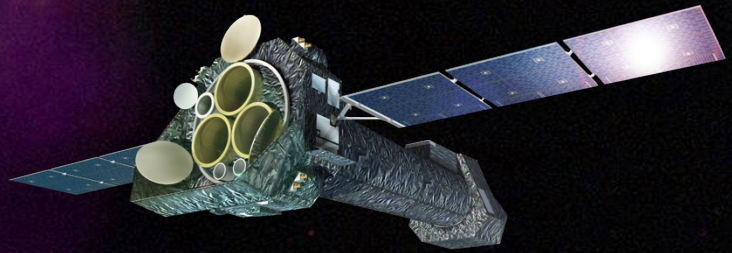
XMM-Newton Mission Status

Peter Kretschmar, Mission Manager

XUG Meeting #25

26 June 2024



Toala et al. (2022) XMM-Newton & VLT

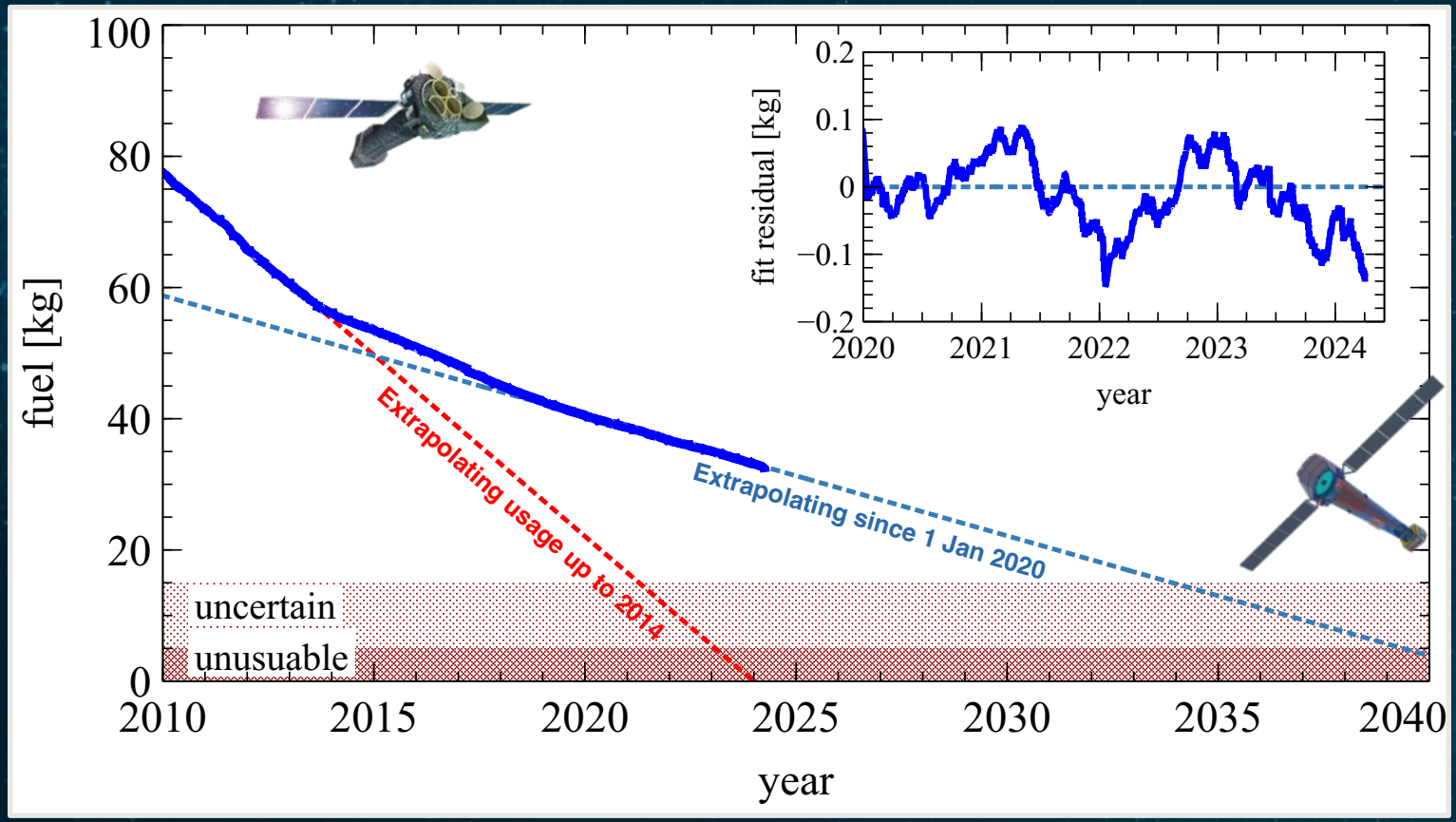
The spacecraft is in great shape but there are risks

- ✓ All instruments in same general shape as last year. No major incidents.
- ✓ Successful fuel replenishment operations in 2020 & 2022, 2023 **and June 2024** (very smooth).
- ✓ Collision avoidance monitoring no issue until ~2027.
- ✓ New Safe Mode (no fuel usage) together with further on-board monitoring and safety actions for instruments is being developed. Tentative plan for upload and commissioning is February 2025.

  Need to keep an eye on long-term degradation of some components:
  - Battery
  - Coarse Attitude Anomaly Detector
  - Opto couplers

➥ Evaluating risks aiming for science operations well into 2030s!

Fuel usage allows for lifetime clearly >2030

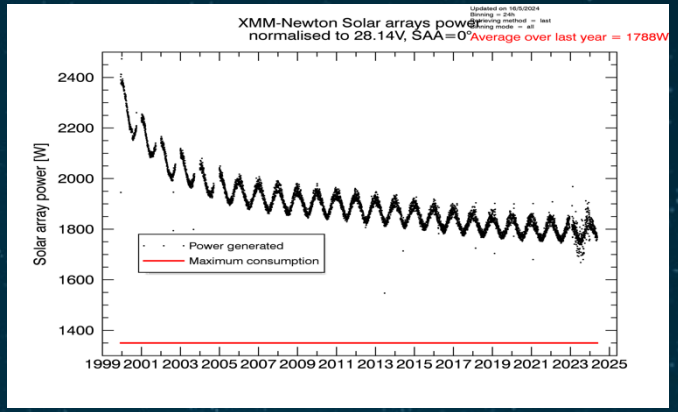


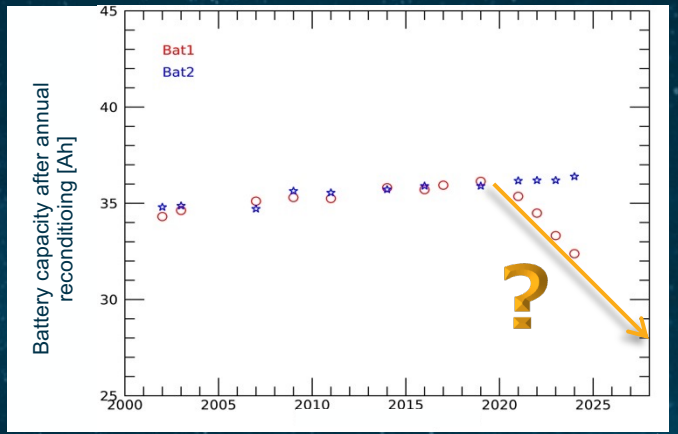
Solar power and batteries – great status, but …

- ✓ Normal solar power generation, no unexpected degradation.
- ✓ Batteries have healthy capacity: Almost 4 times maximum discharge observed in longest eclipse (9.5 Ah).
- ✓ Optimized power usage in eclipse saves ~15%.

  Since 2021 reconditioning Battery 1 shows decreasing capacity.
- ➥ Assessment started on forecast for possible impact on eclipse operations, when a single battery would be marginal.

  Note: power usage in eclipse might be reduced.

