EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-OPS-OF

No. 133
Week 14

11.04.05

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 02.04.05 until 08.04.05 (both dates inclusive) and covers the revolutions 302 & 303.

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); the Norma Arm; the Galactic Plane and the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0). The activities consisted of raster and hexagonal dithering; grid and GPS 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.

No slews were missed from the Timeline during this period.

The fuel consumption over the period between 01/04/2005 and 07/04/2005 was 0.0933 kg. The remaining propellant is in the order of 162.0269 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 (but only 96 effective due to TM leakage anomaly INT_SC-107) and an actual occupation of 95.6 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.

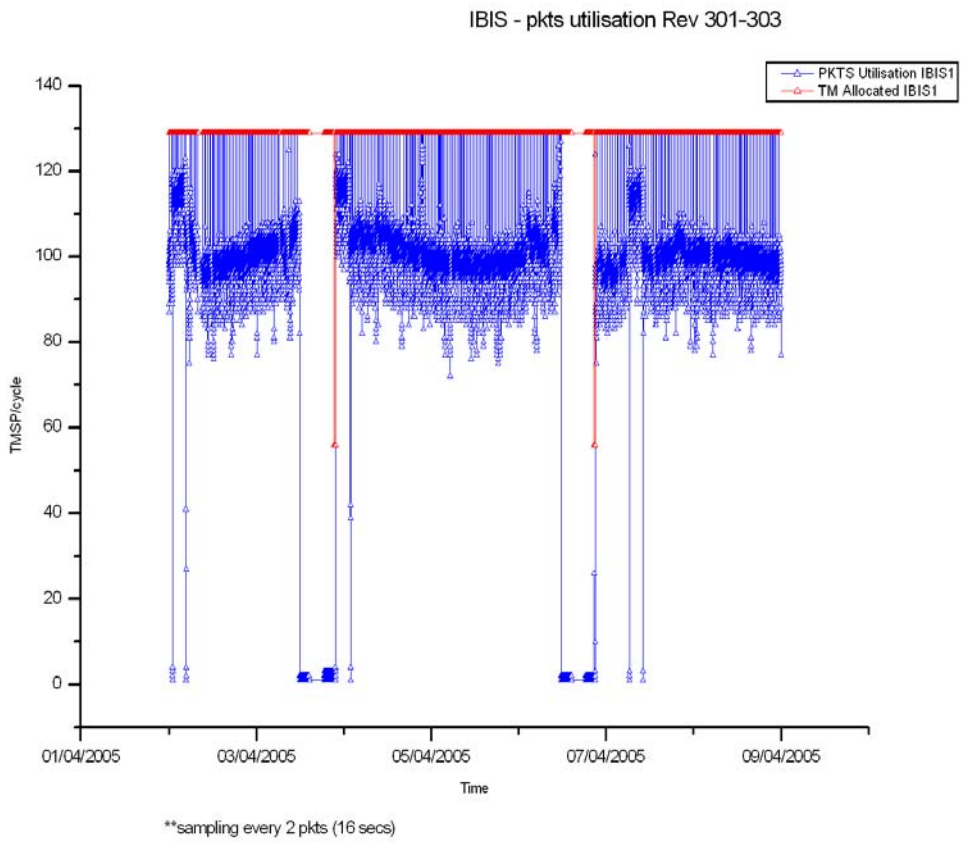
3.2.2 IBIS

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 102.85 TMPS/cycle, down 11.8 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 242 OMC pointings executed nominally, none 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, 242 pointings were executed correctly, none were lost. There were only occasional packets lost due to ground problems.

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 were some occasions when some bad TM frames were received from Redu, and the repeated problems with the links with ISDC, but apart from that nothing. The overall performance was nearly 100%.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning
No mission planning activities has taken place in ISOC this week. No replanning request or ToO received. PSF's up to rev 310 have been received. TSF for rev 302 and 303 were received.

2. Observation status
No ECS's received this week.

3. ISOC science data archive
A meeting took place this week with INTEGRAL management resulting in a revised schedule for making ISDA publicly available. New date is mid May. The ISDA data-base upgraded to the latest ISDC version (10.0). Ingestion of some "revision 2" data was successfully performed.

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 the last 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 11/04/2005:

- Latest Standard Analysis completed: observation 02297000013 (CAS A, Revolution 261-269) on 20/03/2005

- 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 092, at 06:56, 24 bad frames were received from Redu, there was no impact.
- At 08:06, there following was seen TCONsolidator RT: Error receiving data, the idda then disappeared from the Global MMI, together with the VC7 & bad frame links. CCC informed that all applications were down on the idda, reasons unknown. At 08:40, the machine was rebooted, and at 09:16, the situation was again nominal. There was no impact.
- At 12:25, ISDC reported they have received no OLF files since 08:03, and no THF since 07:31. The problem was cleared the following day, when the queues were emptied and the applications restarted.
- From 18:05:50 to 18:05:52, there was no TC bitlock, this was repeated at 18:17 & 18:21. Network inform no problems with Redu, there was no impact.
- On DoY 093, at 06:40, the idda was rebooted as no aux files were being received by ISDC. At 09:00, the machine was again rebooted, as the files were still not being received. At 10:41, the file transfer was restored, after cleaning the queues of MAB/IMC and restarting the routines.
- On DoY 094, at 06:43, there were 2 VC0 TM gaps from Redu, each missing 1 packet. There was no impact.
- At 19:19, there was an error sending data to the isds. The isds and ifrd were restarted 4 times without success. At 22:28, the effort was given up until the day-shift.
- On DoY 096, at 21:00, there was a drop in VC0 & VC7 TM from Redu. A Queue overflow in the TMP was reported. There was no impact.
- On DoY 097, at 05:47 and again at 07:13, the idda on the Global MMI turned briefly red, there was no impact.

- On DoY 098, at 00:35, the imcs-a swap space was reduced to 412MB. The application launcher was restarted at 02:00, restoring the swap space to 3.24GB. There was no impact.
- At 10:00, Network requested to reboot the Firewall, the impact was a loss of communications with ISDC from 10:05 to 10:24.
- At 12:15, the imcs-b swap space was less than 500MB the application launcher was restarted curing the problem, there was no impact.

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

AR id	Date Created	Subject	Segment	Status
INT-2723	05/04/2005	DSS-24 support cancelled, DSS-16 support instead	NASA Station	Closed

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 302
The observations in revolution 302 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 grid observation of the Norma Arm of the Galaxy, performed for the remaining ~57 hours of observation time.

Revolution 303
The observations in revolution 303 consisted of:

- 13 pointings of a GPS lasting ~9 hours;
- Hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~3.5 hours;
- 5 pointings of a GPS lasting ~3 hours;
- Grid observation of the Norma Arm of the Galaxy lasting ~39 hours;
- Raster dithering observation of the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0), performed for the remaining ~6 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

```
2005-03-16T20:35:23.000Z     162.3582    F   Automatic TM processing.
2005-03-18T06:41:35.000Z     162.3375    F   Automatic TM processing.
2005-03-21T06:30:23.000Z     162.3166    F   Automatic TM processing.
2005-03-22T20:06:11.000Z     162.3115    F   Automatic TM processing.
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.

This report was generated  Fri Apr 8 08:00:24 GMT 2005
```

8.3 Detailed Satellite Information

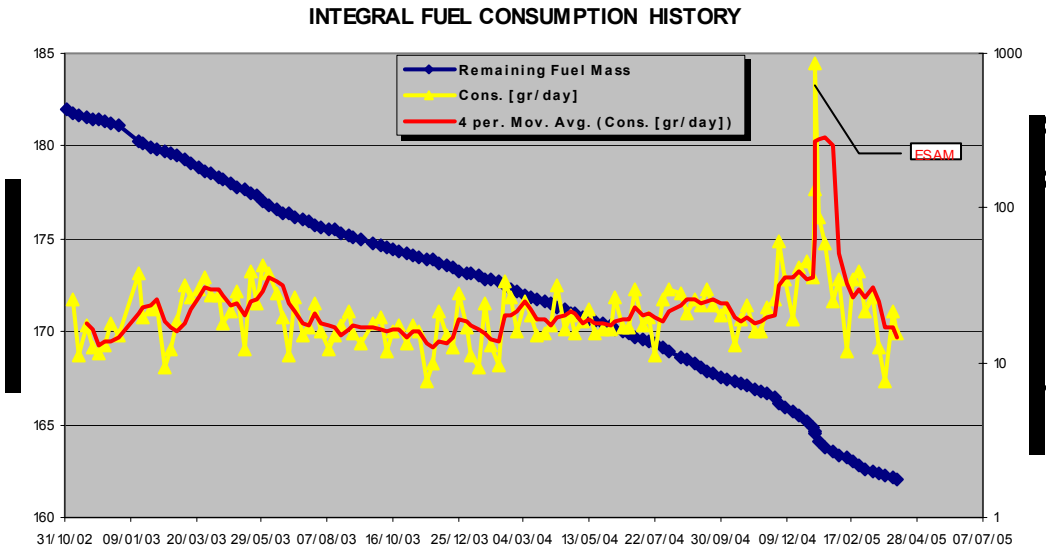
This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS Summary Operations Report 02/04/2005-08/04/2005

AOCS operations were executed from the Automatic Timeline.

During this period, 94 Open Loop Slews, 161 Closed Loop Slews and 4 Momentum Bias were executed. No slews were missed.

The fuel consumption over the period between 01/11/2002 and 07/04/2005 is reported in the plot below.



02/04/05 (Day of Year 092, Revolution 301)

Nothing to report

03/04/05 (Day of Year 093, Revolution 301-302)

Reported at 13.33Z the speed of Wheel # 2 in OOL after the last slew of the revolution 301, in preparation for the perigee passage. The predicted value (FD source) was ~425 rpm while the observed value was ~350 rpm. FD confirmed no further impact on RW2 speed due to the action of external torques for the perigee passage. At the beginning of revolution 302, after the first RWB, the OOL was cleared and the situation went back to nominal at 19:12Z. No impact reported.

04/04/05 (Day of Year 094, Revolution 302)

Nothing to report

05/04/05 (Day of Year 095, Revolution 302)

Nothing to report

06/04/05 (Day of Year 096, Revolution 302-303)

Nothing to report.

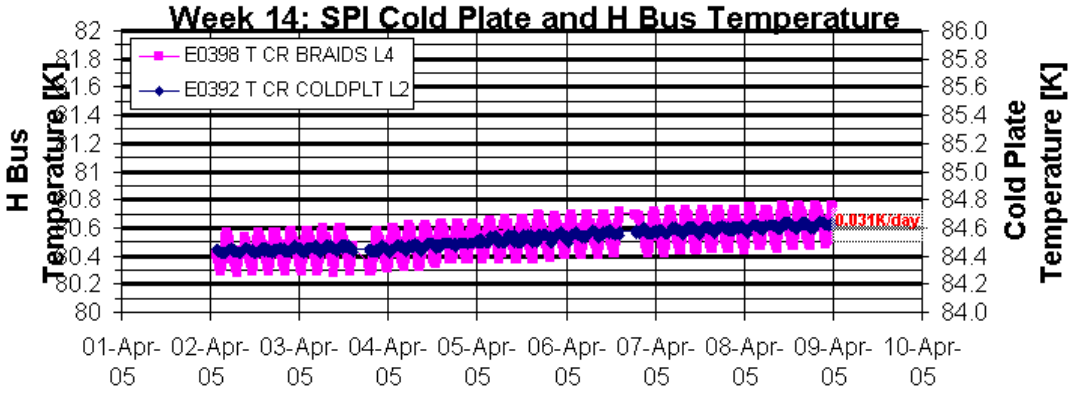
07/04/05 (Day of Year 097, Revolution 303)

Nothing to report

08/04/05 (Day of Year 098, Revolution 303)
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.

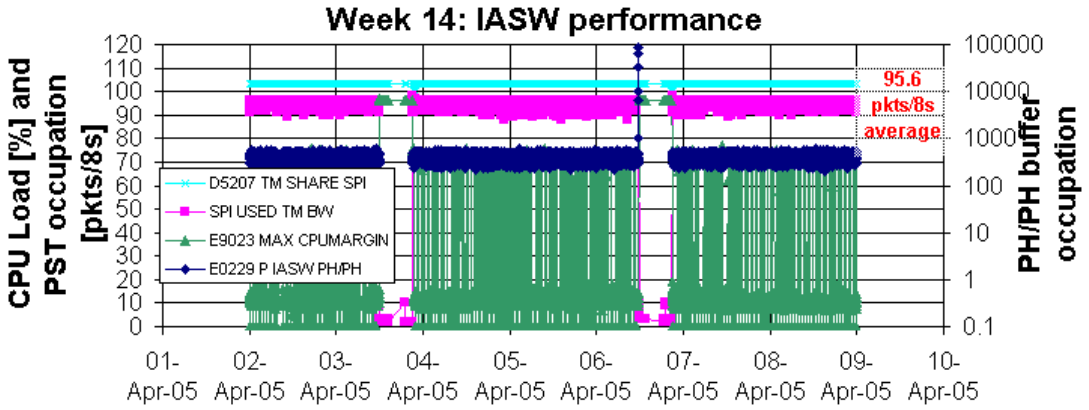


DPE & IASW:
The IASW performance is nominal. The PST TM bandwidth allocation was 103 pkts/cycle in the science windows; the actual TM bandwidth usage was:

- 96 pkts/cycle peak, due to the TM leakage anomaly;
- 95.6 pkts/cycle average in science mode.

The temporary workaround to the TM leakage anomaly (INT_SC-107), consisting in the manual upload at every beginning of rev. of a new PST rearranged to avoid the problem, was still suspended during the reporting period.
Ground testing activities with the SPI simulator in Toulouse are on-going to fix the problem definitively.

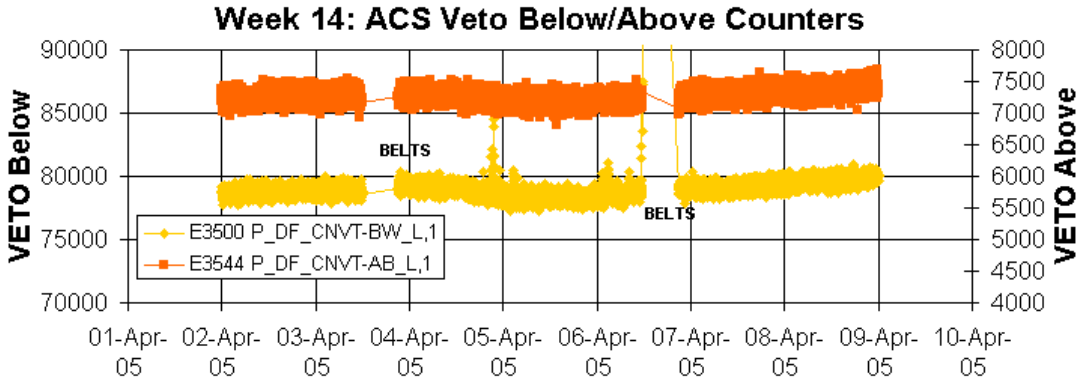
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

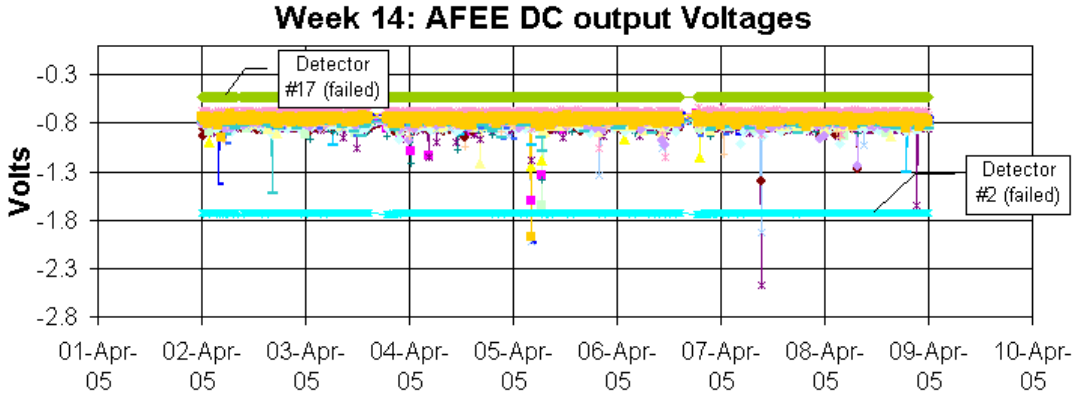
The following plot shows the ACS overall count rate evolution during the reporting period.



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.

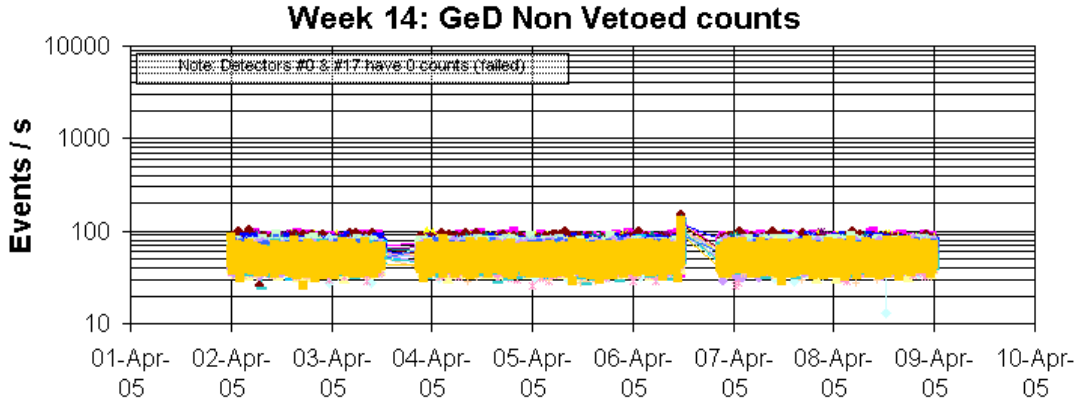
The following plot shows the AFEE dc output signals during the reporting period.

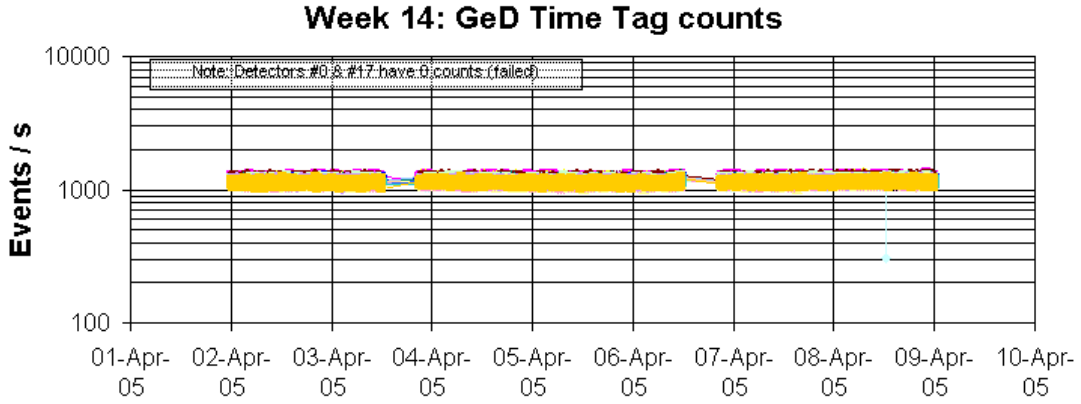


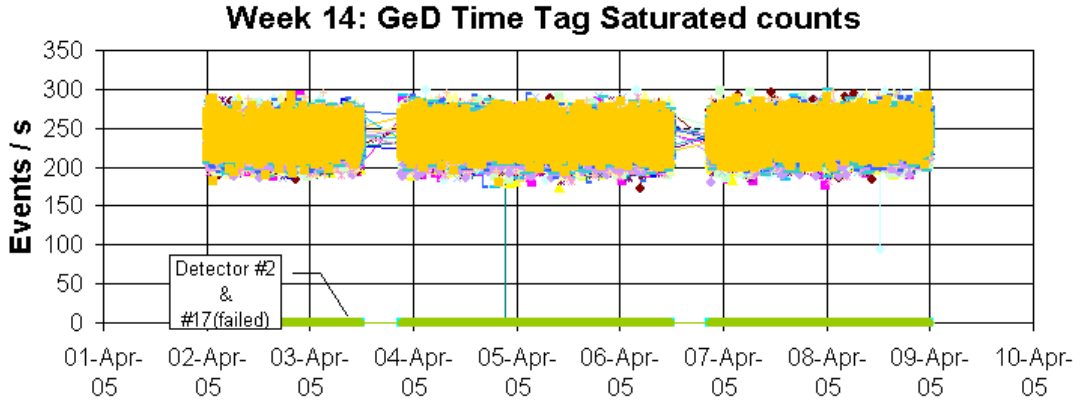
DFEE:

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.





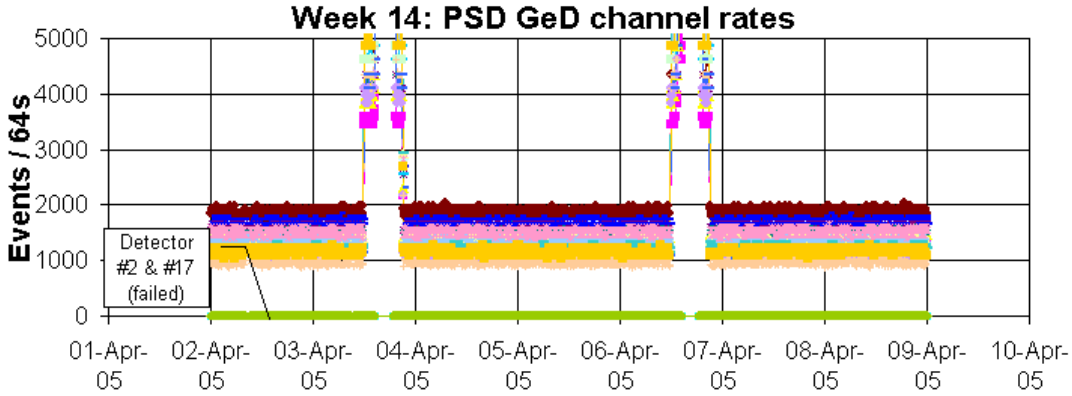


PSD:

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.

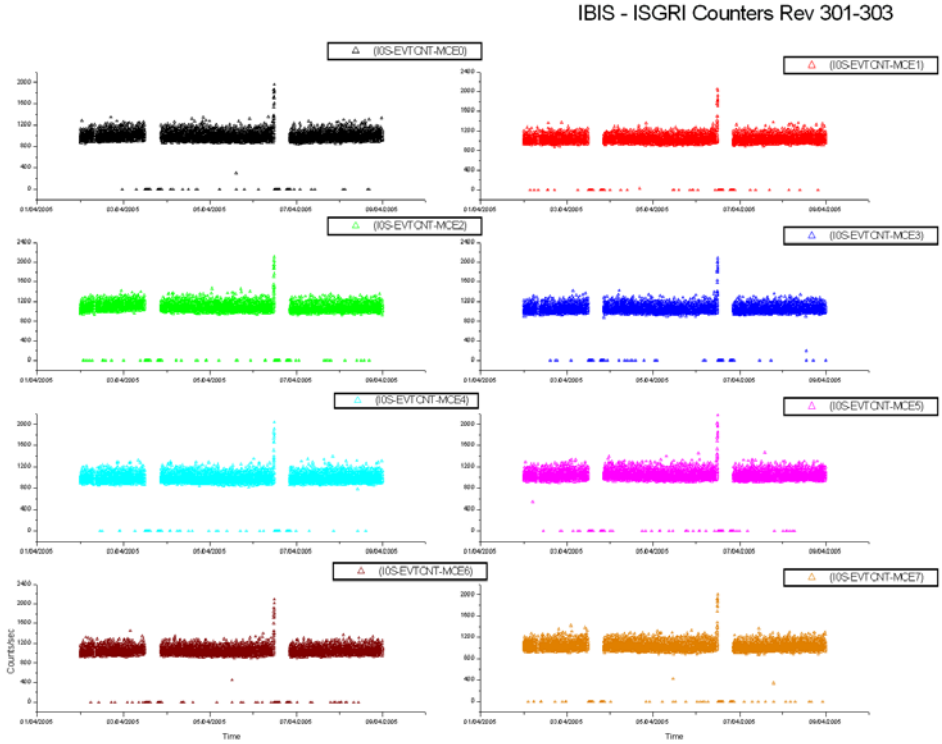
The following plot shows the PSD channel rates during the reporting period.



8.3.3 IBIS Operations

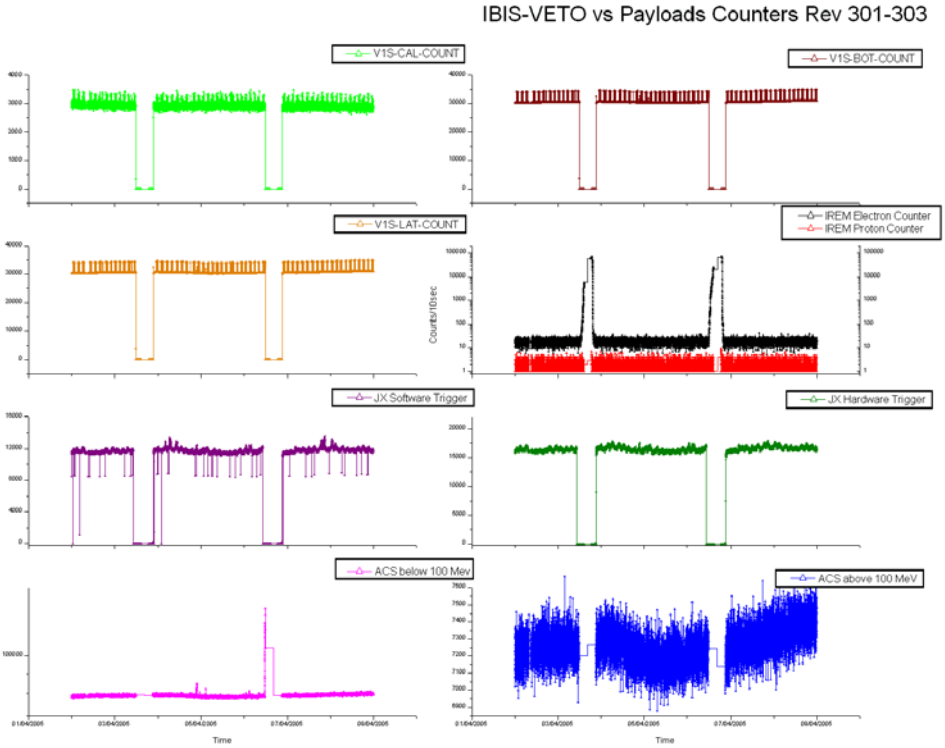
IBIS Events Counters Plots.

ISGRI Counters:



**sampling every 4 pkts (32 secs)

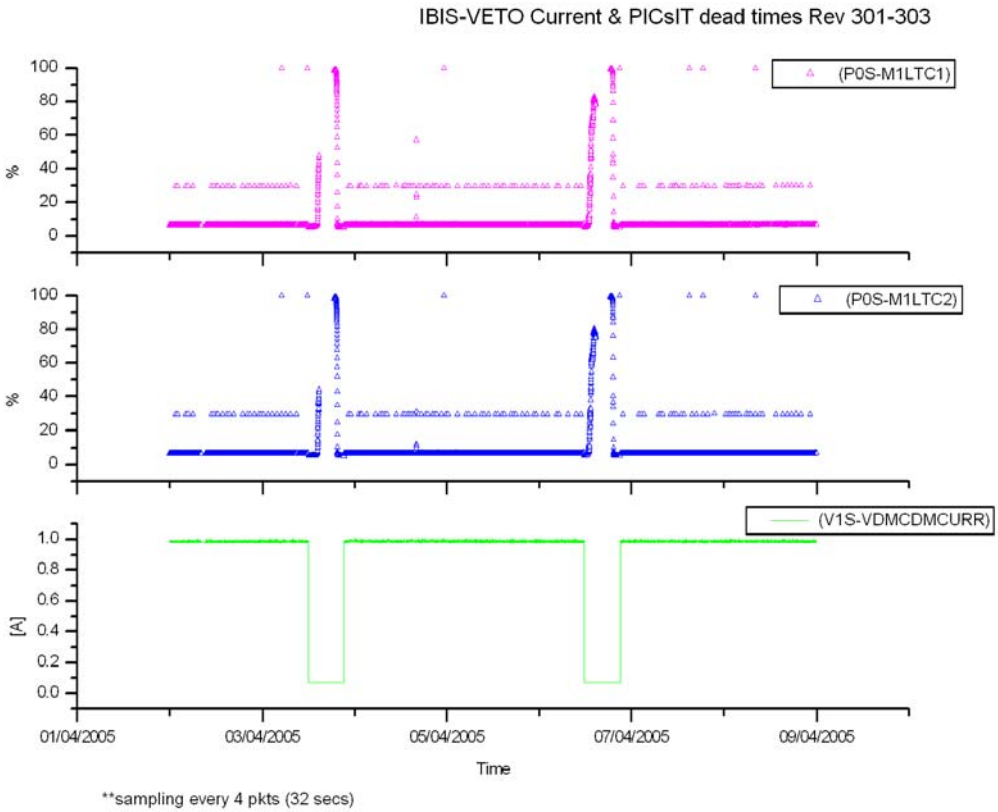
VETO vs Payloads Counters:



**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

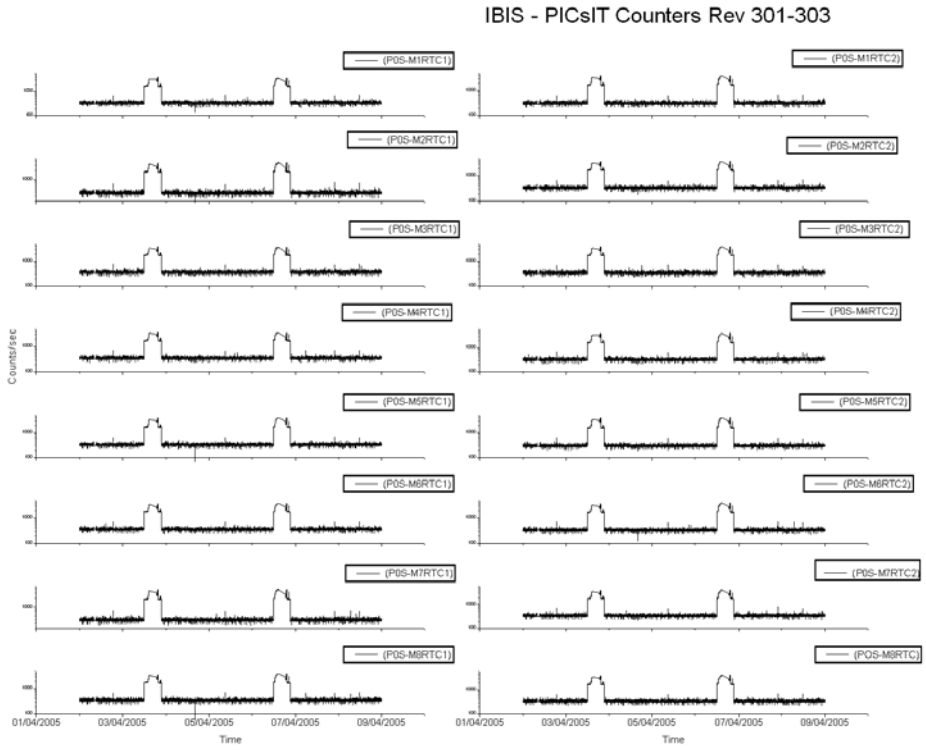
The week was characterised by low solar activity.

VETO Current:



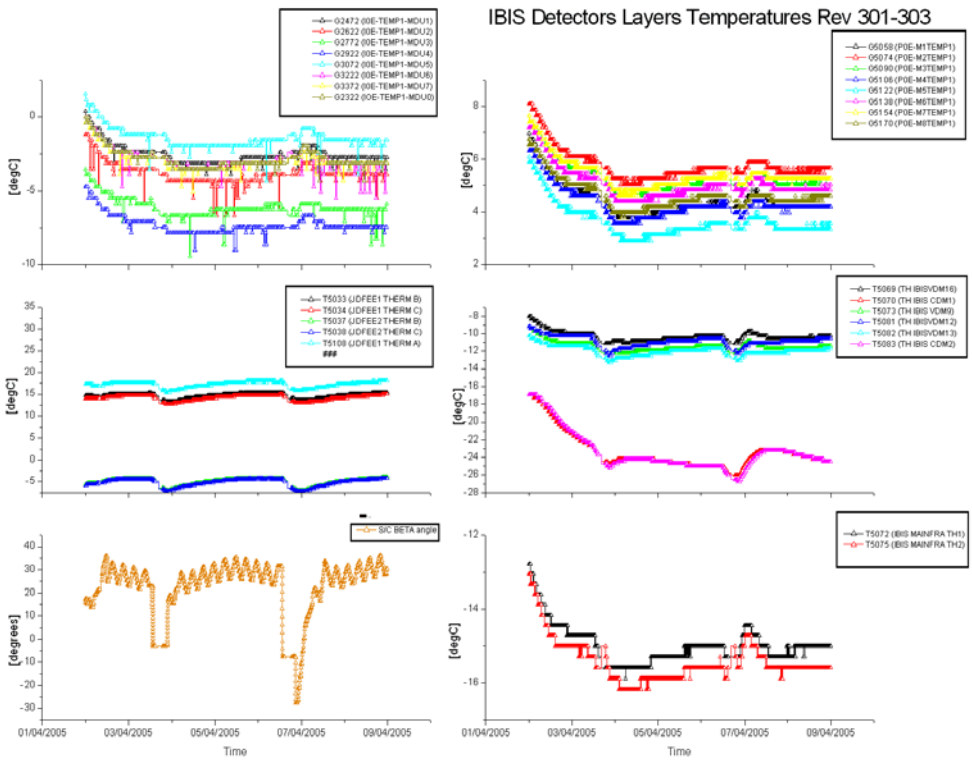
**sampling every 4 pkts (32 secs)

PICsIT Counters:



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:



**sampling every 8 pkts (64 secs)

IBIS daily report:

DoY 2005.092 (02/04/2005)

Nothing to report.

DoY 2005.093 (03/04/2005)

At 11:54Z, 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 21:16Z. As this happened inside radiation belts, according to V-VLT-1 no action was taken.

DoY 2005.094 (04/04/2005)

At 16:03Z TM family G5068 (PDMi semi-module #1 FIFO Error Flag) and TM family G5072 (PDMi semi-module #2 FIFO Error Flag) were reported OOL "SCC fail". According to P-FIF-1, no action was taken.

DoY 2005.095 (05/04/2005)

Nothing to report.

DoY 2005.096 (06/04/2005)

At 11:43Z, 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 21:05Z. As this happened inside radiation belts, according to V-VLT-1 no action was taken.

Between 14:13 and 19:11Z, TM parameters G5033 (POS-M7-RTC2: PDM7 counter semi-module2), G5038 (POS-M8-RTC2) and G5018 (POS-M4-RTC2) toggled OOL "high" several times. According to P-CNT-1, as this occurred inside radiation belts, no action was taken.

At 20:35Z, TM parameter G2014 (IOE_OVF_MPX_ADD_M1) failed SCC, and then went back within limit. As indicated in reaction I-OVF-1, no action was taken.
At 20:42Z, TM parameter G2084 (IOE_OVF_MPX_ADD_M7) failed SCC, and then went back within limit. As indicated in reaction I-OVF-1, no action was taken.

DoY 2005.097 (07/04/2005)

Nothing to report.

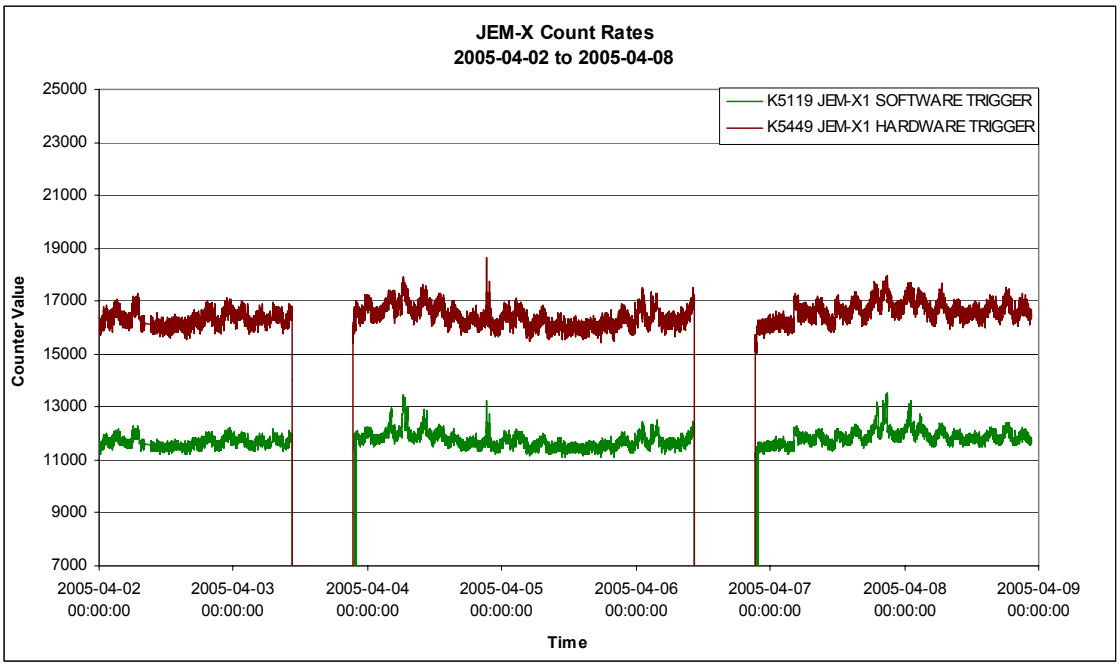
DoY 2005.098 (08/04/2005)

Nothing to report.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

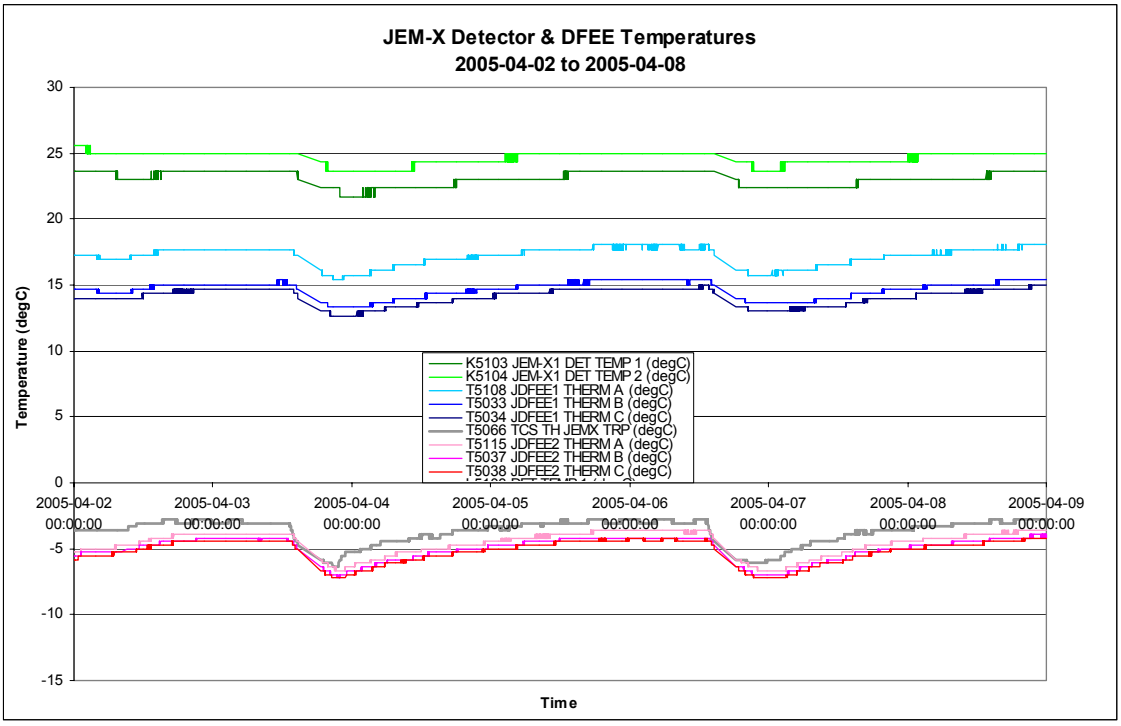
JEM-X count rates over the reporting period are displayed in the following graph[1].



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[2].

[1] Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.
[2] Data sampled (1 frame in 8)



8.3.4.3 JEM-X Daily Report

2005-04-02 (DOY 092, Rev 301) to 2005-04-08 (DOY 098, Rev 303)

Nothing to report

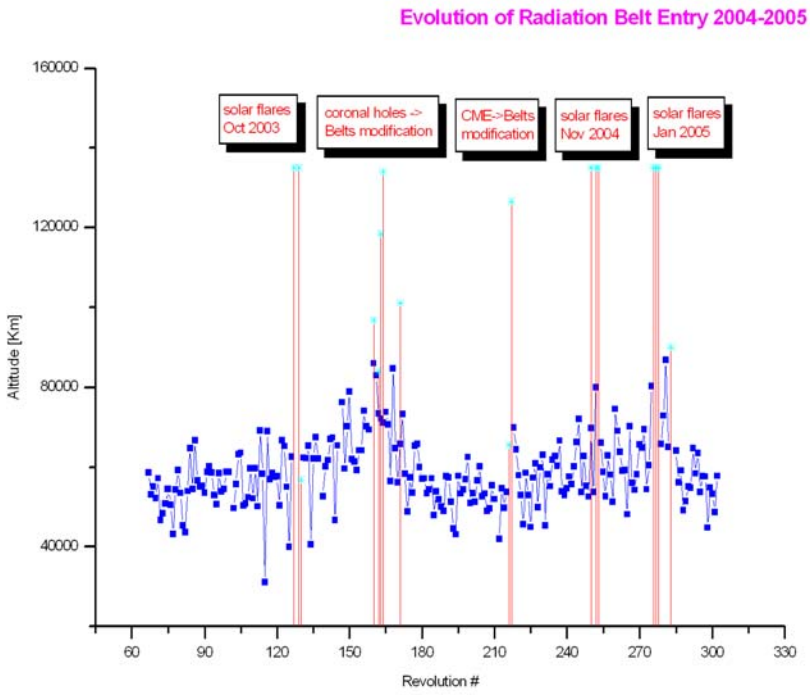
8.3.5 OMC Operations

Nothing to report

On DoY 093 at 11:54:17 and DoY 096 at 11:43:37, 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

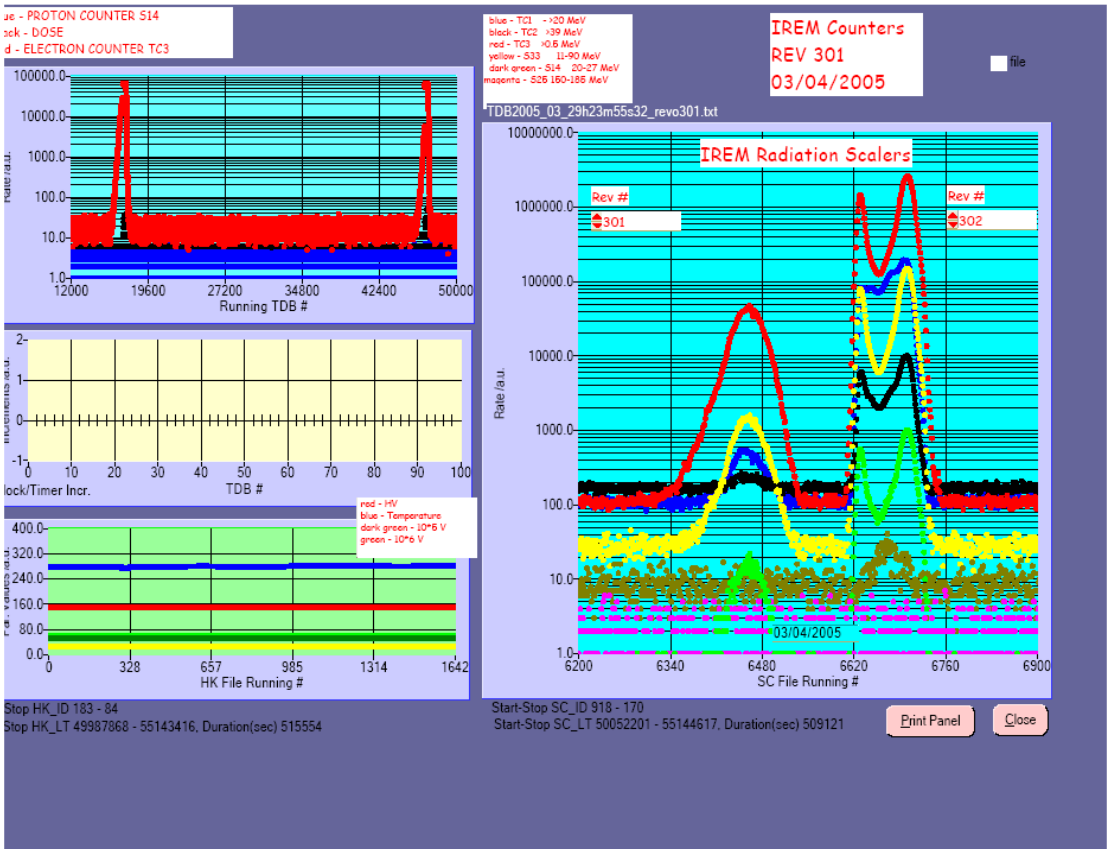
REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
301	RAD_ENTR R 2005-04-03T11:54:00Z	2005-04-03 13:17:58	48739.4	2005-04-03 12:45:03	53136
302	RAD_EXIT R 2005-04-03T21:04:34Z	2005-04-03 19:39:42	>24871.8	2005-04-03 19:55:03	29083
302	RAD_ENTR R 2005-04-06T11:43:21Z	2005-04-06 11:58:30	>57788.3	2005-04-06 12:32:09	53454
303	RAD_EXIT R 2005-04-06T20:53:52Z	2005-04-06 19:46:22	>>24872.6	2005-04-06 19:42:09	28685

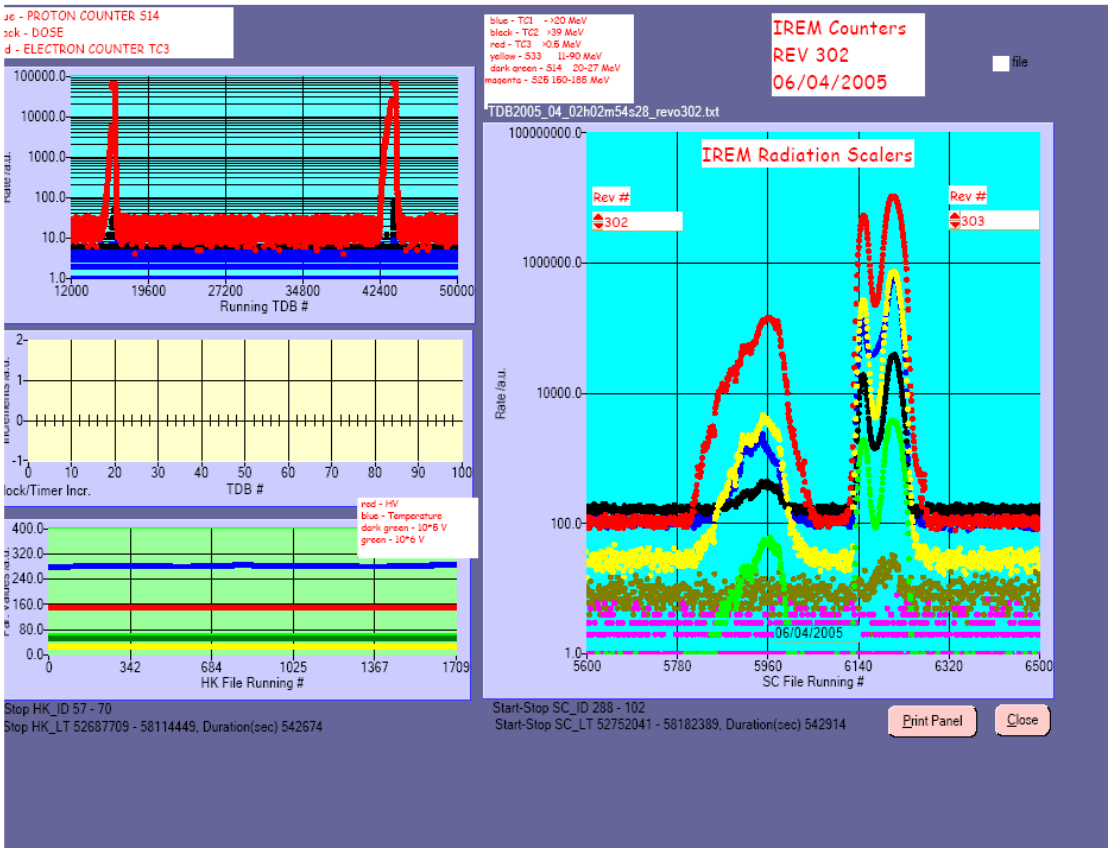
Reference
Very small error vs reference (less than 10 minutes)
Small error vs reference (between 10 and 30 minutes)
Large error vs reference (more than 30 minutes)
Radiation Spike

Proton Belts

The flux of protons >8MEV computed by RadMon, did not exceed the threshold. Therefore, no predicted proton cut-off is provided for this week.

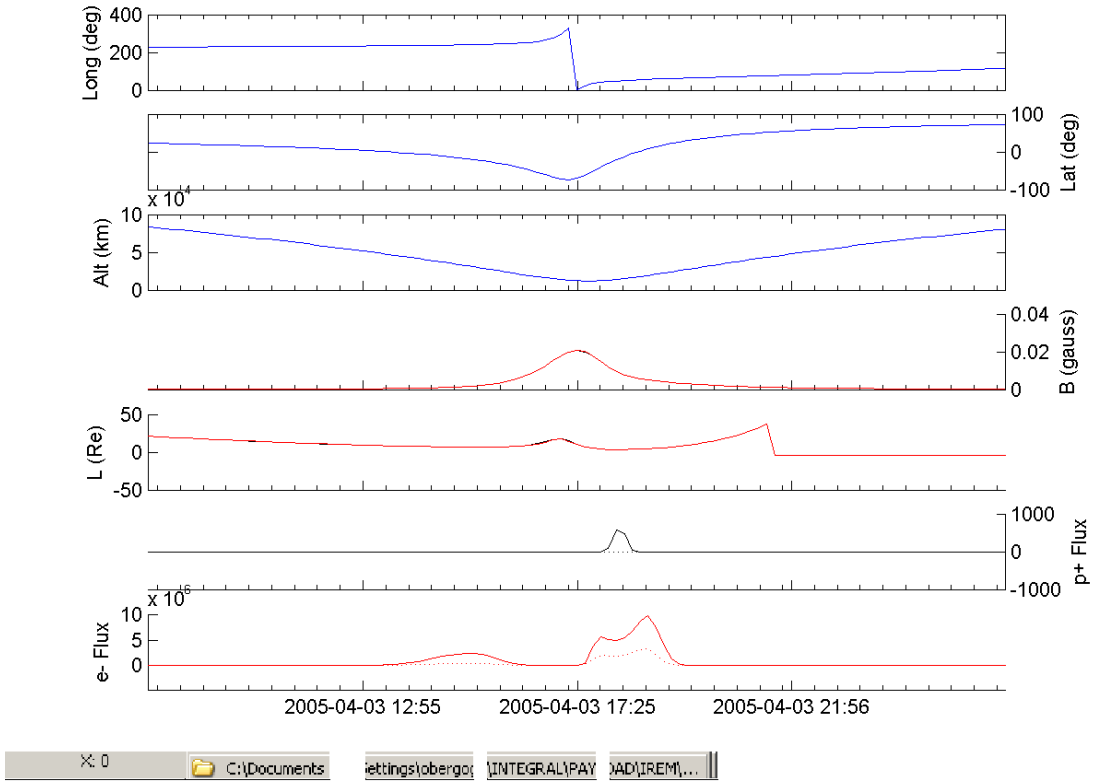
IREM radiation counters



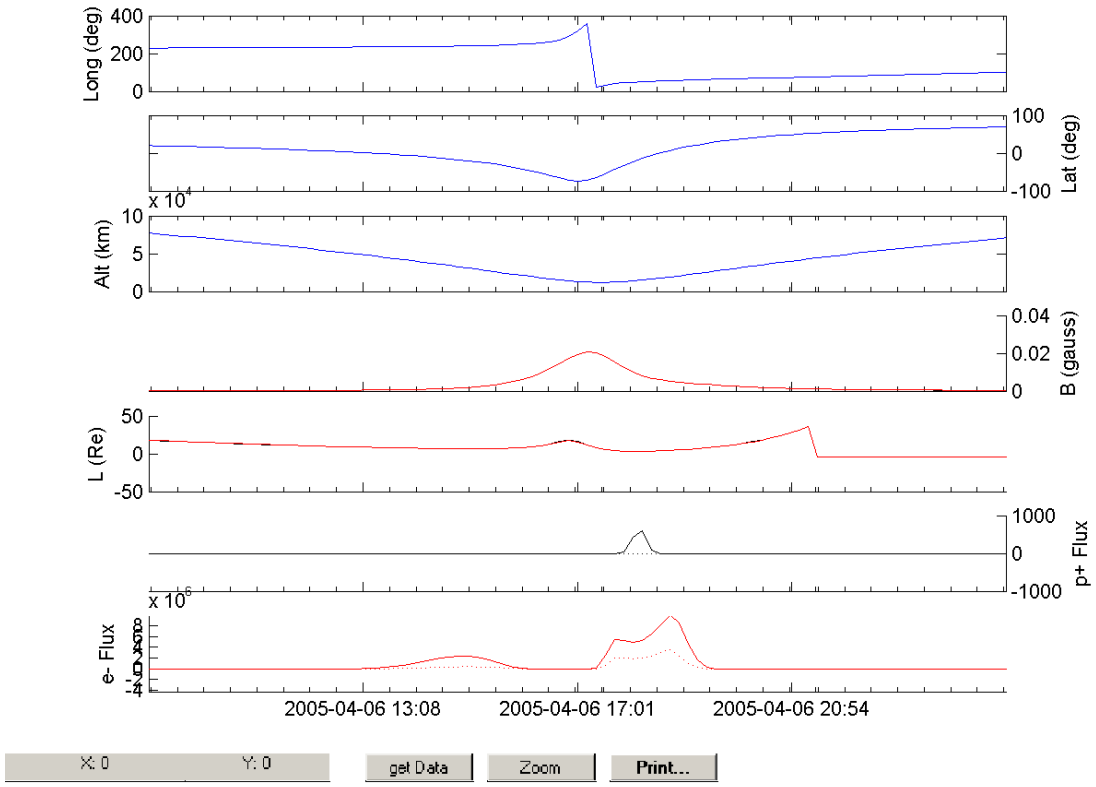


IREM Predicted Radiation Belt Passages.

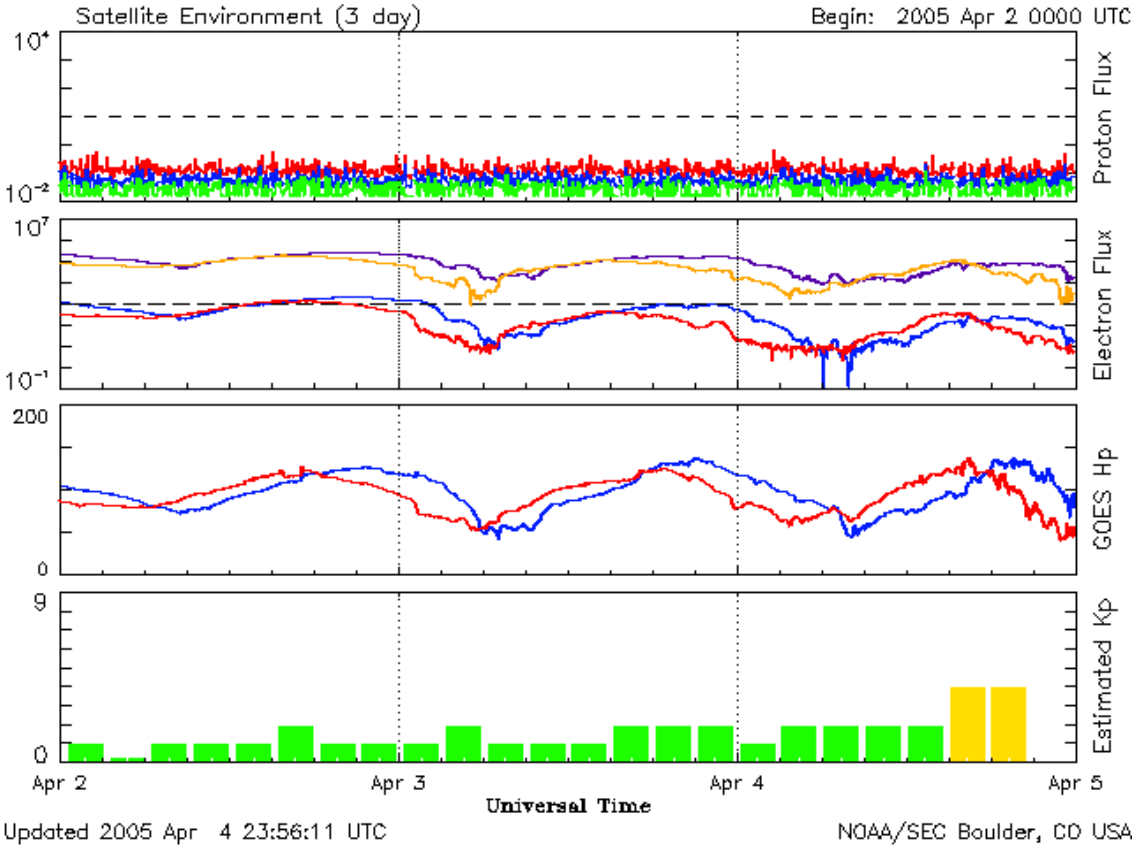
Rev 301

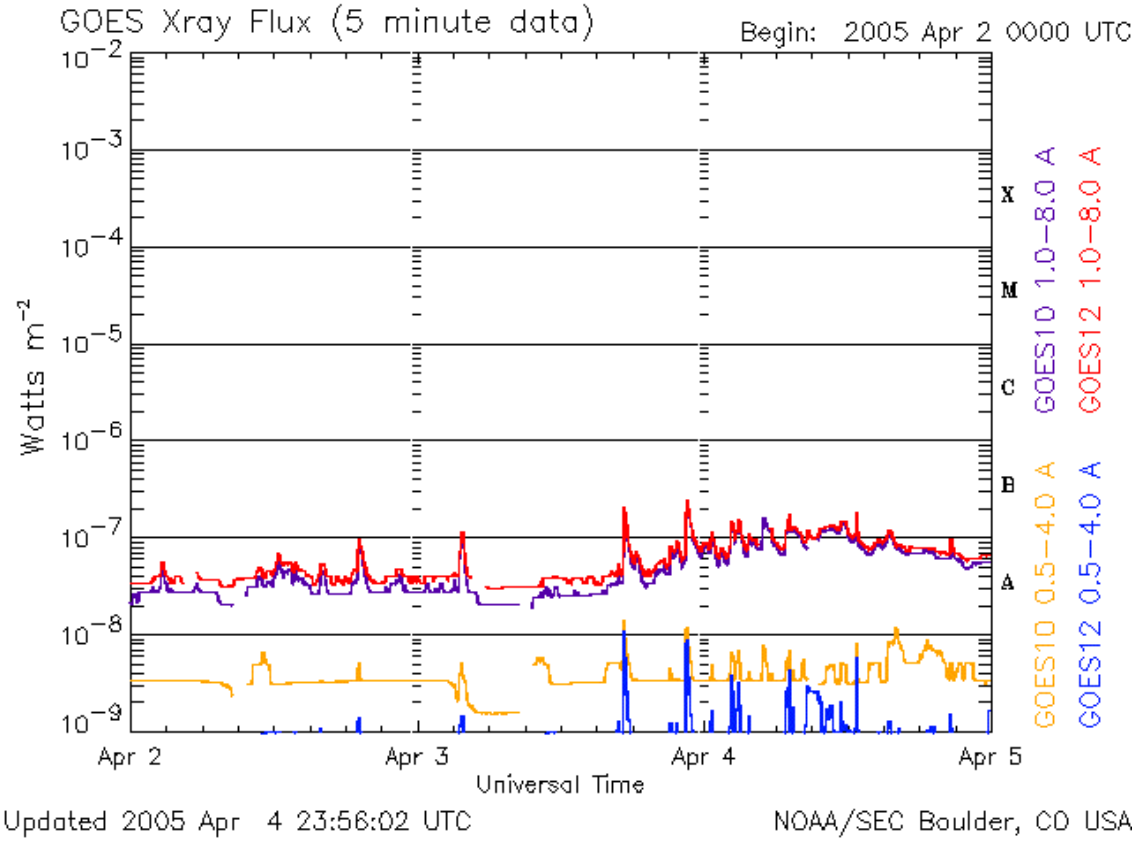


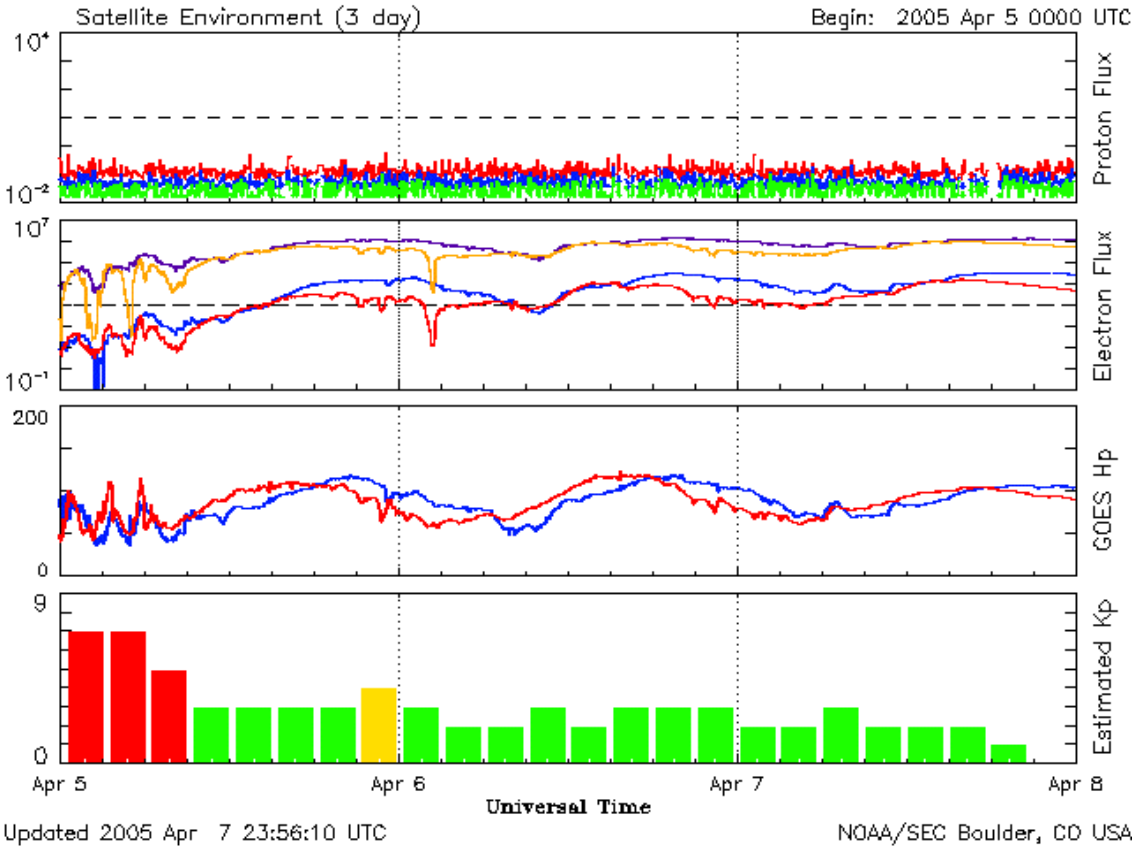
Rev 302

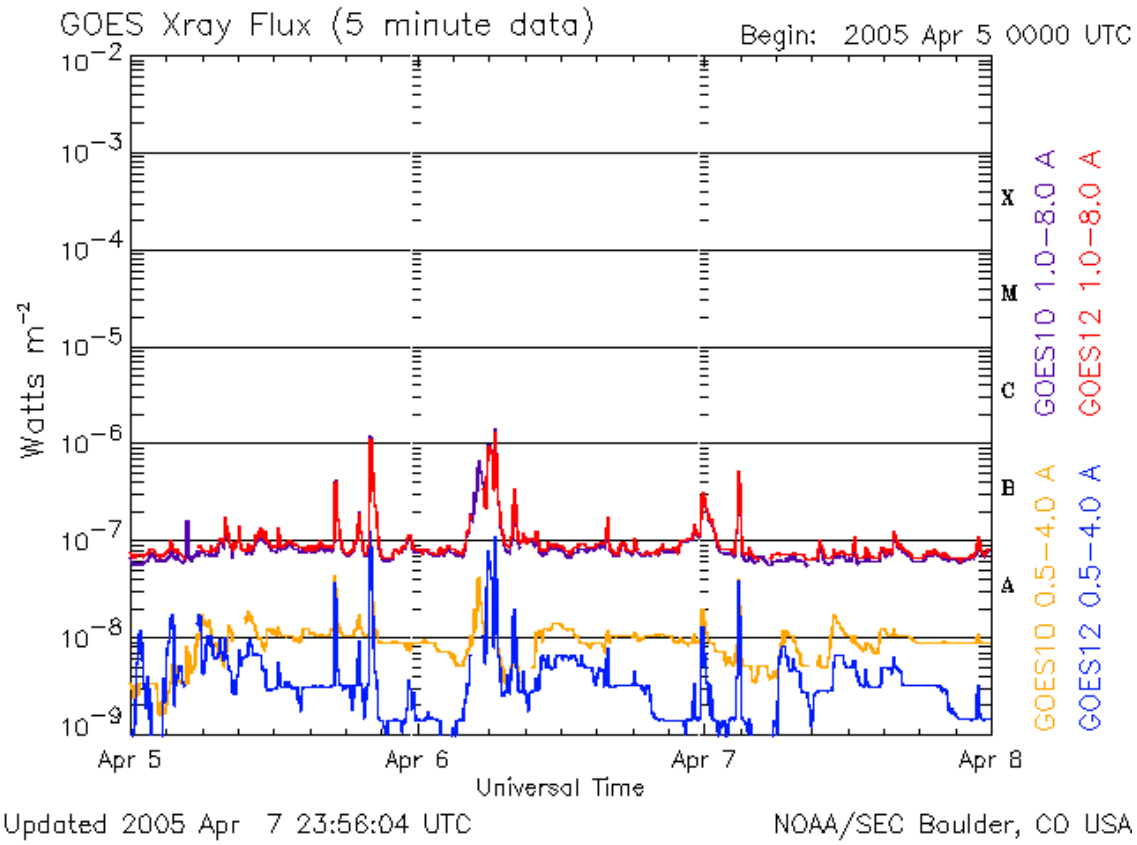


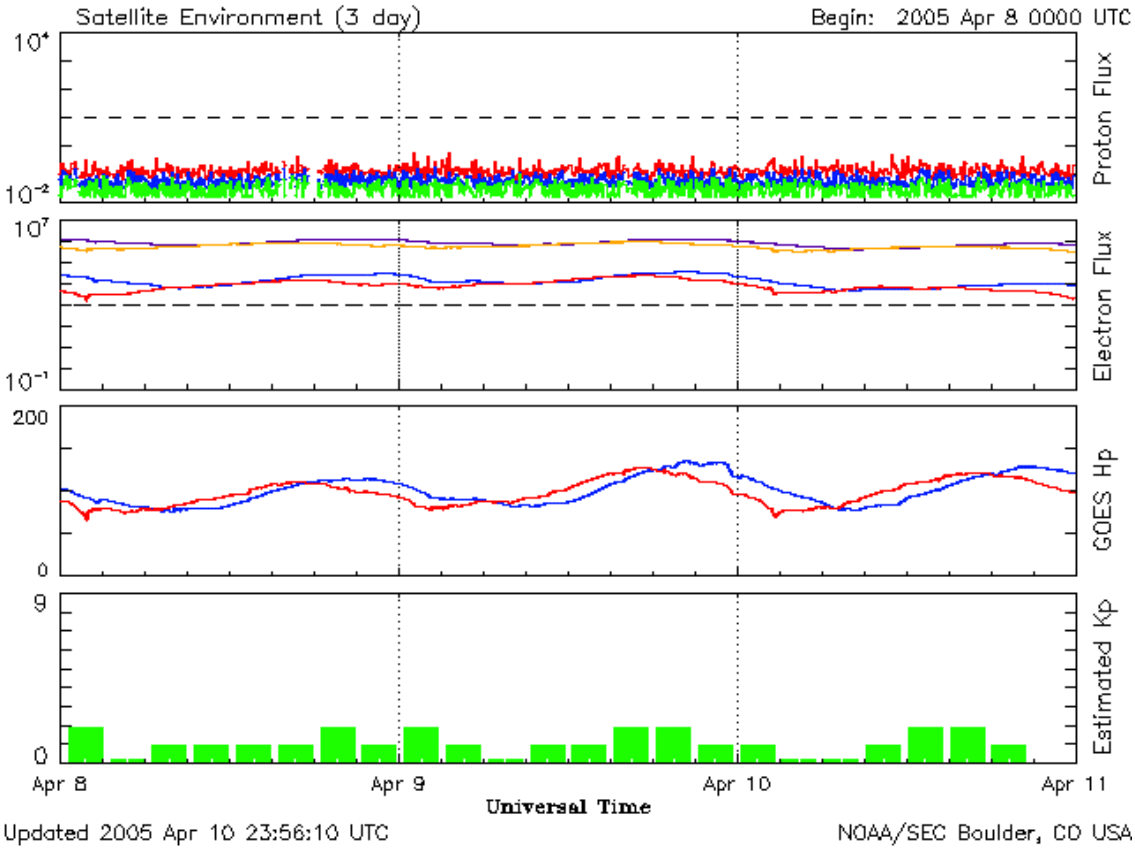
SEC-GOES Observed Particles Fluxes.

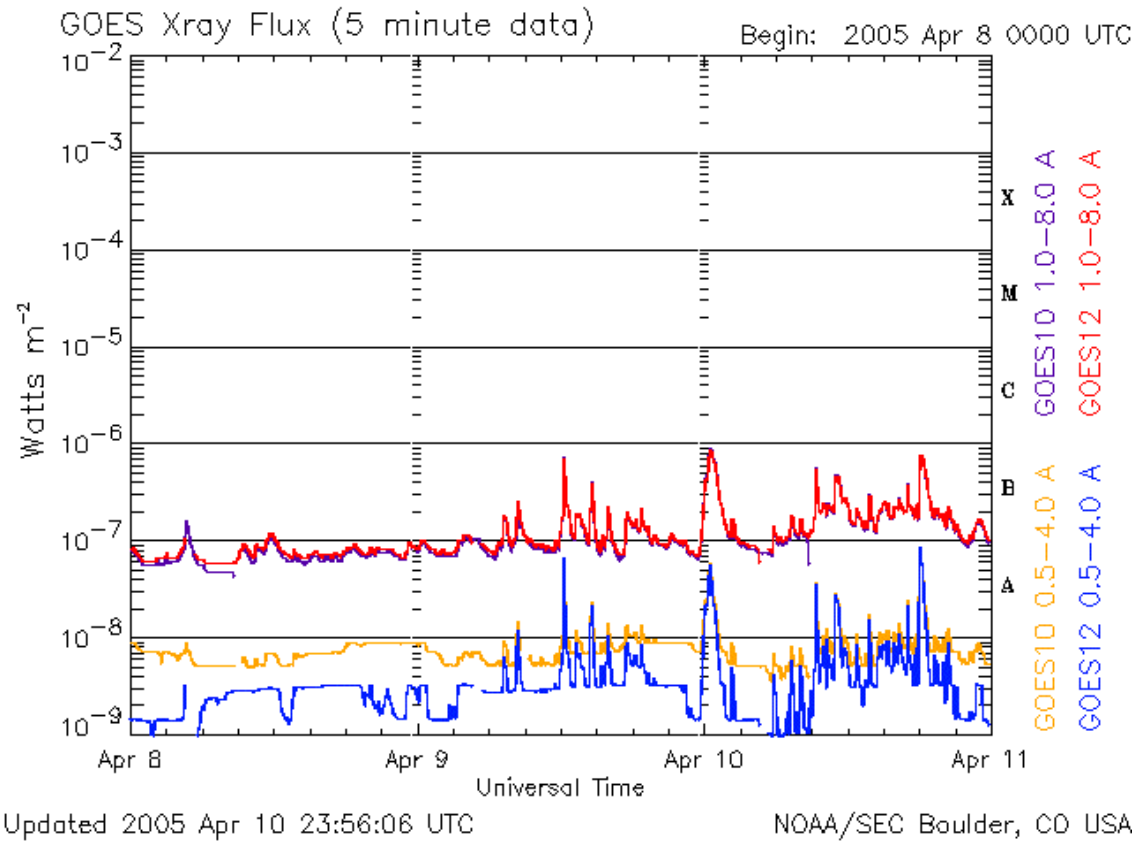





Satellite Environment (3 day)
Begin: 2005 Apr 5 0000 UTC
Proton Flux
Electron Flux
GOES Hp
Estimated Kp
Apr 5
Apr 6
Apr 7
Apr 8
Universal Time
Updated 2005 Apr 7 23:56:10 UTC
NOAA/SEC Boulder, CO USA


GOES Xray Flux (5 minute data)
Begin: 2005 Apr 5 0000 UTC
Watts m-2
X
M
C
B
A
GOES10 1.0-8.0 A
GOES12 1.0-8.0 A
GOES10 0.5-4.0 A
GOES12 0.5-4.0 A
Apr 5
Apr 6
Apr 7
Apr 8
Universal Time
Updated 2005 Apr 7 23:56:04 UTC
NOAA/SEC Boulder, CO USA


Satellite Environment (3 day)
Begin: 2005 Apr 8 0000 UTC
Proton Flux
Electron Flux
GOES Hp
Estimated Kp
Apr 8
Apr 9
Apr 10
Apr 11
Universal Time
Updated 2005 Apr 10 23:56:10 UTC
NOAA/SEC Boulder, CO USA


GOES Xray Flux (5 minute data)
Begin: 2005 Apr 8 0000 UTC
Watts m-2
X
M
C
B
A
GOES10 1.0-8.0 A
GOES12 1.0-8.0 A
GOES10 0.5-4.0 A
GOES12 0.5-4.0 A
Apr 8
Apr 9
Apr 10
Apr 11
Universal Time
Updated 2005 Apr 10 23:56:06 UTC
NOAA/SEC Boulder, CO USA