

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 093
Week 28
05.07.04
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 26.06.04 until 02.07.04 (both dates inclusive) and covers the revolutions 208, 209 & 210.

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 Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0); the galactic plane and Cygnus X (RA 20:33:10.00; DEC +41:12:00.0). The activities consisted of raster dithering and GPS observations. SPI cooling phases, activation and check-out following the annealing were completed. In addition an FSS/STR Misalignment Calibration was performed.

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.

The eclipse passages were completely nominal from an AOCS point of view, with the last eclipse of this season occurring on 26/06/2004. After the end of the season, the AMD thresholds were set to their non-eclipse season values and the ACC/FDE/FCE Eclipse Timers were stopped.

After each of the three slews to the attitude with RA: 01:58:05 and DEC: -00:50:10, the Flight Dynamics System could not reconstruct the reached attitude because from the mapping data it could not match enough stars with the catalogue extract. The FDS needs to match at least three stars for a valid attitude determination. Each time the FDS was therefore not able to update the parameters of the next slew in the Timeline. Because of this problem two slews were missed from the Timeline, which had to be done manually. Another slew was executed with the default parameters.

The pointings required for the FSS/STR Misalignment Calibration were planned in a dedicated engineering window in the Timeline of revolution 209. At the request of FCT, 4 additional pointings were also included in this window for the calibration of

the SAS Alpha and Beta Scale Factors. The operation executed nominally from the Automatic Timeline.

A rescaling of the RCS-A Thruster Torque Reciprocals, PWM look-up table, AMD Thruster On Times and the TIM Thresholds was done by FD based on an estimated mean thrust level of 9.789 N. The thrust level was derived assuming a tank temperature of 25 °C and a fuel content of 169.758 kg in the middle of revolution 209. The results of this rescaling were uplinked on 01/07/2004.

An update of the complete IMU usage up to 28/06/2004 is provided in the Appendix.

The fuel consumption over the period between 25/06/2004 and 02/07/2004 was 0.173 kg. The remaining propellant is in the order of 169.714 Kg on the 2nd of July.

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.

During the reporting period Integral passed through eclipse 8 (the last eclipse) of the summer eclipse season:

A summary of the eclipses is provided in the following table:

Eclipse	Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Total Duration	Umbra duration
8	26/06/04	11:33:20	11:36:58	12:00:31	12:03:41	0:30:21	0:23:33

A summary of the batteries discharge and recharge capacities is provided in the following table:

Eclipse	DOD1 (Ah)	DOD2 (Ah)	EOC Time		Recharge Duration		Recharged Capacity	
			Batt 1	Batt 2	Batt 1	Batt 2	Batt 1 (Ah)	Batt 2 (Ah)
8	1.91	1.89	13:10:31	13:09:51	1:06:50	1:06:10	2.07	2.05

As this eclipse also took place entirely outside ground station coverage, no direct monitoring of batteries behaviour during eclipse was possible. However all indications from on-board stored data (ECD and OBM) are that the behaviour was nominal.

Following the end of the eclipse season, the EPS was reconfigured for Non-eclipse season:

FCP_EPS_1273 Select full Charge Rate (C/26), BCR1.
 FCP_EPS_1274 Select full Charge Rate (C/26), BCR2.
 FCP_EPS_1262 Battery EOC Timer – Enable EOC.

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.

Following the end of the eclipse season, the On-board Monitoring Table for Non-eclipse season was loaded:

FCP_DHS_1231 Load OBM Entries for Non-eclipse Season.

3.1.5 RFS

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

3.2 Payload

3.2.1 SPI

The overall status of the instrument is nominal.

During the reporting period the 4th annealing of the Germanium detectors terminated, the camera was successfully turned on and the cryo-cooler entered in the fine tuning operations phase.

More than 70 runs of ACS calibration cycles have been executed before the camera switch on, to allow the collection of good statistics. The camera was also subject of two special calibration tests:

Saturating event background characterization

ACS – Detector time tagged events calibration

The allocated telemetry bandwidth during the period was of 98 pkts/cycle; the used bandwidth was however only 10 pkts/cycle in average during the annealing operations and around 96 after camera activation.

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 reduced (at the beginning of revolution 210) from 134 to 129 TMSP / Cycle. To cope with the reduced TM allocation the on-board configuration was modified setting the Spectral Timing Histograms (58) Integration Time from the current value of 1.95msec to the new

value of 3.9msec. This change allows saving 10 TM packets/Cycle. Five of these packets were allocated to SPI.

With 134TMSP / Cycle assigned, the mean IBIS Bandwidth usage was 105.9 TMSP / Cycle (previous week was 106.45).

With 129TMSP / Cycle assigned, the mean IBIS Bandwidth usage was 98.4 TMSP / Cycle.

Reported problem during the uplink (by timeline) of the VETO S/W patch, during the last Eclipse of the season. The S/W generated several OEM flagging a problem in defining the lateral counter. The recovery procedure foresaw the re-uplink of the patch, and then continuing with the nominal re-configuration as per timeline.

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.

During science observations in revolution 208 both JEM-X1 and JEM-X2 were operated in Data Taking with a TM allocation of 9 packets/cycle each. During the other revolutions, JEM-X1 was operated in Data Taking mode during science observations, with a TM allocation of 8 packets/cycle and JEM-X2 was dormant with a TM allocation of 1 packet/cycle.

On 2004-06-27, spikes similar to those observed in revolution 170 were observed on the JEM-X2 SW and HW Trigger counters. However, these subsided after 2004-06-27T23:00Z and no action was taken.

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 125 OMC pointings executed nominally, 1 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 characterized 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 very good this week, well above the system performance requirements, only 1 pointing was lost.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period. There were a few minor problems that were easily resolved.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. There was a brief problem with the y-axis on DSS-16, but no slews were lost. The performance was well above the 95% requirement.

The testing of the IP migration regarding the link to Redu was continued. Since some problems were identified the transfer to the operational environment will be delayed.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF's: Received up to rev. 219

POS and POD generated: up to rev 219

TSF's: Received up to rev 212

No ToO request received. No re-planning performed this week. The data-base is updated with new telemetry allocation and associated IBIS configuration change.

2. Observation status

ECS's for rev's 168, 189, 197 and 200 received. Corresponding OCS sent. No extra time credited. This means all missing revolutions from the past have now been received.

3. ISOC science archive

No new data received this week. The web browser version 1.1 is now operationally in use within ISOC.

4. ISOC system

The ISOC system version 10.4 has been upgraded to 10.4.5. The main reason for this upgrade is inclusion of GCDE observations for the second cycle of AO 2 and some minor updates to Proposal Handling System (PHS) to make it fully compatible with the modifications already implemented in the Proposal Generation Tool (PGT) for the AO 3. The ISOC system is then ready to support the AO 3 activity starting mid September. However one cosmetic change to PGT requested very late will still be implemented shortly.

5. Problems

No new problem.

4.3.2 ISDC

Status of ISDC observation processing on 05/07/2004:

- Latest Standard Analysis completed: observation 01201570003 (Cygnus X, Revolution 190-191) on 12/06/2004
- Latest products archived: 01201570003 (Cygnus X, Revolution 190-191) on 14/06/2004
- Latest observation products sent to the observer: observation 01201570003 (Cygnus X, Revolution 190-191) on 17/06/2004

5 Special Events

SPI Annealing – see 8.3.2

Some tests regarding the IP migration were performed.

6 Anomalies

There were a number of problems related to the ground segment that impacted the operations:

- On DoY 179 at 07:20 the FDS failed to update the Slew 0208077, which was eventually executed using default values, there was no impact.
- Later, at 12:50, there were event log warnings, indicating the opening of the archive had failed. These messages stopped after 2 minutes, and no action was taken.
- On DoY 180, at 03:37, the FDS again failed to update a slew, due to insufficient stars in the field of view. The slew to pointing 02080037 was eventually executed late.
- Later, at 12:25, there were errors for about 10 seconds sending data to the ISDS, the cause remains unknown, there was no impact.
- On DoY 182, at 12:30, CCC reported disk problems on idda, S/W were informed.
- On DoY 183, at 02:21, the FD update of slew failed, due to insufficient stars in the Field of View, the AOCs commanding was disabled while the recovery continued, and was re-enabled at 03:19 in time for the next manoeuvre, there was no impact.
- On DoY 183, at 07:45, TM from DSS-16 was lost due to the y-axis stopping on the antenna. TM & TC returned at 07:50, without impact. The DR# is G104577.
- On DoY 184, at 04:50, sun121 was yellow, with 34% cpu, the number of displays was reduced, at the status returned to green.

- Later, at 22:53, there was an error sending data to the isds. At 22:59, the data was flowing again without impact.

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

AR id	Date Occurrence	Subject	Segment	Status
INT-2611	02/07/2004	REDU "OPS STATE UNKOWN"	ESA Station	Pending
INT-2612	02/07/2004	JPL Y-Axis on antenna stopped	NASA Station	Pending

7 Future Milestones

Further tests regarding the IP migration are foreseen.

The acceptance testing of the new release of the Mission Control System will start end of July.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 208

In revolution 208 a raster dithering observation of Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0) was performed throughout the available observation time (~61.5 hours).

Throughout this observation all instruments were in their nominal science modes, except SPI that was undergoing passive cooling following the annealing. The TM allocation during this observation was IBIS 134; SPI 89; JEM-X1 9; JEM-X2 9; OMC 5.

Revolution 209

The observations in revolution 209 began with 13 pointings of a GPS lasting ~9.5 hours. This was followed by the FSS/STR Misalignment Calibration lasting ~14 hours (from 2004-06-30T02:57:50Z to 2004-06-30T16:57:50Z). One GPS pointing was then performed, lasting ~40 mins, and this was followed by a raster dithering observation of Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0), which was performed for the remaining ~35.5 hours of observation time.

During these observations IBIS, JEM-X1 and OMC were in their nominal science modes and JEM-X2 was in Safe mode. SPI was undergoing activation and test activities in parallel to the cooling phases following annealing. The TM allocation throughout these observations was IBIS 134; SPI 98; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 210

The observations in revolution 210 consisted of 12 pointing of a GPS lasting ~8 hours, followed by a raster dithering observation of Cygnus X (RA 20:33:10.00; DEC +41:12:00.0) lasting ~26 hours and then a raster dithering observation of Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0), which was performed for the remaining ~22 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2 which was in Safe mode, 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

2004-06-13T02:44:21.000Z	170.0911	F	Automatic TM processing.
2004-06-14T10:24:24.000Z	170.0471	F	Automatic TM processing.
2004-06-14T17:06:01.000Z	170.0434	F	Automatic TM processing.
2004-06-16T02:42:05.000Z	170.0215	F	Automatic TM processing.
2004-06-17T16:49:29.000Z	170.0093	F	Automatic TM processing.
2004-06-20T16:33:53.000Z	169.9927	F	Automatic TM processing.
2004-06-23T16:18:32.000Z	169.9595	F	Automatic TM processing.
2004-06-24T21:32:59.000Z	169.8868	F	Automatic TM processing.
2004-06-26T10:01:58.000Z	169.8671	F	Automatic TM processing.
2004-06-26T15:47:11.000Z	169.8559	F	Automatic TM processing.
2004-06-28T02:11:06.000Z	169.8362	F	Automatic TM processing.
2004-06-29T09:49:18.000Z	169.7957	F	Automatic TM processing.
2004-06-29T15:09:18.000Z	169.7787	F	Automatic TM processing.
2004-06-29T17:59:18.000Z	169.7558	F	Automatic TM processing.
2004-06-30T17:48:25.000Z	169.7141	F	Automatic TM processing.

This report was generated Fri Jul 2 08:00:15 GMT 2004

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 26/06/2004-02/07/2004

AOCS operations were executed from the Automatic Timeline.

During this period, 73 Open Loop Slews, 87 Closed Loop Slews and 10 Momentum Bias were executed. Two slews were missed or executed manually. This is equivalent to a 1.2% loss.

The AOCS eclipse operations were completely nominal. For each revolution, the Eclipse Timers and the Time-Tagged sequence to re-enable the IMU Auto Switch-Off function of the ACC were loaded from the Timeline and the pre-eclipse IMU health checks were performed at the planned times. Some information regarding the eclipse times and IMU usage up to the end of the eclipse season are provided here:

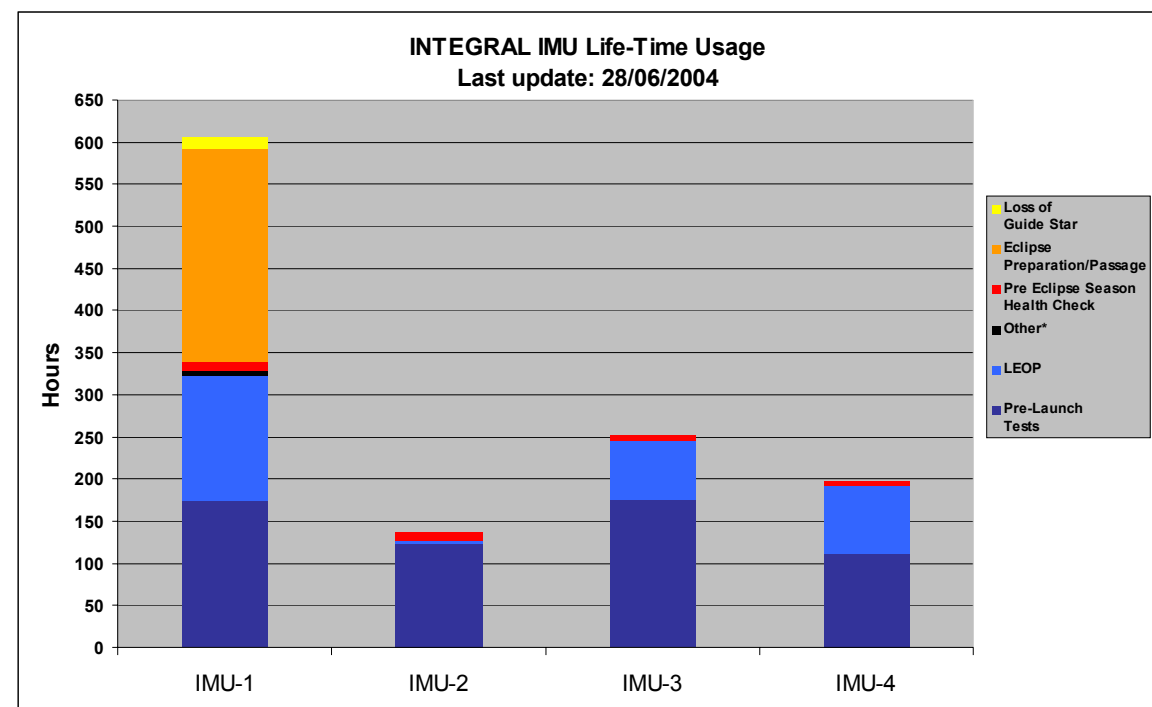
AOCS Eclipse Times														Summer 2004	
Date	LOS	AOS	ACC Eclipse Imminent	Eclipse Start						Eclipse End				Eclipse Duration	
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE		ACC
2004-06-05	12:18:43	16:31:03	11:39:19	12:21:18	12:32:08	12:32:52	12:38:59	12:42:36	12:43:26	13:13:44	13:14:33	13:17:34	13:23:40	13:27:13	0:38:35
2004-06-08	12:06:19	16:21:15	11:18:06	12:00:14	12:10:32	12:11:16	12:17:46	12:20:01	12:20:23	13:15:23	13:15:47	13:17:24	13:22:36	13:27:14	0:59:38
2004-06-11	11:53:50	16:03:15	11:04:18	11:46:18	11:56:00	11:56:44	12:03:58	12:05:53	12:06:09	13:10:29	13:10:50	13:12:08	13:16:52	13:21:50	1:08:10
2004-06-14	11:39:27	15:51:03	10:53:03	11:35:14	11:44:49	11:45:33	11:52:43	11:54:40	11:54:44	13:01:16	13:01:46	13:02:45	13:07:53	13:12:40	1:10:02
2004-06-17	11:26:28	15:35:29	10:43:31	11:25:36	11:35:00	11:35:44	11:43:11	11:45:19	11:45:12	12:49:00	12:49:47	12:50:29	12:55:08	13:00:16	1:07:18
2004-06-20	11:13:02	15:20:06	10:36:11	11:18:09	11:29:40	11:30:24	11:35:51	11:38:14	11:37:54	12:34:53	12:35:51	12:36:26	12:43:12	12:46:05	1:00:35
2004-06-23	10:59:55	15:03:44	10:31:45	11:13:49	11:23:30	11:24:14	11:31:25	11:34:31	11:33:45	12:19:03	12:20:39	12:20:53	12:26:02	12:30:39	0:49:28
2004-06-26	10:46:44	14:47:46	10:33:48	11:15:55	11:26:12	11:26:56	11:33:28	11:36:16	11:37:06	12:00:37	12:01:17	12:03:47	12:08:56	12:13:36	0:30:19

IMU Usage during Eclipse Season						Summer 2004	
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time	
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]			
2004-06-05 07:54:32	2004-06-05 13:29:34	0.1920	0.2305	0.2725	5:35:02	5:35:02	
2004-06-08 08:16:42	2004-06-08 13:29:24	0.1928	0.0839	0.1378	5:12:42	10:47:44	
2004-06-11 08:28:19	2004-06-11 13:24:08	0.1989	0.2500	0.2155	4:55:49	15:43:33	
2004-06-14 08:40:08	2004-06-14 13:14:45	0.2243	0.2163	0.1670	4:34:37	20:18:10	
2004-06-17 08:13:32	2004-06-17 13:02:29	0.2391	0.2825	0.2420	4:48:57	25:07:07	
2004-06-20 07:59:30	2004-06-20 12:48:26	0.1993	0.1010	0.1053	4:48:56	29:56:03	
2004-06-23 07:43:01	2004-06-23 12:32:52	0.1837	0.1234	0.1765	4:49:51	34:45:54	
2004-06-26 07:45:00	2004-06-26 12:15:47	0.1865	0.2437	0.2167	4:30:47	39:16:41	

An update (on a best effort basis) of the complete IMU usage up to 28/06/2004 is also provided in the following table and plot:

INTEGRAL IMU Life-Time Usage									
Unit	Total [hours]	% Usage WRT 1800 hr Reserved Flight Time	Pre-Launch Tests	LEOP	Loss of Guide Star	Eclipse Preparation/Passage	Pre Eclipse Season Health Check	Other*	Last Switch-Off
IMU-1	606.478889	33.69	175.045556	147.371944	14.843889	251.634444	11.785833	5.797222	26/06/2004
IMU-2	136.635833	7.59	123.023889	3.871111	0.000000	0.000000	9.740833	0.000000	01/06/2004
IMU-3	251.777778	13.99	175.449167	70.057500	0.000000	0.000000	6.271111	0.000000	01/06/2004
IMU-4	197.518611	10.97	111.528889	80.834167	0.000000	0.000000	5.155556	0.000000	01/06/2004

* Other consists of operations like STR bright object test, STR window dump, etc.



* Other consists of operations like the STR Bright Object Test, STR Window Dump, etc.

26/06/04 (Day of Year 178, Revolution 207-208)

Nothing to report.

27/06/04 (Day of Year 179, Revolution 208)

Open Loop Slew 02080017 executed with the Timeline default values: After slewing to the attitude of PID 02080016 with RA: 01:58:05.56 and DEC: -00:50:13.9, the Flight Dynamics System failed to reconstruct the reached attitude, because from the STR mapping data not enough stars could be matched with the star-catalogue extract. The FDS was therefore not able to update the parameters of the next slew in the Timeline. A mapping was commanded and a second attempt was made to manually update the slew parameters using the Timeline Recovery Tool. This time as well the FDS could not determine the attitude because only two stars could be matched. The FDS needs to match at least three stars for a valid attitude determination. The end effect was that the parameters of Open Loop Slew 02080017 could not be updated in the Timeline. Since the previous slew was a Close Loop Slew, which had been correctly executed, it was decided to let slew 02080017 execute with the Timeline-default values. This had no impact on the observations.

It should be noted that the same problem occurred at PID 02070072 with the same attitude. There are currently no means implemented in the system to verify at mission planning level the availability of a minimum number of valid stars in each pointing.

28/06/04 (Day of Year 180, Revolution 208)

Execution of Close Loop Slew 02080037 failed from the Timeline: After slewing to the attitude of PID 02080036 with RA: 01:58:05.45 and DEC: -00:50:11.4, the Flight Dynamics System failed to reconstruct the reached attitude, because from the STR mapping data not enough stars could be matched with the star-catalogue extract. The FDS was therefore not able to update the parameters of the next slew in the Timeline - Close Loop Slew 02080037. Because the Timeline-default star was the same Guide Star that the STR was tracking, the execution of the Close Loop Slew failed. The SPACONs tried to generate a manual slew to the next attitude in the timeline by commanding mappings and then using the Timeline recovery tool to generate the slew. After several attempts, the FDS could finally match 3 stars from the STR mapping data, determine the attitude and generate the manual slew to the attitude of PID 02080037. This pointing was affected.

Reconfiguration of the AOCS after the eclipse season: With the ending of the eclipse season, the AMD thresholds were set back to their non-eclipse season values. The manual operation started at 07:37 and the following AMD thresholds were loaded:

Thresholds from INT-MA-AI-0001, 5.3.2.4.2.2, and INT-PR-MMB-0005 page 5-9, modified as per new AMD Threshold agreement for the eclipse season.									
01- Update of thresholds after uplink of new RW Inertias on 22/01/2004. 0155_0001_M.RWI									
Wheel Inertia:									
RW#1:	0.096000	Kgm**2							
RW#2:	0.097650	Kgm**2							
RW#3:	0.097272	Kgm**2							
RW#4:	0.097649	Kgm**2							
Sunlight Season:									
	Subset 1		Subset 2						
WSMAX	39		35.9						
WSMIN	2.2		4.8						
WSMAX	To Uplink:					In rpm:			
	X1		X2			X1	X2		
RW#1:	406.250000	rd/s	373.958333	rd/s		3879	3571		
RW#2:	399.387606	rd/s	367.641411	rd/s		3814	3511		
RW#3:	400.938401	rd/s	369.068939	rd/s		3829	3524		
RW#4:	399.388015	rd/s	367.641788	rd/s		3814	3511		
WSMIN	To Uplink:					In rpm:			
	X1		X2			X1	X2		
RW#1:	22.916667	rd/s	50.000000	rd/s		219	477		
RW#2:	22.529557	rd/s	49.155398	rd/s		215	469		
RW#3:	22.617038	rd/s	49.346265	rd/s		216	471		
RW#4:	22.529580	rd/s	49.155448	rd/s		215	469		

The ACC, FDE and FCE Eclipse Timers were also stopped. This consists of:

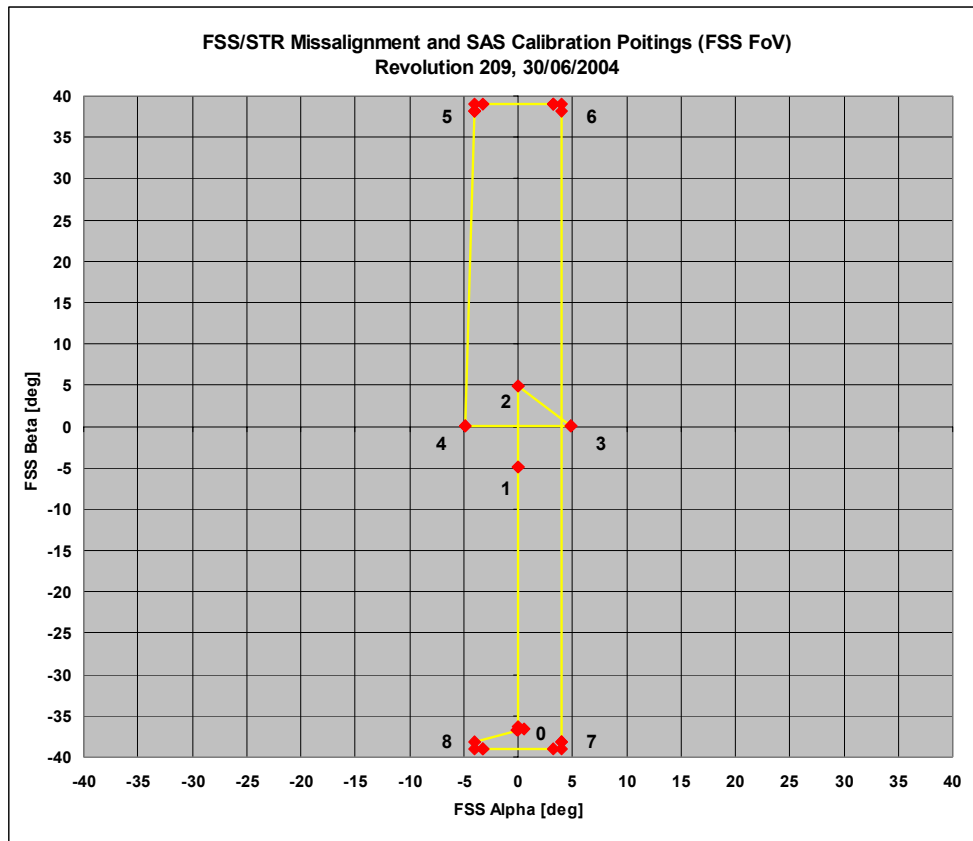
- Freezing the FDE Eclipse Timer in the sunlight state (by loading zero and starting the Timer).
- Freezing the FCE Eclipse Timer in the sunlight state (by loading zero and starting the Timer).
- Stopping the ACC Eclipse Timer task.

29/06/04 (Day of Year 181, Revolution 208-209)

Nothing to report.

30/06/04 (Day of Year 182, Revolution 209)

FSS-STR misalignment calibration: The pointings/operations required for the FSS-STR misalignment calibration were executed from the Timeline in a dedicated engineering window from 02:57:50 to 16:57:50. At the request of the FCT, four additional pointings were inserted at the beginning of the sequence of slews, to be used for the calibration of the SAS Alpha and Beta Scale Factors and update of the SAS thresholds. These included four pointings with (Alpha, Beta) equal to (0, -4.9), (0, 4.9), (4.9, 0) and (-4.9, 0) degrees.



01/07/04 (Day of Year 183, Revolution 209)

Automatic update of Close Loop Slew 02090027 failed: After slewing to the attitude of PID 02090026 with RA: 01:58:05.26 and DEC: -00:50:06.5, the Flight Dynamics System failed to reconstruct the reached attitude, because from the STR mapping data not enough stars could be matched with the star-catalogue extract. The FDS was therefore not able to update the parameters of the next slew in the Timeline - Close Loop Slew 02090027. As this had happened in previous visits to this attitude, the problem was anticipated and FD had prepared a manual Open Loop Slew to be used instead of slew 02090027. The manual slew was commanded at 03:11 after disabling the AOCS commanding from the Timeline. The slew started at 03:14:35 and ended at 03:16:30. The Timeline-planned end time of the original slew was 03:17:26.

Update of TIM Thresholds, RCS-A Thruster Torque Reciprocals and AMD On Times: A rescaling of the RCS-A Thruster Torque Reciprocals, PWM look-up table, AMD Thruster On Times and TIM Thresholds was done by FD based on an estimated mean thrust level of 9.789 N. The thrust level was derived assuming a tank temperature of 25 °C and a fuel content of 169.758 kg in the middle of revolution 209.

- Update of the RTIM, PTIM, YTIM and TTIM thresholds, completed at 06:34
- Update of the RCS-A Thruster Torque Reciprocals along with the ESAM PWM look-up table (the PWM value is not changed), completed at 07:17
- Update of the AMD On Times of RCS-A, completed at 08:19

It has been agreed to perform the Thruster Torque Calibration once every year rather than every six months and instead do a re-scaling of the parameters six months after the last thruster calibration. The re-scaling is based on the estimated thrust level.

02/07/04 (Day of Year 184, Revolution 209-210)

Flickering of the Pointing Bit due to Yaw Error: At 21:18:42, an undetected False Event on the STR caused a jump of [121, -154] CCD units in the position of the Guide Star. The error in yaw was more than the OTF threshold for this axis and caused the flickering of the Pointing Bit, which was not seen at BCP level. The 8.10 Mi Guide Star was located at [4369, -785] and the S/C was at an altitude of about 76000 km.

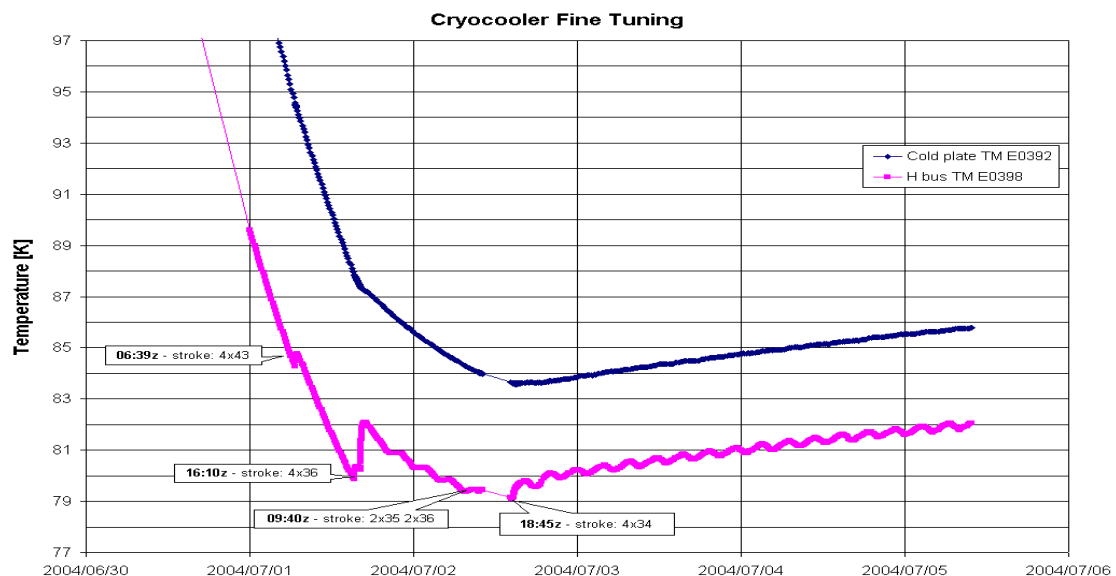
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:

The performance of the cryo-cooler is nominal.

The cooling phase terminated as planned and the fine-tuning operations started, maintaining the temperature at 85K +/-1K.

The following plot shows the detectors cold-plate and H bus temperatures at the transition to the fine-tuning phase.



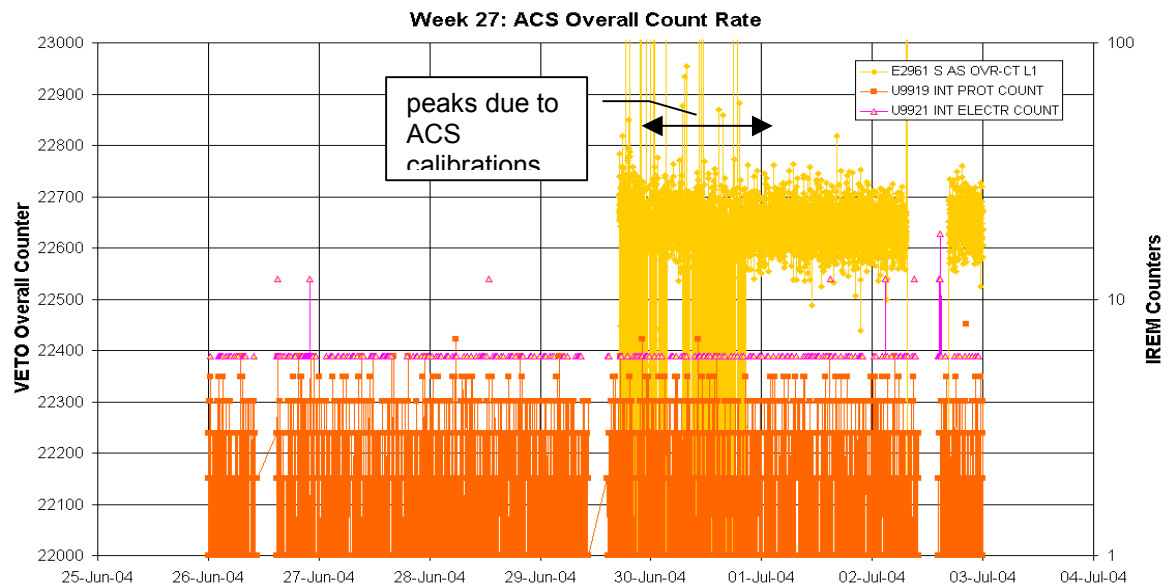
IASW/DPE:

The performance of the IASW/DPE is nominal.

ACS:

The performance of the ACS is nominal. The ACS PMT HV power supplies were kept switched off for the annealing operations. They were turned on again on the 29th June, at belts exit of rev.209 and a series of ACS calibration runs (>70) were executed. The calibration data have still to be processed.

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



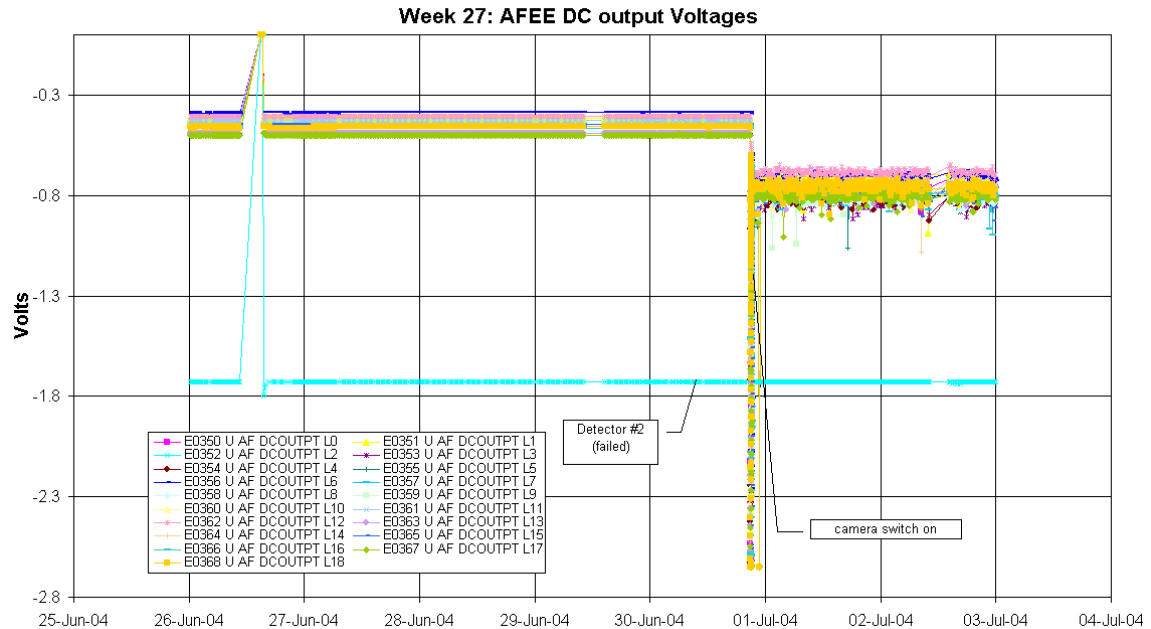
AFEE:

The performance of the unit is nominal.

The HV power supply of the Ge detectors was kept off due to the annealing operations.

They were successfully turned on again at around 22:00z on 30th July.

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



DFEE:

The performance of the unit is nominal.

Two special calibrations were performed after the camera switch on, involving the DFEE and ACS:

Saturating event background characterization

ACS – Detector time tagged events calibration

The analysis of the collected data is not yet available; however, preliminary evaluations show that:

More than 99% of the detector saturating events, detected by the AFEE and counted by the DFEE, are all vetoed by the ACS. Only a small fraction is outside the veto window.

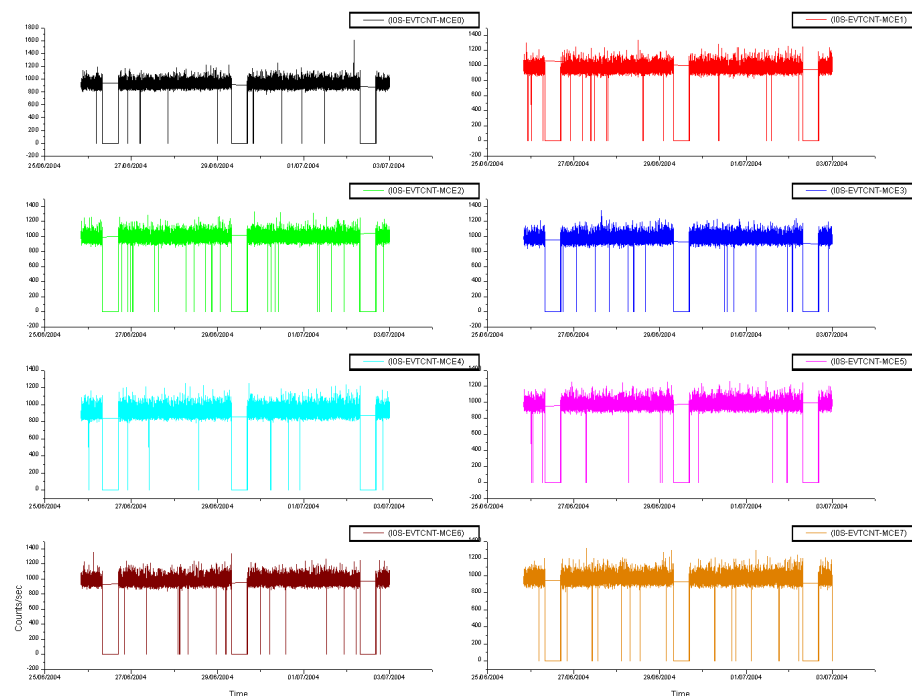
The alignment between the ACS veto signal and the DFEE events timing, tuned for the last time during the commissioning phase, was verified and still valid.

8.3.3 IBIS Operations

IBIS Event Counters Plots.

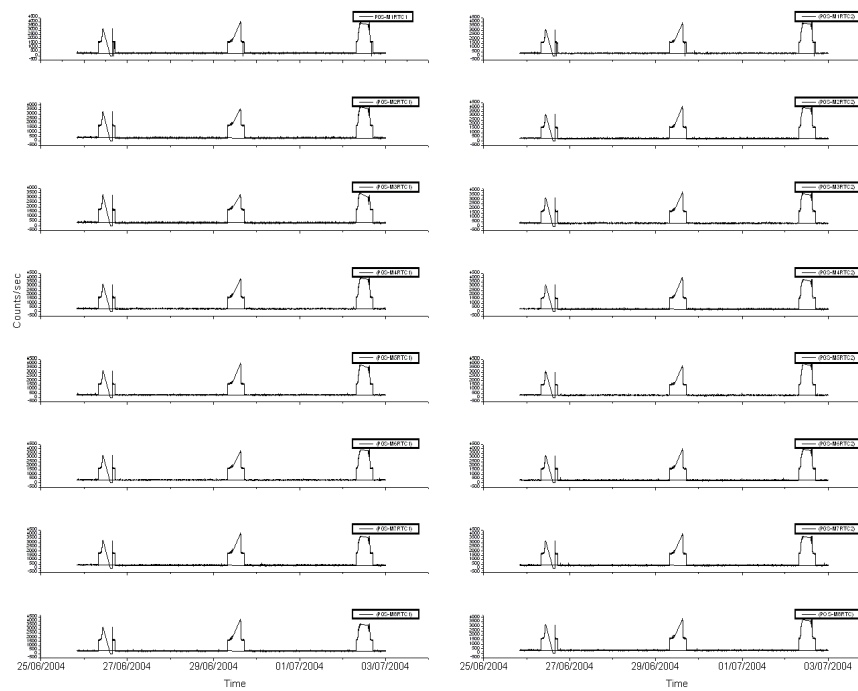
ISGRI Counters:

IBIS - ISGRI Counters Rev 207-209

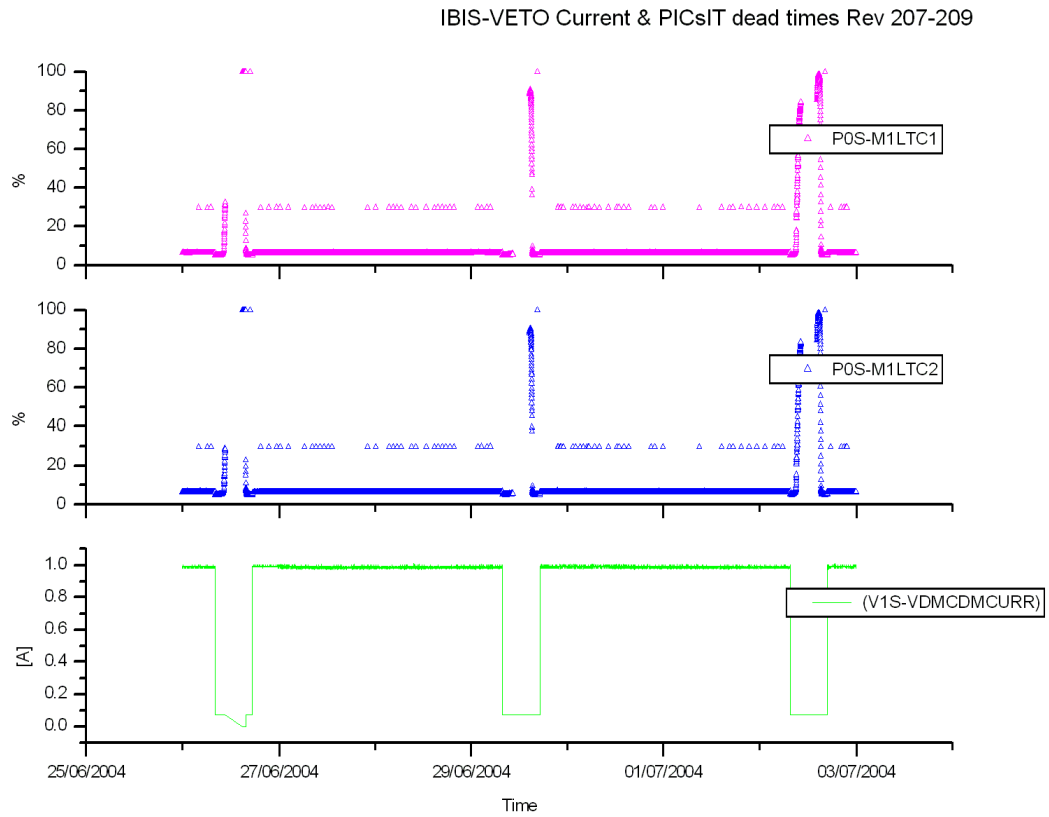


Picsit Counters:

IBIS - PICsIT Counters Rev 207-209



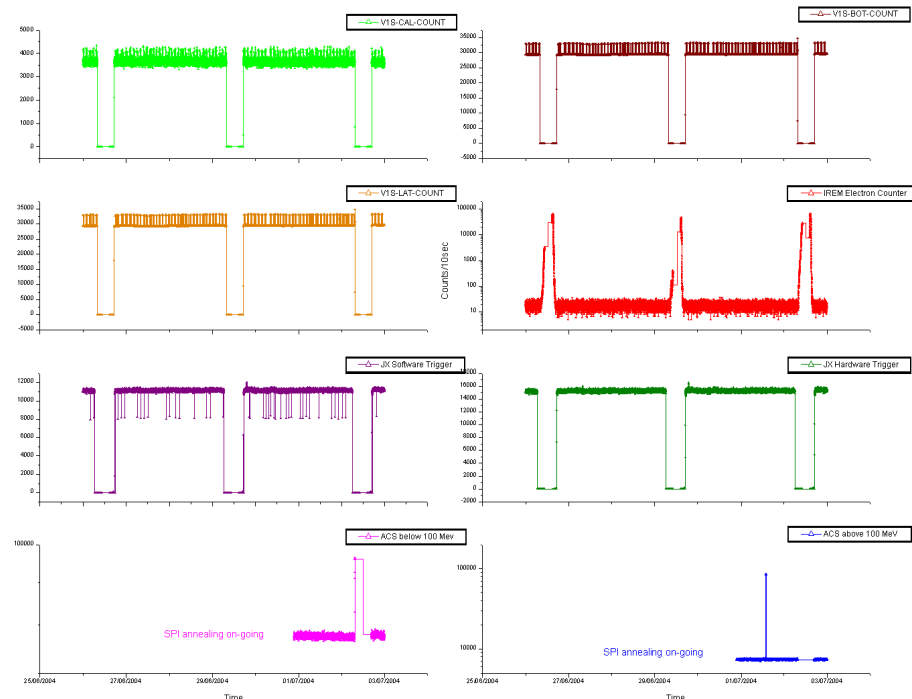
Veto Current:



VETO vs Payloads Counters

The comparison between the count-rates reported by VETO, the SPI-ACS and JEM-X hardware/software triggers, in general gives an indication of the stability of the background environment (protons and heavy ions): this is shown in the following plot, where all the on-board sources mentioned are considered.

IBIS-VETO vs Payloads Counters Rev 207-209



*with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec

IBIS daily report **DoY 2004.178 (26/06/04)**

At 00:45Z the SCC for TM parameter G2000 failed (Overflow of the noisy pixel address buffer in MCE0) after few TM cycles the parameter returned within limits and no further action was taken.

At 07:37Z the SCC for TM parameter G2084 failed (Overflow of the noisy pixel address buffer in MCE6) after few TM cycles the parameter returned within limits and no further action was taken.

At 16:04Z there were several instances of the OEM APID 1280 CLASS 0 ID 181 <<IBIS1 VETO LATERAL COUNTER IS NOT POSSIBLE TO BE DEFINED>>. This event issued by the VETO SW was not referring to a real contingency on the counters but it was generated in coincidence with a problem uplinking the VETO S/W patch (by using the nominal automatic sequence GEVESP01) after the Eclipse reconfiguration. From the comparison of the on-board/on-ground counters it could be determined that 22 TCs were uplinked and received on-board (CLCW and by the DPE). The first TC received by the DPE (patching the specific routine for the rescaling of the VETO counters) was not executed by the VETO S/W, as is evident from the following dump of the same memory area. This generated an anomalous reaction (OEM) when the second patch TC (pointer to the are above) was uplinked, as the S/W was trying to access to the patched area expecting a different content. During all these activities VETO was still inside the Radiation Belts with all the HVs switched OFF and no count-rates generated by any of the bottom/lateral/calibration

units. During the mentioned period no failure was reported by IMCS and no gap in the TC link.

The recovery applied foresaw the re-uplink of the VETO patch (GEVESP01): after the first 2 TCs of the patch-sequence the unit stopped generating the above OEM and at the end of the patch was possible to continue the nominal reconfiguration as per timeline. The unit was monitored until the switch ON of the High Voltages and the first transitions to Scientific Standard Mode and no further anomaly occurred.

DoY 2004.179 (27/06/04)

Nothing to report

DoY 2004.180 (28/06/04)

Nothing to report.

DoY 2004.181 (29/06/04)

Nothing to report.

DoY 2004.182 (30/06/04)

Nothing to report.

DoY 2004.183 (01/07/04)

Nothing to report.

DoY 2004.184 (02/07/04)

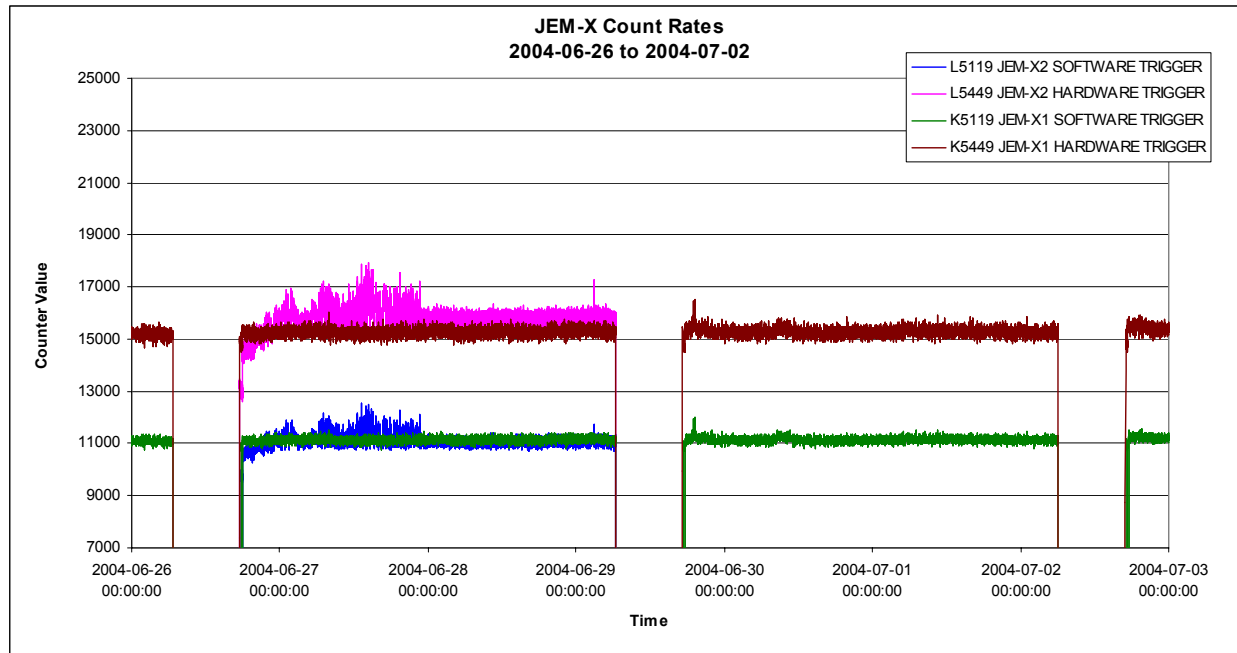
Nothing to report

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 graph¹.

¹ JEM-X1 Data sampled (1 frame in 4) and data for both units smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

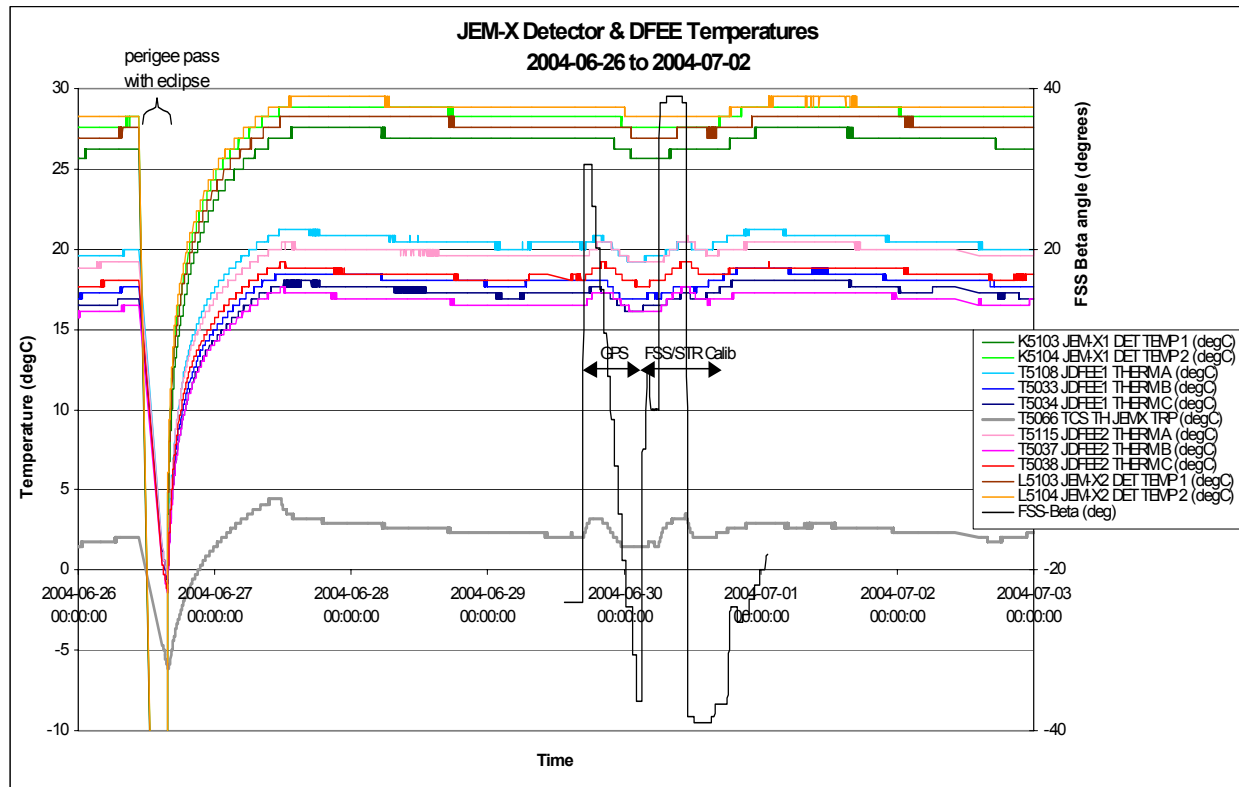


As is evident from this graph, spikes were observed in the JEM-X2 HW and SW Trigger counters on 2004-06-27, soon after JEM-X2 activation in revolution 208. These spikes are similar to those observed during the Crab calibration in revolution 170, just prior to the switch from JEM-X2 to JEM-X1 as the active unit. This spiking phenomenon in the JEM-X2 count rates stopped at about 2004-06-27T23:00Z.

8.3.4.2 JEM-X Temperatures

The JEM-X1 and JEM-X2 detector temperatures over the reporting period are displayed in the following graph, along with the temperatures at a selection of DFEE locations and on the detector bench between the two units².

² Data sampled (1 frame in 8)



The oscillations in the temperatures between ~2004-06-29T17:00Z and ~2004-06-30T18:00Z are evidently correlated to the variations in the FSS-Beta angle (spacecraft pitch angle) over this period. The extreme changes in FSS-Beta, as indicated on the plot above, were due to the execution of a GPS followed by the FSS/STR Misalignment Calibration.

8.3.4.3 JEM-X Daily Report

2004-06-26 (DOY 178, Rev 207-208)

Nothing to report. The post-eclipse activation of both JEM-X units at the start of revolution 208 was nominal.

2004-06-27 (DOY 179, Rev 208)

Spikes were observed in the JEM-X2 SW and HW Triggers (TM parameters L5119 and L5449 respectively), similar to those observed during revolution 170. This can be clearly seen in the plot of the JEM-X count rates in Section 8.3.4.1, where it is evident that the same phenomenon was not occurring on JEM-X1. This was reported by the PI as being due to a hot spot on an anode strip.

In addition, Out Of Limits were received on the TM parameter L5136 JEM-X2 BUFFER LOSS as follows:

L5136 OOL Time	OOL Value	Number of TM cycles OOL
13:58:14Z	203	1
13:59:18Z	336	3
14:00:22Z	228	2
14:02:38Z	349	1
14:22:30Z	110	2
14:53:42Z	118	2
14:54:54Z	180	1
14:57:42Z	101	2
15:09:34Z	304	1
15:10:30Z	140	1

2004-06-28 (DOY 180, Rev 208)

The JEM-X2 count rates were monitored in case that the frequency or magnitude of the spikes increased, however as the spikes had subsided after around 2004-06-27T23:00Z, no action was required. The JEM-X2 count rates appeared nominal for the remainder of the revolution.

2004-06-29 (DOY 181, Rev 208-209) to 2004-07-02 (DOY 184, Rev 209-210)

Nothing to report.

8.3.5 OMC Operations

On DoY 180, at 04:30:12, due to an AOCS problem with insufficient guide stars, pointing 02080037 was lost, it was at this time that the following pair of commands were rejected:

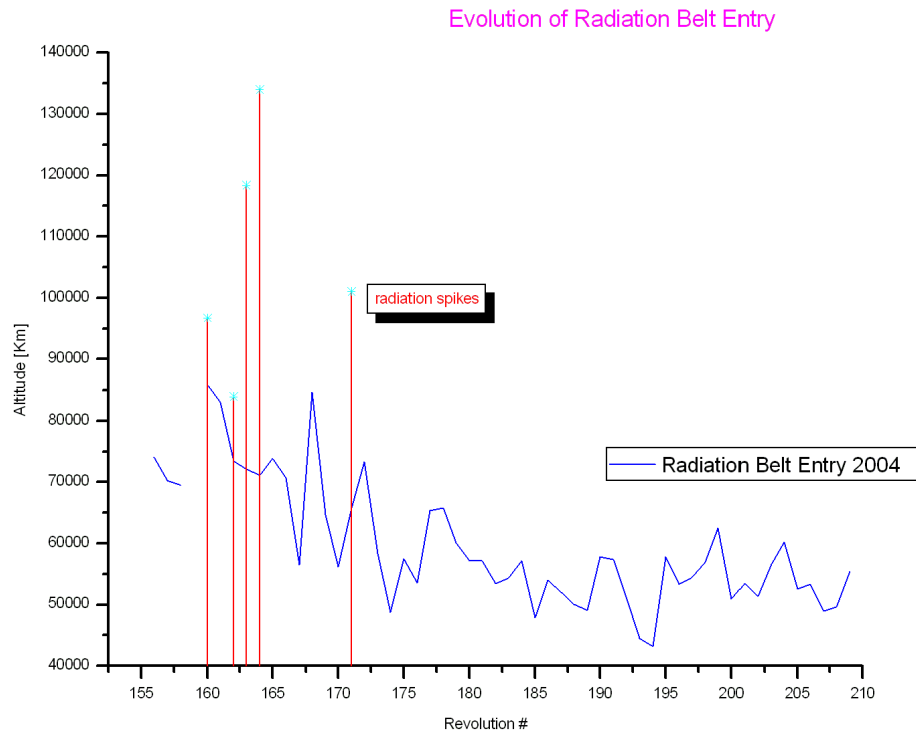
```
2004.180.04.30.20.083 2004.180.04.30.11.281 1792 Real Time Rejection 131
REJECTED TC1
      FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0 M9069=926
2004.180.04.30.12.579 2004.180.04.30.05.281 1792 Real Time Rejection 131
REJECTED TC1
      FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM M9068=1 FIX2=0
M9069=925
```

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 02080037.

On DoY 178 at 08:02:35, DoY 181 at 07:47:00, and DoY 184 at 07:30:57, OMC was switched by the Timeline to SAFE mode, at the nominal times.

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]
207	RAD_ENTR R 2004-06-26T08:02	26/06/2004 09:23	49023	26-Jun-2004 08:47	53803
208	RAD_EXIT R 2004-06-26T17:09	26/06/2004 16:14	>28029	26-Jun-2004 15:47	26904
208	RAD_ENTR R 2004-06-29T07:46	29/06/2004 09:05	49626	29-Jun-2004 08:31	53944
209	RAD_EXIT R 2004-06-29T16:54	29/06/2004 15:33	27078	29-Jun-2004 15:41	28296
209	RAD_ENTR R 2004-07-02T07:30	02/07/2004 08:02	55464	02-Jul-2004 08:11	54689
210	RAD_EXIT R 2004-07-02T16:38	02/07/2004 15:32	>24854	02-Jul-2004 15:21	27394

Reference

Small error vs reference

Large error vs reference

Radiation Spike

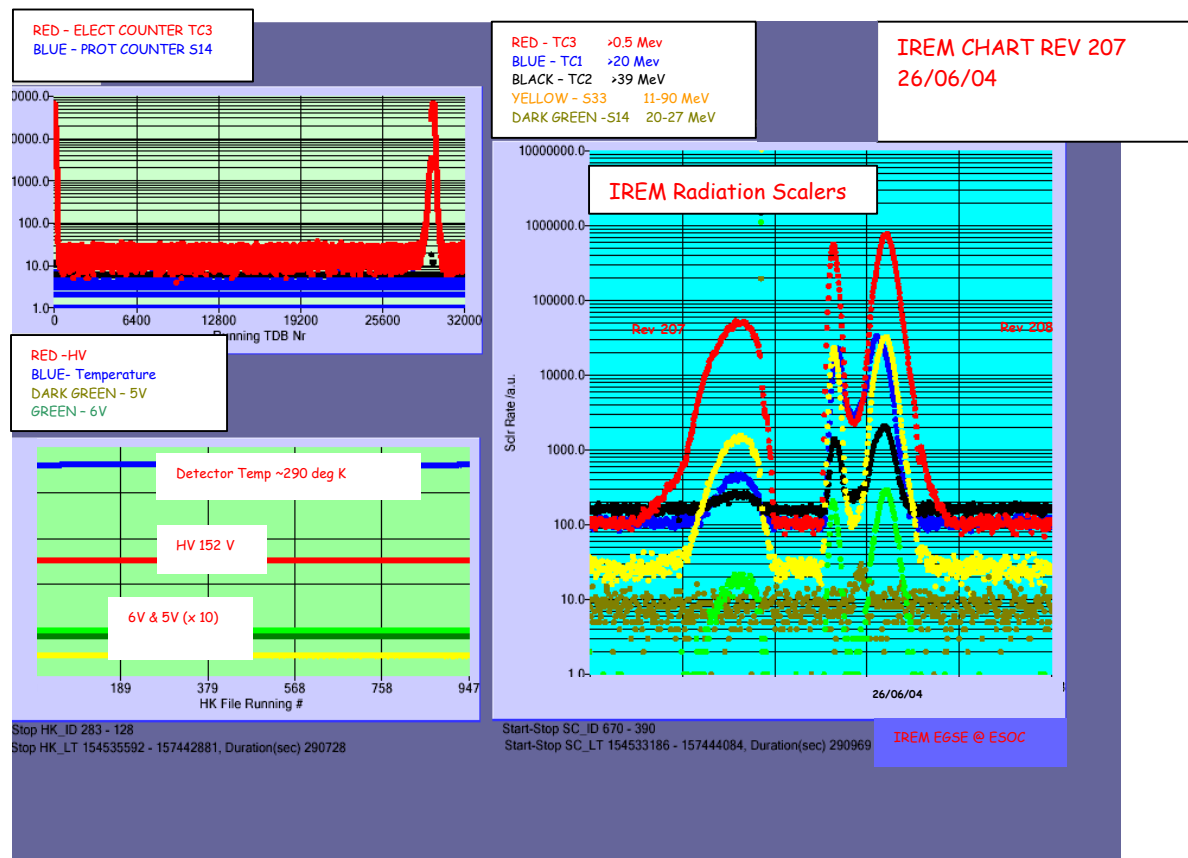
Proton Belts

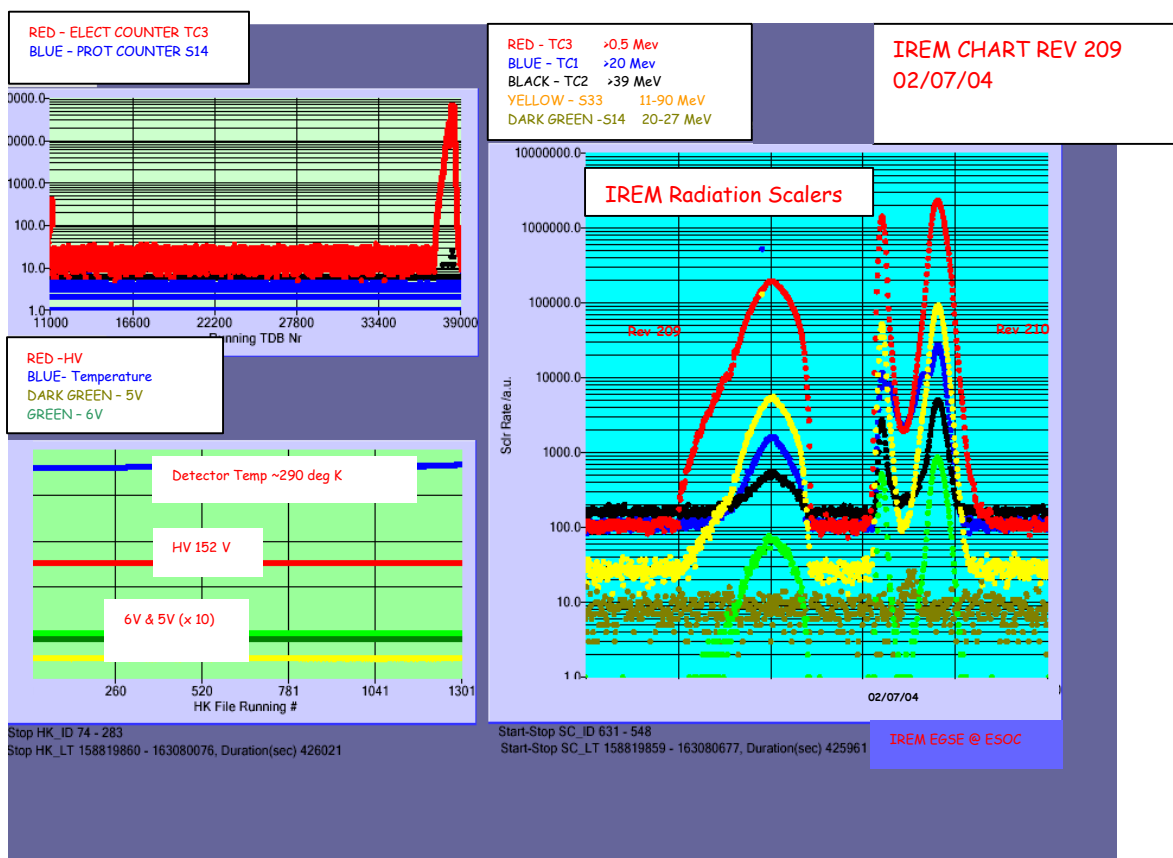
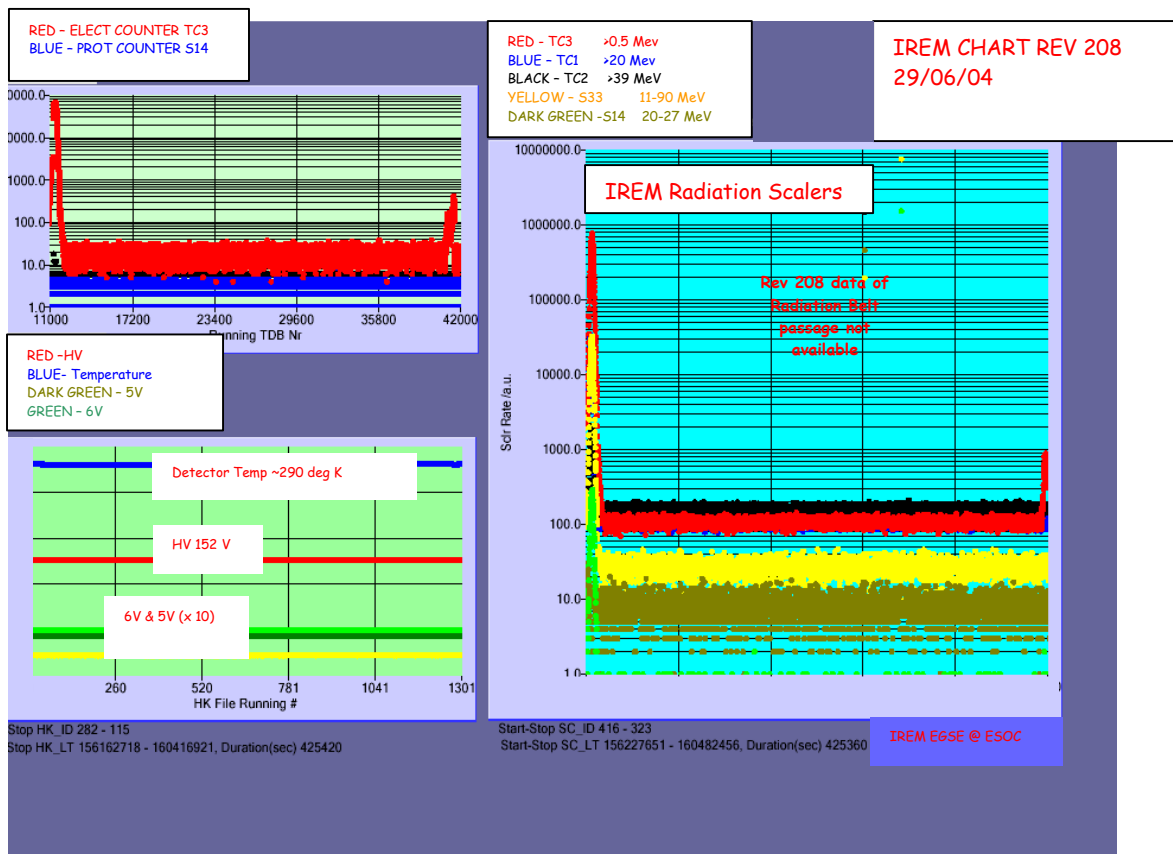
REV		Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
207	PROTON_RAD_ENTR	26-Jun-2004 14:17	13278
207	PROTON_RAD_EXIT	26-Jun-2004 14:37	15684
208	PROTON_RAD_ENTR	29-Jun-2004 14:01	13244
208	PROTON_RAD_EXIT	29-Jun-2004 14:21	15555
209	PROTON_RAD_ENTR	02-Jul-2004 13:51	13687
209	PROTON_RAD_EXIT	02-Jul-2004 14:01	14843

IREM daily report

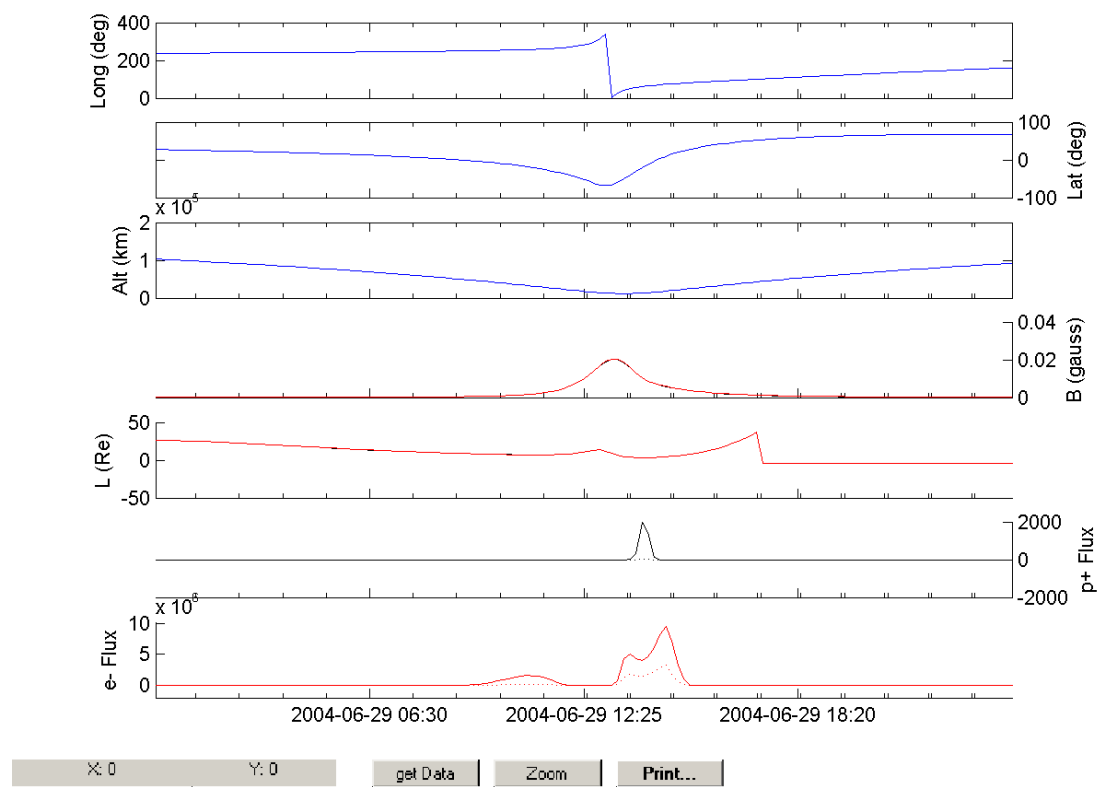
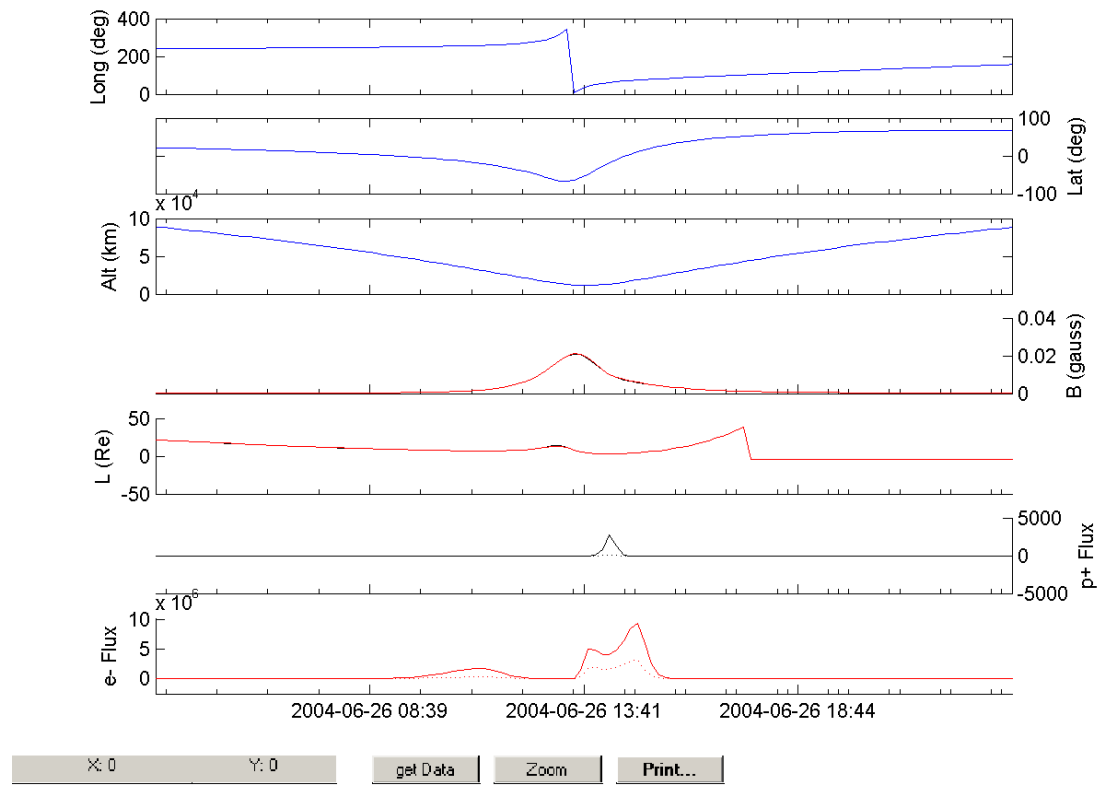
Nothing to report.

