XMM-Newton Science Support,

Working together in support of the scientific community

Maria Santos-Lleo

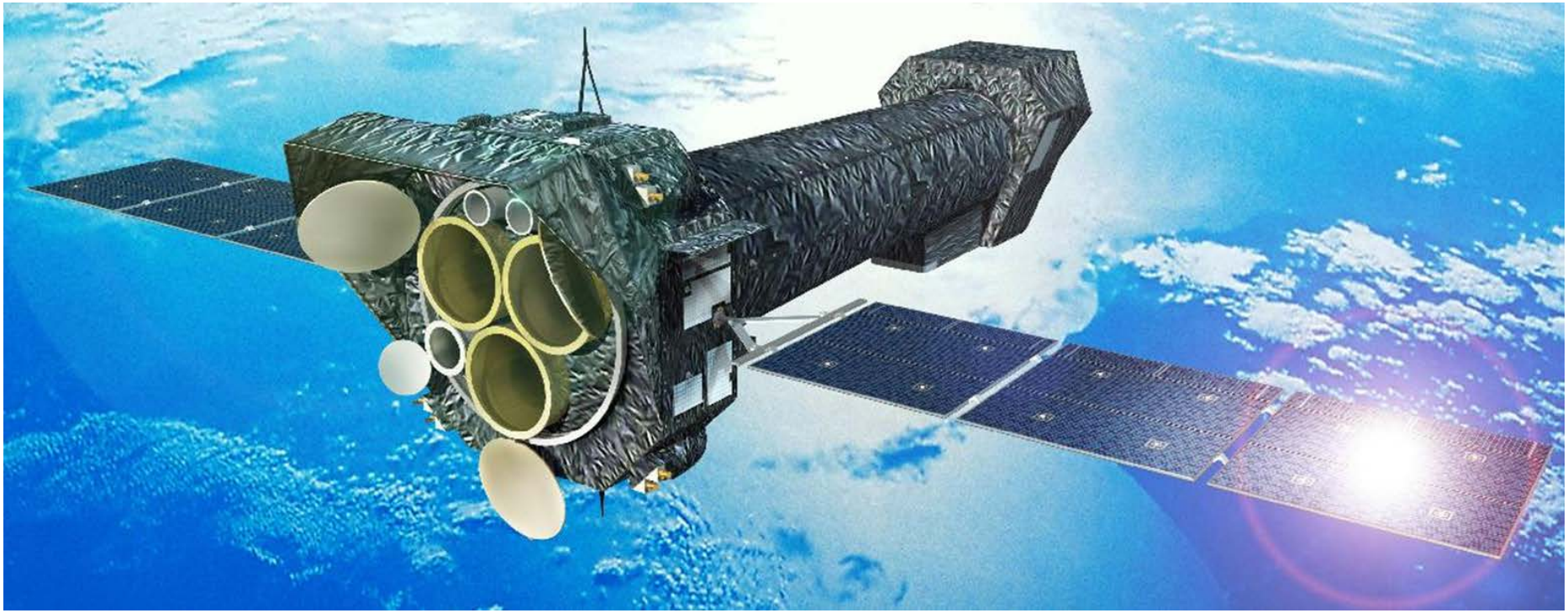
With acknowledgement to the whole XMM-Newton Science Operations Centre at ESAC

In this talk

- Introduction to XMM-Newton
- A personal view of the evolution and achievements of the Scientific Support since launch in Dec 1999