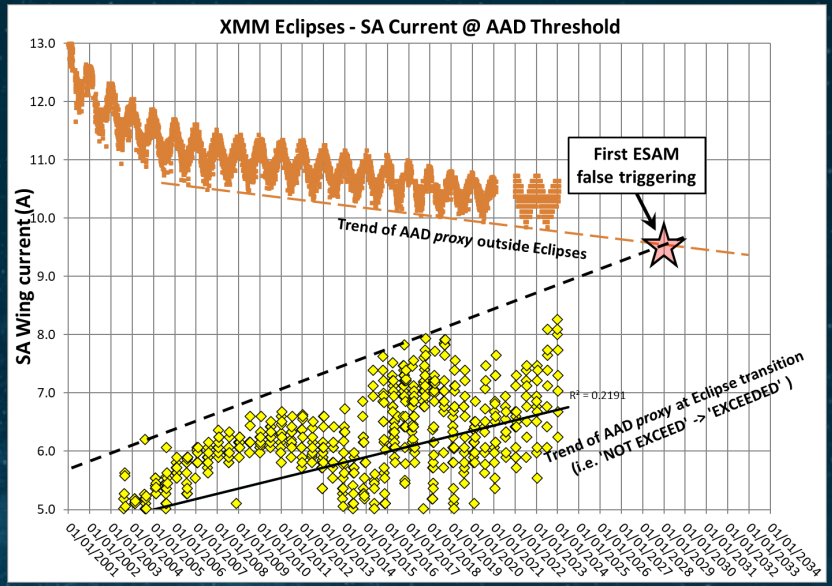




Attitude Anomaly Detector slowly degrading

- ⚠ Radiation damage degrading detector's solar efficiency ➠ signal can fall below threshold ➠ false ESAM trigger.
- ⚠ Happened in SOHO, same unit for XMM-Newton.
- ⚠ Extrapolation of proxy data from eclipses ➠ Might happen first time in 2029.
- ➥ Possibly disable detector from safe mode criteria early in 2028 (~1 year margin)
- ➥ Might be substituted by Inertial Measurement Units, but not an easy option.

Details in ESA-XMM-OPS-TN-0014



OptoCouplers

- Contactless information transmitted, used to control heater and reaction wheels
- ⚠ Age due to radiation ➟ Risk of wheel speed information corrupted and possibly heater problems.
- ⚠ Analysis in 2015
  ➟ Should work until 2028+
- ➥ Being investigated again with more radiation data & better models. Outcome open.
- ➥ Speed corruption first at very high speeds, avoided by XMM-Newton ➟ may not immediately affect operations.
- ➥ Discussion with SOHO about possible tests with their wheels & OptoCouplers

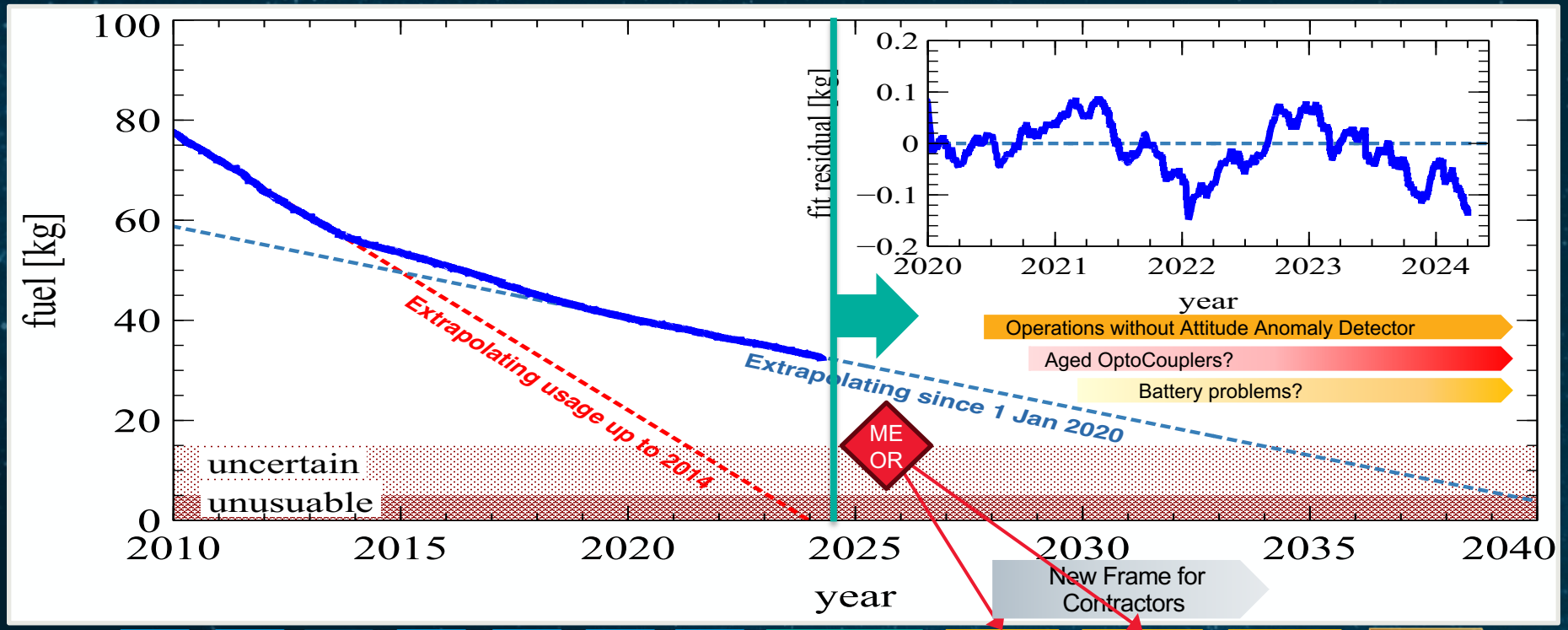
Summary table at T=Tops=25degC

Charge Transfer Ratio

Device	fuction	CTR BOL	CTR min	Degradation factors TID	DDEF	Age	temp	Mission End-date CTR 2015	2021	2023	2028
3C91	heater control	1.1	**0.18**	0.96	0.80	0.930	1	0.786			
				0.94	0.50	0.910	1		0.470		
				0.93	0.50	0.905	1			0.463	
				0.92	0.50	0.900	1				0.455
OP224 / 604	RWA Commutation & Speed	0.75	**0.165**	0.9	0.701	0.930	1	0.440			
				0.86	0.342	0.910	1		0.201		
				0.82	0.341	0.905	1			0.190	
				0.78	0.341	0.900	1				0.180

Table 2 : Summary of Opto Degradation factors

The future is not just about fuel



Not quite just another year in the Ground Segment …

- Migration of the complete ESAC Datacentre 19–22 April: **All computers switched off, moved and restarted!**
- Long and detailed preparation, between SOC, SITU, Corporate IT, Facilities, …

➥ Payed off by rather smooth migration in the end.

- Added complication by bomb alert in Darmstadt.

➥ **Full evacuation of ESOC on 18 April**, but called off after some hours.

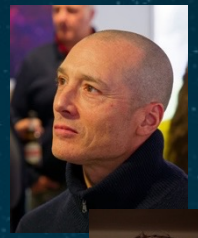
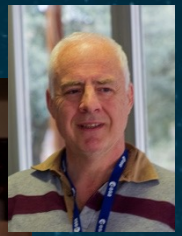
Darmstadt: Vermeintlicher Bombenfund entpuppt sich als Rohrstück

Von **Katja Heßberger** - 18. April 2024 304

The people are a-changin' …

- Felix Meeker-Fürst moved to staff position as Science Operations Scientist
  ➠ Gabriele Matzeu joined support team.
- Guillaume Bélanger integrated after sabbatical as High-Energy Archive Scientist (XMM-Newton and INTEGRAL)
  ➠ PK no longer Archive Scientist.
- Anthony Marston on final leave before retirement since March
  ➠ John Hoar back as System Engineer (but part-time).
- Yvonne Eggers and Landry Amiard finishing 2nd year of YGT projects (YE: Superresolution for Bright XMM Sources; LA: Instrument Monitoring, ARES);
  Esin Gübalhar started last September (SAS Datalabs).



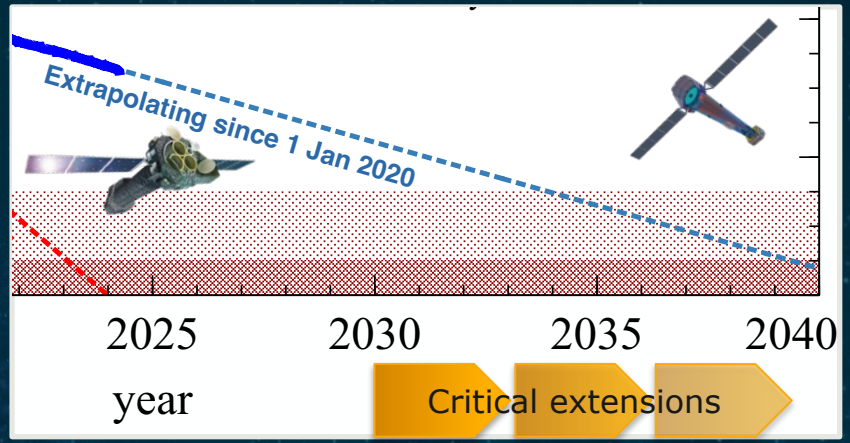


Staying fit for many more years

- Need to ensure **technically and financially sustainable** operations for 10+ years more.
- Team **will** evolve further.
- IT environment **will** change.
- **Strong competition for resources** with other, especially newer missions.

➥ Rejuvenating systems, bringing all to **supported technology** and focusing on common systems shared across missions, where possible.

➥ Major effort for SOC and MOC, also in shared projects for various topics.



Rejuvenating systems & operations – MOC

- Hardware and operating systems brought up to date, while maintaining 24/7/365 operations. — Regularly
- Mission Control System migration. — Done
- Migration of radiation monitoring system to solution based on tool provided by SOC. — Underway
- Fuel replenishment automation, first elements in use — Underway
- Procedure for recovery without propellant, first manual, then semi-automated. — Underway

Rejuvenating systems & operations – SOC/MOC

- Virtualization of RGS on-board software server. — Done
- Further automation of operational tasks like instrument recovery after problems. — Continuing & Improving
- Use of ARES system for instrument trend analysis and more. — Underway
- Change to new database system (DABYS) for operational database at MOC, adaption of interface processes at SOC. — Underway

Rejuvenating systems & operations – SOC

- Hardware and operating systems brought up to date, while maintaining mostly continuous operations and upgrading software. — Continuing
- Automation of raw data ingestion and quality checks. — Mostly done
- Updated proposal handling software for Phase I and Phase II. — Done
- Move to use of Python for scripting and visualization in science analysis software and enabling analysis within Datalabs. — Continuing
- Automated ingestion of delivered catalogues into XSA. — Mostly done
- New XSA frontend software. — Currently on hold
- New Helpdesk. — Done

Further rejuvenation steps – SOC

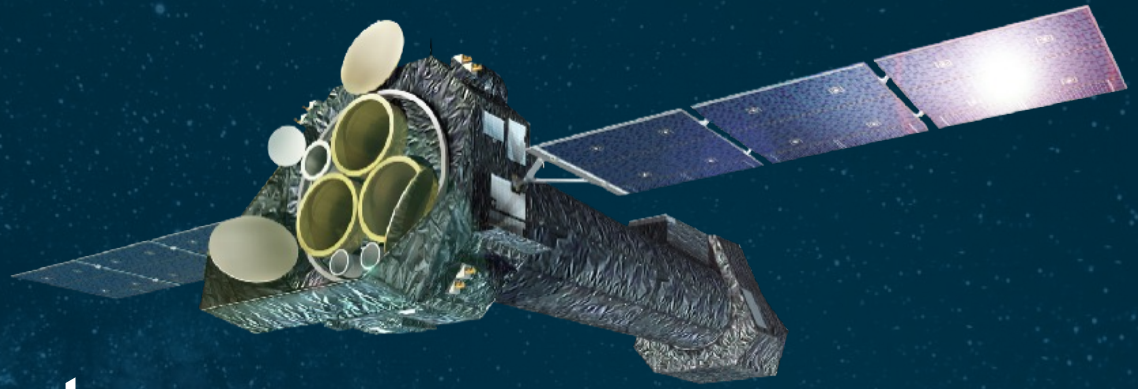
- New, improved systems to develop and build operational and science analysis software.
- Enhance interactive science analysis in Datalabs
- Investigation of Machine Learning or Artificial Intelligence Methods in operations.
- Enhancing pipeline products, considering legacy.

Ongoing, well advanced

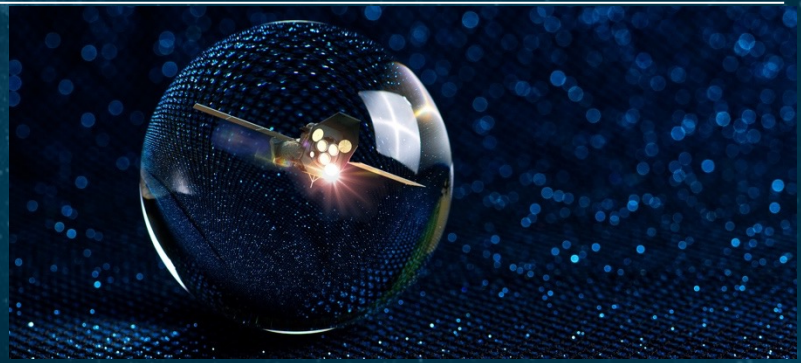
Ongoing, well advanced
YGT project

Preliminary studies done
YGT starting in fall

Rediscussing ideas in fall



25 years of XMM-Newton – looking ahead



~24.5 years ago

Half a year of intense activity to enable science

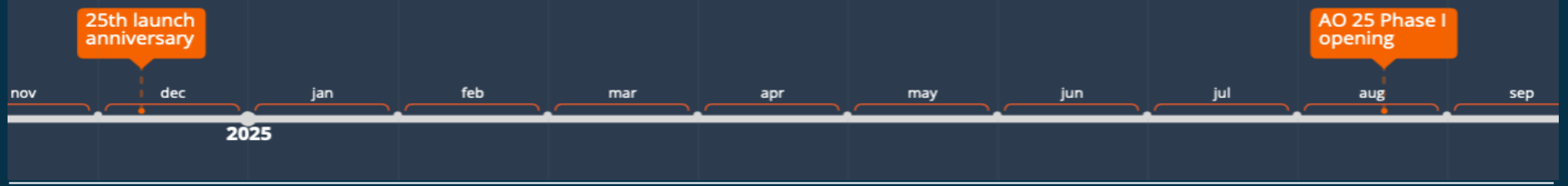
- Launch
- OM first light
- MOS first light
- EPIC first light
- RGS first light
- Cal. & PV phase start
- First AO-1 observation

dec | jan | feb | mar | apr | may | jun

2000

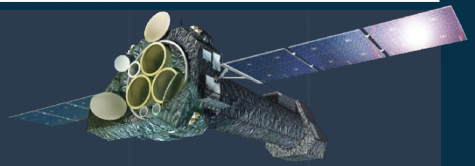
Less than a year ahead …

‘Natural’ time range for events linked to 25 years of XMM-Newton science



Filling the time

‘Natural’ time range for events linked to 25 years of XMM-Newton science



Renewed XSA (basic)

Anniversary event @ ESAC

25th launch anniversary

NASA GOF workshop

Renewed XSA (advanced)

5XMM delivery

On-line data analysis workshop

XSA with 5XMM

Event on 5XMM?

AO 25 Phase I opening

nov | dec | jan | feb | mar | apr | may | jun | jul | aug | sep

2025

Filling the time – events

- Smaller event than for 20th anniversary – details TBD.
- Event for teams making XMM-Newton work for community: MOC, SOC, GOF, SSC, PI teams, …
- Not focusing on past achievements but on future – at least 10 years ahead!

Anniversary event @ ESAC

- No details known yet.
- Will be coordi-nated.

NASA GOF workshop

- Showcase easy access to analysis via web
- Datalabs, Sciserver, more?
- Include other missions?
- Looking for volunteer tutors …

On-line data analysis workshop

- So far just for consi-deration

Event on 5XMM?

25th launch anniversary

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2025