XMM-Newton
Instrument Operations & Data Generation

J.R. Muñoz and the IOT members, SRE-OOX
UGM#17, ESAC
7 Jun 2016
Overview

Instrument Operations
- Instruments Status and Anomalies
- Instrument Operations
  - Spacecraft
  - Eclipses
  - Thermal control
  - Radiation
  - Ground stations

Data Generation and Distribution
- Statistics
- Status of data production
- SOC Migration
Instruments Status (1)

- **Instruments status:**
  - **General:** All instruments healthy and working fine. 3000+ Revs !!!

- **Recent anomalies** (since last UGM – 21/05/2015):

  - **Major Instrument anomalies:**
    - **NCR#139: MOS1 HK Telemetry corruption (A/D chain)**
      - Same problem as for MOS2 that developed in 2010/2011
      - MRB#36 called, with final decision to go to the MOS1B chain:
        - Verified that B chain was still available (first switch-on since the post-launch verification in 2000. Chain OK.
        - Swap performed on 26-Nov-2015 (start of rev 2924, eclipse season).
        - No science data affected (nor re-calibration required).
      - Both MOSs now working on the B chains. Chains A are still usable and we can go back at any time but with corruption present: work started on the implementation of the invalidation of corrupted TM in case the problems develops also on the B chains.
    - NCR#139: Closed
• One new case of NCR#133 (false current limiter activation of an unused EPIC internal circuit) on 21-May-2016. No impact.

• Minor Instrument anomalies:

  ➢ MOS1
  • CCD noise due to bad columns in CCD2. Cleaned by a new set of MOS Offset Tables (V20) uploaded on 18-Aug-2015.

  ➢ MOS2
  • Above case of false current limiter activation.
In Instruments Status (3):

- **OM**
  - On 17-Apr-2016 (rev 2995), after recovery from a SAFE status, all OM exposures during this rev and the next (2996) contained corrupted data. The problem was stopped via a DPU reset and full RAM load.
  - Since last UGM OM suffered 3 cases of DPU reset and 27 cases of on-board memory corruption. Similar to previous years. Recovery from this type of contingencies is being analysed to be made automatic through the MOIS MOC tool.

- **PN**
  - No anomalies, everything nominal. New Bad Pixels Table (V5) to be uploaded in the coming weeks.

- **RGSs**
Main events

- **Spacecraft:**
  - AMD (Autonomous Momentum Dump) on 09-Mar-2016. No impact on the instruments but affected two observations that were performed off-target. MOC investigating the reason for the AMD.
  - No CDMU in the last year.
Eclipse Operations

- **Post-Perigee eclipse season (26th Apr – 26th May 2015)**
  - Nominal operations.
  - Post eclipse operations split at planning level in two sections: Time Tagged commands section and Instrument Engineering section.

- **Lunar eclipse (13th Sep 2015)**
  - Nominal operations. Used to test several adjustments for the coming eclipse season.

- **Pre-Perigee eclipse season (17th Oct – 10th Dec 2015) with GS gap**
  - Problem for this eclipse season was the un-availability of GSs (no coverage) during the last part of the eclipse and first ops after the eclipse. Maspalomas and Goldstone could be used (part time), limiting the amount of gaps.
  - The new on-board TCL (Thermal Control Loop) was used nominally for the first time and made possible to go through the season without major incidents.

- **Post-Perigee eclipse season (28th Mar – 9th May 2016)**
  - Only incident occurred on 19-Apr-2016 when a GS failure led to both MOS1A and MOS1B being powered on. It was recovered without any impact.
Eclipses impact:

- **Science start:**
  - Approximately 15 mins (autumn eclipses) with MOSs temperatures higher than nominal at start of science window. Down from 2 hrs on previous autumn eclipses.
  - No impact on spring eclipses.

- **Increased noise for MOS1 CCDs**
  - Cleared after new MOS Offset Tables upload.

Thermal control

- Fully functional
- Used primarily for eclipses with GS gaps
- Maintains the CCDs temperatures within predefined values by turning off and on the substitution heaters.
ECL autumn 2015 - CCDs temps

- P1407
- P2101
- T4001 [DegC]
- T4005 [DegC]
- T4014 [DegC]
**Radiation**

- No big Solar Flares in the period.
- Impact of radiation on science very low.

**Ground Stations:**

- Yatharagga became operational since Nov 2015, replacing Perth.
  - Some initial problems with testing (configuration files) leading to bad time correlation, fixed.
  - Corruption of the so called STATS package (containing info like current BRAT). The problem is also present at the MOC. Work is ongoing to determine the final source. For the time being a warm re-start of the SOC systems cleans the problem.
- Santiago became formally Kourou backup on Feb 2016.

**Automation:**

- Implementation at MOC of the MOIS (Manufacturing and Operations Information System) allowing the automation of repetitive simple tasks like Radiation Monitor recovery (already in place). Other that are planned are some eclipse ops and the OM recovery.
Overall, very good behavior of Instruments and all Ground Segment elements.

Efficiency is, at least, maintained for all Instruments.

High radiation periods (very few) at end of revolution used for calibration purposes with Close-Cal filters.

Statistics (next slides)
PN efficiency in the routine phase: Revs 2501 to 2987

- Scheduled Science: 58388 ks
- Performed Science: 57023 ks

![Graph showing PN efficiency over time](image-url)
PN efficiency breakdown over the last 6 months (revs 2898 to 2987)

Scheduled Science: 10879 ks
Performed Science: 10717 ks

Science window breakdown

Revolution breakdown

- Radiation belts: 17.65%
- Science Window: 82.35%

G/S problems: 0.71%
Inst problems: 0.00%
Support to other S/C: 0.00%
S/C problems: 0.04%

Contingencies: 0.75%
High radiation: 0.41%
Overheads: 4.10%
Slews: 10.53%
S/C-activities: 0.42%
Engineering Obs: 0.29%
Calibration Obs: 3.75%
Science Obs: 79.34%
RGS1 efficiency breakdown over the last 6 months (revs 2898 to 2987)

Scheduled Science: 11373 ks
Performed Science: 11253 ks

Revolution breakdown:
- Radiation belts: 17.95%
- Science Window: 82.35%

G/S problems:
- 0.58% Contingencies
- 0.00% Inst problems
- 0.00% Support to other S/C
- 0.03% S/C problems

Science window breakdown:
- High radiation: 0.28%
- Overheads: 0.45%
- Slows: 10.92%
- Engineering Obs: 0.00%
- Calibration Obs: 4.05%
- S/C-activities: 0.22%
- Science Obs: 83.48%
**Routine Phase Statistics (revs 0103 – 3008 [17th – May - 2016])**

- Scheduled observations: 11706
- Performed: 11285
- ODFs produced: 11124
- PPS products: 11040

- Not performed out of Scheduled due to Solar Flares, antennas, Technical issues, ...
- No ODFs out of performed due to empty (dummies) observations, technical problems (no link, system problems, ...), manual execution, special calibrations.
- No PPS Products out of ODFs produced due to (most below rev 1000) manual ops, TM problems (HK), ...

- Production of data is nominal, delay in ODF/SDF completion respect to data acquisition is 4-5 days.
➢ All data (ODFs, Pipeline Products) routinely delivered to the XMM-Newton Science Archive (XSA).

➢ Web site migrated to new corporate web environment, COSMOS.
### Personnel changes

- Data Aide left with 15 years experience. Replaced by a former INSCON.
- One SWS Engineer came back after very long sick leave (1.3 years)
- One SWS Engineer replaced by a former Engineer with 10+ years experience.

### SOC Migration

- SOC has already migrated to Virtual systems the following subsystems:
  - Reprocessing chain (PMS, ODS).
  - Mission Planning system.
  - Archive Management Subsystem
  - HRPS and XRPS (for Phases I and II of an AO).
  - Most auxiliary subsystems (ODF checking, TCX generation, ...)
  - In progress: Real Time chain with the support of the MOC
Thanks for your attention,

Questions?