

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 213
Week 42
23.10.06
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 14.10.06 until 20.10.06 (both dates inclusive) and covers the revolutions 489, 490 and 491.

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 4 raster dithers of the Region at $l=0$, $b=-25$ (RA 19:36:28.82, DEC -39:08:24.8), 3 hexagonal dithers of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), 2 hexagonal dithers of the Galactic Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), an OMC Flat Field Calibration, which was a staring observation at attitude (RA 19:57:12.00, DEC -22:36:00.0) and a raster dither of the Region at $l=0$, $b=-25$ (RA 19:36:28.82, DEC -39:08:24.8).

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

3 Satellite Status

3.1 Platform

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

3.1.1 AOCS

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

No slews were missed during the observation period.

The fuel consumption over the period between 14/10/2006 and 17/10/2006 was 0.2471 Kg. The remaining propellant is in the order of 150.8080 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.

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

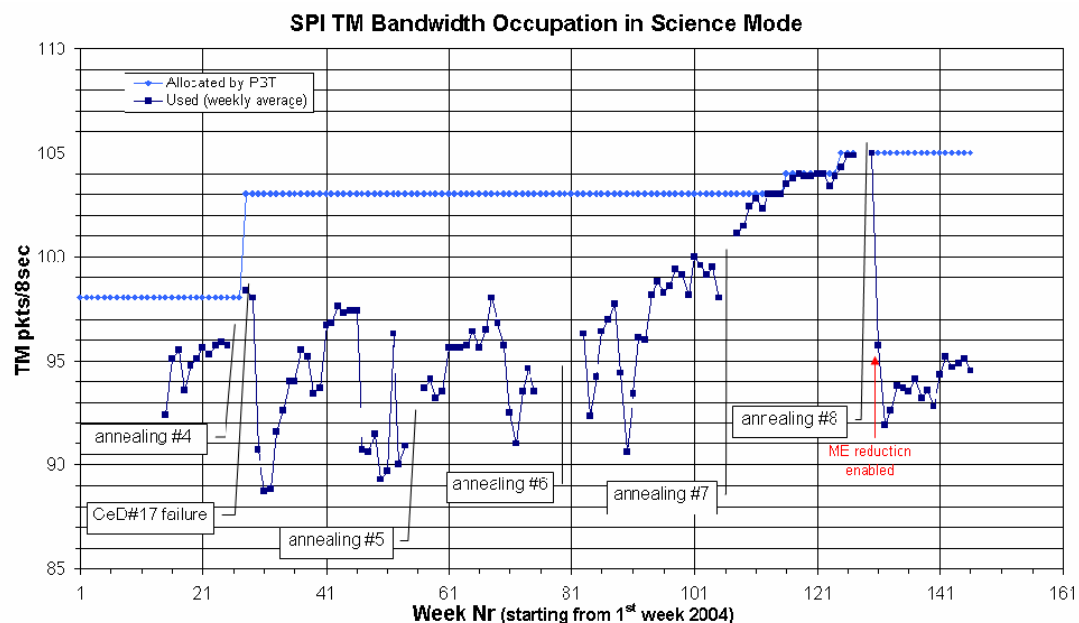
3.2.1 SPI

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 from 2006-10-18T11:48:45Z to 2006-10-18T15:35:10Z (OMC Flat Field Calibration) when the TM allocation was 85 packets/cycle. The average telemetry occupation when the allocation 105 packets/cycle 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.

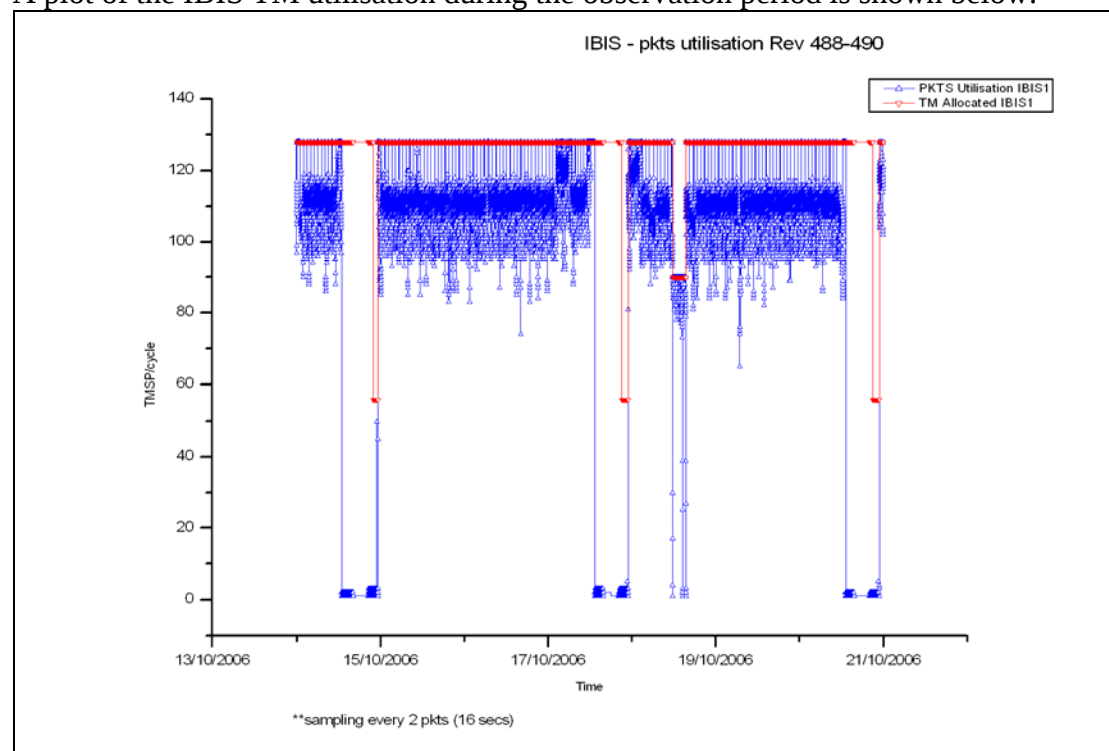
3.2.2 IBIS

The overall status of the unit is nominal.

At Radiation Belts entry, VETO reported high radiations. Indeed the lateral and bottom count rates featured several wraps-around. This was not harmful to the unit since the VETO photo-multipliers are very robust and can handle up to 260000 counts (corresponding to ~4 added wraps-around) before entering the alarm high range.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. However on 18/10/2006 between 11:50Z and 15:36Z, it was 90 TMPS/cycle due to an OMC Flat Field Calibration. The IBIS mean bandwidth utilisation during the observation period was 110.77 TMPS/cycle, down 1.41 on last week.

A plot of the IBIS TM utilisation during the observation period is shown below:



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

3.2.3 JEM-X

The status of both JEM-X units is nominal.

JEM-X operations were performed by the automatic Timeline.

JEM-X1 was operated in Data Taking mode with a TM allocation of 8 packets/cycle during science observations. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

JEM-X1 made two autonomous transitions to Safe mode, triggered by the Software Ratemeter, during the reporting period. These were ~15 minutes before the planned transition to Safe mode before radiation belt entry of revolutions 488 and 489.

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, all 138 planned science pointings for OMC were executed nominally. In addition, an OMC Flat Field calibration was also performed nominally.

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.

During the observation period, the sun was blank, hence posing no threat of strong solar flares. On 20/10/2006 a new sunspot, 917, emerged. It posed no threat either.

Reference: www.spaceweather.com

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

4 Ground Facilities

The Operational ground facilities performance was excellent this week. No slews were lost. The overall performance, however, was nearly 100%.

4.1 Mission Operations Centre

The performance of the MOC was good this week. The main problems reported were the TC history (twice) and Command Verifier tasks crashing, there was 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 hit on the line from Redu, and another occasion where there were missing source packets, there was no impact. 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 497. Observations have been planned and files sent up to revolution 497.

TSF's up to revolution 491 have been received.

2. Observation status

ECS have been received and processed up to revolution 482.

3. ISOC Science Data Archive

ISDA 2.6 beta1 was released on 20/10/2006.

Additional disk space for ISDA has not yet been installed due to technical problems (Sun is investigating)

ISDA Oracle database version 9.2.0.6 will be upgraded to 9.2.0.8 due to security issues

4. ISOC system

ISOC software version 13.1.1 is being used. Work is ongoing on version 14.0.

The new ISOC WWW pages using the WebDB system have been made public. For the moment, they are relying on the Web servers at ESTEC.

5. Problems

The change of the IFTS chain at MOC required a change in the firewall configuration at ESAC. As the change was not announced in advance, there was a delay during which no files could be transmitted. The ESAC firewall now supports both A & B chain.

4.3.2 ISDC

Status of ISDC observation processing on 23/10/2006:

- 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

There were no problems reported this week that impacted operations.

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

AR id	Date Created	Subject	Segment	Status
INT-2890	2006-10-25	OBQD displays incorrect and contradictory.	IMCS	Pending
INT-2889	2006-10-24	HFA TM Crash / IMCS Low Performances	IMCS	Pending
INT-2888	2006-10-20	Command Verifier on IMCA terminated	IMCS	Pending

7 Future Milestones

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 489

The observations in revolution 489 began with a raster dither of the Region at $l=0$, $b=-25$ (RA 19:36:28.82, DEC -39:08:24.8), lasting ~49.0 hours. This was followed by a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. Finally a hexagonal dither of the Galactic Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours, was performed, which lasted until the end of the revolution.

Revolution 490

The observations in revolution 490 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 ~7.8 hours. This was followed by an OMC Flat Field Calibration, which was a staring observation at attitude (RA 19:57:12.00, DEC -22:36:00.0), lasting ~3.4 hours. Finally another raster dither of the Region at $l=0$, $b=-25$ (RA 19:36:28.82, DEC -39:08:24.8), lasting ~42.2 hours, was performed, which lasted until the end of the revolution.

Revolution 491

The observations in revolution 491 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 hexagonal dither of the Galactic Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours. Finally, a raster dither of the Region at $l=0$, $b=-25$ (RA 19:36:28.82, DEC -39:08:24.8), lasting ~48.0 hours, was performed, which lasted 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, except during the Flat Field calibration in revolution 490, from 2006-10-18T11:49:28Z to 2006-10-18T15:35:53Z, when it was IBIS 90; SPI 85; JEM-X1 8; JEM-X2 0; OMC 63.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-10-02T16:44:12.000Z	151.5518	F	Automatic TM processing.
2006-10-02T22:08:12.000Z	151.5497	F	Automatic TM processing.
2006-10-04T08:12:25.000Z	151.4539	F	Automatic TM processing.
2006-10-05T22:00:45.000Z	151.3793	F	Automatic TM processing.
2006-10-08T14:31:56.000Z	151.3692	F	Automatic TM processing.
2006-10-08T21:45:09.000Z	151.2790	F	Automatic TM processing.
2006-10-11T14:41:16.000Z	151.1619	F	Automatic TM processing.
2006-10-11T15:58:04.000Z	151.0921	F	Automatic TM processing.
2006-10-11T21:23:32.000Z	151.0713	F	Automatic TM processing.
2006-10-13T07:27:28.000Z	151.0551	F	Automatic TM processing.

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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.

This report was generated Fri Oct 20 08:05:43 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, 14/10/2006 – 20/10/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 80 Open Loop Slews, 84 Closed Loop Slews and 7 Momentum Biases were executed.

No slews were missed during the observation period.

Orbit Control

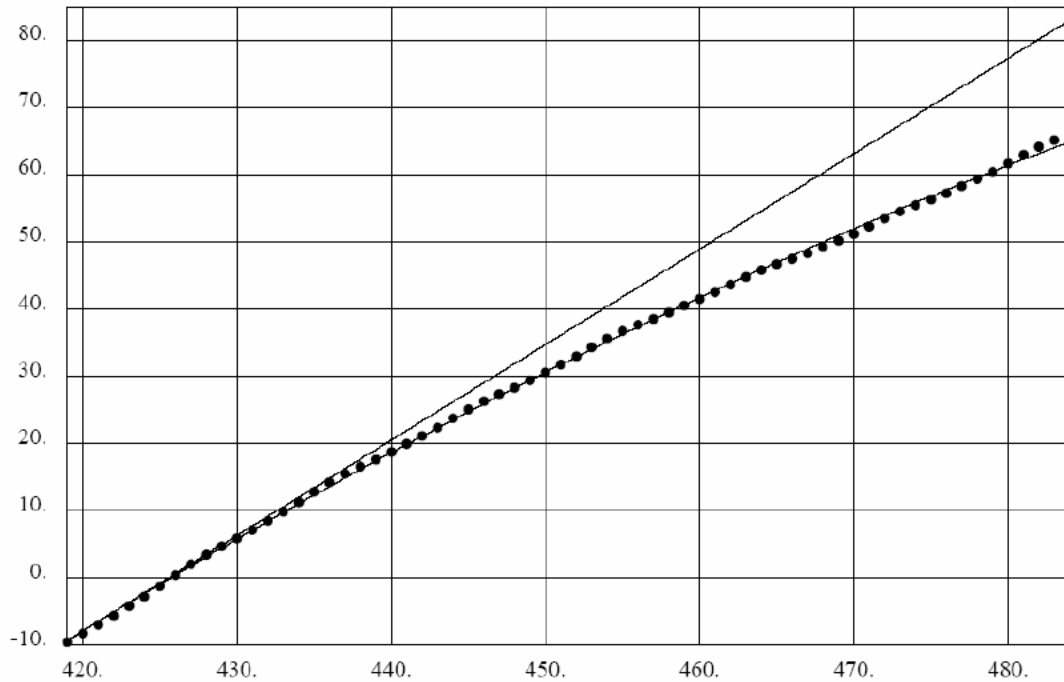
It has been noticed that the orbit is evolving in an unfavourable manner since May 2006 and it might be necessary to use Goldstone again to close the Apogee gap. This situation should be avoided as it will impact science activities. It has been decided to force the orbit in a more favourable direction.

