26/10/2006 19:25:56	-1138.00	-1064	
FDE Eclipse Start	26/10/2006 19:35:23	-571.00	26/10/2006 19:37:05	-469.00	-404	176
FCE Eclipse Start	26/10/2006 19:36:07	-527.00	26/10/2006 19:37:46	-428.00	-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	26/10/2006 20:14:27	208	26/10/2006 20:16:09	310.00	360	176
FDE Eclipse End	26/10/2006 20:14:27	208	26/10/2006 20:16:09	310.00	360	176
ACC Eclipse End	26/10/2006 20:19:21	502	26/10/2006 20:19:23	504.00	578	

IMU	**Uplink**	**Execution**	**WRT Penumbra End [sec]**
IMU Auto Off Enable	26/10/2006 20:23:53	26/10/2006 20:21:17	618

IMU On	26/10/2006 12:00:41	IMU H/C Noise Roll [as/s]	0.2423
IMU Off	26/10/2006 20:21:37	IMU H/C Drift Roll [as/s]	0.2417
IMU On Time	8:20:56	IMU Auto Cal Drift Roll [as/s]	0.2313

STR SEU threshold exceeded: at 20:41 z due to false event the IMU was switched ON by the ACC, just after AOS at the beginning of rev 493.

The guide star at moment of the false event was Mi 8.15 at CCD location [23684 , 16277]. A new guide star was picked after the mapping commanded by the ACC autonomously.

A manual recovery was then started at 20:52z and the first slew in TL (04920001) manually updated at 21:00z.

No impact on TL.

Problem on NCTRS: at 22:31z due to a problem on NCTRS, the slew ID 0493002(CSL) failed release and the AOCS s/s disabled in TL.

A manual recovery was then started at 22:38z from attitude of PID 04930001 to the attitude of PID 04930002. The next slew 04930003 was manually updated at 23:06z.

The AOCS s/s was enabled in TL at 23:07z.

The following slew was missed in TL: 04930002(CSL).

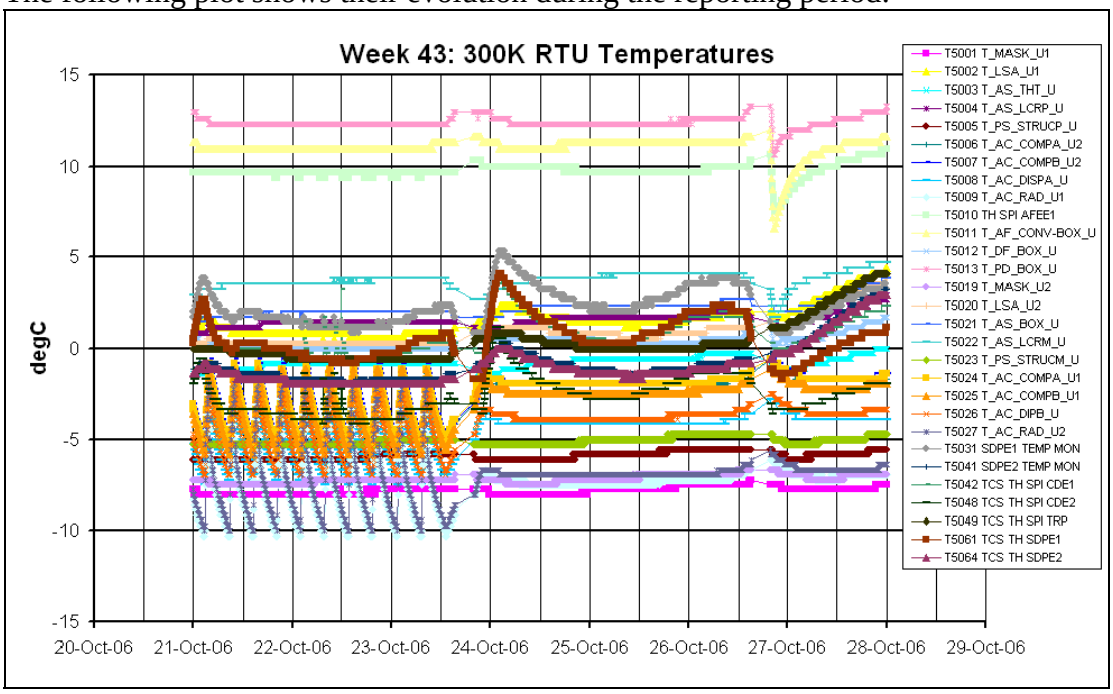
27/10/06 (Day of Year 300, Revolution 493)

FDS GTPs did stop to receive real time TM: at 11:02z the FDS stopped to receive real time TM due to the crash of the GTP processors (likely caused by a previous problem on the IMCS HFA task on IMCA).

The GTPs processors were re-started with the help of FD on call and no manual recovery was requested. No impact on TL.

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. In revolution 491, the cold plate temperature was maintained in the range to 82K +/-1K with a positive drift of 0.023deg/day. The stroke of all four compressors was set at 39. The average LCL currents of the CDEs were in revolution 491:

- Average CDE1 LCL Current = 4.57A
- Average CDE2 LCL Current = 4.35A.

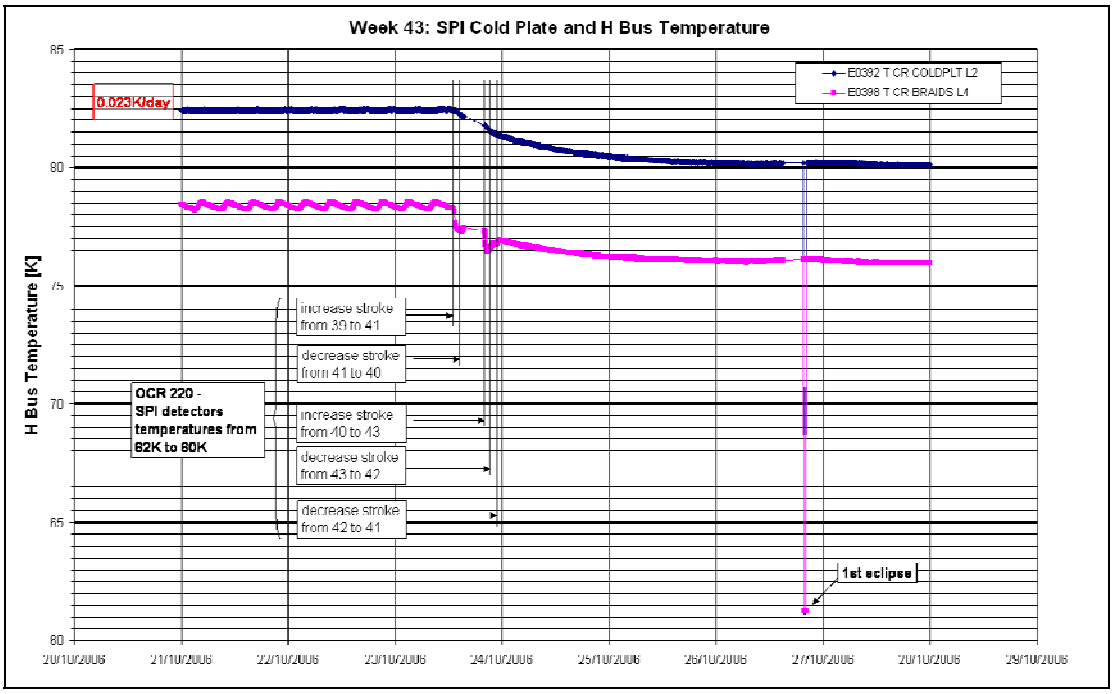
During Perigee Passage from revolution 491 to 492 (on 23/10/2006), the OCR 220 "SPI detectors temperature from 82K to 80K" was implemented. Based on OR 267, the operations took place as follows:

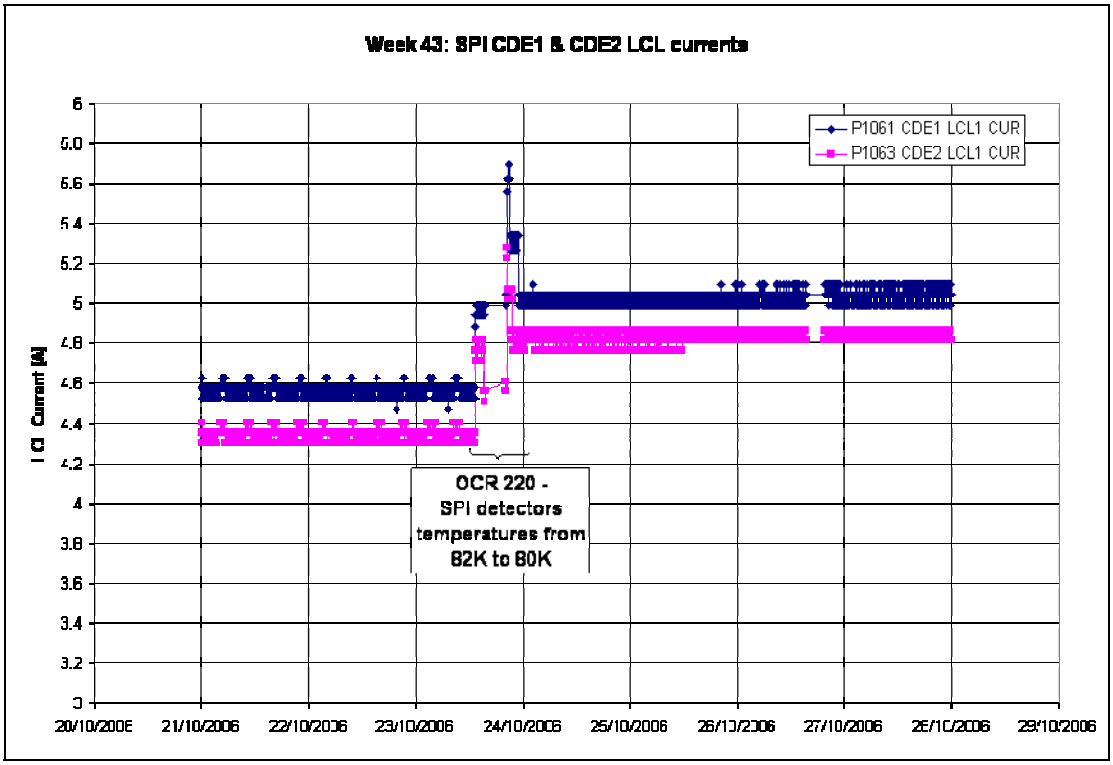
- At 13:10Z, the stroke of all four cryocoolers was increased from 39 to 41
- At 15:04Z, after evaluating the trend in the thermal braids temperature, it was decided to decrease the stroke to 40 for the following Perigee Passage
- At 20:11Z, after AOS, the stroke were changed to 43
- At 20:33Z the stroke for cryocoolers C&D was decreased from 43 to 42
- At 21:07Z the stroke for cryocoolers A&B was decreased from 43 to 42
- At 21:39Z the stroke for cryocoolers C&D was decreased from 42 to 41
- At 22:52Z the stroke for cryocoolers A&B was decreased from 42 to 41.

After stabilisation, the cold plate temperature was maintained in the range to 80K +/-1K. The stroke of all four compressors has been finally set to 41 and the average LCL currents of the CDEs from revolution 492 onwards were:

- Average CDE1 LCL Current = 5.07A
- Average CDE2 LCL Current = 4.85A.

The following plots show the evolution of the cold plate and H bus temperatures, as well as the CDE1 & CDE2 LCL currents during the reporting period.

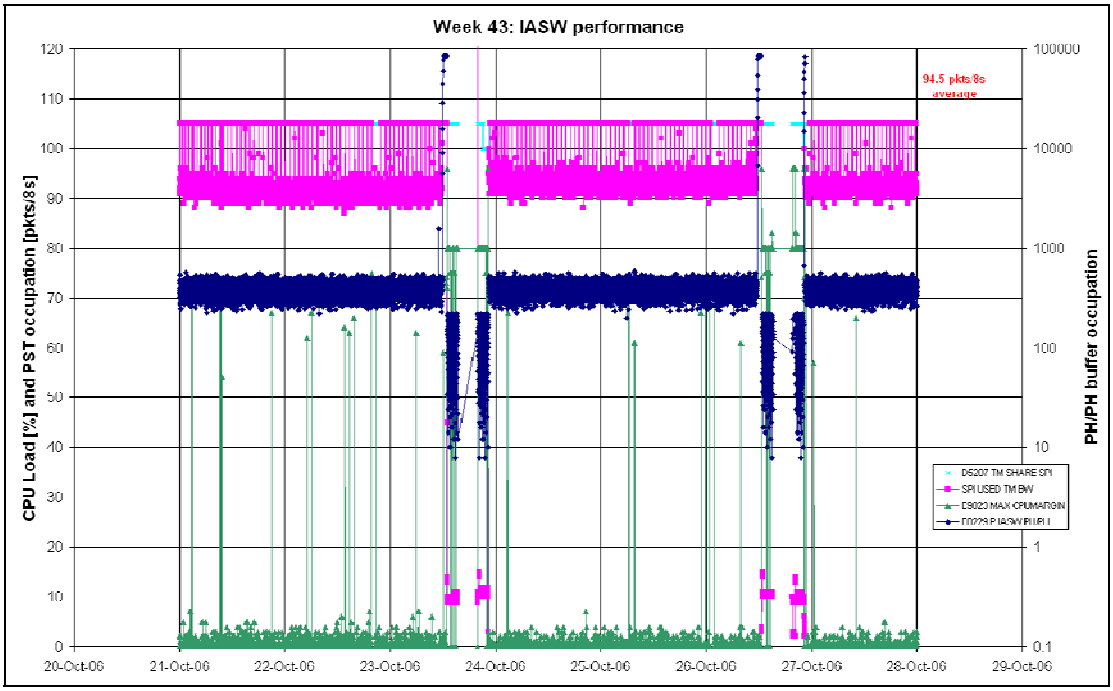




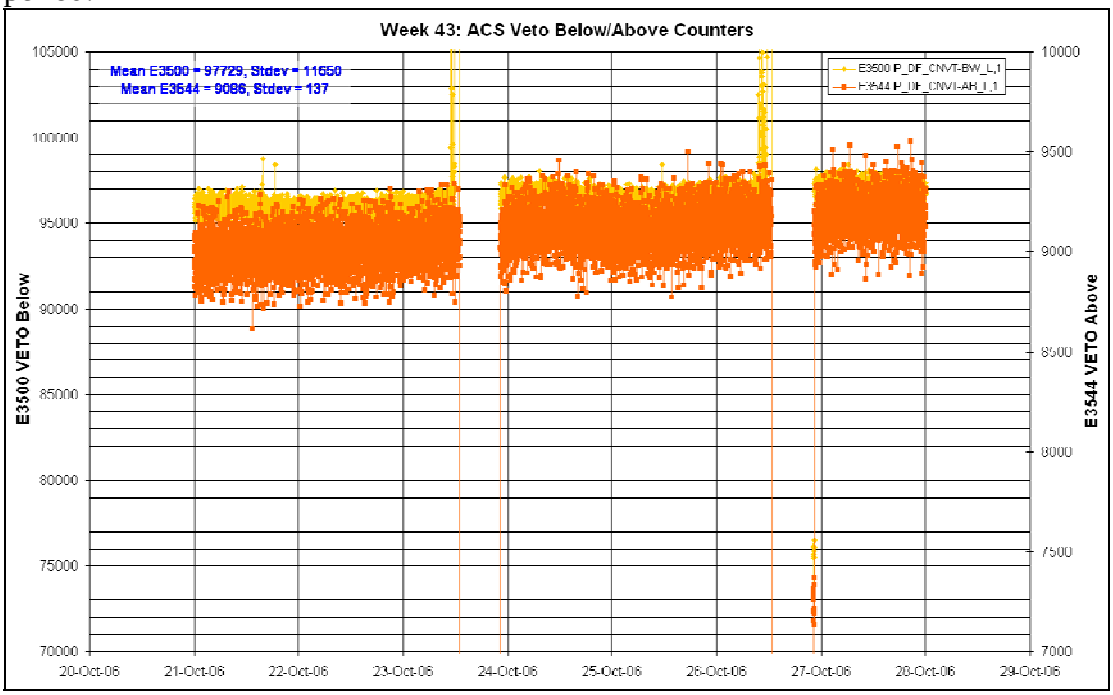
DPE & IASW: The DPE health and IASW performance is nominal. The current IASW version installed is 432.

The average TM bandwidth occupation of SPI was 94.5 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.

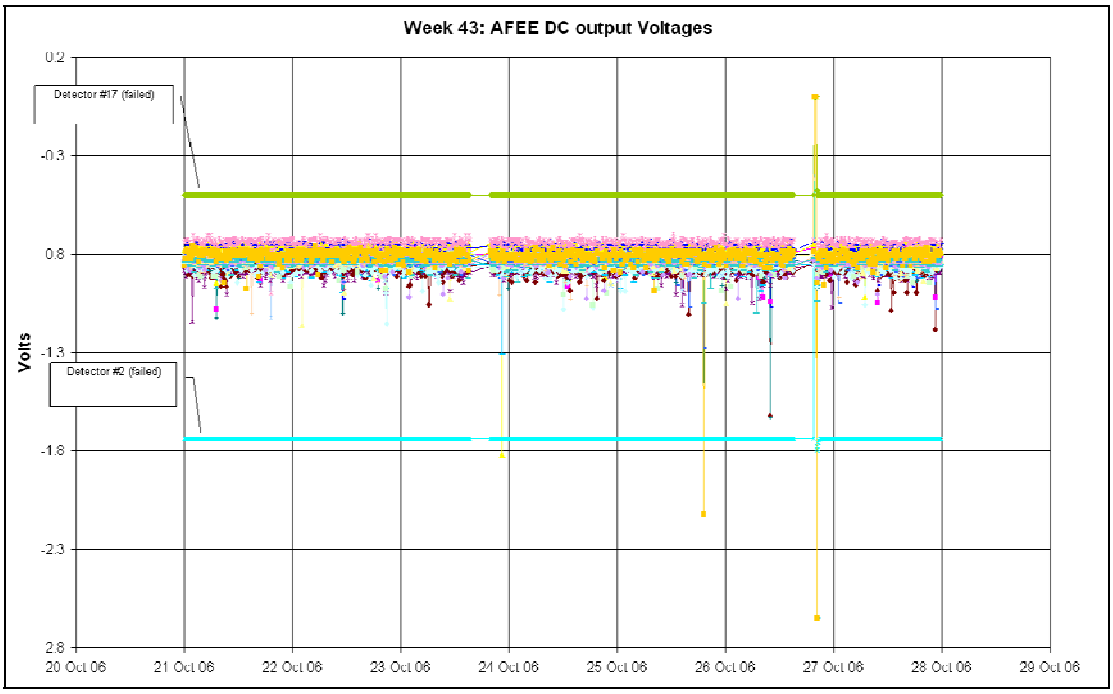


ACS: The performance of the ACS is nominal.
The following plot shows the ACS overall count rate evolution during the reporting period:

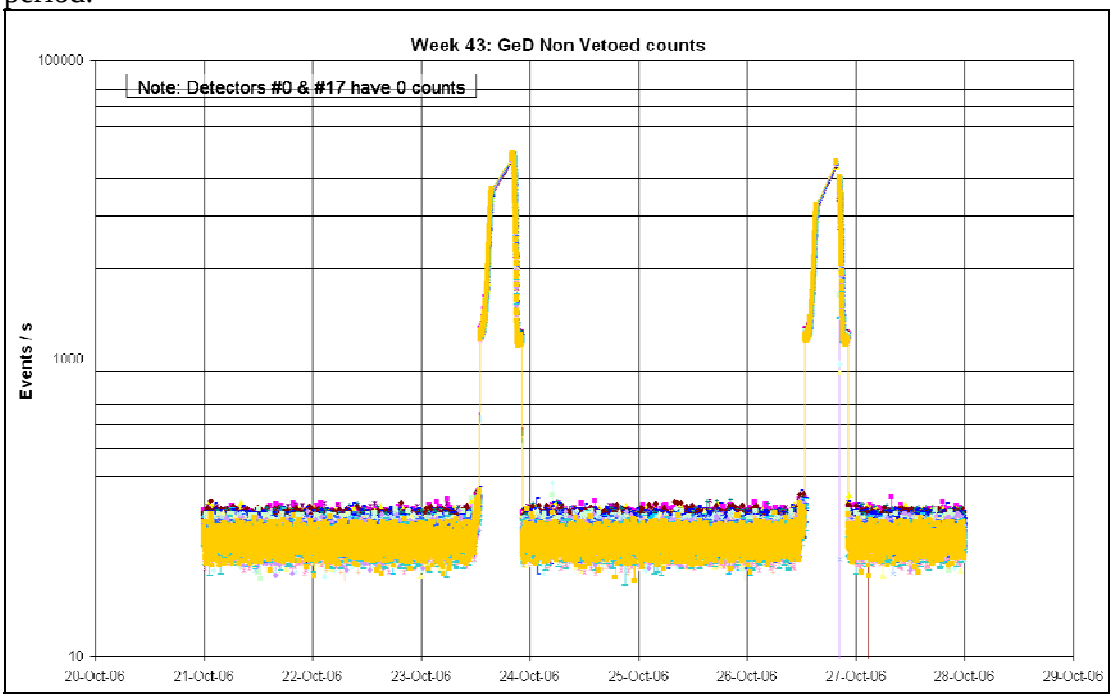


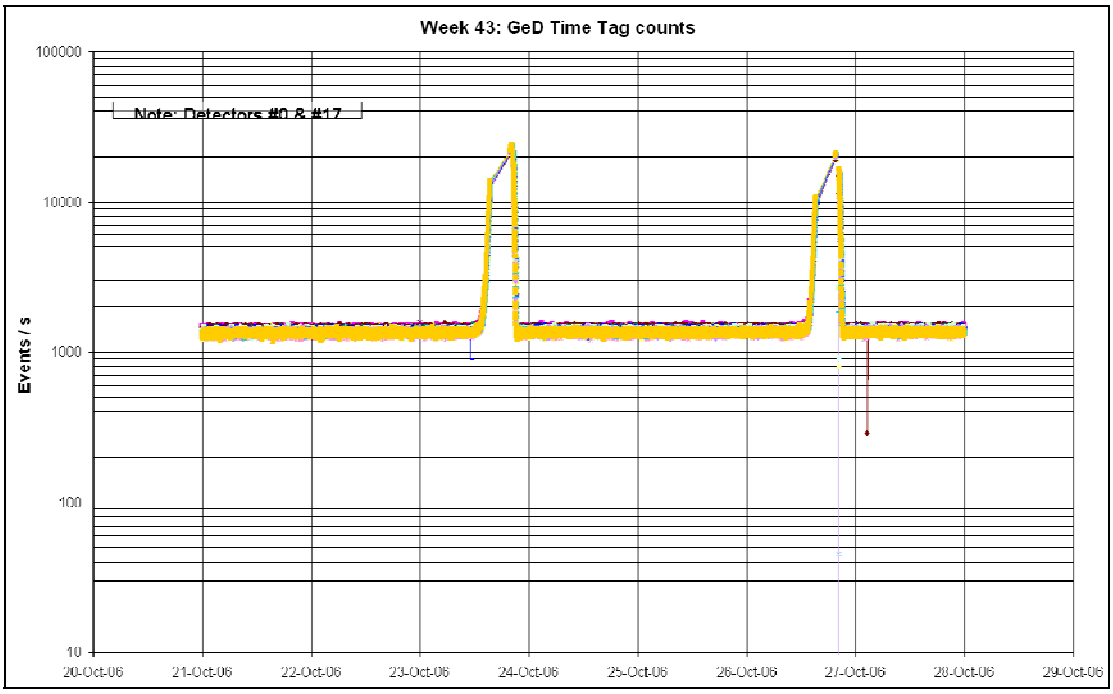
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with the last annealing.

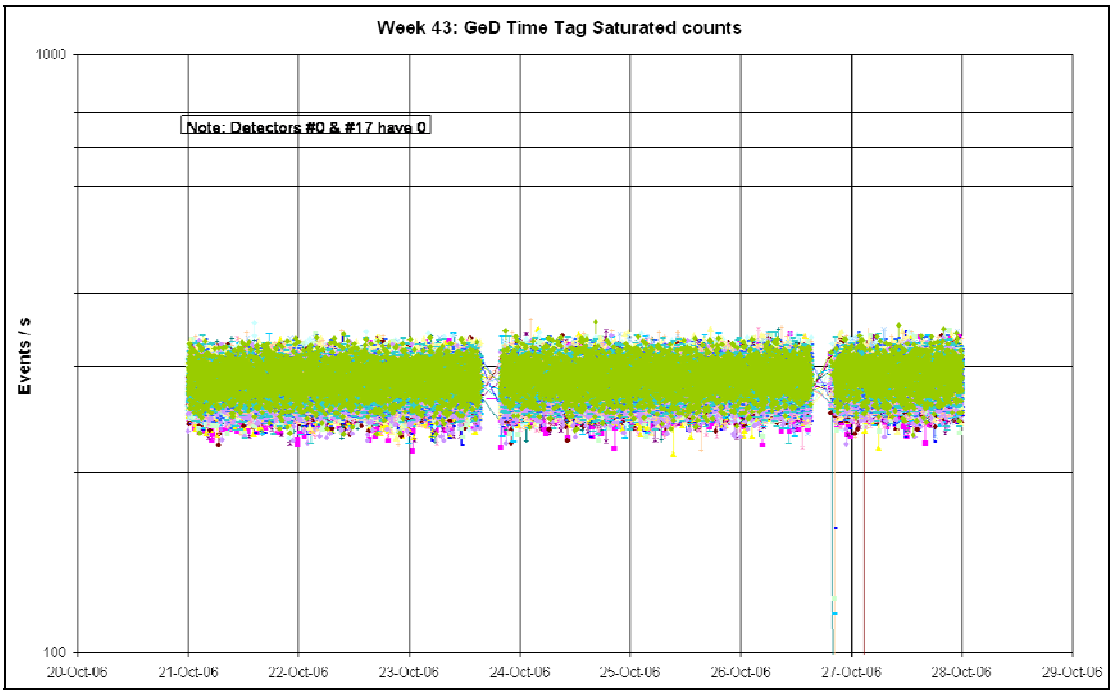
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



