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

INTEGRAL
Mission Report

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

No. 170
Week 51

29.12.05

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 17.12.05 until 23.12.05 (both dates inclusive) and covers the revolutions 388, 389 and 390.

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 Cas A /Tycho (RA 23:51:43.00; DEC +62:03:55.0) and the Galactic Plane. The activities consisted of raster dithering 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.

1slew was lost from the Timeline during this period due to a problem on the IMCS-A chain.

The fuel consumption over the period between 15/11/2005 and 22/12/2005 was 0.1152 kg. The remaining propellant is in the order of 157.4988 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

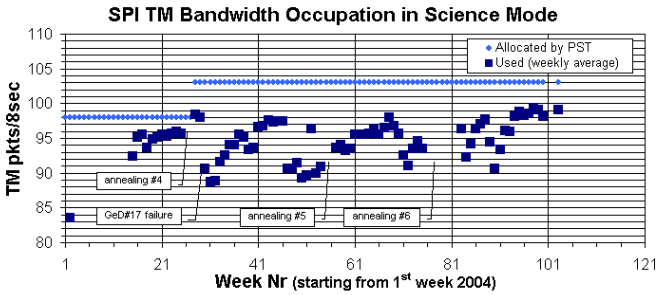
3.2.1 SPI

The overall status of the instrument is nominal.

During science operations, the instrument was 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 99.1 pkts/cycle.

The Stirling compressors are working well, maintaining the detector cold-plate temperature within 85+/-1K.

The following plot shows the TM bandwidth occupation information.



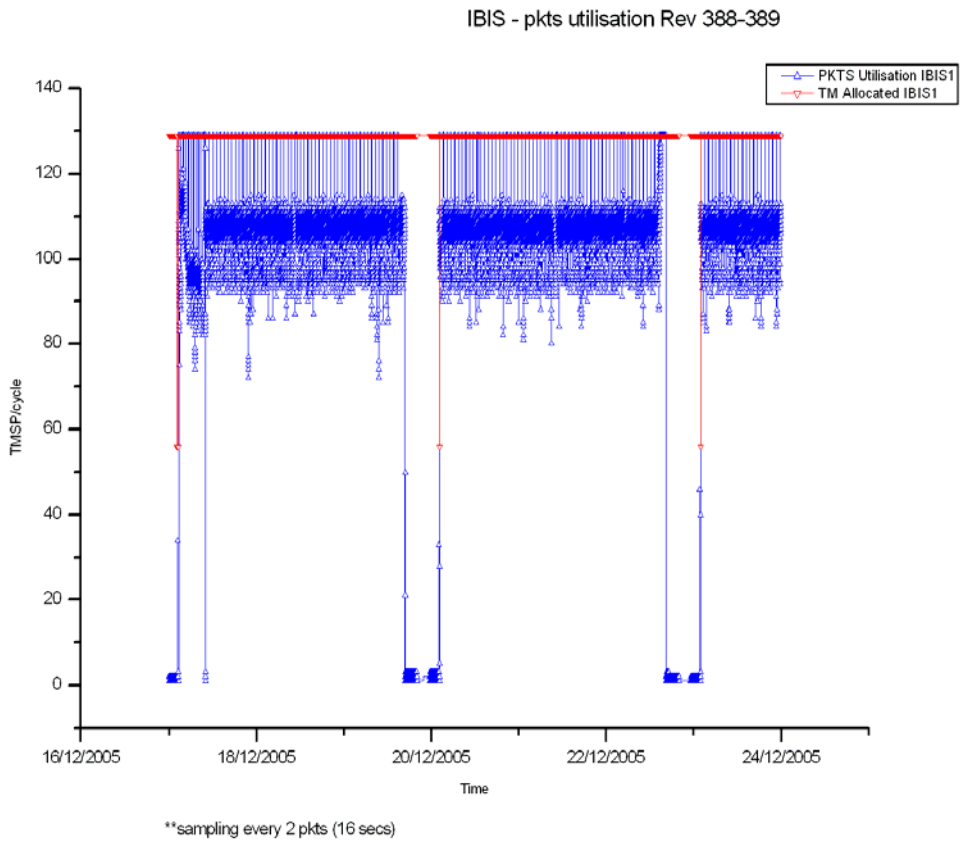
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The Overall status of the unit is Nominal.

During the reporting period, the PST allocation to IBIS was 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 107.3 TMPS/cycle, down 1.4 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.

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, 142 of the 143 planned science pointings for OMC were executed nominally, one was 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. The sun was quiet this week. Only tiny sunspots were reported during the week that did not pose any threat of Solar Flare.

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 very good this week, only one pointing was lost when an AOCS TC failed release. The overall performance below the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week, one pointing was lost when the CPD task was not receiving TM. The overall performance well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week There were a few instances of bad frames and TM drops, but these had no impact on the mission. The overall performance though was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF's have been received for revolutions 398-402. Planning has been done and sent up to revolution 398. The revolutions including Earth observations will be set up after the Christmas break as these also require and IODB update on the ISOC operational system for OMC.

TSF's have been received up to revolution 396.

No ToO has been scheduled, but advance warning on a possible ToO on 3C279 has been received.

In week 52 there will be only duty scientist support to ToO requests available. Week 1 of 2006 will also be at low activity. As agreed with MOC, observations have been pre-planned up to mid January to allow this.

2. Observation status

ECS's for revolutions 379 and 380 were received. The Corresponding OCS' have been sent ISDC. No extra time has been credited.

3. ISOC science data archive

Nothing to report.

4. ISOC system

Version 12.0 has been released in preparation of AO-4. It contains new PGT, PRV and PLD supporting generic JEM-X settings by the user and Key Programmes on the input side.

5. Problems

None.

4.3.2 ISDC

Status of ISDC observation processing on 26/12/2005:

- Latest Standard Analysis completed: observation 03201080006 (Field 6, Revolutions 372-373) on 21/12/2005

- Latest products archived: observation 03201080006 (Field 6, Revolutions 372-373) on 23/12/2005

- Latest observation products sent to the observer: observation 03200420001 (Swift J1753.5-0127, Revolution 345) on 03/10/2005

5 Special Events

6 Anomalies

The following problem impacted operations:

- On DoY 356, at 04:09, the AOCS command A7213 (RESET TIM ACCUM) failed release due to the dynamic PTV, this was caused by the CPD task not receiving TM. The situation was recovered by restarting the CPD TM cache. The impact was the loss of pointing 03890049.

There were no new anomaly reports entered into the ARTS system this week.

7 Future Milestones

Preparation is on-going for the earth observation, currently planned to take place in January.

The upgrade of the IMCS has been delayed for incorporation of an urgent fix which has become available from infrastructure, new release date will probably be early January depending upon the time taken to integrate and test this patch.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 388

The observations in revolution 388 consisted of a GPS lasting ~6.5 hours, followed by a raster dithering observation of Cas A /Tycho (RA 23:51:43.00; DEC +62:03:55.0), performed for the remaining ~54 hours of observation time.

Revolution 389

The observations in revolution 389 continued with raster dithering observations of the Cas A / Tycho supernova (RA 23:51:43.00; DEC +62:03:55.0) lasting ~58.5 hours.

Revolution 390

The observations in revolution 390 continued with raster dithering observations of the Cas A /Tycho (RA 23:51:43.00; DEC +62:03:55.0) lasting ~57.5 hours.

