

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 181
Week 10
13.03.06
Routine Phase

Prepared by: M. Walker (OPS-OFO)

LIST OF CONTENTS

1	General.....	3
2	Summary of Activities.....	3
3	Satellite Status.....	3
3.1	Platform.....	3
3.1.1	AOCS.....	3
3.1.2	Power.....	3
3.1.3	Thermal.....	3
3.1.4	OBDH.....	3
3.1.5	RFS.....	4
3.2	Payload.....	4
3.2.1	SPI.....	4
3.2.2	IBIS.....	4
3.2.3	JEM-X.....	5
3.2.4	OMC.....	5
3.2.5	IREM.....	6
4	Ground Facilities.....	6
4.1	Mission Operations Centre.....	6
4.2	Ground Stations & Network.....	6
4.3	Science Ground Segment.....	6
4.3.1	ISOC.....	6
4.3.2	ISDC.....	7
5	Special Events.....	7
6	Anomalies.....	7
7	Future Milestones.....	8
8	Appendix.....	9
8.1	Overview of Revolutions.....	9
8.2	Consumables.....	9
8.2.1	Detailed Fuel Book-keeping.....	9
8.3	Detailed Satellite Information.....	10
8.3.1	AOCS SUMMARY OPERATIONS REPORT, 04/03/2006 – 10/03/2006.....	10
8.3.2	SPI Operations.....	13
8.3.3	IBIS Operations.....	16
8.3.4	JEM-X Operations.....	20
8.3.5	OMC Operations.....	21
8.3.6	IREM Operations.....	22

DISTRIBUTION LIST

Addressees	Copy	Addressees	Copy
D/OPS		ESA HQ	
G. Winters D/OPS	1	D. Southwood D/SCI	1
W. Frank OPS-O	1		
A. Smith OPS-OF	1	ESTEC	
J. F. Kaufeler OPS-G	1	J. Louet SCI-P	1
N. Bobrinsky OPS-ON	1	A. Gimenez-Canete SCI-S	1
		ESTEC / PG	
M. Schmidt	1	G. Sarri	1
R. Southworth	1		
F. Di Marco	1		
F. Cordero	1		
M. Walker	1		
P. Lippi	1	ESTEC/RSSD	
R. Lemme	1	M. Kessler SCI-SD	1
S. Fahmy	1	C. Winkler	1
SPACONs	1	A. Parmar	1
O. Bergogne	1	L. Hansson	1
I. Bayliss	1	E. Kuulkers	1
G. Di Girolamo	1		
F. Dreger	1	ISDC	
G. Gienger	1	T. Courvoisier	1
S. Pallaschke	1	R. Walter	1
W. Hell	1	N. Mowlavi	1
K.J. Schulz	1	ISDC Shift Team	1
M.A. Larsen	1		
K. Capelle	1	ALENIA	
M. Butkovic	1	M. Montagna	1
D. Heinzer	1	F. Ravera	1
U. Feucht	1		
Shift - Coord	1	PI / Instrument Teams	
Scheduling Office	1	J. P. Roques – SPI	1
T. Beck	1	G. La Rosa – IBIS	1
J. Wardill	1	P. Ubertini – IBIS	1
M. Unal	1	S. Brandt – JEM X	1
P. Maldari	1	E. De Miguel - OMC	1
		W. Hajdas – IREM	1
Redu			
B. Demellenne	1	JPL / Goldstone	
		D. Holmes	1
Vilspa		J. Valencia	1
P. Kretschmar	1	Jesse Velasco	1
		DSN - MPSETD	1
ESTEC/SCI-A			
Nicola Rando	1		

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 04.03.06 until 10.03.06 (both dates inclusive) and covers the revolutions 414, 415 & 416.

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 Galactic Plane Survey, a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), hexagonal and raster dithers of XTE J1817-330 (a target of opportunity), (RA 18:17:42.00; DEC -33:01:04.8), a raster dither of the Galactic Centre, (RA 17:45:40.00; DEC -29:00:28.0) and finally a Galactic Latitude Scan.

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 lost during the reporting period.

The fuel consumption over the period between 03/03/2006 and 08/03/2006 was 0.1190 kg. The remaining propellant is in the order of 155.8406 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.

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 since 09.02.2006 a slightly degraded energy resolution. Detector #2 is failed since 06.12.2003, detector #17 since 17.07.2004.

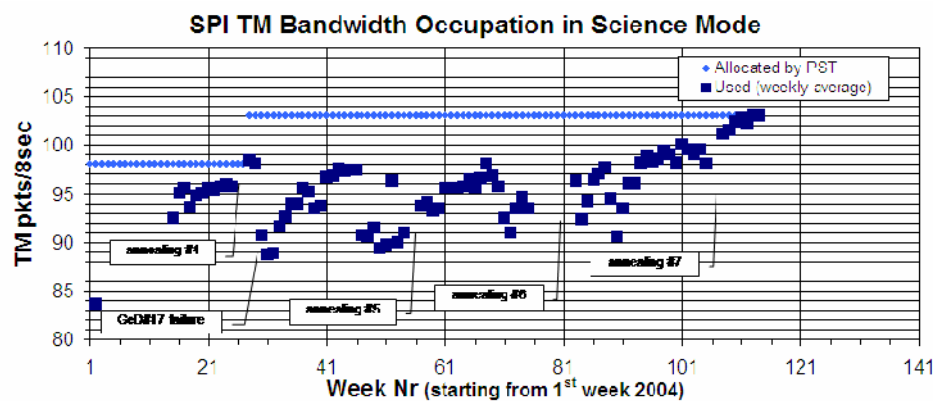
A PSD count rate anomaly occurred once again on 5th March. The anomaly was only temporary.

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 103 pkts/cycle.

The telemetry downlink of SPI has therefore reached saturation and since this week some of the Photon telemetry, acquired during the science windows, was lost.

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.



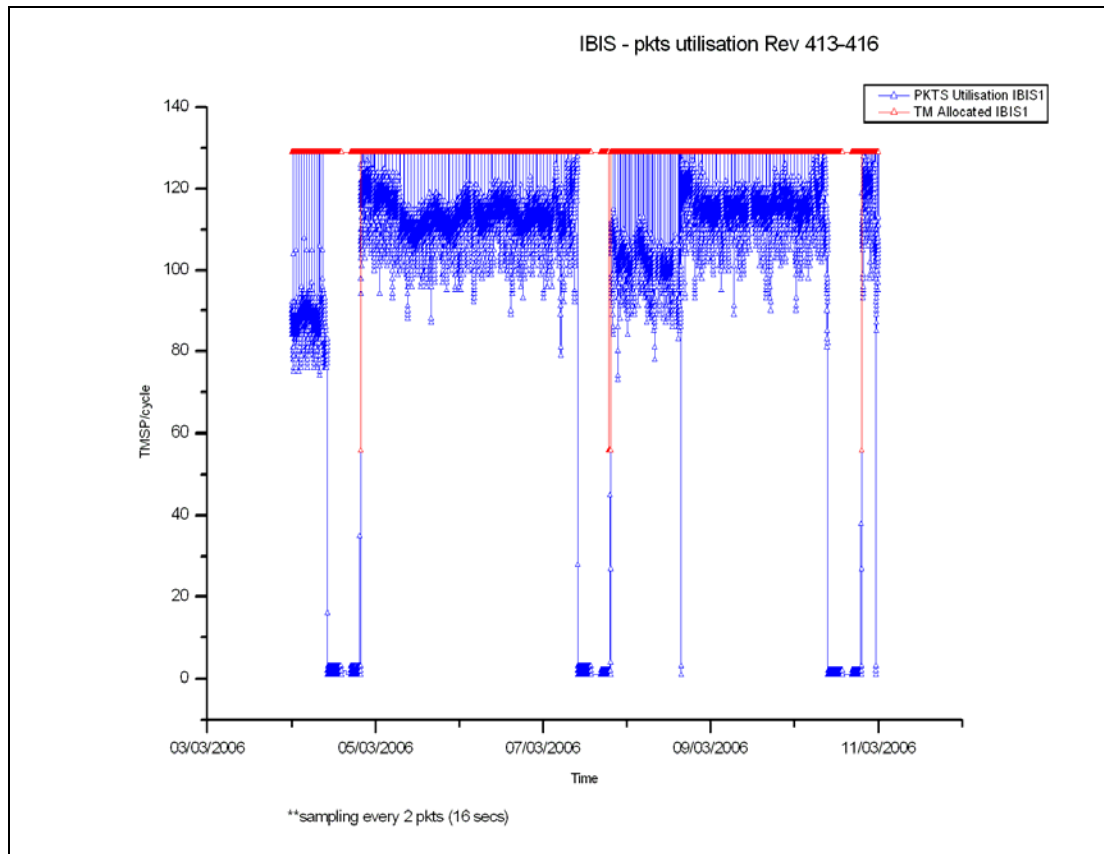
Note: Some more information concerning the SPI operations is provided in the Appendix.

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. The IBIS mean bandwidth utilisation during the observation period was 111.76 TMPS/cycle, up 10.36 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.

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 of the 155 planned science pointings for OMC were executed 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 very low solar activity.

The Sun was blank during most of the 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 excellent this week. There were several minor problems with ground station and ISDC links, but these had no impact. The overall performance was nearly 100% requirement.

4.1 Mission Operations Centre

The performance of the MOC was excellent this week. The overall performance was nearly 100% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was excellent 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

New PSF's for revolutions 422 and 423 have been received. Planning for the revolution 423 has been performed and sent to MOC. No replanning has been performed and no ToO request has been received. Revolution 422 planning is pending inputs for the AOCS calibration and finalisation of the instrument calibration using the CRAB. TSF's up to revolution 423 are now available.

2. Observation status

ECS's for revolutions up to 406 plus 409 are now available. All revolutions have been processed by ISOC and the corresponding OCS's sent to ISDC. No extra time has been credited.

3. ISOC science data archive

The ISDA version 2.5 is now ready for release to the public. However as mentioned before this release needs to be simultaneous with a release of the XMM-Newton and

ISO archive. That is now the responsibility of the ESAC Archive group. The DELL hardware problem mentioned the last weeks is still not resolved.

4. ISOC system

The version 12.2 was released during the week. This version contains all the solution to the problems and suggestions for improvements that originated from the user test campaign some weeks ago.

5. AO 4 preparation

All documentation and software is now ready for public release Monday 13 March as planned. All last minute inputs are now available and the consistency between the OTE and the documentation has been verified. In a couple of occasions during the last AO campaign the users had difficulties to submit proposals through firewalls at their sites. In a couple of weeks there will be a modified proposal generation tool, PGT available that uses a different way of communication with ISOC. In the unlikely situation that someone needs to send in a proposal before the modified PGT is available they may send the proposal to Integral Helpdesk as an attachment to an email.

6. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 13/03/2006:

- Latest Standard Analysis completed: observation 03200160002 (NGC 4945, Revolution 400) on 08/03/2006
- Latest products archived: observation 03200160001 (NGC 4945, Revolutions 396) on 08/03/2006
- 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 were no problems relating to the ground segment that impacted operations this week.

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

AR id	Date Created	Subject	Segment	Status
INT-2842	15/03/2006	imcb Stops Processing TM	IMCS	Pending

Doc. Title : INTEGRAL Mission Report #181
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 13/03/06

Issue : 1
Rev. : 0
Page : 8

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 414

The observations in revolution 414 began with a Hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), for ~3.5 hours. This was followed by first a Hexagonal dither of XTE J1817-330 (a target of opportunity), (RA 18:17:42.00; DEC -33:01:04.8) for 7 hours, then a raster dither of the same object, for ~47.8 hours.

Revolution 415

The observations in revolution 415 began with a Galactic Plane Survey, which lasted ~15.9 hours. This was followed with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), for ~3.5 hours. For the remainder of the orbit, a raster dither of the Galactic Centre, (RA 17:45:40.00; DEC -29:00:28.0), for ~35.8 hours was performed.

Revolution 416

The observations in revolution 416 began with a hexagonal dither of the Galactic Bulge region (RA 17:45:36.00; DEC -28:56:00.0), for ~3.5 hours. For the remainder of the orbit, a Galactic Latitude Scan (Cycle 4), which lasted ~54.3 hours, was performed.

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

2006-02-26T12:40:01.000Z	156.0893	F	Automatic TM processing.
2006-02-26T14:03:53.000Z	156.0721	F	Automatic TM processing.
2006-02-26T18:03:53.000Z	156.0650	F	Automatic TM processing.
2006-02-27T03:10:34.000Z	156.0396	F	Automatic TM processing.
2006-02-27T10:21:55.000Z	156.0217	F	Automatic TM processing.
2006-02-27T14:12:04.000Z	156.0067	F	Automatic TM processing.
2006-03-01T13:48:57.000Z	155.9897	F	Automatic TM processing.
2006-03-01T17:48:17.000Z	155.9790	F	Automatic TM processing.
2006-03-03T04:08:29.000Z	155.9596	F	Automatic TM processing.
2006-03-04T17:34:32.000Z	155.9377	F	Automatic TM processing.
2006-03-07T13:14:47.000Z	155.9279	F	Automatic TM processing.
2006-03-07T17:15:44.000Z	155.8949	F	Automatic TM processing.
2006-03-08T02:22:25.000Z	155.8846	F	Automatic TM processing.
2006-03-08T09:33:30.000Z	155.8640	F	Automatic TM processing.
2006-03-08T14:02:10.000Z	155.8406	F	Automatic TM processing.

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, 04/03/2006 – 10/03/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 89 Open Loop Slews, 80 Closed Loop Slews and 8 Momentum Bias were executed (TL + Manual Recovery).

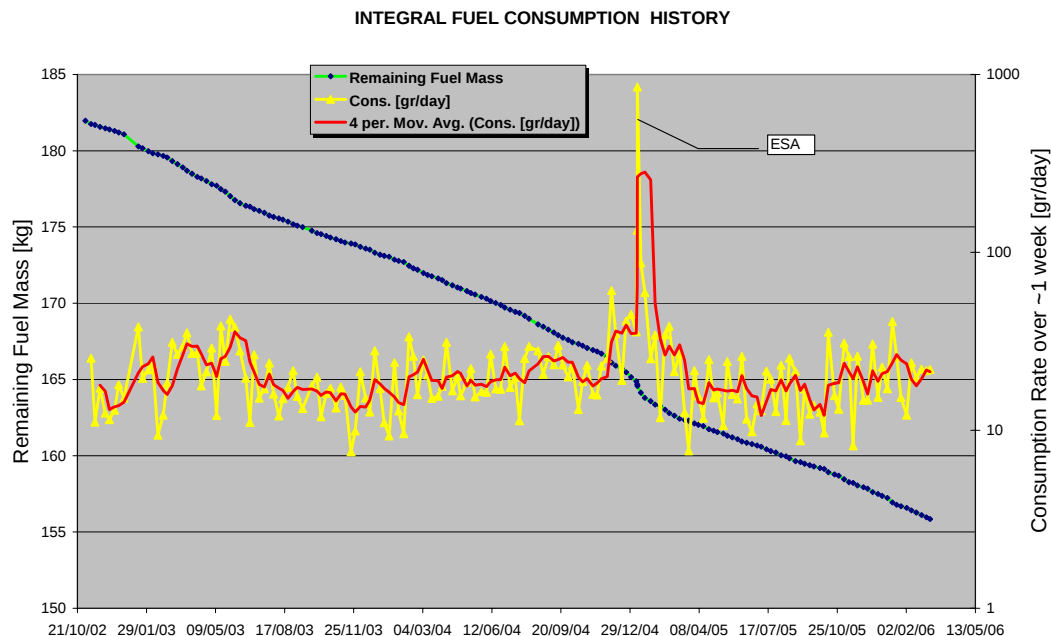
No slews lost during the observation period.

Orbit Control

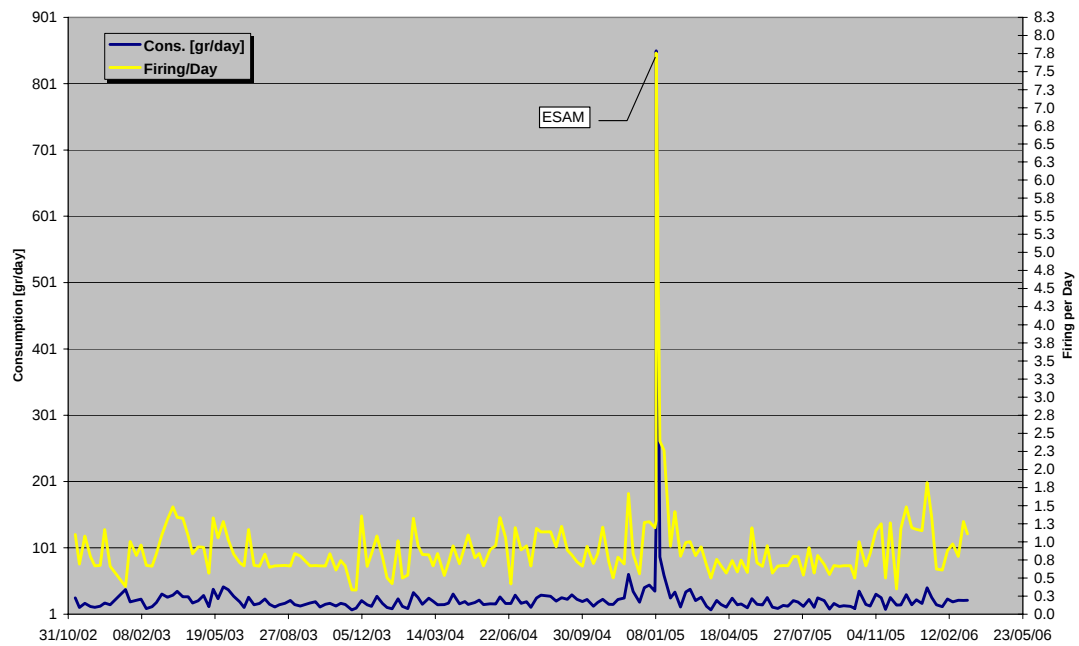
At present time the plan is to reverse the control and to increase the semi-major axis as from mid March 2006 and onwards. The "Redu only" situation could be reached in the second half of 2006, possibly mid August. The apogee longitude would then be about 32 deg East.

Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 08/03/2006 is reported in the plot below.

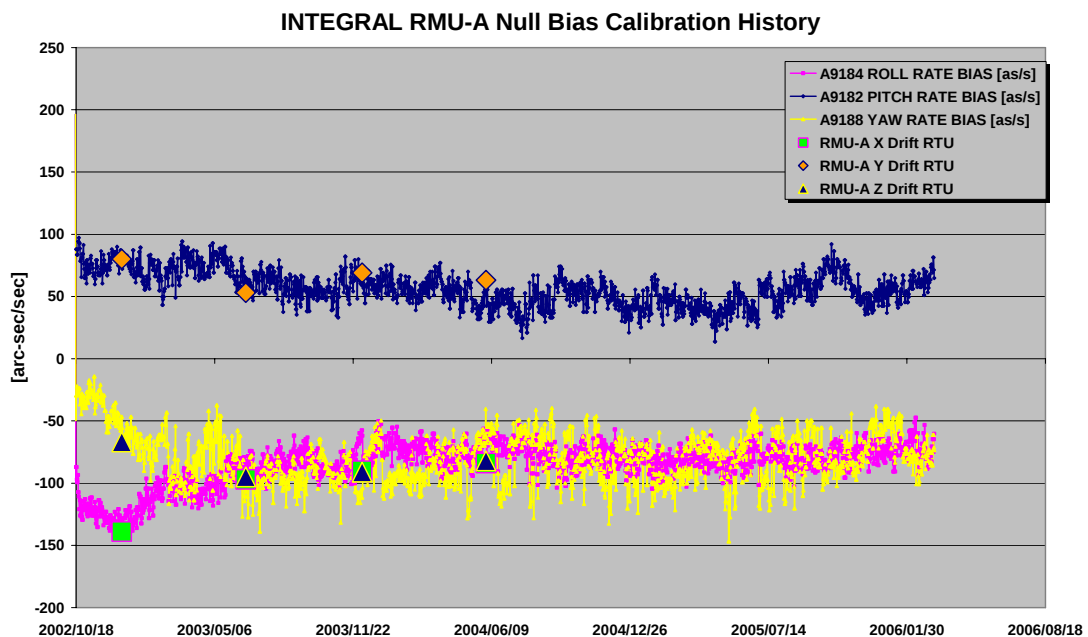


The firing\day over the period between 01/11/2002 and 08/03/2006 is reported in the plot below.

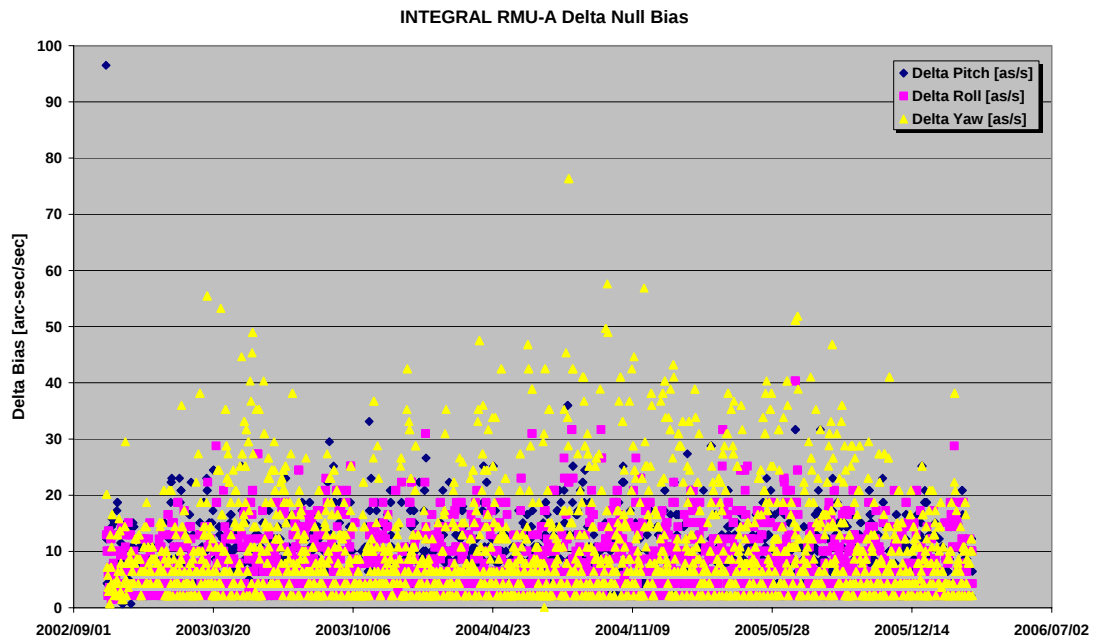


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 10/03/2006 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 10/03/2006 is reported in the plot below.



04/03/06 (Day of Year 063, Revolution 413-414)

Nothing to report.

05/03/06 (Day of Year 064, Revolution 414)

Nothing to report.

06/03/06 (Day of Year 065, Revolution 414)

Nothing to report.

07/03/06 (Day of Year 066, Revolution 414-415)

Nothing to report.

08/03/06 (Day of Year 067, Revolution 415)

STR 1750 processor fault: at 08:10:33z a STR 1750 processor fault occurred during the execution of the PID 04150020. The sequence of the events was:

08:09:58z Open Loop Slew End for PID 04150020
 08:10:17z Mapping start
 08:10:33z 1750 FAULT reported in TM
 08:10:34z Mapping End prematurely (aborted)
 08:10:34z New automatic mapping commanded by the ACC.

The guide star at the moment of the anomaly was Mi 6.7 [3216 , 10555] ID 8692-1220. The new guide star picked after ACC commanded mapping was Mi 8.2 at CCD location [5520, -1650]. No IMU was activated during the anomaly because the fault occurred during the first minute after the end of the slew.

The reason of the fault is likely due to a very bright object (Rigel Centaurus, Mi 0.01) present in STR FOV at the end of the slew, at the same CCD column of the used guide star.

No impact reported on the TL execution except that the OTF for the 04150020 was not reached.

09/03/06 (Day of Year 068, Revolution 415)

Guide star released: at 11:27z the ACC reported lost of guide star: the guide star, was released and the IMU1 switched ON and a new guide star was picked in the first automatic mapping, which was kept afterwards. The OTF was not reached during the PID 04150054.

A manual recovery was then performed and the following slew ID 04150055 manually updated.

No impact on TL reported, except that the OTF for the 04150054 was not reached.

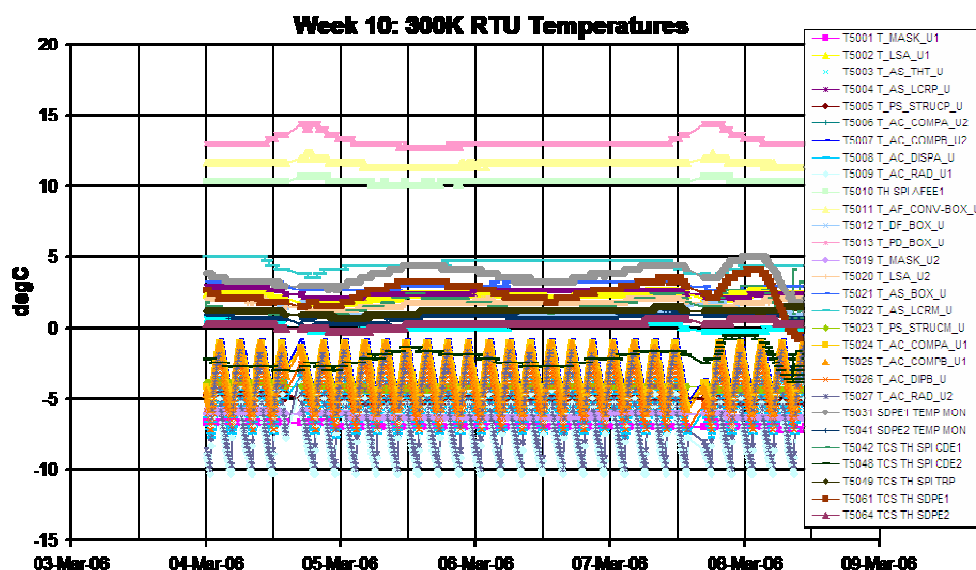
10/03/06 (Day of Year 069, Revolution 415-416)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures:

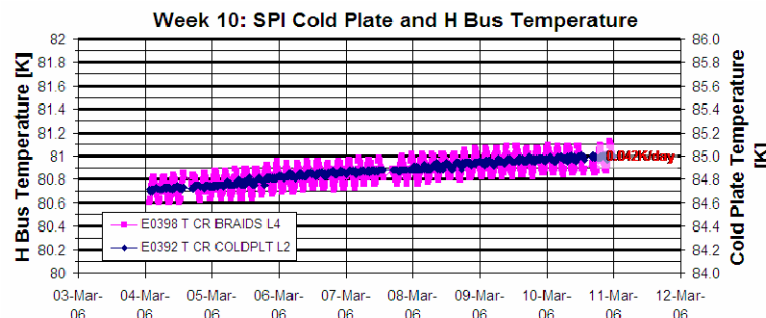
All the equipment temperatures are inside the operational limits. The following plot shows their evolution along the reporting period.



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.

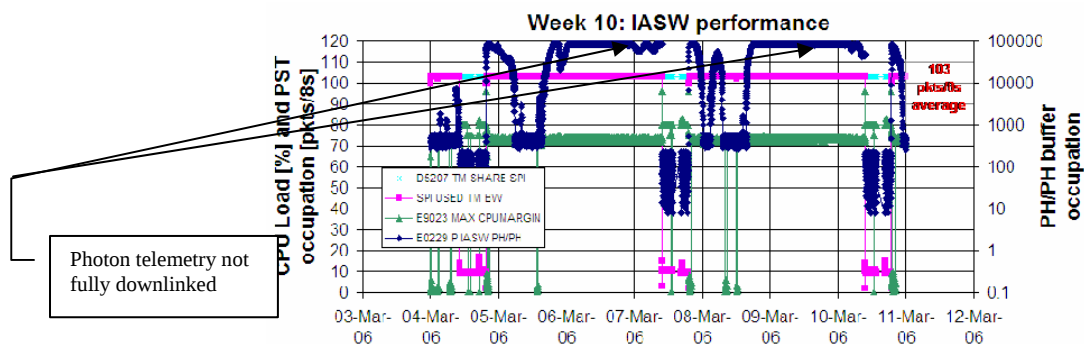
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



DPE & IASW:

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

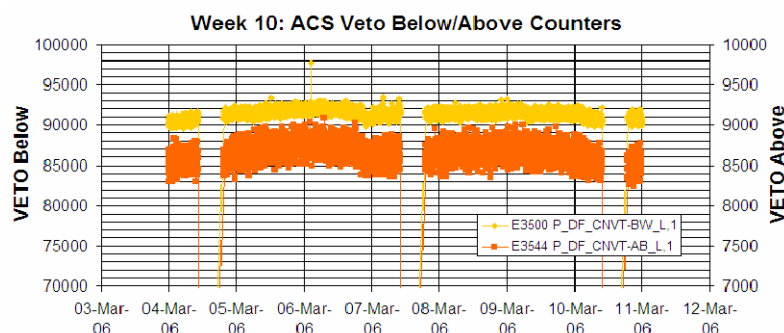
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

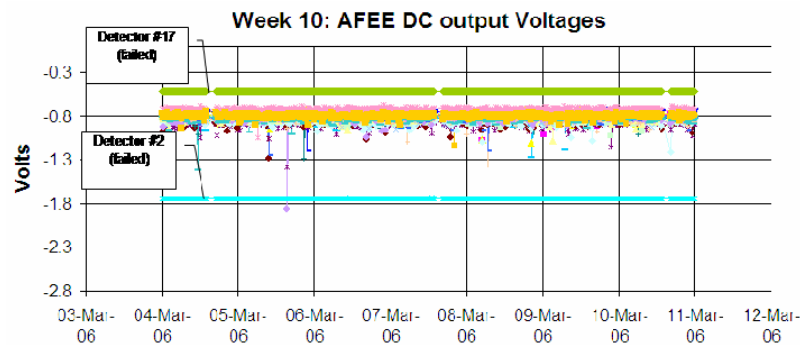
The following plot shows the ACS overall count rate evolution during the reporting period



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.

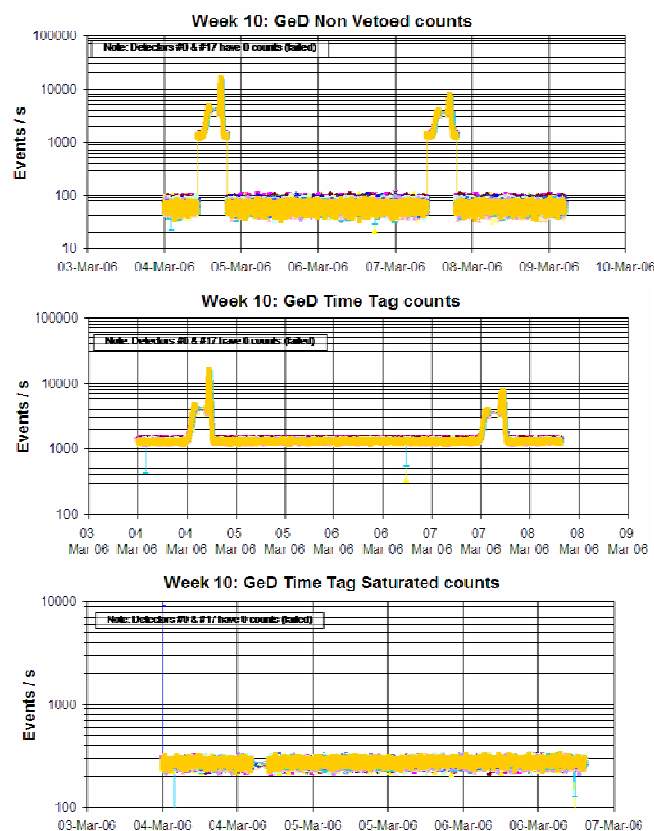
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



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:

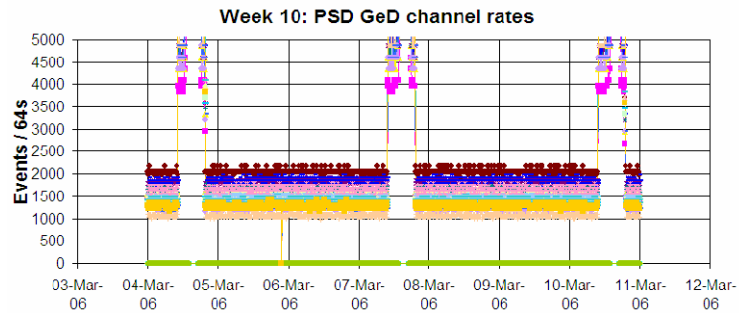
The performance of the unit is nominal, except on DOY 064 (5th March) at 21:33:26Z where all the TM parameters E3840 to E3858 (PSD channel rates) dropped to zero (OOL Low). They remained at zero until 21:38:46Z, when all count rates returned to their nominal values, as they were before the anomaly.

No other Out of Limits or OEMs were observed at the time of the anomaly and the DC output voltages were nominal during the anomaly.

This anomaly has already been observed (see Anomaly Report INT_SC-90), but has not occurred since the PSD channels for the failed detectors #2 and #17 were disabled. These channels are still disabled.

The anomaly was logged by ARTS INT_SC-142.

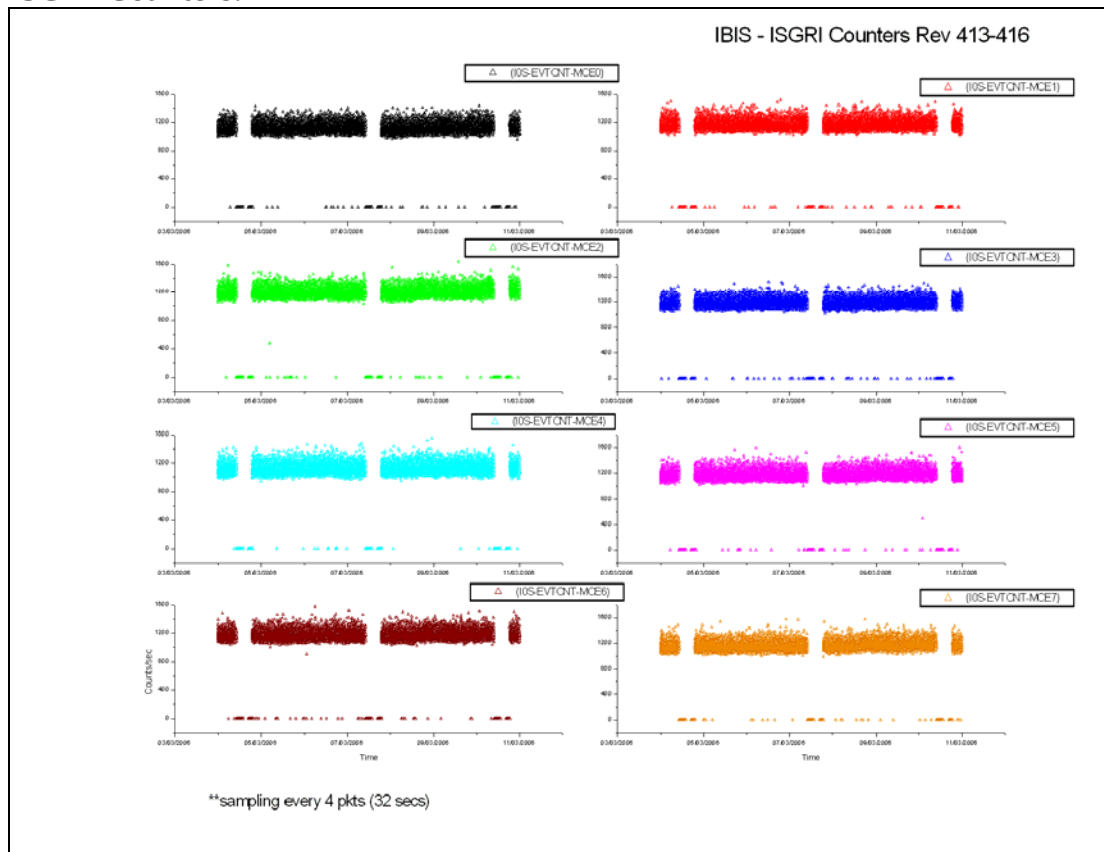
The following plots show the PSD channel rates during the reporting period



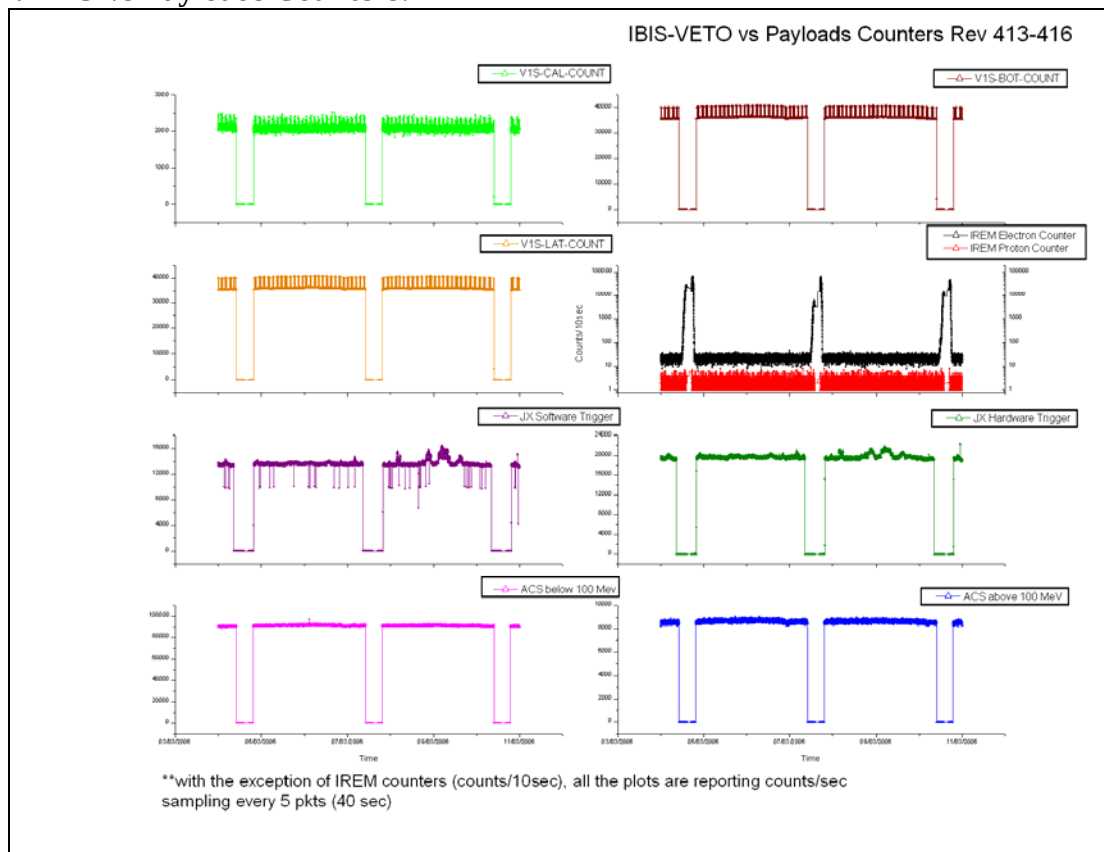
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

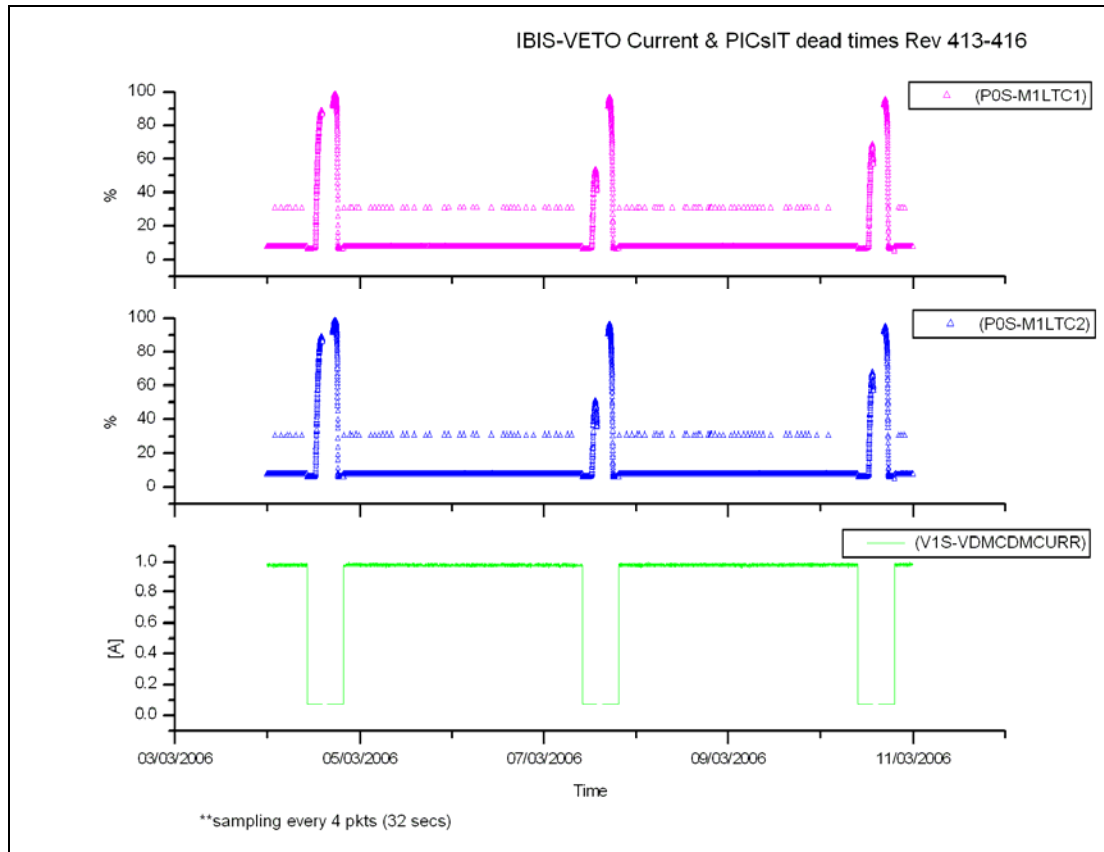


VETO vs Payloads Counters:

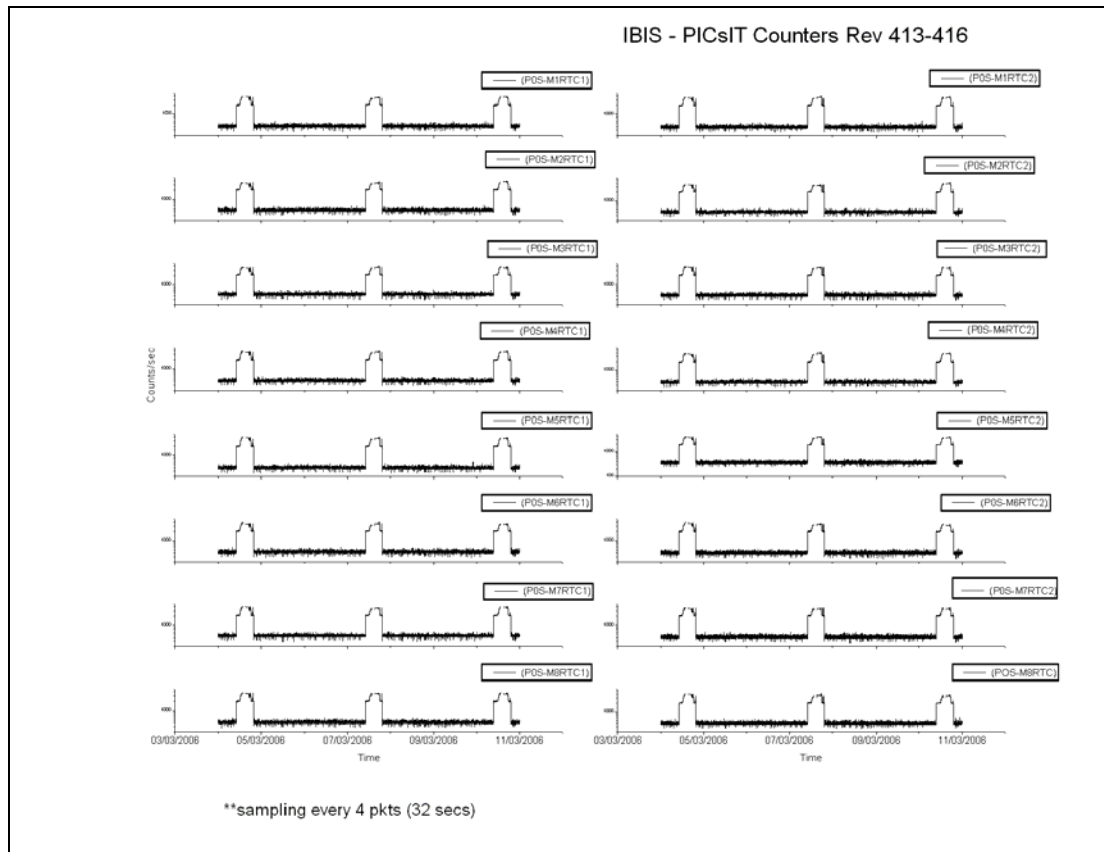


The week was characterised by low radiation.

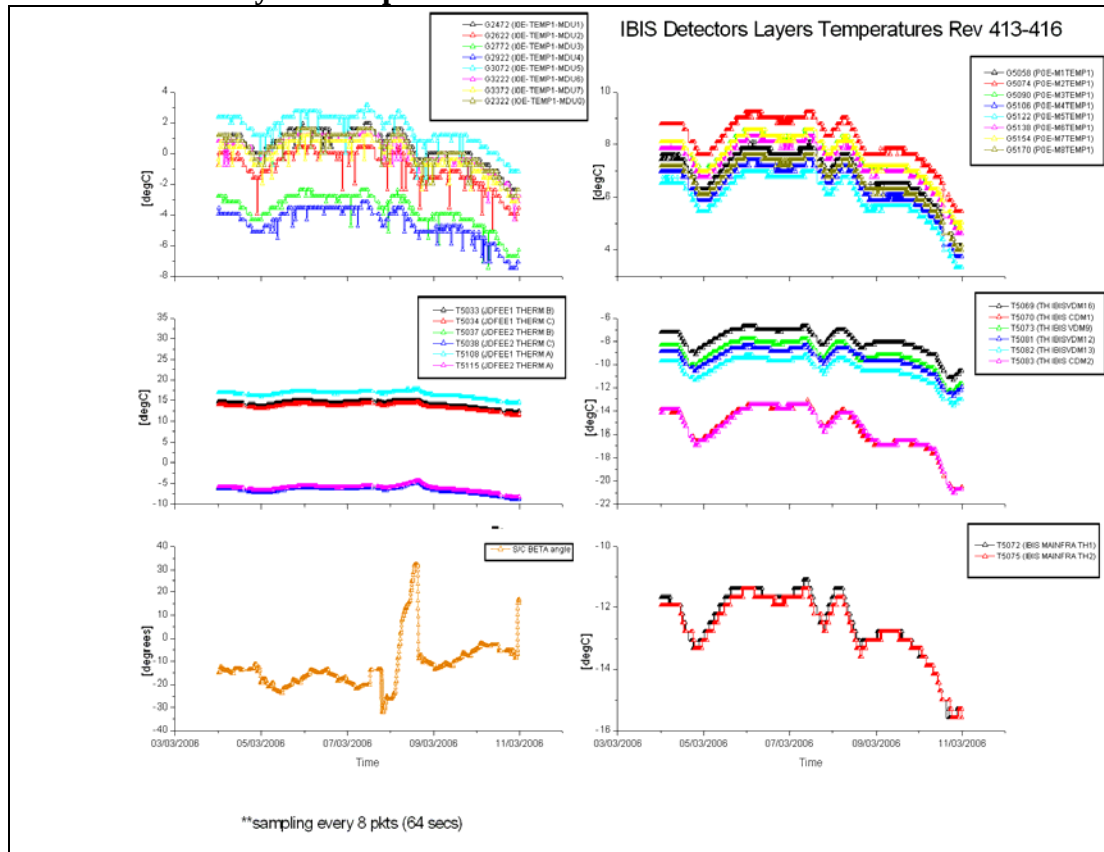
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 2006.063 (04/03/2006):

At 10:17Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 19:44Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameter G5032 (POS-M7RTC1) was toggling OOL high. According to P-CNT-1, no action was taken.

At the beginning of revolution 414, the operator could not upload the ISGRI CTX table due to an error message ("failed validation"). Therefore the CTX from revolution 412 were uplinked at 17:50Z.

DoY 2006.066 (07/03/2006):

At 09:58Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 19:27Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5012 (POS-M3RTC1), G5018 (POS-M4RTC2), G5027 (POS-M6RTC1) and G5038 (POS-M8RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

At 18:58Z, TM parameter G2070 (I0E-OVFWPXADD-M5) failed SCC and back. At 19:12Z, 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 2006.069 (10/03/2006):

At 09:40Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 19:09Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

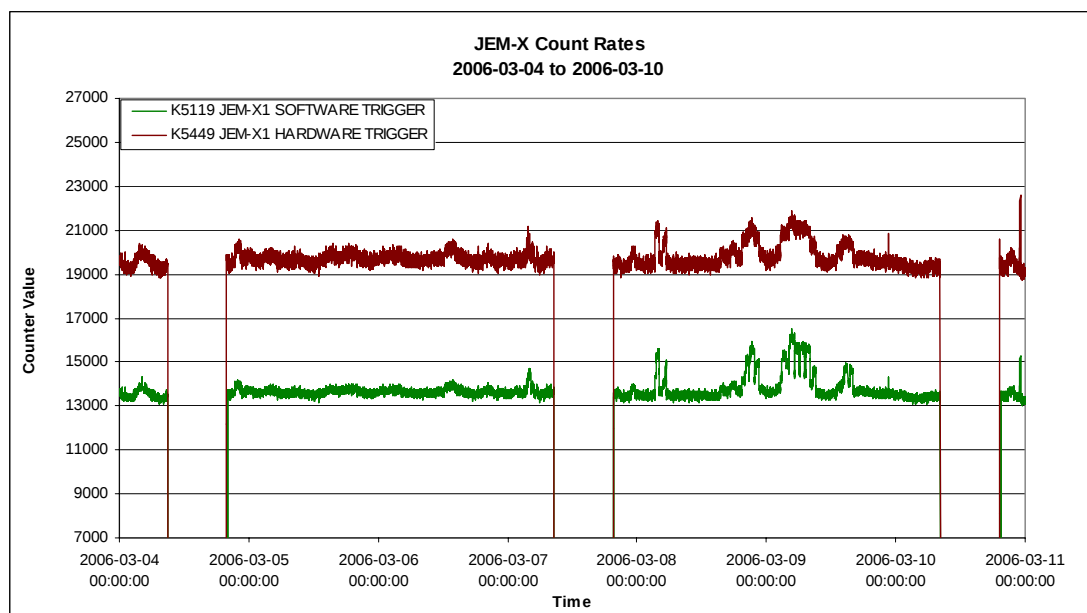
Inside the radiation belts, TM parameters G5007 (P0S-M2RTC1) and G5008 (P0S-M2RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

At 18:44Z, TM parameter G2084 (I0E-OVFWPXADD-M6) failed SCC and back. According to I-OVF-1, as this happened inside radiation belts, no action was taken.

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.

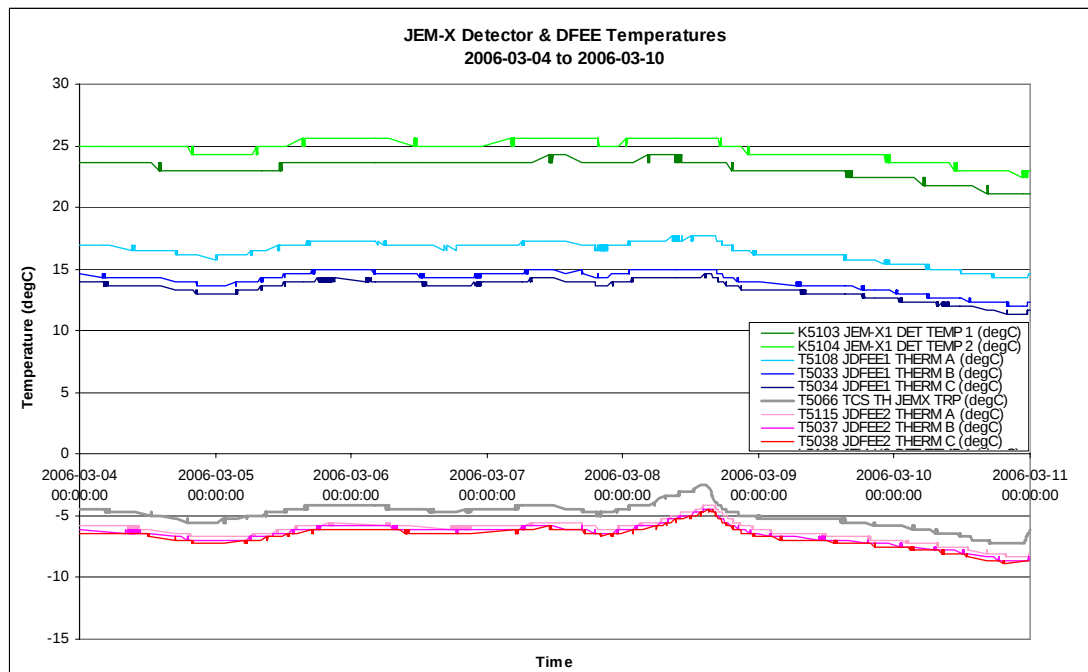


8.3.4.2 JEM-X Temperatures

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

2006-03-04 (DOY 063, Rev 413-414) to 2006-03-10 (DOY 069, Rev 415-416)

Nothing to report

8.3.5 OMC Operations

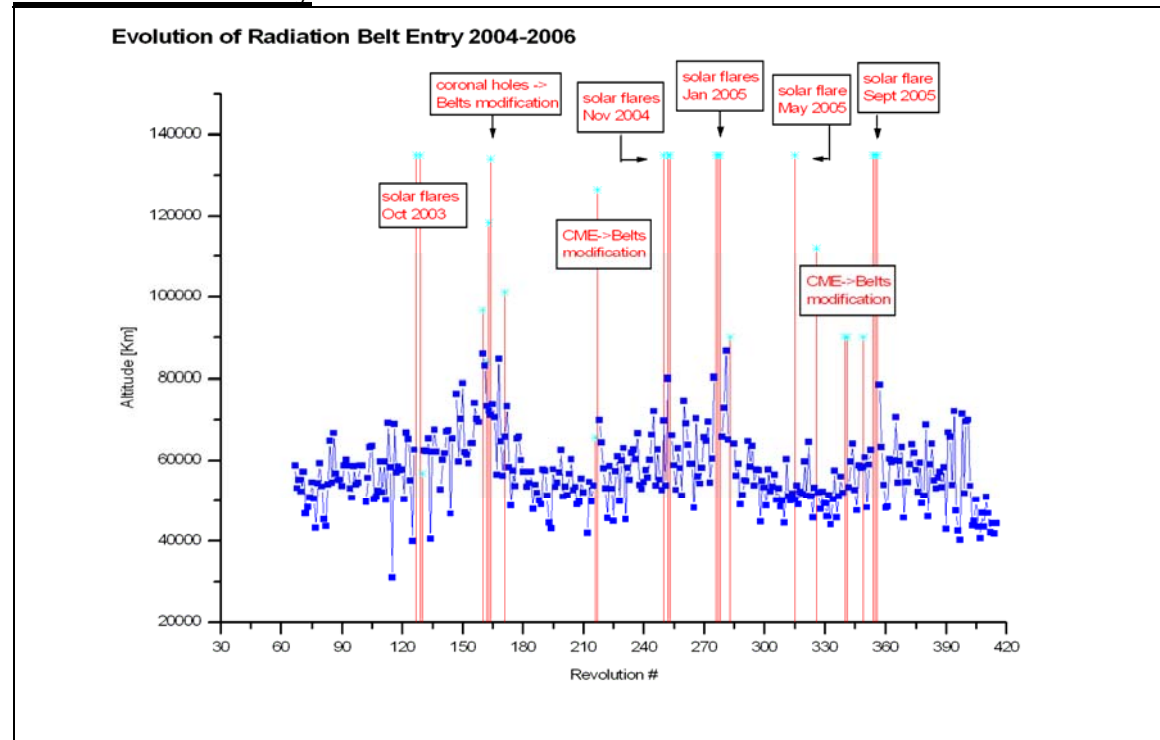
2006-03-04 (DOY 063, Rev 413-414) to 2006-03-10 (DOY 069, Rev 415-416)

Nothing to report

On DoY 063 at 10:16:55, DoY 066 at 09:58:31 and DoY 069 at 09:40:40 OMC was switched by the Timeline to SAFE mode, at the nominal time.

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]
413	RAD_ENTR R 2006-03-04T10:16:52Z	2006-03-04 12:13:35	<44365.0	2006-03-04 11:37:44	49675
414	RAD_EXIT R 2006-03-04T19:32:30Z	2006-03-04 18:46:07	>>23335.0	2006-03-04 18:47:44	32592
414	RAD_ENTR R 2006-03-07T09:58:28Z	2006-03-07 12:07:11	>41845.0	2006-03-07 11:26:54	48878
415	RAD_EXIT R 2006-03-07T19:14:21Z	2006-03-07 18:21:03	<<36463.8	2006-03-07 18:36:54	33462
415	RAD_ENTR R 2006-03-10T09:40:33Z	2006-03-10 11:37:51	<44402.4	2006-03-10 11:06:54	49519
416	RAD_EXIT R 2006-03-10T18:56:14Z	2006-03-10 18:11:35	>>2333..7	2006-03-10 18:16:54	32760

Reference

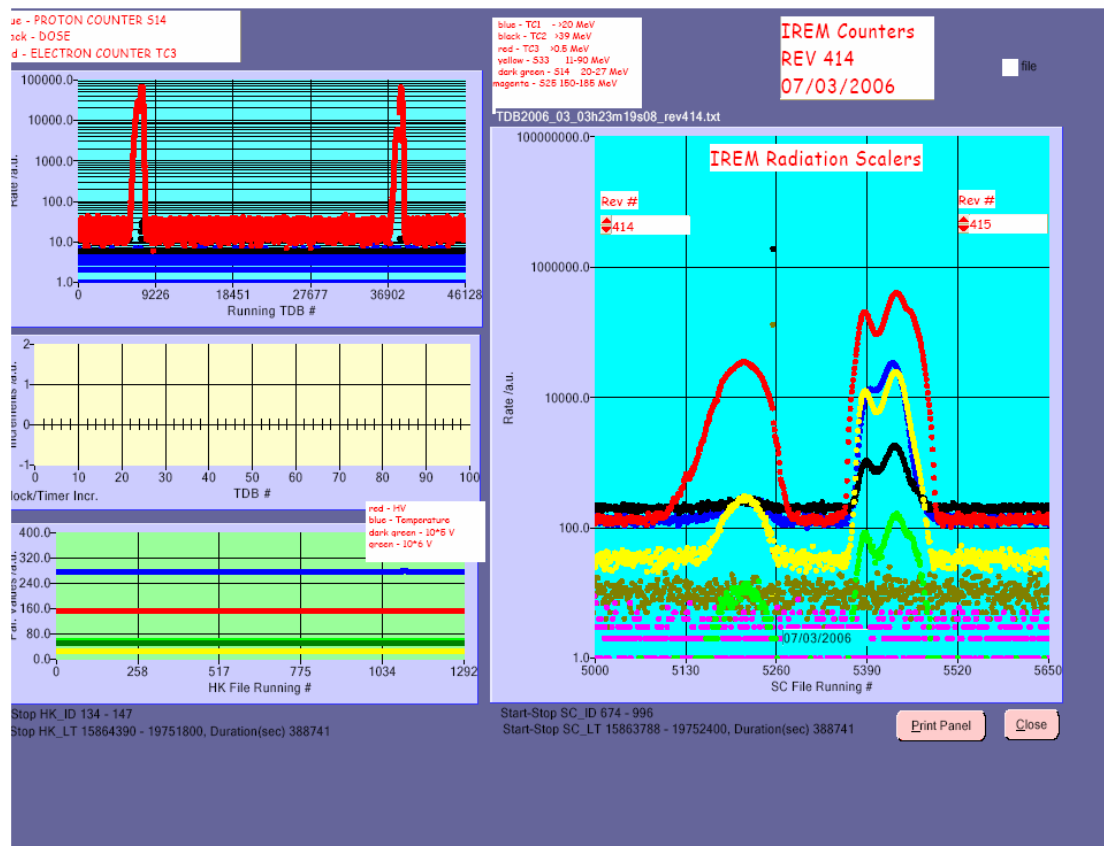
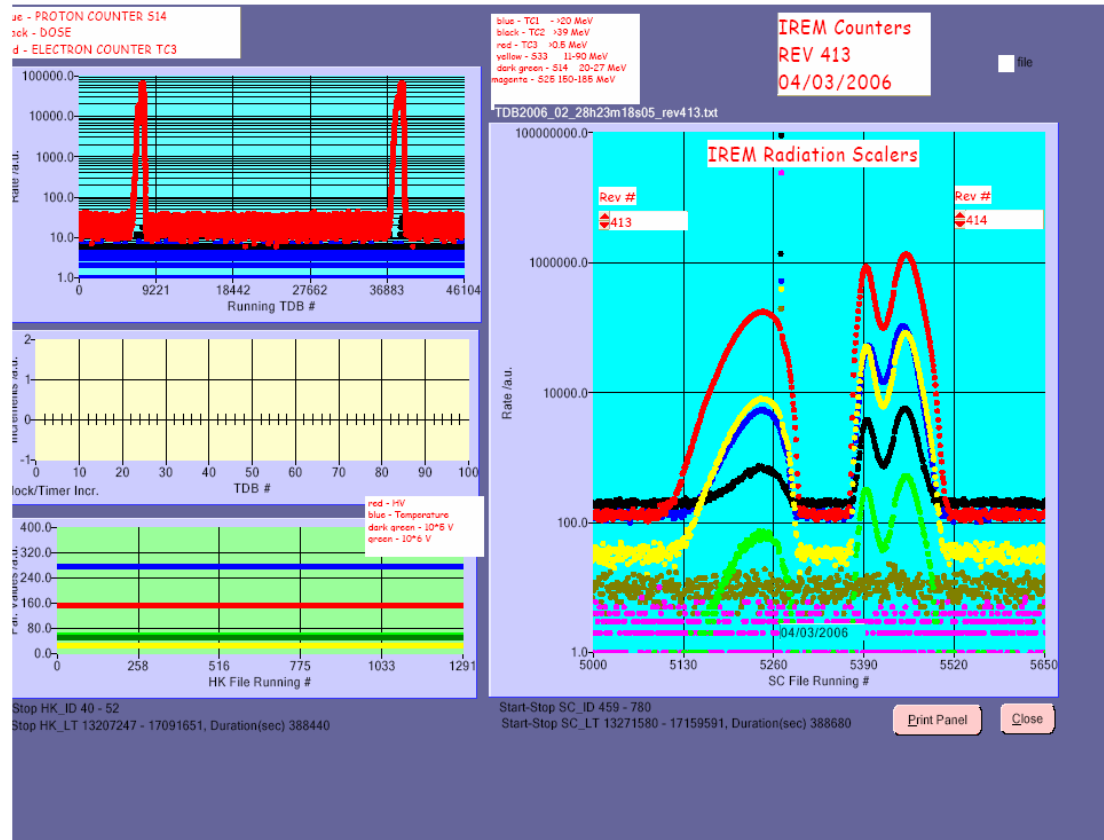
Very small error vs reference (less than 10 minutes)

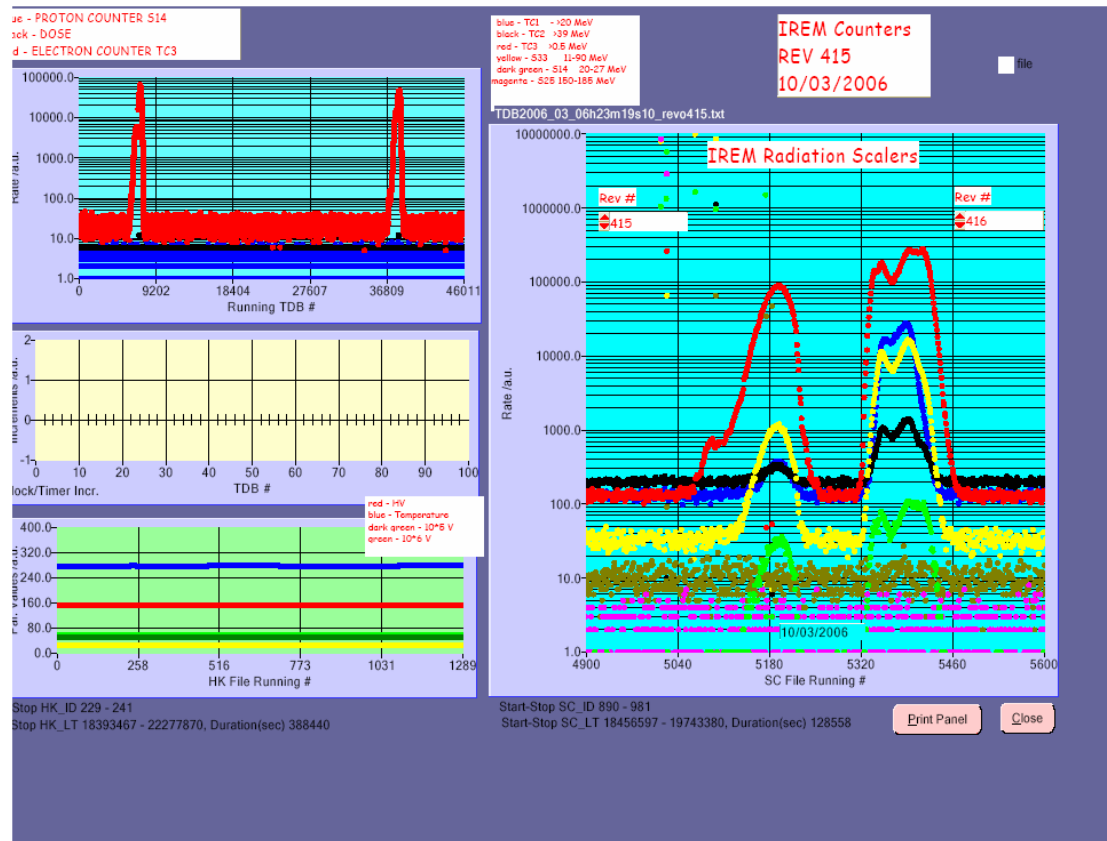
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

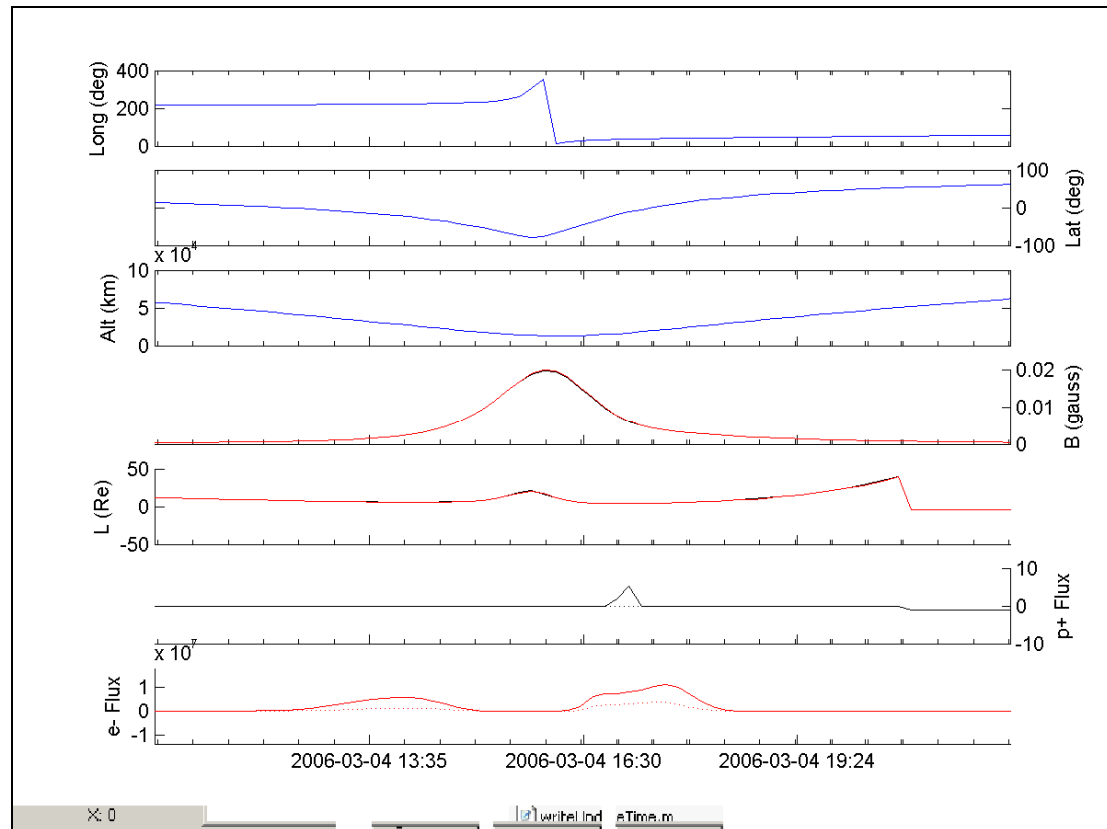
IREM radiation counters:



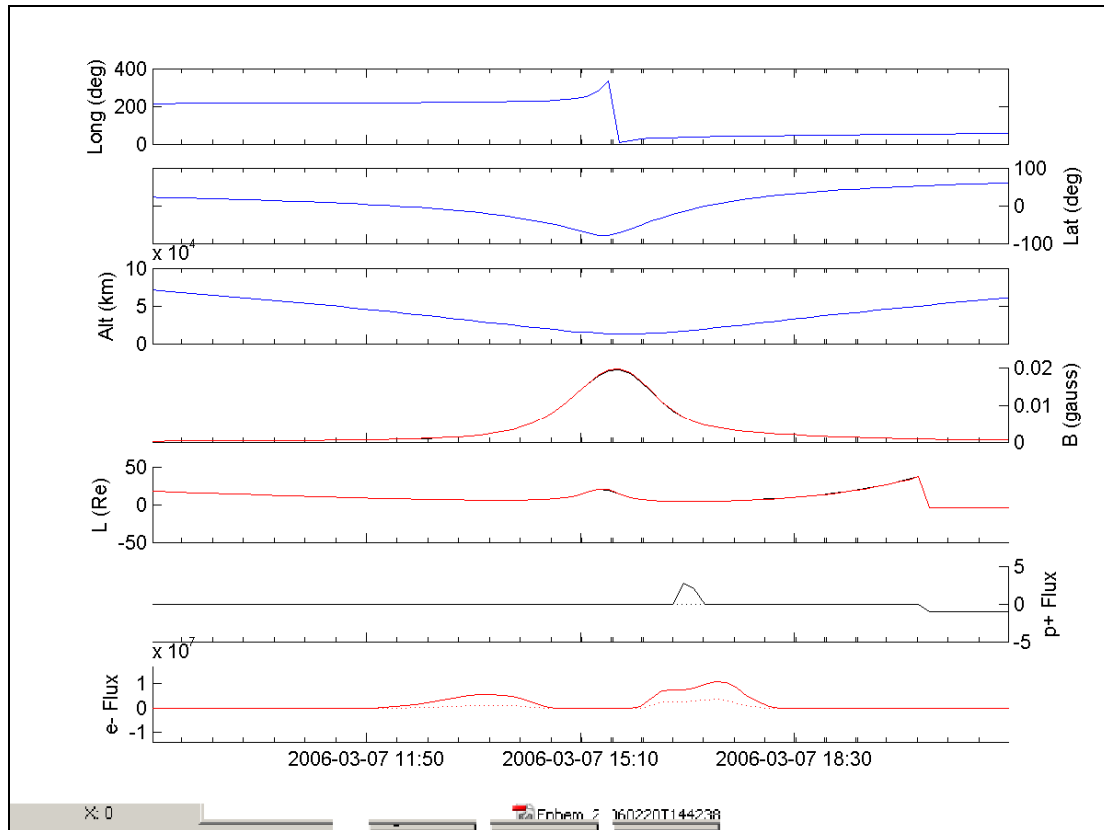


IREM Predicted Radiation Belt Passages:

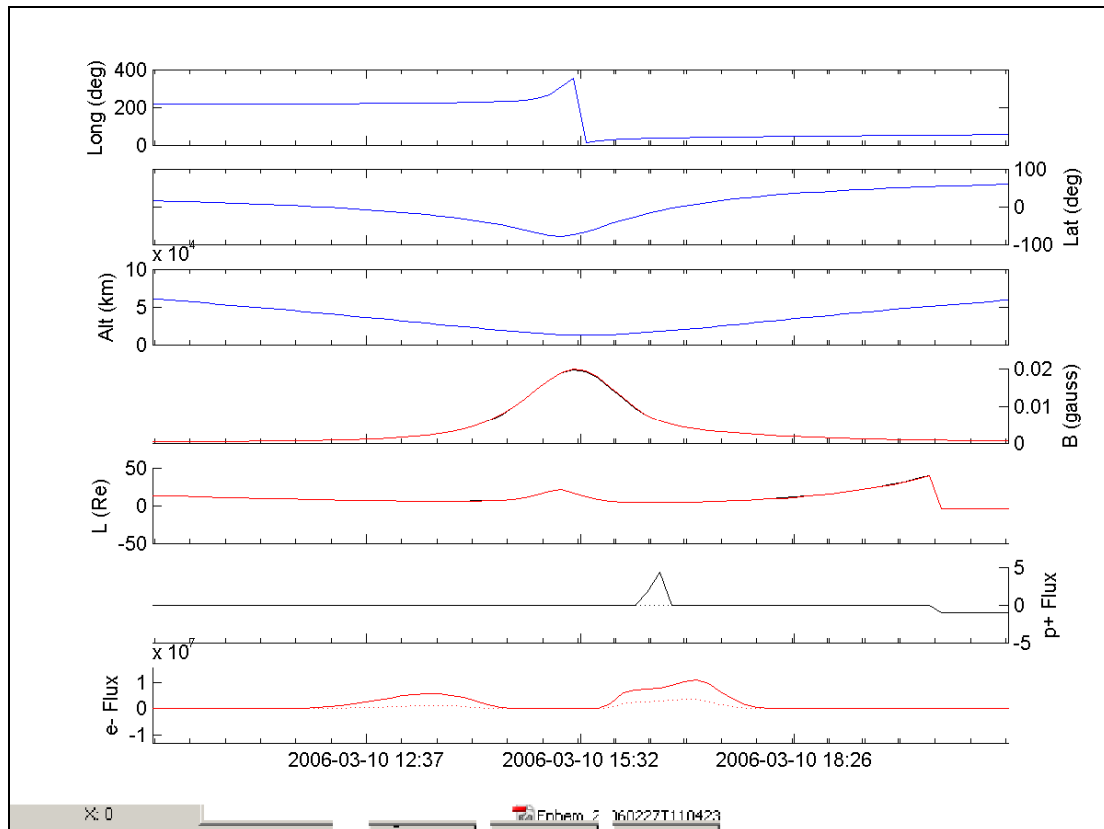
Rev 413



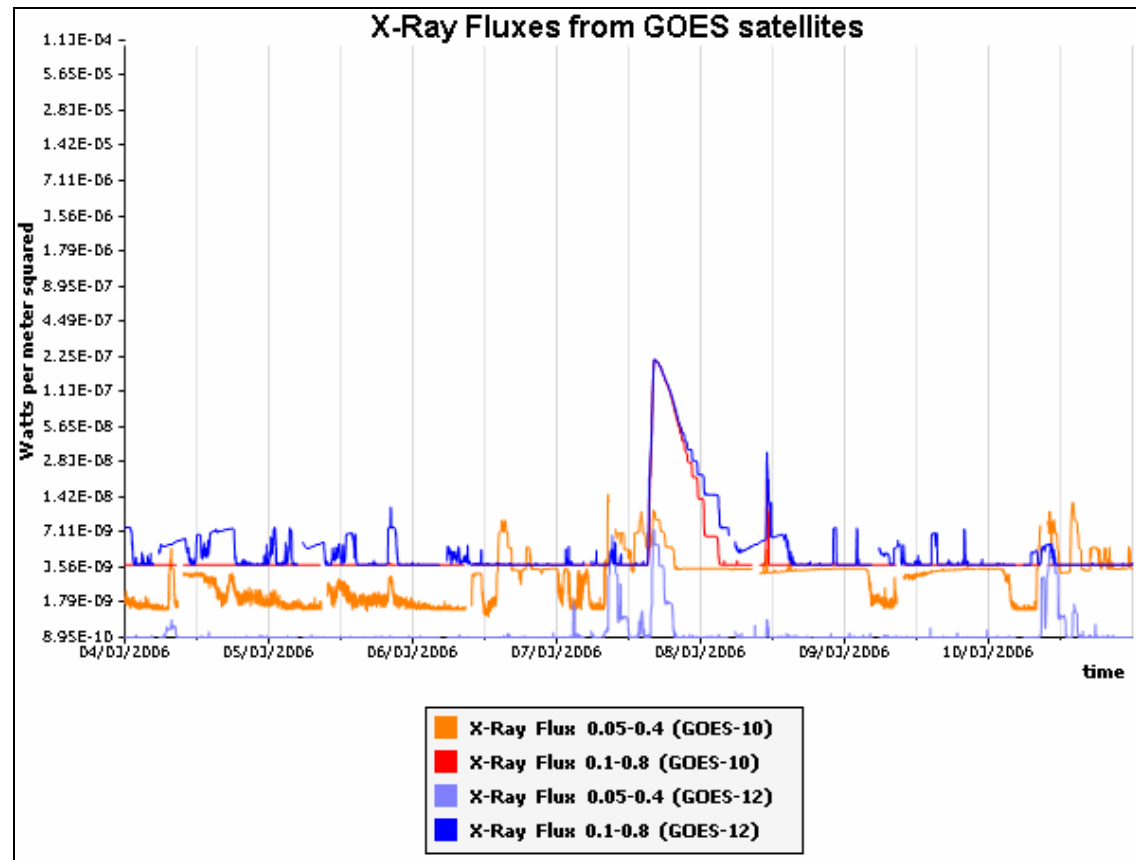
Rev 414



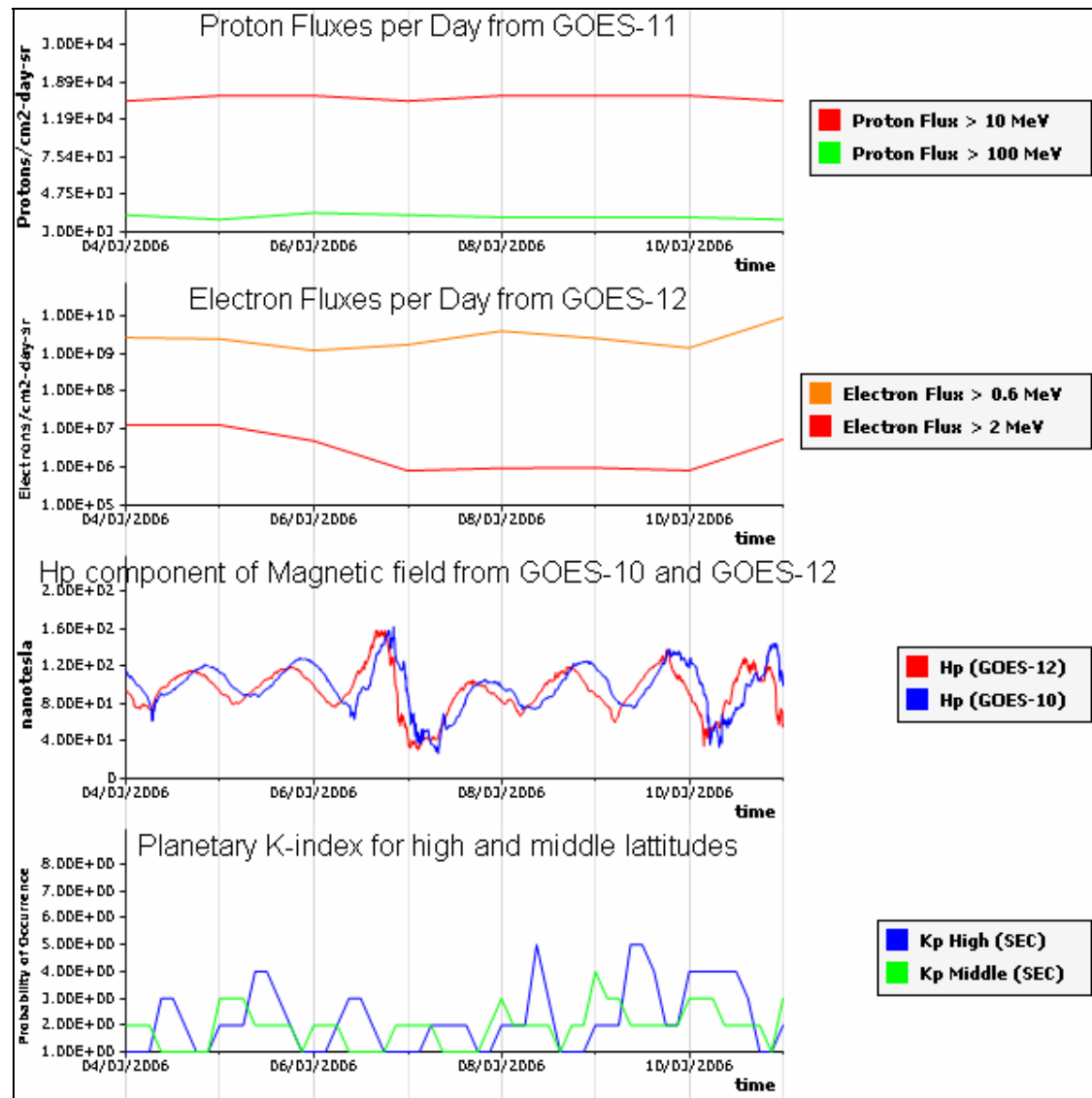
Rev 415



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



X-Ray fluxes start to be significant over 10^{-5} W/m² (corresponding to M-class flares). Above 10^{-4} W/m², they correspond to strong X-class flares.



Proton and electron flux are rather low, reporting no high 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.