

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-OPS-OF**  
**No. 134**  
**Week 15**  
**18.04.05**  
**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 09.04.05 until 15.04.05 (both dates inclusive) and covers the revolutions 304 & 305.

## **2 Summary of Activities**

The operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

The targets of these revolutions were the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0); GRO J1655-40 (RA 16:54:0.14; DEC -39:50:44.9); the Galactic Center field (RA 17:45:40.00; DEC -29:00:28.0) and GRS 1915+105 (RA 19:15:11.50; DEC +10:56:44.0). The activities consisted of raster and hexagonal dithering observations.

*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.

4 slews (3 OSL , 1 CSL) were missed from the Timeline during this period.

The fuel consumption over the period between 07/04/2005 and 14/04/2005 was 0.0824 kg. The remaining propellant is in the order of 161.9445 Kg.

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

#### **3.1.2 Power**

The EPS is working nominally, available power from the arrays is of the order of 2100W.

#### **3.1.3 Thermal**

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

#### **3.1.4 OBDH**

The OBDH subsystem is working flawlessly. No on-board communications problem was identified.

### 3.1.5 RFS

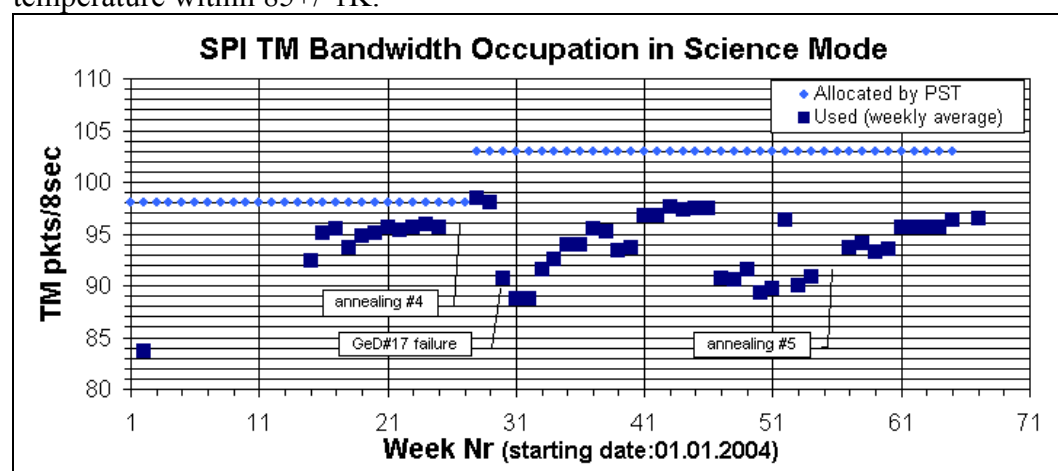
The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

## 3.2 Payload

### 3.2.1 SPI

The overall status of the instrument in this week is nominal.

During the reporting period, the instrument has been kept in photon-by-photon mode, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an actual occupation of 96.4 pkts/cycle average. The Stirling compressors are working well, maintaining the detector cold-plate temperature within 85+/-1K.



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

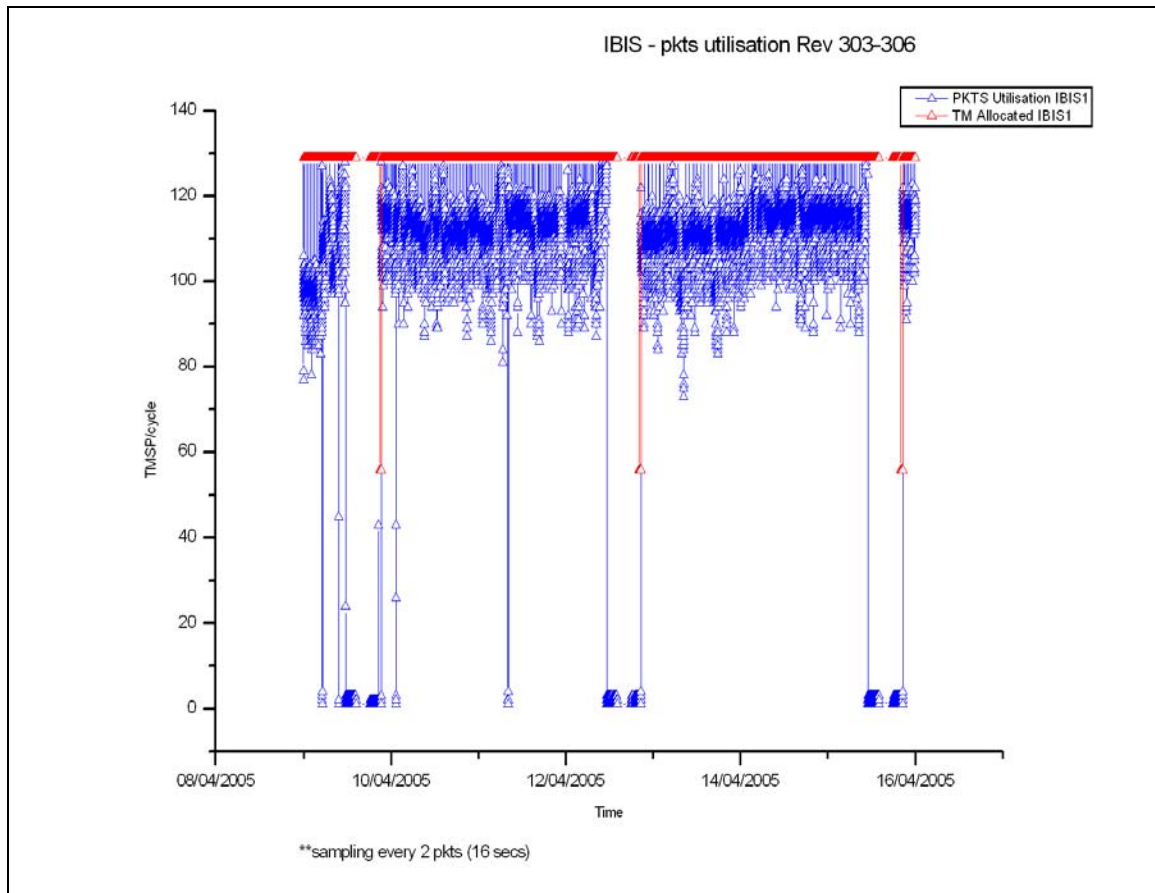
### 3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by low solar activity.

During the reporting period the PST allocation to IBIS was most of the time 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 112.98 TMPS/cycle, up 10.13 on last week.

A plot of the IBIS TM utilisation during the observation period is shown below:



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

### **3.2.3 JEM-X**

The status of both JEM-X units is nominal.

JEM-X operations were performed by the automatic Timeline.

JEM-X1 was operated in Data Taking mode during science observations with a TM allocation of 8 packets/cycle and JEM-X2 was dormant (DFEE OFF) with a TM allocation of 1 packet/cycle.

*Further information on the JEM-X operations can be found in the Appendix Section 8.3.4.*

### **3.2.4 OMC**

The status of OMC is nominal.

During the reporting period OMC operations were performed by the automatic timeline, with the TM allocation to OMC of 5 packets/cycle.

There were 206 OMC pointings executed nominally, 4 were lost.

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

### **3.2.5 IREM**

The overall status of the unit is nominal.

#### **Solar Activity**

The observation period was characterised by low solar activity.

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

## **4 Ground Facilities**

The performance of the Operational ground facilities was excellent this week, well above the system performance requirements, 206 pointings were executed correctly, 4 were lost, due to on-board problems. There were only occasional packets lost due to hits on the line.

### **4.1 Mission Operations Centre**

The performance of the MOC was excellent this week, with no pointings lost.

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

The performance of the ground stations and Network was excellent this week. There was one occasion when the line from DSS-16 dropped, probably due to hits on the line, but apart from that nothing. The overall performance was nearly 100%.

### **4.3 Science Ground Segment**

#### **4.3.1 ISOC**

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

Mission planning up to revolution 314 generated and sent to MOC. Rev 310 contains an OMC flat field and dark current calibration. The POS for this revolution has been generated with ISOC system 10.8.2. No manual editing of the POS has taken place. No replanning request or ToO received. PSF's up to rev 314 have been received. TSF for rev 304 to 307 were received.

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

ECS's up to rev 291 received except rev 277, which is missing. No extra time credited.

##### **3. ISOC science data archive**

Problems fixed with ORACLE embedded code delivered from ISDC. Fluxes can now be extracted from the archive and stored in database tables for rapid display.

The ISDA browser has been extensively tested with Revision 2 data. It can be concluded that much of the functionality is available without modification. Development of scripts for the fully automatic transfer and ingestion of data is in progress.

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

The version 10.8.2 of the ISOC system has been installed this week. This version adds functionality to avoid the necessity for manual editing of a POS containing an OMC flat field calibration.

## 5. ISOC move

Installation of ISOC applications on the recently received computers has continued. The computers required in ESAC have now been properly configured to allow installation of the ISOC applications currently running on RSSD computers.

## 6. Problems

The problem reported in recent weeks with unavailable science staff in ISOC is still not yet fully resolved. For one company the finalisation is still pending.

### 4.3.2 ISDC

Status of ISDC observation processing on 18/04/2005:

- Latest Standard Analysis completed: observation 02201460003 (3C273, Revolution 270) on 11/04/2005
- Latest products archived: observation 02297000013 (CAS A, Revolution 261-269) on 23/03/2005
- Latest observation products sent to the observer: observation 02297000013 (CAS A, Revolution 261-269) on 24/03/2005

## 5 Special Events

## 6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 101, at 08:27, the following message was seen 5 times in the event logger: TCONmainPB, idda error HFACTMrecord Error writing TM.
- At 23:02, at the end of slew 03040089, the guide star was lost, and the OTF went low. The subsequent recovery took longer than expected. The impact was pointings 03040090 through to 03040093 were lost.
- On DoY 103, at 07:59, the ED DEBPG200 failed release due to a ground-station handover delay, it was uplinked manually at 08:06. There was no impact.
- On DoY 104, at 10:10, there were several drops in the TM & TC from DSS-16, probably due to 'hits on the line', there was no impact.

The following new anomaly report was entered into the ARTS system.

| AR id    | Date Created | Subject              | Segment | Status  |
|----------|--------------|----------------------|---------|---------|
| INT-2724 | 13/04/2005   | MMI for IDDA crashed | IMCS    | Pending |

## 7 Future Milestones

Upgrade of the NCTRS (Network Controller and Telemetry Router System) for Integral to release 9.1.4. This will cure some known problems with the current release

and is also compatible with TCP IP communications to ESA Stations as well as X25. The upgrade is currently planned to take place in April.

Upgrade of the IMCS, to use S2K release 3.1, a major update of the MCS is currently undergoing acceptance testing. A date for installation on the operational machines has not yet been decided.

Change of communication protocol to ESA Station from X25 to TCP IP, testing of this change will start in April. It will be used operationally only once testing is complete and the operational machines have been upgraded with the latest versions of the NCTRS and MCS.

## 8 Appendix

The appendix includes various detailed information.

### 8.1 Overview of Revolutions

#### Revolution 304

The observations in revolution 304 consisted of a hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~3.5 hours, followed by a raster dithering observation of GRO J1655-40 (RA 16:54:0.14; DEC -39:50:44.9) lasting ~30.5 hours. A raster dithering observation of the Galactic Center field (RA 17:45:40.00; DEC -29:00:28.0) was then performed for the remaining ~26.5 hours of observation time.

#### Revolution 305

The observations in revolution 305 consisted of a hexagonal dithering observation of GRS 1915+105 (RA 19:15:11.50; DEC +10:56:44.0) lasting ~30.5 hours, followed by a hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~4 hours. A raster dithering observation of the Galactic Center field (RA 17:45:40.00; DEC -29:00:28.0) was then performed for the remaining ~26.5 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2 for which the DFEE was off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

### 8.2 Consumables

#### 8.2.1 Detailed Fuel Book-keeping

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2005-03-24T06:27:42.000Z | 162.2916 | F | Automatic TM processing. |
| 2005-03-25T19:57:14.000Z | 162.2822 | F | Automatic TM processing. |
| 2005-03-27T06:19:26.000Z | 162.2234 | F | Automatic TM processing. |
| 2005-03-28T19:45:23.000Z | 162.2112 | F | Automatic TM processing. |
| 2005-03-30T05:51:50.000Z | 162.1765 | F | Automatic TM processing. |
| 2005-03-31T19:27:14.000Z | 162.1670 | F | Automatic TM processing. |
| 2005-04-01T04:22:03.000Z | 162.1202 | F | Automatic TM processing. |
| 2005-04-03T19:15:22.000Z | 162.1045 | F | Automatic TM processing. |
| 2005-04-05T05:45:34.000Z | 162.0605 | F | Automatic TM processing. |

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2005-04-06T19:05:46.000Z | 162.0495 | F | Automatic TM processing. |
| 2005-04-07T03:56:51.000Z | 162.0269 | F | Automatic TM processing. |
| 2005-04-09T18:55:29.000Z | 162.0095 | F | Automatic TM processing. |
| 2005-04-11T05:15:09.000Z | 161.9784 | F | Automatic TM processing. |
| 2005-04-12T18:43:53.000Z | 161.9711 | F | Automatic TM processing. |
| 2005-04-14T05:01:01.000Z | 161.9445 | F | Automatic TM processing. |

This report was generated Fri Apr 15 08:00:23 GMT 2005

### 8.3 Detailed Satellite Information

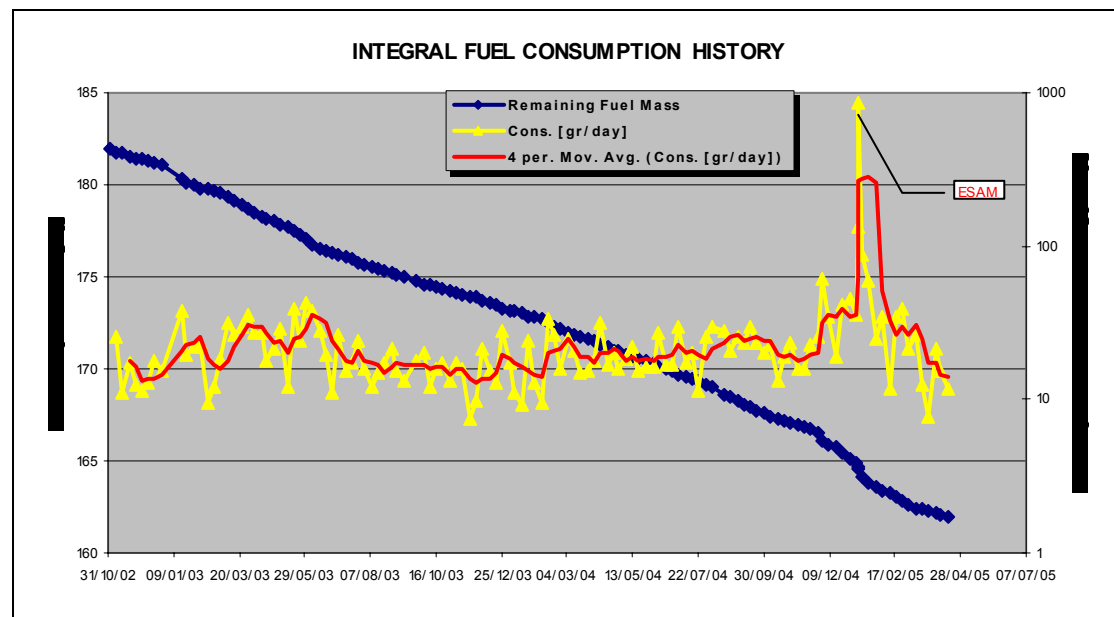
This section contains some detailed information concerning the various subsystems of the satellite and instruments.

#### 8.3.1 AOCS Summary Operations Report 09/04/2005 - 15/04/2005

AOCS operations were executed from the Automatic Timeline.

During this period, 83 Open Loop Slews, 138 Closed Loop Slews and 5 Momentum Bias were executed. 4 slews were missed due to lost of guide star after slew ID 03040089 and following recovery of the AOCS. This is equivalent to a  $\sim 1.7\%$ .

The fuel consumption over the period between 01/11/2002 and 14/04/2005 is reported in the plot below.



#### 09/04/05 (Day of Year 099, Revolution 303-304)

**STR SEU threshold exceeded:** At 17:26:39Z, during the perigee passage, the magnitude 6.28 guide star (ID 5111-01347) at CCD location [10301, 1601] was released when the number of detected False Events on the STR exceeded the STR SEU Filter. As consequence the IMU was switched on at 17:26:39Z. A new automatic mapping was commanded by the ACC and new guide star was picked and tracked by the STR. At 17:36:39Z the IMU automatically switched off. No slews were affected.

### **10/04/05 (Day of Year 100, Revolution 304)**

**TC A1092 rejected due to earlier uplink time:** At 5:17:53Z during the execution of the OEM buffer dump and AOCS daily check activities, the TC (A1092), to reset the stored OEM, was rejected on-board because the uplink time was earlier than planned in the relevant procedure. As consequence, the ACC generated the OEM

APID 640 Class Rejection ID 19 <<ACC DLOAD IN PROG >>

flagging the rejection of the reset command due to the on-going (and not completed) execution of the report all stored OEM command (A1091). As recovery action, the command for the reset of stored OEM was re-sent after the successful and complete report of all stored OEM (at 05:17:59Z). As consequence of the rejection the two TM parameters A5008 (recoverable error) and A5009 (TC errors) reported the value increased by 1 unit. No impacts on the AOCS activities were reported.

### **11/04/05 (Day of Year 101, Revolution 304)**

**Lost of guide star:** after the execution of slew ID 03040089, and during the following mapping, the magnitude 7.1 guide star (ID 7382-01056) at CCD location [30021, -12930] was released. Here follows a short summary of the events:

- 1) the slew ID 03040089 was performed successfully; the Slew End OEM was reported at 22:58:40Z
- 2) the magnitude 7.1 guide star picked at the end of the slew reported CCD coordinates at the edge of the FOV: CCD location [ 30021,-12930]
- 3) the first mapping after the slew started at 22:58:40Z and the DCA\RGAs went to 1\6 --> with consequent OTF REACHED
- 4) during the mapping, at 22:58:43Z, the guide star (ID 7382-01056) Mi 7.1 at CCD location [ 30021,-12930] was lost
- 5) due to the lost of guide star the OTF went to NOT REACHED , as expected.
- 6) the lost of the star caused the failing of the attitude reconstruction process at FDS with consequent no update of the next slew (ID 03040090) generated by FDS
- 7) a new mapping was automatically commanded by ACC at 22:59:33Z and a new valid guide star picked with Mi 8.40 at CCD location [7090, 2460]
- 8) as consequence of the failing of the attitude reconstruction process no update for slew ID 03040090 was generated, being the system based only on the data coming from the first mapping after the slew. The OTF remained NOT REACHED, as expected, until the AOCS recovery. At 23:18Z the AOCS s/s was disabled in TL.

The slews IDs 03040090-91-92-93 were missed. A manual recovery was then performed to the attitude of PID 03040093. The next slew (OSL) for PID 03040094 was manually updated and executed from the Timeline. At 01:14Z the AOCS s/s was re-enabled in TL.

The reason which the guide star ID 7382-01056 was lost is likely due to the peripheral position of the guide star in the STR FOV (Yccd=30021). No extended/ bright objects were present in the FOV: the only noticeable objects were the dark nebula LDN 1752 and the variable star V433 (Mi= 6.3-6.7) located tens of arcmins away.

### 12/04/05 (Day of Year 102, Revolution 304-305)

Nothing to report

### 13/04/05 (Day of Year 103, Revolution 305)

Nothing to report.

### 14/04/05 (Day of Year 104, Revolution 305)

**ACC STR threshold exceeded:** At 13:07:25Z, a detected False Events on the STR exceeded the STR SEU Filter and caused the release of the magnitude 7.2 guide star at CCD location [20120, 18294]. The false event occurred during the execution of the open loop slew ID 03050047, while performing a mapping. A new guide star was automatically picked and no further impacts were reported.

### 15/04/05 (Day of Year 105, Revolution 305-306)

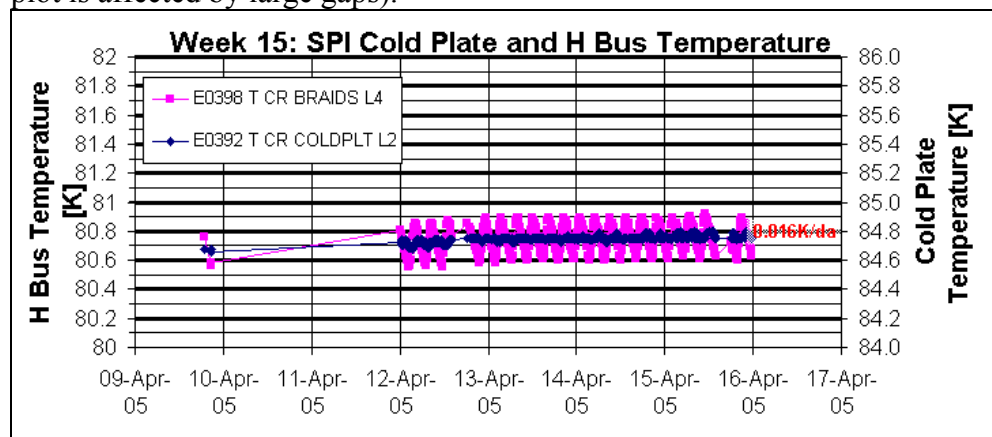
Nothing to report.

## 8.3.2 SPI Operations

### Stirling compressors and Cryostat

The performance of the compressors is nominal. The cold plate temperature was maintained at 85K+/-1K over the reporting period, showing the expected positive drift.

The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period (NOTE: due to problems in the data retrieval system the plot is affected by large gaps).



### DPE & IASW

The IASW performance is nominal. The PST TM bandwidth allocation was 103 pkts/cycle in the science windows; the actual TM bandwidth usage is:

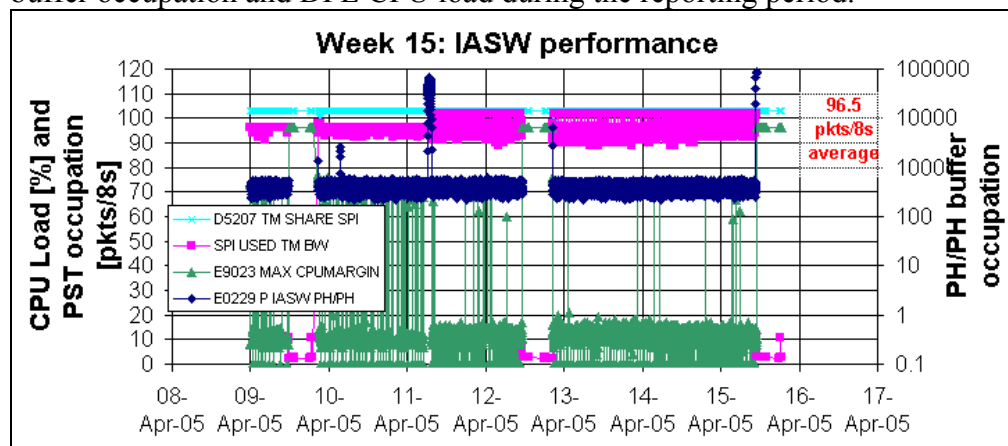
102 pkts/cycle peak (1 pkt/cycle is unused due to TM leakage problem, see after);

96.4 pkts/cycle average in science mode.

The temporary workaround (OR INT\_SC-116) to the TM leakage anomaly (AR INT\_SC-107), applied at every revolution, has been resumed on 11<sup>th</sup> April.

A software patch is in preparation to fix both the TM leakage malfunction and the missed ACS HV switch off at belts entry malfunction (INT\_SC-115).

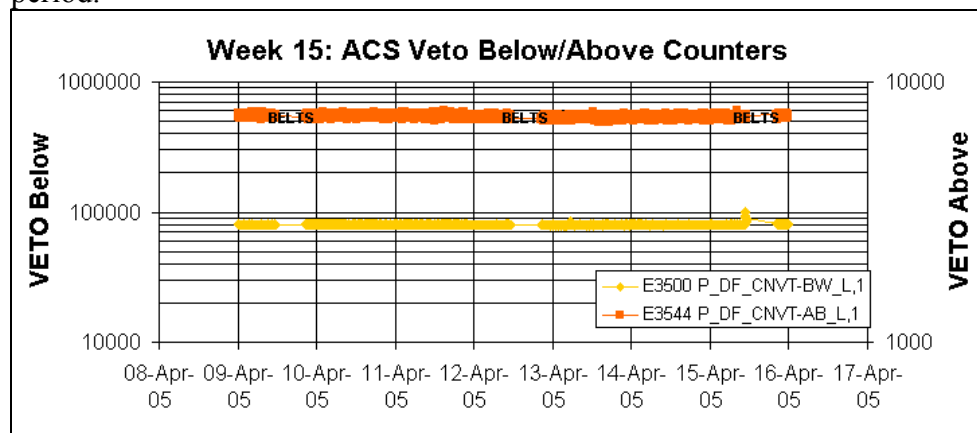
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



### ACS

The performance of the ACS is nominal.

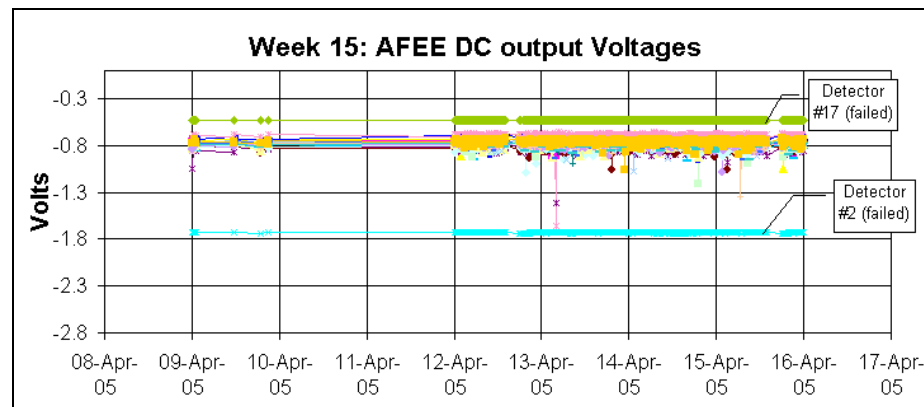
The following plot shows the ACS overall count rate evolution during the reporting period.



### AFEE and Germanium Detectors

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

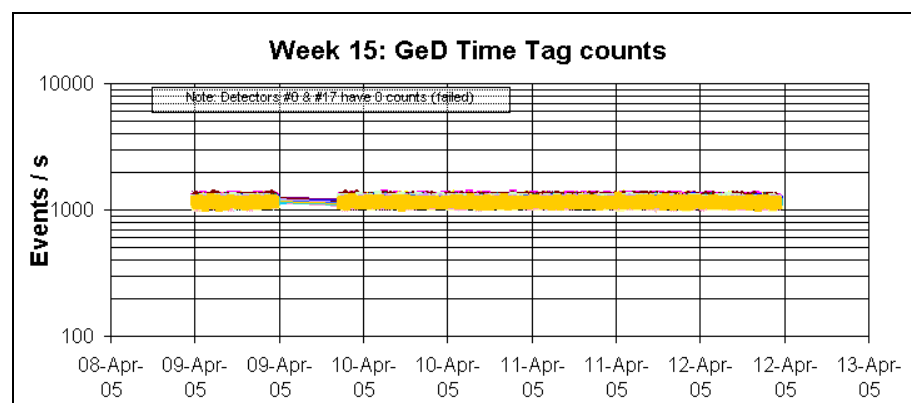
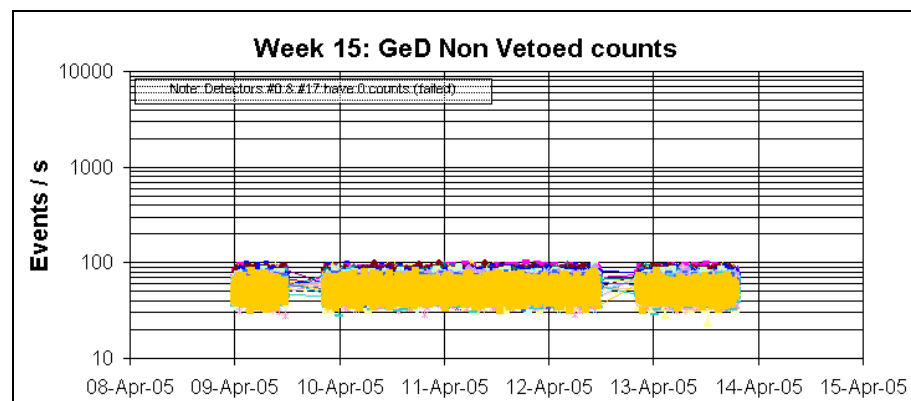
The following plot shows the AFEE dc output signals during the reporting period (NOTE: due to problems in the data retrieval system the plot is affected by large gaps).

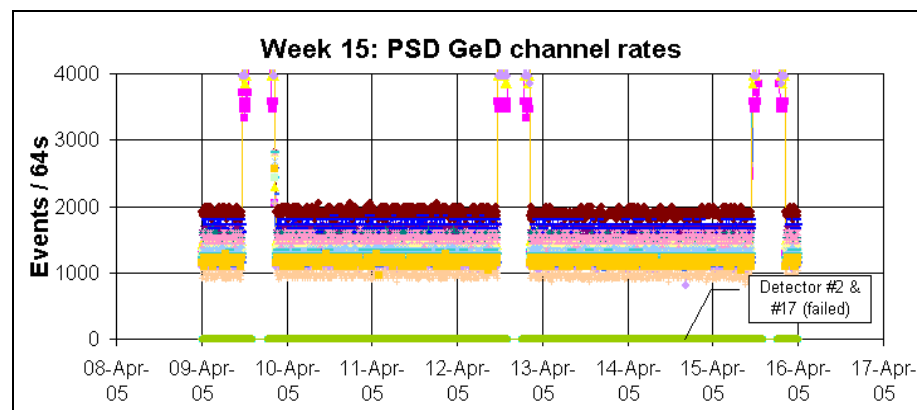
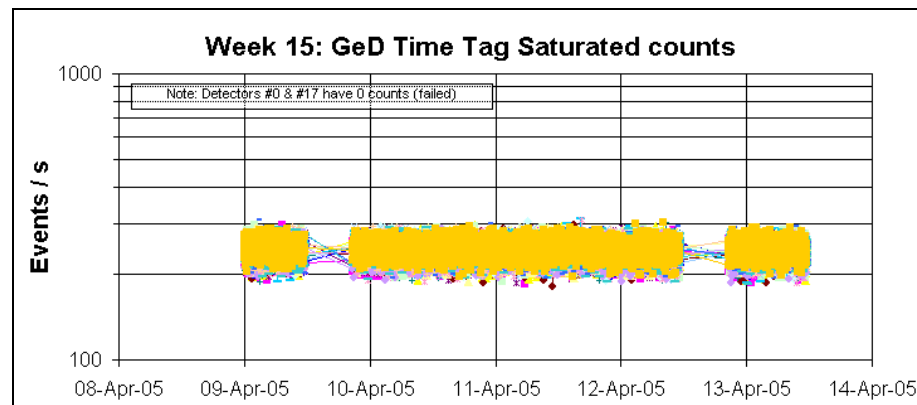


### DFEE

The performance of the unit is nominal.

The following plot shows the Non Vetoed event rates, processed by the DFEE during the reporting period. The count rate of each detector is within the expected range, except for the failed detector #2 and #17. (NOTE: due to problems in the data retrieval system the plot is affected by large gaps).





### PSD

The performance of the unit is nominal.

Following the execution of OCR#191 (PSD input channels #2 and #17 disable), executed at belts entry of rev.290), the channel rates blocking malfunction did not appear again. It was therefore decided to keep this setting.

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

### SPI DAILY EVENTS

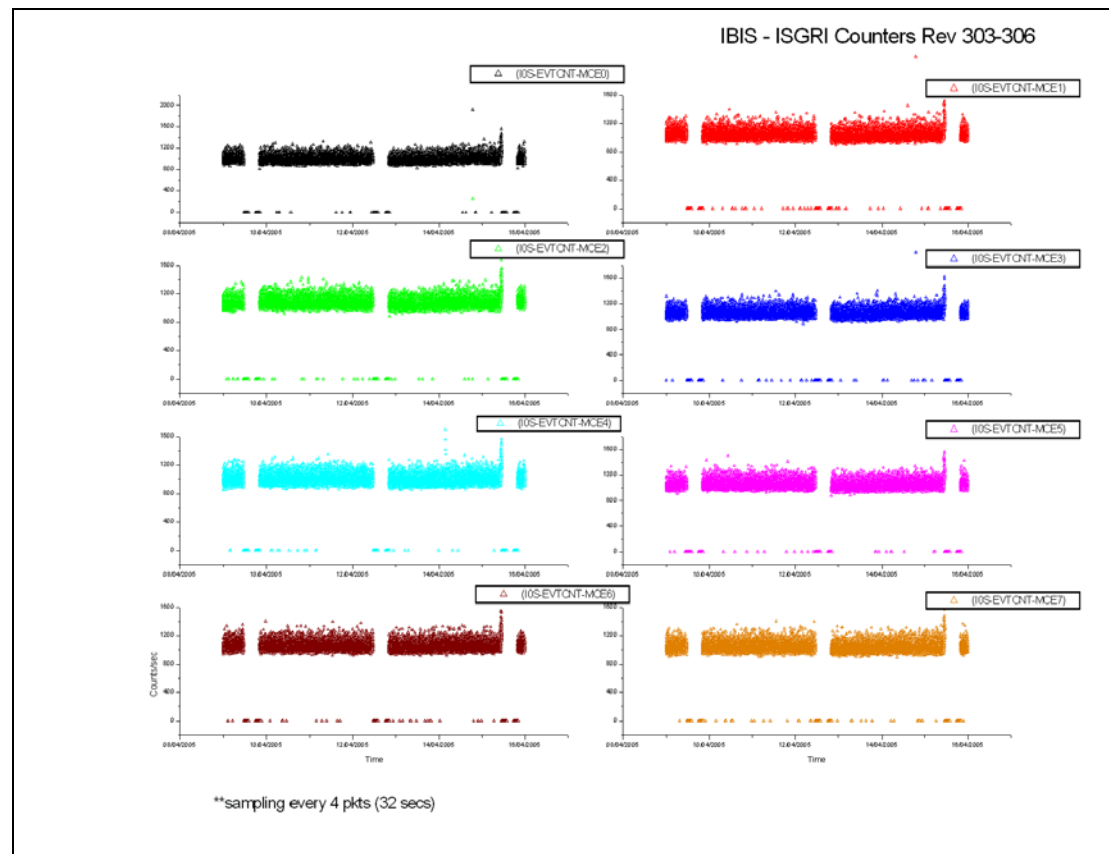
NOTE: The events log is extracted from the revolution pass summary.

| DOY Time              | Event                                                                                                                                                                                  |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 101<br>07:31<br>08:19 | Execution of OR_0190 "Update PST Manually" upon request of SOE because SPI reached TM bandwidth saturation and could not downlink the spectra TM and photon buffer started saturating. |
| 105 - 01:13           | TM E2205 OOL, back in limits @ 01:24                                                                                                                                                   |
| 105 - 10:48           | TM E3500 OOL, back in limits @ 10:49                                                                                                                                                   |
| 105 - 20:36           | Man. PST update, INT OR 0190                                                                                                                                                           |

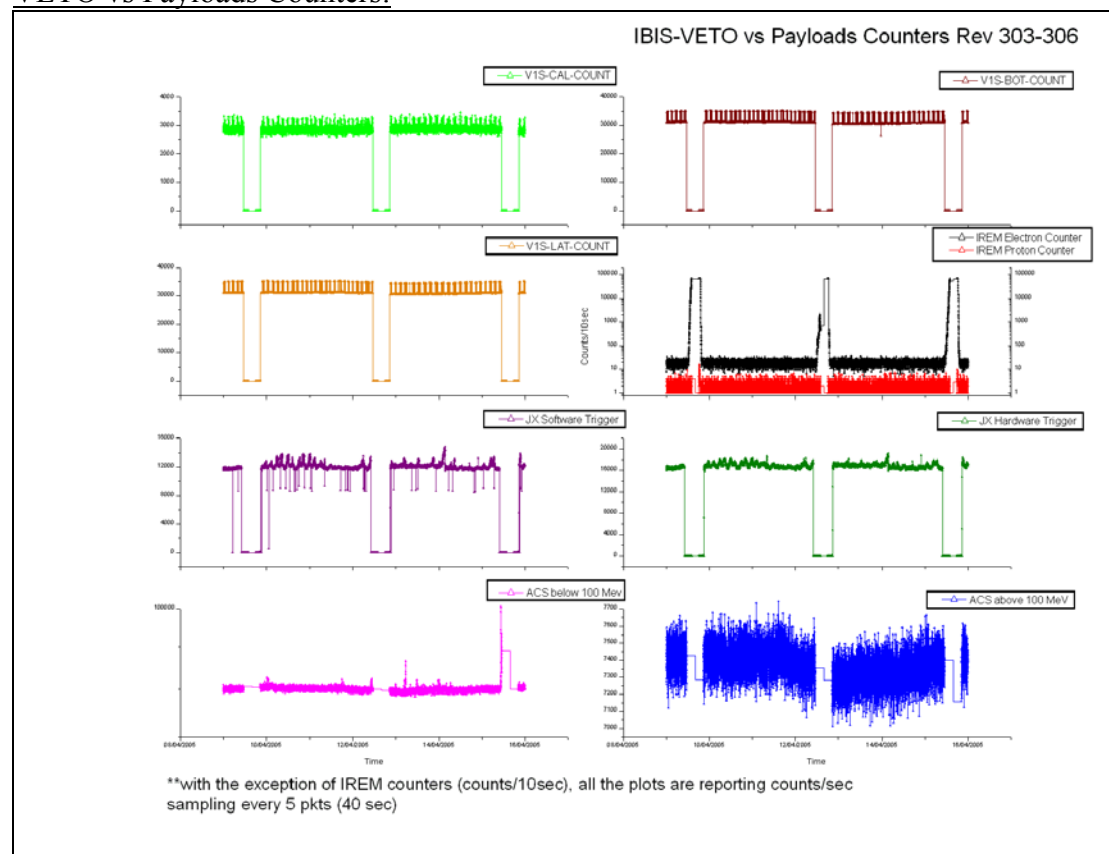
### **8.3.3 IBIS Operations**

#### **IBIS Events Counters Plots.**

ISGRI Counters:

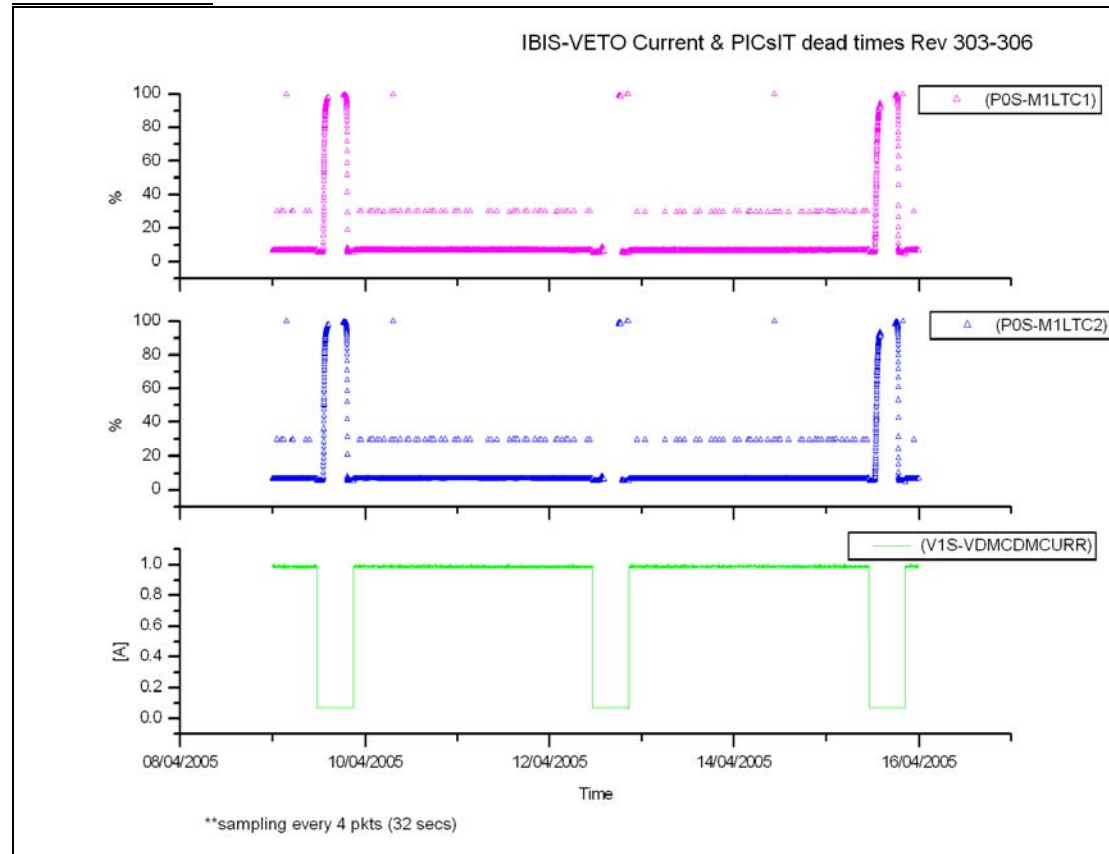


### VETO vs Payloads Counters:

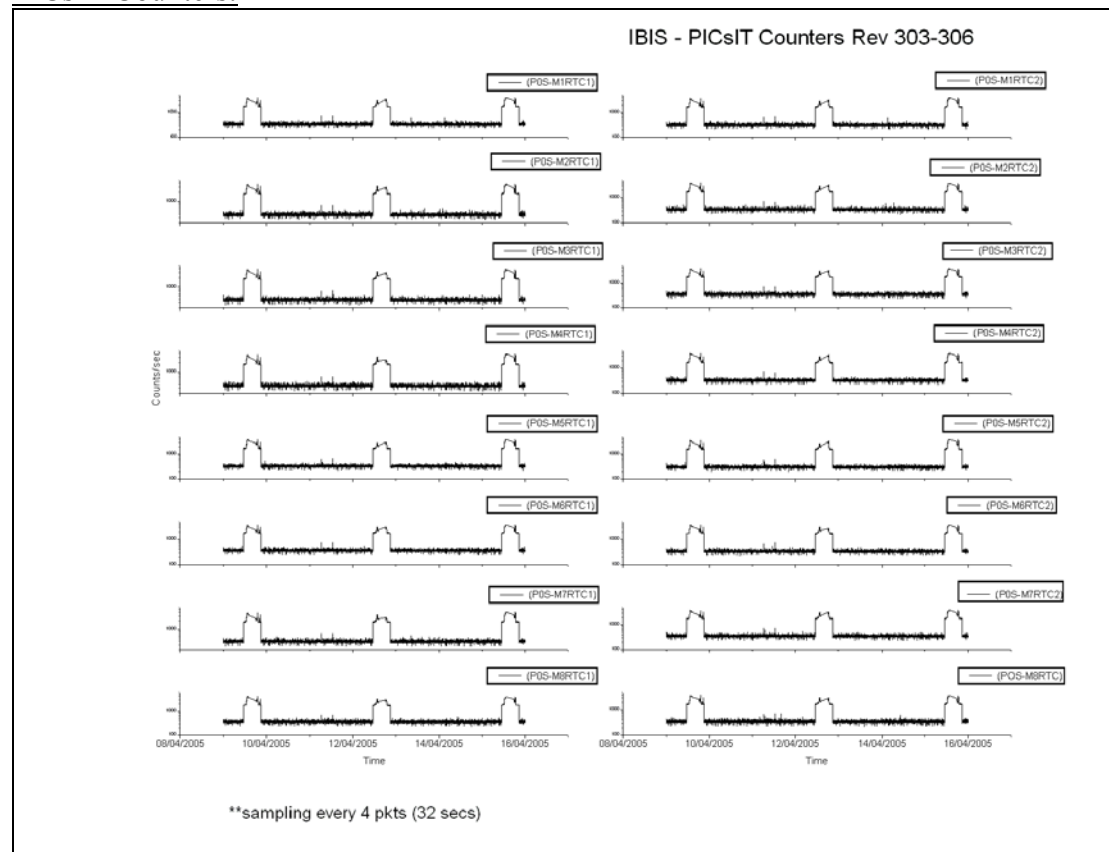


The week was characterised by low solar activity.

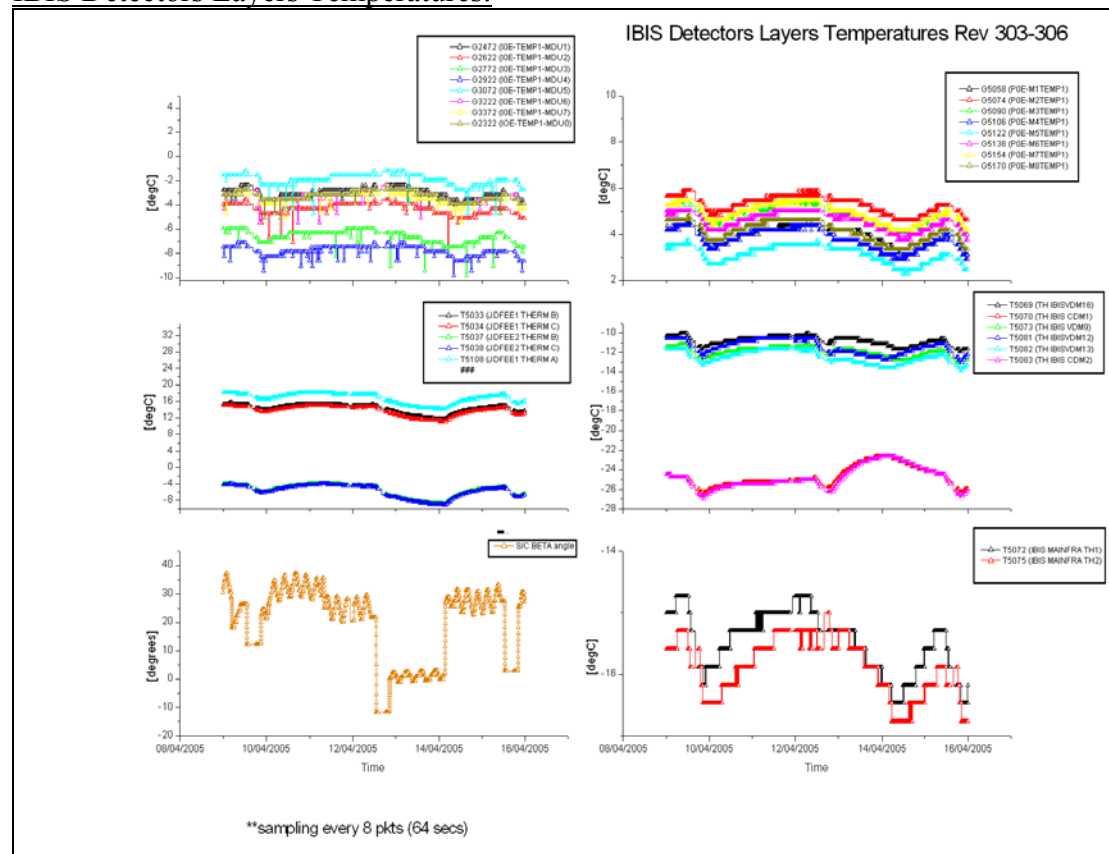
### VETO Current:



### PICsIT Counters:



### IBIS Detectors Layers Temperatures:



### IBIS daily report:

#### DoY 2005.099 (09/04/2005)

At 09:38Z the synthetic TM parameter X7500 took the value “false”, which means that the histograms downloading process stopped. Following INT\_OR\_109, at 09:44Z FCP\_IBIS1\_0312 was applied and all remaining histograms were read. IBIS was then put in Stand-by mode and back to Scientific Standard mode at 09:46Z. X7500 changed back to “true”.

At 11:32Z, TM parameter G8015 (S1E-A2-PMT V) went out of limit 'high' with the value of 29.4V (limit value). It went back inside limit at 20:55Z. As this happened inside radiation belts, according to V-VLT-1 no action was taken.

At 13:30Z TM parameter G5037 (POS-M8RTC1, PDM 8 counter semi module 1) toggled in and out of limit ‘high’ and back. As this happened in radiation belts, according to reaction P-CNT-1, no action was taken.

#### DoY 2005.100 (10/04/2005)

Nothing to report.

#### DoY 2005.101 (11/04/2005)

Nothing to report.

#### **DoY 2005.102 (12/04/2005)**

Nothing to report.

#### **DoY 2005.103 (13/04/2005)**

Nothing to report.

#### **DoY 2005.104 (14/04/2005)**

Nothing to report.

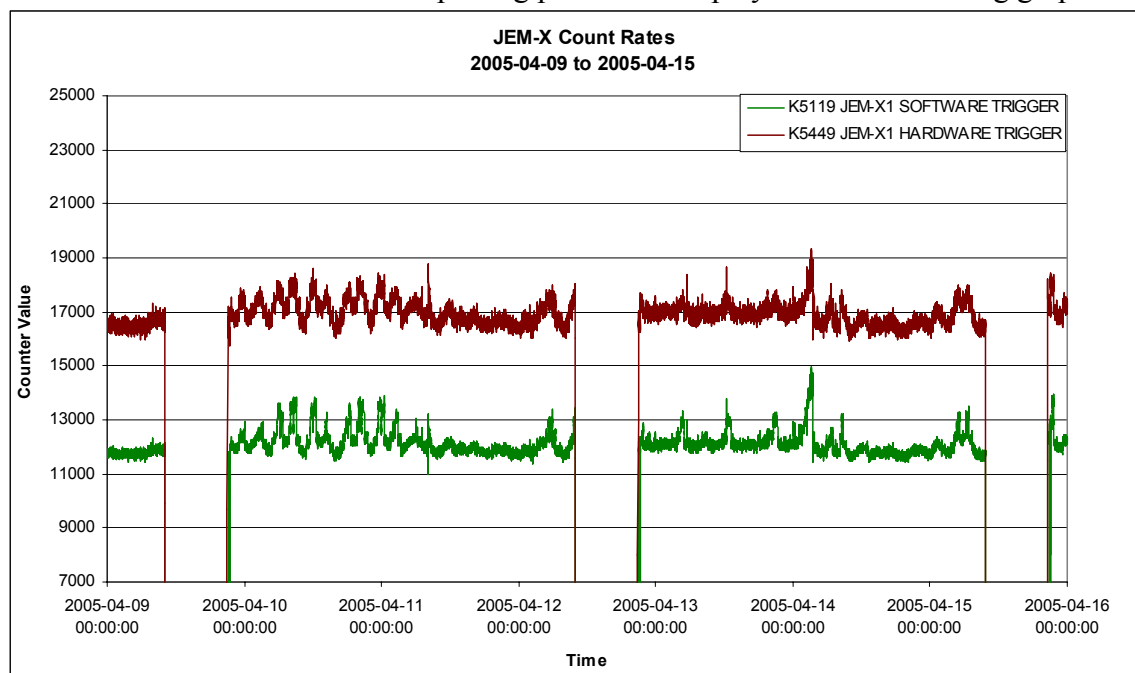
#### **DoY 2005.105 (15/04/2005)**

At 11:05Z, TM parameter G8015 (S1E-A2-PMT V) went out of limit 'high' with the value of 29.4V (limit value). As this happened inside radiation belts, according to V-VLT-1 no action was taken.

### **8.3.4 JEM-X Operations**

#### **8.3.4.1 JEM-X Count Rates**

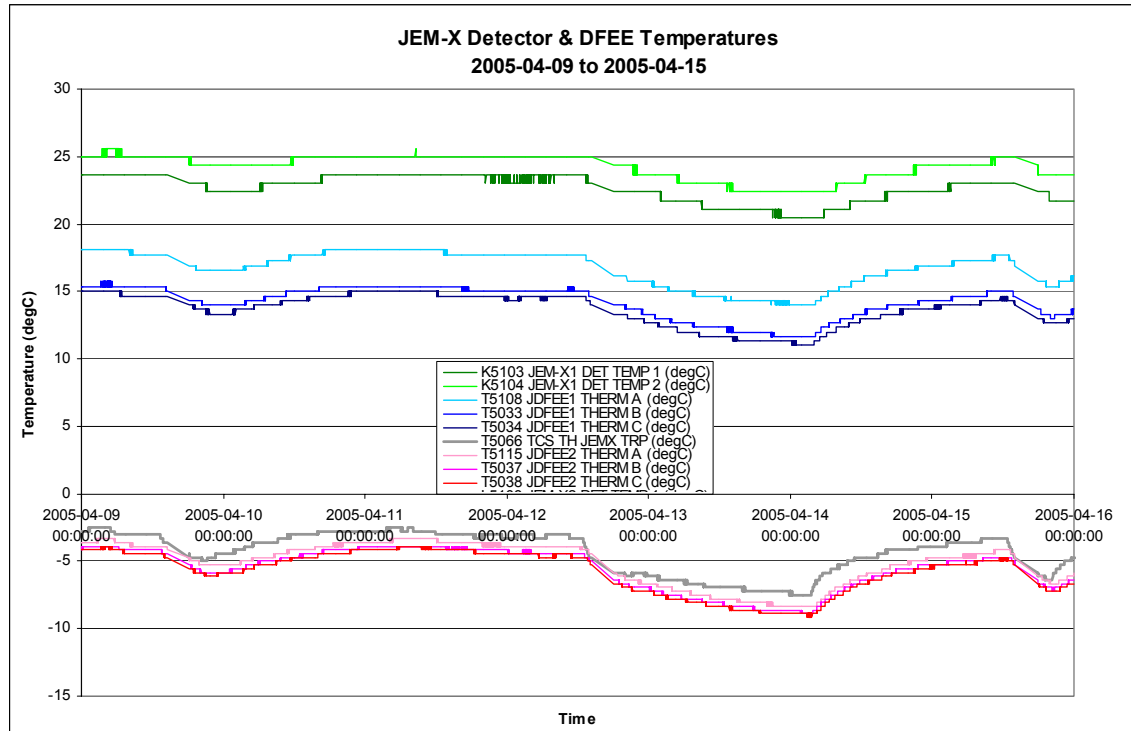
JEM-X count rates over the reporting period are displayed in the following graph<sup>1</sup>.



<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.

### 8.3.4.2 JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph<sup>2</sup>.



### 8.3.4.3 JEM-X Daily Report

**2005-04-09 (DOY 099, Rev 303-304) to 2005-04-15 (DOY 105, Rev 305-306)**

Nothing to report

### 8.3.5 OMC Operations

On DoY 101, at 22:58, AOCS problems caused the Timeline to be suspended. The ongoing pointing (03040089) continued as planned, but subsequent pointings were affected. The impact was the loss of pointings 03040090 to 03040093. It was during this period that the following commands were rejected:

```
2005.102.01.05.13.644 2005.102.01.05.05.553 1792 Real Time Rejection 131
REJECTED TC1
      FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0
M9069=2163
2005.102.01.05.06.062 2005.102.01.04.58.928 1792 Real Time Rejection 131
REJECTED TC1
      FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM M9068=1 FIX2=0
M9069=2162
```

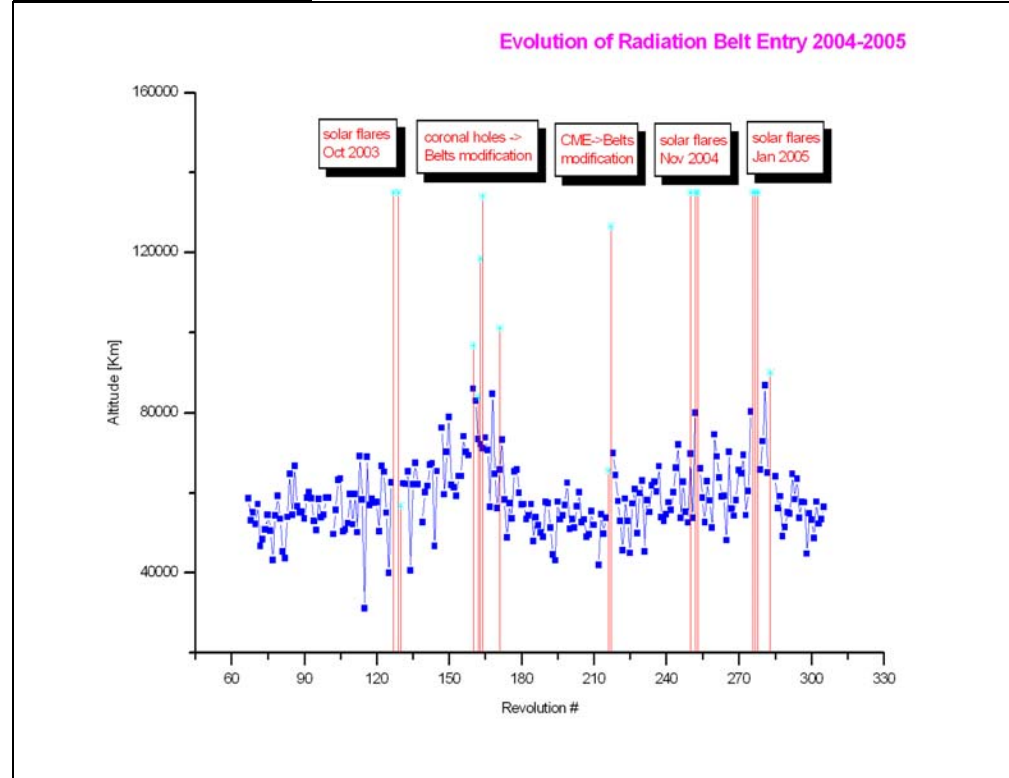
These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 03040093.

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

On DoY 099 at 11:32:15, DoY 102 at 11:19:11 and DoY 105 at 11:05:27, OMC was switched by the Timeline to SAFE mode, at the nominal time.

### 8.3.6 IREM Operations

#### Radiation Belts Entry



#### IREM daily report

Nothing to report.

#### Electron Belts

| REV | S/C BCPKT (electron)            | Electron CUT-OFF Observed Entry/Exit | Observed Entry/Exit Altitude [Km] | Electron CUT-OFF Predicted Entry/Exit | Predicted Entry/Exit Altitude [Km] |
|-----|---------------------------------|--------------------------------------|-----------------------------------|---------------------------------------|------------------------------------|
| 303 | RAD_ENTR R 2005-04-09T11:31:57Z | 2005-04-09 12:33:50                  | 52287.1                           | 2005-04-09 12:24:18                   | 52898                              |
| 304 | RAD_EXIT R 2005-04-09T20:43:11Z | 2005-04-09 19:30:30                  | >>24879.5                         | 2005-04-09 19:34:18                   | 29261                              |
| 304 | RAD_ENTR R 2005-04-12T11:18:48Z | 2005-04-12 12:09:02                  | 53503.0                           | 2005-04-12 12:14:19                   | 52705                              |
| 305 | RAD_EXIT R 2005-04-12T20:30:54Z | 2005-04-12 19:10:14                  | >>24888.2                         | 2005-04-12 19:24:19                   | 29373                              |
| 305 | RAD_ENTR R 2005-04-15T11:05:05Z | 2005-04-15 11:35:50                  | 56491.7                           | 2005-04-15 12:04:19                   | 52559                              |
| 306 | RAD_EXIT R 2005-04-15T20:17:30Z | 2005-04-15 19:02:23                  | >>24893.0                         | 2005-04-15 19:14:19                   | 29512                              |

#### Reference

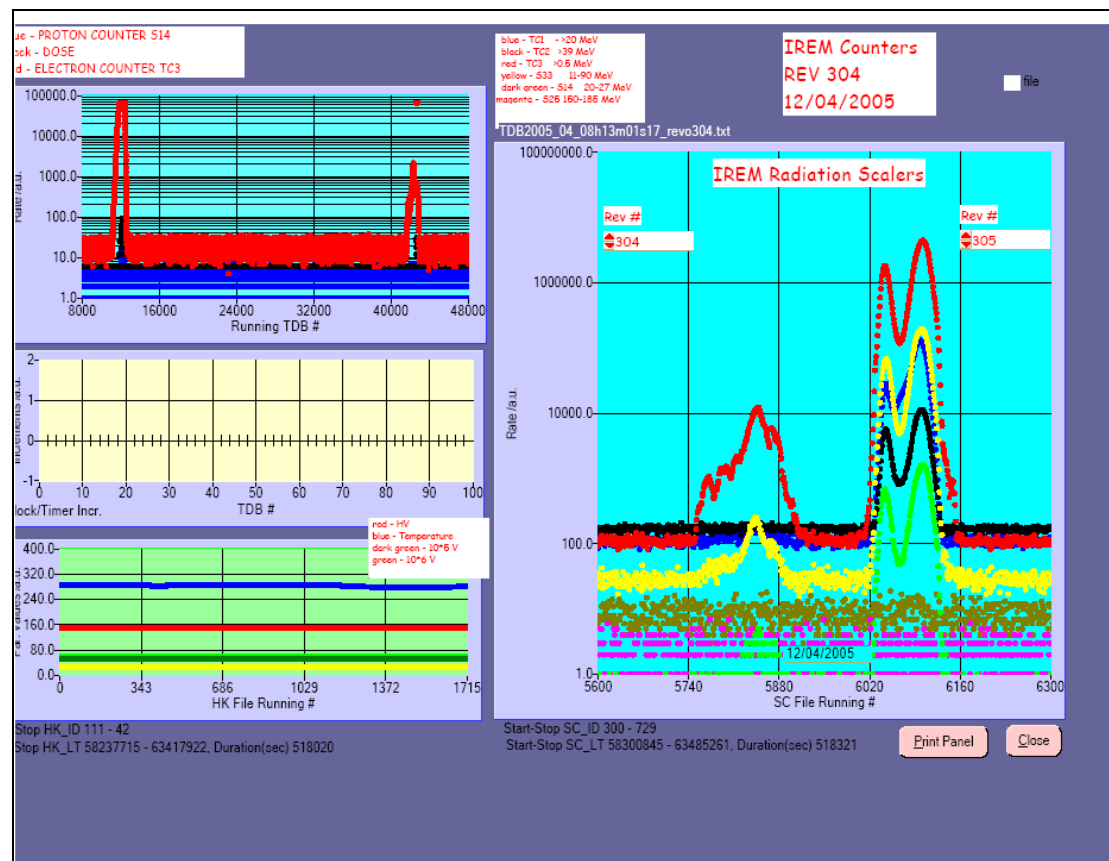
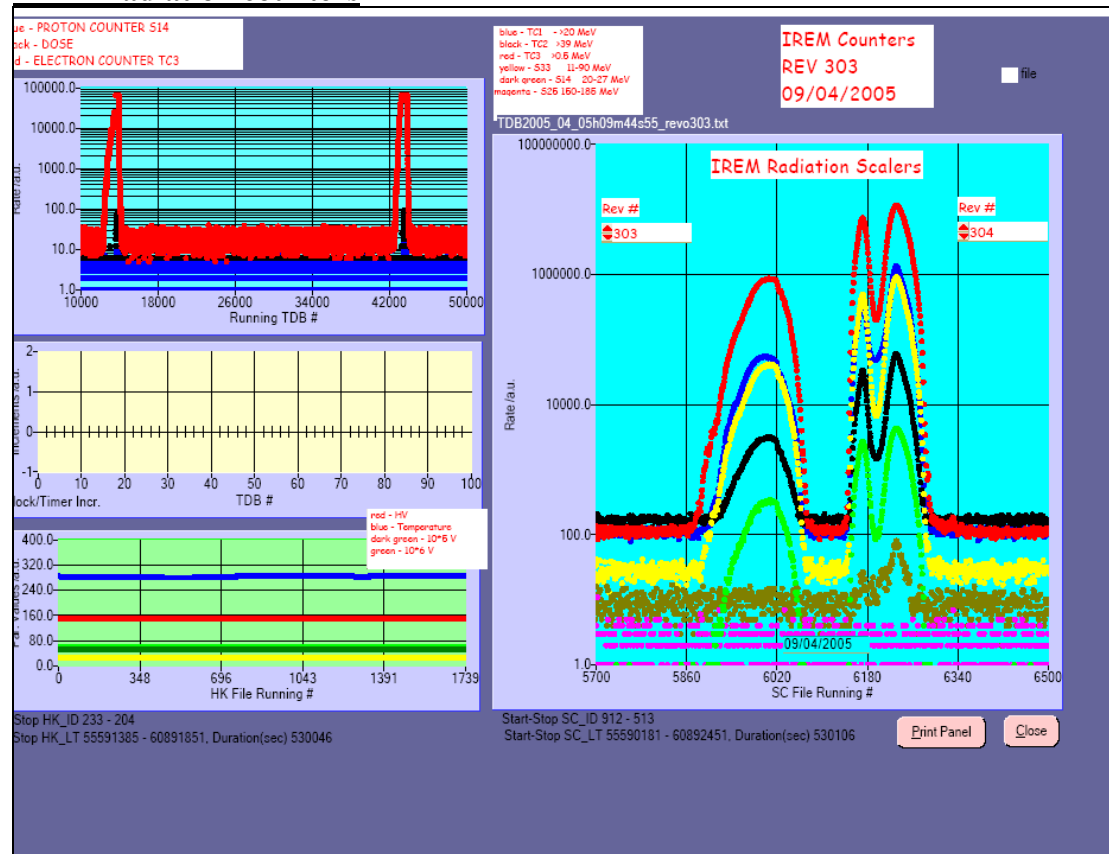
Very small error vs reference (less than 10 minutes)

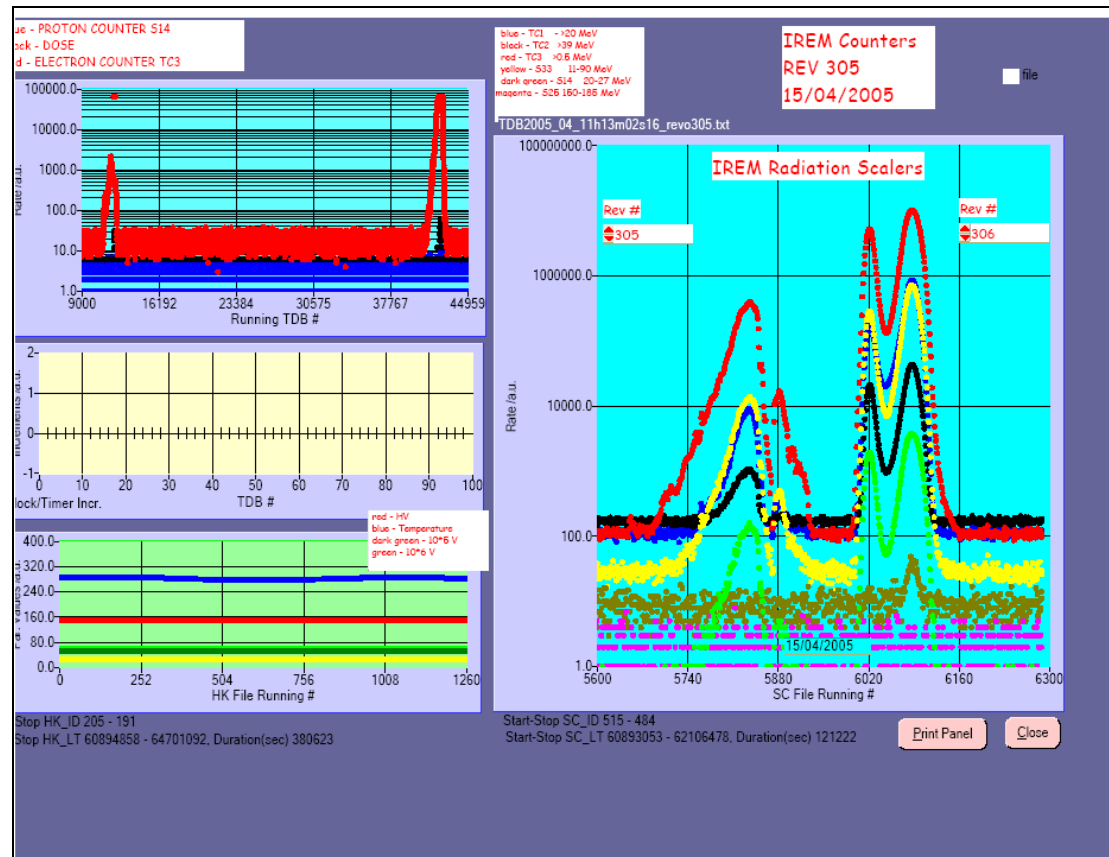
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

#### Radiation Spike

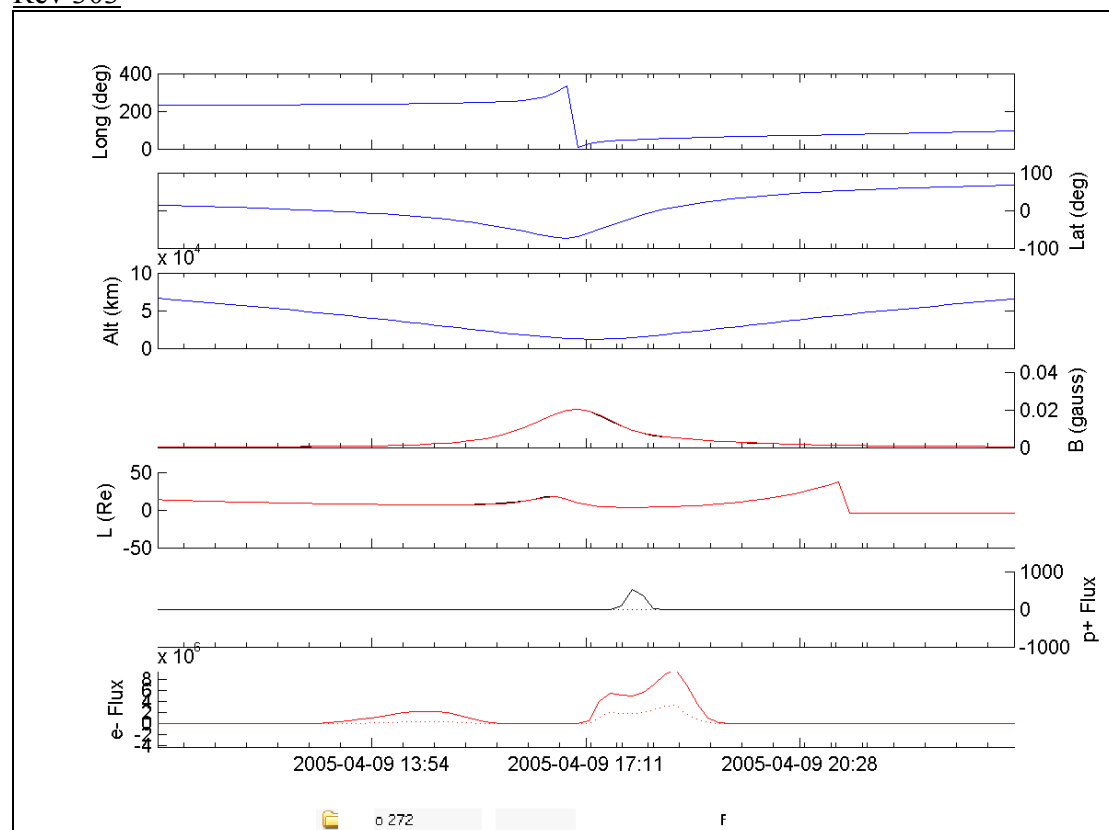
## IREM radiation counters



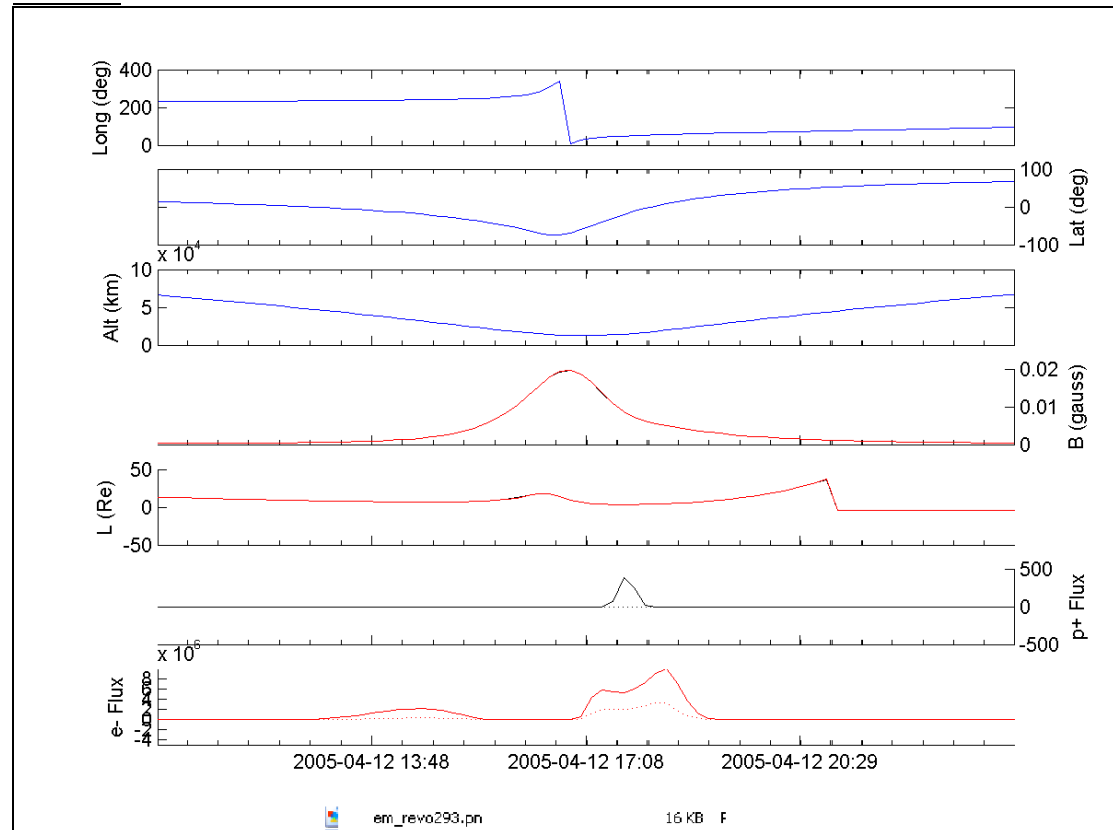


## IREM Predicted Radiation Belt Passages.

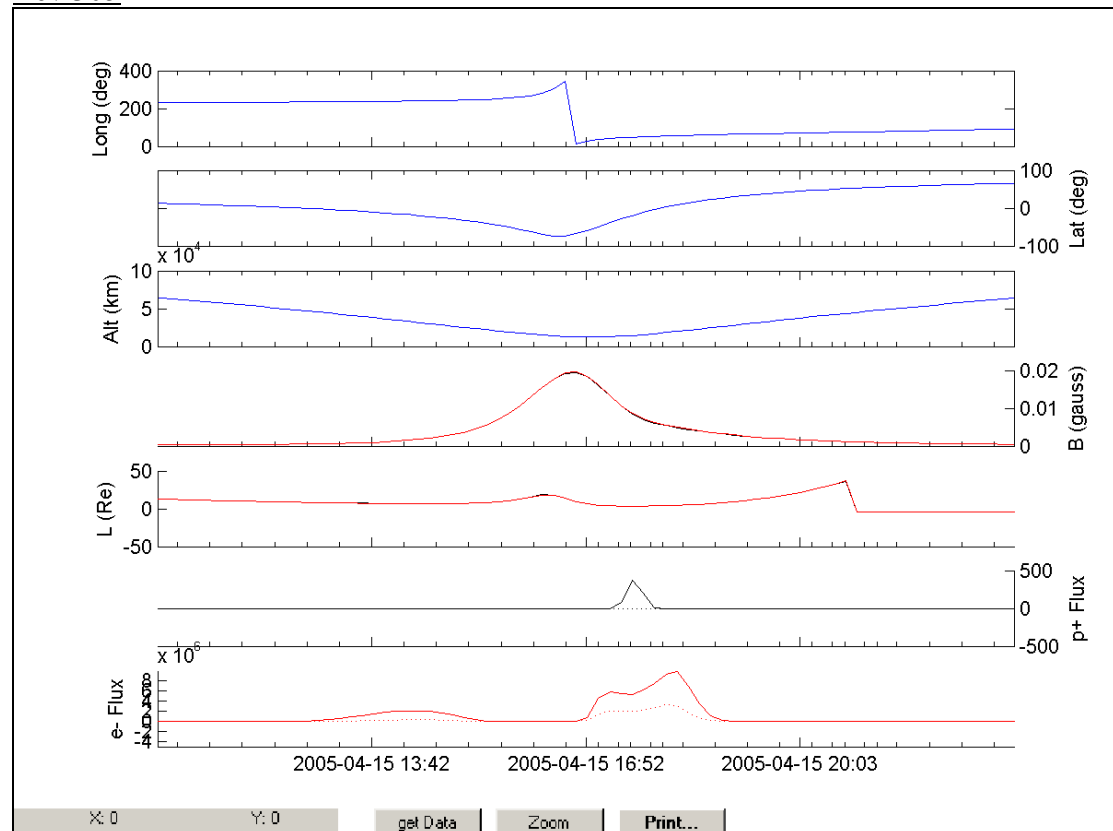
Rev 303



Rev 304



Rev 305



# SEC-GOES Observed Particles Fluxes.