Throughout these observations all instruments were in their nominal science modes, except for a short period on 25/12/2005 around 03:42:17z when a special configuration for the on board time wrap-around was executed. JEM-X2 DFEE remained off along the entire period. 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

```
2005-12-14T03:20:47.000Z     157.6890    F   Automatic TM processing.
2005-12-14T03:52:23.000Z     157.6820    F   Automatic TM processing.
2005-12-14T05:07:11.000Z     157.6610    F   Automatic TM processing.
2005-12-14T06:31:35.000Z     157.6370    F   Automatic TM processing.
2005-12-14T10:01:19.000Z     157.6180    F   Automatic TM processing.
2005-12-15T11:18:42.000Z     157.6140    F   Automatic TM processing.
2005-12-16T20:07:42.000Z     157.5962    F   Automatic TM processing.
2005-12-17T00:32:06.000Z     157.5687    F   Automatic TM processing.
2005-12-17T09:29:11.000Z     157.5572    F   Automatic TM processing.
2005-12-18T10:47:14.000Z     157.5481    F   Automatic TM processing.
2005-12-19T19:42:38.000Z     157.5339    F   Automatic TM processing.
2005-12-20T00:15:42.000Z     157.5328    F   Automatic TM processing.
2005-12-21T10:23:38.000Z     157.5206    F   Automatic TM processing.
2005-12-22T19:37:02.000Z     157.5064    F   Automatic TM processing.
2005-12-22T23:59:27.000Z     157.4988    F   Automatic TM processing.

This report was generated  Fri Dec 23 08:00:31 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, 17/12/2005 – 23/12/2005

AOCS operations were executed from the Automatic Timeline.

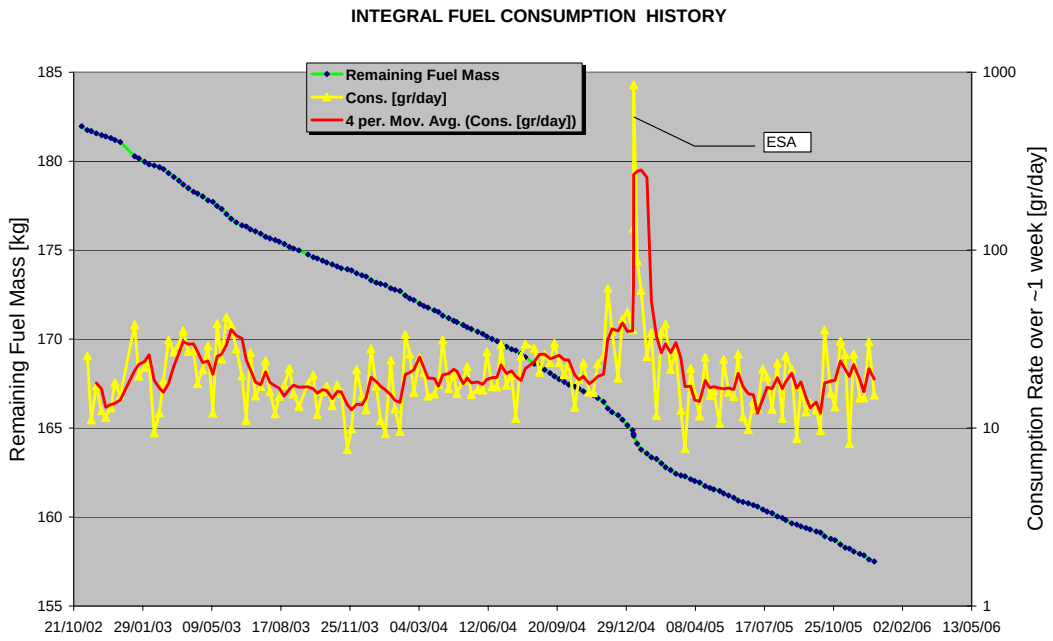
During this period, 42 Open Loop Slews, 105 Closed Loop Slews and 8 Momentum Bias were executed (TL + manual recovery).

1 slew was lost from the Timeline during this period due to a problem on the IMCS-A chain.

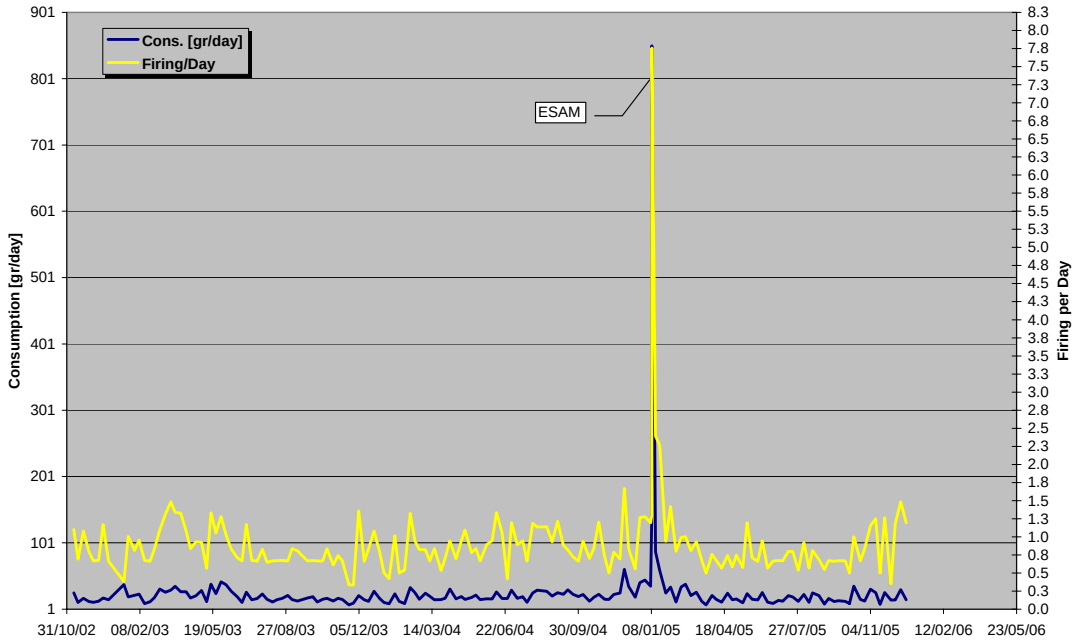
This is equivalent to 0.7 % of the total number of slews planned (147).

Orbit Control
N.A, provided on monthly basis.

Fuel consumption
The fuel consumption (total, grams/day) over the period between 01/11/2002 and 22/12/2005 is shown in the plot below.

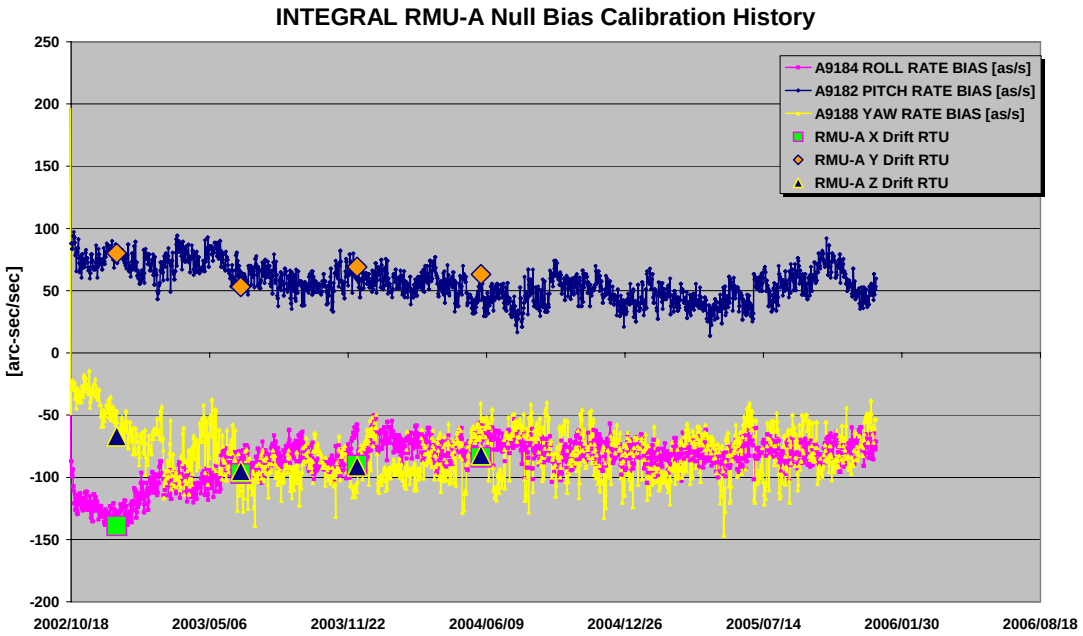


The firing\day over the period between 01/11/2002 and 15/12/2005 is shown in the plot below.

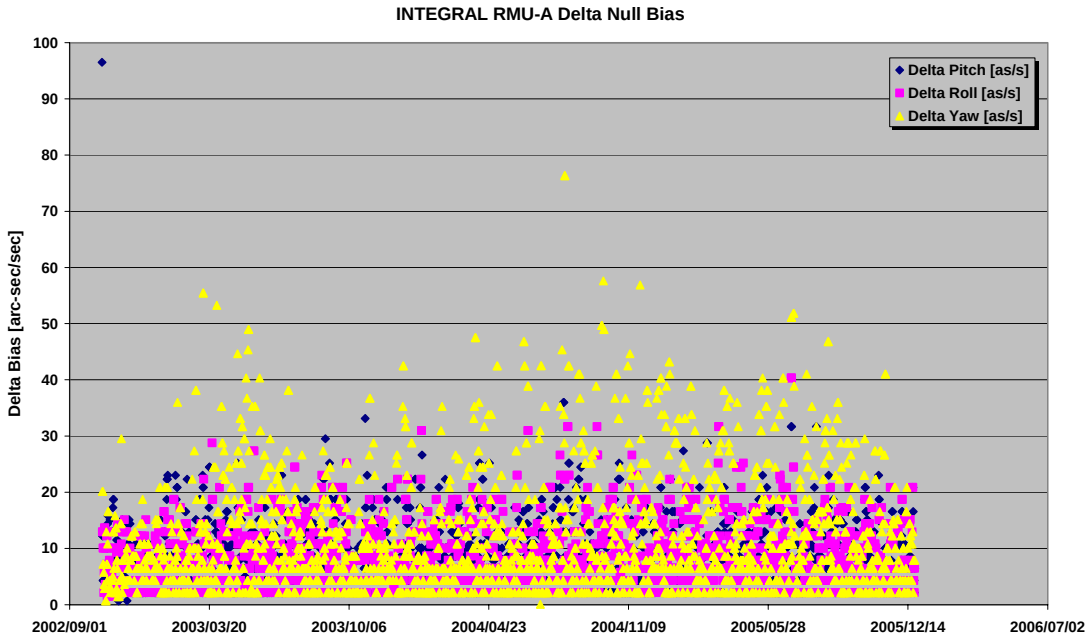


The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 23/12/2005 is reported in the plot below.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 23/12/2005 is reported in the plot below.



17/12/05 (Day of Year 351, Revolution 388)

Nothing to report.

18/12/05 (Day of Year 352, Revolution 388)

Nothing to report.

19/12/05 (Day of Year 353, Revolution 388)

Nothing to report.

20/12/05 (Day of Year 354, Revolution 388-389)

Nothing to report.

21/12/05 (Day of Year 355, Revolution 389)

Nothing to report.

22/12/05 (Day of Year 356, Revolution 389)

Slew missed from the Timeline: Due to a problem occurred on IMCS-A chain (CPD task not receiving TM, see detailed problem report in section 6), the slew ID 03890049 failed release.

The AOCS s/s was disabled in TL at 04:09z.

A manual recovery was attempted from attitude of PID 03890048 to the attitude of PID 03890049. The next CSL was manually updated and executed from the Timeline.

The AOCS s/s was re-enabled in TL at 04:50z.

The following slew was not executed from TL while recovering the AOCS s/s: 0389049(CSL).

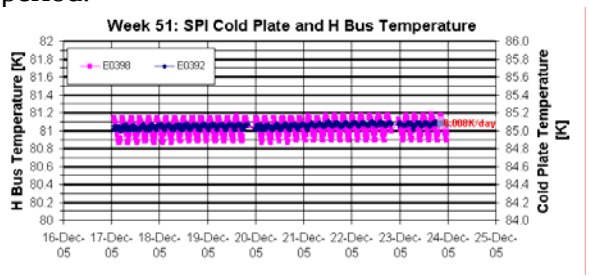
23/12/05 (Day of Year 357, Revolution 389-390)

Nothing to report.

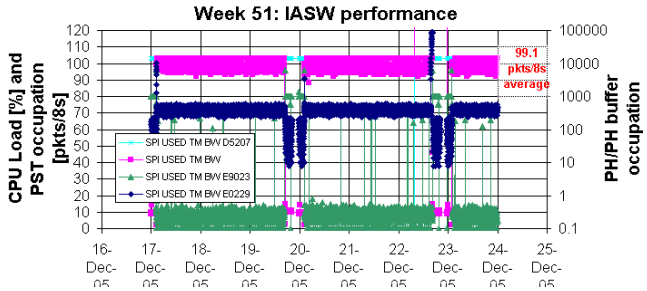
8.3.2 SPI Operations

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

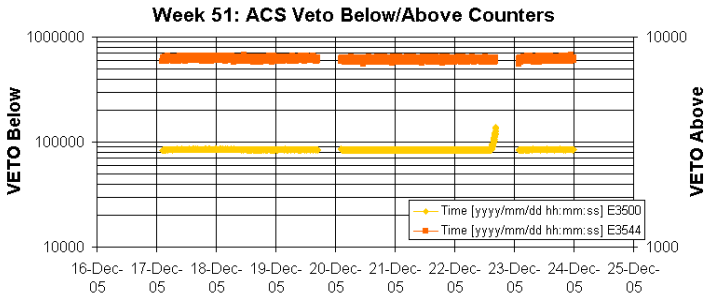
Stirling Compressors and Cryostat:
The performance of the compressors is nominal. The cold plate temperature was maintained at 85K+/-1K showing the expected positive drift.
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



DPE & IASW:
The Iasw performance is nominal.
The current Iasw version installed is 432.
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



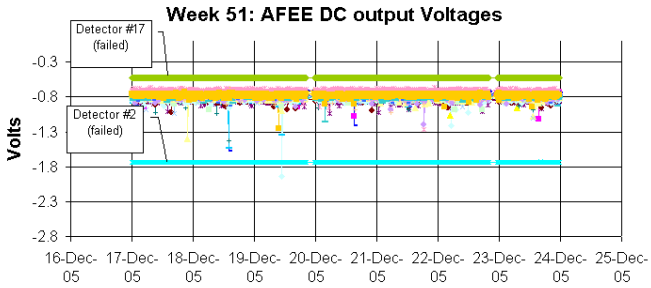
ACS:
The performance of the ACS is nominal.
The following plot shows the ACS overall count rate evolution during the reporting period (due to problems in the data retrieval tool, some gaps could be present).



AFEE:

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.

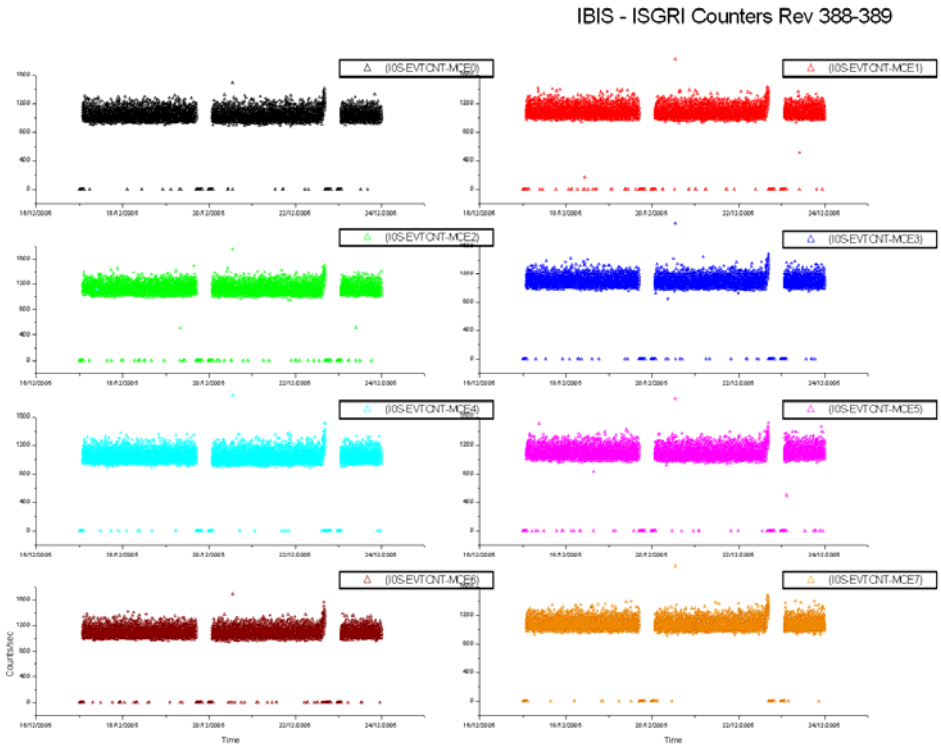
PSD:

The performance of the unit is nominal

8.3.3 IBIS Operations

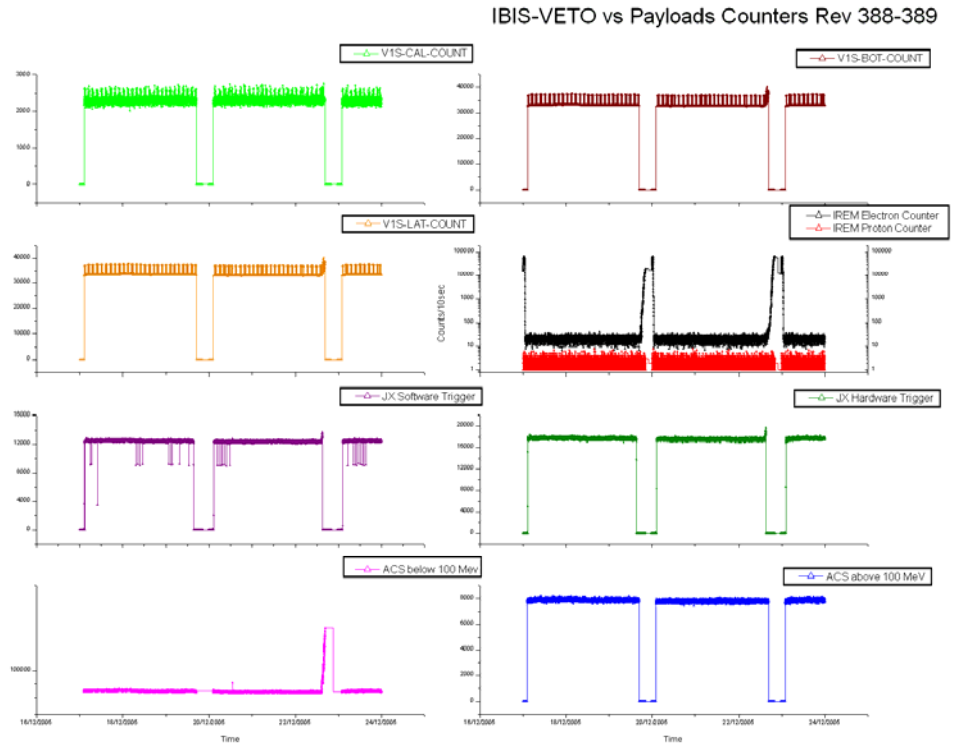
IBIS Event Counters Plots.

ISGRI Counters:



**sampling every 4 pkts (32 secs)

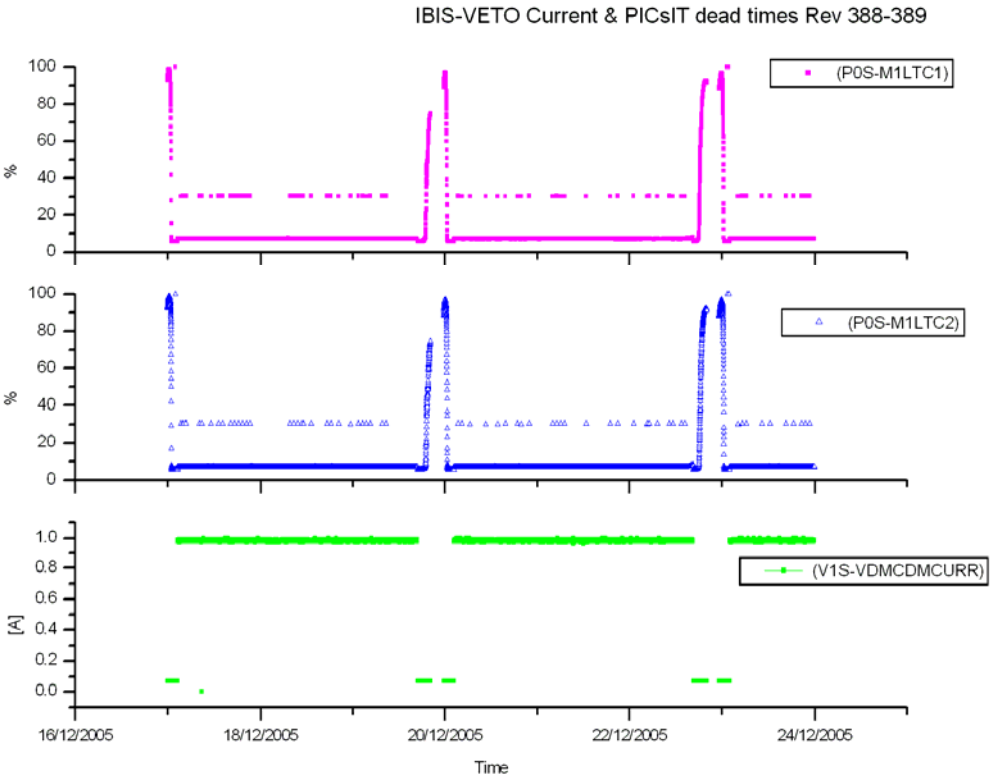
VETO vs Payloads Counters:



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

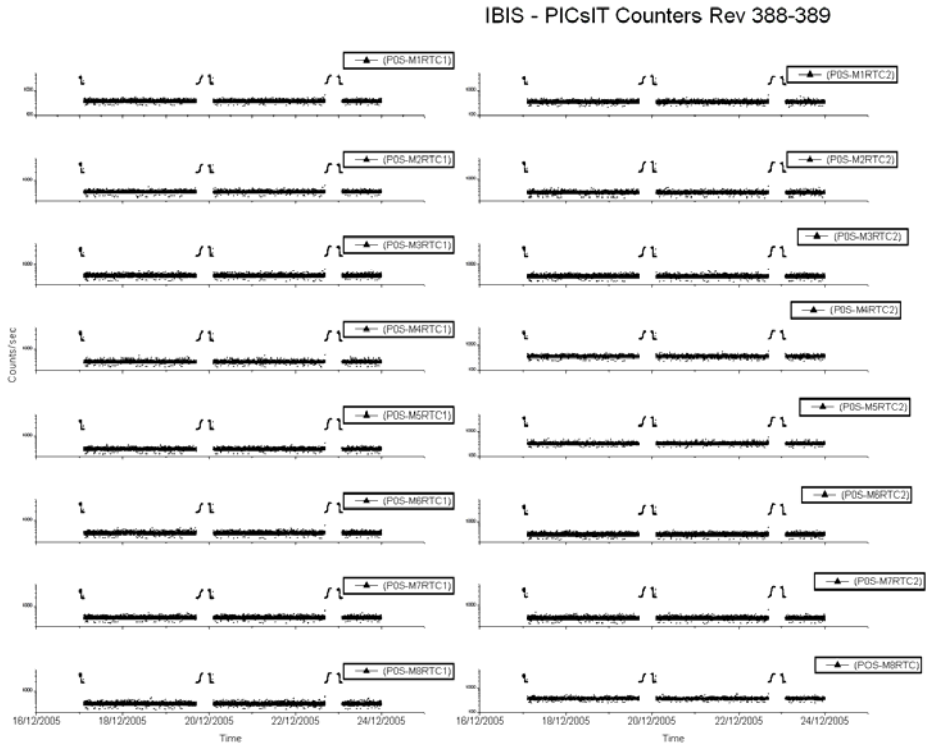
The week was characterised by low radiation.

VETO Current:



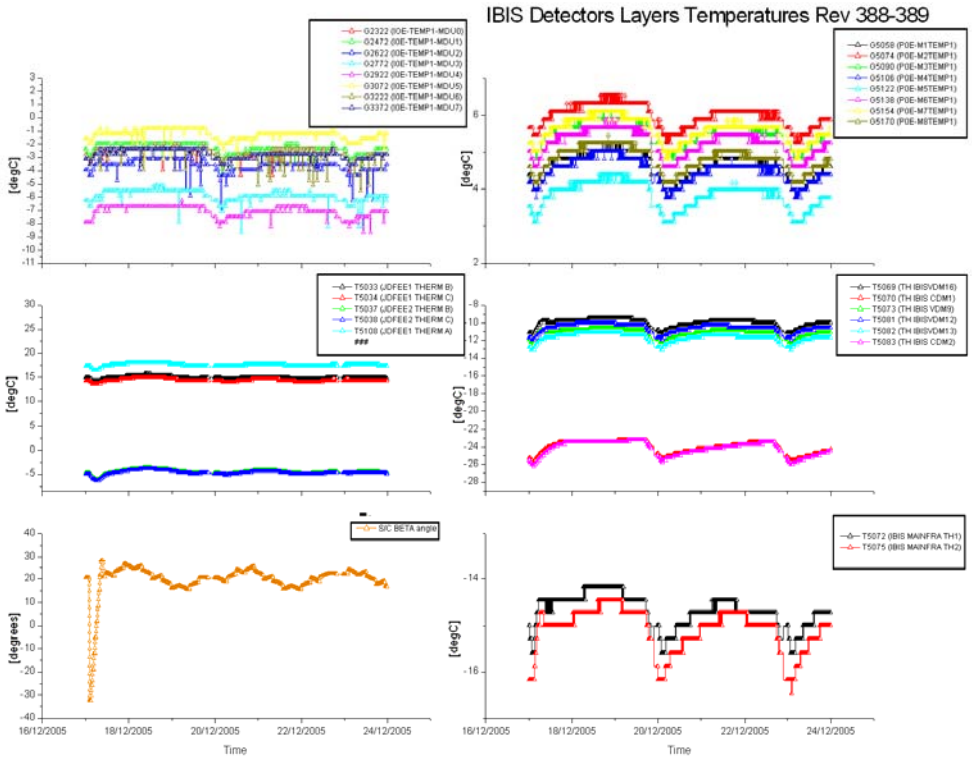
**sampling every 4 pkts (32 secs)

PICsIT Counters:



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:



**sampling every 8 pkts (64 secs)

IBIS daily report

DoY 2005.351 (17/12/2005): HEPI Time-Out

On DoY 2005.351 (17/12/2005) at 08:43:51Z, the following OEM APID 1280 ID 133 CLASS 2 was reported:

"IBIS1 IASW LSL TRANSFER FAILED (LOW LEVEL)"

together with OEM APID 1280 ID 131 CLASS 2:

"IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET"

This anomaly is similar to the previous ones that flagged a Time-Out in several peripherals and that refer to the anomaly report INT_SC-113. This time, according to G1581 (parameter of OEM ID 131), the anomaly occurred with VETO.

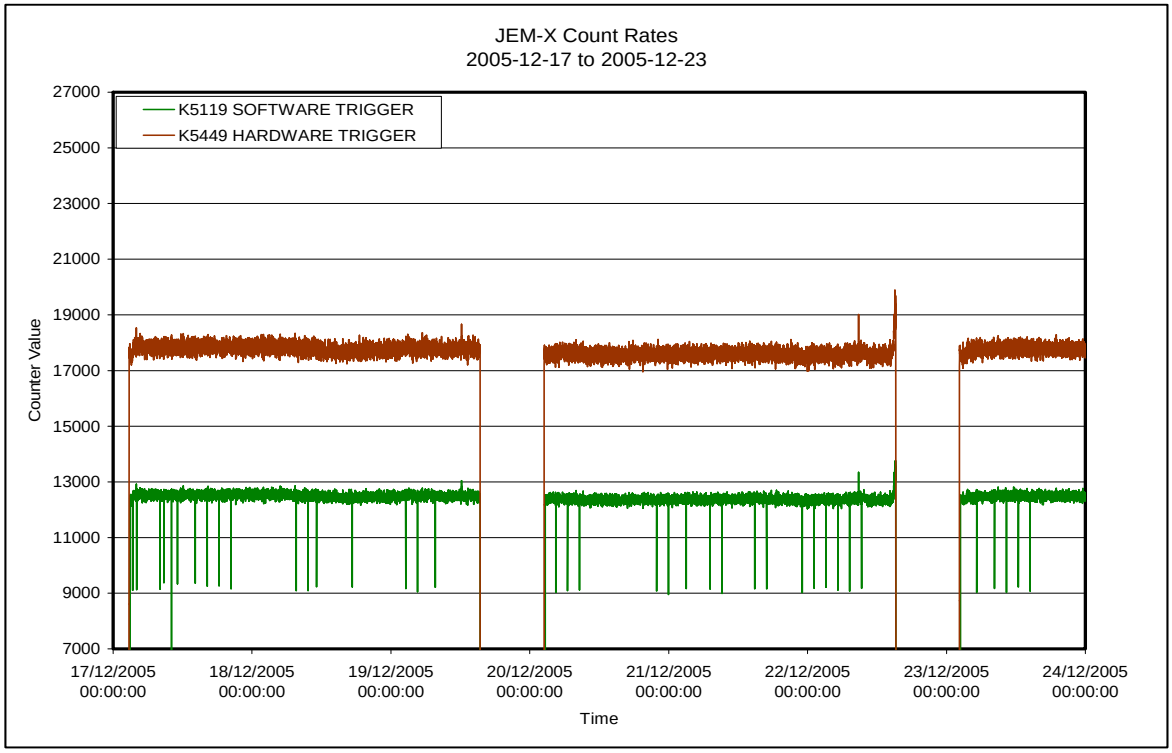
IBIS incurred a timing problem on the Low Speed Line that affected the communication with VETO. During this time, a request for HK1 was sent to VETO without any answer due to the black-out in communication between the peripheral and the DPE. During this time no valid HK was collected from VETO therefore, what was reported in the HK1 was simply the IASW default (i.e all 0000...). This is confirmed by the reading of TM parameters that turned to raw value 0 (VETO VDM HV to raw

0 for example). The unit solved autonomously the internal conflict on the LSL and reported the valid HK1 for VETO in next cycle.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

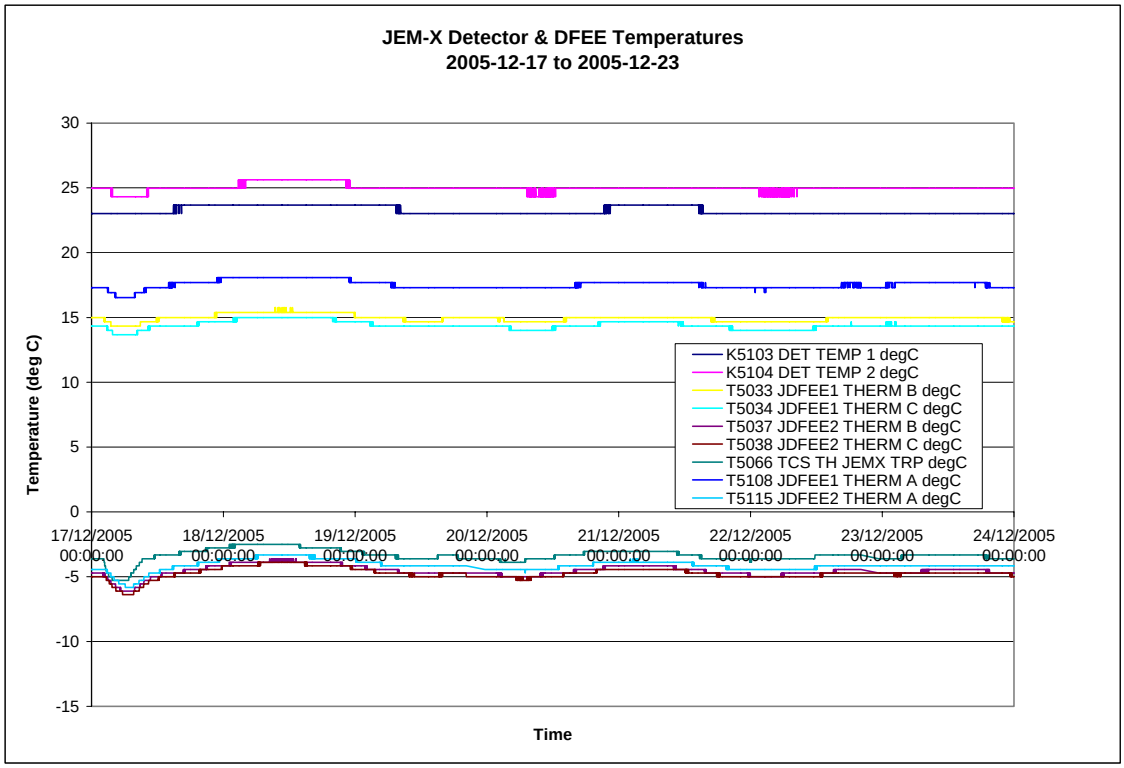
JEM-X count rates over the reporting period are displayed in the following graph[1].



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

