

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 179
Week 08
27.02.06
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 18.02.06 until 24.02.06 (both dates inclusive) and covers the revolutions 410 and 411.

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 were a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), a Galactic Plane Survey, a raster dither of Mid-latitude North region (RA 16:18:13.65; DEC -14:13:46.6), and finally a Galactic Centre Deep Exposure.

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.

4 slews were missed from the Timeline during this period due to problem on FDS slew update task.

The fuel consumption over the period between 17/02/2006 and 24/02/2006 was 0.1660 kg. The remaining propellant is in the order of 156.1117 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 was identified.

On DoY 051 (20/02/2006) an adjustment of CLCW ratio in VC-0 TM Frames was made.

The background of this operation is that it is necessary to periodically change the Virtual Channel used for tele-commanding, minimising the degradation of the TM path through the RFDNs by switching the RFDN in use for antenna swapping - the SWT RFDN is moved using VC-0 commands, the SWA using VC-7 commands.

In order to use VC-0 for commanding, an operation was carried out to alter the CLCW distribution in VC-0 TM frames in favour of VC-0 CLCWs. The ratio during the INSTRUMENT window was about 3.7:1 in favour of VC-7, the operation reversed this ratio.

The procedure consists of switching back and forth between low and high bit rate until a satisfactory CLCW ratio is achieved. Note that in this configuration VC-0 commanding channel cannot be used for nominal operations via Goldstone. If TC operations are to be moved to VC-0, this operation must be repeated to produce a CLCW ratio heavily in favour of VC-0 TCs. It is currently planned to use VC-0 for commanding for the next year.

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

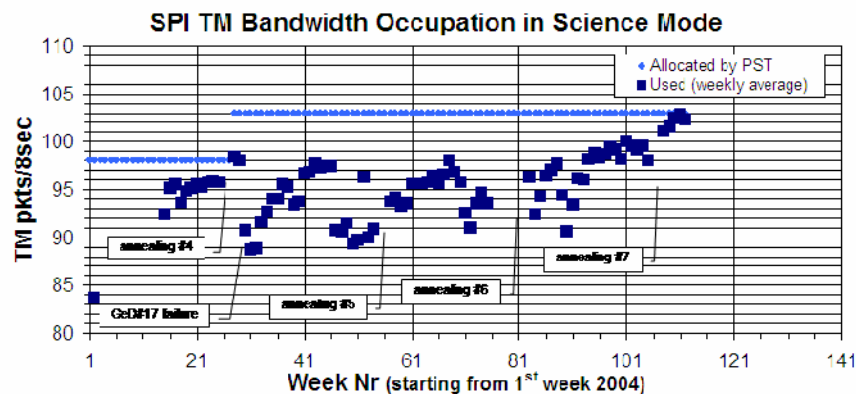
3.2.1 SPI

Following the 7th annealing, ended on 24th January, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #15, which is showing an anomalous energy resolution. Currently the detector #15 is working with slightly reduced high voltage setting, where the energy resolution is almost nominal at low energy, degraded by approx 10% at 1764 keV and 20 % at 2.7 MeV. Detector #2 is failed since 06.12.2003, detector #17 since 17.07.2004.

During science operations, the instrument was kept in photon-by-photon mode, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an average occupation of 102.3 pkts/cycle. The telemetry downlink of SPI is therefore approaching saturation, with the Spectra telemetry already lost most of the times. The Photon telemetry is still correctly transmitted for most of the revolution except when approaching the belts (1-2 hours before 60000km descending and after 40000km ascending).

The Stirling compressors work nominally, maintaining the Germanium detectors at 85K +/-1K.

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



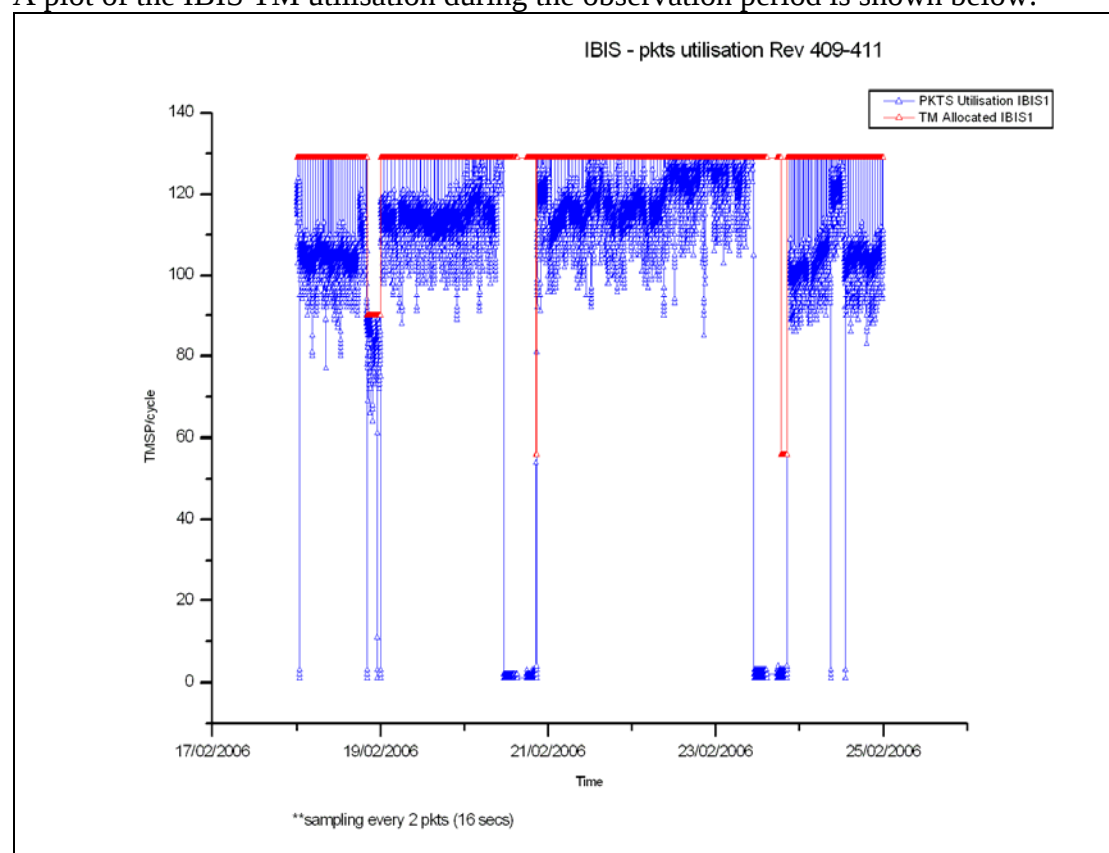
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The Overall status of the unit is nominal.

During the reporting period, the PST allocation to IBIS was 129 TMPS/cycle. However on 18/02/2006 between 20:17:25 and 00:05:57, it was 90TMPS/cycle due to an OMC Flat Field Calibration. The IBIS mean bandwidth utilisation during the observation period was 113.58 TMPS/cycle, up 3.72 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 during science observations throughout the reporting period, with a TM allocation of 8 packets/cycle. JEM-X2 was dormant (DFEE OFF) with 1 packet/cycle.

In revolution 410 the TM parameters K5449 and K5136 fluctuated in and out of limits due to higher than normal count rates from the source being observed, however the count rates were not high enough to cause an autonomous transition of JEM-X1 to Safe mode.

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, 162 of the 164 planned science pointings for OMC were executed nominally, one pointing was slightly shortened, and one 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 low solar activity.
The Sun was blank 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 problem with the Flight Dynamics Tool, led to the loss of 4 pointings, although only one of these was a science pointing. There were several minor problems with ground station links, but these had no impact. The overall performance was well above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week, although as indicated above, FD system problems led to the loss of 4 pointings. The overall performance was well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were several instances though of bad frames and a few TM drops, plus a couple of problems sending data to the ISDC, but these had no impact on the mission. The overall performance though was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

No new PSF's have been received. Planning of revolution 417 has been performed. No replanning activity has been performed. No ToO request was received. TSF's up to revolutions 411 and 412 have been received. Request to perform AOCS calibration around 30 Kseconds has been received. Also there is requested to perform further instrument calibration using the CRAB. Coordination activity is ongoing in ISOC to coordinate these requests and determine optimum time periods.

2. Observation status

No new ECS's were received. For revolution 417 it was decided to credit an observation 30 Kseconds due to unavailability of essential instruments. This was caused by a solar flare.

3. ISOC science data archive

Automatic ingestion of data from ISDC was resumed this week. The final testing of the beta version of the ISDA version 2.5 is now concluded. Some performance issues have been detected. It will be discussed next week how to remove them. The intention is to remove these problems before publicly releasing the version 2.5. The release has to be synchronized with a new release of the XSA and the ISO archives. A formal agreement to use the ISGRI catalogue has been obtained from the IBIS team.

4. ISOC system

The version 12.1 has been used this week. User testing of the facilities required to support the AO 4 proposal submission has continued. Some suggestions for improvements as well as some problems detected has been evaluated. The intention is to have an ISOC system 12.2 operational before the AO 4 proposal submission start on 13 March. This version will include the agreed improvements and fixes of the detected problems except for the firewall problem mentioned last week.

5. AO 4 preparation

All AO documentation from ISOC is now considered complete except that the SPI and IBIS instrument manuals need to be checked against the output from the Observation Time Estimator (OTE). The OTE data files were received very late but are now integrated into the OTE. It is recommended to extend the range for the OTE

to above 2.9 MeV and the sensitivity curves in the SPI user manual as well. However to be able to do this inputs are still necessary from the SPI PI.

On the software side there are still needed some data files from MOC / Flight Dynamics to be able to perform visibility predictions over the entire AO 4 period. These files have been promised for next week. The intention is that the version 12.2 of the ISOC system will be the version to support the proposal submission. The firewall problem will not be resolved before the AO submission start. However back up procedures are in place in case proposers have problems at their home sites with firewalls.

6. INTEGRAL helpdesk system

As mentioned before the INTEGRAL helpdesk system will be moved to ESAC and replaced by a more modern system based on the KAYOKE software. The system is now set up and configured in cooperation with the users both in ISOC and ISDC. The remaining work is to move old mail to the new system. This work is progressing well. The intention is now to switch to this new system on 8 March.

7. Problems

None besides the communication problem mentioned above.

4.3.2 ISDC

Status of ISDC observation processing on 27/02/2006:

- Latest Standard Analysis completed: observation 03200560001 (Cas A /Tycho, Revolutions 386-395) on 05/02/2006
- Latest products archived: observation 03200560001 (Cas A /Tycho, Revolutions 386-395) on 07/02/2006
- Latest observation products sent to the observer: observation 02297000019 (Cas A, Revolutions 352 & 384-385) on 13/02/2006

5 Special Events

6 Anomalies

There was just one problem relating to the ground segment that impacted the operations:

- On DoY 054, at 18:30, the Flight Dynamics Tool failed to update the parameters for Slew 04110001. Further difficulties encountered during the recovery led to the loss of pointings 04110002, 04110003 & 04110004. Pointing 04110005 started with about a 5 minute delay.

The following anomaly report was entered into the ARTS system this week:

AR id	Date	Subject	Segment	Status
-------	------	---------	---------	--------

Doc. Title : INTEGRAL Mission Report #179
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 27/02/06

Issue : 1
Rev. : 0
Page : 9

	Created			
INT-2841	22/02/2006	Saved stacks do not properly handle SPI checksum	IMCS	Open

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 410

The observations in revolution 410 began with a Hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), which lasted ~3.5 hours. This was followed by a raster dither of Mid-latitude North (RA 16:18:13.65; DEC -14:13:46.6), which lasted ~55.1 hours.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2 for which the DFEE was off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 411

The observations in revolution 411 began with a Galactic Plane survey, which lasted 11 hours. This was followed by a Hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), which lasted ~3.5 hours. Finally a Galactic Centre Deep Exposure was executed for ~41.9 hours.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2 for which the DFEE was off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-02-09T08:30:53.000Z	156.4288	F	Automatic TM processing.
2006-02-09T09:22:13.000Z	156.4197	F	Automatic TM processing.
2006-02-11T15:20:59.000Z	156.4022	F	Automatic TM processing.
2006-02-11T19:26:59.000Z	156.3671	F	Automatic TM processing.
2006-02-12T08:35:09.000Z	156.3486	F	Automatic TM processing.
2006-02-12T15:48:05.000Z	156.3189	F	Automatic TM processing.
2006-02-14T15:05:55.000Z	156.3023	F	Automatic TM processing.
2006-02-14T19:11:07.000Z	156.2867	F	Automatic TM processing.
2006-02-16T14:38:15.000Z	156.2777	F	Automatic TM processing.
2006-02-17T14:50:18.000Z	156.2657	F	Automatic TM processing.
2006-02-17T18:55:46.000Z	156.2366	F	Automatic TM processing.
2006-02-20T19:06:10.000Z	156.2058	F	Automatic TM processing.
2006-02-23T14:18:10.000Z	156.1918	F	Automatic TM processing.
2006-02-23T18:20:18.000Z	156.1486	F	Automatic TM processing.
2006-02-24T03:27:39.000Z	156.1117	F	Automatic TM processing.

This report was generated Fri Feb 24 08:00:36 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 APCS SUMMARY OPERATIONS REPORT, 18/02/2006 – 24/02/2006

APCS operations were executed from the Automatic Timeline.

During this period, 89 Open Loop Slews, 86 Closed Loop Slews and 4 Momentum Bias were executed (TL + Manual Recovery).

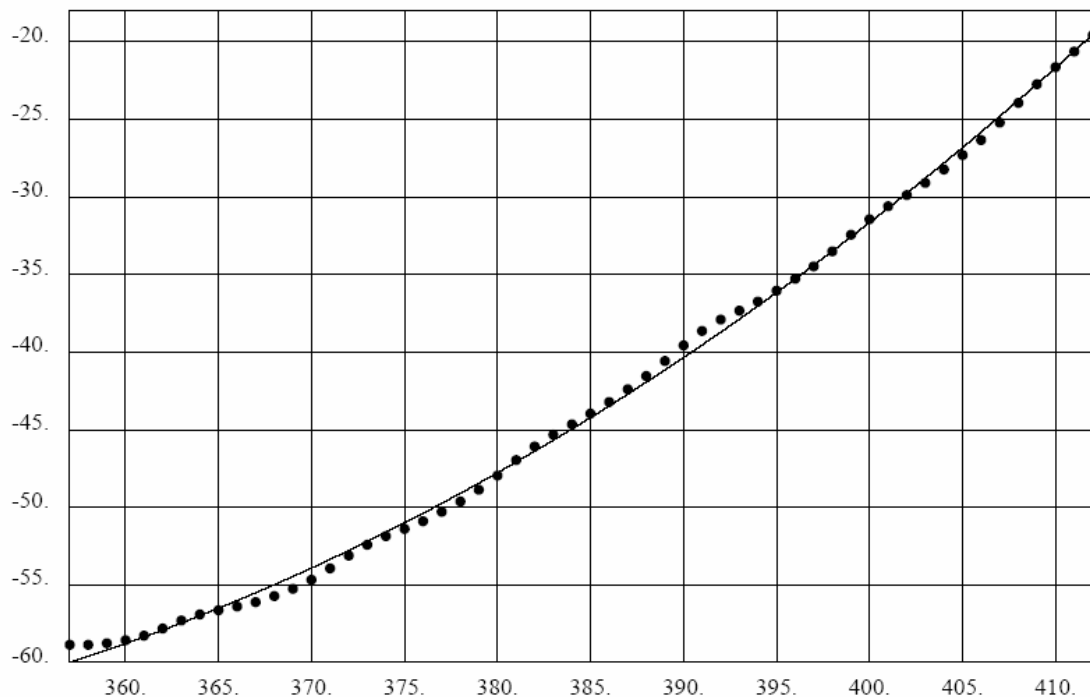
4 slews (OSL) were missed from the Timeline during this period due to a problem on FDS slew update task, at the beginning of rev 411.

This is equivalent to a 2.3 % of the total number of slews planned (177).

Orbit Control

At present time the plan is to reverse the control and to increase the semi-major axis as from mid March 2006 and onwards. The "Redu only" situation could be reached in the second half of 2006, possibly mid August. The apogee longitude would then be about 32 deg East.

APOGEE LONGITUDES OF INTEGRAL 7.9.2005 - 01.03.2006
 LEAST SQUARES APPROXIMATION WITH PARABLE



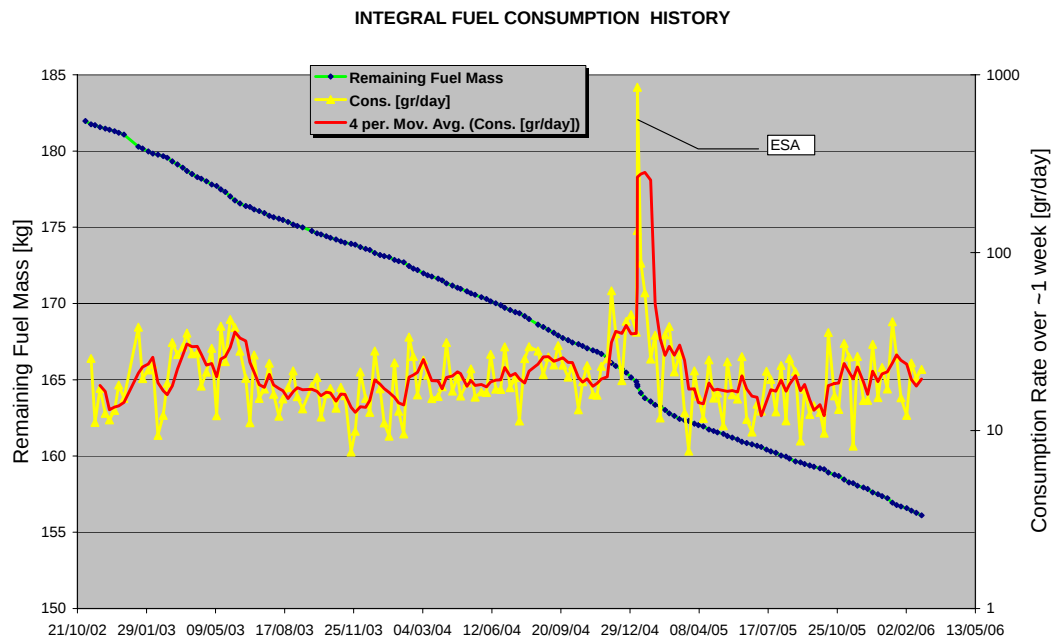
The plot shows the apogee longitude of Integral as a function of the orbit number. According to the linear least squares approximation with a parable the drift rate is 1.09 deg eastward shift per orbit at the end of the period.

The following table shows the shortening of the necessary Goldstone pass:

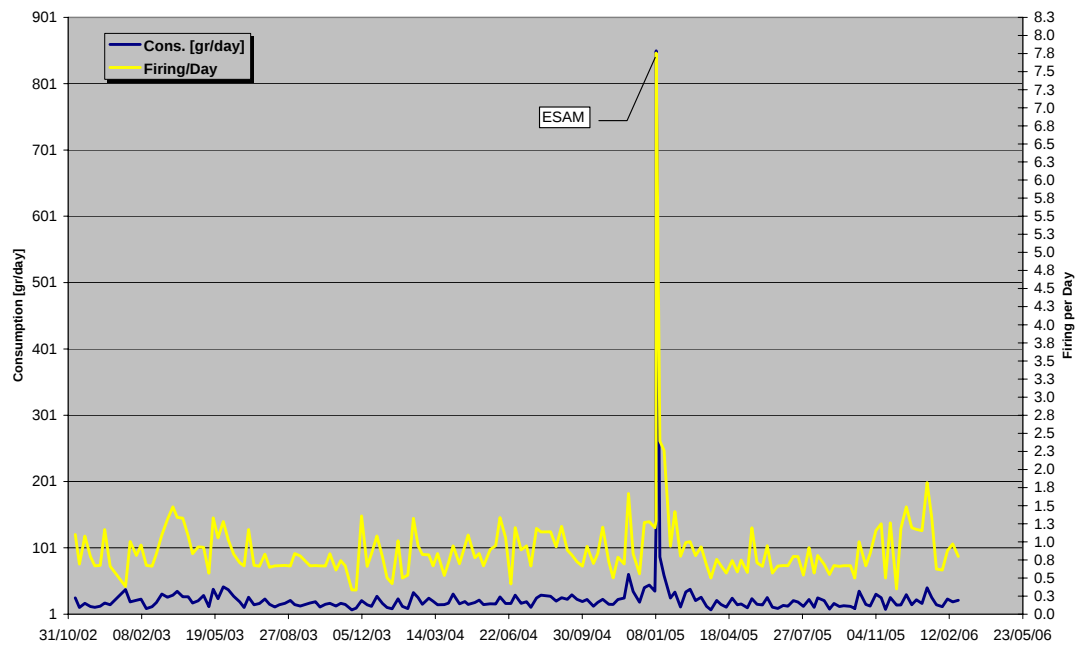
Orbit number	Apogee passage date	Time from LOS Redu to 40000 km altitude
362	2005/10/01	284 min
372	2005/10/31	268 min
382	2005/11/30	244 min
393	2006/01/02	213 min
402	2006/01/29	188 min
412	2006/02/28	159 min

Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 24/02/2006 is reported in the plot below.

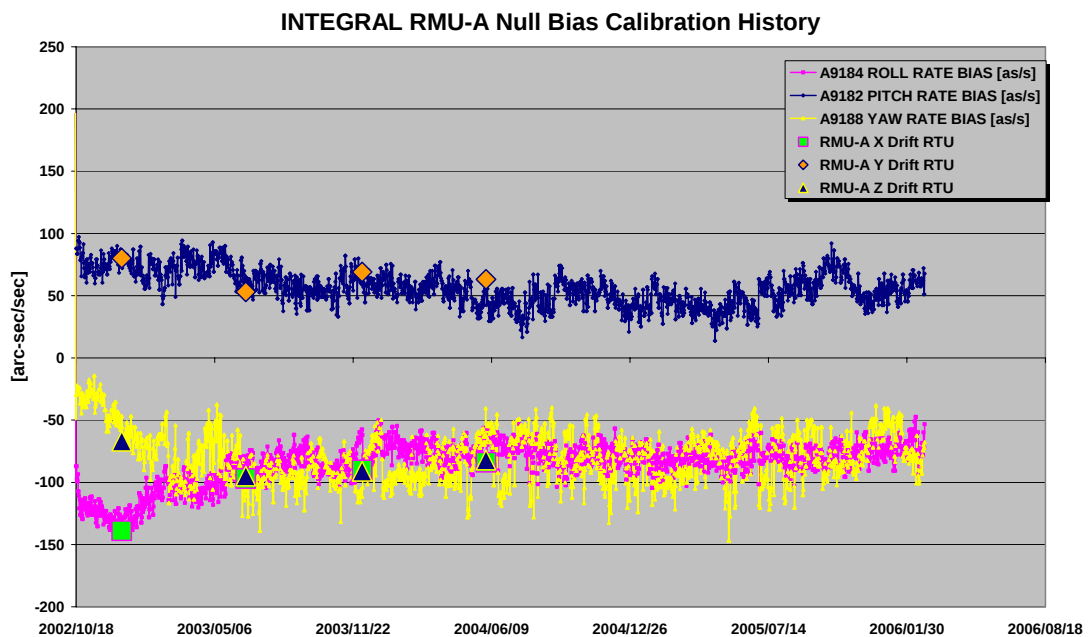


The firing\day over the period between 01/11/2002 and 24/02/2006 is reported in the plot below.

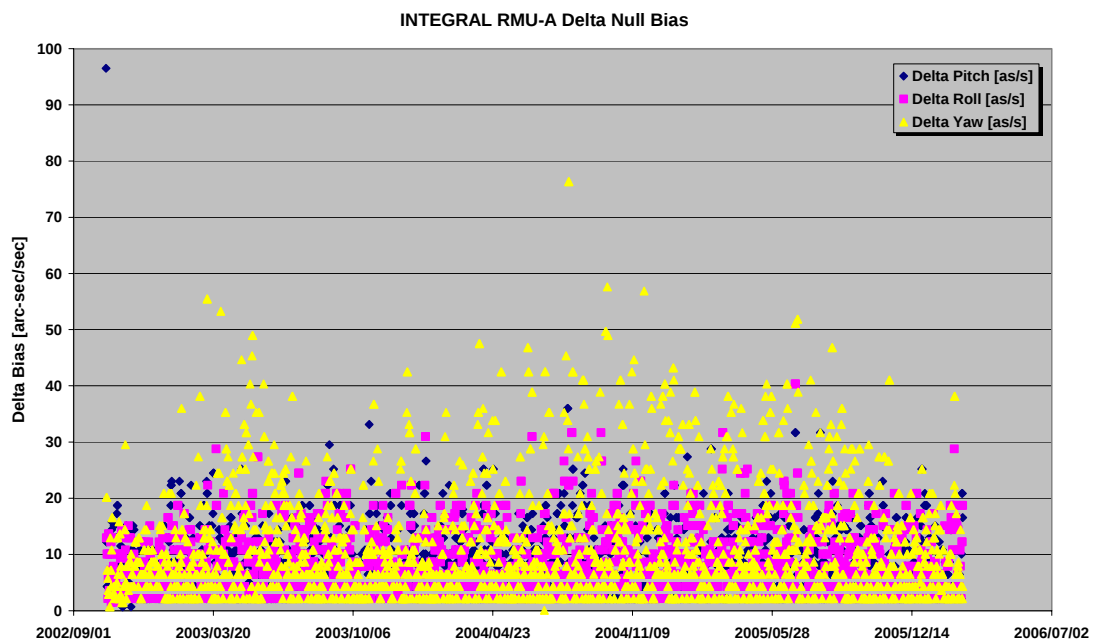


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 24/02/2006 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 24/02/2006 is reported in the plot below.



18/02/06 (Day of Year 049, Revolution 409)

Nothing to report.

19/02/06 (Day of Year 050, Revolution 409)

Nothing to report.

20/02/06 (Day of Year 051, Revolution 409-410)

Drop on TC\TM link: At 18:20Z due to a drop on the nominal TC\TM link with REDU station the AOCS s/s was disabled. The link was then moved to the back-up ISDN line and the operations continued.

Due to the drop the expected RWB at the beginning of rev 410 failed release. The recovery was manually performed and the bias uplinked at 18:59Z.

The AOCS s/s was re-enabled at 19:06Z.

No impact on TL reported.

21/02/06 (Day of Year 052, Revolution 410)

Nothing to report.

22/02/06 (Day of Year 053, Revolution 410)

Nothing to report.

23/02/06 (Day of Year 054, Revolution 410-411)

FDS failed slew update: At 18:38Z the FD system failed to update of the first slew of rev 411, ID 04110001 (OSL) due to a divergence in the measured wheel speeds wrt the planned profiles. After a preliminary investigation this divergence, which was still inside the margin defined for the FDS (~100 rpm) had to be consider as an unexpected behaviour, investigations are on-going by the FD team.

The AOCS s/s was disabled at 18:38Z

The recovery was manually performed to attitude of PID 04110001 and then from attitude of PID 04110001 to the attitude of PID 04110004. The update for the next slew (ID 04110005) from TL was performed at 21:07Z and the AOCS s/s was re-enabled in TL.

The following slews, 04110001(OSL)-02(OSL)-03(OSL)-04(OSL) were not executed from the TL.

