

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-OPS-OF**  
**No. 175**  
**Week 04**  
**30.01.06**  
**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 21.01.06 until 27.01.06 (both dates inclusive) and covers the revolutions 400 and 401 (The 1<sup>st</sup> 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 an Earth Observation (RA 12:00:00.00; DEC -20:00:00.0), a Post Earth Observation (RA 16:46:53.56; DEC -60:56:09.3), which were staring observations, 3C 279 (RA 12:56:11.00; DEC -05:47:21.5), NGC 4945 (RA 13:05:27.48 ; DEC -49:28:05.6), Field\_1 (RA 15:26:18.00; DEC +12:29:19.0) which were raster dithering observations 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.

The First Earth Observation (EO1) activity was performed on 24-25 January 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 IMU1 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.

No slews were missed from the Timeline during this period.

The fuel consumption over the period between 18/01/2006 and 25/01/2006 was 0.0984 kg. The remaining propellant is in the order of 156.6832 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

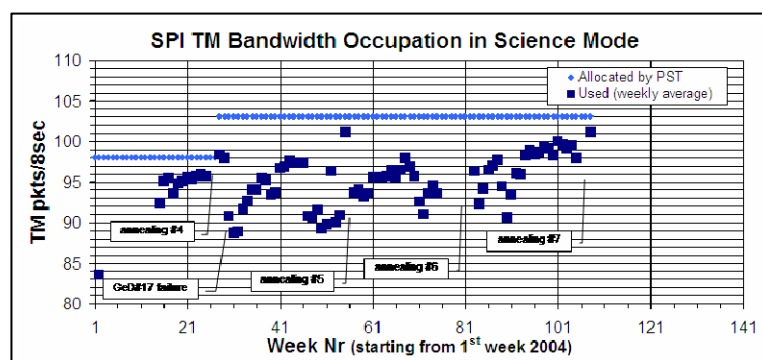
### 3.2.1 SPI

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

The 7<sup>th</sup> annealing cycle of the Germanium detectors, started on 9<sup>th</sup> January at radiation belts entry of rev.398 (14:18z), ended on 24<sup>th</sup> January at 21:30z, when the compressors entered the 85K fine tuning operations. Major annealing events are presented by dedicated plots in this report.

The Stirling compressors were restarted 19<sup>th</sup> January at ~11:30z and successfully cooled down to 85K the Germanium detectors, in time for the forthcoming Earth Observation in rev.401.

The Germanium detectors were turned on successfully on 23<sup>rd</sup> January at around 08:00z. 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 101.1 pkts/cycle.



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

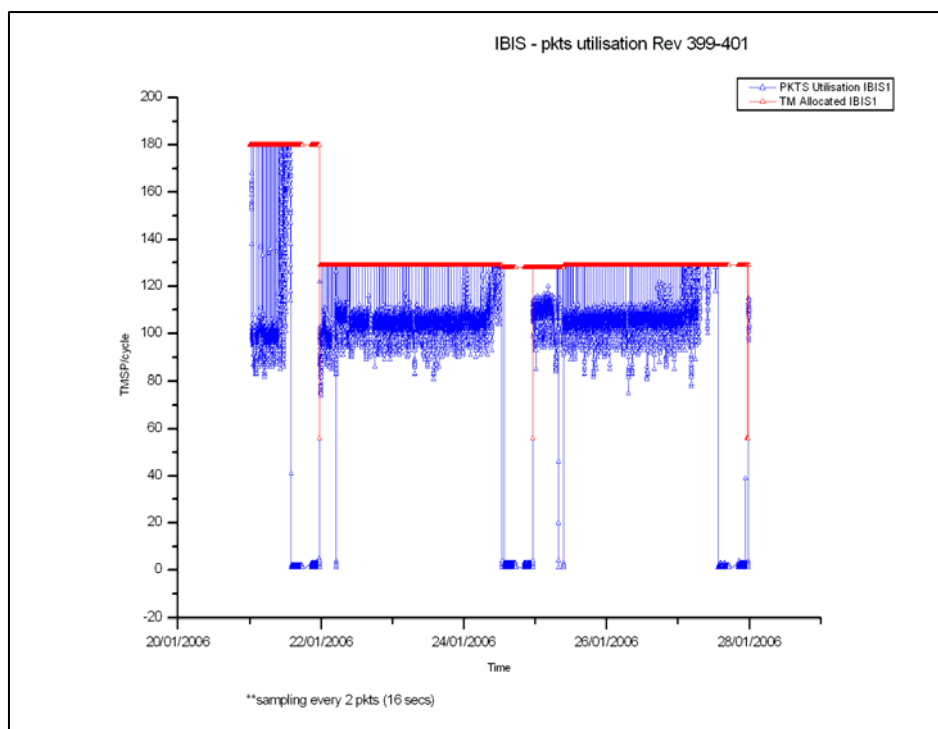
### 3.2.2 IBIS

The Overall status of the unit is nominal.

At the beginning of revolution 401, the first 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, due to SPI annealing, it was 180 TMPS/cycle during revolution 399 (until 21/01/2006 23:32:44Z). In addition, during the Earth Observation (from 24/01/2006 12:59:40Z to 25/01/2006 09:43:24Z), 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 109.53 TMPS/cycle, up 1.07 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 8 packets/cycle in revolution 395 and with 15 packets/cycle in revolutions 396 and 397. JEM-X2 was dormant (DFEE OFF) with a TM allocation of 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 148 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.*

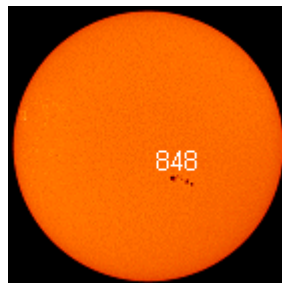
### **3.2.5 IREM**

The overall status of the unit is nominal.

#### **Solar Activity**

The observation period was characterised by moderate to low solar activity.

From the 21<sup>st</sup> to the 22<sup>nd</sup> of January sunspot 848 that appeared last week (on the 18<sup>th</sup>) kept growing. On the 23<sup>rd</sup> (cf. picture) it was posing threat for strong solar flares until the 25<sup>th</sup> when it started decaying. No X-class or M-class solar flare was emitted; however solar activity was reported with several C-class X-ray emissions.



*Reference: [www.spaceweather.com](http://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 very good this week, no pointing was lost. There were few 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 very good this week. No problem was reported. The overall performance was well above the 95% requirement.

## **4.2 Ground Stations & Network**

The performance of the ground stations and Network was good this week. Problems with the INCTRA were reported, causing a swap of configuration (IMCS-INCTRS) but no impact on the science. Moreover, a problem with TMP1 caused an earlier TMP swap and few very small gaps in TM. Finally, there were several instances of bad frames from REDU, but these had no impact on the mission. The overall performance was still 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 409. Mission planning in ISOC has been performed up to revolution 407. They have been sent to MOC. No replanning or ToO have been done this week. A ToO request that was received late last week is still pending waiting to see if the source meets the trigger criteria. Revolution 408 will contain an OMC flat field calibration observation. The SPI annealing has been completed as planned. Also the first of the earth observations has been performed. Spacecraft and instruments performance was as expected. Also the procedures and mission planning has performed very satisfactory. The very first results look very encouraging. A meeting next week will conclude on the continuation of this campaign. TSF's have been received up to revolution 404.

#### **2. Observation status**

ECS's for revolutions up to rev 392 were received. Corresponding OCS's have been sent to ISDC.

No extra time has been credited.

#### **4. ISOC science data archive**

A beta release of the ISDA version 2.5 is now available. It is being extensively tested internally. This week an agreement with the ISO and XMM-Newton archivists has been reached that will facilitate implementation of links between these ESA archives. Manpower both on ISOC side and the Archive group side continues to be a problem. The problem is amplified by the fact that a team member of the Archive group left recently and no replacement is yet found. The ingestion of data from ISDC has recently required more manual intervention than anticipated. A solution will be discussed between ISOC and the Archive group to reduce dependency on changes on ISDC side.

#### **5. ISOC system**

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

#### **6. AO 4 preparation**

This week has seen intense activities in ISOC to provide a final version of the document package for AO 4. All documents except one is considered in the desired state. The last document is still internally being reviewed. It is expected to be in the same state as the other ones early next week. Sensitivity curves for Observing Time

Estimator software has been received now for ISGRI and PICSIT. No changes for SPI are expected.

7. Problems  
None.

#### **4.3.2 ISDC**

Status of ISDC observation processing on 30/01/2006:

- Latest Standard Analysis completed: observation 03297000001 (GRO J0852-4642 , Revolution 373-383) on 20/01/2006
- 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 several problems but they did not impact the operations.

There was only one new anomaly report entered into the ARTS system this week, although it refers to an anomaly that happened on 19/01/2006.

| AR id      | Date Created | Subject                                                         | Segment | Status |
|------------|--------------|-----------------------------------------------------------------|---------|--------|
| INT_SC-137 | 2006-01-27   | JEM-X2 Buffer filling due to automatic grey filter not reducing | Payload | Open   |

## **7 Future Milestones**

Preparation is on-going for the earth observation, currently planned to take place in February in revolutions 404, 405 and 406.

A new upgrade of the IMCS should be implemented to fix the Command Verifier problem in the next weeks.

## **8 Appendix**

The appendix includes various detailed information.

### **8.1 Overview of Revolutions**

#### **Revolution 400**

The observations in revolution 400 commenced with a GPS survey lasting ~4.3 hours, it continued with a raster dithering observation of 3C 279 (RA 12:56:11.00 ; DEC - 05:47:21.5 ) lasting ~4.0 hours, followed by another raster dithering of NGC 4945

(RA 13:05:27.48 ; DEC -49:28:05.6 ) which continued for ~47.5 hours. It terminated after a 0.75 hour staring observation at pre-Earth pointing 1 attitude of (RA 16:46:53.56; DEC -60:56:09.3)

Throughout these observations all instruments were in their nominal science modes, except JEM-X2, and SPI, which was in Configuration Mode undergoing annealing. The TM allocation throughout all observations up to 2006-01-24T12:59:20 was: IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5, after this time JEM-X2 was activated for the remainder of the revolution and the TM Allocation was: IBIS 128; SPI 103; JEM-X1 5; JEM-X2 5; OMC 5

### Revolution 401

The observations in revolution 401 commenced with a staring Earth Observation at an attitude of RA 12:00:00.00; DEC -20:00:00.0) lasting ~7.5 hours, it continued with another staring Post Earth Observation at an attitude of (RA 16:46:53.56; DEC -60:56:09.3) lasting ~0.6 hours, this was followed by a raster dithering observation of Field\_1 with attitude (RA 15:26:18.00; DEC +12:29:19.0) lasting ~48.2 hours.

Throughout these observations all instruments were in their nominal science modes during the Earth Observation. Subsequently the TM allocation JEM-X2 was reduced, but the instrument was left in Data Taking. The TM allocation throughout all observations up to 2006-01-25T09:43:27 was: IBIS 128; SPI 103; JEM-X1 5; JEM-X2 5; OMC 5, after this time JEM-X2 was activated for the remainder of the revolution 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

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2006-01-10T15:16:32.000Z | 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. |
| 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. |

This report was generated Fri Jan 27 08:00:27 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, 21/01/2006 – 27/01/2006**

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 024-025.

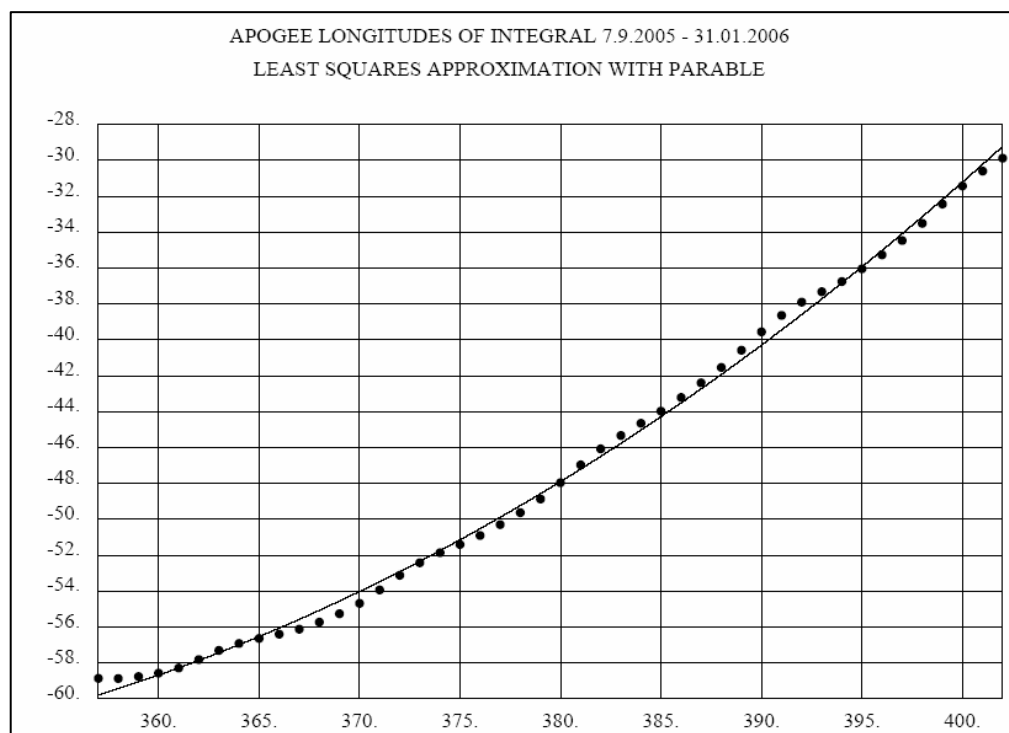
During this period, 65 Open Loop Slews, 94 Closed Loop Slews and 7 Momentum Bias were executed (TL + EO configuration).

No slews were missed from the Timeline during this period.

#### **Orbit Control**

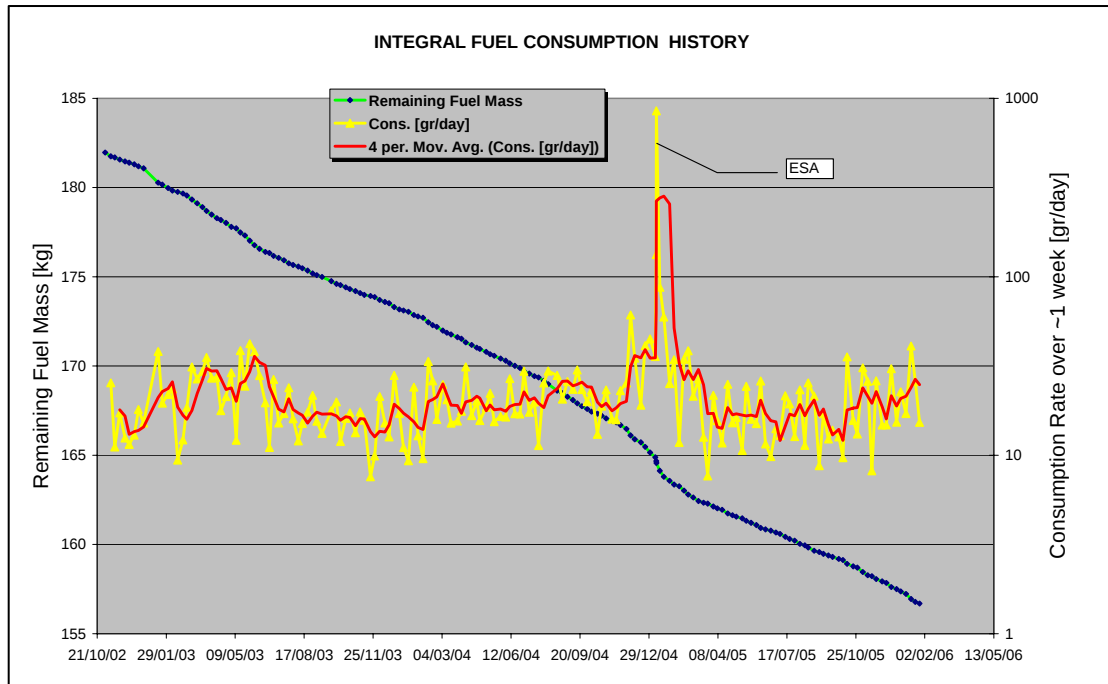
The plot below shows the apogee longitude of Integral as a function of the orbit number. According to the linear least squares approximation with a parable the drift rate at the end of 2005 was 1.01 deg eastward shift per orbit.

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.

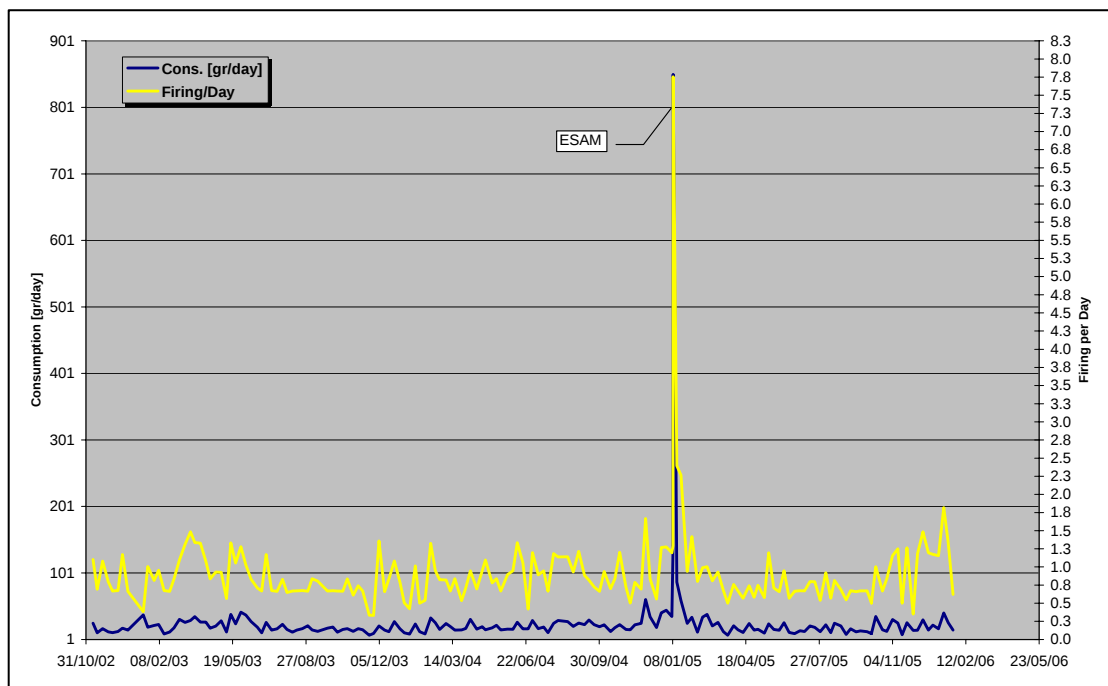


#### **Fuel consumption**

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 25/01/2006 is reported in the plot below.

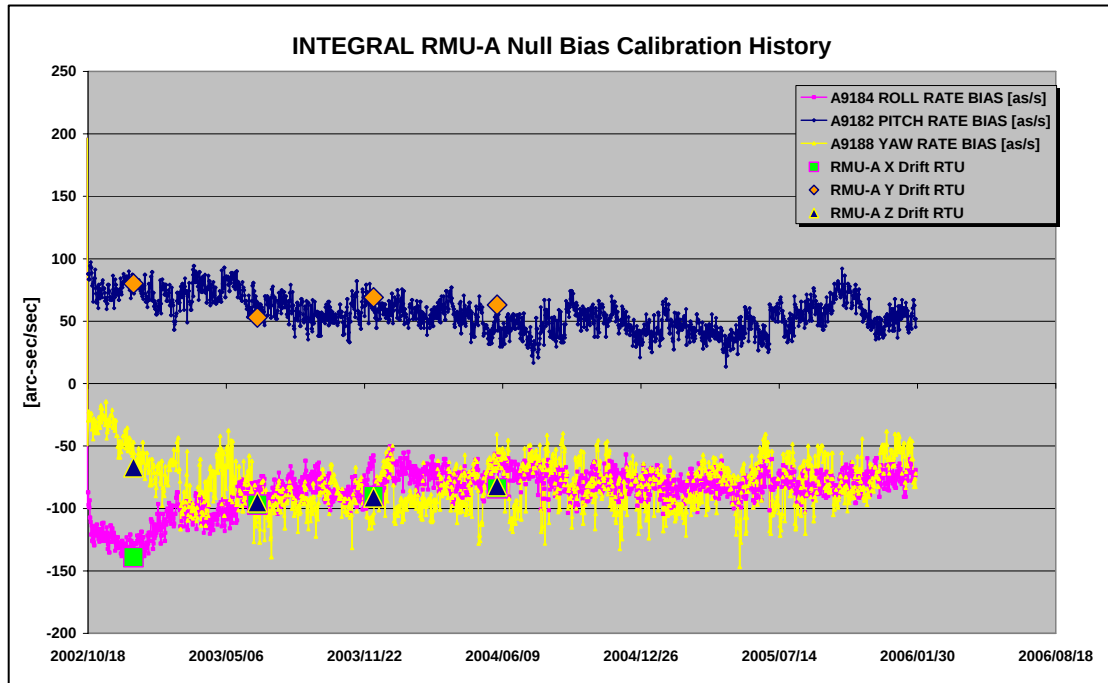


The firing\day over the period between 01/11/2002 and 25/01/2006 is reported in the plot below.

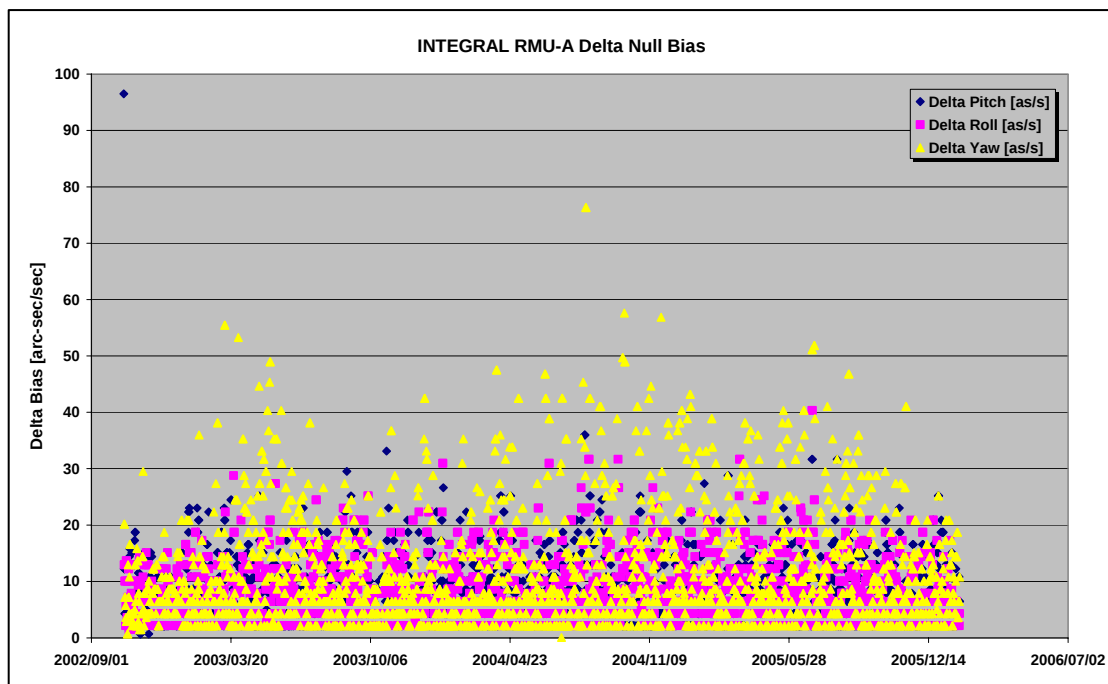


### The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 27/01/2006 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 27/01/2006 is reported in the plot below.



**21/01/06 (Day of Year 021, Revolution 399-400)**

**OTF low during PID 03990051:** at 23:58:01Z, the OTF went low (flickering of the pointing bit) and the pointing ID 03990051 not reached. The reason of the flickering is likely due a false event. The guide star was Mi 8.1 at CCD location [3173 , -10072].

No impact on TL, the next slew was manually updated and executed correctly. Due to the flickering of the pointing bit the OTF was not reached and the pointing ID 03990051 lost.

## 22/01/06 (Day of Year 022, Revolution 400)

**OTF low during PID 04000024:** at 16:48:27Z, the OTF went low (flickering of the pointing bit) and the pointing ID 04000024 not reached. The reason of the flickering is likely due a false event. The guide star was Mi 8.5 at CCD location [710 , -7197].

No impact on TL. Due to the flickering of the pointing bit the OTF was not reached and the pointing ID 04000024 lost.

## 23/01/06 (Day of Year 023, Revolution 400)

Nothing to report.

## 24/01/06 (Day of Year 024, Revolution 400-401)

**First Earth Observation 24-25 January 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 40 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 22:08Z 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:

| Time (Z)                | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                         | REV 400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |          |
| 2006/01/24<br>13:00:00Z | <p>Start of activities for S\C configuration.<br/>           The starting attitude for the IMU switch ON and warming up is that for PID 04000068 (EO attitude). The Automatic Timeline commands the Slew to 'Earth Observation Attitude' as reported below:</p> <p>PID 04000068<br/> <math>\alpha = 16:47:52.88</math><br/> <math>\delta = -60:52:12.6</math><br/>           Pos angle = 067:36:13.7</p> <p>Expected Wheels speeds<br/>           RW1= not selected<br/>           RW2=+2797 rpm<br/>           RW3=+2763 rpm<br/>           RW4=-434 rpm</p> <p>FSS<br/>           Alpha F=0.06 deg<br/>           Beta F=-33.55 deg</p> <p>Expected STR guide star ID 9042-02625<br/>           CCD_Y= 1736<br/>           CCD_Z= -1963<br/>           Mi=6.25</p> | TIMELINE |

| Time (Z)               | INTEGRAL Earth Observation (DoY 024-025 2006) |  |
|------------------------|-----------------------------------------------|--|
| Start IMU activities   |                                               |  |
| 13:15:00Z              | MANUAL                                        |  |
| 13:16:00Z              |                                               |  |
| 13:26:28Z              |                                               |  |
| 13:34:00Z              |                                               |  |
| 14:12:00Z              | MANUAL                                        |  |
| 14:47:00Z              |                                               |  |
| 15:50:00Z              | MANUAL                                        |  |
| 15:50:00Z to 17:20:00Z | Stable pointing: PID 04000068                 |  |
|                        | OFF-LINE ANALYSIS                             |  |
| 15:53:36Z              | TIMELINE                                      |  |
| 16:26:31Z              | TIMELINE                                      |  |
| 16:45:38Z              | TIMELINE                                      |  |

| Time (Z)                      | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 16:47:30Z                     | WHEEL_BIAS<br>Bias will not be executed, the wheel speeds for Perigee already set in previous Bias at 15:00:00Z.                                                                                                                                                                                                                                                                                                                                                                                                   | TIMELINE                                                                                                                 |
| 17:19:38Z                     | CGS will not be executed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TIMELINE                                                                                                                 |
| 17:30:42Z                     | Loss of TC signal for GOLDST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TIMELINE                                                                                                                 |
| 17:37:00Z                     | Loss of TM signal for GOLDST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TIMELINE                                                                                                                 |
|                               | <b>TPF for IMU drift (AEDRA_00) to be generated by FDS and transferred to IMCS (imca/imcb/sun121/sun122/sun123/sun124)</b>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                          |
| 19:36:07Z                     | PERIGEE PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                          |
|                               | <b>REV 401</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                          |
| 20:27:18                      | Acquisition of TM signal for REDU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | TIMELINE                                                                                                                 |
| 20:33:14                      | Acquisition of TC signal for REDU<br><br><b>Verify AOCS s/s is DISABLED in Timeline</b><br><br>Verify UDC in TM SPACON                                                                                                                                                                                                                                                                                                                                                                                             | TIMELINE                                                                                                                 |
|                               | <b>Start of B/U window for the IMU Calibration</b><br><br><b>TPF for IMU drift (AEDRA_00) generated by FDS and transferred to IMCS (imca/imcb/sun121/sun122/sun123)</b>                                                                                                                                                                                                                                                                                                                                            | MANUAL                                                                                                                   |
| 20:37:00Z                     | Load of IMU Drifts, FCP_AOC_1622                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                          |
| 20:53:14Z                     | AOCS Daily Maintenance, FCP_AOC_0540                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                          |
| 21:03:14Z                     | Perform Manual Mapping and start Recovery Schedule Tool until attitude reconstruction process to generate the last ASF for ISDC before the EO.<br><br><b>Verify with ISDC, via loop, the reception of the ASF .</b>                                                                                                                                                                                                                                                                                                |                                                                                                                          |
| 20:58:14Z                     | WHEEL_BIAS , will not be executed, appropriate wheel speeds were set in last RWB in revolution 400, AOCS s/s DISABLED in Timeline                                                                                                                                                                                                                                                                                                                                                                                  | TIMELINE                                                                                                                 |
| <b><u>Disable STR use</u></b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                          |
| 21:20:14Z                     | Manual RMU calibration<br><br><i>Perform, in parallel, quick IMU-1 Drift and Noise evaluation, FCP-AOC-0523 step 8</i>                                                                                                                                                                                                                                                                                                                                                                                             | MANUAL                                                                                                                   |
| 22:08:29Z                     | Disable the STR use and select IMU 1 for attitude control, FCP_AOC_1104 (since the IMU 1 is already configured and calibrated, execute only from step 5)<br><br>As soon as the STR use is disabled, the ACC will switch control to FSS on Roll & Pitch and IMU on Yaw.<br><br><i>The attitude will slowly drift on Yaw due to the residual IMU drift (not corrected by the calibration). Roll and Pitch will follow the apparent motion of the Sun, the S/C attitude is not inertial therefore the attitude at</i> | No problems arise from the SAS1-(X-Y) windows criteria, because the sun position is maintained in the centre of the FOV. |

| Time (Z)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>the end of observation will be slightly different (apparent sun drift ~150 as/h).</p> <p>Execute periodic manual STR mapping to monitor the STR FOV blinding, FCP_AOC_0531. The initial frequency is set every 15 minutes (TBA)</p>                                                                                                             |                                                                                                                                                                        |
| <p><b><u>S/C Earth's Avoidance Manoeuvre</u></b></p> <p>To abort the observation. Criteria TBD by Integral PIs.<br/>         S/C slew around the sunline by using the IMU drift , FCP_AOC_1106.</p> <p>To perform a slew around the Sun line by changing the IMU drift. This procedure has to be performed in extreme case, under SOM authorization, when requested to change the orientation of the S/C, in IPS, in case of STR blinding.</p> <ul style="list-style-type: none"> <li>Earth's motion in STR CCD coordinates: from <math>+Z_{CCD}</math> to <math>-Z_{CCD}</math></li> <li>The IMU drift to be commanded is = <math>-4.85E-05</math> rad/sec (10 degrees/hour =10 as/s)</li> <li>The sign of the drift to be applied is negative(-), causing a negative rotation of the S/C around the Yaw axis in opposite direction to the Earth's apparent motion</li> <li><b>MAX time requested to drift out the Earth (11+3 deg) from the STR FOV =&gt;1 hour, assuming</b> <ol style="list-style-type: none"> <li>1)Commanded drift = <math>-4.85E-05</math> rad/sec</li> <li>2) mean Earth's radius during the occultation= 5.5 deg</li> <li>3) Earth's motion in STR CCD, parallel to <math>Z_{CCD}</math> axis</li> </ol> </li> </ul> <p>The Escape attitude will be RA[HMS]=16:29:21.67; DEC[DMS]=-52:55:40.7; POS[DMS]=077:01:49.1</p> <p>The drift is subtracted from the measurement, i.e. the sign of the processed body rates will be the contrary of the commanded drift. The sign of the commanded slew will be in agreement with the sign of the commanded drift.</p> <p>A drift &gt;30 deg will determine the STR get eventually blinded by the Moon, while travelling along the escape path.</p> |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                        |
| <b><u>Start STR Earth constraint violation – Attitude control on IMU1 and FSS-A</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                        |
| 22:40:00Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p><u>Start of the Earth constraint violation</u> (= STR FOV &lt;15 deg away from the Earth's limb)</p> <ul style="list-style-type: none"> <li>Earth angular radius ~ 8.49 deg at 22:39:57</li> <li>S/C Altitude 36845.1 Km</li> </ul> <p>STR mappings commanded periodically by ground, in order to monitor STR status and FOV, FCP_AOC_0531.</p> | <p><u>STR emergency transition to Stand-By</u></p> <p>In case the STR is not reacting during a mapping, ARM the procedure to set it to Stand-By Mode, FCP_AOC_1415</p> |
| 23:16:32Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>CSL (PID 04010001)– this slew will not be executed , AOCS s/s DISABLED in Timeline, however it is inserted in order to trigger the following:</p> <ul style="list-style-type: none"> <li>PST Load</li> <li>BCPKT setting</li> <li>OTF Reset</li> <li>Instrument Commands</li> </ul>                                                             | TIMELINE                                                                                                                                                               |
| 23:32:32Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>All instrument completed the EO configuration</b>                                                                                                                                                                                                                                                                                               |                                                                                                                                                                        |
| 2006/01/25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <u>Start of Earth occultation</u>                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                        |

| Time (Z)                     | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                          |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 00:34:00Z                    | <ul style="list-style-type: none"> <li>Earth angular radius ~ 6.12 deg at 00.34.49Z</li> <li>S\C altitude 53447.0 Km</li> </ul> <p>STR mappings commanded periodically by ground, in order to monitor STR status and FOV, FCP_AOC_0531.</p> <p>Monitor of the STR background parameter</p>                                                                                                                                                                |                                                                                                                                                                                                                                          |
| 01:34:57Z                    | <p><u>STR Bore sight to the centre of the Earth</u></p> <ul style="list-style-type: none"> <li>Earth angular radius ~ 5.42 deg at 01.34.49Z</li> <li>S\C altitude 61188.9 Km</li> </ul> <p>Monitor of the STR background parameter</p>                                                                                                                                                                                                                    | Perigee + 6 Hours                                                                                                                                                                                                                        |
| 02:35:00Z                    | <p><u>End of Earth occultation</u></p> <ul style="list-style-type: none"> <li>Earth angular radius ~ 4.89 deg at 02.34.49Z</li> <li>S\C altitude 68369.0 Km</li> </ul> <p>STR mappings commanded periodically by ground, in order to monitor STR status and FOV, FCP_AOC_0531.</p> <p>Monitor of the STR background parameter</p>                                                                                                                         |                                                                                                                                                                                                                                          |
| 03:12:44Z                    | RMU calibration – this activity will not be executed, it was advanced at 21:23:53Z, AOCS s/s DISABLED in Timeline                                                                                                                                                                                                                                                                                                                                         | TIMELINE                                                                                                                                                                                                                                 |
| 07:00:00Z                    | <p><u>End STR Earth constraint violation</u>(= STR FOV &gt;15 deg away from the earth limb)</p> <ul style="list-style-type: none"> <li>Earth angular radius ~3.60 deg at 07.04.49Z</li> <li>S\C altitude 95093.3 Km</li> </ul> <p>STR mappings commanded periodically by ground FCP_AOC_0531.</p> <p>Monitor of the background</p>                                                                                                                        |                                                                                                                                                                                                                                          |
| 07:00:00                     | <p>Earliest time to start procedure to return to STR attitude control</p> <p>Verification AOCS status (AOCS daily check)</p> <p><math>\alpha \sim 16:47:52.88</math><br/> <math>\delta \sim -60:52:12.6</math><br/>           Pos angle <math>\sim 067:36:13.7</math></p> <p>RW1= not selected<br/>           RW2=+2274<br/>           RW3=+2035<br/>           RW4=-2297</p> <p>FSS<br/>           Alpha F=0.36 deg<br/>           Beta F=-33.33 deg</p> | <i>Due to the residual IMU drift on Yaw and to the apparent motion of the Sun, the attitude at the end of observation is slightly different from the initial attitude (apparent sun drift ~150 as/h, IMU residual drift ~ ____ as/h)</i> |
| <b><u>Enable STR use</u></b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| 07:00:00Z                    | <p>STR mapping for verification STR functionality, FCP_AOC_0531</p> <ul style="list-style-type: none"> <li>STR guide star</li> <li>CCD_Y= 12986</li> <li>CCD_Z= 8559</li> <li>Mi=6.4</li> </ul>                                                                                                                                                                                                                                                           | MANUAL                                                                                                                                                                                                                                   |
| 07:00:02Z                    | <p><u>WHEEL_BIAS</u></p> <p>This RWB will not be executed, AOCS s/s DISABLED in</p>                                                                                                                                                                                                                                                                                                                                                                       | TIMELINE                                                                                                                                                                                                                                 |

| Time (Z)  | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                                                                                                                                                                                                                                                         |                                                                                             |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|           | Timeline                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                             |
| 07:07:00Z | <p>Enable STR use in control loop, FCP_AOC_1105, only steps from 1to 4.3</p> <p>As soon as the STR use is enabled, the ACC will switch control to STR on Pitch &amp; Yaw and FSS on Roll.</p>                                                                                                                                                                                                         | MANUAL                                                                                      |
| 07:25:24Z | <p>OSL (PID 04010002) to EO attitude – this slew will not be executed, AOCS s/s DISABLED in Timeline</p> <p>The consistency of the Timeline is achieved by inserting a slew to an unconstrained perigee attitude, this the slew back to the EO from the perigee attitude.</p>                                                                                                                         | TIMELINE                                                                                    |
| 07:10:22Z | <p>STR mapping for attitude reconstruction, FCP_AOC_0531</p> <ul style="list-style-type: none"> <li>• STR guide star</li> <li>• CCD_Y= 12985</li> <li>• CCD_Z= 8558</li> <li>• Mi= 6.4</li> <li>•</li> </ul>                                                                                                                                                                                          | MANUAL                                                                                      |
| 07:20:00Z | Corrective CSL, to EO attitude, after IMU control, FCP_AOC_0520.                                                                                                                                                                                                                                                                                                                                      | MANUAL                                                                                      |
| 07:45:00Z | Deselect IMU1 from ACC Word B, FCP-AOC-1050 (TC_parameter A1377=NO IMU ACTIV , A1378=NO IMU ACTIV)                                                                                                                                                                                                                                                                                                    | MANUAL                                                                                      |
| 07:58.16Z | Corrective OSL (PID 04010003) to EO attitude – this slew will not be executed, AOCS s/s DISABLED in Timeline                                                                                                                                                                                                                                                                                          | TIMELINE                                                                                    |
| 07:51:38Z | <p>Switch Off IMU1, FCP-AOC-1601</p> <p><b>OTF reverted to automatic control</b></p>                                                                                                                                                                                                                                                                                                                  | MANUAL                                                                                      |
| 08:05:00Z | Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-1051 (select TC_parameter A1379=ENABLE)                                                                                                                                                                                                                                                                                                              | MANUAL                                                                                      |
| 08:37:40Z | <p><b>RE-ENABLE AOCS in timeline.</b></p> <p>This must be executed before allowing the subsequent RWB and PREQs to execute in TIMELINE.</p>                                                                                                                                                                                                                                                           | MANUAL                                                                                      |
| 08:37:40Z | <b>Latest time to complete AOCS reconfiguration</b>                                                                                                                                                                                                                                                                                                                                                   |                                                                                             |
| 08:37:55Z | <p>CGS in preparation for the Wheel Bias (not needed)</p> <p>WHEEL_BIAS</p> <p>This RWB opportunity shall be used to compensate of the drifts during the EO and in order to reconfigure the S/C after the Earth Observation to the timeline planned profiles.</p> <ul style="list-style-type: none"> <li>• RW1= not selected</li> <li>• RW2=+1835</li> <li>• RW3=+1835</li> <li>• RW4=+421</li> </ul> | <p>TIMELINE</p> <p>Start RWB window<br/>08:37:55Z<br/>Close of RWB window<br/>08:59:55Z</p> |
| 09:03:17Z | <p>Open Loop Slew to next Science pointing – long OSL.</p> <p>FSS<br/>Alpha F=0.0960 deg<br/>Beta F= -33.0220 deg</p> <p>STR guide star<br/>CCD_Y=<br/>CCD_Z=<br/>Mi=</p>                                                                                                                                                                                                                             | TIMELINE                                                                                    |

| Time (Z)                              | INTEGRAL Earth Observation (DoY 024-025 2006)                                                                                                                 |          |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                                       |                                                                                                                                                               |          |
| 09:42:29Z                             | Corrective Close Loop Slew to next Science pointing<br><br>FSS<br>Alpha F=0.1079 deg<br>Beta F= -12.0646 deg<br><br>STR guide star<br>CCD_Y=<br>CCD_Z=<br>Mi= | TIMELINE |
| End of the Earth Observation activity |                                                                                                                                                               |          |

LEGENDA: REQUIRED FD SUPPORT CONTINGENCY PROCEDURE ACTIVITY NOT EXECUTED

## 25/01/06 (Day of Year 025, Revolution 401)

**First Earth Observation 24-25 January 2006:** At 07:07Z 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 16:47:52  
 DEC -60:52:09  
 POS 067:36:55

alpha F=0.29 deg  
 beta F=-33.33 deg

RW2=+1993  
 RW3=+2012  
 RW4=-2007

Final EO Attitude (at STR re-enabling, 07:07Z)

RA 16:49:16  
 DEC -60:40:05  
 POS 067:44:56

alpha F=0.30 deg  
 beta F=-33.32 deg

RW2=+2274 rpm  
 RW3=+2035 rpm  
 RW4=-2297 rpm

### **Inertial Measurement Unit (IMU)**

Drift correction loaded, estimated during the calibration (2 hours) = 0.1585 as/s  
Noise estimated during the calibration = 0.0638 as/s

Drift correction estim. (calibration) , by using quick evaluation tool, = 0.1550 as/s  
Drift correction estim. (EO exit) , by using quick evaluation tool, = 0.1628 as/s

FD estimated residual drift ~0.0285 as/s (attitude at 23:30z wrt attitude at 03:44Z)

Observed during the IMU calibration a small thermal effect induced by heater cycle in the IMU electronic head (~0.001 as)

### **Star Tracker (STR)**

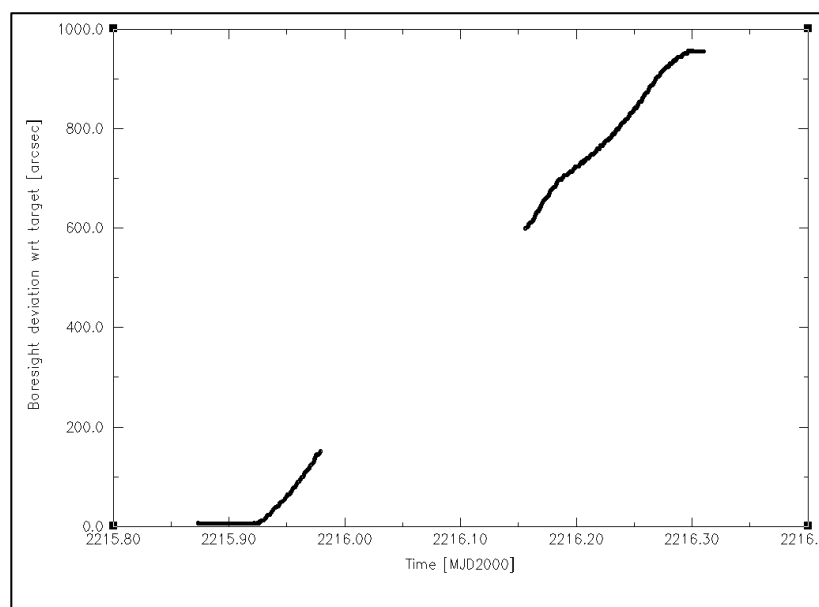
STR reported star lost on 24/01 at 23:30Z with background ~2000 mV

- Earth limb was at ~7.2 deg from the STR boresight.
- Guide star was Mi 7.55 at ( 22:08Z) CCD coordinates [ -12319, -19319]

STR reported star tracked on the 25/01 at 03:44Z with background ~3800 mV

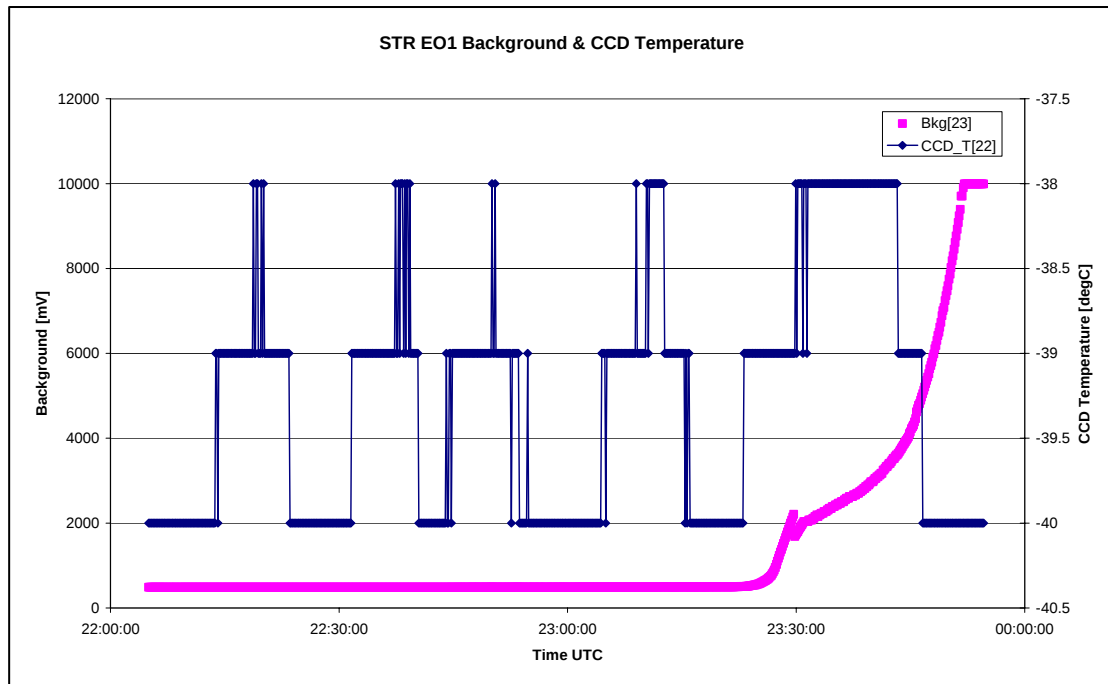
- Earth's Limb ~4.9 deg from the STR boresight
- Guide star was Mi 6.3 at CCD coordinates [ 11627 , 9142]

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.



(courtesy M. Montagna, Alenia Spazio)

The table below reports the predicted geometry for the Earth observation in rev 401.

Revolution: 401

RA 16:47:52

DEC -60:52:09

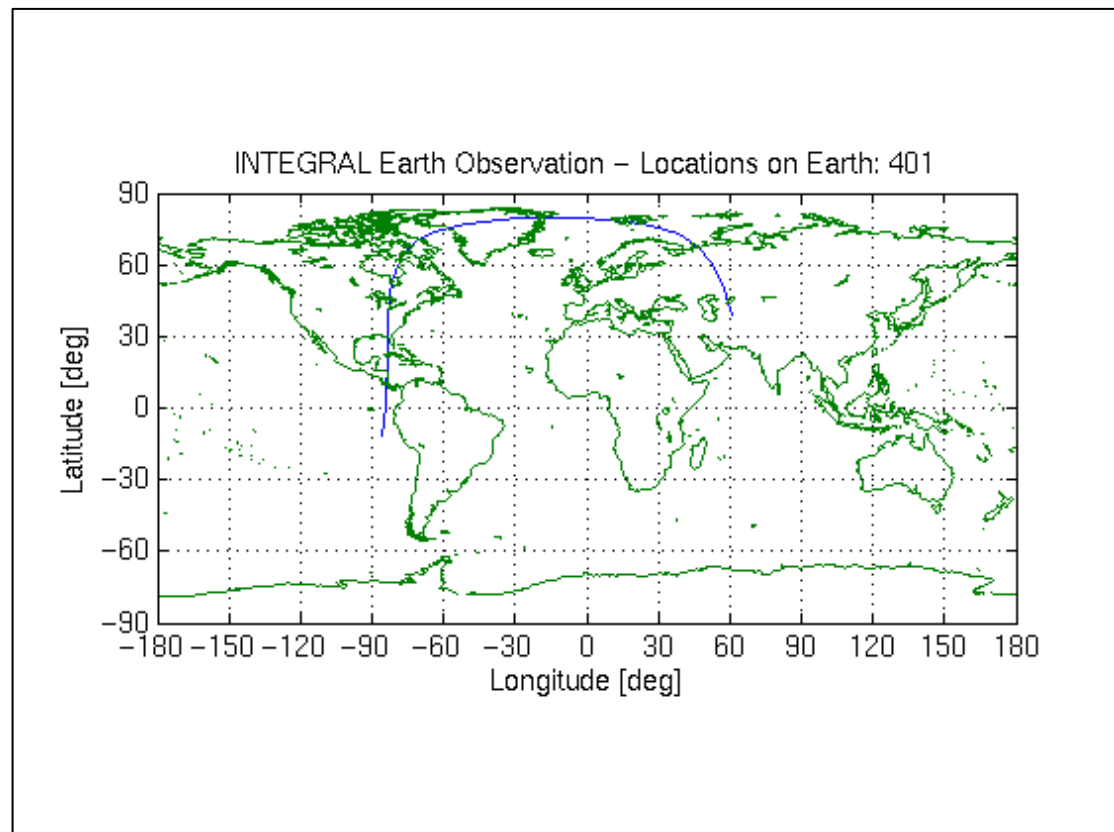
POS 067:36:55

| time                 | Apparent .radius<br>[deg] | altitude<br>[km] | Angle STR boresight wrt Earth's Limb<br>[deg] |
|----------------------|---------------------------|------------------|-----------------------------------------------|
| 2006-01-24T22:34:49Z | 8.64                      | 36070.5          | 16.02                                         |
| 2006-01-24T22:39:49Z | 8.49                      | 36845.5          | 15.09                                         |
| 2006-01-24T22:44:49Z | 8.34                      | 37616.5          | 14.18                                         |
| 2006-01-24T23:04:49Z | 7.79                      | 40657.5          | 10.86                                         |
| 2006-01-24T23:09:49Z | 7.67                      | 41406.6          | 10.09                                         |
| 2006-01-24T23:14:49Z | 7.55                      | 42151.3          | 9.34                                          |
| 2006-01-24T23:29:49Z | 7.22                      | 44357.9          | 7.24                                          |
| 2006-01-24T23:34:49Z | 7.12                      | 45084.3          | 6.57                                          |
| 2006-01-24T23:39:49Z | 7.02                      | 45806            | 5.93                                          |
| 2006-01-24T23:44:49Z | 6.92                      | 46523.2          | 5.3                                           |
| 2006-01-25T00:09:49Z | 6.49                      | 50041            | 2.38                                          |
| 2006-01-25T00:14:49Z | 6.41                      | 50731            | 1.84                                          |
| 2006-01-25T00:19:49Z | 6.34                      | 51416.6          | 1.31                                          |
| 2006-01-25T00:24:49Z | 6.26                      | 52097.8          | 0.79                                          |
| 2006-01-25T00:29:49Z | 6.19                      | 52774.6          | 0.28                                          |
| 2006-01-25T00:34:49Z | 6.12                      | 53447            |                                               |
| 2006-01-25T02:29:49Z | 4.93                      | 67790.6          |                                               |
| 2006-01-25T02:34:49Z | 4.89                      | 68369            |                                               |
| 2006-01-25T02:39:49Z | 4.86                      | 68943.8          | 0.28                                          |
| 2006-01-25T02:44:49Z | 4.82                      | 69515.1          | 0.67                                          |

|                      |      |         |       |
|----------------------|------|---------|-------|
| 2006-01-25T02:49:49Z | 4.78 | 70083.1 | 1.05  |
| 2006-01-25T02:54:49Z | 4.75 | 70647.6 | 1.42  |
| 2006-01-25T02:59:49Z | 4.72 | 71208.7 | 1.79  |
| 2006-01-25T03:04:49Z | 4.68 | 71766.5 | 2.16  |
| 2006-01-25T03:49:49Z | 4.41 | 76640.8 | 5.21  |
| 2006-01-25T03:59:49Z | 4.35 | 77689.5 | 5.83  |
| 2006-01-25T04:14:49Z | 4.27 | 79240   | 6.75  |
| 2006-01-25T04:24:49Z | 4.22 | 80258.8 | 7.34  |
| 2006-01-25T04:59:49Z | 4.06 | 83734.6 | 9.29  |
| 2006-01-25T05:04:49Z | 4.04 | 84220   | 9.56  |
| 2006-01-25T05:09:49Z | 4.02 | 84702.6 | 9.83  |
| 2006-01-25T05:14:49Z | 3.99 | 85182.5 | 10.09 |
| 2006-01-25T05:19:49Z | 3.97 | 85659.8 | 10.34 |
| 2006-01-25T05:24:49Z | 3.95 | 86134.4 | 10.6  |
| 2006-01-25T05:29:49Z | 3.93 | 86606.3 | 10.85 |
| 2006-01-25T06:34:49Z | 3.7  | 92508.4 | 13.92 |
| 2006-01-25T06:39:49Z | 3.68 | 92945.1 | 14.14 |
| 2006-01-25T06:59:49Z | 3.62 | 94668.2 | 15    |
| 2006-01-25T07:04:49Z | 3.6  | 95093.1 | 15.21 |

(courtesy F. Dreger, FD Team)

## Earth Observation: STR Boresight Path during rev 401



(courtesy F. Dreger, FD Team)

**26/01/06 (Day of Year 026, Revolution 401)**

Nothing to report.

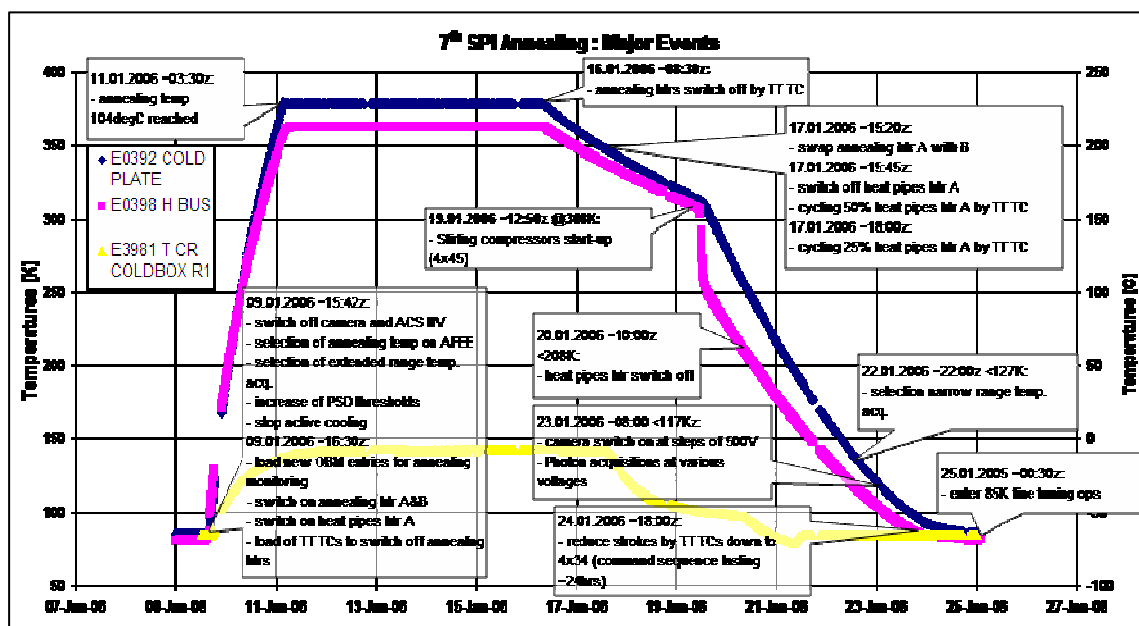
27/01/06 (Day of Year 027, Revolution 401-402)

Nothing to report.

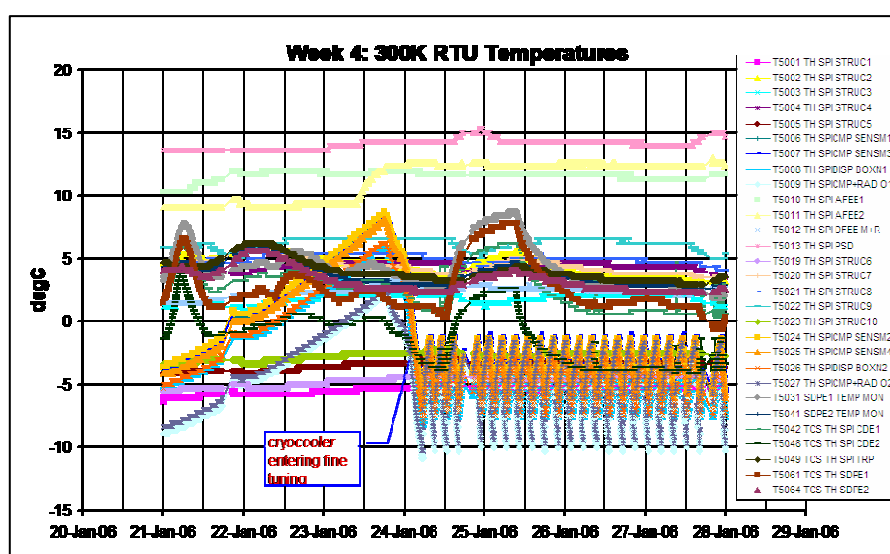
### 8.3.2 SPI Operations

#### Annealing events:

The major events that took place during the annealing are presented in the following plot, together with the evolution of the cold box, cold plate and thermal braids temperatures.

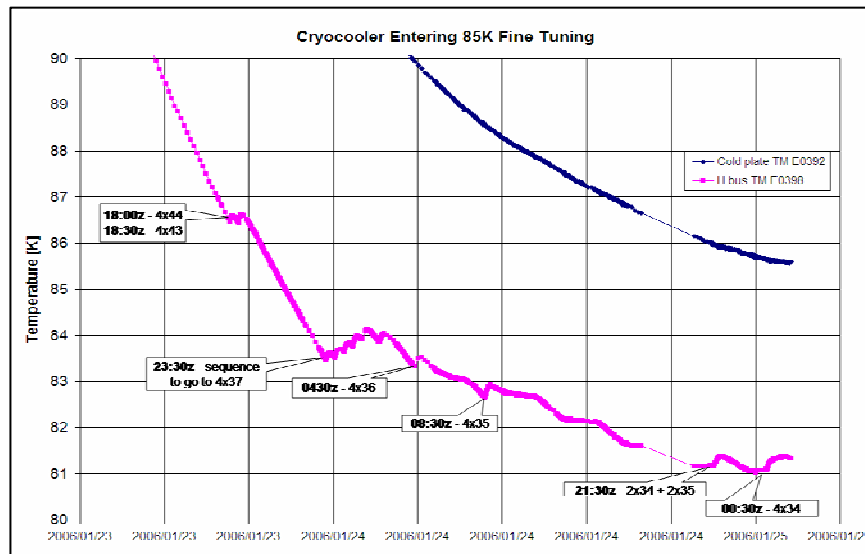


**Unit Temperatures:** All the equipment temperatures are inside the operational limits. The following plot shows their evolution along the reporting period.



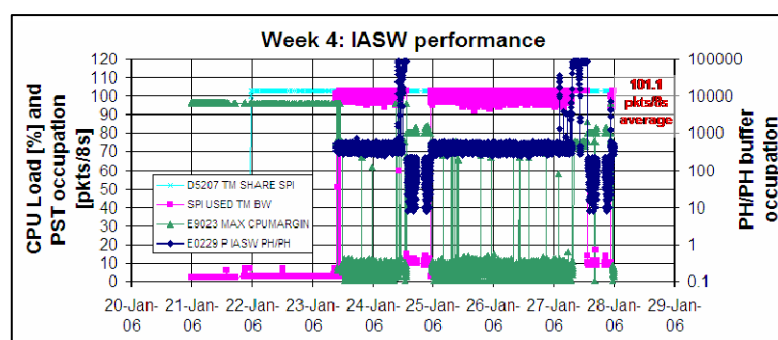
**Stirling Compressors and Cryostat:** The performance of the compressors is nominal. The cryocooler was re-started after the end of the passive cooling phase, on 19<sup>th</sup> January at ~11:30z. The start-up and cooling performance is in line with the previous observed data. The four compressors run at full stroke, with compressor demand set to 4x45dec raw, until 86K on the thermal braids was reached. At that point a predefined sequence of time tag commands slowly reduced the compressor demand down to 4x34, such to enter the 85K fine tuning region on the 25<sup>th</sup> January at 00:30z.

The following plot shows the effects of this command sequence.



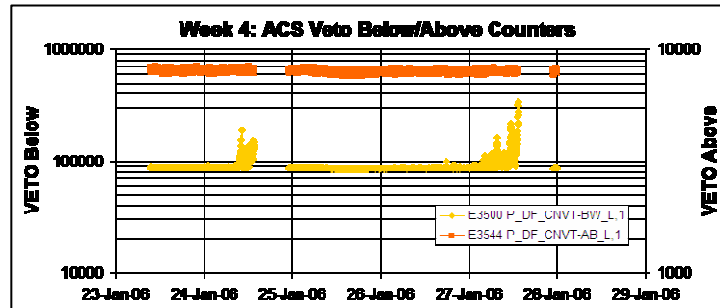
**DPE & IASW:** The IASW performance is nominal. The current IASW version installed is 432.

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 (due to problems in the data retrieval tool, some gaps could be present).

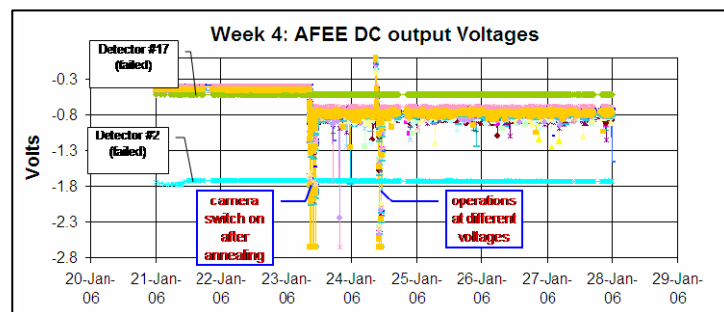


#### AFEE:

The performance of the AFEE and the detectors is nominal.

The performance of the AFEE and the detectors is nominal except for the detector #2, failed since 06.12.2003, and detector #17, failed since 17.07.2004

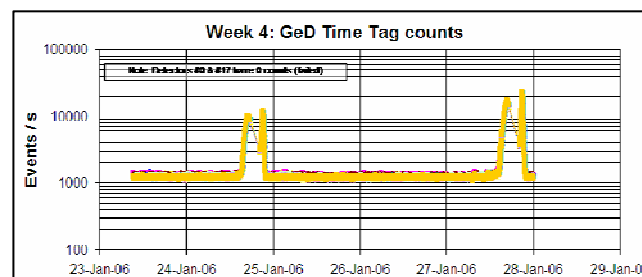
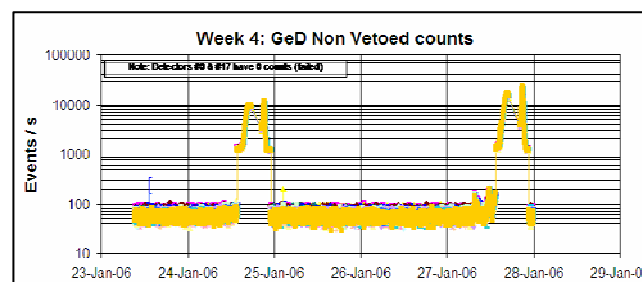
The following plot shows the dc voltage offset of the detector channels during the reporting period.

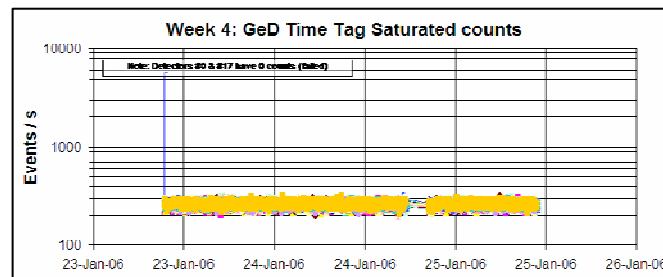


#### DFEE:

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).

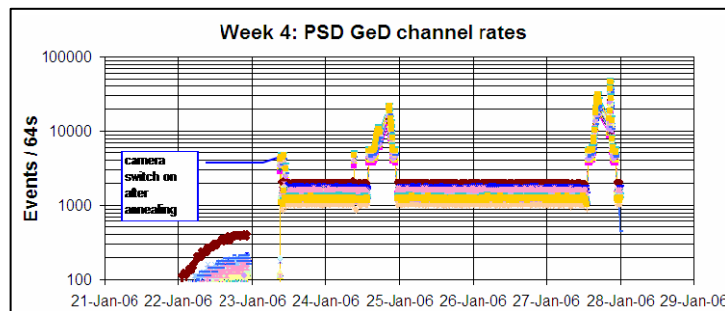




### PSD:

The performance of the unit is nominal.

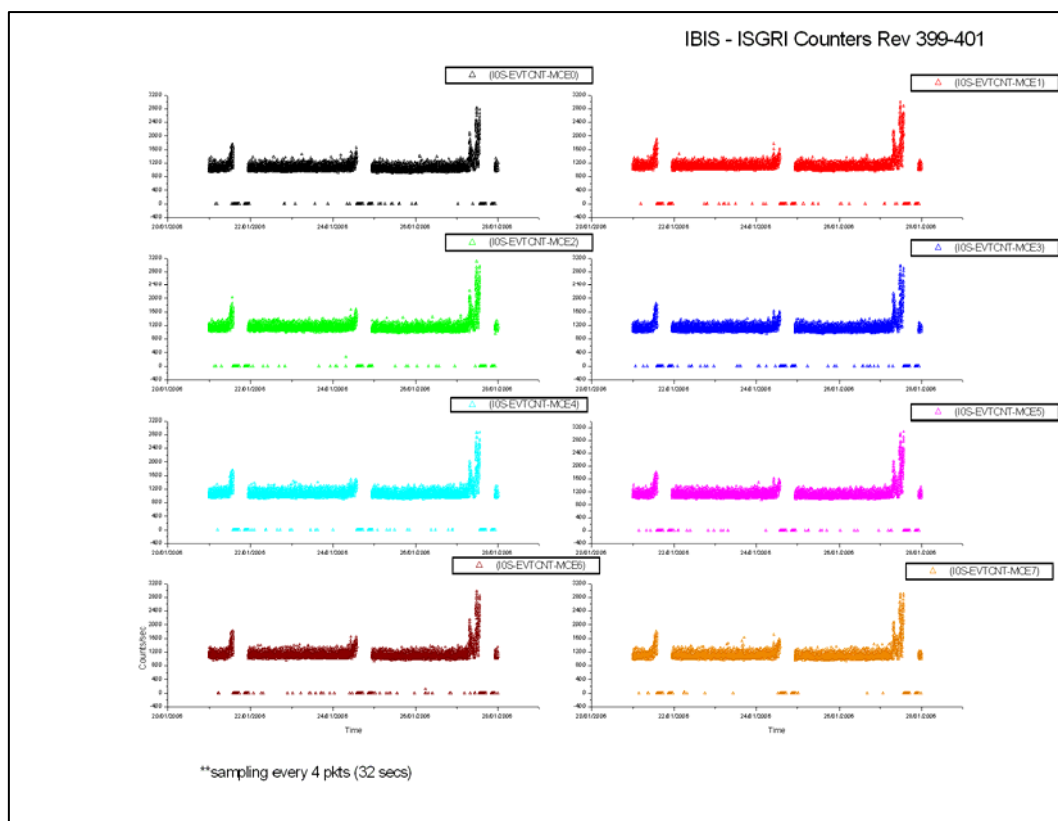
The following plots show the PSD channel rates during the reporting period.



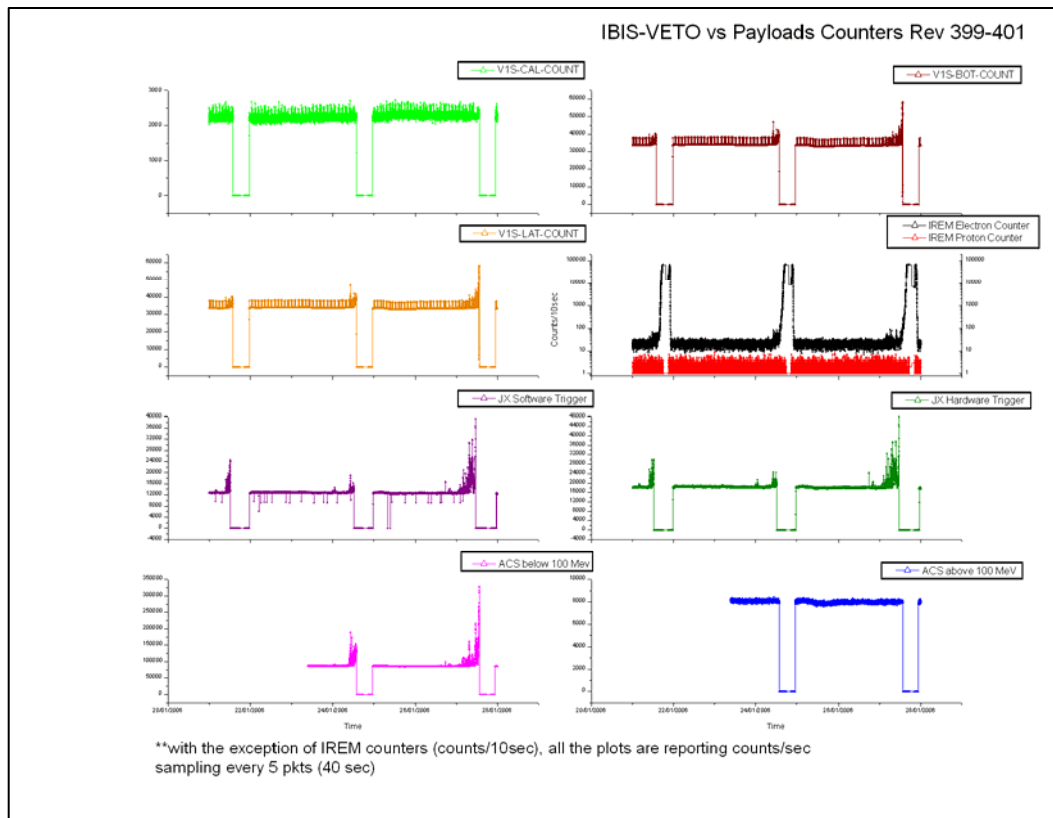
### 8.3.3 IBIS Operations

#### IBIS Event Counters Plots.

#### ISGRI Counters:

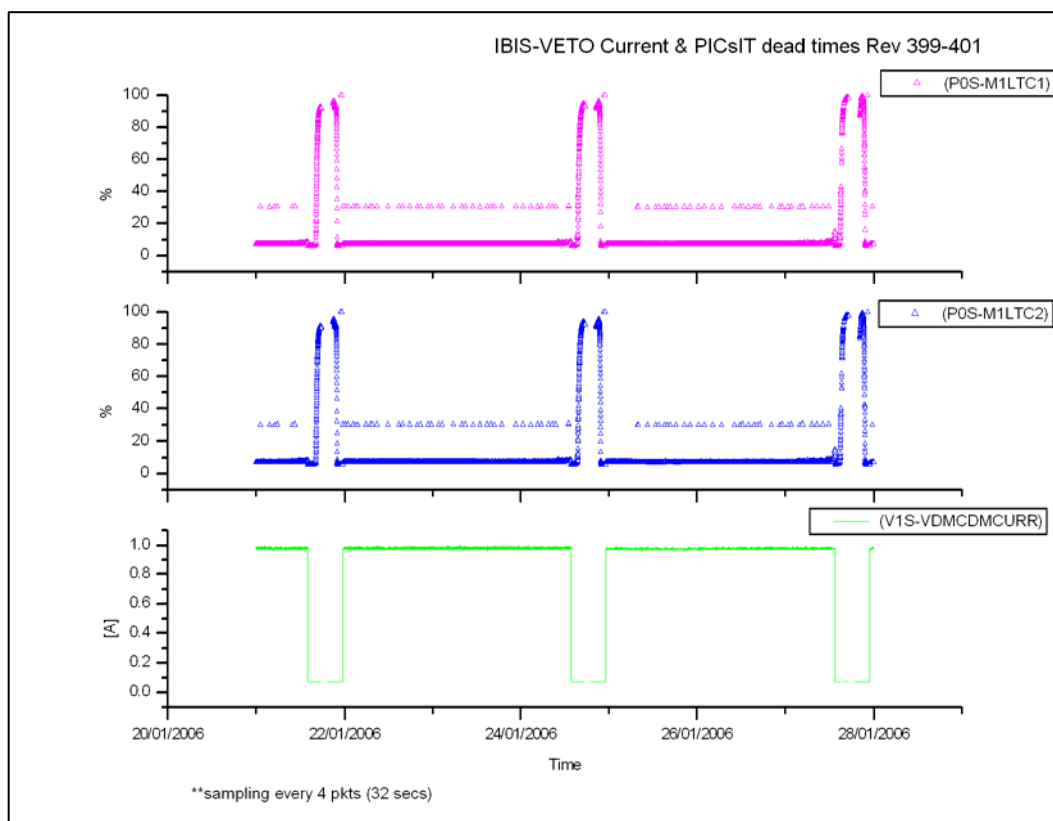


## VETO vs Payloads Counters:

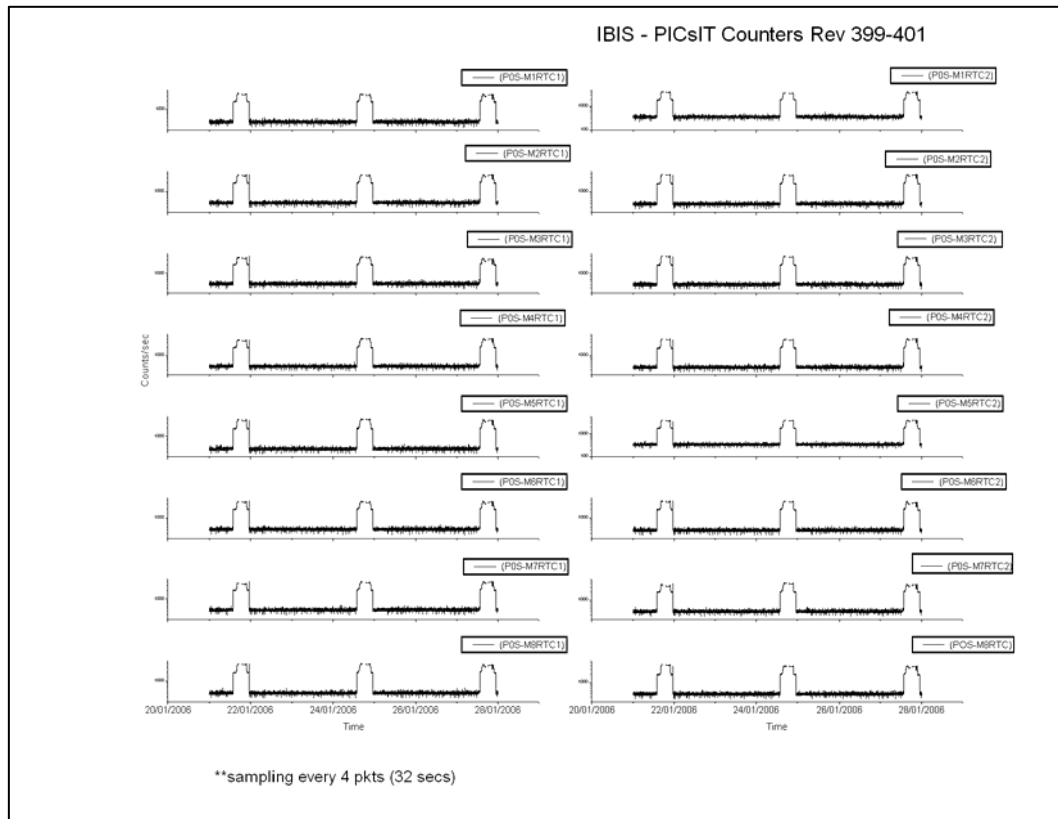


The week was characterised by moderate to low radiation.

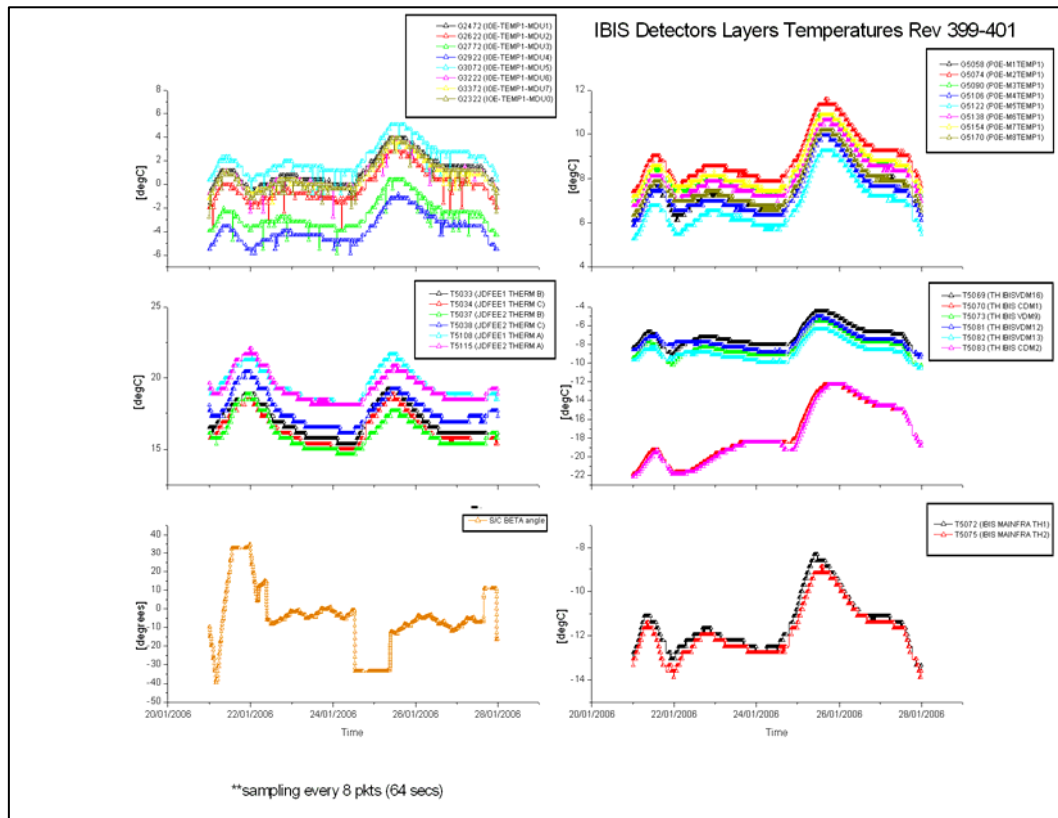
## VETO Current:



## PICsIT Counters:



## IBIS Detectors Layers Temperatures:



**IBIS daily report:**

**DoY 2006.021 (21/01/2006):**

At 14:01Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 23:30Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5003 (P0S-M1RTC2), G5032 (P0S-M7RTC1) and G5038 (P0S-M8RTC2) were toggling OOL high. According to P-CNT-1, no action was taken.

**DoY 2006.024 (24/01/2006):**

At 13:44Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 23:14Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

Inside the radiation belts, TM parameters G5017 (P0S-M4RTC1), G5023 (P0S-M5RTC2), G5033 (P0S-M7RTC2) and G5037 (P0S-M8RTC1) were toggling OOL high. According to P-CNT-1, no action was taken.

At 22:56Z, TM parameter G2098 (I0E-OVFWPXADD-M7) failed SCC and back. According to I-OVF-1, as this happened inside radiation belts, no action was taken.

**DoY 2006.027 (27/01/2006):**

From 07:52Z until the Radiation Belts Entry (13:29Z), TM parameter G8080 (S1E-VS HBRA-RT) was toggling OOL High and back. This was due to high radiation as the S/C was approaching the Belts. Therefore, according to H-OVF-2, no action was taken.

From 11:28Z until the Radiation Belts Entry (13:29Z), TM family G2013 (I0S-EVTCNT-MCEi) was toggling OOL High. This was due to high radiation as the S/C was approaching the Belts. Therefore, according to I-CNT-1, no action was taken.

From 13:14Z until the Radiation Belts Entry (13:29Z), 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.

At 13:29Z, TM parameter G8015 was reported Out Of Limit high. It went back inside limit at 22:58Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

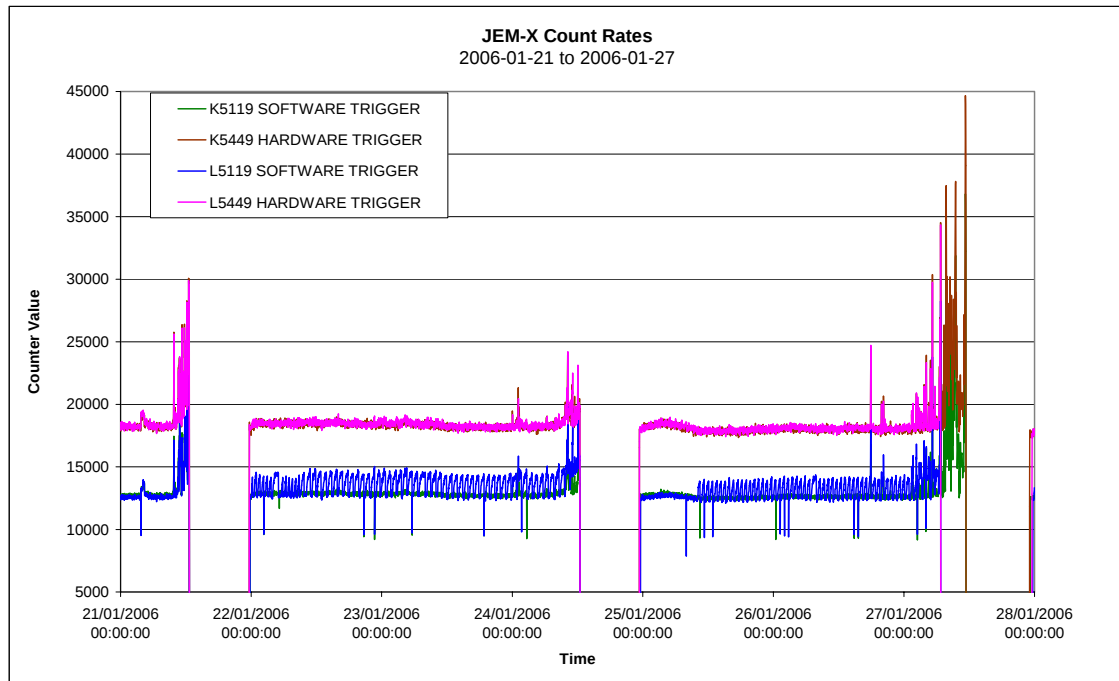
Inside the radiation belts, TM parameters G5017 (P0S-M4RTC1), G5018 (P0S-M4RTC2), G5023 (P0S-M5RTC2) and G5032 (P0S-M7RTC1) were toggling OOL high. According to P-CNT-1, no action was taken.

At 22:41Z, 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.

### 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 graph<sup>1</sup>.

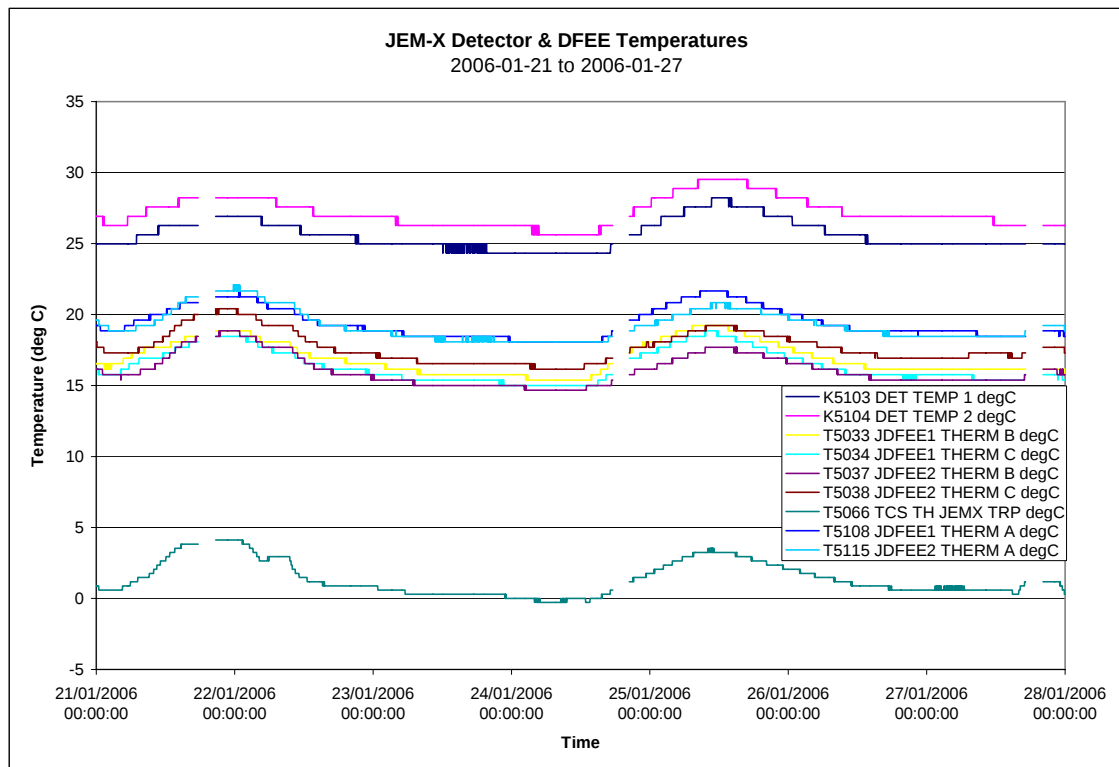


#### 8.3.4.2 JEM-X Temperatures

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 graph<sup>2</sup>.

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

<sup>2</sup> Data sampled (1 frame in 8)



### 8.3.4.3 JEM-X Daily Report

The Operation Request 238, to set the BCP override for the TM share for JEM-X2 to DISABLED was executed on DoY 21, at 23:18, DoY 25 after the Earth observation at 09:47, and DoY 27 at 22:45, the reverse to set the flag to ENABLED was executed on DoY 24, at 13:00Z.

#### 2006-01-21 (DOY 021, Rev 399) to 2006-01-26 (DOY 026, Rev 401)

Nothing to report

#### 2006-01-27 (DOY 027, Rev 401-402)

At 06:44 JEM-X2 was switched to safe mode by the software trigger after detecting high background radiation. At 11:24, the same thing happened to JEM-X1.

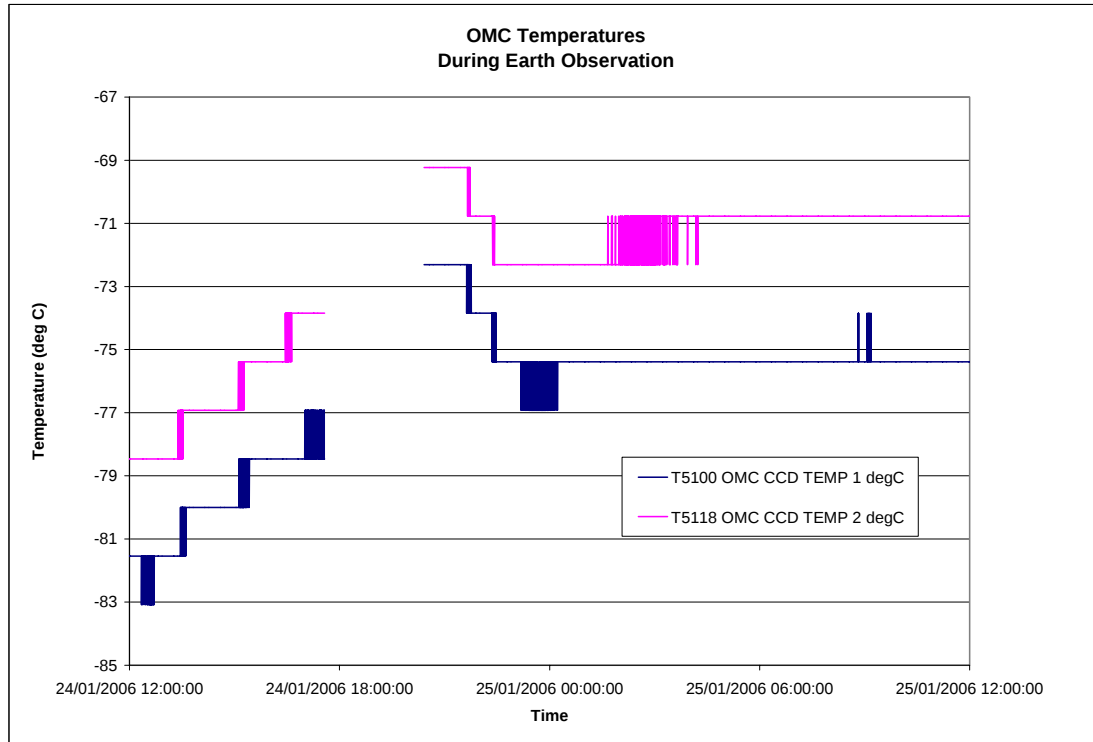
### 8.3.5 OMC Operations

#### 2006-01-21 (DOY 021, 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.



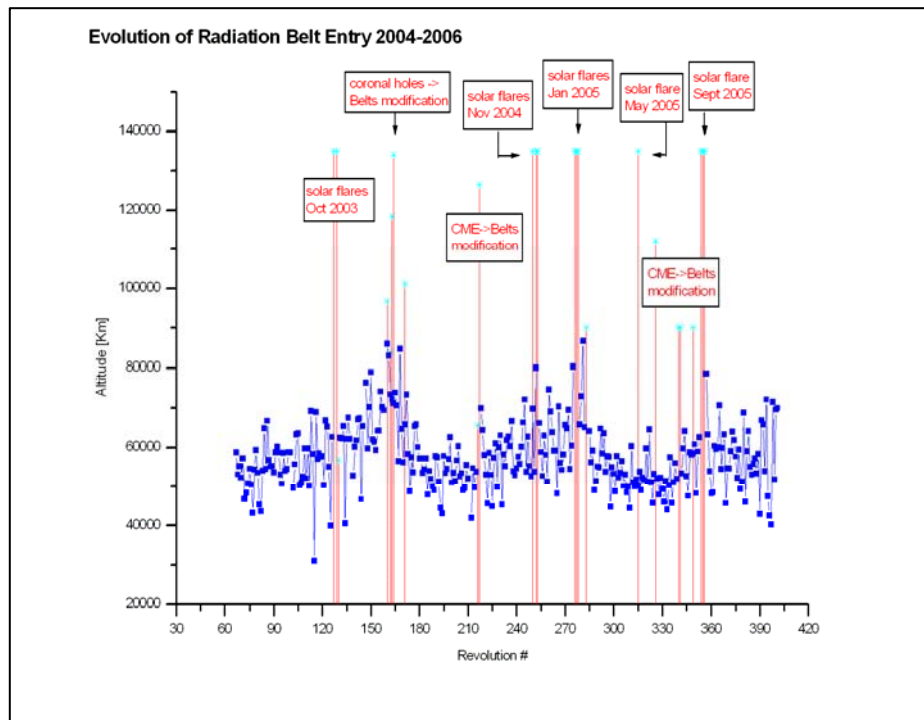
**2006-01-25 (DOY 025, Rev 401) to 2006-01-27 (DOY 027, Rev 401-402)**

Nothing to report

On DoY 021 at 14:01:01, DoY 024 at 13:44:29, and DoY 027 at 13:29:01 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<br>Observed Entry/Exit | Observed Entry/Exit<br>Altitude [Km] | Electron CUT-OFF<br>Predicted Entry/Exit | Predicted<br>Entry/Exit<br>Altitude [Km] |
|-----|---------------------------------|-----------------------------------------|--------------------------------------|------------------------------------------|------------------------------------------|
| 399 | RAD_ENTR R 2006-01-21T14:00:58Z | 2006-01-21 15:02:37                     | >51837.7                             | 2006-01-21 15:20:26                      | 49373                                    |
| 400 | RAD_EXIT R 2006-01-21T23:17:09Z | 2006-01-21 22:23:33                     | >>23350.7                            | 2006-01-21 22:30:26                      | 32880                                    |
| 400 | RAD_ENTR R 2006-01-24T13:44:27Z | 2006-01-24 12:26:13                     | <69639.8                             | 2006-01-24 14:59:20                      | 20001                                    |
| 401 | RAD_EXIT R 2006-01-24T23:00:28Z | 2006-01-24 22:12:21                     | >>23345.7                            | 2006-01-24 22:09:20                      | 32184                                    |
| 401 | RAD_ENTR R 2006-01-27T13:28:54Z | 2006-01-27 12:02:53                     | >70004.6                             | 2006-01-27 14:49:20                      | 49380                                    |
| 402 | RAD_EXIT R 2006-01-27T22:44:08Z | 2006-01-27 22:08:37                     | <<44189.5                            | 2006-01-27 21:59:20                      | 32969                                    |

## Reference

Very small error vs reference (less than 10 minutes)

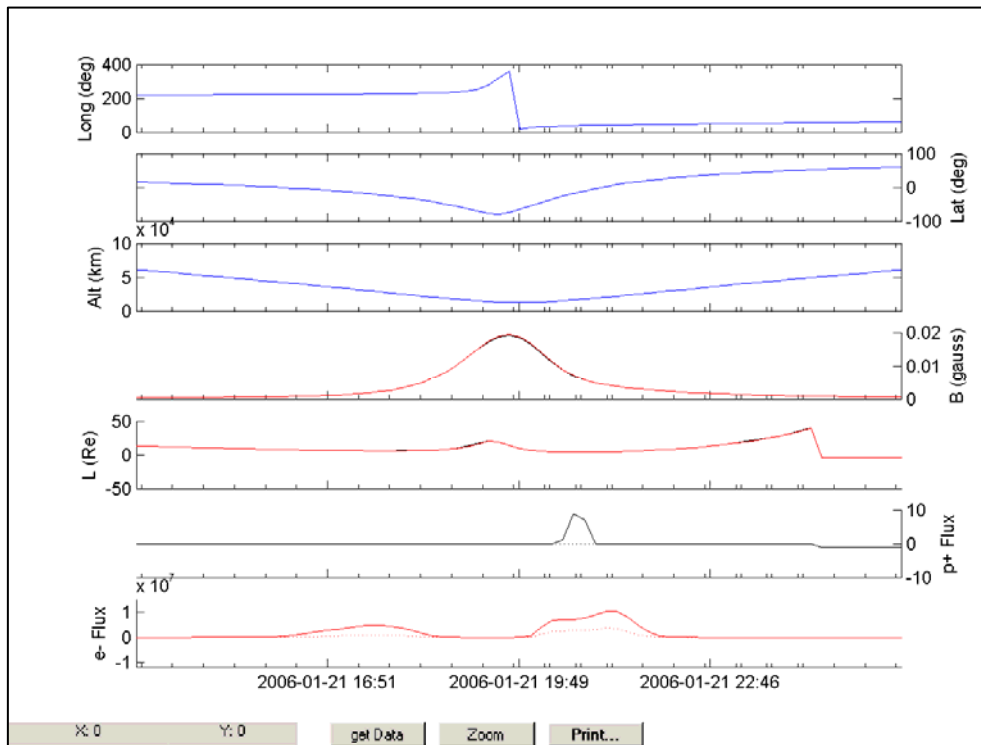
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

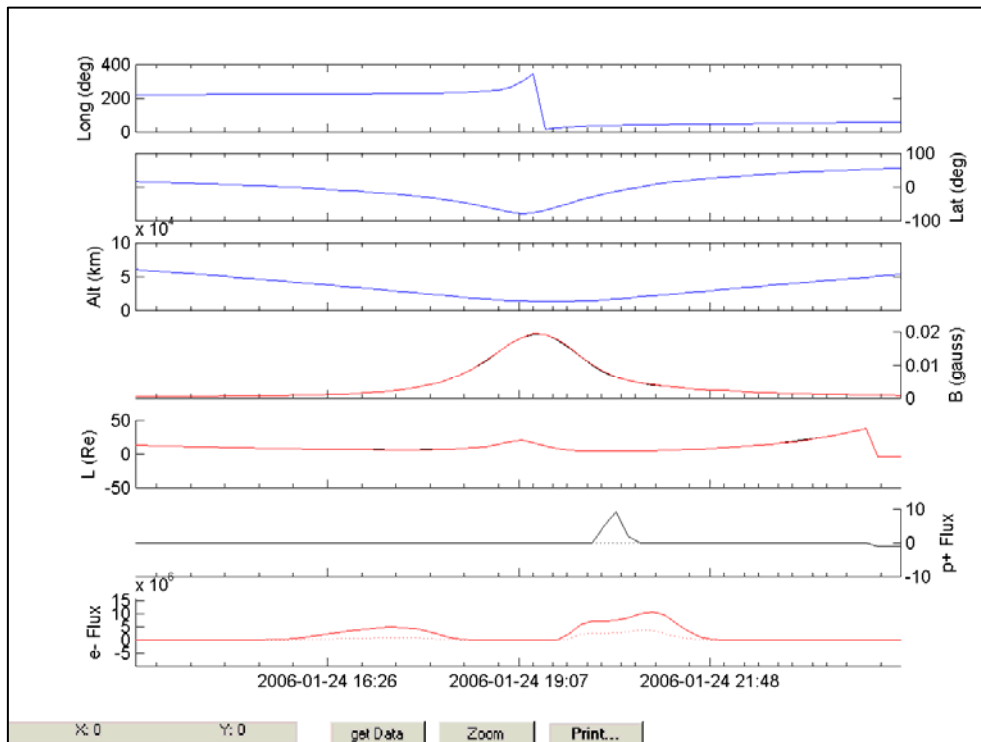
High Radiation

# IREM radiation counters:

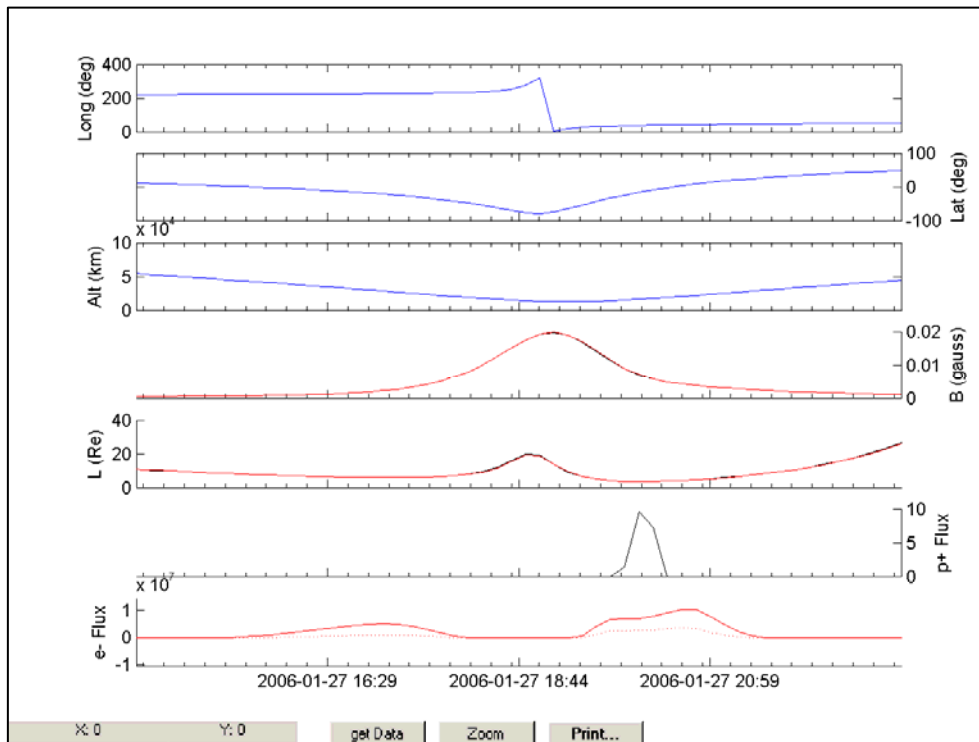
Rev 399:



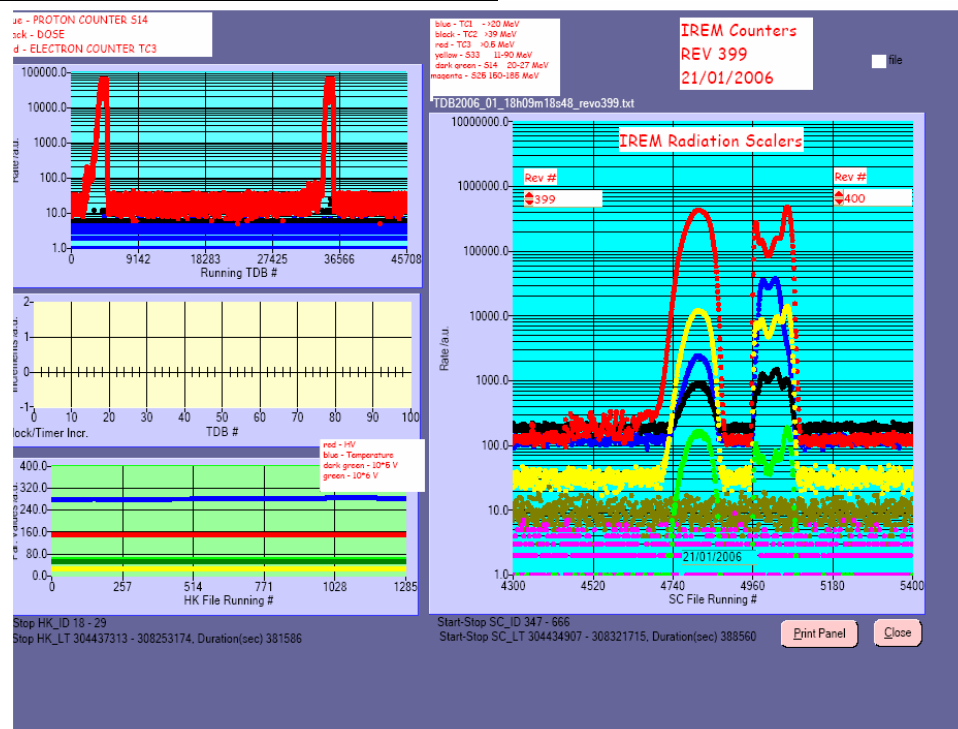
Rev 400:

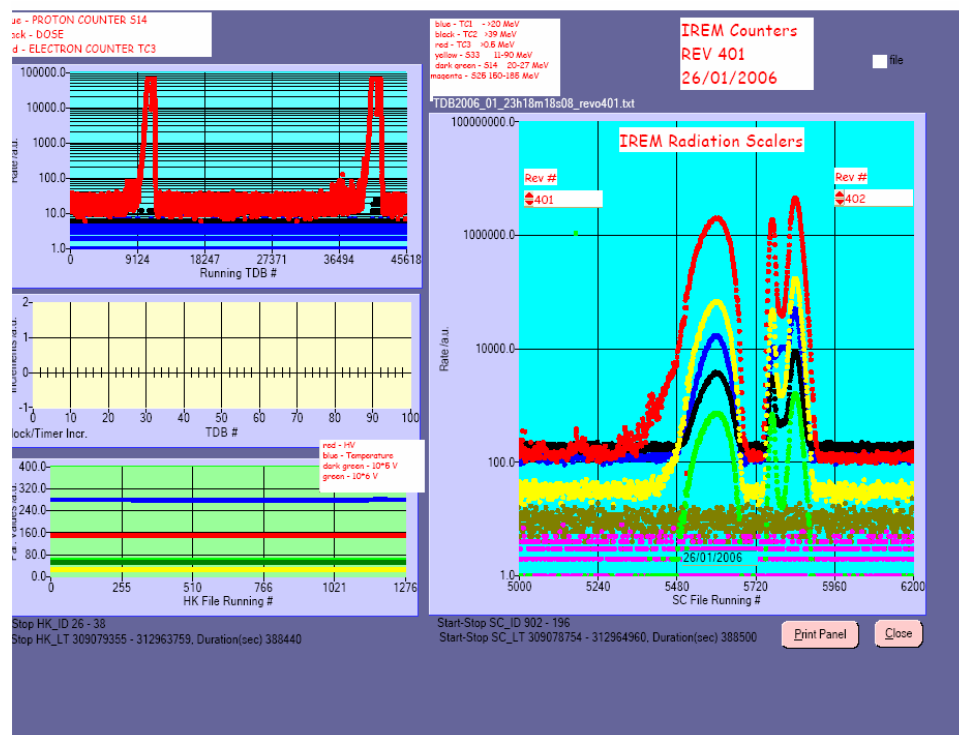
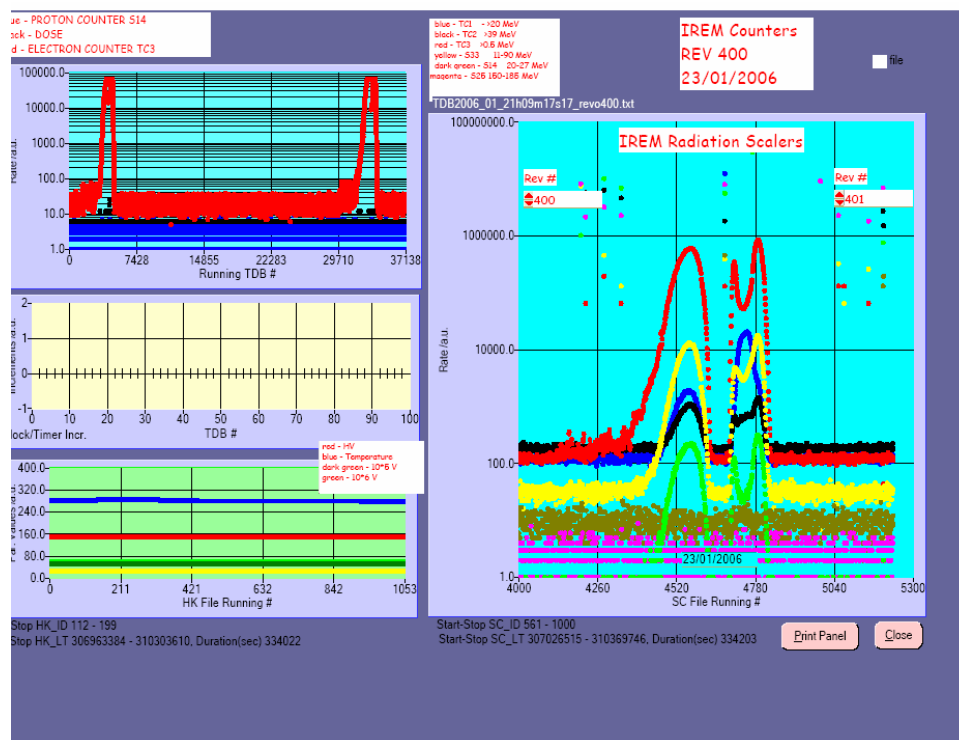


Rev 401:



## IREM Predicted Radiation Belt Passages





## SEC-GOES Observed Particles Fluxes:

