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

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 137
Week 18
09.05.05
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 30.04.05 until 06.05.05 (both dates inclusive) and covers the revolutions 311, 312 & 313.

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 Plane; M51 (RA 13:29:52.37; DEC +47:11:40.8) and NGC 2992 (RA 09:45:42.05; DEC -14:19:35.0). 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 (2 CSL, 1 OSL) were missed from the Timeline during this period, due to problem on REDU station.

The fuel consumption over the period between 29/04/2005 and 04/05/2005 was 0.0871 kg. The remaining propellant is in the order of 161.5507 Kg.

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

3.1.2 Power

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

3.1.3 Thermal

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

3.1.4 OBDH

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

3.1.5 RFS

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

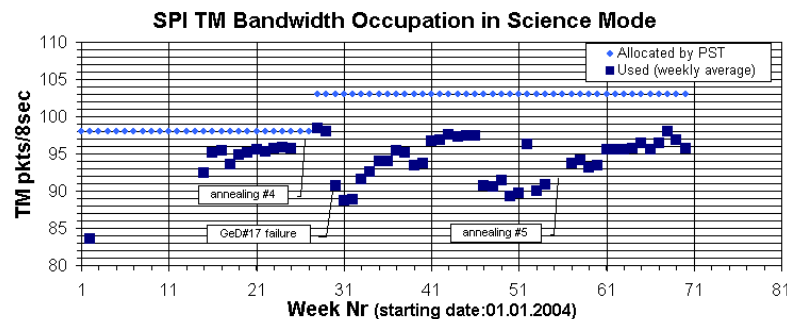
3.2 Payload

3.2.1 SPI

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

During the reporting period, the instrument has been kept in photon-by-photon mode, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an actual occupation of 95.7 pkts/cycle average. The workaround to the TM leakage anomaly (INT_SC-107) has been resumed, since 11th April.

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.

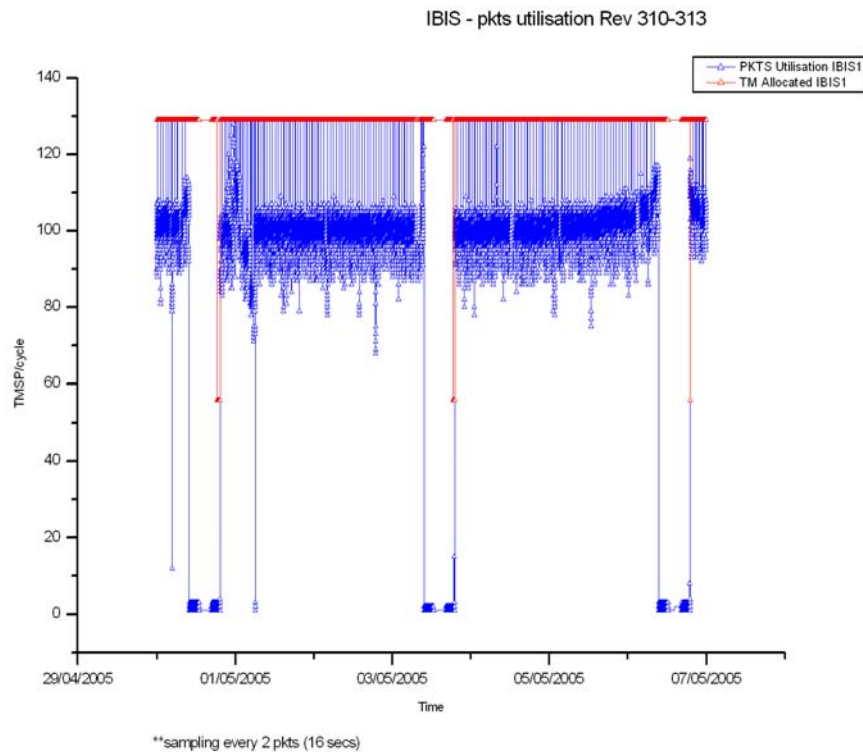
3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by 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 102.10 TMPS/cycle, up 2.10 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.

On 2005-04-30 the new, reduced nominal HV for JEM-X1 of 77 RAW took effect from the start of revolution 311 (set by ISOC in the POS). Pending the next IODB release, INT_OR_0204 was put into effect as of revolution 311 to ensure the new HV setting is also used in case of manual activation of JEM-X1.

On 2005-05-03, due to a temporary loss of ground station support, the ED KESAFE01 to put JEM-X1 into Safe mode before radiation belt entry of revolution 311 was missed from the Timeline. JEM-X1 was then commanded to Safe mode manually approximately 30minutes later than planned 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.

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, 150 pointings were executed nominally, 1 was started 20 minutes late, and 2 were lost.

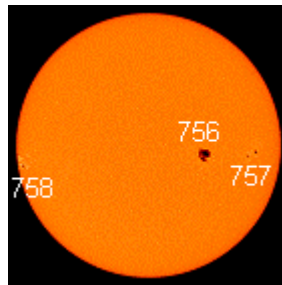
Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

The observation period was characterised by moderate solar activity.



Sunspot 756, which appeared on the 25th of April, became a so-called “big” sunspot about 4 times wider than Earth. It posed threat for M-class solar flare until the 3rd of May (cf. figure: daily sun on the 3rd of May, Image credit: SOHO/MDI).

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, well above the system performance requirements, 150 pointings were executed correctly, 1 was delayed, and 2 were lost.

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 good this week. One pointing was delayed due to link problems with Redu. Two pointings were lost due to link problems with DSS-16. There were other occasions when the TM/TC line both from REDU and DSS-16 dropped. The overall performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Mission planning for revolutions 319 - 321 generated and sent to MOC. One ToO request was received but it was not accepted since the triggering criteria were not met. No replanning took place. PSF's up to rev 321 have been received. TSF for rev 312 - 315 were received.

2. Observation status

No input received from ISDC.

3. ISOC science data archive

Development ongoing. A meeting took place with ISDC resulting in agreement on the main outstanding point, namely synchronisation of private and public information between ISDC and ISDA. This subject needed to be resolved before ISDA archive could go public. The plan to have a beta version available by mid May is still the baseline.

4. ISOC system

The version 10.8.2 of the ISOC system is still in use without problems. The move of the ISOC web pages as mentioned last week has worked very smoothly. An updated OMC catalogue was received from the OMC team. It is installed and will be used from revolution 322 and potentially replanned earlier revolutions.

5. 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 09/05/2005:

- Latest Standard Analysis completed: observation 03201090002 (Gal. Bulge region, Revolution 288) on 09/05/2005

- Latest products archived: observation 03200450029 (GRO J1655-40, Revolution 290) on 09/05/2005

- 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 120, at 03:54, the idda icon on the global MMI briefly went red before returning to green, the cause is unknown, there was no impact.

- On DoY 123, at 00:15, all links with Redu were lost, probably due to a hit on the line. They returned at 00:17. The impact was the loss of pointing 03110066.
- At 06:14 and again at 06:50, there were errors sending data to the isds, no action was taken and the situation corrected autonomously. There was no impact.
- Between 07:15, and 07:47, there were several drops in all the links with DSS-16, there was no impact.
- At 07:55, an AOCS command failed release due to another TM drop, the impact was the loss of pointings 03110074 & 03110075. Also the command K0008, to put Jemx-1 to SAFE mode was missed, this was sent manually at 08:50. The DR# is 111993.
- At 16:56, the message: IPKTmain, imon, ERROR, LOG, SP – INVALID – Reason Invalid Pkt Checksum was observed in the event log, there was no further impact.
- On DoY 125, at 11:10, low swap space and high cpu load was being indicated for both imca & imcb. The application launcher was stopped and restarted on both machines curing the problem. There was no impact.
- On DoY 126, at 16:48, the TM & TC links with Redu dropped causing the Timeline to be stopped. The impact was several Eds had to be manually uplinked, and a Reaction Wheel Bias had to be manually executed. As all this happened below the belts, no pointings were lost.

The following anomaly report was entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
INT-2727	02/05/2005	TDRS returns incomplete data without warning message	IMCS	Pending
INT-2728	10/05/2005	TC & TM link drop at REDU	ESA Stations	Pending
INT-2729	10/05/2005	TC link lost at REDU due to early carrier-up at DSS-16	NASA Station	Closed

7 Future Milestones

The next Eclipse season will start on 18th May.

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 May.

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. 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 311

The observations in revolution 311 consisted of 13 pointings of a GPS lasting ~9 hours, followed by a raster dithering observation of M51 (RA 13:29:52.37; DEC +47:11:40.8), performed for the remaining ~51.5 hours of observation time.

Revolution 312

The observations in revolution 312 consisted of a raster dithering observation of M51 (RA 13:29:52.37; DEC +47:11:40.8) lasting ~17 hours, followed by a raster dithering observation of NGC 2992 (RA 09:45:42.05; DEC -14:19:35.0), performed for the remaining ~43 hours of observation time.

Revolution 313

In revolution 313 a raster dithering observation of NGC 2992 (RA 09:45:42.05; DEC -14:19:35.0) was performed throughout the available observation time (~62 hours).

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

2005-04-14T05:01:01.000Z	161.9445	F	Automatic TM processing.
2005-04-15T18:31:38.000Z	161.9368	F	Automatic TM processing.
2005-04-17T04:38:13.000Z	161.8691	F	Automatic TM processing.
2005-04-18T18:14:09.000Z	161.8549	F	Automatic TM processing.
2005-04-19T03:08:34.000Z	161.8321	F	Automatic TM processing.
2005-04-21T18:05:29.000Z	161.7674	F	Automatic TM processing.
2005-04-22T07:26:26.000Z	161.7421	F	Automatic TM processing.
2005-04-24T17:49:45.000Z	161.7361	F	Automatic TM processing.
2005-04-26T04:17:40.000Z	161.7159	F	Automatic TM processing.
2005-04-27T17:36:16.000Z	161.6996	F	Automatic TM processing.
2005-04-29T04:05:16.000Z	161.6378	F	Automatic TM processing.
2005-04-30T17:20:08.000Z	161.6165	F	Automatic TM processing.
2005-05-01T02:16:49.000Z	161.5859	F	Automatic TM processing.
2005-05-03T17:10:09.000Z	161.5719	F	Automatic TM processing.
2005-05-04T12:40:03.000Z	161.5507	F	Automatic TM processing.

This report was generated Fri May 6 08:00:21 GMT 2005

8.3 Detailed Satellite Information

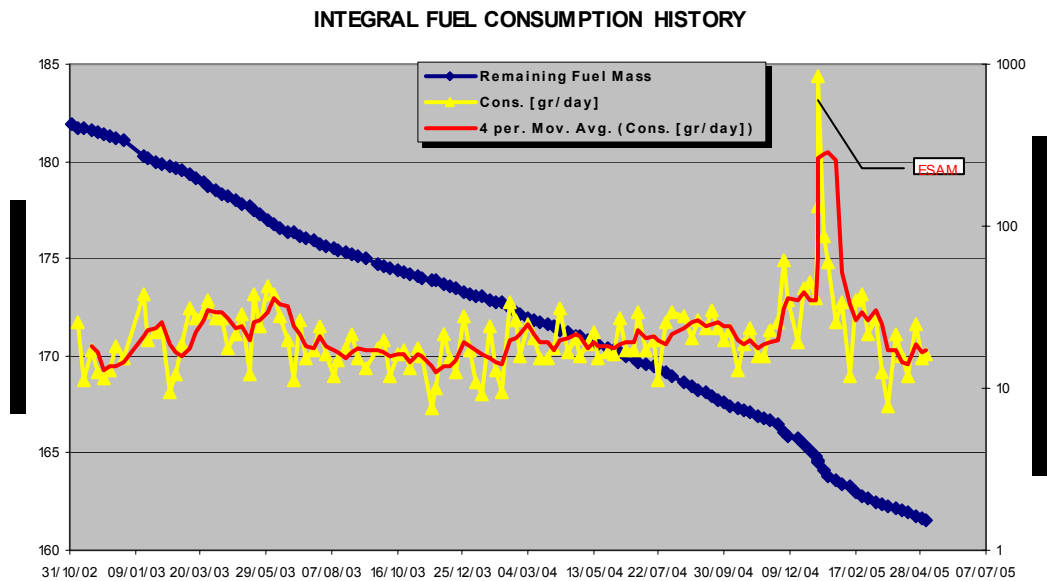
This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCs SUMMARY OPERATIONS REPORT, 30/04/2005 - 06/05/2005

AOCs operations were executed from the Automatic Timeline.

During this period, 71 Open Loop Slews, 93 Closed Loop Slews and 4 Momentum Bias were executed. 3 slews were missed due to problem on the TM\TC links with REDU station

The fuel consumption over the period between 01/11/2002 and 04/05/2005 is reported in the plot below.



30/04/05 (Day of Year 120, Revolution 310-311)

Nothing to report.

01/05/05 (Day of Year 121, Revolution 311)

Nothing to report.

02/05/05 (Day of Year 122, Revolution 311)

Failed attitude verification process: Due to a problem during the attitude reconstruction process (not enough stars found, expected 4 when found only 3), the slews ID 03110055 did not receive the automatic update from the FD system.

A manual recovery was then quickly performed and the slew ID 55 updated. No impact reported on the scheduled activities.

03/05/05 (Day of Year 123, Revolution 311-312)

Slew missed from the Timeline: Due to a problem on REDU station (TM\TC link dropped), the slew ID 03110066(CSL) was not executed and the AOCS s/s disabled in TL at 00:15z. A manual recovery was then performed to the attitude of PID 03110066. The next slew (CSL) for PID 03110067 was manually updated and executed from the Timeline. The AOCS s/s was re-enabled in TL at 00:53z.

Slews missed from the Timeline: Due to a problem on REDU station (TM link dropped), the slew ID 03110074(CSL)-75(OSL) were not executed and the TL stopped at 07:55z. A manual recovery was then performed to the attitude of PID 03110075. The next slew (OSL) for PID 03110076 was manually updated and executed from the Timeline. The TL was re-started at 09:09z.

04/05/05 (Day of Year 124, Revolution 312)

Nothing to report.

05/05/05 (Day of Year 125, Revolution 312)

Nothing to report.

06/05/05 (Day of Year 126, Revolution 312-313)

Possible STR 1750 processor faults: a possible STR 1750 processor fault occurred during PID 03120063. The sequence of the events was the following:

03:10:09z	Closed Loop Slew End
03:11:15z	Mapping start
03:11:35z	Mapping End prematurely
03:11:35z	IMU-1 ON
03:11:35z	New Mapping start and new guide start picked
03:12:19z	Mapping End
03:21:35	IMU-1 OFF

The attitude for PID 63 resulted to be:

PID	AR	DEC	POS
03120063	10:01:52	-17:10:13	284:27:43

The fault, which occurred after the end of the close loop slews, resulted in the abortion of the on-going commanded mapping (duration shortened to 20 sec), IMU switch ON, and start of a new mapping. The guide star at the moment of the fault was

ID 6045 – 1407	Mi 8.05	CCD location [-13596,-14031]
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The guide star picked after the new mapping was

ID 6050 – 1466	Mi 8.0	CCD location [10425, -5940]
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According to the Star Catalogue, no extended\variable\bright objects were in the STR FoV at the time of the fault.

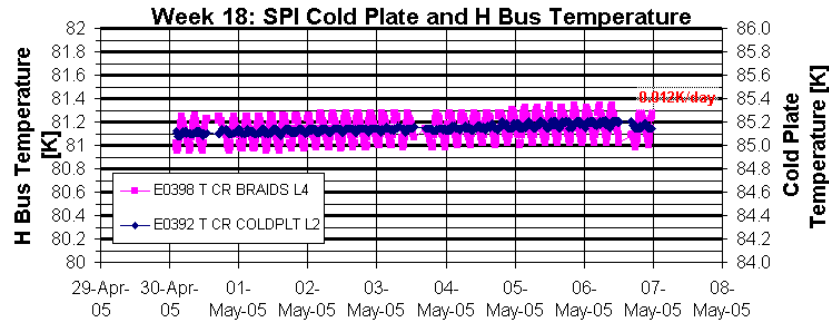
No slews were missed. The operational impact of the fault was the OTF not reached during PID 03120063.

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 is:

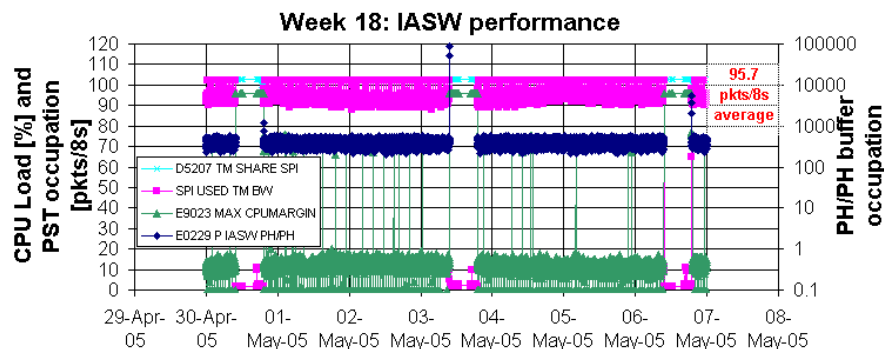
102 pkts/cycle peak (1 pkt/cycle is unused due to TM leakage problem, see after);

95.7 pkts/cycle average in science mode.

The temporary workaround to the TM leakage anomaly (AR INT_SC-107), applied at every revolution, has been resumed since 11th April.

A software patch to fix both the TM leakage malfunction and the missed belts entry ACS HV switch off malfunction (INT_SC-115) is ready: however due to an anomaly in the DPE used for ground testing, validation of the patch is not progressing.

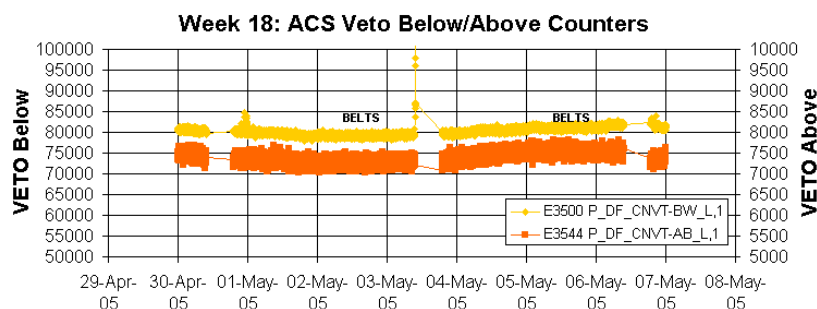
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS

The performance of the ACS is nominal.

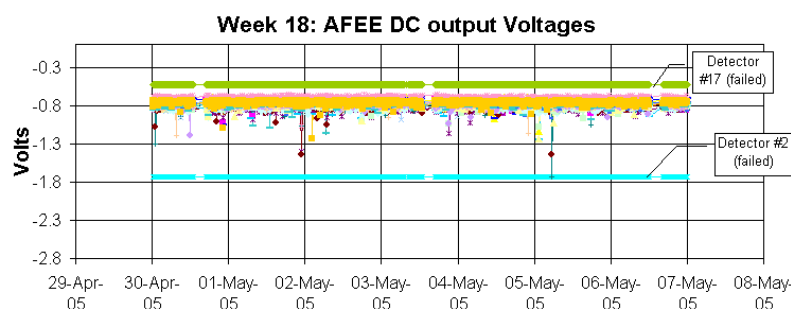
The following plot shows the ACS overall count rate evolution during the reporting period.



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.

