

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-OPS-OF**  
**No. 150**  
**Week 31**  
**08.08.05**  
**Routine Phase**

Prepared by: M. Walker (OPS-OFO)

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## **1 General**

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

It addresses the activities from 30.07.05 until 05.08.05 (both dates inclusive) and covers the revolutions 342 and 343.

## **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 Her X-1 (RA 16:57:49.83; DEC +35:20:32.6); the XMM LSS field (RA 02:17:60.00; DEC -07:00:00.0); the galactic plane and 3C120 (RA 04:33:11.10; DEC +05:21:15.6). The activities consisted of GPS and raster 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.

3 slews (CSL) were not executed from the Timeline during this period, due to problems with the REDU station (IFMS problems and modulation lost on Downlink).

The fuel consumption over the period between 28/07/2005 and 04/08/2005 was 0.1766 kg. The remaining propellant is in the order of 160.0337 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.

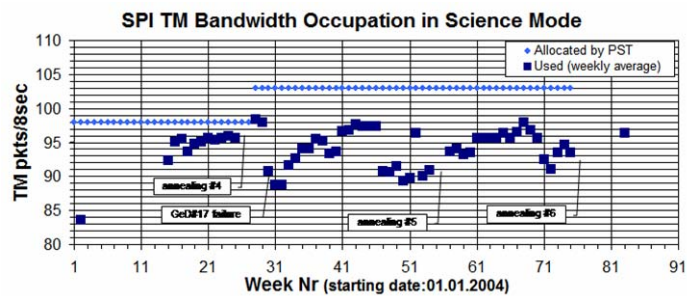
## 3.2 Payload

### 3.2.1 SPI

The overall status of the instrument 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 average occupation of 96.8 pkts/cycle. The Stirling compressors are working well, maintaining the detector cold-plate temperature within 85 $\pm$ 1K.

The following plot shows the TM bandwidth occupation information.



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

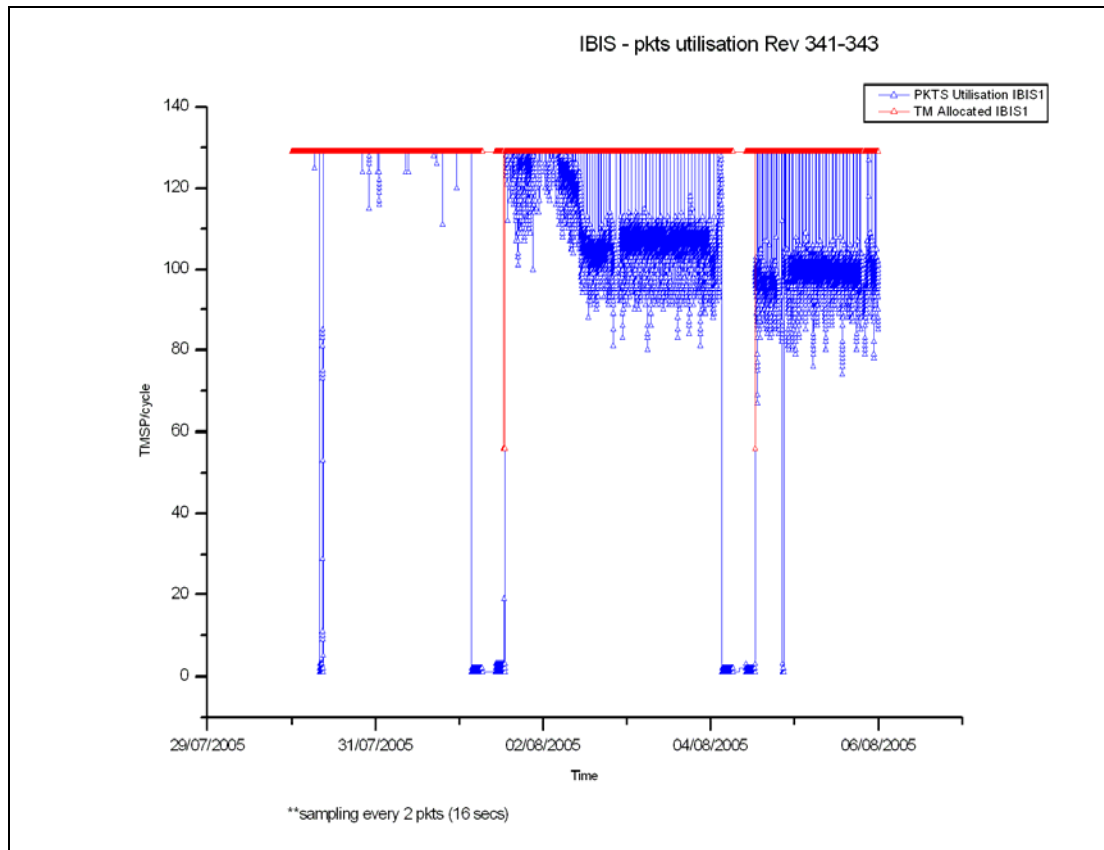
### 3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by moderate 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 115.71 TMPS/cycle, down 3.46 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.

JEM-X1 began the reporting period in Safe mode due to high background radiation conditions (having been commanded to Safe mode on 2005-07-28 at 00:15:57Z, see Mission Report # 149) and remained so until the start of revolution 342 (on 2005-08-01), when it was activated nominally by the automatic Timeline.

On 2005-07-30 at 14:18:23Z, an anomaly occurred on the JEM-X1 DPE, consisting of a reset of the DPE CPU. JEM-X1 was recovered by 20.10Z, following a DPE and DFEE power cycle according to CRP\_JEM1\_5020. The details of this anomaly and recovery actions are reported in Anomaly Report INT\_SC-124.

On 2005-08-04, at the start of revolution 343, a new nominal micro-strip gas gain voltage (dV) for JEM-X1 of 76 RAW was applied, along with the implementation of INTGSCCR-80 (JEM-X HV-switch-on procedure update).

On 2005-08-04, due to an IMCS problem, part of the ED KEDATA02 scheduled at 20:40:44Z was missed and JEM-X1 remained in Setup mode until 21:10:24Z, when it was commanded back to Data Taking mode.

On 2005-08-05 the TM parameter K5136 BUFFER LOSS went Out of Limits High on several occasions.

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

### **3.2.4 OMC**

The status of OMC is nominal.

OMC operations were performed by the automatic Timeline. OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle.

During this reporting period, 126 of the 158 planned science pointings for OMC were executed nominally, 3 were interrupted, 2 were lost to ground problems, and 27 lost to high solar radiation forcing the instrument to SAFE mode.

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

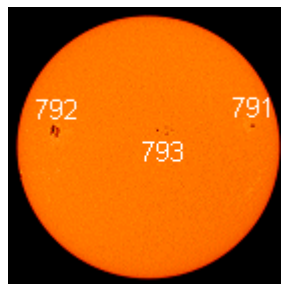
### **3.2.5 IREM**

The overall status of the unit is nominal.

### **Solar Activity**

The observation period was characterised by moderate solar activity.

At the beginning of the observation period, a powerful X-class solar flare erupted from sunspot 792 that was very active while on the far side of the sun last week (see picture from SOHO below). This sunspot remained rather active until the 3<sup>rd</sup> of August and then started to disappear.



*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 performance of the Operational ground facilities very good this week, 165 slews were executed correctly, there was an incident where the communications between Redu and the S/C were interrupted forcing operations to use Vilspa, and some minor incidents where TM & TC links were interrupted.

### **4.1 Mission Operations Centre**

The performance of the MOC was very good this week, there were only minor problems, which did not impact science return.

#### **4.1.1 Upgrade of IMCS.**

The new system is continually being refined, and the number of problems is dropping.

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

The performance of the ground stations and Network was impacted this week by an interference problem at Redu, as well as minor link problems. The overall performance though was nevertheless still above the 95%% requirement.

### **4.3 Science Ground Segment**

#### **4.3.1 ISOC**

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

PSF's have been received up to revolution 350. Planning has been done up to revolution 348.

No ToO has been performed but a ToO on SWIFT SWIFT J1753.5-0127 has been planned for in revolution 345. The ToO conditions will be verified once more on Aug 8. An alternative planning is available.

The coordinated observation with Suzaku (Astro-E2) will not take place in revolution 346, a date is not yet available from the Suzaku team.

Scheduling for revolutions 349ff is pending, waiting for more information, regarding the Suzaku deployment.

The TSF for revolution 343 was received.

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

ECS's received up to revolution 326. No extra time has been credited.

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

SCW data up to 315 has been ingested. Since release in 11/07/2005 the archive has been accessed 101 times and 15 Gbytes of data retrieved.

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

The current version is still 11.0.0, except for a database patch to fix ED parameter settings in the POS.

Version 11.1.0 which will include Hex Pattern COP shift is in preparation.

## 5. Problems

Import of a new IODB (where MOC defaults were expressed in engineering values when they had previously been expressed as raw values) caused problems. A patch to fix this in the short term was applied to the ISOC system (see point 4 above), but this problem should be studied by ISOC to see if a more general solution is necessary.

### 4.3.2 ISDC

Status of ISDC observation processing on 08/08/2005:

- Latest Standard Analysis completed: observation 02201540001 (Coma Cluster, Revolution 315-319) on 26/07/2005
- Latest products archived: observation 02201540001 (Coma Cluster, Revolution 315-319) on 26/07/2005
- Latest observation products sent to the observer: observation 02201540001 (Coma Cluster, Revolution 315-319) on 28/07/2005

## 5 Special Events

## 6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 211, at 08:04, there was an IREM SEU, see section 8.3.6 for details.
- At 14:22 an on-board reset of the JEMX-1 DPE occurred, see section 8.3.4 for details.
- On DoY 213, at 12:55, the AOCS command A3085, RC Sun Steer Ini had an unverified completion status, there was no impact.
- At 14:44, the bad frame link with Redu dropped.
- At 15:17, Reed-Solomon alarms were observed from Redu, and the TM link dropped, 6388 bad frames were received at this time. At 15:27, the AOCS sub-system was disabled. At 15:58, a manual CSL was performed to go to Slew ID 03420006. At 16:22, the operations were moved to VIL2. The impact was the interruption of pointing 03420004, and the loss of pointing 03420005.
- At 18:49, after switching back to Redu, another AOCS command failed release due to no TM. The links were switched to VIL2, and the commands sent. There was no impact.
- On DoY 214, at 01:42, there was a brief drop in VC0 & VC7 TM from VIL2, this was caused when the antenna was switched from Auto-track to Program-track, there was no impact.
- At 09:37, the Event log message: CPDisTM, idda, Warning, System, FIFO Buffer full, loosing 999 packets appeared, and continued to come up every 4 minutes. There was no apparent impact.
- At from 20:54 to 20:58, there was a brief drop in the VC0 & VC7 TM from Redu. Network reported a hit on the line. There was no impact.

- On DoY 215, from 08:20 to 08:21, there was a brief drop in the TM from Redu, caused by the on-going playback. There was no impact.
- At 10:58, in the event log, the messages: TPKT, imca, ERROR, SYSTEM, No TM flow on connection VC-0/ONT (1/inetra), followed by: TM flow on connection VC-0/ONT (1/inetra) was seen. There was no apparent impact.
- On DoY 216, at 20:41, the connection to the TM RT cache was lost, and the Command Verifier died. This was manually restarted, and the EDs: GESTAN02, imaging commands, KEDATA02 and DEBPG200 manually uplinked, there was no loss of scientific data.
- On DoY 217, from 01:04 to 01:08, the TM & TC links with Redu dropped. There was no impact.
- At 19:37 and 19:38 respectively, the TM & TC links with Redu dropped. At 20:04, the connection with the S/C was restored using VIL2. The impact was the loss of pointing 03430036.

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

| AR id      | Date Created | Subject                                                               | Segment      | Status  |
|------------|--------------|-----------------------------------------------------------------------|--------------|---------|
| INT_SC-123 | 30/07/2005   | IREM Anomaly: reset of IREM_CSCI S/W #25, 30/07/2005                  | Payload      | Pending |
| INT_SC-124 | 01/08/2005   | JEM-X1 DPE Anomaly 2005-07-30                                         | Payload      | Pending |
| INT-2773   | 01/08/2005   | OBSM FARC not working.                                                | IMCS         | Pending |
| INT-2774   | 02/08/2005   | IFMS problems in REDU                                                 | ESA Stations | Pending |
| INT-2775   | 02/08/2005   | Disk Space problem on MCS machines                                    | IMCS         | Pending |
| INT-2776   | 02/08/2005   | Problem with ED parameter value flags in ICP (Raw vs Engineering)     | ISOC         | Open    |
| INT-2777   | 05/08/2005   | Divergence in measured wheel speeds wrt the predicted values for RW#4 | FDS          | Open    |

## 7 Future Milestones

Change of communication protocol to ESA Station from X25 to TCP IP: The testing has been performed. The release is not yet operational because an upgrade of the communications set-up is required.

## 8 Appendix

The appendix includes various detailed information.

### 8.1 Overview of Revolutions

#### Revolution 342

The observations in revolution 342 consisted of a raster dithering observation of Her X-1 (RA 16:57:49.83; DEC +35:20:32.6) lasting ~31 hours, followed by a raster dithering observation of the XMM LSS field (RA 02:17:60.00; DEC -07:00:00.0), performed for the remaining ~28.5 hours of observation time.

#### Revolution 343

The observations in revolution 343 consisted of 10 pointings of a GPS lasting ~6.5 hours, followed by a raster dithering observation of 3C120 (RA 04:33:11.10; DEC +05:21:15.6), performed for the remaining ~53.5 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2 for which the DFEE remained 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

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2005-07-17T12:48:22.000Z | 160.3747 | F | Automatic TM processing. |
| 2005-07-18T22:32:41.000Z | 160.3512 | F | Automatic TM processing. |
| 2005-07-20T11:50:21.000Z | 160.3440 | F | Automatic TM processing. |
| 2005-07-20T19:22:54.000Z | 160.3046 | F | Automatic TM processing. |
| 2005-07-23T11:39:34.000Z | 160.2919 | F | Automatic TM processing. |
| 2005-07-24T21:42:17.000Z | 160.2683 | F | Automatic TM processing. |
| 2005-07-27T22:17:05.000Z | 160.2299 | F | Automatic TM processing. |
| 2005-07-28T05:01:46.000Z | 160.2103 | F | Automatic TM processing. |
| 2005-07-29T11:18:13.000Z | 160.2065 | F | Automatic TM processing. |
| 2005-07-30T18:51:08.000Z | 160.1577 | F | Automatic TM processing. |
| 2005-08-01T11:06:44.000Z | 160.1440 | F | Automatic TM processing. |
| 2005-08-02T21:08:40.000Z | 160.1245 | F | Automatic TM processing. |
| 2005-08-04T04:20:11.000Z | 160.0694 | F | Automatic TM processing. |
| 2005-08-04T10:48:52.000Z | 160.0634 | F | Automatic TM processing. |
| 2005-08-04T19:44:05.000Z | 160.0337 | F | Automatic TM processing. |

This report was generated Fri Aug 5 08:00:42 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, 30/07/2005 – 05/08/2005

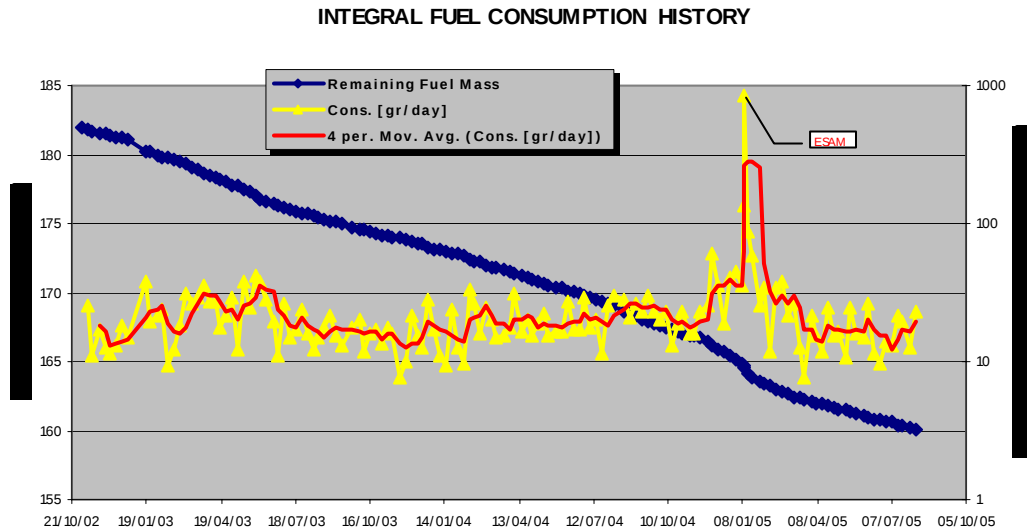
AOCs operations were executed from the Automatic Timeline.

During this period, 67 Open Loop Slews, 98 Closed Loop Slews and 6 Momentum Bias were executed (TL + manual recovery). 3 slews (CSL) were not executed from

the Timeline during this period, due to problems with the REDU station (modulation lost on Downlink and IFMS problem).

This is equivalent to a  $\sim 1.8\%$  of the total number of slews planned (166).

The fuel consumption over the period between 01/11/2002 and 04/08/2005 is reported in the plot below.



### 30/07/05 (Day of Year 211, Revolution 341)

Nothing to report.

### 31/07/05 (Day of Year 212, Revolution 341)

Nothing to report.

### 01/08/05 (Day of Year 213, Revolution 341-342)

**RMU calibration failed:** Due to problem on FDS to access the system HK1 packet history file, the planned RMU calibration failed the automatic generation of the TPF at 01:33z. After action by FD on-call the problem was fixed (after 4 attempts) and the RMU calibration TPF manually generated.

**Slews missed from the Timeline:** Due to a problem on REDU station (reported Reed Solomon alarm, bad frames counter reached 6500 units and large fluctuations in AGC were observed) the slew ID 03420005 (CSL) was missed and the AOCS s/s was disabled in TL at 15:27z. A first manual recovery (CSL) was successfully performed to the attitude of PID 03420006. In order to continue the scheduled activities and perform in parallel an investigation on REDU problem, was requested the support of VILSPA2 station at 16:22z. The next slew (CSL) for PID 03420007 was manually updated and executed from the TL. At 17:41z the links were moved back to REDU but a problem with IFMS prevented Timeline commanding activities. At 18:54z the links were moved back to VILSPA2 and the slew ID 03420010 (CSL) manually updated and executed from TL.

The AOCS s/s was finally re-enabled in TL at 19:04z.

The following slews were not executed from TL while recovering the AOCS s/s: 03420005(CSL)-06 (CSL).

#### **02/08/05 (Day of Year 214, Revolution 342)**

Nothing to report.

#### **03/08/05 (Day of Year 215, Revolution 342)**

Nothing to report.

#### **04/08/05 (Day of Year 216, Revolution 342-343)**

Nothing to report.

#### **05/08/05 (Day of Year 217, Revolution 343)**

**Slew missed from the Timeline:** Due to a problem on REDU station (modulation lost on Downlink) the slew ID 03430036 (CSL) was missed and the AOCS s/s disabled in TL at 19:38z. In order to continue the scheduled activities and perform in parallel an investigation on REDU problem (REDU CDSs did not work and on-call engineer called out), was requested the support of VILSPA2 station at 20:04z. A manual recovery (CSL) was successfully performed to the attitude of PID 03430036. The next slew (CSL) for PID 03430037 was manually updated and executed from the TL.

The AOCS s/s was re-enabled in TL at 20:58z. The support of VILSPA2 station continued until 03:36z of the following day (06/08/2005)

The following slew was not executed from TL while recovering the AOCS s/s: 03430036(CSL).

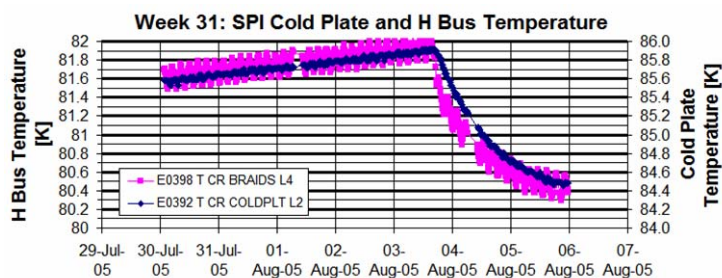
### **8.3.2 SPI Operations**

#### Stirling compressors and Cryostat:

The performance of the compressors is nominal. The cold plate temperature was maintained at 85K $\pm$ 1K showing the usual positive drift with the expected slope.

To correct for the accumulated effects of the drift during the past weeks, the stroke was increased by 1 LSB on the four compressors on DOY 215 (3<sup>rd</sup> August) at 17:14z to 4x37dec raw.

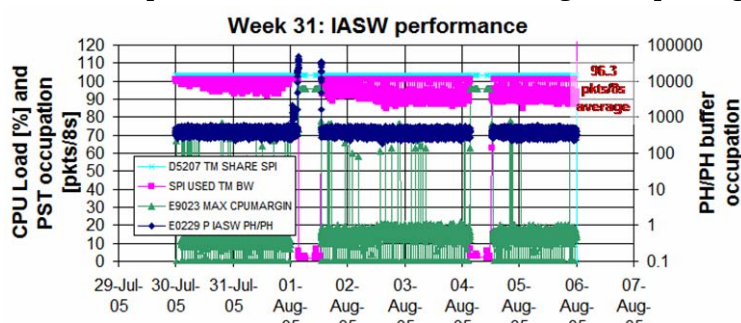
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



#### DPE & IASW:

The IASW performance is nominal.

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



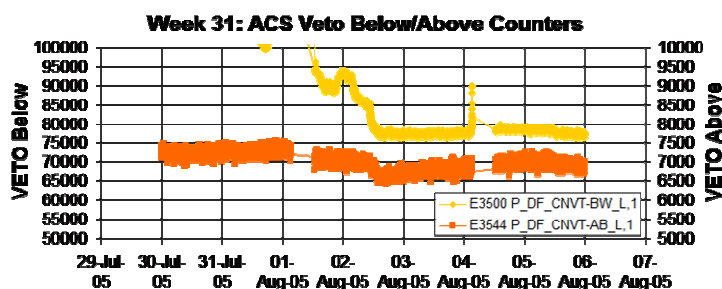
#### ACS:

The performance of the ACS is nominal.

The temperature sensor in the PSAC E2116, exceeding its higher operational limit since 24<sup>th</sup> May (after an ACS post-eclipse reactivation) has been declared faulty and removed from the ground monitoring list.

The first part of the week has been dominated by atypical radiation conditions, still however within the SPI operational range.

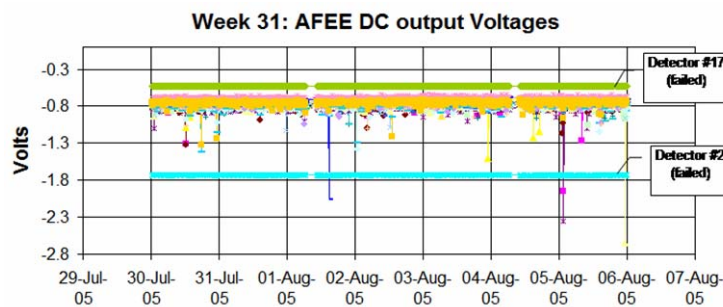
The following plot shows the ACS overall count rate evolution during the reporting period.



#### AFEE and Germanium Detectors:

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

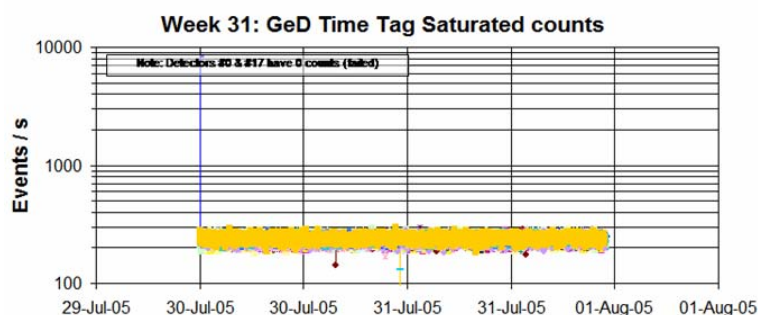
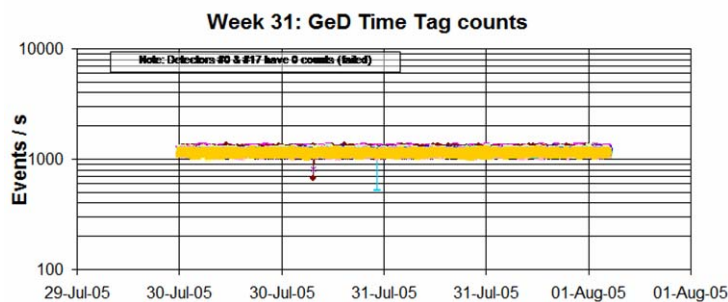
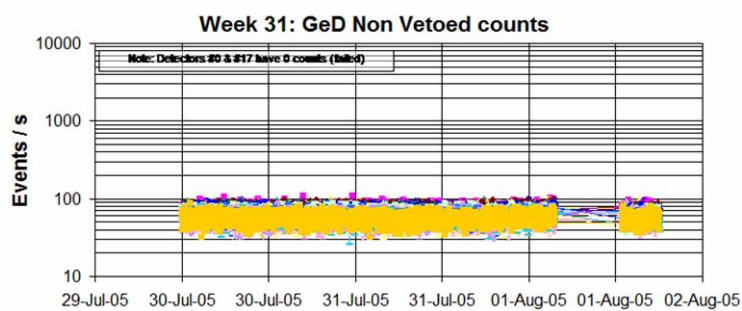
The following plot shows the dc voltage offset of the detector channels during the reporting period.



#### DFEE:

The performance of the unit is nominal.

The following plots show the count rates of the detectors during the reporting period.



#### PSD:

The performance of the unit is nominal.

#### SPI DAILY EVENTS

NOTE: This event log was extracted from the revolution pass summary reports of rev.339, 340 and 341.

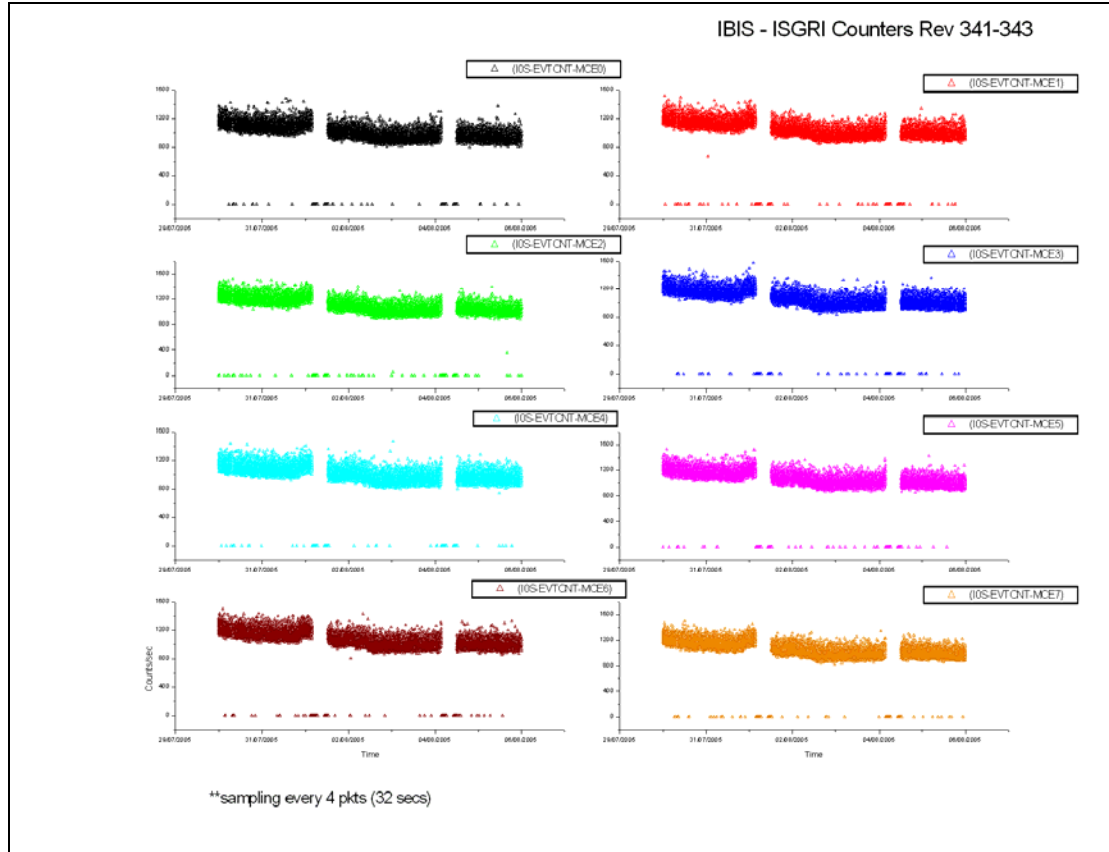
| DOY Time    | Event                                |
|-------------|--------------------------------------|
| 214 - 02:21 | TM E2365 OOL, back in limits @ 02:33 |
| 215 - 15:32 | TM E0392 OOL, back in limits @ 16:28 |
| 215 - 16:26 | TM E0392 OOL, back in limits @ 16:47 |
| 215 - 16:58 | TM E0392 OOL                         |

|             |                                      |
|-------------|--------------------------------------|
| 217 - 23:22 | TM E0360 OOL, back in limits @ 23:32 |
| 219 - 03:01 | TM E3500 OOL, back in limits @ 03:04 |

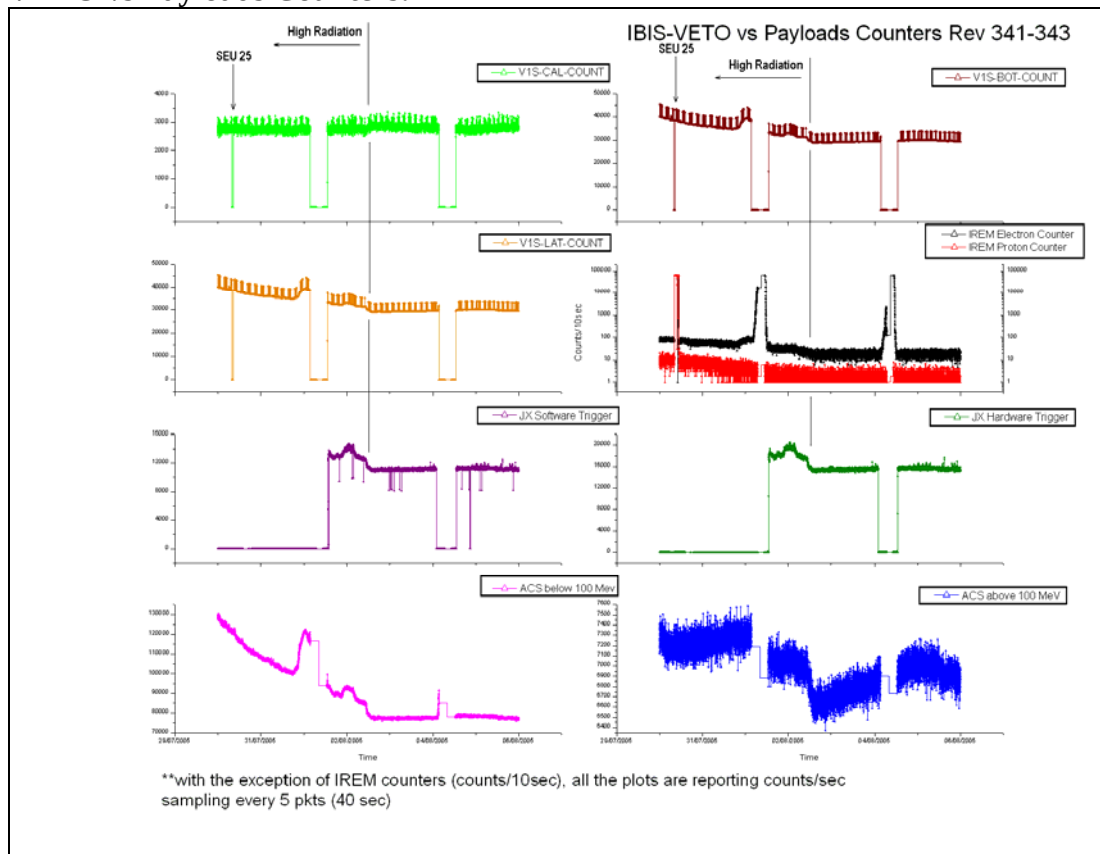
### 8.3.3 IBIS Operations

#### IBIS Event Counters Plots.

##### ISGRI Counters:

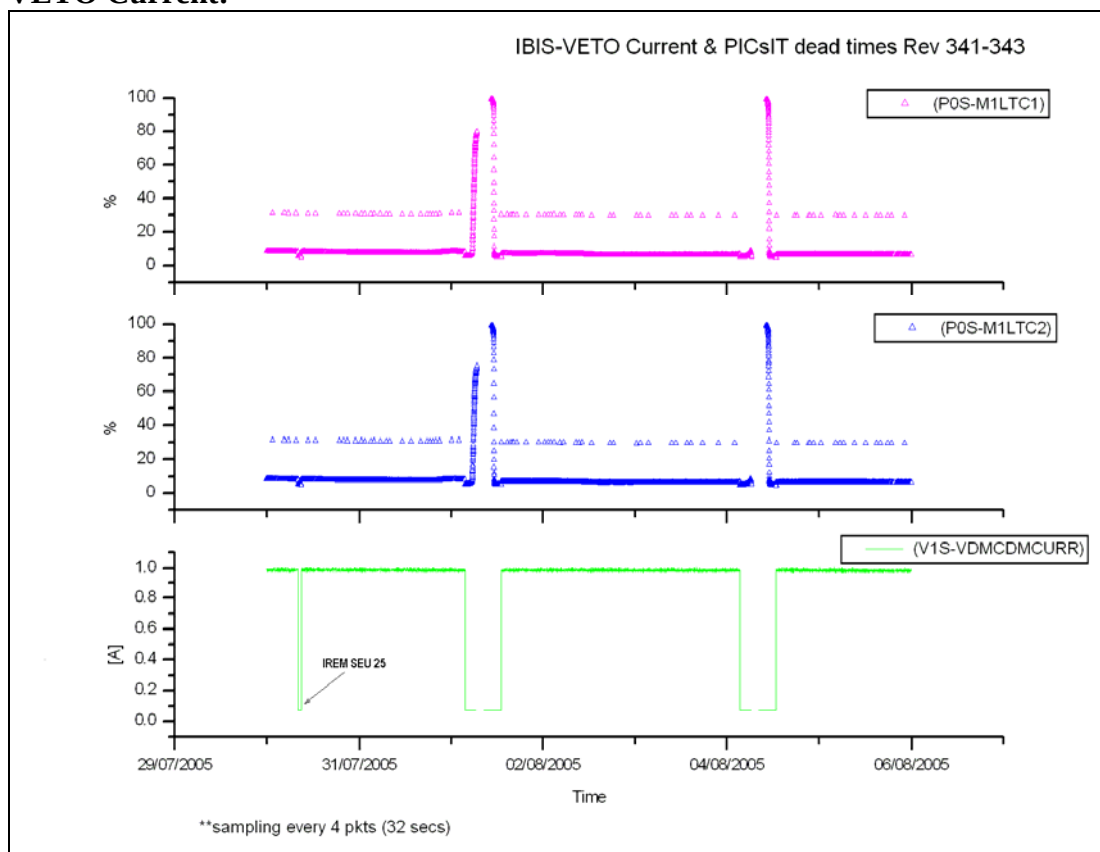


## VETO vs Payloads Counters:

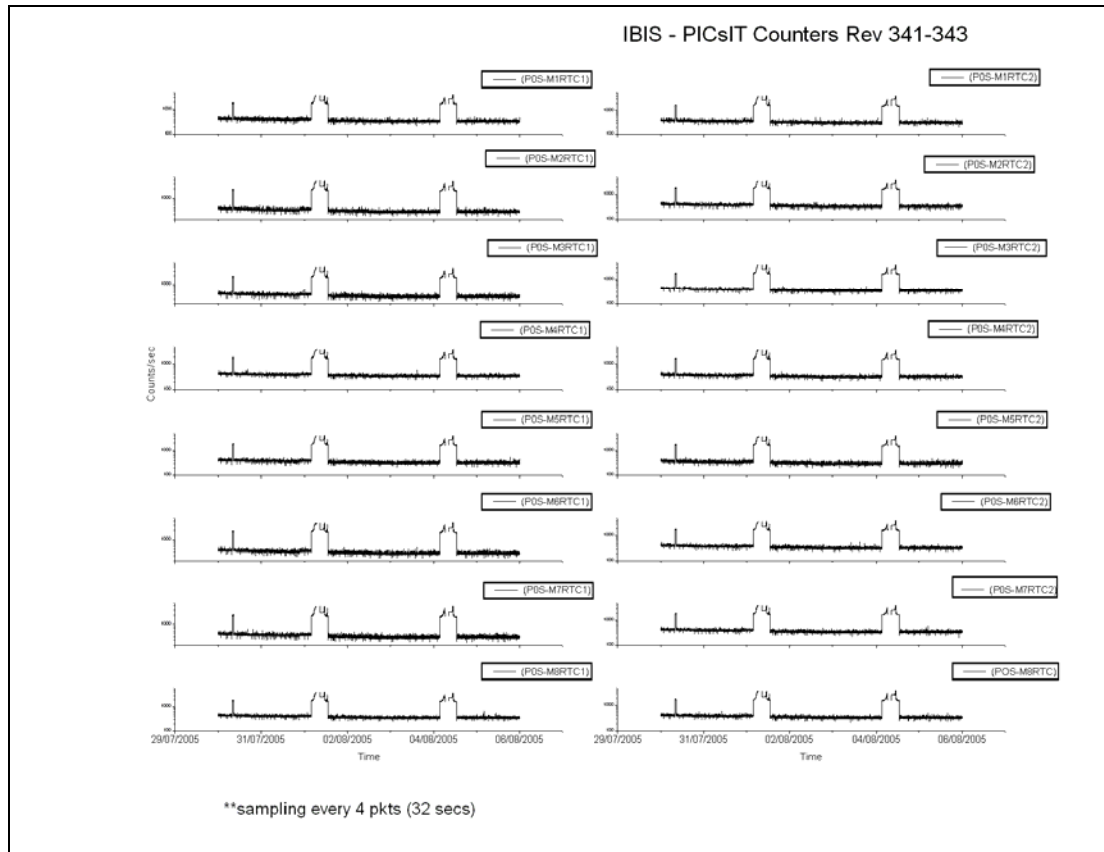


The week was characterised by moderate radiation.

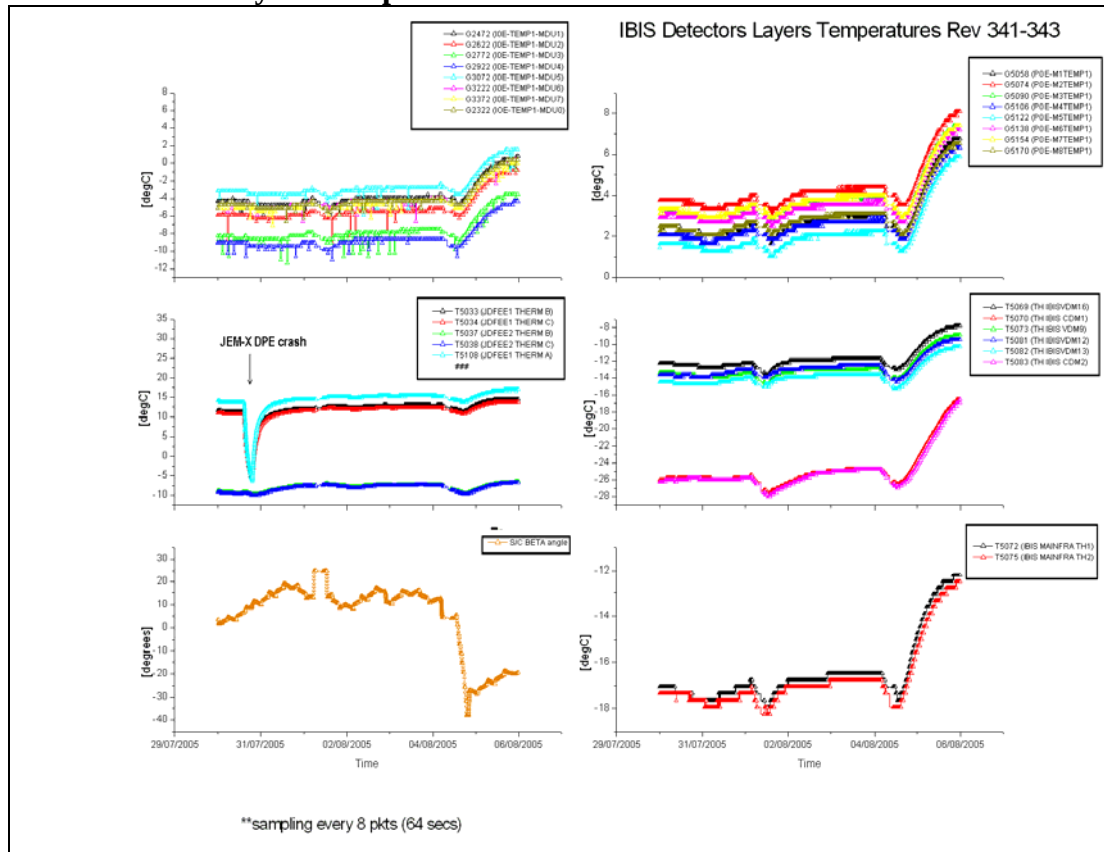
## VETO Current:



## PICsIT Counters:



## IBIS Detectors Layers Temperatures:



## **IBIS daily report**

### **DoY 2005.211 (30/07/2005)**

At 08:04Z an IREM SW failure (SEU #25) forced IBIS to Stand-by mode. Following procedure FCP\_IBIS1\_0803, IBIS exited this Safe configuration and went back to Scientific Standard mode at 09:05Z.

At 08:04Z 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 08:50Z. As this happened in "fake" high radiation background (due to IREM S/W reset), no action was taken.

### **DoY 2005.213 (01/08/2005)**

At 03:35Z TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limit at 13:03Z. As this happened inside the Radiation Belts, according to V-VLT-1, no action was taken.

Between 06:33Z and 11:17Z, TM parameters G5003 (P0S-M1RTC2), G5012 (P0S-M3RTC1) and G5017 (P0S-M4RTC1) were toggling OOL High. According to P-CNT-1, as this happened inside radiation belts, no action was taken.

### **DoY 2005.216 (04/08/2005)**

At 03:23Z TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limit at 12:50Z. As this happened inside the Radiation Belts, according to V-VLT-1, no action was taken.

At 10:54Z TM parameter G5003 (P0S-M1RTC2) went OOL High and back. At this happened inside Radiation Belts, according to P-CNT-1, no action was taken.

At 20:41Z GESTAN02 failed release due to MCS problem. It was re-uplinked at 20:58Z.

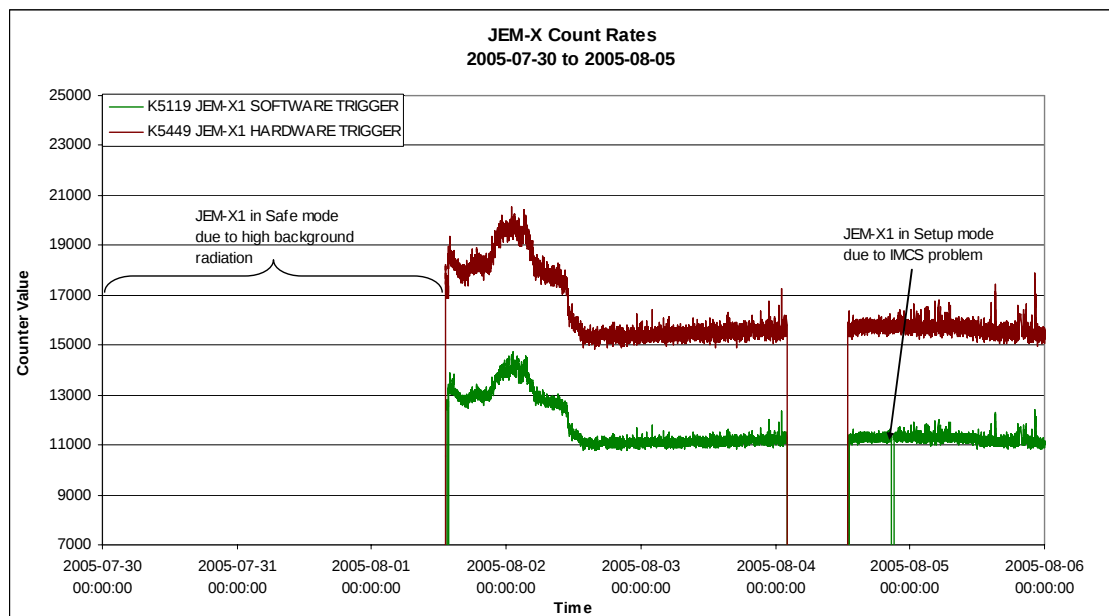
## **8.3.4 JEM-X Operations**

### **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>.

---

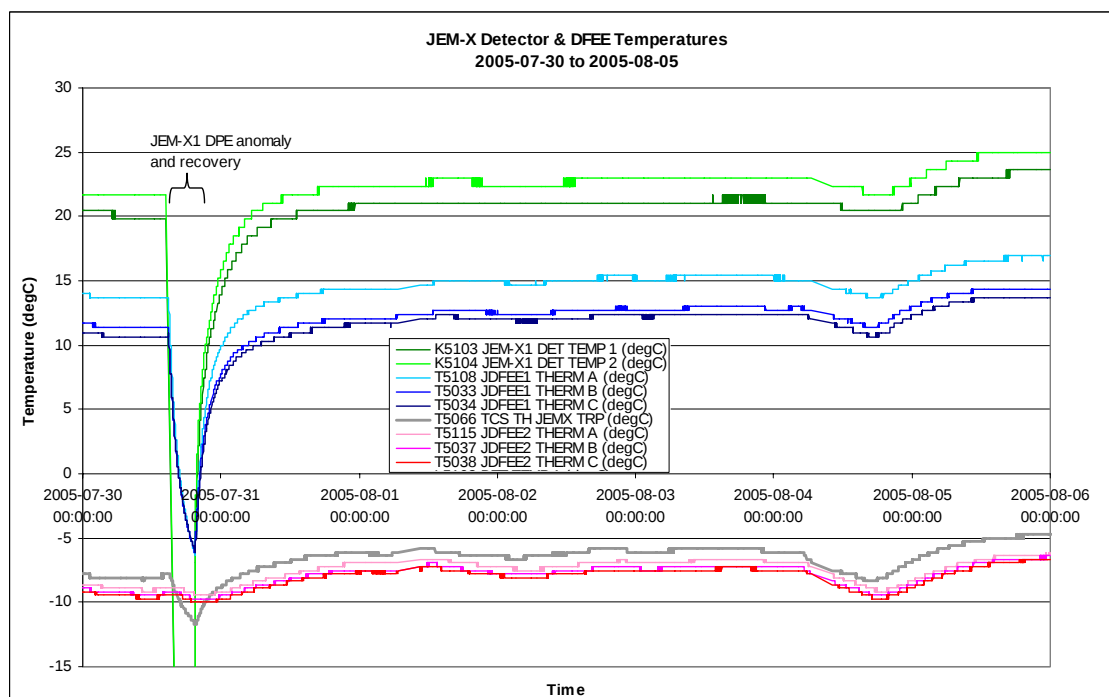
<sup>1</sup> Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.



