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

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 127
Week 08
28.02.05
Routine Phase

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1 General

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

It addresses the activities from 19.02.05 until 25.02.05 (both dates inclusive) and covers the revolutions 288 & 289.

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 Target of Opportunity V0332+53 (RA 03:34:59.89; DEC +53:10:23.6); the galactic bulge region (RA 17:45:36.00; DEC -28:55:60.0); the galactic disk $l < 0$ (RA 16:18:32.00; DEC -50:22:26.0) and the Target of Opportunity GRO J1655-40 (RA 16:54:0.10; DEC -39:50:44.9). The activities consisted of raster and hexagonal dithering observations.

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

The AOCS operations were performed from the timeline during this period.

5 slews (3CSL, 2OSL) were missed from the Timeline during this period due a problem on late update from FD system and problems at DSS16 & Vilspa2 stations.

The fuel consumption over the period between 17/02/2005 and 23/02/2005 was 0.2305 kg. The remaining propellant is in the order of 162.7909 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

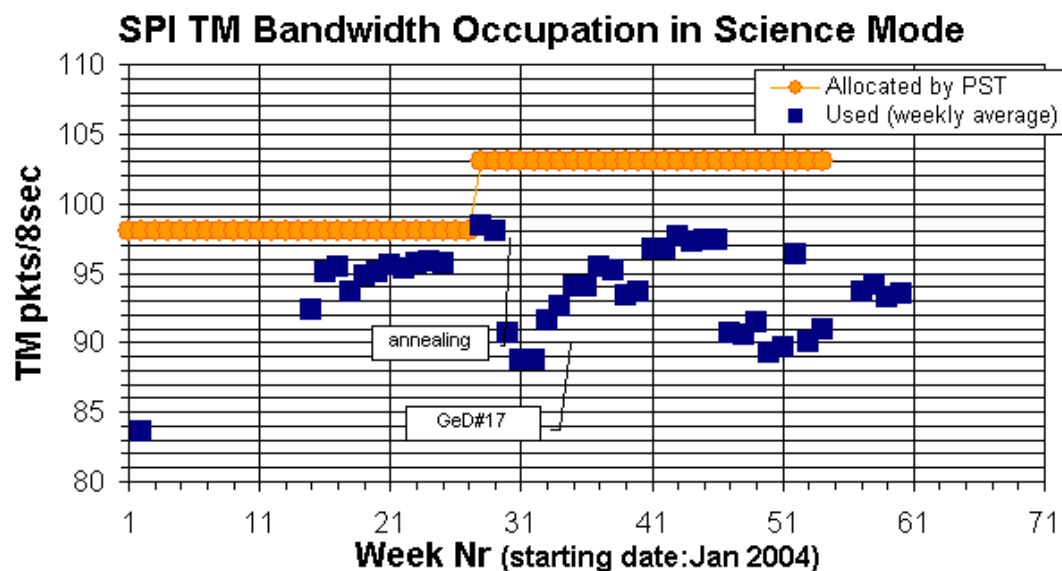
The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

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

The instrument was in photon-by-photon mode for the whole period, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an actual occupation of 93.5 pkts/cycle average.



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

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

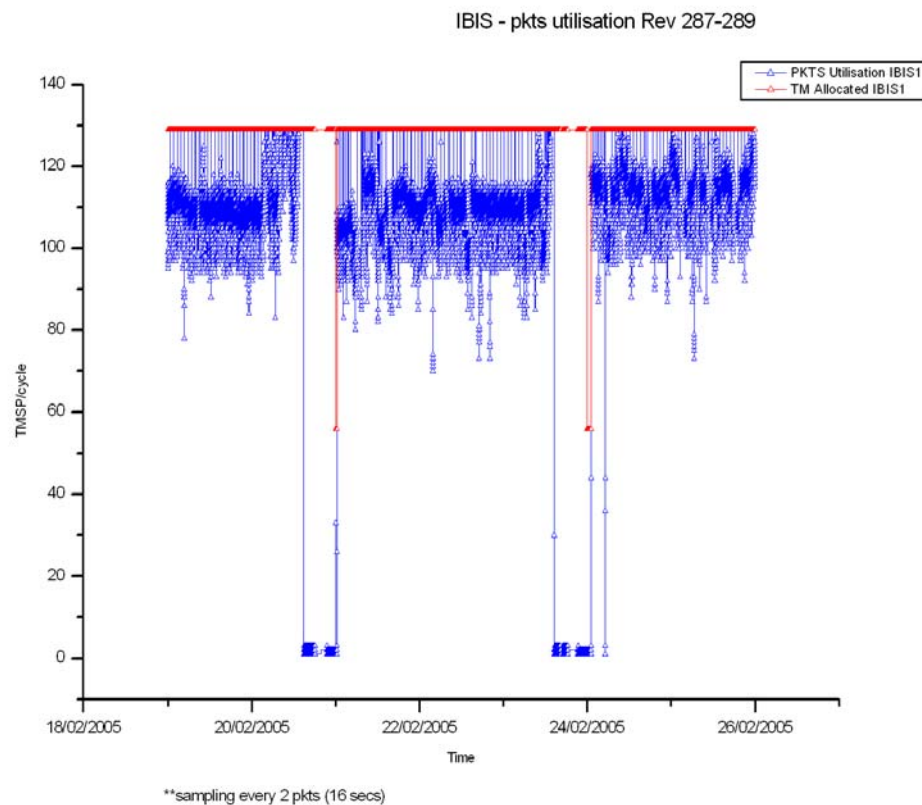
3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by low solar activity.

During the reporting period the PST allocation to IBIS was most of the time 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 112.3 TMPS/cycle, up 2.5 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. JEM-X2 remained dormant (DFEE OFF) with a TM allocation of 1 packet/cycle.

INT_OR_0189 was executed at the start of each revolution to reset the JEM-X1 Broadcast Packet override flags for IREM to DISABLED following the anode calibration ED KEACAL01 in the Timeline.

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 140 OMC pointings executed nominally, 1 was delayed by 20 minutes and 2 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 good this week, well above the system performance requirements, 2 science pointings and 2 engineering pointings were lost, and 1 science pointing was delayed by 20 minutes due to ground problems.

4.1 Mission Operations Centre

The performance of the MOC was good this week, although a pointing was lost due to the late arrival of a tpf. Also, the links with ISDC were interrupted when the firewall was rebooted.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were however a number of problems with both the prime stations and their backups. A pointing was lost and another delayed by communications difficulties, also the perigee configuration during revolution 288 had to be set using Perth, (which was commandeered from XMM causing the loss of ToO for that mission), as both DSS-16 and DSS-24 were unavailable. The overall performance was still well over the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

This week has seen quite some replanning due to two ToO triggers on the same target, GRO J1655-40. For this reason revolutions 288 - 290 were replanned. Rev 288 was also replanned as RPOS, i.e. replanning of a running revolution. This was to obtain a more favourable perigee attitude. POS's generated and sent up to rev 294. No new PSF's have been received. TSF for rev 289 was received.

2. Observation status

ECS's for rev 270, 271 and 274 was received. Corresponding OCS's were sent. No extra time was credited.

3. ISOC science data archive

A new data tape under way from ISDC. The ISDA hardware is now up and running. Installation activities have been performed this both on the archive database server and the archive file server. The archive at ESTEC is now removed after the data was backed up.

4. ISOC system

Version 10.7.3 is still in use. No major problems reported.

5. ISOC move

A second batch of computers and office equipment was shipped from ESTEC this week. It is expected to arrive in ESAC on Tuesday 1 March. This is the last major shipment. Only a few items still in use in ESTEC will be shipped later.

6. Problems

The problem reported last weeks with unavailable science staff in ISOC is not yet formally resolved Very little progress achieved to resolve the problem.

4.3.2 ISDC

Status of ISDC observation processing on 28/02/2005:

- Latest Standard Analysis completed: observation 02600010001 (Cyg X-1 Cal/11.3, Revolution 257) on 12/02/2005
- Latest products archived: observation 02201460001 (3C273, Revolution 267) on 13/02/2005
- Latest observation products sent to the observer: observation 02297000015 (Abell 2256, Revolution 257) on 20/02/2005

5 Special Events

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 052, at 12:17, due to a late arrival of a tpf, pointing 02880020 was missed.
- On DoY 053, from 13:10 to 13:40, the links to ISDC were down while the firewall was being rebooted.
- At 14:06, there were a few short TM drops from Redu, followed at 14:08, by a longer TM outage. The FEC was rebooted clearing the problem.
- On DoY 054, at 11:32, after the hand-over to DSS-16, there was no bit-lock due to the idle mode not being set on. The corresponding DR# is G105340. The problem was fixed by 11:41. The impact was a loss of pointing 02880062.
- From 14:33 to 14:49, the TC link from DSS-16 dropped. The corresponding DR# is G105343, the impact was SPI sequence EEORTM01 was missed, and had to be manually uplinked.

- At 15:33, the TC link from DSS-16 again dropped, the links were restored at 16:36 using DSS-24, but 2 minutes later at 16:38, the TM dropped again. The links were restored at 17:14 using Perth to complete the perigee configuration. Pointings 02880065 and 02880066 were lost, but the spacecraft was already inside the belts, and the instruments were in safe mode anyway.
- On DoY 055, at 14:35, the TM link from VIL2 dropped. The link was restored at 14:43, but the cause was unknown. At 15:00, the TM dropped again. At 15:02, and 15:06, the VC0 & Vc7 links were restored, but at 15:07, the TM dropped again. At 15:12, the links were restored. There was no apparent impact.
- At 15:13, errors writing TM records to the archive appeared. These continued until 15:44.
- At 16:15, a hit on the line caused the TM & TC links to drop. The links were back at 16:23, the impact was a 20 minute delay in the start of pointing 02890022.
- From 18:18 to 18:22, the links with VIL2 dropped again, the reason is unknown. There was no impact.
- At 08:15, ISDC reported they were not receiving ASF & OLF files since day 055. The files were again being sent after the idda was rebooted.

The following new anomaly reports were entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
INT-2703	22/02/2005	TC Bitlock toggling in/out at REDU	ESA Stations	Pending
INT-2704	24/02/2005	TC/TM failure at DSS-16/24	NASA Stations	Closed

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 288

The activities in revolution 288 consisted of a hexagonal dithering observation of the Target of Opportunity V0332+53 (RA 03:34:59.89; DEC +53:10:23.6) lasting ~4.5 hours, followed by a hexagonal dithering observation of the galactic bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~3.5 hours. An amalgamated raster dithering observation of the galactic disk l<0 (RA 16:18:32.00; DEC -50:22:26.0) was then performed for the remaining ~50 hours of observation time.

Revolution 289

The activities in revolution 289 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 hexagonal dithering observation of the Target of Opportunity GRO J1655-40 (RA 16:54:0.10; DEC -39:50:44.9), performed for the remaining ~56 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

2005-02-08T23:10:08.000Z	163.2791	F	Automatic TM processing.
2005-02-10T20:47:56.000Z	163.2652	F	Automatic TM processing.
2005-02-11T15:40:38.000Z	163.2048	F	Automatic TM processing.
2005-02-11T22:58:31.000Z	163.1928	F	Automatic TM processing.
2005-02-12T05:38:32.000Z	163.1488	F	Automatic TM processing.
2005-02-14T17:35:18.000Z	163.1315	F	Automatic TM processing.
2005-02-14T22:48:23.000Z	163.1208	F	Automatic TM processing.
2005-02-15T07:40:57.000Z	163.0638	F	Automatic TM processing.
2005-02-17T22:34:07.000Z	163.0214	F	Automatic TM processing.
2005-02-19T09:01:47.000Z	162.9700	F	Automatic TM processing.
2005-02-20T22:28:30.000Z	162.9494	F	Automatic TM processing.
2005-02-21T06:17:11.000Z	162.9080	F	Automatic TM processing.
2005-02-22T08:28:26.000Z	162.8591	F	Automatic TM processing.
2005-02-23T17:27:49.000Z	162.8084	F	Automatic TM processing.
2005-02-23T22:14:54.000Z	162.7909	F	Automatic TM processing.

This report was generated Fri Feb 25 08:00:21 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 19/02/2005-25/02/2005

AOCs operations were executed from the Automatic Timeline.

During this period, 54 Open Loop Slews, 100 Closed Loop Slews and 7 Momentum Bias were executed. 5 slews were not executed due late TPF update from FD system and problems at DSS16 & Vilspa2 stations. This is equivalent to a $\sim 3.2\%$.

19/02/05 (Day of Year 050, Revolution 287)

Nothing to report.

20/02/05 (Day of Year 051, Revolution 287-288)

Nothing to report.

21/02/05 (Day of Year 052, Revolution 288)

Slew missed from the Timeline: Due to late update from the FD system, the TPF for slew 02880020 (CSL) failed validation and the slew not executed. A manual recovery was then performed to the attitude of PID 02880020 and the pointing was reached with a delay of ~ 15 minutes wrt the planned slew in TL. The next slew (CSL) for PID 02880021 was manually updated and executed from the Timeline.

22/02/05 (Day of Year 053, Revolution 288)

Nothing to report.

23/02/05 (Day of Year 054, Revolution 288-289)

Slew missed from the Timeline: Due to a problem on DSS16 (NO BIT LOCK), the slew ID 02880062 (CSL) was not executed. A manual recovery was then performed to the attitude of PID 02880062 and the pointing was reached with a delay of ~ 20 minutes wrt the planned slew in TL. The next slew (CSL) for PID 02880063 was manually updated and executed from the Timeline.

Slews missed from the Timeline: Due to a problem on DSS16 (TC LINK DROP), the last part of TL activities before perigee passage were missed. Due to the emergency condition, possible violation of STR constraint (Earth in STR FoV), was requested the support of Perth station in order to perform the reconfiguration of the S/C before the perigee passage. The recovery was manually executed and the safe condition reached at 18:31, ~ 1 hour later wrt the TL planned activities. The slews ID 02880065 and 66 were not executed.

24/02/05 (Day of Year 055, Revolution 289)

Slew missed from the Timeline: Due to a problem on Vilspa2 station (TM/TC LINK LOST), the slew ID 02890022 (CSL) was not executed. A manual recovery was then performed to the attitude of PID 02890022 and the pointing was reached with a delay

of ~20 minutes wrt the planned slew in TL. The next slew (CSL) for PID 02890023 was manually updated and executed from the Timeline.

25/02/05 (Day of Year 056, Revolution 289)

STR 1750 processor faults: reported three cases of STR 1750 processor fault occurred during the execution of the PIDs 02890032-02890039-02890046 (OSLs). The sequence of the events was (time referring to PID 39) the following:

10:44:47z Closed Loop Slew End
10:45:06z Mapping start
10:45:11z Mapping End prematurely
10:45:11z New Mapping start and new guide start picked
10:46:06z Mapping End

The attitude for PIDs 32-39-46 resulted to be the same, hereafter is reported:

PID	AR	DEC	POS
02890032	16:52:34.87	-41:50:51.7	094:07:01.4
02890039	16:52:32.70	-41:50:48.2	094:12:44.1
02890046	16:52:32.70	-41:50:48.2	094:18:43.1

The fault, which occurred after the end of the open loop slews, resulted in the abortion of the on-going mapping (duration shortened) and start of a new mapping.

The IMU was not switched ON, as the problem occurred during the first minute after the execution of a slew. According to the Star Catalogue, one extended object, the diffuse Nebula NGC 6231 was in the STR FoV at the time of the fault. This object is considerably large (max diameter of ~ 900 arcsec) and quite star rich. This probably, as seen previously, was the cause of the fault.

No slews were missed. The operational impact of the fault was the OTF not reached during PIDs 02890032-02890039-02890046.

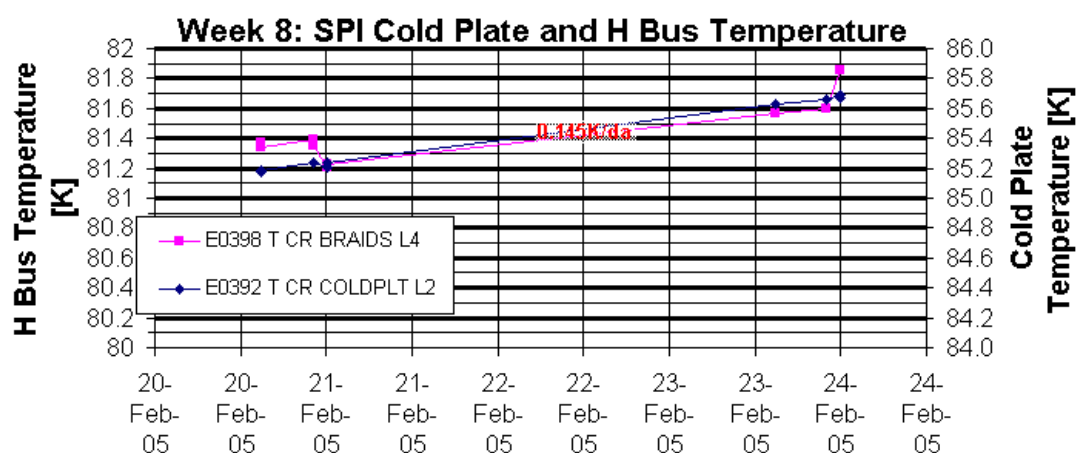
8.3.2 SPI Operations

Stirling compressors and Cryostat

The performance of the compressors is nominal.

The cold plate temperature was maintained at 85K $\pm$ 1K over the reporting period, showing the positive drift expected after the annealing cycle.

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



DPE & IASW

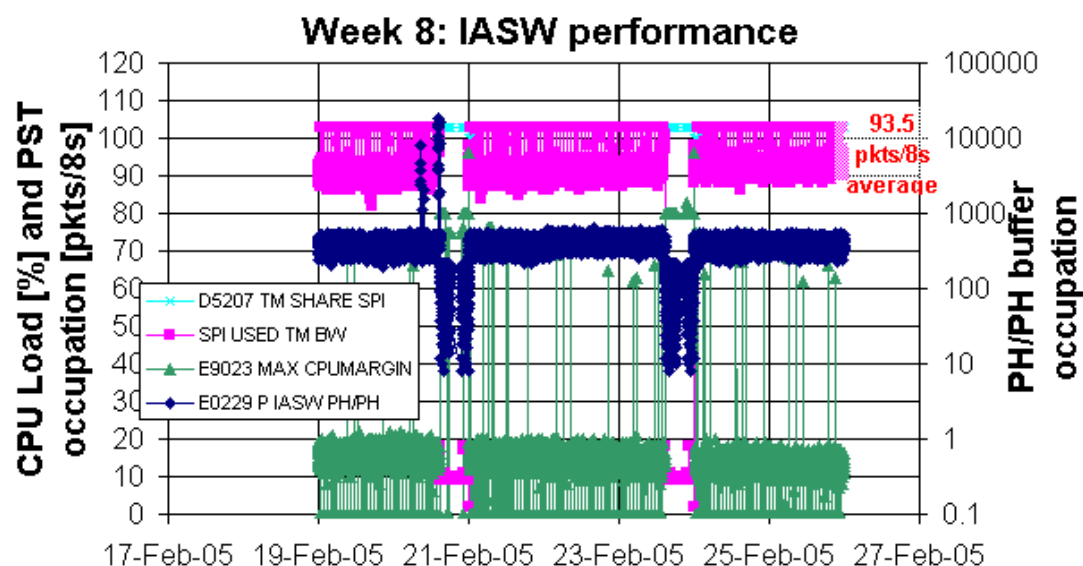
The IASW performance is nominal. The PST TM bandwidth allocation was 103 pkts/cycle in the science windows; the actual TM bandwidth usage is :

103 pkts/cycle peak;

93.5 pkts/cycle average in science mode.

The SPI team is currently analysing the IASW code, investigating on the TM leakage anomaly INT_SC-107. The re-arrangement of the SPI TM slots in the PST, uplinked manually by the SPACON at every revolution, is still used as workaround to this malfunction.

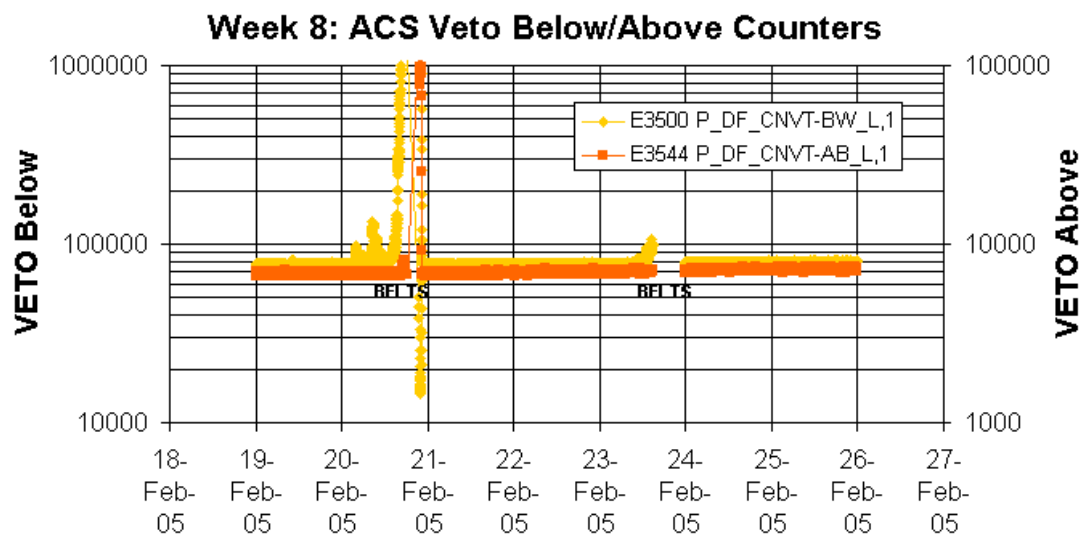
The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS

The performance of the ACS is nominal.

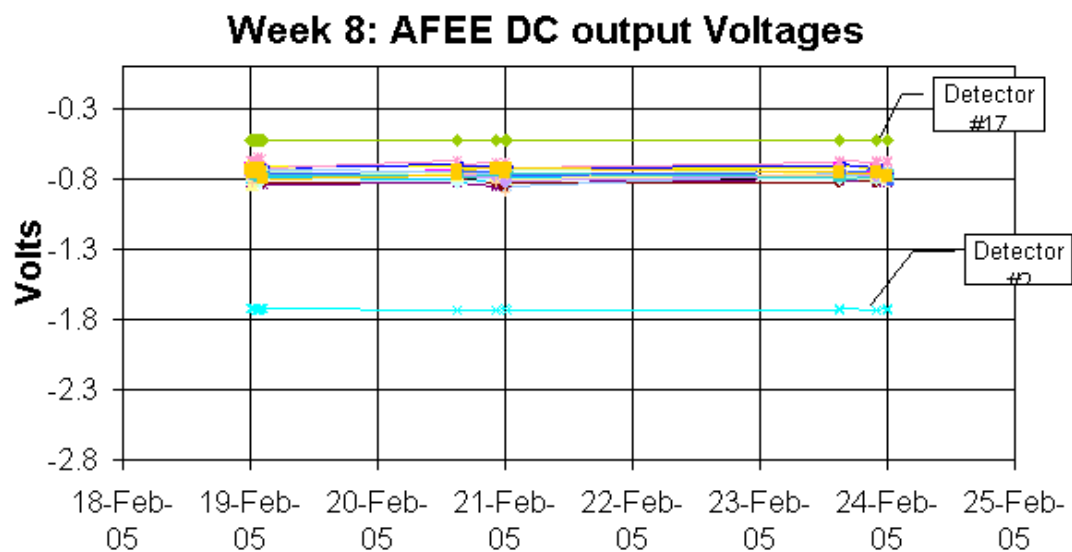
The following plot shows the ACS overall count rate evolution during the reporting period.



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.

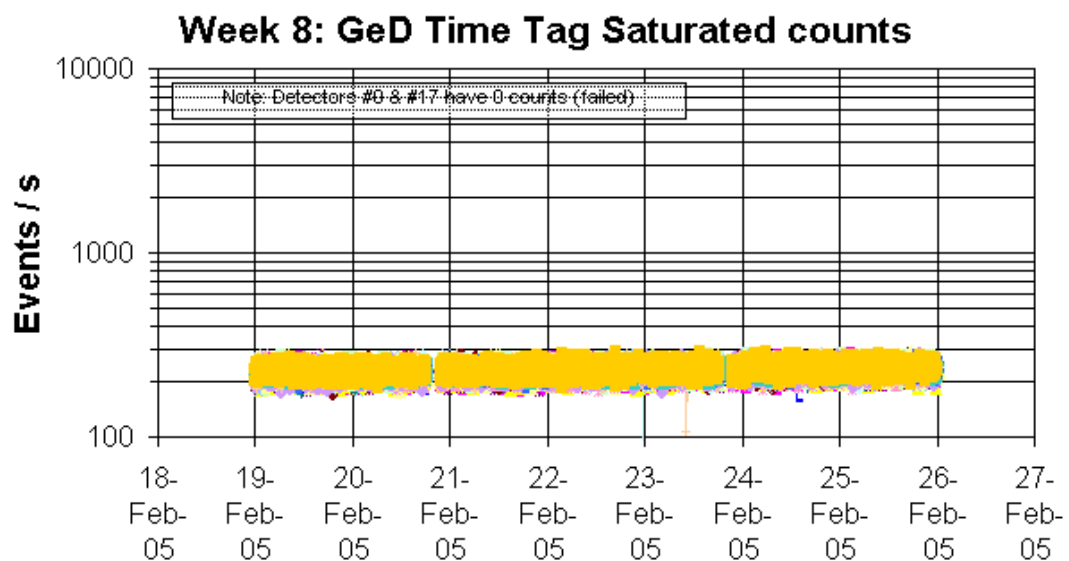
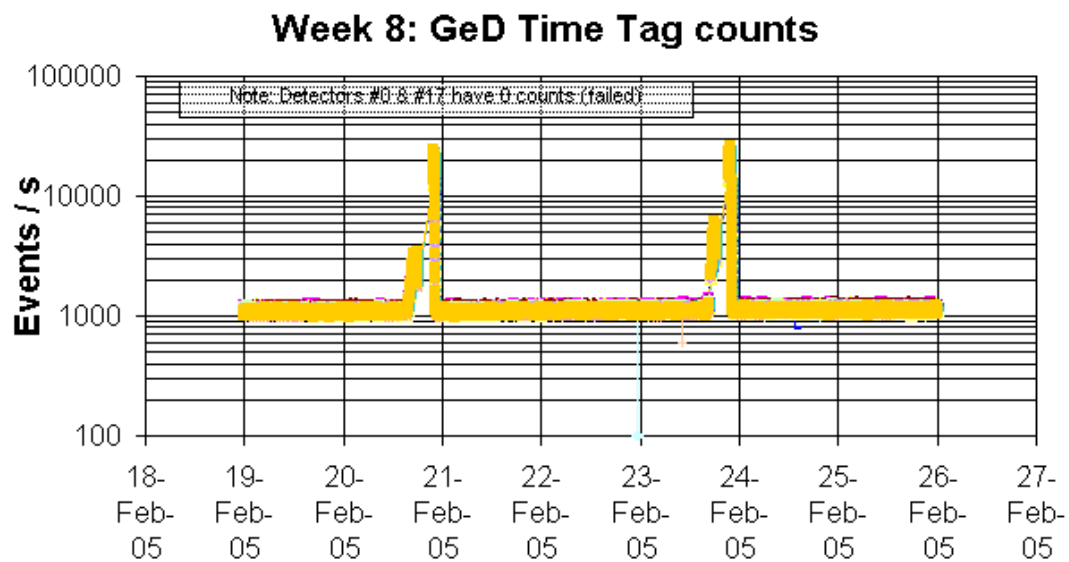
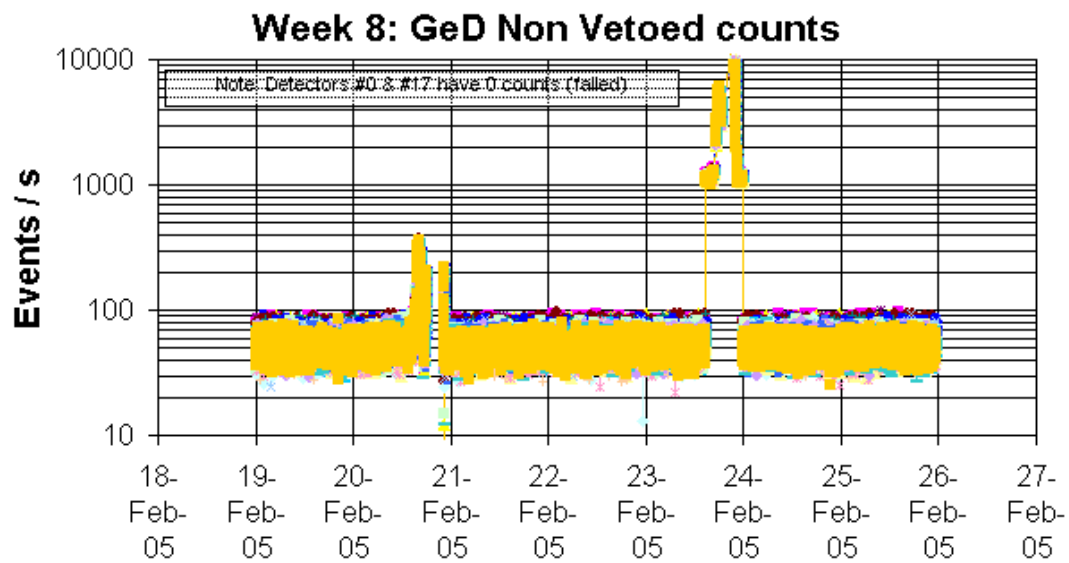
The following plot shows the AFEE dc output signals during the reporting period.



DFEE

The performance of the unit is nominal.

The following plot shows the Non Vetoes 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.

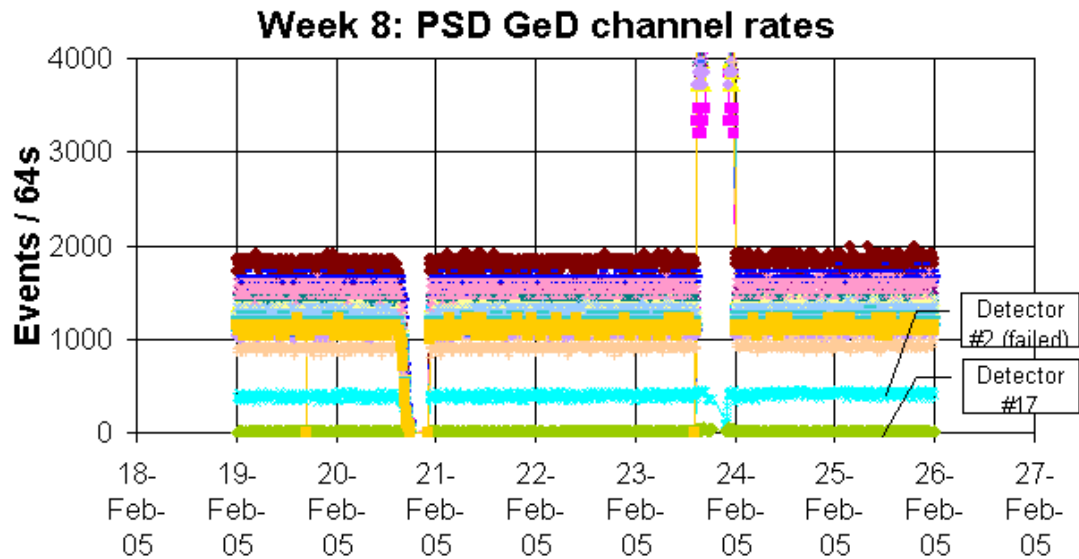


PSD

The performance of the unit is nominal.

The malfunction of the channel rates blanking occurred again this week (see AR INT_SC-90 for a detailed description of the anomaly).

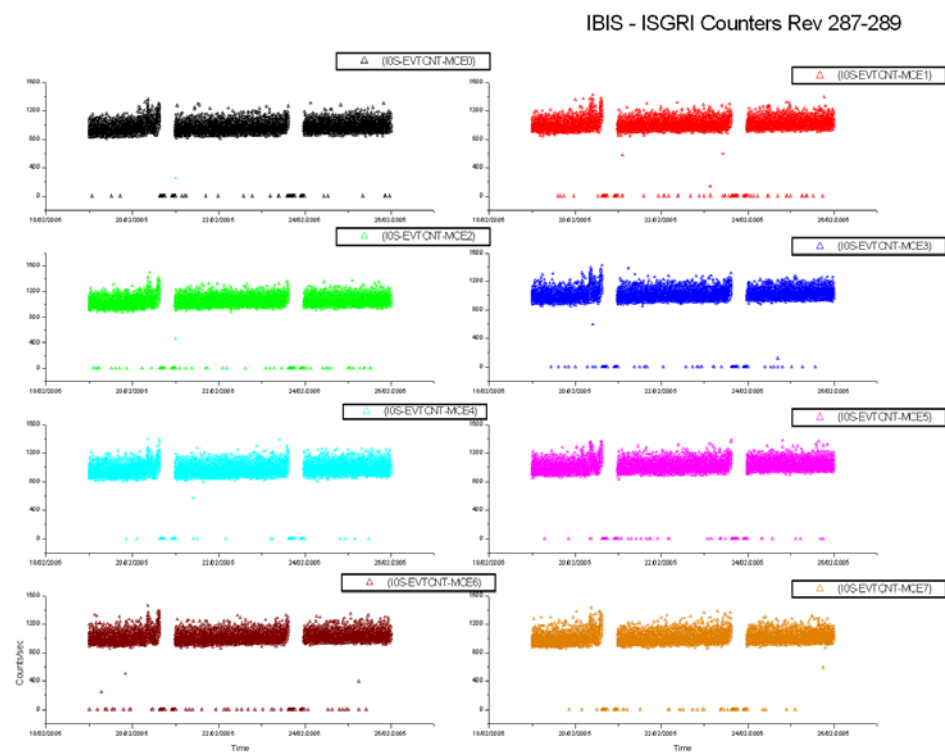
The following plot shows the PSD channel rates during the reporting period.



8.3.3 IBIS Operations

IBIS Event Counters Plots.

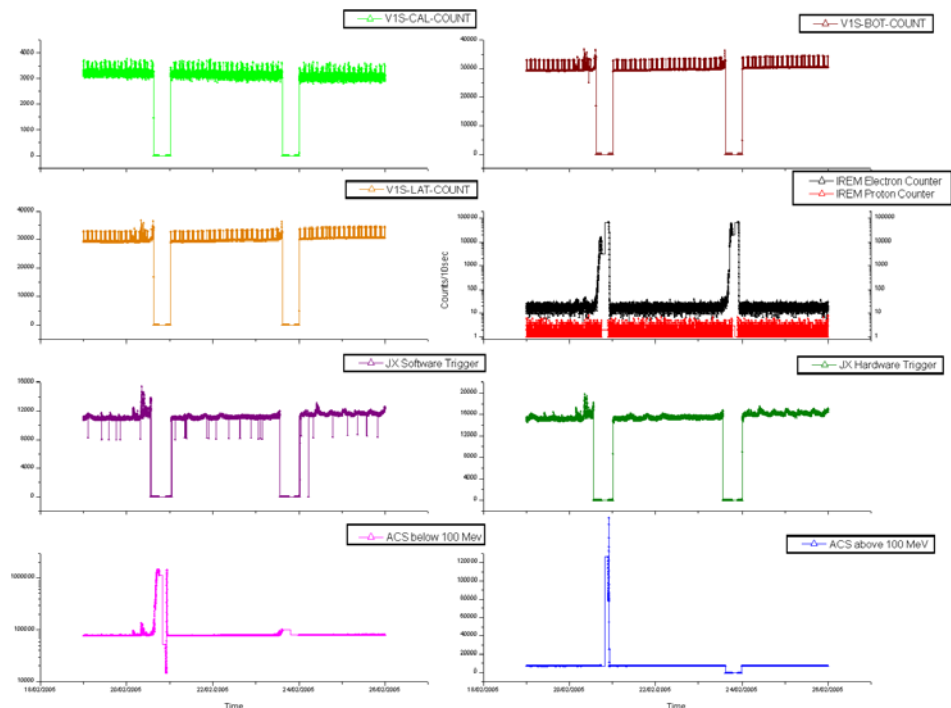
ISGRI Counters:



**sampling every 4 pkts (32 secs)

VETO vs Payloads Counters

IBIS-VETO vs Payloads Counters Rev 287-289

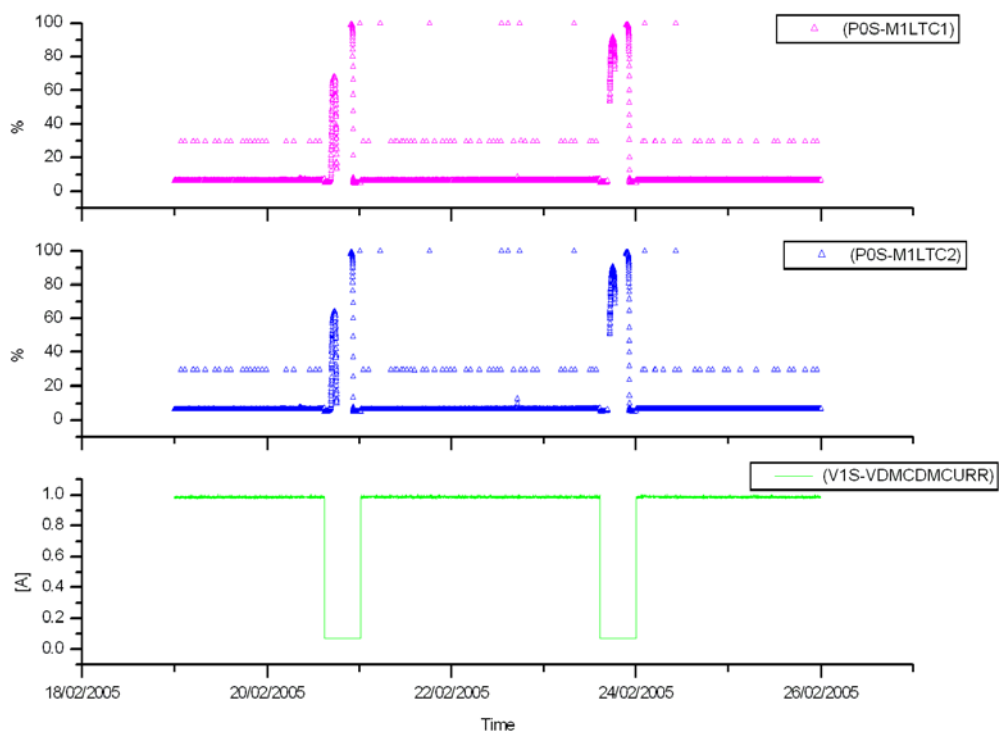


**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

The week was characterised by low solar activity.

