

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 174
Week 03
23.01.13
Routine Phase

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1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC.

It addresses the activities from 14.01.06 until 21.01.06 (both dates inclusive) and covers the revolutions 398 and 399.

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 3C 279 (RA 12:56:11.00; DEC -05:47:21.5), which was a raster dithering observation and a GPS survey.

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.

An update of the RCS-A Thruster Torque Reciprocals, PWM look-up table, AMD Thruster On Times and the TIM Thresholds was executed during rev 399, following the RCS-A Thruster Calibration performed during revolution 396 (10/01/06).

No slews were missed from the Timeline during this period.

The fuel consumption over the period between 12/01/2006 and 18/01/2006 was 0.1558 kg. The remaining propellant is in the order of 156.7816 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. The 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

The overall status of the gamma-ray spectrometer is nominal.

The 7th annealing cycle of the Germanium detectors, started on 9th January at radiation belts entry of rev 398 (14:18z), is still in progress and the instrument is not performing any observation.

A detailed analysis of all major annealing events will be presented in the next weekly report, when the annealing is over.

The Stirling compressors were restarted 19th January at ~11:30z and currently working at full stroke to cool the detector cold plate down to 85K.

A summary annealing timeline is reported in the future activities section.

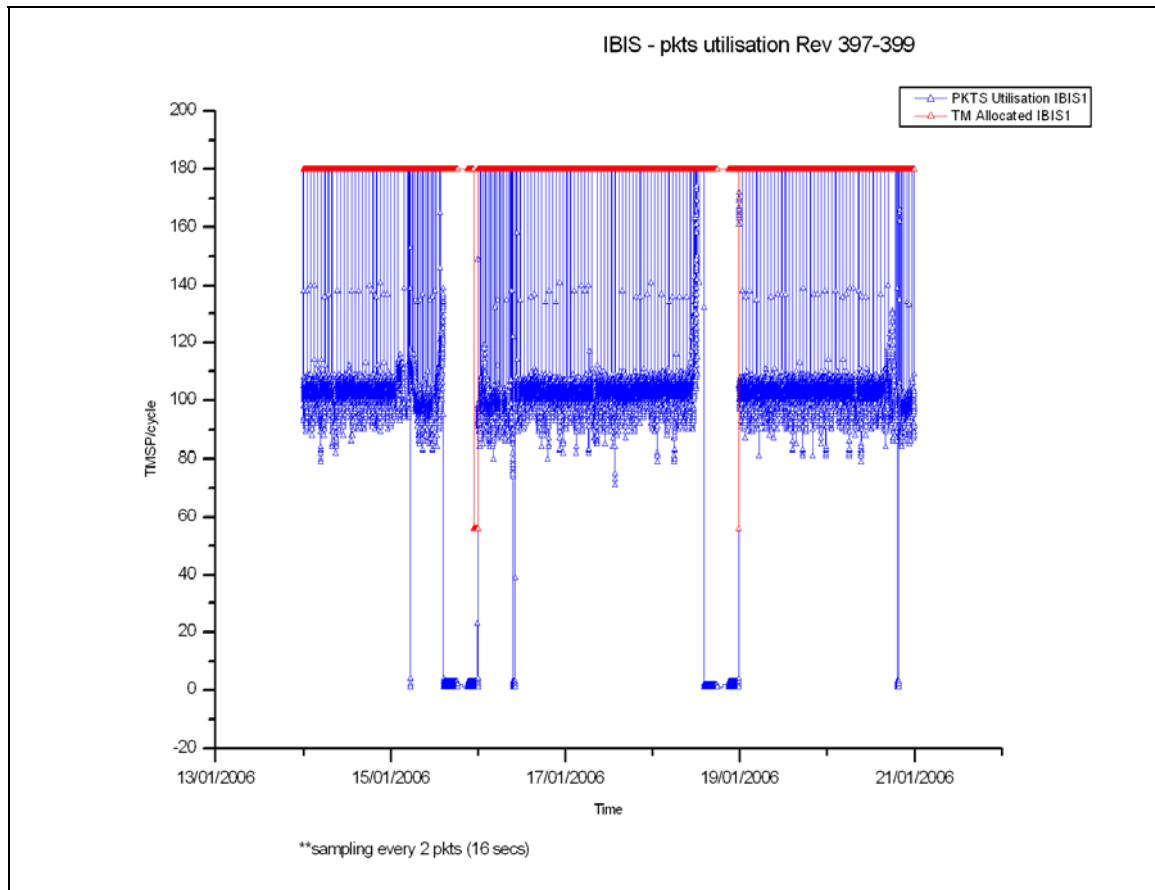
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The Overall status of the unit is Nominal.

During the reporting period, the PST allocation to IBIS was 180 TMPS/cycle due to SPI annealing. The IBIS mean bandwidth utilisation during the observation period was 108.46 TMPS/cycle, down 0.64 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 with a TM allocation of 15 packets/cycle in revolutions 397, 398 and up to 2006-01-20T19:11:16Z in revolution 399, after which time it had a TM allocation of 8 packets/cycle.

JEM-X2 was dormant (DFEE OFF) with a TM allocation of 1 packet/cycle until radiation belt entry of revolution 398, when the DFEE was switched on at 2006-01-18T15:33Z. It was then operated in Data Taking mode in revolution 399, with a TM allocation as follows:

- o 2006-01-18T23:49:18Z - 2006-01-19T11:48:37Z: 1 packet/cycle
- o 2006-01-19T11:48:37Z - 2006-01-19T15:46:11Z: various, due to ongoing grey filter investigations and recovery operations
- o 2006-01-19T 15:46:11Z - 2006-01-20T19:11:16Z: 15 packets/cycle
- o 2006-01-20T19:11:16Z - end of reporting period: 8 packets/cycle

On 2006-01-19, while JEM-X2 was in Data Taking with a TM allocation of 1 packet/cycle, it was observed that the JEM-X2 automatic grey filter was not working

as expected, causing the DPE buffer to fill to the maximum (60000 events) without a reduction in the grey filter. Investigations revealed that the grey filter algorithm requires the TM allocation to JEM-X (as considered by JEM-X, i.e. in the Broadcast Packet) to be greater than 1 in order for the grey filter to be reduced (the actual allocation to JEM-X in the PST can, however, be 1 packet/cycle). Further details of this anomaly and the recovery actions are given in Section 8.3.4.

On 2006-01-18 at 12:50Z JEM-X1 made an autonomous transition to Safe mode, triggered by the unit's Software Trigger, due to high background conditions, a few minutes before it was due to be commanded to Safe before radiation belt entry.

On 2006-01-16 and 2006-01-20, problems with the IMCS caused the failure of Data Taking EDs, which were then re-uplinked manually.

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, 151 of the 153 planned science pointings for OMC were executed nominally, two were delayed, none were lost.

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

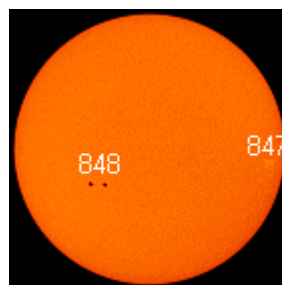
3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by low solar activity.

At the beginning of the observation period, 2 sunspots appeared (846 and 847). They stayed small and quiet. On the 19th of January a new sunspot (848) was reported growing quickly (cf. picture). However it did not posed threat of solar flare.



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 significantly delayed. There were several minor problems with ground station links and IMCS tasks 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 Command Verifier, however, caused a delay in 2 pointings. The overall performance was still 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 TM drops, 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

PSF's have been received for up to revolution 406. Mission planning in ISOC has been performed up to revolution 405. They have been sent to MOC. No re-planning or ToO have been done this week. A ToO request was received late Friday afternoon. It has been subject of lengthy discussions within ISOC and with the Project Scientist. No final decision is made at this time. It is a complicated matter due to limited visibility and the constraints imposed by the upcoming Earth Observation. ISOC has been quite involved in sorting out an instrument configuration of the JEM-X2 during the revolutions prior to the first earth observation in revolution 401. In the end no re-planning in ISOC was necessary but some additional manual commanding is to be performed by MOC. The SPI annealing has started as planned and the instrument will be switched on again according to plan in revolution 400. TSF's have been received up to revolution 402.

2. Special earth observation

The first observation will start next weekend. All planning and special procedures for the earth observation are now in place. Further observations are planned for revolutions 404, 405 and 406. Whether or not to proceed with the observations two to four will be determined in a special go ahead meeting with all parties involved on 31 January. A strategy for rolling back and do normal observations in stead of the earth observations is available in ISOC and is also agreed with MOC

3. Observation status

ECS's for revolutions 384 and 386 were received. Corresponding OCS's have been sent to ISDC.

No extra time has been credited.

4. ISOC science data archive

A test version of the ISDA version 2.5 is available. A beta release is expected next week. Missing ISGRI files have now been delivered by the University of Southampton. Recently the availability of the ISDA to the outside world has become a concern. A discussion with the Science Archive team on this subject will be done shortly.

5. ISOC system

The version 12.0 is still in use. No problems detected.

6. AO 4 preparation

The proposal generation part of the ISOC software to support AO 4 is available. The changes to the proposal handling system to accommodate the new Key Programme functionality are now defined and implementation is under way. This implementation requires some interface agreements with ISDC. A meeting is planned for end of January to agree the interface. The review and updating of the AO 4 documentation is progressing according to plan.

7. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 23/01/2006:

- Latest Standard Analysis completed: observation 03297000001 (GRO J0852-4642, Revolutions 373-383) on 20/01/2006
- Latest products archived: observation 03297000001 (GRO J0852-4642, Revolutions 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 016, at 09:45, the Command Verifier died, it was restarted at 09:46. The impact was a delay from 19:12 to 19:42 in the start of pointing 03980019.
- On DoY 020, at 19:12, the Command Verifier died, it was restarted at 19:24. The impact was a delay from 19:12 to 19:42 in the start of pointing 03990044.

The following anomaly reports were entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
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8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 398

The observations in revolution 398 commenced with a GPS survey lasting ~7.3 hours and continued with a raster dithering observation of 3C 279 (RA 12:56:11.00; DEC -05:47:21.5) lasting ~49.5 hours.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2 for which the DFEE was off, and SPI, which was in Configuration Mode undergoing annealing. The TM allocation was IBIS 180; SPI 45; JEM-X1 15; JEM-X2 1; OMC 5.

Revolution 399

The observations in revolution 399 commenced with a GPS survey lasting ~15.9 hours, and continued with a raster dithering observation of 3C 279 (RA 12:56:11.00 ; DEC -05:47:21.5) lasting ~40.0 hours

Throughout these observations all instruments were in their nominal science modes, except JEM-X2 for which the DFEE was off, and SPI, which was in Configuration Mode undergoing annealing. The TM allocation throughout all observations up to and including 03990043, which terminated at 2006.020.19.00 was: IBIS 180; SPI 45; JEM-X1 15; JEM-X2 1; OMC 5, after this time JEM-X2 is activated for the remainder of the revolution and the TM Allocation is: IBIS 180; SPI 45; JEM-X1 8; JEM-X2 8; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-01-09T22:24:53.000Z	157.0698	F	Automatic TM processing.
2006-01-10T07:26:06.000Z	157.0380	F	Automatic TM processing.
2006-01-10T10:11:34.000Z	157.0122	F	Automatic TM processing.
2006-01-10T14:15:00.000Z	156.9913	F	After thruster torque calibration
2006-01-10T15:16:32.000Z	156.9642	F	Automatic TM processing.
2006-01-12T17:54:45.000Z	156.9529	F	Automatic TM processing.
2006-01-12T22:08:54.000Z	156.9374	F	Automatic TM processing.
2006-01-15T03:46:28.000Z	156.8931	F	Automatic TM processing.
2006-01-15T12:16:36.000Z	156.8793	F	Automatic TM processing.
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.

8.3 Detailed Satellite Information

This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS SUMMARY OPERATIONS REPORT, 14/01/2006 – 20/01/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 84 Open Loop Slews, 84 Closed Loop Slews and 8 Momentum Bias were executed (TL + manual recovery).

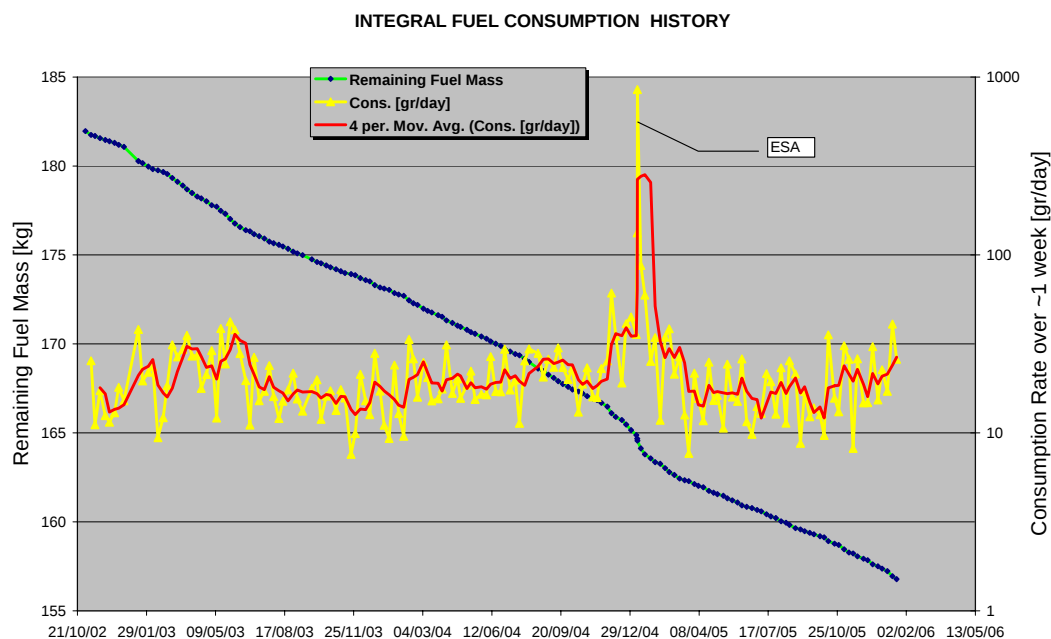
No slews were missed from the Timeline during this period.

Orbit Control

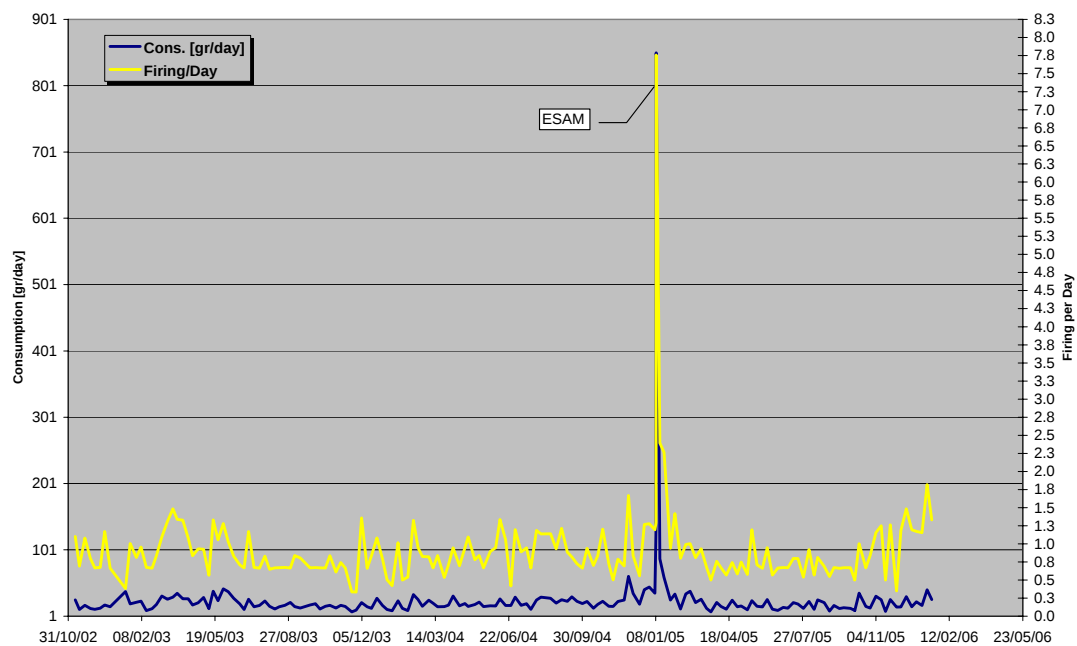
Provided on monthly basis

Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 18/01/2006 is reported in the plot below.

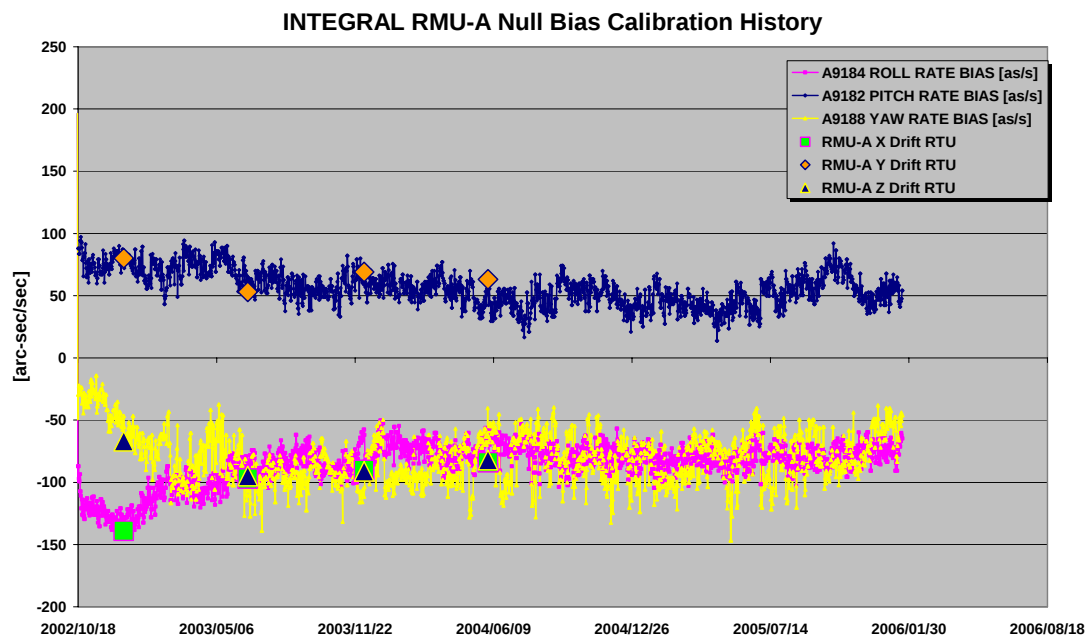


The firing\day over the period between 01/11/2002 and 18/01/2006 is reported in the plot below.