### 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>.

N.B. Spurious data on 2005-07-30 between 05:50Z and 08:30Z, resulting from the reset of the time in the packet header following the JEM-X1 DPE anomaly on 2005-07-30 at 14:18:23Z (see report of this anomaly which follows), have been removed from this plot.



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

### 8.3.4.3 JEM-X Daily Report

#### 2005-07-30 (DOY 211, Rev 341)

JEM-X1 began the day in Safe mode due to ongoing high background radiation conditions. At 08:04Z an IREM S/W reset occurred (see Anomaly Report INT\_SC-123), but this did not affect JEM-X1 as the JEM-X1 overrides for the RMC counters are DISABLED and JEM-X1 was already in Safe mode.

At 14.18.23Z, an anomaly occurred on the JEM-X1 DPE, consisting of a reset of the DPE CPU. This anomaly is reported in Anomaly Report INT\_SC-124. A summary of the anomaly follows:

#### Symptoms

1) The following OEMs were received:

2005.211.14.18.14.735 2005.211.14.18.23.220 129 RealTime 82  
EXCEPTION EX OBIH TM ST11 WRONG RBI STATUS

>> Indicating that the RBI (Remote Bus Interface) protocol communication with the JEM-X1 DPE is correct but the DPE delivers an RBI status which is not correct with respect to the checks performed by the RBI S/W, in this case that the JEM-X1 DPE has reset and is in NOT RUNNING state.

2005.164.23.22.00.263 2005.211.14.18.31.516 1536 RealTime 0  
EVENT JEM-X1 CAUSE OF CPU RESET

>> Indicating that the JDPE1 CPU has reset

2005.164.23.23.04.763 2005.211.14.19.34.613 1536 RealTime 4  
ANOMALY JEM-X1 CSSW INT ER BUF OVER

>> Indicating a JDPE1 CSSW internal error - buffer overflow

2005.164.23.23.04.763 2005.211.14.19.34.625 1536 RealTime 3  
TC REJECT JEM-X1 TC REP TC SBFULL

>> Indicating a rejected/failed TC report due to the JDPE1 TC sub-buffer being full

These last two OEMs ("JEM-X1 CSSW INT ER BUF OVER" and "JEM-X1 TC REP TC SBFULL") then continued to be received every TM cycle (8 seconds).

2) All the HK TM parameters from the JEM-X1 IASW were reporting values corresponding to 0 RAW, indicating that no data was being received via the IASW. (For example, K5022 DFEE STATUS was reporting DFEE OFF although P2106 LCL STA JEM-X1 A was CLOSE and P2004 LCL CUR JEM-X1 A was the nominal 1.06A.) Only TM parameters coming from the CSSW had non-zero values.

The Source Sequence Counter was also reset to zero, as was the DPE Local On-board Time. This had the effect that the Generation Time of the OEMs from the DPE, calculated on ground by the IMCS, was reset to the time of the last LOBT wraparound (2005.164.23.22Z) from the time of the DPE reset onwards (see OEM times in point 1 above). In addition, the calculated Generation Time of the TM packets (calculated on-ground by the IMCS) was reset to 2005.211.05.50.17Z at the time of the DPE reset. This corresponds to the time of the last wraparound of the time in the packet header (which consists of the 2 least significant bytes of course time) and is the time used in the time correlation for DPE packets. (This is the same time as associated to the TM parameters in these packets when performing retrievals). The packet time then continued to progress from this wraparound time. Note that this is different from what occurred after the last DPE reset (see Anomaly Report INT\_SC-97), due to the different handling of the time correlation in the new IMCS release (SCOS evolution).

The above 2 sets of symptoms are consistent with a reset of the JEM-X1 DPE, in which the CSSW is initialised but the IASW is not initialised (the TM parameter K9243 JDPE1 RUNNING = RUNNING after the reset). Thus all TM parameters values supplied by the IASW are zero, and the DPE buffer overflows due to the received broadcast packet TCs which are not executed due to the IASW not being started (hence the OEMs "JEM-X1 CSSW INT ER BUF OVER" and "JEM-X1 TC REP TC SBFULL" being generated every TM cycle).

### **Recovery actions**

Following the recovery actions suggested for repeated occurrences of the OEM "CSSW INT ER BUF OVER" in the Integral User Manual (Section 5.8.8.2.2.3.1.1), a full power cycle of the DPE and DFEE, including the reloading of all the DPE and DFEE patches, was then performed according to CRP\_JEM1\_5020. As in the previous case of a JEM-X1 DPE reset, FCP\_JEM\_9010 JEM-X1 DFEE SWITCH OFF was replaced by CRP\_JEM1\_9010 JEMX1 UNCONDITIONED DFEE SWITCH OFF in Step 2 of this procedure. The operations were performed as follows:

**14.54.04Z** CRP\_JEM1\_9010 JEMX1 UNCONDITIONED DFEE SWITCH OFF

**15.16.58Z** FCP\_JEM1\_9001 JEMX1 DISABLE BCP DISTRIBUTION. The Broadcast Packet Distribution to JEM-X1 was stopped at 15.18.41Z, after which the OEMs "JEM-X1 CSSW INT ER BUF OVER" and "JEM-X1 TC REP TC SBFULL" stopped.

At this stage, for the purpose of further analysis of the anomaly, a dump of the area of the JEM-X1 DPE corresponding to the JDPE1 image IIMG\_P\_JM1\_0129\_00006\_F\_X\_000\_000\_2.INT was performed via FCP\_JEM1\_9800.

**16.58.32Z** FCP\_JEM1\_9000 JEMX1 DPE SWITCH OFF started and JDPE1 switched off.

**17.10.17Z** FCP\_JEM1\_0010 JEMX1 DPE AND CSSW ACTIVATION started.

Doc. Title : INTEGRAL Mission Report #150  
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF  
Date : 08/08/05

Issue : 1  
Rev. : 0  
Page : 22

Step 10 of this procedure (Enable the DPE Substitution Heater A) was postponed as the value of T5059 TCS TH JDPE1 was not above the required value stated in the procedure of -1.94degC.

As part of this procedure, the following was then performed:

**17.29.07Z** FCP\_JEM1\_9810 JEMX1 LOAD NEW SW VERSION, to load the DPE image IIMG\_P\_JM1\_0129\_00006\_F\_X\_000\_000\_2.INT.

**18.58.52Z** FCP\_JEM1\_0011 JEMX1 IASW DPE PATCH FOR BCP PID INTERPRETATION

**19.04.28Z** FCP\_JEM1\_0015 JEMX1 IASW ACTIVATION.

**19.20.29Z** FCP\_JEM1\_0016 JEMX1 ENABLE BCP DISTRIBUTION

**19.26.13Z** FCP\_JEM1\_0017 JEMX1 IASW EXTENDED TM CHECK

**19.30.38Z** FCP\_JEM1\_0020 JEMX1 DFEE 1<sup>st</sup> ACTIVATION AFTER DPE SWITCH-ON

As part of this procedure, the following procedures were executed:

**19.34.12Z** FCP\_JEM1\_0025 JEMX1 DFEE SW PATCH SEQUENCE (ver 4.0 to 5.3)

**19.54.47Z** FCP\_JEM1\_0060 JEMX1 UPDATE ENERGY LINEARISATION TABLE

These operations were completed at 20.10Z. As the background radiation levels were still high, JEM-X1 was left in Safe mode, with commanding from the Timeline disabled, for the rest of the day.

Following the DFEE switch-on, the TM parameter K5102 DET PRESSURE 2 went Out of Limits Low (value = 134020) at 19:44:34Z. At 19:51:54Z the TM parameter K5101 DET PRESSURE 1 also went OOL Low (value = 133950). These OOLs are usually received when the DFEE is switched on after having been off for a considerable period of time. K5101 returned stably within limits at 22:40:02Z and K5102 remained OOL for the rest of the day.

#### **2005-07-31 (DOY 212, Rev 341)**

At 00:45:55Z K5102 returned stably within limits.

Due to continuing high background radiation conditions, JEM-X1 remained in Safe mode, with commanding from the automatic Timeline disabled, throughout the day.

#### **2005-08-01 (DOY 213, Rev 341-342)**

JEM-X1 began the day in Safe mode, with commanding from the Timeline disabled, due to continuing high background radiation conditions and remained so until the end of revolution 341.

At the start of revolution 342, JEM-X1 was activated nominally from the automatic Timeline.

At 16:58Z TC T5556 TSW JDPE1 HTA ON (the postponed step 10 of FCP\_JEM1\_0010) was sent. This was despite the fact that the value of TM T5059 TCS TH JDPE1 was still not above the limit indicated in the procedure (it had fluctuated around ~4degC, which is within its usual range of values during normal operations).

#### **2005-08-02 (DOY 214, Rev 342) to 2005-08-03 (DOY 215, Rev 342)**

Nothing to report

#### **2005-08-04 (DOY 216, Rev 342-343)**

A new nominal microstrip gas gain voltage for JEM-X1 of 76 RAW was applied from the start of revolution 343. This was implemented by ISOC in the POS. (In line with OCR-197: Lowering of JEM-X1 nominal dV-voltage in MOC IODB, the MOC IODB default value had already been updated during the perigee passage of revolution 339-340 and INT\_OR\_0215 had been raised to cover the period of the inconsistency.)

In addition, INTGSCCR-80 (JEM-X HV-switch-on procedure update) was implemented at the start of revolution 343, with the ED KEHVAC01 (JEM-X1 HV Activation in 1 Step and Config for Science) replacing the previously scheduled ED KEACT\_03 (JEM-X1 HV Activation (Paras) and Config for Science).

Due to a problem with the Command Verifier of the IMCS, the commands KU0014 and K0021 of the ED KEDATA02, scheduled at 20:40:44Z, had their acceptance verification returned 'Unknown' and the Data Taking command K0011 was not released. JEM-X1 thus remained in Setup mode until the Verifier was recovered and these commands were re-uplinked manually (starting at 21:03:14Z). JEM-X1 was commanded to Data Taking mode at 21:10:24Z and JEM-X1 operations then continued nominally.

#### **2005-08-05 (DOY 217, Rev 343)**

The TM parameter K5136 BUFFER LOSS went Out of Limits briefly on several occasions, as follows:

- 15:07:07Z K5136 OOL High (value = 198), back in limits at 15:07:23Z
- 15:10:03Z K5136 OOL High (value = 224), back in limits at 15:10:11Z
- 22:16:19Z K5136 OOL High (value = 128), back in limits at 22:16:27Z
- 22:17:55Z K5136 OOL High (value = 174), back in limits at 22:18:03Z
- 23:47:39Z K5136 OOL High (value = 200), back in limits at 23:47:47Z

### 8.3.5 OMC Operations

#### 2005-07-30 (DOY 211, Rev 341)

At 22:59:54 the unit was returned to Stand-by mode, and at 23.01.32, normal observations were resumed after being in SAFE mode since day 208 at 23:31:01 due to high radiation. The impact was pointings 03410013 to 03410033 (20 pointings) were lost.

At 23:52:29 the instrument was again autonomously switched to SAFE mode when the background radiation rose. It remained in this state until 06:13:12 the following day when it was manually returned to stand-by. The impact was pointing 03410035 was interrupted after 137 from a scheduled 2800 seconds, and pointings 03410036 to 03410042 were lost.

#### 2005-08-01 (DOY 213, Rev 342)

At 15:17, problems with Reed-Solomon errors and bad TM frames from Redu, caused the Timeline to be stopped. The impact was the interruption after about 1900 from a scheduled 2800 seconds of pointing 03420004, and the loss of pointing 03420005, It was at this time the following commands were rejected:

|                       |                       |      |          |       |    |        |  |
|-----------------------|-----------------------|------|----------|-------|----|--------|--|
| 2005.213.15.32.22.694 | 2005.213.15.32.30.546 | 1792 | RealTime | 131   | TC | REJECT |  |
| REJECTED TC1          |                       | 0    | 0        | 65535 | PR | N      |  |
| E E                   |                       |      |          |       |    |        |  |
| 2005.213.15.32.28.944 | 2005.213.15.32.39.392 | 1792 | RealTime | 131   | TC | REJECT |  |
| REJECTED TC1          |                       | 0    | 0        | 65535 | PR | N      |  |
| E E                   |                       |      |          |       |    |        |  |

Which correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) for latter pointing.

#### 2005-08-05 (DOY 217, Rev 343)

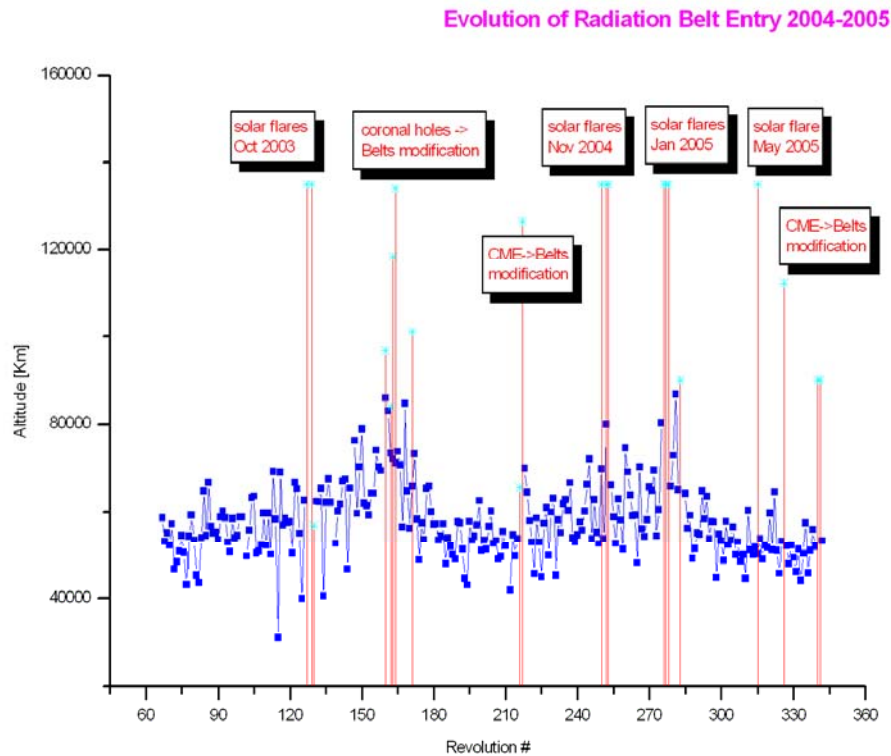
At 19:37 a problem with the ground station caused the links to drop. They were restored at 20:04 using Vilspa. The impact was the interruption of pointing 03430035 after about 3000 from a scheduled 3334 seconds and the loss of pointing 03430036

On DoY 213 at 03:35:49 and DoY 216 at 03:23:25, OMC was switched by the Timeline to SAFE mode, at the nominal times.

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### 8.3.6 IREM Operations

#### Radiation Belts Entry



#### IREM daily report

##### **DoY 2005.211 (30/07/2005):**

At 08:04Z a local reset of the IREM CSCI S/W (SEU #25) occurred: as previously (see anomalies on 16/12/02, 01/01/03, 03/06/03, 11/07/03, 19/07/03, 05/08/03, 24/08/03, 26/12/03, 13/05/04, 16/05/04, 09/06/04, 12/06/04, 10/09/04, 14/09/04, 28/10/04, 06/11/04, 01/12/04, 11/12/04, 30/01/05, 11/02/05, 04/03/05, 11/05/05, 17/05/05, 15/06/05) the status of the unit, before the anomaly, 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 2005.211.08.04.00 at 134878.3 km when the unit 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 at 08:29Z using procedure CRP\_SYS\_2570. The first dump of the status word after the anomaly shown a value of BCC0 HEX = 48320 DEC = 1011110011000000, ie. the unit was still reporting the status as if it was in Integral mode with counting ON, accumulation ON and checksum failure flag 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) A dump of all the registers gave a status word BC80 HEX = 48256 DEC = 1011110010000000, ie. The unit was still reporting the status as if it was in Integral mode but the checksum failure flag was now OFF and the checksum counter in the register number 3 incremented by 1 unit.

7) The patch was performed successfully with the correct re-starting of the S/W. The operation was completed at 11:06Z.

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. It must be noticed that due to high radiation background OMC was already in Safe mode, therefore only IBIS was affected by this IREM reset this time.

The recovery of the payload was performed with IBIS re-enabled at 09:05Z.

The cause of this S/W reset is still under investigation, but it is apparently due to the unit's memory device that is sensitive to ionising radiation.

### Electron Belts

| REV | S/C BCPKT (electron)            | Electron CUT-<br>OFF 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] |
|-----|---------------------------------|---------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|
| 324 | RAD_ENTR R 2005-06-11T07:02:01Z | 2005-06-11<br>08:45:30                      | 45744.1                                    | 2005-06-11<br>07:54:26                      | 53043                                       |
| 341 | RAD_ENTR R 2005-08-01T03:35:45Z | -                                           | -                                          | 2005-08-01<br>04:33:42                      | 52031                                       |
| 342 | RAD_EXIT R 2005-08-01T12:50:02Z | 2005-08-01<br>12:17:49                      | <<39283.5                                  | 2005-08-01<br>11:43:42                      | 29982                                       |
| 342 | RAD_ENTR R 2005-08-04T03:23:23Z | 2005-08-04<br>04:16:37                      | 53344.1                                    | 2005-08-04<br>04:24:10                      | 51823                                       |
| 343 | RAD_EXIT R 2005-08-04T12:37:15Z | 2005-08-04<br>11:48:29                      | >>24909.4                                  | 2005-08-04<br>11:34:10                      | 30301                                       |

### Reference

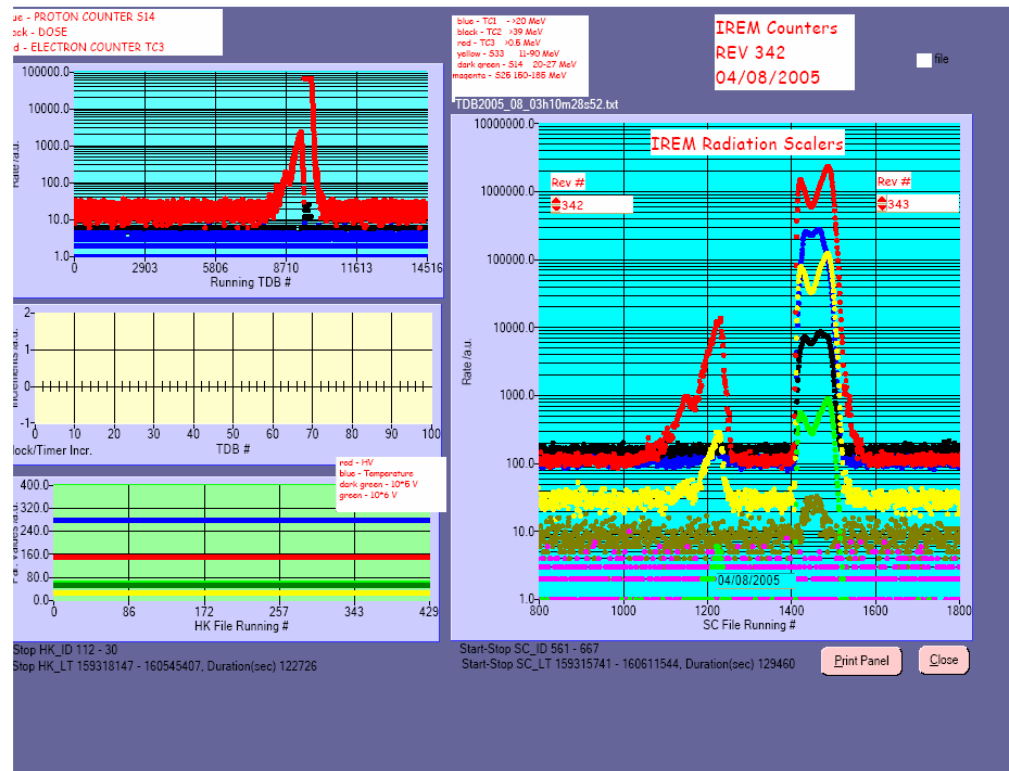
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

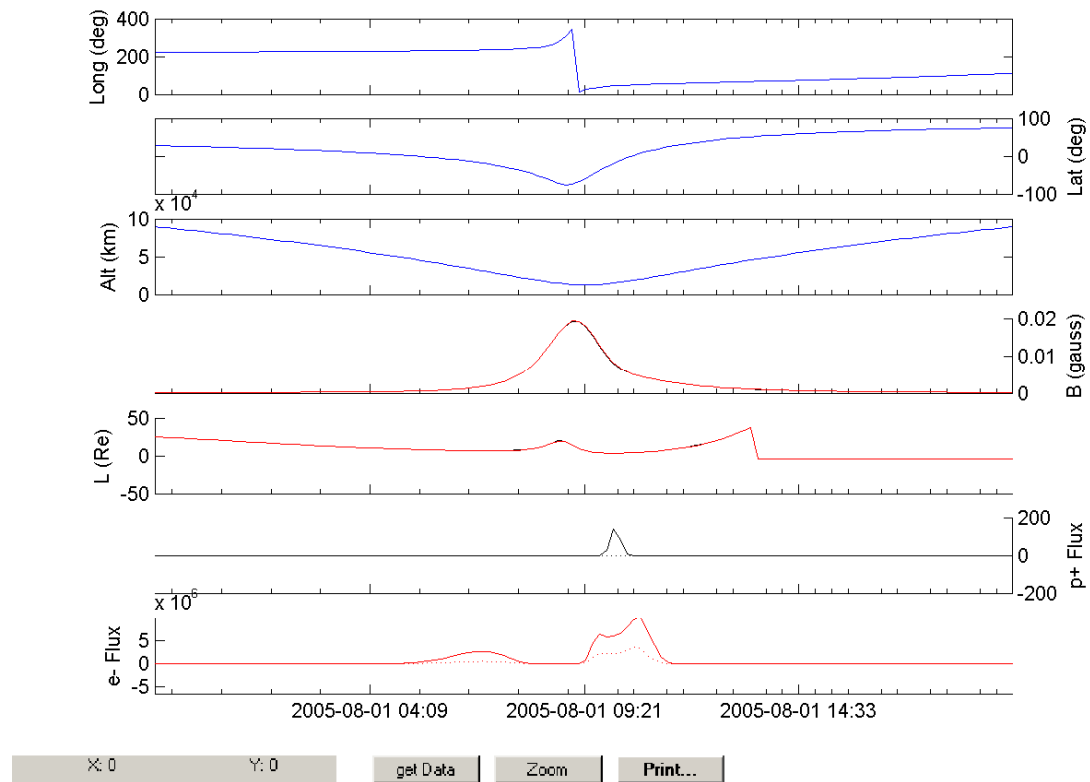
### IREM radiation counters:



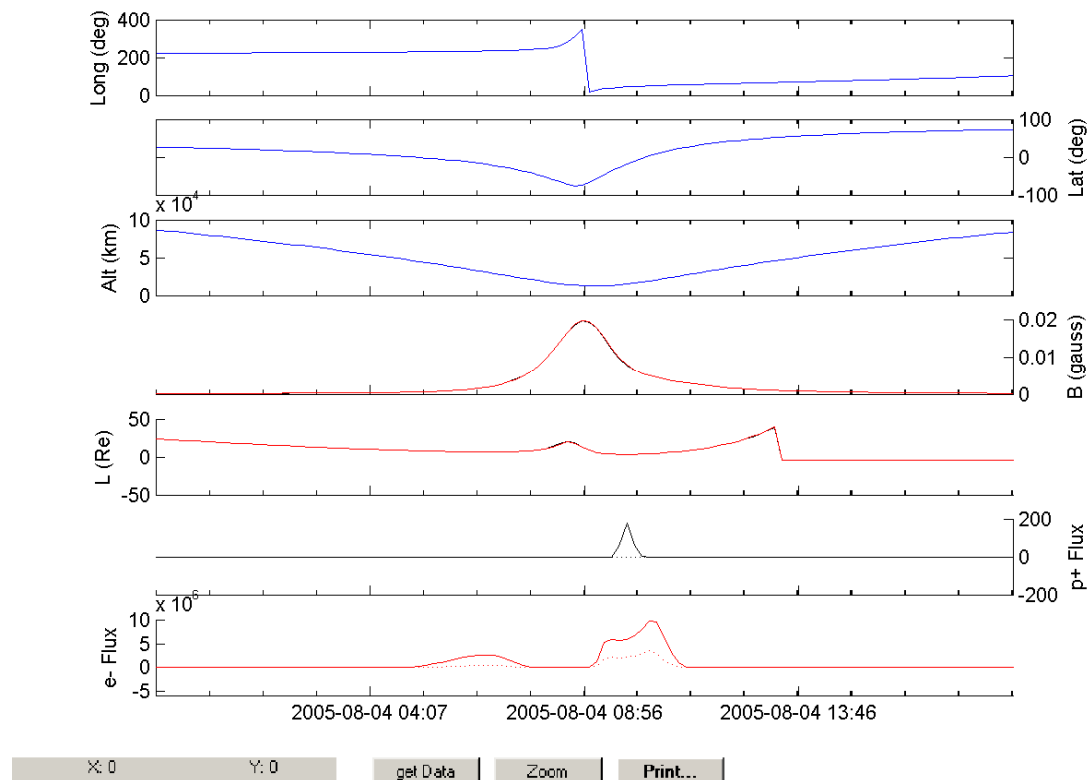
Due to problem with the ECOE machine, no data are available until the 3<sup>rd</sup> of August. The diagram shows the end of revolution 342 and the belt passage between 342 and 343.

### IREM Predicted Radiation Belt Passages:

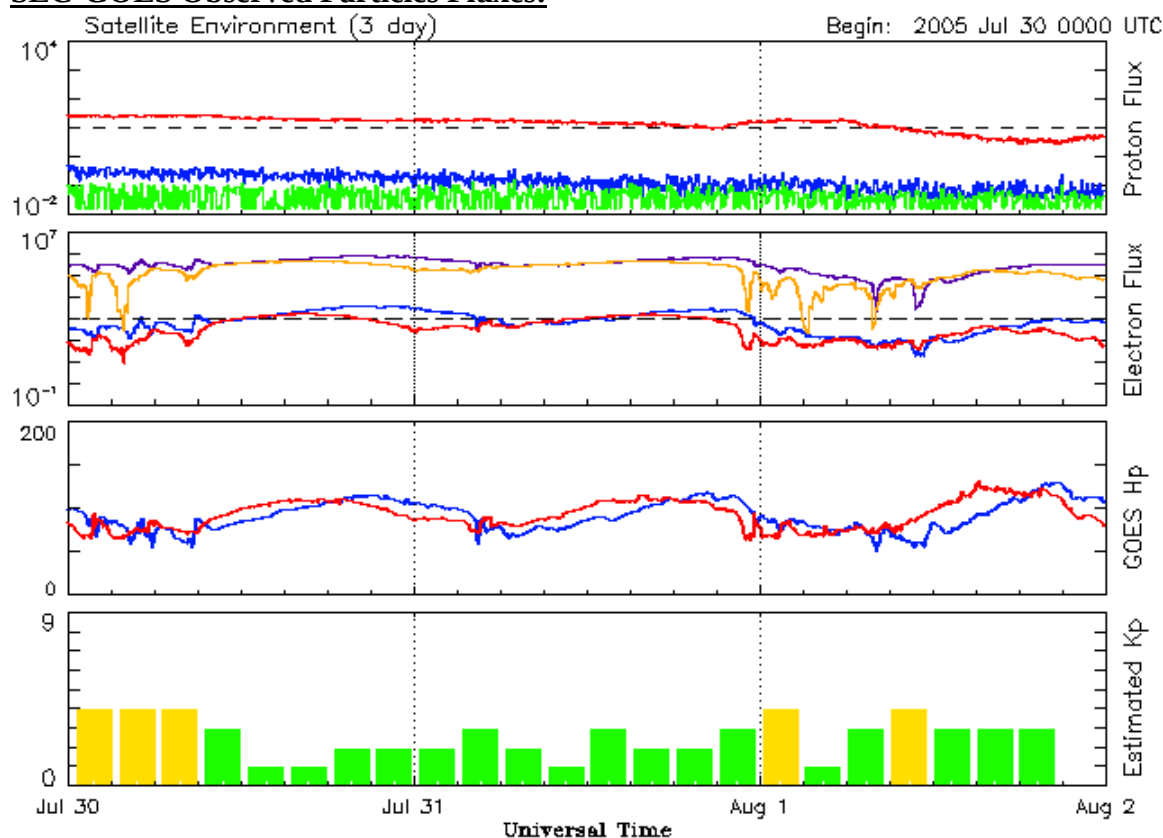
Rev 341:



Rev 342:

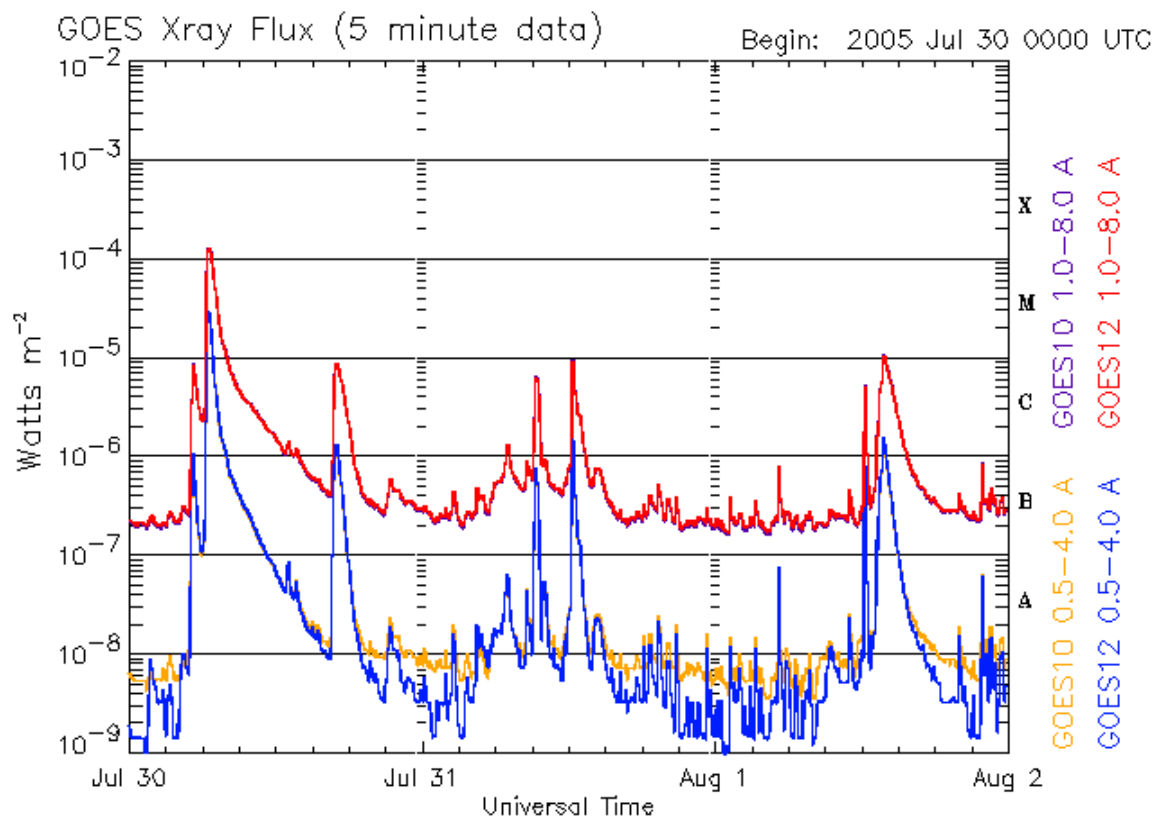


# SEC-GOES Observed Particles Fluxes:



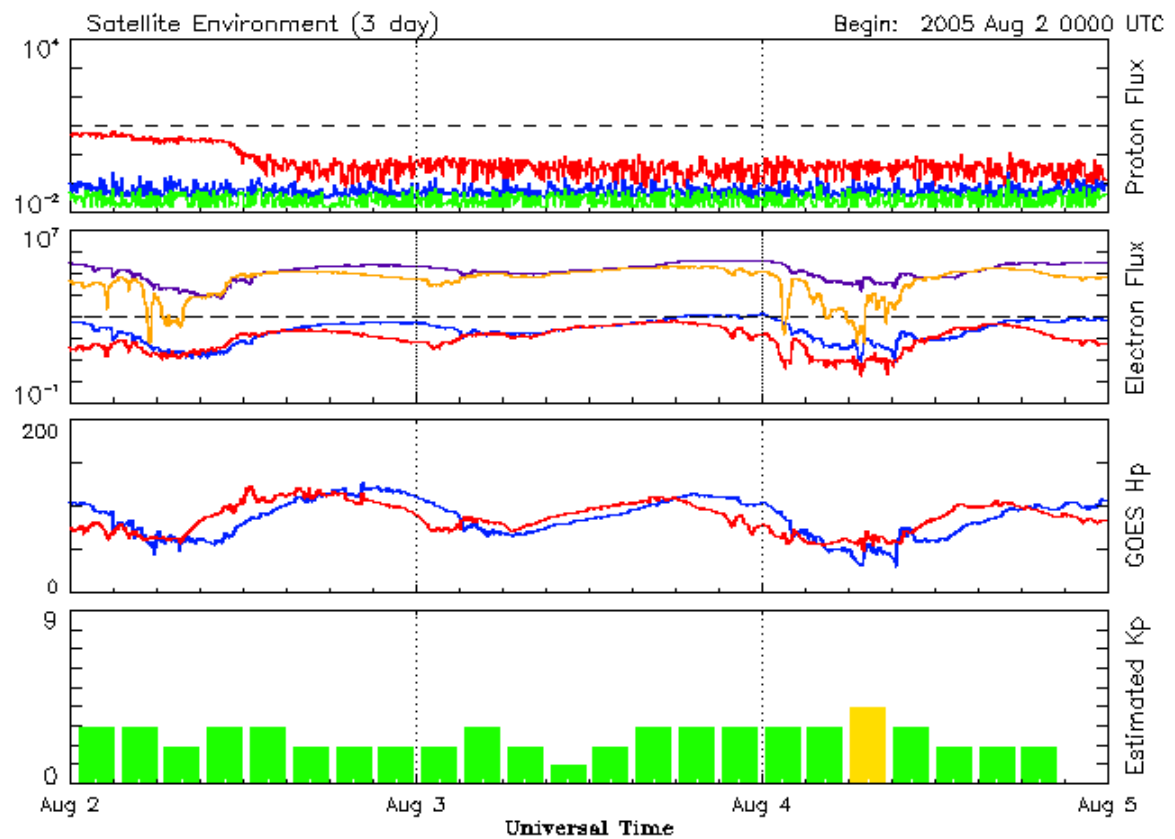
Updated 2005 Aug 1 23:56:13 UTC

NOAA/SEC Boulder, CO USA



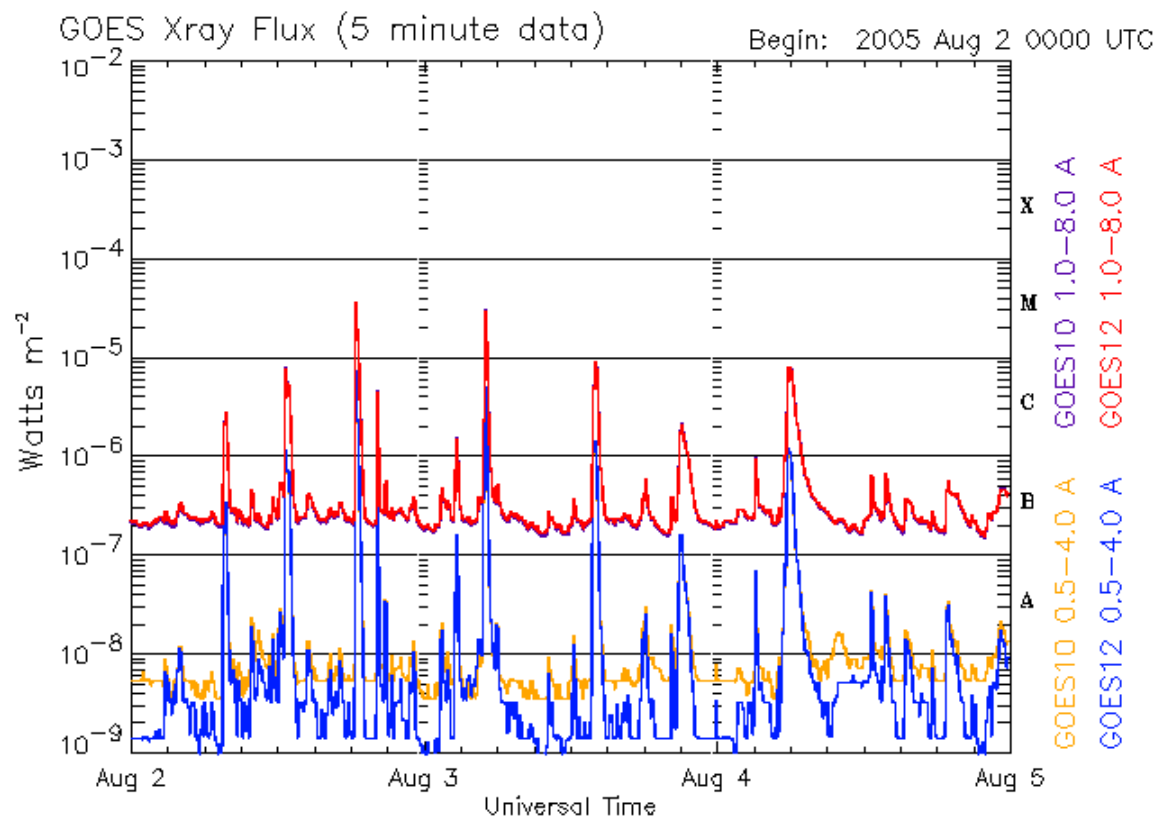
Updated 2005 Aug 1 23:56:04 UTC

NOAA/SEC Boulder, CO USA



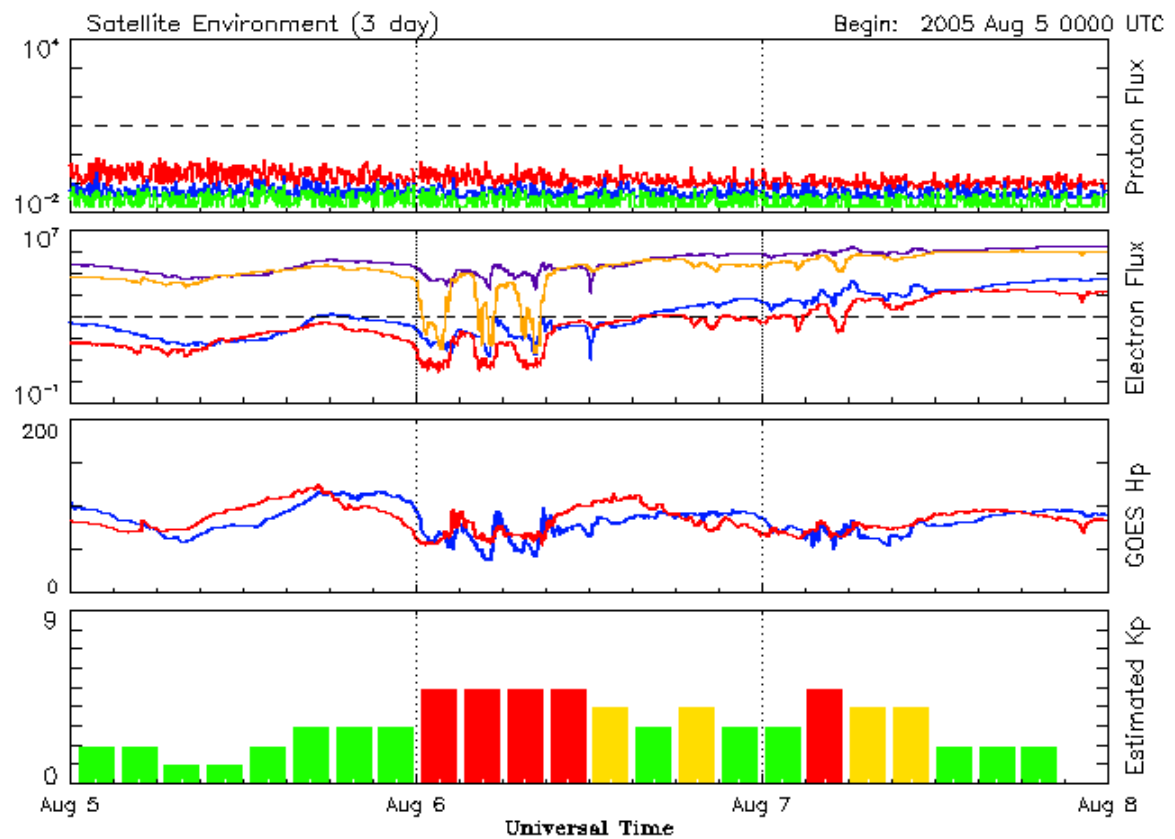
Updated 2005 Aug 4 23:56:13 UTC

NOAA/SEC Boulder, CO USA



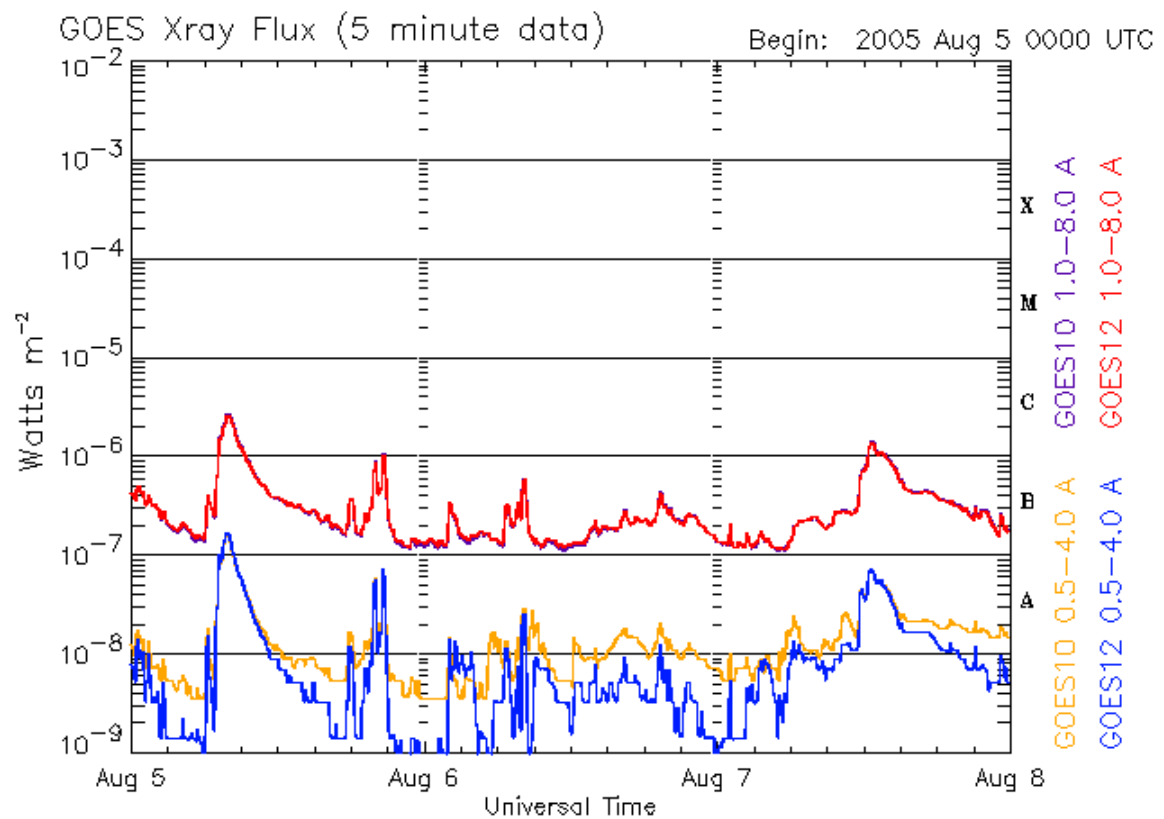
Updated 2005 Aug 4 23:56:04 UTC

NOAA/SEC Boulder, CO USA



Updated 2005 Aug 7 23:56:13 UTC

NOAA/SEC Boulder, CO USA



Updated 2005 Aug 7 23:56:04 UTC

NOAA/SEC Boulder, CO USA