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

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

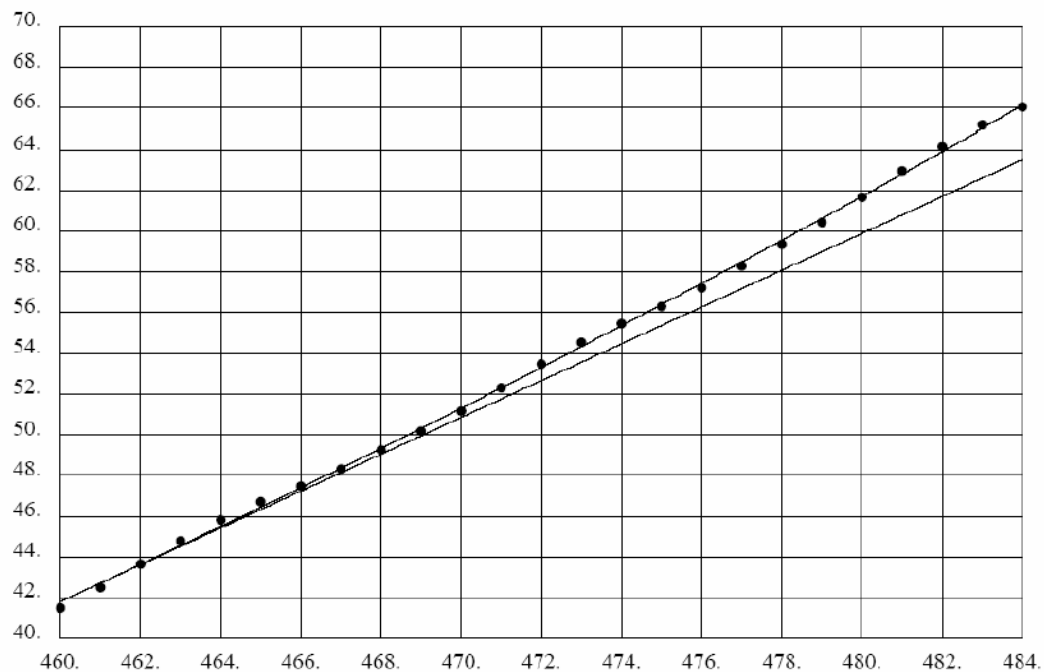
The attached plot shows the apogee longitude of Integral as a function of the orbit number. Using a parabolic approximation, the average semi-major axis increase due to momentum dumping manoeuvres is estimated to have been 464 m per orbital revolution.

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:

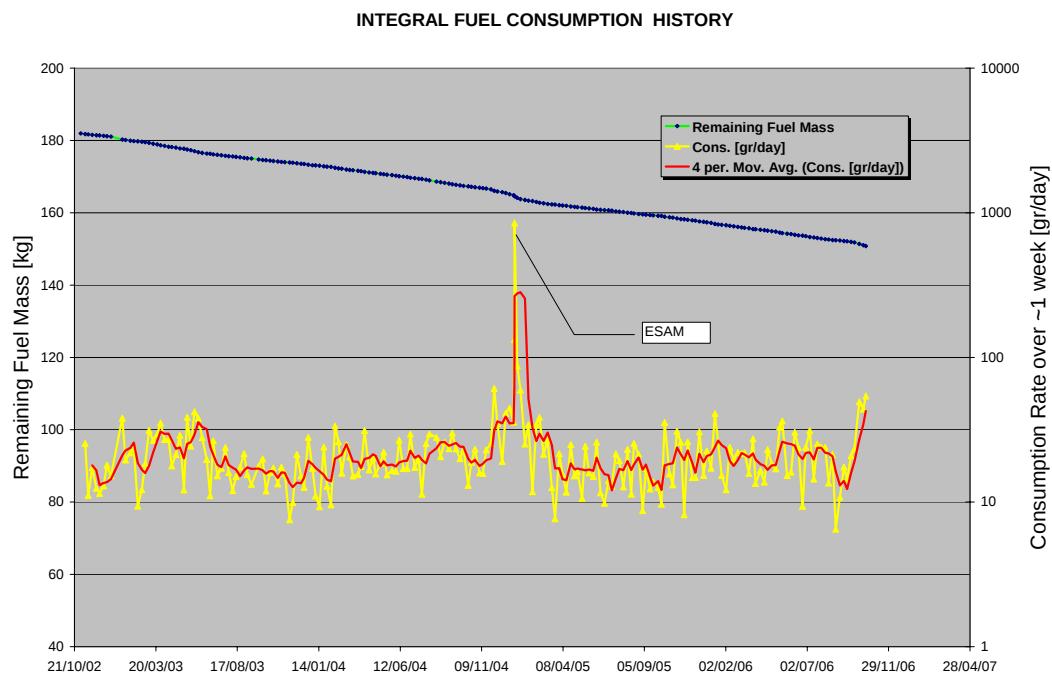
1. avoiding making momentum dumping manoeuvres close to perigee when pointing towards the "galactic centre";
2. performing artificial large momentum dump manoeuvres when the pointing is suitable for orbit control

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.

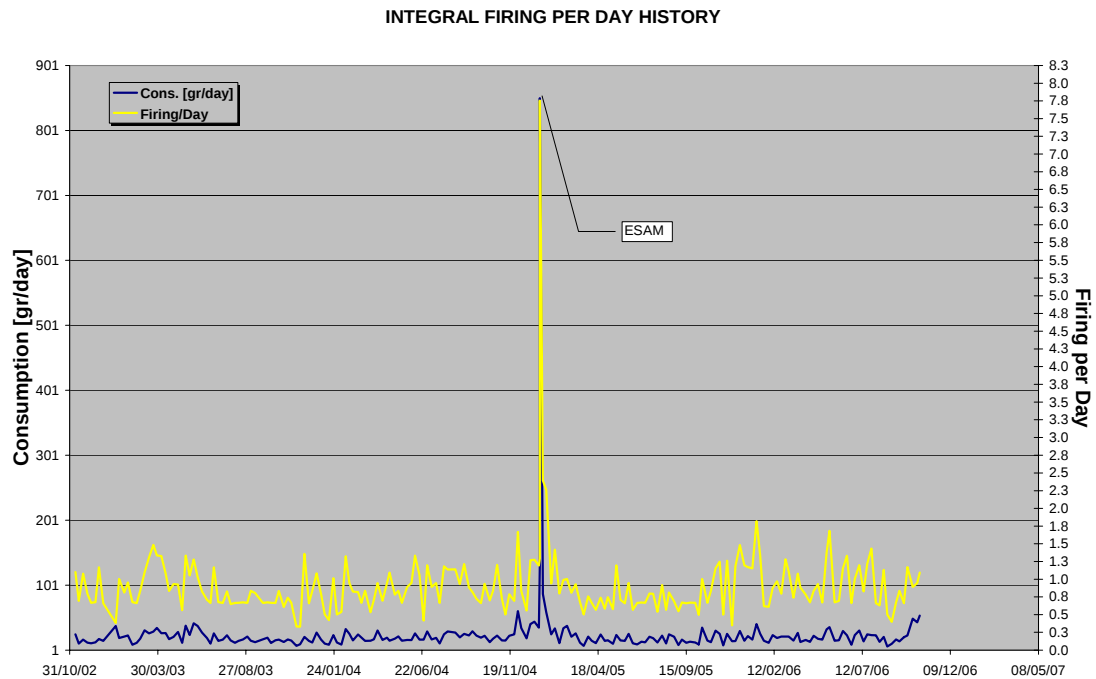
Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 17/10/2006 is reported in the plot below.

The large fuel consumption observed in the last weeks is still due to the new strategy to perform artificial large momentum dump manoeuvres when the pointing is suitable for orbit control. In this way it will 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.

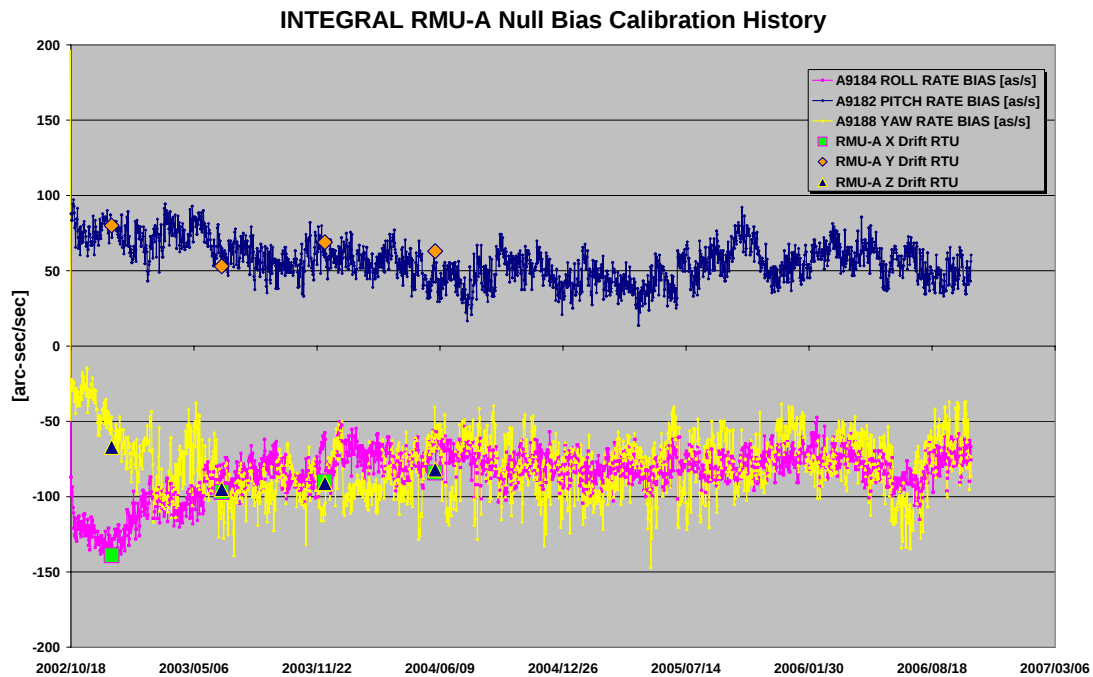


The firing\day over the period between 01/11/2002 and 17/10/2006 is reported in the plot below.

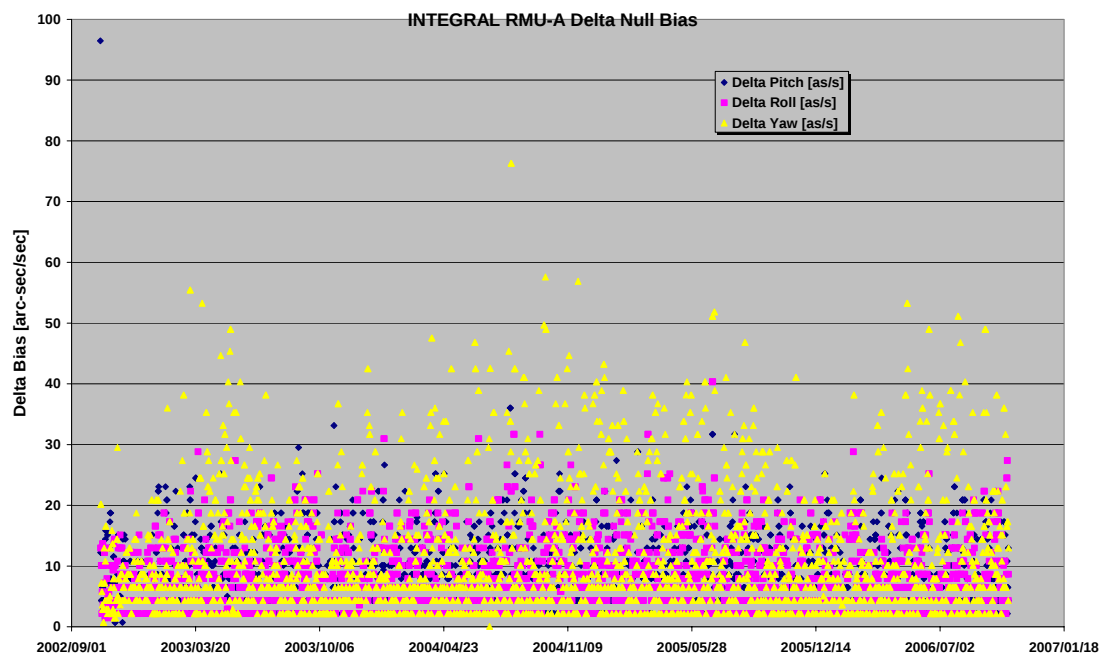


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 20/10/2006 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 20/10/2006 is reported in the plot below



14/10/06 (Day of Year 287, Revolution 488-489)

STR lost of guide star: at 00:08z due to lost of guide star the IMU was switched ON by the ACC, during the execution of PID 04880057.