Veto Current:

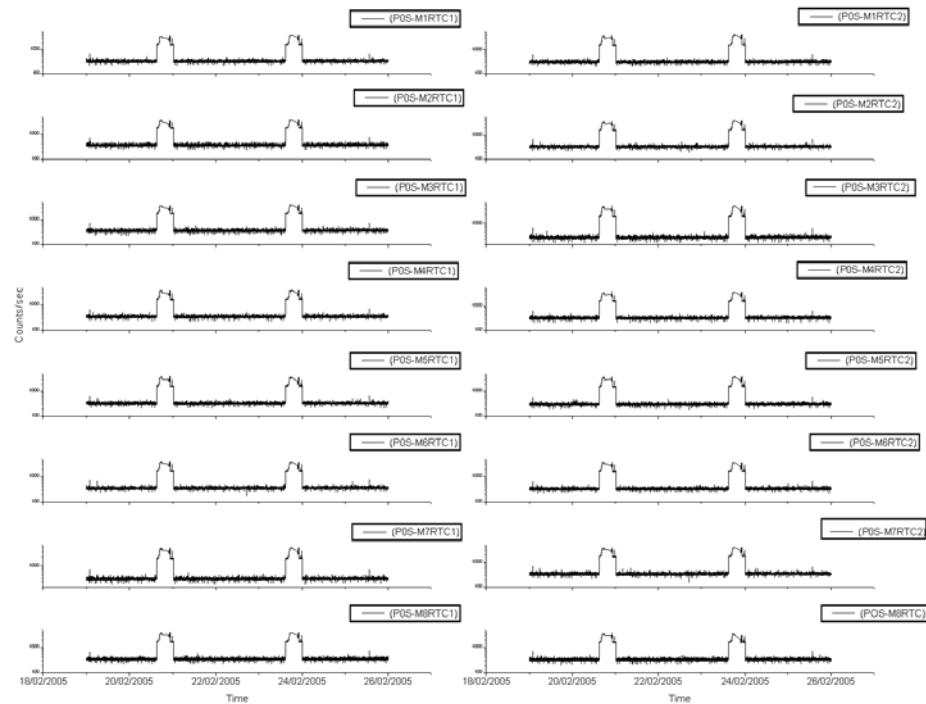
IBIS-VETO Current & PICsIT dead times Rev 287-289



**sampling every 4 pkts (32 secs)

Picsit Counters

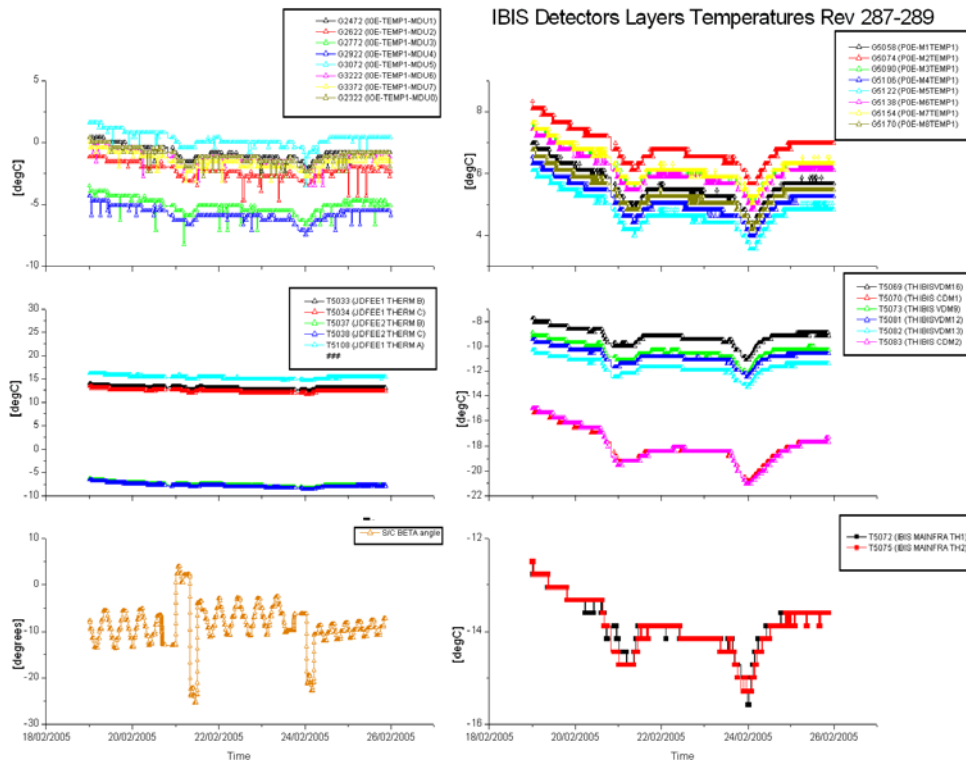
IBIS - PICsIT Counters Rev 287-289



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures

IBIS Detectors Layers Temperatures Rev 287-289



**sampling every 8 pkts (64 secs)

IBIS daily report
DoY 2005.051 (20/02/2005)

At 14:55Z TM parameter G8015 (S1E-A2 PMT V) went Out of Limit high (29.4V). According to reaction V-VLT-1, after 5 minutes, IBIS SOE was informed. However, the OOL did not last long, therefore no action was taken.

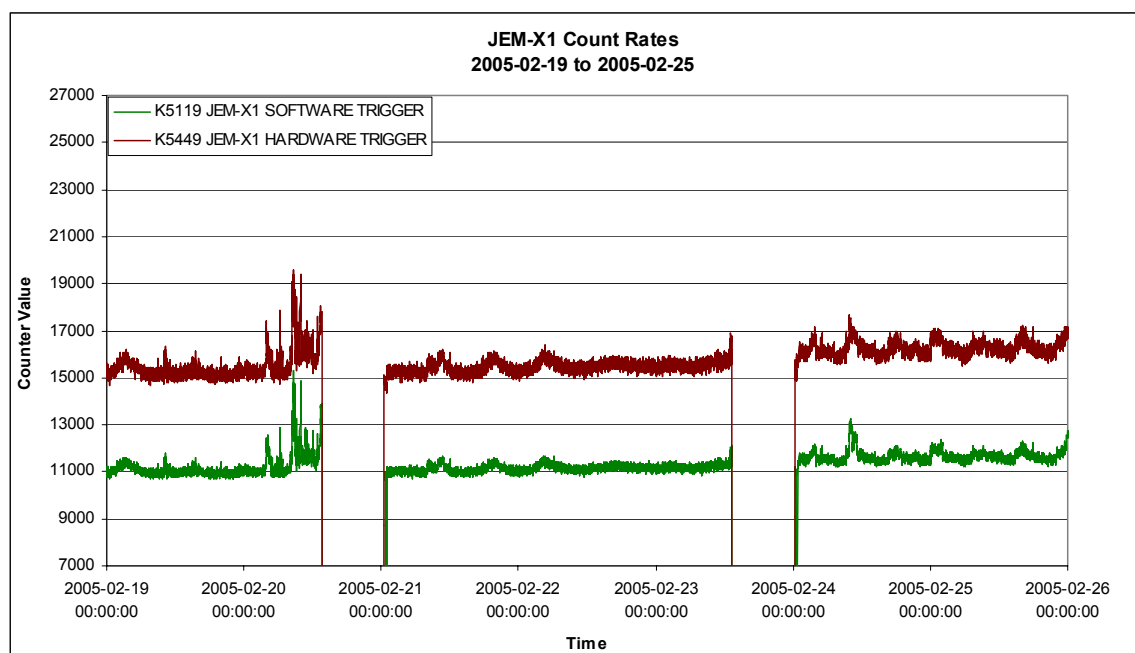
DoY 2005.053 (22/02/2005)

At 17:07Z TM family G5068 (PDMi: semimodule #1 FIFO Error Flag) flagged "SSC fail". As 3 minutes later they were back into limits, no action was taken.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

JEM-X1 count rates over the reporting period are displayed in the following graph¹.

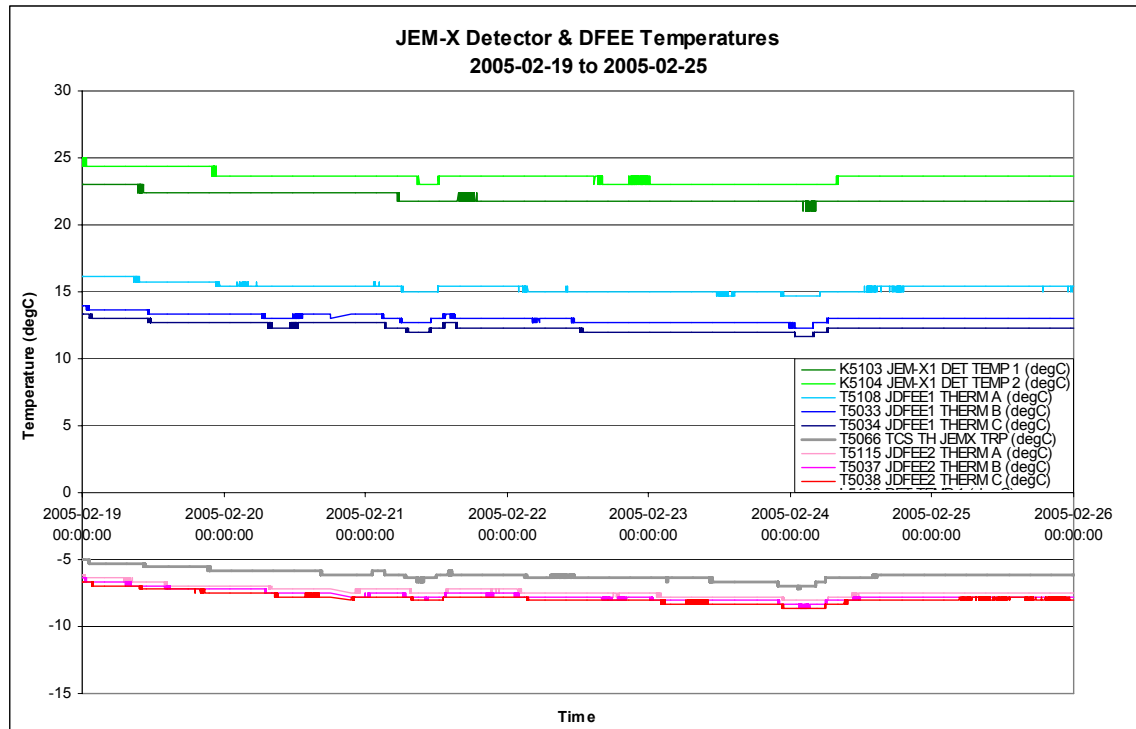


8.3.4.2 JEM-X Temperatures

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 graph².

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

2005-02-19 (DOY 050, Rev 287) to 2005-02-20 (DOY 051, Rev 287-288)

Nothing to report

2005-02-21 (DOY 052, Rev 288)

At the start of revolution 288, at 00.02.48Z, FCP_JEM1_0120 was executed to disable the JEM-X1 reactions to the IREM count rates in the Broadcast Packet as per INT_OR_0189.

2005-02-22 (DOY 053, Rev 288)

Nothing to report

2005-02-23 (DOY 054, Rev 288-289)

At the start of revolution 289, at 23.50.01Z, FCP_JEM1_0120 was executed to disable the JEM-X1 reactions to the IREM count rates in the Broadcast Packet as per INT_OR_0189.

2005-02-24 (DOY 055, Rev 289) to 2005-02-25 (DOY 056, Rev 289)

Nothing to report

8.3.5 OMC Operations

On DoY 052, at 12:17, a late tpf caused the loss of pointing 02880020.

On DoY 054, at 11:32 a problem with the ground station caused the loss of pointing 02880062

On DoY 055, at 16:15, a problem with the links to the ground station caused a 20-minute delay in the start of pointing 02890022. It was at this time the following commands were rejected:

```
2005.055.16.23.29.371 2005.055.16.23.20.567 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0
M9069=1210
2005.055.16.23.21.390 2005.055.16.23.14.317 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM M9068=1 FIX2=0
M9069=1209
```

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

On DoY 051 at 14:55:16 and DoY 054 at 14:41:48, OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry

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]
287	RAD_ENTR R 2005-02-20T14:54:59Z	2005-02-20 14:59:16	59165.7	2005-02-20 15:43:27	53478.95
288	RAD_EXIT R 2005-02-21T00:04:55Z	2005-02-20 22:28:36	24868.5	2005-02-20 22:53:27	28709.77
288	RAD_ENTR R 2005-02-23T14:42:10Z	2005-02-23 16:02:44	49131.1	2005-02-23 15:35:17	52879.66
289	RAD_EXIT R 2005-02-23T23:51:41Z	2005-02-23 22:25:40	26527.0	2005-02-23 22:35:17	27851.95

Reference

Very small error vs reference (less than 10 minutes)

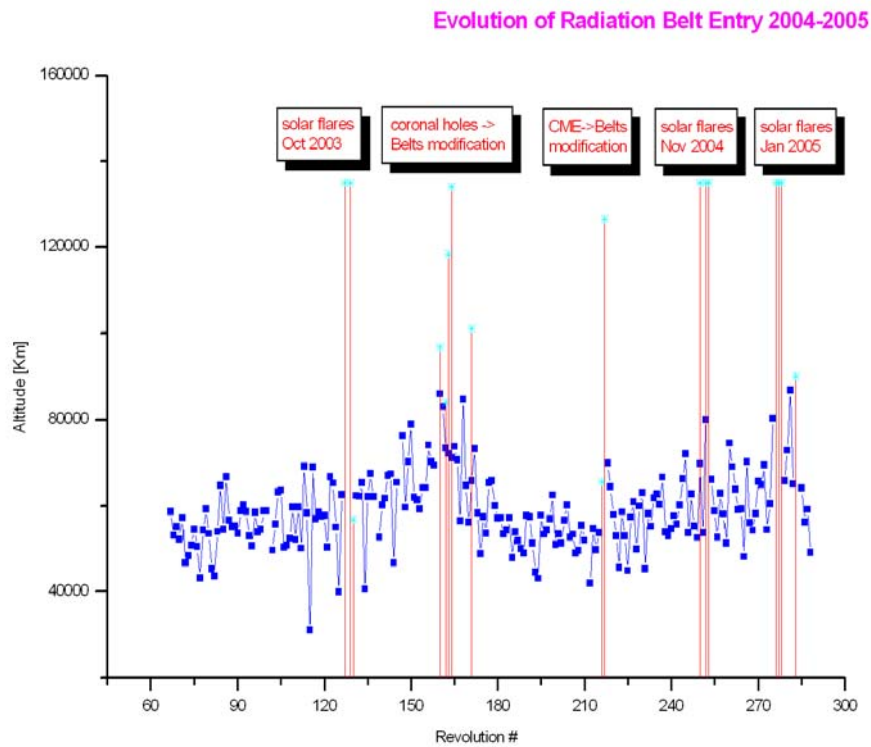
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

Proton Belts

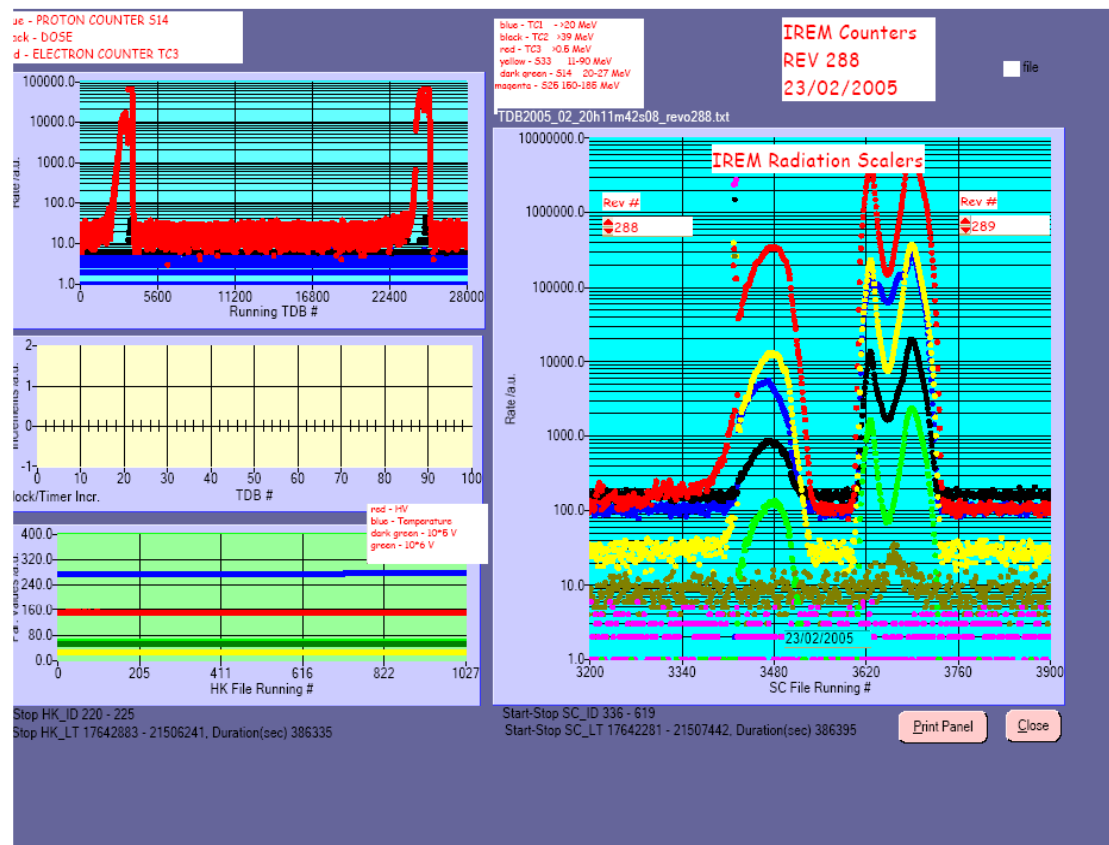
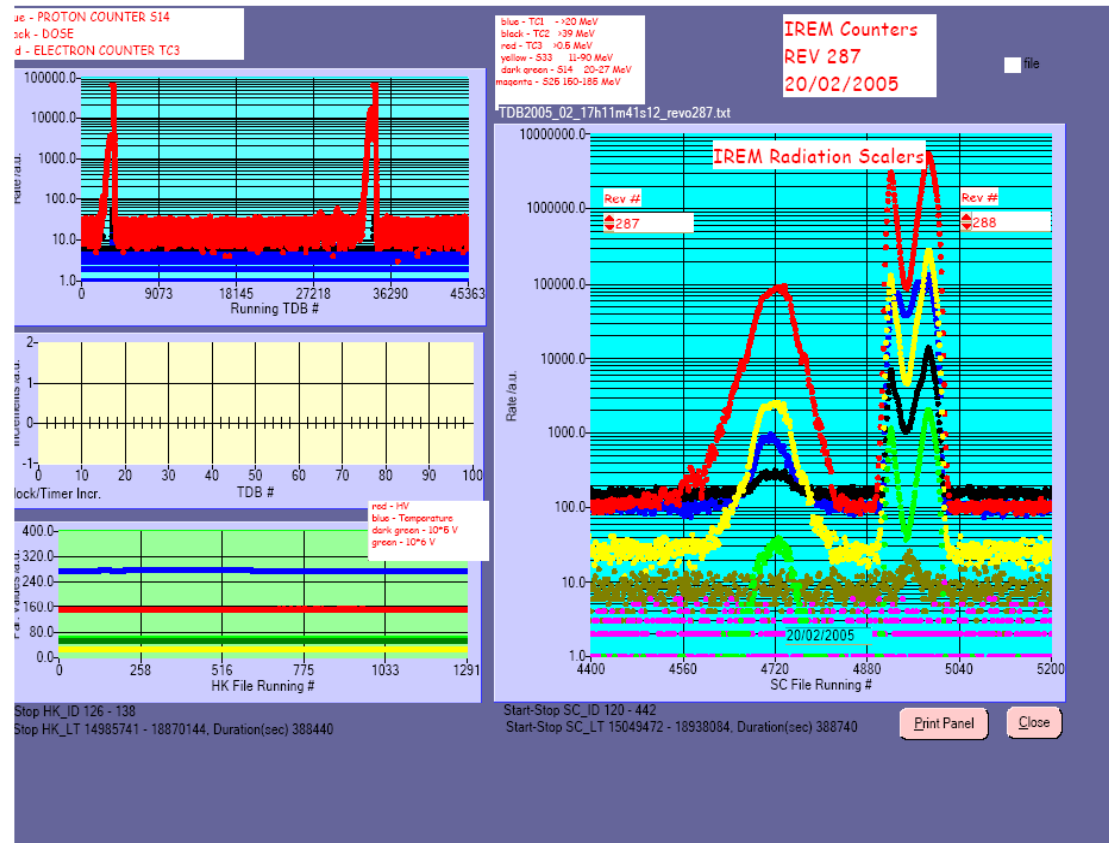
The flux of protons >8MEV computed by RadMon, did not exceed the threshold. Therefore, no predicted proton cut-off is provided for this week.



IREM daily report

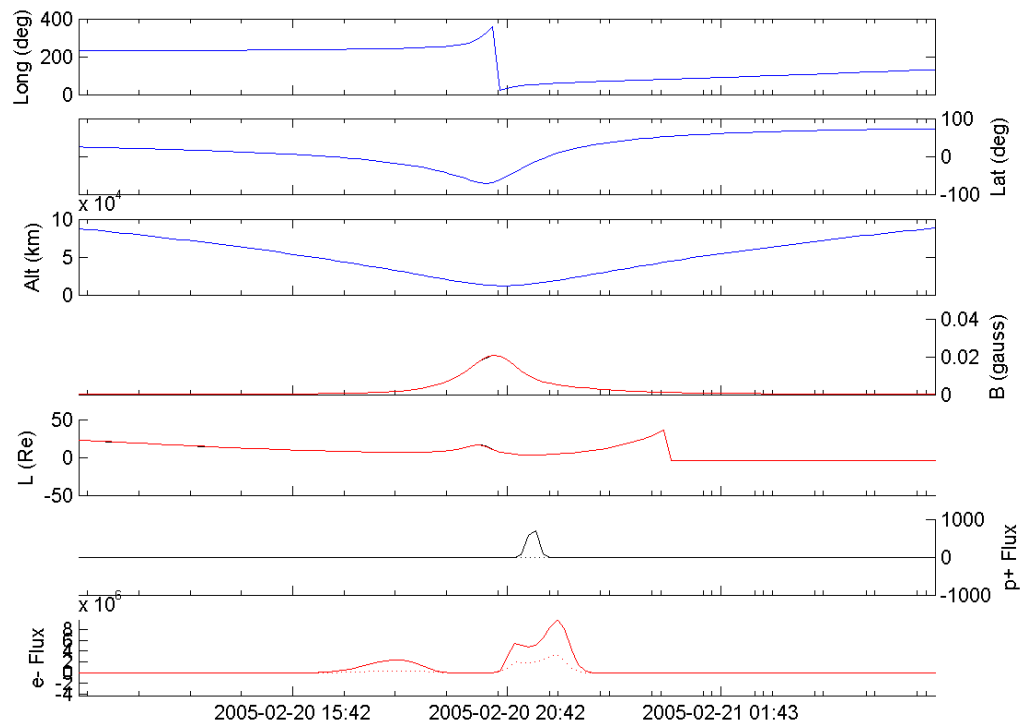
Due to ground station problems at the end of revolution 288, the sequence UEGROF01 (IREM ground link off) was sent at 2005.054.17.56Z instead of 17:20Z as planned in the timeline.

IREM radiation counters



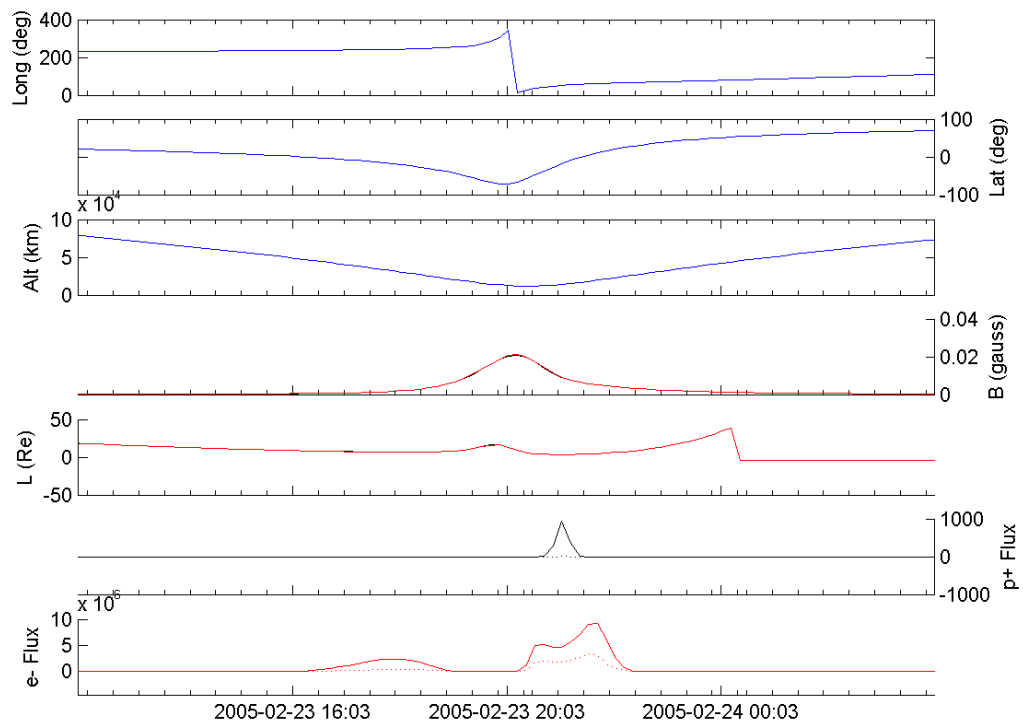
IREM Predicted Radiation Belt Passages.

Rev 287



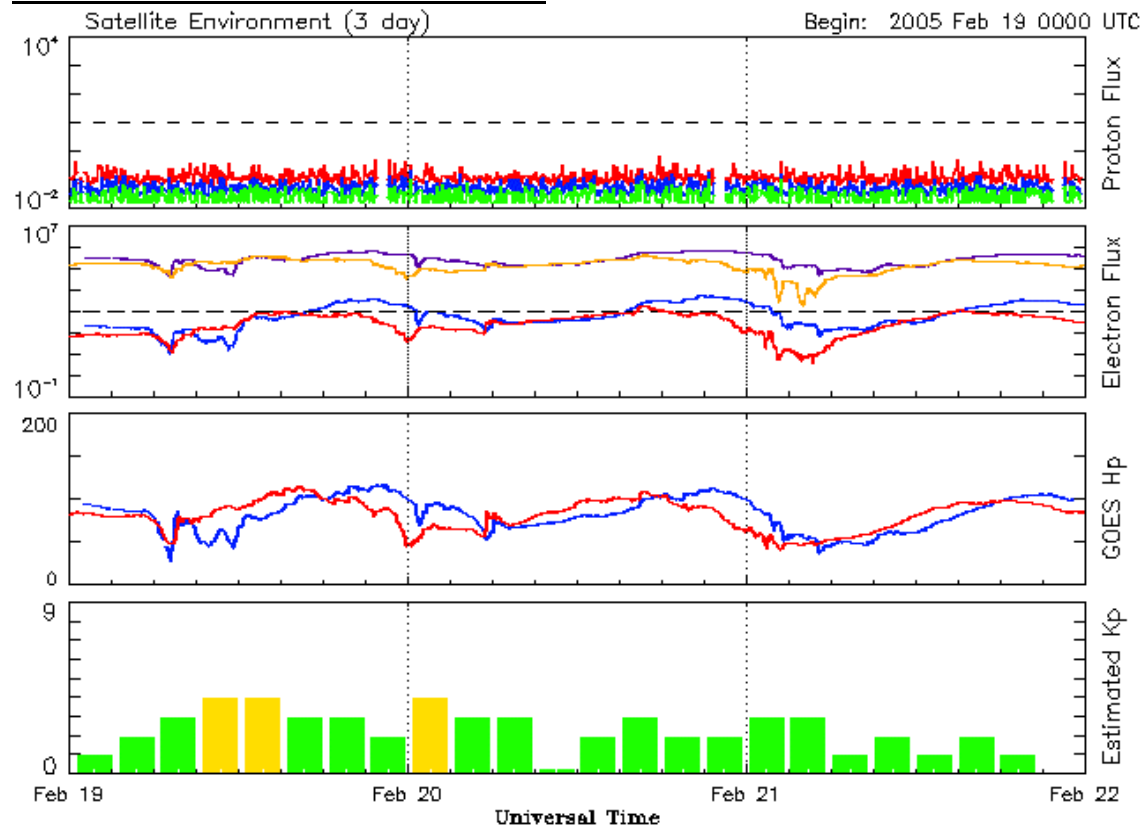
X: 0 Y: 0 [get Data](#) [Zoom](#) [Print...](#)

Rev 288



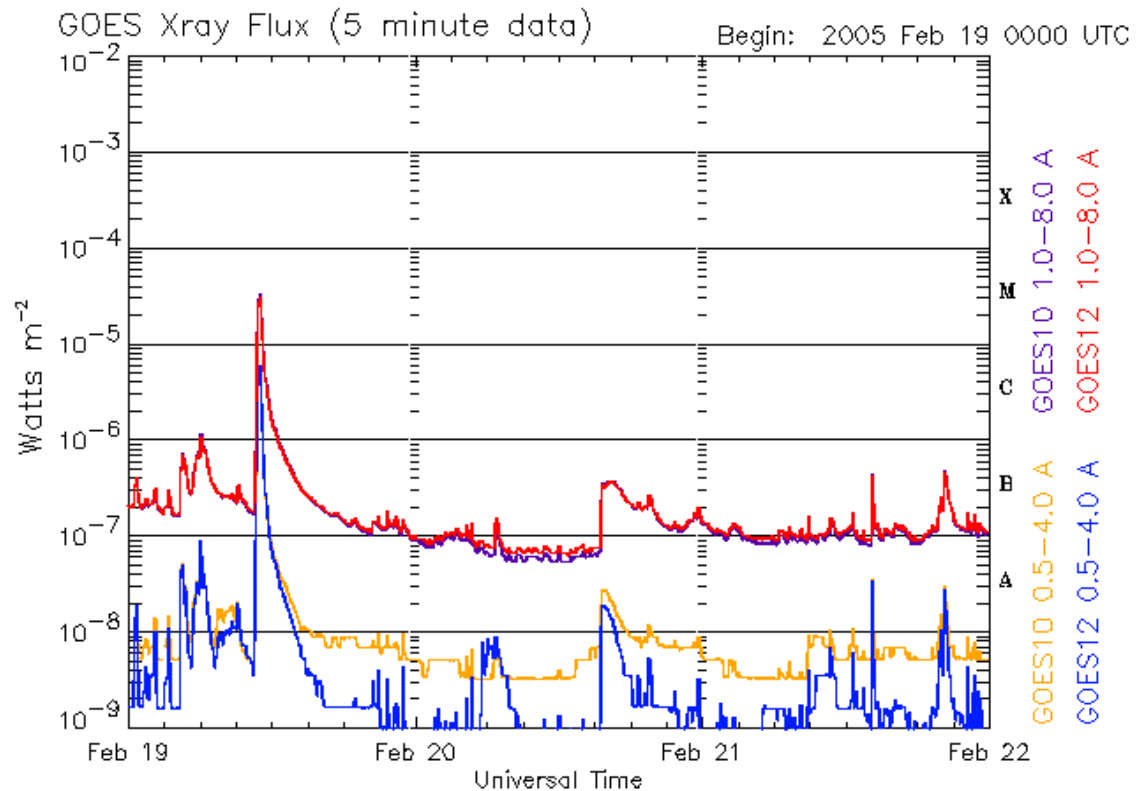
X: 0 Y: 0 [get Data](#) [Zoom](#) [Print...](#)

SEC-GOES Observed Particles Fluxes.



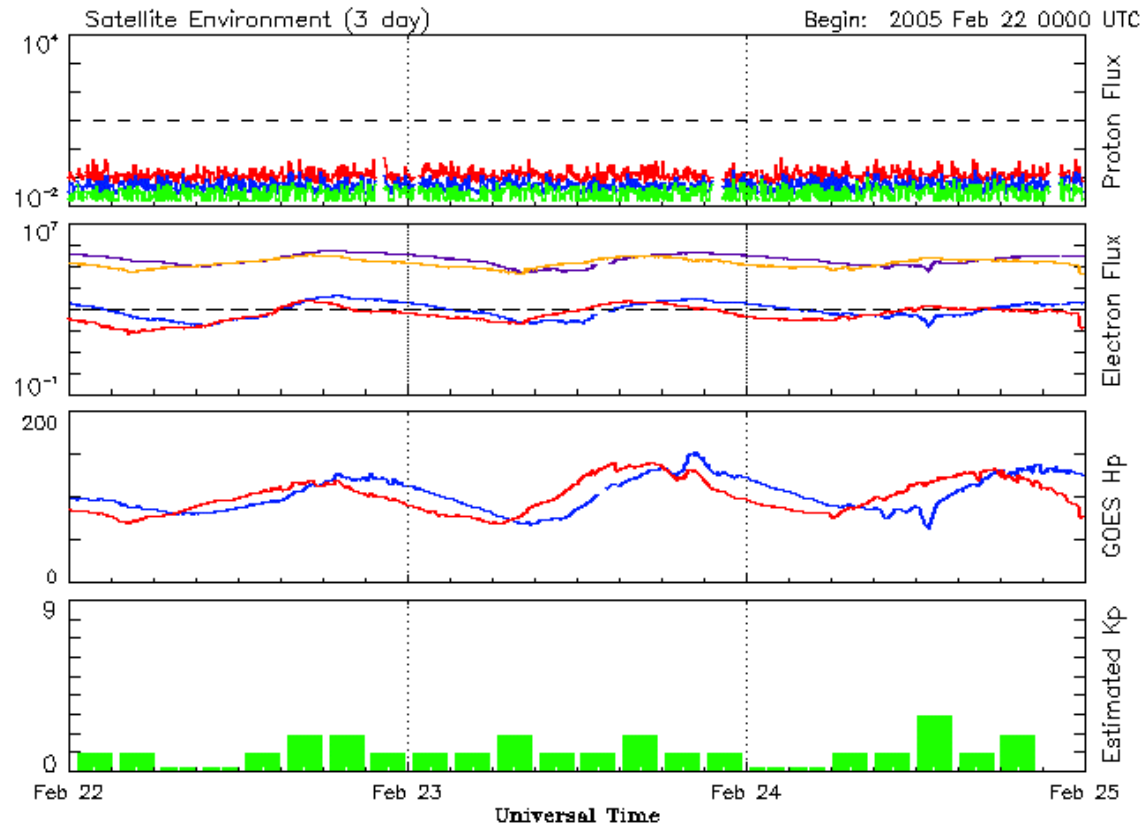
Updated 2005 Feb 21 23:56:12 UTC

NOAA/SEC Boulder, CO USA



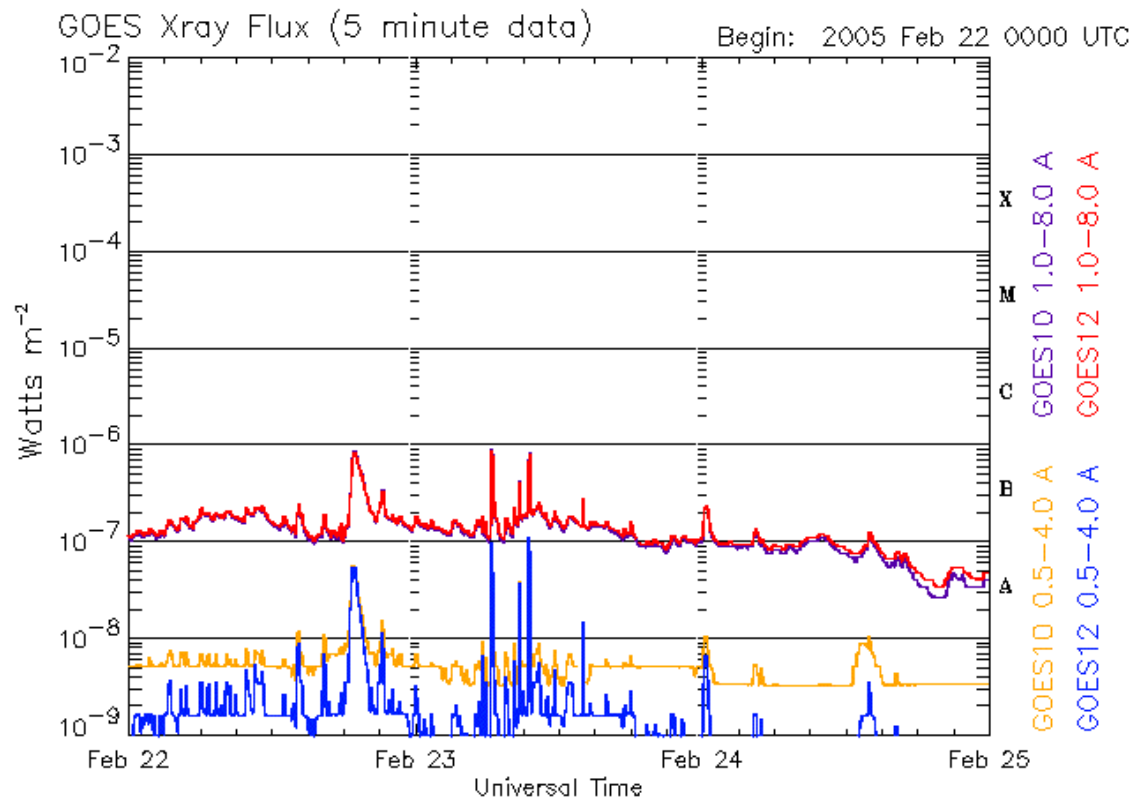
Updated 2005 Feb 21 23:56:05 UTC

NOAA/SEC Boulder, CO USA



Updated 2005 Feb 24 23:56:11 UTC

NOAA/SEC Boulder, CO USA



Updated 2005 Feb 24 23:56:05 UTC

NOAA/SEC Boulder, CO USA