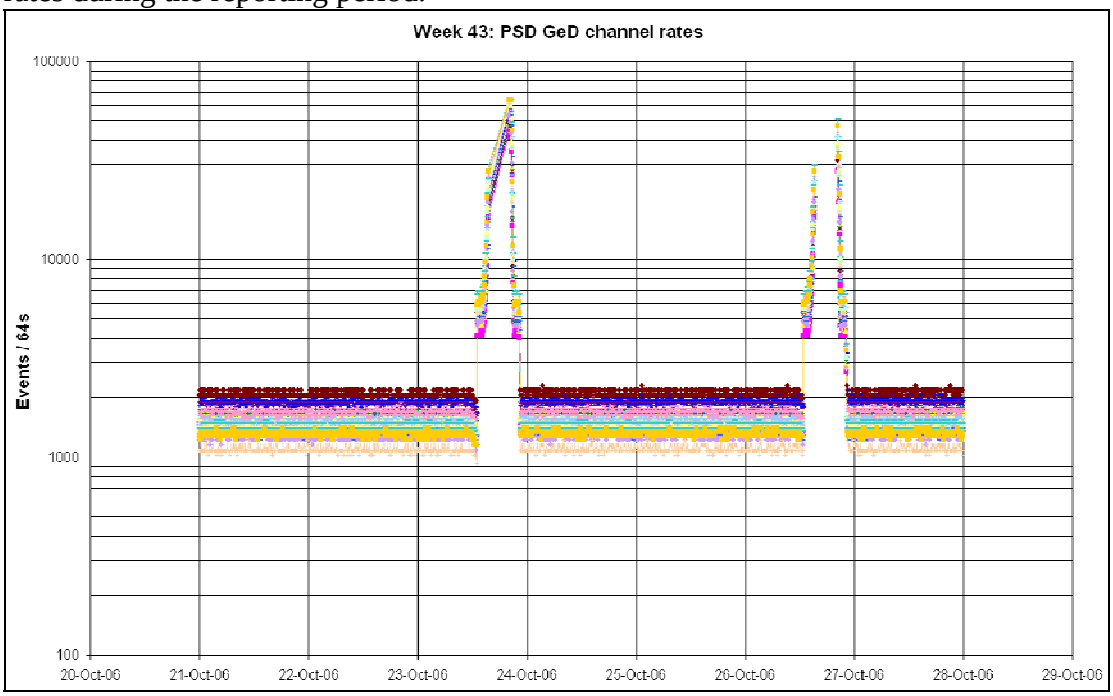
DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.




Week 43: GeD Time Tag counts
Note: Detectors #0 & #17
Events / s
100000
10000
1000
100
10
20-Oct-06
21-Oct-06
22-Oct-06
23-Oct-06
24-Oct-06
25-Oct-06
26-Oct-06
27-Oct-06
28-Oct-06
29-Oct-06


Week 43: GeD Time Tag Saturated counts
Note: Detectors #0 & #17 have 0
Events / s
1000
100
20-Oct-06
21-Oct-06
22-Oct-06
23-Oct-06
24-Oct-06
25-Oct-06
26-Oct-06
27-Oct-06
28-Oct-06
29-Oct-06

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 OOLs and OEMs were received from SPI during the reporting period:

- On 2006-10-23 at 15:14Z, the following OEM was reported:

```
APID 1024  ID     1     EXCEPTION   SPI1 FIXED POINT OVERFLOW
      INTERRUPTED TASK        22
      MESS CLASS              1
      MESS ID                 1
      STATUS WORD INT         4096
      INSTR COUNT INT         419
```

  As this occurred during the Radiation Belts passage of revolution 491, no action was taken.

- On 2006-10-24 at 12:11Z, the following OEM was reported:

```
APID 1024  ID   229     EXCEPTION   SPI1 PARTIAL FLAG OVERFLOW
      FIX6                    0
      EMESS CLASS             1
      MESS ID                 229
      SUBBLOCK ID             SP15
      FIX16                   0
```

  As this was a single occurrence, no action was taken.

- 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.
- On 2006-10-23 at 11:06Z, TM parameter E3500 (P_DF_CNVT-BW_L,1) started toggling OOL high-high as the spacecraft was approaching the Radiation Belts planned in the timeline at 12:58Z.

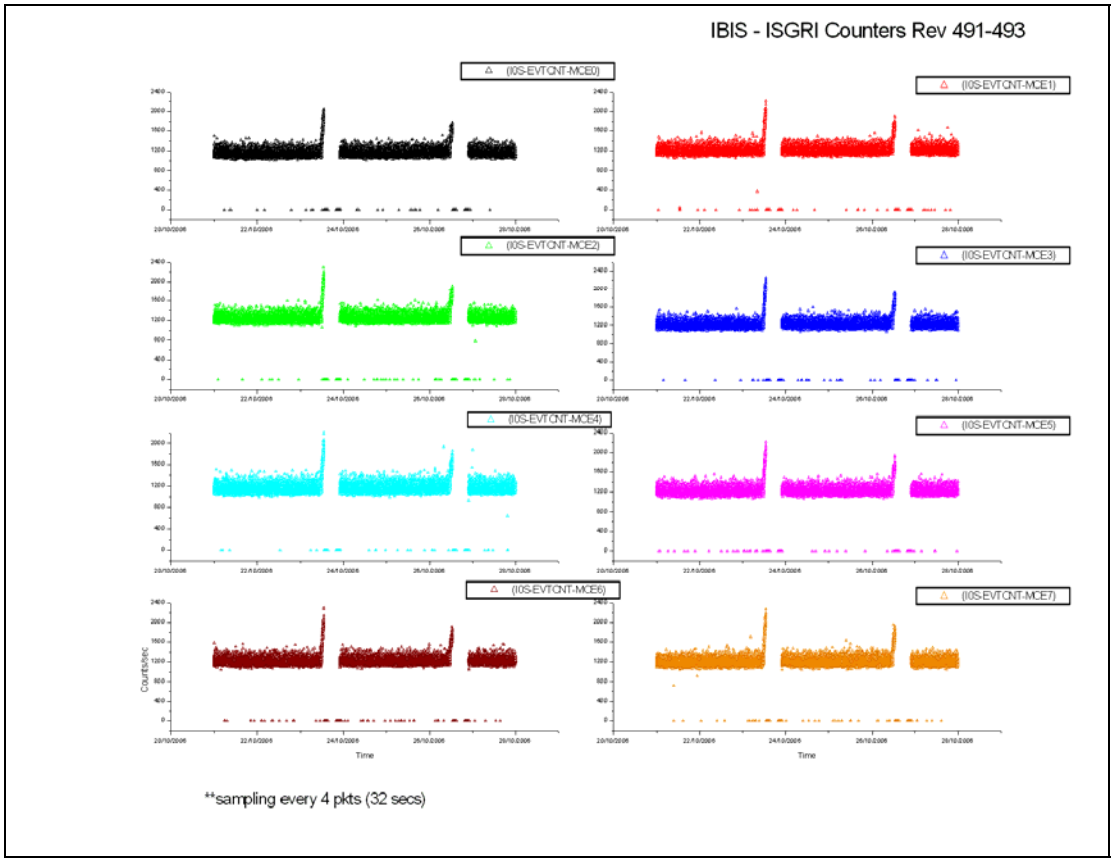
- On 2006-10-26 at 11:33Z, TM parameter E3500 (P_DF_CNVT-BW_L,1) started toggling OOL high-high as the spacecraft was approaching the Radiation Belts planned in the timeline at 12:45Z.

The first eclipse of the season took place on 26/10/2006. All EDs were performed nominally from the timeline except ED EEXIT-02. Actually, at 22:15Z, the 10th command of this sequence, TC EU0201D, failed due to Dynamic PTV equals to "wait". This is probably due to a problem on ground with the update of the dynamic default parameters for this TC. The rest of the sequence was uplinked via timeline and put SPI into Photon mode. At 22:28Z, the operator resent the complete Event Designator which was then executed successfully. The impact was a minor delay on the SPI activation for science observation.

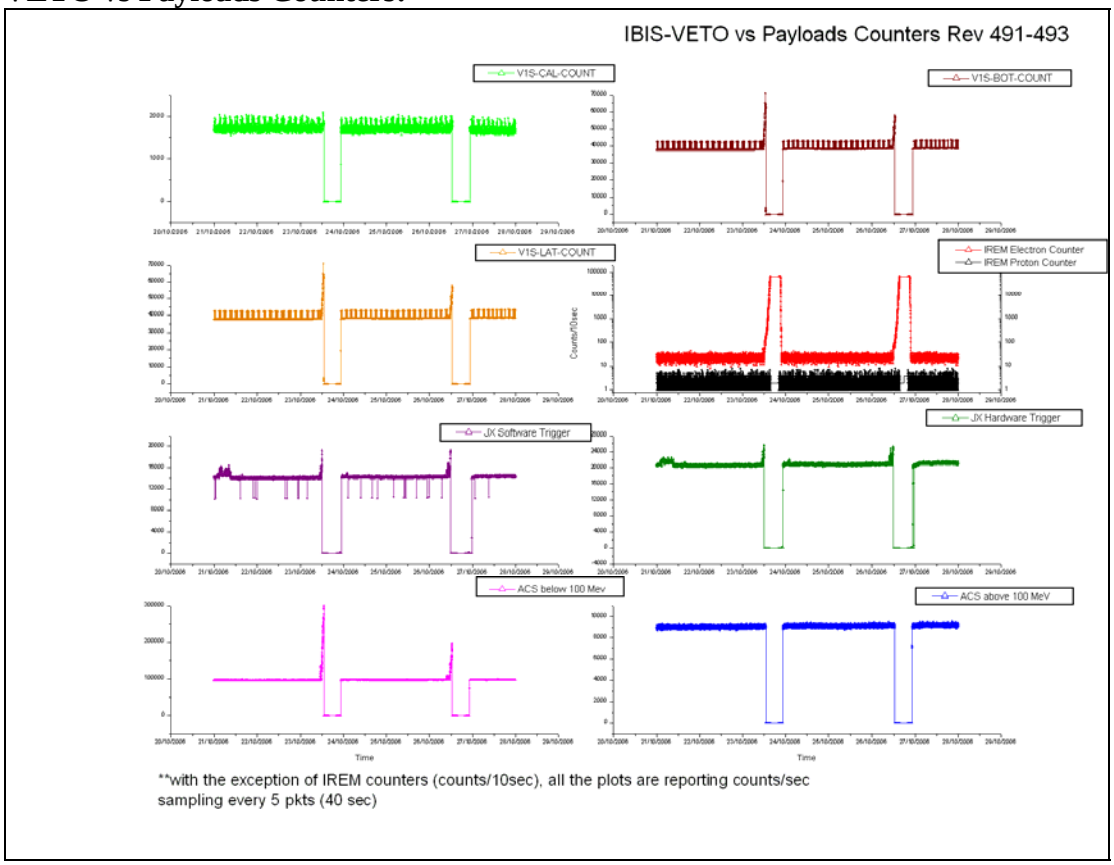
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