The guide star at moment of the false event was Mi 8.4 at CCD location [27680, -19731]. A new guide star was picked after the mapping commanded by the ACC autonomously.

A manual recovery was then started at 00:23z and the next slew in TL (04880058) manually updated at 00:33z.

No impact on TL, except the OTF not reached for PID 04880057.

15/10/06 (Day of Year 288, Revolution 489)

Nothing to report.

16/10/06 (Day of Year 289, Revolution 489)

Nothing to report.

17/10/06 (Day of Year 290, Revolution 489-490)

FDS failed update slew due to wheels speed constraints violation: at 12:06z the update of slew ID 04890070 failed, at the end of revolution, as it happened already during rev 485 and 486 (see relevant AR).

FDS reported an error during the update process invoking a wheel constraint violation

during the generation of the TPF for the next OSL: an additional RWB was requested by FDS in order to continue with the planning.

The AOCS s/s was disabled from TL, FD support called in and a manual recovery was performed as follows:

- a manual RWB was not needed to recover the TL: due to a known bug of the FDS planning system, the internal wheels margins were temporarily modified from 100 to 150 rpm and the update re-generated;
- at 12:32z a manual update for OSL 04860070 was performed;

No further corrections were requested.

No impact on TL.

18/10/06 (Day of Year 291, Revolution 490)

Problem on IMCS Command Verifier Task: at 11:50z due to a problem on the IMCS Command Verifier task, the TPF update for slew 04900022 failed due to mapping sequence failing execution.

A manual recovery was then started at 12:27z and the slew 04900022 manually updated at 12:37z.

No impact on TL.

19/10/06 (Day of Year 292, Revolution 490)

Winter 2006 Eclipse Season, IMU 1-2 calibration and RMU-B health check: in preparation for the winter 2006 eclipse season the ACC IMU 1-2 drifts were evaluated and the RMU-B health checked during rev 490.

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

Time z	IMU1 IMU2 Health-Check / Calibration and RMU-B Health Check 19/10/2006 (DoY 292 , rev 490)	
06:12	Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051 (Set INHIBIT only TC para A1379)	Step 1, IMU1 PID 04900038 Start at 06:01:51 End at 07:00:41
06:21:20 06:26:15	IMU1 Switch On, FCP-AOC-1600 RMU-B switch On, FCP-AOC-1902	
06:32 06:35	Set IMU Selection ACC: IMU1 on Roll, IMU1 on Yaw, FCP-AOC-1050 FDE: IMU1-X on Roll, IMU1-Z on Yaw, FCP-AOC-1218	
	IMU 1 warm-up time (>30 minutes)	
07:34:57 07:36:29	Reset IAAD Accumulators, FCP-AOC-1210 Reset FCE RMU Integrators, FCP-AOC-1254 Perform IMU-1 Drift and Noise evaluation, FCP-AOC-	PID 04900039 Start at 07:27:59

	0523 step 8		
07:34:57 to 08:26:00	>>30 minutes of data collection From TM (average): IMU1 Noise Roll = 0.2029 as/s IMU1 Drift Roll = 0.1717 as/s IMU1 Noise Yaw = 0.0895 as/s IMU1 Drift Yaw = 0.1866 as/s	Calculated by FD: => 0.1894 as/s => 0.1843 as/s	Stable pointing: PID 04900039 Start of Slew 04900040: 08:26:49
8:36	Deselect IMU1 from ACC Word B, FCP-AOC-1050		PID 04900040 Start at 08:28:45 Start of Slew 04900041: 09:27:35
08:41	Deselect IMU1 from FDE, FCP-AOC-1218		
08:47:43	Switch Off IMU1, FCP-AOC-1601		
08:52	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-0526		
08:55:41	RMU-B switch Off, FCP-AOC-1903		
Thermal stabilisation after IMU1 Switch Off (> 2 hours) PID 04900040-04900041- 04900042 08:50:00 – 11:30:00Z			
11:39	Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051		Step 2, IMU2 PID 04900043 Start at 11:31:35 Start of Slew 04900044: 12:30:25
11:46:50	IMU2 Switch On, FCP-AOC-1602		
11:55 12:03	Set IMU Selection ACC: IMU2 on Roll, IMU2 on Yaw, FCP-AOC-1050 FDE: IMU2-X on Roll, IMU2-Z on Yaw, FCP-AOC-1218		
	IMU 2 warm-up time (>30 minutes)		
12:39:55	Reset IAAD Accumulators, FCP-AOC-1210 Perform IMU-2 Drift and Noise evaluation, FCP-AOC-1635 step 8		PID 04900044 Start at 12:32:37
12:39:55 to 13:31:00	>>30 minutes of data collection From TM(average): IMU2 Noise Roll = 0.2216 as/s IMU2 Drift Roll = 0.1109 as/s IMU2 Noise Yaw = 0.0199 as/s IMU2 Drift Yaw = 0.0055	Calculated by FD: => 0.1090 as/s => 0.0046 as/s	Stable pointing: PID 04900044 Start of Slew 04900045: 13:31:27

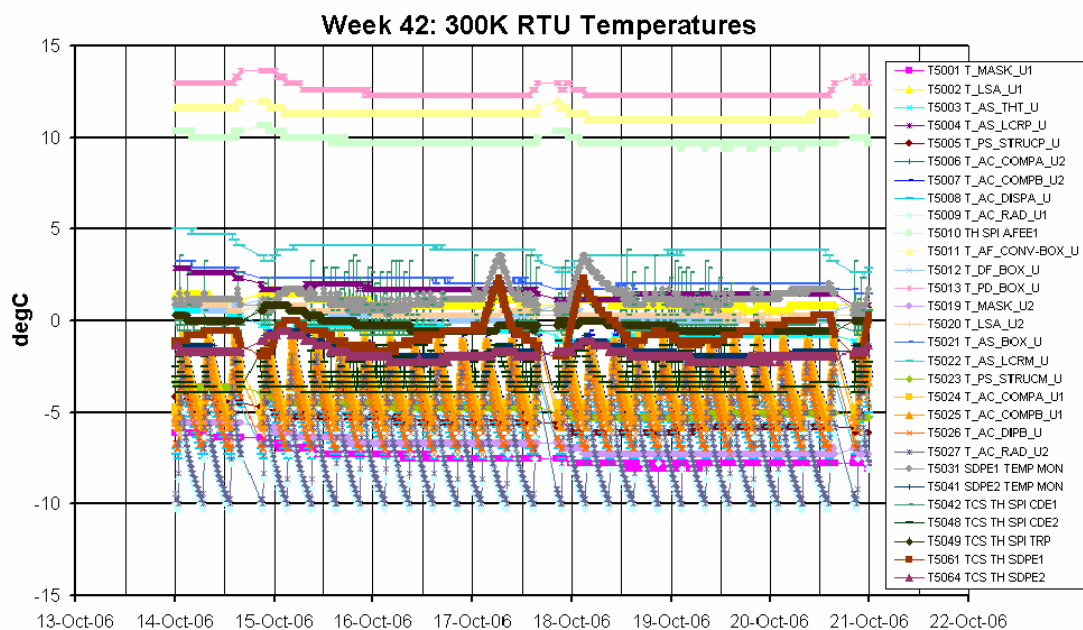
	as/s	
13:41	Deselect IMU2 from ACC Word B, FCP-AOC-1050	PID 04900045 Start at 13:33:23 Start of Slew 04900046: 14:32:13
13:47	Deselect IMU2 from FDE, FCP-AOC-1218	
13:52:13	Switch Off IMU2, FCP-AOC-1603	
13:57	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-0526	

20/10/06 (Day of Year 293, Revolution 490-491)

Nothing to report.

8.3.2 SPI Operations

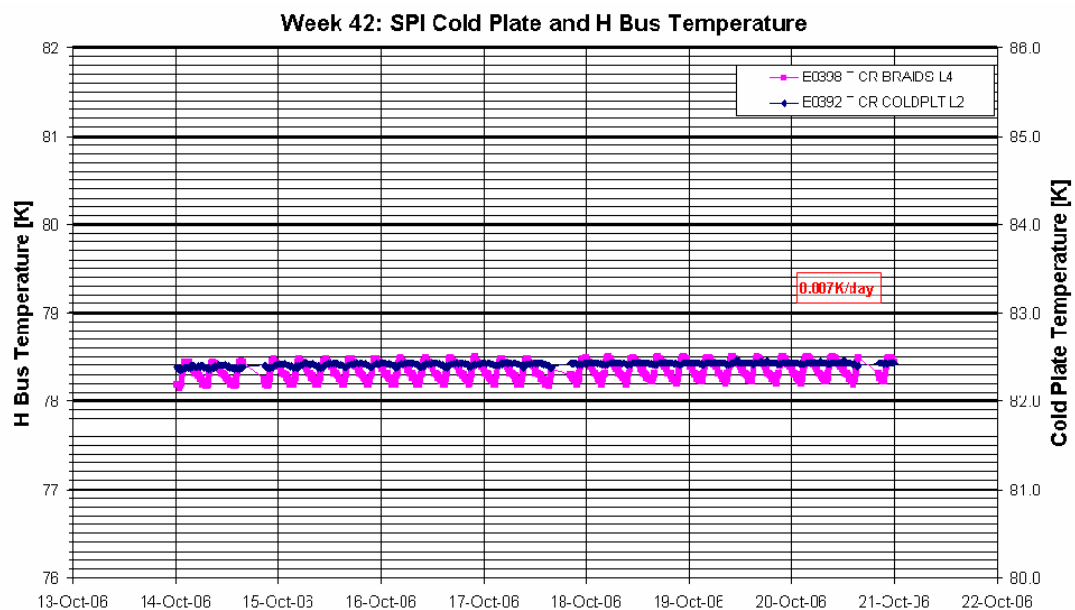
Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period:



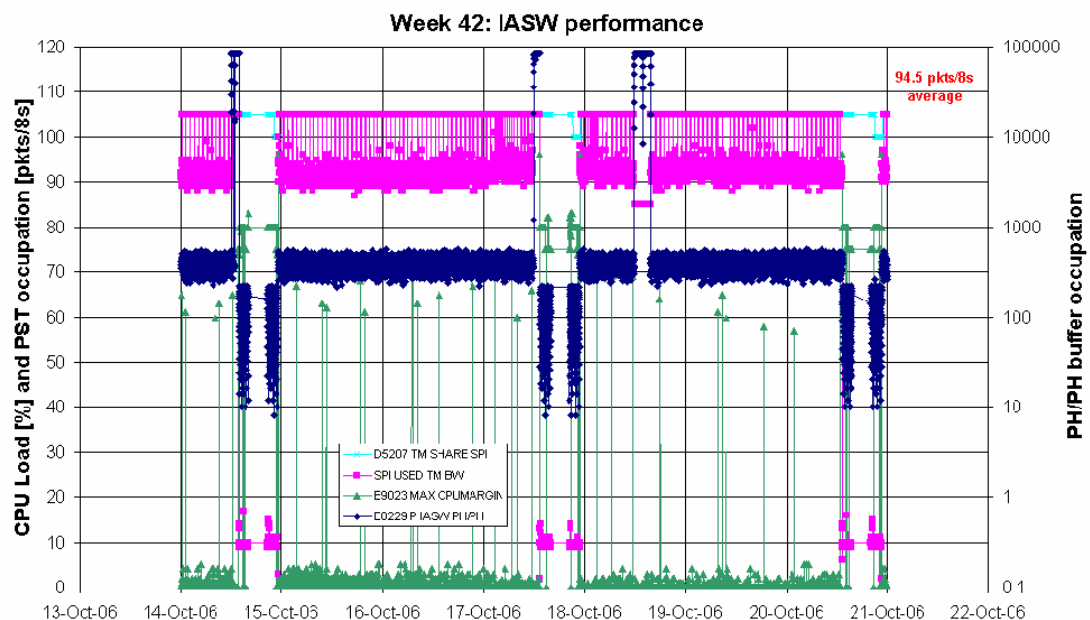
Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range to 82K +/-1K with a positive drift of 0.007deg/day. The stroke of all four compressors is currently set to 39. The average LCL currents of the CDEs over the week were:

- Average CDE1 LCL Current = 4.56A
- Average CDE2 LCL Current = 4.34A

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

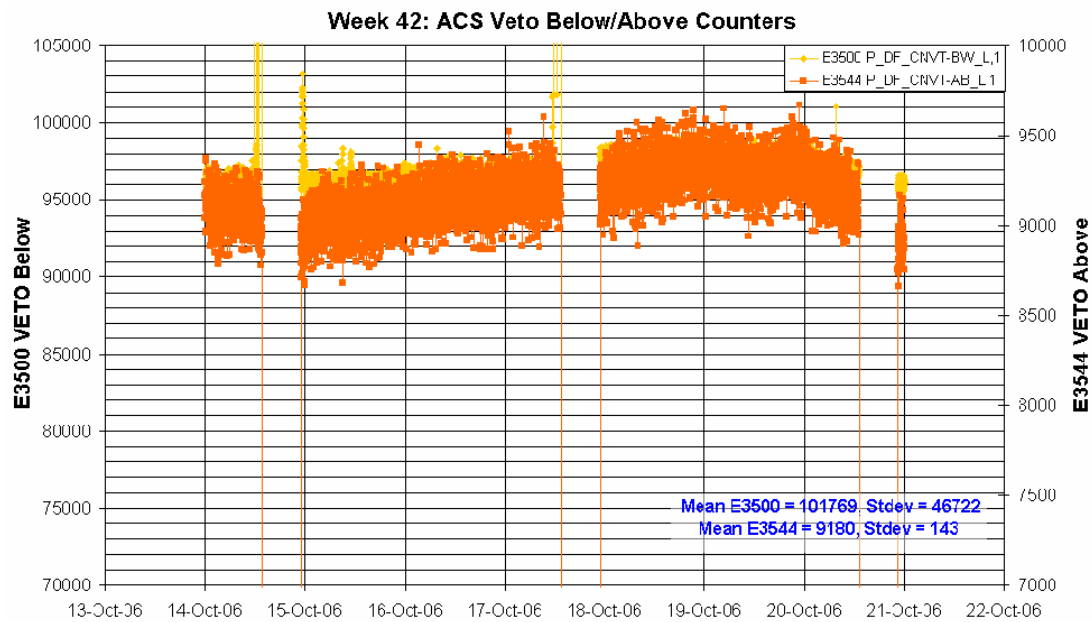


DPE & IASW: The DPE health and IASW performance is nominal. The current IASW version installed is 432. The average TM bandwidth occupation of SPI was 94.5 packets/cycle over the science window, when the TM allocation was 105 packets/cycle (note that from 2006-10-18T11:48:45Z to 2006-10-18T15:35:10Z the TM allocation was 85 packets/cycle due to an OMC Flat Field Calibration). The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



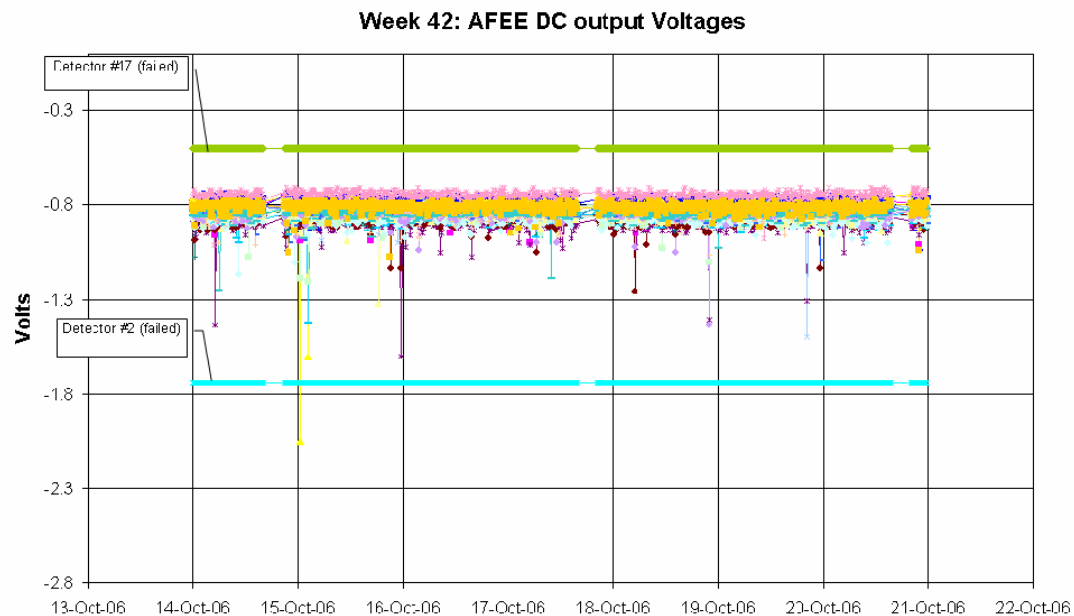
ACS: The performance of the ACS is nominal.

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

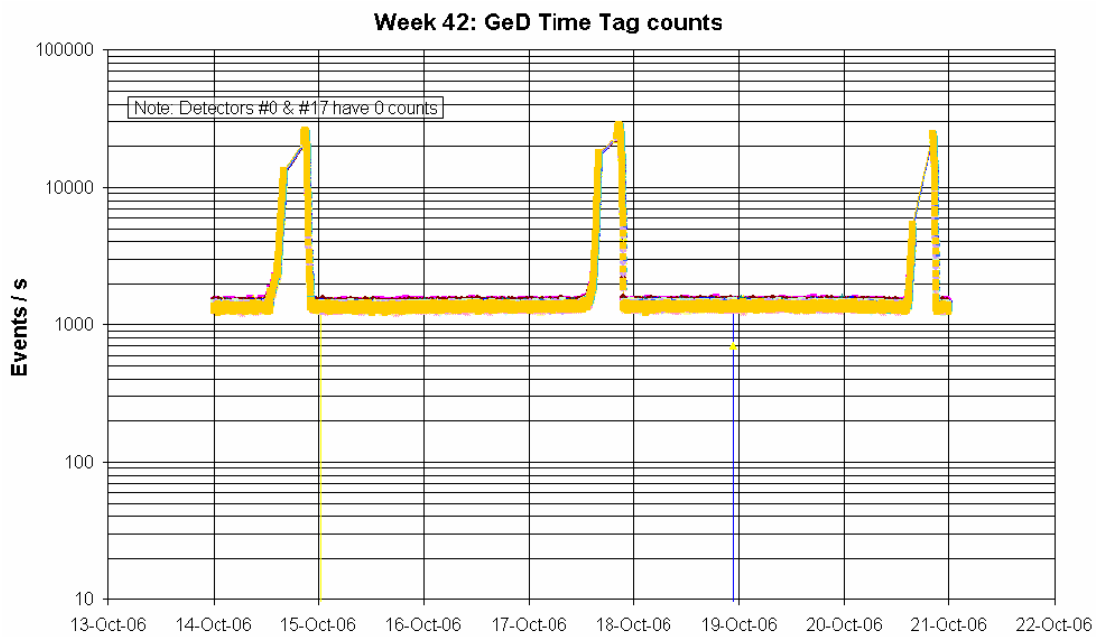
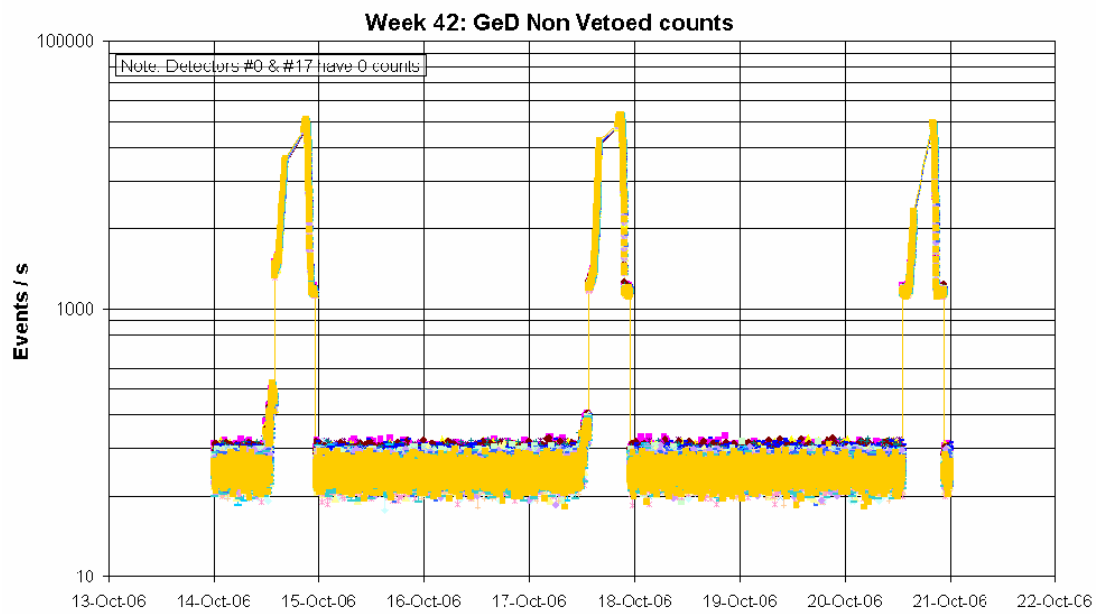


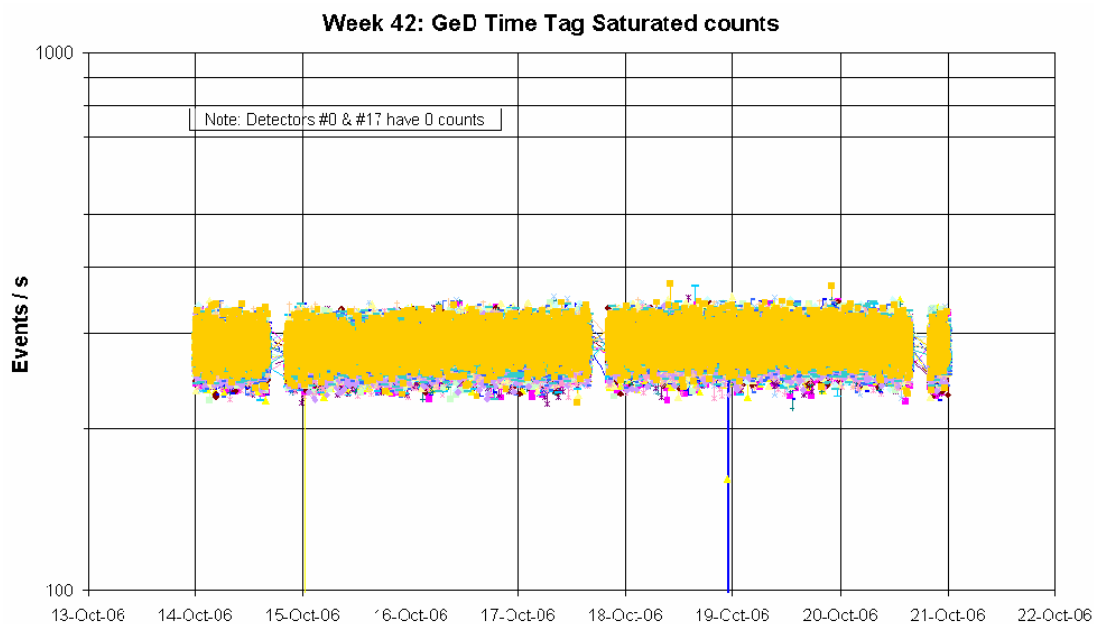
AFEE: The health of the AFEE is nominal. The performance of the AFEE and the detectors is nominal, except for the Ge detectors #4 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with the last annealing.

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

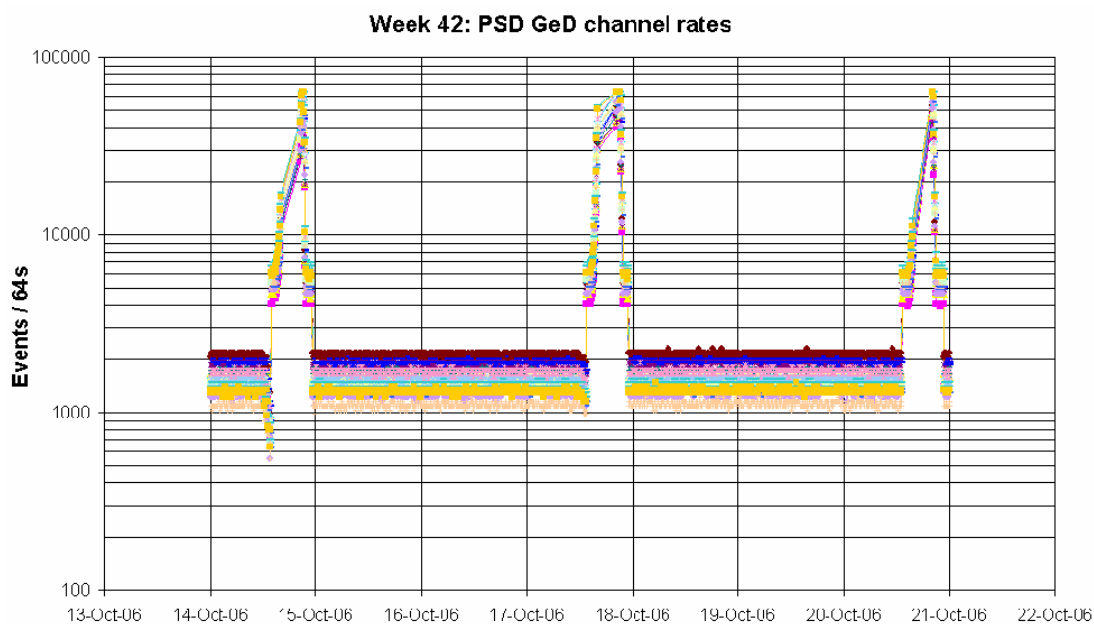


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.





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:

- On 2006-10-14 starting at 12:39Z the TM parameter E3500 P_DF_CNVT-BW_L starting going OOL High. This was ~1 hour before radiation belt entry of revolution 488 and therefore no action was taken.
- On 2006-10-17 starting at 11:54Z the TM parameter E3500 P_DF_CNVT-BW_L starting toggling OOL High. This was ~1.5 hours before radiation belt entry of revolution 489 and therefore no action was taken.
- From 2006-10-18T15:47:16Z to 2006-10-18T15:48:20Z 17 occurrences of the following OEMs were received:

APID 1024 ID 224 EXCEPTION SPI1 SW ERROR
 APID 1024 ID 7 EXCEPTION SPI1 CONSTRAINT DPE
 CULPR

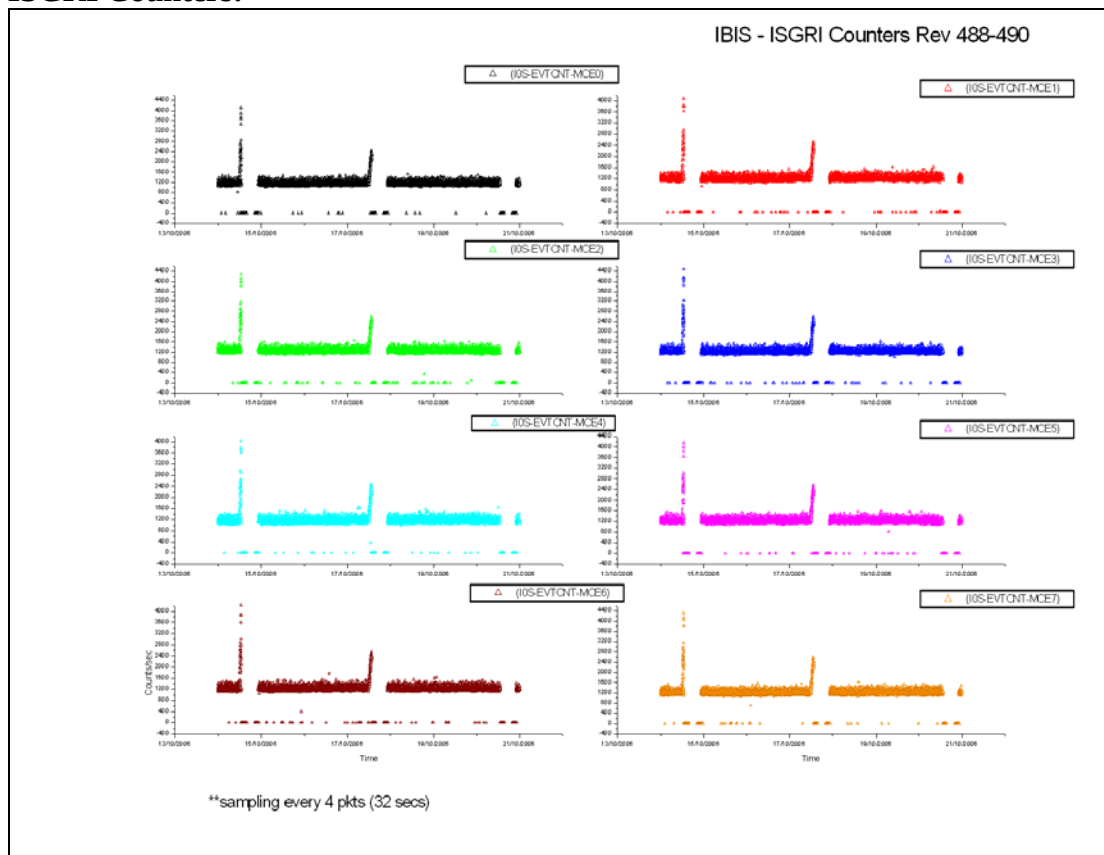
This was in the first pointing after the OMC Flat Field Calibration, ~10 minutes after the TM allocation had been changed from 85 packets/cycle back to 105 packets/cycle. It is usual to get these OEMs in this situation and they stopped of their own accord.

- TM parameter E2116 T AS PSAC L2 (Plastic Scintillator temperature) went OOL Low several times during the week. No action was taken as this is a known and recurring problem due to this thermistor being unreliable.

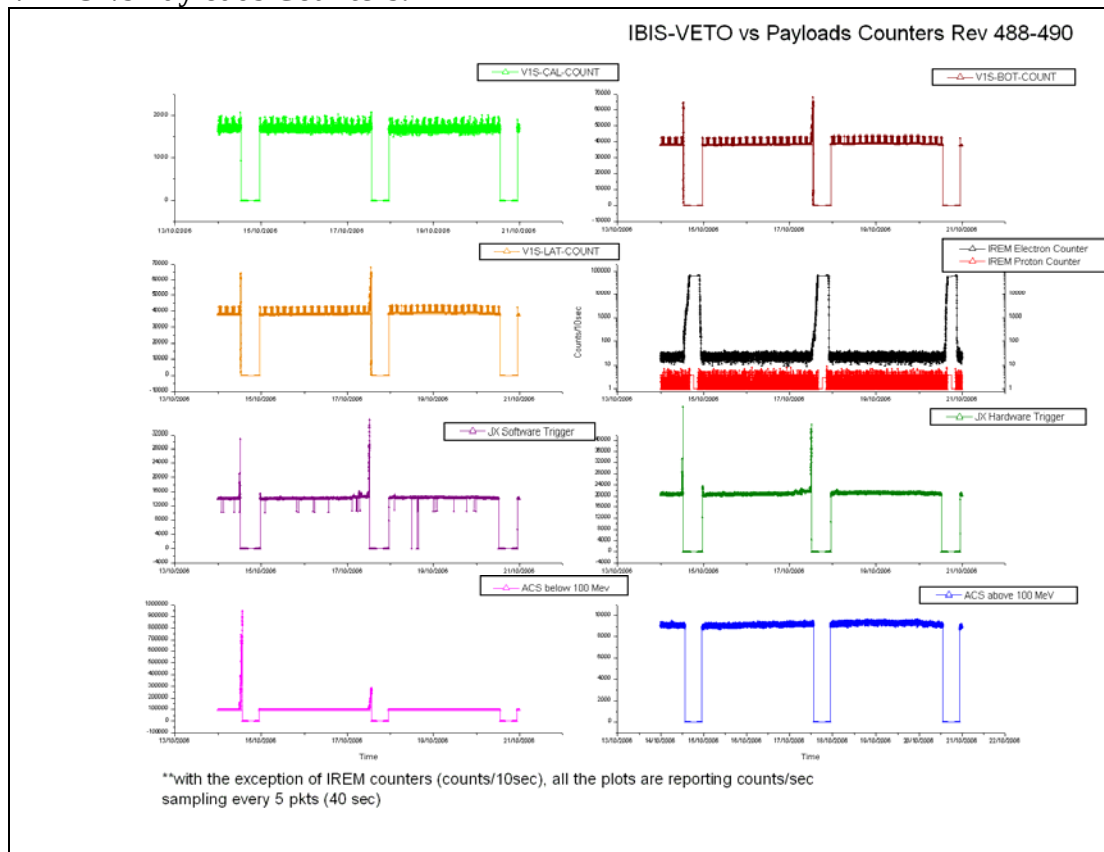
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

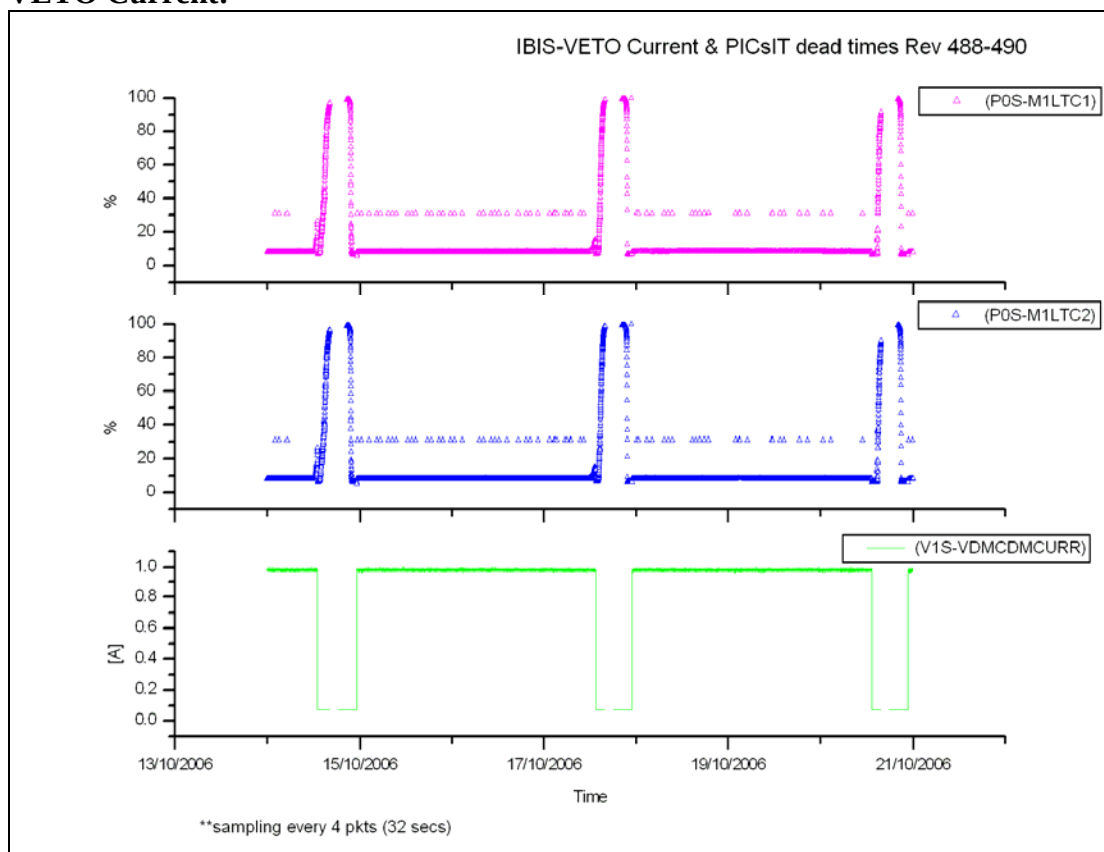


VETO vs Payloads Counters:



The week was characterised by low radiation.

VETO Current:



IBIS daily report

DoY 2006.287 (14/10/2006):

At 12:29Z TM parameters G6062 (V1S-BOT-COUNT) and G6063 (V1S-LAT-COUNT) were reported OOL High. They remained OOL until IBIS entered the Belts at 12:59Z via automatic reaction to IREM.

At 12:30Z TM parameter G8080 (S1E-VS HBRA-RT) was reported OOL High. It kept toggling OOL until IBIS went into Safe configuration.

At 12:39Z TM family G2013 (I0S-EVTCNT-MCEi) reported several parameters in OOL High. It kept toggling until IBIS went into Safe configuration.

At 12:59Z, TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 23:15Z. 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.

At 13:58Z, TM parameter G5079 (P0E-M2 ASICLINE) was reported OOL High. It went back at the next cycle. According to P-VLT-2 in FDIR no action was taken.

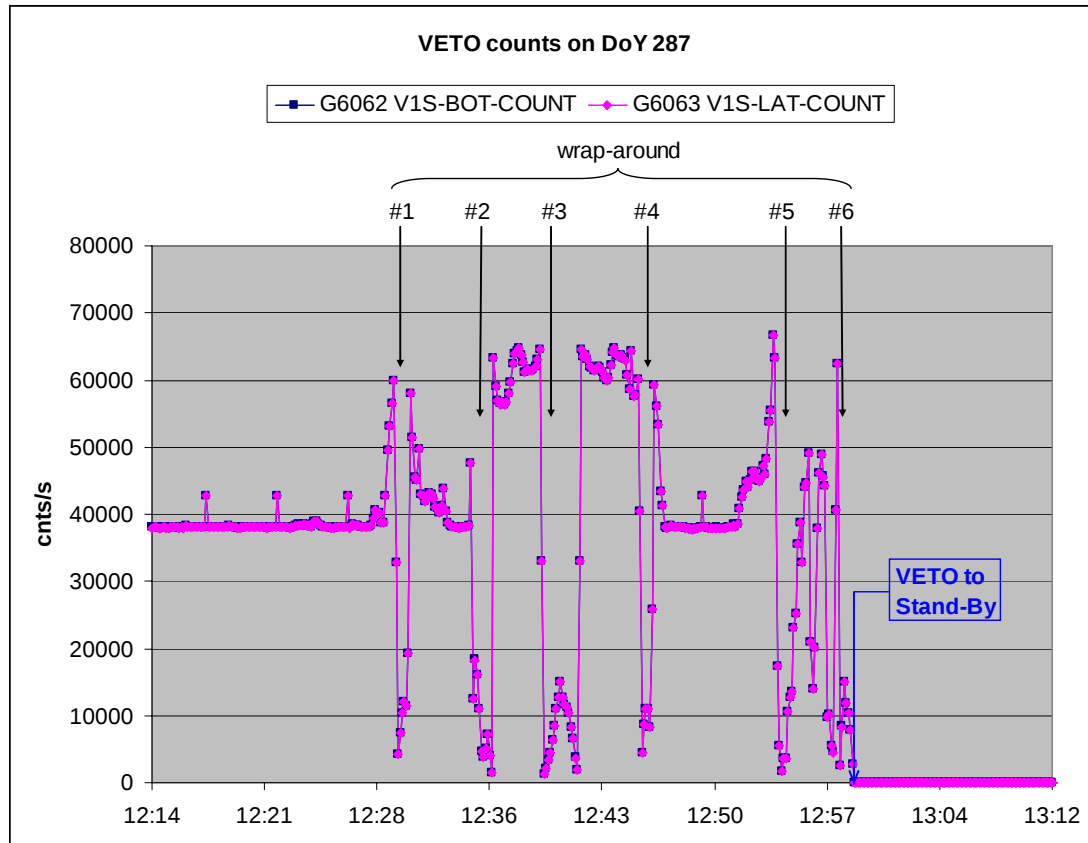
DoY 2006.287 (14/10/2006): VETO Lateral and Bottom counters wrap-around

At Radiation Belts entry, both lateral and bottom VETO counters reported high radiation with at least 6 wraps-around!

Actually, as the TM parameters G6062 and G6063 are defined as 16bits words, they can only increase up to 65535 (FFFF hex). For higher rates, the parameters restart incrementing from 0 (= wrap-around). The VETO photo-multipliers are very robust units and can handle very high count-rates. However an “alarm high” reaction has been defined for measured rates over 260000 cnts/s (~4 added wraps-around).

On 14/10/2006, 6 successive wraps-around were reported within half an hour. In the worst case, assuming that the counters kept increasing and did not come back to nominal range (0 to 65535 cnts/s), these 6 wraps-around would correspond to rates above 393210 cnts/s (6 times 65535).

The high radiation background was due to the radiation belts that are at the moment expanding (seasonal modification). Therefore, no action was performed by the operator. The critical descending altitude (Belts entry) was planned in the timeline at 13:43:16Z (56000km). However IBIS went automatically into Safe configuration at 12:59:21Z when the IREM electron counter rate crossed the IBIS threshold of 300cnts/10s.



DoY 2006.289 (16/10/2006): MCE0 Time-Out (HK1 request failed)

At 21:22Z, the following OEM APID 1280 ID 133 CLASS 2 was reported:

"IBIS1 IASW LSL TRANSFER FAILED (LOW LEVEL)"

together with OEM APID 1280 ID 131 CLASS 2:

"IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET".

These 2 OEMs were followed after few seconds by OEM APID1280 ID 198 CLASS 3:

"IBIS1 MCE0 TIME OUT",

the numbering system in the OEM goes from 0 to 7, this OEM indeed concerns HW MCE1.

This anomaly is similar to the previous ones that flagged a Time-Out in several peripherals and that refer to the anomaly report INT_SC-113. This time, according to G1581 (parameter of OEM ID 131), the anomaly occurred with ISGRI MCE0.

Summarising, IBIS incurred a timing problem on the Low Speed Line that affected the communication with the peripheral. During this time, a request for HK1 was sent to the MCE0 without any answer due to a black out in communication between the peripheral and the DPE. The IASW flagged the non-generation of HK1 from MCE0 as an on-board rejection (time-out) of the internal TC indicated in the OEM body. During this time no valid HK was collected from MCE0 therefore, what was reported in the HK1 was simply the IASW default (i.e all 0000...). This is confirmed by the reading of some TM parameters as the bias, operating mode and MDU temperatures

all reporting the raw value 0. The unit solved autonomously the internal conflict on the LSL and reported the valid HK1 for MCE0 in the next cycle. No further action was requested as per recovery action I-REJ-1.

DoY 2006.290 (17/10/2006):

At 11:58Z TM parameter G8080 (S1E-VS HBRA-RT) was reported OOL High and back. According to H-OVF-2 in FDIR no action was taken.

At 12:29Z TM parameters G6062 (V1S-BOT-COUNT) and G6063 (V1S-LAT-COUNT) were reported OOL High. They remained OOL until IBIS entered the Belts at 13:29Z via automatic reaction to BCPKT.

At 12:44Z TM family G2013 (I0S-EVTCNT-MCEi) reported several parameters in OOL High. It kept toggling until IBIS went into Safe configuration at Belts entry.

At 13:29Z TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 22:58Z. 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.

At 22:35Z TM parameter G2027 (I0S-EVTCNT-MCE1) was reported OOL Low-low with the value 0 and back.

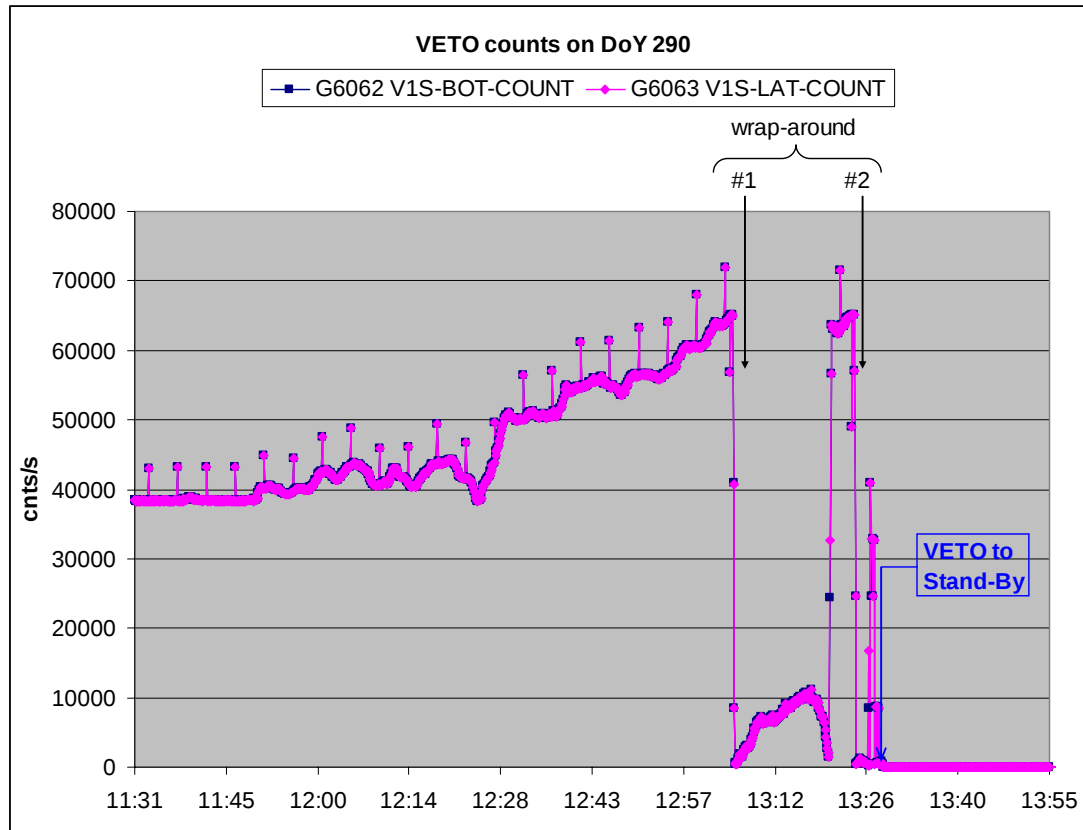
At 22:41Z, TM parameter G2014 (I0E-OVFWPXADD-M1) failed Status Consistency Check.

According to FDIR, no action was taken.

DoY 2006.290 (17/10/2006): VETO Lateral and Bottom counters wrap-around

At Radiation Belts entry, both lateral and bottom VETO counters reported high radiation with 2 wraps-around!

The high radiation background was due to the radiation belts that are at the moment expanding (seasonal modification). Therefore, no action was performed by the operator. IBIS went automatically into Safe configuration following the Broadcast Packet Belt Entry flag at 13:29Z (56000km).



DoY 2006.293 (20/10/2006):

At 13:14Z TM parameter G8015 (S1E-A2_PMT_V) was reported Out Of Limit High. It went back inside limits at 22:45Z. 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.

At 22:16Z, TM parameter G2084 (I0E-OVFWPXADD-M6) failed Status Consistency Check. At 22:27Z, TM parameter G2014 (I0E-OVFWPXADD-M1) failed Status Consistency Check. According to I-OVF-1 in FDIR, no action was taken.

DoY 2006.293 (20/10/2006): **MCE0 Time-Out (HK3 request failed)**

At 07:26Z, the following OEM APID 1280 ID 133 CLASS 2 was reported:

"IBIS1 IASW LSL TRANSFER FAILED (LOW LEVEL)"

together with OEM APID 1280 ID 131 CLASS 2:

"IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET".

These 2 OEMs were followed after few seconds by OEM APID1280 ID 198 CLASS 3:

"IBIS1 MCE0 TIME OUT",

the numbering system in the OEM goes from 0 to 7, this OEM indeed concerns HW MCE1.

This anomaly is similar to the previous ones that flagged a Time-Out in several peripherals and that refer to the anomaly report INT_SC-113. This time, according to G1581 (parameter of OEM ID 131), the anomaly occurred with ISGRI MCE0.

Summarising, IBIS incurred a timing problem on the Low Speed Line that affected the communication with the peripheral. During this time, a request for HK3, according to G1582 (parameter of OEM ID 131), was sent to the MCE0 without any answer due to a black out in communication between the peripheral and the DPE. The IASW flagged the non-generation of HK3 from MCE0 as an on-board rejection (time-out) of the internal TC indicated in the OEM body. During this time no valid HK was collected from MCE0 and the MCE0 validation code (TM parameter G8200, S0E-UPH3S-M0) reported LBR FAIL. The unit solved autonomously the internal conflict on the LSL and reported the valid HK3 for MCE0 in the next cycle (256s later). No further action was requested as per recovery action I-REJ-1.

8.3.4 JEM-X Operations

JEM-X Count Rates

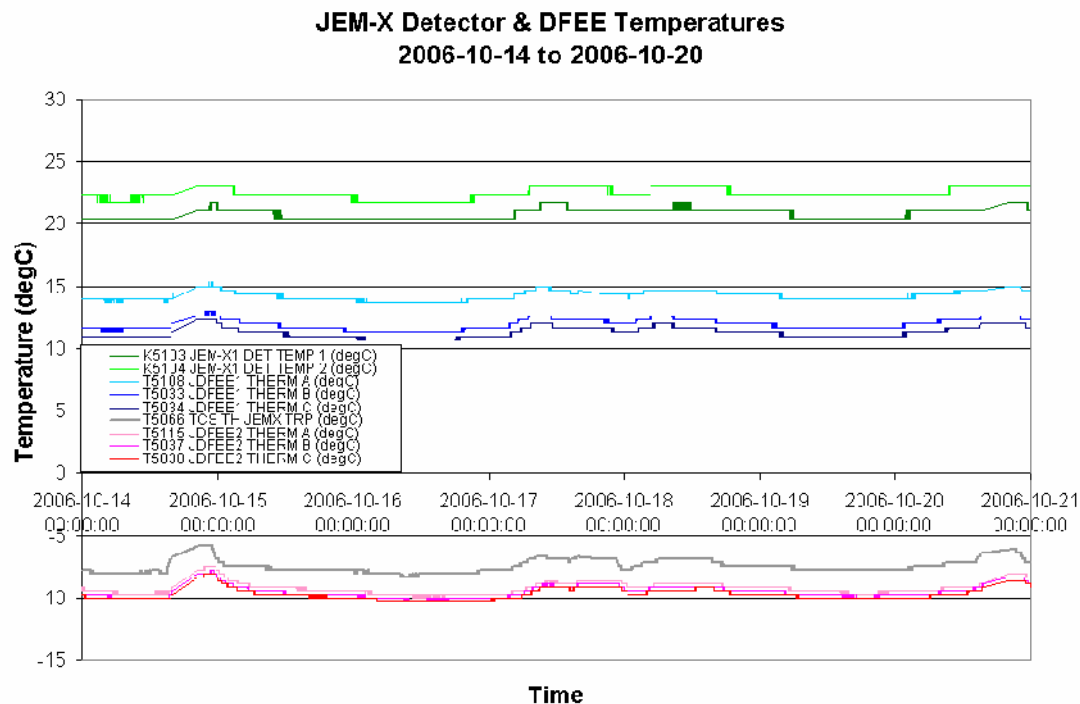
JEM-X count rates over the reporting period are displayed in the following graph¹.



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

JEM-X Temperatures

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



JEM-X Daily Report

2006-10-14 (DOY 287, Rev 488-489)

Due to high background radiation conditions before the expected radiation belt entry of revolution 488, at 11:56:49Z the TM parameters K5136 BUFFER LOSS and K5449 HARDWARE TRIGGER began to toggle Out of Limits High and back. At 12:30:01Z K5119 SOFTWARE TRIGGER also began to go OOL High and at 12:30:20Z JEM-X1 made an autonomous transition to Safe mode, triggered by the Software Ratemeter. The OEM 189 JEM-X1 PROB DFEE 9 (Unexpected DFEE state reported in housekeeping) was received at this time, as the TM parameter K5462 DFEE STATE IASW was reporting state Setup while K5022 DFEE STATUS was Safe.

When the ED KESAFE02 went from the Timeline at 12:47:50Z, K5462 DFEE STATE IASW then also went to Safe and OEM 254 ERROR OFF was received.

JEM-X1 operations continued nominally.

2006-10-15 (DOY 288, Rev 489) to 2006-10-16 (DOY 289, Rev 489)

² Data sampled (1 frame in 8)

Nothing to report

2006-10-17 (DOY 290, Rev 489-490)

Due to high background radiation conditions before the expected radiation belt entry of revolution 489, at 11:50:57Z the TM parameters K5136 BUFFER LOSS and K5449 HARDWARE TRIGGER began to toggle Out of Limits High and back. At 12:16:41Z K5119 SOFTWARE TRIGGER also began to go OOL High and at 12:18:05Z JEM-X1 made an autonomous transition to Safe mode, triggered by the Software Ratemeter. Two occurrences of OEM 189 JEM-X1 PROB DFEE 9 (Unexpected DFEE state reported in housekeeping) were received at this time, as the TM parameter K5462 DFEE STATE IASW was reporting state Setup while K5022 DFEE STATUS was Safe.

When the ED KESAFE02 went from the Timeline at 12:33:08Z, K5462 DFEE STATE IASW then also went to Safe and OEM 254 ERROR OFF was received.

JEM-X1 operations continued nominally.

2006-10-18 (DOY 291, Rev 490) to 2006-10-20 (DOY 293, Rev 490-491)

Nothing to report

8.3.5 OMC Operations

2006-10-14 (DOY 287, Rev 488) to 2006-10-17 (DOY 290, Rev 490)

Nothing to report

2006-10-18 (DOY 291, Rev 490)

From 11:49:01, to 14:40:32 a Flat Field calibration was performed. This was followed from 14:41:01 to 15:13:07 by a Dark Current calibration, both were performed successfully.

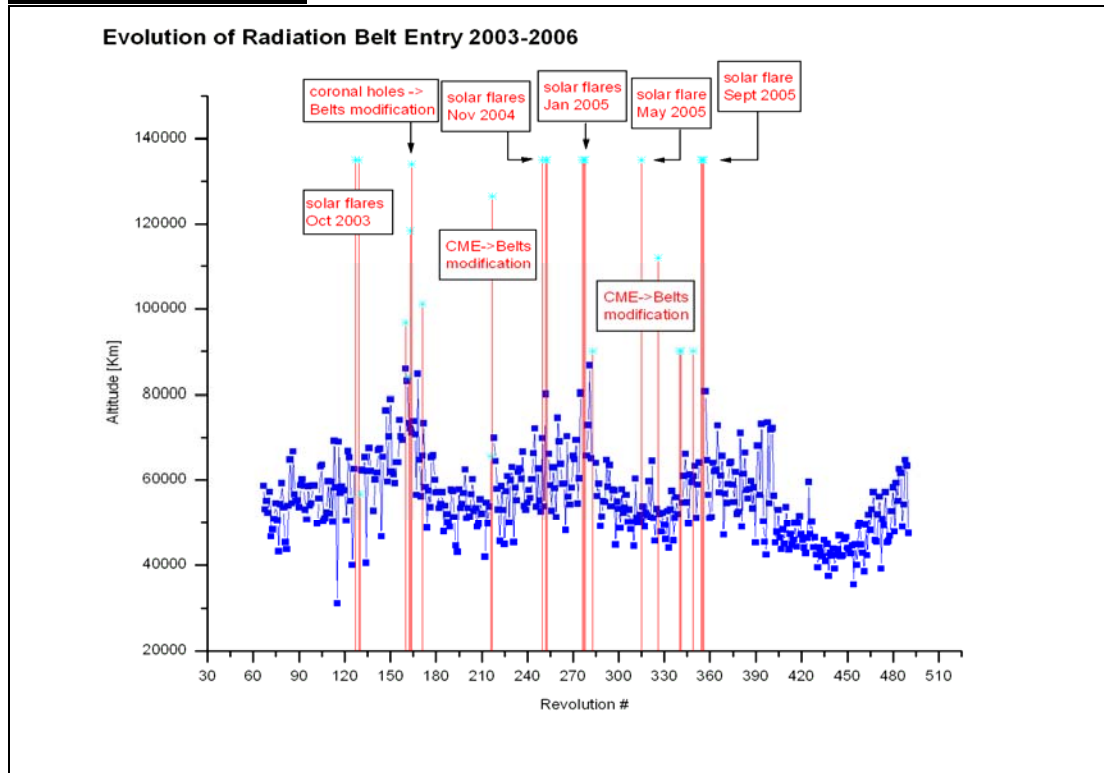
2006-10-19 (DOY 292, Rev 490) to 2006-10-20 (DOY 293, Rev 491)

Nothing to report

On DoY 287 at 13:43:47, DoY 290 at 13:29:07 and DoY 293 at 13:13:55 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]
488	RAD_ENTR R 2006-10-14T13:43:40Z	2006-10-14 12:30:18	64733.1	2006-10-14 14:29:14	49749
489	RAD_EXIT R 2006-10-14T23:04:52Z	2006-10-14 22:11:30	37028.6	2006-10-14 22:39:14	41405
489	RAD_ENTR R 2006-10-17T13:28:59Z	2006-10-17 12:29:30	63405.4	2006-10-17 14:08:28	50445
490	RAD_EXIT R 2006-10-17T22:50:24Z	2006-10-17 21:43:54	34926.1	2006-10-17 22:18:28	40616
490	RAD_ENTR R 2006-10-20T13:13:53Z	2006-10-20 14:17:46	47497.7	2006-10-20 13:58:28	49629
491	RAD_EXIT R 2006-10-20T22:35:44Z	2006-10-20 22:05:46	40675.9	2006-10-20 22:08:28	41439

Reference

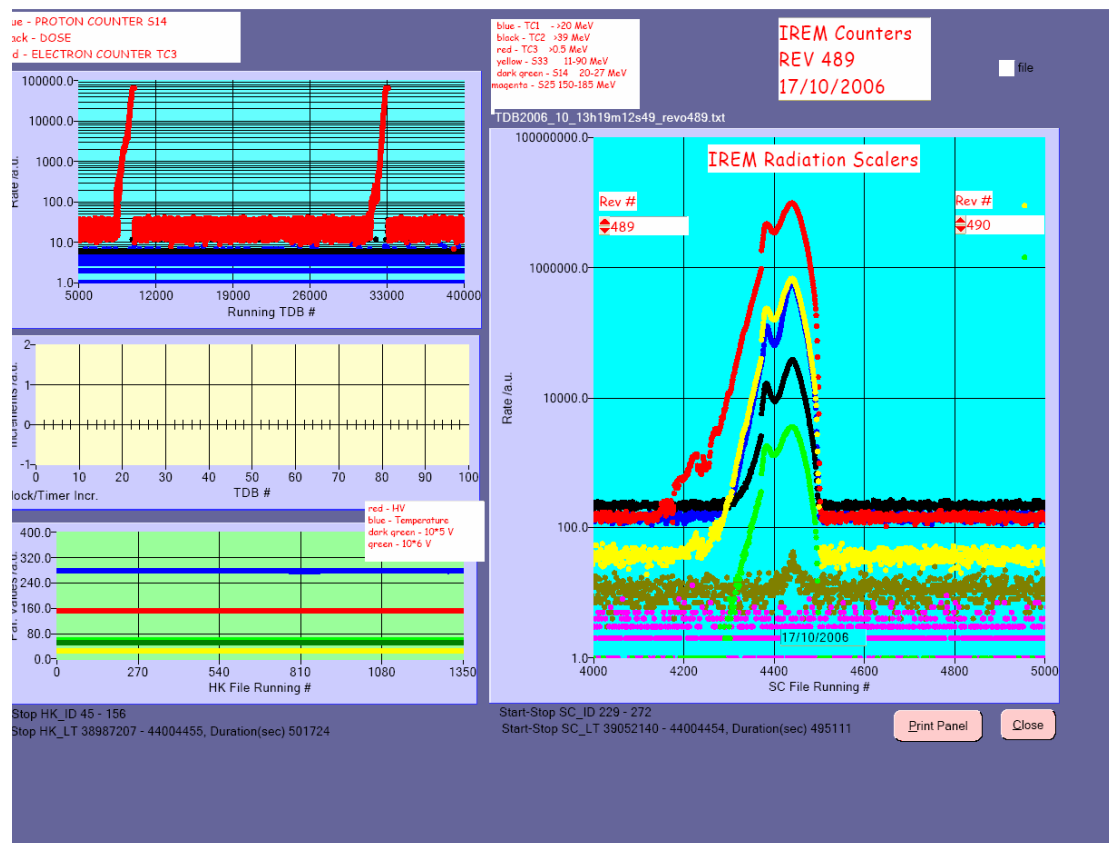
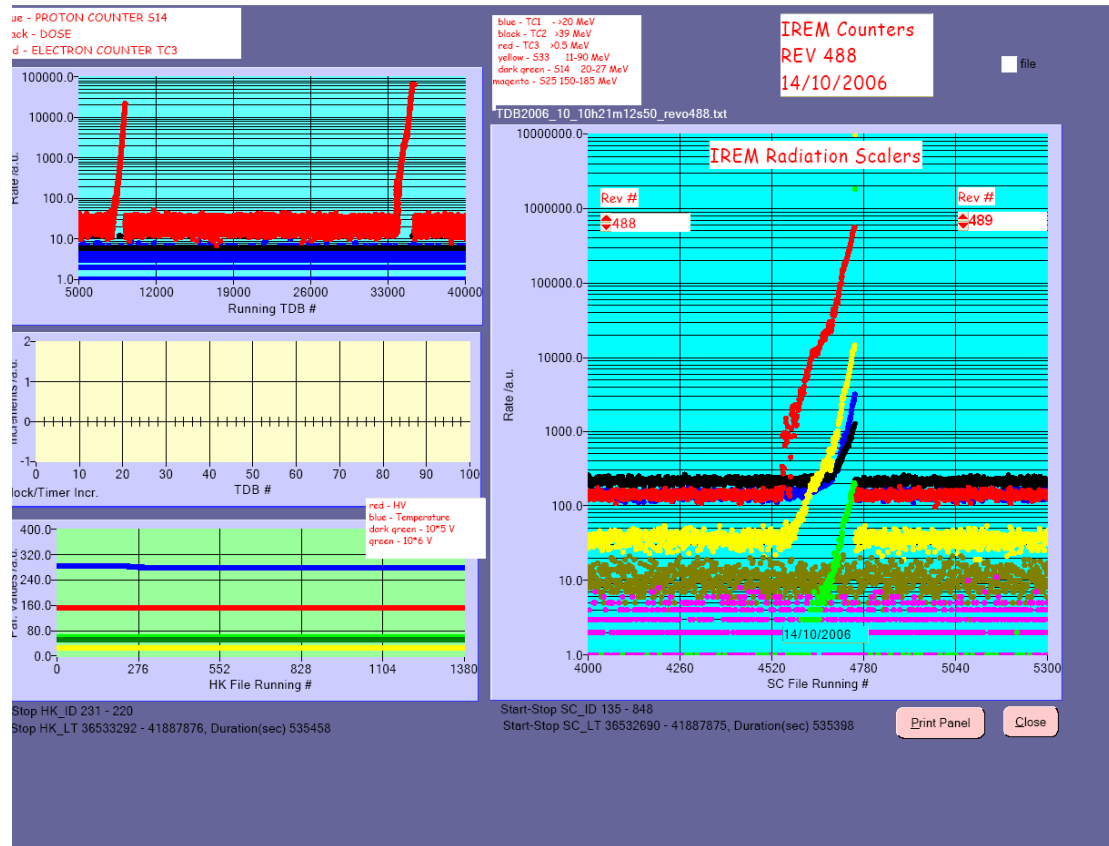
Very small error vs reference (less than 10 minutes)

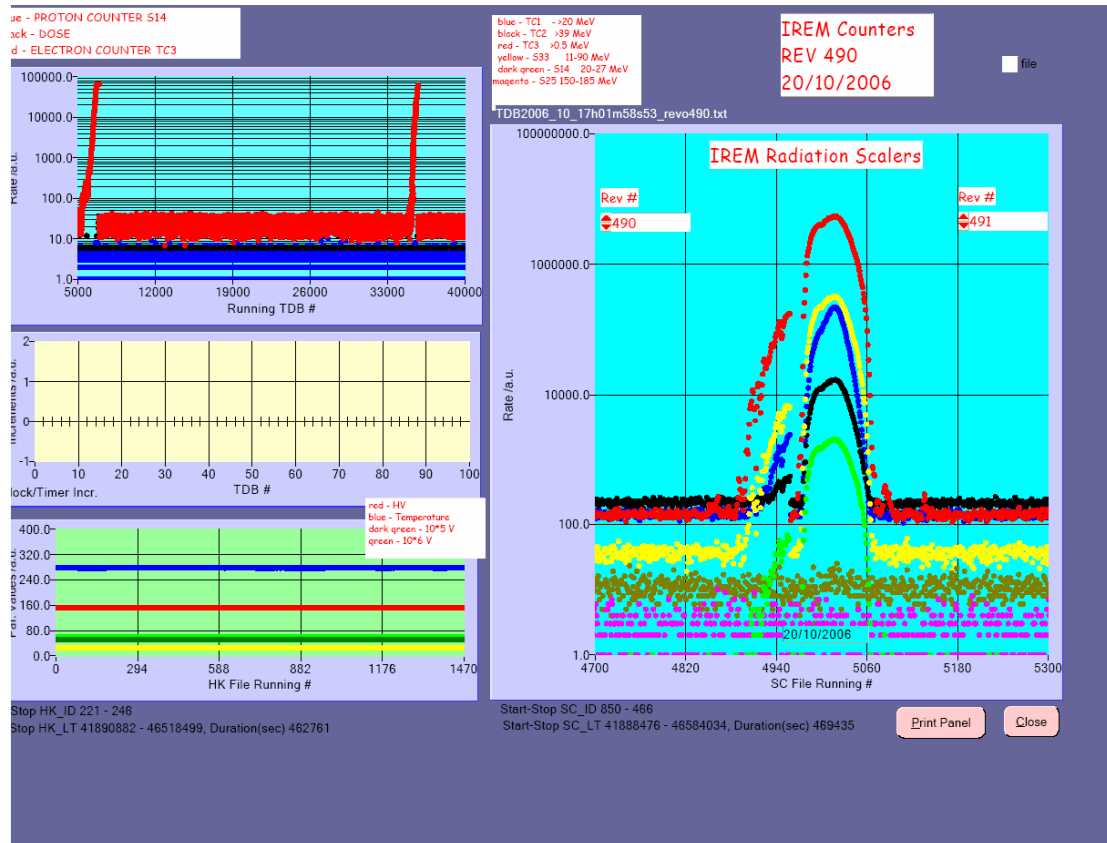
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

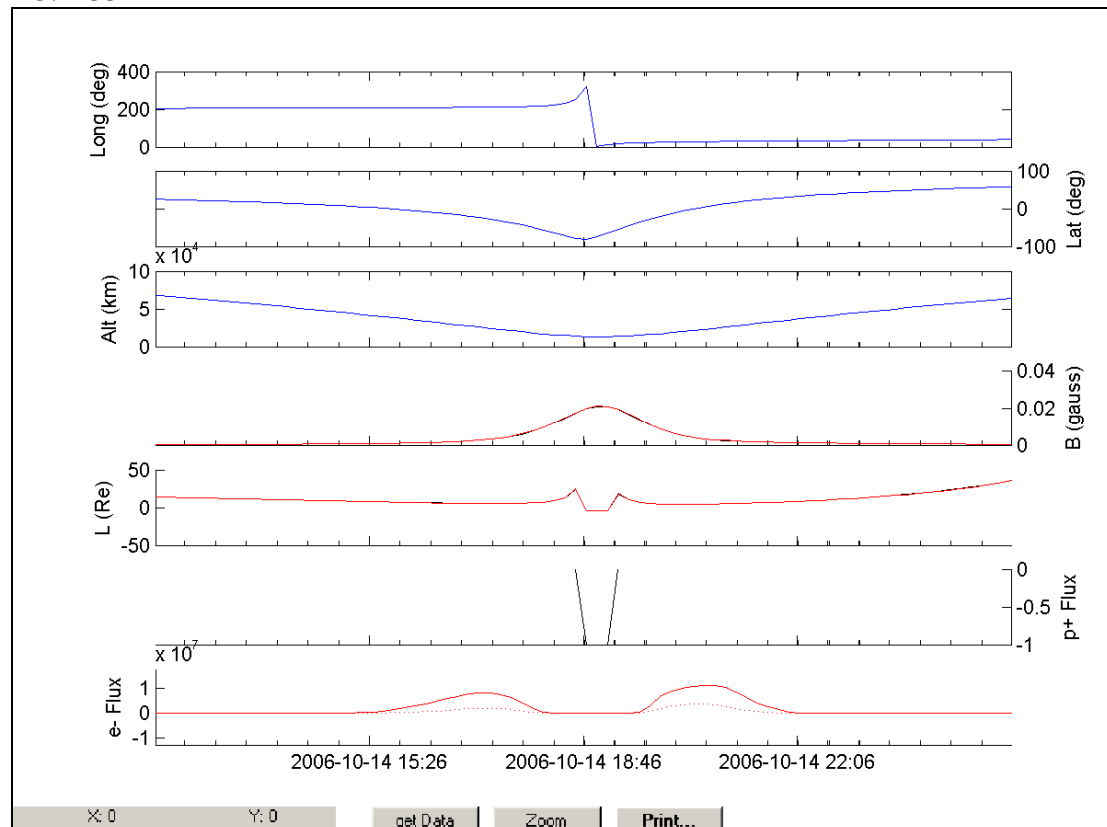
IREM radiation counters:



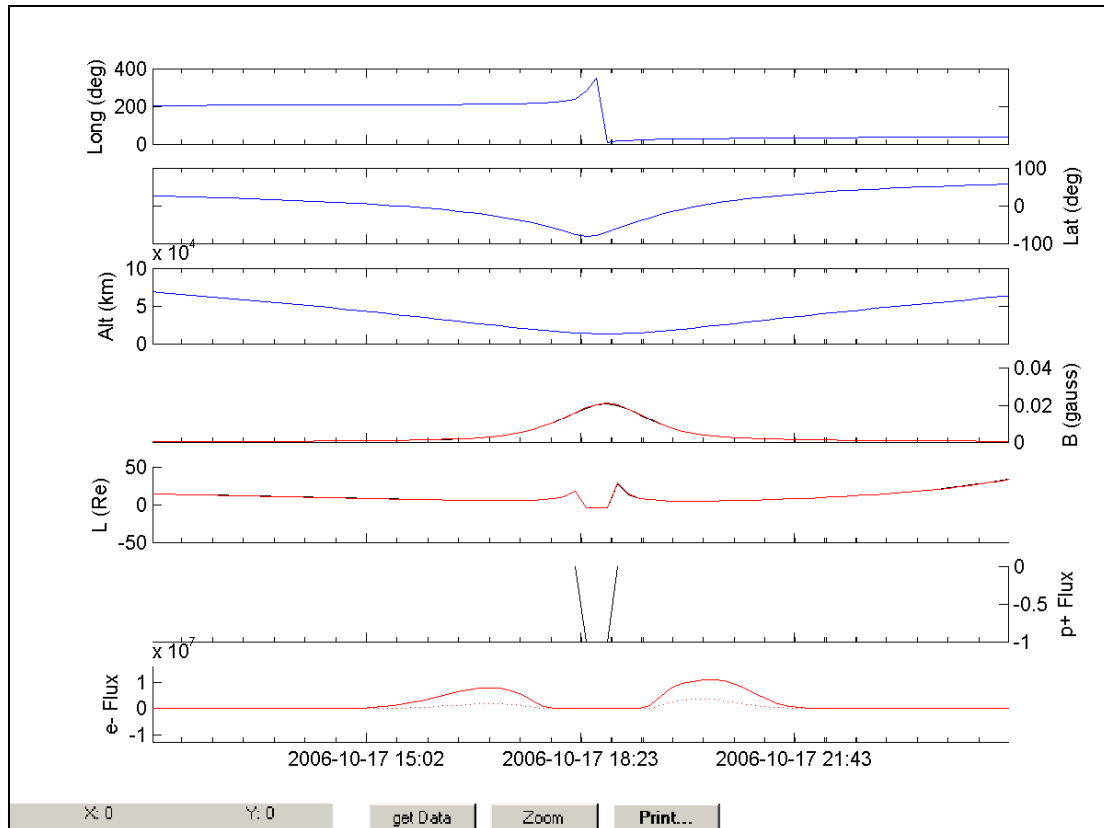


IREM Predicted Radiation Belt Passages

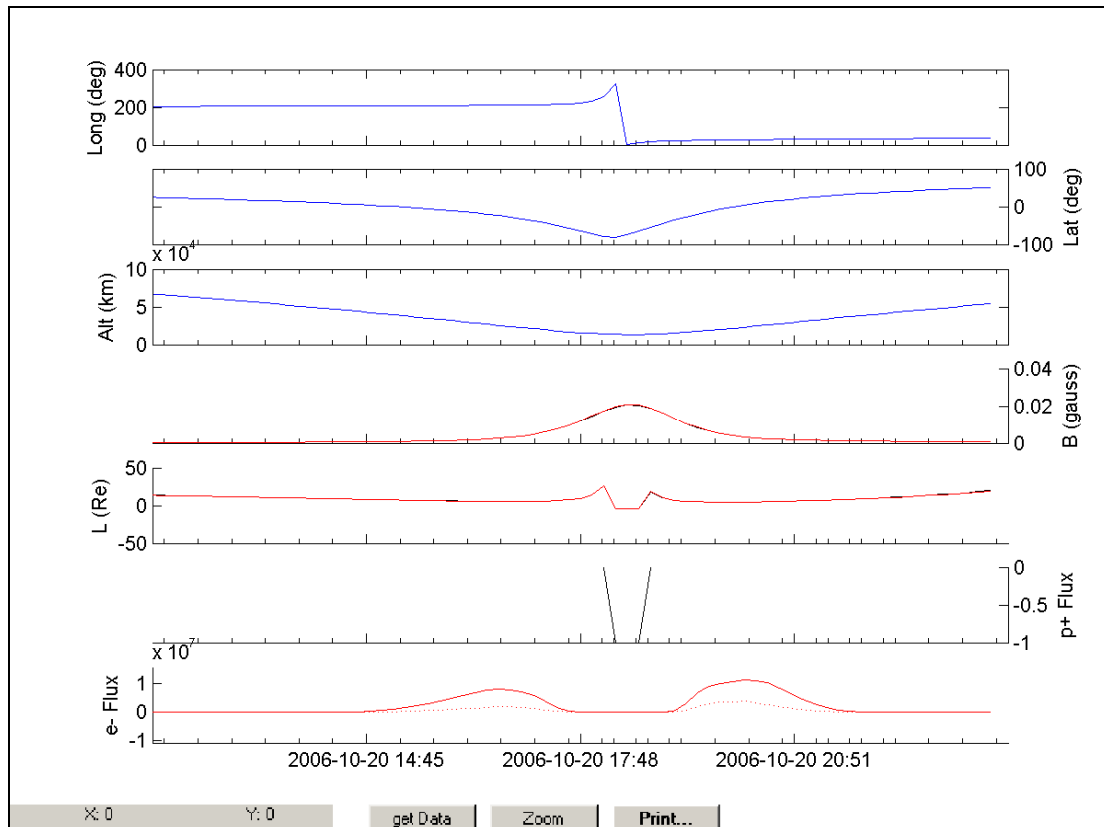
Rev 488



Rev 489



Rev 490



Doc. Title : INTEGRAL Mission Report #213
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 23/10/06

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Rev. : 0
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SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):

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