XMM-Newton: An X-ray OBSERVATORY

Unveiling the hot and extreme conditions at the Universe

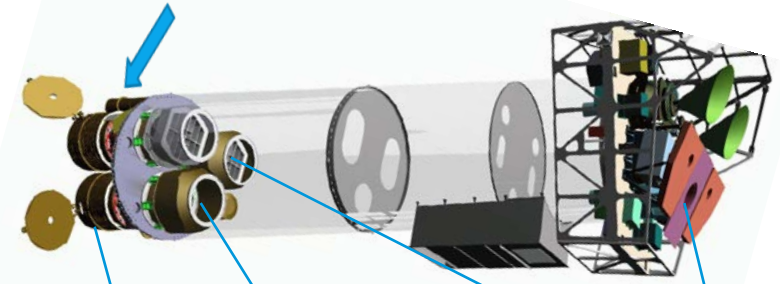


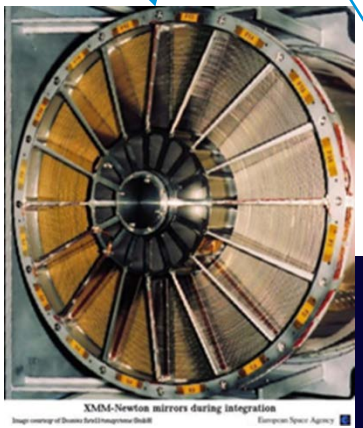
xmm-newton
European Space Agency

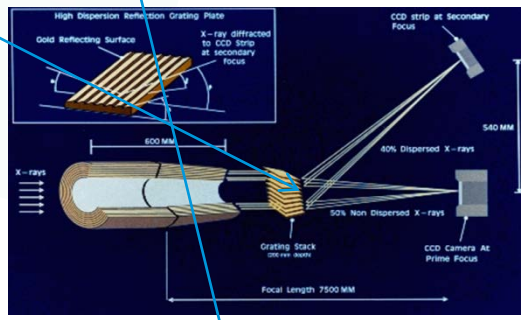
The Observatory: telescopes and instruments in space

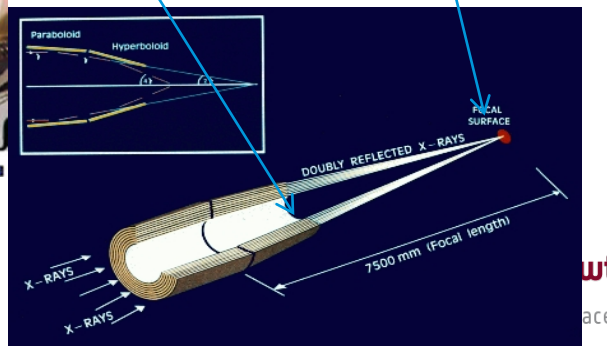
Spacecraft (the dome) & Payload (telescopes and instruments)

- Launched: Dec 1999
- Orbit: 48 h period

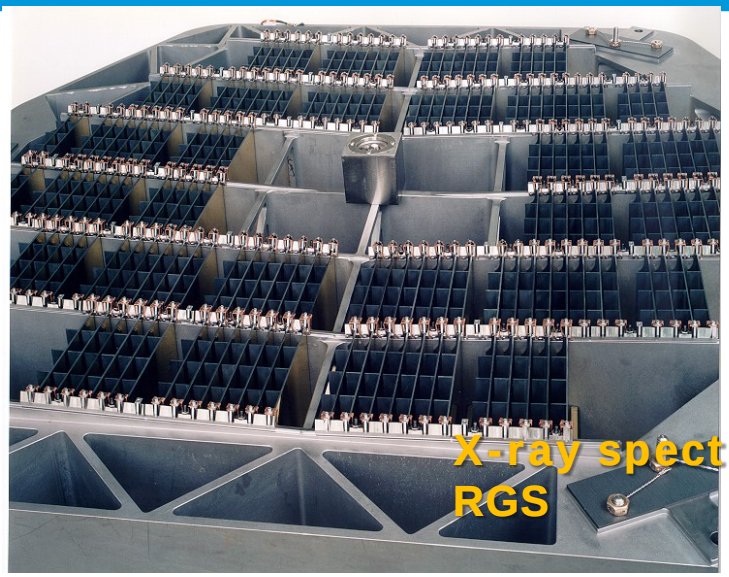




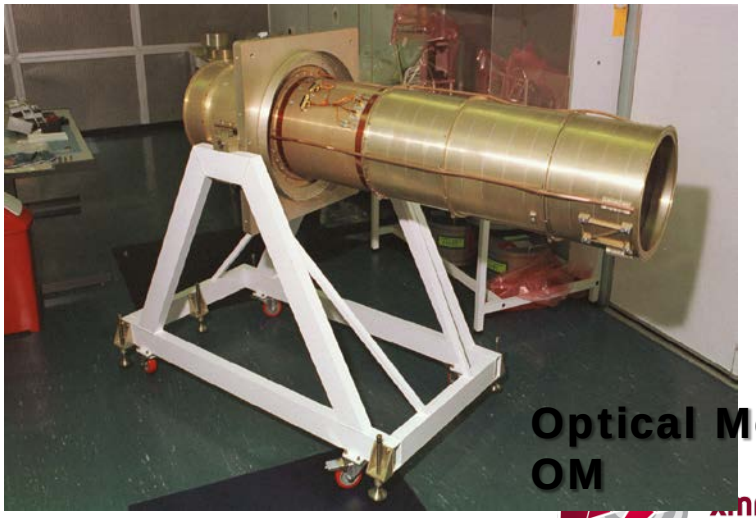




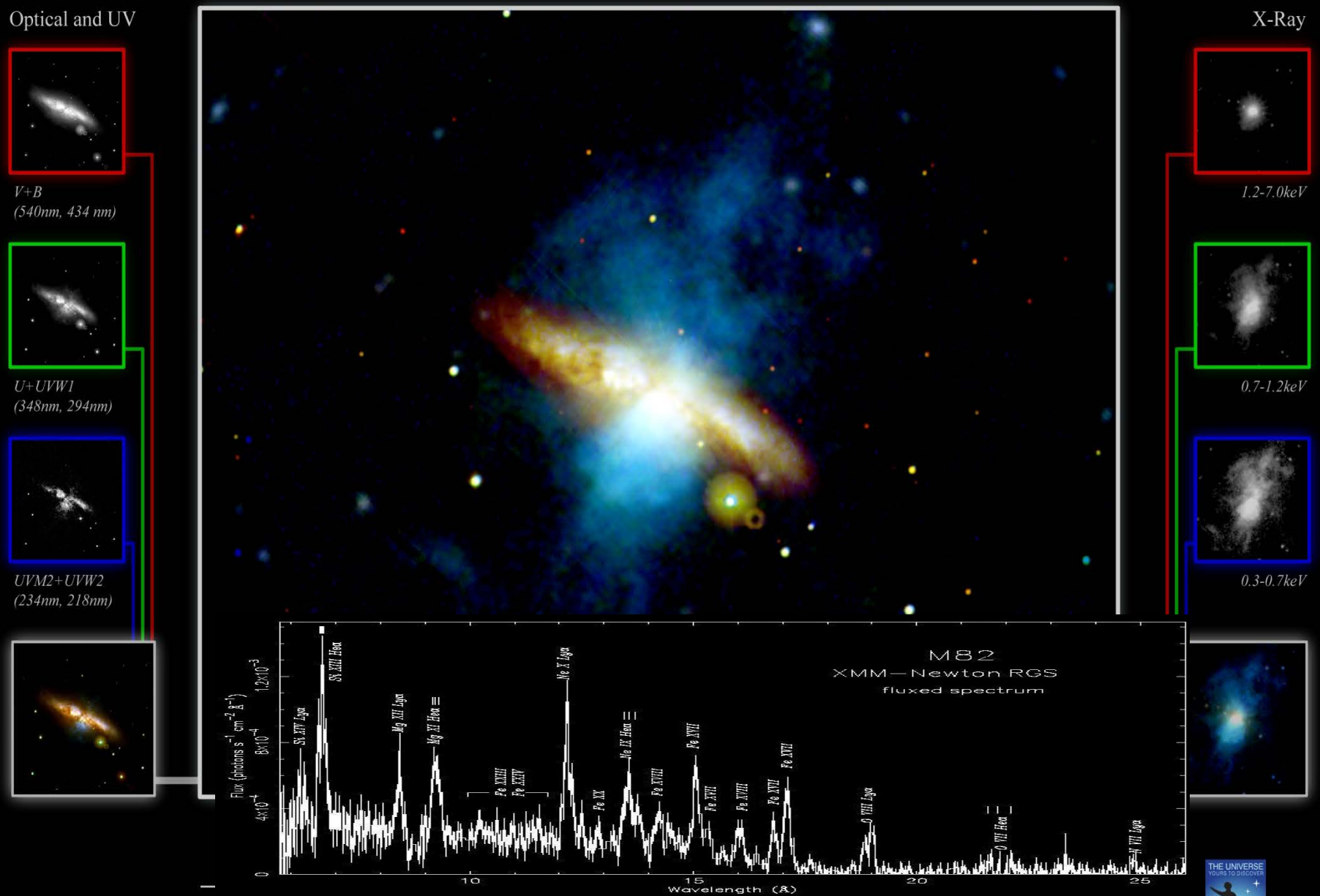
The instruments



EPIC



The science data



Science Support: activities

Observatory-type mission: support astronomers from proposal preparation to scientific publication

- **Run the annual call for proposals, provide relation with scientific community**
- **Provide scientific planning: long & short term plan, ToO**
- **Monitor Instruments**
- **Deliver instrument calibration**
- **Deliver tools for data analysis**
- **Deliver raw and processed data**
- **Provide a scientific archive**
- **Provide generic community support: documents, web, helpdesk, workshops**

Science Support: activities

Observatory-type mission: support astronomers from proposal preparation to scientific publication

➢ **Working together:**

- Run the annual call for proposals, provide relation: **with scientific community & Time Allocation panels**
- Provide scientific planning: long & short term plan, ToO
- Monitor Instruments: **with Instrument PI teams**
- Deliver instrument calibration: **with Instrument PI teams**
- Deliver tools for data analysis: **with Science Survey Centre (SSC)**
- Deliver raw and processed data: **with SSC (discontinued in 2012)**
- Provide a scientific archive: **with ESA Science Archives Team**
- Provides generic community support: documents, web, helpdesk, workshops

Science Support: objective

Observatory-type mission: support astronomers from proposal preparation to scientific publication

➢ **Working together:**

- Run the annual call for proposals, provide relation: **with scientific community** & Time Allocation panels
- Provide scientific planning: long & short term plan, ToO
- Monitor Instruments: with Instrument PI teams
- Deliver instrument calibration: with Instrument PI teams
- Deliver tools for data analysis: with Science Survey Centre (SSC)
- Deliver raw and processed data: with SSC (discontinued in 2012)
- Provide a scientific archive: with ESA Science Archives Team
- Provides generic community support: documents, web, helpdesk, workshops

Science Support: objective

Observatory-type mission: support astronomers from proposal preparation to scientific publication

➢ **Working together:**

- Run the annual call for proposals, provide relation: **with scientific community to get the best science out of XMM-Newton**
- Provide scientific planning: long & short term plan, ToO
- Monitor Instruments: with Instrument PI teams
- Deliver instrument calibration: with Instrument PI teams
- Deliver tools for data analysis: with Science Survey Centre (SSC)
- Deliver raw and processed data: with SSC (discontinued in 2012)
- Provide a scientific archive: with ESA Science Archives Team
- Provides generic community support: documents, web, helpdesk, workshops

Science Support: evolution of resources

Observatory-type mission: support astronomers from proposal preparation to scientific publication

➢ **Working together:**

- Run the annual call for proposals, provide relation: **with scientific community: nearly constant in number, new people**
- Provide scientific planning: long & short term plan, ToO
- Monitor Instruments: **with Instrument PI teams**
- Deliver instrument calibration: **with Instrument PI teams**
- Deliver tools for data analysis: **with Science Survey Centre (SSC)**
- Deliver raw and processed data: ~~**with SSC**~~ **(discontinued in 2012)**
- Provide a scientific archive: **with ESA Science Archives Team**
- Provides generic community support: documents, web, helpdesk, workshops: **Science Ops Centre**

Science Support: evolution of tasks

Observatory-type mission: support astronomers from proposal preparation to scientific publication

- **Working together:**

- **Run the annual call for proposals, provide relation: with scientific community & Time Allocation panels**
- **Provide scientific planning: long & short term plan, ToO**
- **Monitor Instruments: with Instrument PI teams**
- **Deliver instrument calibration: with Instrument PI teams**
- **Deliver tools for data analysis: with Science Survey Centr SC)**
- **Deliver raw and processed data:**
- **Provide a scientific archive: with ESA Science Archives Te**
- **Provides generic community support: documents, web, h esk, workshops**

xmm-newton
European Space Agency

Science Support: evolution of tasks

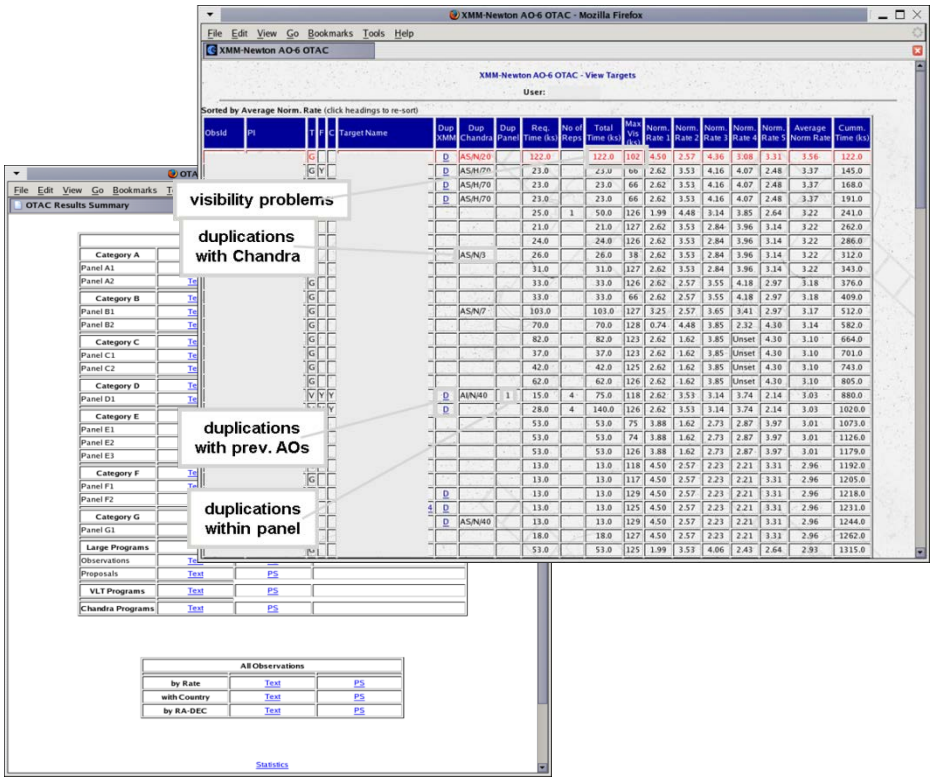
- Proposal cycle:
  - New proposal types
  - New astronomers, Ph D
  - New tools
  - More sophisticated ideas
- Mission planning:
  - increase efficiency
  - fixed-time/coord observations
- Instruments
  - New modes
  - Improve on calibration
  - Contingencies, time evolution, cros-cal with other missions
- Data analysis software
  - New tasks
  - New H/W platforms
- Pipeline data processing
  - Optimized algorithms
  - New science products
- Archive
  - Need to adapt to new technologies: e.g. full re-engineering
- Fixed tasks
  - Check & optimize proposals
  - Mission planning
  - Conferences ...

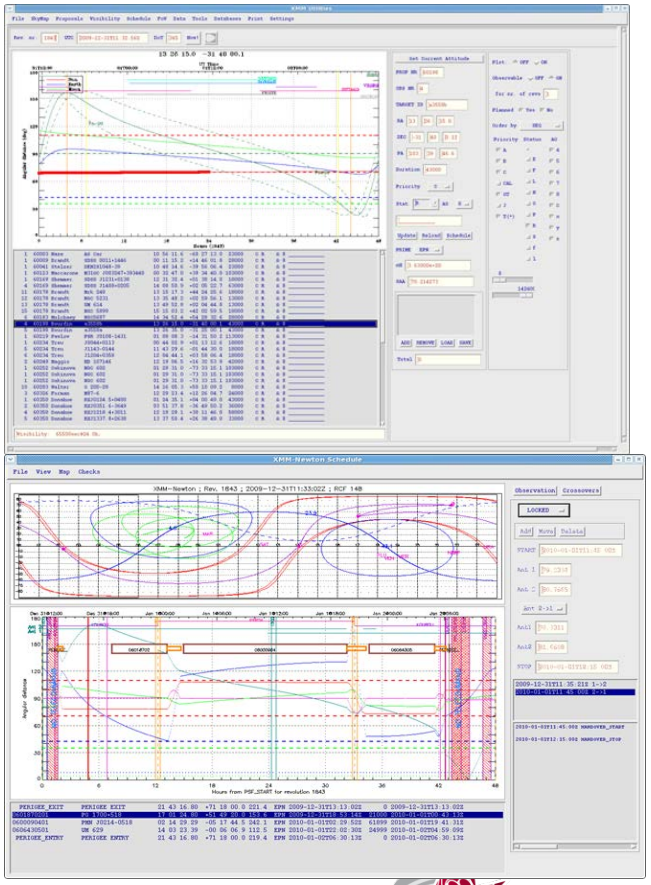
How to manage?

- Budget pressure (with time) but constant load
- Key
  - Team
    - core team with great expertise from previous missions and/or high scientific background (mainly in X-ray astronomy, but not only)
    - new people with a lot of enthusiasm and new ideas
    - Different internal teams co-located and interacting
  - Tools developed in the team or adapted from previous missions
  - Keep inst. modes simple, while adapt to evolution and scientific community needs
  - Smooth interaction with inst. experts, coordinated by ESA cal. scientist
  - Smooth interaction with external S/W developers and taking over of their tasks as they leave, if internal resources allow it
  - Keep interaction with community as highest priority: keep high level of support

Tools

- Mission Planning, ToO (very high rate), proposal technical evaluation tools: xrtops (adpated and significantly enhanced version of early rtops)
- OTAC support tool
- Conference organization tools

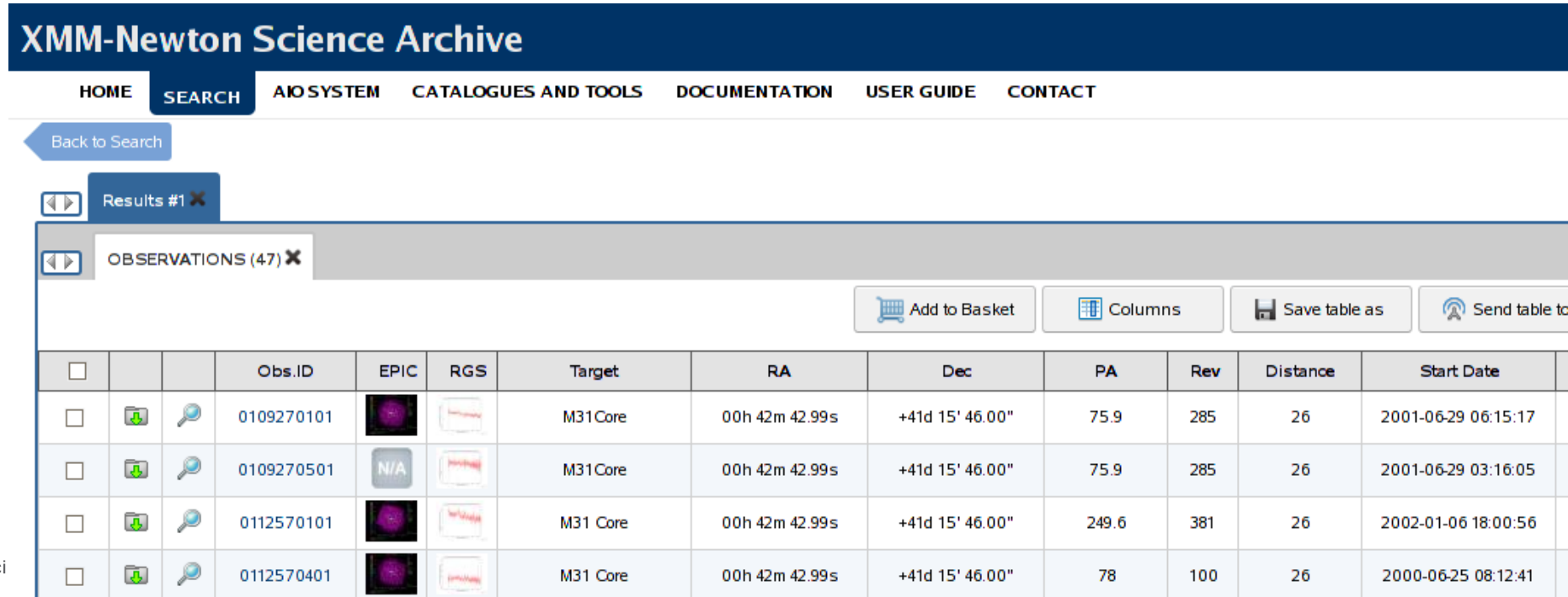




xmm-newton
European Space Agency

Calibration, Data analysis, processing and archive

- Cross-calibration with X-ray instruments of other missions
- Software analysis system (SAS): new releases per year, with changing platforms
- Data processing pipeline, transferred and running
- New archive: requirements prepared as per community needs



Obs.ID	EPIC	RGS	Target	RA	Dec	PA	Rev	Distance	Start Date
0109270101			M31Core	00h 42m 42.99s	+41d 15' 46.00"	75.9	285	26	2001-06-29 06:15:17
0109270501	N/A		M31Core	00h 42m 42.99s	+41d 15' 46.00"	75.9	285	26	2001-06-29 03:16:05
0112570101			M31 Core	00h 42m 42.99s	+41d 15' 46.00"	249.6	381	26	2002-01-06 18:00:56
0112570401			M31 Core	00h 42m 42.99s	+41d 15' 46.00"	78	100	26	2000-06-25 08:12:41

Community Support

- Helpdesk
- Check every proposal & contact PI for science optimization
- Documentation, manuals, reports
- Web
- Image Gallery
- SAS (data analysis) workshops

xmm-newton
European Space Agency

Community Support

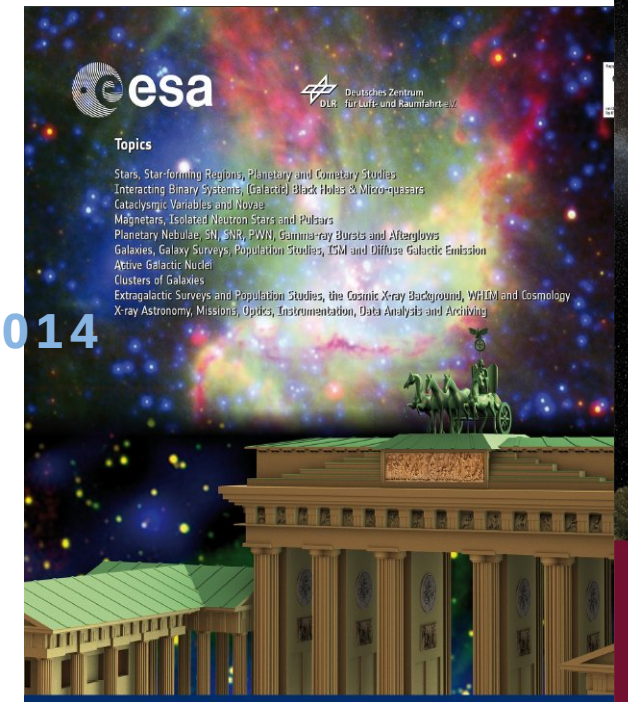
Science Conferences & workshops,

The X-ray Universe 2014

16-19 June, Dublin

Get input via Project Scientist and Users Group

→ Keep contact with community



xmm-newton
European Space Agency

Result

- + 13 years of operations: XMM-Newton remains one of the ESA **flagship missions, ranked very high by advisory committees, keeps interest by scientific community and high productivity indicators:**

  - **Oversubscription** factor in AO12 (October 2012) was 5.9 in time
  - **Number of scientific papers** in refereed journals making direct use of XMM-Newton data remains constant at rate of ~300/yr
  - **Number of astronomers**: proposal PI+CoI, S/W and archive users remains at about 1500, with new people coming in (and going out). Conference attendance over 300 people.