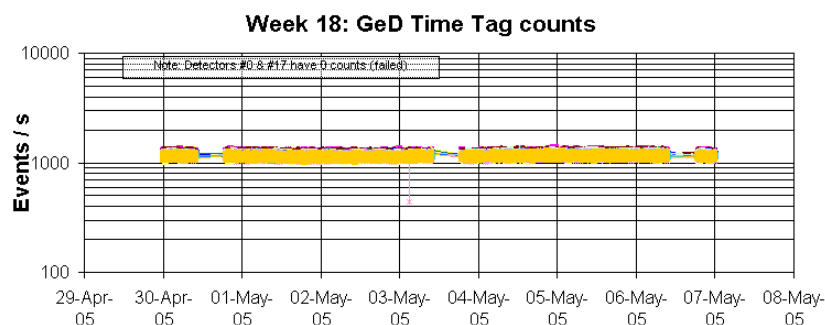
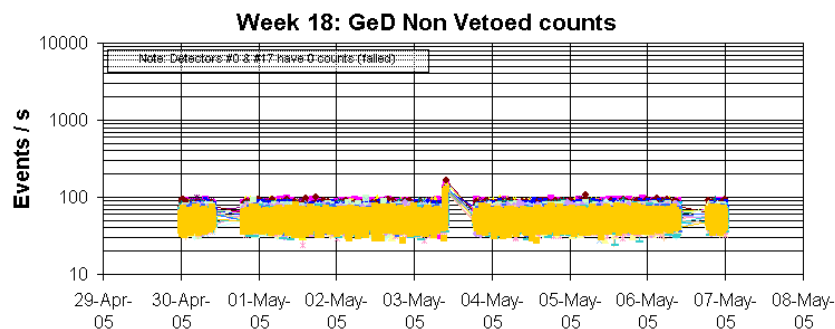
The following plot shows the AFEE dc output signals during the reporting period.

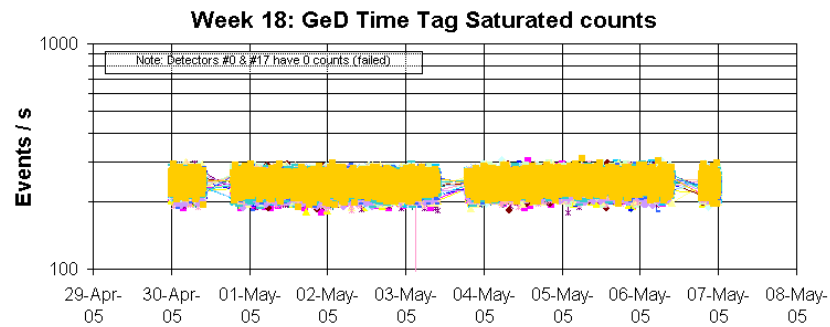


DFEE

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.



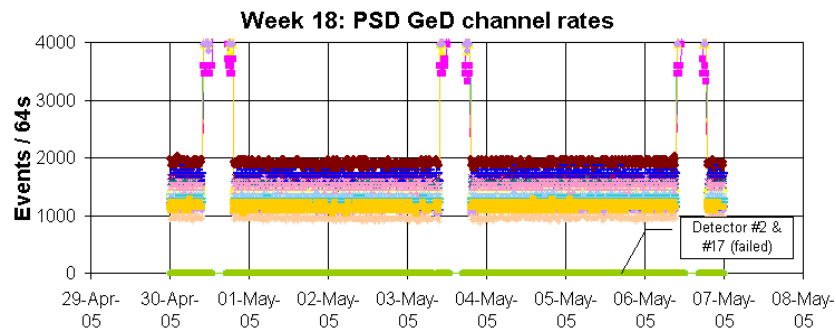


PSD

The performance of the unit is nominal.

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

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



SPI DAILY EVENTS

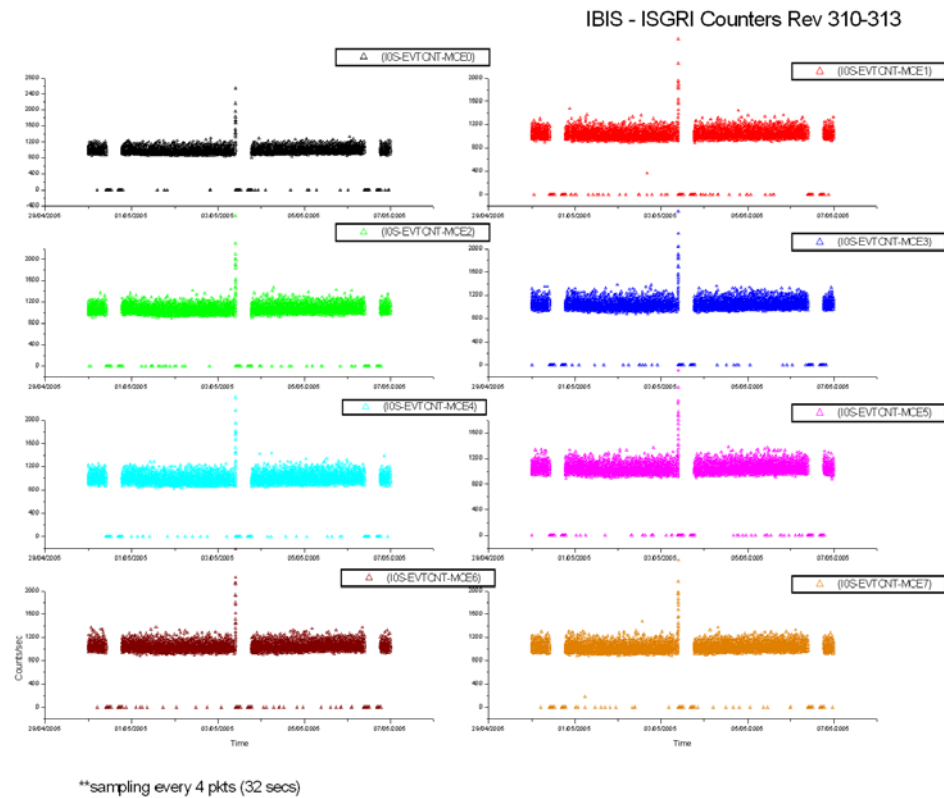
NOTE: The event log is extracted from the revolution pass summary.

DOY Time	Event
121 - 06:18	Man. PST update, INT OR 0190
123 - 09:39	TM E3500 OOL, back in limits @ 09:41
123 - 12:34	OEM SPI FIXED POINT OVERFLOW
126 - 16:48	EEORTM01 failed from timeline due to TM/TC LOS

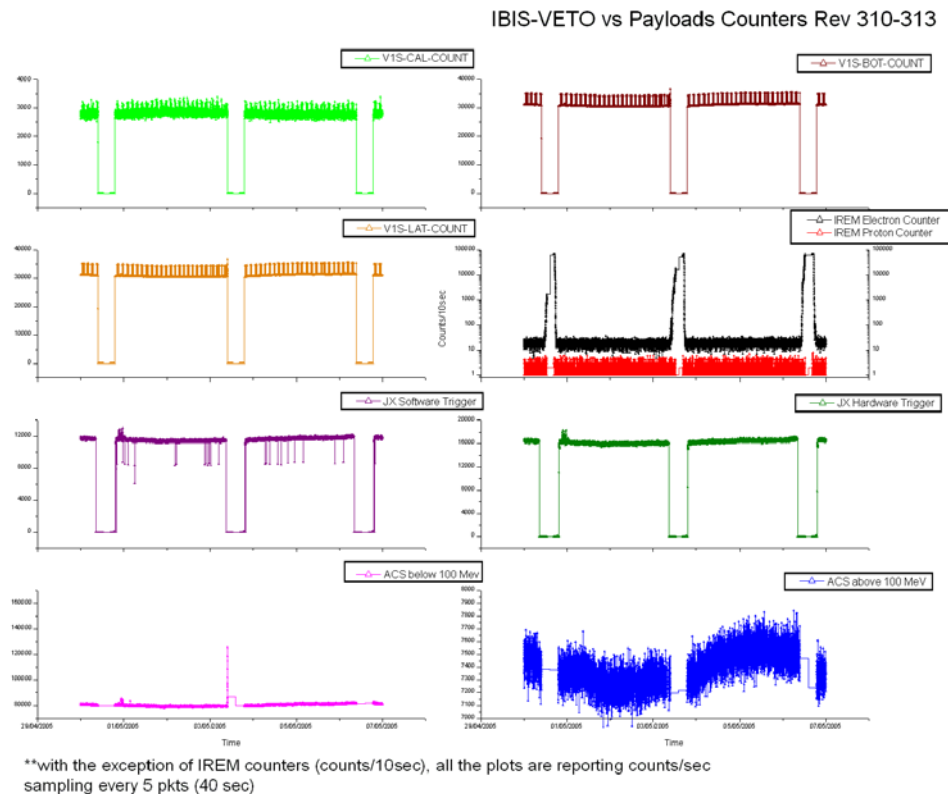
8.3.3 IBIS Operations

IBIS Events Counters Plots.

ISGRI Counters:

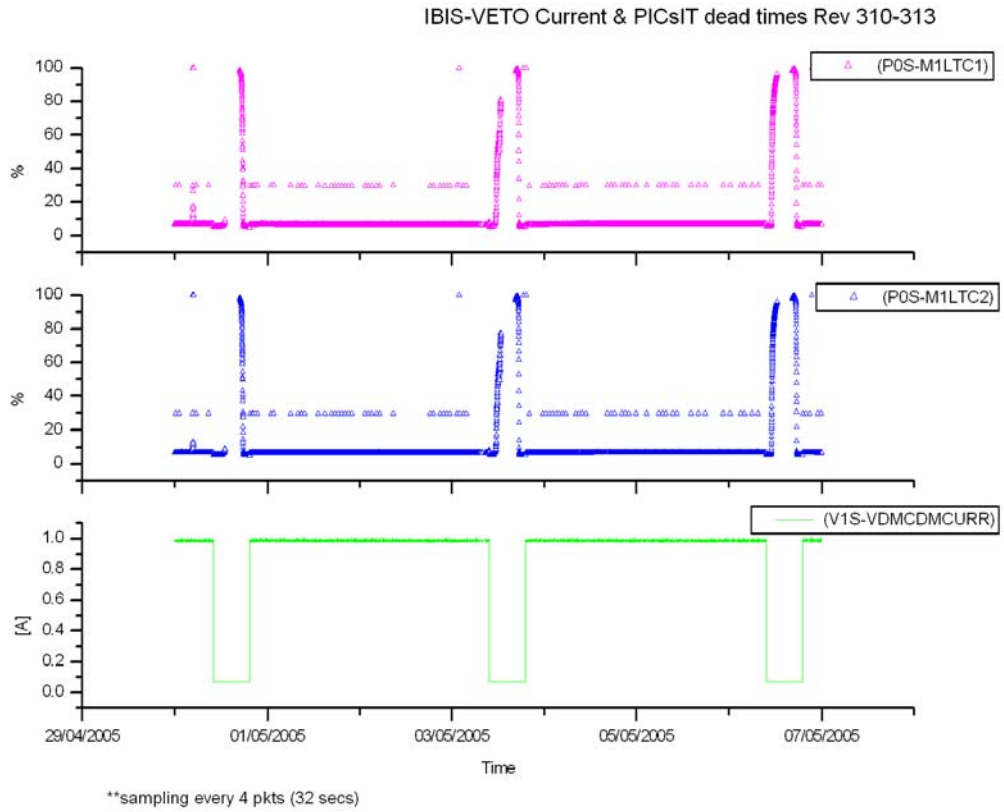


VETO vs Payloads Counters:

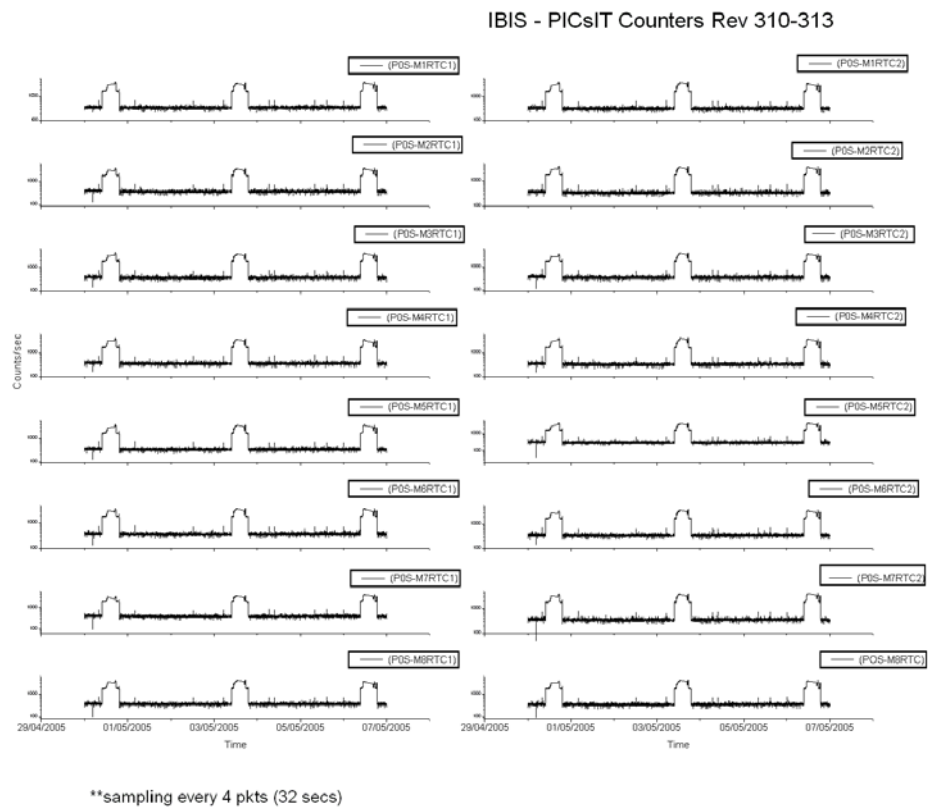


The week was characterised by moderate solar activity.

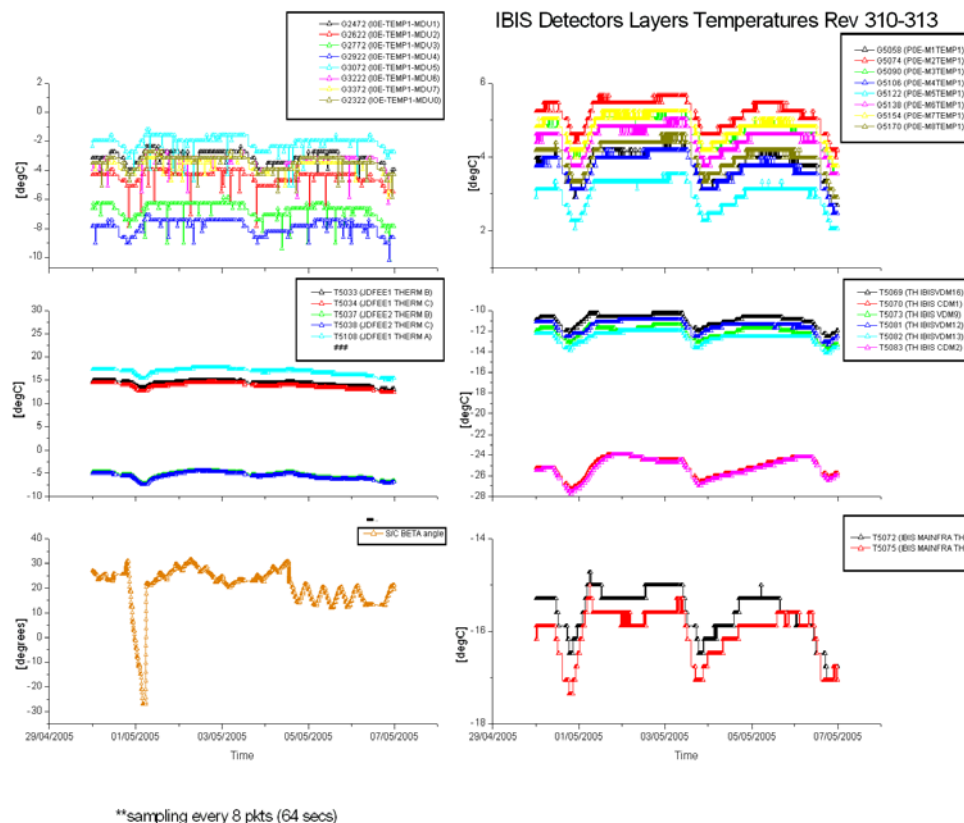
Veto Current:



Picsit Counters:



IBIS Detectors Layer Temperatures:



IBIS daily report

DoY 2005.120 (30/04/2005)

At 09:57Z 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 19:22Z. As this happened close to the radiation belts, according to V-VLT-1 no action was taken.

At 04:40Z, TM families G5068 and G5072 (POS-MiF #1 and #2 ERRF) failed SCC.

At 04:45Z, TM families G5002 and G5003 (POS-MiRTC #1 and #2) went OOL 'low-low'.

At 04:49Z, the OEM id 132 class 0 "IBIS1 IASW HEPI RESYNCHRONISED" was reported.

According to reaction P-CNT-1 that describes the coincidence of these 3 events outside Radiation Belts, no action was taken. IBIS was monitored for 15 minutes during which all the parameters returned within their limits.

DoY 2005.123 (03/05/2005)

At 09:46Z 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 19:11Z. As this happened close to the radiation belts, according to V-VLT-1 no action was taken.

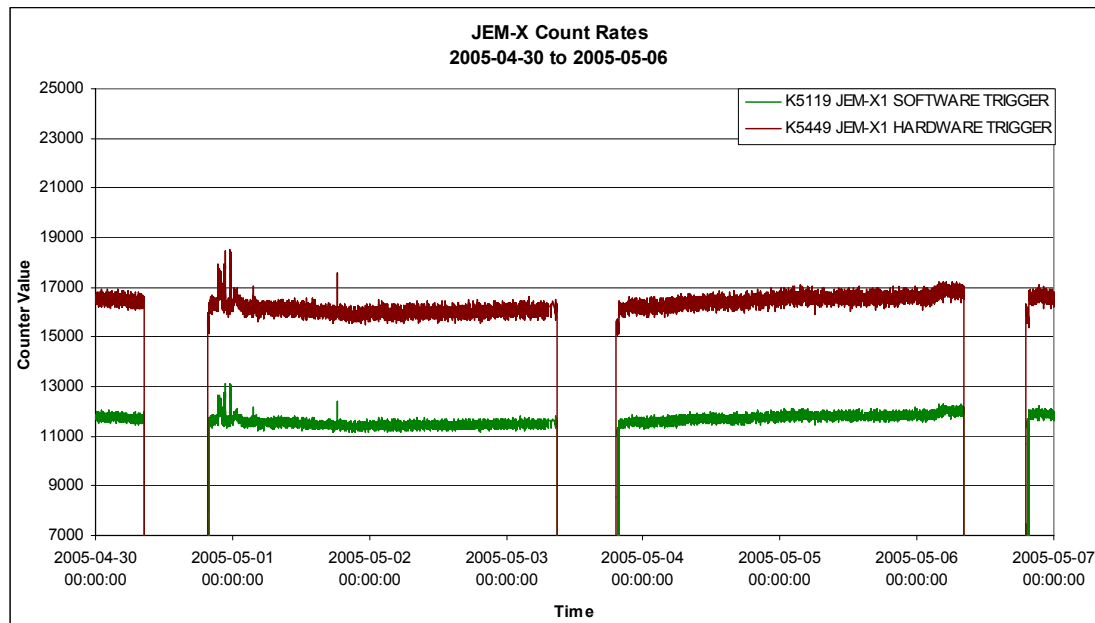
DoY 2005.126 (06/05/2005)

At 09:35Z 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 19:00Z. As this happened close to the radiation belts, according to V-VLT-1 no action was taken.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

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

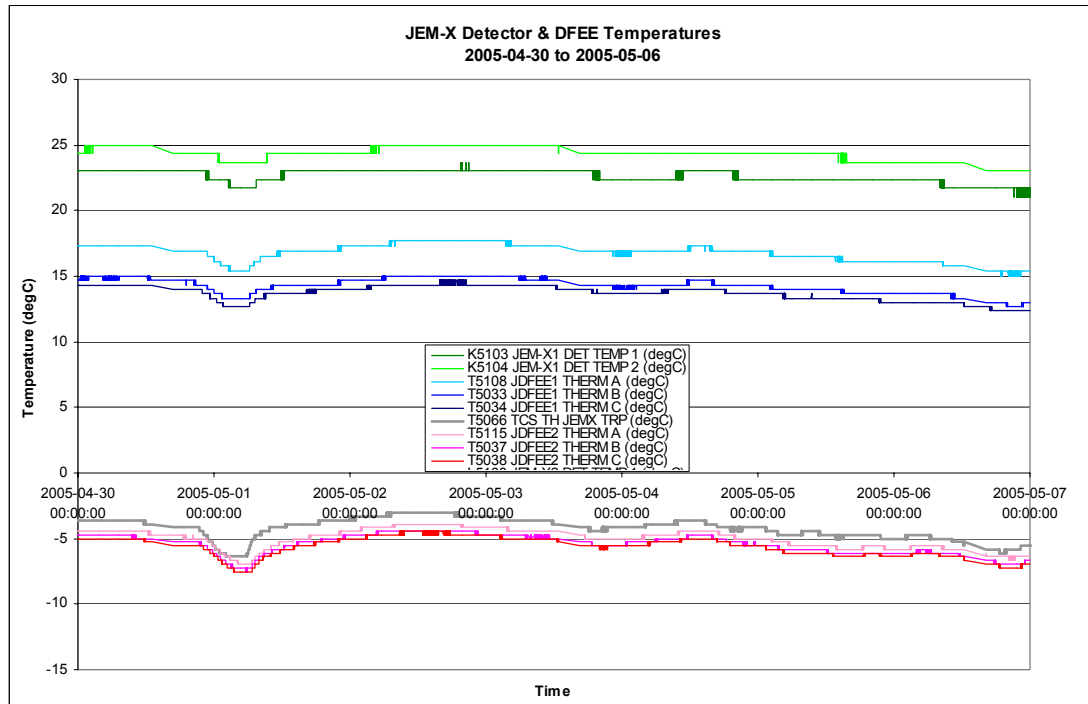


8.3.4.2 JEM-X Temperatures

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

2005-04-30 (DOY 120, Rev 310-311)

A new reduced nominal HV setting for JEM-X1 of 77RAW was applied from revolution 311. This was set via the ED KEACT_03, scheduled by ISOC in the POS at 19:24:58Z. In line with OCR-195, the default values for the JEM-X1 HV have been updated in the working version of the IODB, however these will not take effect until the next IODB release. Therefore, in the meantime, in case of manual activation of JEM-X1, Operational Request INT_OR_0204 was put into effect starting from revolution 311.

2005-05-01 (DOY 121, Rev 311)

At 18:16:22Z the TM parameter K5136 BUFFER LOSS went out of limits High (value = 618) but then returned within limits at the next TM cycle.

2005-05-02 (DOY 122, Rev 311)

Nothing to report

2005-05-03 (DOY 123, Rev 311-312)

Due to problems with the Goldstone ground station, resulting in a loss of TM and TC capability, the Timeline was stopped at 07:56Z and therefore the ED KESAFE01, scheduled at 08:22:49Z to put JEM-X1 in Safe mode before radiation belt entry of revolution 311, was missed. Once ground station support was regained, FCP_JEM1_0040 was executed at 08:50Z to put JEM-X1 in Safe mode manually.

2005-05-04 (DOY 124, Rev 312) to 2005-05-06 (DOY 126, Rev 312-313)

Nothing to report

8.3.5 OMC Operations

2005-05-03 (DOY 123, Rev 311)

At 00:15, a drop in the links with the ground station caused a delay in the up-link of the OMC commands for pointing 03110066. The originally scheduled time for the start of the pointing was about 00:22, the pointing was eventually manually started at 00:42:51.

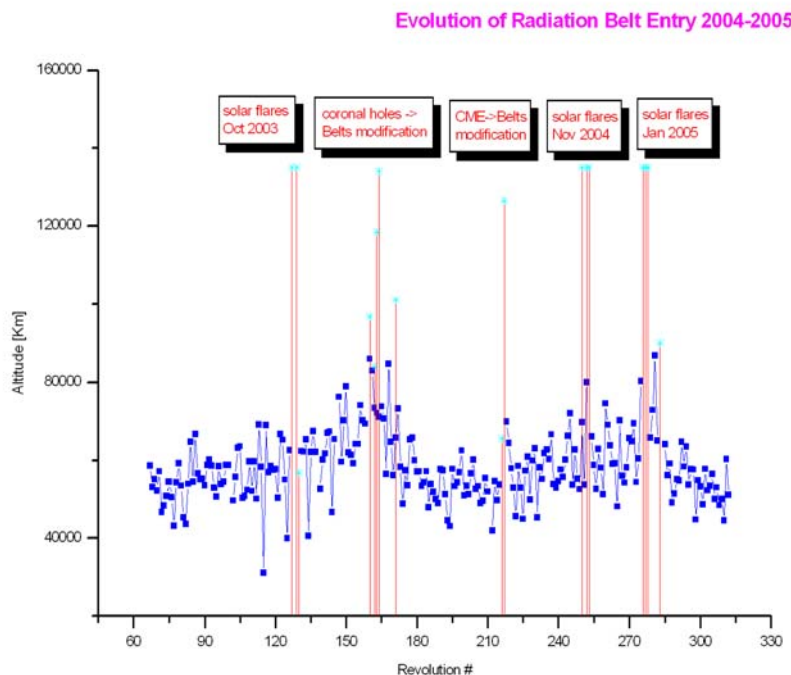
At 07:55, another TM drop, caused the loss of pointings 03110074 & 03110075.

2005-04-29 (DOY 119, Rev 310)

On DoY 120 at 09:57:12 DoY 123 at 09:46:27 and DoY 126 at 09:35:08, OMC was switched by the Timeline to SAFE mode, at the nominal times.

8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

DoY 126 (06/05/2005):

As the timeline was stopped because of TM/TC link problem, the event designator UEGRON01 was resent manually at 17:13Z.

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]
310	RAD_ENTR R 2005-04-30T09:56:55Z	2005-04-30 11:54:47	<44537.9	2005-04-30 10:54:15	52363
311	RAD_EXIT R 2005-04-30T19:10:05Z	2005-04-30 17:53:51	>>24900	2005-04-30 18:04:15	29719
311	RAD_ENTR R 2005-05-03T09:46:09Z	2005-05-03 09:47:35	60348.2	2005-05-03 10:40:29	52766
312	RAD_EXIT R 2005-05-03T18:59:15Z	2005-05-03 17:44:24	>24897.8	2005-05-03 17:50:29	29244
312	RAD_ENTR R 2005-05-06T09:34:52Z	2005-05-06 10:40:24	51097.6	2005-05-06 10:30:29	52625
313	RAD_EXIT R 2005-05-06T18:48:37Z	2005-05-06 18:16:40	>>24908.0	2005-05-06 17:40:29	29346

Reference

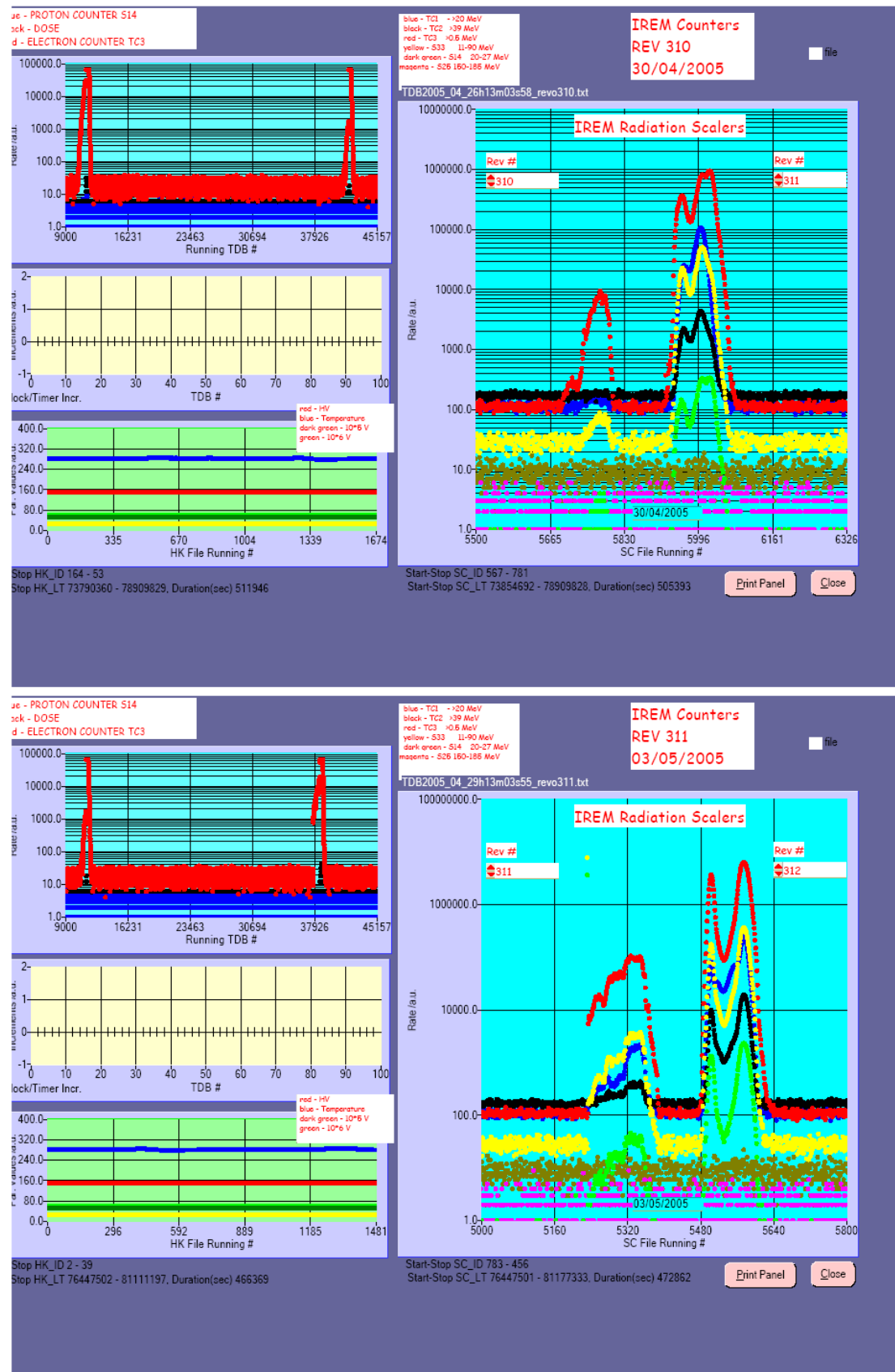
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

