

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 176
Week 05
06.02.06
Routine Phase

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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.....	4
3.1.4	OBDH.....	4
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.....	6
3.2.5	IREM	6
4	Ground Facilities.....	7
4.1	Mission Operations Centre.....	7
4.2	Ground Stations & Network.....	7
4.3	Science Ground Segment.....	7
4.3.1	ISOC	7
4.3.2	ISDC.....	8
5	Special Events.....	8
6	Anomalies.....	8
7	Future Milestones	9
8	Appendix.....	10
8.1	Overview of Revolutions	10
8.2	Consumables	10
8.2.1	Detailed Fuel Book-keeping.....	10
8.3	Detailed Satellite Information	11
8.3.1	AOCS SUMMARY OPERATIONS REPORT, 28/01/2006 – 03/02/2006	11
8.3.2	SPI Operations.....	17
8.3.3	IBIS Operations.....	21
8.3.4	JEM-X Operations.....	25
8.3.5	OMC Operations	28
8.3.6	IREM Operations	30

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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 28.01.06 until 03.02.06 (both dates inclusive) and covers the revolutions 402, 403 and 404 (The 2nd Earth Observation).

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 raster dither observations of Cen X-4 (RA 14:58:22.00; DEC -31:40:08.0) and SN1006 (RA 15:02:48.40; DEC -41:54:42.0), and a staring Earth Observation (RA 16:44:2.85; DEC -61:16:39.7).

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

3 Satellite Status

3.1 Platform

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

3.1.1 AOCS

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

The Second Earth Observation (EO2) activity was performed on 02-03 February 2006. The activity required special AOCS manual configuration with control loop based on FSS-A and IMU1. During the Earth observation period the STR was disabled from the ACC control loop and the IMU 1 selected for attitude control on Yaw axis. At the end of the activity the ACC was reverted back to FSS control on Roll and STR control on Pitch and Yaw. The AOCS special configuration foresaw an IMU calibration in order to reduce to the minimum the residual error.

4 slews were missed from the Timeline during this period due to problem on IMCS and DSS 24 station..

The fuel consumption over the period between 25/01/2006 and 02/02/2006 was 0.0996 kg. The remaining propellant is in the order of 156.5836Kg.

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

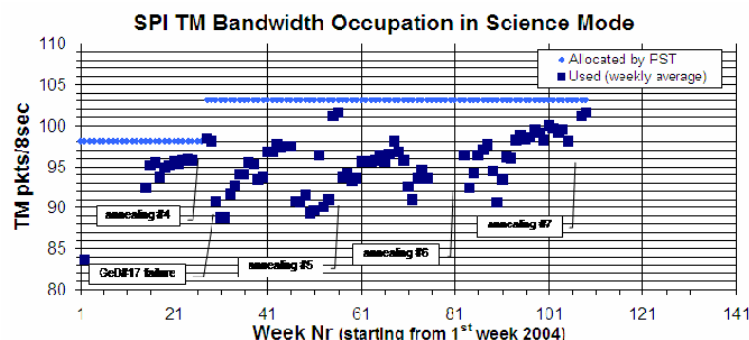
Following the 7th annealing, ended on 24th January, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #15, which is showing an anomalous energy resolution. Further details on this anomaly are reported under the AFEE section.

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 101.5 pkts/cycle.

The occupation bandwidth is therefore approaching saturation, following an increasing trend started a few weeks ago. If the trend does not revert or the bandwidth allocation is not increased, SPI could start losing science data in the forthcoming days.

The Stirling compressors are working 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.

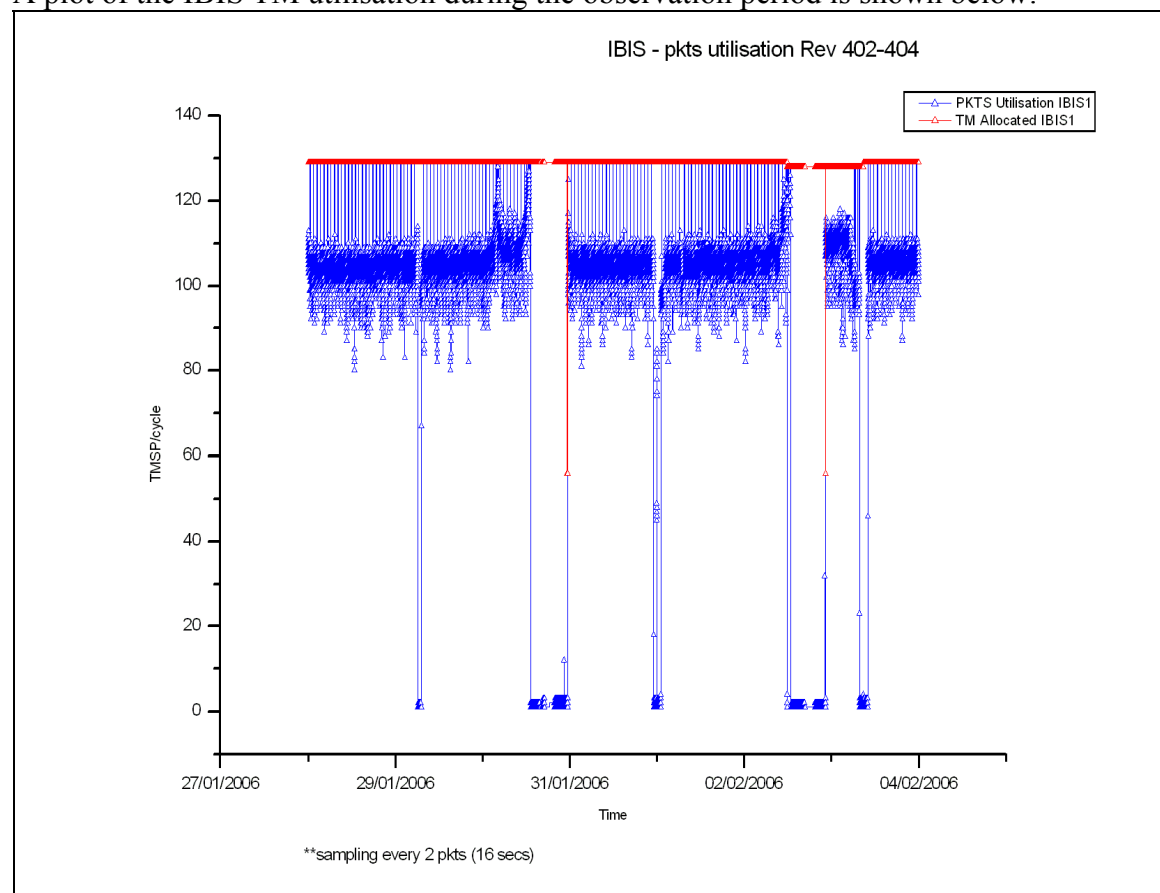
3.2.2 IBIS

The Overall status of the unit is nominal.

At the beginning of revolution 404, the second Earth Observation was performed. This activity was run with IBIS in Scientific Standard mode. No specific configuration was required except for the PST allocation (128 TMPS/cycle). The activity was completed nominally.

During the reporting period, the PST allocation to IBIS was 129 TMPS/cycle. However, during the Earth Observation (from 02/02/2006 11:59:24Z to 03/02/2006 08:57:00Z), due to the activation of both JEM-X1 and JEM-X2, it was set to 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 106.00 TMPS/cycle, down 3.53 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 and JEM-X2 were operated in Data Taking mode during science observations throughout the reporting period. JEM-X1 had a TM allocation of 8 packets/cycle and JEM-X2 had 1 packet/cycle, except during the Earth Observation at

the start of revolution 404 (2006-02-02T21:41:41Z - 2006-02-03T08:56:20Z) during which they had a TM allocation of 5 packets/cycle each.

During the periods in which JEM-X2 was in Data Taking with 1 packet/cycle, the JEM-X2 reactions to the Broadcast Packet TM Share information was disabled, such that JEM-X2 believed it had 8packets/cycle, in order to allow the grey filter algorithm to work as desired (ref: OCR-207 and INT_OR_0238).

The JEM-X2 TC L0021 SW READ INT, uplinked as part of the ED LESAFE02 before radiation belt entry of revolutions 402 and 403 were rejected on board, as at the time of uplink JEM-X2 did not have enough TM allocation to downlink the report packet and by the time the TM allocation to JEM-X2 was increased, the unit was in Safe mode and therefore the report command was invalid. This is understood as a consequence of this special configuration of JEM-X2 for the revolutions around the Earth Observations.

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, 136 of the 140 planned science pointings for OMC were executed nominally, one was delayed by ground station connection problems, one was interrupted by an IREM SEU, and one lost with another delayed by problems at the MOC.

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.

The Sun was blank for the entire observation period. No Threat of solar flare was posed



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, 2 pointings were lost and 2 delayed. There were several minor problems with ground station links which 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. Problems with the tpf transfer, however, caused the loss of 1 pointing, and the delay of another. The overall performance was still well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. A non-science pointing was lost, and a science pointing delayed by ground station link problems. There were also several instances of bad frames and a few TM drops, but these had no impact on the mission. The overall performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Earth observations

The first observation was successfully and smoothly performed. A go ahead meeting with all parties involved was held this week in ISDC. It was unanimously agreed that the earth observations should continue. Therefore the three prepared observations in revolutions 404 to 406 will be performed as planned.

2. Mission planning

PSF's have been received for up to revolution 414. Mission planning in ISOC has been performed up to revolution 413. They have been sent to MOC. Revolutions 407 and 408 had to be regenerated to adjust JEM-X instrument setting. No replanning due to ToO was done this week. However the ToO of the source XTE J1817-330 that was pending since a couple of weeks was finally approved and the observation was included in revolution 408. This caused the planned OMC flat field calibration to be moved to revolution 409. One ToO request of the source CYG-X3 is still pending the

source to reach the state defined as trigger criteria. TSF's up to revolution 406 have been received.

3. Observation status

No ECS was received this week.

4. ISOC science data archive

The testing of the beta release has continued extensively. It is the intention to release this version to an external audience on 13 February. A coordination meeting was held with ISDC this week. This meeting sorted out quite some issues. This type of coordination meetings have proven very useful. They will continue at regular intervals.

5. ISOC system

The version 12.0 is still in use. No problems detected. A version 12.1 is planned for release early next week. With this version the handling of Key Programme proposals is fully supported within ISOC. A meeting with ISDC this week resulted in full agreement on the necessary interface changes between ISDC and ISOC.

6. AO 4 preparation

At the end of this week all AO 4 documents have reached the desired state. They are currently reviewed by the Mission Manager. It is planned to finalise the documentation during next week. With the introduction of the ISOC system version 12.1 the system is ready to support the user testing planned for the week after next.

7. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 06/02/2006:

- Latest Standard Analysis completed: observation 03200560001 (Cas A /Tycho, Revolution 386-395) on 05/02/2006
- Latest products archived: observation 03297000001 (GRO J0852-4642, Revolution 373-383) on 20/01/2006
- Latest observation products sent to the observer: observation 03200930001 (GX 17+2, Revolutions 369-370) on 02/01/2006

5 Special Events

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 030, at 11:26, problems with the link to Redu caused an AOCS TC to fail release, a recovery performed and the Timeline rejoined at 12:09. The impact was a 43 minute delay in the start of pointing 040200064.
- At 15:56, the links with DSS-24 dropped causing the loss of pointing 04020066. This was the last slew of the revolution, no recovery was necessary
- On DoY 034, at 08:31, OSL 04040006 failed to go, as the tpf was not received in time. After a recovery the timeline was rejoined at 10:10, the impact was the loss of pointing 04040006, 04040007, and a 15 minute delay in the start of pointing 04040008.

The following new anomaly reports were entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
INT_SC-138	30/01/2006	IBIS: VETO VDM 16 High Voltage break down	Payload	Open
INT_SC-139	01/02/2006	IREM Anomaly: jump in the Dose count-rate (U9920)	Payload	Open
INT_SC-140	07/02/2006	GeD#15 degradation following RWB, after EO#1 pointing	Payload	Open
INT-2833	07/02/2006	Ground Station Delay difference of 40 micro seconds	ESA Station	Pending

7 Future Milestones

Preparation is on-going for the earth observations, taking place this week and next.

The upgrade of the IMCS has been delayed for incorporation of an urgent fix which has become available from infrastructure, new release date will probably be early March depending upon the time taken to integrate and test this patch.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 402

The observations in revolution 402 consisted entirely of a raster dither of Cen X-4 (RA 14:58:22.00; DEC -31:40:08.0) lasting ~58.3 hours.

Revolution 403

The observations in revolution 403 consisted of a raster dithering observation of Cen X-4 (RA 14:58:22.00; DEC -31:40:08.0) lasting ~60 hours, followed by a staring observation at the Earth Observation attitude (RA 16:44:2.85; DEC -61:16:39.7), performed for the remaining ~40 minutes of observation time.

Revolution 404

The observations in revolution 404 began with an Earth Observation (RA 16:44:2.85; DEC -61:16:39.7) lasting ~10 hours. A raster dithering observation of Cen X-4 (RA 14:58:22.00; DEC -31:40:08.0) lasting ~24 hours was then performed, followed by a raster dithering observation of SN1006 (RA 15:02:48.40; DEC -41:54:42.0) lasting ~25 hours. A staring observation at the Earth Observation attitude (RA 16:42:36.91; DEC -61:06:42.1) was then performed for the remaining ~40 minutes of observation time.

Throughout these observations SPI, IBIS and both JEM-X units were in their nominal science modes. For the pointings at the Earth Observation attitude OMC was in FFCalibration mode and the TM allocation was IBIS 128; SPI 103; JEM-X1 5; JEM-X2 5; OMC 5 and otherwise OMC was in Science Normal mode 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

2006-01-15T15:06:29.000Z	156.8560	F	Automatic TM processing.
2006-01-15T17:39:41.000Z	156.8545	F	Automatic TM processing.
2006-01-15T21:53:41.000Z	156.8355	F	Automatic TM processing.
2006-01-16T06:54:14.000Z	156.8177	F	Automatic TM processing.
2006-01-18T17:24:21.000Z	156.8031	F	Automatic TM processing.
2006-01-18T22:14:53.000Z	156.7816	F	Automatic TM processing.
2006-01-21T21:19:41.000Z	156.7708	F	Automatic TM processing.
2006-01-22T04:22:54.000Z	156.7490	F	Automatic TM processing.
2006-01-24T14:23:40.000Z	156.7175	F	Automatic TM processing.
2006-01-25T08:45:34.000Z	156.6832	F	Automatic TM processing.
2006-01-27T15:21:16.000Z	156.6670	F	Automatic TM processing.
2006-01-27T16:36:52.000Z	156.6600	F	Automatic TM processing.
2006-01-27T20:49:48.000Z	156.6390	F	Automatic TM processing.
2006-01-30T20:31:41.000Z	156.6112	F	Automatic TM processing.
2006-02-02T13:20:12.000Z	156.5836	F	Automatic TM processing.

This report was generated Fri Feb 3 08:00:28 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, 28/01/2006 – 03/02/2006

AOCS operations were executed from the Automatic Timeline with the exception of the special AOCS (manual) configuration foreseen for the first Earth Observation on DoY 033-034.

During this period, 51 Open Loop Slews, 95 Closed Loop Slews and 3 Momentum Bias were executed (TL + EO2 configuration).

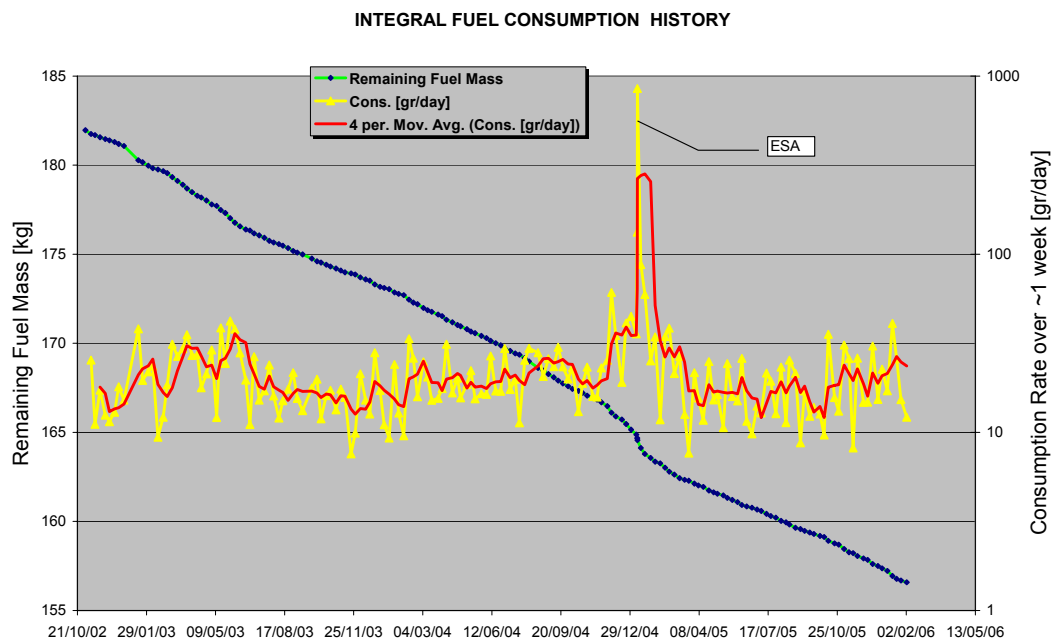
4 (2OSL, 2CSL) slews were missed from the Timeline during this period due to problem on IMCS and DSS 24 station.

Orbit Control

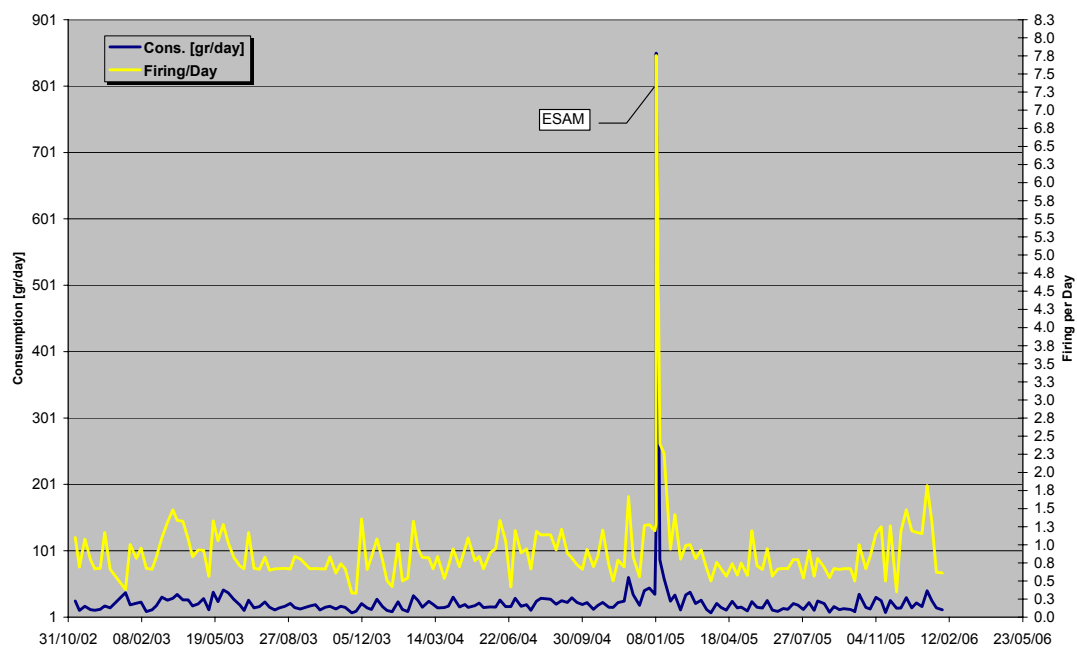
At present time the plan is to reverse the control and to increase the semi-major axis as from mid April 2006 and onwards. The "Redu only" situation could then be reached in the second half of 2006, possibly mid August. The apogee longitude would then be about 32 deg East. Plot provided on monthly basis

Fuel consumption

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

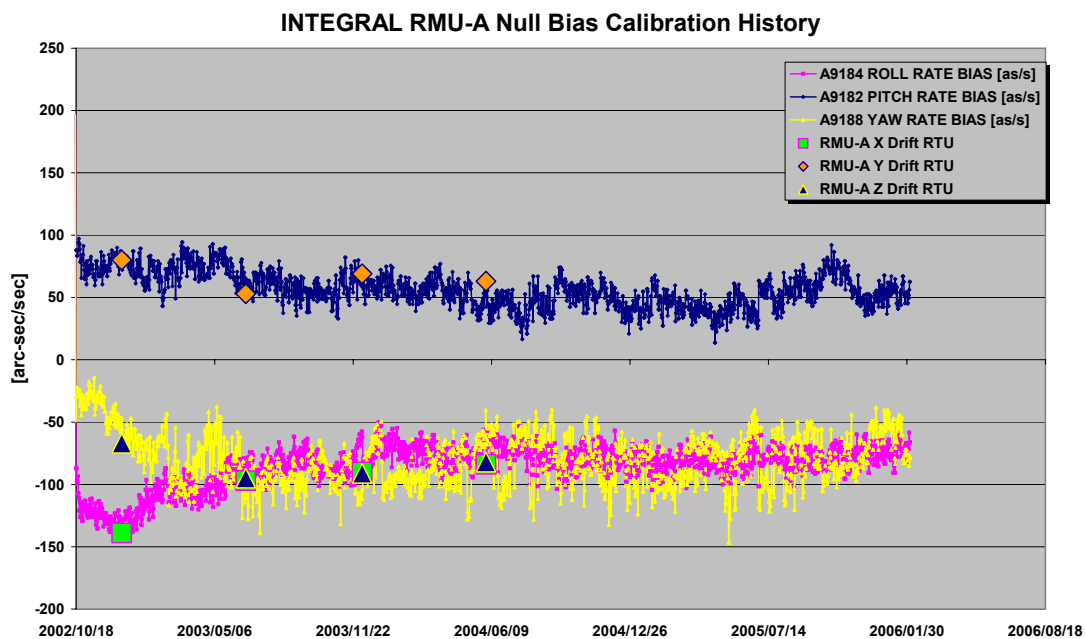


The firing\day over the period between 01/11/2002 and 02/02/2006 is reported in the plot below.

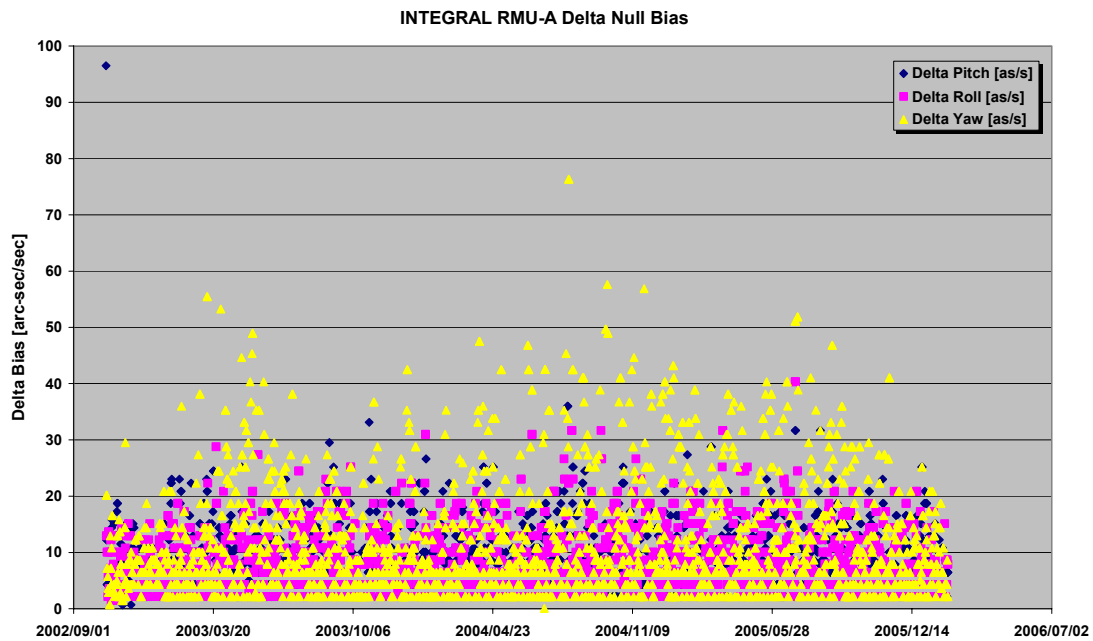


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 03/02/2006 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 03/02/2006 is reported in the plot below.



28/01/06 (Day of Year 028, Revolution 402)

Nothing to report.

29/01/06 (Day of Year 029, Revolution 402)

Nothing to report.

30/01/06 (Day of Year 030, Revolution 402-403)

Slew missed from the Timeline: At 15:56Z, due to a problem on the DSS24 station, the slew ID 04020066 (CSL) failed release.

The AOCS s/s was disabled from TL at 15:57Z, but no manual recovery was performed being the S\C at LOS perigee and the perigee safe attitude already reached. After Having checked the attitude constraints, the guide star validity and the RWs speeds across the perigee passage was decided by FCT and FD to not perform any recovery at start of rev 403.

AOCS s/s was re-enabled at the beginning of rev 403.

The following slew ID 04020066 (CSL) was not executed from the TL.

31/01/06 (Day of Year 031, Revolution 403)

Nothing to report.

01/02/06 (Day of Year 032, Revolution 403)

FDS failed slew update: At 10:45Z the FD system failed the update of slew ID 04030039 (OSL). The slew update was promptly manual performed by operator and

no impact on TL was reported. The reason of the update failure is still under investigation.

02/02/06 (Day of Year 033, Revolution 403-404)

EO2 Second Earth Observation 02-03 February 2006: the aim of the activity was to point towards the centre of the Earth at perigee + 6 hours (i.e. above 40000 Km). Integral reached the 'EO attitude' ~09 hours 56 min before it violated the STR Earth Limb constraint (>15 deg) and the Earth left entering in the STR FOV. The STR use was disabled at 21:27Z and the IMU 1(Z) was selected for attitude control on Yaw axis. As soon as the STR use was disabled, the ACC switched control to FSS-A on Roll and Pitch and IMU1 on Yaw. The IMU1 (Yaw channel) was calibrated and the AOCS configured for the Earth observation activity by following the AOCS detailed Timeline reported below:

03/02/06 (Day of Year 034, Revolution 404)

EO2 Second Earth Observation 02-03 February 2006: At 06:35Z the STR use was re-enabled, the ACC switched control to STR on Pitch & Yaw and FSS on Roll. The S/C attitude was not inertial, due to the residual IMU drift on Yaw (not corrected by the calibration) and FSS-A following the apparent motion of the Sun on Roll and Pitch: therefore the attitude at the end of observation was slightly different (~ 8 arcmin difference) wrt the initial 'EO attitude'.

Hereafter is reported a summary of AOCS performances during the EO1

Attitude

Initial EO attitude (at STR disabling, 22: 08:Z)

RA 16:45:07
DEC -61:13:46
POS 075:39:15

alpha F=0.28 deg
beta F=-26.58 deg

RW2=+2130 rpm
RW3=+2016 rpm
RW4=-2078 rpm

Final EO Attitude (at STR re-enabling, 06:35Z)

RA 16:47:45
DEC -61:26:19
POS 075:16:27

alpha F=0.33 deg
beta F=-26.54 deg

RW2=+2315 rpm
RW3=+2044 rpm

RW4=-2286 rpm

The STR boresight deviation wrt the target was estimated about 8.3 arcmins over a period of 4 hours 12 minutes (STR blinding period).

Inertial Measurement Unit (IMU)

The Drift correction on the IMU-1 Yaw channel, as calculated by FD during a period of 113 minutes was

15:00:00Z	Calculated by FCT :	Calculated by FD:	
to	IMU1 Noise Roll = 0.1844 as/s IMU1 Drift Roll = 0.1925 as/s IMU1 Noise Yaw = 0.0519 as/s IMU1 Drift Yaw = 0.1158 as/s	=> 0.1892 as/s => 0.1134 as/s	Stable pointing
16:53:00Z			

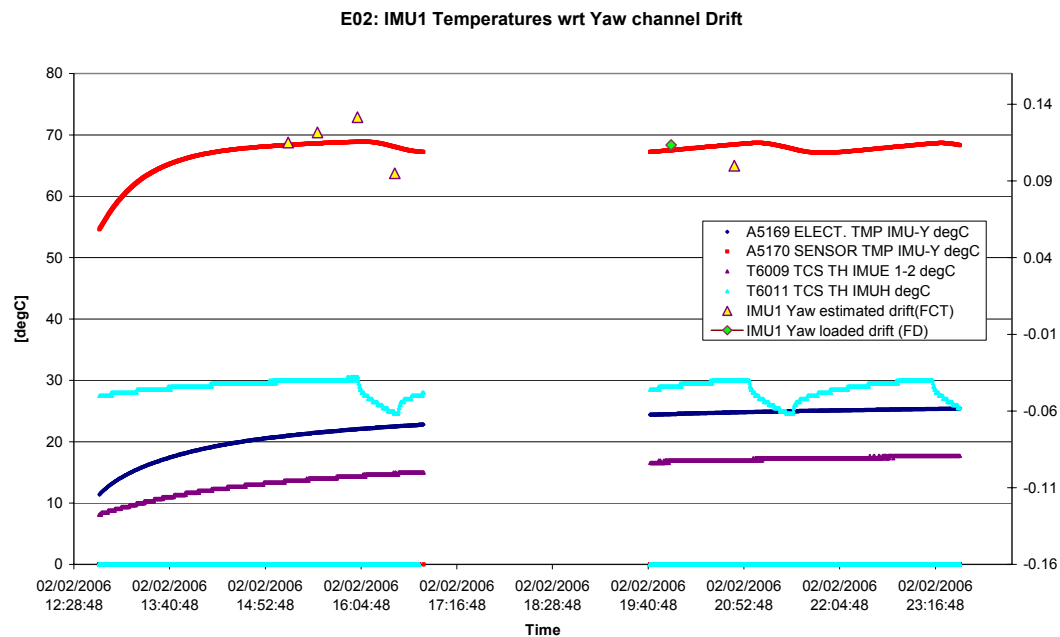
The loaded drift correction on-board was 0.1134 as/s.

Drift in IMU-1 Yaw channel estimated during the calibration, by FCT, was 0.1158 as/s

Drift in IMU-1 Yaw channel estimated at EO2 exit, by FCT, was 0.1628 as/s

The estimated (FCT) residual drift was ~0.03 as/s (at 03:02Z).

Still observed during on the IMU a small thermal effect induced by heater cycle in the IMU electronic head. The plot below shows the evolution of the IMU1 temperatures during the initial warming-up (~2 hours) and the following calibration period (~2 hours) together with the Yaw drift estimation from FCT and FD.



Star Tracker (STR)

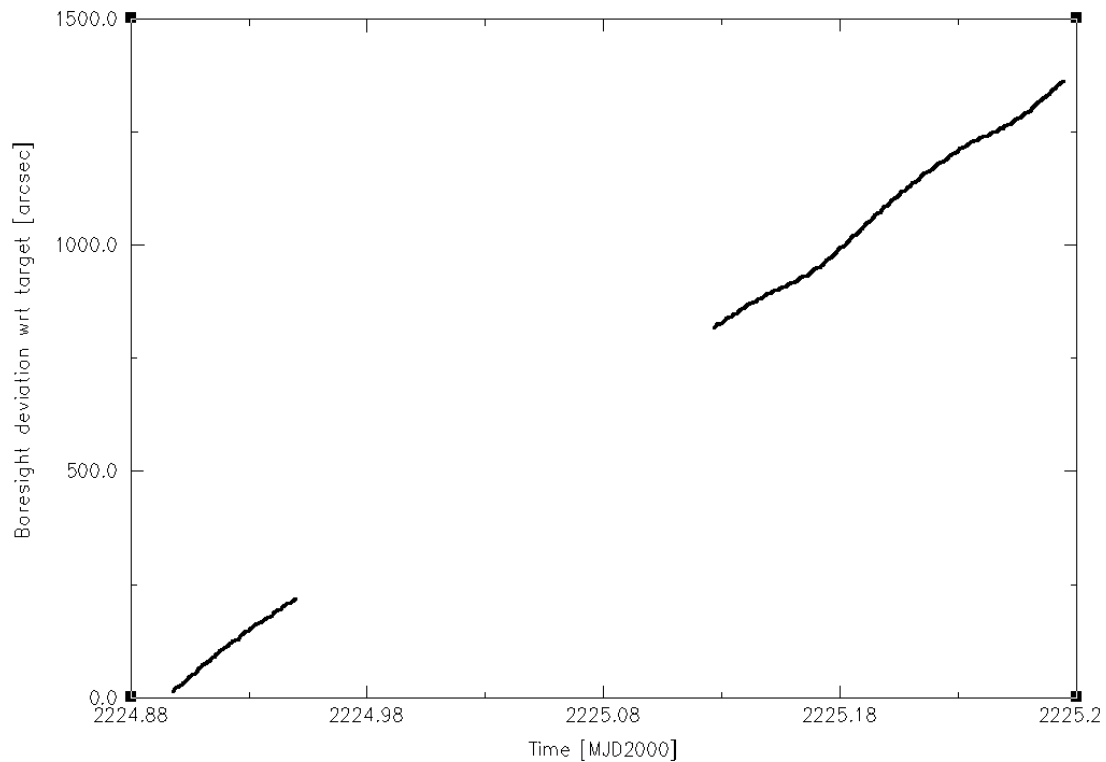
STR reported star lost on 02/02 at 22:48Z with background ~3900 mV

- Earth limb was at ~6.55 deg from the STR boresight.
- Guide star was Mi 5.2 at (22:41Z) CCD coordinates [2632, 481]

STR reported star tracked on the 03/02 at 03:02Z with background ~3330 mV

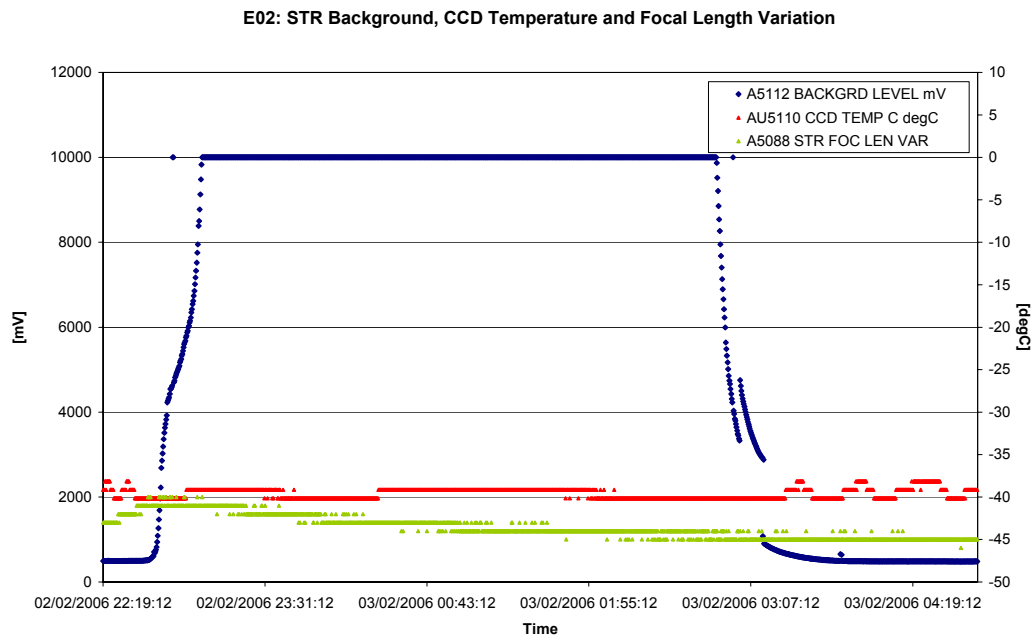
- Earth's Limb was at ~5 deg from the STR boresight
- Guide star was Mi 6.5 at CCD coordinates [12167 , 8476]

The plot hereafter shows the evolution of the STR boresight error (w.r.t. the target attitude for the Earth observation) during the period under IMU control to the point where STR control was re-enabled. The gap in the plot is the period where there is no STR data available.



(courtesy M. Tuttlebee, FD Team)

The plot below shows the evolution of the STR background and CCD temperature parameter during the occultation of the STR FOV by the Earth.



Slew missed from the Timeline: At 08:31Z, during the AOCS reconfiguration after EO2, due to a problem on the Command Verifier task on IMCS, the slew ID 04040006 (OSL) failed release.

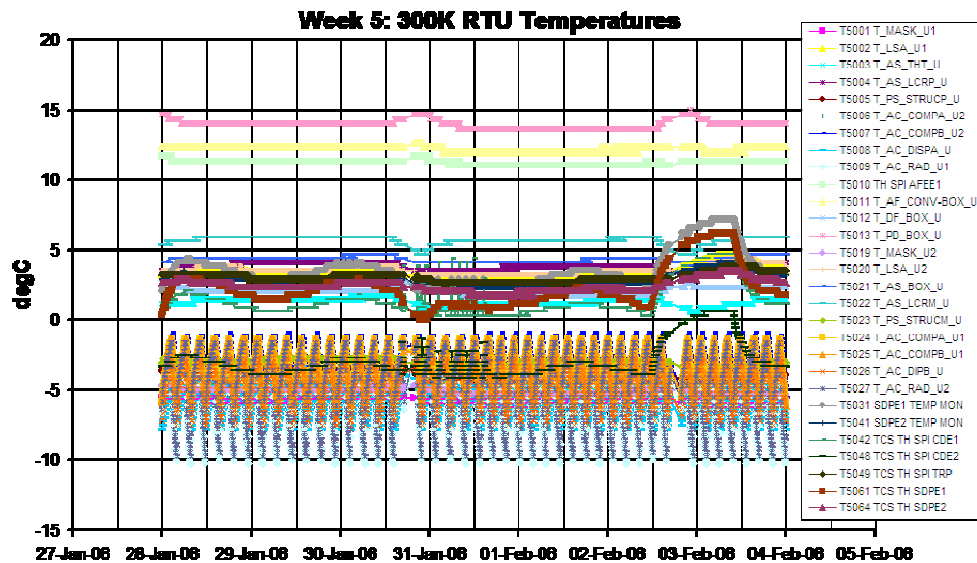
The AOCS s/s was maintained disabled and the manual recovery (EO reconfiguration) continued in order to re-join the TL for PID 04040009. The update for the next slew (ID 04040009) from TL was performed at 10:18Z and the AOCS s/s was re-enabled at 10:20.

The following slews, 04040006 (OSL)-07(CSL)-08 (OSL) were not executed from the TL.

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.

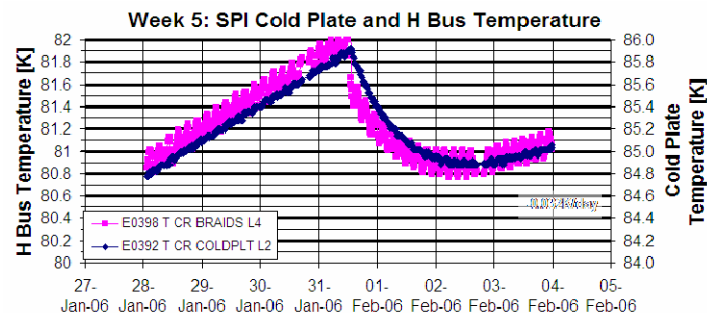


Stirling Compressors and Cryostat:

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

The stroke was adjusted from 4x34 to 4x35 to compensate for the drift.

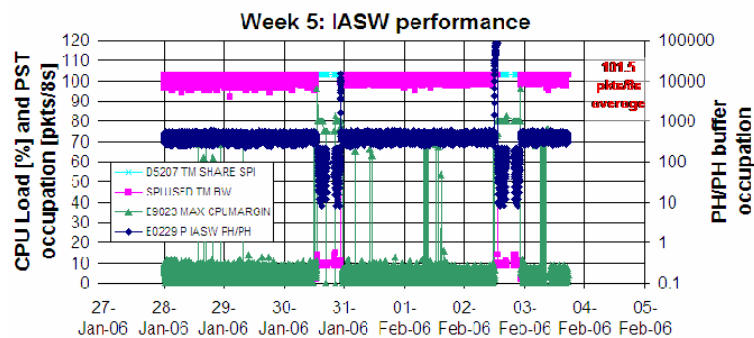
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



DPE & IASW:

The Iasw performance is nominal. The current version installed is 4.32.

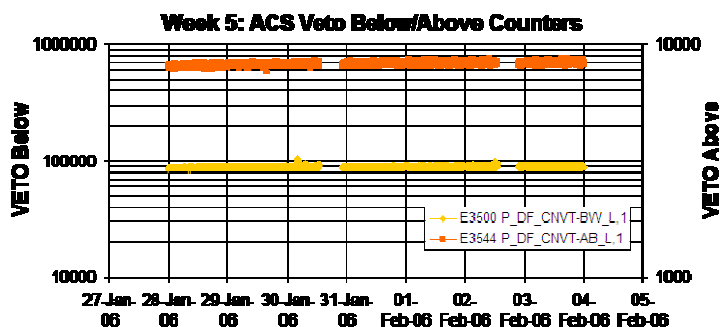
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



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 was 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) with the id. INT_SC-140.

The performance of detector #15 was nominal immediately after the annealing. The energy resolution of the 198 keV line suddenly degraded on January 25th between 8:30 and 9:00, about a day after the end of the annealing and the subsequent Earth Observation #1 (EO#1).

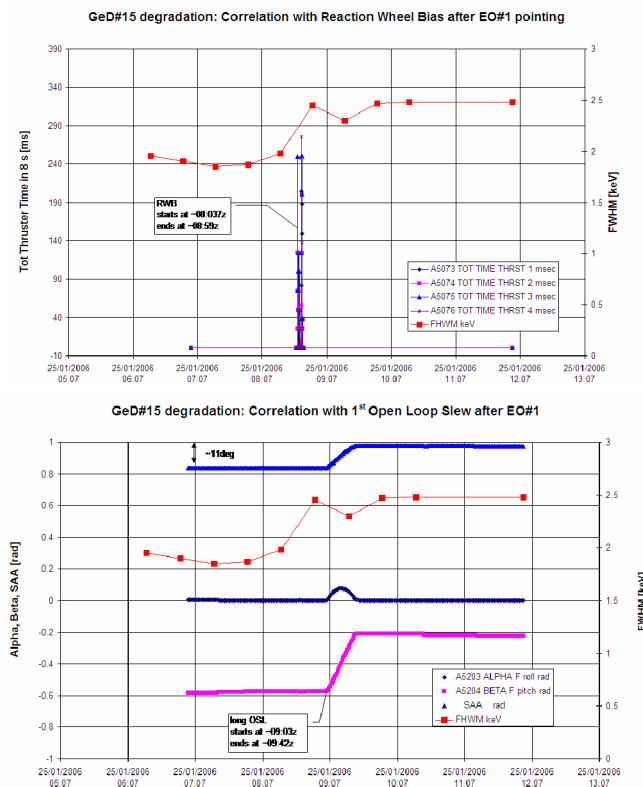
The degradation was significant +20 % and did not evolve. The results are summarized in the next table (last column).

	Photons	Peak nrj	Peak keV	Sigma keV	FHWM keV	
6H24 to 6H54	4850,87	1462,26	198,14	6,15	1,95	
6H54 to 7H24	4788,06	1462,36	198,15	5,99	1,9	
7H24 to 7H54	4811,5	1462,13	198,12	5,83	1,85	
7H54 to 8H24	4949,48	1462,32	198,14	5,9	1,87	
8H24 to 8H54	4830,24	1462,36	198,15	6,25	1,98	
8H54 to 9H24	4837,52	1462,11	198,12	7,73	2,45	(ANOMALY)
9H24 to 9H54	4751,5	1462,1	198,12	7,25	2,3	
9H54 to 10H24	4749,09	1461,96	198,1	7,79	2,47	
10H24 to 12H24	19498,16	1461,7	198,06	7,83	2,48	

It is recalled that GeD#15 had a bad energy resolution immediately after launch, cured with the first annealing.

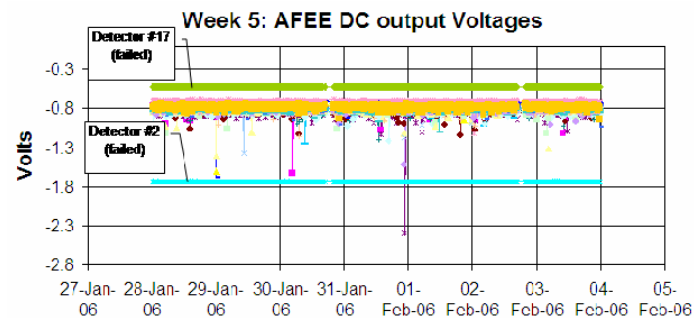
The AOCS timeline of EO#1 shows that just before the resolution degradation, a Reaction Wheel Bias (RWB) was undergoing. This was followed by a long Open Loop Slew (OSL) to go from EO attitude to the first observation point of the POS.

The first of the following two plots shows the correlation of the anomaly with the RWB thruster firings, the second one with the OSL.



It seems therefore that the degradation could be correlated to the RWB. However further analysis is required to confirm if it is the cause and not just a coincidence.

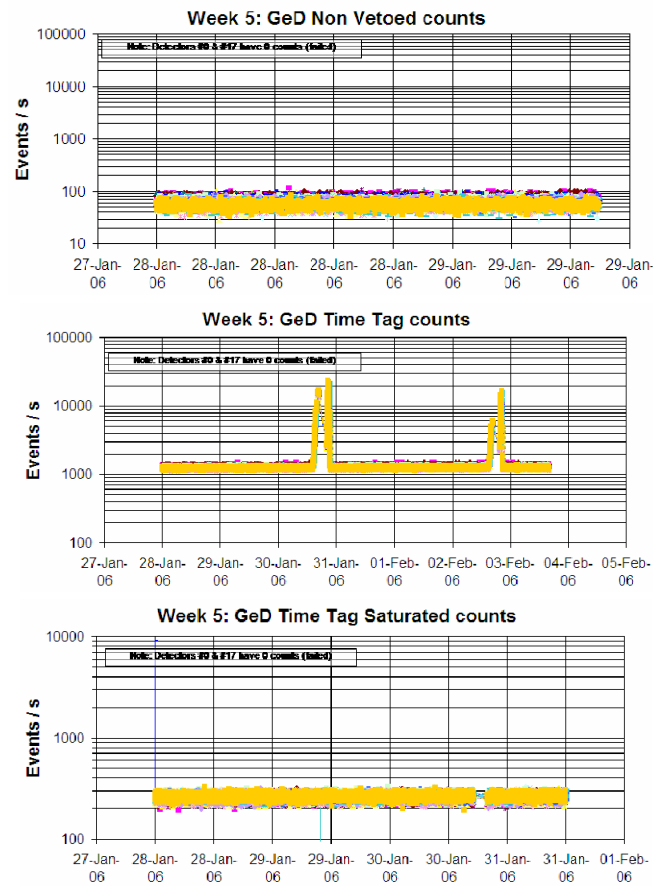
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004.



DFEE:

The performance of the unit is nominal.

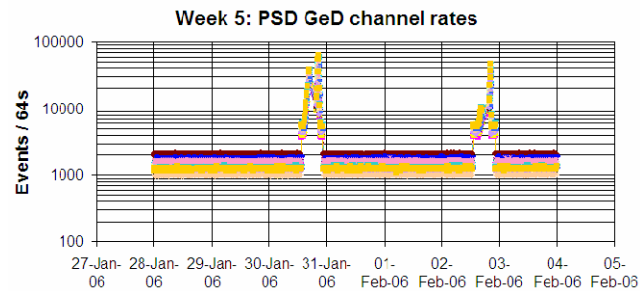
The following plots show the count rates of the detectors during the reporting period (due to problems in the data retrieval tool, some gaps could be present).



PSD:

The performance of the unit is nominal.

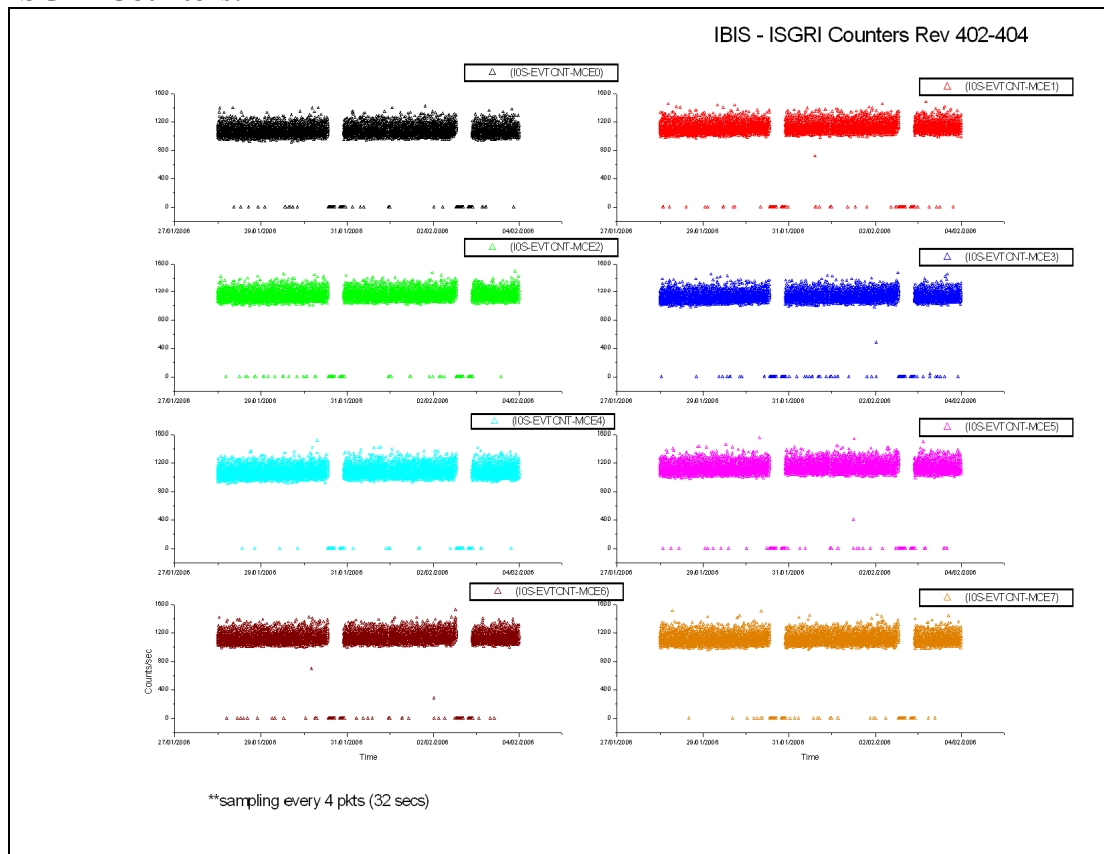
The following plots show the PSD channel rates during the reporting period



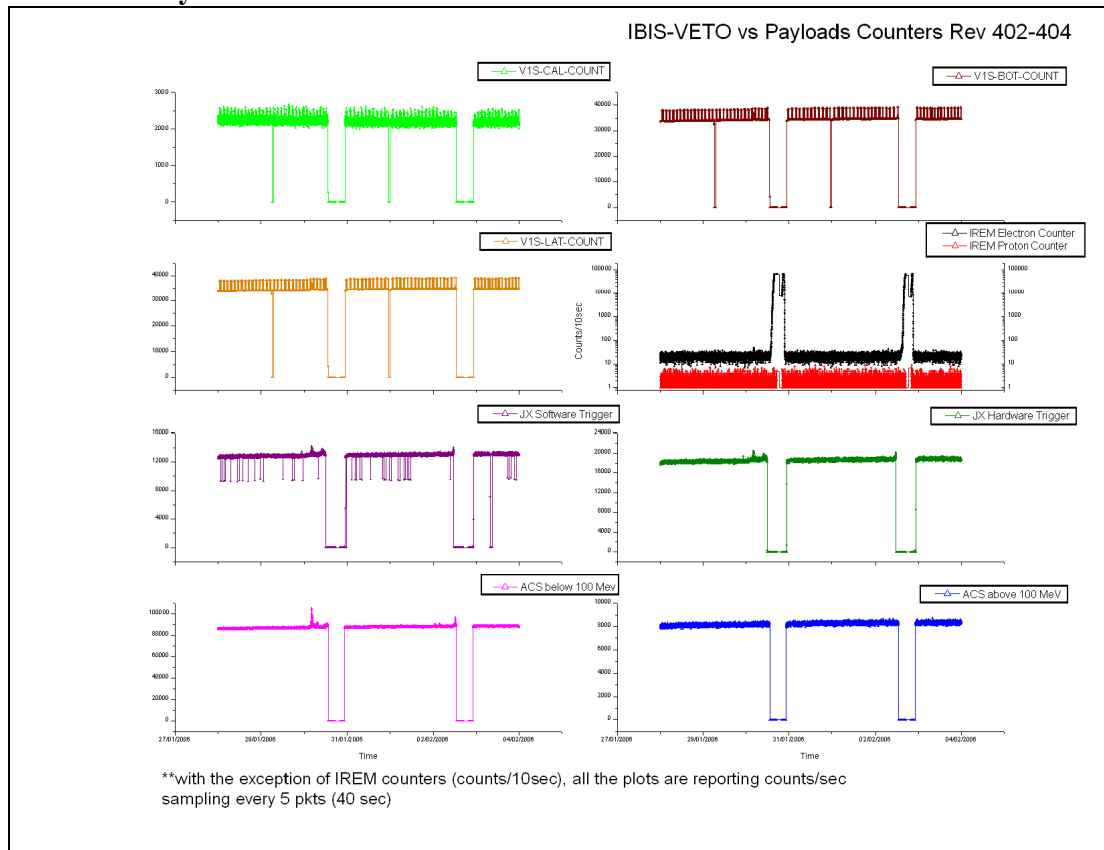
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

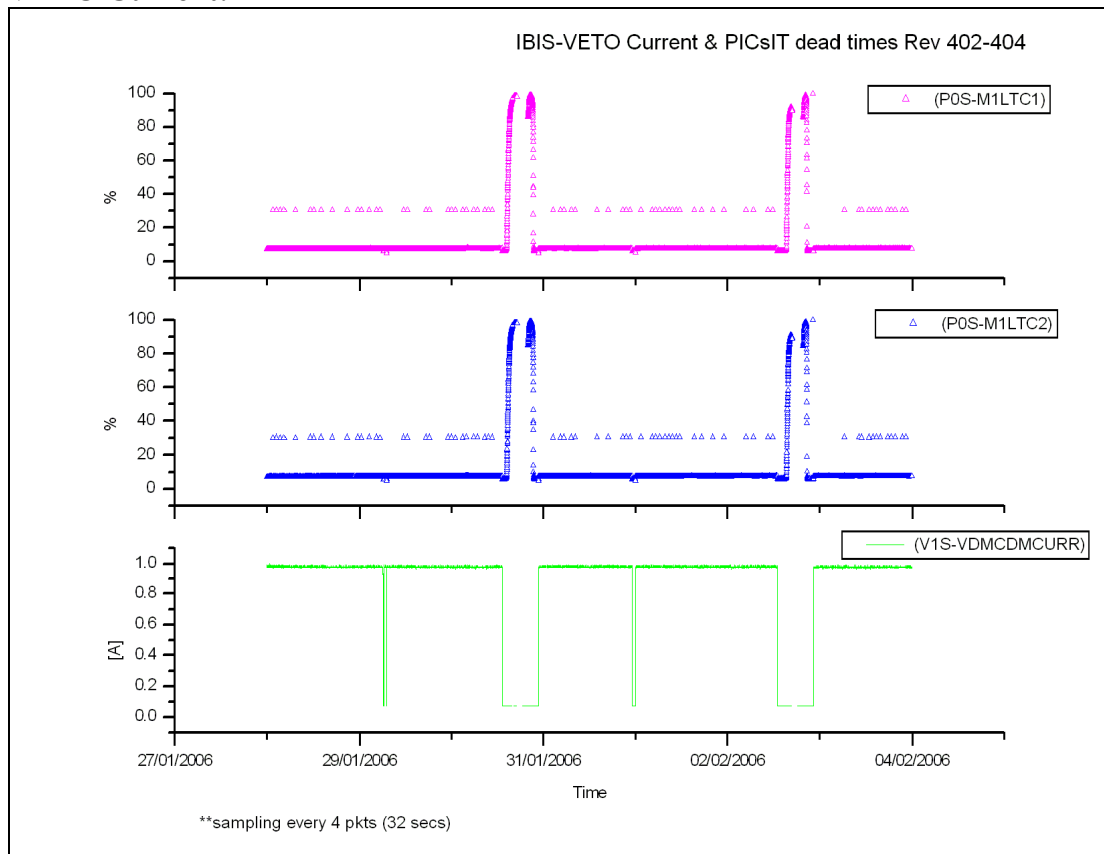


VETO vs Payloads Counters:

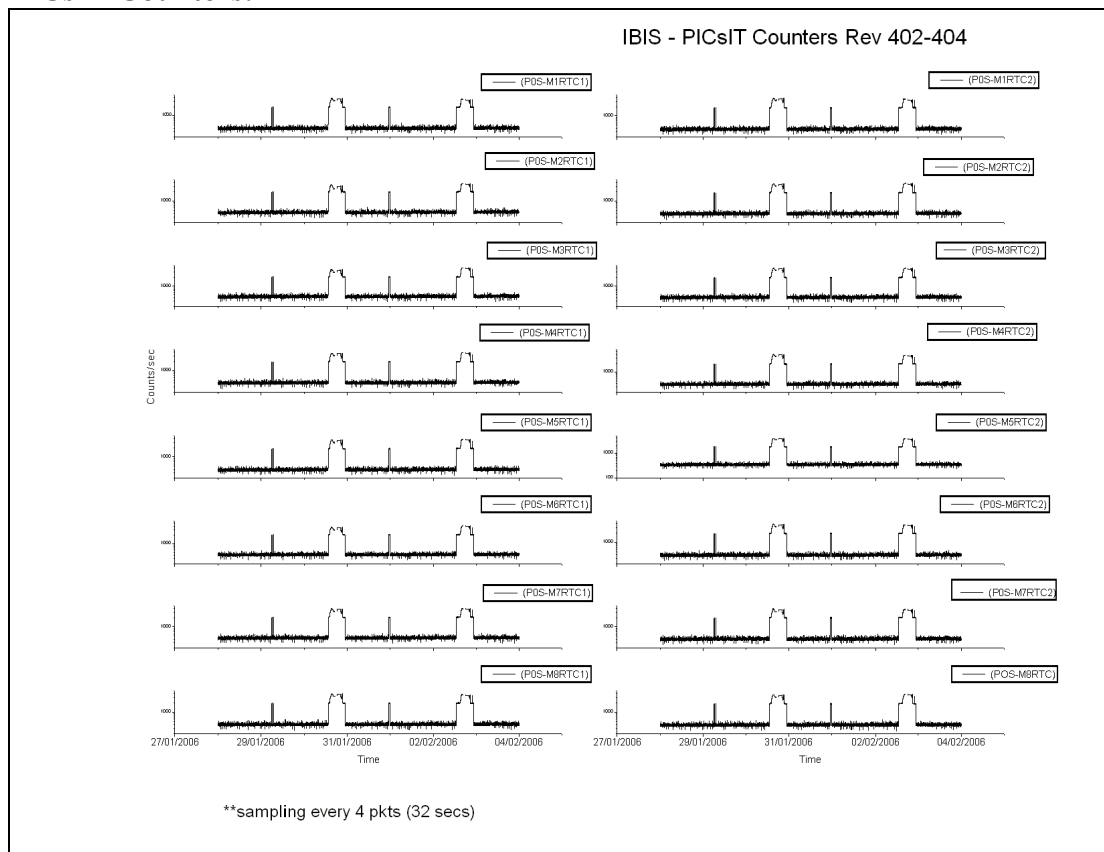


The week was characterised by low radiation.

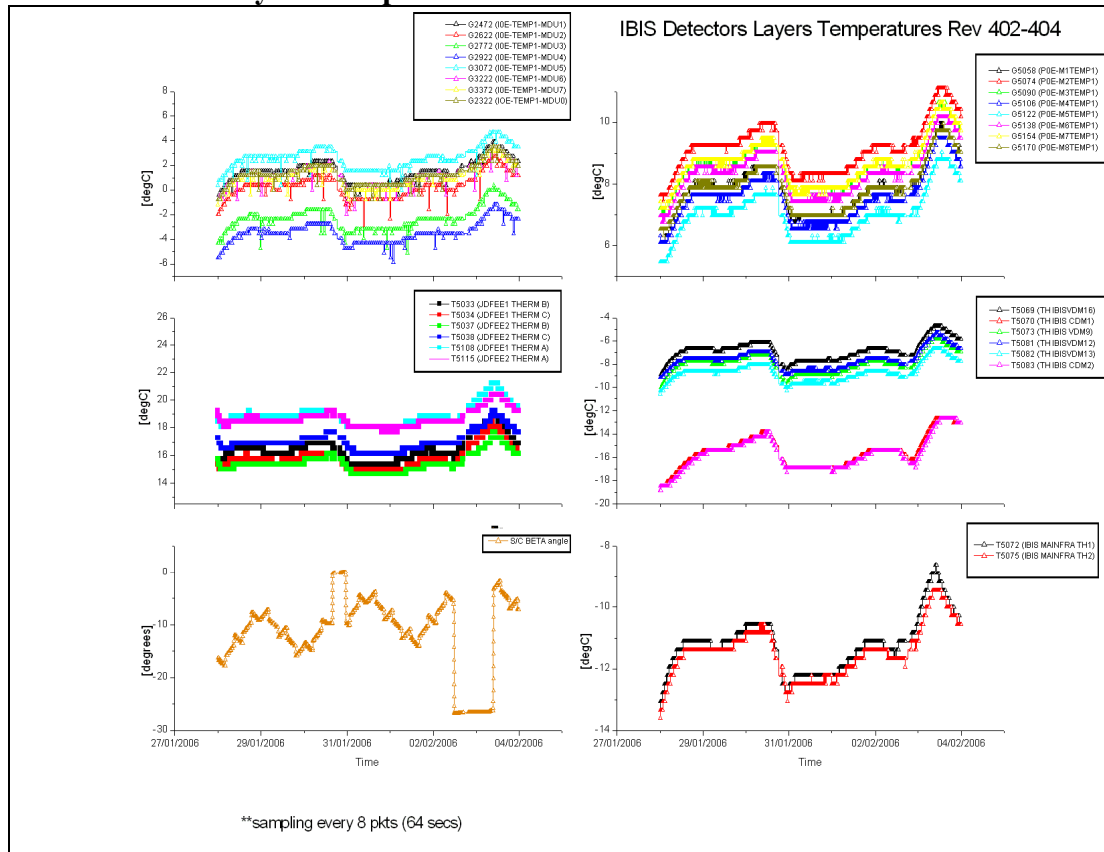
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 2006.029 (29/01/2006): VETO VDM 16 High Voltage Break Down

At 06:06Z, TM parameter G6050 (V1S-VDM16HV) was reported OOL low-low with a value ~0V. At the same time the following OEM (class 2, ID 186) was reported:

<< IBIS1 VETO PMTXX IS ON NAD CORRESPONDING HV MONITORING IS ABOUT ZERO >>.

These events were flagging a High Voltage break-down in VDM 16. The operator recovered the unit following reaction V-HV-1 in FDIR (cf. INT_SC-138).

DoY 2006.030 (30/01/2006):

At 13:15Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 22:42Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5018 (P0S-M4RTC2), G5028 (P0S-M6RTC2), G5033 (P0S-M7RTC2) and G5037 (P0S-M8RTC1) were toggling OOL high. According to P-CNT-1, no action was taken.

At 22:12Z, TM parameter G2000 (I0E-OVFWPXADD-M0) failed SCC and back. According to I-OVF-1, as this happened inside radiation belts, no action was taken.

DoY 2006.031 (31/01/2006):

At 23:11Z, IBIS went into Stand-By mode due to spike in the IREM dose counts. This spike appeared to be an anomaly of IREM (cf. INT_sc-139). Therefore, IBIS was re-enabled safely following the usual procedure (FCP_IBIS1_0803). IBIS was back in Scientific Standard mode at 01:11Z and re-enabled in the timeline at 01:13Z.

DoY 2006.033 (02/02/2006):

At 13:01Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 22:28Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5012 (P0S-M3RTC1) and G5027 (P0S-M6RTC1) were toggling OOL high. According to P-CNT-1, no action was taken.

At 22:03Z, TM parameter G2056 (I0E-OVFWPXADD-M4) failed SCC and back. According to I-OVF-1, as this happened inside radiation belts, no action was taken.

DoY 2006.034 (03/02/2006):

At 08:58Z the Command Verifier died. Consequently the last command (TC G0129) of ED GESTAN02 failed from the timeline. It was manually up-linked at 10:10Z.

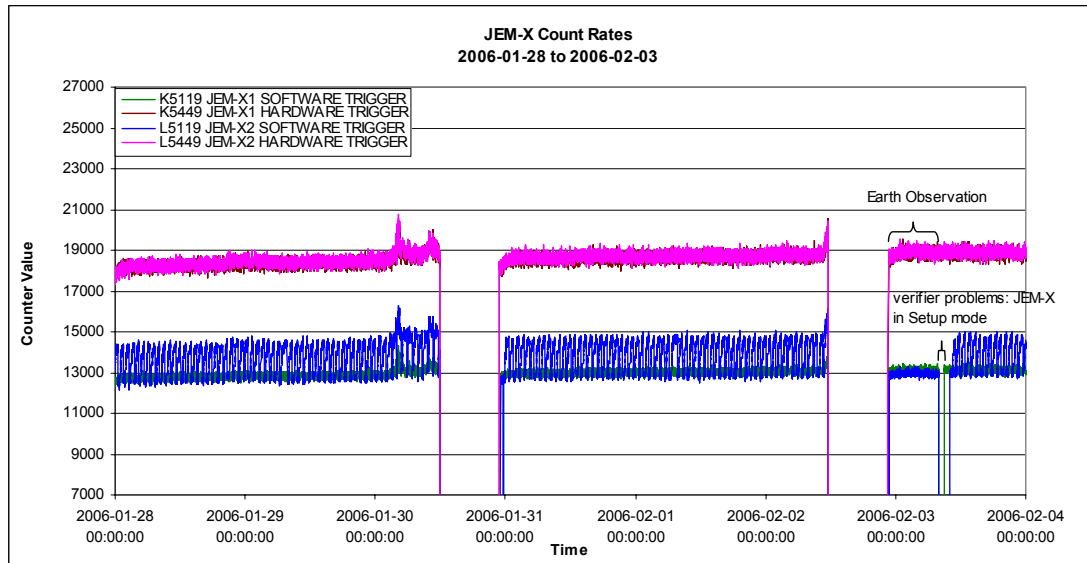
8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

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

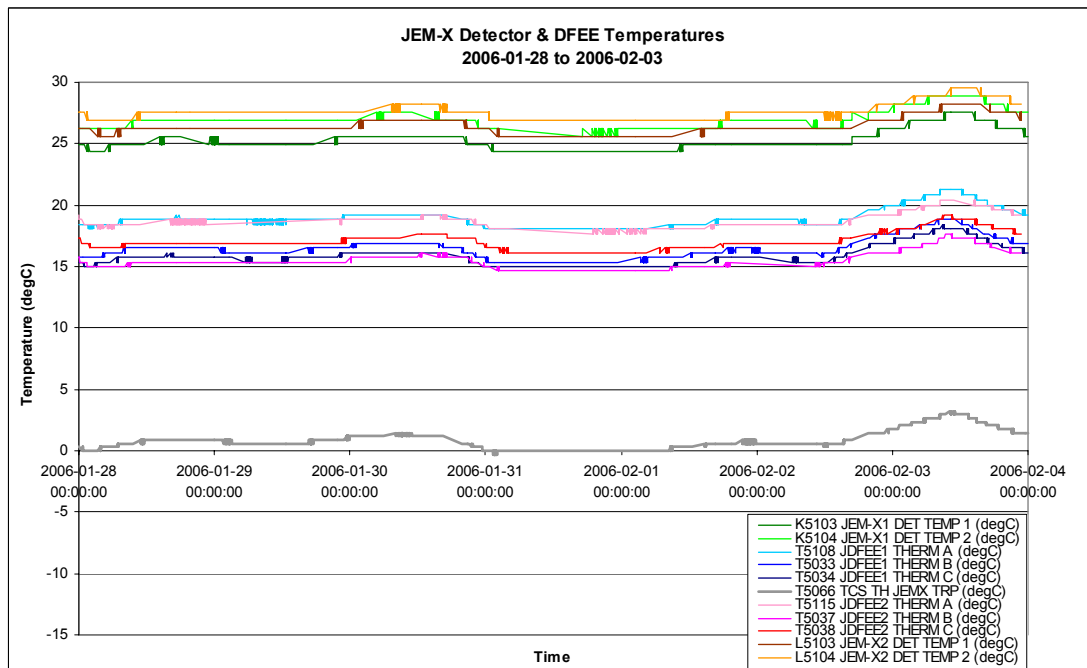
The high levels of the JEM-X2 Software Trigger are during periods when JEM-X2 is in Data Taking but with a TM allocation of 1 packet/cycle. At the start of each pointing (when the DPE buffer is flushed) the Software Trigger is at a normal value but then builds up as the buffer fills and the grey filter reduces.

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



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.



8.3.4.3 JEM-X Daily Report

2006-01-28 (DOY 028, Rev 402) to 2006-01-29 (DOY 029, Rev 402)

Nothing to report

² Data sampled (1 frame in 8)

2006-01-30 (DOY 030, Rev 402-403)

At 20:20:23Z the following OEMs were received from JEM-X2:

OEM 183 JEM-X2 PROB DFEE 3

>> indicating a negative acknowledgement on the LSL due to the request not being valid. The source sequence counter reported in this OEM corresponded to the TC L0021 SW READ INT uplinked at 11:50:50Z as part of the ED LESAFE02.

OEM 137 JEM-X2 TC REJEC 10

>> indicating a failed TC (command execution started but failed)

This was just after the time when the bandwidth to JEM-X2 was increased from 1 packet/cycle to 9 packets/cycle via the ED DEBWHI00 (Assign TM bandwidth for patch and dump). Therefore, the command rejection is due to the fact that the report TC L0021 had remained pending until the time when the TM allocation was enough to generate the report packet, however at this time JEM-X2 was in Safe mode (inside the radiation belts) and therefore the TC was no longer valid as JEM-X2 is required to be in Setup mode for this TC.

At 22:30:17Z, in line with INT_OR_0238, FCP_JEM2_0120 was executed to set the JEM-X2 BCP DATA RATE FLAG back to DISABLED after the ED LEACAL01.

At 23:33:55Z, in line with INT_OR_0239, the ED LEDATA02 JEM-X2 Data Taking was sent manually with default parameter values as this ED was not present in the Timeline.

2006-01-31 (DOY 031, Rev 403) to 2006-02-01 (DOY 032, Rev 403)

Nothing to report

2006-02-02 (DOY 033, Rev 403-404)

At 11:59:11Z the following OEMs were received from JEM-X2:

OEM 183 JEM-X2 PROB DFEE 3

>> indicating a negative acknowledgement on the LSL due to the request not being valid. The source sequence counter reported in this OEM corresponded to the TC L0021 SW READ INT uplinked at 11:38:12Z as part of the ED LESAFE02.

OEM 137 JEM-X2 TC REJEC 10

>> indicating a failed TC (command execution started but failed)

This was just after the time when the bandwidth to JEM-X2 was increased from 1 packet/cycle to 5 packets/cycle via the ED DEPST204, in preparation for the upcoming Earth Observation in revolution 404. As in the previous case on 2006-01-30, at this time JEM-X2 was already in Safe mode and therefore the TC was no longer valid as JEM-X2 is required to be in Setup mode for this TC. This is understood and no action was taken.

At 12:20:33Z, in line with INT_OR_0238, FCP_JEM2_0120 was executed to set the JEM-X2 BCP DATA RATE FLAG to ENABLED before the upcoming Earth observation.

2006-02-03 (DOY 034, Rev 404)

At 07:55:17Z, due to a problem with the command verifier of the IMCS, the TCs K0011 and L0011 STATE DATA TAKE of the EDs K/LEDATA02 failed release. Both units thus remained in Setup mode until they were commanded back to Data Taking; JEM-X1 by the ED KEDATA02 in the Timeline at 08:56:35Z and JEM-X2 manually via FCP_JEM2_0044 at 09:53:15Z.

Then, at 09:58:39Z, FCP_JEM2_0120 was executed to set the JEM-X2 BCP DATA RATE FLAG back to DISABLED following the Earth observation (INT_OR_0238).

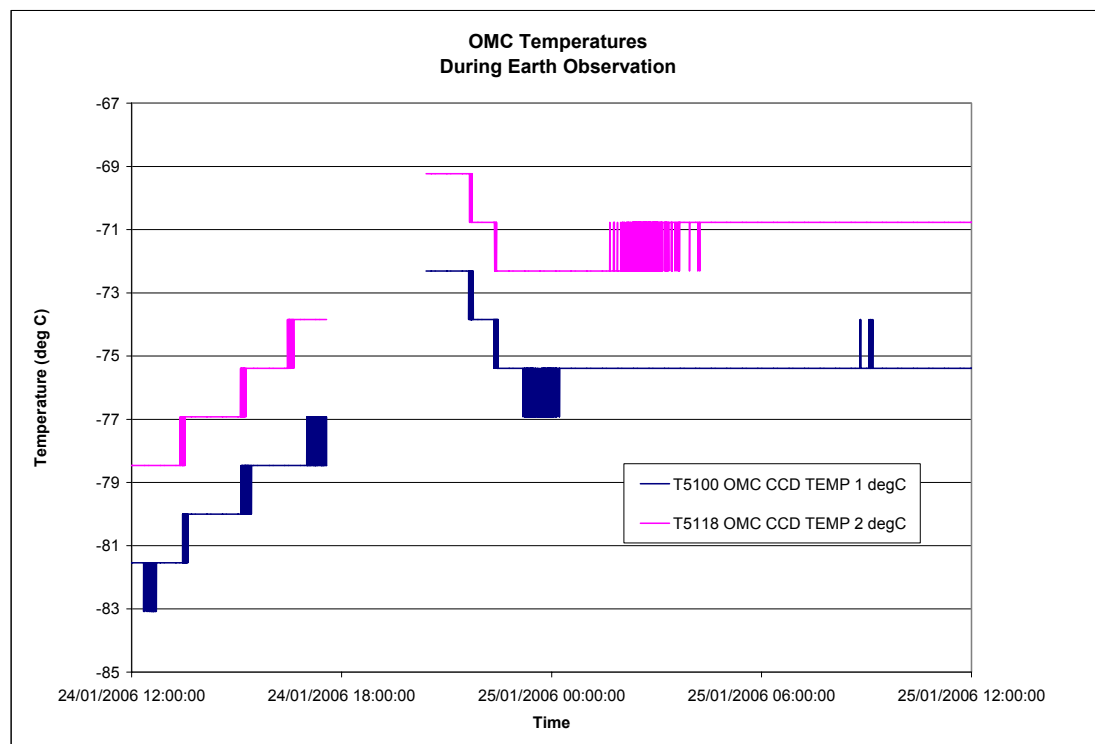
8.3.5 OMC Operations

2006-01-21 (DOY 020, Rev 399-400) to 2006-01-23 (DOY 023, Rev 400)

Nothing to report

2006-01-24 (DOY 024, Rev 401)

At 23:17:03Z, OMC was switched from Standby to Flat-Field Calibration mode prior to the Earth Crossing. Subsequently a total of 12 shots were taken with the unit. The following graph shows the temperature variations of the instrument during the Earth observation.



2006-01-28 (DOY 028, Rev 402) to 2006-01-29 (DOY 029, Rev 402)

Nothing to report

2006-01-30 (DOY 030, Rev 402-403)

On DoY 030, at 11:54, link problems with Redu caused the timeline to be stopped, the impact was a delay in the start of pointing 04020064 from 11:32:28 to 12:15:49, it was at this time that the following pair of commands were rejected:

2006.030.11.32.21.865	2006.030.11.32.30.910	1792	RealTime	131	TC REJECT		
REJECTED TC1			0	0	65535	PR	N
E E							
2006.030.11.32.28.990	2006.030.11.32.39.483	1792	RealTime	131	TC REJECT		
REJECTED TC1			0	0	65535	PR	N
E E							

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

2006-01-31 (DOY 031, Rev 403)

At 23:11:02, an anomalous spike in the output from IREM caused OMC to switch to SAFE mode. At 23:24:34, shortly before the scheduled start of the next pointing, it was manually reset to stand-by. The impact was pointing 04030026 was cut short from a planned 3334 to 2040 seconds.

2006-02-01 (DOY 032, Rev 403)

Nothing to report

2006-02-02 (DOY 033, Rev 404)

The second earth observation proceeded nominally, however the images of the earth obtained by OMC were completely saturated.

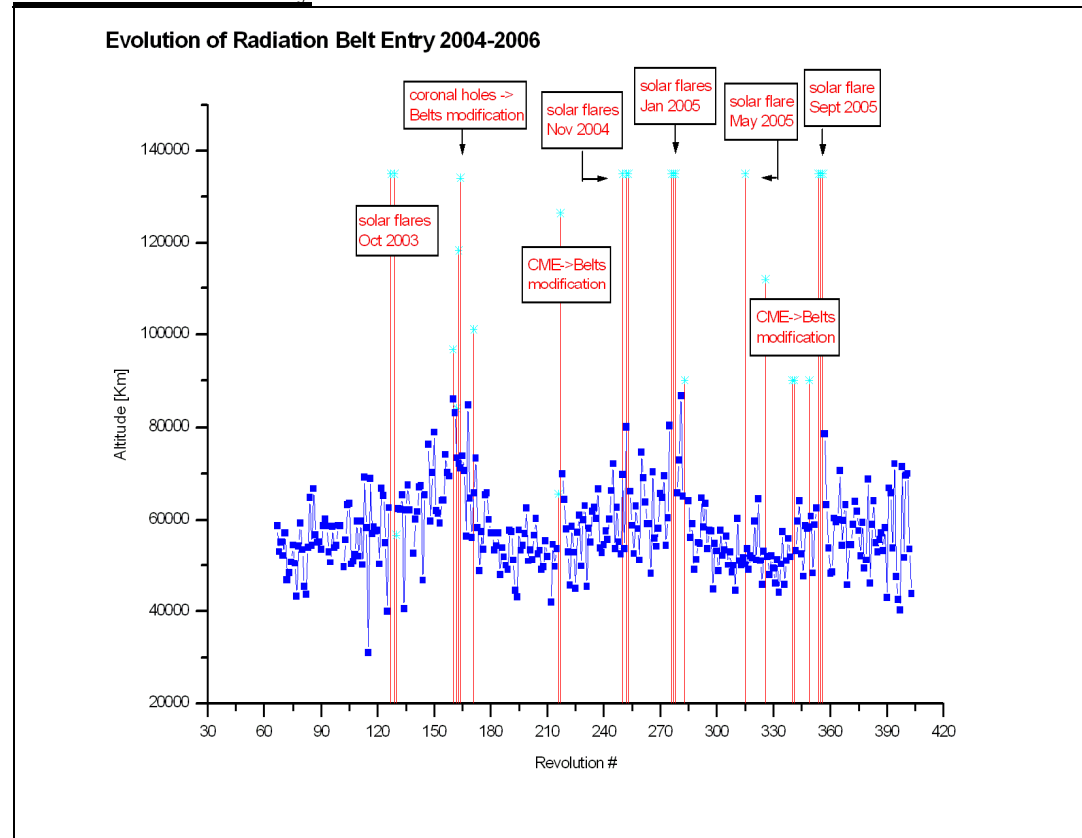
2006-02-03 (DOY 034, Rev 404)

At 08:31, the OSL 04040006 did not go from the Timeline as the tpf was not received with sufficient time to check the parameters. The Timeline was recovered at 10:20. The impact was the loss of pointing 04040007 and a delay in the start of pointing 04040008 from a scheduled 09:55 to 10:10:13.

On DoY 030 at 13:15:18 and DoY 033 at 13:01:10 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 DoY 2006.031 (31/01/2006) at 23:11Z and for one cycle only, the Dose count-rate of IREM (TM parameter U9920) reported the value "Dec 6291". Nominally, in a quiet radiation background, this parameter evolves in the range [0,12].

This high count-rate affected OMC and IBIS since at the moment they have the IREM automatism enabled (automatism disabled for JEM-X and SPI as PIs requested). As their dose threshold (OMC: 256 [TBC] and IBIS: 60) was crossed, they both went into a Safe configuration. Following the usual procedures in case of high radiation detected by IREM, they were recovered rapidly.

No recovery of IREM was necessary since at the next cycle, the dose count rate was back to nominal value.

The radiation background at the time of this high count-rate was very low according to the SEIS tool. No X-ray or proton spike was reported.

Following a first investigation, all IREM data were reported nominal at the time of the anomaly. Only parameter U9920 was irrelevant.

The status of the unit before the anomaly was:

- LCL current =0.088 A

- radiation counters: proton=2, dose=0, electron=24
- LSW of the IREM block counter =52232
- MSW of the IREM block counter =11
- the last IREM HK file reported nominal value (HK File ID = 92 at 23:06Z);

During the occurrence of the anomaly:

- LCL current =0.088 A
- radiation counters: proton=3, dose=6291, electron=21
- LSW of the IREM block counter =52233
- MSW of the IREM block counter =11;

After the anomaly:

- LCL current =0.088 A
- radiation counters: proton=1, dose=0, electron=32
- LSW of the IREM block counter =52234
- MSW of the IREM block counter =11
- the first IREM HK file reported nominal value (HK File ID = 93 at 23:11Z).

A closer look into the scientific file accumulated in the IREM ECOE did not yield more information. The content of the TDB for Accumulation file ID 469, was nominal, only the dose count in the fix part of the 15 words was corrupted.

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]
402	RAD_ENTR R 2006-01-30T13:15:17Z	2006-01-30 14:02:29	53674.3	2006-01-30 14:29:15	49947
403	RAD_EXIT R 2006-01-30T22:29:56Z	2006-01-30 21:47:01	>>23309.9	2006-01-30 21:39:15	32445
403	RAD_ENTR R 2006-02-02T13:01:02Z	2006-02-02 15:01:57	<43844.5	2006-02-02 13:14:46	49185
404	RAD_EXIT R 2006-02-02T22:15:59Z	2006-02-02 21:09:17	>>23319.1	2006-02-02 20:24:46	32919

Reference

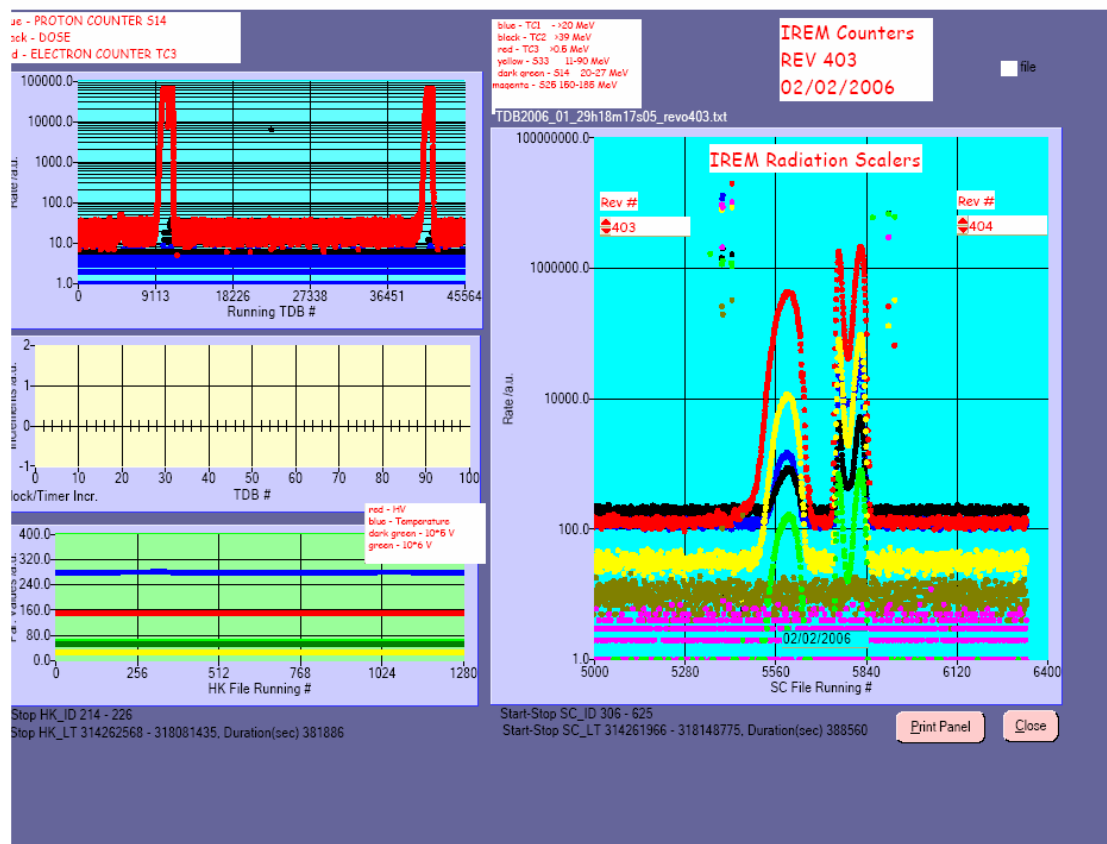
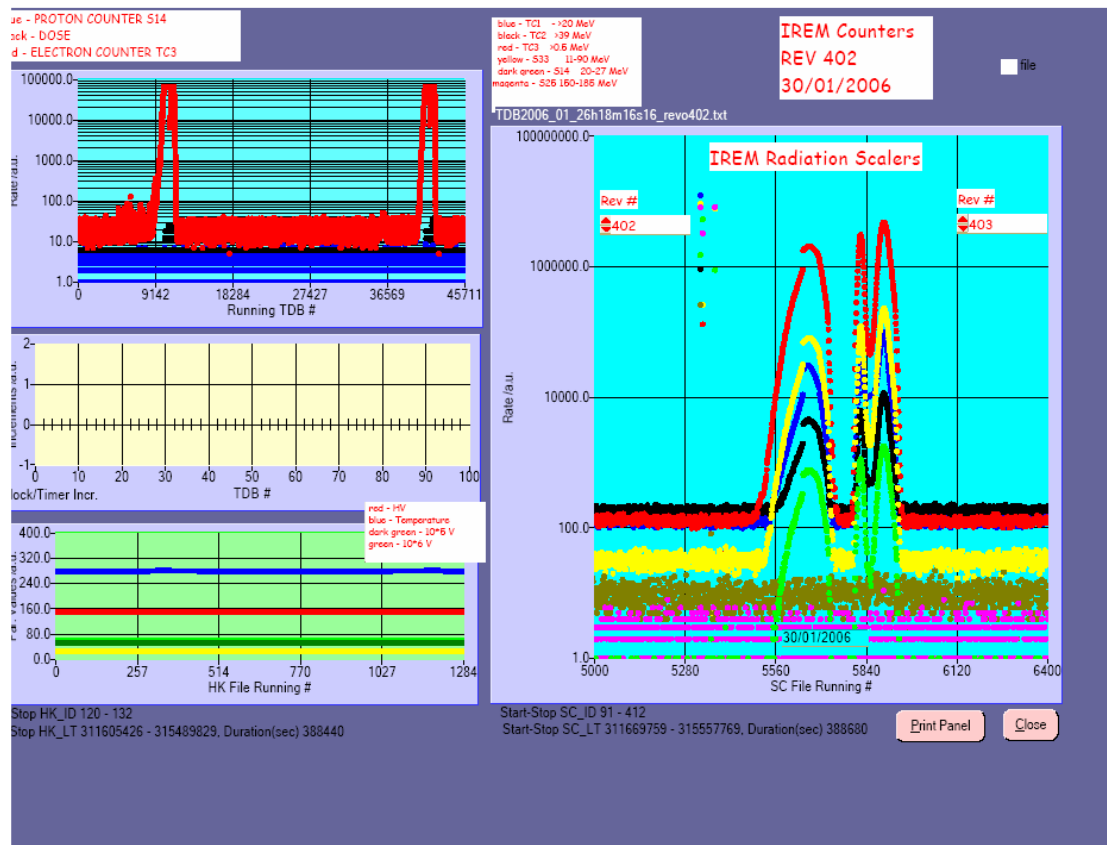
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

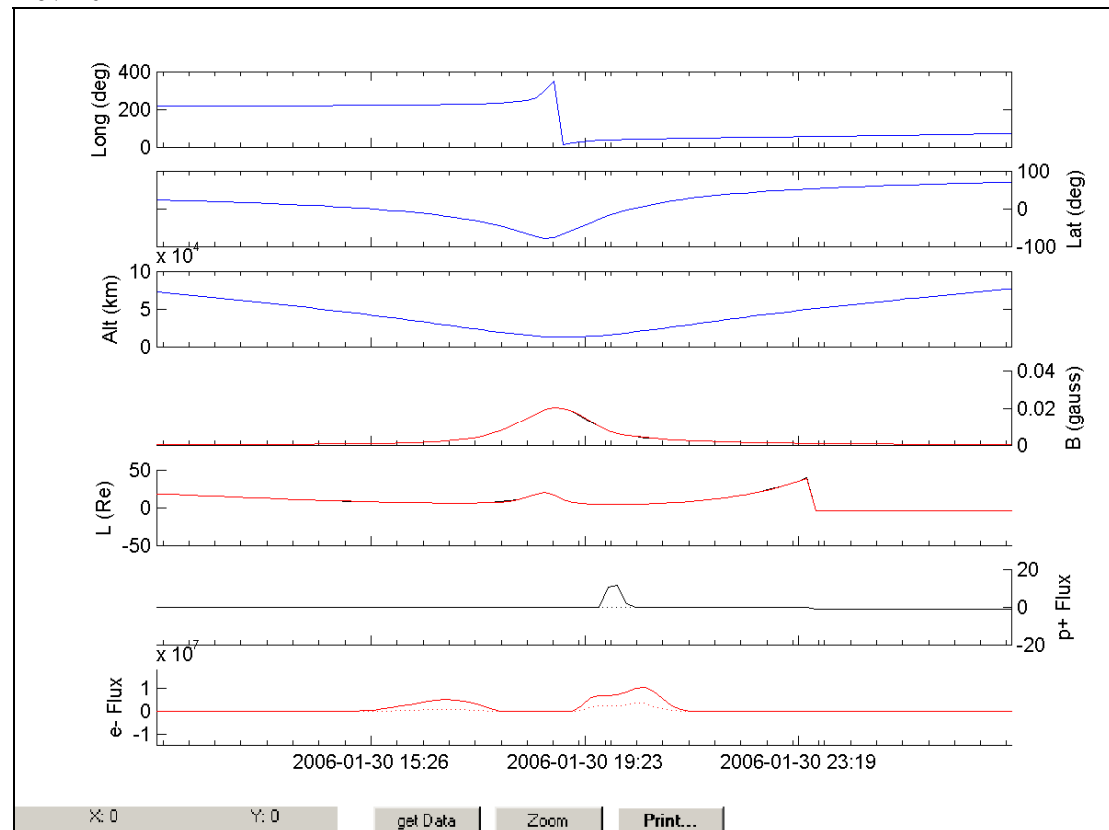
Radiation Spike

IREM radiation counters:

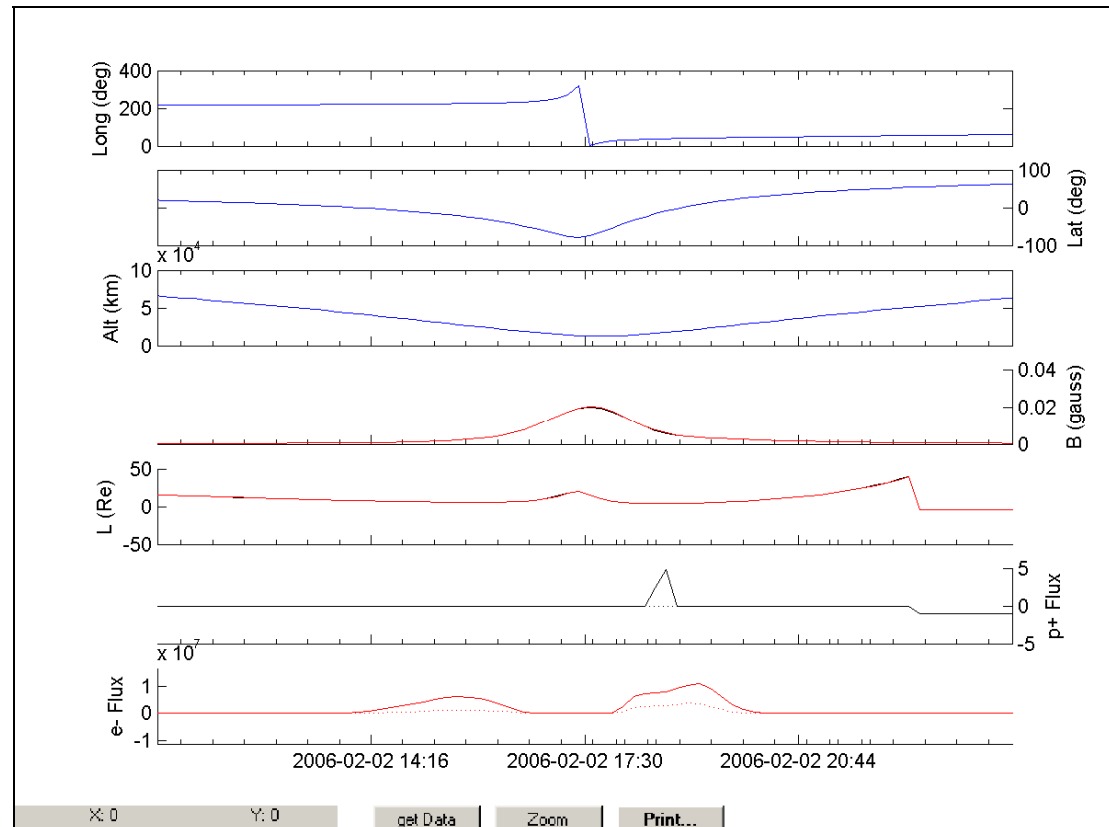


IREM Predicted Radiation Belt Passages:

Rev 402



Rev 403



SEC-GOES Observed Particles Fluxes:

