

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 197
Week 26
03.07.06
Routine Phase

Prepared by: M. Walker (OPS-OFO)

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1 General

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

It addresses the activities from 24.06.06 until 30.06.06 (both dates inclusive) and covers the revolutions 452 and 453.

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 consisted only of a Galactic Plane Survey, and raster dithers of Field_13 (RA 02:54:53.00, DEC -38:54:33.0), Field_11 (RA 01:45:28.00, DEC -17:33:19.0), Field_8 (RA 01:01:15.00, DEC +32:40:34.0) and Field_14 (RA 05:17:33.00, DEC -40:53:55.0).

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.

2 slews were lost during the observation period due to a problem with the IMCS and TC/TM links with VIL2 station.

The fuel consumption over the period between 23/06/2006 and 30/06/2006 was 0.1436 kg. The remaining propellant is in the order of 153.5458 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 has been identified.

3.1.5 RFS

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

Following the 8th annealing, ended on 26th June, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detectors #2 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 has been recovered with this annealing. Detector #2 is failed since 06.12.2003 and detector #17 since 17.07.2004.

The following table reports the major events/steps performed during the annealing.

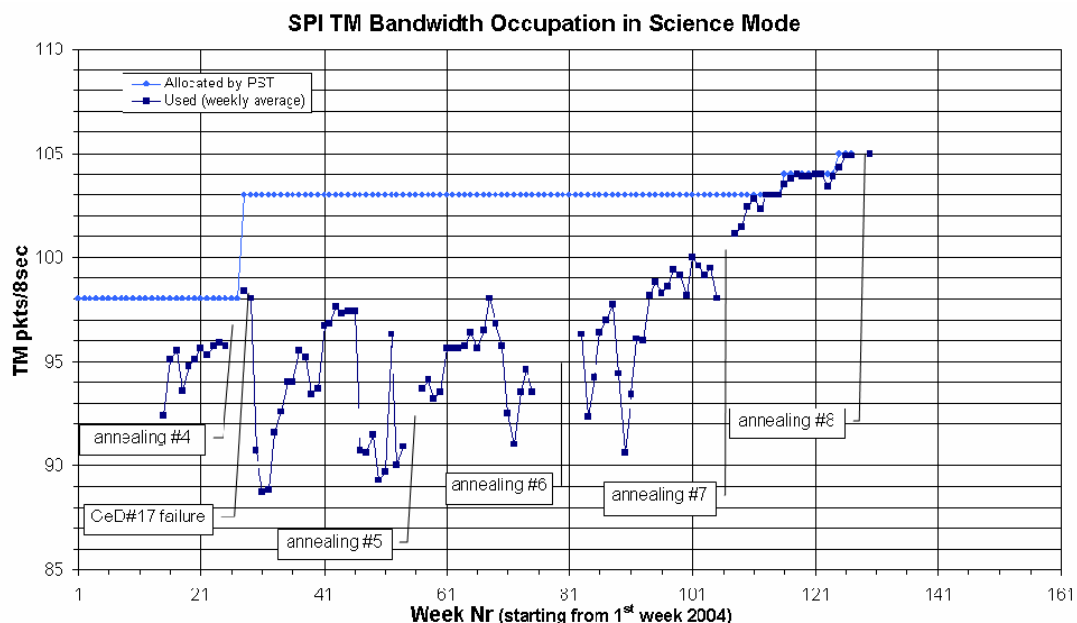
Date/Time	Activity
08/06/2006 00:50Z	Configure SPI for start of Annealing and stop SPI active cooling
08/06/2006 02:07Z	Annealing Heater Main ON
08/06/2006 04:07Z	Annealing Heater Redundant ON
08/06/2006 16:30Z	Heat Pipe Heater Main ON, All Antifreeze Heaters (1A; 2A; 1B; 2B) OFF
09/06/2006 04:30Z	Heat Pipe Heater Redundant ON
09/06/2006 13:40Z	Cold plate temperature reached 377K (104degC)
17/06/2006 12:04Z	Stop SPI Annealing: Annealing Heater Main and Redundant OFF; Heat Pipe Heater Main and Redundant OFF; Antifreeze Heater 1A ON
17/06/2006 12:15Z	Start Toggling of Heat Pipe Heater to manage Cold box temperature: Heat Pipe Heater Main and Redundant ON
17/06/2006 12:31Z	Start ACS Calibration
17/06/2006 18:15Z	Heat Pipe Heater Redundant OFF
18/06/2006 06:15Z	Heat Pipe Heater Main OFF and start toggling of Heat Pipe Heater Main at 75% ON cycle
19/06/2006 00:15Z	Start toggling of Heat Pipe Heater Main at 50% ON cycle
19/06/2006 04:17Z	End ACS Calibration
19/06/2006 18:15Z	Start toggling of Heat Pipe Heater Main at 25% ON cycle
20/06/2006 17:18Z	Thermal braids temperature reached 308K (35degC)
20/06/2006 18:51Z	Start active cooling: Cryocooler switch on to full stroke
21/06/2006 12:15Z	End toggling of Heat Pipe Heater Main: Heat Pipe Heater Main OFF
24/06/2006 03:16Z	Cold plate temperature reached 127K
24/06/2006 03:26Z	Selected narrow range cryocooler temperatures and restored nominal PSD thresholds
24/06/2006 09:50Z	Cold plate temperature reached 117K
24/06/2006 14:30Z	Camera Switch-on (at 110K): • Enable IASW reactions to Coldplate temperature • Switch on GeD HV in steps of 500V: 0.5kV; 1.0kV; 1.5kV; 2kV • From 15:19Z – 15:51Z: SPI in Photon with all GeD HV @ 2kV • Increase GeD HV in steps of 500V: 2.5kV; 3kV • From 16:05Z – 16:25Z: SPI in Photon with all GeD HV @ 3kV

	Increase GeD HV in steps of 500V: 3.5kV; 4kV (except GeD12 HV which was set to 1.5kV in both cases)
24/06/2006 16:47Z	Set nominal ACS HV configuration
24/06/2006 16:56Z	SPI to Photon mode
25/06/2006 01:40Z	Thermal braids temperature reached 86K
25/06/2006 01:54Z	Cryocooler stroke reduction for 85K target started (time-tag commands)
25/06/2006 09:18Z – 10:23Z	HV of GeD12 adjusted: 3kV, 3.5kV, 3kV. SPI left in Photon mode with all GeD at 4kV except GeD12 HV which was set to 3kV.
25/06/2006 17:49Z -17:56Z	SPI to Conf, HV of GeD12 set to 4kV, back to Photon
26/06/2006 02:01Z	Cold Plate temperature entered range 85K +/-1K
26/06/2006 08:29Z	Cryocooler stroke reduction for 85K target (time-tag commands) completed. Stroke set to 34 on both CDEs.
26/06/2006 08:50Z	POS-driven observations resumed: SPI to Conf, uplinked ES1700_IASW-PAR_fmconfig_0009.TPF and back to Photon.

The Stirling compressors are working nominally, maintaining the Germanium detectors at 85K +/-1K as of 26/06/2006 at 02:00Z.

During science operations, the instrument was kept in photon-by-photon mode with spectra TM enabled. The assigned TM bandwidth in the science observation windows was 105 pkts/cycle and the average telemetry occupation was 105 pkts/cycle. The telemetry downlink of SPI has therefore reached the saturation.

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



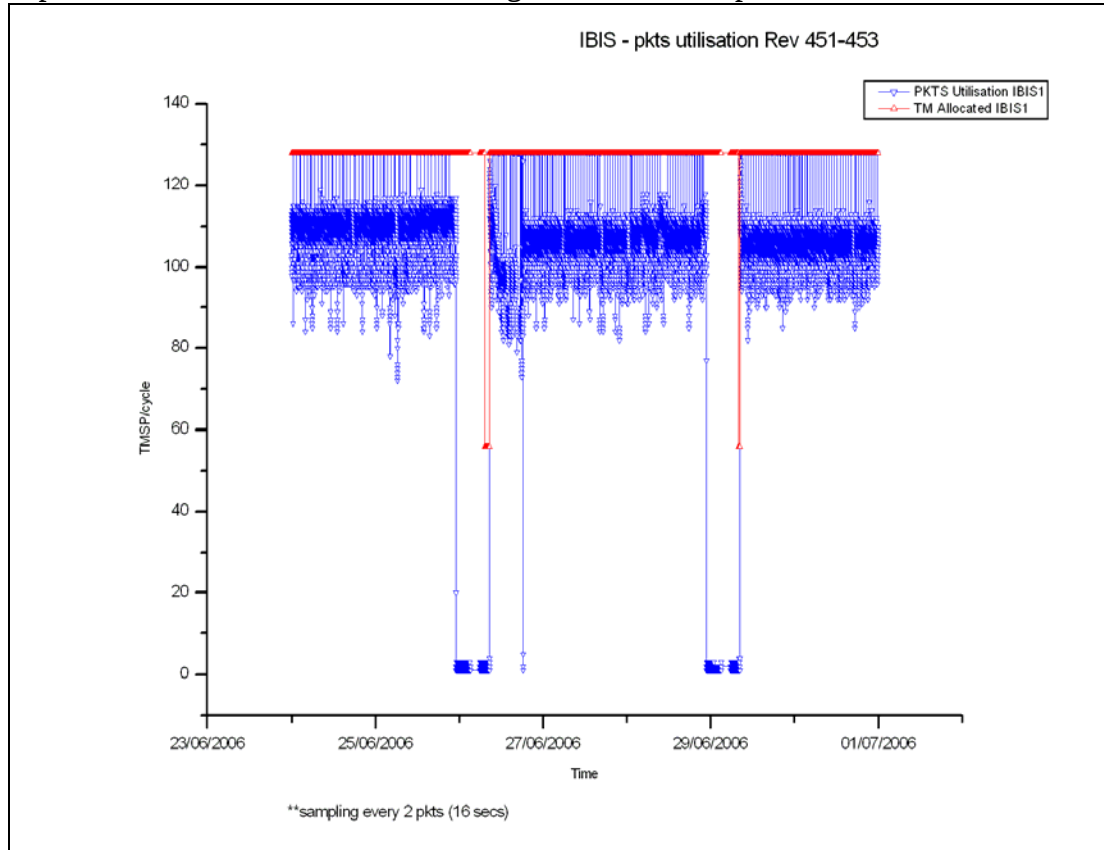
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The overall status of the unit is nominal.

During the reporting period, the PST allocation to IBIS was 128 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 107.77 TMPS/cycle, down 3.81 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 with a TM allocation of 8 packets/cycle during science observations and JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

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, 167 of the 168 planned science pointings for OMC were executed nominally, 1 was 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.

On 2006-06-27 (revolution 452), the second forced IREM reset was performed successfully. This operation was transparent for the Payload.

Solar Activity

The observation period was characterised low solar activity.

On 25/06/2006 sunspot 897 emerged. It was growing until 29/06/2006 when it was posing threat for M-class solar flares. In addition on 28/06/2006 a big sunspot, 898, appeared.

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 very good this week, although 1 pointing was lost to MOC problems, and 1 to ground station problems. There were also problems with the links with ISDC. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was much better this week. A pointing was lost to lost links with the MISCdynamic server. The overall performance was still over the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network also better this week, there were several instances of bad frames and TM drops, one of which caused loss of a pointing. There were also several occasions when the links with ISDC dropped. The overall performance though was well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF for revolution 460 to 462 were delivered. Due to an accepted and urgent ToO received and accepted replanning from revolution 454 to 458 had to be performed again. An OMC flat field calibration had to be moved to revolution 455. Planning of revolution 459 was done and the files sent to MOC and ISDC. When attempting to

plan revolution 460 the planning experienced a problem caused by a lunar eclipse occurring in revolution 461. A solution is being discussed with MOC. TSF for revolutions 454 to 455 were received from MOC.

2. Observation status

No ECS's were received this week.

3. ISOC science data archive

Version 2.5.2 Beta of ISDA released. A long delay in this was avoided by removing the requirement for generation of mosaiced images at the observation level. However, the delays will still impact on version 2.6, which is now not expected until Autumn 2006.

The progress in the archive areas was again seriously affected by the Operational and post-TAC related tasks.

4. ISOC system

The ISOC system version 12.4 has been used this week without any problem.

5. AO 4

This week most of the ISOC scientists have been involved in performing post-TAC activities. The ISOC web pages have been updated to include the AO 4 results. The activities after the TAC has turned out to be more demanding this time than anticipated. In particular the introduction of the new feature Key Programme has caused a lot of extra work.

6. Problems

No new problems encountered

4.3.2 ISDC

Status of ISDC observation processing on 03/07/2006:

- Latest Standard Analysis completed: observation 03297000008 (GRO J0852-4642, Revolution 439-440) on 02/07/2006.

- Latest products archived: observation 03297000008 (GRO J0852-4642, Revolution 439-440) on 03/07/2006.

- Latest observation products sent to the observer: observation 03201090063 (Galactic Bulge, Revolution 426) on 01/06/2006.

5 Special Events

6 Anomalies

The following problems impacted operations this week:

- On DoY 177, at 13:50, the connection to the MISCdynamic server dropped. This caused the IMCS to crash. The IMCS was restarted, a recovery

performed and the Timeline rejoined at 14:50. The impact was the loss of pointing 04520012.

- At 17:44, bad frames from Vil2, caused an AOCS command to fail release. A recovery was performed, and the following slew was updated. The impact was the loss of pointing 04520016.

The following anomaly reports were entered into the ARTS system this week:

AR id	Date Created	Subject	Segment	Status
INT-2861	29/06/2006	Command Verifier on IMCA crashed	IMCS	Pending
INT-2862	29/06/2006	Various SOCS applications died at time of on-board antenna swap	IMCS	Pending
INT-2863	29/06/2006	IMCA application USER died	IMCS	Pending
INT-2864	29/06/2006	MISC DYNAMIC server on IMCA died	IMCS	Pending

7 Future Milestones

A new imcs release will be installed in June. This release will be based on SCOS 2000 3.1 patch M04, to bring the system in-line with that used by XMM.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 452

The observations in revolution 452 began with a Galactic Plane Survey, lasting ~6.7 hours. This was followed by a raster dithers of Field_13 (RA 02:54:53.00, DEC -38:54:33.0), lasting ~11.1 hours; Field_11 (RA 01:45:28.00, DEC -17:33:19.0), lasting ~17.0 hours and finally Field_8 (RA 01:01:15.00, DEC +32:40:34.0), lasting ~18.5 hours.

Revolution 453

The observations in revolution 453 began with a raster dither of Field_11 (RA 01:45:28.00, DEC -17:33:19.0), lasting ~38.5 hours. This was followed by a Galactic Plane Survey lasting ~7.3 hours. Finally a raster dither of Field_14 (RA 05:17:33.00, DEC -40:53:55.0), lasting ~6.7 hours was executed.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2, which is switched off. The TM allocation was IBIS 128; SPI 105; JEM-X1 8; JEM-X2 0; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2006-06-14T03:49:05.000Z	153.7856	F	Automatic TM processing.
2006-06-14T07:36:33.000Z	153.7770	F	Automatic TM processing.
2006-06-15T17:51:49.000Z	153.7598	F	Automatic TM processing.
2006-06-17T08:13:37.000Z	153.7471	F	Automatic TM processing.
2006-06-18T18:29:24.000Z	153.7344	F	Automatic TM processing.
2006-06-20T07:09:20.000Z	153.7204	F	Automatic TM processing.
2006-06-21T18:14:03.000Z	153.7054	F	Automatic TM processing.
2006-06-23T06:51:51.000Z	153.6894	F	Automatic TM processing.
2006-06-24T17:56:35.000Z	153.6704	F	Automatic TM processing.
2006-06-26T06:38:46.000Z	153.6390	F	Automatic TM processing.
2006-06-26T15:34:55.000Z	153.6273	F	Automatic TM processing.
2006-06-26T16:42:23.000Z	153.5893	F	Automatic TM processing.
2006-06-29T00:13:49.000Z	153.5784	F	Automatic TM processing.
2006-06-29T02:24:05.000Z	153.5659	F	Automatic TM processing.
2006-06-29T06:17:50.000Z	153.5458	F	Automatic TM processing.

This report was generated Fri Jun 30 08:00:33 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, 24/06/2006 – 30/06/2006

AOCS operations were executed from the Automatic Timeline.

During this period, 86 Open Loop Slews, 93 Closed Loop Slews and 7 Momentum Biases were executed.

2 Open Loop Slews were lost during the observation period due to problem on the IMCS (MISCdynamic server mainly) and TC/TM links with VIL2 station.

This is equivalent to a 1 % of the total number of slews planned (181).

Orbit Control

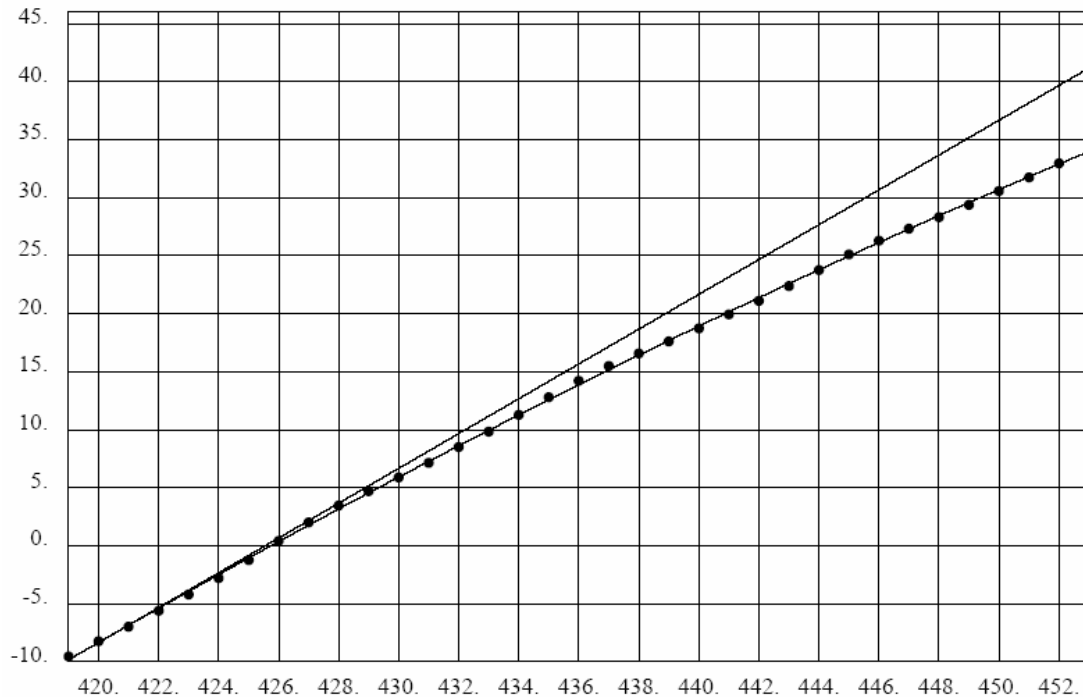
The following table shows the shortening of the necessary Goldstone pass:

Orbit number	Apogee passage date	Time from LOS Redu to 40000 km altitude
362	2005/10/01	284 min
372	2005/10/31	268 min
382	2005/11/30	244 min
393	2006/01/02	213 min
402	2006/01/29	188 min
412	2006/02/28	159 min
422	2006/03/30	122 min
433	2006/05/01	80 min
443	2006/05/31	46 min
453	2006/06/30	16 min

From orbit 461 and onwards Redu will give coverage down to 40000 km altitude.

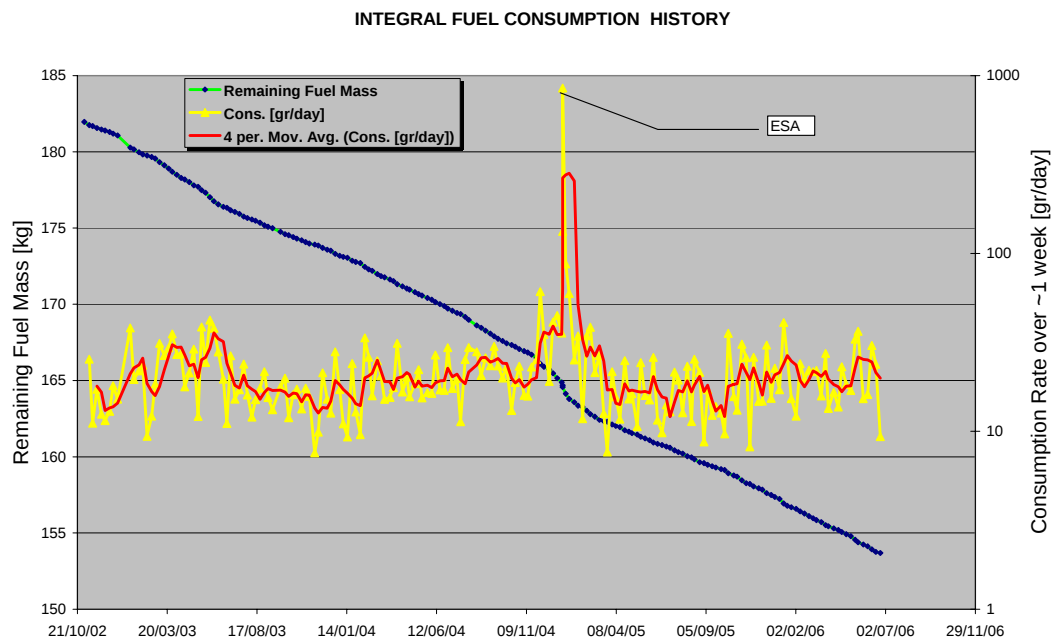
The attached plot shows the apogee longitude of Integral as a function of the orbit number. From this, an estimate of the rate of semi-major axis increase of about 800m per orbital revolution can be made.

APOGEE LONGITUDES OF INTEGRAL 21.03.2006 - 01.07.2006
 LEAST SQUARES APPROXIMATION WITH PARABLE

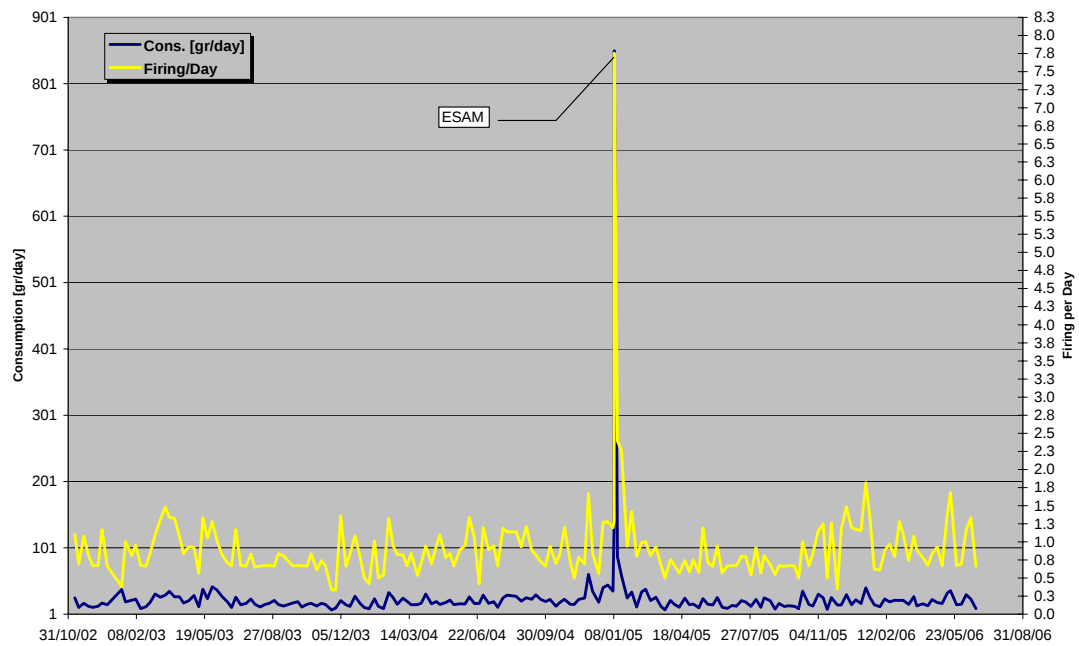


Fuel consumption

The fuel consumption (total, grams/day) over the period between 01/11/2002 and 30/06/2006 is reported in the plot below.

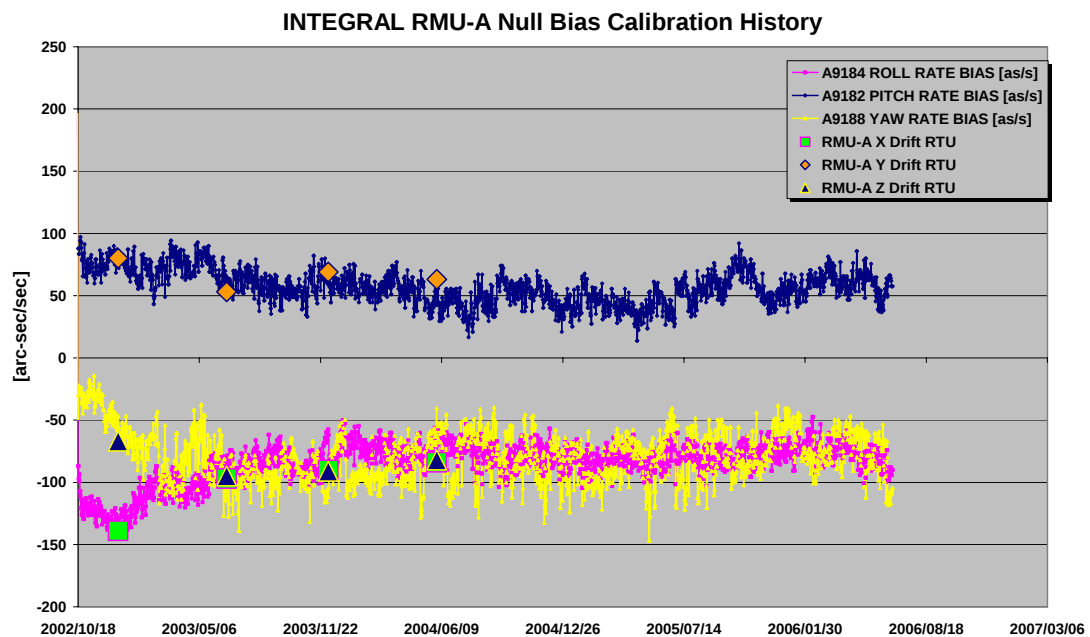


The firing\day over the period between 01/11/2002 and 30/06/2006 is reported in the plot below.

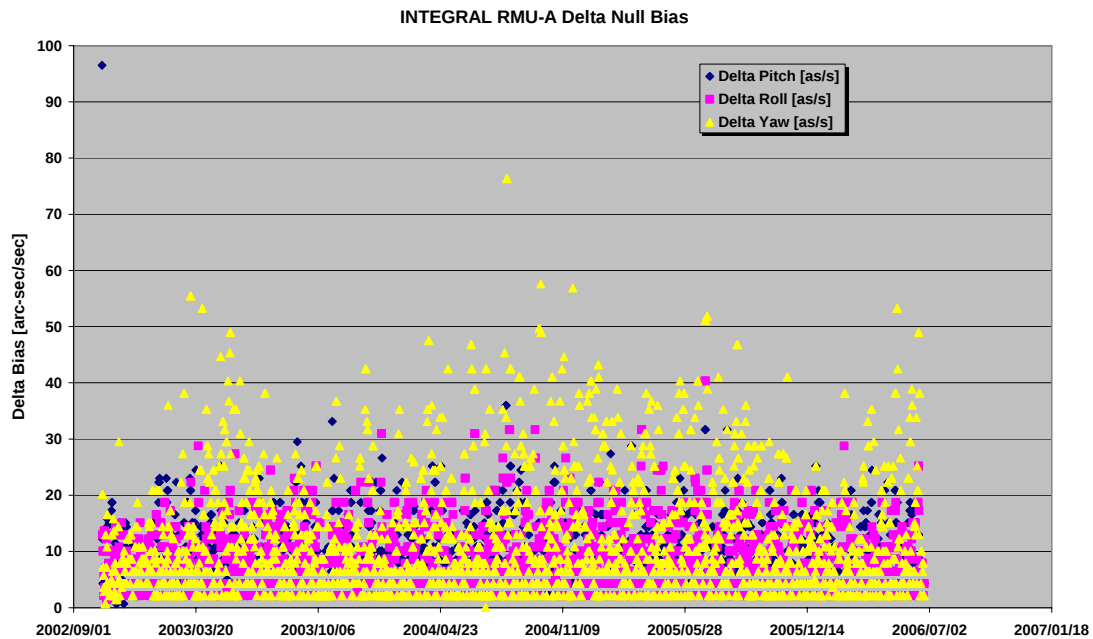


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 30/06/2006 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 30/06/2006 is reported in the plot below.



24/06/06 (Day of Year 175, Revolution 451)

Nothing to report.

25/06/06 (Day of Year 176, Revolution 451)

Nothing to report.

26/06/06 (Day of Year 177, Revolution 451-452)

Slew failed due to problem on IMCS: at 13:50z due to a problem on the IMCS MISCdynamic server, the IMCS crashed, preventing uplink of the command sequence for the Open Loop Slew 04520012.

A manual recovery was then started at 14:14z, from attitude of PID 04520011 to the attitude of PID 04520013. From 14:39 to 14:47, an Open Loop Slew was performed, and the Timeline rejoined at 14:50.

The following slew was not executed from TL: ID 04520012 (OSL).

Dynamic PTV failed due to problem on TM link: at 17:45z due to a problem on the TM link with VIL2 station, the sequence for slew ID 04520016 failed release due to the dynamic PTV.

A manual mapping was then started at 17:47z, and the next slew to the attitude of PID 04520017 updated. This was then executed from the Timeline at the nominal time.

The following slew was not executed from TL: ID 04520016 (CSL).

27/06/06 (Day of Year 178, Revolution 452)

Nothing to report.

28/06/06 (Day of Year 179, Revolution 452)

Nothing to report.

29/06/06 (Day of Year 180, Revolution 452-453)

Nothing to report.

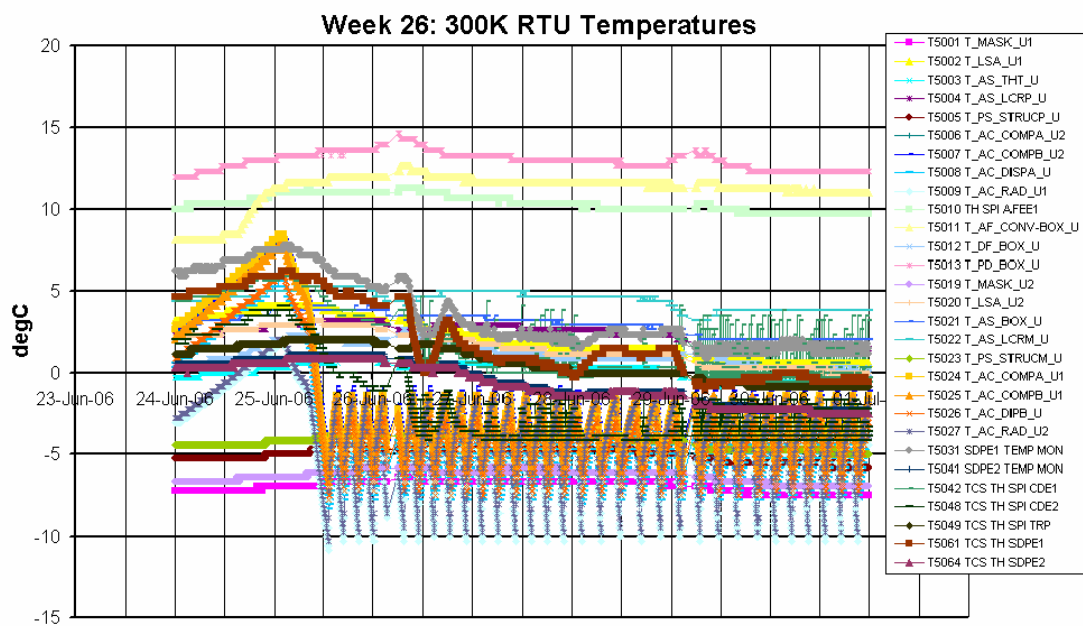
30/06/06 (Day of Year 181, Revolution 453)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures:

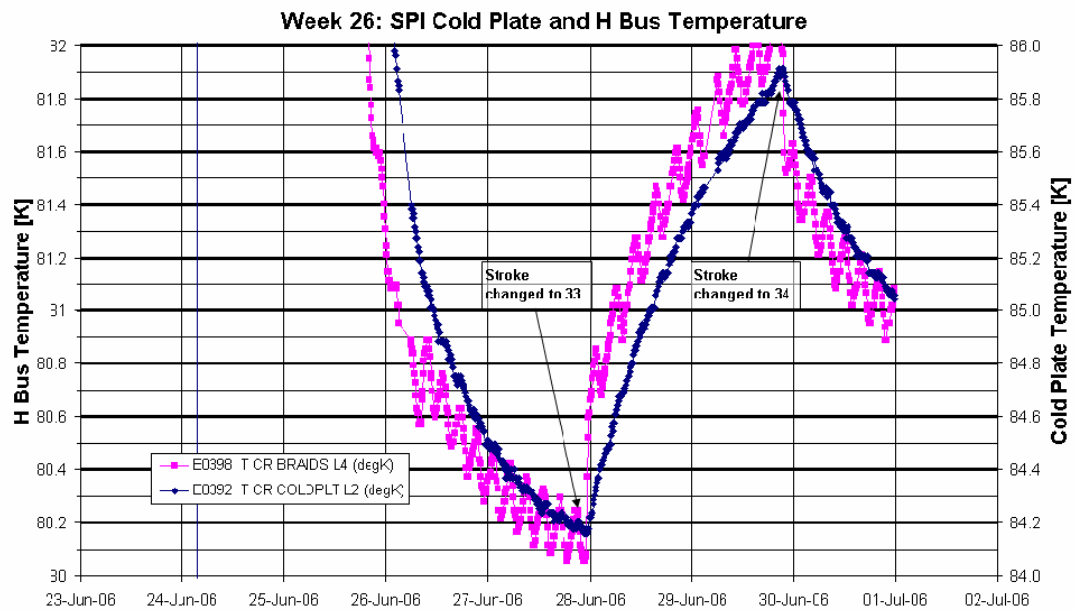
All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period:



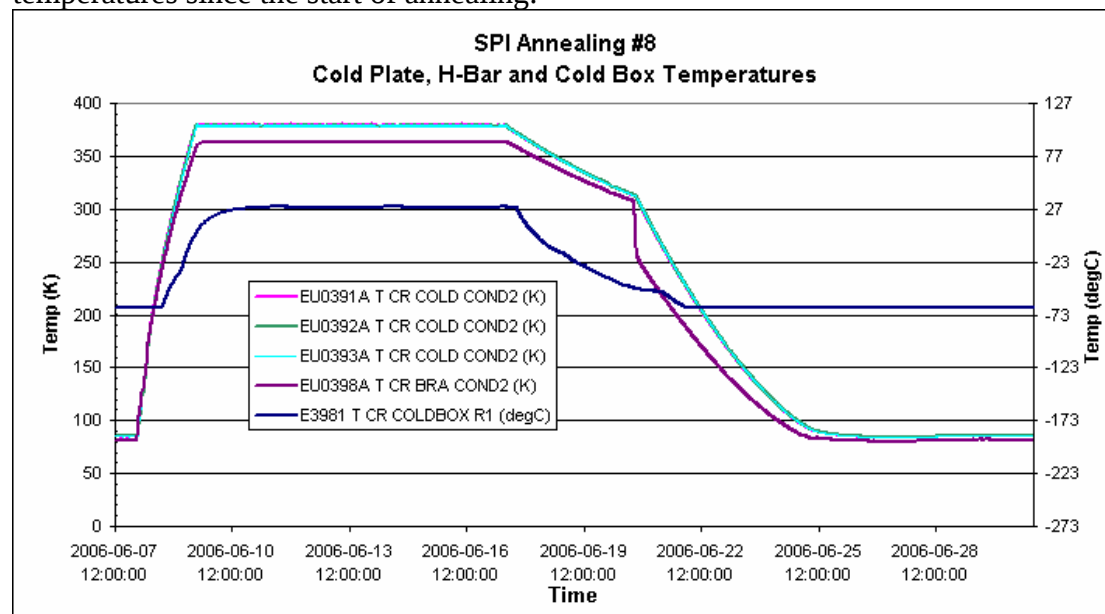
Stirling Compressors and Cryostat:

The performance of the compressors is nominal. Following the start of active cooling on 20/06/2006 at 18:51Z, the cold plate temperature entered the range 85K $\pm$ 1K on 26/06/2006 at 02:00Z.

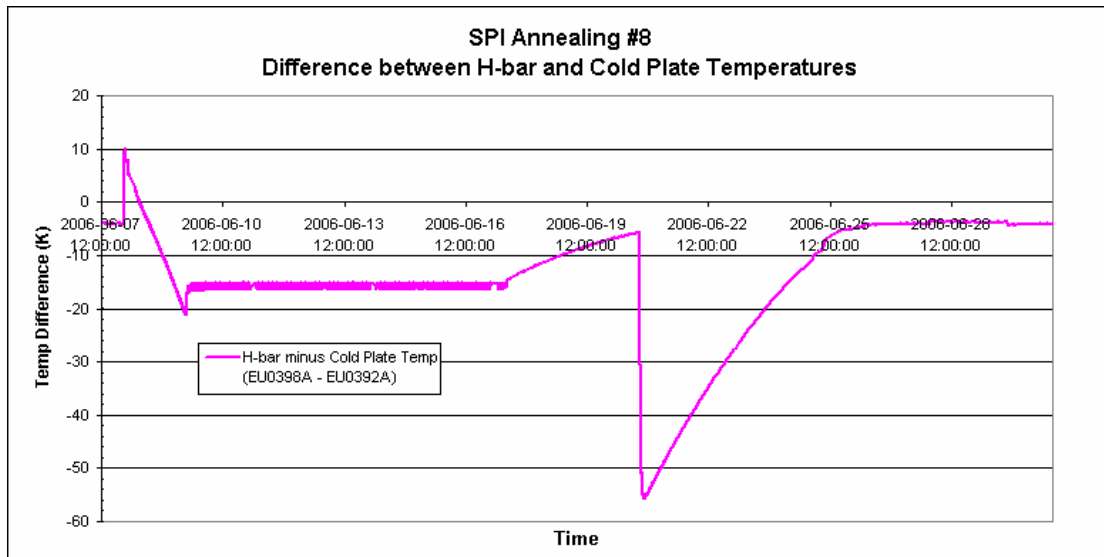
The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.



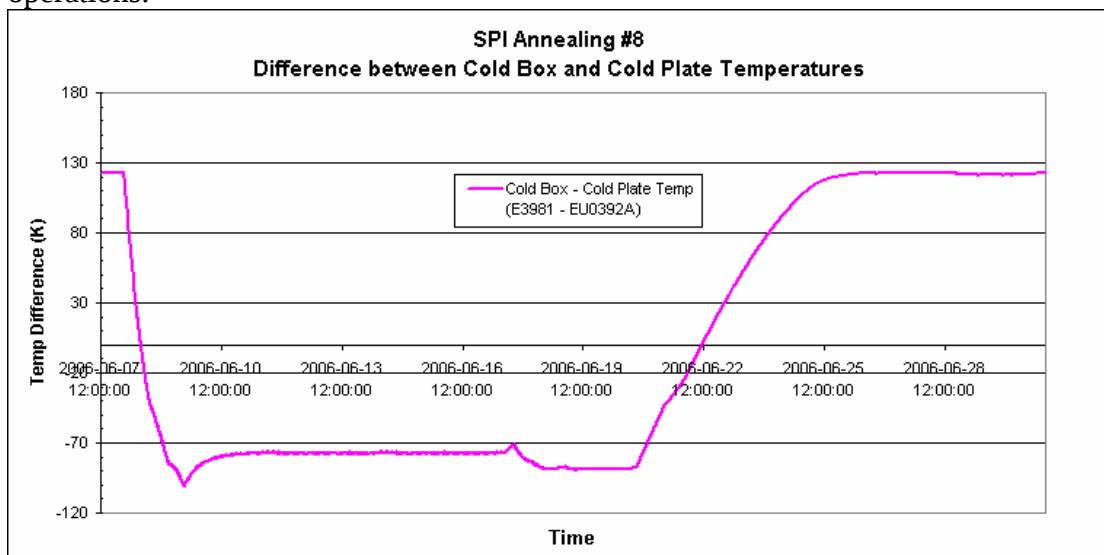
The following plot shows the evolution of the cold box, the cold plate and H-bar temperatures since the start of annealing:



The following plot shows the temperature difference between the cold plate and the H-bar, to identify where the temperature inversions took place during the annealing operations:

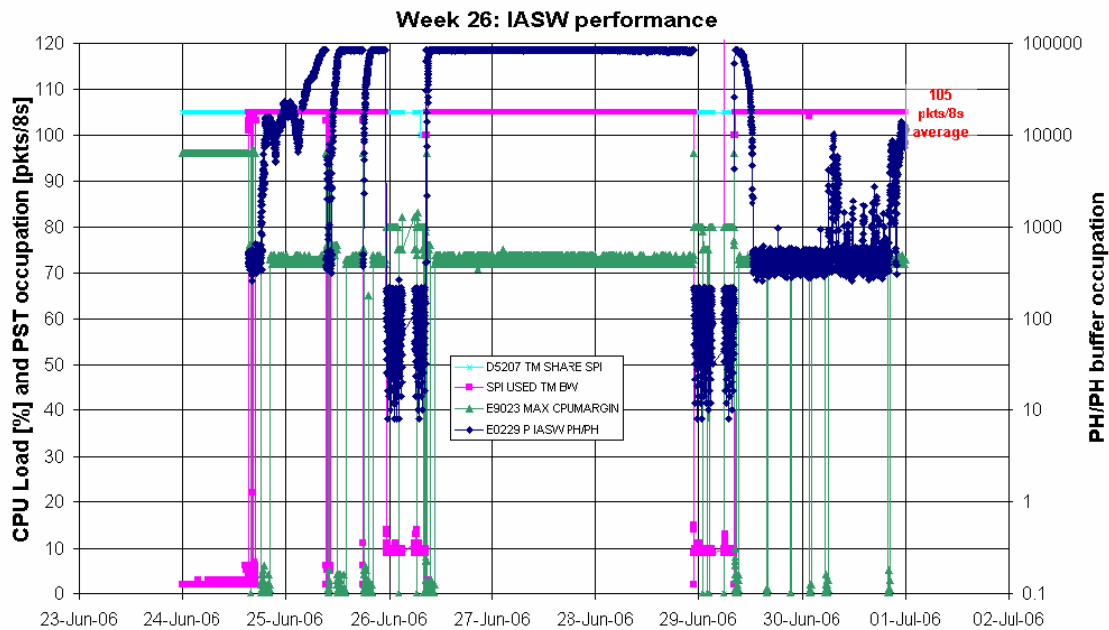


The following plot shows the temperature difference between the cold plate and the cold box, to identify where the temperature inversions took place during the annealing operations:



DPE & IASW:

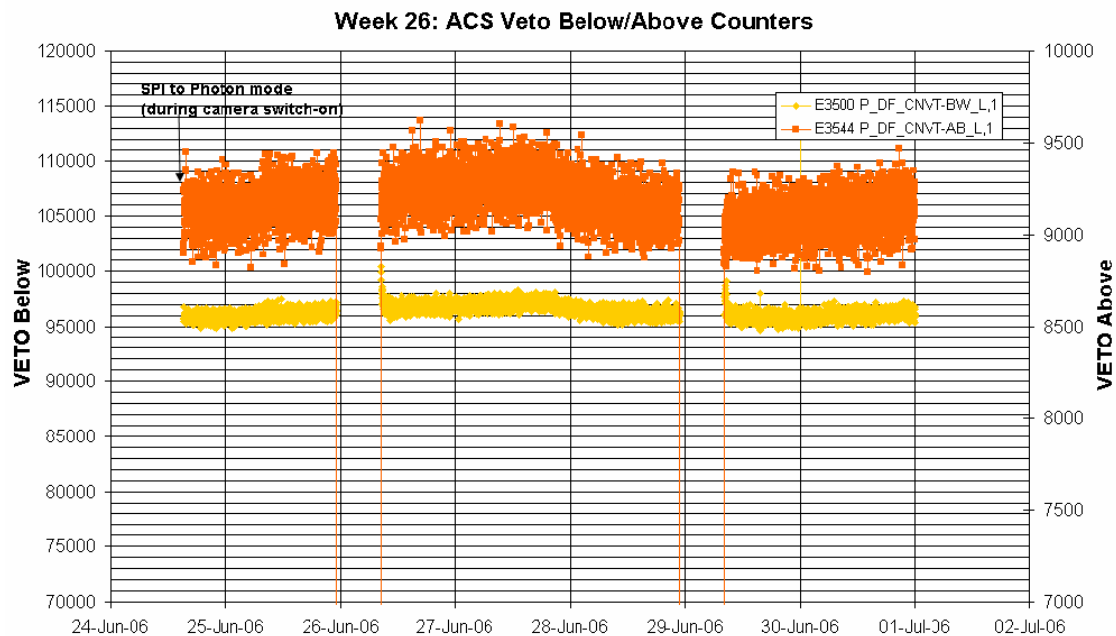
The DPE health and IASW performance is nominal. The current IASW version installed is 432. The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period



ACS:

The performance of the ACS is nominal. During the annealing the ACS HVPs were maintained switched on at the minimum voltage ($\sim 980V$). On 24/06/2006 at 16:47Z, after the camera switch-on, the nominal ACS HV configuration was set.

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

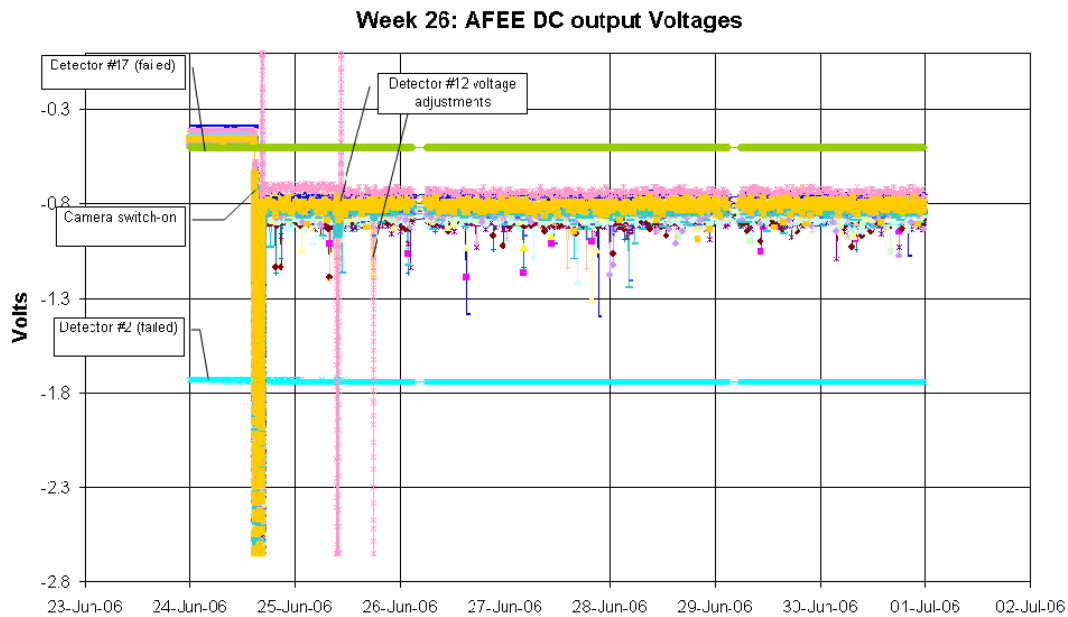


AFEE:

The health of the AFEE is nominal. At the start of the reporting period, due to the annealing operations, the detector HVPs were off and only the LVPs were left on. The camera switch-on was performed on 24/06/2006 starting at 14:30Z.

The performance of the AFEE and the detectors is nominal, except for the Ge detectors #2 and #12 which are showing a slightly degraded energy resolution. The energy resolution of GeD#15 was recovered with this annealing.

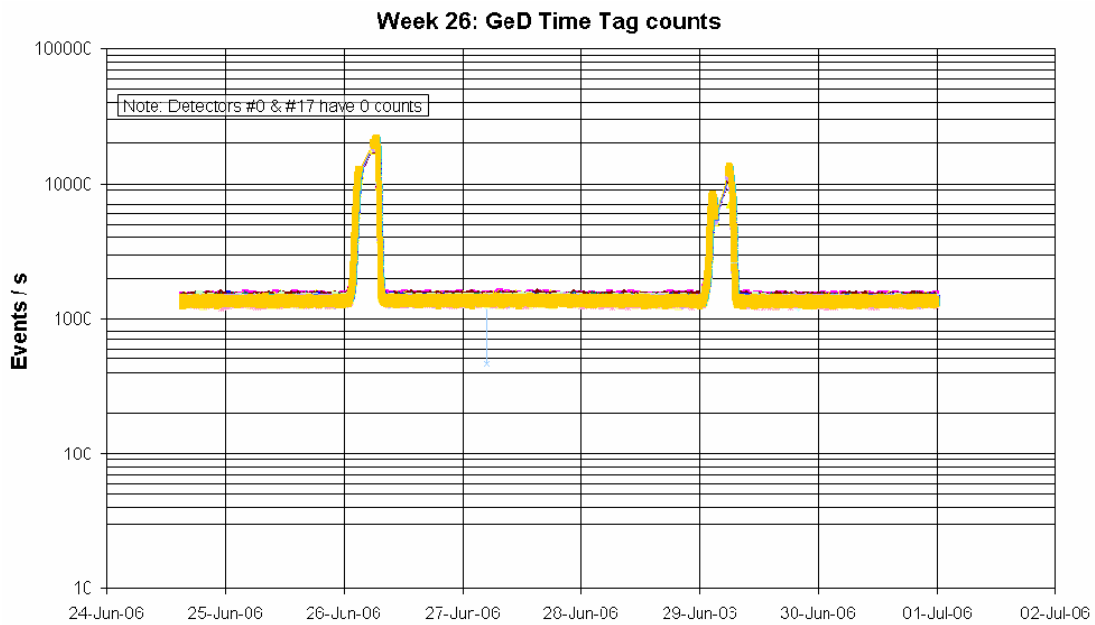
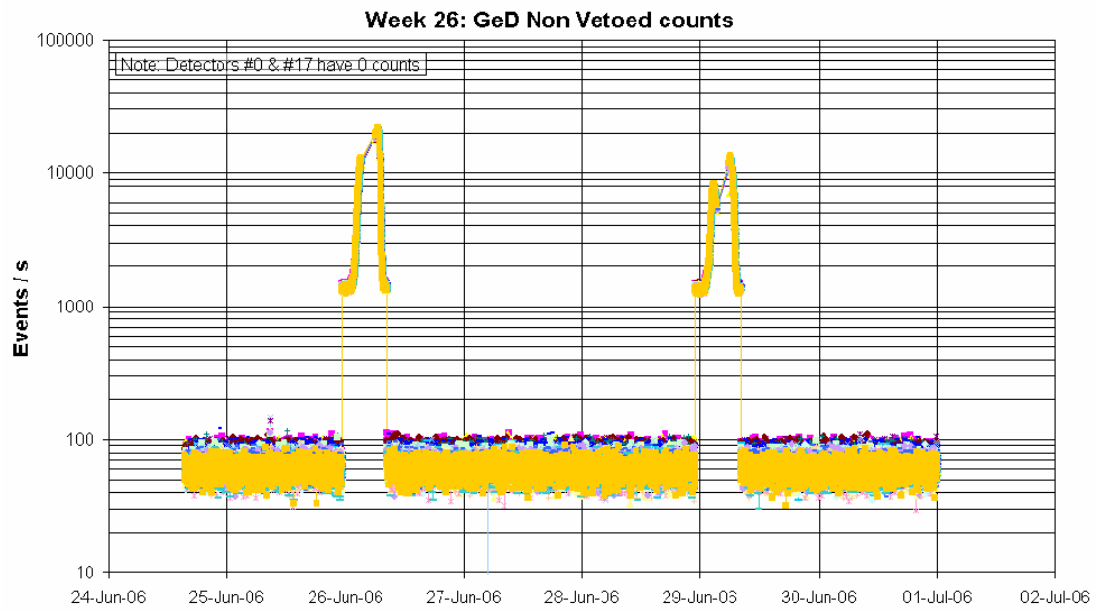
The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06.12.2003 and detector #17 is failed since 17.07.2004

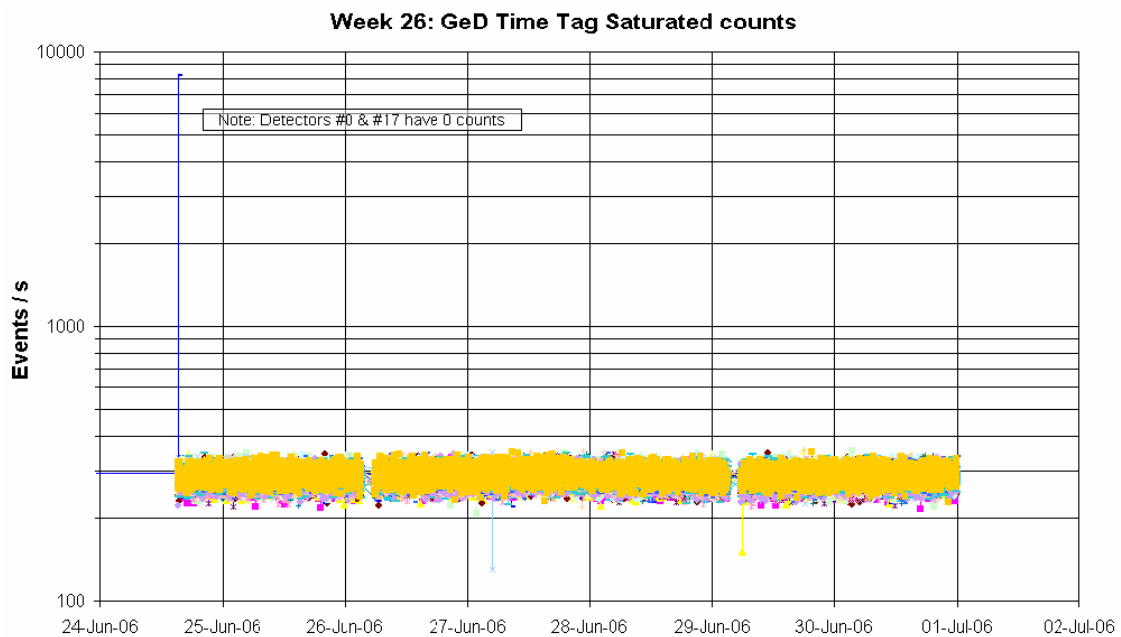


DFEE:

The performance of the unit is nominal. The DFEE was maintained in Conf mode during annealing and switched on on 24/06/2006 at 14:30Z.

The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event Count Rates during the reporting period.

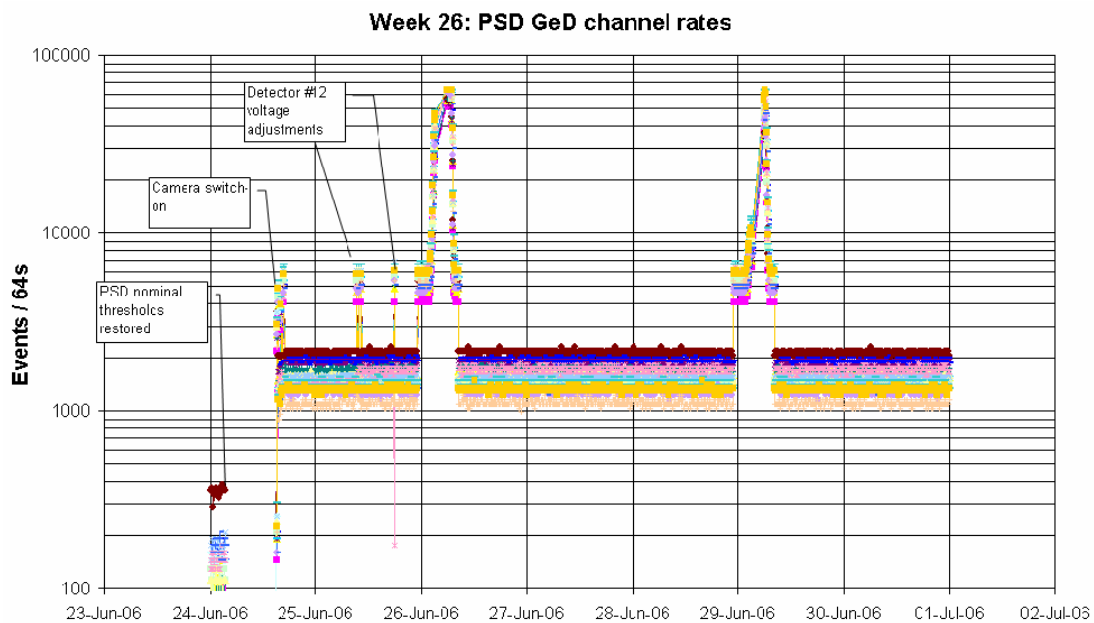




PSD:

The health of the unit is nominal. The PSD was maintained in Conf mode during annealing. The PSD nominal thresholds were restored on 24/06/2006 at 03:26Z.

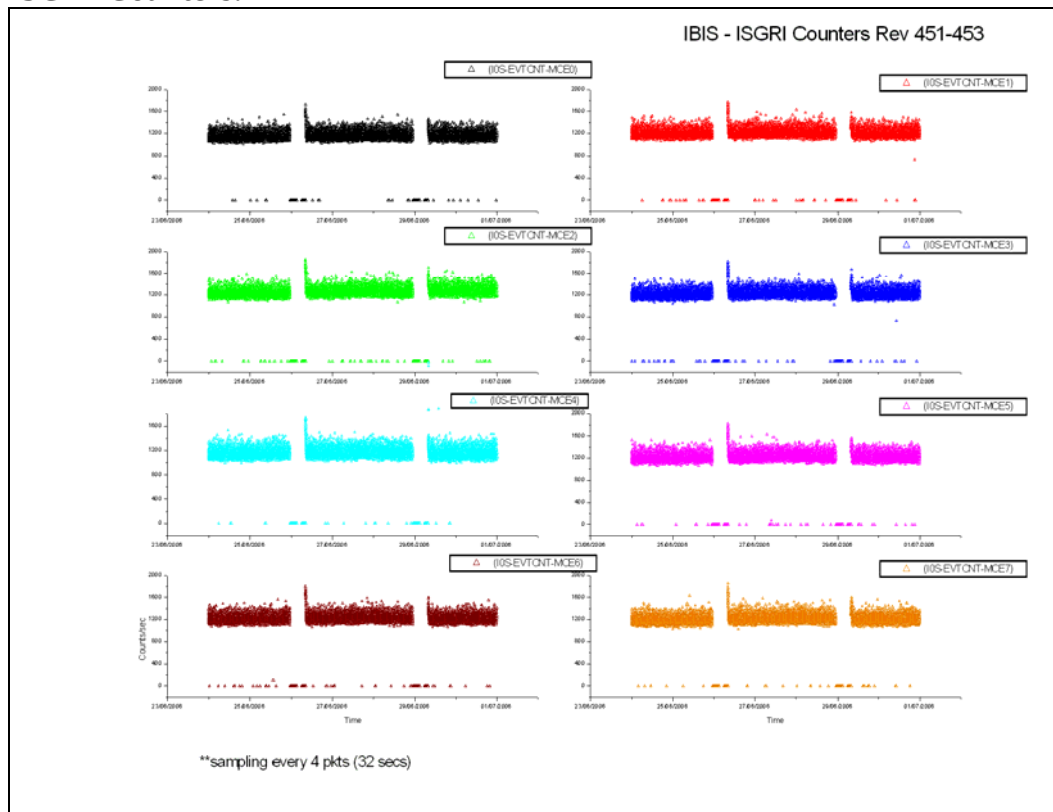
The following plot shows the PSD channel rates during the reporting period.



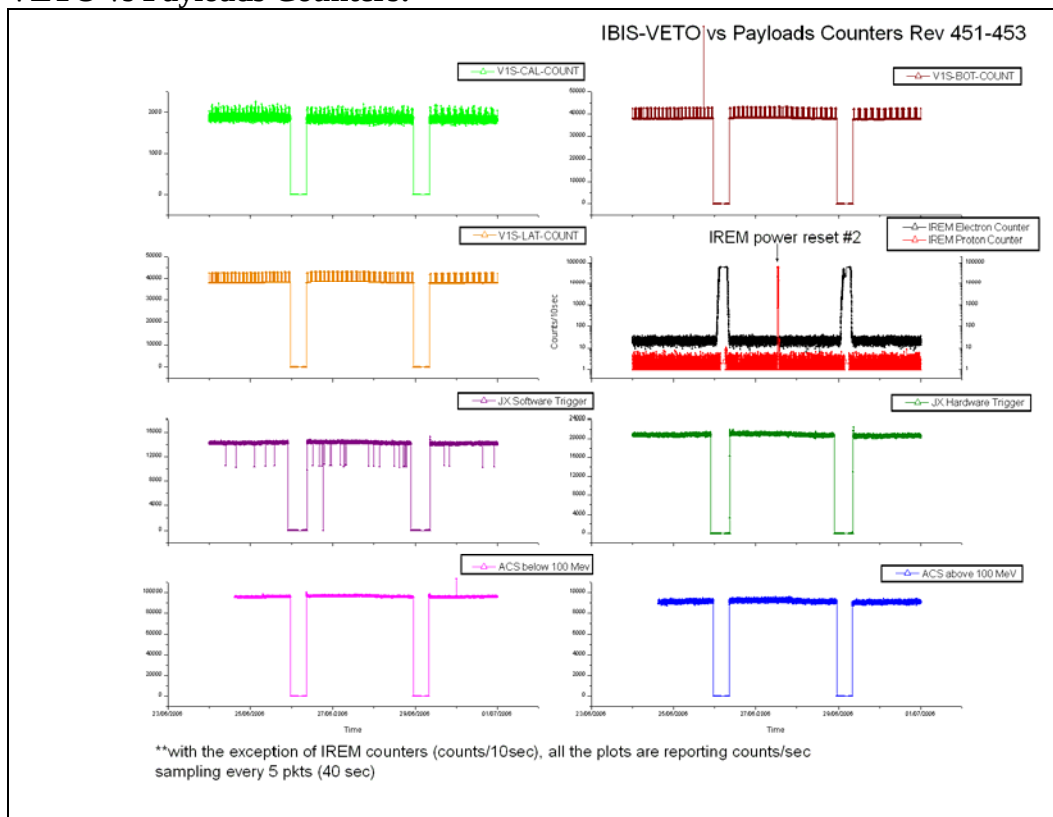
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:



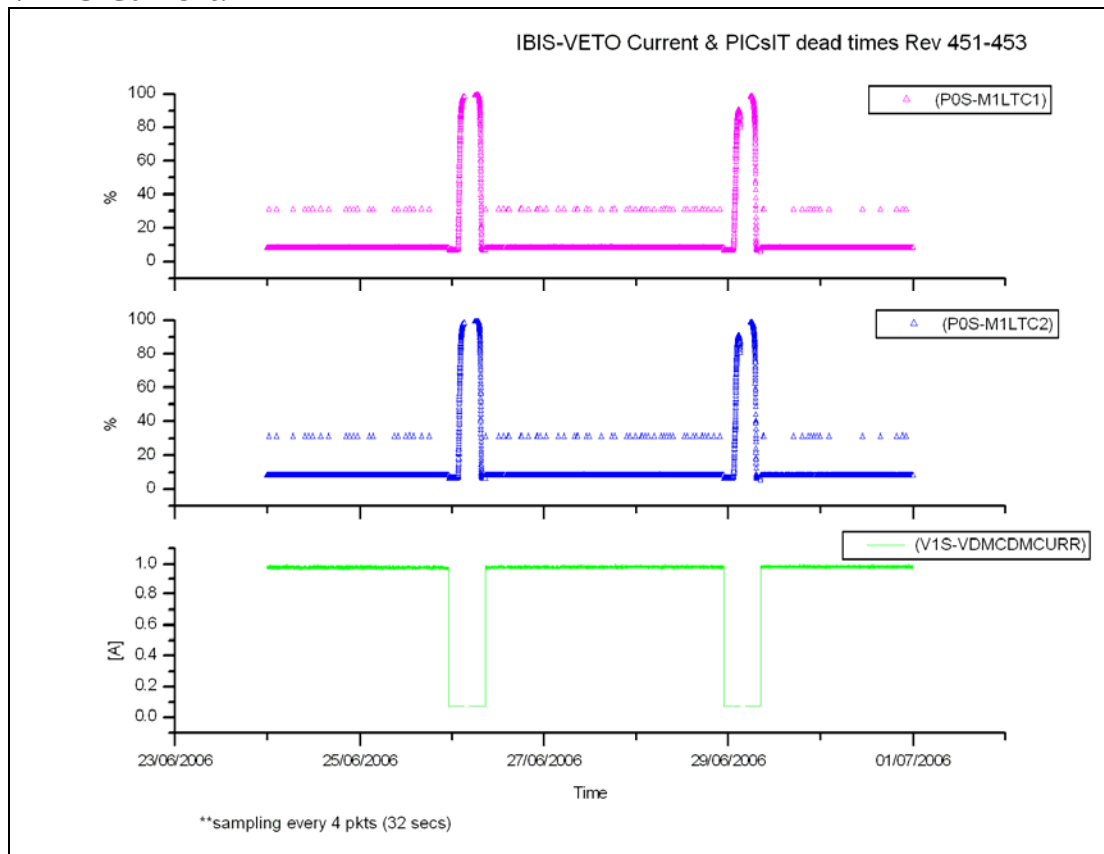
VETO vs Payloads Counters:



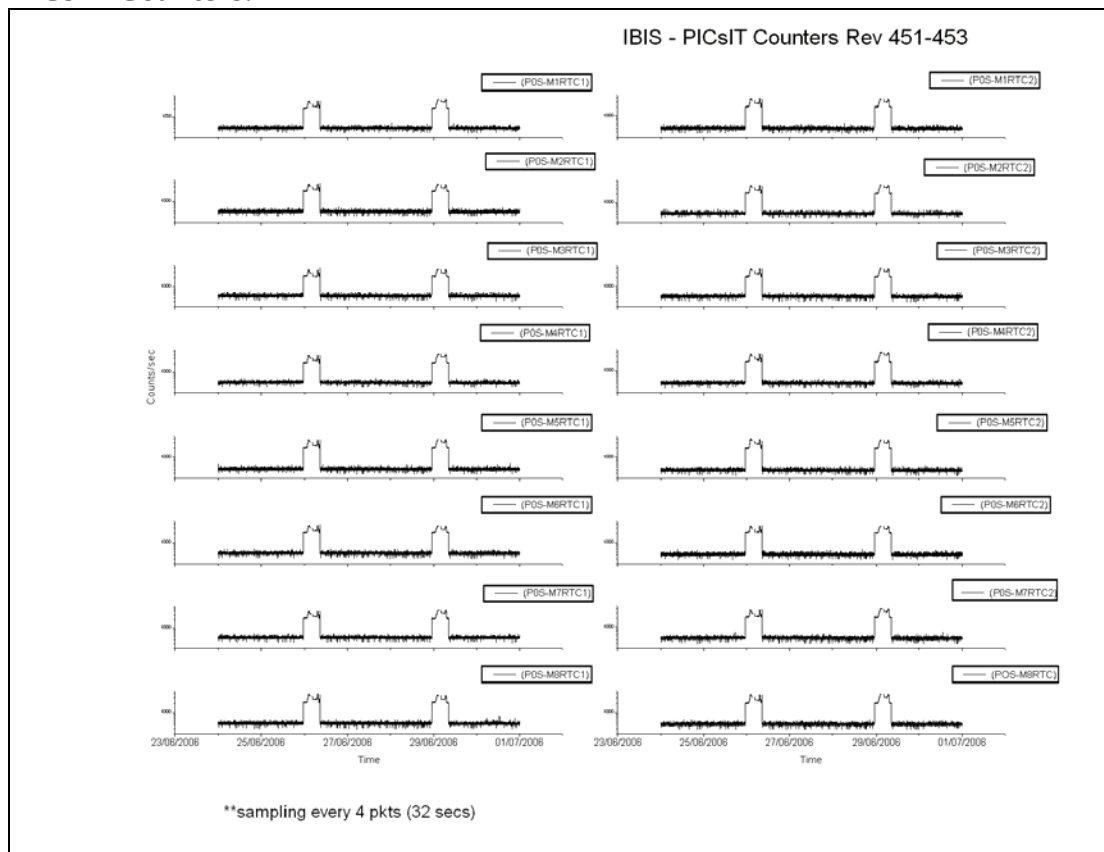
The week was characterised by low radiation.

SPI data are missing at the beginning of the week (on 24/06/2006) due to the annealing.

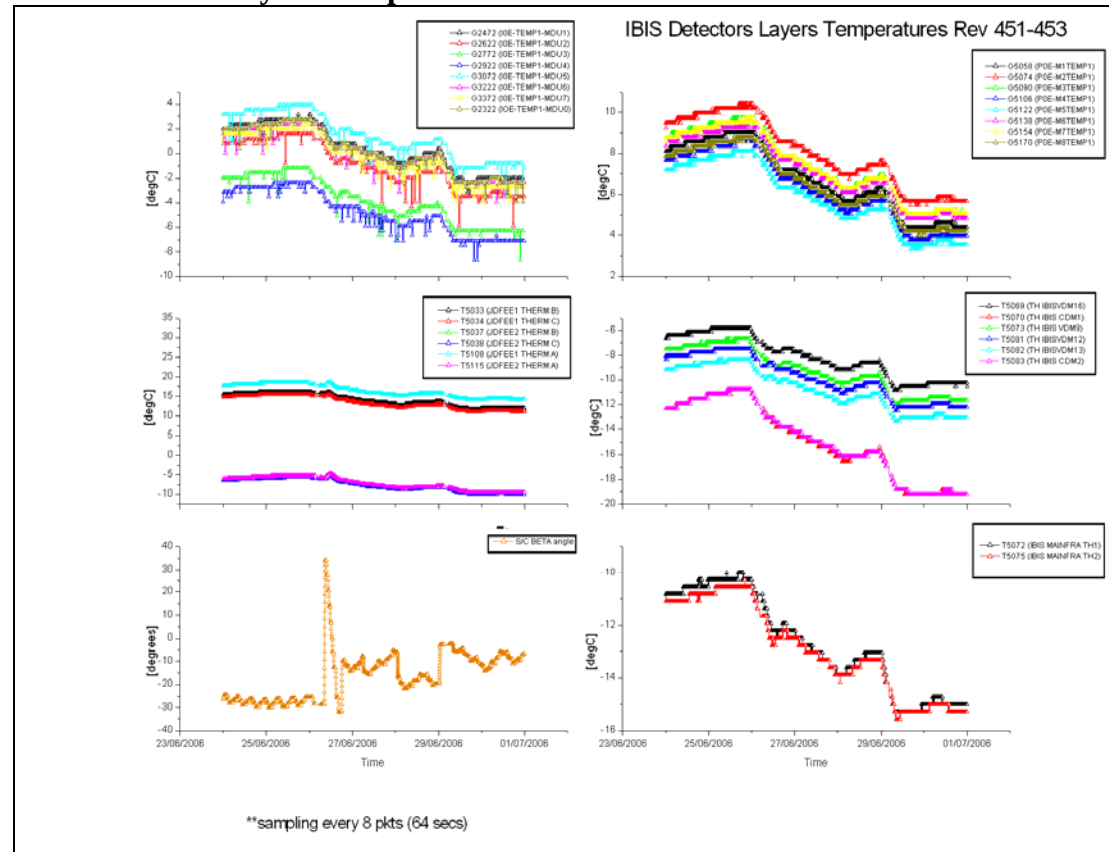
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 2006.176 (25/06/2006):

At 23:11Z, TM parameter G8015 (S1E-A2 PMT V) was reported Out Of Limit high. It went back inside limit on DoY 177 (26/06/2006) at 08:43Z. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 no action was taken.

DoY 2006.177 (26/06/2006):

At 08:25Z TM parameter G2014 (I0E-OVFWPXADD-M1) failed SCC and back. According to I-OVF-1, no action was taken.

DoY 2006.179 (28/06/2006):

At 22:54Z, TM parameter G8015 (S1E-A2 PMT V) was reported Out Of Limit high. It went back inside limit on DoY 180 (29/06/2006) at 08:25Z. As this happened inside the radiation belts (following VETO Stand-By mode), according to V-VLT-1 no action was taken.

DoY 2006.180 (29/06/2006):

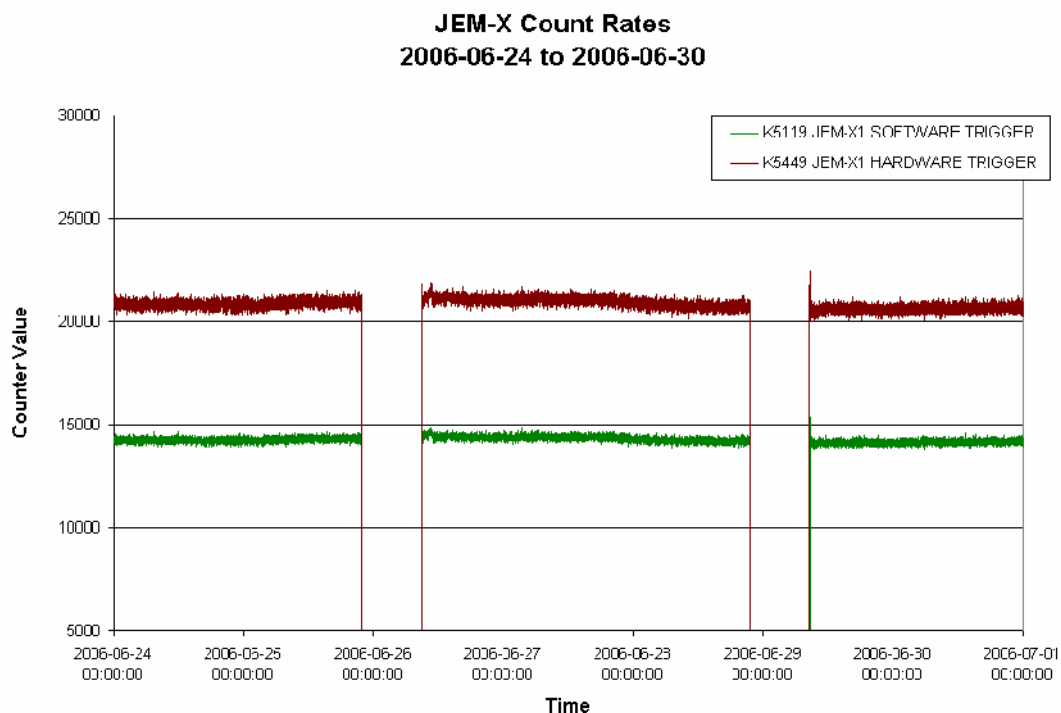
During the Belts, several TM parameters from families G5002 (P0S-Mi RTC1) and G5003 (P0S-Mi RTC2) went OOL High and back. According to P-CNT-1, no action was taken.

At 08:07Z TM parameter G2056 (I0E-OVFWPXADD-M4) failed SCC and back. At 10:45Z it happened again. According to I-OVF-1, no action was taken.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

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

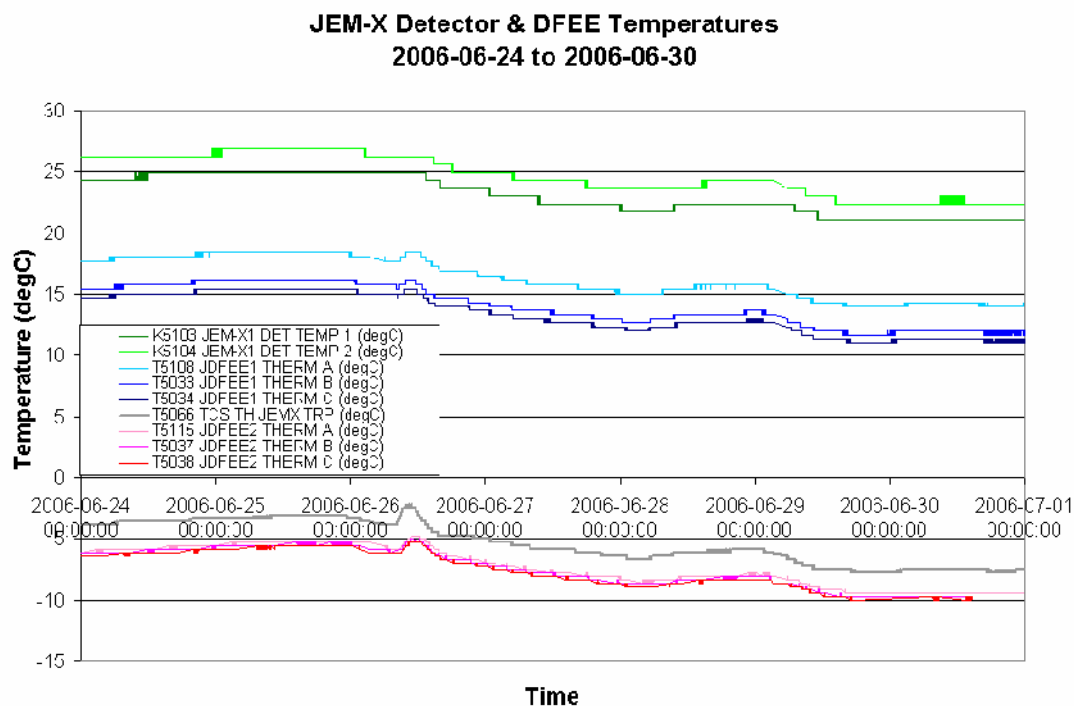


8.3.4.2 JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph².

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

² Data sampled (1 frame in 8)



8.3.4.3 JEM-X Daily Report

2006-06-24 (DOY 175, Rev 451) to 2006-06-30 (DOY 181, Rev 453)

Nothing to report

8.3.5 OMC Operations

2006-06-24 (DOY 175, Rev 451) to 2006-06-25 (DOY 176, Rev 451)

Nothing to report

2006-06-26 (DOY 177, Rev 452)

At 13:50z due to a problem on the IMCS MISCdynamic server, the IMCS crashed, preventing uplink of the command sequence for slew 04520012.

A manual recovery was performed, and the Timeline rejoined at 14:50. The impact was the loss of pointing 04520012.

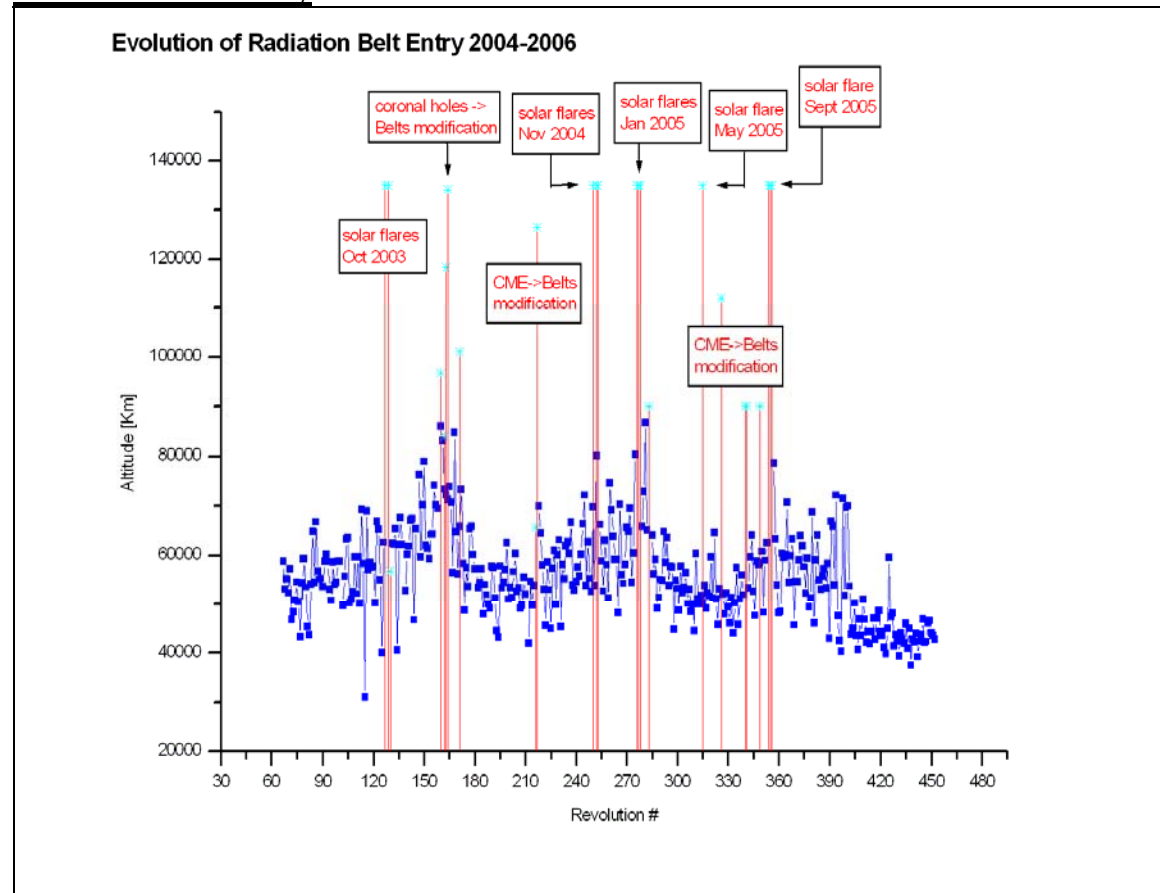
2006-06-27 (DOY 178, Rev 452) to 2006-06-30 (DOY 181, Rev 453)

Nothing to report

On DoY 176 at 23:11:09 and DoY 179 at 22:54:29 OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

On 2006-06-27 (revolution 452), the second forced IREM reset was performed to try to reduce the number of SEU affecting the unit. This activity has been run every 2 months since April. After a test period of 6 months, the efficiency of this operation will be assessed and possible extensions will be discussed.

The activity took place as follows:

1. Radiation assessment with SEIS tool
2. At 12:26Z, power OFF of IREM with FCP_RM_9000
3. At 12:31Z, power ON of IREM with FCP_RM_0010
4. At 12:34Z, patch for IREM counters rescaling factors with FCP_RM_0081.

This operation did not affect the instruments as the DRMC flag was disabled.

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]
451	RAD_ENTR R 2006-06-25T23:11:06Z	2006-06-26 01:09:42	>43586.4	2006-06-26 00:35:39	48543
452	RAD_EXIT R 2006-06-26T08:29:25Z	2006-06-26 08:05:33	>35630.8	2006-06-26 08:15:39	38268

Doc. Title : INTEGRAL Mission Report #197
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 03/07/06

Issue : 1
Rev. : 0
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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]
452	RAD_ENTR R 2006-06-28T22:54:23Z	2006-06-29 00:59:33	>42765.7	2006-06-29 00:23:39	47958
453	RAD_EXIT R 2006-06-29T08:12:13Z	2006-06-29 07:30:46	<<39567.0	2006-06-29 07:53:39	37429

Reference

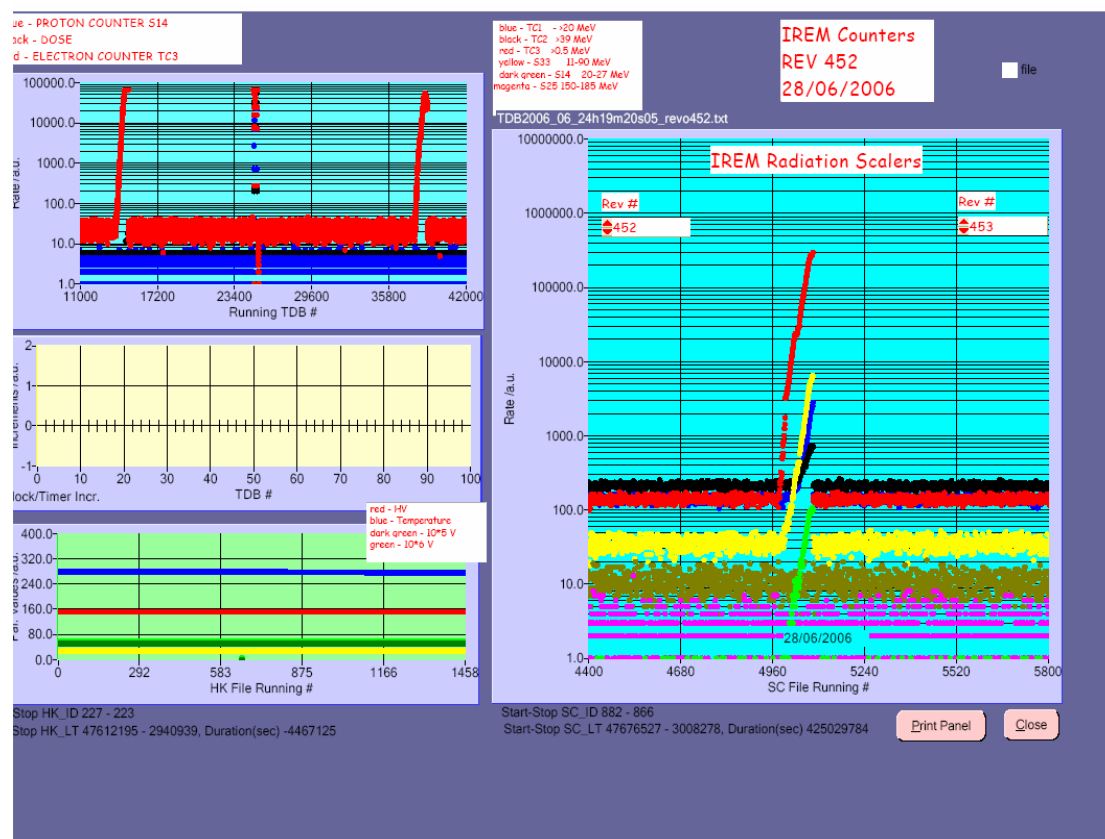
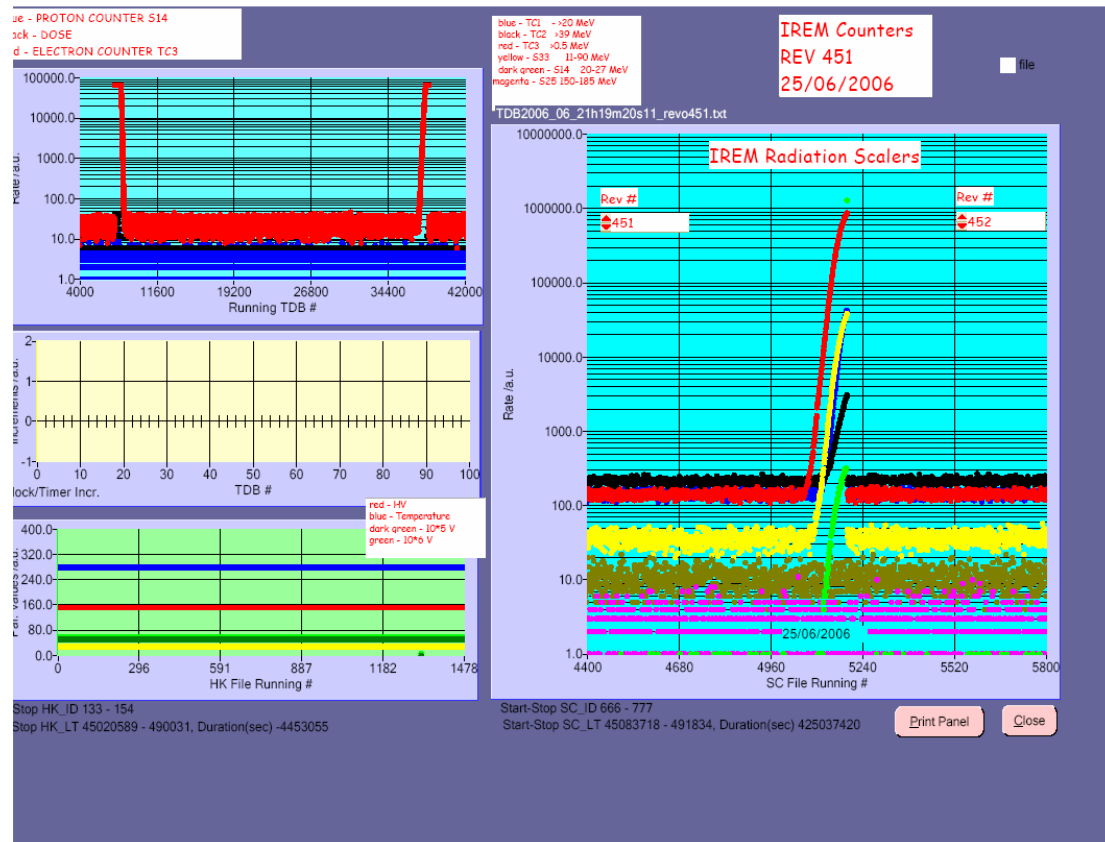
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

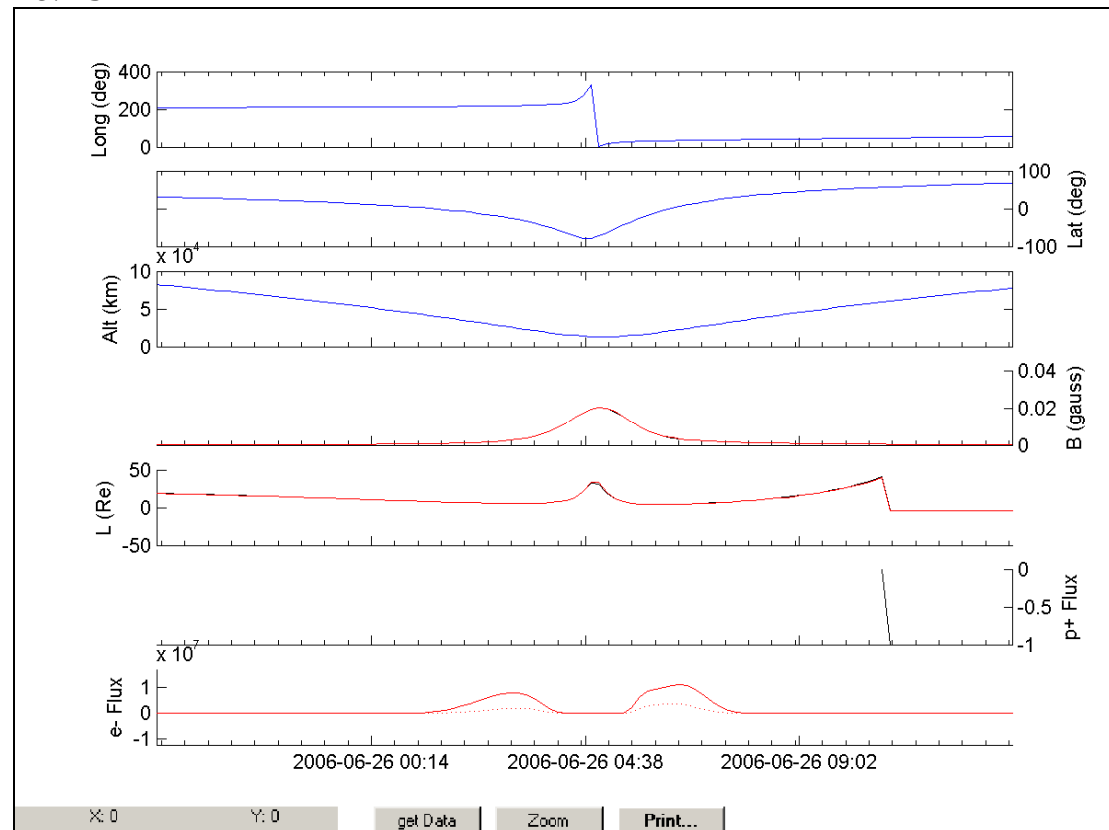
Radiation Spike

IREM radiation counters:

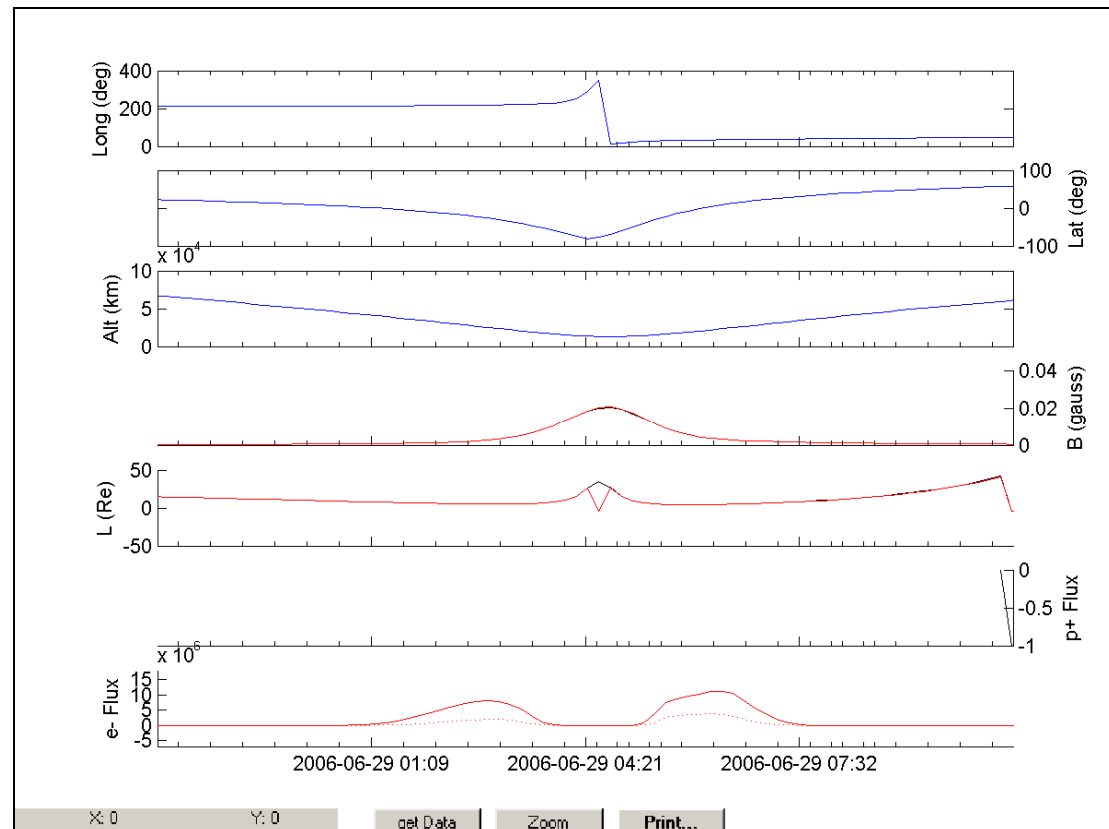


IREM Predicted Radiation Belt Passages:

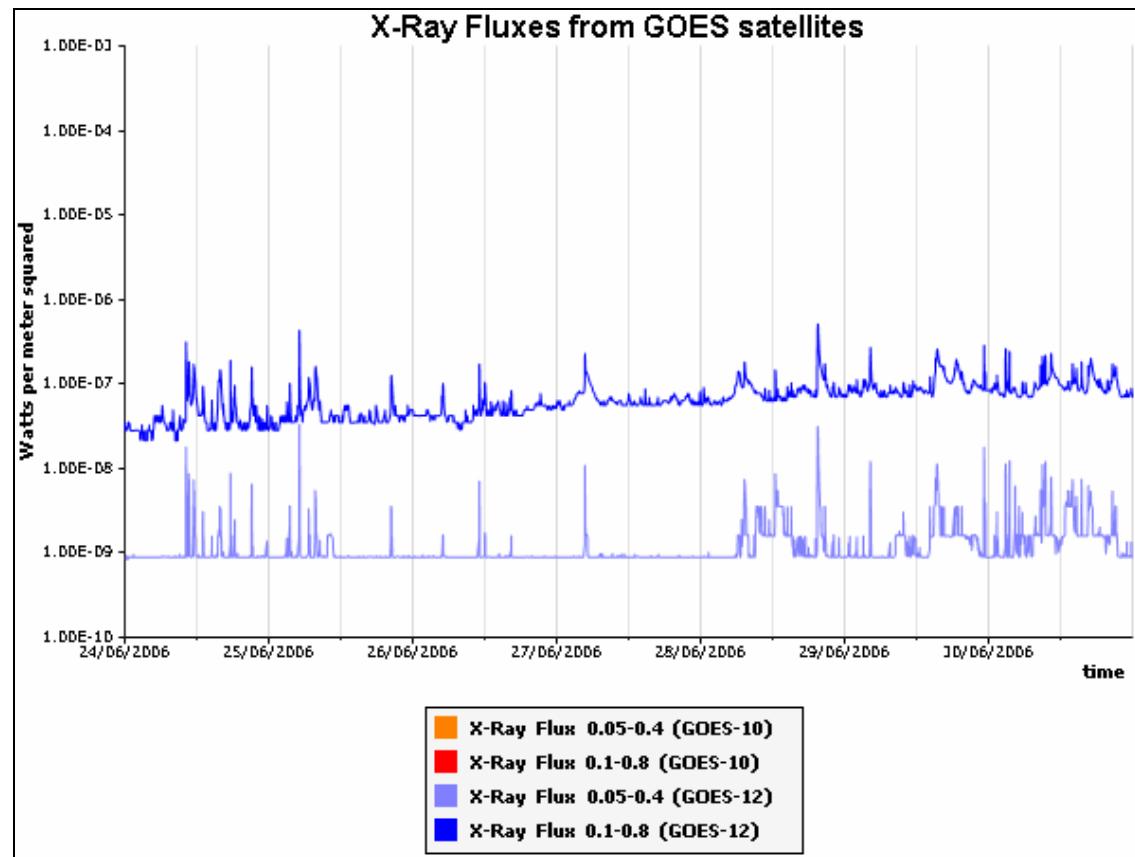
Rev 451



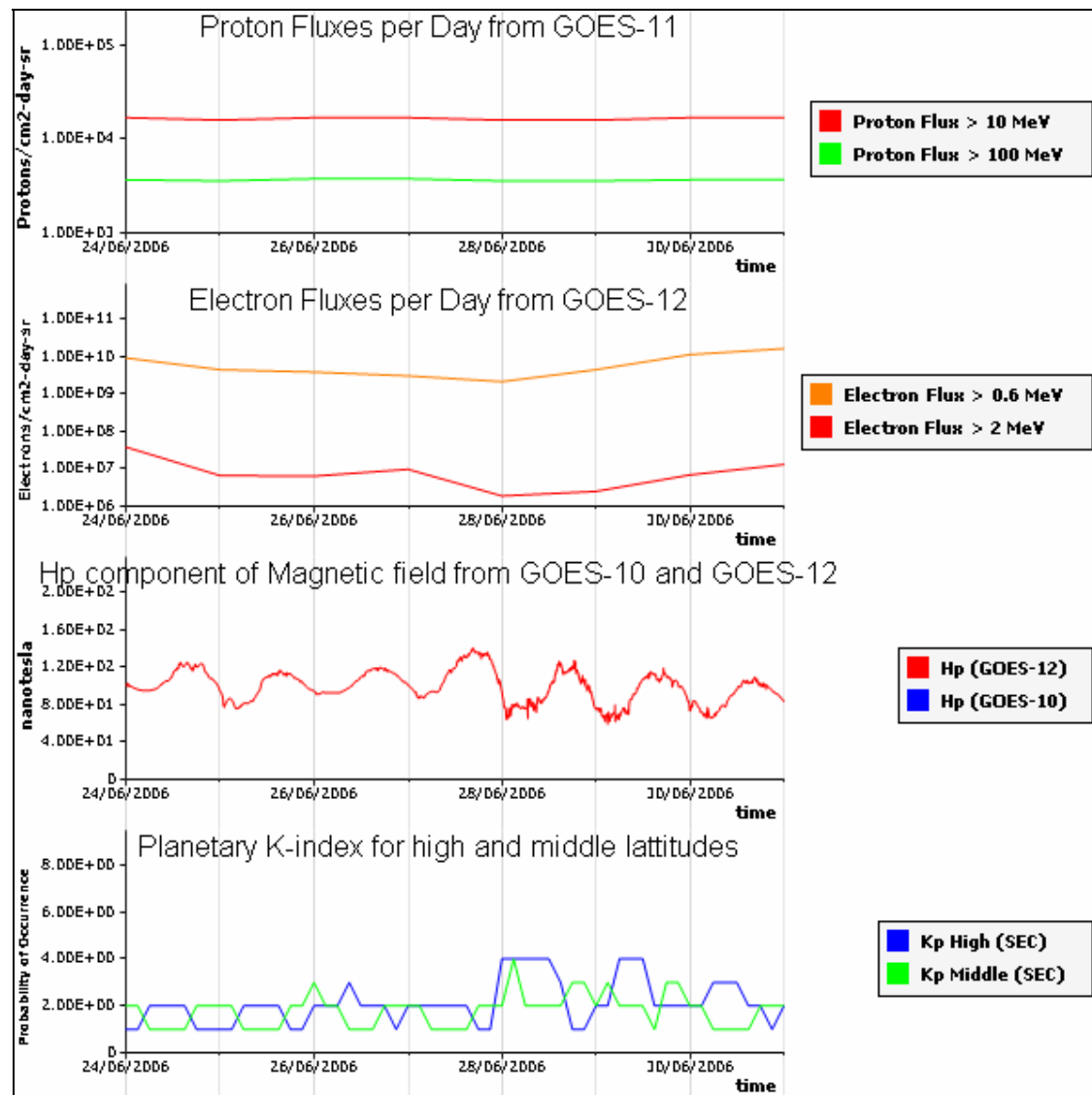
Rev 452



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



X-Ray fluxes start to be significant over 10^{-5}W/m^2 (corresponding to M-class flares). Above 10^{-4}W/m^2 , they correspond to strong X-class flares.



Proton and electron flux are rather low, reporting no high radiation background. Hp component of the Geomagnetic Field is essentially parallel to the Earth's rotation axis. A drop near 0 nT is associated with a significant variation in the magnetic field. Kp index is based on ground magnetometers. Kp ≥ 5 features storm-level geomagnetic activity.