

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-TOS-OF
No. 056
Week 42
20.10.03
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 11.10.03 until 17.10.03 (both dates inclusive) and covers the revolutions 122 & 123.

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 Center and IC443 (RA 06:17:39.50; DEC +22:23:41.0). The activities performed consisted of GCDE 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.

There was a Star Tracker 1750 Processor fault, which was caused by the presence of an extended celestial object (Diffuse Nebula M17) in the STR field-of-view, in the same search window that contained the Guide Star.

There were also three cases of flickering of the OTF flag after Open-Loop Slews. Two of them were caused by roll errors introduced by mappings that were performed right after the slew end and before the SSL was enabled. The third case was due to an inaccurate attitude determination, which was based on a mapping in a sparse field where the FDS could only select three stars for attitude reconstruction. None of these OTF flickers were seen at BCP level and therefore had no impact on the observations.

Four slews were missed or performed manually due to Ground Station problems, which interrupted the TM/TC links.

The fuel consumption over the period between 10/10/2003 and 17/10/2003 was 0.121Kg. The remaining propellant is in the order of 174.41 Kg on the 17th of October.

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

3.1.2 Power

The power subsystem is working as specified. The available power from the arrays is in the order of **2250W**. This means that there is no noticeable degradation of the solar arrays since launch.

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 identified.

3.1.5 RF

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 instrument was in photon-by-photon mode with spectra TM enabled and an assigned TM bandwidth in the science windows of 98 pkts/cycle.

The cryo-cooler is working well, keeping the Ge detector cold plate temperature within 85+/-1K.

The Project Scientist decided the date for the 3rd Ge detectors annealing cycle, to take place from rev.129 to 133 (starting on 3rd November).

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

3.2.2 IBIS

The Status of the unit is Nominal. The TM bandwidth assigned to IBIS is 134 pkts/8sec.

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.

During this period JEM-X2 operations were performed by the automatic Timeline, with a TM allocation of 8 packets/cycle during science operations, and JEM-X1 was dormant with a TM allocation of 1 packet/cycle.

3.2.4 OMC

The status of OMC is nominal.

During this period OMC operations were performed by the automatic Timeline, with the TM allocation to OMC of 5 packets/cycle during normal science operations. A total of 264 images were captured during this period. With 3 being missed due to ground stations problems.

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

3.2.5 IREM

The status of the unit is Nominal.

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

4 Ground Facilities

The main problems this week, as previous weeks, concern the consolidator, the link to the ISDC was quieter this week, with only four mentions.

4.1 Mission Operations Centre

On DoY 284, the manual stack on sun122 froze.

4.2 Ground Stations & Network

See above.

4.3 Science Ground Segment

4.3.1 ISOC

This report covers to end of week 42.

1. Planning.

Short term PSF: up to rev. 132 received from MOC

Long term PSF: up to rev. 146

POS and POD generated: up to rev 132 and sent to MOC and ISDC

TSF: up to rev 125 received from MOC

Revs 124 - 127 were replanned, at the request of MOC, following the redelivery of all PSF beyond from Rev 124 onwards. The reason for the redelivery being the discovery of an unusually large deviation in the times of the orbital events between when these PSFs and now. Revs 128 & beyond will be regenerated next week.

2. Observation status

ECS's for rev's 100, 101 and 108 received from ISDC. Corresponding OCS sent To ISDC. ECS's for Rev 106 are still pending resolution of problems detect by ISDC.

3. ISOC science archive

No change in this area due to concentration of science team effort in support of TAC process.

4. System

The system performance is very stable. No system update or patch performed

5. Problems

none

4.3.2 ISDC

On 20/10/2003, the status of ISDC observation processing is:

- Latest Standard Analysis completed: observation 01201140002 (IC 4329A, Revolution 104) on 20/10/2003
- Latest products archived: observation 01201020004 (Cygnus X-1, Revolution 79-80) on 17/10/2003
- Latest observation products sent to the observer: observation 01201020004 (Cygnus X-1, Revolution 79-80) on 17/10/2003

5 Special Events

Nothing to report

6 Anomalies

New anomalies raised during the past week are listed below:

On DoY 284, from 14:55 to 15:00, the antenna in Redu stopped, causing TM & TC links to drop. The impact was that a manual star mapping had to be performed, and slew 01210055 had to be updated. Also from 15:14 to 15:16, the TC link dropped, this time there was no impact.

On DoY 284 at 15:16 and 19:00, the manual stack on sun122 froze, no impact.

On DoY 285, at 04:51, the TC link to DSS-16 dropped, it returned a minute later at 04:52, however it caused the loss of pointing 01210080, with 01210081 having to be manually executed.

On DoY 285 from 23:31 until 23:33 all the TM links to DSS-16 dropped. The ground station reported a hydraulic problem, and raised a DR G103492. There was no impact.

On DoY 286 from 17:57 to 18:20, and again on DoY 287 from 12:06 to 15:56 there were occasional drops in TM due to the on-going playbacks, no impact.

On DoY 287 at 23:00, during the handover, DSS-16 was unable to get lock on VC0. From this time until 23:53, when lock was received, TC was conducted from DSS-16, with TM being received from Redu. The corresponding DR is G103511. There was no impact.

On DoY 288 at 01:05, the TM link to DSS-16 dropped, at 01:07, the TC also dropped. The links were recovered at 01:34 and 01:37 respectively. The impact was that pointing 01220074 was lost, and the slew for 01220075 was performed manually.

On DoY 288 between 15:11 and 17:17 there were occasional brief TM drops during the playback from Redu, there was no impact.

On DoY 288 at 21:12, and DoY 289 at 02:09, and 03:02 and DoY 289 at 17:45 there were errors sending data to ISDC.

On DoY 288 at 21:26, the VC7 link to DSS-16 froze. GFCC restarted the NCTRS-A. There was no impact.

On DoY 289 from 13:16 to 15:41, there were occasional brief TM drops due to the playback from Redu.

On DoY 290 at 10:17 the TM & TC links to Redu dropped, the TM link returned at 10:21, and the TC link at 10:27.

On DoY 290 at 23:01, the TM Bad Frame Link from DSS-16 briefly dropped. There was no impact.

Arid	Date Occurrence	Subject	Segment	Status
INT - 002483	13/10/2003	Loss of TC and TM link via REDU	Ground	ESA Sta.
INT - 002484	13/10/2003	Manual stack not responding	Ground	IMCS
INT - 002485	13/10/2003	Not possible to shut down IDDA.	Ground	IMCS
INT - 002487	13/10/2003	Lost TC link via Goldstone's DSS-16	Ground	NASA Sta.
INT - 002488	13/10/2003	Telemetry loss from DSS-16 DR G103492	Ground	NASA Sta.
INT - 002489	15/10/2003	Late handover to DSS-16 DR G103511	Ground	NASA Sta.
INT - 002490	15/10/2003	Lost TC and TM link via Goldstone's DSS-16 DR G109995	Ground	NASA Sta.

7 Future Milestones

It is currently planned to install the next release of the OMCAS (Version 2.9) on Tuesday 28th October.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 122

In revolution 122, GCDE observations were performed for the entire duration of observation time (~62 hours).

Revolution 123

The observations in revolution 123 consisted of a series of GCDE observations performed for ~56 hours, followed by a hexagonal dithering observation of the supernova remnant IC443 (RA 06:17:39.50; DEC +22:23:41.0) lasting ~3 hours.

Throughout these revolutions all instruments were in their nominal science modes, except for JEM-X1, which remained in Safe mode, and the TM allocation was 134 IBIS, 98 SPI, 1 JEM-X1, 8 JEM-X2, 5 OMC.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

The latest entries in the history file for INTEGRAL

2003-09-25T09:23:37.000Z	174.7532	F	Automatic TM processing.
2003-09-26T19:53:48.000Z	174.7378	F	Automatic TM processing.
2003-09-28T09:08:48.000Z	174.7331	F	Automatic TM processing.
2003-09-29T19:37:15.000Z	174.6779	F	Automatic TM processing.
2003-10-01T08:58:47.000Z	174.6181	F	Automatic TM processing.
2003-10-02T19:36:59.000Z	174.6053	F	Automatic TM processing.
2003-10-04T08:41:58.000Z	174.5895	F	Automatic TM processing.
2003-10-05T19:08:42.000Z	174.5730	F	Automatic TM processing.
2003-10-07T08:31:01.000Z	174.5628	F	Automatic TM processing.
2003-10-08T19:12:57.000Z	174.5340	F	Automatic TM processing.
2003-10-10T08:21:57.000Z	174.5147	F	Automatic TM processing.
2003-10-11T18:47:04.000Z	174.4793	F	Automatic TM processing.
2003-10-13T08:14:28.000Z	174.4496	F	Automatic TM processing.
2003-10-14T18:50:48.000Z	174.4231	F	Automatic TM processing.
2003-10-16T08:03:00.000Z	174.4129	F	Automatic TM processing.

This report was generated Fri Oct 17 08:00:15 GMT 2003

8.3 Detailed Satellite Information

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

8.3.1 AOCS Operations

AOCS operations were executed from the Automatic Timeline.

During this period, 130 Open Loop Slews, 155 Closed Loop Slews and 5 Momentum Bias were executed. 4 slews were missed or executed manually. This is equivalent to a 1.4%.

11/10/03 (Day of Year 284, Revolution 121)

Loss of STR Mapping at the end of Slew: At 14:55, a problem with the antenna at the Redu G/S caused a 5-minute glitch in TM/TC links. This resulted in the missing of STR Mapping at the end of Close-Loop Slew 01210055. After re-establishment of the links, a manual mapping was commanded, which was then used by the FDS to update the next slew. This had no operational impact.

12/10/03 (Day of Year 285, Revolution 121)

Slew lost due to Ground Station problem (Goldstone, DSS-16): At 04:51 and near the end of the Goldstone pass, the Telecommand link was lost. This resulted in slew/pointing 01210080 being missed. After re-establishment of the TC link, the Timeline Recovery Tool was used to manually slew to the attitude of pointing 01210081 and then to update the parameters for the next slew. The attitude of pointing 81 was reached prior to the originally planned time in the Timeline and therefore this pointing was not affected.

13/10/03 (Day of Year 286, Revolution 121-122)

OTF flicker due to Roll Error at the end of Open Loop Slew: At the end of Open-Loop Slew 01220002, the error in roll with respect to the Sun-Steering Law assumed roll angle was 236°, which is higher than the OTF threshold of 120°. In the first ACC cycle after enabling of the SSL, the OTF was set to TRUE (this is an ACC feature, which sets the OTF to TRUE in the first cycle after SSL enabling, regardless of the error). In the second cycle, the OTF was set to FALSE, taking the roll error into account and the ACC started correcting the error, which caused a jitter in the S/C attitude. The OTF flicker was not seen at Broadcast Packet level.

The roll error was already there at the end of the large Open-Loop Slew 01220001. The OTF did not flicker in this case because the SSL was enabled by ground TC. The reason that this error propagated to the next slew was that the SSL was enabled near the end of the STR mapping after slew 01220001, which was used to update the parameters for the next slew. This caused an incorrect assumption of the initial roll angle for slew 01220002 by the FDS.

14/10/03 (Day of Year 287, Revolution 122)

Nothing to report.

15/10/03 (Day of Year 288, Revolution 122)

Slew lost due to Ground Station problem (Goldstone, DSS-16): At 01:07 the TM and TC links from the Goldstone G/S were lost. The effect was that slew/pointing 01220074 was missed. After re-establishment of the links, a manual slew was done to the attitude of pointing 01220075. This attitude was achieved at 01:58:04, about three minutes later than the originally planned start time of the pointing.

OTF jitter due to Roll error at the end of the manual Open Loop Slew: At the end of the manual slew to reach pointing 01220075, the error in roll with respect to the SSL assumed roll angle was 180°. This caused an OTF flicker, which was not seen at BCP level. The error was introduced by the mapping that was used to generate the

slew parameters. There were not many stars in the STR FoV, and the FDS could only use three stars to reconstruct the attitude, with lower accuracy. In fact, this error does not exist in a previous attitude determination at the same attitude that was based on a mapping in which four stars were found. The threshold for attitude determination was reduced from four to three stars because there were occasional failures of the FDS to reconstruct the attitude in sparse fields. The situation will be monitored and if more cases like this one are encountered then appropriate measures should be taken, like reducing the thresholds for star selection criteria, making use of the FSS data in attitude reconstruction or rolling back to using at least four stars.

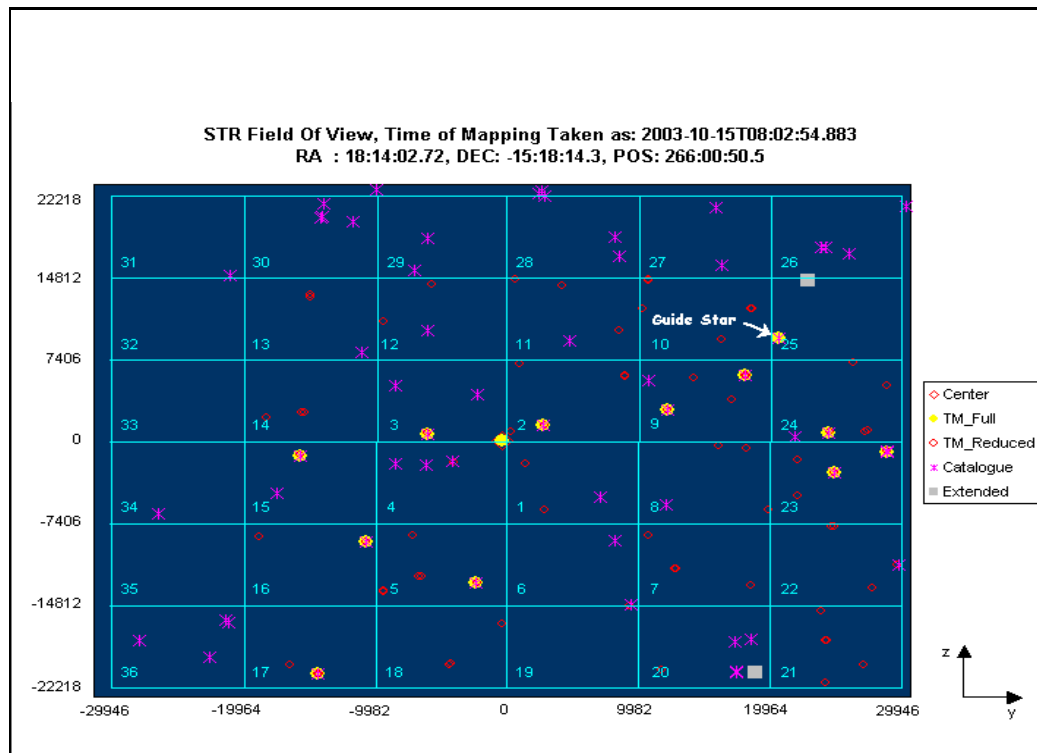
Star Tracker 1750 Processor Fault: At 08:03:32.383, a Star Tracker 1750 Processor Fault occurred during a mapping, which was commanded after Close-Loop Slew 01220086. The sequence of events were:

08:01:38.890 Close-Loop Slew end
08:01:39.390 Sun-Steering Law enabled (RGA 6)
08:02:54.476 Mapping start
08:03:32.382 Mapping ended prematurely
08:03:32.390 IMU switched On
08:03:32.394 New Mapping start, a new guide was picked during this Mapping

The ACC cycle in which the reset occurred was not in synch with the Housekeeping cycle and no indication of the fault were reported in the HK telemetry. At the time of the event, the magnitude 5.25 Guide Star had CCD coordinates (20919, 9290), which falls in the Elementary Search Window 25. This star has the following Star Catalogue designations:

Tycho#: 6265-01256-1, *Hip#:* 89851, *RA:* 18H 20 08.81, *Dec:* -15 49'54.4"

A reconstruction of the STR FoV during the aborted Mapping is shown below. As can be seen, an extended celestial object lies across the boundary between ESWs 25 and 26, with its centre located at CCD coordinates (23173, 14538). This is the Diffuse Nebula M17 (NGC 6618) also called the Swan Nebula with an overall magnitude of 6.0. The fault happened when processing ESW 25, which contained the Guide star and the extended object. The last processed ESW was 24.



There is another Extended object located in the ESW 20 at CCD (19149, -21038). This is the Open Cluster M16 (NGC 6611) and the associated Eagle Nebula with an overall visual magnitude of 6.4.

The impact of this problem was that the OTF remained low for pointing 01220086.

16/10/03 (Day of Year 289, Revolution 122-123)

OTF flicker due to Roll Error at the end of Open Loop Slew: At the end of Open-Loop Slew 01230002, the error in roll with respect to the SSL assumed roll angle was 136". As with the case at the beginning of revolution 122, the error was already there at the end of the large Open-Loop Slew 01230001 and it propagated to the next slew because the mapping that was used to update the parameters for slew 01230002 was performed in the time between the slew-end and enabling of the SSL. The OTF flicker was not seen at BCP level.

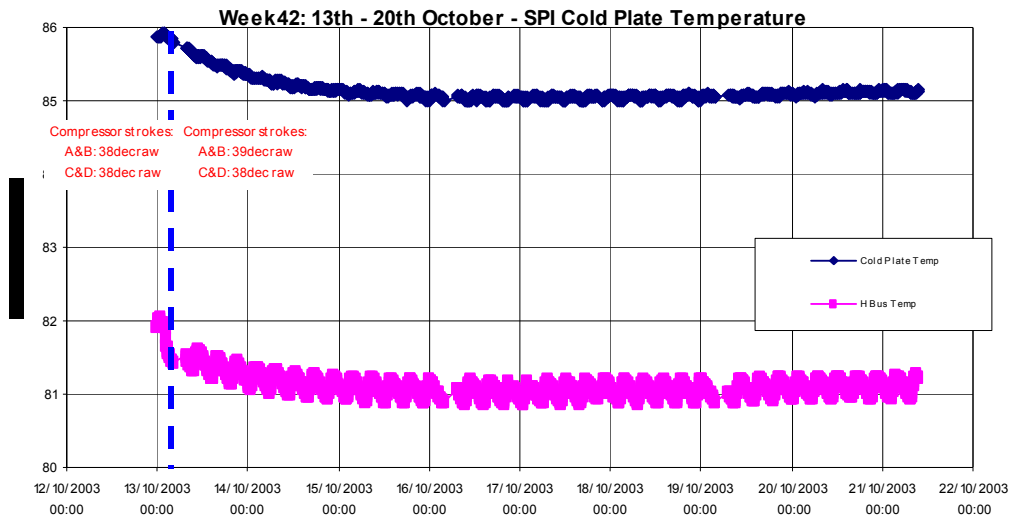
17/10/03 (Day of Year 290, Revolution 123)

Nothing to report.

8.3.2 SPI Operations

Cryo-cooler:

As a consequence of the slow positive drift accumulated in the last month, the stroke of the compressor A&B had to be increased by 1 LSB on compressors A&B, on 13th October at 02:12z. During the reporting period, after the stroke change, the temperature stabilized at around 85K and started again drifting high as expected.



IASW/DPE:

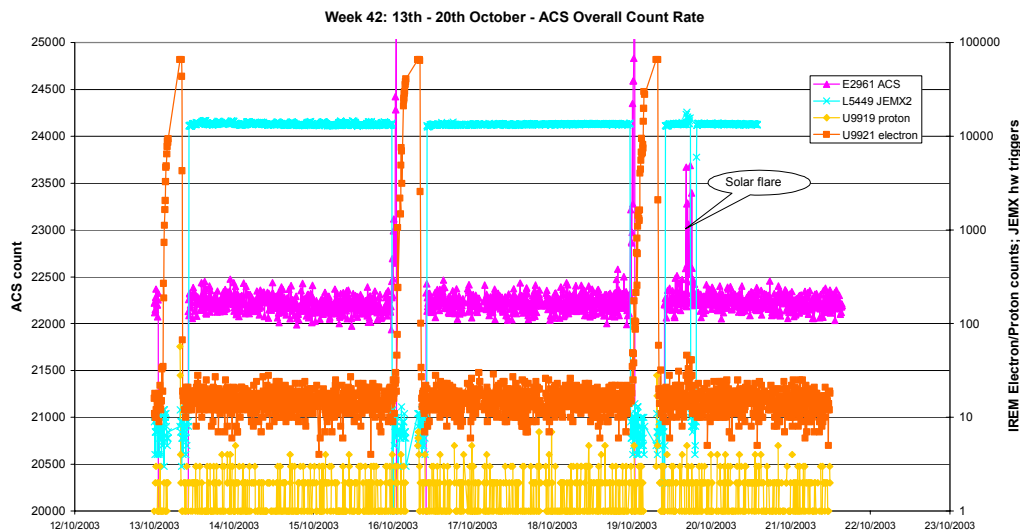
The new IASW release 4.3.0 produced by CNES Toulouse has been received at MOC. A reduced set of independent acceptance tests is being executed using the DPE OBSMS facility at MOC. The database and procedure changes to control the added functionalities have been discussed by teleconference and already implemented. They will be exported into the Mission Control System by the end of the month.

The DPE will be patched with the new IASW during the 3rd annealing cycle planned in November.

ACS:

The next figure reports the plot of the ACS, IREM and JEMX2 count rate. The unusual count rate peaks were due to a solar flare, which was also detected by IREM electron counter and JEMX2 event trigger counter (JEMX2 turned itself off as a consequence of this flux peak).

The following plot shows the ACS count rate during the last week.



AFEE :
Nothing to report.

DFEE:
Nothing to report.

PSD:
Nothing to report.

Future activities:

The period for the 3rd SPI annealing has been allocated between rev129 and rev133. A preliminary, detailed timeline was produced and is currently in the review process by the SPI PI and ISOC. The new constraints for SPI annealing (i.e. 100hrs annealing time and camera re-activation below 105K), the patch of the IASW 4.3.0 and a few additional tests to investigate the FEE#57 anomaly, were incorporated in the timeline.

Below is a summary view of the preliminary schedule:

[illegible]

8.3.3 IBIS Operations

DOY 2003.288 (15/10)

Reported at 18:24Z

the OEM ID 184 Class 2 <<IBIS1 VETO +28V VDM/CDM VOLTAGE OUT OF RANGE>>. The relevant TM_para G6107 reported values inside limits and therefore the problem was disregarded, as suggested by the nominal reaction to this OEM.

DOY 2003.289 (16/10)

Reported (few) during Belt passages the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by PIs. The Noisy semimodule was PDM6-SM2

8.3.4 JEM-X Operations

Nothing to report.

8.3.5 OMC Operations

On DoY 285 at 04:55, two commands were rejected, these were due to the missed pointing of 01210080. Pointing 01210081 was completed manually.

On DoY 288 at 01:53, two more commands were rejected. The first was due to ground station problems which prevented the Timeline from running, and caused the loss of 01220074, The second pointing (which was the one where the commands were rejected) was lost when, as part of the recover schedule operation, the required attitude was reached after the expected time in the timeline. This was 01220075, up-linked manually at 02:13.

8.3.6 IREM Operations

The plots of the IREM count rates and statuses for the Belts passage in rev 122-123, as recorded by the IREM EGSE at ESOC are shown below.