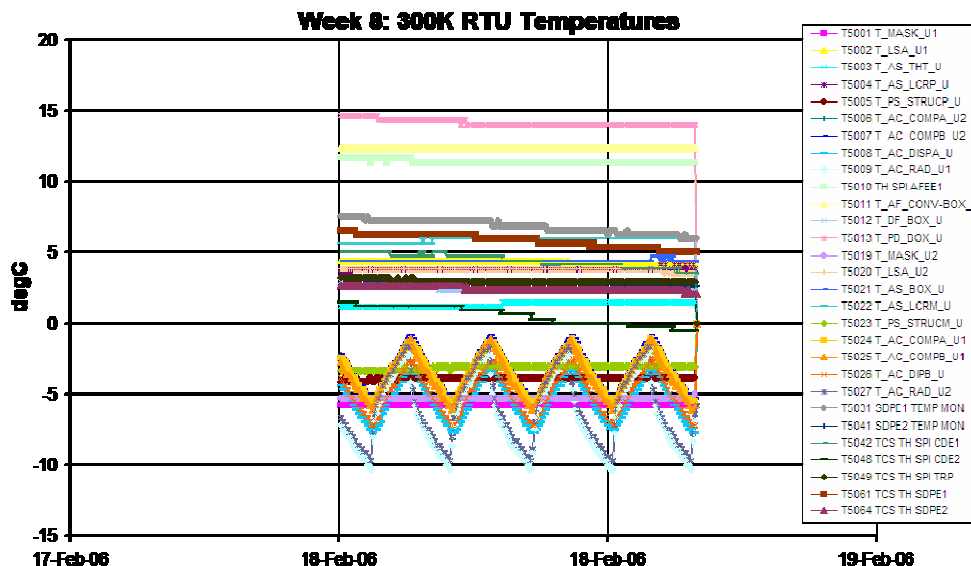
24/02/06 (Day of Year 055, Revolution 411)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures:

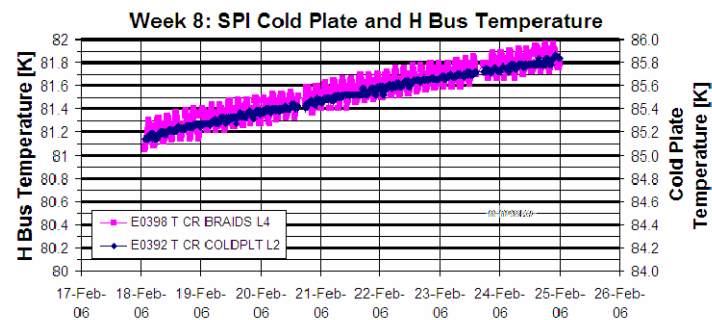
All the equipment temperatures are inside the operational limits. The following plot shows their evolution along the reporting period (due to problems in the data retrieval tool, only day 18th Feb is available).



Stirling Compressors and Cryostat:

The performance of the compressors is nominal. The cold plate temperature was maintained at 85K $\pm$ 1K showing the expected positive drift.

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

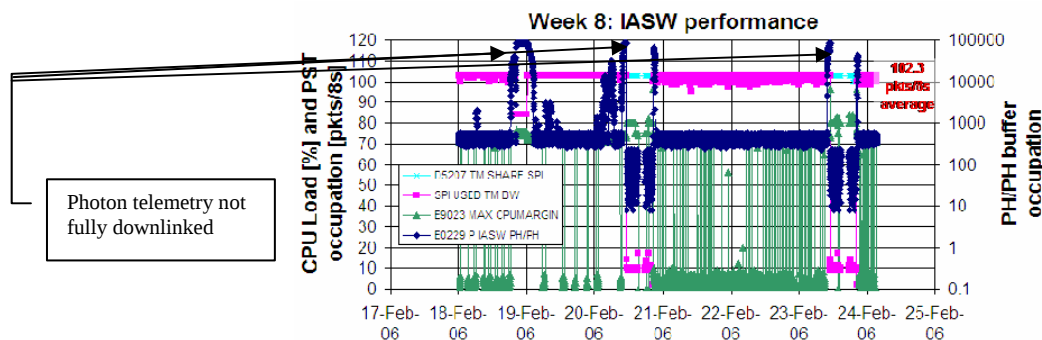


DPE & IASW:

The Iasw performance is nominal. The current Iasw version installed is 432.

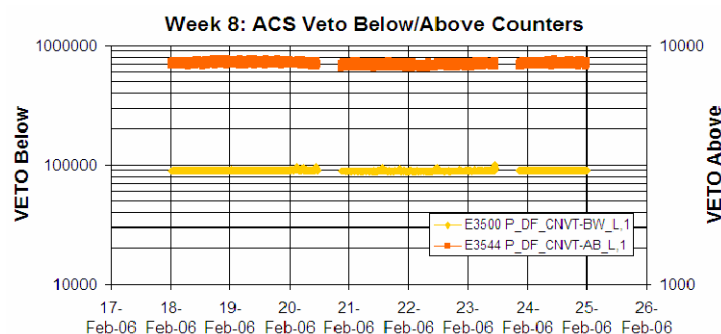
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.

Between 18th 20:16z and 19th 00:05z an OMC Flat Field Calibration was scheduled: during this period the telemetry allocation was reduced to 84 and not all scientific telemetry could be down-linked.



ACS: The performance of the ACS is nominal.

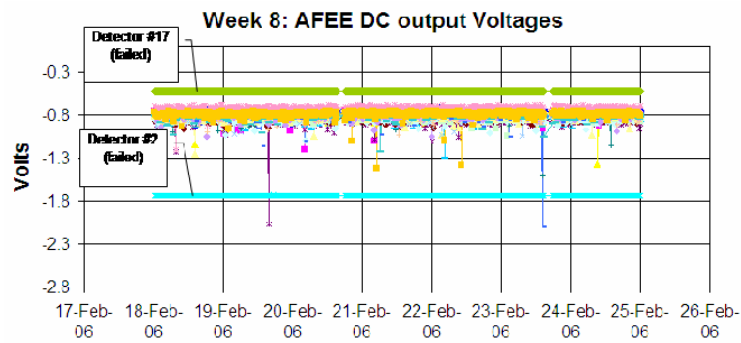
The following plot shows the ACS overall count rate evolution during the reporting period



AFEE:

The performance of the AFEE and the detectors is nominal, except for detector #15, which shows a degraded energy resolution. The anomaly has been recorded in the ESOC Anomaly Report and Tracking System (ARTS) as INT_SC-140.

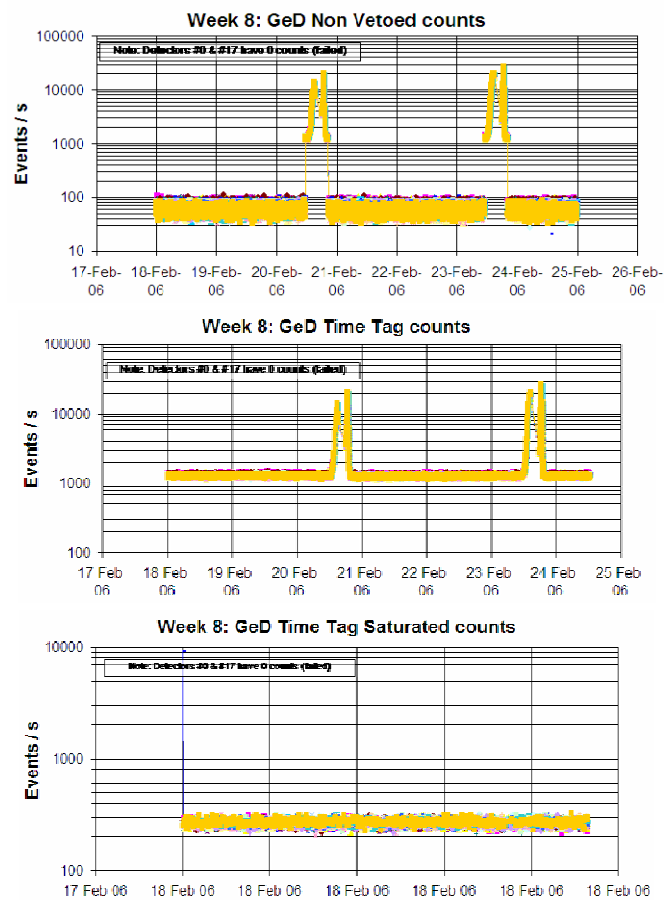
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



DFEE:

The performance of the unit is nominal.

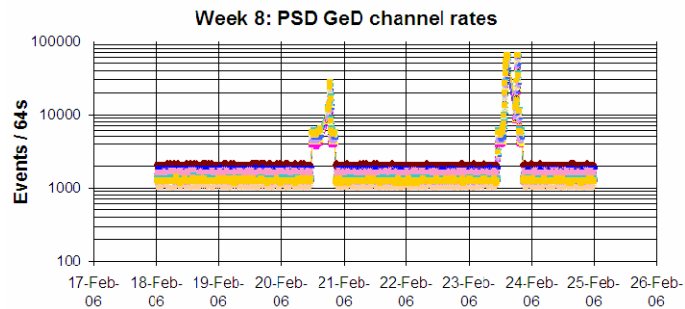
The following plots show the count rates of the detectors during the reporting period (due to problems in the data retrieval tool, some gaps could be present).



PSD:

The performance of the unit is nominal.

The following plots show the PSD channel rates during the reporting period



SPI EVENTS LOG

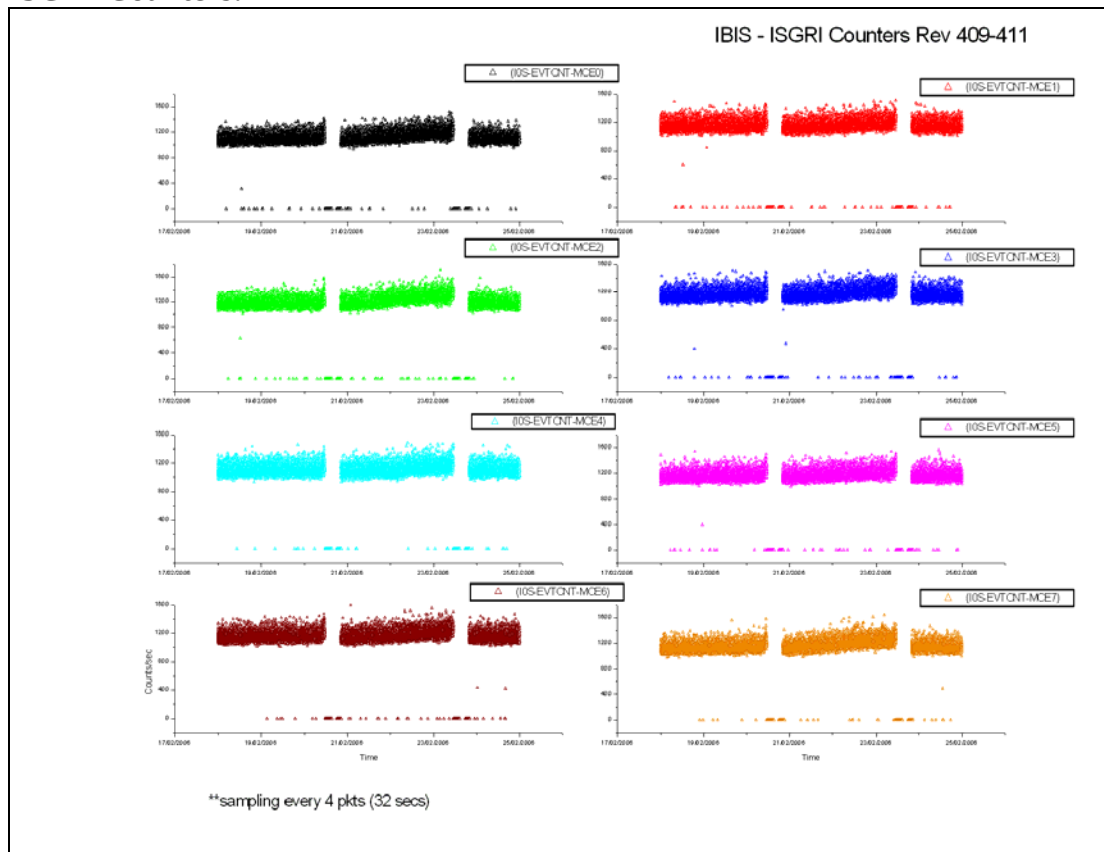
NOTE: The events log is extracted from the revolution pass summaries (courtesy of the Integral Analysts).

DOY Time	Event
050 23:40-23:42	TM E6055 "TCS TH RCS 5 –Y" OOL Warning Hig at 56,25 Celsius and back into limits.
051 / 10:34	TM E3500 "P_DF_CNVT-BW_L,1" OOL Alarm High.
056 08:25-08:36 11:58-	TM E0392 "T CR COLDPLT L2" OOL Warning High.
056 / 12:09	Execution of the FCP_SPI1_2504 to increase the stroke of all the four cryogenic compressor from raw 36 to raw 37.

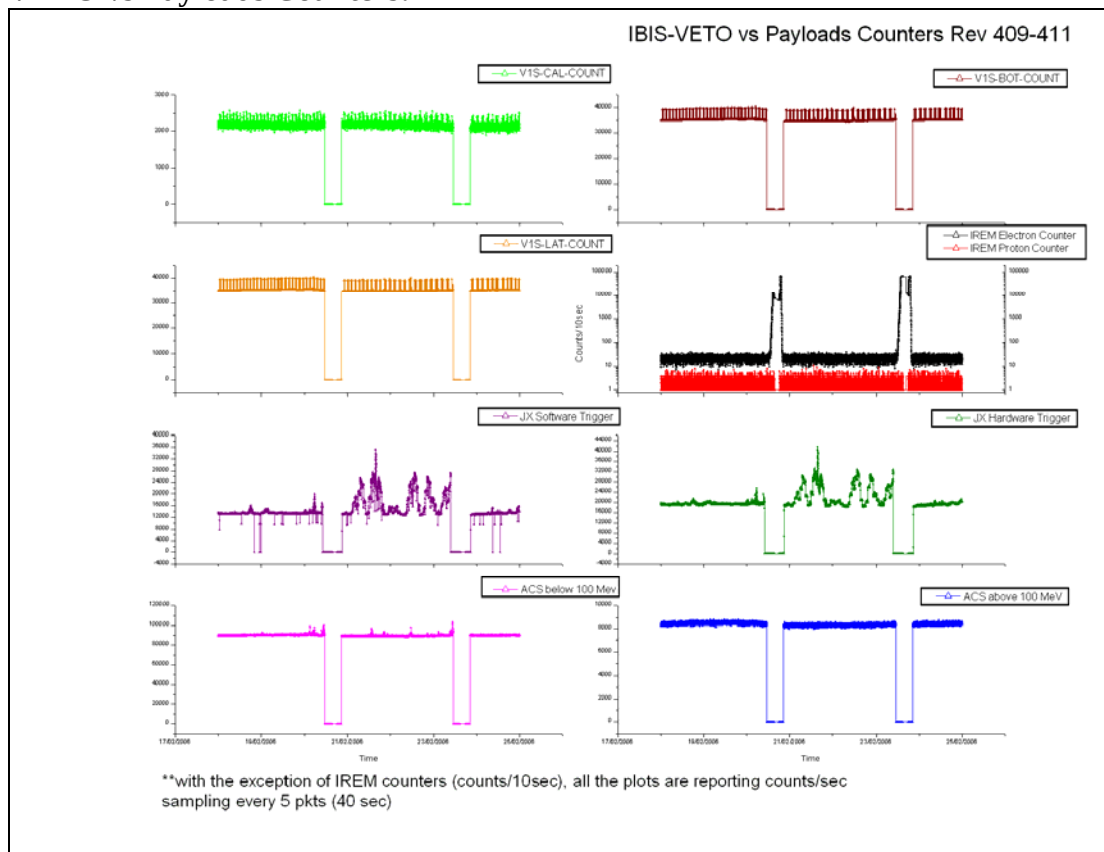
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

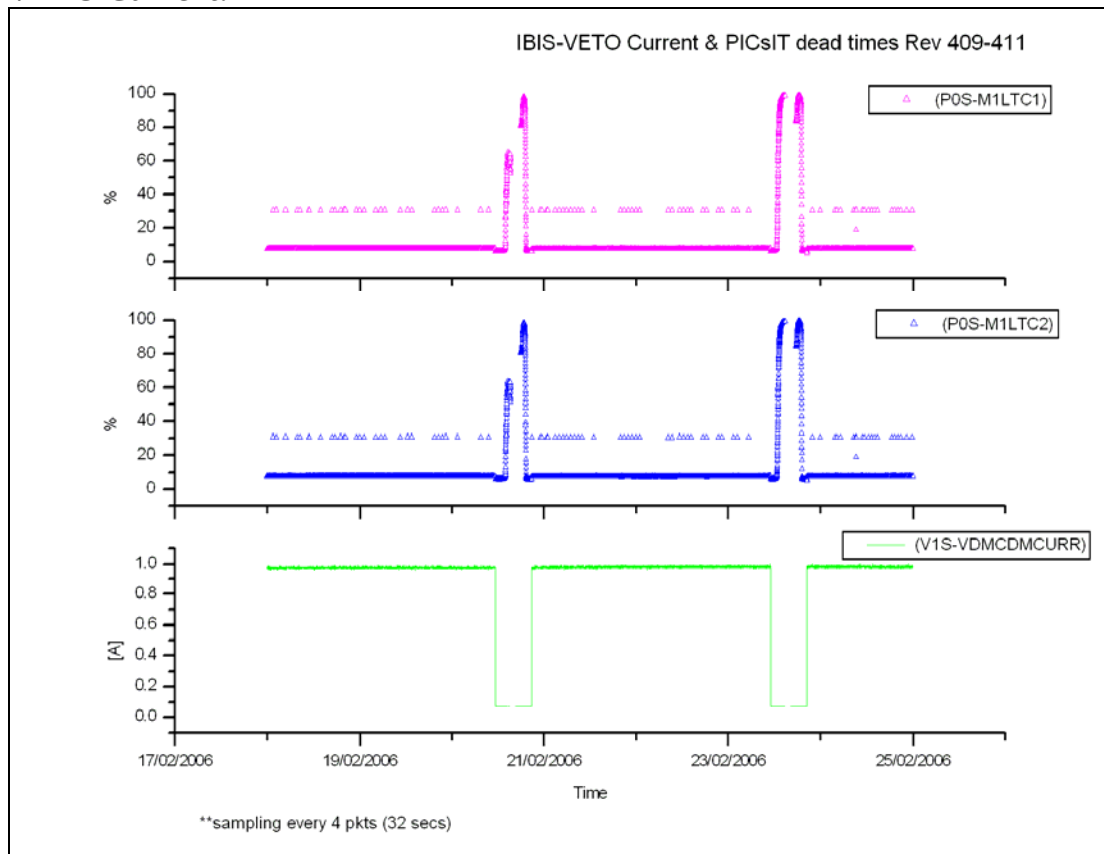


VETO vs Payloads Counters:

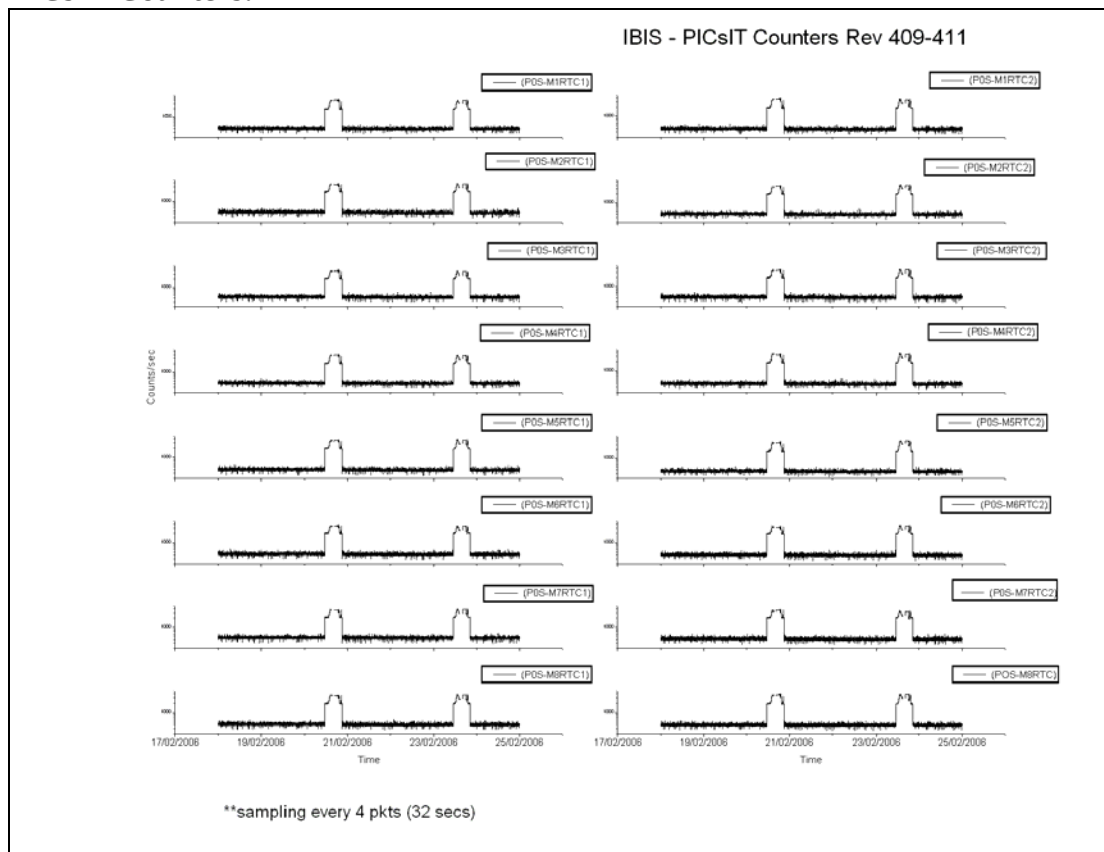


The week was characterised by low radiation.

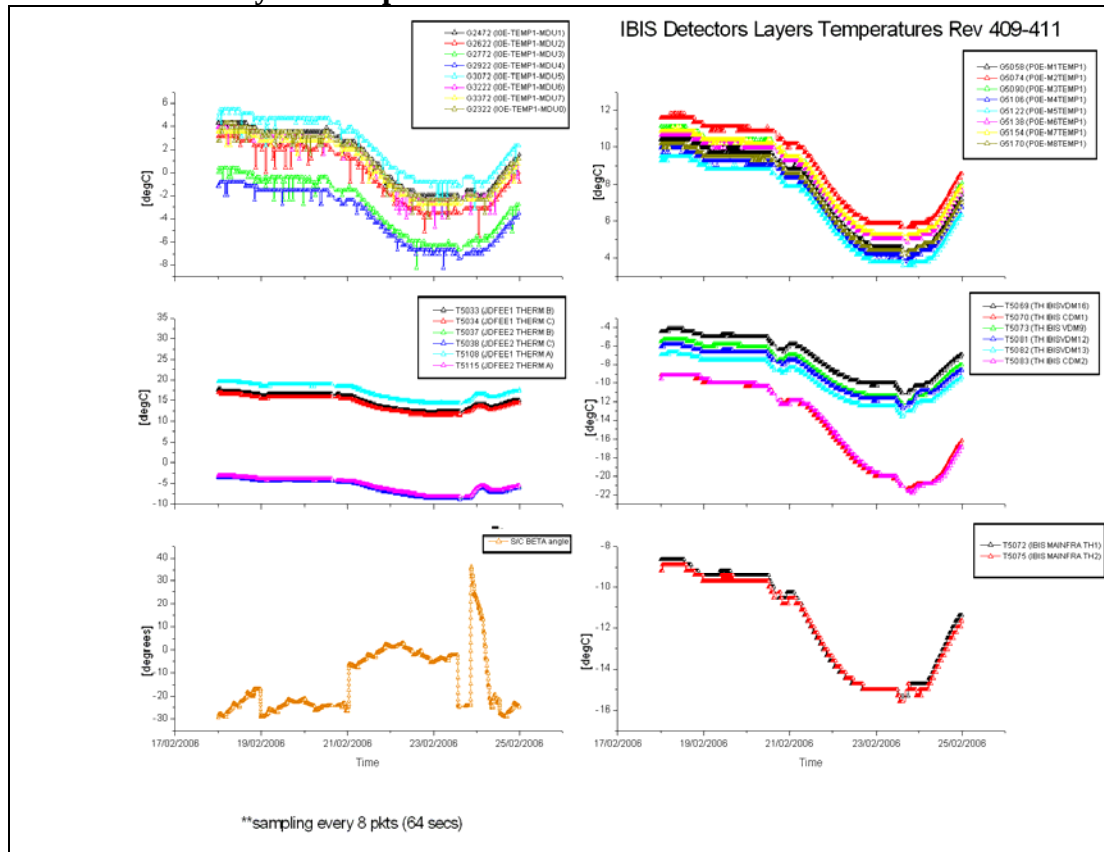
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 2006.051 (20/02/2006):

At 11:20Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 20:48Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5002 (P0S-M1RTC1), G5012 (P0S-M3RTC1), G5017 (P0S-M4RTC1) and G5038 (P0S-M8RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

At 20:18Z, TM parameter G2084 (I0E-OVFWPXADD-M6) failed SCC and back. At 20:23Z, TM parameter G2014 (I0E-OVFWPXADD-M1) failed SCC and back. According to I-OVF-1, as this happened inside radiation belts, no action was taken.

DoY 2006.054 (23/02/2006):

At 11:04Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 20:31Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

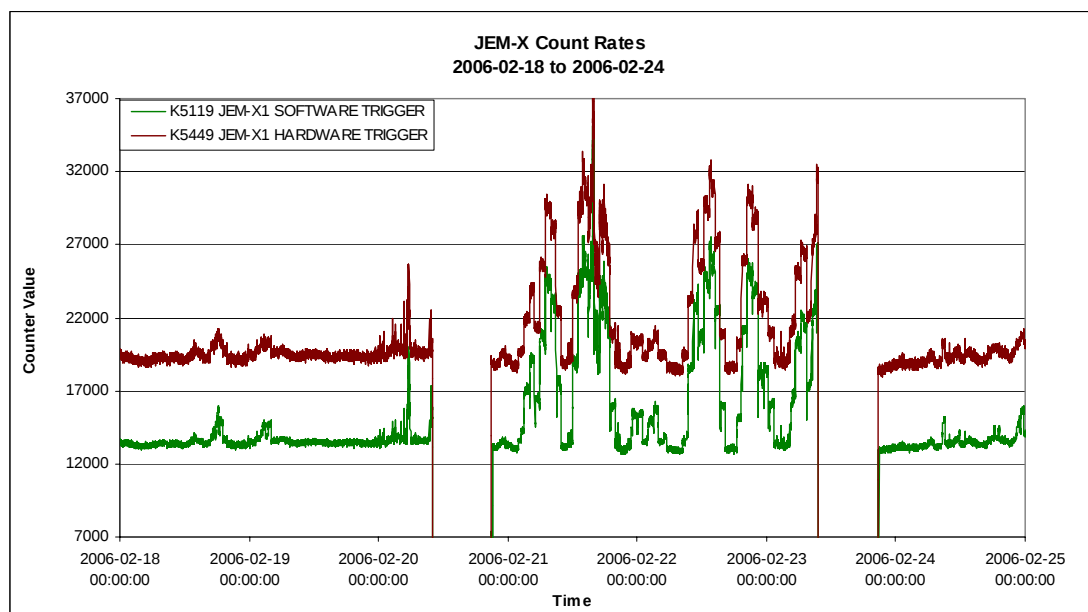
Inside the radiation belts, TM parameters G5008 (P0S-M2RTC2) and G5023 (P0S-M5RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

At 22:37Z, TM parameter G6061 (V1S-CAL COUNT) was reported OOL low-low with the value 1972 cnts/s. This has occurred several times since then. Actually, due to the exponential decay of the radioactive source, the low limit of this parameter must be regularly re-defined. In November 2005, it was lower from 2200 cnts/s to 2000 cnts/s. Now, it must be investigated whether the limit should be decreased to 1900 cnts/s or 1800 cnts/s (**investigation required**).

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

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

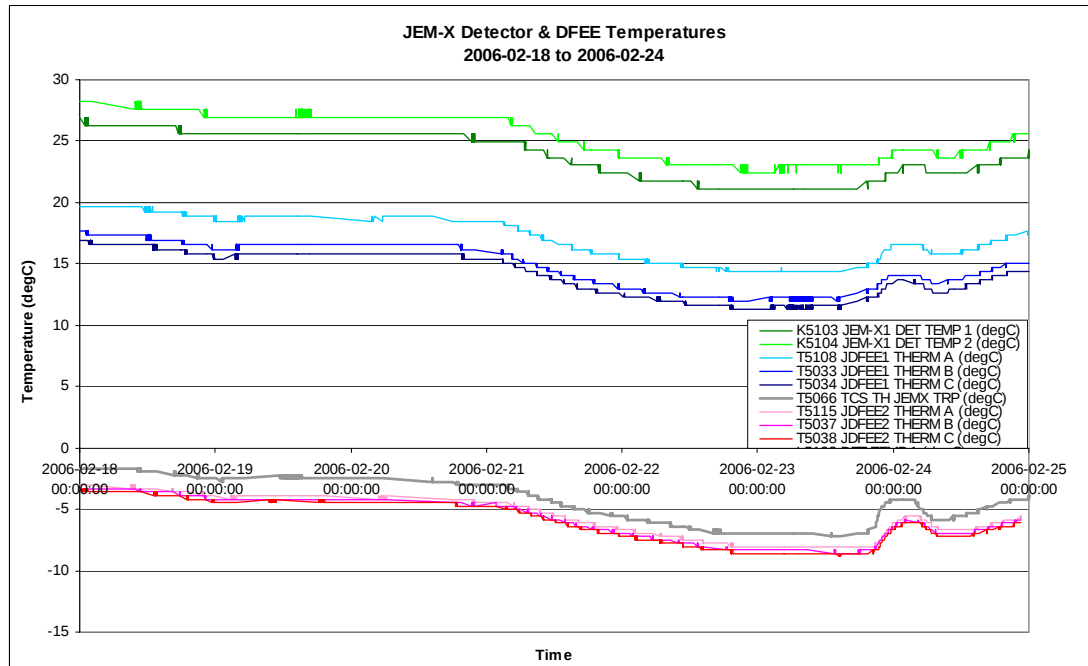


8.3.4.2 JEM-X Temperatures

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)



8.3.4.3 JEM-X Daily Report

2006-02-18 (DOY 049, Rev 409) to 2006-02-20 (DOY 051, Rev 409-410)

Nothing to report

2006-02-21 (DOY 052, Rev 410)

The TM parameters K5449 and K5136 fluctuated in and out of limits during the following time periods:

- Between 05:58:29Z - 07:59:17Z and 12:58:29Z - 17:59:25Z K5136 BUFFER LOSS OOL High
- Between 06:57:57Z - 07:18:13Z and 13:18:29Z - 17:57:33Z K5449 HARDWARE TRIGGER OOL High

2006-02-22 (DOY 053, Rev 410)

The TM parameters K5449 and K5136 fluctuated in and out of limits during the following time periods:

- Between 10:24:53Z - 14:25:41Z and 19:24:53Z - 21:25:41Z K5136 BUFFER LOSS OOL High
- Between 12:24:21Z - 14:22:45Z and 20:24:45Z - 21:23:25Z K5449 HARDWARE TRIGGER OOL High

2006-02-23 (DOY 054, Rev 410-411)

The TM parameters K5449 and K5136 fluctuated in and out of limits during the following time periods:

- Between 05:24:37Z - 09:25:25Z K5136 BUFFER LOSS OOL High

- Between 09:22:53Z - 09:41:01Z K5449 HARDWARE TRIGGER OOL High

2006-02-24 (DOY 055, Rev 411)

Nothing to report

8.3.5 OMC Operations

2006-02-18 (DOY 049, Rev 409)

From 20:16:42 to 23.08.32, a Flat Field calibration was successfully performed. This was followed by a Dark Current calibration from 23.09.02 to 23.41.06, also performed successfully.

2006-02-19 (DOY 050, Rev 409) to 2006-02-22 (DOY 053, Rev 410)

Nothing to report

2006-02-23 (DOY 054, Rev 410-411)

At 18:38, the AOCS sub-system was disabled after the failure by the FDS to update slew 04110001. The Timeline was recovered later at 21:07. The impact was the loss of pointing 04110004, and a delay of about 4 minutes in the start of pointing 04110005. The scheduled duration of which was 2200 seconds, with about 2176 taking place.

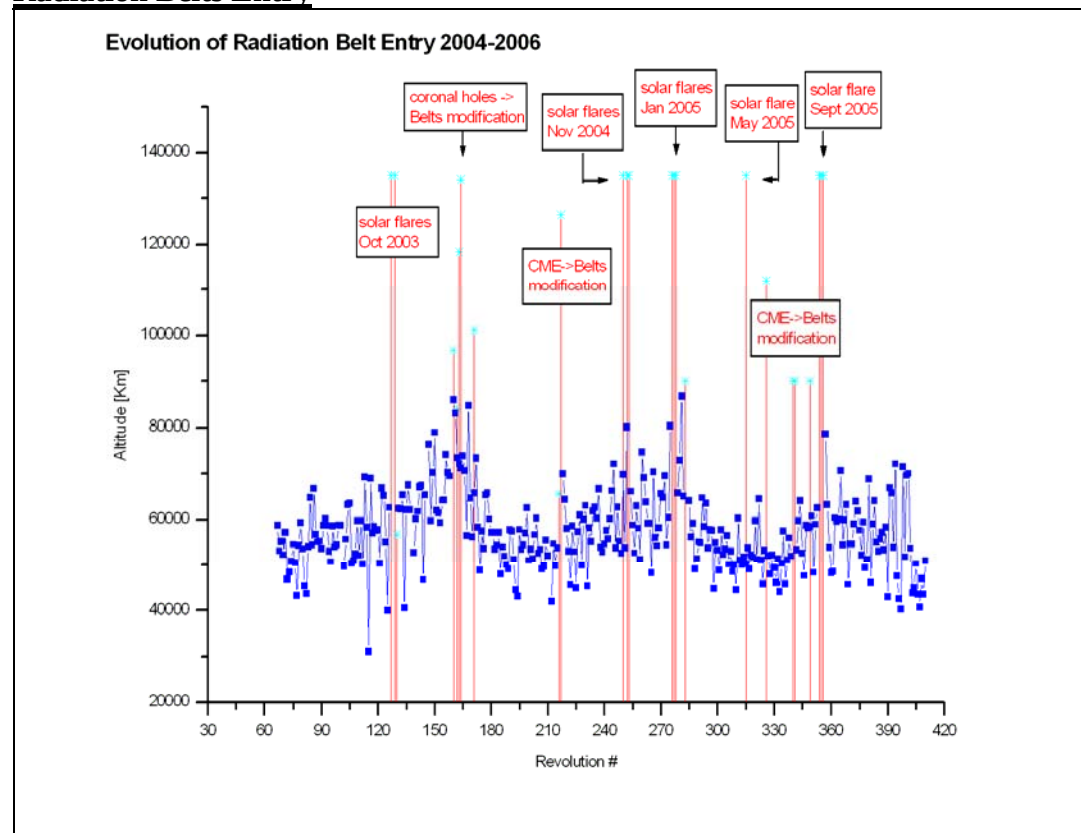
2006-02-24 (DOY 055, Rev 411)

Nothing to report

On DoY 051 at 11:20:47 and DoY 054 at 11:04:47 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 20/02/2006 at 18:27Z, ED UEGRON01 was missed from the timeline due to TM/TC link problem. This sequence was manually uplinked at 18:36Z.

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]
409	RAD_ENTR R 2006-02-20T11:20:41Z	2006-02-20 13:23:42	<43597.1	2006-02-20 12:41:44	48906
410	RAD_EXIT R 2006-02-20T20:36:04Z	2006-02-20 19:51:26	<<39923.3	2006-02-20 19:51:44	33497
410	RAD_ENTR R 2006-02-23T11:04:39Z	2006-02-23 12:09:58	>50858.4	2006-02-23 12:29:20	48733
411	RAD_EXIT R 2006-02-23T20:19:33Z	2006-02-23 19:39:50	>33263.6	2006-02-23 19:39:20	33773

Reference

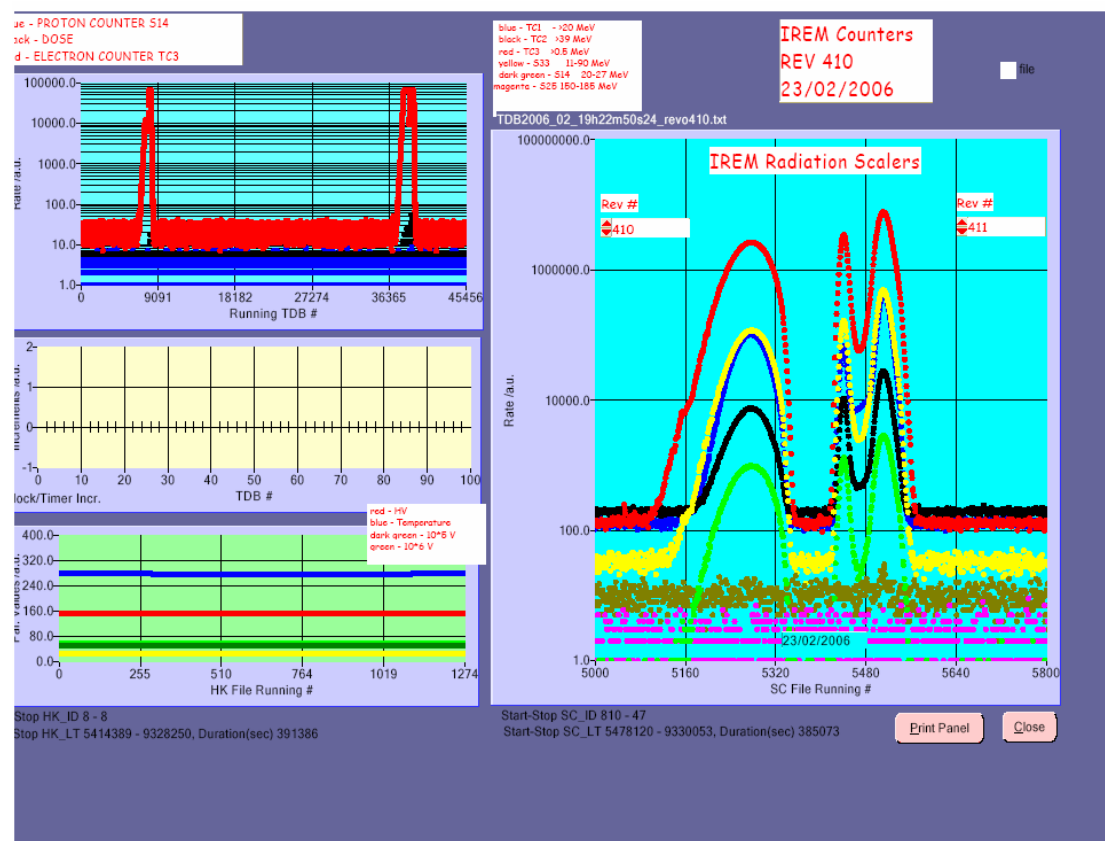
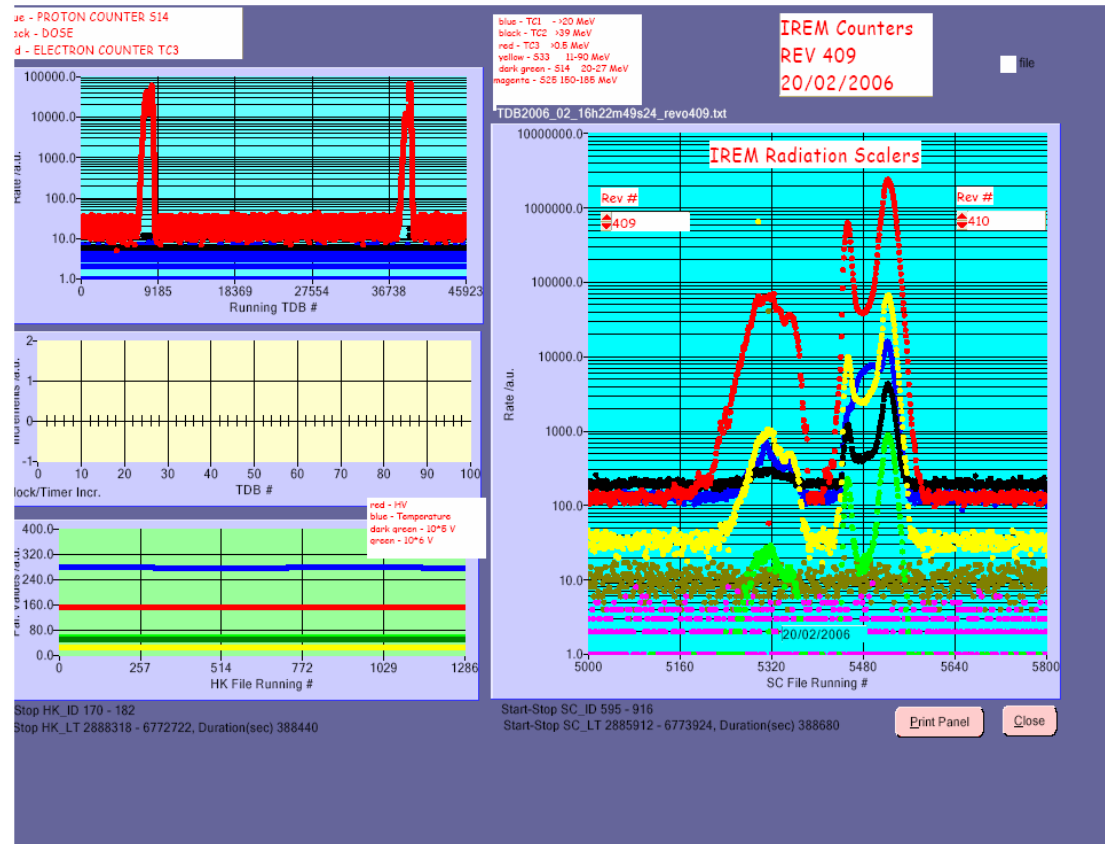
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

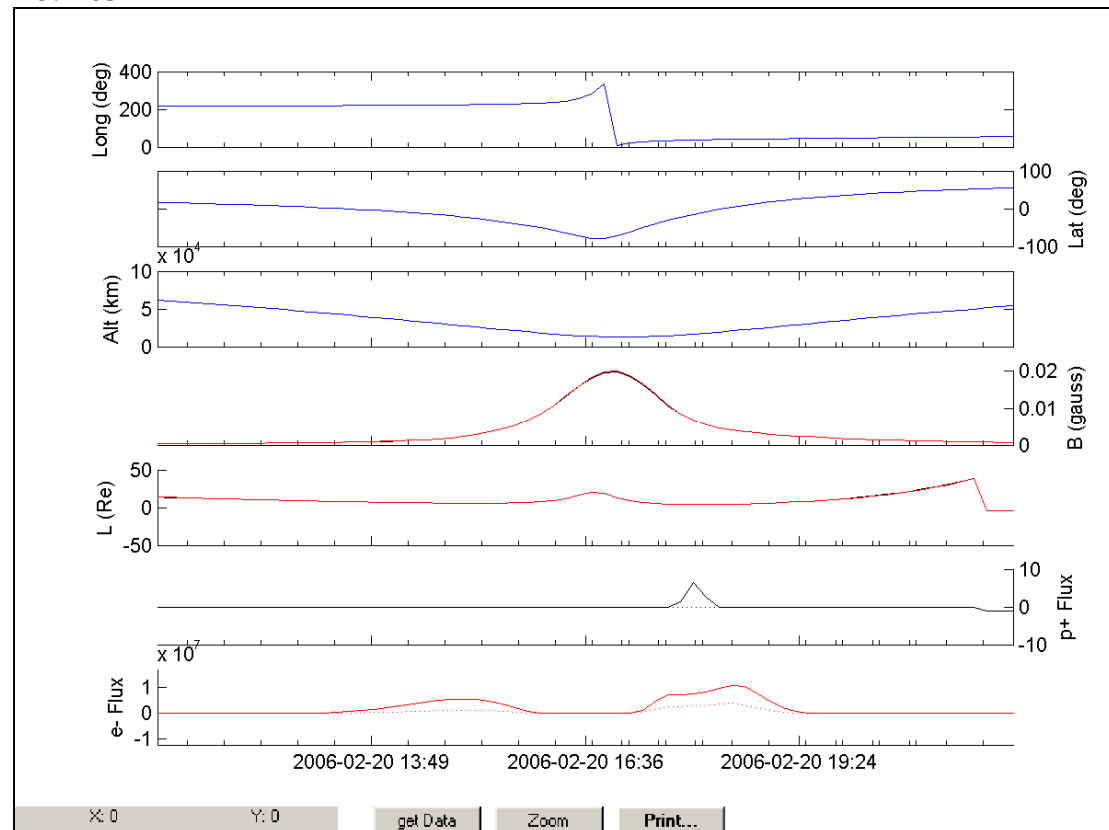
Radiation Spike

IREM radiation counters:

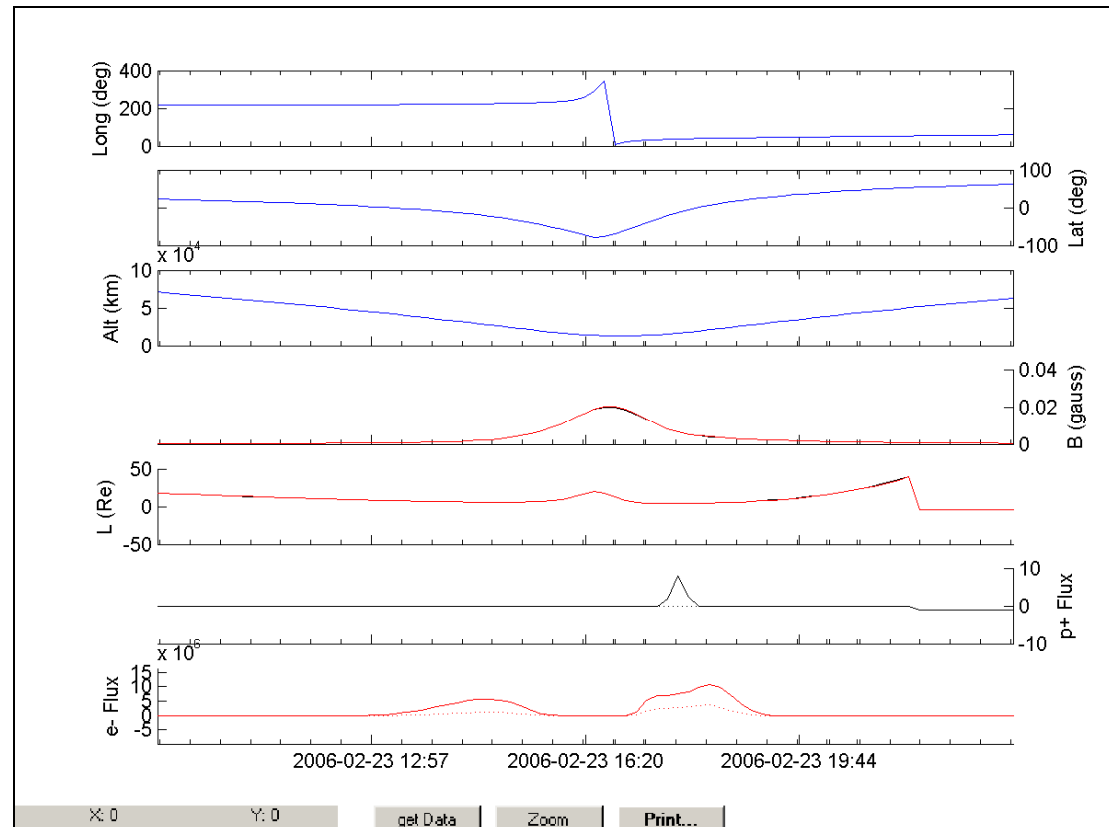


IREM Predicted Radiation Belt Passages:

Rev 409



Rev 410



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