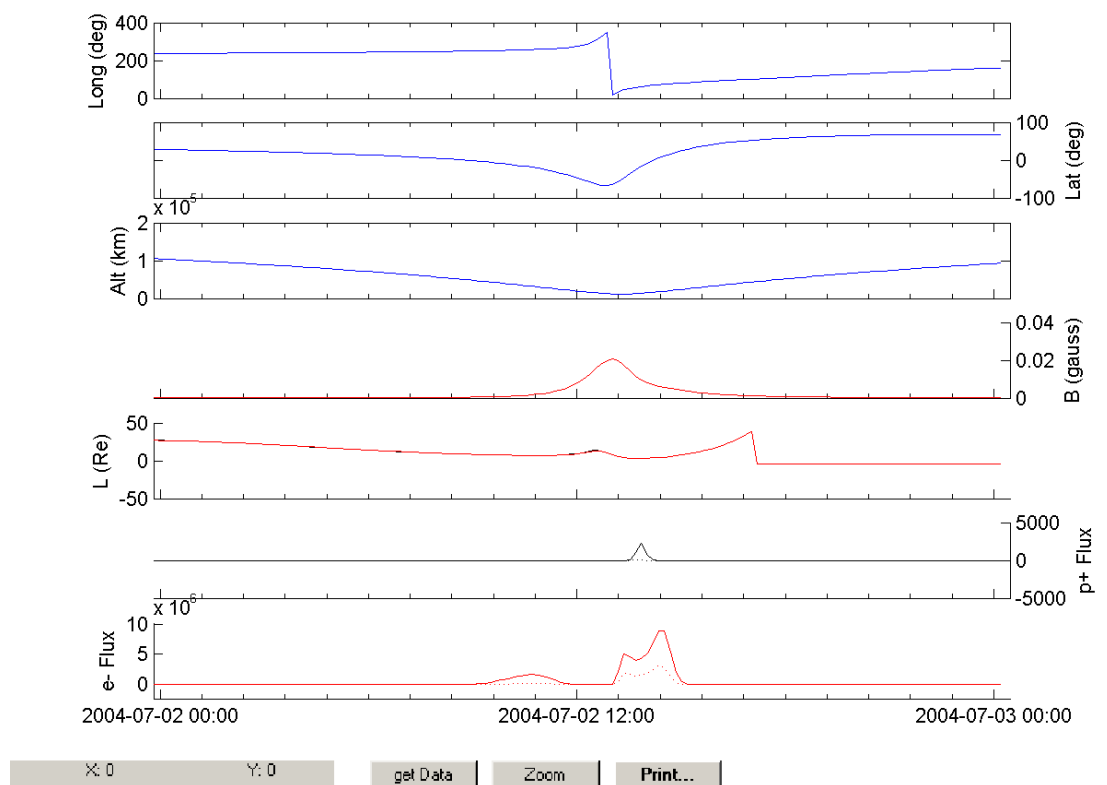
IREM radiation counters



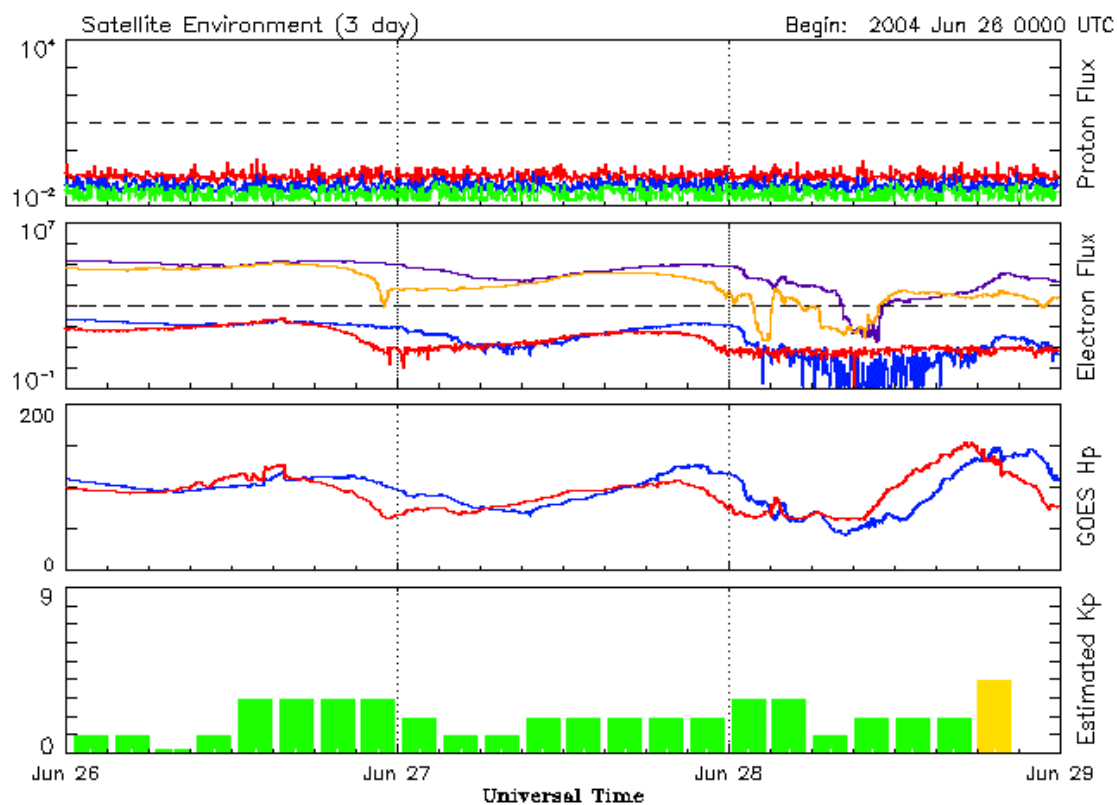


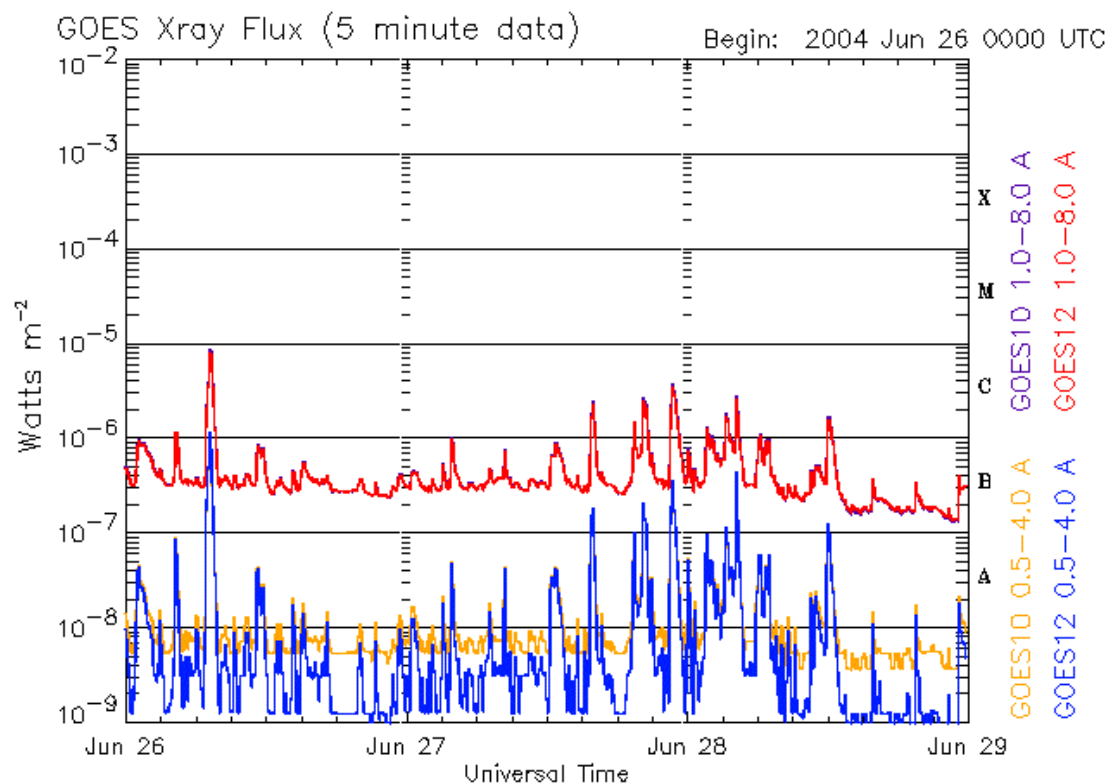
IREM Predicted Radiation Counters.





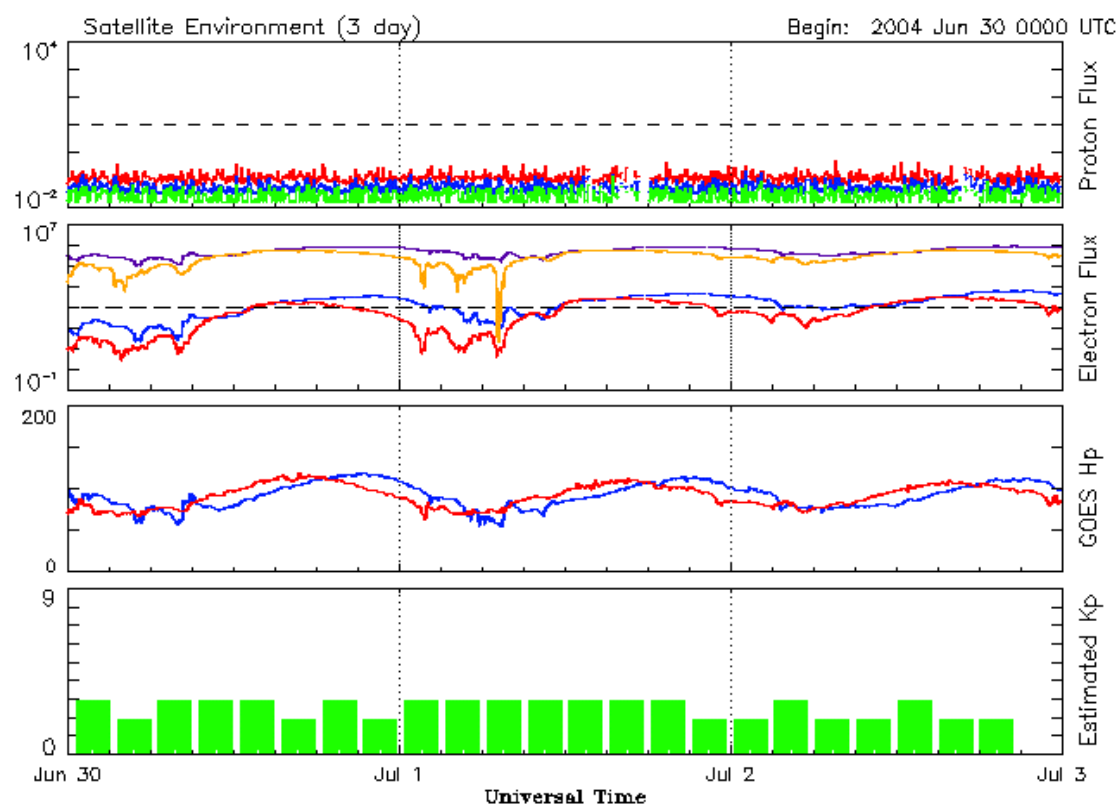
SEC-GOES Observed Particles Fluxes.





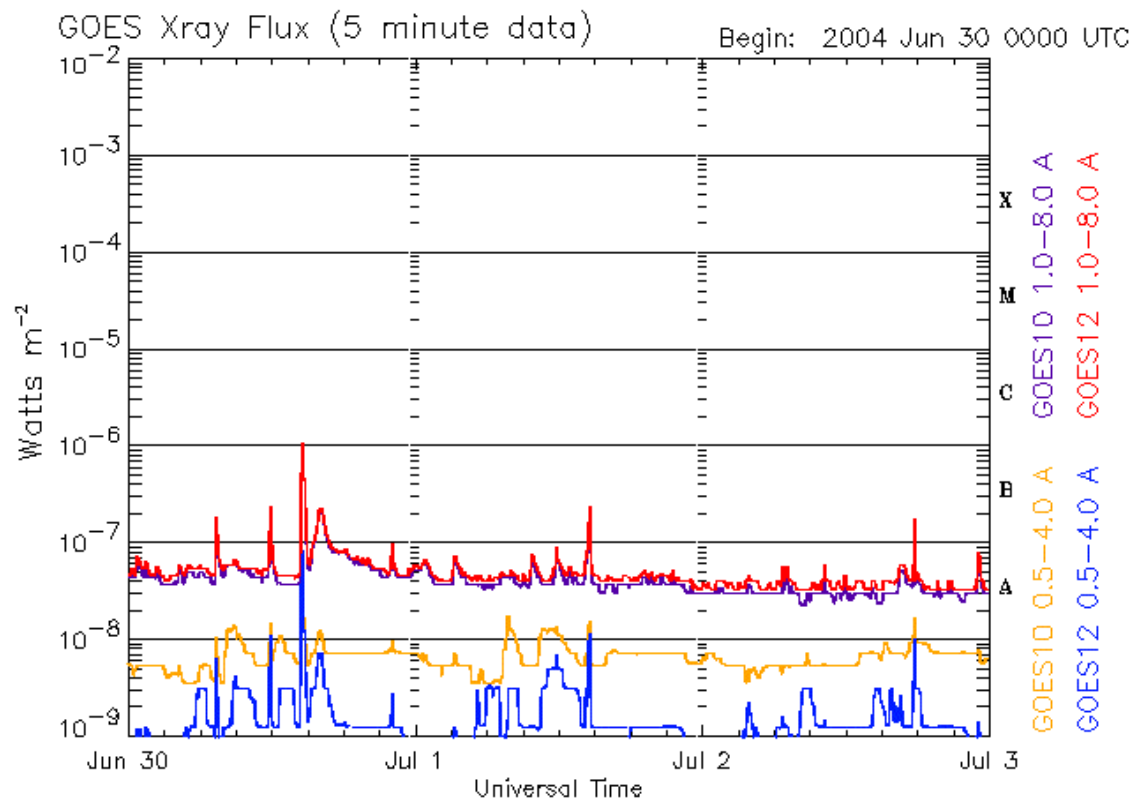
Updated 2004 Jun 28 23:56:04 UTC

NOAA/SEC Boulder, CO USA



Updated 2004 Jul 2 23:56:09 UTC

NOAA/SEC Boulder, CO USA



Updated 2004 Jul 2 23:56:03 UTC

NOAA/SEC Boulder, CO USA