

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 210
Week 39
02.10.06
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 23.09.06 until 29.09.06 (both dates inclusive) and covers the revolutions 482 and 483.

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 2 hexagonal dithers of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), a raster dither of the Galactic Plane Region 3 (RA 19:43:54.33, DEC +23:53:25.4), a raster dither of the Orion OB1 (RA 05:17:00.30, DEC +01:47:17.7) and the Crab calibration, which consisted of 3 staring observations for JEMX1&2 observations at an attitude of (RA 05:34:31.97, DEC +22:00:52.1), followed by a raster dither at the same attitude for SPI & IBIS.

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.

Two slews were missed during the observation period due to a problem on FDS originated by sparse stars field/extended object.

The fuel consumption over the period between 21/09/2006 and 26/09/2006 was 0.1396 Kg. The remaining propellant is in the order of 151.8220 Kg.

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

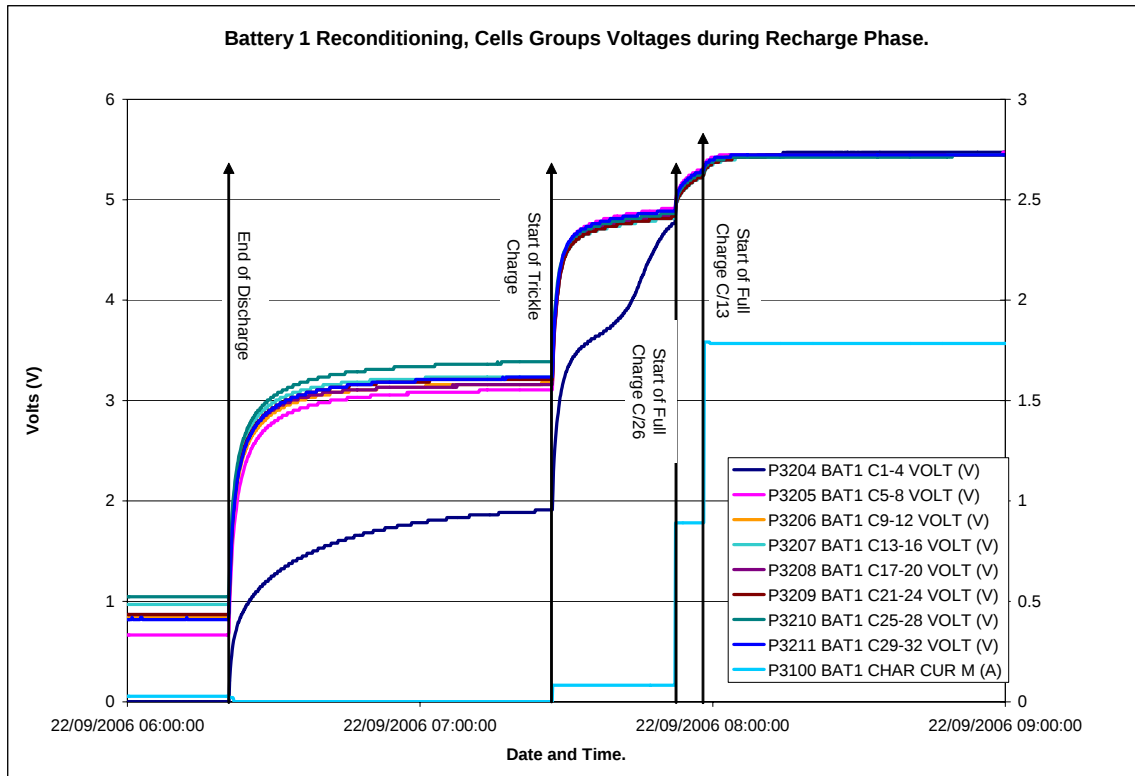
3.1.2 Power

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

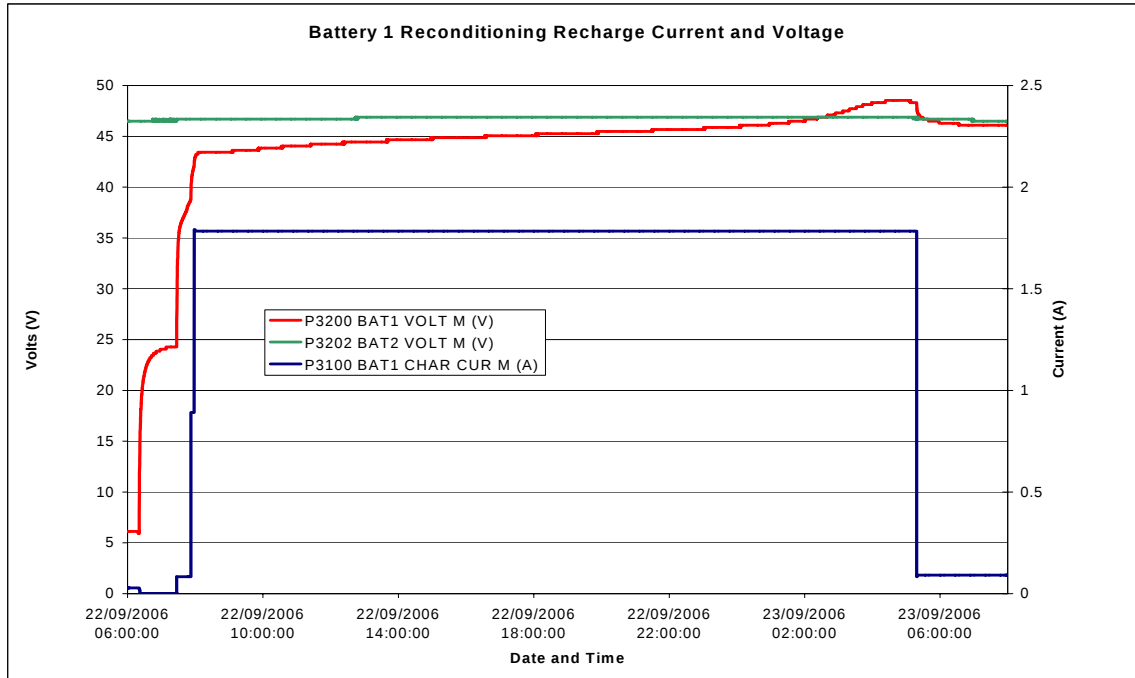
Battery 1 Reconditioning.

Battery 1 reconditioning recharge phase terminated on 23/9/2006 at 05.18z. The recharged capacity was 38.7Ah, compared with a discharged capacity of 35.7Ah, this gives a recharge ratio of about 1.08.

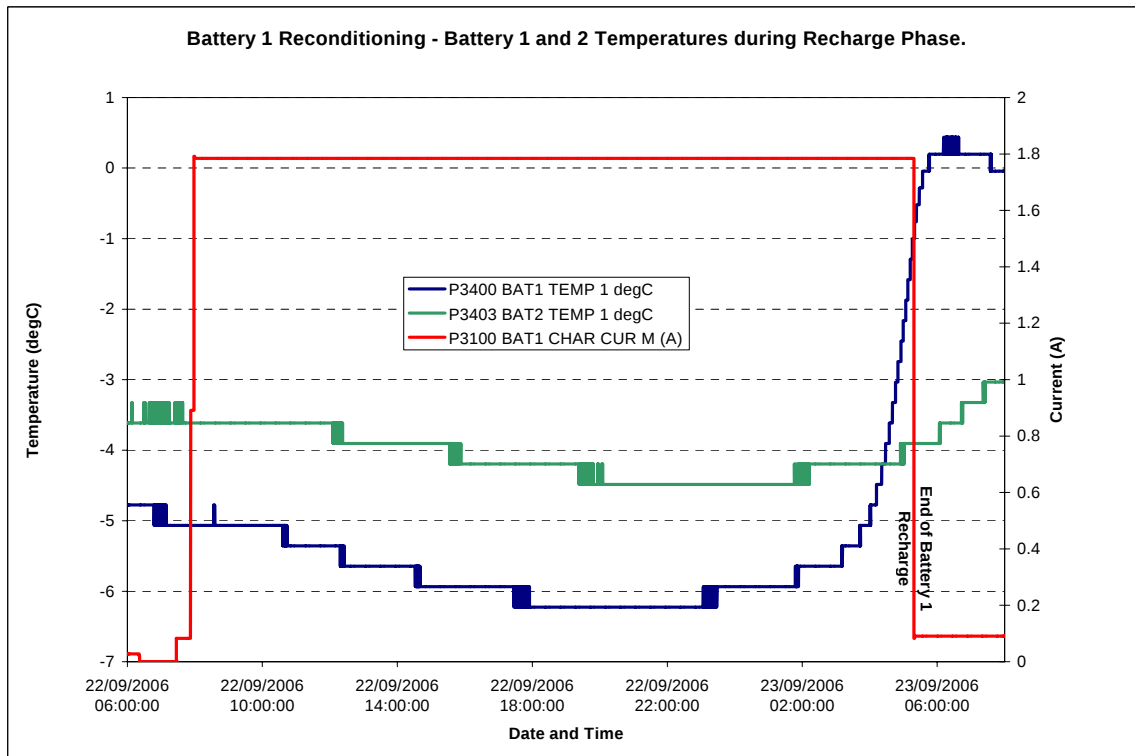
The following plot shows the behaviour of the cells group voltages during the first part of the recharge phase, in particular it can be seen that cell group 1-4 displayed a different voltage profile to that of the other cell groups during the initial trickle charge phase, a similar behaviour was observed during the last battery 1 reconditioning operation in 2004. After about 20minutes under trickle charge the cell group voltage recovered to be in line with that of the other cell groups, during the subsequent charge phase only minimal deviation of the cell group voltages was observed.



The next plot shows the batteries voltage profile throughout the complete recharge phase. It can be seen that towards the end of the recharge phase battery 1 terminal voltage is about 2V higher than battery 2 terminal voltage. Following the end of charge and switch from full to trickle charge the terminal voltage falls to be in line with that of battery 2.



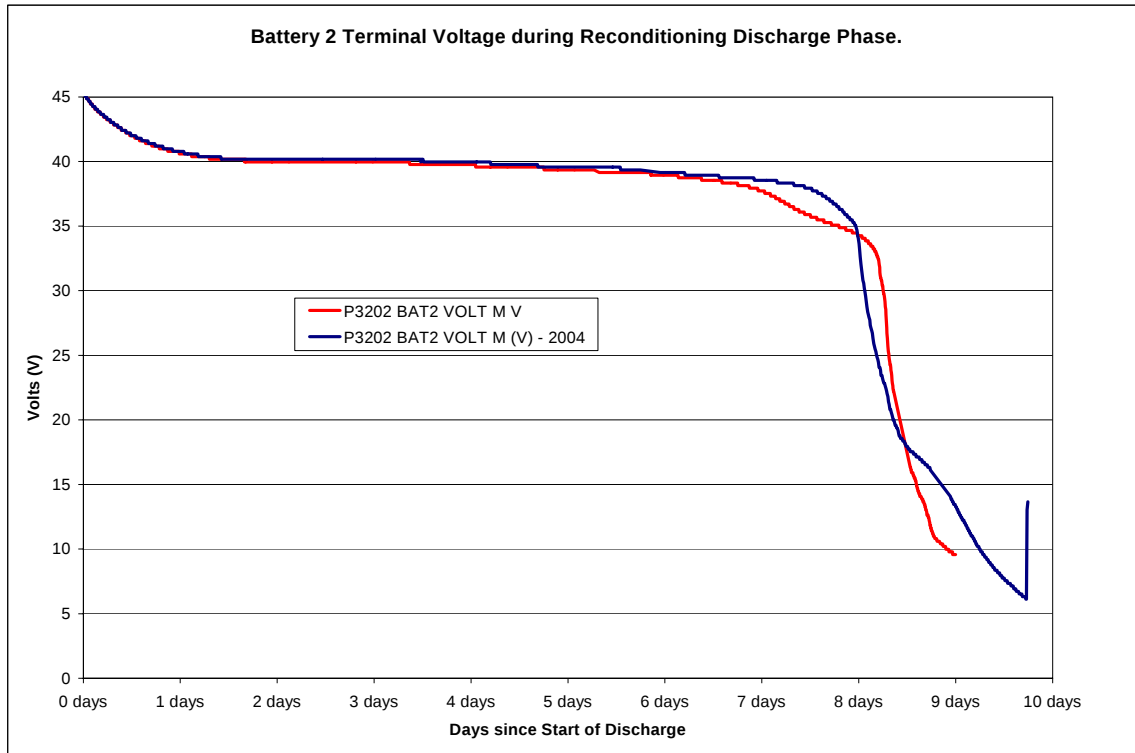
Finally, the next plot shows the evolution of battery temperatures during the recharge phase, the sharp temperature increase of battery 1 during the last 90 minutes of recharge is a further indication that the battery was fully recharged and corresponds well with the required over charge of about 8%.



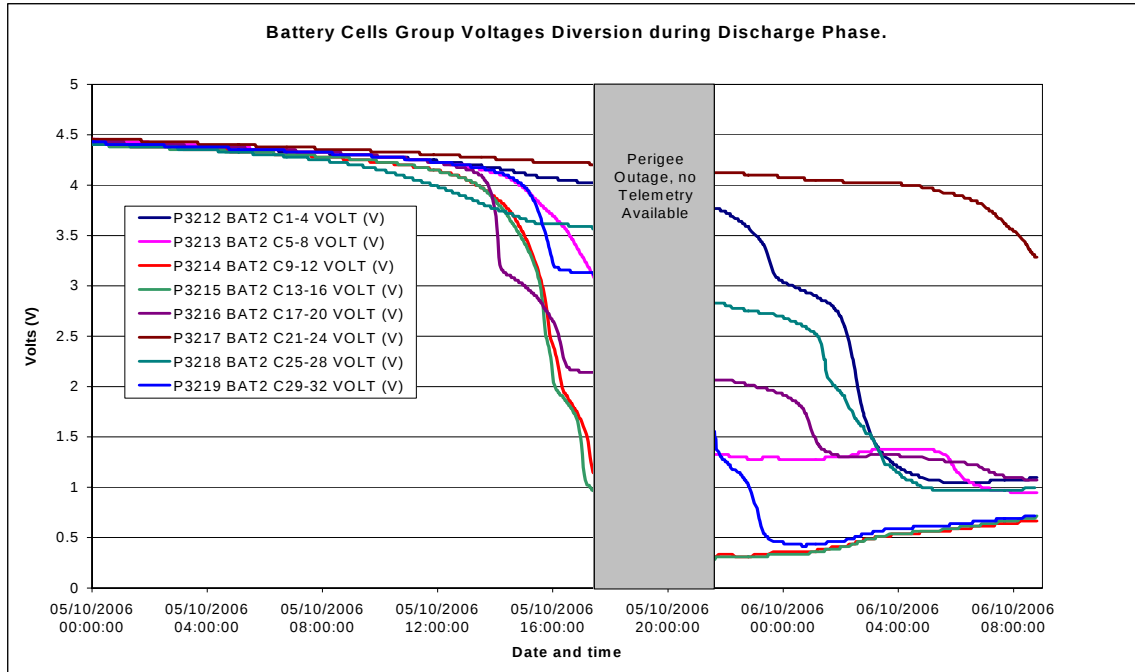
Battery 2 Reconditioning.

Following the smooth execution of battery 1 reconditioning, battery 2 reconditioning was started as planned on 27/9/2006, discharge started at 08.38z, end of discharge is expected early on 7/10/2006. To date all operations have progressed nominally.

As observed on battery 1 the discharge profile is rather different to that observed in 2004, the discharge profiles diverge after about 7 days. In fact battery 2 displays almost exactly the same behaviour as battery 1, this divergence may be an indication that a battery reconditioning was necessary, an evaluation of this behaviour is expected from industry.



At a deep depth of discharge some divergence of the battery cell group voltages has occurred, similar behaviour was observed on battery 1 in the last 1.5 days of discharge. Note that during reconditioning discharge phase the battery discharge current is dependent on battery terminal voltage (discharge is via a fixed resistance) hence even though there are still more than 1.5 days of discharge remaining when this divergence starts, the depth of discharge is already well over 90%.