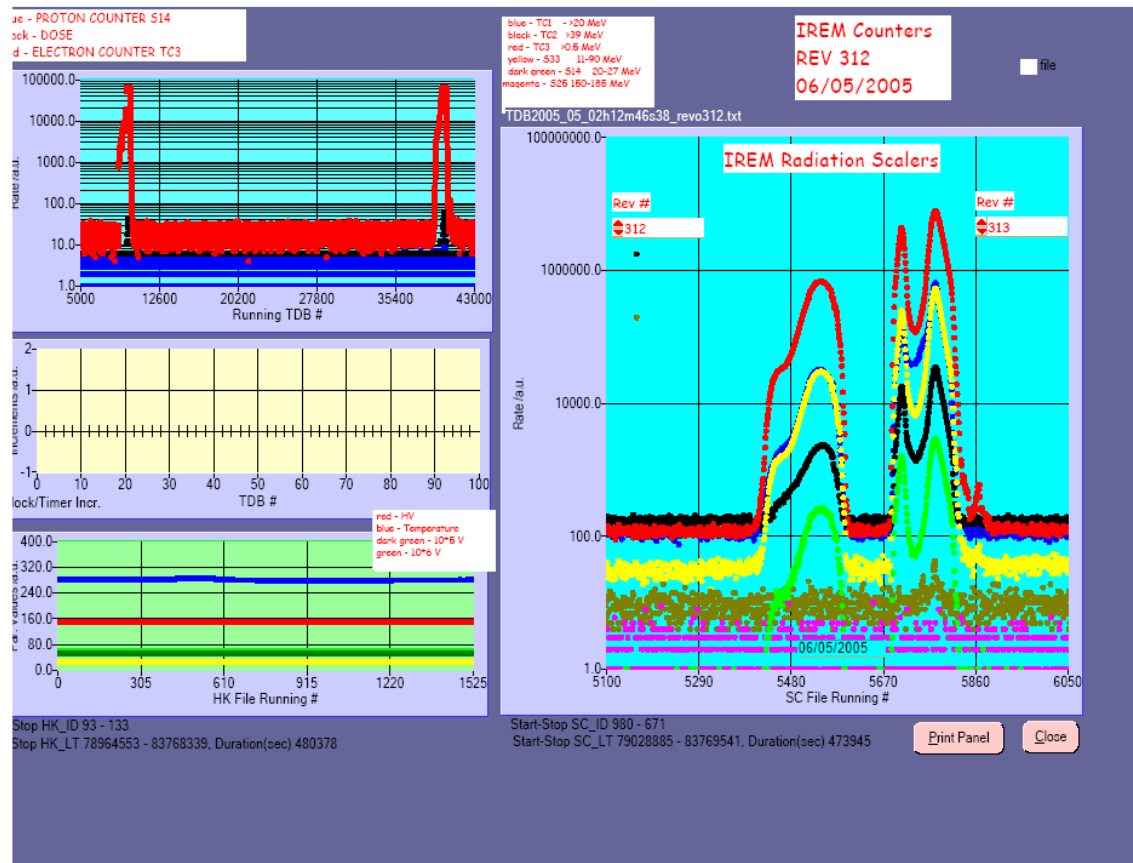
Large error vs reference (more than 30 minutes)

Radiation Spike

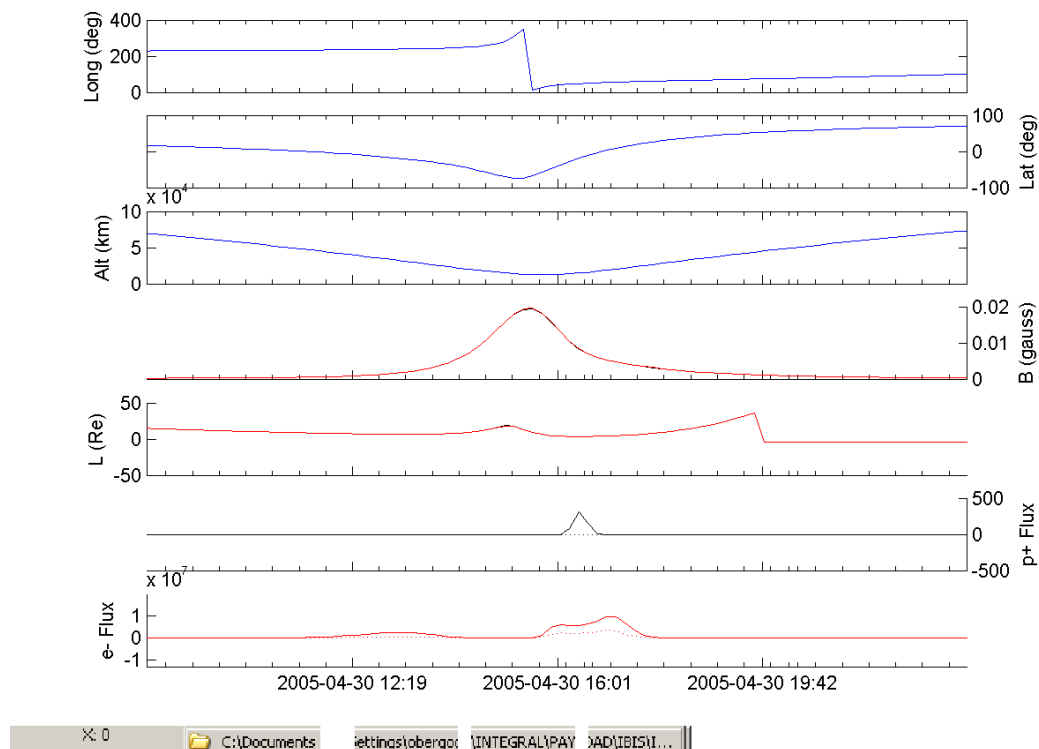
IREM radiation counters:



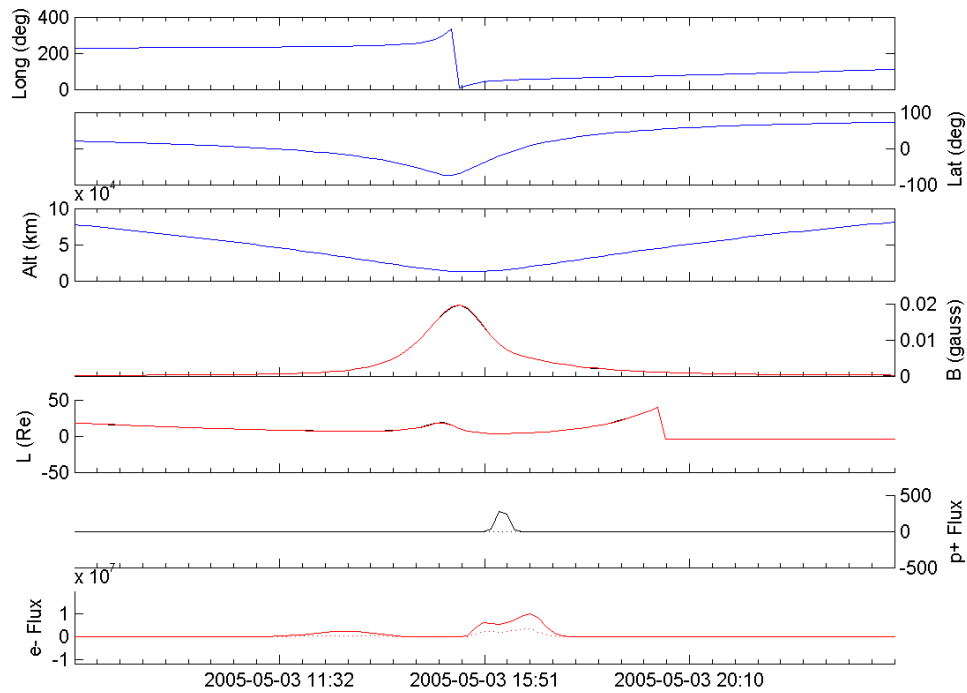
Due to problem with the TCPIP server, data for the beginning of radiation belts passage from revolution 311 to 312 are missing.



IREM Predicted Radiation Belt Passages: Rev 310

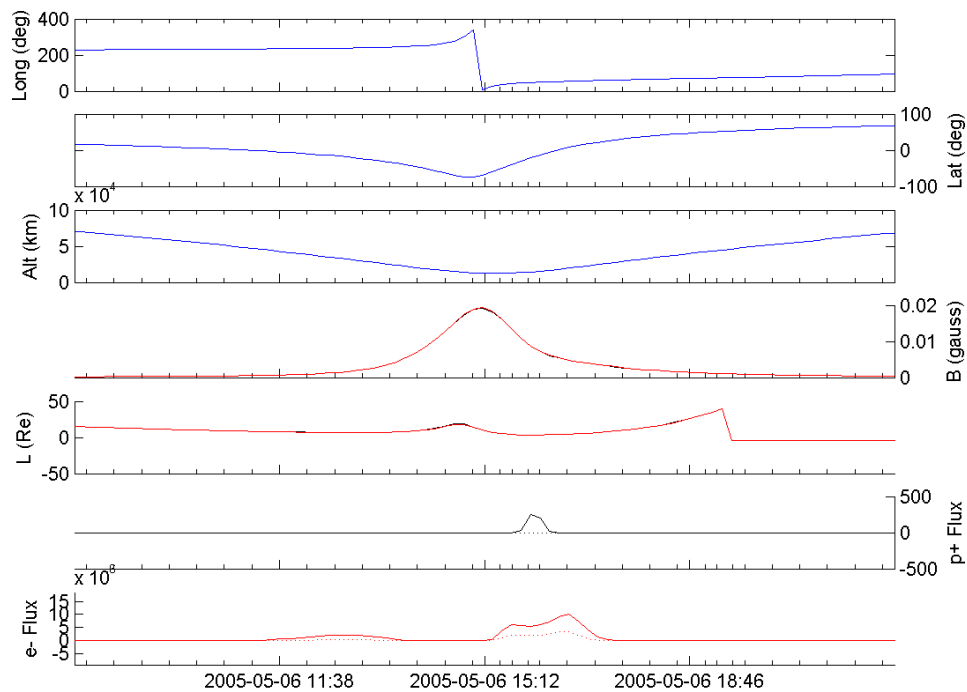


Rev 311



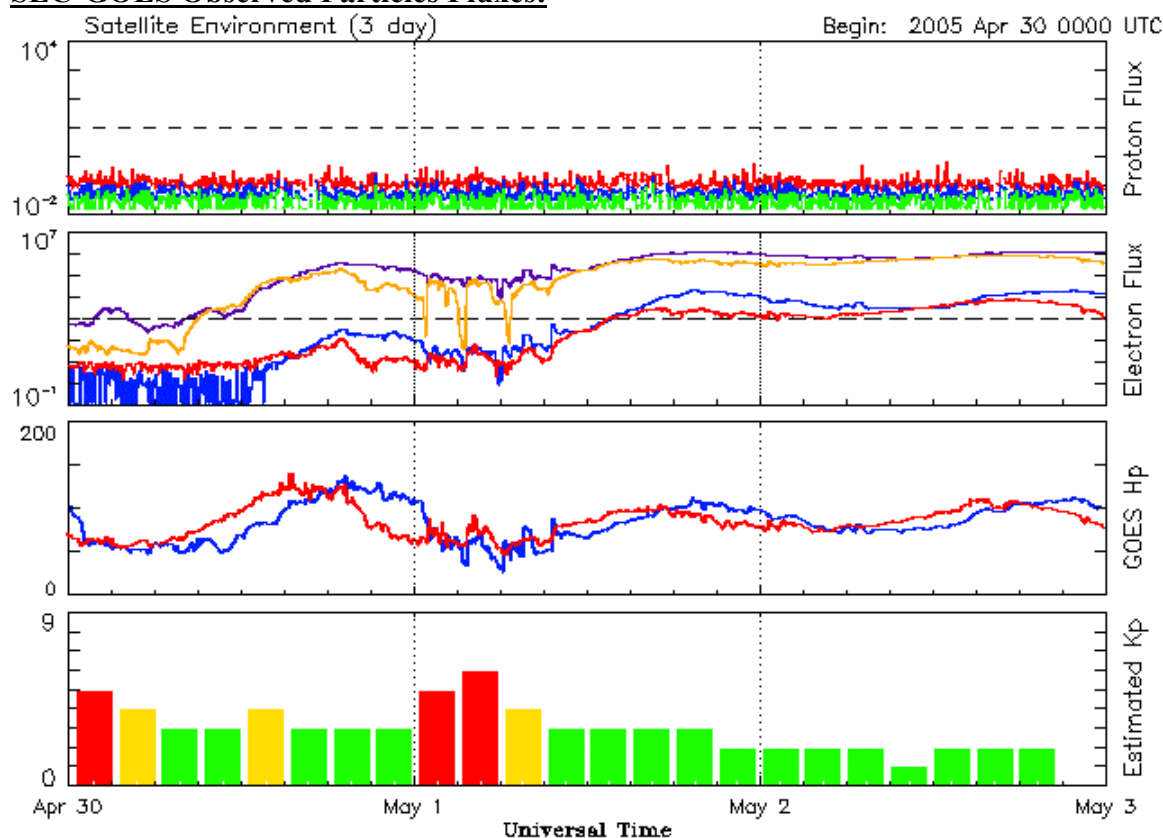
× 0 C:\Documents settingsloborgo INTEGRALPAY AD\IBIS\I...

Rev 312



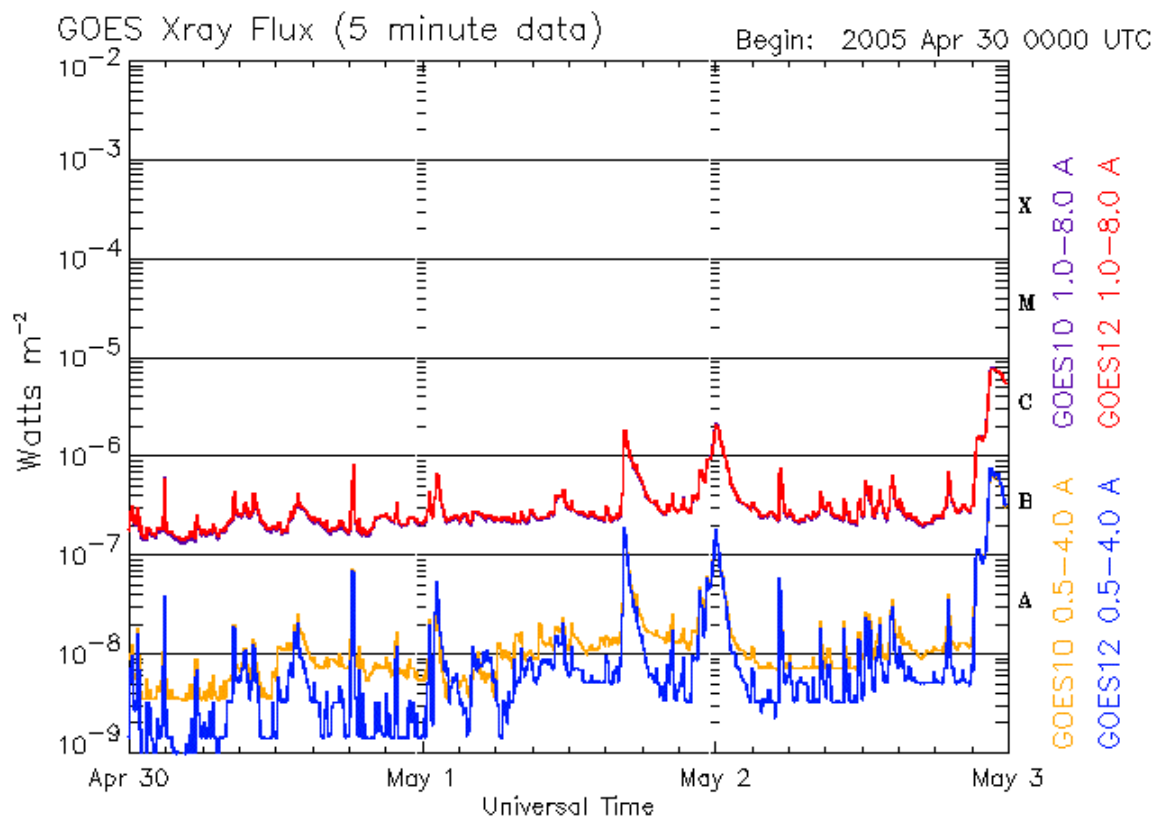
× 0 C:\Documents settingsloborgo INTEGRALPAY AD\IBIS\I...

SEC-GOES Observed Particles Fluxes:



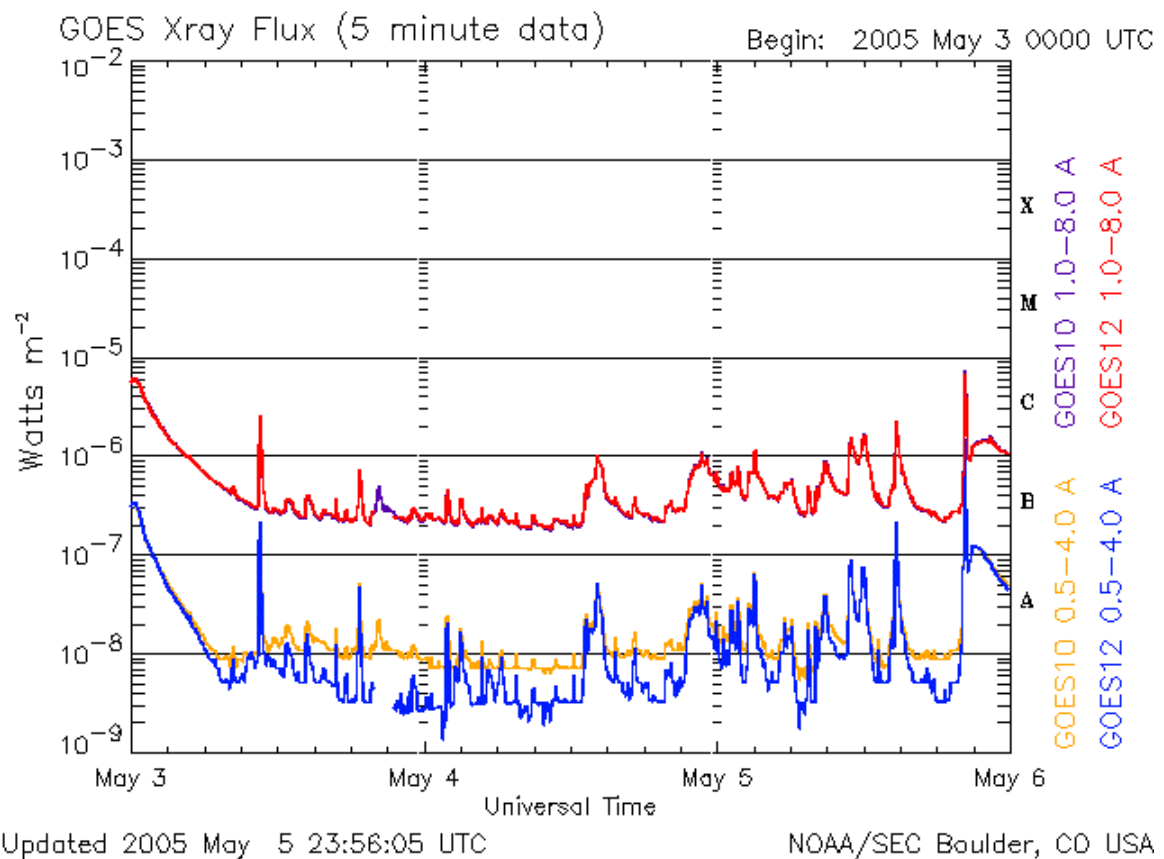
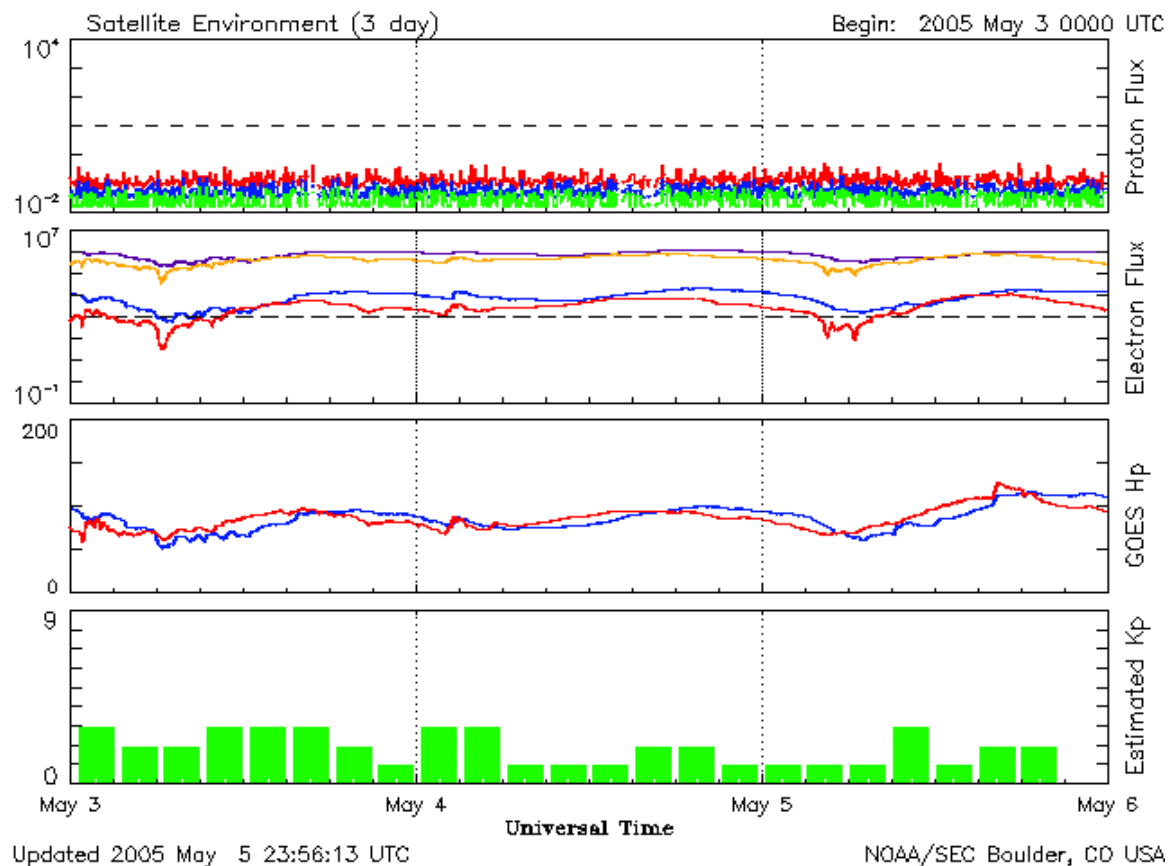
Updated 2005 May 2 23:56:14 UTC

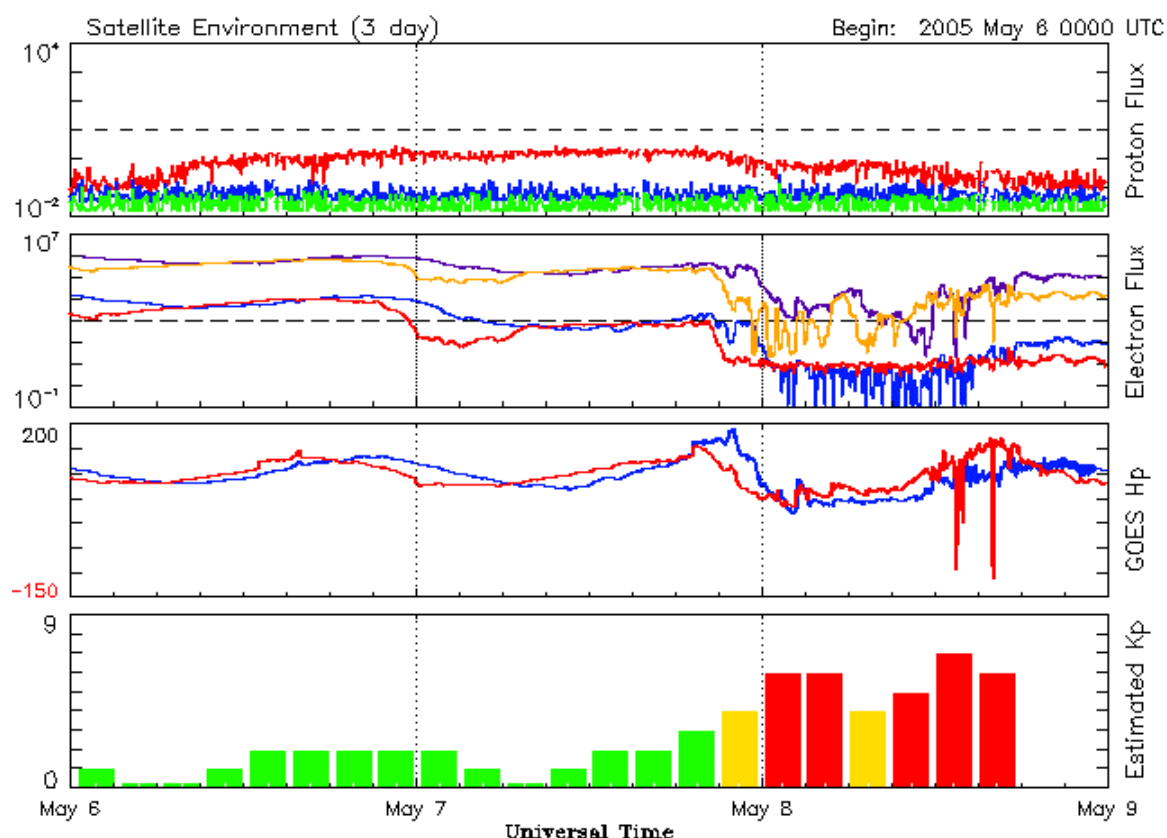
NOAA/SEC Boulder, CO USA



Updated 2005 May 2 23:56:03 UTC

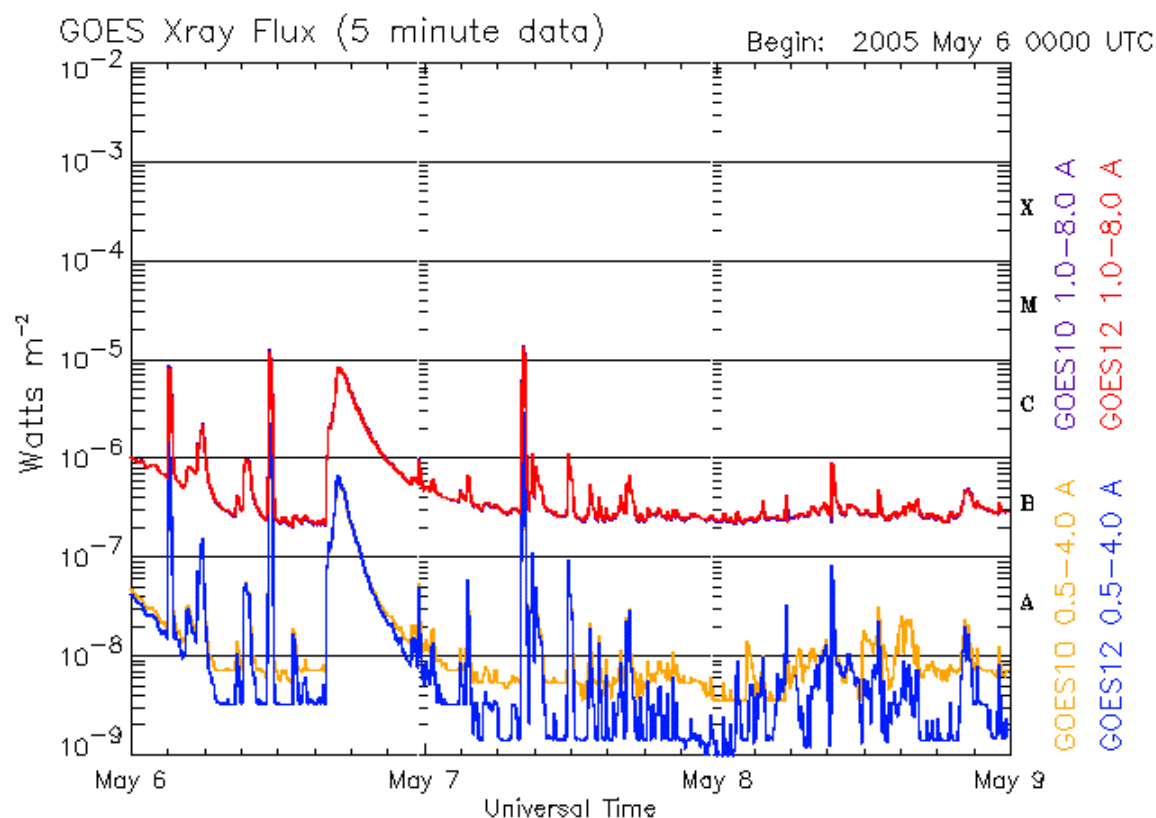
NOAA/SEC Boulder, CO USA





Updated 2005 May 8 23:56:13 UTC

NOAA/SEC Boulder, CO USA



Updated 2005 May 8 23:56:05 UTC

NOAA/SEC Boulder, CO USA