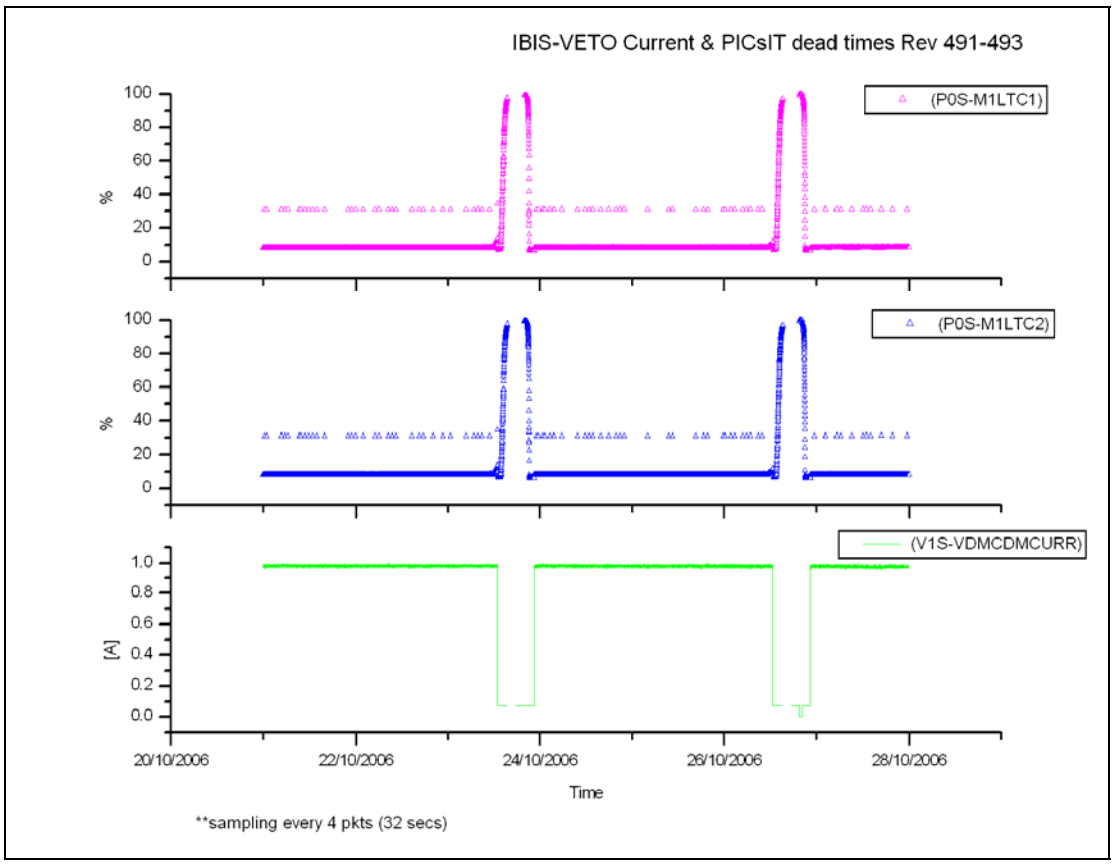


VETO vs Payloads Counters:

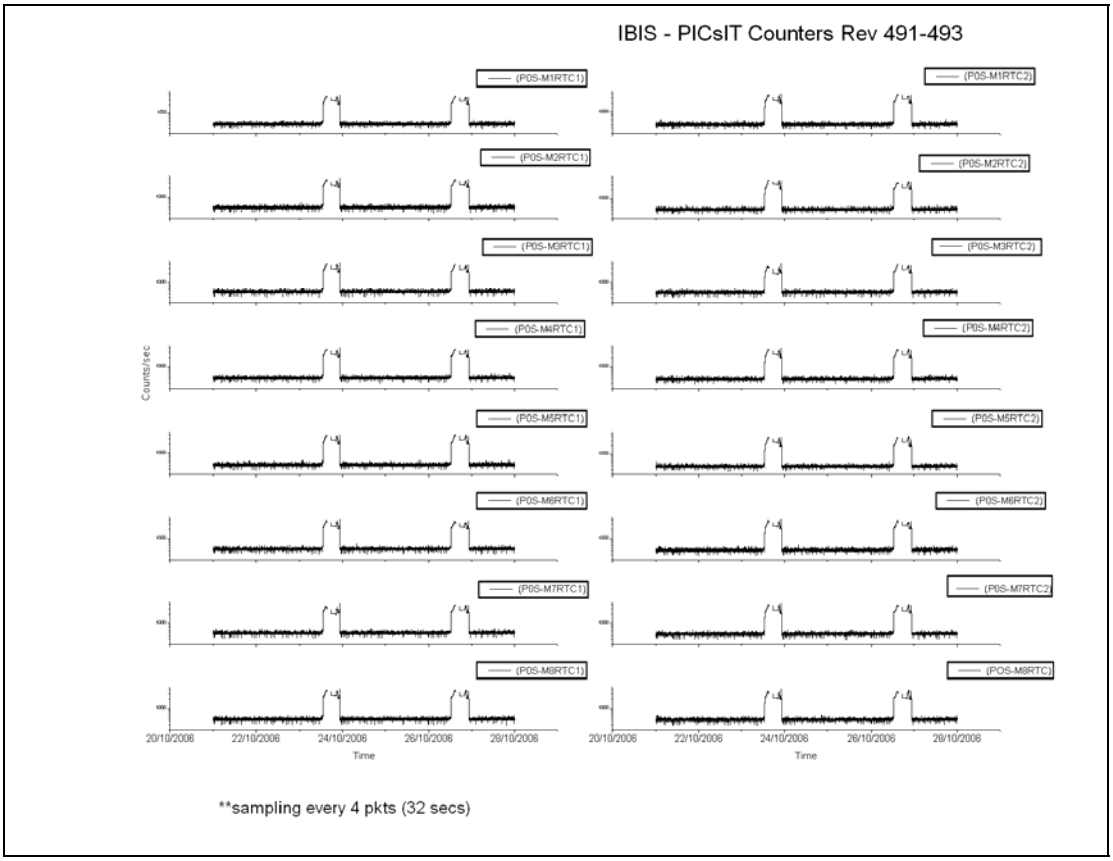


The week was characterised by low radiation.

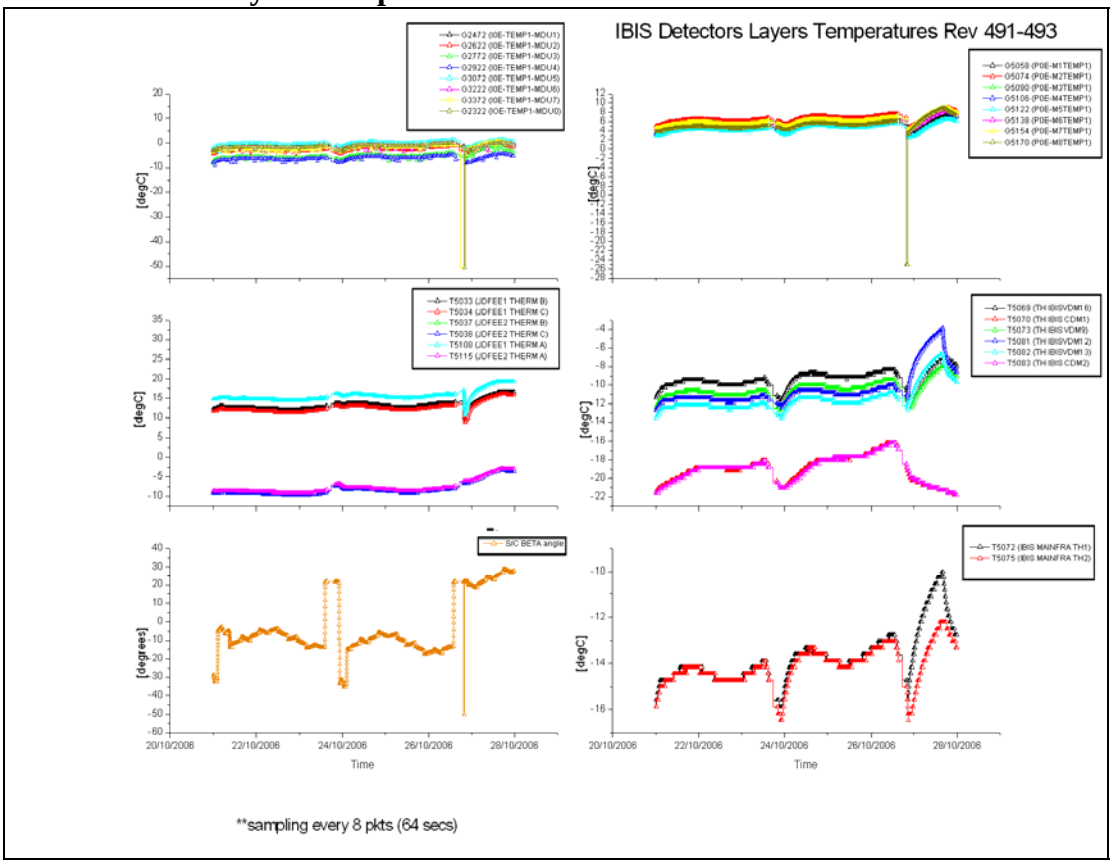
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

The usual ("nominal") 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.

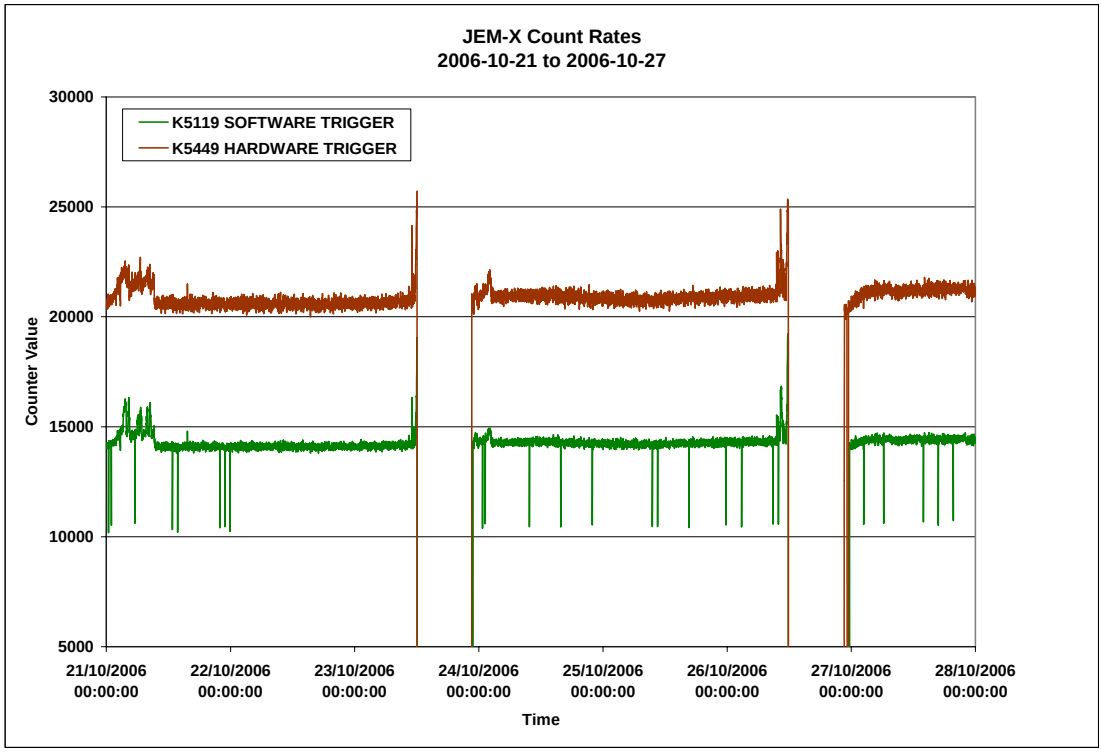
DoY 2006.299 (26/10/2006):

The 1st eclipse of the season took place after the Perigee Passage from revolution 492 to 493. All sequences were executed nominally for IBIS.
However an anomaly with a SPI sequence implied other EDs from the timeline to fail due to Dynamic PTV Fail. Particularly, ED GESTAN02 that was planned at 22:32Z was missed. The operator recovered this sequence at 23:28Z. The impact is a delay of ~1hour on science observations for revolution 493.

8.3.4 JEM-X Operations

JEM-X Count Rates

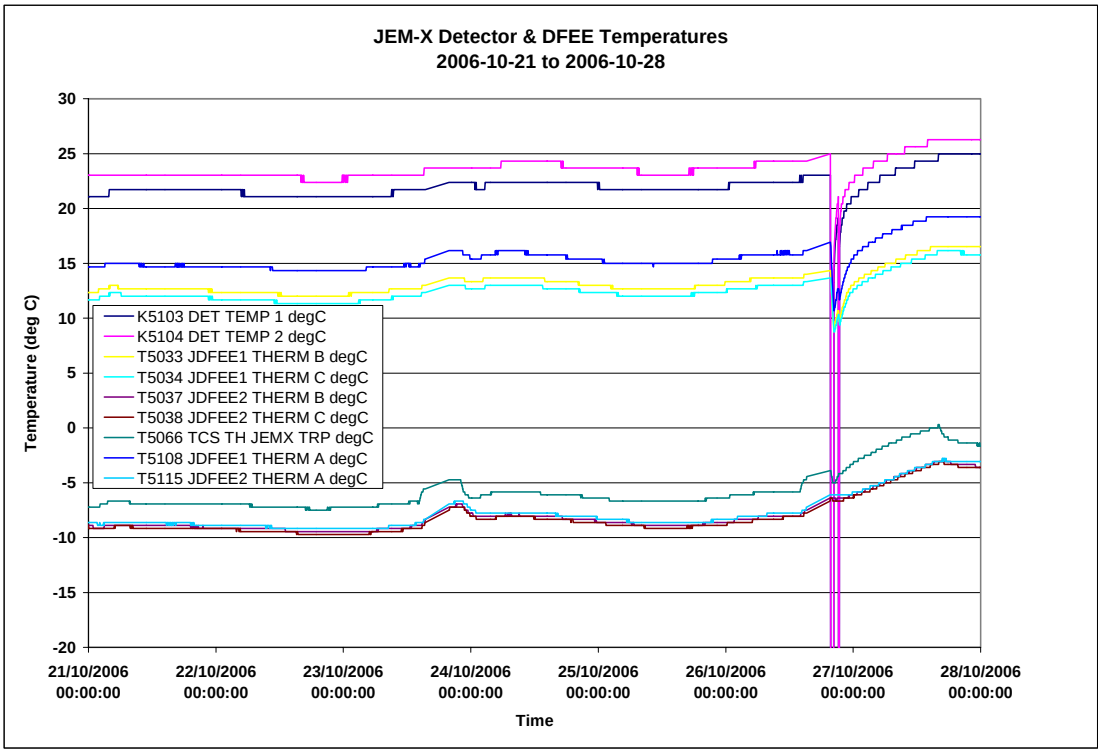
JEM-X count rates over the reporting period are displayed in the following graph[1].



[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

2006-10-21 (DOY 294, Rev 491) to 2006-10-25 (DOY 298, Rev 490-492)

Nothing to report

2006-10-26 (DOY 299, Rev 493)

At 20:23Z, during the post-eclipse reconfiguration of JEM-X1 following the 1st eclipse of this season, another DFEE anomaly occurred like those observed on 2004-06-20, 2004-06-23, 2004-12-08, 2005-05-18, 2005-11-14 (ref: Anomaly Reports INT_SC-84; INT_SC-104, INT_SC-119 and INT_SC-131). This anomaly is recorded as INT_SC-161, the details of which are as follows:

The symptoms of the anomaly were:
1) The following OEMs were received after the JEM-X1 DFEE was switched on by the ED KECLEX01 in the Timeline (uplinked at 2006-10-26T20:21:52Z):

```
2006.299.20.22.39.200  2006.299.20.22.45.501  1536 Real Time  191
EVENT    JEM-X1 PROB DFEE 11
  FIX6   11
  K9079   MESS CLASS  0
  K9080   MESS ID   191
```

[2] Data sampled (1 frame in 8)

```
  FIX16   8
  FIX16   0

>> Indicating that the operation “Load DFEE context” was unsuccessful
due to CRC failure for code area B000 to CFFF.
2006.299.20.22.39.200  2006.299.20.22.45.534  1536 Real Time  234
EVENT    JEM-X1 AUTO EVENT 4
  FIX6   4
  K9079  MESS CLASS   0
  K9080  MESS ID    234
  K5419  ACTUAL LEVEL  ECLIPSE
  K5420  TARGET LEVEL  RAD. BELTS
```

>>> Indicating failure of the automatic recovery from shutdown level ECLIPSE to shutdown level RAD. BELTS

2) Following the KECLEX01 ED, the JEM-X1 DFEE state (TM parameter K5022) remained MEMORY, instead of SAFE, and the Active Shutdown Level (TM parameter K5381) remained ECLIPSE instead of RAD. BELTS. This also remained the case after the broadcast packet radiation belt exit time of 2006-10-26T20:09:37Z.

3) The DFEE CPU speed, TM parameter K5583 CPU MODE, remained at a value of 8 MHz WAIT (as at start-up) rather than the nominal value of 16MHz.

Commanding to JEM-X1 from the Timeline was disabled at 21:08Z, before the Anode Calibration ED KEACAL01, and the recovery of JEM-X1 was then performed via a DFEE power cycle according to CRP_JEM1_5010 JEMX1 DFEE POWER CYCLE, consisting of:

- 21:05Z FCP_JEM1_9010 JEMX1 DFEE SWITCH OFF
- 21:29Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION

Commanding to JEM-X1 from the Timeline was re-enabled at 21:39Z and JEM-X1 operations then continued nominally. There was no loss of science data

At 22:31Z, due to Dynamic PTV problems, the first command in the sequence KEHVAC01 failed release. At 22:53, the sequence was re-sent manually, but the TC K0002 (HV ON) was rejected.

```
2006.299.22.53.44.081   2006.299.22.53.48.831   1536   RealTime   137
TC REJECT   JEM-X1 TC REJEC 10
  FIX6   10
  K9079  MESS CLASS   3
  K9080  MESS ID    137
  FIX8   0
  K9068  LSBIT APID   1
  FIX2   0
  K9069  TCP SS COUNT  1232
```

The recovery consisted of:

- 23:10Z FCP_JEM1_0040 GO TO SAFE
- 23:17Z FCP_JEM1_0041 GO TO SETUP
- 23:20Z Sequence KEAVAC01 sent
- 23:36Z Sequence KEDATA02 sent

The impact was a delayed start to science operations from a scheduled 22:47Z to 23:36.

2006-10-27 (DOY 300, Rev 493)

Nothing to report

8.3.5 OMC Operations

2006-10-21 (DOY 294, Rev 491)

Nothing to report

2006-10-22 (DOY 295, Rev 491)

At 19:35, an imcs problem caused the Timeline to be interrupted. A recovery was performed, and the OMC commands manually uplinked at 20:01. The impact was the start of pointing 04910053 was delayed from a nominal 19:39 to 20:07.

2006-10-23 (DOY 296, Rev 491) to 2006-10-24 (DOY 297, Rev 492)

Nothing to report

2006-10-25 (DOY 298, Rev 492)

At 23:40, AOCS problems prevented the execution of the slew to attitude of PID 04920056. The impact was the loss of that pointing.

2006-10-26 (DOY 299, Rev 492)

At 22:15, due to IMCS problems, the slew to the attitude of PID 04930002 was lost. Although the OMC went to normal mode, the attitude was incorrect, and the pointing was lost.

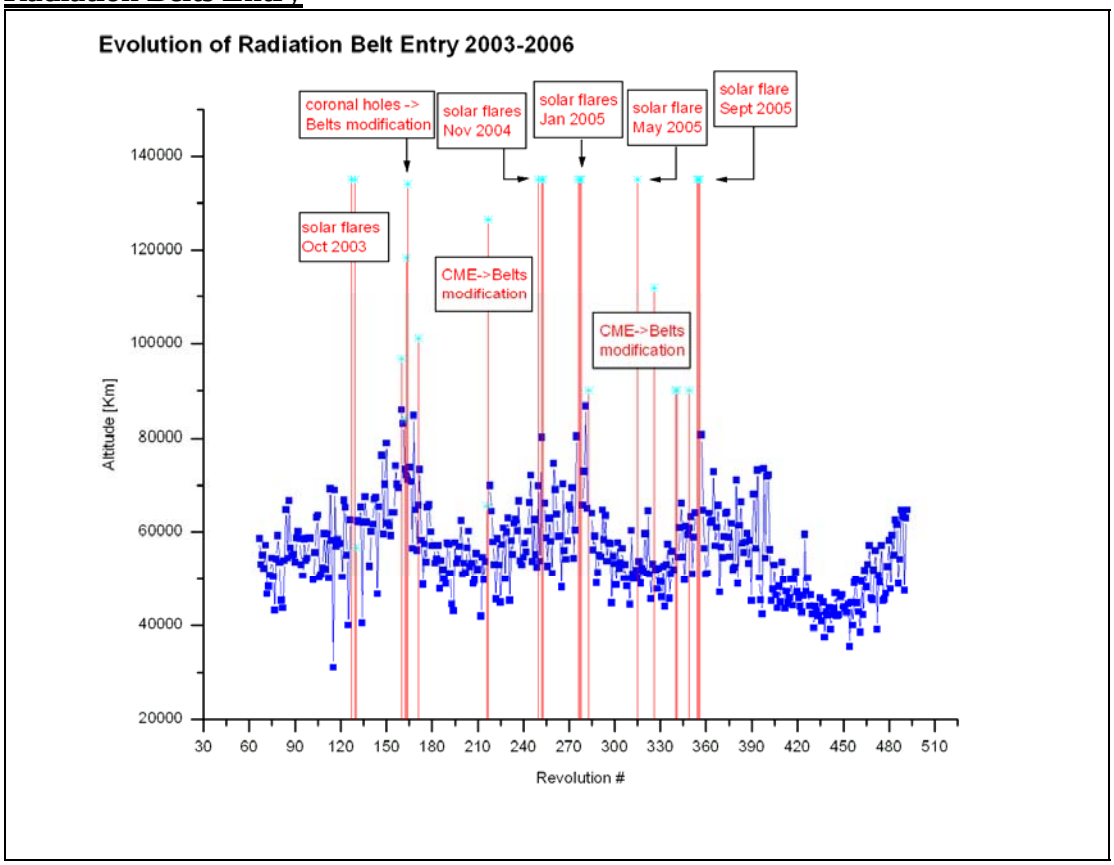
2006-10-27 (DOY 300, Rev 493)

Nothing to report

On DoY 296 at 12:58:43 and DoY 299 at 12:45:40 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

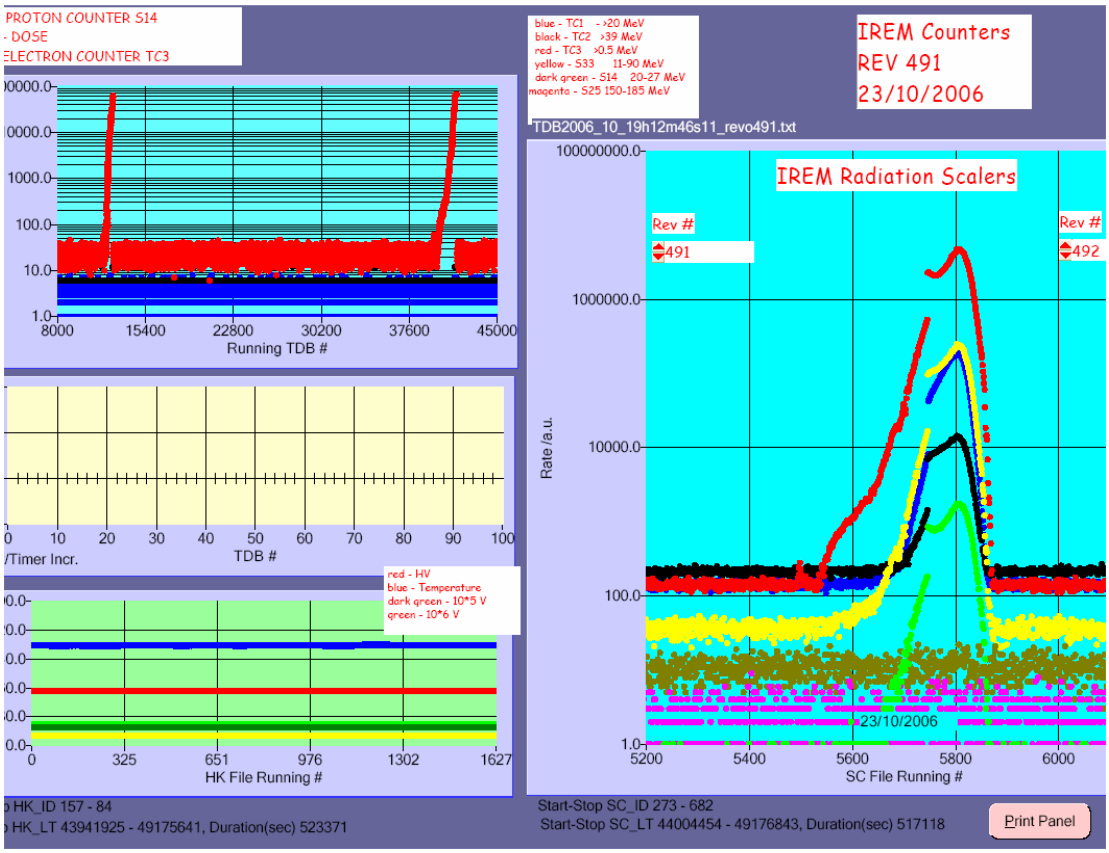
Nothing to report

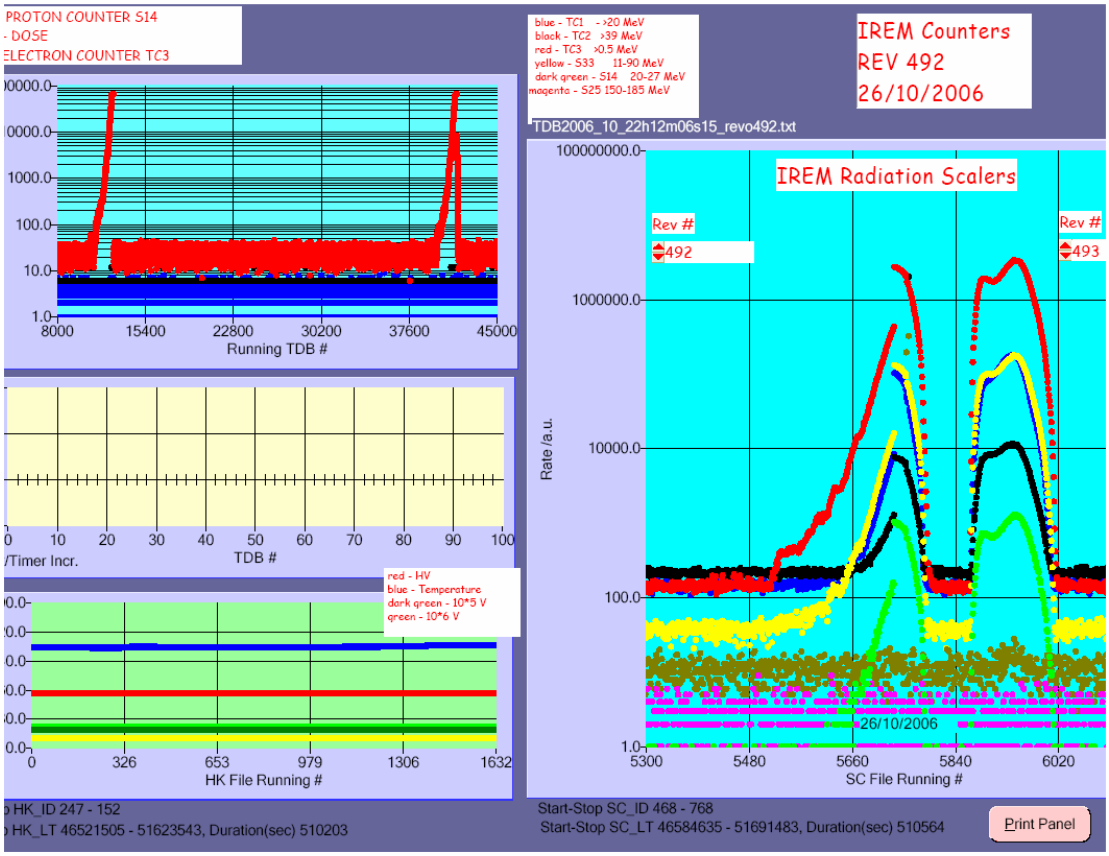
Electron Belts

REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
491	RAD_ENTR R 2006-10-23T12:58:39Z	2006-10-23 11:59:14	63064.1	2006-10-23 13:37:13	49692
492	RAD_EXIT R 2006-10-23T22:20:33Z	2006-10-23 21:18:10	35674.5	2006-10-23 21:47:13	41377
492	RAD_ENTR R 2006-10-26T12:45:33Z	2006-10-26 11:38:50	64756.4	2006-10-26 13:26:23	49519
493	RAD_EXIT R 2006-10-26T22:07:02Z	2006-10-26 21:09:38	35982.9	2006-10-26 21:36:23	41629

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

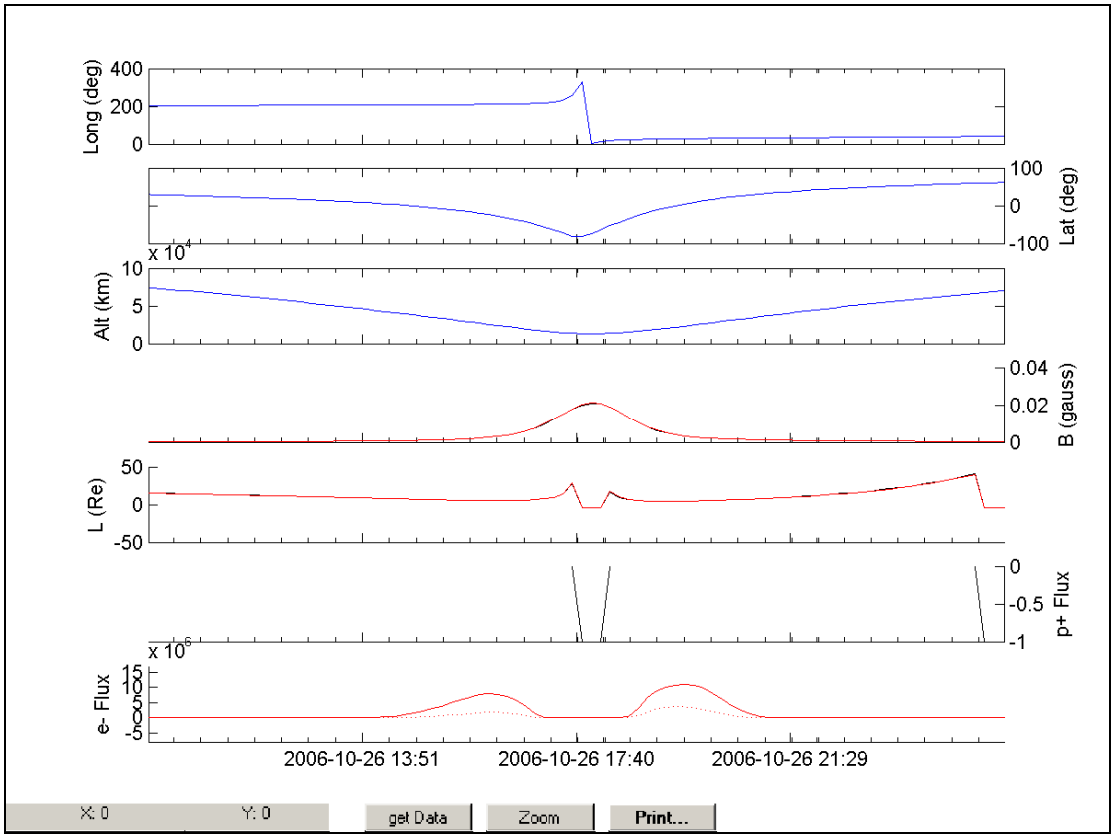
IREM radiation counters:



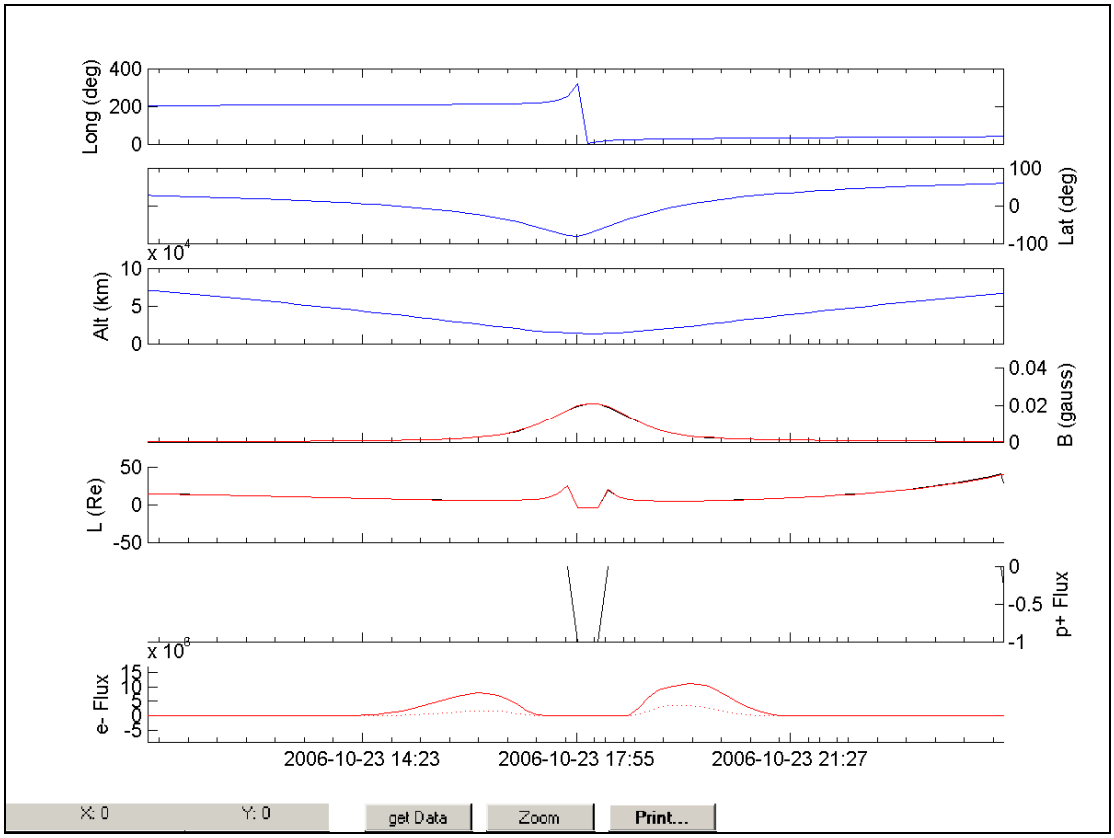


IREM Predicted Radiation Belt Passages

Rev 491



Rev 492



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

Due to temporary unavailability of the SEIS-RAT tool, no plots are available this week.