2005-12-17 (DOY 351, Rev 388) to 2005-12-23 (DOY 357, Rev 390)

Nothing to report

8.3.5 OMC Operations

2005-12-17 (DOY 351, Rev 388) to 2005-12-21 (DOY 355, Rev 389)

Nothing to report

2005-12-22 (DOY 356, Rev 389)

On DoY 356, at 04:09, an AOCS command failed release due to the dynamic PTV., see AOCS section for details.. The impact was the loss of pointing 03890049.

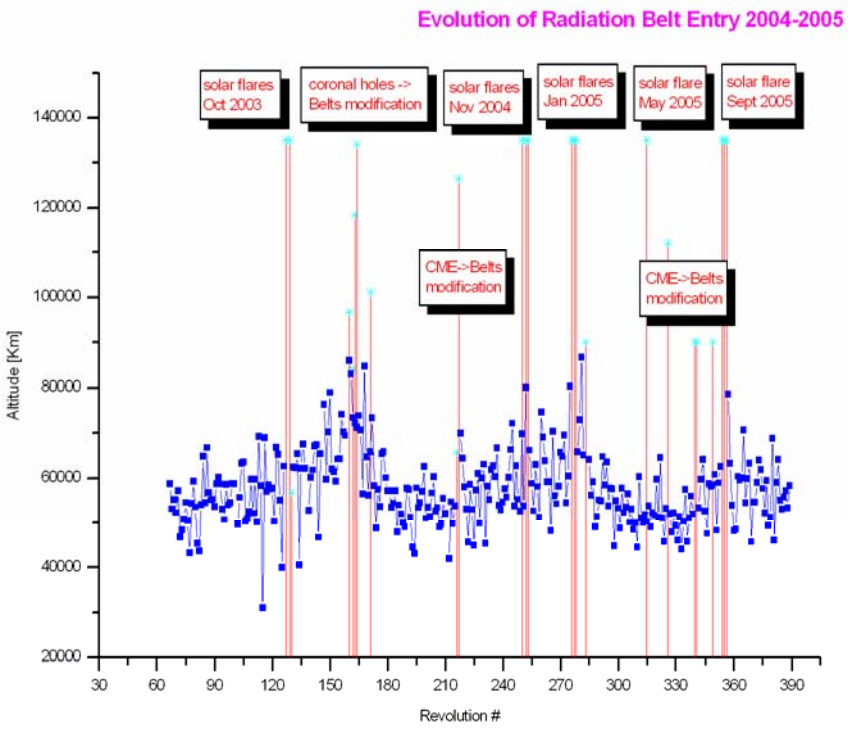
2005-12-23 (DOY 357, Rev 390)

Nothing to report

On DoY 353 at 16:50:04 and DoY 356 at 16:34:21 OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

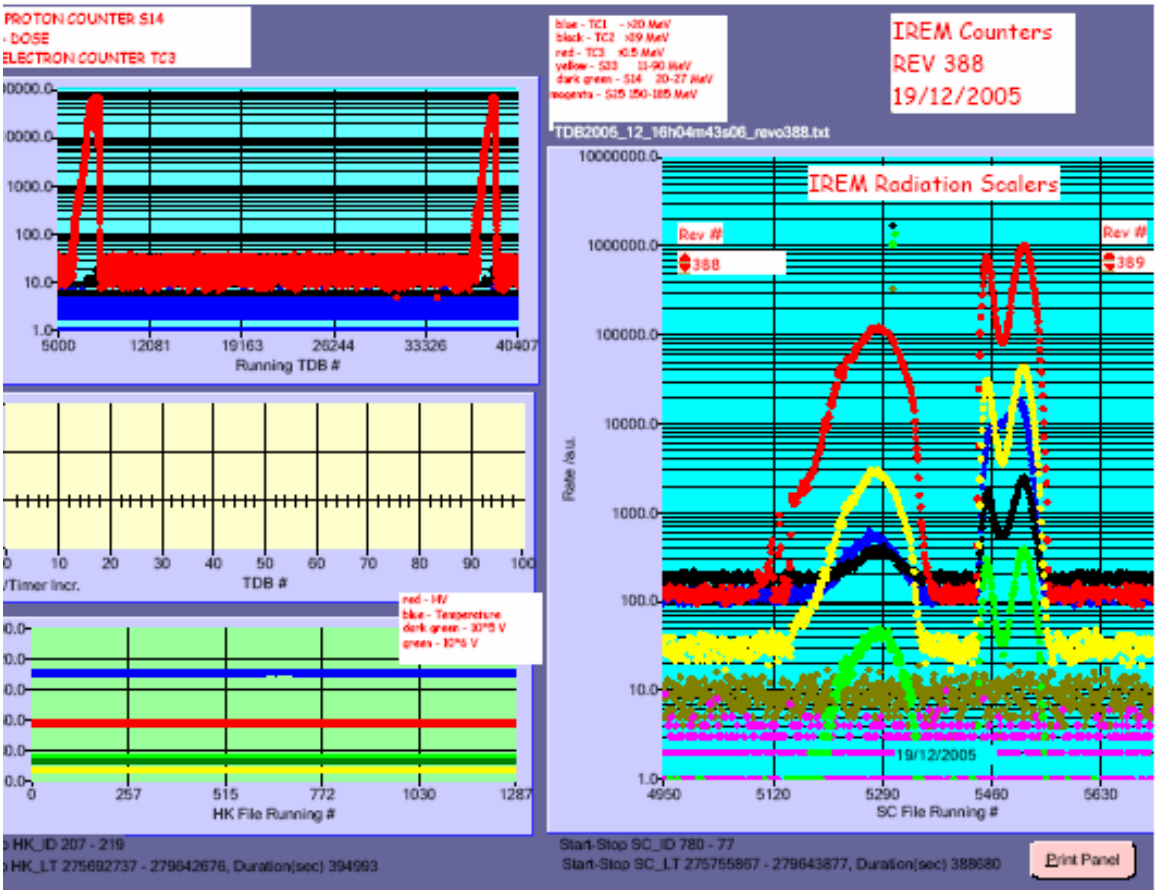
Nothing to report.

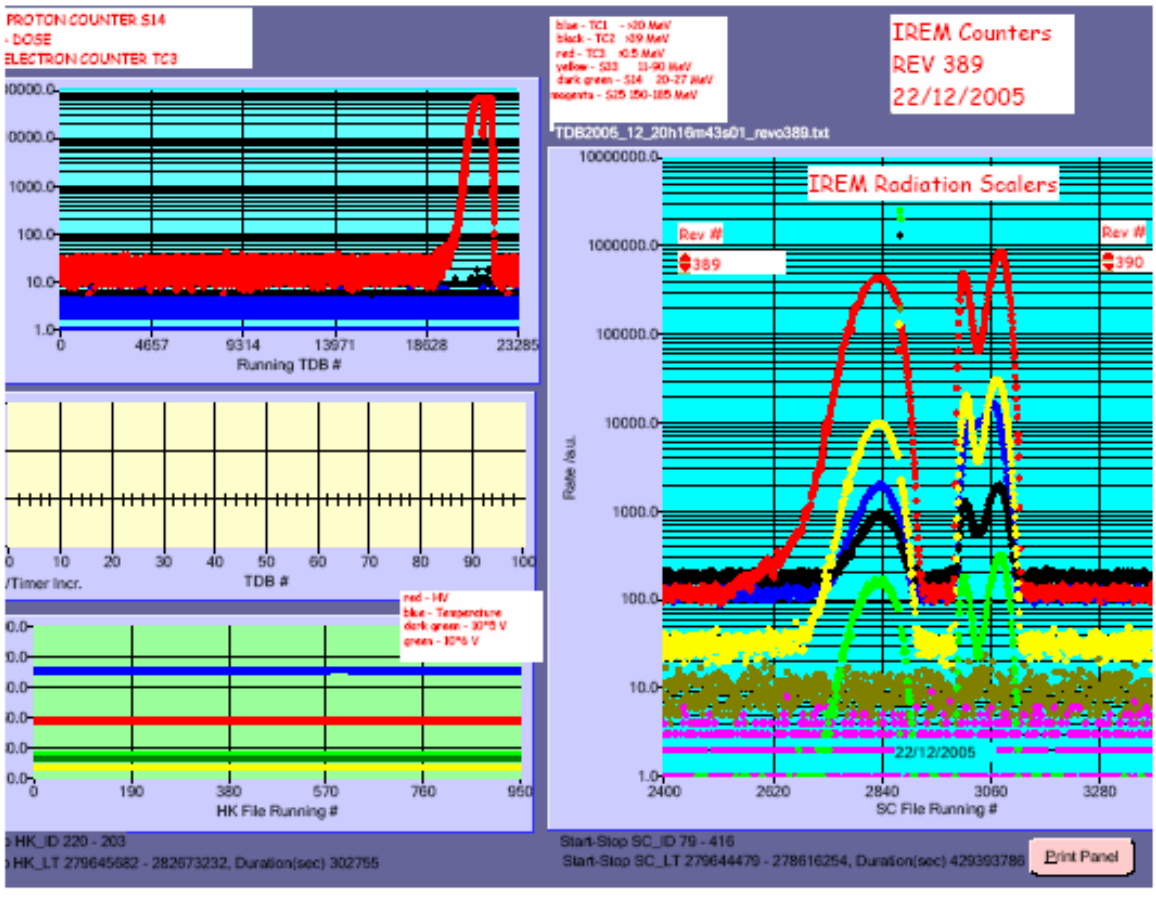
Electron Belts

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]
388	RAD_EXIT R 2005-12-17T02:24:11Z	17/12/2005 01:21:15	>24975.7	17-Dec-2005 01:26:34	31216.38
388	RAD_ENTR R 2005-12-19T16:50:02Z	19/12/2005 17:42:35	53309.1	19-Dec-2005 17:56:34	50450.91
389	RAD_EXIT R 2005-12-20T02:07:57Z	20/12/2005 00:58:59	>24967.4	20-Dec-2005 01:06:34	31528.49
389	RAD_ENTR R 2005-12-22T16:34:17Z	22/12/2005 16:51:07	58297.3	22-Dec-2005 17:45:34	50556.27
390	RAD_EXIT R 2005-12-23T01:52:06Z	23/12/2005 00:57:39	>24964.1	23-Dec-2005 00:55:34	31373.85

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

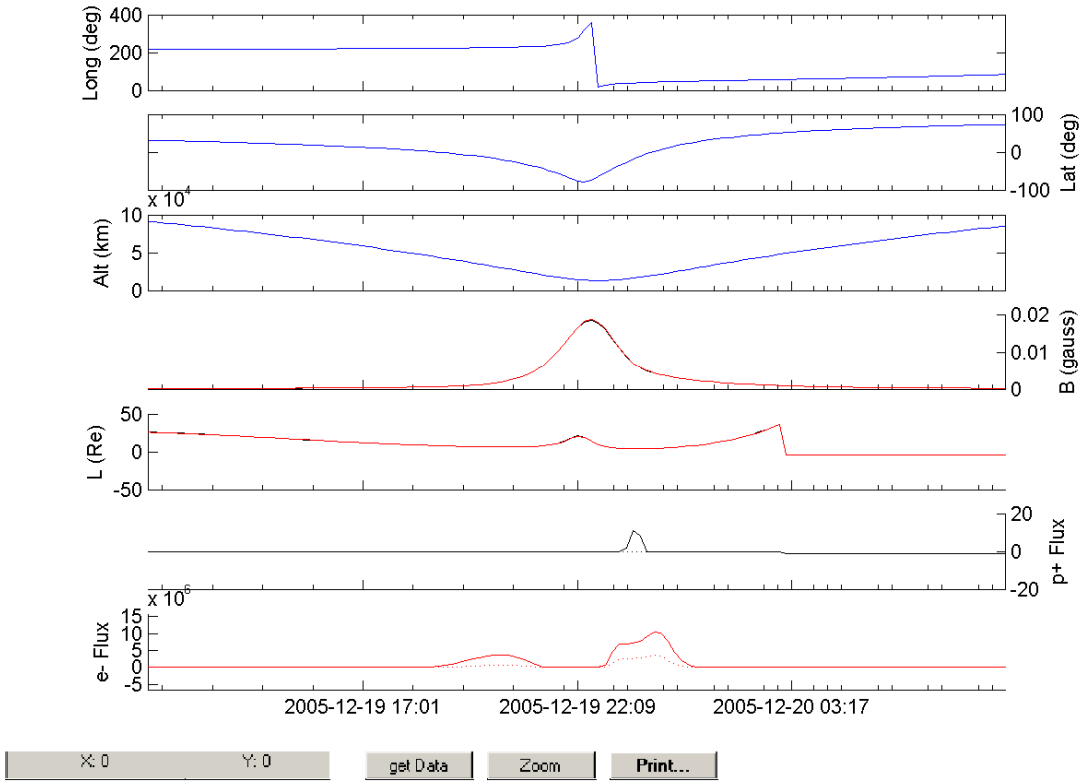
IREM radiation counters:



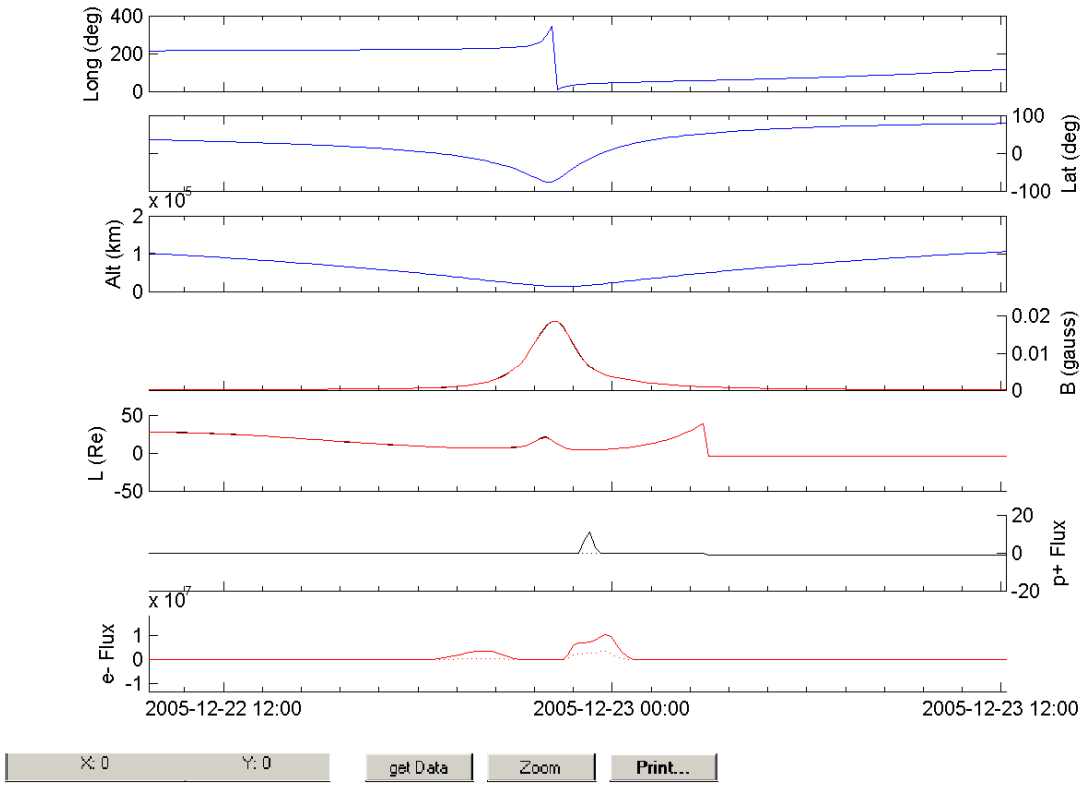


IREM Predicted Radiation Belt Passages:

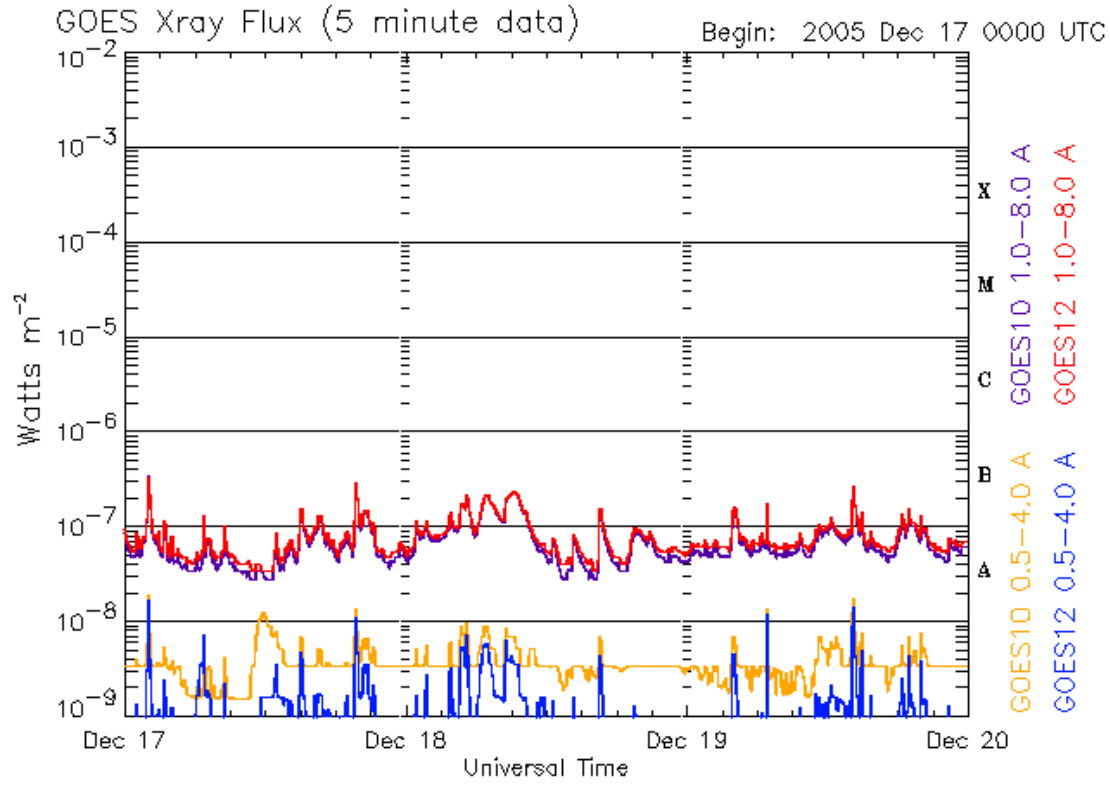
Rev 388

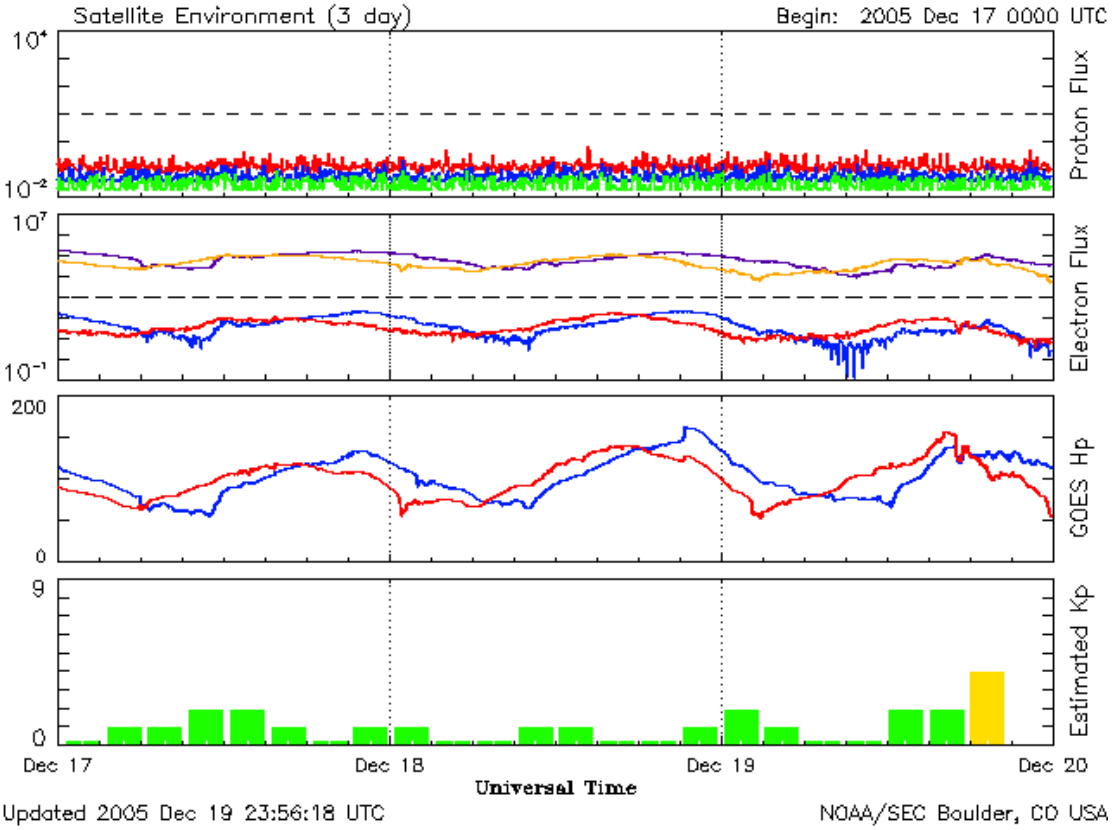


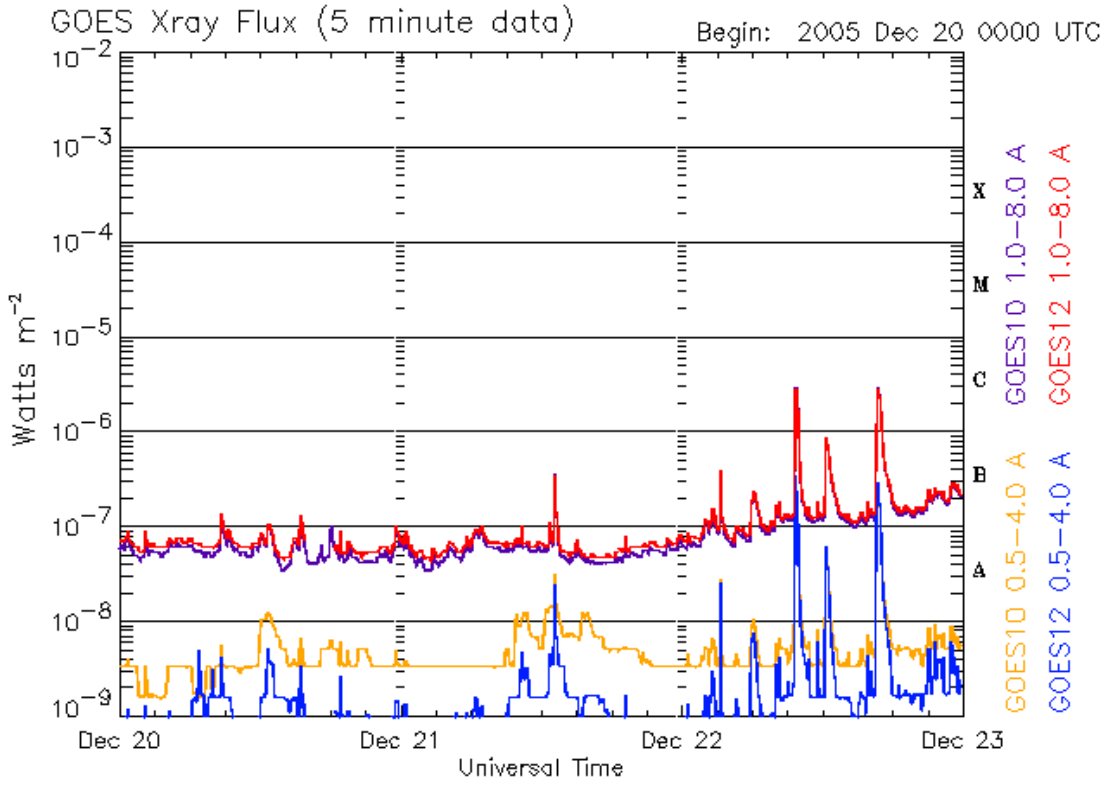
Rev 389

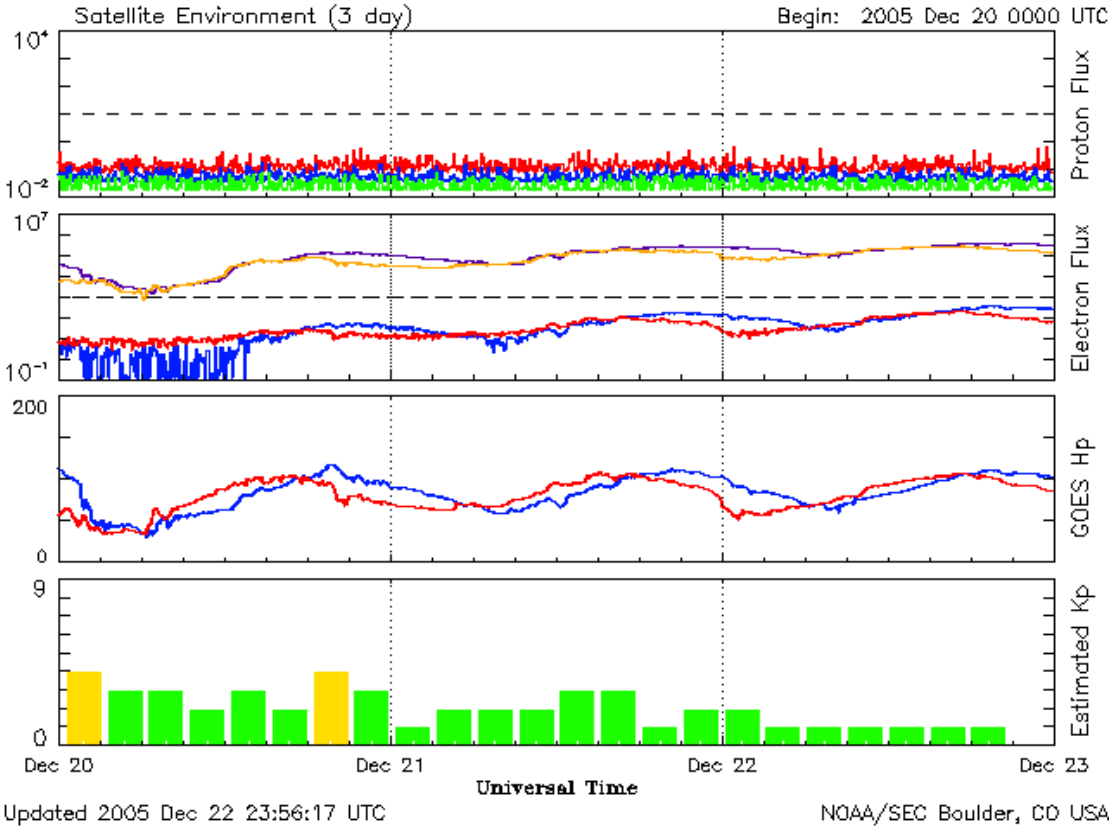


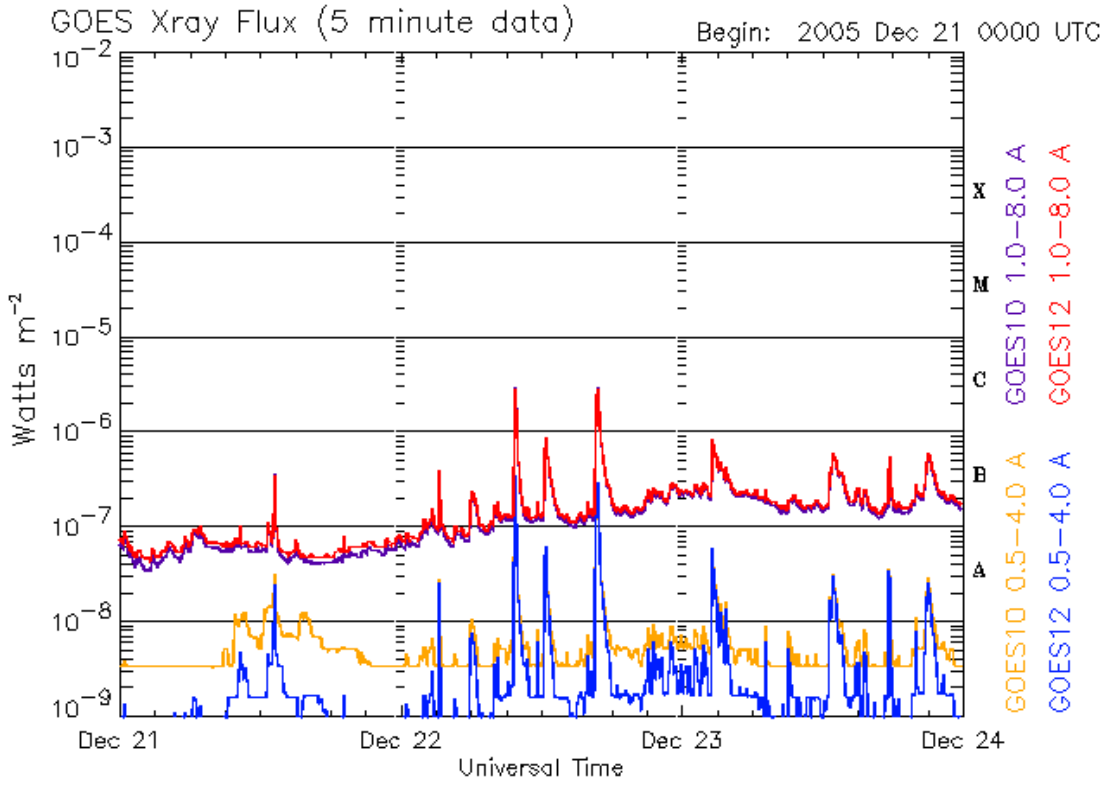
SEC-GOES Observed Particles Fluxes:

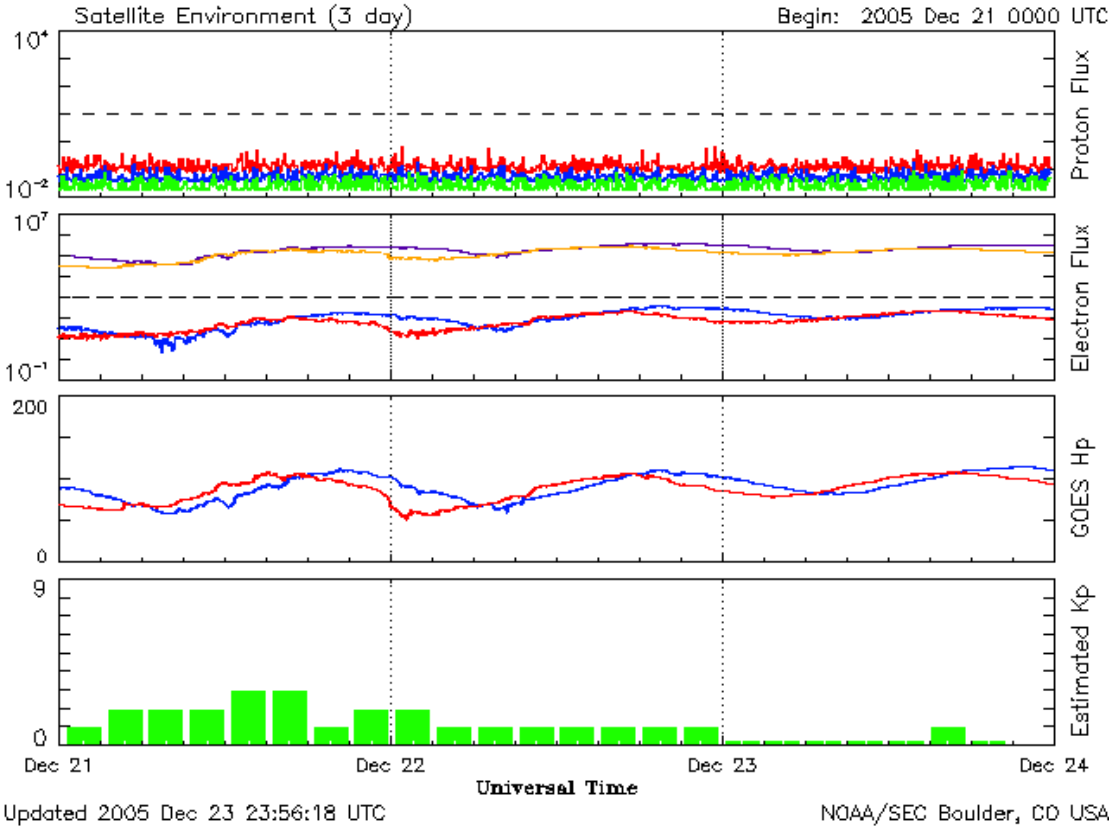





GOES Xray Flux (5 minute data)
Begin: 2005 Dec 20 0000 UTC
Watts m-2
X
M
C
B
A
GOES10 1.0–8.0 A
GOES12 1.0–8.0 A
GOES10 0.5–4.0 A
GOES12 0.5–4.0 A
Dec 20
Dec 21
Dec 22
Dec 23
Universal Time
Updated 2005 Dec 22 23:56:07 UTC
NOAA/SEC Boulder, CO USA


Satellite Environment (3 day)
Begin: 2005 Dec 20 0000 UTC
Proton Flux
Electron Flux
GOES Hp
Estimated Kp
Dec 20
Dec 21
Dec 22
Dec 23
Universal Time
Updated 2005 Dec 22 23:56:17 UTC
NOAA/SEC Boulder, CO USA


GOES Xray Flux (5 minute data)
Begin: 2005 Dec 21 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
Dec 21
Dec 22
Dec 23
Dec 24
Universal Time
Updated 2005 Dec 23 23:56:08 UTC
NOAA/SEC Boulder, CO USA


Satellite Environment (3 day)
Begin: 2005 Dec 21 0000 UTC
Proton Flux
Electron Flux
GOES Hp
Estimated Kp
Dec 21
Dec 22
Dec 23
Dec 24
Universal Time
Updated 2005 Dec 23 23:56:18 UTC
NOAA/SEC Boulder, CO USA