

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-OPS-OAI**  
**No. 362**  
**Week 35**  
**31.08.09**  
**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 22.08.09 until 28.08.09 (both dates inclusive) and covers the revolutions 837 and 838.

## **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 a raster dither of MCG +8-11-11 (RA 05:54:53.60, +46:26:21.6), a hexagonal dither of Galactic Bulge region (RA 17:45:36.00, -28:56:00.0), and a raster dither of the Galactic Centre (RA 17:45:40.03, -29:00:28.1).

*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.

One slews were missed from the timeline.

The fuel consumption over the period between 22/08/2009 and 28/08/2009 was 0.0820 Kg. The remaining propellant is in the order of 132.6850 Kg.

*Note: Some more information concerning the AOCS operations 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

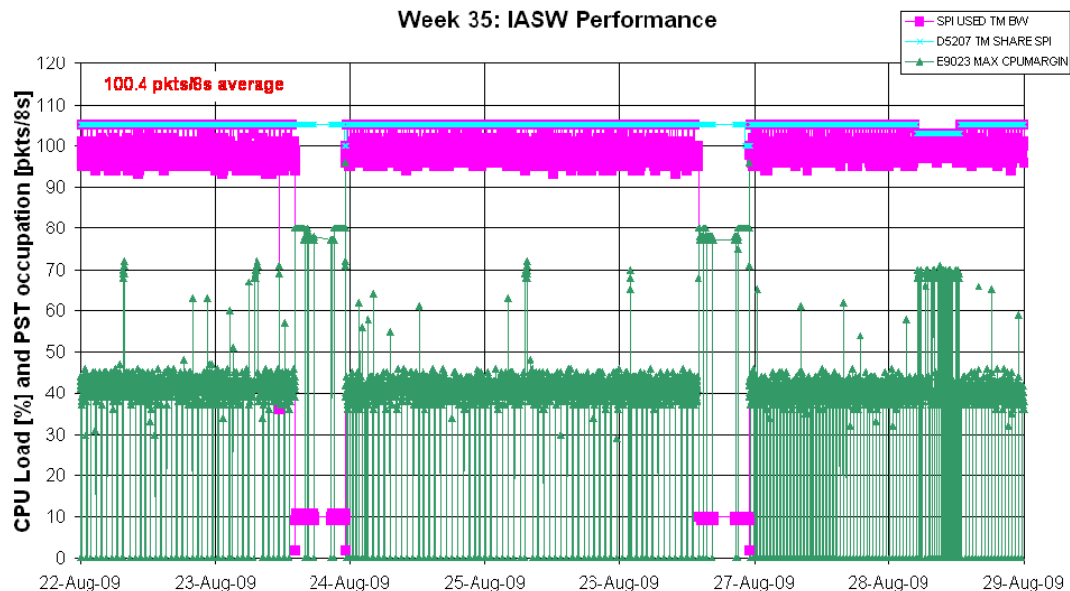
### 3.2.1 SPI

Following the 13<sup>th</sup> SPI annealing, which ended on 11/05/2009, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004) and detector #5 (failed since 19/02/2009).

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

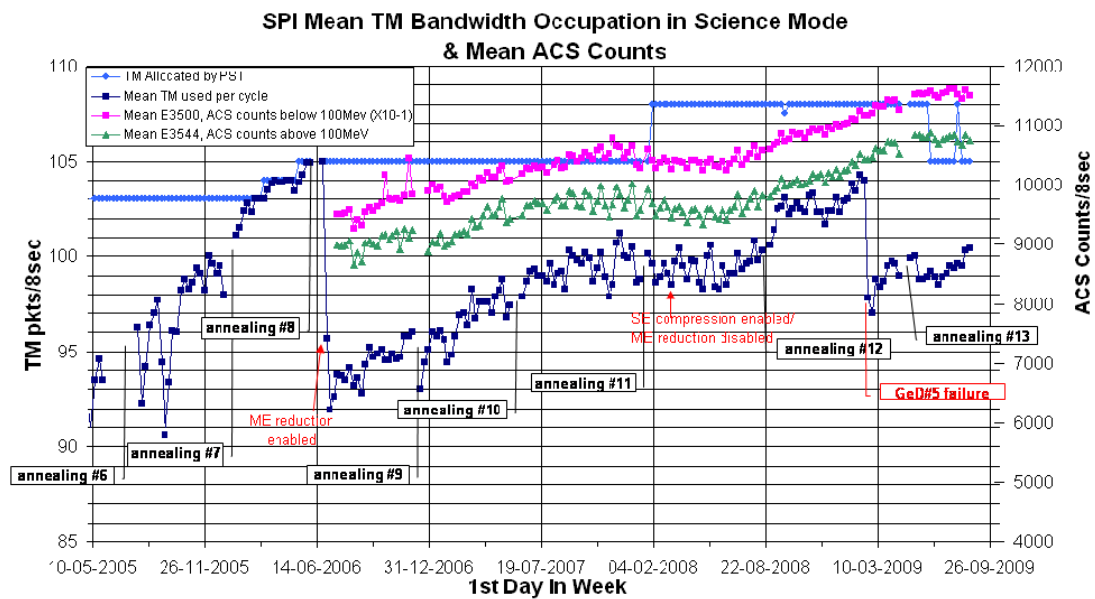
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 105 packets/cycle the average telemetry occupation was 100.4 packets/cycle.

The following plot shows the TM bandwidth allocation, occupation and DPE CPU load during the reporting period<sup>1</sup>:



The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005 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.

<sup>1</sup> Data sampled every 8<sup>th</sup> packet (64sec)



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

### 3.2.2 IBIS

The overall status of IBIS is nominal.

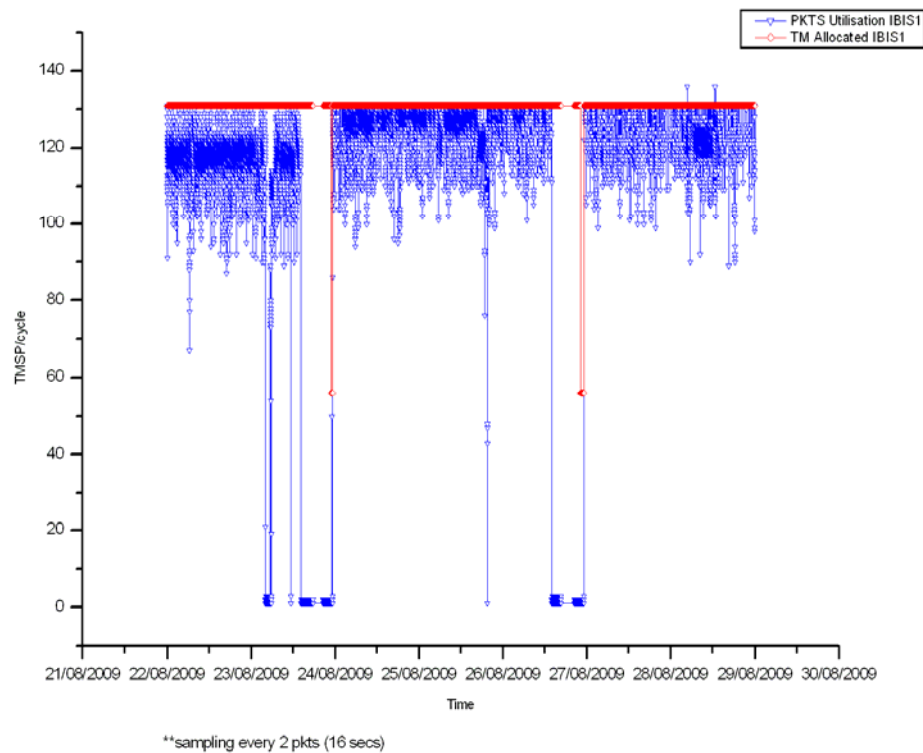
During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 131 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 125.18 packets/cycle (up 2.35 on previous week)
- Percentage of TM cycles for which full bandwidth was used: 45.6%

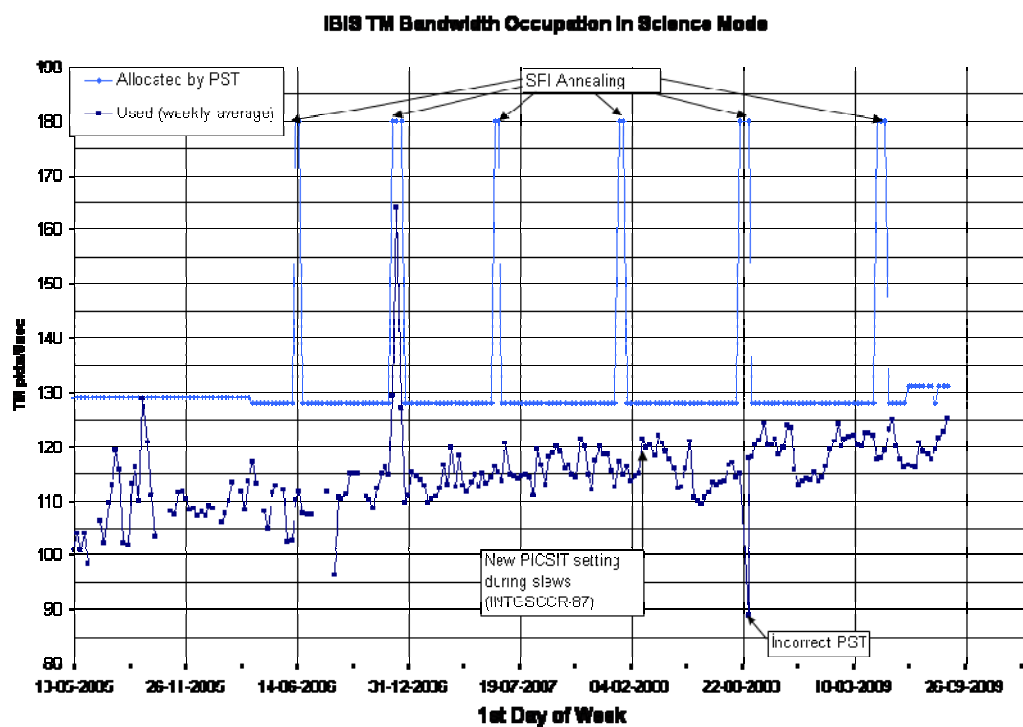
The plot below shows the IBIS TM utilisation during the reporting period.

(N.B. The two spikes in bandwidth usage, on 2009-08-28 at 04:46:33Z and 12:41:05Z, correspond to times when a PST change was being commanded, during which the PST is briefly reverted to PST1, which has an allocation to IBIS of 136 packets/cycle.)

IBIS - TM Bandwidth Utilisation Rev 837-839



A plot of the IBIS weekly bandwidth utilisation since May 2005 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/cycle.

During this reporting period, 192 of the 194 planned science pointings were executed nominally, 1 was cut short, 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.

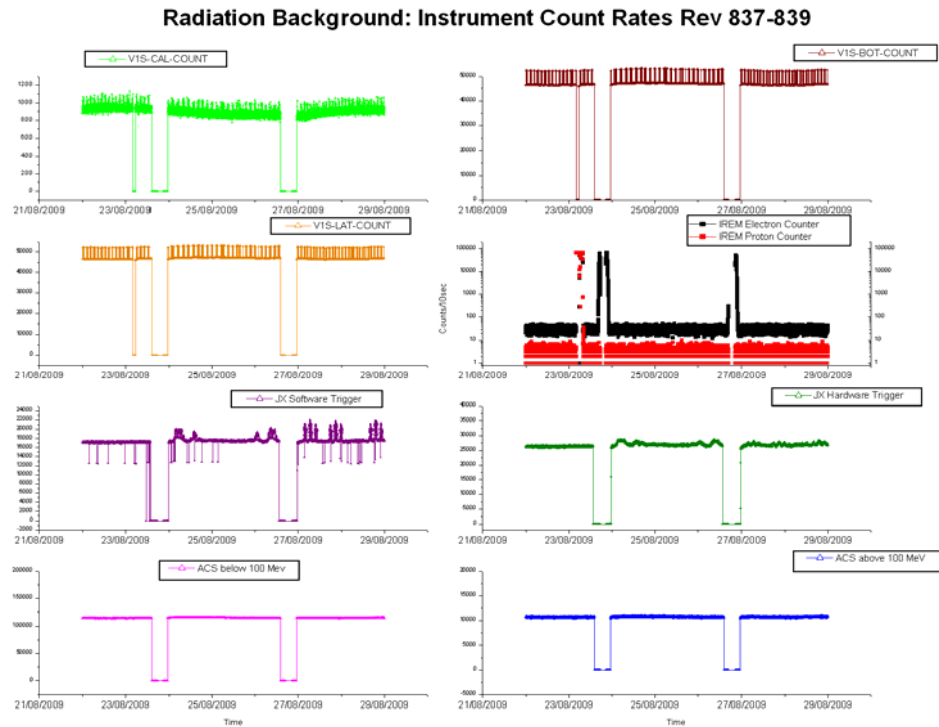
#### **Solar Activity**

The observation period was characterised by low solar activity. The sun was blank all week. The risk of solar flares was very low.

*Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.*

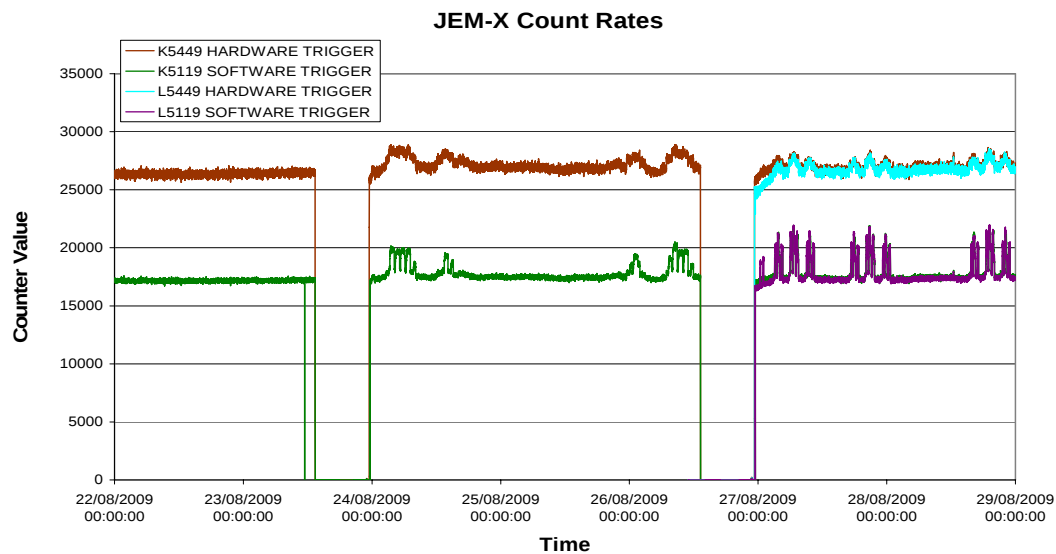
### 3.2.6 Radiation Background

The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the week<sup>2</sup>:



### JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph<sup>3</sup>.

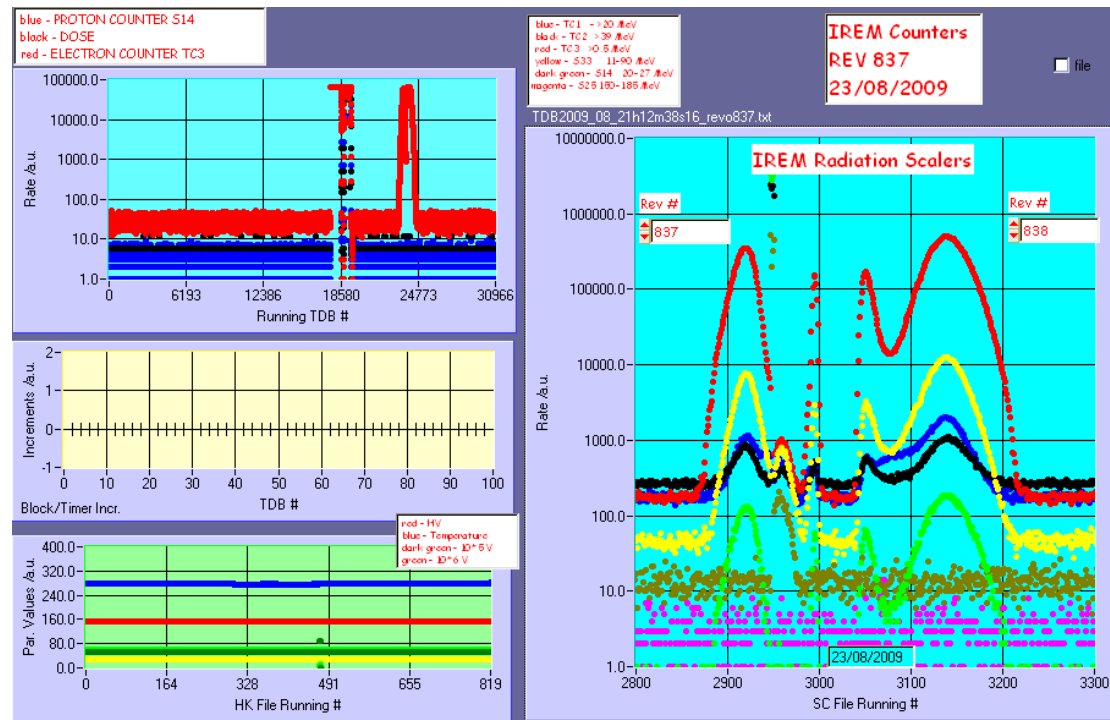


<sup>2</sup> Data sampled every 6<sup>th</sup> packet (48sec)

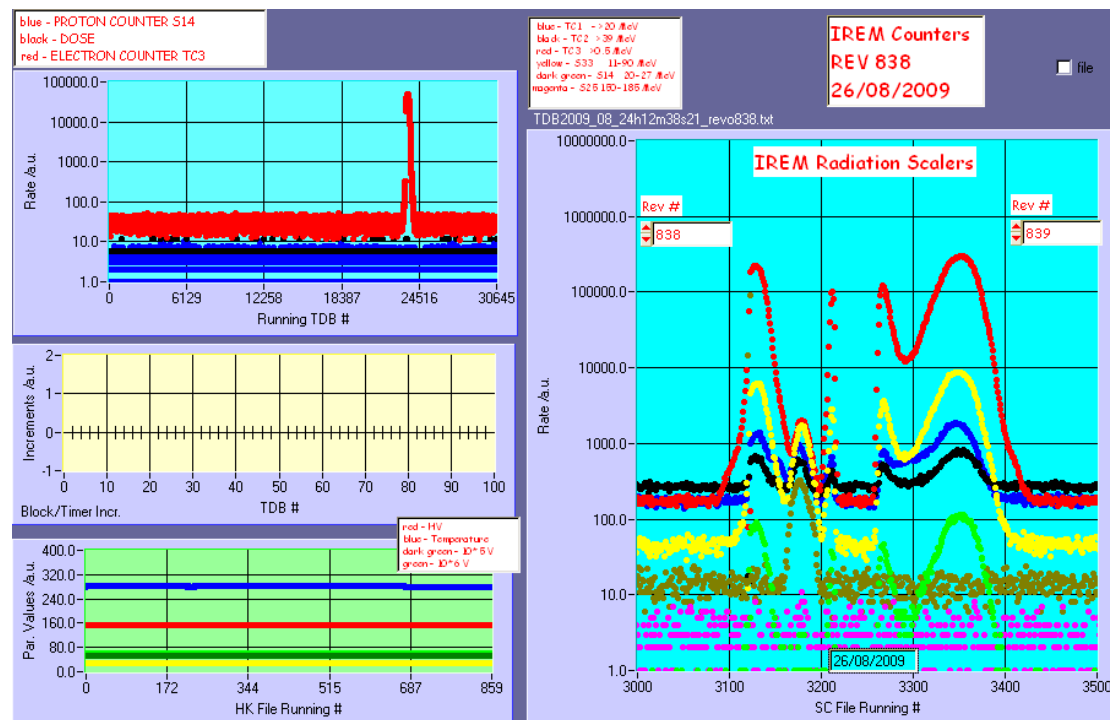
<sup>3</sup> Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

## IREM radiation counters:

### Revolution 837



### Revolution 838



## **4 Ground Facilities**

The Operational ground facilities performance was good this week. The overall performance was over the 95% requirement.

### **4.1 Mission Operations Centre**

The performance of the MOC was very good this week. There were two occasions when the HFA TM and MULTIPLEXER task on imca died, necessitating a restart. The MULTIPLEXER died due to a harddisk problem on the operational workstation sun122, there was no impact. There was one occasion when the links with ISDC dropped, necessitating a restart of the isds & ifrd, there was no impact.

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

The performance of the ground stations and Network was good this week. There were two occasions of a TM drop VC0 and VC7 from DSS-27. The incident on DOY235 at 06:27z caused a loss of TM VC0 and VC7 from DSS27. DSN reported that the antenna stopped track and connection to the FEC was lost. The FEC was rebooted and track and uplink restarted. 13 minutes of TM were lost.

### **4.3 Science Ground Segment**

#### **4.3.1 ISOC**

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

New PSFs have been received for revolutions 845 to 848. Due to problems at ISOC with hand-over windows, the PSFs for revolutions 845 and 846 have been updated by ESOC.

The planning files for revolutions 843 and 844 were approved and transmitted early in the week. Further observations have been planned for revolutions 845 to 848, after the abovementioned problems were overcome.

New TSFs have been received for revolutions 839-841.

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

No new ECS files have been received. The last one processed was for revolution 826.

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

Data ingestion is going on regularly. A test environment for the SAT has been set up. Work is ongoing to define the replacement for the ISDA server.

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

ISOC software V23 has been successfully tested and will be installed operationally in the coming days.

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

The problems encountered in planning revolutions 845 & 846 need further investigation.

## 5 Special Events

## 6 Anomalies

The following anomalies occurred this week:

| AR id      | Date Created | Subject                                              | Segment | Status  |
|------------|--------------|------------------------------------------------------|---------|---------|
| INT_SC-265 | 2009-08-31   | IREM Anomaly: Reset of IREM_CSCI S/W #80, 23/08/2009 | Payload | Testing |

## 7 Future Milestones

## 8 Appendix

The appendix includes various detailed information.

### 8.1 Consumables

### 8.2 Detailed Satellite Information

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

#### 8.2.1 AOCS SUMMARY OPERATIONS REPORT, 22/08/2009 – 28/08/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 134 Open Loop Slews, 71 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

Slew 08370060 was missed from the timeline.

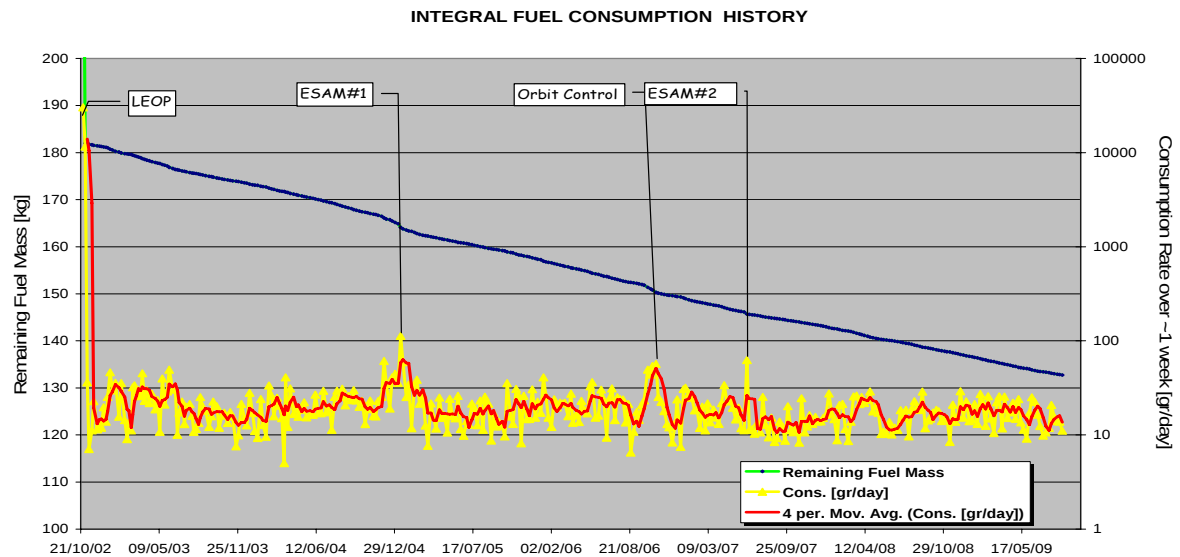
The OTF was not reached for PIDs 08380032 and 08380055

### Orbit Control

No update.

### Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 28/08/2009 is reported in the plot below.

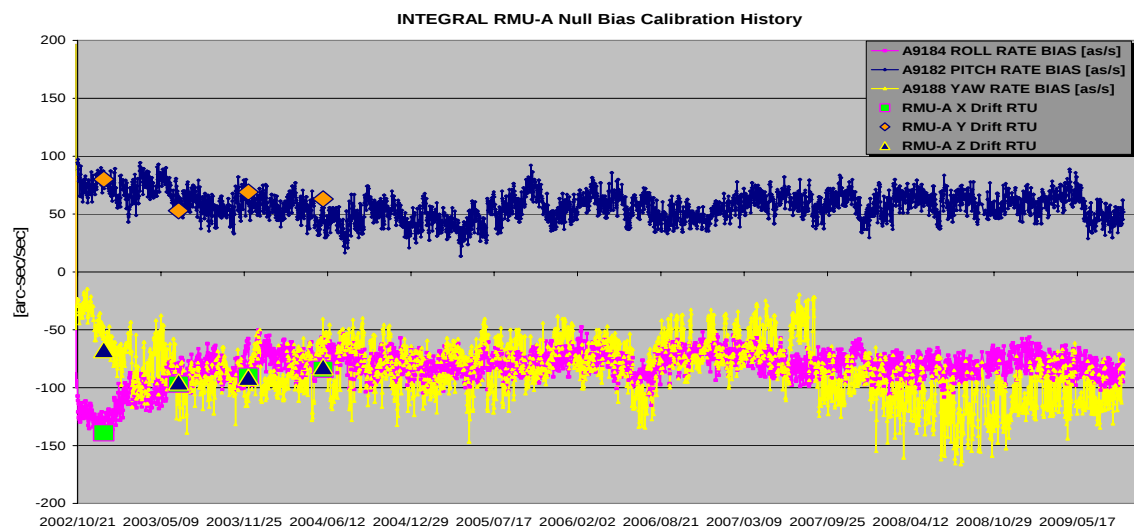


The above plot considers the ESAM fuel consumption spread over period of ~1 week.

### 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 28/08/2009 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.



### Daily events Log:

**Week 362**

**22/08/2009 (Day of Year 234, Revolution 837)**

Nothing to report

**23/08/2009 (Day of Year 235, Revolution 837 to 838)**

- CSL 08370060 failed execution (06:39:00Z) because of a Ground Station problem. After the GS problem was solved and the TC link was restored, the SPACON recovered by generating a slew (spacontool) from PID 08370059 to PID 08370060 (0837\_0501\_M.OSL).

Then, he manually updated the parameters for slew 08370061 in the auto stack (0837\_0502\_M.CSL).

Slew 08370060 was missed from the Timeline.

**24/08/2009 (Day of Year 236, Revolution 838)**

Nothing to report

**25/08/2009 (Day of Year 237, Revolution 838)**

- IMU1 switched ON during the stable pointing of PID 08380032 (02:51:00Z). A manual mapping was commanded and the parameters for slew 08380033 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08380032.

- Performance of IMU calibration prior to the eclipse season (from 07:40Z to 13:55Z)

**26/08/2009 (Day of Year 238, Revolution 838 to 839)**

- IMU1 switched ON during the stable pointing of PID 08380055 (04:38:00Z). A manual mapping was commanded and the parameters for slew 08380056 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08380055.

**27/08/2009 (Day of Year 239, Revolution 839)**

Nothing to report

**28/08/2009 (Day of Year 240, Revolution 839)**

Nothing to report

## 8.2.2 SPI Operations

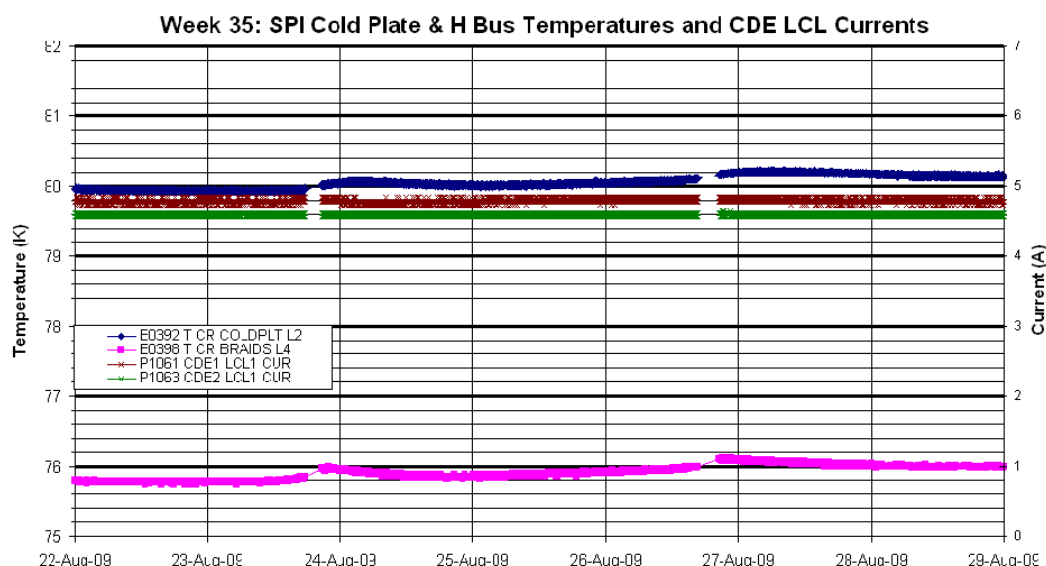
**Unit Temperatures:** All the equipment temperatures are inside the operational limits.

**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 40 throughout the week and the average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.79A
- CDE2 LCL Current = 4.59A

The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period<sup>4</sup>:

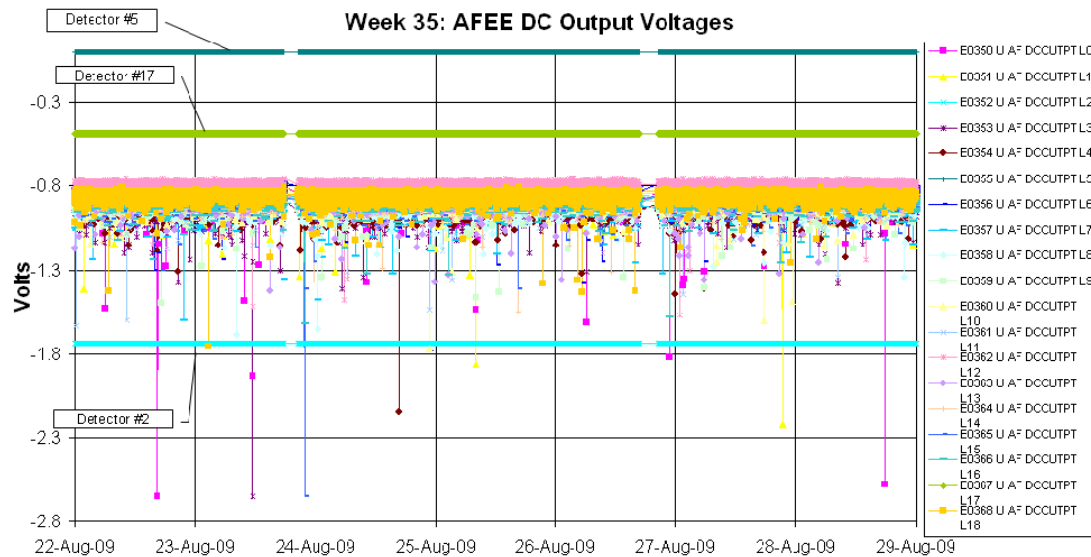


**DPE & IASW:** The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

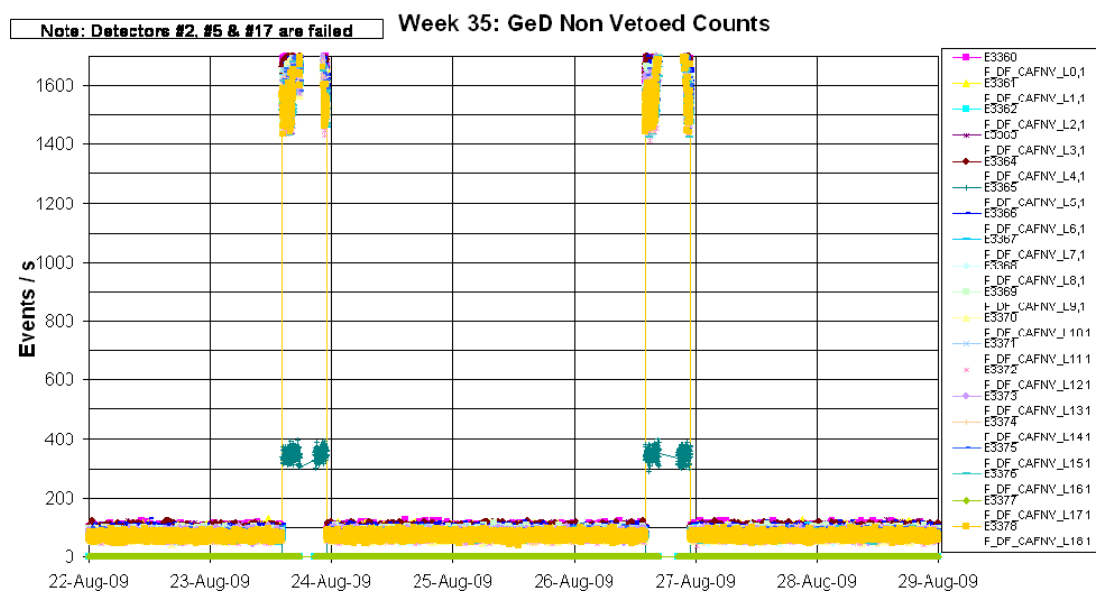
**ACS:** The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT\_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT\_SC-61). A plot of the ACS counts is given in Section 3.2.6.

<sup>4</sup> Data sampled every 8<sup>th</sup> packet (64sec)

**AFEE:** The health of the AFEE is nominal. The following plot shows the dc output voltage of the detector channels during the reporting period<sup>5</sup>. The values are nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004 and detector #5 is failed since 19/02/2009. The HV of the failed detectors are nominally set to 0.5kV.

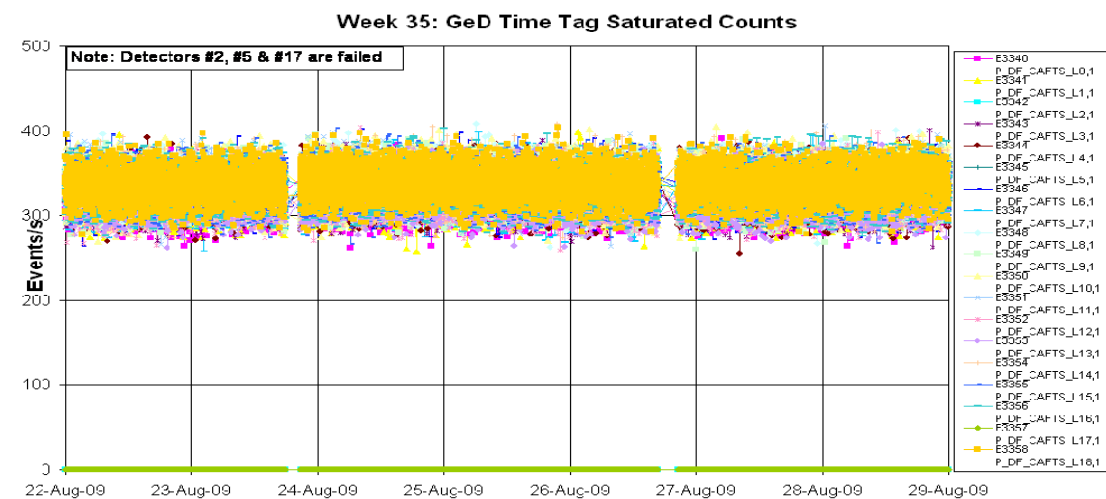
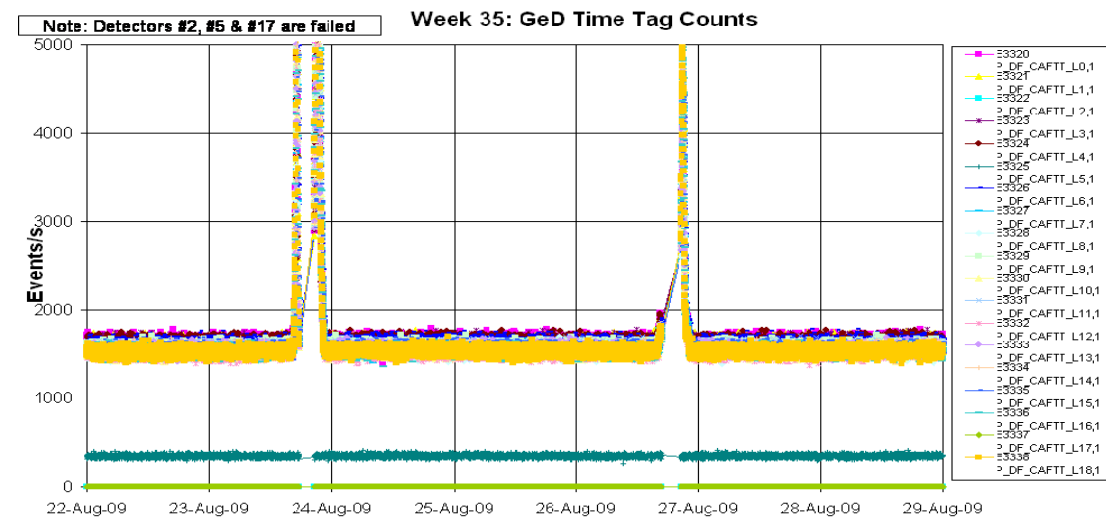


**DFEE:** The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period<sup>6</sup>.

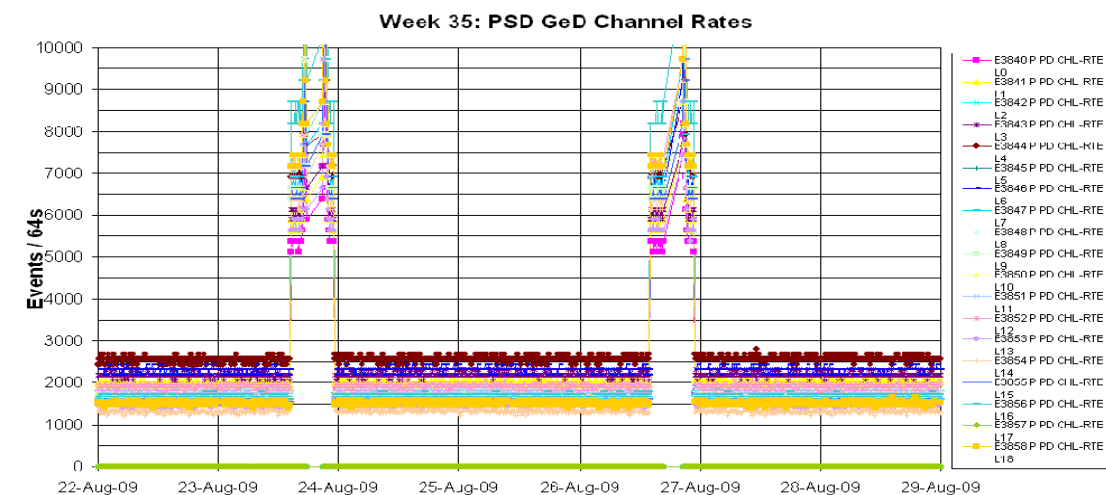


<sup>5</sup> Data sampled every 8<sup>th</sup> packet (64sec)

<sup>6</sup> Data sampled every 8<sup>th</sup> packet (64sec)



**PSD:** The overall health of the unit is nominal. The following plot shows the PSD channel rates over the reporting period<sup>7</sup>:



## Event Log:

No non-nominal events occurred with SPI over the reporting period.

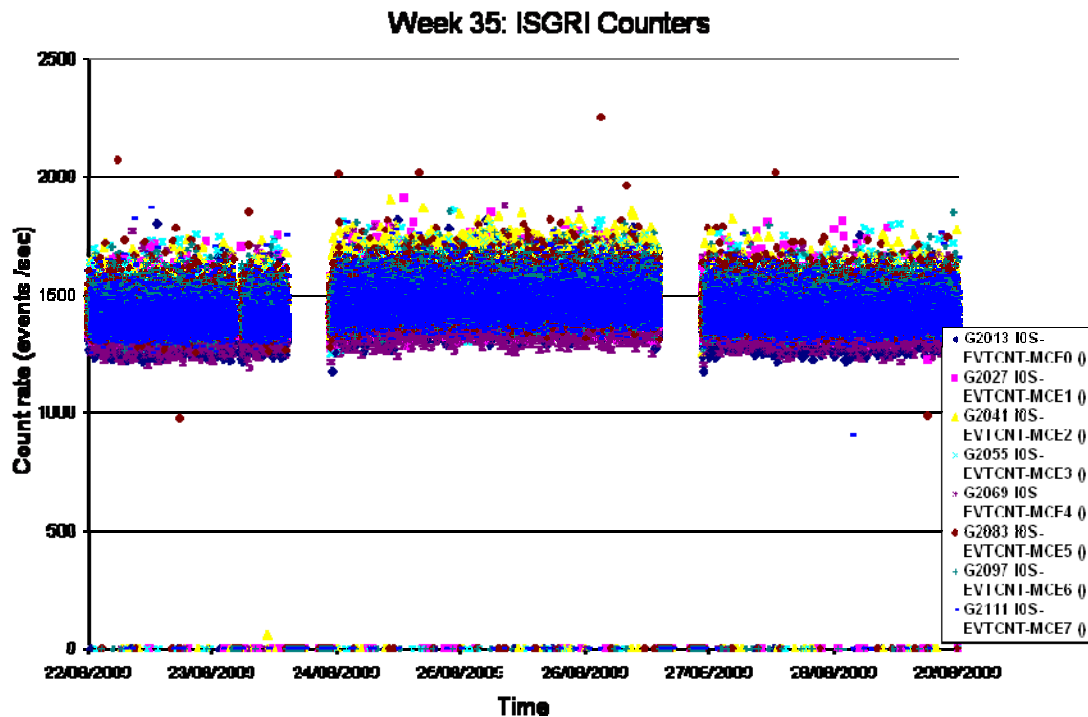
<sup>7</sup> Data sampled every 8<sup>th</sup> packet (64sec)

### 8.2.3 IBIS Operations

**Unit Temperatures:** All the equipment temperatures were inside the operational limits throughout the week.

#### ISGRI

The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the week<sup>8</sup>:

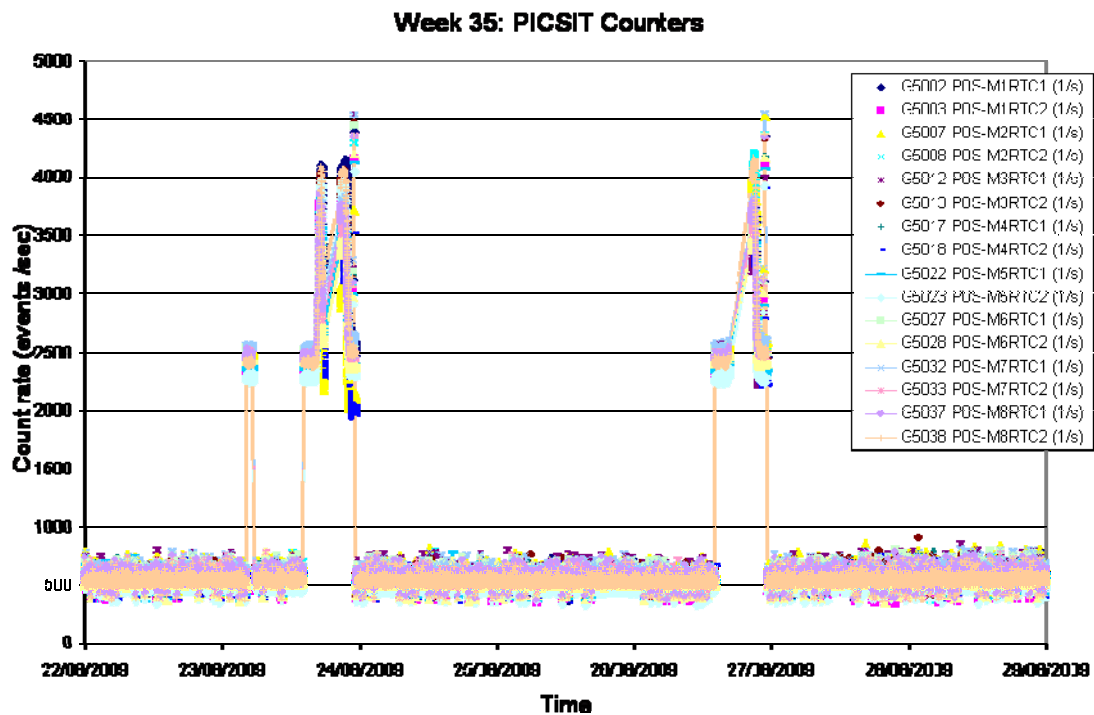


#### PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week<sup>9</sup>:

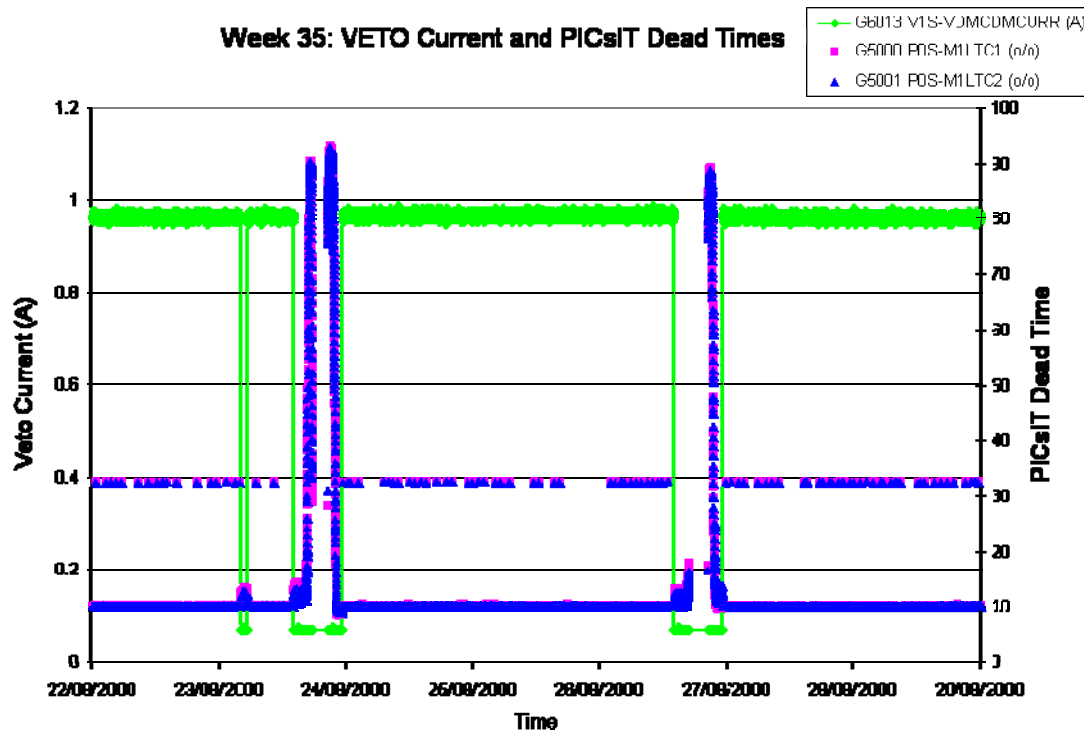
<sup>8</sup> Data sampled every 4<sup>th</sup> packet (32sec)

<sup>9</sup> Data sampled every 4<sup>th</sup> packet (32sec)



## VETO

The health and performance of VETO was nominal during the reporting period. The following plot shows the VETO current and PICSIT dead-times during the week<sup>10</sup>:



<sup>10</sup> Data sampled every 4<sup>th</sup> packet (32sec)

## **IBIS Daily Report**

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

### **2009-08-22 (DOY 234, Rev. 837)**

At 06:24:16Z TM parameter G2070 went OOL, indicating an overflow of the noisy pixel address buffer in MCE5. As it returned within limits of its own accord at 06:24:24Z, no action was taken.

### **2009-08-23 (DOY 235, Rev. 837-838)**

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 04:09:55Z. It was recovered as follows:

- At 05:25:19Z FCP\_IBIS1\_0803 IBIS EXIT FROM SAFE MODE
  - At 05:41:28Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.
- IBIS operations continued nominally.

### **2009-08-24 (DOY 236, Rev. 838)**

IBIS operations executed nominally.

### **2009-08-25 (DOY 237, Rev. 838)**

At 17:32Z, following a ground station handover, TM parameter X7500 went OOL, indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

- 19:36:41Z FCP\_IBIS1\_0312
  - 19:38:30Z TC G0129 uplinked to return IBIS to Science Standard mode.
- IBIS operations continued nominally.

### **2009-08-26 (DOY 238, Rev. 838-839)**

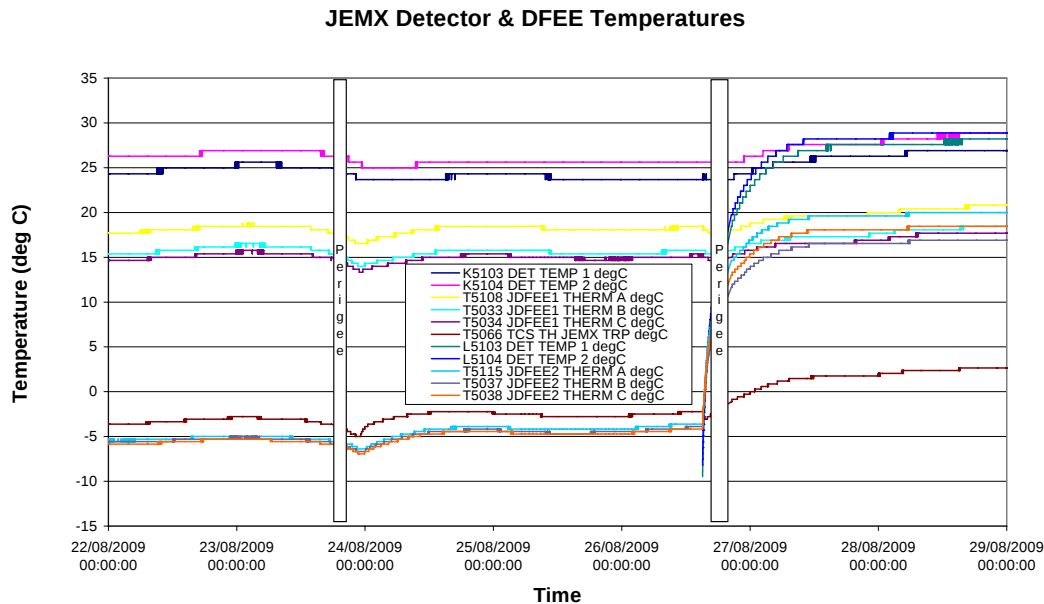
At 23:33:44Z TM parameter G6061 went OOL (value = 796counts/s). This is the VETO calibration source counter. As it returned within limits of its own accord at 23:33:52Z, no action was taken. However the value of this parameter is decreasing due to the radioactive decay of the source and the lower limit for this parameter will be reduced to 700counts/s in the next IODB release.

### **2009-08-27 (DOY 239, Rev. 839) to 2009-08-28 (DOY 240, Rev. 839)**

IBIS operations executed nominally.

## 8.2.4 JEM-X Operations

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>11</sup>.



## JEM-X Daily Report

### 2009-08-22 (DoY 234 Rev 837)

At the indicated times, the following OEMs were received:

|                             |                       |       |          |       |           |
|-----------------------------|-----------------------|-------|----------|-------|-----------|
| 2009.234.16.36.39.034       | 2009.234.16.36.42.175 | 1536  | RealTime | 5     | EXCEPTION |
| JEM-X1 EXC IACS INTERF EXID |                       | 0     | 0        | 65535 | PR N      |
| E                           | E                     |       |          |       |           |
| FIX6                        |                       | 0     |          |       |           |
| K9079                       | MESS CLASS            | 1     |          |       |           |
| K9080                       | MESS ID               | 5     |          |       |           |
| K9065                       | CSSW OPERAT ID        | START |          |       |           |
| K9066                       | TASK ID 8             | IASW  |          |       |           |
| K9067                       | LOGICAL ADDRESS       | 4989  |          |       |           |
| 2009.234.16.36.39.034       | 2009.234.16.36.42.236 | 1536  | RealTime | 6     | EXCEPTION |
| JEM-X1 EXC IACS INTERF CULP |                       | 0     | 0        | 65535 | PR N      |
| E                           | E                     |       |          |       |           |
| FIX6                        |                       | 0     |          |       |           |
| K9079                       | MESS CLASS            | 1     |          |       |           |
| K9080                       | MESS ID               | 6     |          |       |           |
| K9065                       | CSSW OPERAT ID        | START |          |       |           |
| K9066                       | TASK ID 8             | IASW  |          |       |           |
| K9067                       | LOGICAL ADDRESS       | 19726 |          |       |           |

No action was taken, and there was no impact.

### 2009-08-23 (DoY 235 Rev 837-838)

At 04:10:28 JEMX parameters K5315, K5316 & K5317 went Out-of-Limits due to an IREM SEU (#80). There was no impact as the reaction has been disabled.

<sup>11</sup> Data sampled (1 frame in 8)

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## 2009-08-24 (DoY 236 Rev 838)

JEM-X 1 operations executed nominally.

## 2009-08-25 (DoY 237 Rev 838)

At the indicated times, the following OEMs were received:

|                             |                       |      |          |   |       |         |
|-----------------------------|-----------------------|------|----------|---|-------|---------|
| 2009.237.00.47.45.167       | 2009.237.00.47.46.413 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.456 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.458 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.458 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.459 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.460 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 4989 |          |   |       |         |
| 2009.237.00.47.45.167       | 2009.237.00.47.46.460 | 1536 | RealTime | 5 |       | ANOMALY |
| JEM-X1 CSSW INT ER EXCEPTIO |                       |      | 0        | 0 | 65535 | PR N    |
| E                           |                       |      |          |   |       |         |
| FIX6                        |                       | 0    |          |   |       |         |
| K9079                       | MESS CLASS            | 2    |          |   |       |         |
| K9080                       | MESS ID               | 5    |          |   |       |         |
| K9074                       | TASK ID 16            | 12   |          |   |       |         |
| K9067                       | LOGICAL ADDRESS       | 5336 |          |   |       |         |

No action was taken, and there was no impact.

## 2009-08-26 (DoY 238 Rev 838-839)

At 14:05, operations to activate JEMX-2 prior to the Crab-calibration were commenced. At the indicated times, the following procedures were completed:

14:40:00 FCP\_JEM2\_0010 JEMX2 DPE AND CSSW ACTIVATION  
 14:47:00 FCP\_JEM2\_0015 JEMX2 IASW ACTIVATION  
 14:55:00 FCP\_JEM2\_0016 JEMX2 ENABLE BCP DISTRIBUTION  
 14:56:00 FCP\_JEM2\_0017 JEMX IASW EXTENDED TM CHECK  
 15:39:00 FCP\_JEM2\_0020 JEMX2 DFEE 1ST ACTIVATION AFTER DPE SWITCH  
 15:38:00 FCP\_JEM2\_0060 JEMX2 UPDATE ENERGY LINEARISATION TABLE  
 15:40:00 FCP\_JEM2\_0040 JEMX2 TRANSITION TO SAFE

The operations were completed by 15:40, before LOS at 16:45.

The rest of the activation was executed from the Timeline, with both units entering Data-taking at the nominal time.

There was a string of JEMX-2 out of limits associated with the switch-on, but these were normal, and disappeared after the unit had warmed up.

## 2009-08-27 (DoY 239 Rev 839) to 2009-08-28 (DoY 240 Rev 839)

JEM-X 1 & 2 operations executed nominally.

### 8.2.5 OMC Operations

## 2009-08-22 (DoY 234, Rev 837)

Nothing to report.

## 2009-08-23 (DoY 235, Rev 837-838)

At 04:09:46, an IREM SEU (#80) forced OMC to SAFE mode, a recovery was performed, and the unit returned to standby at 04:48:19. The impact was the interruption after 625 from a planned 3200 seconds of pointing 08370057.

At 06:29:00, a ground station drop forced a suspension of operations. At 06:44:00, the link was re-established, and a recover performed. The impact was the loss of pointing 08370060. It was at this time that the following pair of commands were rejected:

|                       |                       |      |          |     |            |
|-----------------------|-----------------------|------|----------|-----|------------|
| 2009.235.06.43.35.056 | 2009.235.06.43.40.418 | 1792 | RealTime | 131 | TC REJECT  |
| REJECTED TC1          |                       |      | 0        | 0   | 65535 PR N |
| E E                   |                       |      |          |     |            |
| 2009.235.06.43.41.306 | 2009.235.06.43.47.598 | 1792 | RealTime | 131 | TC REJECT  |
| REJECTED TC1          |                       |      | 0        | 0   | 65535 PR N |
| E E                   |                       |      |          |     |            |

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

## 2009-08-24 (DoY 236, Rev 838) to 2009-08-28 (DoY 240, Rev 839)

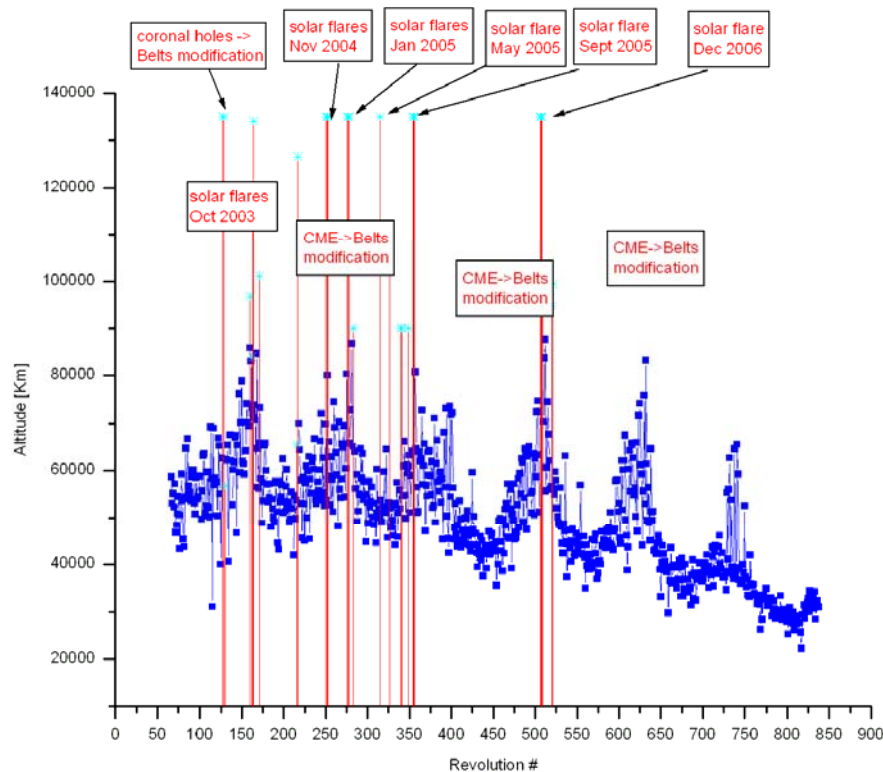
Nothing to report.

On DoY 235 at 14:14:26 and DoY 238 at 14:04:50 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

## 8.2.6 IREM Operations

### Radiation Belts Entry

Evolution of Radiation Belt Entry 2003-2008



### IREM daily report

#### DoY 2009.235 (23/08/2009):

At 04:09:45Z, a local reset of the IREM CSCI S/W (SEU #80) 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 2009.235.04.09:45Z (114903.9 km). The unit had performed an automatic transition to Standard Mode (ie. 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 08:42:00Z.

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 04:48:19Z and IBIS at 05:52:00Z.

### 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] |
|-----|---------------------------------|--------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|
| 837 | RAD_ENTR R 2009-08-23T14:14:19Z | 23/08/2009<br>16:33:21                     | 31097.0                                    | 23-Aug-2009<br>16:44:17                     | 30234.67                                    |
| 838 | RAD_EXIT R 2009-08-23T23:08:30Z | 23/08/2009<br>22:23:45                     | >>32773.2                                  | 23-Aug-2009<br>22:54:17                     | 46958.2                                     |
| 838 | RAD_ENTR R 2009-08-26T14:04:46Z | 26/08/2009<br>16:27:29                     | 31019.9                                    | 26-Aug-2009<br>16:35:15                     | 30274.91                                    |
| 839 | RAD_EXIT R 2009-08-26T22:58:16Z | 26/08/2009<br>21:59:45                     | >>32803.1                                  | 26-Aug-2009<br>22:45:15                     | 46998.49                                    |

### Reference

#### High radiation

Very small error vs reference (less than 10 minutes)

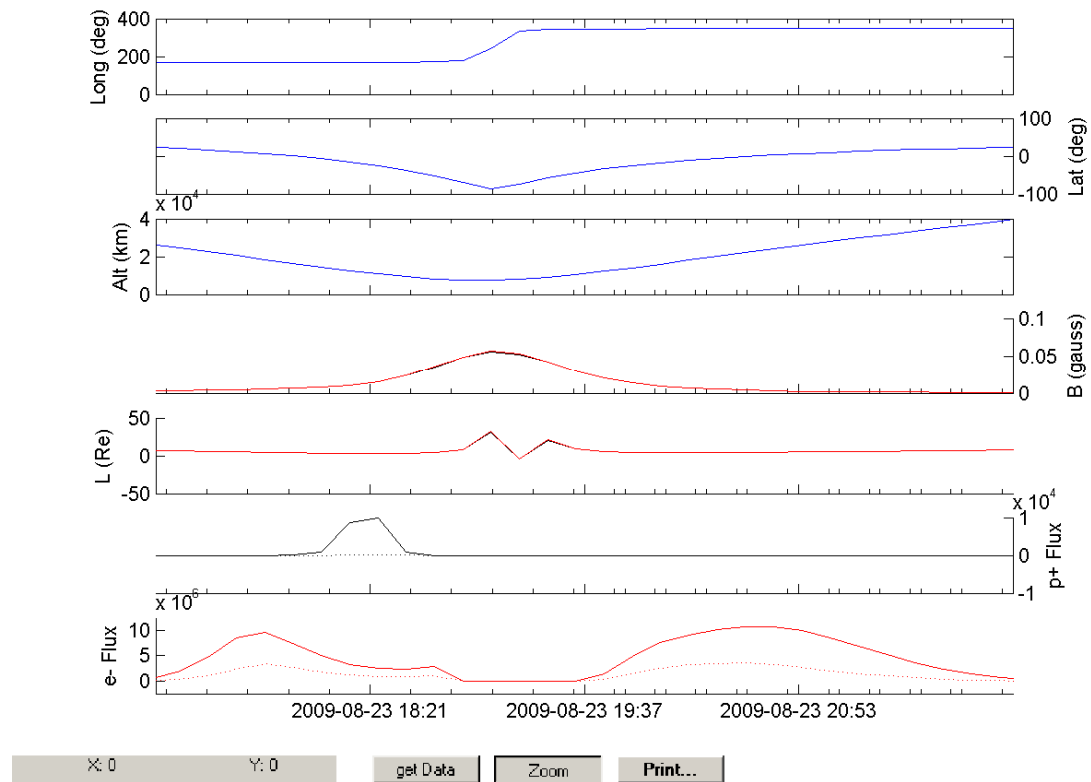
Small error vs reference (between 10 and 30 minutes)

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 Predicted Radiation Belt Passages**

Rev 837



Rev 838

