

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-OPS-OAI**  
**No. 332**  
**Week 05**  
**02.02.09**  
**Routine Phase**

Prepared by: F.Schmidt (OPS-OAI) and INTEGRAL FCT

## LIST OF CONTENTS

|       |                                                              |    |
|-------|--------------------------------------------------------------|----|
| 1     | General.....                                                 | 3  |
| 2     | Summary of Activities.....                                   | 3  |
| 3     | Satellite Status.....                                        | 3  |
| 3.1   | Platform.....                                                | 3  |
| 3.1.1 | AOCS.....                                                    | 3  |
| 3.1.2 | Power.....                                                   | 3  |
| 3.1.3 | Thermal.....                                                 | 3  |
| 3.1.4 | OBDH.....                                                    | 4  |
| 3.1.5 | RFS.....                                                     | 4  |
| 3.2   | Payload.....                                                 | 4  |
| 3.2.1 | SPI.....                                                     | 4  |
| 3.2.2 | IBIS.....                                                    | 5  |
| 3.2.3 | JEM-X.....                                                   | 7  |
| 3.2.4 | OMC.....                                                     | 7  |
| 3.2.5 | IREM.....                                                    | 7  |
| 4     | Ground Facilities.....                                       | 8  |
| 4.1   | Mission Operations Centre.....                               | 8  |
| 4.2   | Ground Stations & Network.....                               | 8  |
| 4.3   | Science Ground Segment.....                                  | 8  |
| 4.3.1 | ISOC.....                                                    | 8  |
| 4.3.2 | ISDC.....                                                    | 9  |
| 5     | Special Events.....                                          | 9  |
| 6     | Anomalies.....                                               | 9  |
| 7     | Future Milestones.....                                       | 9  |
| 8     | Appendix.....                                                | 10 |
| 8.1   | Overview of Revolutions.....                                 | 10 |
| 8.2   | Consumables.....                                             | 10 |
| 8.2.1 | Detailed Fuel Book-keeping.....                              | 10 |
| 8.3   | Detailed Satellite Information.....                          | 11 |
| 8.3.1 | AOCS SUMMARY OPERATIONS REPORT, 24/01/2009 – 30/01/2009..... | 11 |
| 8.3.2 | SPI Operations.....                                          | 15 |
| 8.3.3 | IBIS Operations.....                                         | 21 |
| 8.3.4 | JEM-X Operations.....                                        | 24 |
| 8.3.5 | OMC Operations.....                                          | 25 |
| 8.3.6 | IREM Operations.....                                         | 26 |

## DISTRIBUTION LIST

| Addressees           | Copy | Addressees            | Copy |
|----------------------|------|-----------------------|------|
| D/OPS                |      | ESAC                  |      |
| G. Winters D/OPS     | 1    | P. Kretschmar         | 1    |
| J. F. Kaufeler OPS-G | 1    | V. Gomez SCI-O        | 1    |
| N. Bobrinsky OPS-ON  | 1    | E. Kuulkers           | 1    |
| A. Rudolf OPS-OA     | 1    | K. Engan              | 1    |
|                      |      |                       |      |
|                      |      | ESTEC/SCI-A           |      |
| M. Schmidt           | 1    | Nicola Rando          | 1    |
| R. Southworth        | 1    |                       |      |
| F. Di Marco          | 1    | ESA HQ                |      |
| F. Cordero           | 1    | D. Southwood D/SCI    | 1    |
| M. Walker            | 1    |                       |      |
| S. DePadova          | 1    | ESTEC                 |      |
| S. Fahmy             | 1    | J. Louet SCI-P        | 1    |
| F. Schmidt           | 1    |                       |      |
| M. Kirsch            | 1    | ESTEC / PG            |      |
| D. Webert            | 1    | G. Sarri              | 1    |
| M. Panteleoni        | 1    |                       |      |
| J. Martin            | 1    | ESTEC/RSSD            |      |
|                      |      | M. Kessler SCI-SD     | 1    |
| A. Mantineo          | 1    | C. Winkler            | 1    |
| K. Scott             | 1    | A. Parmar             | 1    |
|                      |      |                       |      |
|                      |      | ISDC                  |      |
| SPACONs              | 1    | T. Courvoisier        | 1    |
| I. Bayliss           | 1    | R. Walter             | 1    |
| G. Di Girolamo       | 1    | ISDC Shift Team       | 1    |
| F. Dreger            | 1    |                       |      |
| G. Gienger           | 1    | ALENIA                |      |
| S. Pallaschke        | 1    | M. Montagna           | 1    |
| W. Hell              | 1    | F. Ravera             | 1    |
| K.J. Schulz          | 1    |                       |      |
| M.A. Larsen          | 1    | PI / Instrument Teams |      |
|                      |      | J. P. Roques – SPI    | 1    |
| M. Butkovic          | 1    | G. La Rosa – IBIS     | 1    |
| D. Heinzer           | 1    | P. Ubertini – IBIS    | 1    |
| U. Feucht            | 1    | A. Bazzano - IBIS     | 1    |
| Shift – Coord        | 1    | F. Lebrun - IBIS      | 1    |
| Scheduling Office    | 1    | S. Brandt – JEM X     | 1    |
| T. Beck              | 1    | E. De Miguel - OMC    | 1    |
| M. Rossmann          | 1    | W. Hajdas – IREM      | 1    |
| M. Unal              | 1    |                       |      |
| P. Maldari           | 1    | JPL / Goldstone       |      |
|                      |      | D. Holmes             | 1    |
|                      |      | J. Valencia           | 1    |
| Redu                 |      | Jesse Velasco         | 1    |
| B. Demellenne        | 1    | DSN - MPSETD          | 1    |
|                      |      |                       |      |

## **1 General**

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

It addresses the activities from 24.01.09 until 30.01.09 (both dates inclusive) and covers the revolutions 767, 768 and 769.

## **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 of two Targets of Opportunity, a hexagonal dither of the blazer PKS 1510-089 (RA 15:12:50.53, DEC -09:05:59.8) and a hexagonal dither of the anomalous X-ray pulsar 1E1547.0-5408 (RA 15:50:55.30, DEC -54:19:02.0), a hexagonal dither of the radio galaxy Centaurus A (RA 13:25:27.61, DEC -43:01:08.9) and a hexagonal dither of the gamma-ray blazer 3C 279 (RA 12:56:11.17, DEC -05:47:21.5).

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

## **3 Satellite Status**

### **3.1 Platform**

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

#### **3.1.1 AOCS**

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

No slews were missed from TL, during the observation period.

The fuel consumption over the period between 24/01/2009 and 30/01/2009 was 0.2008 Kg. The remaining propellant is in the order of 136.1850 Kg.

*Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix.*

#### **3.1.2 Power**

All the other units of EPS are 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.

The PST was over-subscribed by 3 packets, which were allocated to SPI during the Instrument window for the entire reporting period.

### **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**

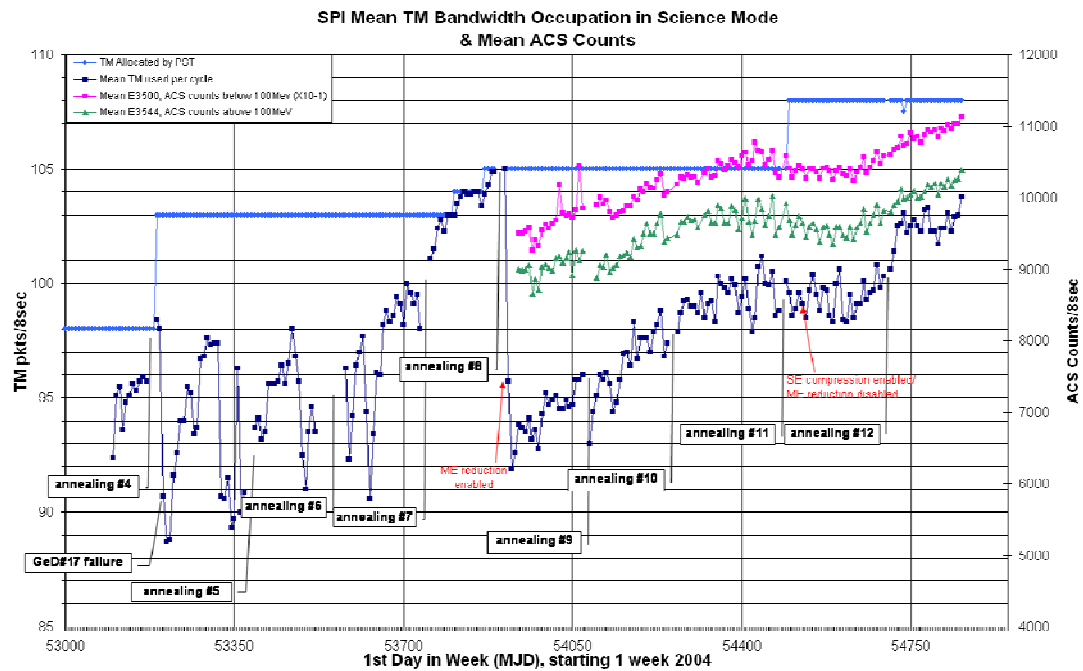
### **3.2.1 SPI**

Following the 12th annealing, ended on 04/09/2008 at 23:50Z, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003) and detector #17 (failed since 17/07/2004). The energy resolution of the previously degraded GeD#12 has improved following this annealing and the bias of this detector is now set to 4kV as for the other detectors.

The Stirling compressors are working nominally. The Germanium detectors temperature was kept in the range 80K $\pm$ 1K throughout the week.

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 108 packets/cycle and the average telemetry occupation was 103.8 packets/cycle.

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth along with the mean ACS count rate evolution (since July 2006). As can be seen, there is a strong correlation between the evolution of the background as measured by the ACS and the overall TM bandwidth usage.



*Note: Some more information concerning the SPI operations is provided in the Appendix 8.3.2.*

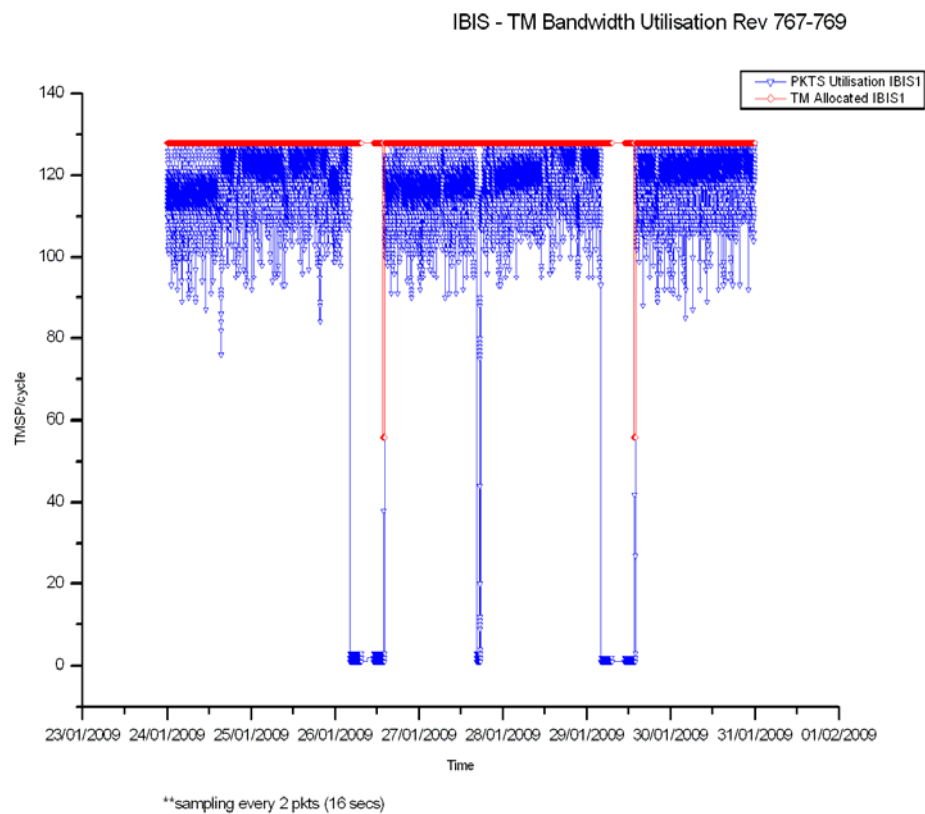
### 3.2.2 IBIS

The overall status of the unit is nominal.

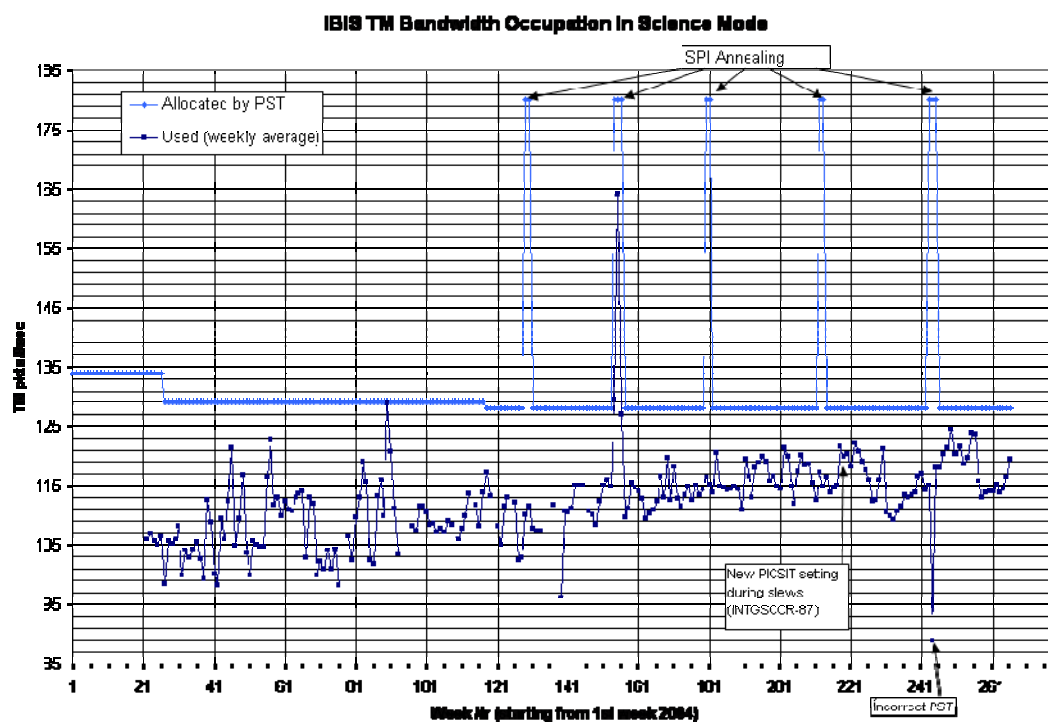
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 119.58 packets/cycle (up 3.20 on previous week)
- Percentage of TM cycles in which full bandwidth was used: 10.14%

The plot below shows the IBIS TM utilisation during the reporting period.



A plot of the IBIS weekly bandwidth utilisation since 2004 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. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

*Note: Some more information concerning the JEM-X operations is provided 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 per cycle.

During this reporting period, 160 of the 162 planned science pointings were executed nominally, 1 was interrupted, and 1 lost.

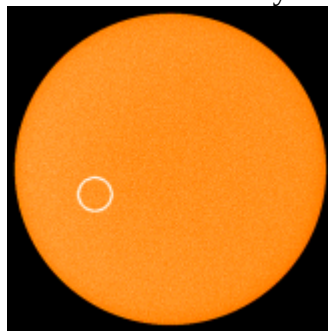
*Note: Some more information concerning the OMC operations is provided in the Appendix.*

### **3.2.5 IREM**

The overall status of the unit is nominal.

#### **Solar Activity**

The observation period was characterised by low solar activity. A new sun spot appeared on the 27<sup>th</sup>, but faded away by the following day, apart from that, the sun was blank all week. The risk of solar flares was very low.



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 good this week. No pointing was lost due to ground problems. The overall performance was over the 95% requirement.

### **4.1 Mission Operations Centre**

The performance of the MOC was good this week. FD slew update failed to arrive on 1 occasion, there was no impact. A Target of opportunity was requested and a consequent re-planning performed during revolution 768. An IREM SEU occurred and two days after that the unit had to be cycled and the patch re-applied again, due to the fact that the counters were about 2 orders of magnitude lower than expected.

### **4.2 Ground Stations & Network**

The performance of the ground stations and Network was good this week. On DoY 028 a drop in TM occurred from Redu while DSS 27 brought the carrier 15 minutes too early up.

### **4.3 Science Ground Segment**

#### **4.3.1 ISOC**

##### **1. Mission planning**

New PSFs have been received for revolutions 773 and 774.

Revolutions 768 to 770 were replanned in order to include further TOO observations of 1E1547.0-5408. The first had to be done as RPOS.

An updated TSF has been received for revolution 768, new TSFs for revolutions 769 and 770.

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

ECS files have been received and processed for revolutions 760 to 762.

##### **3. ISOC Science Data Archive**

No news.

##### **4. ISOC system**

ISOC system V20.1 is in use. Work is continuing on V21, expected for early February.

##### **5. Problems**

No new problems.

#### **4.3.2 ISDC**

Status of ISDC observation processing on 30/01/2009:

- Latest Standard Analysis completed: observation 06200520002 (PKS 0208-512, Revolution 746) on 24/01/2009.
- Latest products archived: observation 06200520002 (PKS 0208-512, Revolution 746) on 24/01/2009.
- Latest observation products sent to the observer: observation 06200520002 (PKS 0208-512, Revolution 746) on 24/01/2009.

### **5 Special Events**

### **6 Anomalies**

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

| <b>AR id</b> | <b>Date Created</b> | <b>Subject</b>                             | <b>Segment</b> | <b>Status</b> |
|--------------|---------------------|--------------------------------------------|----------------|---------------|
| INT-3055     | 2009-01-28          | DSS27 - Carrier up at wrong time (DOY 028) | NASA Station   | Pending       |

### **7 Future Milestones**

## 8 Appendix

The appendix includes various detailed information.

### 8.1 Overview of Revolutions

#### Revolution 767

The observations in revolution 767 began with a target of opportunity, a hexagonal dither of the blazer PKS 1510-089 (RA 15:12:50.53, DEC -09:05:59.8), lasting ~23.8 hours. They continued with a target of opportunity, a hexagonal dither of the anomalous X-ray pulsar 1E1547.0-5408 (RA 15:50:55.30, DEC -54:19:02.0), lasting ~27.7 hours. This was followed by hexagonal dither of the radio galaxy Centaurus A (RA 13:25:27.61, DEC -43:01:08.9), lasting ~4.7 hours a until the end of the revolution.

#### Revolution 768

The observation in revolution 768 began with a a hexagonal dither of the gamma-ray blazer 3C 279 (RA 12:56:11.17, DEC -05:47:21.5), lasting ~16.0 hours. They continued with a hexagonal dither of the radio galaxy Centaurus A (RA 13:25:27.61, DEC -43:01:08.9), lasting ~27.6 hours. This was followed by a target of opportunity, a hexagonal dither of the anomalous X-ray pulsar 1E1547.0-5408 (RA 15:50:55.30, DEC -54:19:02.0), lasting ~11.8 hours until the end of the revolution.

#### Revolution 769

The observation in revolution 769 was a target of opportunity, a hexagonal dither of the anomalous X-ray pulsar 1E1547.0-5408 (RA 15:50:55.30, DEC -54:19:02.0), lasting ~58.2 hours.

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 108; JEM-X1 8; JEM-X2 0; OMC 5.

### 8.2 Consumables

#### 8.2.1 Detailed Fuel Book-keeping

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2009-01-15T22:07:01.000Z | 136.4853 | F | Automatic TM processing. |
| 2009-01-17T12:11:29.000Z | 136.4771 | F | Automatic TM processing. |
| 2009-01-18T22:22:53.000Z | 136.4618 | F | Automatic TM processing. |
| 2009-01-20T12:00:41.000Z | 136.4431 | F | Automatic TM processing. |
| 2009-01-21T21:33:56.000Z | 136.4213 | F | Automatic TM processing. |
| 2009-01-23T12:09:45.000Z | 136.3858 | F | Automatic TM processing. |
| 2009-01-24T21:29:32.000Z | 136.3616 | F | Automatic TM processing. |
| 2009-01-26T11:40:41.000Z | 136.3508 | F | Automatic TM processing. |
| 2009-01-27T06:54:59.000Z | 136.3322 | F | Automatic TM processing. |
| 2009-01-27T21:36:53.000Z | 136.3206 | F | Automatic TM processing. |
| 2009-01-28T13:37:35.000Z | 136.3016 | F | Automatic TM processing. |
| 2009-01-29T05:37:29.000Z | 136.2670 | F | Automatic TM processing. |
| 2009-01-29T06:53:21.000Z | 136.2523 | F | Automatic TM processing. |

This report was generated Fri Jan 30 08:00:22 GMT 2009

### 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, 24/01/2009 – 30/01/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 93 Open Loop Slews, 79 Closed Loop Slews and 9 Momentum Biases were executed (as reported by ACC OEM).

No slews were missed from TL, during the observation period.

The OTF was not reached during part of PID 07670035 and PID 07680033, due to loss of guide star.

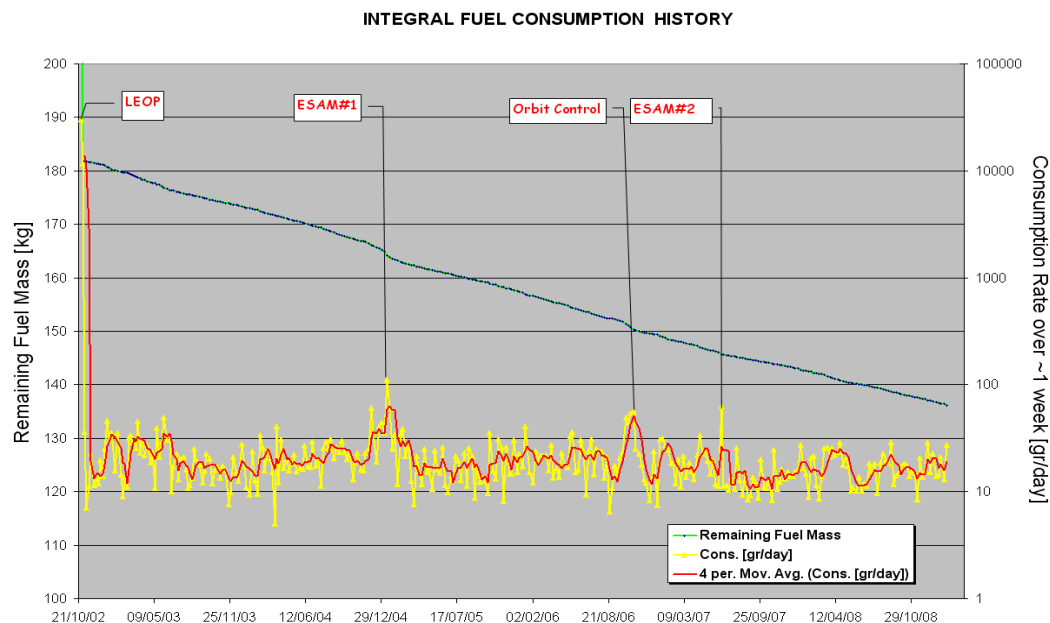
A Target of opportunity was requested and consequent re-planning performed on 26/01/2009 during revolution 768. The Timeline 0768-08 was closed at 15:30Z and the new timeline 0768-13 generated by FD/MPS loaded. The higher numbers of Bias performed during this week is a direct consequence of the re-planning activity.

#### Orbit Control

No update

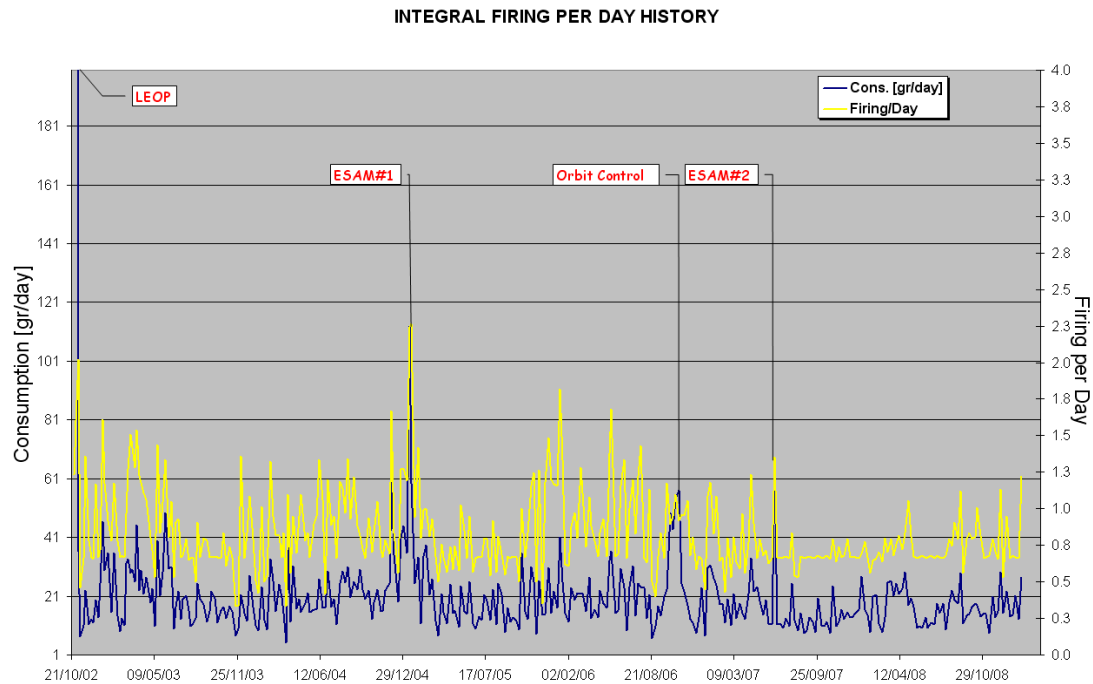
#### Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 30/01/2009 is reported in the plot below.



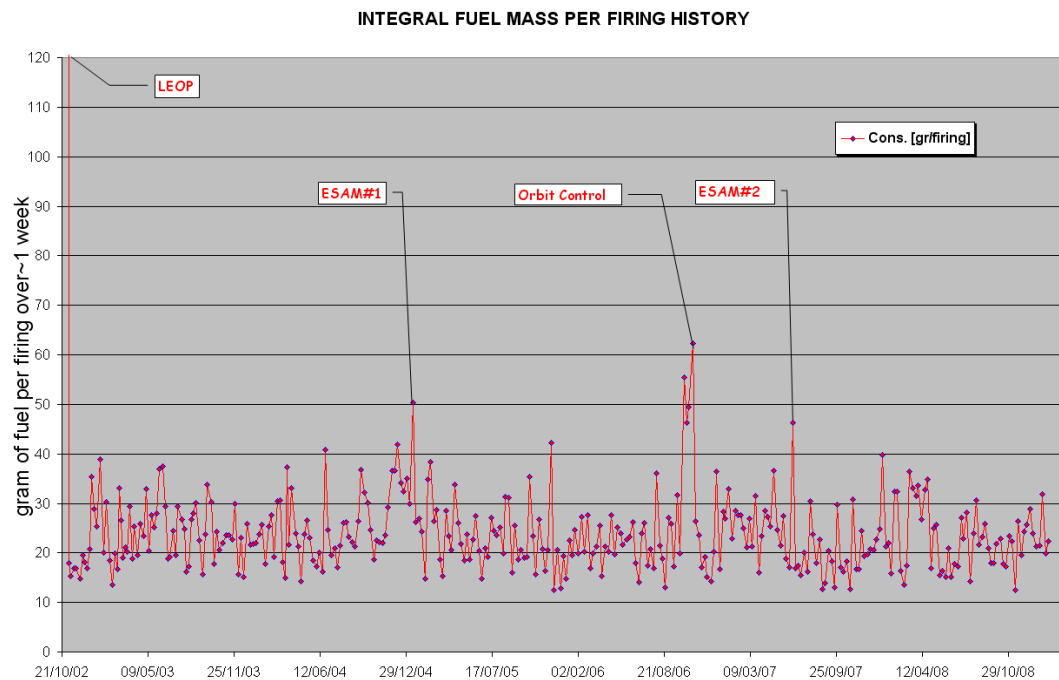
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 30/01/2009 is reported in the plot below.



The above plot considers the ESAM fuel consumption spread over period of ~1 week.

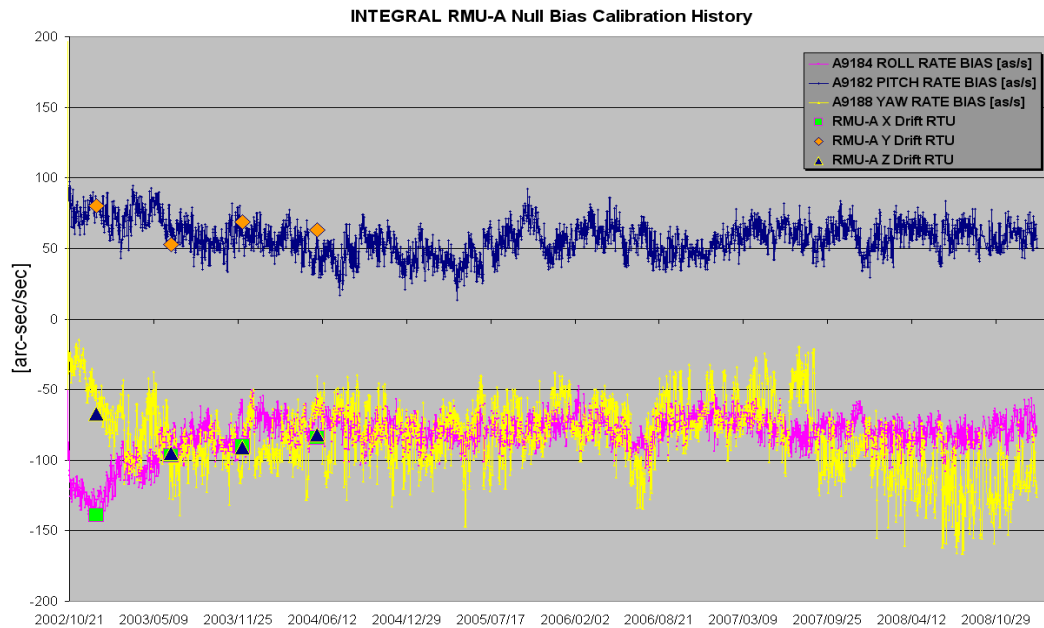
The fuel per firing over the period between 01/11/2002 and 30/01/2009 is shown in the plot below.



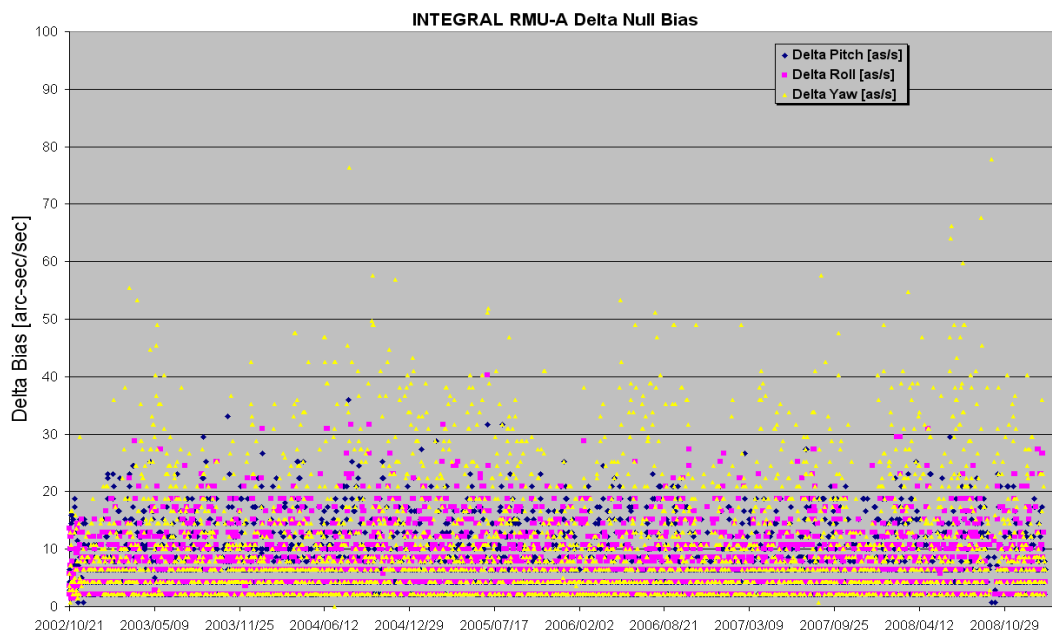
### The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 30/01/2009 is reported in the plot below.

The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs. At moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 30/01/2009 is reported in the plot below.



**24/01/2009 (Day of Year 024, Revolution 767)**

**Loss of guide star:** at 19:40:56z a loss of the selected guide star occurred during PID 07670035. The origin of the event is not clear, likely due to SEU affecting the STR.

As foreseen by the IPS logic, the ACC switched ON the IMU 1, a new automatic mapping was commanded and a new guide star picked. The next slew 07670036 was manually updated in TL.

No impact on TL.

The OTF was not reached during the last part of PID 07670035.

**25/01/2009 (Day of Year 025, Revolution 767)**

Nothing to report.

**26/01/2009 (Day of Year 026, Revolution 767-768)**

**ToO:** a target of opportunity was requested and consequent re-planning performed during revolution 768. The Timeline 0768-08 was closed at 15:30Z and the new timeline 0768-13 generated by FD/MPS loaded.

**27/01/2009 (Day of Year 027, Revolution 768)**

**Loss of guide star:** at 19:48:16z a loss of the selected guide star occurred during PID 07680033. The origin of the event is not clear, likely due to SEU affecting the STR.

As foreseen by the IPS logic, the ACC switched ON the IMU 1, a new automatic mapping was commanded and a new guide star picked. The next slew 07680034 was manually updated in TL.

No impact on TL.

The OTF was not reached during the last part of PID 07680033.

**28/01/2009 (Day of Year 028, Revolution 768)**

Nothing to report.

**29/01/2009 (Day of Year 029, Revolution 768-769)**

**FDS problem during slew update:** at 13:58z a problem (automatic job was not scheduled) on FDS caused the slew update not to be generated for slews ID 07690001-2.

A quick manual recovery by SPACON and FD Team was then performed, the job scheduler restarted and the slew ID 07690003 automatically updated in TL.

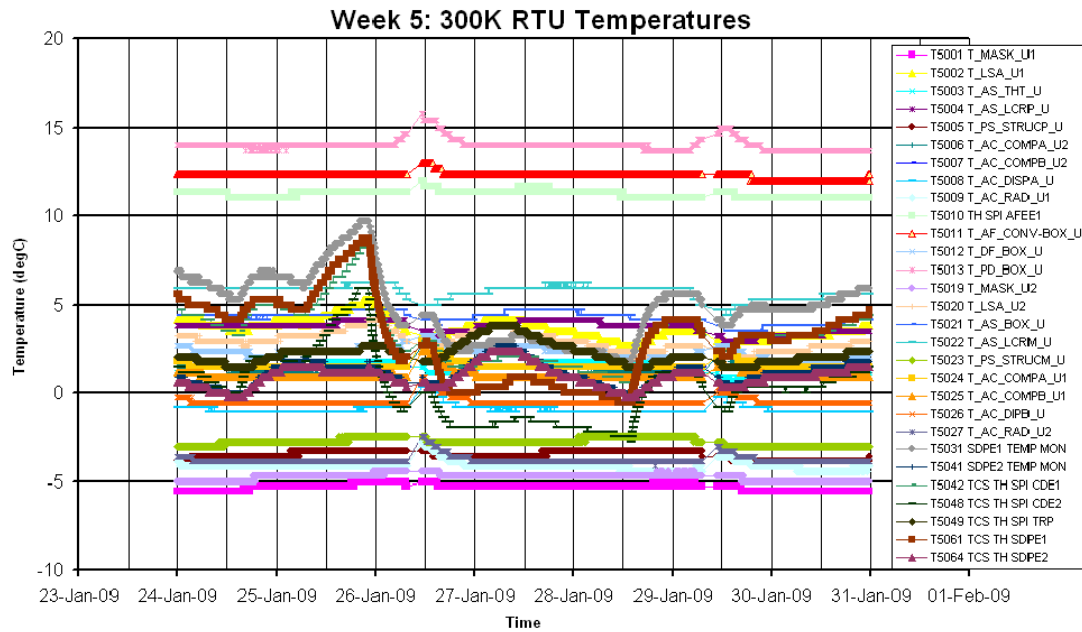
No impact on TL.

**30/01/2009 (Day of Year 030, Revolution 769)**

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.



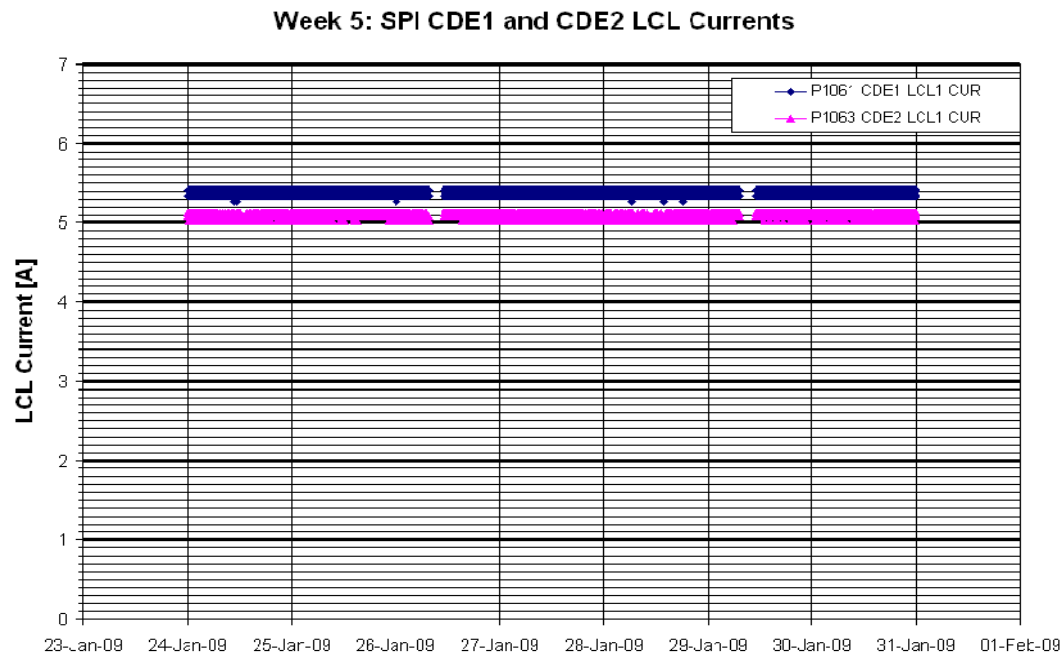
**Stirling Compressors and Cryostat:** The performance of the compressors is nominal.

The cold plate temperature was maintained in the range 80K +/-1K.

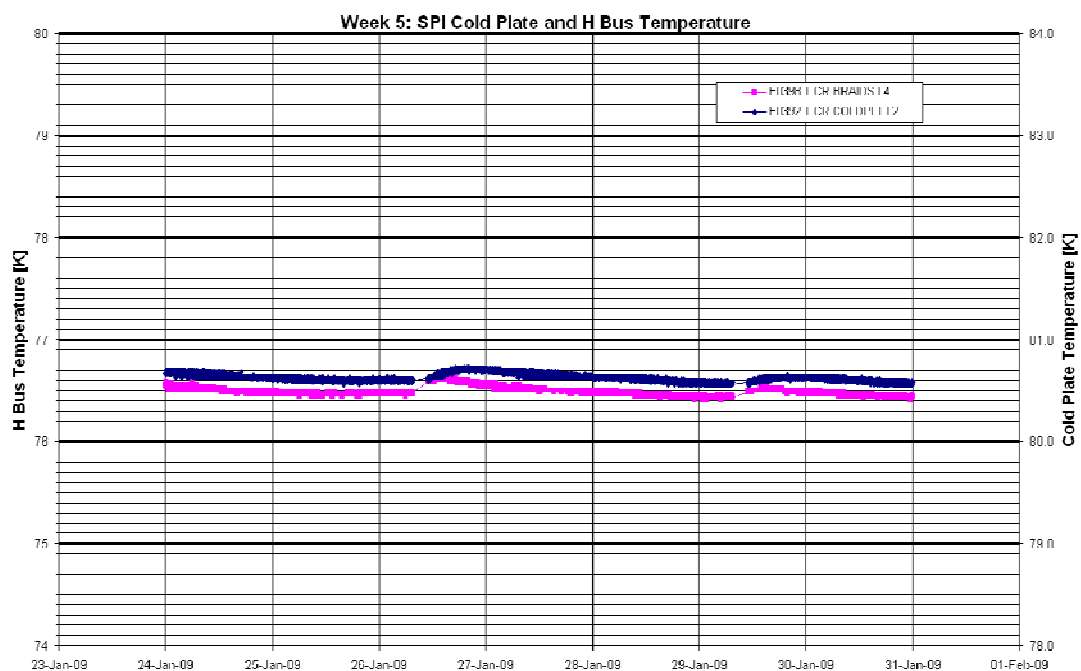
The stroke of all four compressors was set to 42 throughout the week and the average CDE LCL currents were as follows:

- CDE1 LCL Current = 5.37A
- CDE2 LCL Current = 5.08A

The following plot shows the evolution of the CDE LCL currents during the reporting period.



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

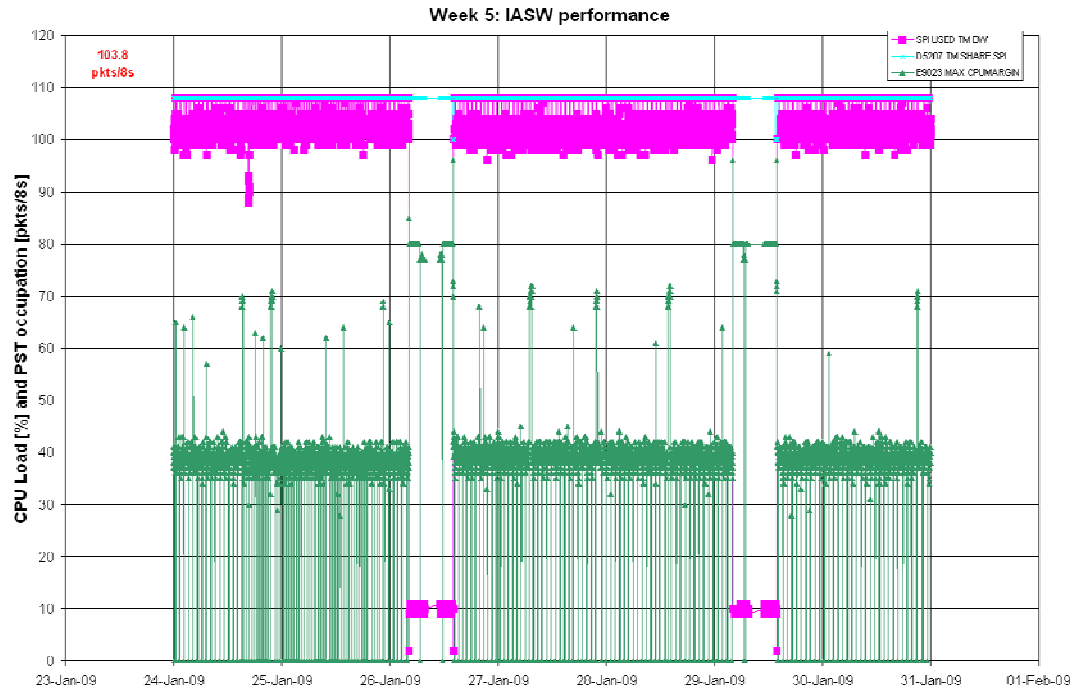


**DPE & IASW:** The DPE health and IASW performance are nominal.

The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The average TM bandwidth occupation of SPI

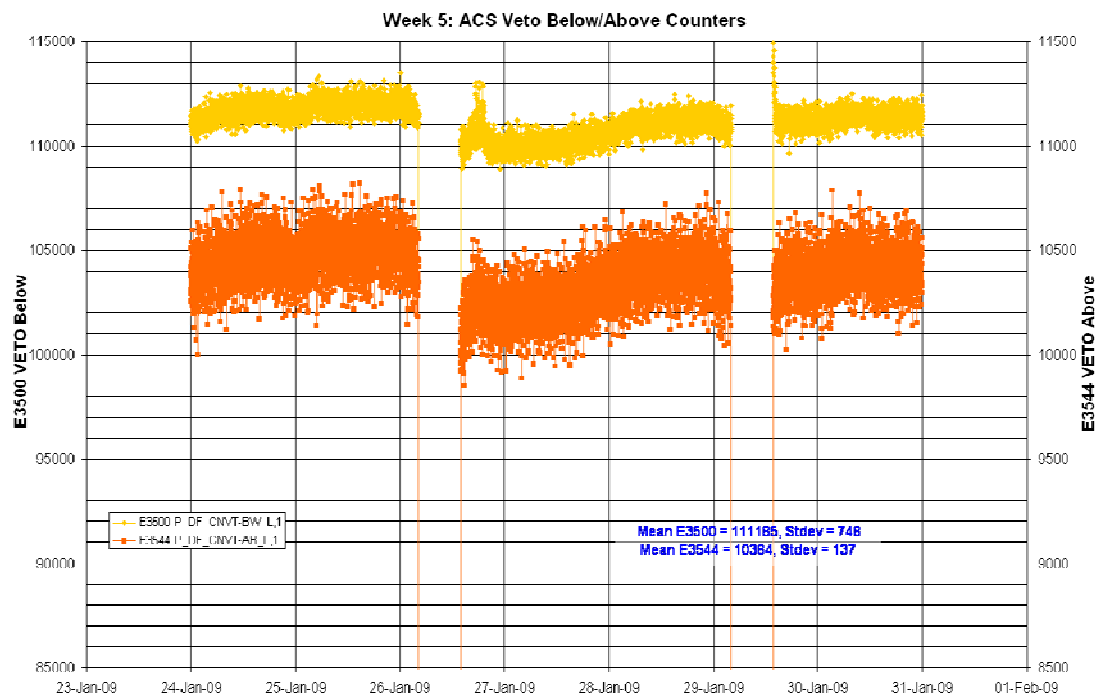
was 103.8 packets/cycle over the science window when the TM allocation was 108 packets/cycle.

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

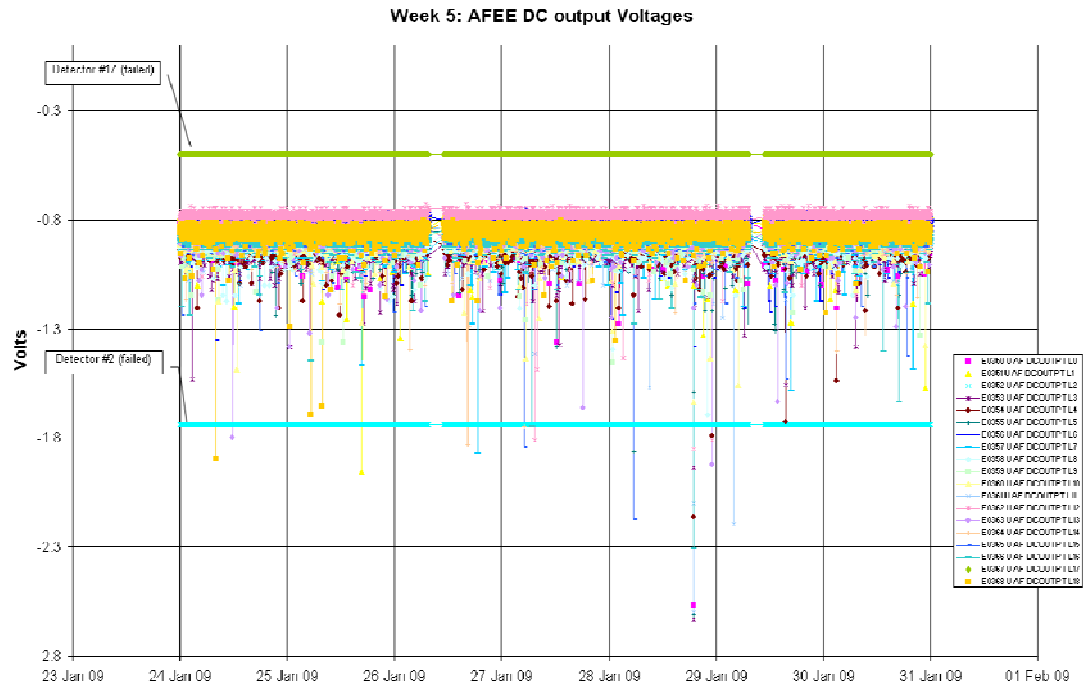


**ACS:** The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT\_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT\_SC-61).

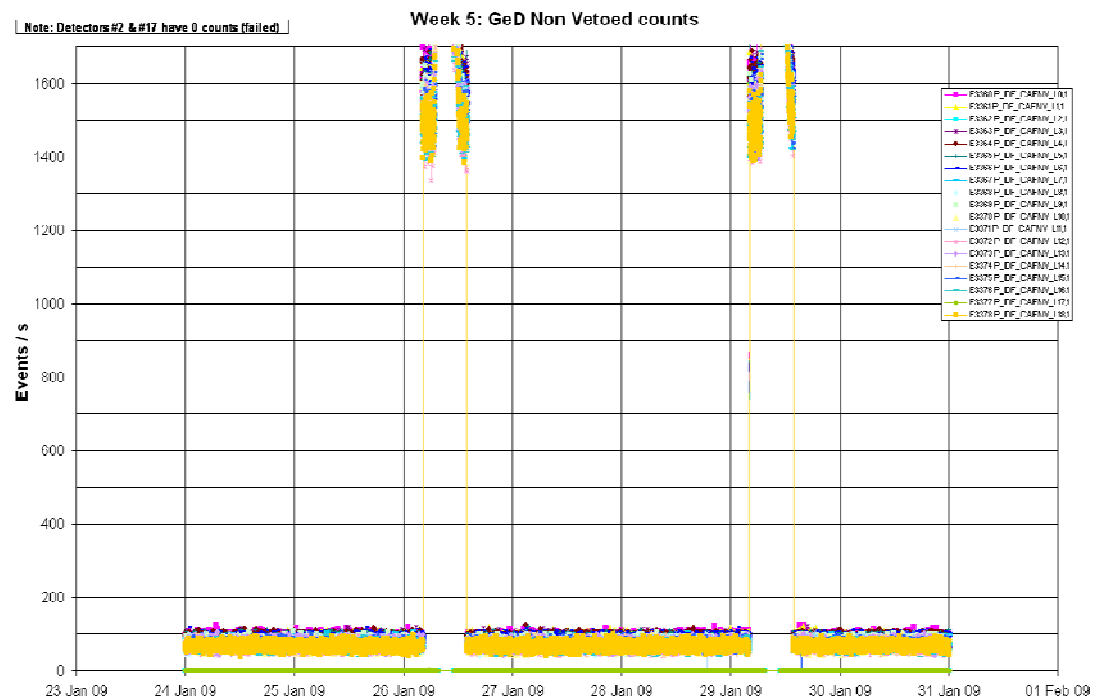
The following plot shows the ACS overall count rate evolution during the reporting period:

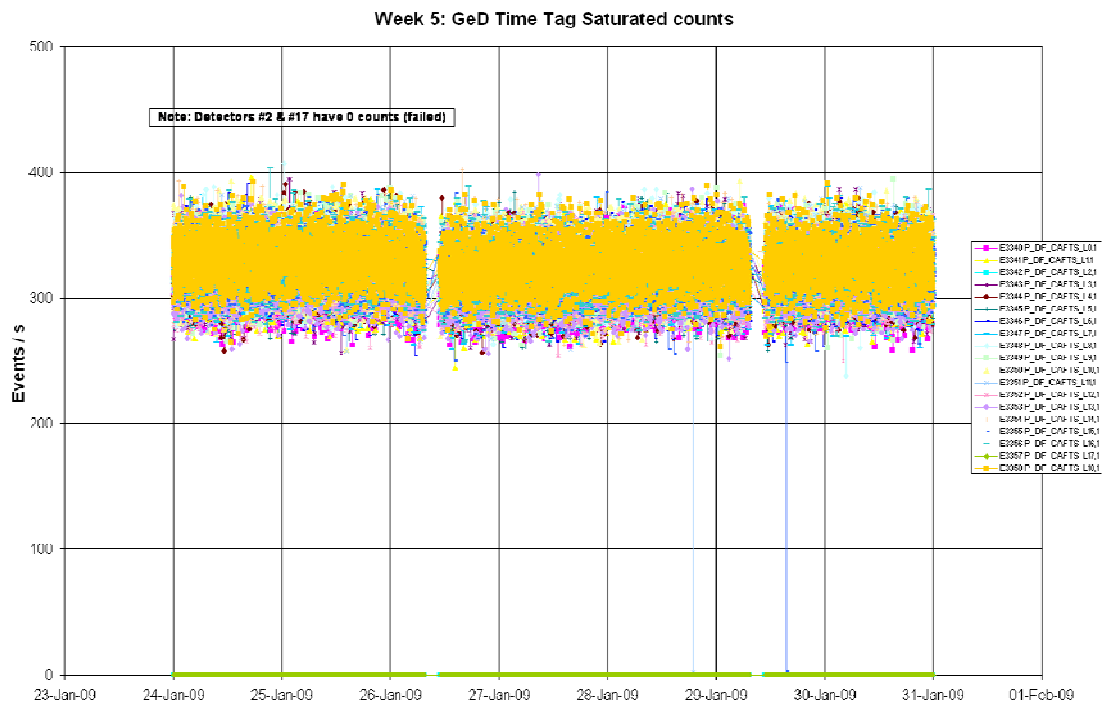
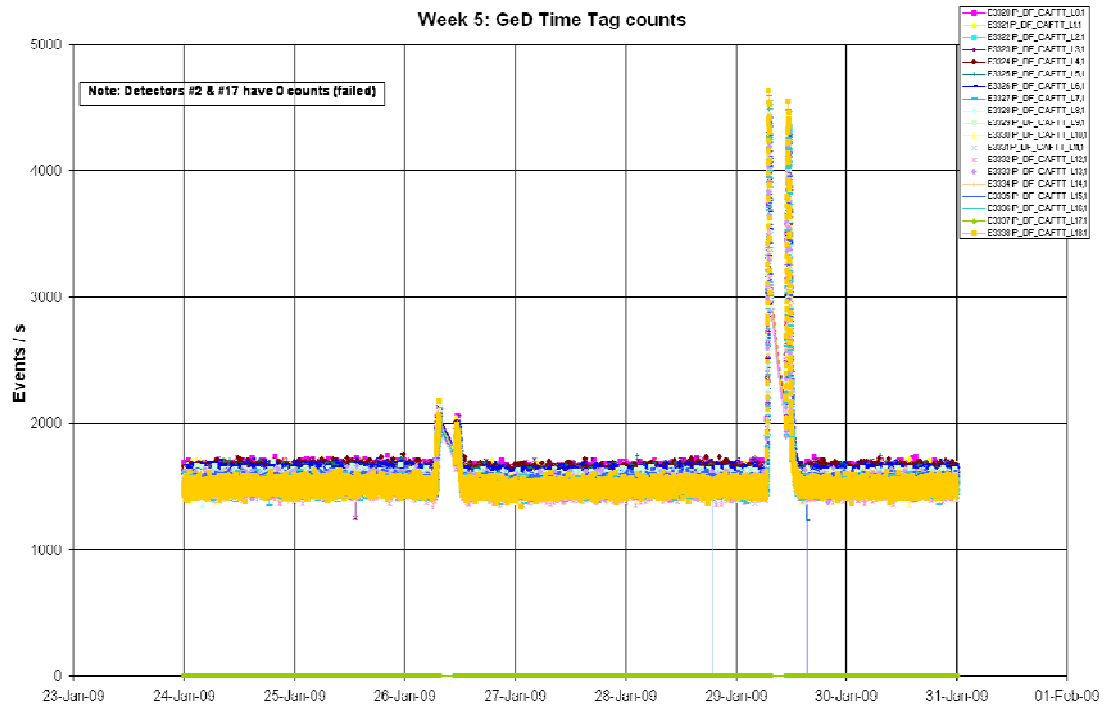


**AFEE:** The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

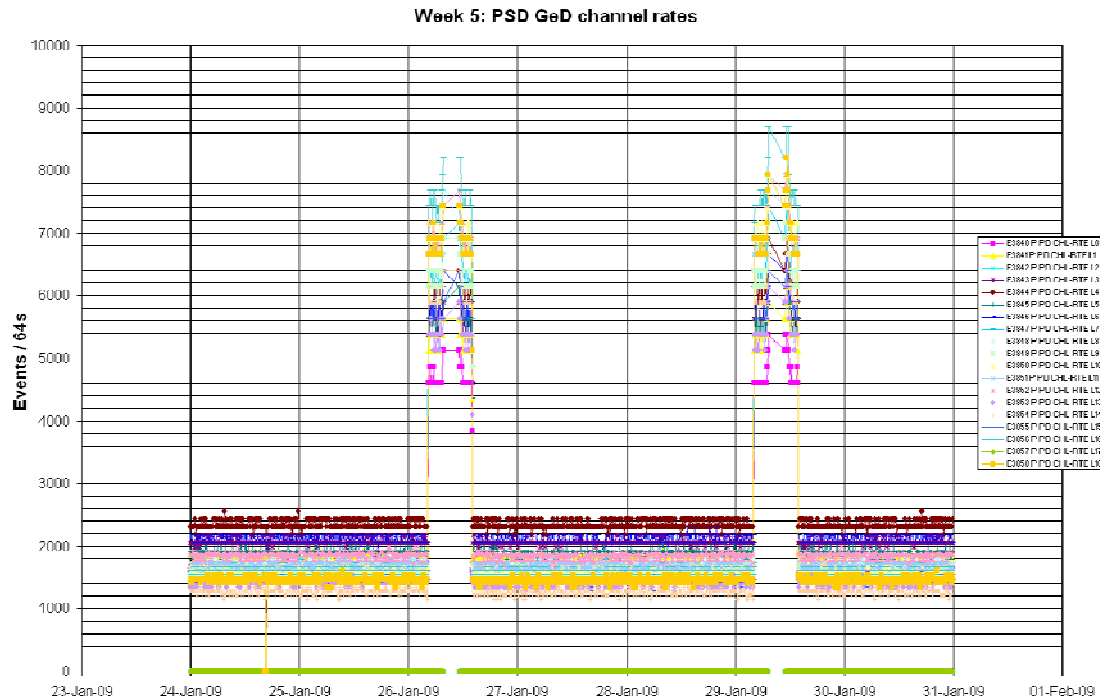


**DFEE:** The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





**PSD:** The health of the unit is nominal. The following plot shows the PSD channel rates during the reporting period.



### Event Log:

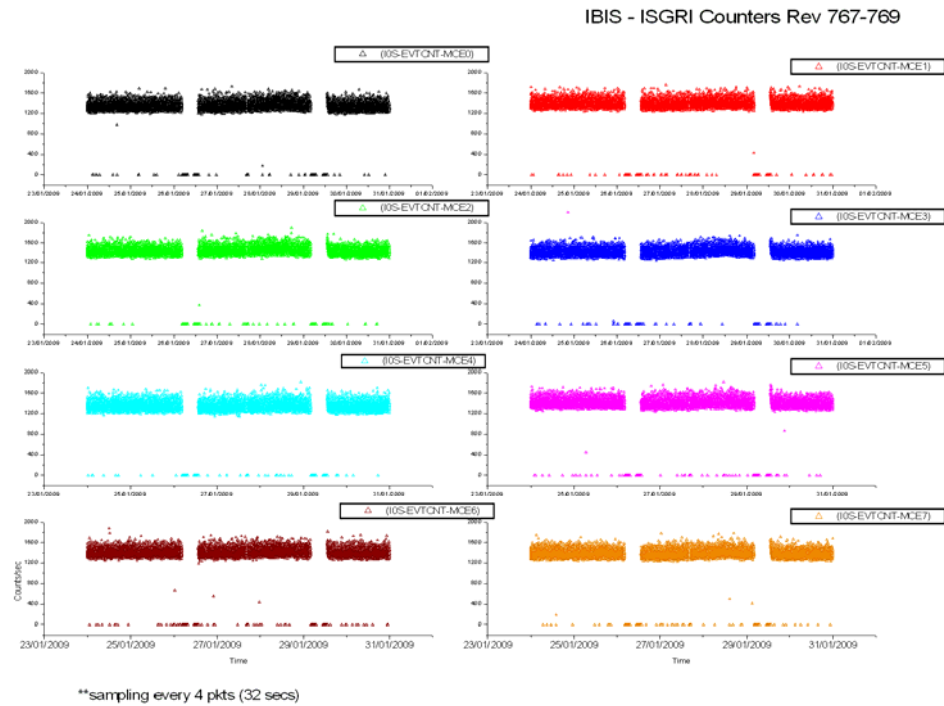
The following non-nominal events occurred with SPI during the reporting period:

- On 2009-01-24 at 16:29:01Z TM parameters E3840 to E3858 went OOL Low (value = 0). These are the PSD GeD channel rates. They returned within limits of their own accord at 16:40:45Z. This is re-occurrence of the known anomaly INT\_SC-194.
- On 2009-01-25 at 08:43:52Z OEM APID 1024 ID 229 EXCEPTION SPI1 PARTIAL FLAG OVERFLOW was received with parameter E9783 (SUBBLOCK ID) = SE. As it was a single occurrence, no action was taken.
- On 2009-01-28 at 13:58:42Z TM parameter E3276 went OOL (value = PARAM > SPEC). This is the ACS FEE HV status #80. As it returned within limits of its own accord when the next packet was received at 14:09:22Z, no action was taken.
- On 2009-01-29 at 14:06:46Z OEM APID 1024 ID 229 EXCEPTION SPI1 PARTIAL FLAG OVERFLOW was received with parameter E9783 (SUBBLOCK ID) = SP18. As it was a single occurrence, no action was taken.
- On 2009-01-30 at 18:14:42Z TM parameter E2085 went OOL (value = PARAM > SPEC). This is the ACS FEE HV status #44. As it returned within limits of its own accord when the next packet was received at 18:25:22Z, no action was taken.

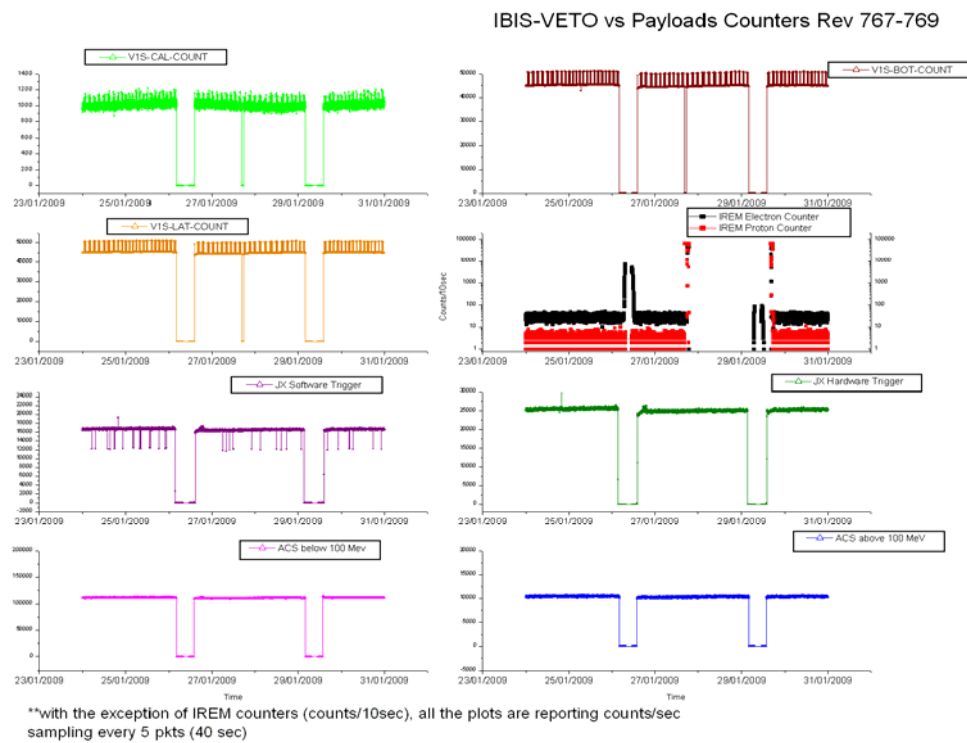
### 8.3.3 IBIS Operations

#### IBIS Event Counters Plots

#### ISGRI Counters:

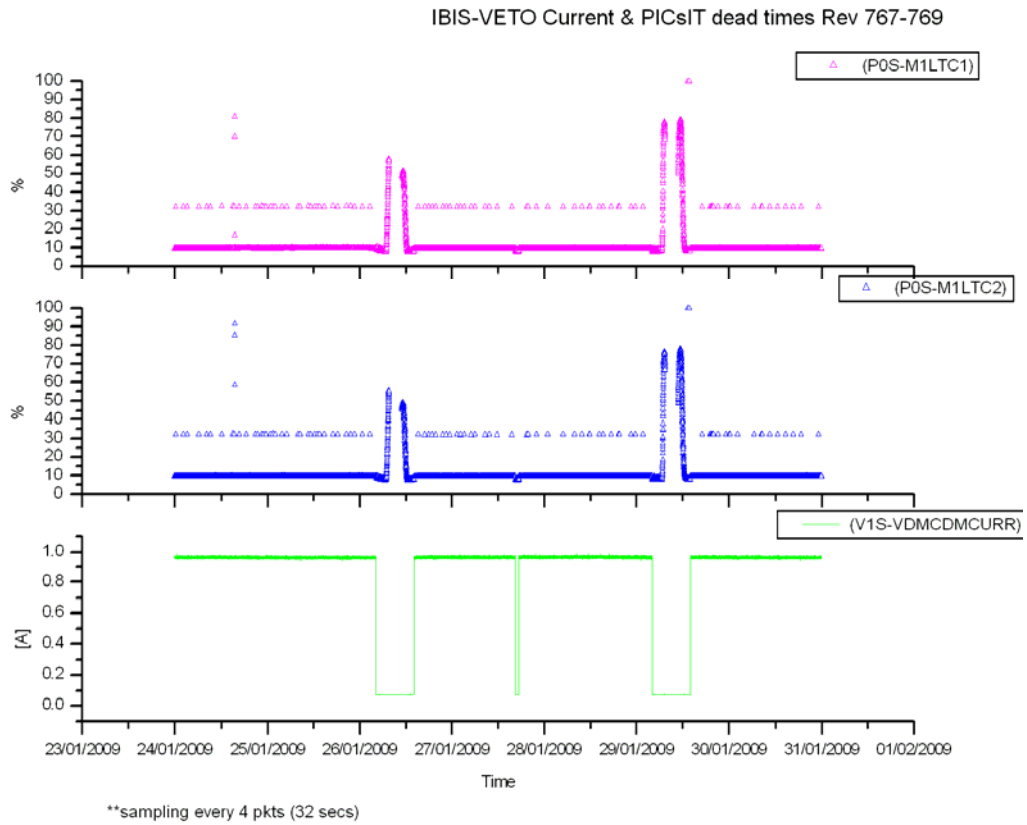


#### VETO vs Payload Counters:

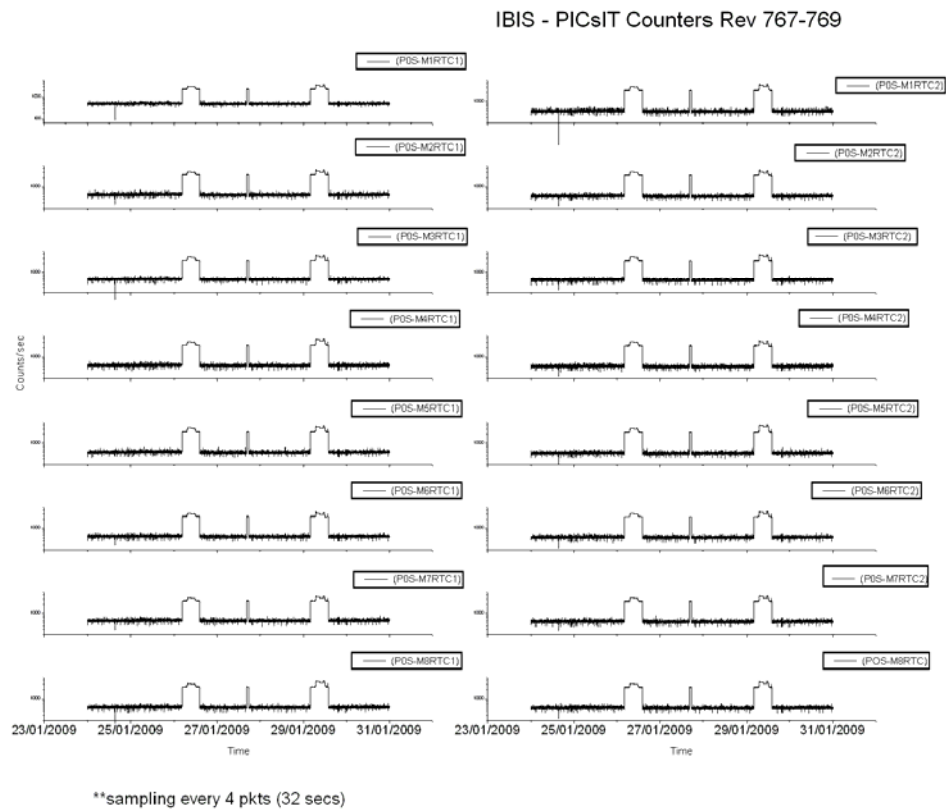


The week was characterised by low radiation as reported by the payload.

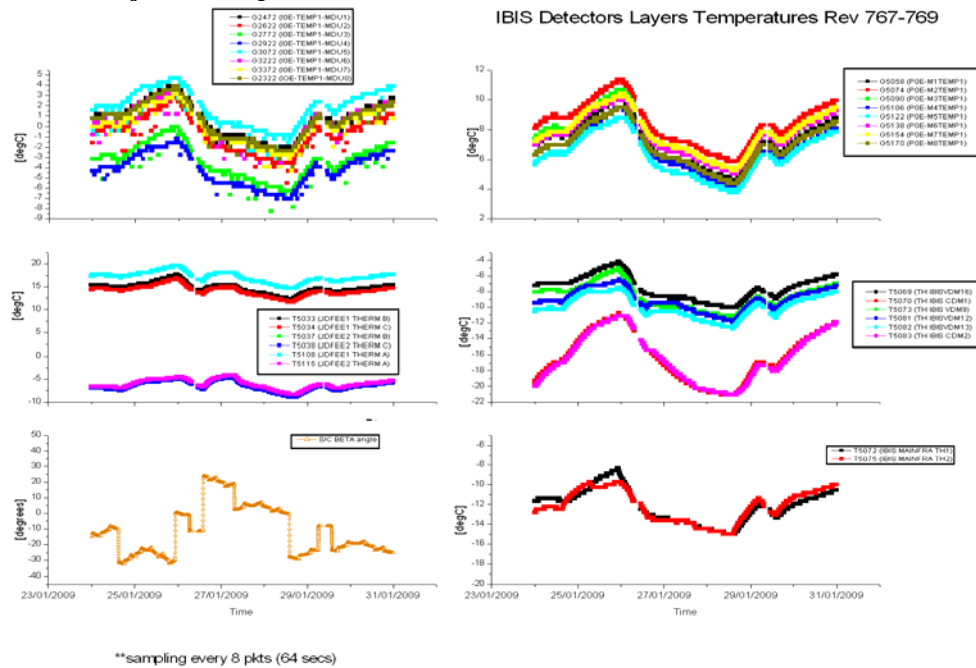
## VETO Current:



## PICsIT Counters:



## IBIS Detectors Layers Temperatures:



## IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2\_PMT\_V), G5002 (P0S-Mi\_RTC1) and G5003 (P0S-Mi\_RTC2) families and G2000 family (I0E-OVFWPXADD-Mi) were received during the radiation belt passages.

### 2009-01-24 (DOY 024, Rev 767)

At 15:30:09Z several parameters of the TM parameter families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. As they had all returned within limits of their own accord by 15:31:45Z, no action was taken.

### 2009-01-25 (DOY 025, Rev 767) to 2009-01-26 (DOY 026, Rev 767-768)

IBIS operations executed nominally.

### 2009-01-27 (DOY 027, Rev 768)

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 16:31:33Z. It was recovered as follows:

- At 17:18:04Z FCP\_IBIS1\_0803 IBIS EXIT FROM SAFE MODE
  - At 17:38:17Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.
- IBIS operations continued nominally.

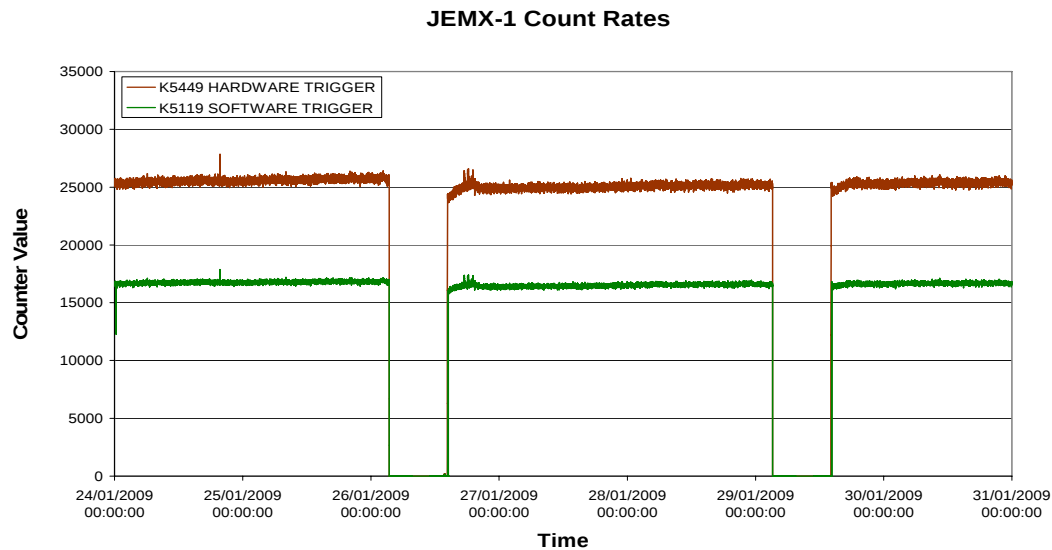
### 2009-01-28 (DOY 028, Rev 768) to 2009-01-30 (DOY 030, Rev 769)

IBIS operations executed nominally.

### 8.3.4 JEM-X Operations

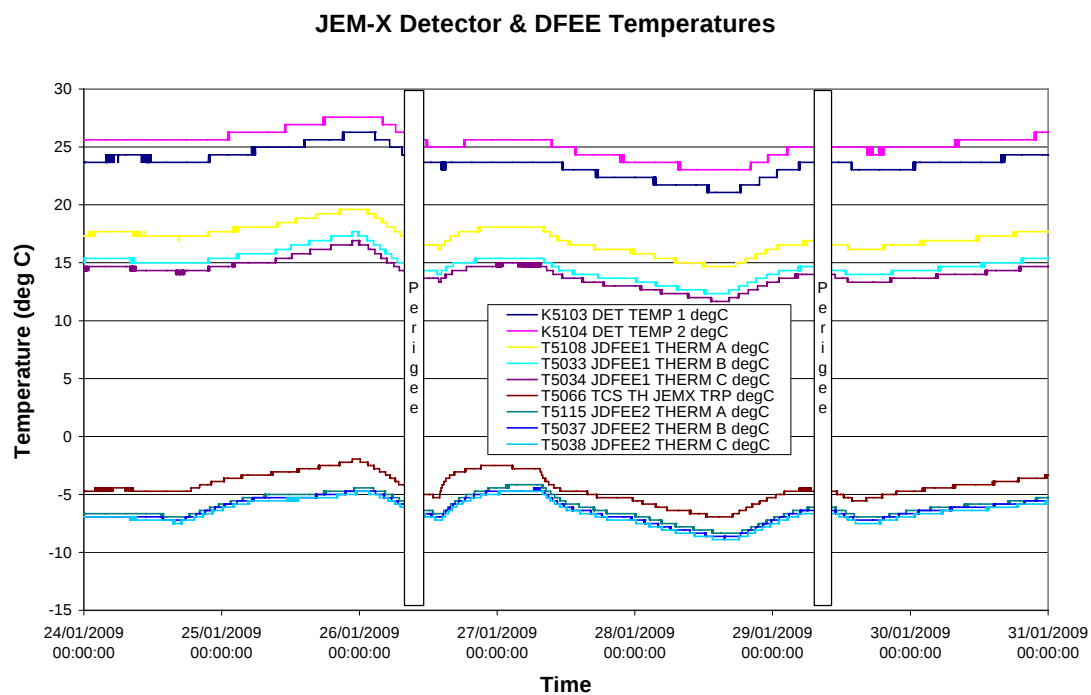
#### JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph<sup>1</sup>.



#### 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)

## **JEM-X Daily Report**

### **2009-01-24 (DoY 024, Rev 767)**

At 19:45:12, parameter K5449, briefly exceeded soft limits, no action was taken, and there was no impact.

### **2009-01-25 (DoY 025, Rev 767) to 2009-01-26 (DoY 026, Rev 768)**

JEM-X 1 operations executed nominally.

### **2009-01-27 (DoY 027, Rev 768)**

At 16:32:15 JEMX parameters K5315, K5316 & K5317 went Out-of-Limits due to an IREM SEU (#70). There was no impact as the reaction has been disabled.

### **2009-01-28 (DoY 028, Rev 768) to 2009-01-30 (DoY 030, Rev 769)**

JEM-X 1 operations executed nominally.

## **8.3.5 OMC Operations**

### **2009-01-24 (DoY 024, Rev 767) to 2009-01-26 (DoY 026, Rev 768)**

Nothing to report.

### **2009-01-27 (DoY 027, Rev 768)**

At 16:31:35, an IREM SEU, (#70) forced the OMC to SAFE mode. A recovery was performed, and the unit returned to STAND-BY at 17:10:11. The impact was pointing 07680029 was cut short from a planned 3429 to 3177 seconds, and pointing 07680030 was lost. It was at this time that the following pair of commands was rejected:

|                       |                       |      |          |     |           |    |   |
|-----------------------|-----------------------|------|----------|-----|-----------|----|---|
| 2009.027.16.36.07.860 | 2009.027.16.36.18.411 | 1792 | RealTime | 131 | TC REJECT |    |   |
| REJECTED TC1          |                       |      | 0        | 0   | 65535     | PR | N |
| E E                   |                       |      |          |     |           |    |   |
| 2009.027.16.36.14.048 | 2009.027.16.36.24.659 | 1792 | RealTime | 131 | TC REJECT |    |   |
| REJECTED TC1          |                       |      | 0        | 0   | 65535     | PR | N |
| E E                   |                       |      |          |     |           |    |   |

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 07680030.

### **2009-01-28 (DoY 028, Rev 768)**

Nothing to report.

### **2009-01-29 (DoY 029, Rev 768-769)**

At 14:07:49, during pointing 07690002 a TRIGGER Command was received from ISDC, subsequently 31 shots were nominally performed.

### **2009-01-30 (DoY 030, Rev 769)**

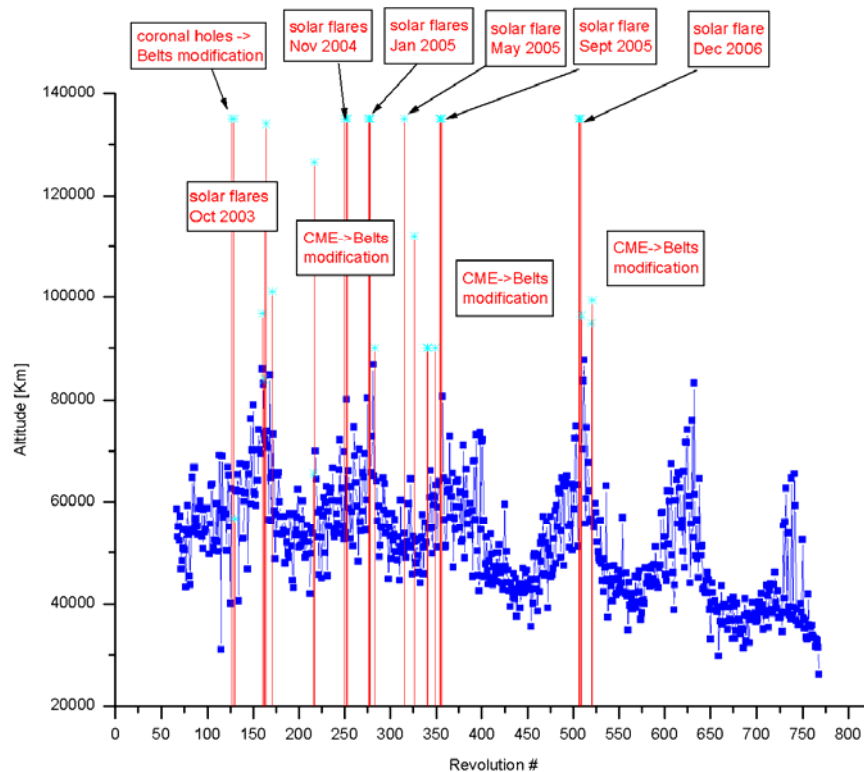
Nothing to report.

On DoY 026 at 04:17:03 and DoY 029 at 04:04:47 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

### 8.3.6 IREM Operations

#### Radiation Belts Entry

Evolution of Radiation Belt Entry 2003-2008



#### IREM daily report

##### **DoY 2009.027 (27/01/2009):**

At 16:31:33Z, a local reset of the IREM CSCI S/W (SEU #70) occurred. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2009.027.16.31:33Z (152027.1 km). The unit had performed an automatic transition to Standard Mode (i.e. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;
- 5) The recovery of the unit started immediately using procedure CRP\_SYS\_2570. The first dump of the status word after the anomaly reported a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e. the Checksum Failure Flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and

accumulation ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.

6) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP\_RM\_0081. The operation was completed at 19:28:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the PIs request. OMC was recovered at 17:10:11Z and IBIS at 17:39:00Z.

The cause of these S/W resets is apparently due to the unit's memory device that is sensitive to high energy radiation, as proved during test campaign on-ground.

### DoY 2009.029 (29/01/2009):

At 15:45, it was observed that during the previous radiation belt passage, the IREM counters were about 2 orders of magnitude lower then expected. Furthermore the counts had been consistently lower since the IREM recovery from the SEU. The unit was 'cycled', and the patch re-applied. This was completed at 18:17, after which the counters behaved nominally. Investigation has not revealed the cause.

### Electron Belts

| REV | S/C BCPKT (electron)                | Electron CUT-OFF<br>Observed<br>Entry/Exit | Observed<br>Entry/Exit<br>Altitude<br>[Km] | Electron CUT-OFF<br>Predicted<br>Entry/Exit | Predicted<br>Entry/Exit<br>Altitude<br>[Km] |
|-----|-------------------------------------|--------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|
| 767 | RAD_ENTR R 2009-01-<br>26T04:16:47Z | 26/01/2009<br>06:56:30                     | 31472.6                                    | 26-Jan-2009<br>06:36:40                     | 33943.59                                    |
| 768 | RAD_EXIT R 2009-01-<br>26T13:57:31Z | 26/01/2009<br>12:21:50                     | >>32267.4                                  | 26-Jan-2009<br>13:16:40                     | 47123.91                                    |
| 768 | RAD_ENTR R 2009-01-<br>29T04:04:19Z | 29/01/2009<br>07:08:06                     | 26223.3                                    | 29-Jan-2009<br>06:24:58                     | 33959.39                                    |
| 769 | RAD_EXIT R 2009-01-<br>29T13:45:51Z | 29/01/2009<br>11:38:46                     | 32239.9                                    | 29-Jan-2009<br>13:04:58                     | 47024.33                                    |

### Reference

High radiation

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)

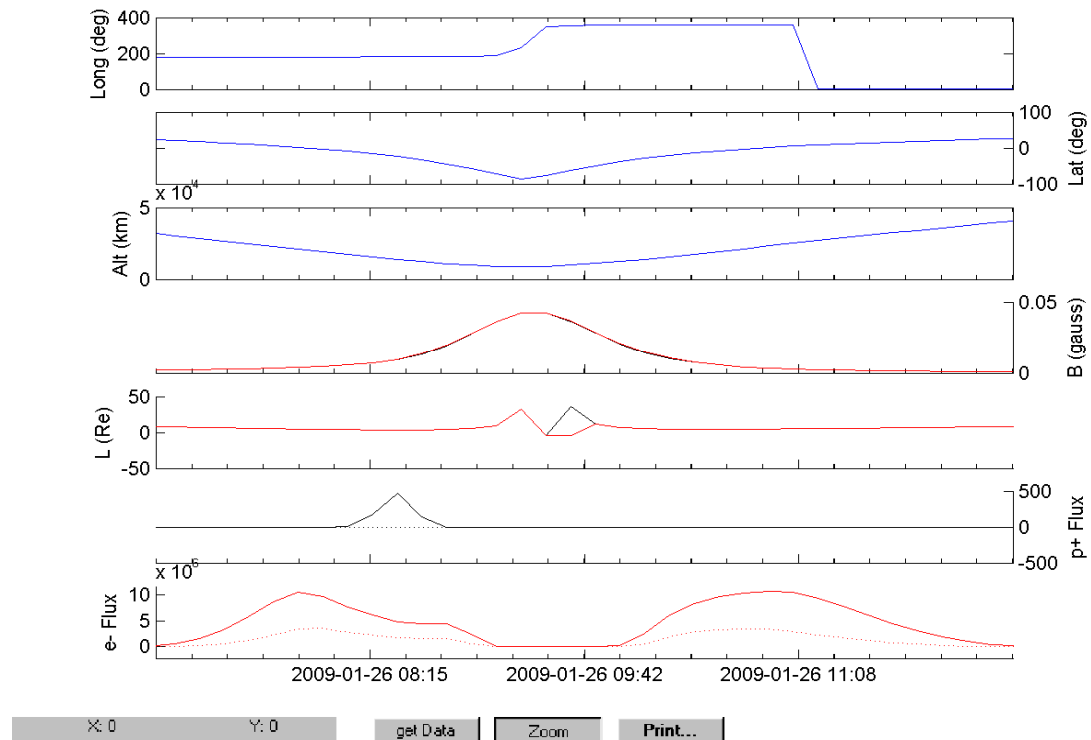
\* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

### IREM radiation counters:

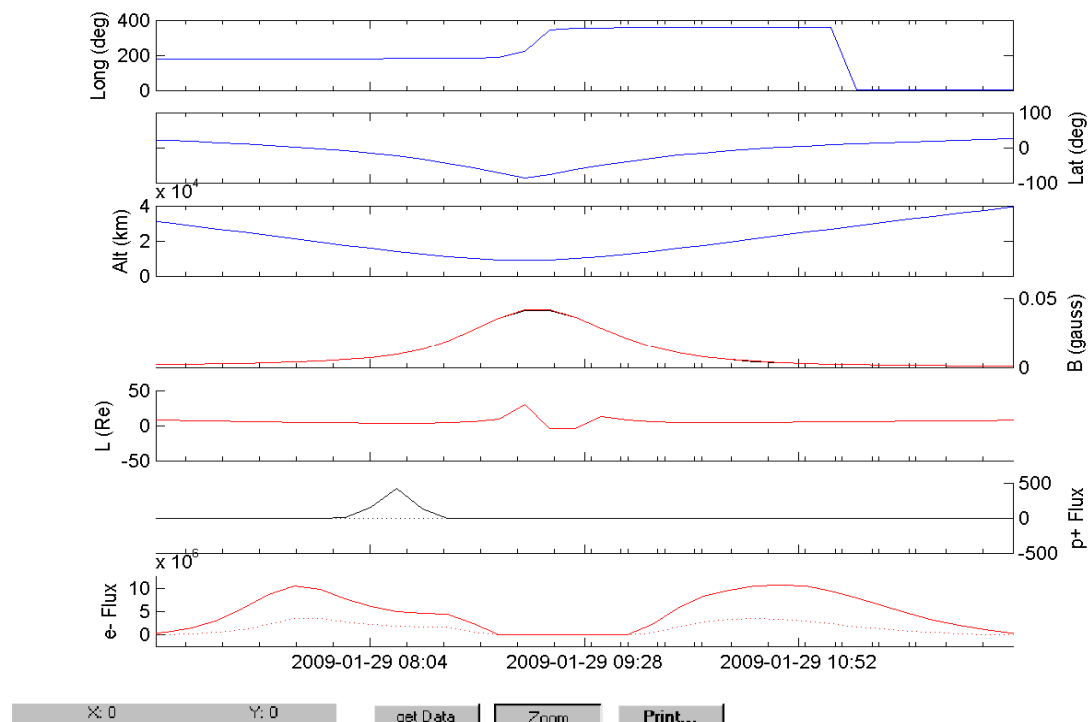
The IREM radiation counter plots are not available this week.

### IREM Predicted Radiation Belt Passages

Rev 767



Rev 768



# Radiation Assessment

Generated with SEIS Report and Analysis tool.

## INTRODUCTION

This note summarises the space weather status over the observation period

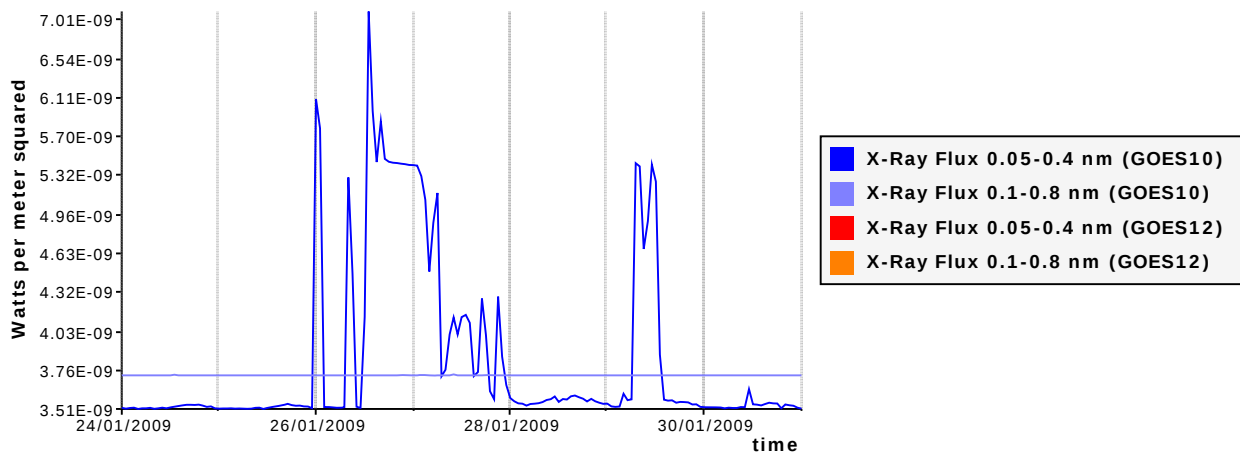
## DAILY SUN

see in WR section 3.2.5

## RADIATION FLUXES

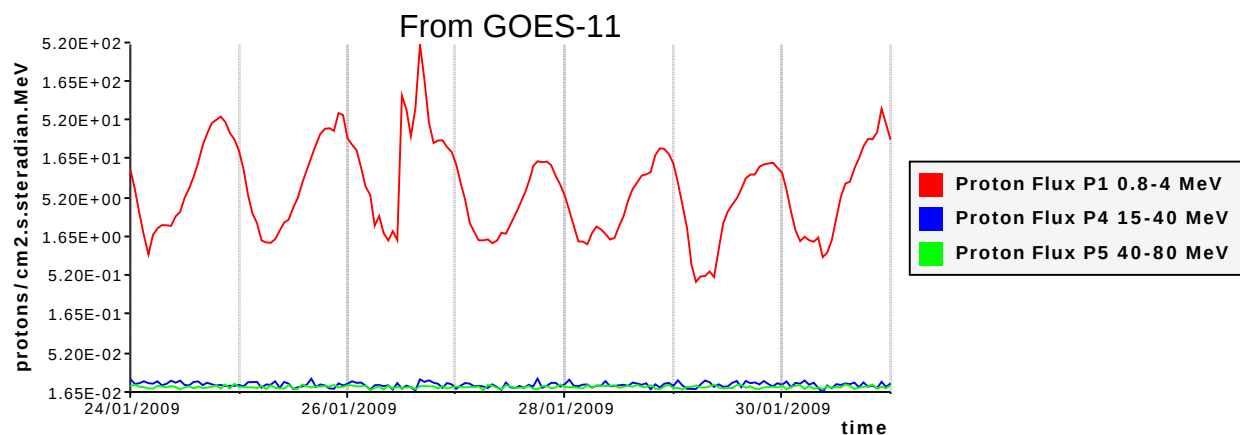
### X-ray fluxes

X-ray fluxes for different energies are presented below as reported by GOES satellites. From  $1\text{E-}5$  W/m<sup>2</sup>, they start featuring significant radiation activity corresponding to M-class solar flares from  $1\text{E-}5$  to  $1\text{E-}4$  W/m<sup>2</sup>, and to X-class solar flares from  $1\text{E-}4$  and onwards.



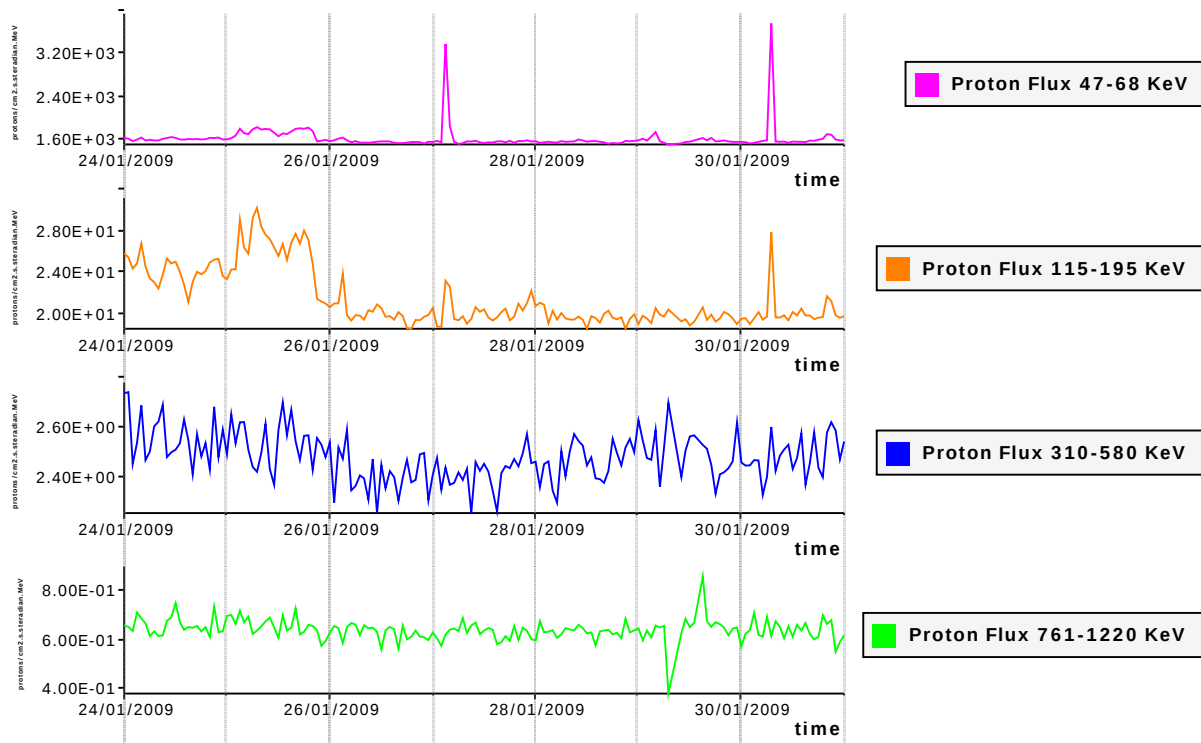
### Proton fluxes (GOES-11)

Proton fluxes as measured by GOES satellites are presented in the following plot. Usually P1 oscillates between  $1\text{E}+1$  and  $1\text{E}+2$ , while P2 and P3 evolve around  $1\text{E-}2$ .



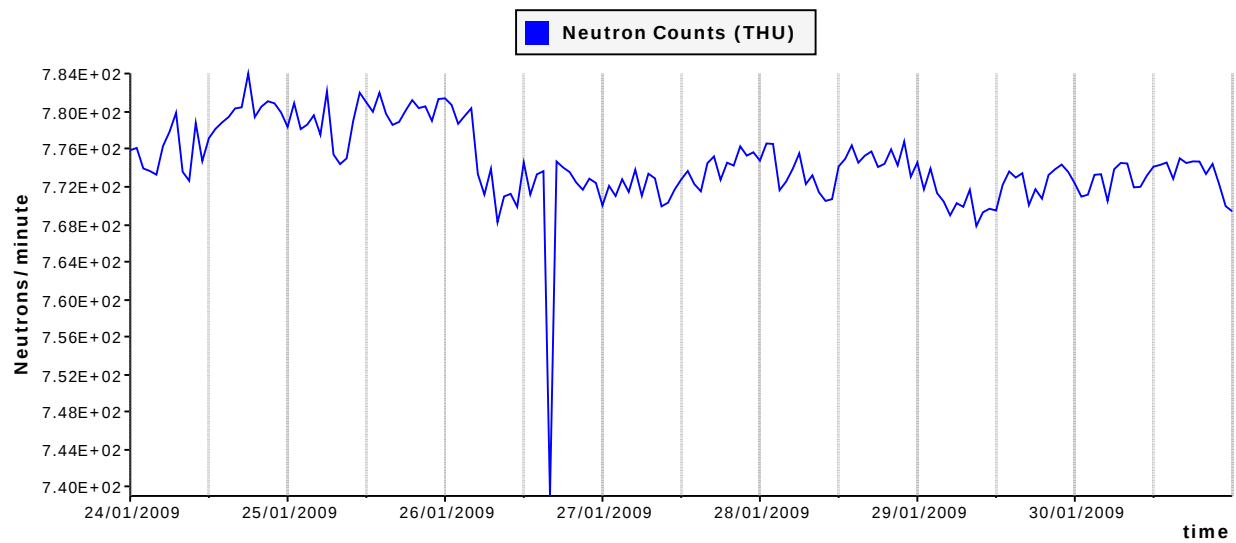
## Proton fluxes (ACE)

Proton fluxes as measured by ACE satellite are presented in the following plot.



## Neutron counts

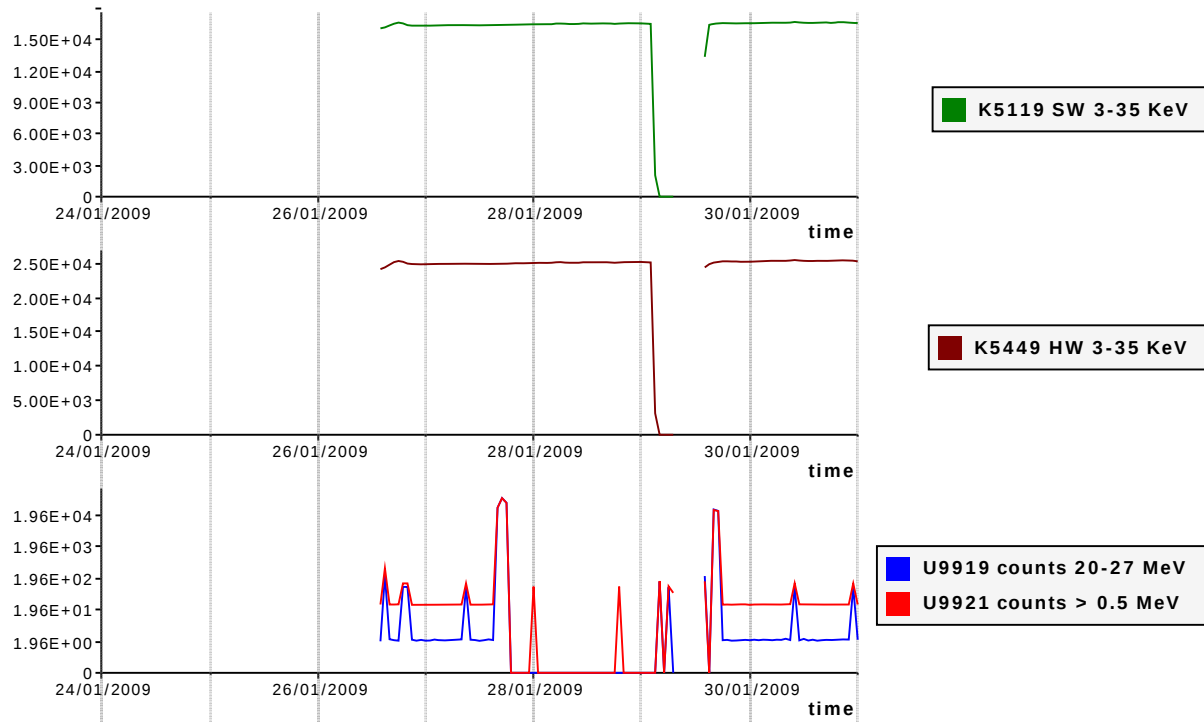
The neutron counts for the last 3 days are presented in the following plot. Nominally they remain stable around  $7.2\text{E}+2$ .



## IREM and JEM-X (INTEGRAL)

IREM proton and electron fluxes as well as JEM-X1 software and hardware triggers are presented in the following plots.

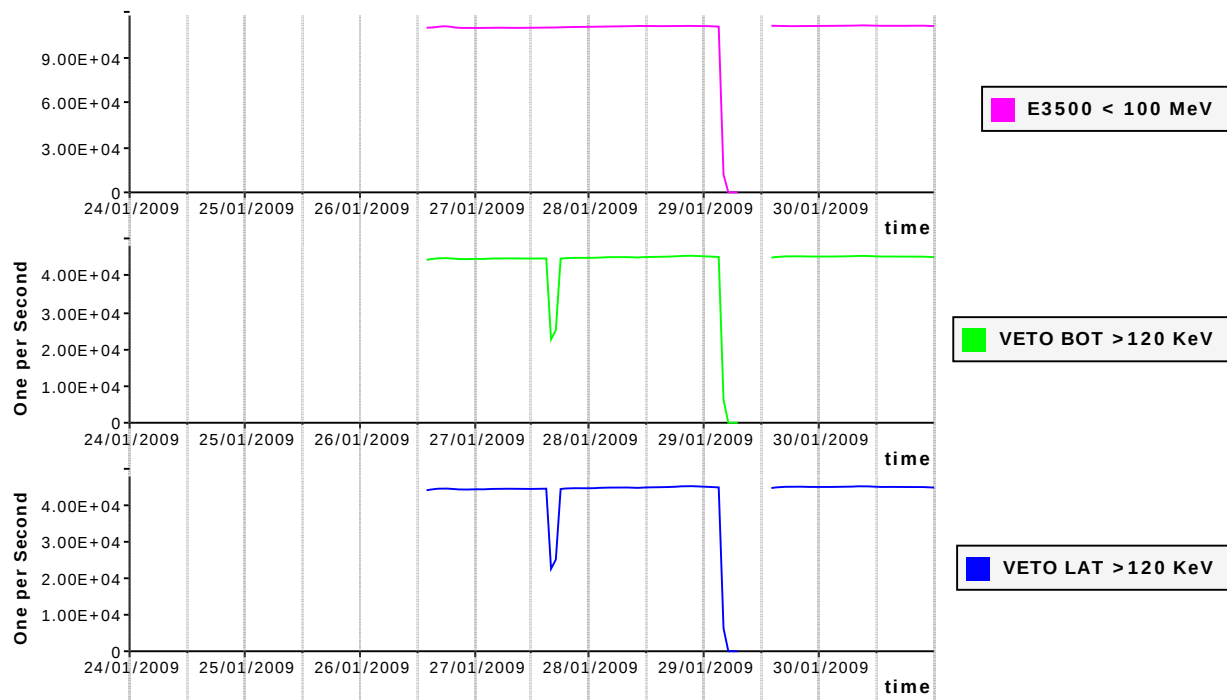
Nominal values are respectively about 1 and 18 for IREM counts, and, 13000 and 19000 for JEM-X ones.



## SPI and IBIS (INTEGRAL)

SPI-ACS counters below 100MeV as well as IBIS-VETO bottom and lateral counters are presented in the following plots.

Nominal values are respectively about 90000 for SPI counts, and 36000 for IBIS ones.



## SOLAR FLARES FORECAST

The probabilities of M and X-class solar flares during the last month are presented below. Chances of solar flare start to be meaningful from 15%.