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

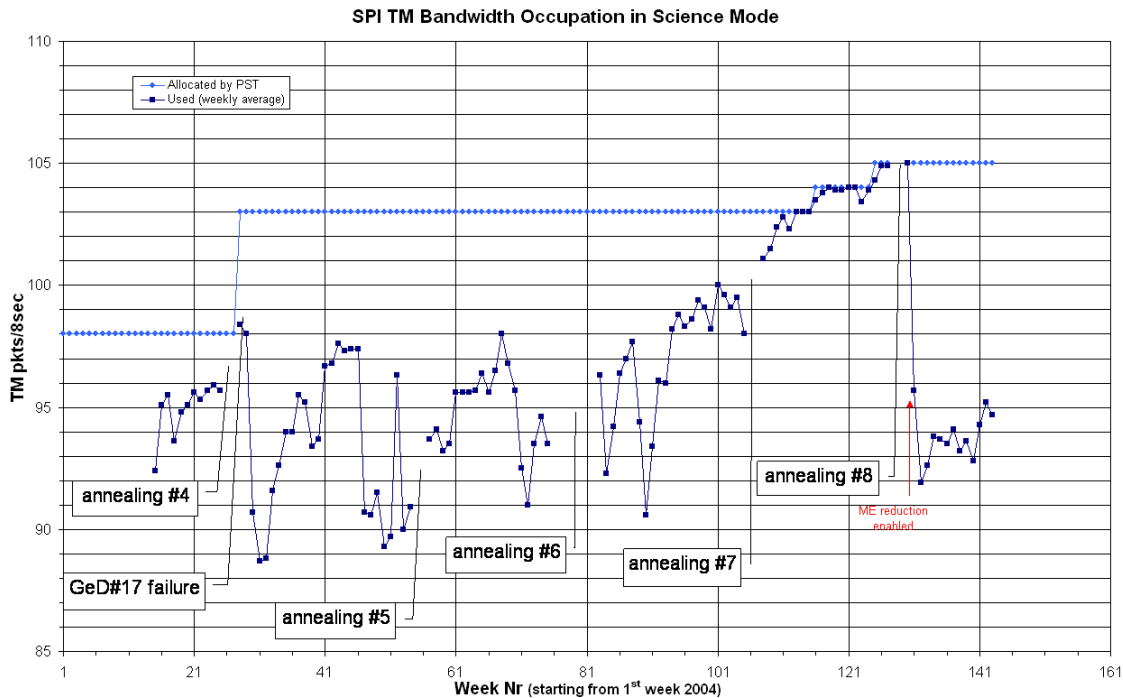
Following the 8th annealing, which ended on 26th June, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with this annealing. Detector #2 is failed since 06.12.2003 and detector #17 since 17.07.2004.

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

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, except during part of the JEM-X CRAB calibration (from 28/09/2006 17:14:28Z to 29/09/2006 01:38:58Z), when the assigned TM bandwidth was 92 packets/cycle. The average telemetry occupation when the TM allocation was 105 packets/cycle in the science window was 94.7 packets/cycle.

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



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

3.2.2 IBIS

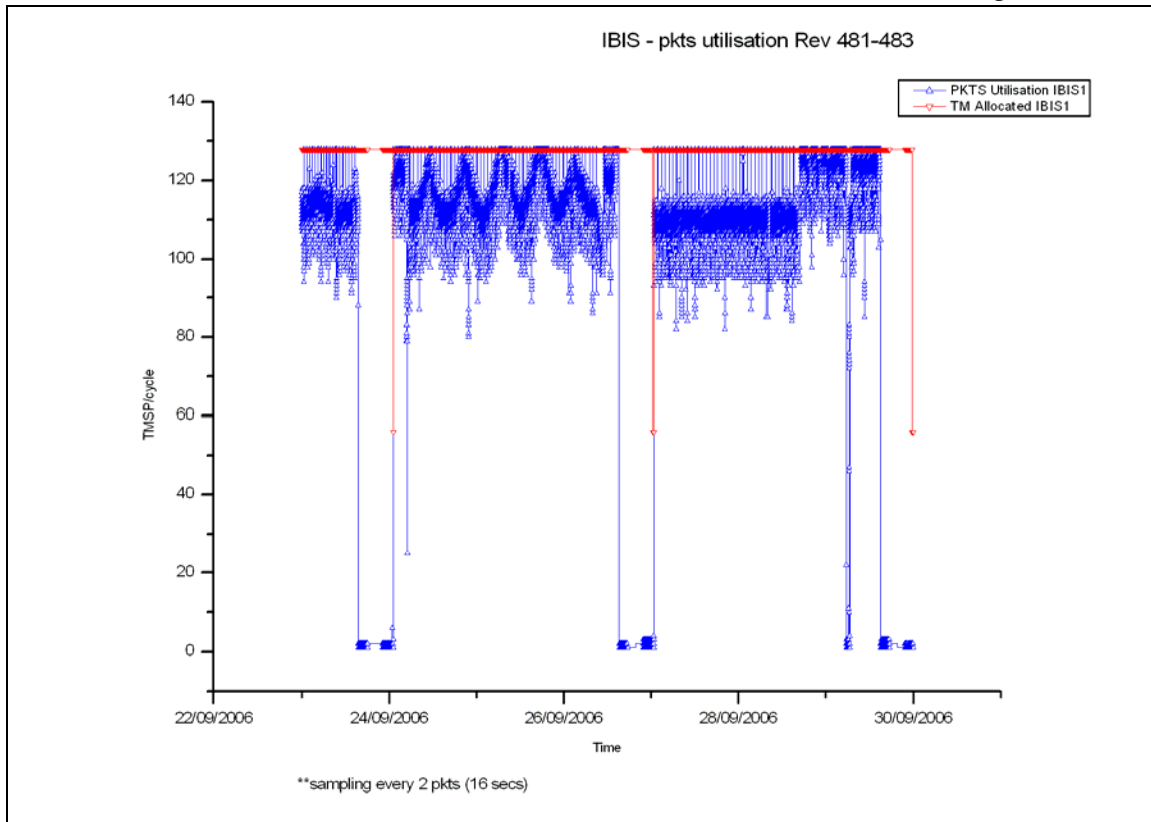
The overall status of the unit is nominal.

During revolution 483, from 2006-09-29 01:40:14Z to 14:59:30Z, the CRAB calibration for IBIS was performed. No special configuration of the instrument was required.

On 2006-09-29 at 05:46Z, a local reset of the IREM CSCI S/W (SEU #36) occurred. This triggered the IBIS radiation automatism that sent the unit into safe mode. IBIS was manually recovered at 06:41Z.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 115.00 TMPS/cycle, up 0.07 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 for revolution 481. On DoY 267, at 01:11:59, at the start of revolution 482, the allocation was reduced to 6 packets/cycle during science observations. JEM-X2 was dormant (DPE OFF) with no TM slots allocated during revolution 481. During the perigee passage between revolutions 481 & 482, JEM-X2 was switched on. On DoY 267, at 01:11:59, at the start of revolution 482, the allocation was set to 2 packets/cycle. On DoY 271 at 17:14:28 for the JEM-X part of the Crab calibration, the allocation for JEM-X2 was increased to 15 packets/cycle. The allocation was reduced to 3 packets/cycle at 01:38:58 on the following day prior to the IBIS/SPI part of the calibration exercise.

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, except from DoY 272 at 01:38:58 until the end of revolution 483 (during the SPI/IBIS part of the Crab calibration), when it was 4 packets/cycle.

During this reporting period, 145 of the 149 planned science pointings for OMC were executed nominally, 1 was interrupted and 3 were lost.

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

3.2.5 IREM

The overall status of the unit is nominal.

On 29/09/2006 at 05:46Z, the IREM CSCI SW reset #36 occurred during the science observations of revolution 483 (CRAB Calibration for IBIS and SPI), which were interrupted as a result for IBIS and OMC (see INT_SC-159).

Solar Activity

The observation period was characterised by low solar activity.

From 23/09/2006 to 26/09/2006 sunspot 910 was present but remained small. On 27/09/2006 the sun was blank. The last 2 days sunspots 912, 913 and 914 appeared but were still very small.

None of these sunspots posed a threat for strong solar flares during the whole observation period

Reference: www.spaceweather.com

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

4 Ground Facilities

The Operational ground facilities performance was good this week. A slew was lost due to problems with a star mapping. The overall performance, however, was well above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was again good this week. The main problems reported were: MISCdynserver errors, TC History crashing, Manual Stack freezing, software conversion overflow within the MONTMdisk task, none of which led to data loss. There was also a problem with paucity of stars during a star mapping, which led to the loss of a pointing. The overall performance was well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was again good this week. There were, however, repeated instances of Reed-Solomon errors, bad frames, hits on the line and data drops from Redu, none of which had any impact. There was also one occurrence reported of 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 490. A planning following the Long Term Plan for revolution 486 has been done and sent to MOC, but there are two different pending ToO requests pending, which both might lead to a re-plan of that revolution early in week 40. For this reason no planning beyond 486 has been undertaken yet. TSF's up to revolution 484 have been received.

2. Observation status

ECS's up to revolution 476 have been received and processed. No extra time has been credited.

3. ISOC Science Data Archive

Ingestion of data from ISDC is completely up to date for most data sets. IBIS OG data ingestion is lagging by ~30 revolutions and in good progress.

ISDA 2.6 release is targeted for end October. Probably at the same time the ISDA will be switched to a new archive server. A date to integrate the visualization tool will be set mid October.

4. ISOC system

ISOC version 13.0 is being used without problems. Work is ongoing on version 13.1 for the A0-5 Key Programme AO support.

5. Problems

IFTS transfer was hanging for some days, without an alarm from the internal watchdog mechanism, both probably caused by network problems. An external warning mechanism is still to be installed.

4.3.2 ISDC

Status of ISDC observation processing on 02/10/2006:

- Latest Standard Analysis completed: observation 04200010004 (Gal. Bulge region, Revolution 472) on 02/10/2006.

- Latest products archived: observation 03201080009 (Field_9, Revolution 461 - 463) on 30/09/2006.

- Latest observation products sent to the observer: observation 03200680001 (Taurus-Auriga, Revolution 464) on 29/09/2006.

5 Special Events

6 Anomalies

The following problem that impacted operations was reported:

- On DoY 271, at 05:46, a local reset of the IREM CSCI S/W (SEU #36) occurred. A recovery was performed, and completed at 06:47, the impact was OMC & IBIS science data for pointing 04830051 was interrupted, with data from pointings 04830052 & 04830053 lost.
- At 07:35, the FD system failed to update the parameters for the next slew due to insufficient detected stars during the star mapping. The impact was the loss of pointing 04830056.

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

AR id	Date Created	Subject	Segment	Status
INT_SC-159	29/09/2006	IREM Anomaly: Reset of IREM_CSCI S/W #36, 29/09/2006	Payload	Open
INT-2883	26/09/2006	No Bitlock after TC/TM links drop	ESA Stations	Pending

:

7 Future Milestones

Battery 2 reconditioning is currently on-going, it should finish on 8/10/2006.

The next eclipse season starts 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 482

The observations in revolution 482 began with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. This was followed by a raster dither of Gal. Plane Region 3 (RA 19:43:54.33, DEC +23:53:25.4), lasting ~50.1 hours. After this, another hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours, was performed, until the end of the revolution.

Throughout these observations all instruments were in their nominal science modes. The TM allocation in this revolution is IBIS 128; SPI 105; JEM-X1 6; JEM-X2 2; OMC 5.

Revolution 483

The observations in revolution 483 began with a raster dither of the Orion OB1 (RA 05:17:00.30, DEC +01:47:17.7), lasting ~37.7 hours. This was followed by the Crab calibration, firstly 3 staring observations at attitude (RA 05:34:31.97, DEC +22:00:52.1), lasting ~2.8 hours each for the JEM-X instrument, followed by a raster dither at the same attitude for ~12.5 hours for the SPI & IBIS instruments, which lasted until the end of the revolution.

Throughout these observations all instruments were in their nominal science modes. The TM allocation starts off as IBIS 128; SPI 105; JEM-X1 6; JEM-X2 2; OMC 5. At 2006-09-28T17:14:28Z, for the JEMX calibrations, it changes to IBIS 128; SPI 92; JEM-X1 6; JEM-X2 15; OMC 5, and at 2006-09-29T01:38:58Z, for the SPI/IBIS calibrations, it changes to IBIS 128; SPI 105; JEM-X1 6; JEM-X2 3; OMC 4, until the end of the revolution.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-09-11T17:13:17.000Z	152.1468	F	Automatic TM processing.
2006-09-12T08:12:55.000Z	152.1360	F	Automatic TM processing.
2006-09-13T10:08:58.000Z	152.1197	F	Automatic TM processing.
2006-09-16T10:03:30.000Z	152.0733	F	Automatic TM processing.
2006-09-17T17:56:22.000Z	152.0453	F	Automatic TM processing.
2006-09-18T07:39:43.000Z	152.0262	F	Automatic TM processing.
2006-09-19T09:16:10.000Z	152.0057	F	Automatic TM processing.
2006-09-20T23:13:42.000Z	151.9616	F	Automatic TM processing.
2006-09-22T09:21:45.000Z	151.9406	F	Automatic TM processing.
2006-09-23T17:23:17.000Z	151.9253	F	Automatic TM processing.
2006-09-24T05:00:22.000Z	151.9115	F	Automatic TM processing.
2006-09-25T09:24:33.000Z	151.8913	F	Automatic TM processing.
2006-09-26T15:21:40.000Z	151.8566	F	Automatic TM processing.
2006-09-26T17:07:56.000Z	151.8468	F	Automatic TM processing.

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2006-09-26T22:37:25.000Z 151.8220 F Automatic TM processing.

This report was generated Fri Sep 29 08:00:58 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, 23/09/2006 – 29/09/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 73 Open Loop Slews, 86 Closed Loop Slews and 8 Momentum Biases were executed.

2 slews (OSL , CSL) were missed during the observation period due to a problem on FDS originated by sparse stars field/extended object in the Taurus constellation (attitude determination process failed due to not enough stars in TM matching catalogued stars).

This is equivalent to a ~ 1.2 % of the total number of slews planned (160).

Orbit Control

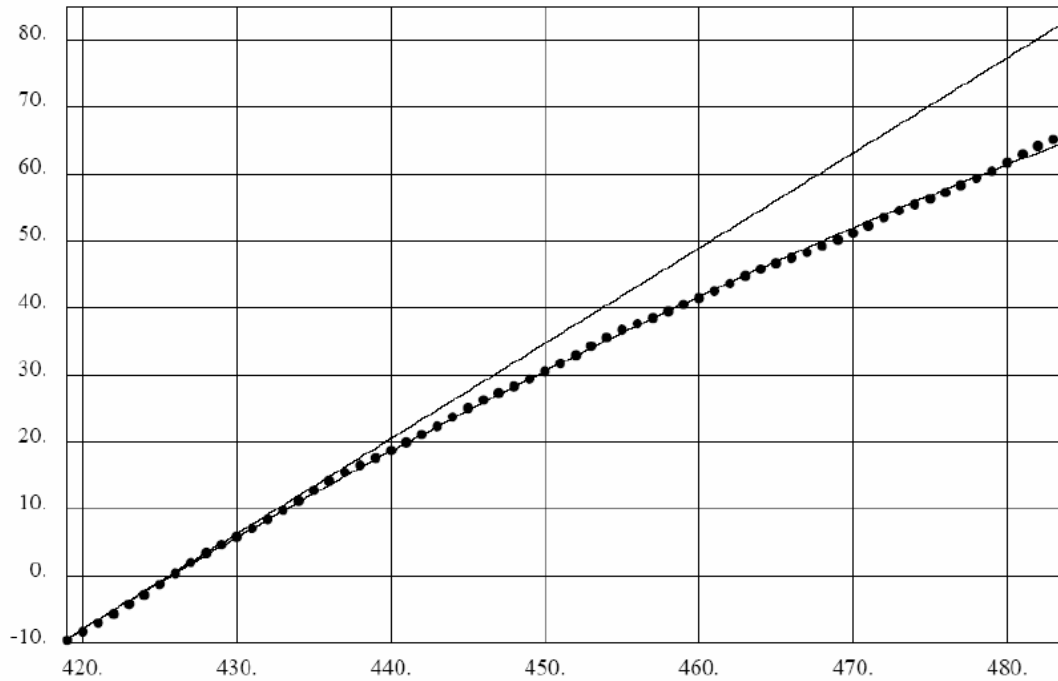
It has been noticed that the orbit is evolving in an unfavourable manner since May 2006 and it might be necessary to use Goldstone again to close the Apogee gap. This situation should be avoided as it will impact science activities. It has been decided to force the orbit in a more favourable direction.

The margins of Redu coverage relative to the period with sufficient altitude to operate the instrument:

Orbit	AOS REDU - 45000 km altitude (Crit.Instr.Alt.Asc.)	56000 km altitude(Crit.Instr.Alt.Des.) - LOS REDU
463	174 minutes	119 minutes
474	165 minutes	141 minutes
484	155 minutes	157 minutes

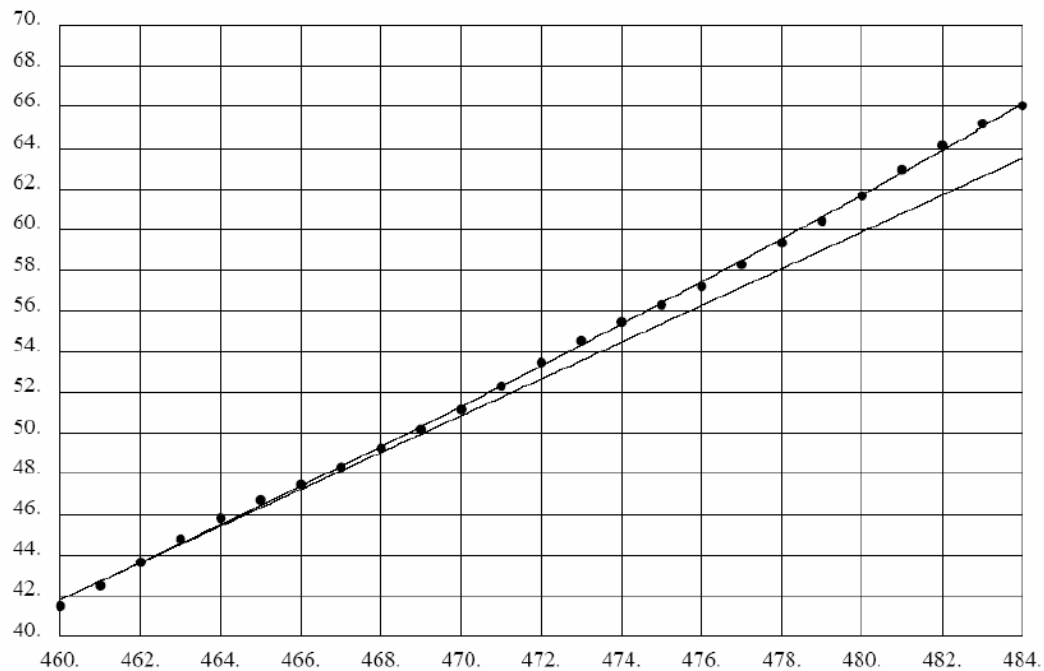
The attached plot shows the apogee longitude of Integral as a function of the orbit number. Using a parabolic approximation, the average semi-major axis increase due to momentum dumping manoeuvres is estimated to have been 464 m per orbital revolution.

APOGEE LONGITUDES OF INTEGRAL 21.03.2006 - 01.10.2006
LEAST SQUARES APPROXIMATION WITH PARABOLA



Making the same analysis for the last 2.5 month:

APOGEE LONGITUDES OF INTEGRAL 21.07.2006 - 01.10.2006
 LEAST SQUARES APPROXIMATION WITH PARABOLA



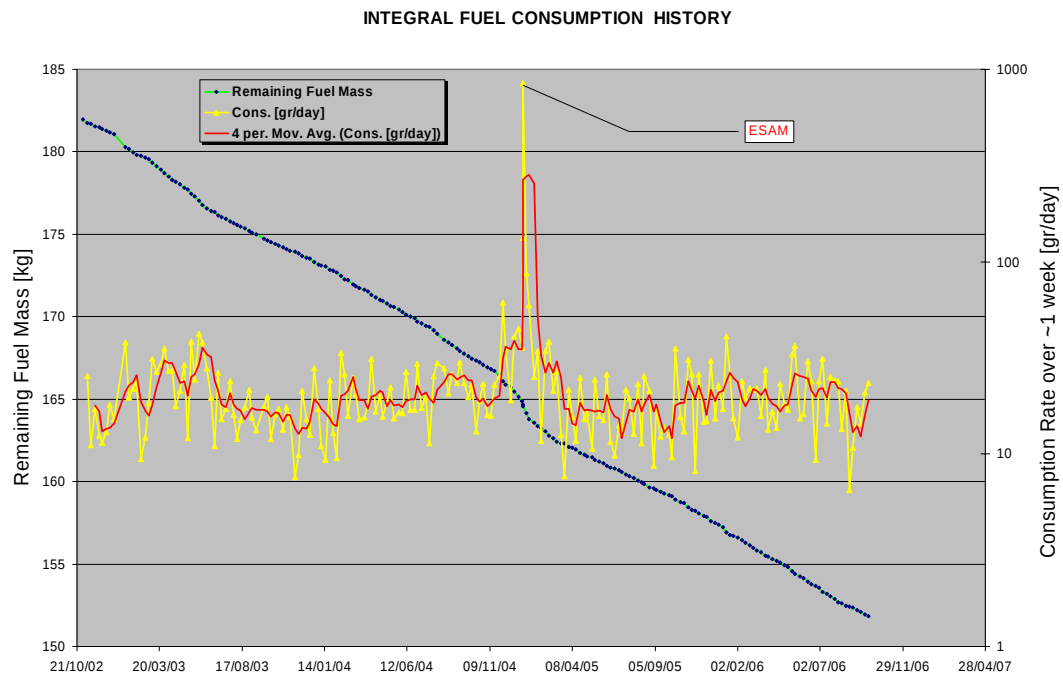
It can be seen that in this period the drift rate has increased slightly instead of decreasing. The reason for this is that the pointing in this period has been towards the galactic centre and this attitude is unsuitable for momentum dumping activities close to perigee. In future this situation will be corrected by:

1. Avoiding making momentum dumping manoeuvres close to perigee when pointing towards the "galactic centre";
2. Performing artificial large momentum dump manoeuvres when the pointing is suitable for orbit control

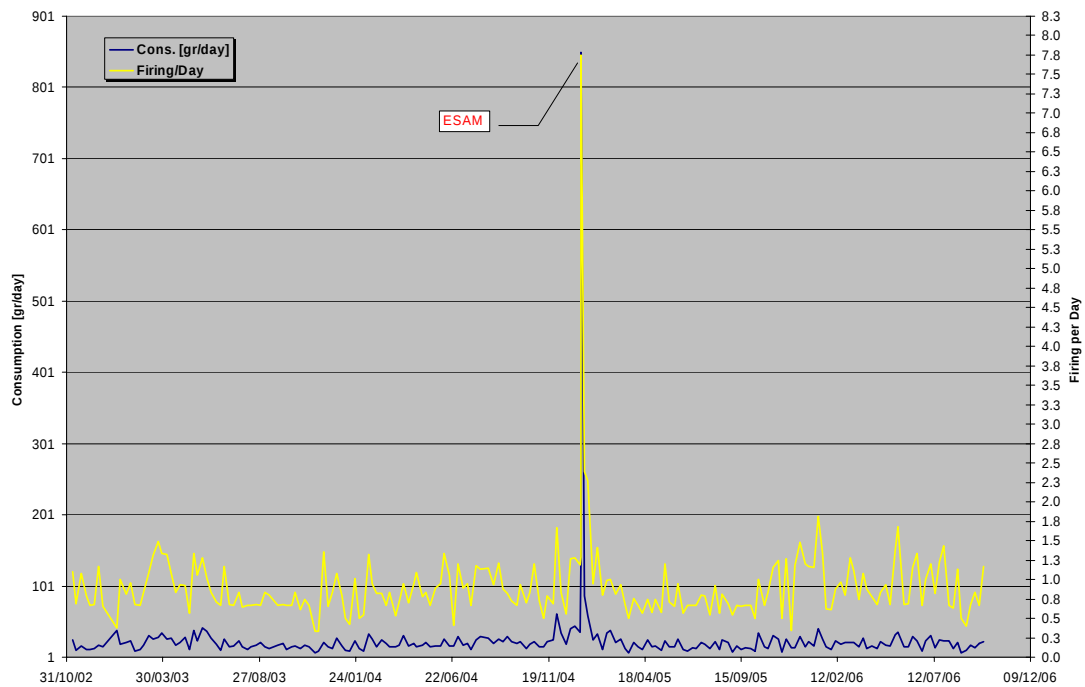
In this way it should be possible to compensate for the lack of drift rate decrease during the last two months and achieve a REDU only situation in the future.

Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 26/09/2006 is reported in the plot below.

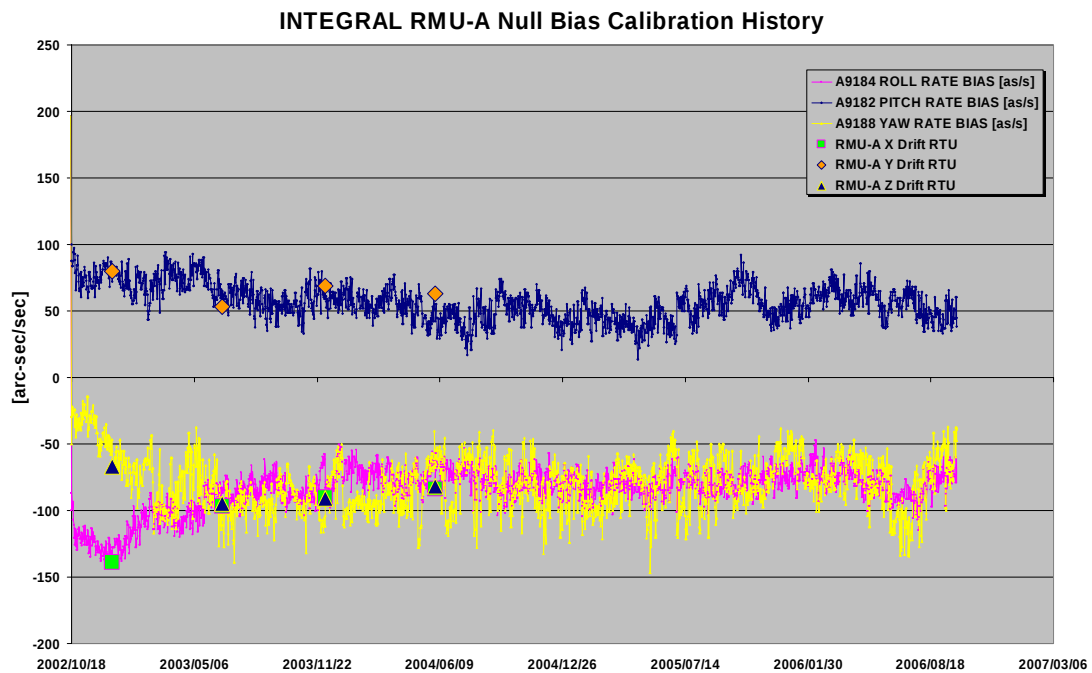


The firing\day over the period between 01/11/2002 and 26/09/2006 is reported in the plot below.

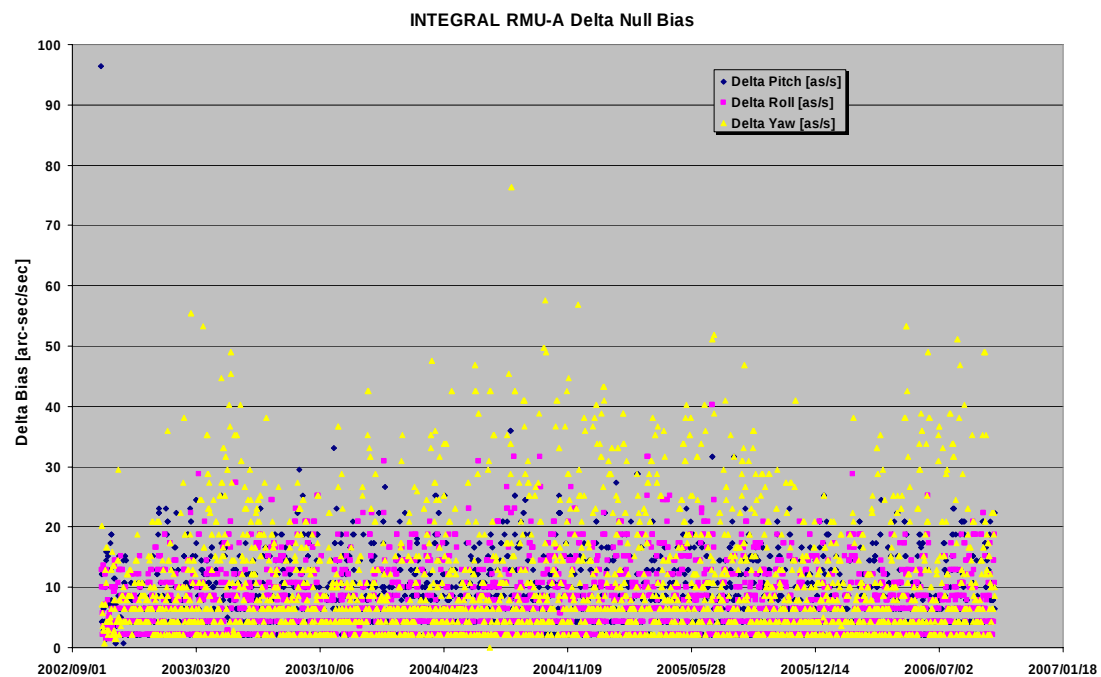


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 29/09/2006 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 29/09/2006 is reported in the plot below



23/09/06 (Day of Year 266, Revolution 481)

Nothing to report.

24/09/06 (Day of Year 267, Revolution 481-482)

Nothing to report.

25/09/06 (Day of Year 268, Revolution 482)

Nothing to report.

26/09/06 (Day of Year 269, Revolution 482)

Nothing to report.

27/09/06 (Day of Year 270, Revolution 482-483)

Nothing to report.

28/09/06 (Day of Year 271, Revolution 483)

Nothing to report.

29/09/06 (Day of Year 272, Revolution 483)

FDS failed the slew update process: at 07:35z the update for the SID 04830056 failed and the AOCS s/s was disabled in TL.

The attitude determination failed because were found not enough stars in TM matching catalogued stars (region of sky in Taurus constellation close to the Crab Nebula M-1) and this interrupted the TPF generation. Repeated mappings did not solve the problem. FD support was called in and in order to continue operations, was requested an on-line change on a FD environment variable used by the attitude determination algorithm: the conditions for overlap between TM and star catalogue were temporary relaxed.

Comments from FD team on this problem: << *The attitude determinations which are performed automatically after each slew are checked for plausibility. One of the checks is that at least 3 stars must be matched. If fewer stars are matched the automatic process stopped, as it is not safe enough to match one or two stars from TM with the catalogue to be certain to go ahead. In this case it is (by design) necessary for the on-call FD expert to assess the situation and validate the attitude determination results in depth.*

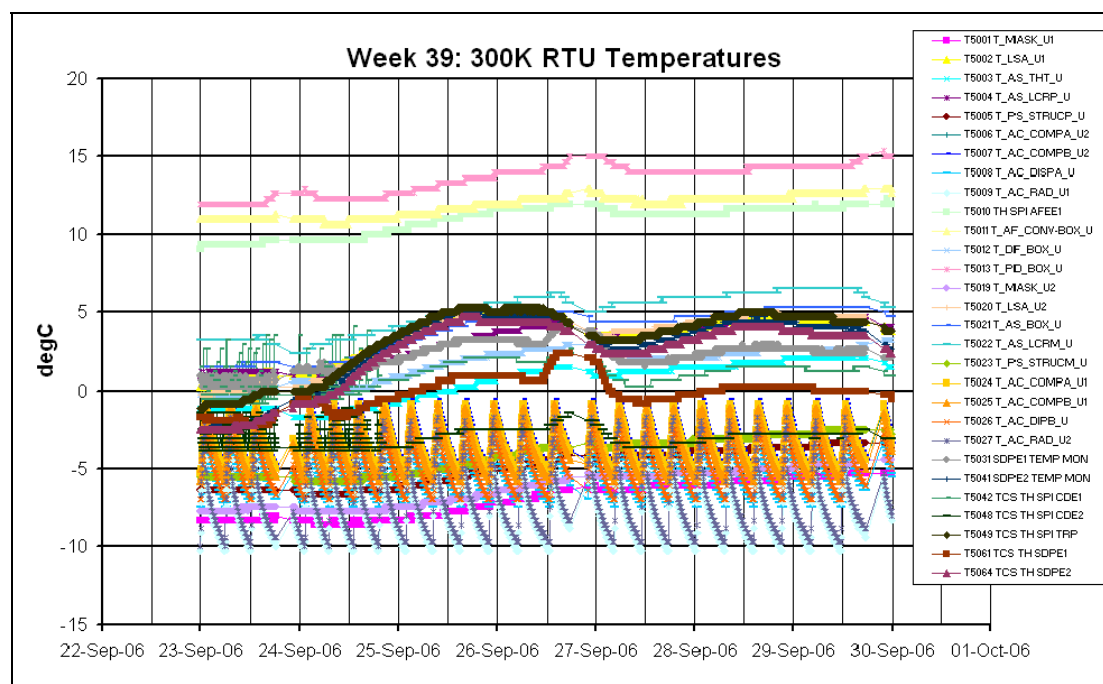
Changing some environment variable is not the solution. For sparse star fields, polluting neighbours or too many blemish pixels, there is nothing more to do>>.

A manual recovery was then started at 08:25z, from attitude of PID 04830055 to the attitude of PID 04830057. The next slew in TL (04830058) was manually updated at 08:39z.

The following slews were not executed from TL: ID 04830056 (OSL) - 57(CSL).

8.3.2 SPI Operations

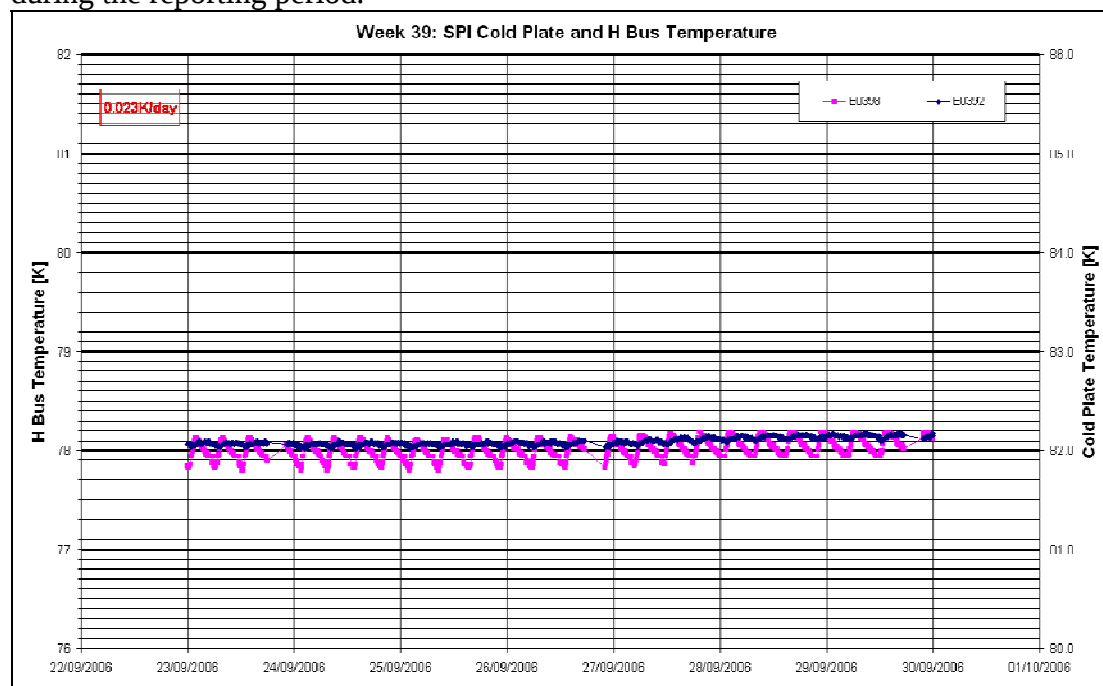
Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period:



Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range to 82K +/-1K with a positive drift of 0.023deg/day. The stroke of all four compressors is currently set to 39. The average LCL currents of the CDEs over the week were:

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

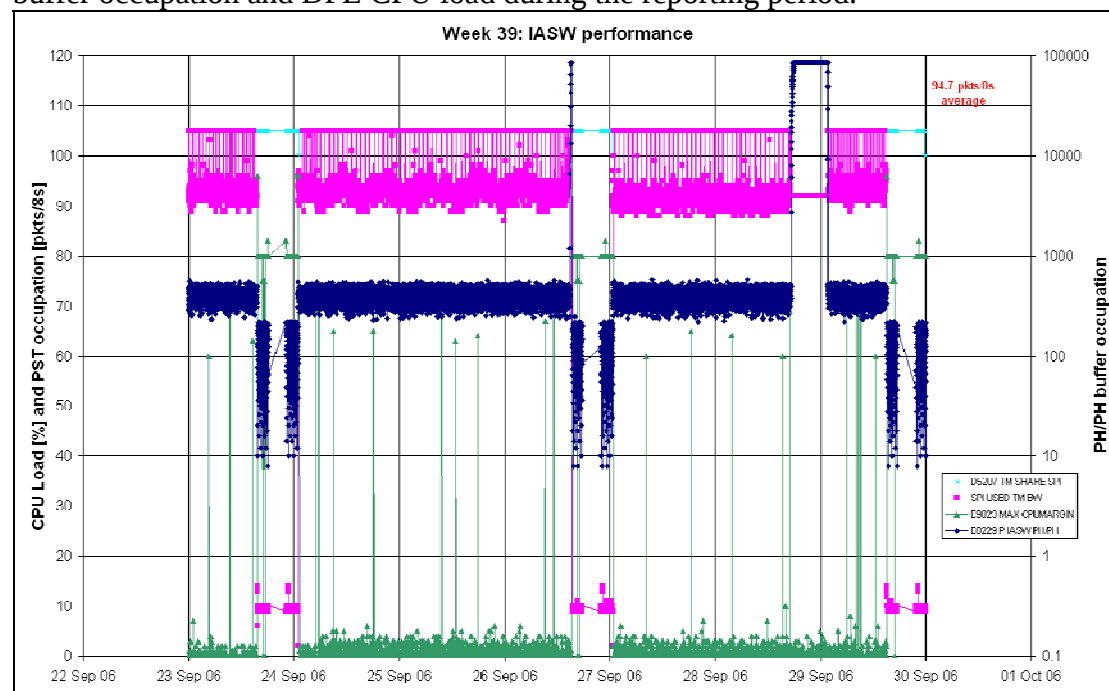
The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.



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

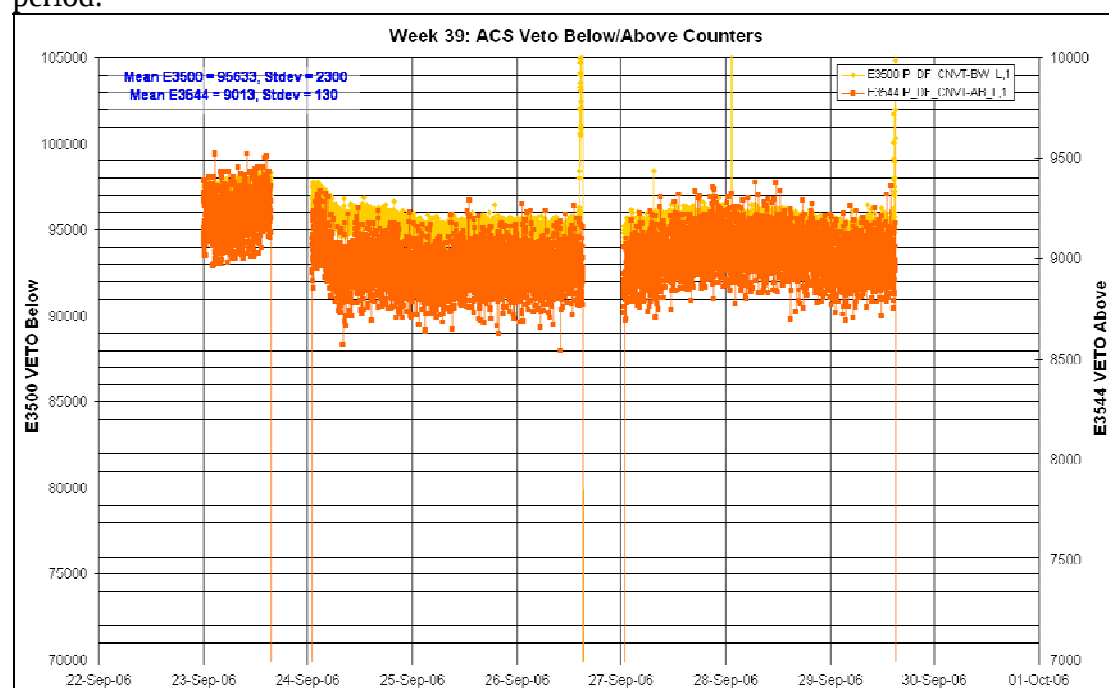
The average TM bandwidth occupation of SPI was 94.7 packets/cycle over the science window when the TM allocation was 105 packets/cycle. From 28/09/2006 17:14:28Z to 29/09/2006 01:38:58Z the assigned bandwidth was 92 packets/cycle due to a modification of the TM allocation during the CRAB calibration (JEM-X2 15 packets/cycle instead of 3, and OMC 5 packets/cycle instead of 4).

The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



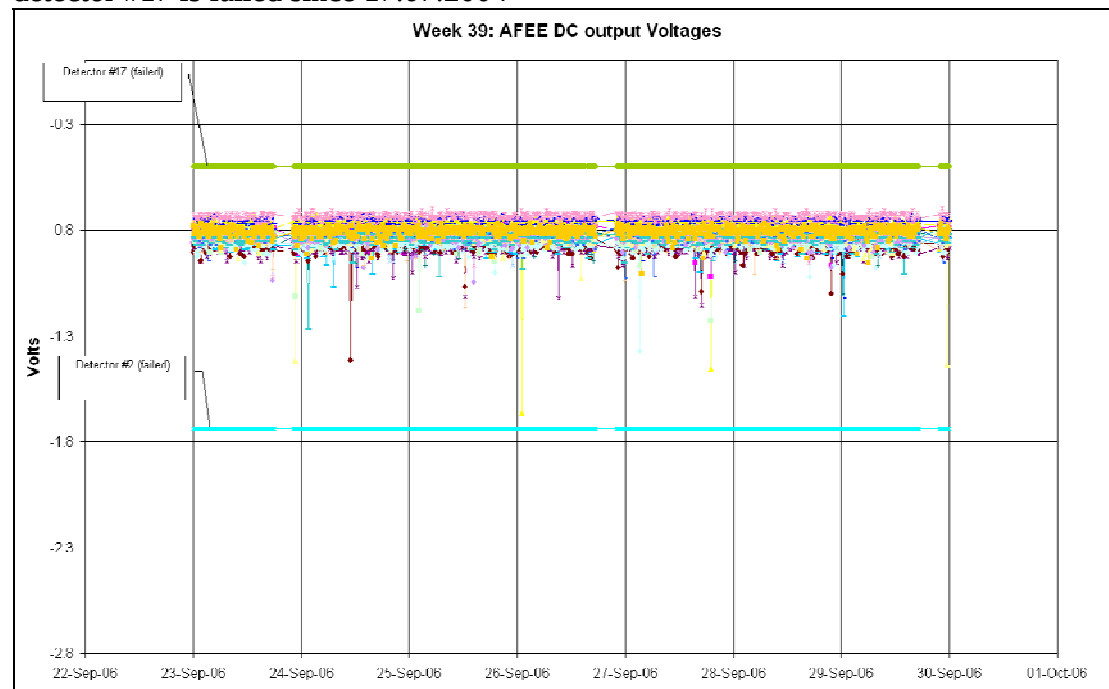
ACS: The performance of the ACS is nominal.

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

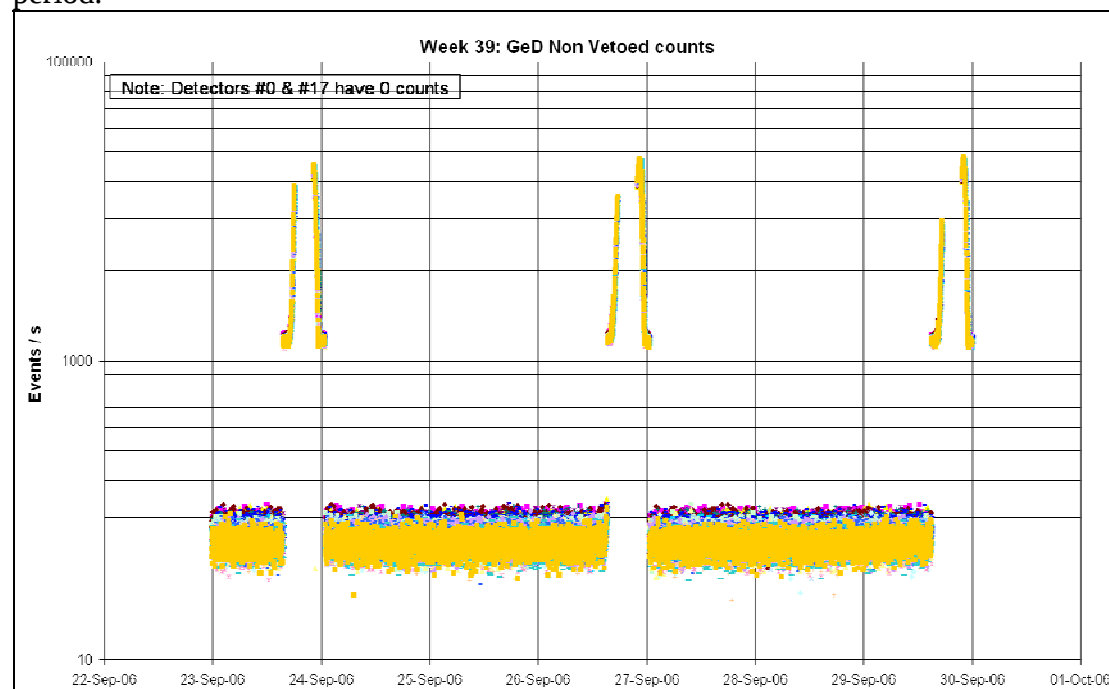


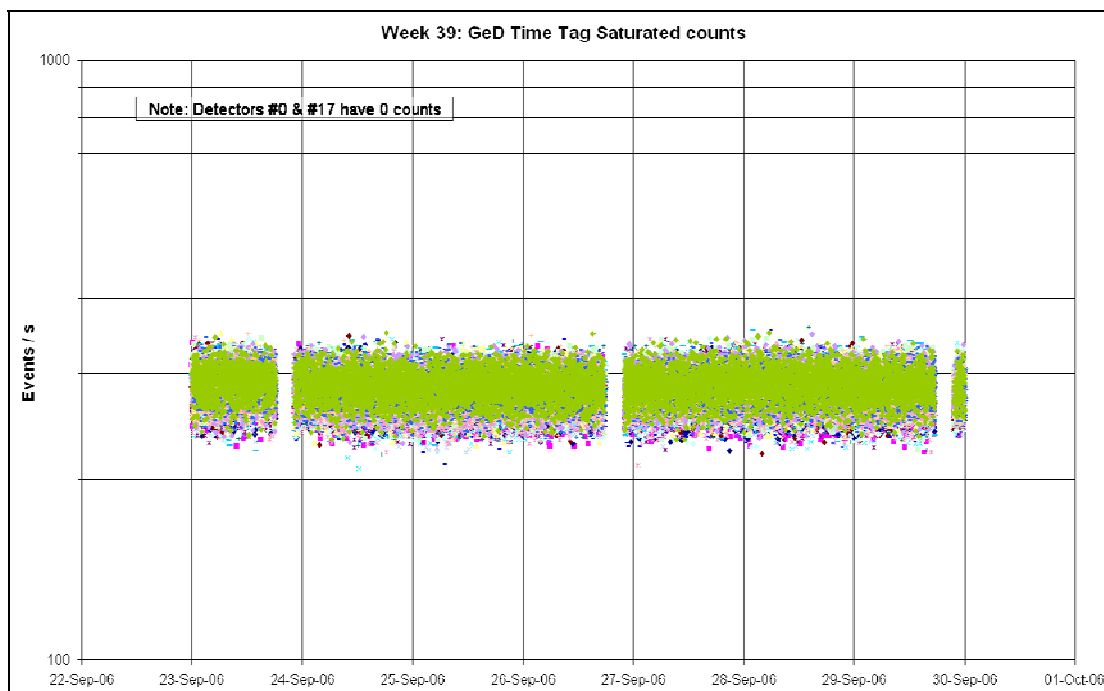
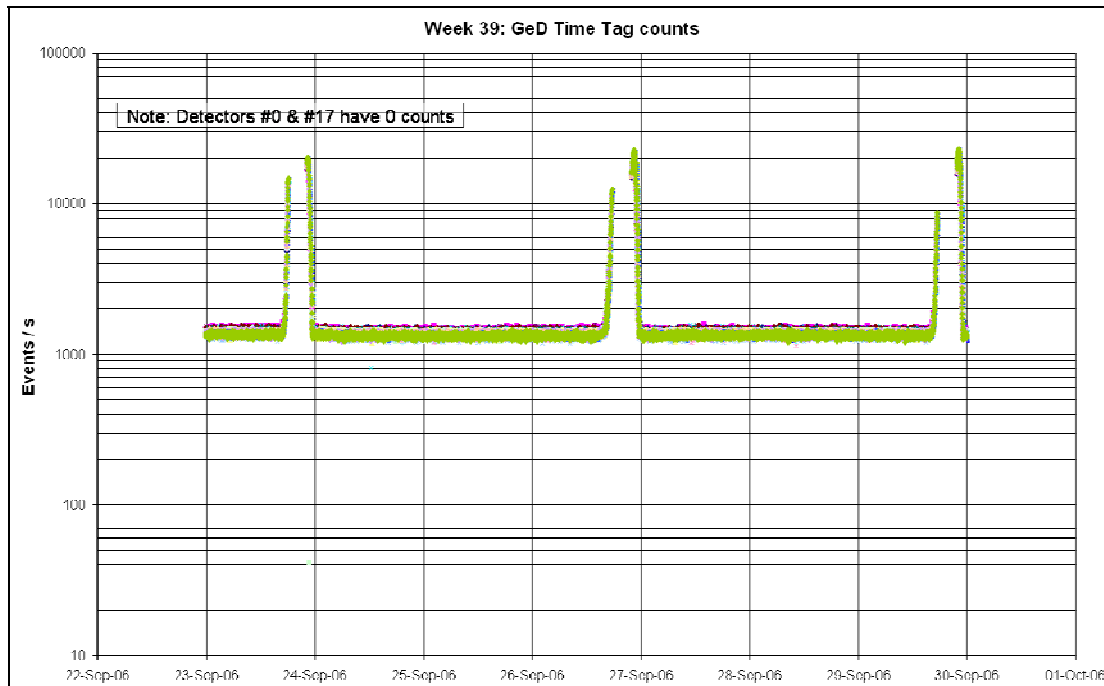
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with the last annealing.

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

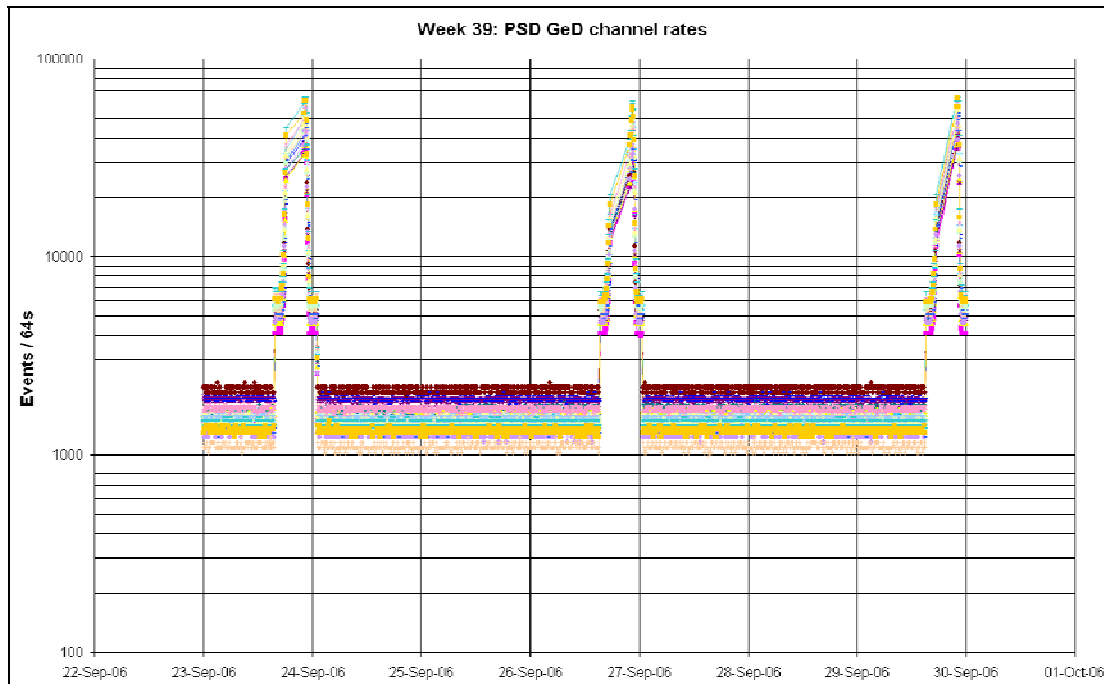


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.





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:

- From 2006-09-23 at 22:37Z to 2006-09-24 ~17:00Z, TM parameter E2116 (T AS PSAC L2) was reported toggling OOL low, indicating a decrease of the Plastic Scintillator Anticoincidence sub-assembly temperature.
- On 2006-09-26 at 14:57Z, TM parameter E3500 (P_DF_CNVT-BW_L,1) went OOL high-high as the spacecraft was approaching the Radiation Belts that were noisy at the end of this revolution (482).
- On 2006-09-26 at 15:18Z, TM parameter E3246 (S AS TEMP L82) was reported OOL (status) indicating that the value of the temperature was higher than the specification. It went back inside limit when the next packet was received.
- On 2006-09-27 at 20:20Z, TM parameter E1296 (S AS IBS ST L) was reported OOL (status) indicating that the ISB response parity was false. It went back when the next packet was received.
- On 2006-09-29 between 01:50:59Z and 01:51:54Z, 17 occurrences of the following pair of OEMs were received:

APID	1024	ID	224	EXCEPTION	SPI1	SW	ERROR
	FIX6		0				
	E9079		MESS CLASS		1		
	E9080		MESS ID		224		
	E9777		FAULTY TASK ID		3		
	FIX16		0				

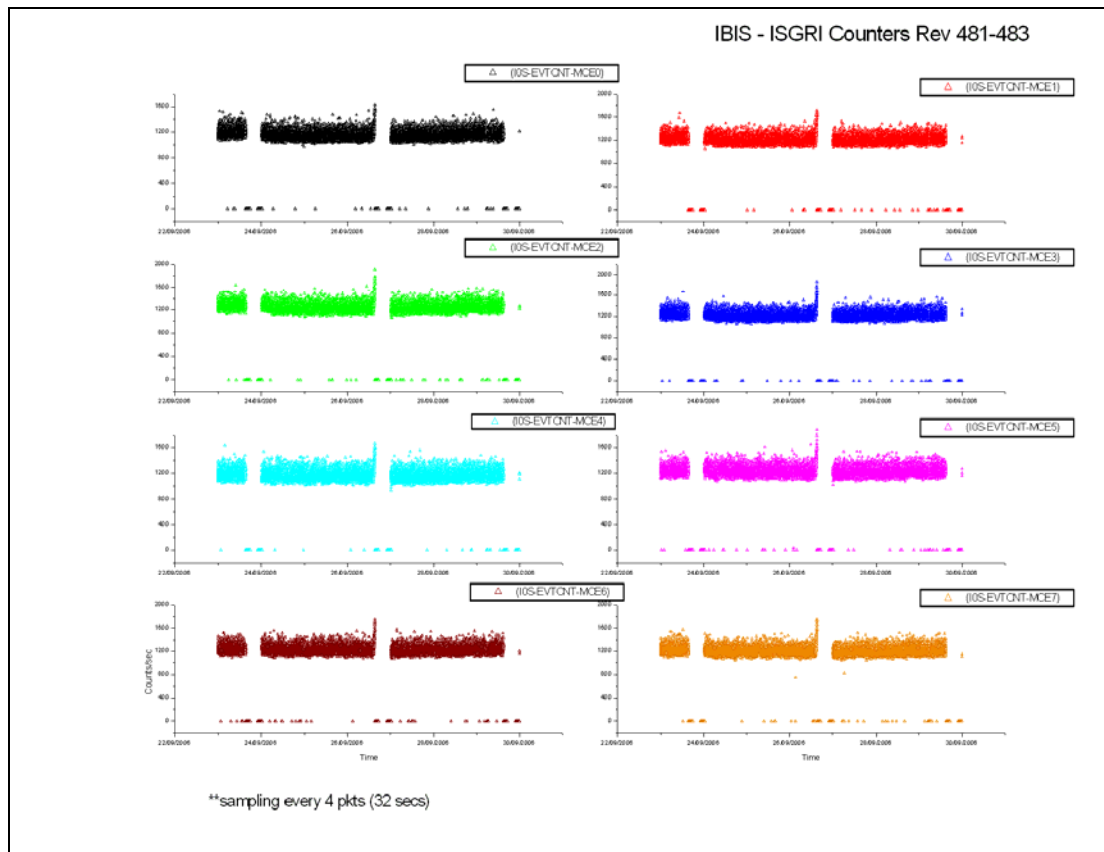
APID	1024	ID	7	EXCEPTION	SPI1	CONSTRAINT	DPE	CULPR
	E9073		TASK ID 6			IASW TASK 3		
	E9079		MESS CLASS		1			
	E9080		MESS ID		7			
	E9076		OUT RANGE VALUE		4097			
	E9067		LOGICAL ADDRESS		11637			

indicating a problem with the Spectra Transmitter task. This was about 10 minutes after the TM allocation had been changed from 92 packets/cycle (due to JEM-X CRAB calibration) back to 105 packets/cycle. It is usual to get these OEMs in this situation and they stopped of their own accord.

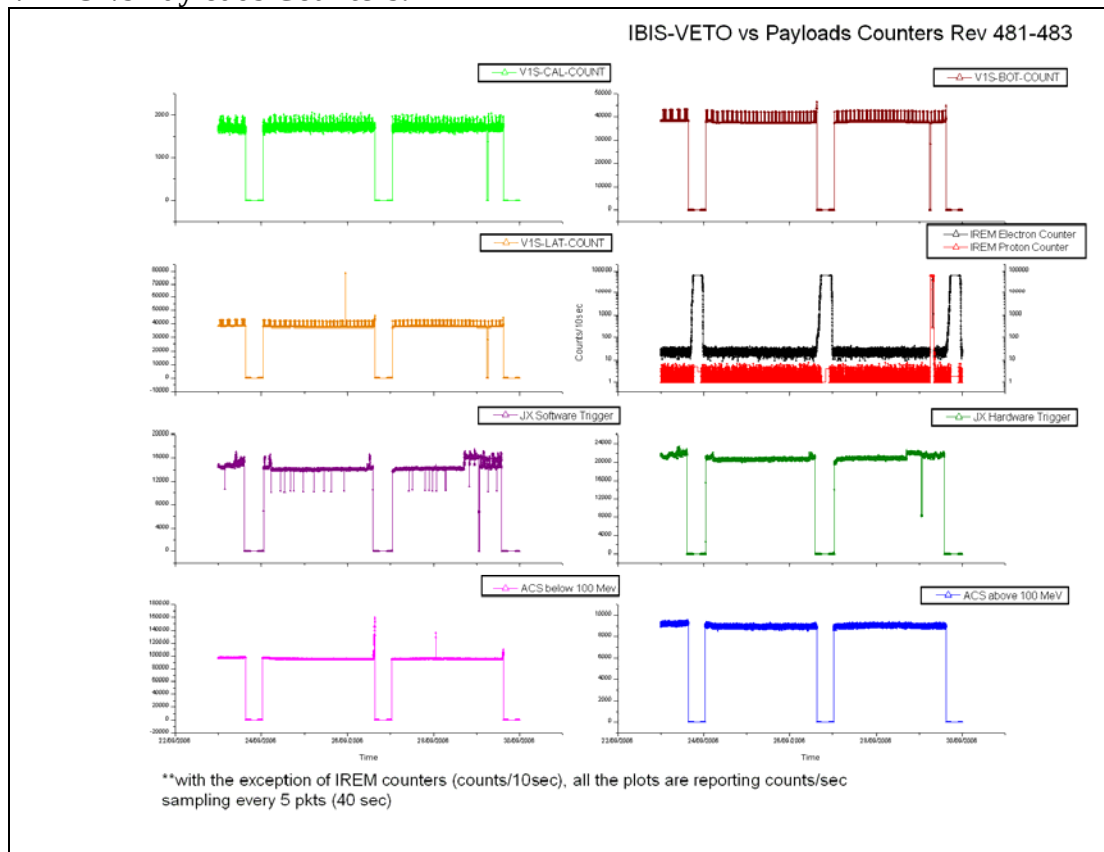
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

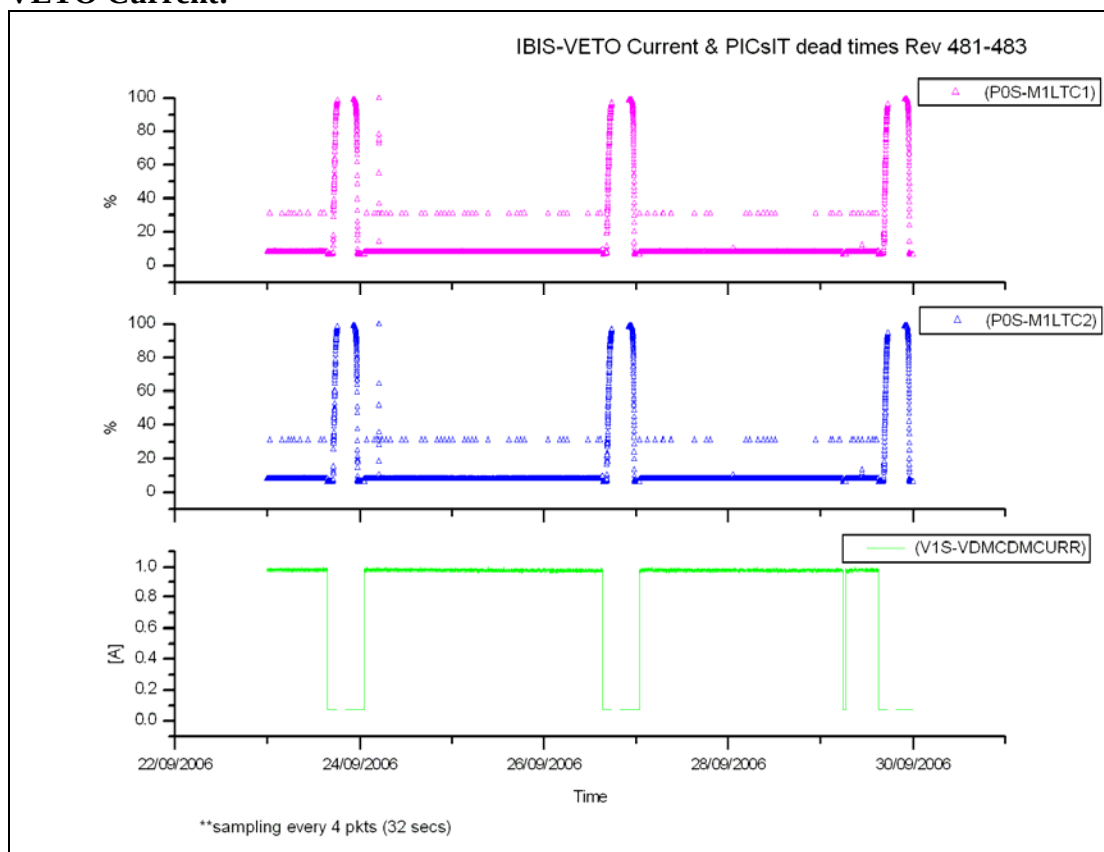


VETO vs Payloads Counters:

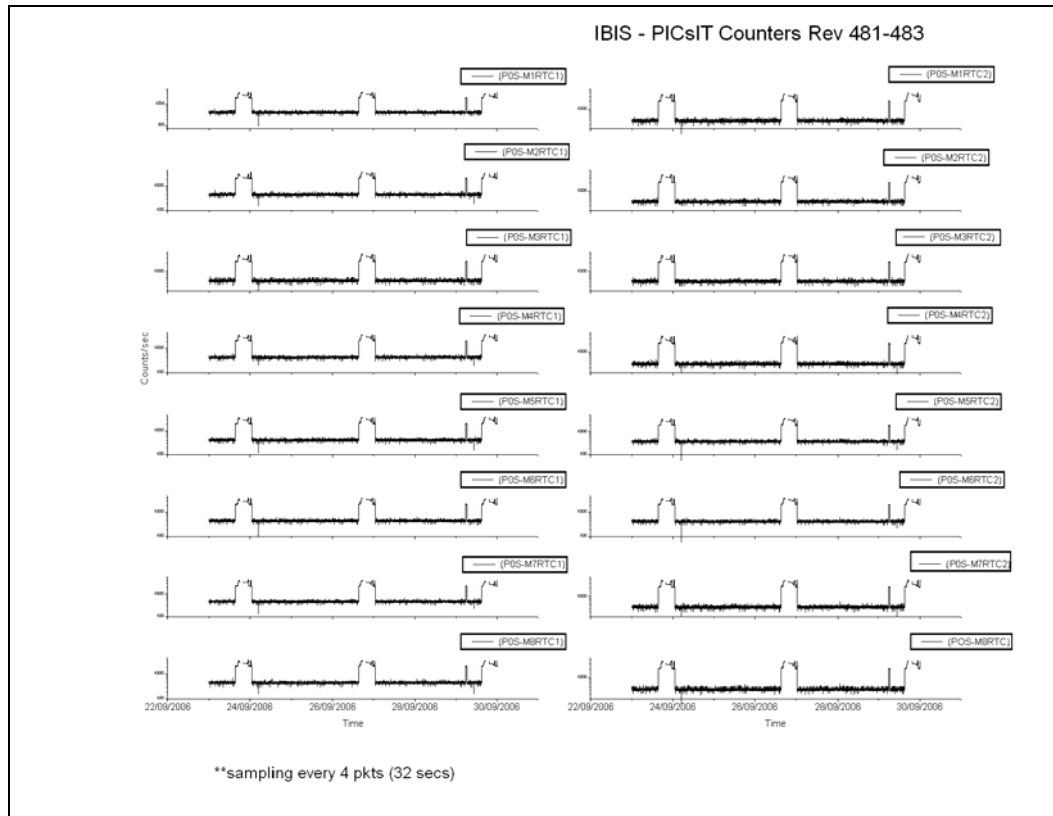


The week was characterised by low radiation.

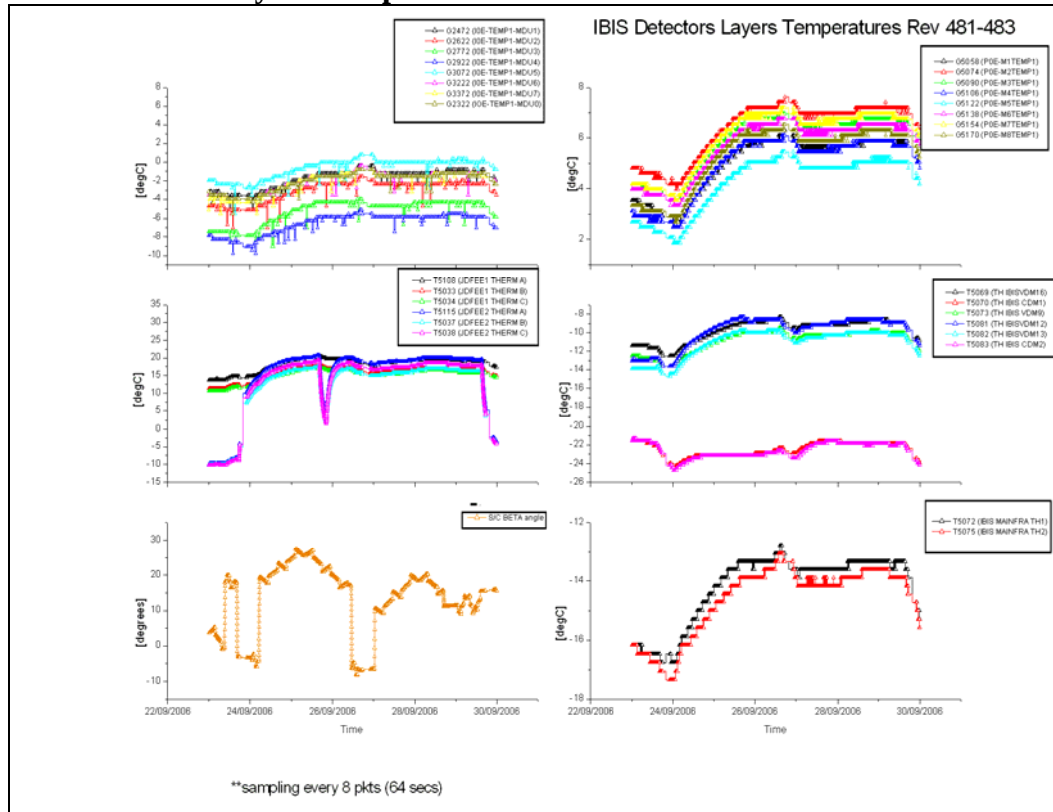
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



NB: as visible on the plots, JEM-X2 was switched ON for revolutions 482 and 483. Due to a patch problem, it was restarted during revolution 482 implying a drop in temperatures.

IBIS daily report

DoY 266 (23/09/2006):

At 15:35Z, TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 01:09Z on DoY 267. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 in FDIR, no action was taken.

During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went Out Of Limit High and back. According to P-CNT-1 in FDIR, no action was taken.

DoY 267 (24/09/2006):

At 04:57Z, TM families G5068 and G5072 (P0S-MiF1 & 2 ERRF) failed SCC.

At 05:00Z TM families G5002 and G5003 (P0S-Mi_RTC1 & 2) were reported OOL low-low.

At 05:03Z, the following OEM (APID 1280) id 132 "IBIS1 IASW HEPI RESYNCHRONIZED" was reported.

The occurrence of these 3 events flagged an automatic resynchronisation of the HEPI. According to the FDIR, no action was taken.

DoY 269 (26/09/2006):

At 15:18Z, TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 00:51Z on DoY 270. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 in FDIR, no action was taken.

DoY 270 (27/09/2006):

At 00:24Z, TM parameter G2056 (I0E-OVFWPXADD-M4) failed Status Consistency Check. At 00:28Z, TM parameter G2014 (I0E-OVFWPXADD-M1) failed Status Consistency Check. At 00:36Z, TM parameter G2084 (I0E-OVFWPXADD-M6) failed Status Consistency Check. According to I-OVF-1 in FDIR, no action was taken.

DoY 272 (29/09/2006): IREM SEU #36

At 05:46Z, due to IREM SEU #36, IBIS automatically went into Stand-by mode with ISGRI and VETO in Stand-by. The recovery was performed as per procedure CRP-SYS-2570 using the EXIT SAFE procedure (FCP_IBIS1_0803) and the GESTAN02 sequence. IBIS was back into Scientific Standard mode at 06:41Z.

At 05:46Z, TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 06:27Z. As this happened while IBIS was in Safe mode due to IREM SEU #36, according to V-VLT-1 in FDIR, no action was taken.

DoY 272 (29/09/2006):

At 10:44Z, TM families G5068 and G5072 (P0S-MiF1 & 2 ERRF) failed SCC and back. According to FDIR, no action was taken.

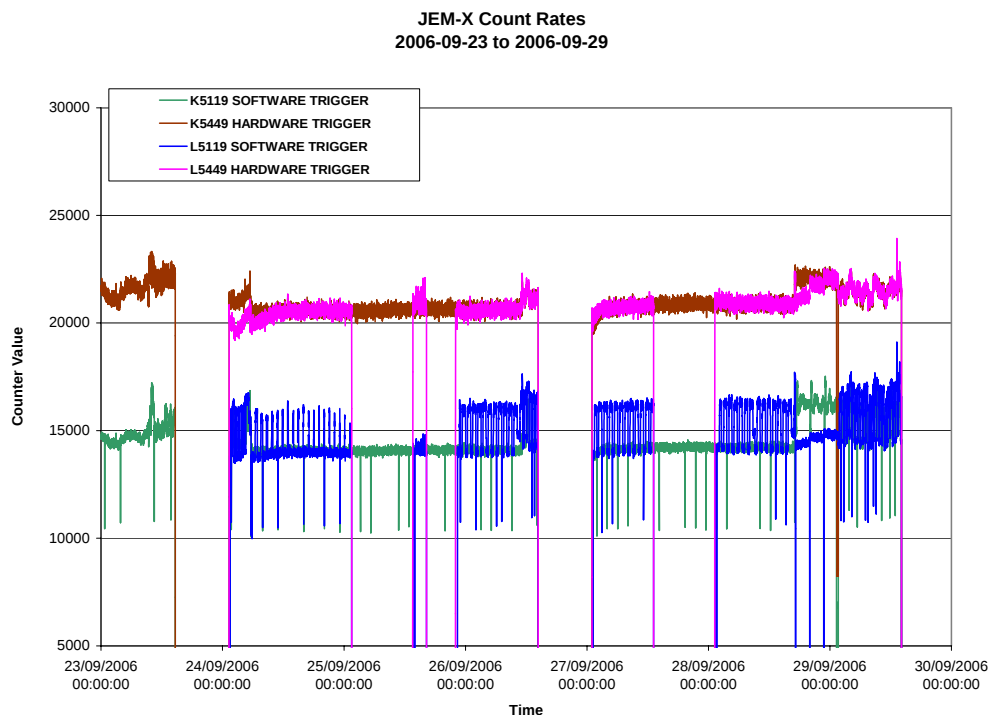
At 15:02Z, TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 00:34ZZ on DoY 273. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 in FDIR, no action was taken.

During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went Out Of Limit High and back. According to P-CNT-1 in FDIR, no action was taken.

8.3.4 JEM-X Operations

JEM-X Count Rates

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

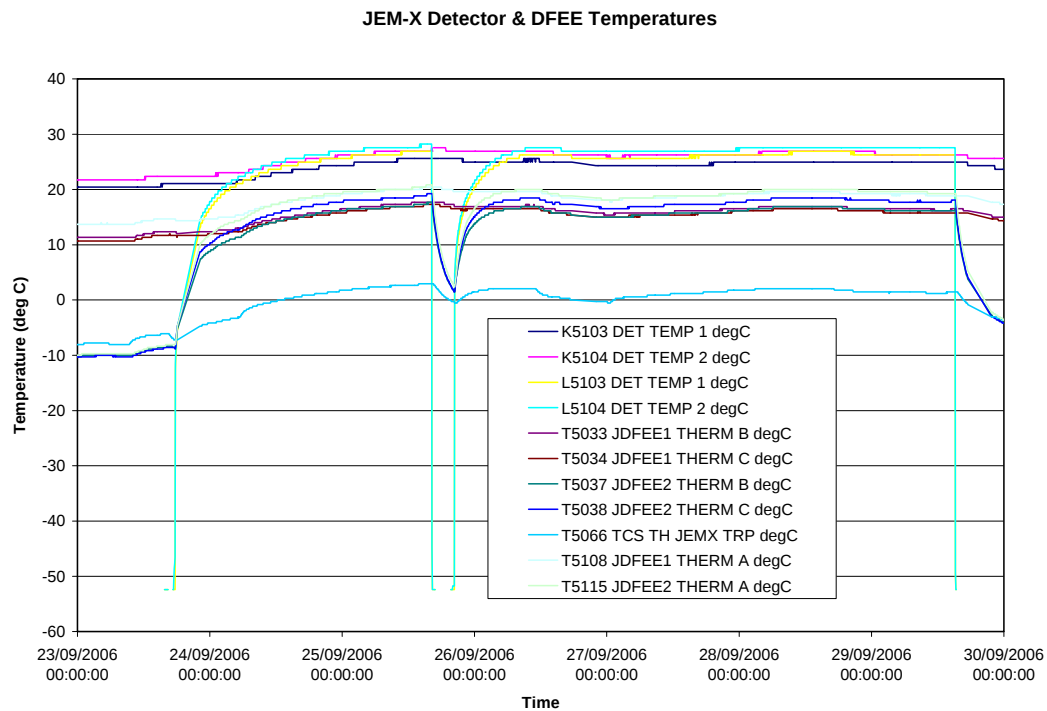


JEM-X Temperatures

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.

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

² Data sampled (1 frame in 8)



JEM-X Daily Report

2006-09-23 (DOY 266, Rev 481-482)

Starting at 15:40:00Z (after radiation belt entry) the JEM-X2 DPE and DFEE were switched on by executing:

- ED DEBWHI00 to assign bandwidth to JEM-X2
- FCP_JEM2-_0010 JEMX2 DPE AND CSSW ACTIVATION
- FCP_JEM2_0011 JEMX2 IASW DPE PATCH FOR BCP PID INTERPRETATION
- FCP_JEM2_0015 JEMX2 IASW ACTIVATION
- FCP_JEM2_0016 JEMX2 ENABLE BCP DISTRIBUTION
- FCP_JEM2_0017 JEMX IASW EXTENDED TM CHECK
- FCP_JEM2_0020 JEMX2 DFEE 1ST ACTIVATION AFTER DPE SWITCH ON. Due to LOS at the end of the revolution, this procedure was halted at 17:53Z before the DFEE SW patch in step 4.5.

After AOS of revolution 482, at 22:26Z FCP_JEM2_0020 JEMX2 DFEE 1ST ACTIVATION AFTER DPE SWITCH ON was resumed at step 4.5. At this stage, FCP_JEM2_0025 was substituted by FCP_JEM2_9830 to load the DFEE SW image IIMG_P_J2D_1665_00255_F_V_004_004_0.IMG, followed by FCP_JEM2_0070 to set the value of SW integer parameter #80 to 1200 decimal and SW integer parameter #81 to 1614 decimal.

The DFEE activation was completed at 23:39Z, after which JEM-X2 was activated nominally via the Timeline.

2006-09-24 (DOY 267, Rev 482)

Nothing to report

2006-09-25 (DOY 268, Rev 482)

Starting at 01:30:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 18 RAW DEC
- FCP_JEM2_0031 JEMX2 SETTING OF DETECTOR CATHODE VOLTAGE (Vc), setting the Vc voltage to 18 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

Starting at 13:30:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0031 JEMX2 SETTING OF DETECTOR CATHODE VOLTAGE (Vc), setting the Vc voltage to 112 RAW DEC
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 71 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

JEM-X2 remained in Data Taking with the micro-strip gas gain voltage set to 71 RAW for 20 minutes after which the following was performed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 74 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

Due to the wrong DFEE SW Image being loaded in JEM-X2, following consultation with the PI and ISOC, a full power cycle of the JEM-X2 DPE and DFEE was executed according to CRP_JEM2_5020. During the re-activation, the DFEE SW Image limg_P_J2d_1665_00255_F_V_004_004_1.Int was loaded (this image having been validated against a dump of the configuration performed on 01/03/04). The operations were performed starting at 16:00Z and JEM-X2 was returned to Data Taking at 22:25Z.

2006-09-26 (DOY 269, Rev 482-483)

Nothing to report

2006-09-27 (DOY 270, Rev 483)

Starting at 13:10:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 18 RAW DEC
- FCP_JEM2_0031 JEMX2 SETTING OF DETECTOR CATHODE VOLTAGE (Vc), setting the Vc voltage to 18 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

2006-09-28 (DOY 271, Rev 483)

Starting at 01:10:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0031 JEMX2 SETTING OF DETECTOR CATHODE VOLTAGE (Vc), setting the Vc voltage to 112 RAW DEC
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 71 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

JEM-X2 remained in Data Taking with the microstrip gas gain voltage set to 71 RAW DEC for 20 minutes after which the following was performed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 74 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

Starting at 17:11:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 70 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

Starting at 19:59:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 72 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

Starting at 22:47:00Z the following was executed:

- FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- FCP_JEM2_0032 JEMX2 SETTING OF MICROSTRIP GAS GAIN VOLTAGE, setting the dV voltage to 74 RAW DEC
- FCP_JEM2_0044 JEMX2 DATA TAKING

2006-09-29 (DOY 272, Rev 483-484)

Starting at 01:19:00Z the following was executed:

- FCP_JEM1_0041 JEMX1 TRANSITION TO SETUP
- FCP_JEM1_0100 JEMX1 MODIFY ANODE CONFIGURATION, setting all anode segments 1, 3 and 4 to DISABLED and anode segment 2 to ENABLED
- FCP_JEM1_0044 JEMX1 DATA TAKING

Starting at 01:38:00Z the following was executed:

- FCP_JEM1_0041 JEMX1 TRANSITION TO SETUP
- FCP_JEM1_0100 JEMX1 MODIFY ANODE CONFIGURATION, setting all anode segments back to ENABLED
- FCP_JEM1_0044 JEMX1 DATA TAKING

Starting at 15:10:00Z (after radiation belt entry) the JEM-X2 DFEE and DPE were switched off again by executing:

- FCP_JEM2_9010 JEMX2 DFEE SWITCH OFF
- FCP_JEM2_9001 JEMX2 DISABLE BCP DISTRIBUTION
- FCP_JEM2_9000 JEMX2 DPE SWITCH OFF

8.3.5 OMC Operations

2006-09-23 (DOY 266, Rev 481) to 2006-09-27 (DOY 270, Rev 483)

Nothing to report.

2006-09-28 (DOY 271, Rev 483)

At 17:05:13, the command M1329, Imaging BX, which was sent by ISDC, failed on board acceptance, as OMC was in Standby mode at the time. There was no impact.

2006.271.17.05.12.604	2006.271.17.05.16.342	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

2006-09-29 (DOY 272, Rev 483)

At 05:45:54, an IREM SEU (#36) occurred, which forced OMC to SAFE mode. A Recovery was performed, and completed at 06:47:22, when OMC was returned to Stand-by. The impact was an interruption of pointing 04830051 after 1241 from a scheduled 1800 seconds, and the loss of pointings 04830052 & 04830053. It was at this time the following commands were rejected:

2006.272.05.55.37.758	2006.272.05.55.49.170	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2006.272.05.55.43.008	2006.272.05.55.49.230	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

Which correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for the pointings 04830052.

At 07:35, an attitude determination problem forced the disablement of the Timeline (See AOCS section for details). A Recovery was performed, and completed at 08:39. The impact was the loss of pointings 04830056. It was at this time the following commands were rejected:

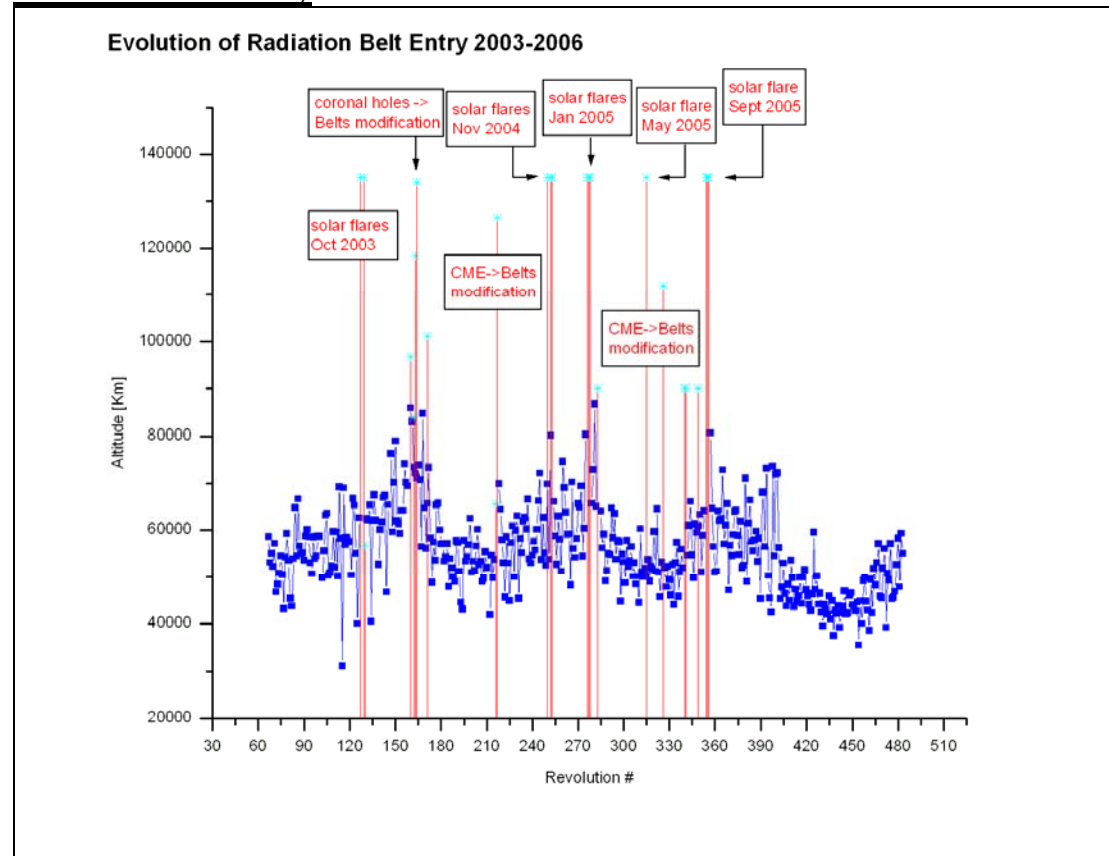
2006.272.08.03.10.887	2006.272.08.03.15.596	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2006.272.08.03.17.012	2006.272.08.03.23.660	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

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

On DoY 266 at 15:35:30, DoY 269 at 15:18:10 and DoY 272 at 15:02:50 OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

On 2006-09-29 at 05:46Z, a local reset of the IREM CSCI S/W (SEU #36) occurred: as previously (see anomalies on 16/12/02, 01/01/03, 03/06/03, 11/07/03, 19/07/03, 05/08/03, 24/08/03, 26/12/03, 13/05/04, 16/05/04, 09/06/04, 12/06/04, 10/09/04, 14/09/04, 28/10/04, 06/11/04, 01/12/04, 11/12/04, 30/01/05, 11/02/05, 04/03/05, 11/05/05, 17/05/05, 15/06/05, 30/07/05, 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) 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 2006.272.05.46Z at 109307.6km. 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 06:09Z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e the Checksum Failure flag shows YES. The

unit was still reporting the status as if it was in Integral mode with counting ON, accumulation ON and checksum failure flag ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

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

7) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 10:46Z.

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 06:41Z and OMC re-enabled at 06:47Z.

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

Corrections and complements to previous weekly report are presented in this table.

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]
481	RAD_ENTR R 2006-09-23T15:35:23Z	2006-09-23 16:36:48	47813.0	2006-09-23 16:29:01	48737
482	RAD_EXIT R 2006-09-24T00:55:41Z	2006-09-23 23:30:16	>>28139.0	2006-09-24 00:29:01	41090
482	RAD_ENTR R 2006-09-26T15:18:09Z	2006-09-26 14:52:37	59387.0	2006-09-26 16:02:45	50013
483	RAD_EXIT R 2006-09-27T00:38:34Z	2006-09-26 23:39:37	>>28140.3	2006-09-27 00:12:45	41194
483	RAD_ENTR R 2006-09-29T15:02:45Z	2006-09-29 15:07:13	55121.4	2006-09-29 15:52:45	49402
484	RAD_EXIT R 2006-09-30T00:22:49Z	2006-09-29 23:12:37	<<39118.9	2006-09-29 23:52:45	40408

Reference

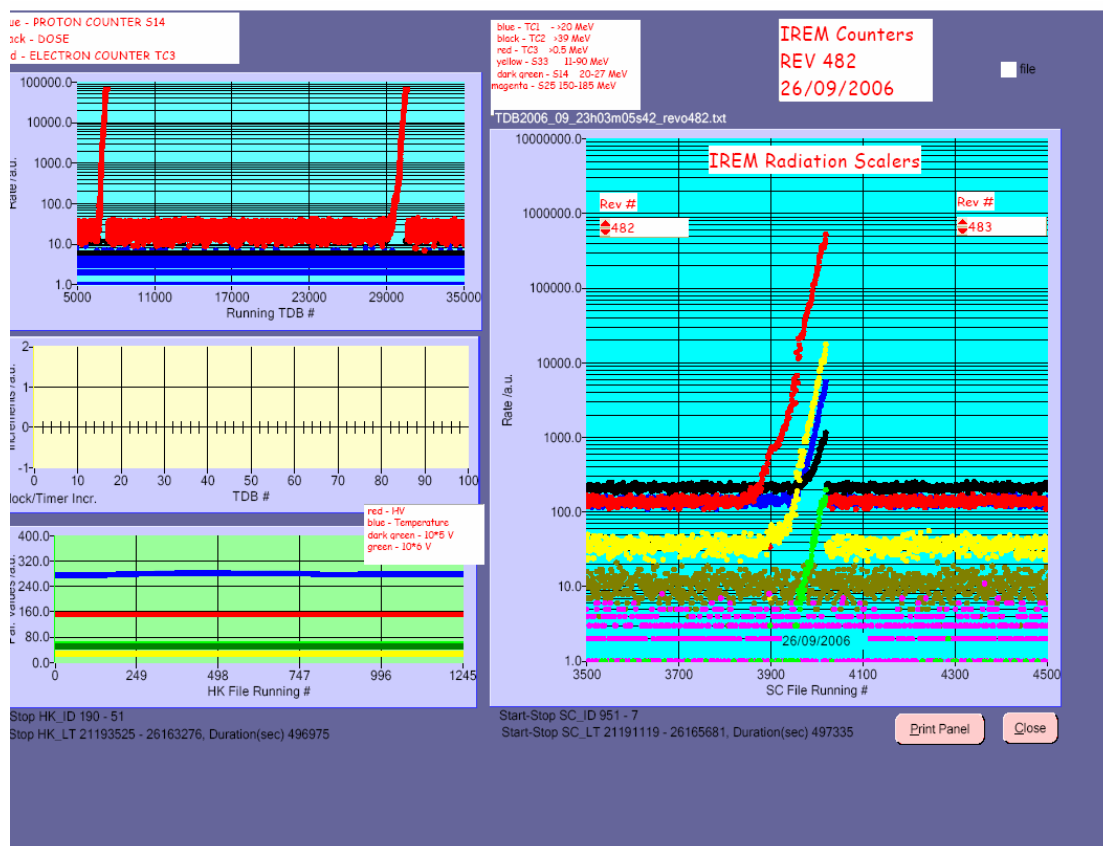
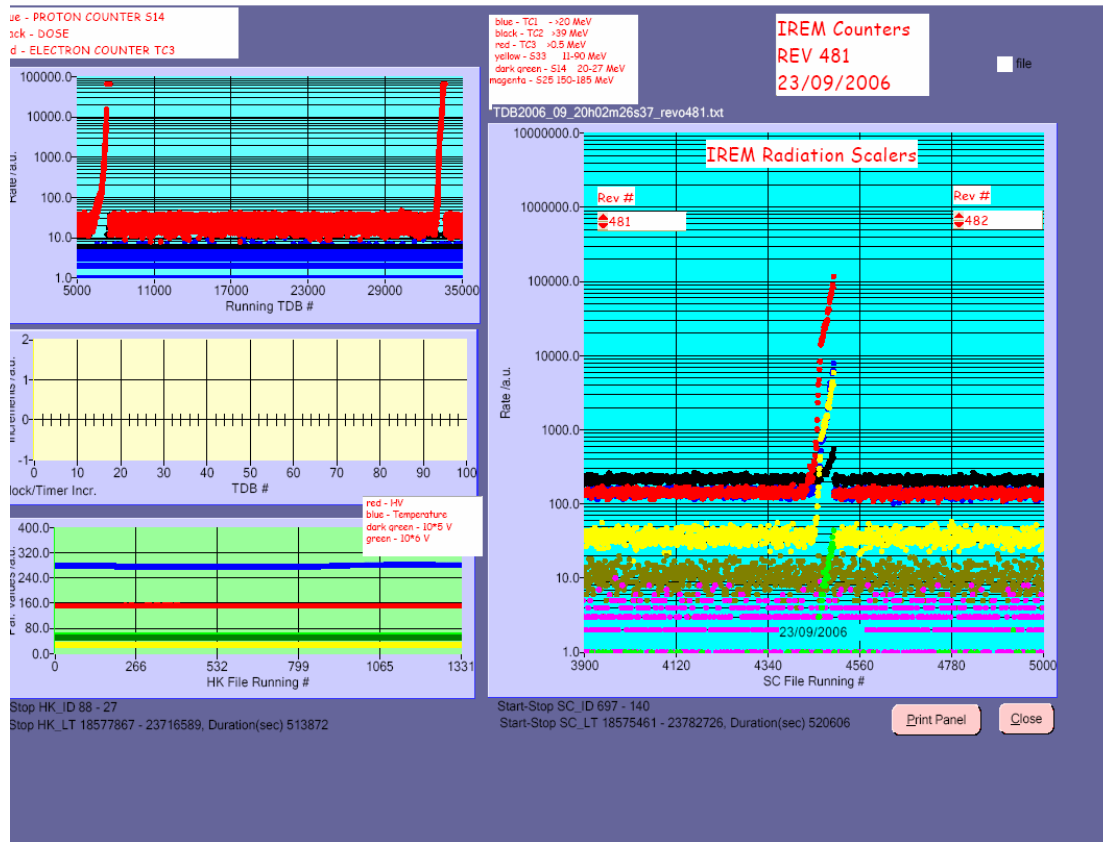
Very small error vs reference (less than 10 minutes)

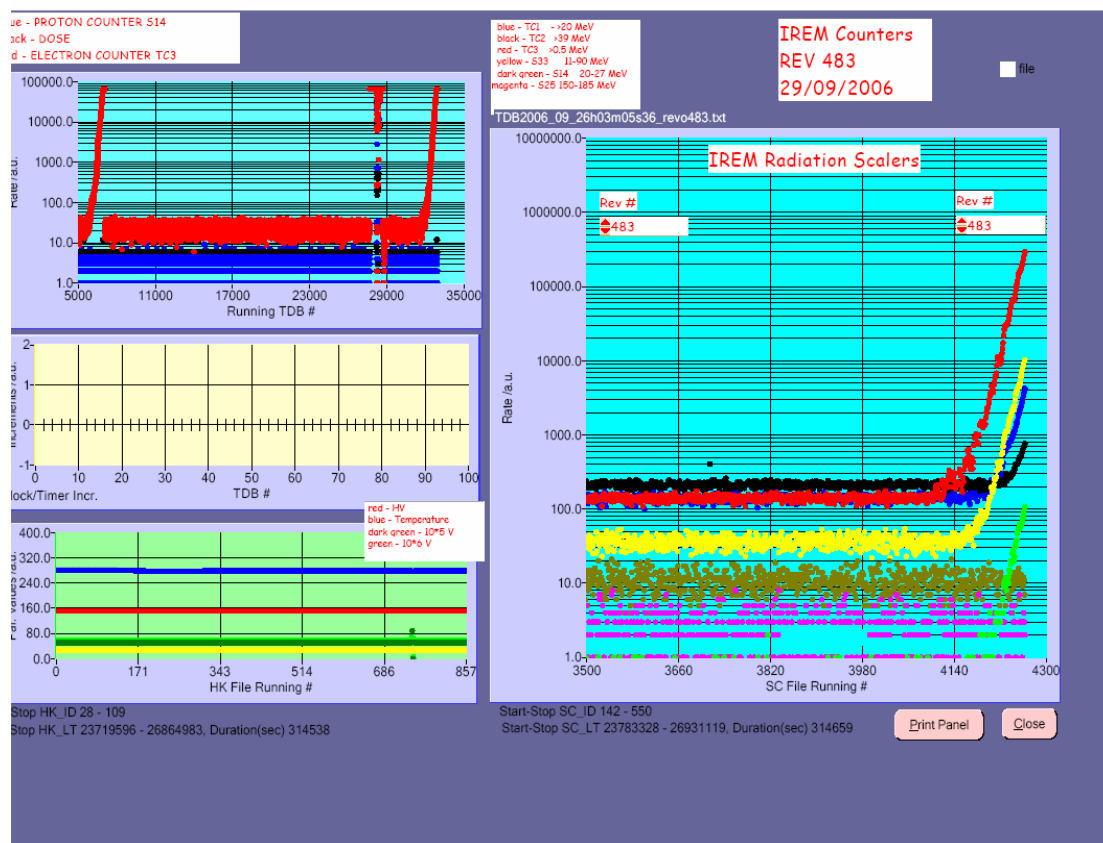
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

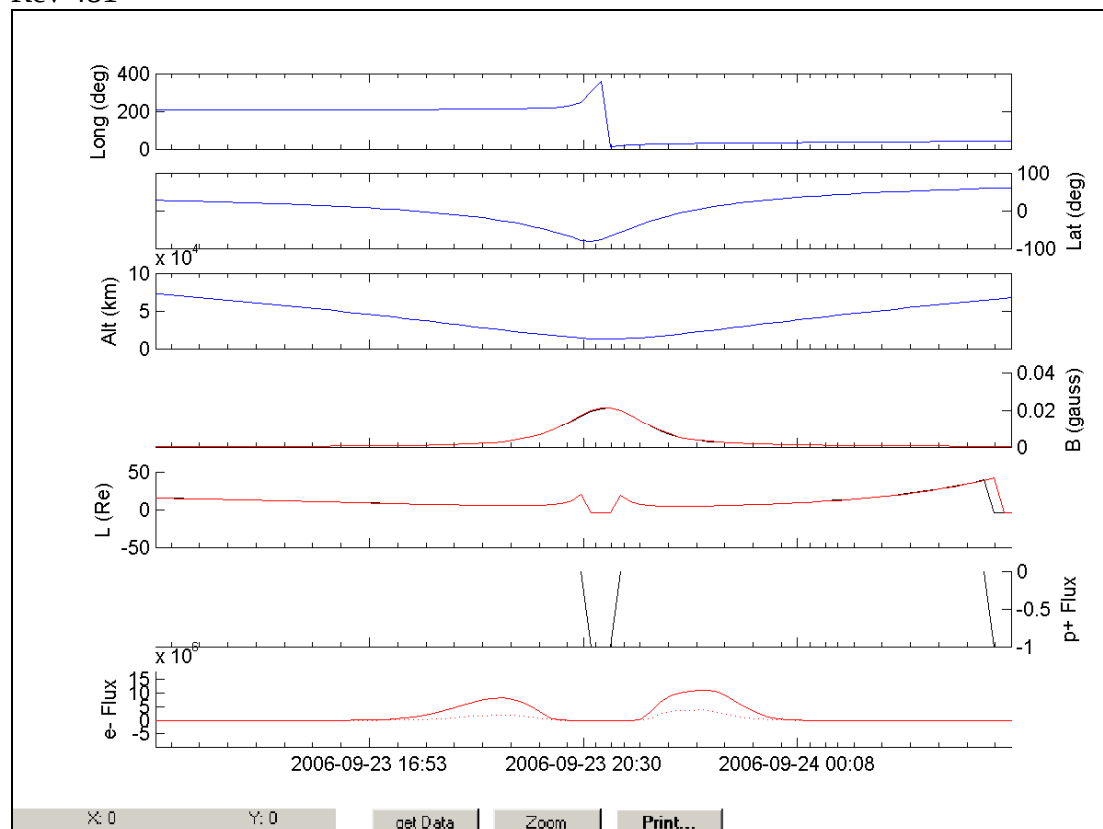
IREM radiation counters:



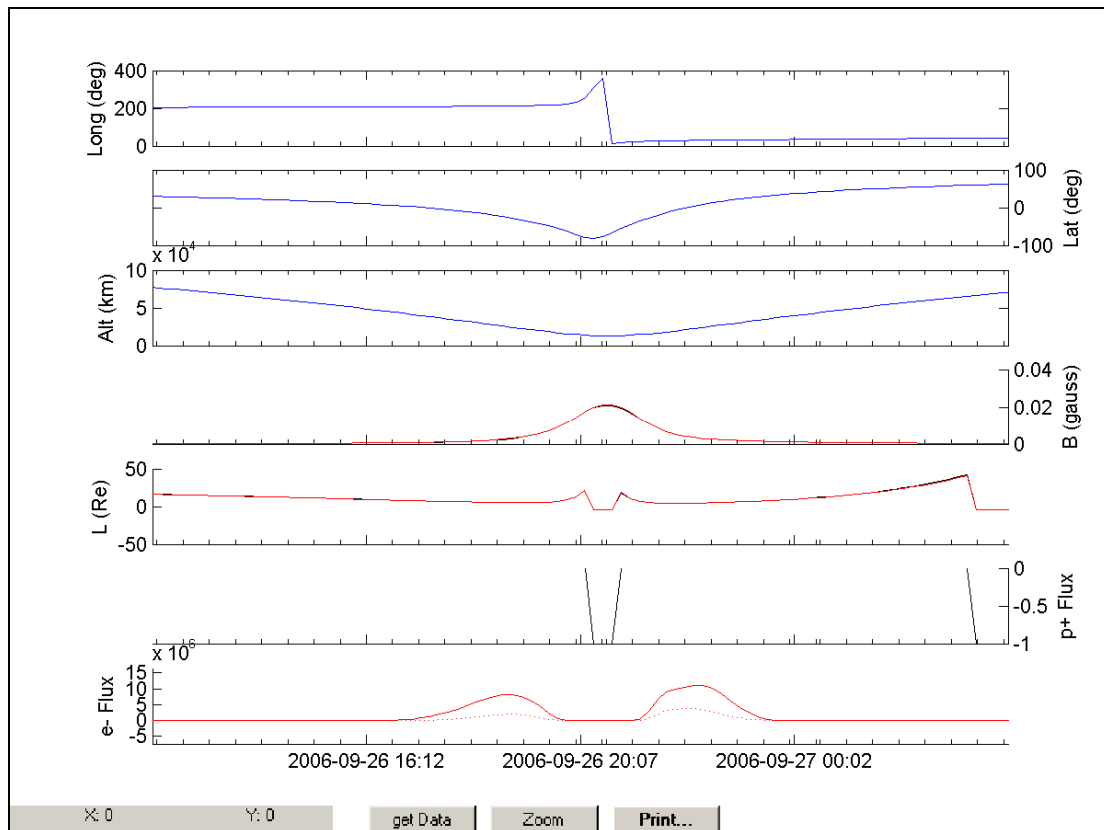


IREM Predicted Radiation Belt Passages:

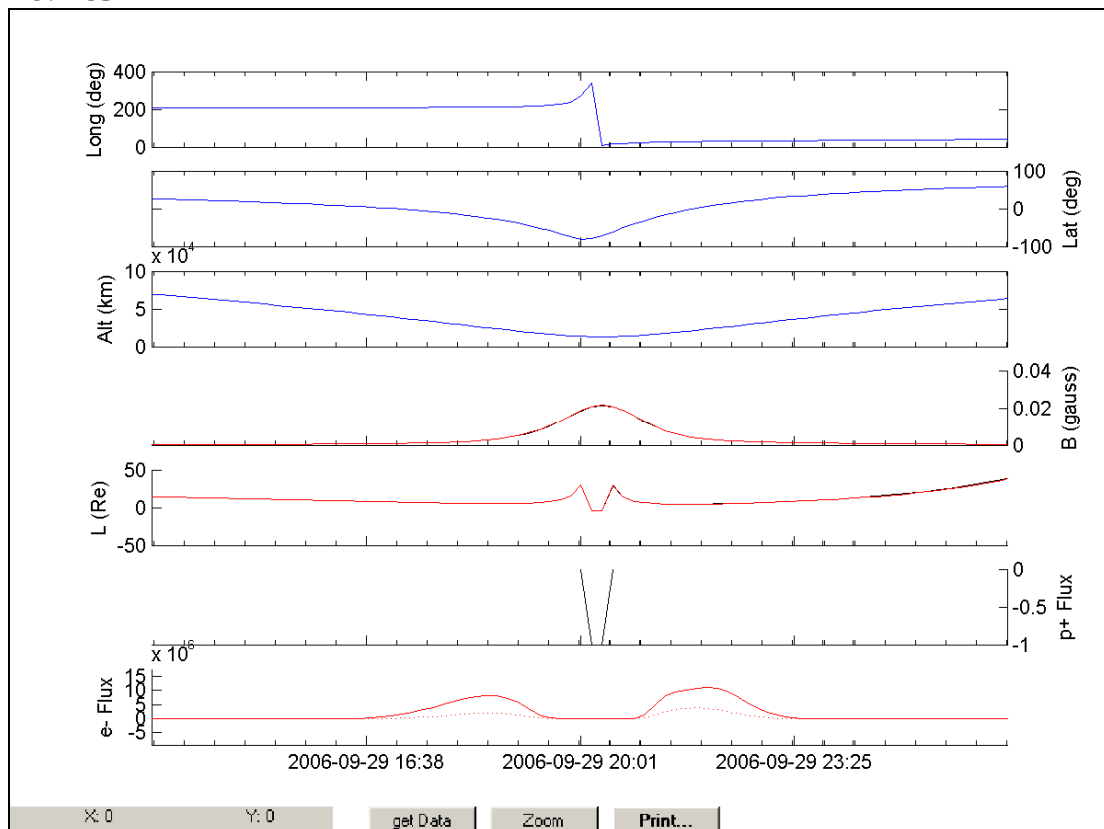
Rev 481



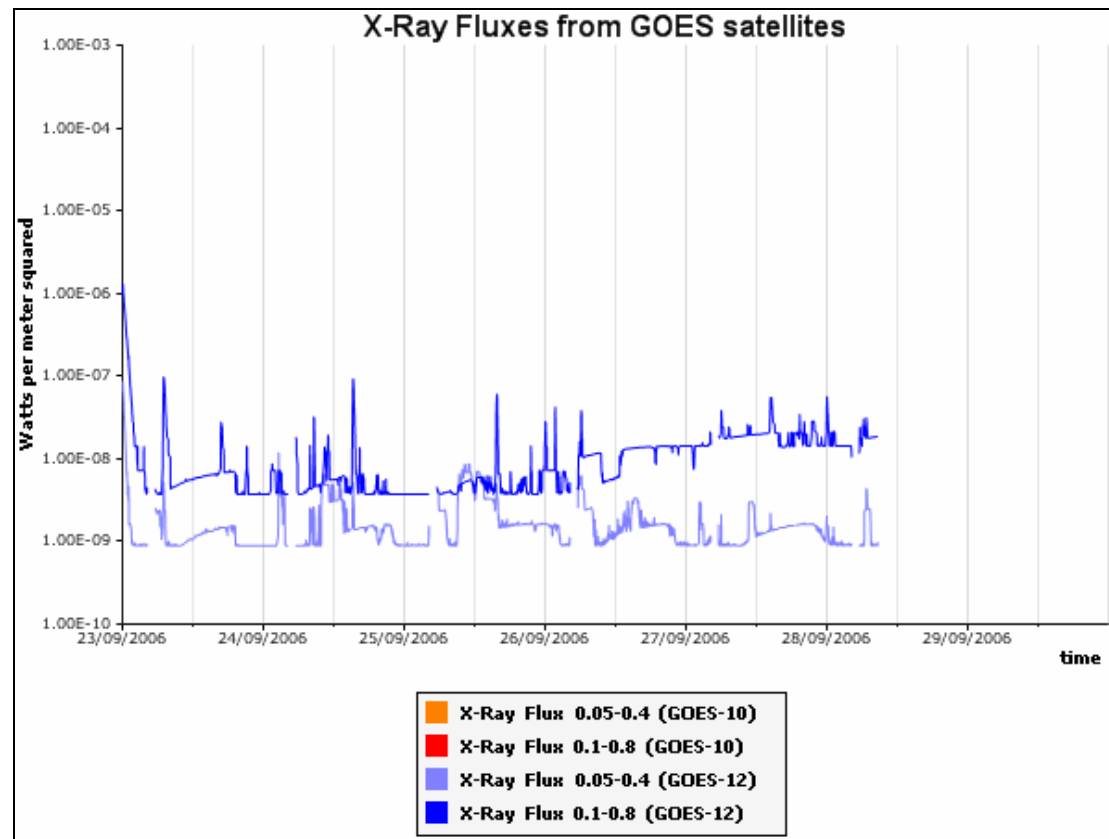
Rev 482



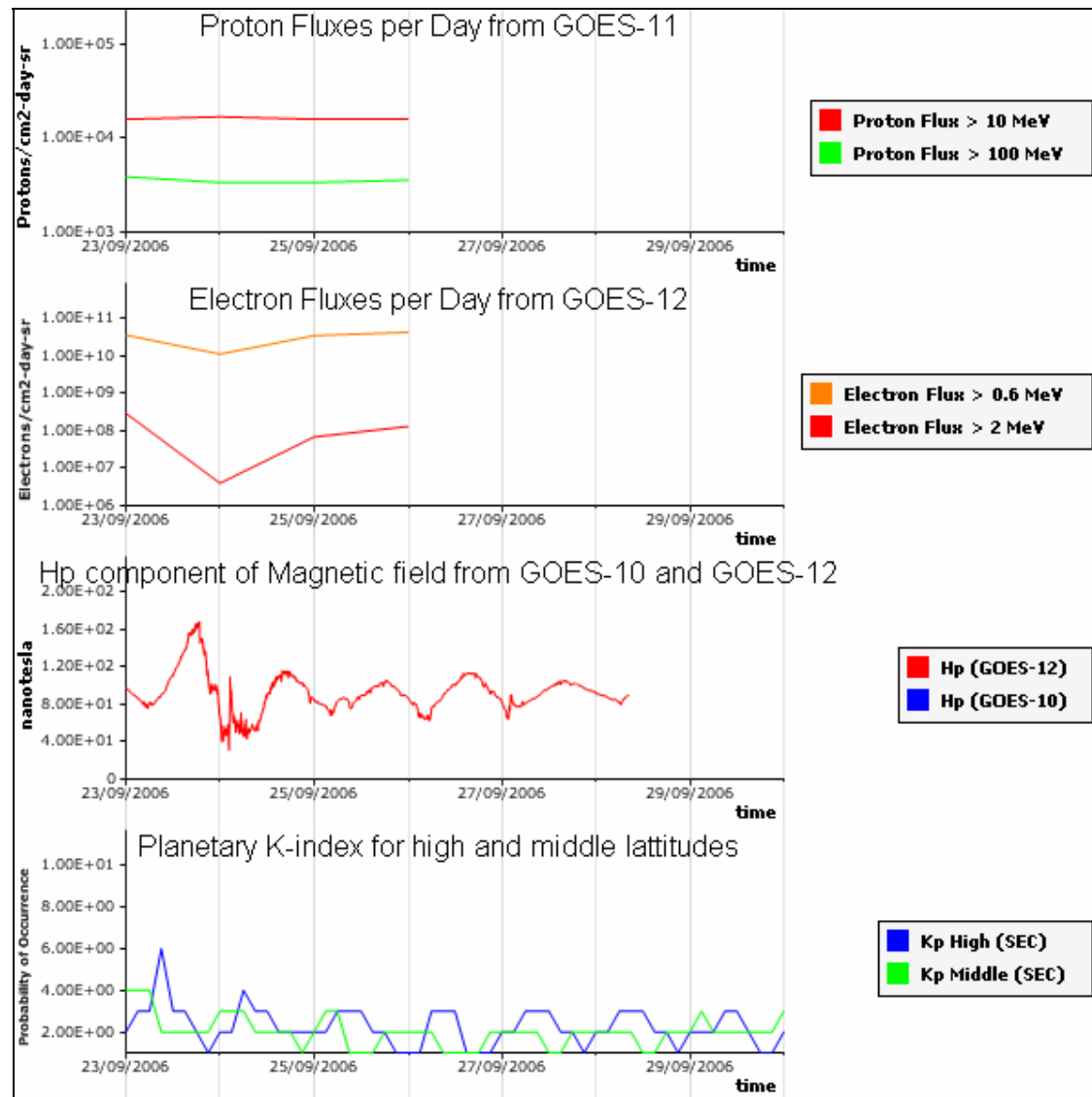
Rev 483



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.