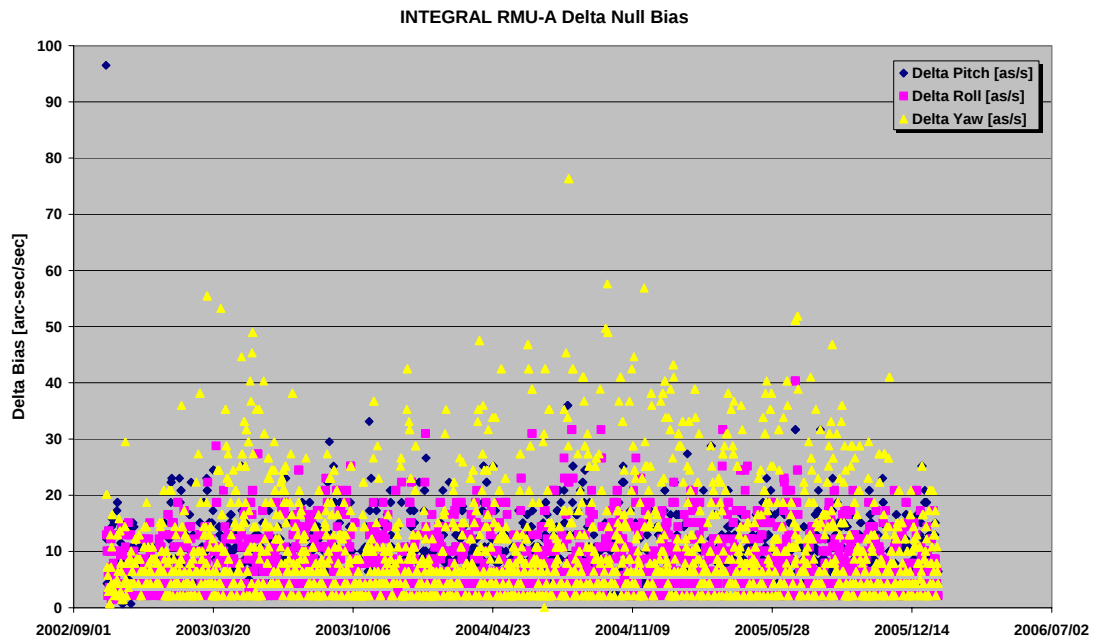


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 18/01/2006 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 18/01/2006 is reported in the plot below.



14/01/06 (Day of Year 014, Revolution 397)

Nothing to report.

15/01/06 (Day of Year 015, Revolution 397-398)

Nothing to report.

16/01/06 (Day of Year 016, Revolution 398)

Nothing to report.

17/01/06 (Day of Year 017, Revolution 398)

Nothing to report.

18/01/06 (Day of Year 018, Revolution 398-399)

FDS reported problem to update wheels profiles: at 21:17z the FDS reported problem on the update of the measured wheels profiles vs the predicted ones. Values reported in the ESM were not anymore in synch with the value displayed in wheels plot.

The AOCS s/s was disabled at 21:32 in TL and the planned RWB failed the execution.

After action by FD on-call on the update problem, a manual recovery was performed by performing a RWB, updating the next slew (CSL) for PID 03990001 and executing it from the Timeline.

No impact reported on TL.

19/01/06 (Day of Year 019, Revolution 399)

Update of RCS-A Thruster Torque Reciprocals, TIM Thresholds and AMD On Times: An update of the RCS-A Thruster Torque Reciprocals and AMD Thruster On Times was performed during rev 399, based on the results of the RCS-A Thruster Calibration, executed on 10/01/2006, and from the estimations of the thrust level (9.61622 N) and remaining fuel mass (157.29 Kg at tank temperature 25.61 C):

THRUSTER-ON-TIME

Average Force Mag: 9.6220 N

Thruster on-time: $1.3/9.6220 = 0.135107$ s

Rounded down by 0.244ms LSB: 0.134932 s (rnd-up=0.135176 s)

on the basis of estimated (mid day 10/01/2006) fuel mass of 157.29 kg and tank temperature of 25.61 C

TIMs

RTIM: 6.25 [50] 6.23581-> rounded up to nearest 0.125s LSb = 6.250
PTIM: 2.125 [17] 2.04543-> rounded up to nearest 0.125s LSb = 2.125
YTIM: 33.21875 [1063] 33.2147-> rounded up to nearest 0.03125s LSb = 33.21875
TTIM: 416 [26] $4000/9.61622 = 415.9638611$ -> rounded up to nearest 16s LSb = 416

Thrust: 9.61622 N

Being RTIM and PTIM thresholds not changed wrt the scaling performed in Summer 2005, were uplinked only the new values for YTIM and TTIM.

RCS-A Thruster Torque Reciprocals

AERCA_00 S

M F 4

2006-01-21T19:51:37Z

2006-01-21T19:51:37Z

A

TORQ_X_A R 0.2533914E+00 1/Nm D Reciprocal Roll Torque (A)

TORQ_Y_A R 0.8311605E-01 1/Nm D Reciprocal Pitch Torque (A)

TORQ_Z_A R 0.6921423E-01 1/Nm D Reciprocal Yaw Torque (A)

PWM_TORQ R 7 D PWM Look Up Table

along with the ESAM PWM look-up table (the PWM value did change to raw 8)

AMD ON TIMES

AEOTA_00 S

M F 32

2006-01-21T19:51:37Z

2006-01-21T19:51:37Z

A

MON_W1T1	R	0.6344000E-01	sec	D	AMD	decrease	on-time	(W1,Th1)
MON_W1T2	R	0.2181360E+00	sec	D	AMD	decrease	on-time	(W1,Th2)
MON_W1T3	R	0.0000000E+00	sec	D	AMD	decrease	on-time	(W1,Th3)
MON_W1T4	R	0.2840160E+00	sec	D	AMD	decrease	on-time	(W1,Th4)
MON_W2T1	R	0.5929200E-01	sec	D	AMD	decrease	on-time	(W2,Th1)
MON_W2T2	R	0.1354200E+00	sec	D	AMD	decrease	on-time	(W2,Th2)
MON_W2T3	R	0.7490800E-01	sec	D	AMD	decrease	on-time	(W2,Th3)
MON_W2T4	R	0.0000000E+00	sec	D	AMD	decrease	on-time	(W2,Th4)
MON_W3T1	R	0.2874320E+00	sec	D	AMD	decrease	on-time	(W3,Th1)
MON_W3T2	R	0.0000000E+00	sec	D	AMD	decrease	on-time	(W3,Th2)
MON_W3T3	R	0.2220400E+00	sec	D	AMD	decrease	on-time	(W3,Th3)
MON_W3T4	R	0.6636800E-01	sec	D	AMD	decrease	on-time	(W3,Th4)
MON_W4T1	R	0.1293200E+00	sec	D	AMD	decrease	on-time	(W4,Th1)
MON_W4T2	R	0.5807200E-01	sec	D	AMD	decrease	on-time	(W4,Th2)
MON_W4T3	R	0.0000000E+00	sec	D	AMD	decrease	on-time	(W4,Th3)
MON_W4T4	R	0.6758800E-01	sec	D	AMD	decrease	on-time	(W4,Th4)
MOFFW1T1	R	0.2191120E+00	sec	D	AMD	increase	on-time	(W1,Th1)
MOFFW1T2	R	0.7856800E-01	sec	D	AMD	increase	on-time	(W1,Th2)
MOFFW1T3	R	0.2984120E+00	sec	D	AMD	increase	on-time	(W1,Th3)
MOFFW1T4	R	0.0000000E+00	sec	D	AMD	increase	on-time	(W1,Th4)
MOFFW2T1	R	0.6954000E-01	sec	D	AMD	increase	on-time	(W2,Th1)
MOFFW2T2	R	0.0000000E+00	sec	D	AMD	increase	on-time	(W2,Th2)
MOFFW2T3	R	0.6124400E-01	sec	D	AMD	increase	on-time	(W2,Th3)
MOFFW2T4	R	0.1295640E+00	sec	D	AMD	increase	on-time	(W2,Th4)
MOFFW3T1	R	0.0000000E+00	sec	D	AMD	increase	on-time	(W3,Th1)
MOFFW3T2	R	0.3020720E+00	sec	D	AMD	increase	on-time	(W3,Th2)
MOFFW3T3	R	0.8174000E-01	sec	D	AMD	increase	on-time	(W3,Th3)
MOFFW3T4	R	0.2227720E+00	sec	D	AMD	increase	on-time	(W3,Th4)
MOFFW4T1	R	0.0000000E+00	sec	D	AMD	increase	on-time	(W4,Th1)
MOFFW4T2	R	0.7759200E-01	sec	D	AMD	increase	on-time	(W4,Th2)
MOFFW4T3	R	0.1363960E+00	sec	D	AMD	increase	on-time	(W4,Th3)
MOFFW4T4	R	0.6222000E-01	sec	D	AMD	increase	on-time	(W4,Th4)

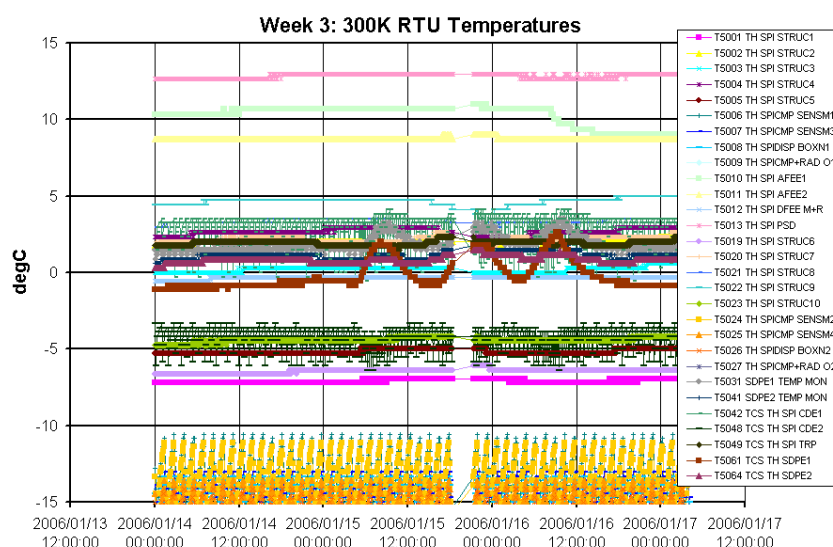
20/01/06 (Day of Year 020, Revolution 399)

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 cryocooler was re-started after the end of the passive cooling phase, on 19th January at ~11:30z. The start-up and cooling performance is in line with the previous observed data. The four compressors are running now at full stroke, with compressor demand set to 4x45dec raw. It is expected to reach 85K on the cold plate on 24th January at around 01:00z.

A more detailed analysis will be presented on the next report, covering the whole period of the annealing.

DPE & IASW:

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

The Iasw is now in Conf mode, supporting the detector, annealing not acquiring any scientific data.

ACS:

The performance of the ACS is nominal. For this 7th annealing, the ACS high voltage power supplies have been left on, reducing the voltage setting to the minimum (980V).

The voltage was set back to nominal value on 16th January and several calibration sequences executed.

AFEE:

The performance of the AFEE and the detectors is nominal. The detectors high voltage power supply are and the complete acquisition chain are off for the annealing. The unit is in Conf mode.

DFEE:

The performance of the unit is nominal.

The unit is in Conf mode.

PSD:

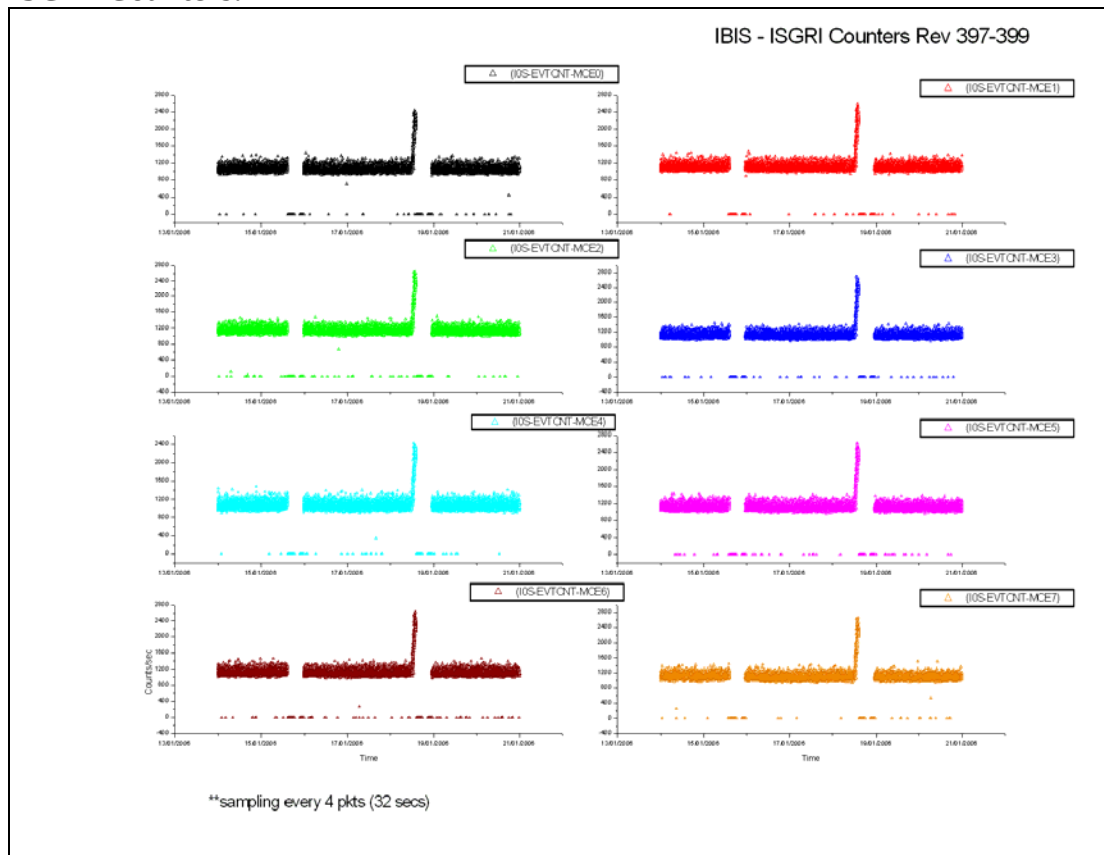
The performance of the unit is nominal.

The unit is in Conf mode.

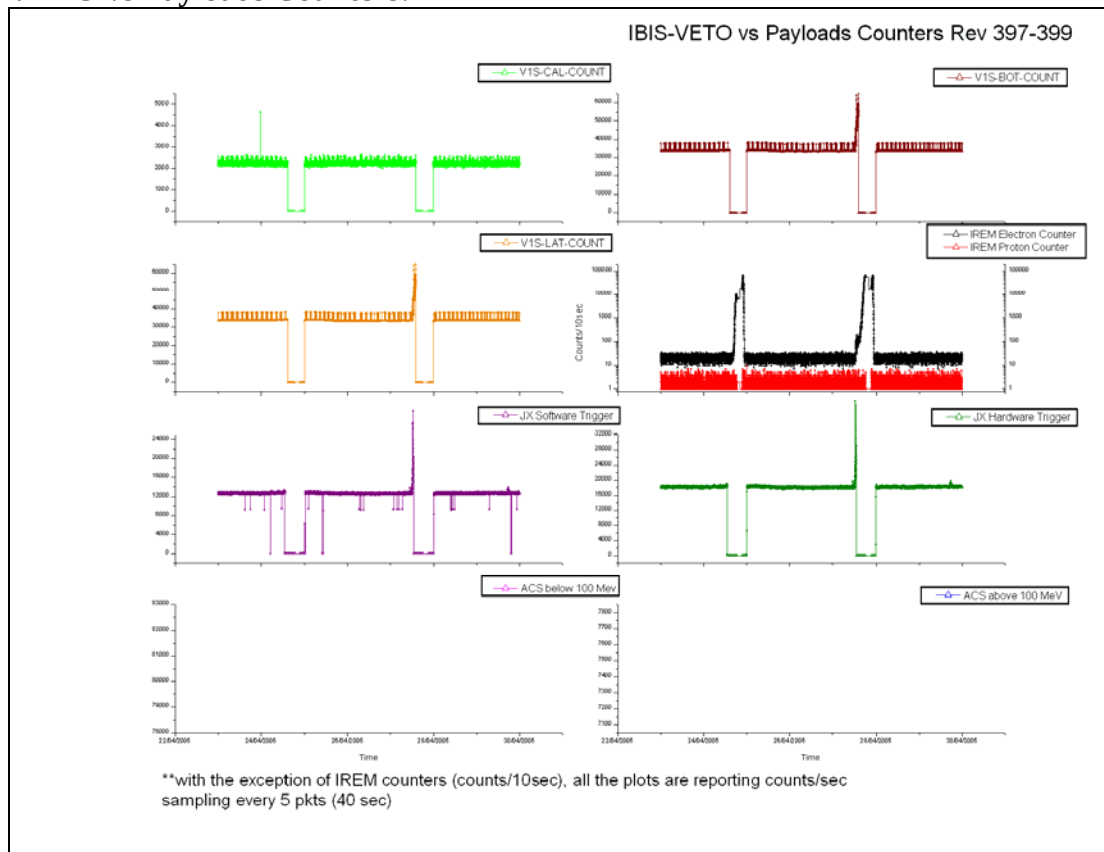
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

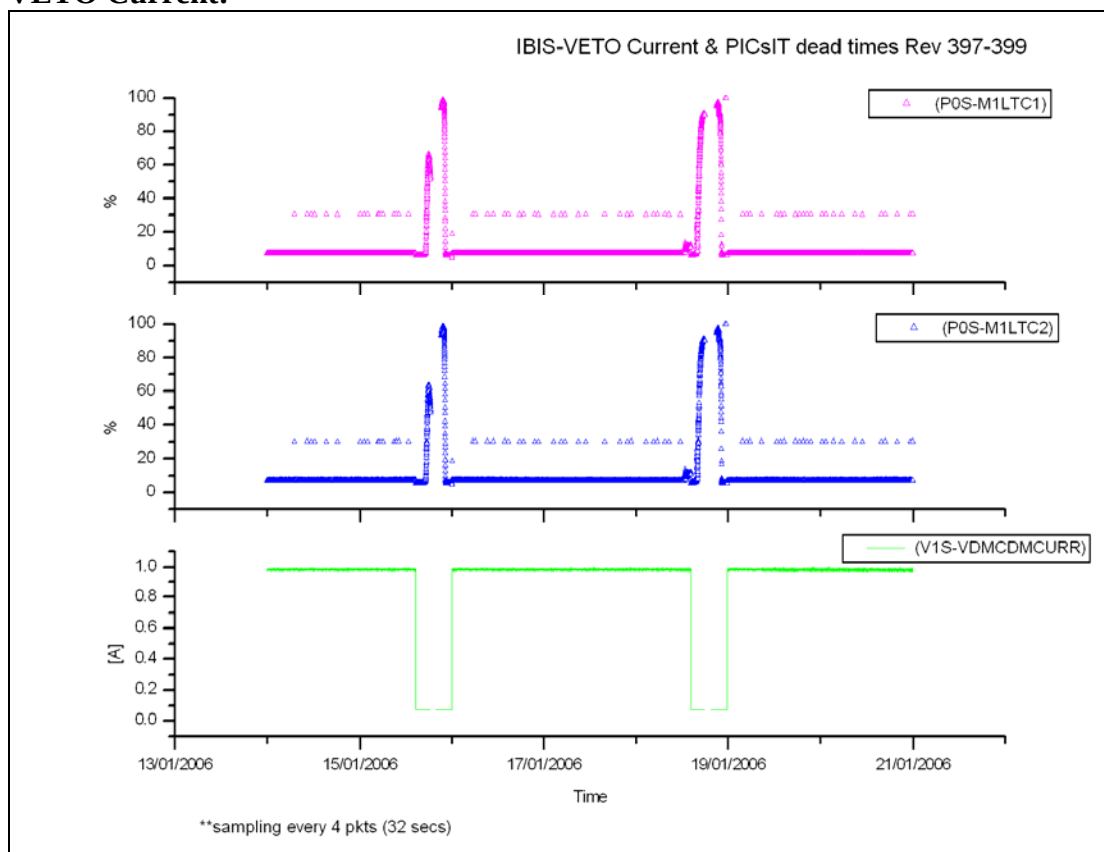


VETO vs Payloads Counters:

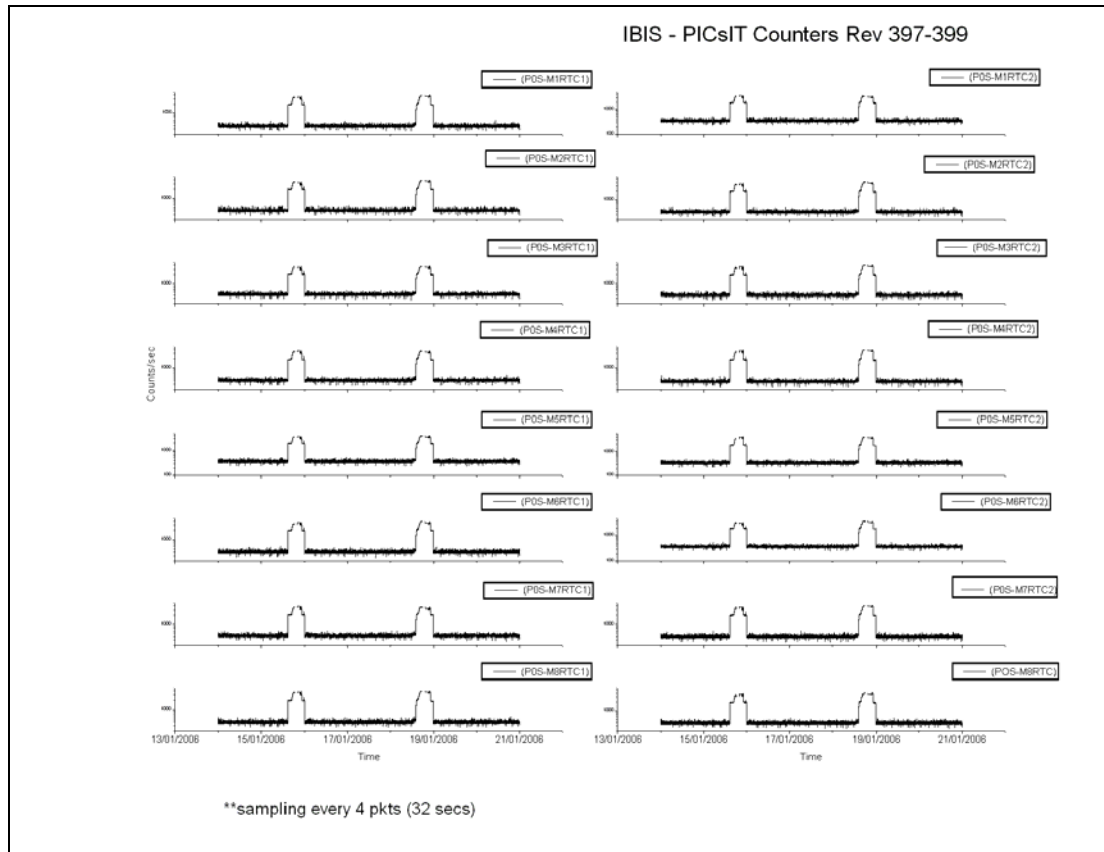


The week was characterised by low radiation.

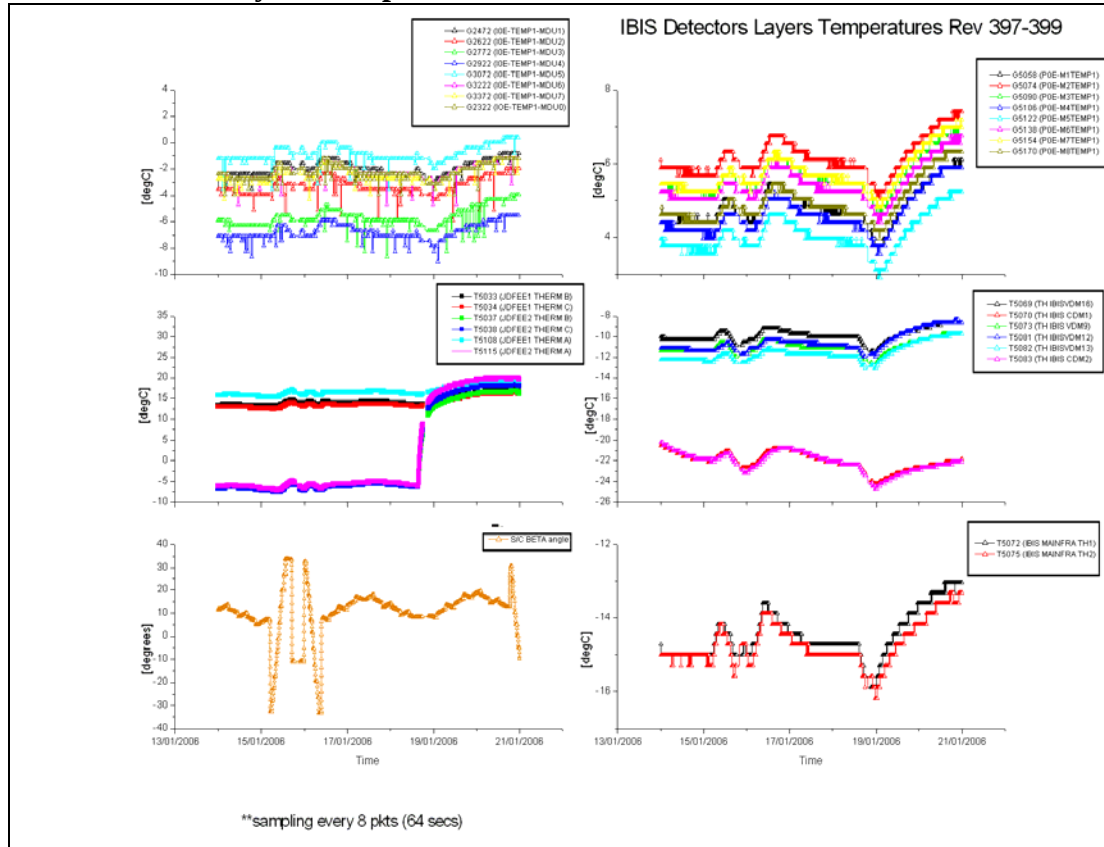
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



N.B. JEMX2 DFEE switch ON on the 18/01/2006.

IBIS daily report

DoY 2006.015 (15/01/2006):

At 14:32Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit on DoY 2006.016 at 00:02Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside radiation belts, TM parameter G5023 (P0S-M5RTC2) was toggling OOL high. According to P-CNT-1, no action was taken.

DoY 2006.018 (18/01/2006):

At 12:30Z TM parameter G8080 (S1E-VS HBRA-RT) was reported OOL High and went back inside limits in the next cycle. According to H-OVF-2, no action was taken.

From 12:43Z until the Radiation Belts entry at 14:17Z, TM parameters G6062 (V1S-BOT-COUNT) and G6063 (V1S-LAT-COUNT) were toggling OOL High and back. As this happened while approaching the Belts, according to V-BOT-1 and V-LAT-1, no action was taken.

From 13:29Z until the Radiation Belts entry at 14:17Z, TM family G2013 (I0S-EVTCNT-MCEi) was reported toggling OOL High and back. As this happened while approaching the Belts, according to I-CNT-1, no action was taken.

At 14:17Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 23:46Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside radiation belts, TM parameters G5008 (P0S-M2RTC2), G5033 (P0S-M7RTC2) and G5038 (P0S-M8RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

DoY 2006.020 (20/01/2006):

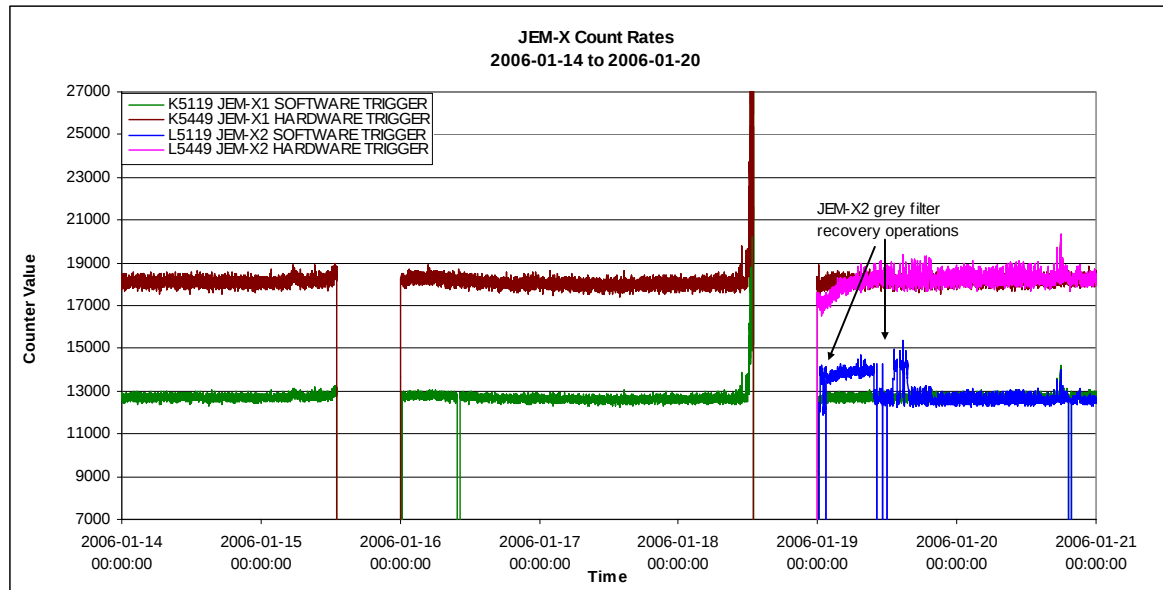
Due to the Command Verifier crashing, ED GESTAN02 was not uplinked from the Timeline at 19:12, but manually at 19:45.

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.

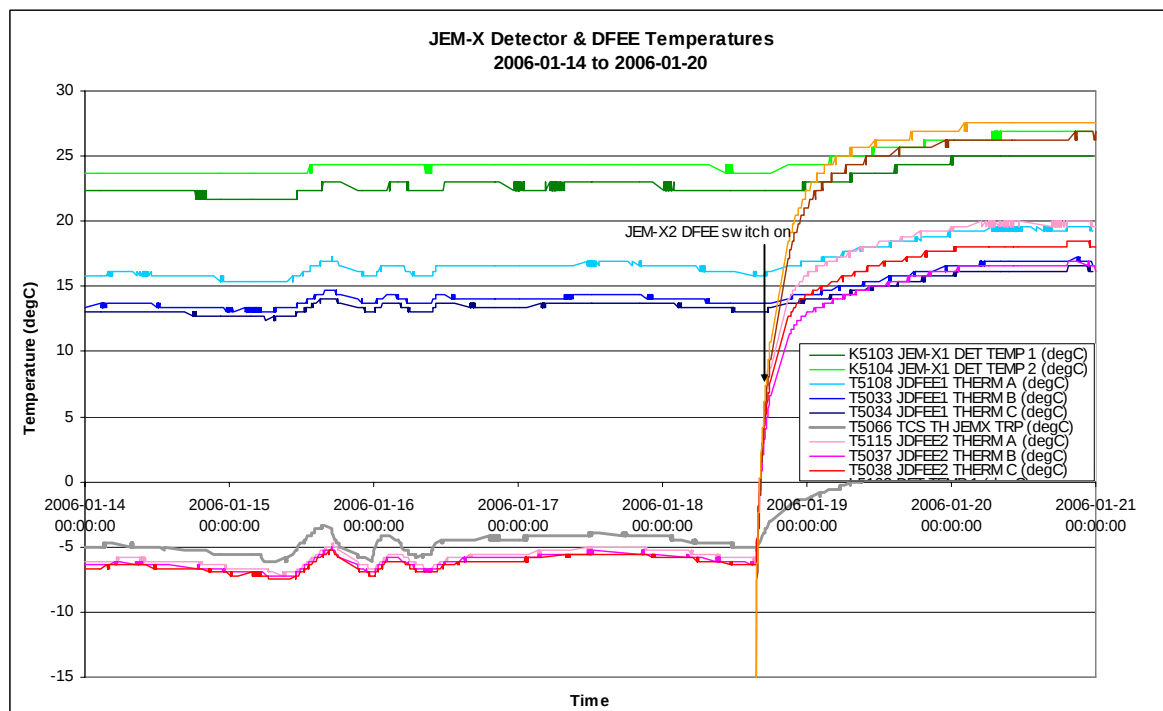
¹ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.



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.

The effect of the switch-on of the JEM-X2 DFEE on 2005-10-06 is evident. The JEM-X1 temperatures increased by ~4 degC and those of JEM-X2 by ~25 degC.



² Data sampled (1 frame in 8)

8.3.4.3 JEM-X Daily Report

2006-01-14 (DOY 014, Rev 397) to 2006-01-15 (DOY 015, Rev 397-398)

Nothing to report

2006-01-16 (DOY 016, Rev 398)

Starting at 09:45:02Z, due to a problem with IMCS (lost connection to TM cache and command verifier, see AR INT-2829), the TCs KU0014 and K0021 of the ED KEDATA02 had acceptance unverified and TC K0011 STATE DATA TAKE failed release. Once the problem was rectified, these TCs were resent manually starting at 10:17:50Z and JEM-X1 was returned to Data Taking mode at 10:19:42Z.

JEM-X1 operations continued nominally.

2006-01-17 (DOY 017, Rev 398)

Nothing to report

2006-01-18 (DOY 018, Rev 398-399)

Starting at 12:19Z the TM parameters K5136 BUFFER LOSS; K5449 HARDWARE TRIGGER and K5317 RAD MONITOR 3 began to fluctuate in and out of their high limits until 12:50:35Z, when K5119 SOFTWARE TRIGGER exceeded its safe threshold (40000), causing JEM-X1 to transition autonomously to Safe mode. This was a few minutes before the ED KESAFE02 was scheduled in the Timeline to put JEM-X1 in Safe mode before radiation belt entry of revolution 398. The TM parameter K5462 DFEE STATE IASW reported Safe on 1 occurrence but then began to report state Setup and thus there were two occurrences of OEM 189 JEM-X1 PROB DFEE 9. Commanding to JEM-X1 from the Timeline was then disabled and thus the ED KESAFE02 was not released. At 14:17:32Z, broadcast packet radiation belt entry time, K5462 also transitioned to Safe mode and OEM 254 ERROR OFF was received, indicating that the condition had been rectified.

At 15:32:21Z, after radiation belt entry of revolution 398, according to INTGSCCR-82 and INT_OR_0236 (JEM-X2 operations for Earth Observation), the JEM-X2 DFEE was switched on via FCP_JEM2_0021 JEMX2 DFEE ACTIVATION.

As is usually the case when the DFEE is switched on after having been off for a considerable period of time, the JEM-X2 Detector Pressures went Out of Limits Low when the DFEE was switched on (TM parameter L5101 DET PRESSURE 1 = 132650Pa and L5102 DET PRESSURE 2 = 135200Pa). L5101 returned stably within limits (137000Pa) at 22:08:07Z and L5102 at 23:28:58Z.

In line with INT_OR_0236, at the start of revolution 399 during the period inside the radiation belts when JEM-X has a TM allocation of 9 packets/cycle, the JEM-X2 DFEE Integer Parameter 64 was reset to 774 DEC as follows:

- 21:58:48Z FCP_JEM2_0120 executed to disable the JEM-X2 reactions to the Broadcast Packet radiation belt times. At this time JEM-X2 transitioned autonomously to Setup mode.
- 22:02:02Z FCP_JEM2_0070 JEMX2 LOAD/REPORT DFEE INTEGER PARAMETERS executed, with the following values for the parameters of TC L0014:

L0014

L0013 = 64 (RAW DEC)

L0014 = 774 (RAW DEC)

At this time, the TC L0022 SW READ FLOAT was also sent to report the DFEE Float parameters, which could not be done during the DFEE switch-on procedure as JEM-X2 had only had 1packet/cycle at that time.

- 22:09:42Z FCP_JEM2_0120 executed to re-enable the JEM-X2 reactions to the Broadcast Packet radiation belt times. At this time JEM-X2 transitioned back to Safe mode autonomously.

JEM-X2 was then activated nominally via the automatic Timeline.

2006-01-19 (DOY 019, Rev 399)

At 00:23:38Z the TM parameter L5135 FIFO FULL LOSS went Out of Limits High (value = 14008), indicating that the DPE buffer was full. It returned within limits at the start of the next pointing but then went Out of Limits High again at 01:13:06Z. To recover from this condition, as per INT_OR_0236, the grey filter was set manually to 5 as follows:

- 01:28:30Z FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
- 01:30:26Z FCP_JEM2_0044 JEMX2 DATA TAKING
- 01:32:19Z FCP_JEM2_0090 JEMX2 SET GREY FILTER SELECTION, setting the following parameter value for the TC L0037:

L0037

L0161 = 5 RAW DEC

At 08:51:19Z the grey filter was set back to automatic via FCP_JEM2_0090 JEMX2 SET GREY FILTER SELECTION, setting the following parameter value for the TC L0037:

L0037

L0161 = FFFF HEX

The behaviour of JEM-X2 was then monitored and it was observed that the grey filter was not reducing as expected once the DPE buffer filling level exceeded 50% (30000 events). Thus the following investigations and recovery actions were performed in consultation with the JEM-X PI:

- 10:14:07Z JEM-X2 commanded to Setup (FCP_JEM2_0041) and back to Data Taking mode (FCP_JEM2_0044) to flush the buffer and restart. The same filling of the buffer without reduction in the grey filter was observed.
- 11:11:58Z JEM-X2 commanded to Setup (FCP_JEM2_0041); the grey filter was re-commanded to automatic (FCP_JEM2_0090) and JEM-X2 was returned to Data Taking mode (FCP_JEM2_0044). The same behaviour of the grey filter was still observed.

- 11:48:37Z The PST was reprogrammed to give JEM-X2 an extra 5 packets (taken from SPI) and the TM allocation in the Broadcast Packet was updated accordingly. The grey filter parameters were then reported as follows:
 - o 11:56:16Z FCP_JEM2_0041 JEMX2 TRANSITION TO SETUP
 - o 11:57:35Z TC L0045 REP PARAM GF to report the grey filter parameters. These were verified as being correct.
 - o 12:01:00Z FCP_JEM2_0044 JEMX2 DATA TAKING
 - o 12:15:51Z PST from the Timeline re-uplinked.

Following further discussion with the JEM-X PI, the Broadcast Packet TM share was modified, giving JEM-X2 additional packets, while not actually allocating the additional slots to JEM-X2 in the PST. This effectively allowed the grey filter algorithm to function by letting JEM-X2 'believe' it had sufficient TM allocation to downlink data. This was observed to work, with the grey filter reducing as expected.

At 14:42:13Z a further test was performed updating the PST and Broadcast Packet to give 1 packet from SPI to JEM-X2. It was verified that the automatic grey filter again behaved as expected, starting to reduce once the DPE buffer reached a filling level of 50%.

At 15:46:11Z the PST was reprogrammed to give JEM-X2 15 packets from SPI. The Broadcast Packet TM share was not updated. JEM-X2 remained in this configuration until the TM allocation was updated by the Timeline at 2006-01-20T19:11:16Z (at which time JEM-X2 was allocated 8 packets/cycle).

2006-01-20 (DOY 020, Rev 399)

Starting at 19:11:51Z, due to a problem with the command verifier task of the IMCS, the acceptance stage of TCs K/LU0014 and K/L0021 of the EDs K/LEDATA02 was unverified and TCs K/L0011 STATE DATA TAKE failed release. Once the problem was rectified, these TCs were resent manually starting at 19:34:53Z. JEM-X1 was returned to Data Taking mode at 19:39:49Z and JEM-X2 at 19:40:17Z.

JEM-X operations continued nominally.

8.3.5 OMC Operations

2006-01-14 (DOY 014, Rev 397) to 2006-01-15 (DOY 015, Rev 397-398)

Nothing to report

2006-01-16 (DOY 016, Rev 398)

Due to a problem with the imcs, the start of pointing 03980019 was delayed from 09:45 to 10:33.

2006-01-17 (DOY 017, Rev 398) to 2006-01-19 (DOY 019, Rev 399)

Nothing to report

Doc. Title : INTEGRAL Mission Report #174
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 23/01/06

Issue : 1
Rev. : 0
Page : 25

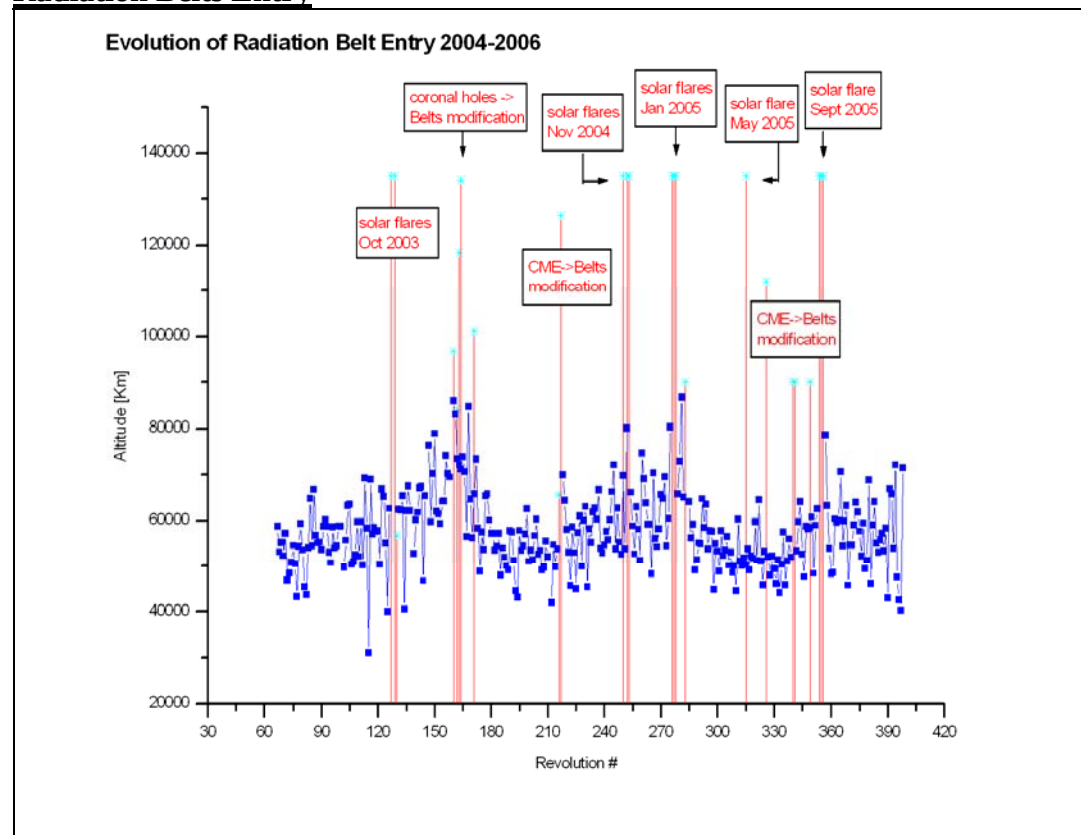
2006-01-20 (DOY 020, Rev 399)

Due to a problem with the imcs, the start of pointing 03990044 was delayed from 19:12 to 19:42.

On DoY 015 at 14:32:45 and DoY 018 at 14:17:17 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]
397	RAD_ENTR R 2006-01-15T14:32:40Z	2006-01-15 16:55:48	40272.9	2006-01-15 15:48:31	49813
398	RAD_EXIT R 2006-01-15T23:48:53Z	2006-01-15 22:41:40	<31542.9	2006-01-15 22:58:31	32417
398	RAD_ENTR R 2006-01-18T14:17:09Z	2006-01-18 12:35:56	>71476.5	2006-01-18 15:33:05	49822
399	RAD_EXIT R 2006-01-18T23:33:10Z	2006-01-18 22:42:36	>>23347.0	2006-01-18 22:43:05	32406

Reference

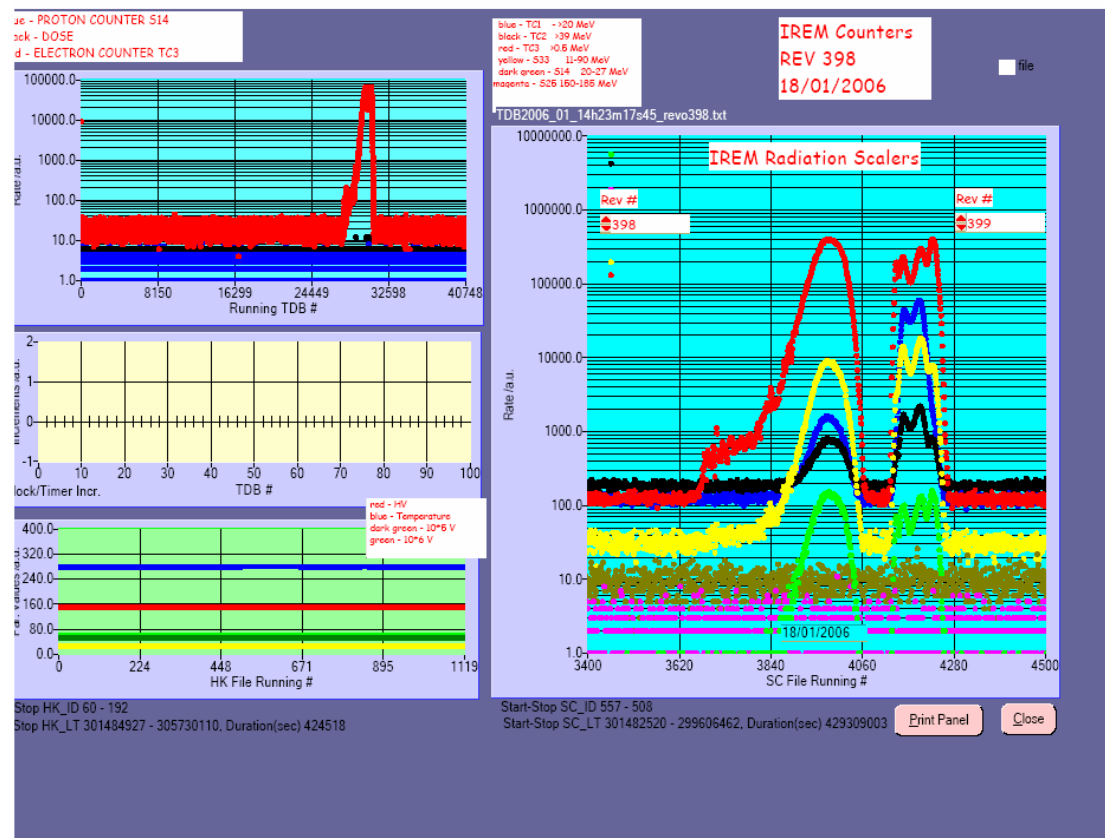
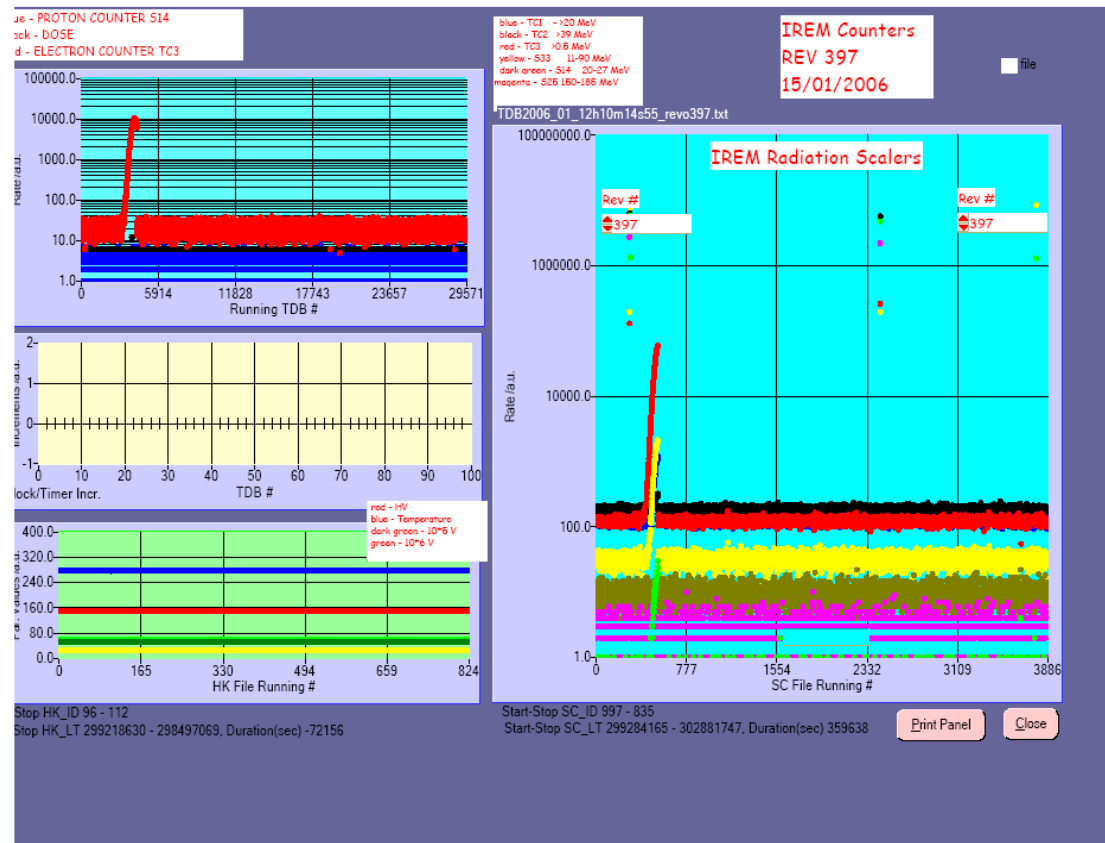
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

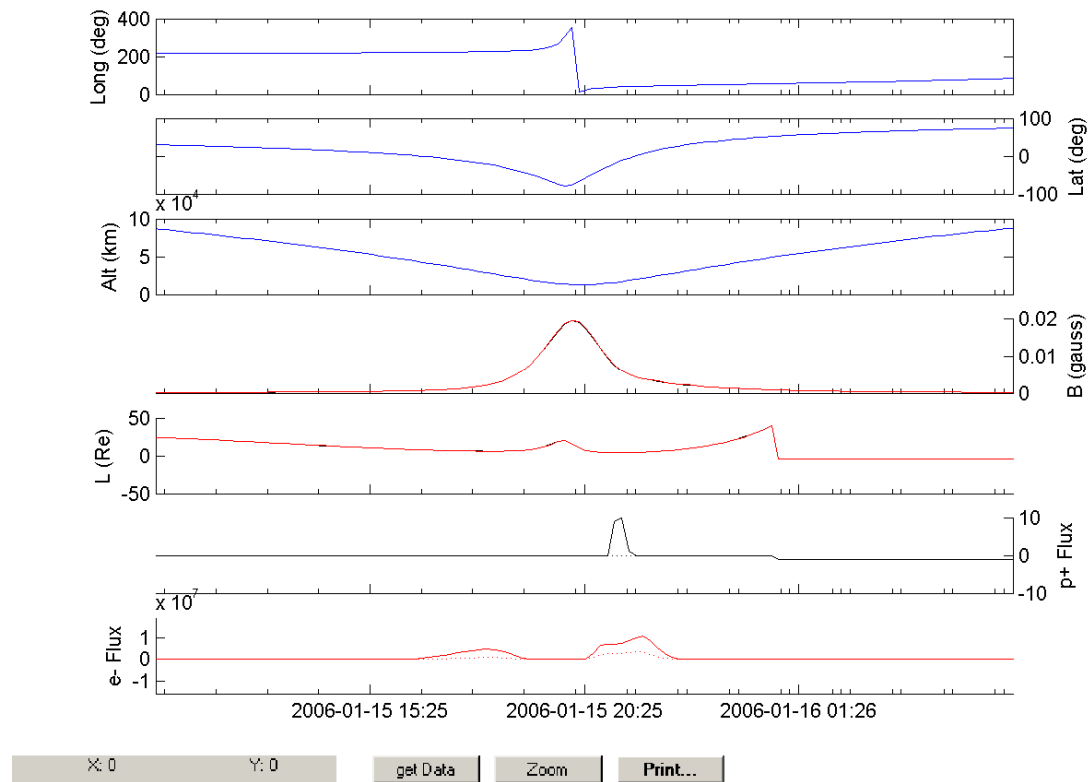
Large error vs reference (more than 30 minutes)

Radiation Spike

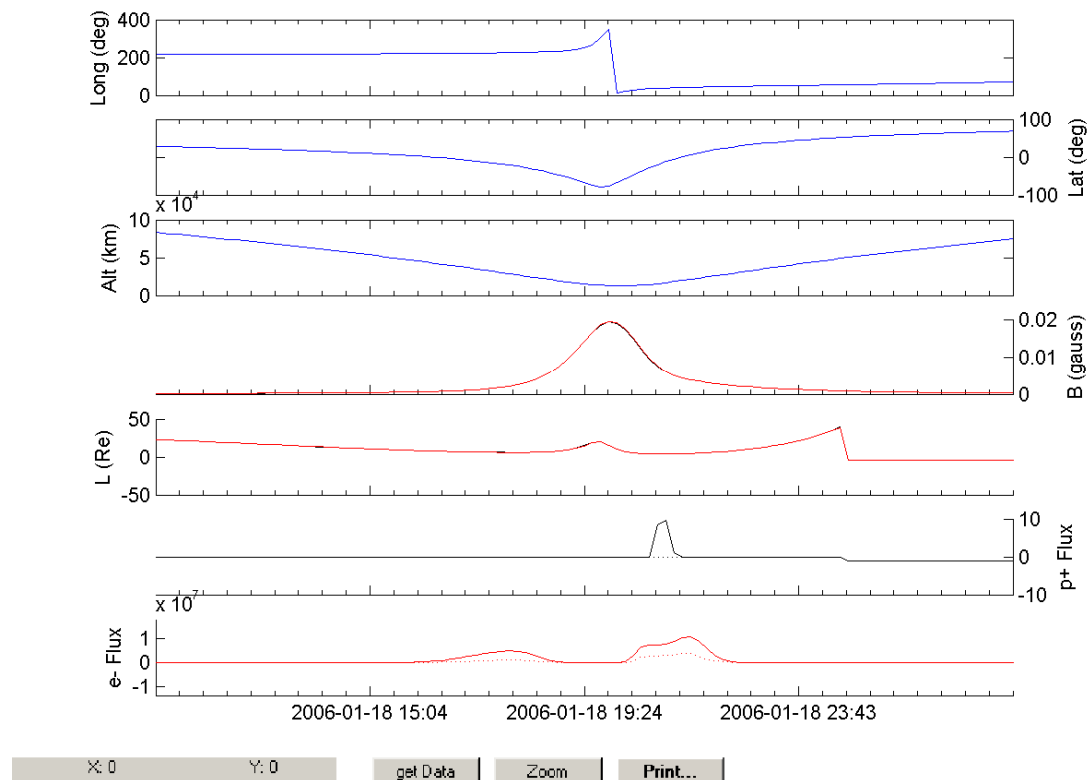
IREM radiation counters:



IREM Predicted Radiation Belt Passages:
Rev 397



Rev 398



SEC-GOES Observed Particles Fluxes:

