# Writing proposals

Matteo Guainazzi - European Space Agency - Noordwijk (The Netherlands)

[With significant help from Elena Jiménez Bailón, UNAM, Ensenada (Mexico)]

# Observatories

- *Chandra* and XMM-Newton (and INTEGRAL, NuSTAR, *Swift*) are observatories

- Almost the whole observing time is open to the astronomical community

- Time is allocated on the basis of *observational proposals*

- There is typically *one call for proposal per year*:

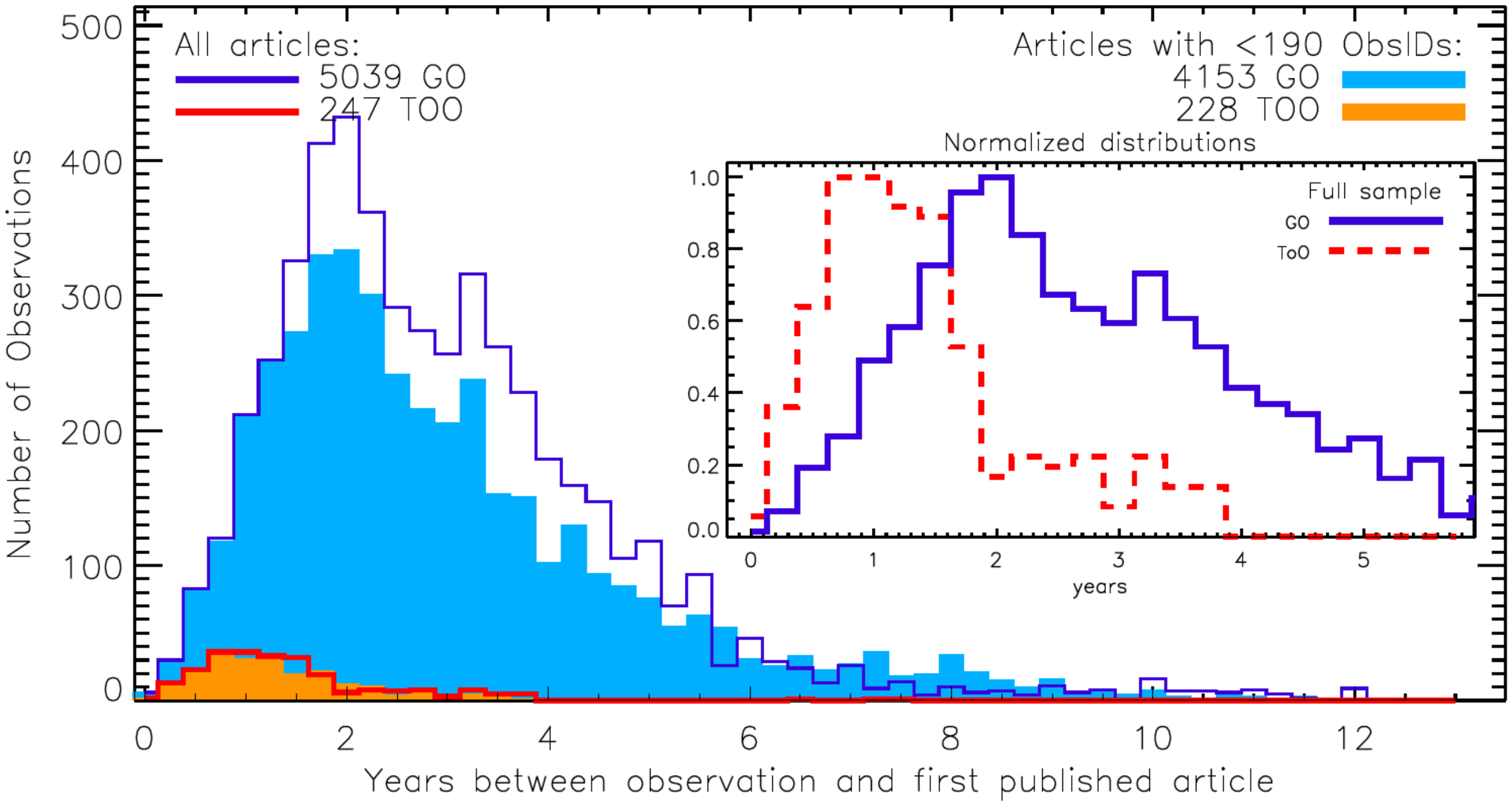
  - Chandra deadline: 14 March 2019

  - XMM-Newton deadline: 11 October 2019

# Many data sit in the archives, unused

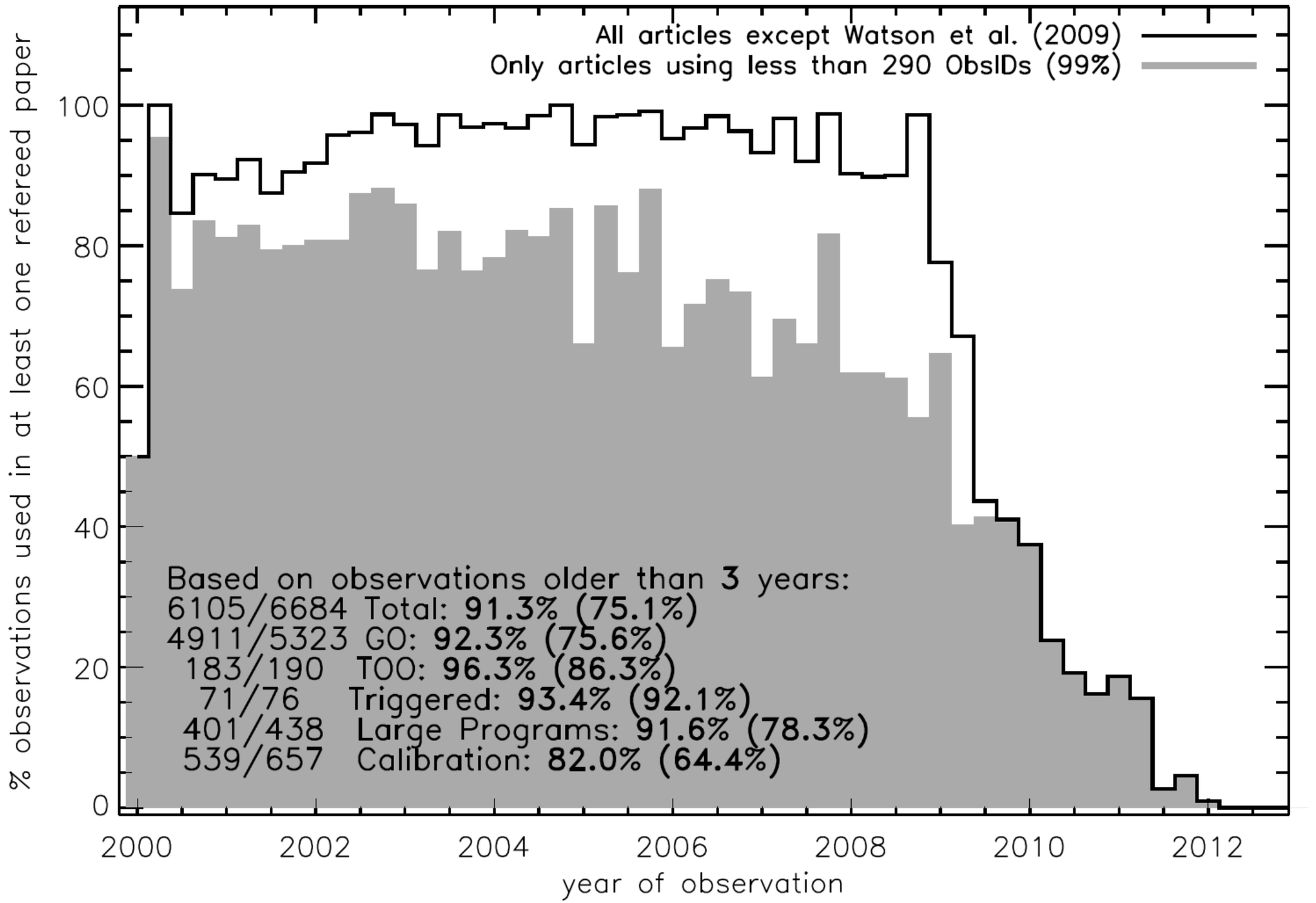
Ness et al., 2014, AN, 335, 210

## Example: XMM-Newton



# Lots of science is hidden in the archives

Ness et al., 2014, AN, 335, 210

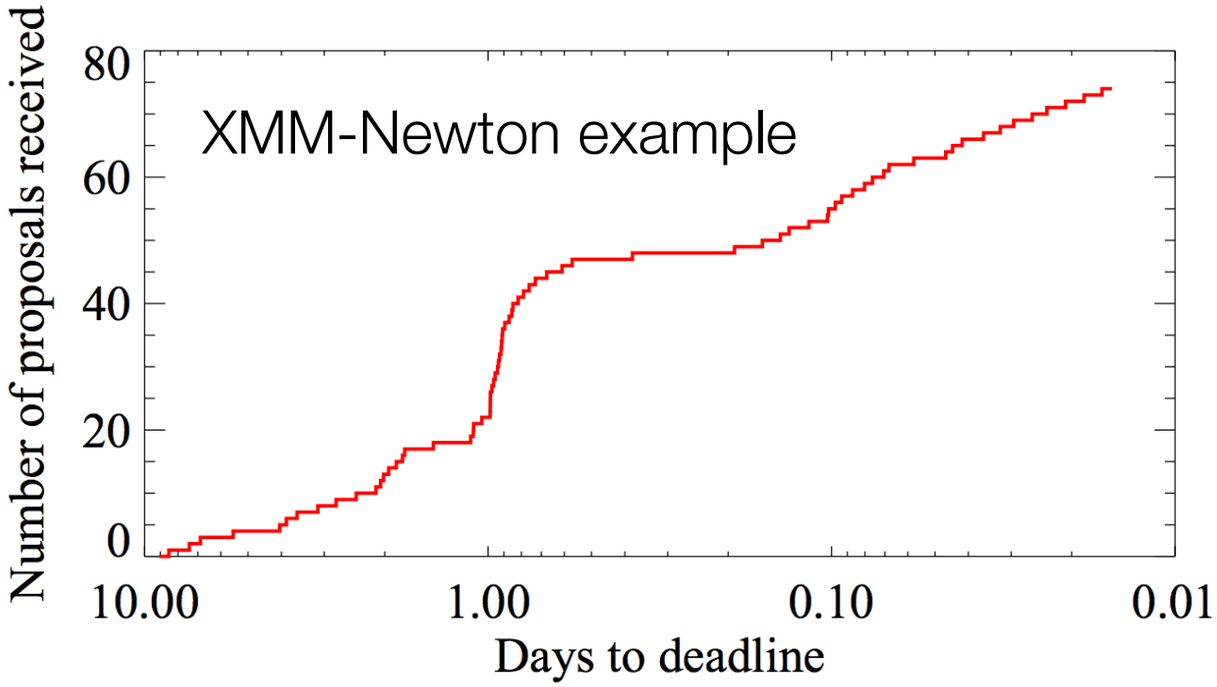


# You have an idea for a new X-ray experiment …

- Define the object/samples
- Check the archives if X-data of these objects are available
  - A good place to start is **`W3Browse`**:
    **`https://heasarc.gsfc.nasa.gov/cgi-bin/W3Browse/w3browse.pl`**
- Even if your object(s) has(ve) been observed, it(they) may be still an interesting target(s) for an additional experiment:
  - Existing data maybe were not taken with the right instrument/configuration
  - Existing data may not have enough signal-to-noise for your science
  - You may be interested in variability studies
- Existing data were probably asked for different scientific goals:
  - Proposal's abstracts are public. Read them!
  - XMM-Newton archive links the paper published with the data. Read them!

# Do not leave things to the last moment!

Don't what most of your colleagues do:




A lot of work has to be done: take your time!

- You have to write a Science justification and run tests/simulations to prove the feasibility of observations
- Proposals are sent via a WWW form
- Ensure that the software and internet connection work well before the deadline
- Agencies will not take into account any problems you may have

# What happens after you submit a proposal

## How is the process of a proposal cycle

- **Agencies start with the "Call of Proposals" few months (3-2) before deadline:**
  + Read it carefully even if it is not the first time you write a proposal
  + Details can change from cycle to cycle

- **Agencies prepare the review panels**
  + Several panellists (6-8) for each topic: AGN (2), X-ray binaries, Clusters of Galaxies, deep fields….
  + Several countries
  + Not all of them X-ray astronomers

- **Days after the deadline, agencies perform the formal checks on proposals**
  + Number of pages
  + Several proposals with the same object
  + Checks on the feasibility: observable object,

- **Agencies send proposals with an specific subject area to the proper review panel**

# What happens after you submit a proposal

## How is the process of a proposal cycle

- **Members of panels review "at home" the proposals**
  + Between 50 and 70 proposals should be read by each member
  + Around for 10 of them, each member of the panel is primary or secondary reviewer
  + These two reviewers will read carefully the proposals, the rest also but will not enter in details.

- **General grades are given to the proposals**
  + Informations is combined and sent to the members of the panel.

- **Typically two days meetings are arranged to discuss the proposals**
  + TRIAGE: One quarter of the proposal with the lowest grades are not discussed
  + Some exceptions

- **Primary and secondary reviewers present the proposals, followed by a brief discussion by the panel (15-20 min)**

# What happens after you submit a proposal

## How is the process of a proposal cycle

- **Proposals are grade again after the discussion**
- **Write up feedbacks** (not always useful)
- **The final list of prioritised proposals is sent to the next panel composed by the chair of each sub-panel**
- **Large and key programs, remove duplicates, boundary cases…**
- **Final decisions are made taking into account all proposals and the available observing time**
- **Remember that only 1 out of 3-6 proposals are allocated so the main job of the panel members are rejecting proposals**

# How to write a proposal - Step I: check visibility

Several tools are available to check the visibility of your target(s):

- General purpose: **`viewing`**
  `https://heasarc.gsfc.nasa.gov/cgi-bin/Tools/viewing/viewing.pl`

- *Chandra*:
  - CIAO task **`ObsVis`** (visualisation of sky images)
  - **`ProVis`** (to check roll angle constraints, useful for grating observations)
    **`http://cxc.harvard.edu/proposer/threads/provis/`**

- XMM-Newton: **`vischeck`**
  `http://xmm2.esac.esa.int/external/xmm_sched/vischeck/index.php`

# How to prepare a proposal - Step II: define science

## Good scientific case

- Science is new
- The results answer an important question for astronomy
- the proposed experiment can not be done (so well) with other telescopes/instruments

## Good feasibility

- The object(s) is(are) observable
- The requested time is the adequate for you science.

You have to convince your fellow colleagues in the panel
Your proposal must demonstrate these points

Have clear in your mind how to address these points before you start writing your observational proposal

# How to write a scientific justification

- **Abstract of the proposal**
  + Clear, concrete, easy to read and include all the important facts of the proposal:
    objective, instruments requested, joint observation, exposures…
    SOME PANELLISTS ONLY READ THAT

- **Topic of your Proposal**
  + Why is your SCIENCE important?
  + What is the big picture?
  + What are the open questions in your topic?
  + Remember that not all panel members are X-ray astronomers

- **Scientific justifications**
  + Why is your OBSERVATION important?
  + Which are your concrete objectives?
  + How and why the targets were selected?
  + What would you get if the observation succeeds or fails ?

- **Probe the observation is doable**
    + Calculate exposure needed, expected count rates, imaging resolution…
    + Simulations of your observations are a MUST!

http://heasarc.gsfc.nasa.gov/cgi-bin/Tools/w3pimms/w3pimms.pl

# Simulation tools: WebPIMMS

- Predicts count rates assuming very simple phenomenological models (power-law, thermal bremsstrahlung, APEC, blackbody)
- Rough pile-up estimator
- Advisable only if you want to proof that your source is detectable
- Insufficient for most of the interesting science cases

**WebPIMMS** HELP

A Mission Count Rate Simulator
Powered by PIMMS v4.8d

Access the multiple component model interface.

| Convert From: | Into: |
|---|---|
| Flux | ASCA |

Examples of Common FLUX Input/Output Ranges

| | | |
|---|---|---|
| Input Energy Range (low-high): default | keV / Angstroms | Units |
| Output Energy Range (low-high): default | keV / Angstroms | Units |

| Source Flux / Count Rate: | (erg/cm²/s) / (counts/s) |
|---|---|

| Galactic nH | Redshift | Intrinsic nH |
|---|---|---|
| (cm$^{-2}$) | none | none (cm$^{-2}$) |

| Model of Source: | Model Parameters |
|---|---|
| Power Law | Photon Index: |
| Black Body | keV: |
| Therm. Bremss. | kT: |
| APEC | 1.0 Solar Abundance / LogT \| keV |

Estimate Count Rate | Reset

**Note: The following parameter is mission-specific.**

| | |
|---|---|
| **CHANDRA:** | Frame time (s) CHANDRA ACIS pile-up calculation only |

# Spectral simulations

Courtesy N.Loiseau, ESAC

## Example from a successful proposal:

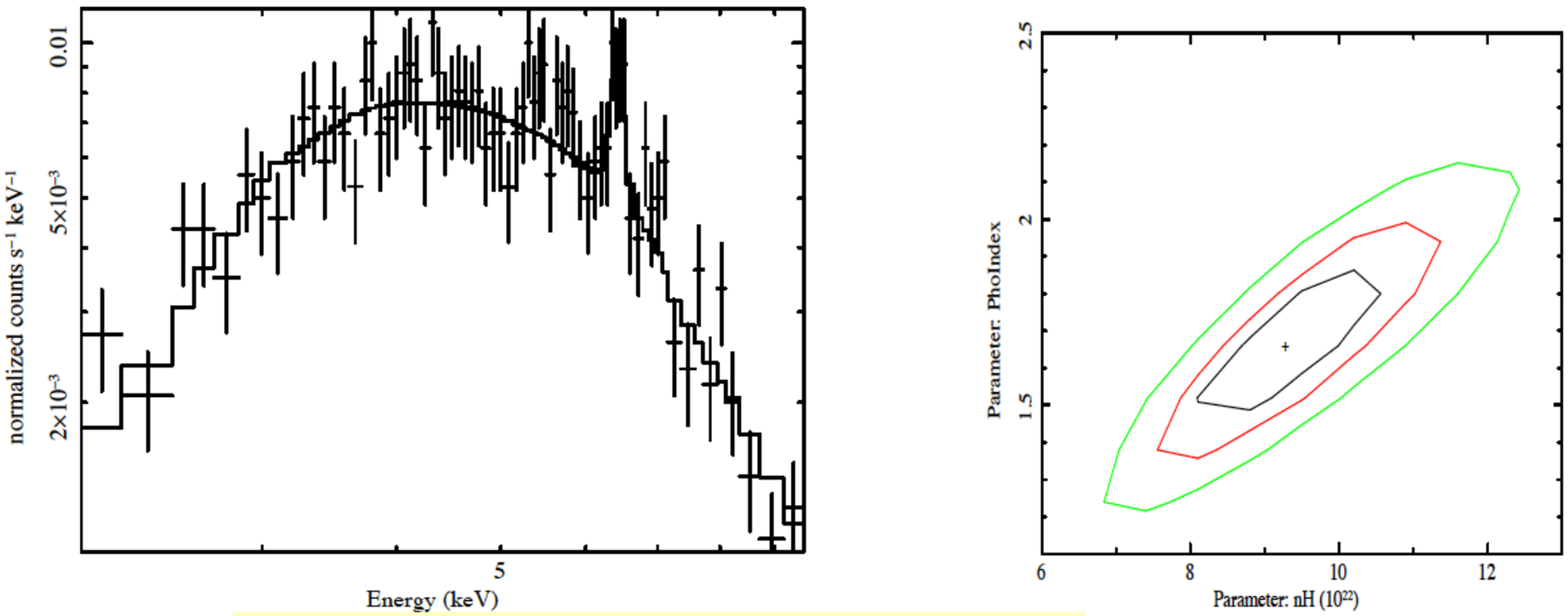



Figure 3: *Left panel*: Expected EPIC-pn spectrum of ESO 291- G 022 assuming an absorbed, NH = $10^{23}$ $cm^{-2}$, power law $\Gamma = 1.8$ for an exposure of 40 ks. *Right panel*: iso-$\chi^2$ contours of $\Gamma$ and NH for the same object.

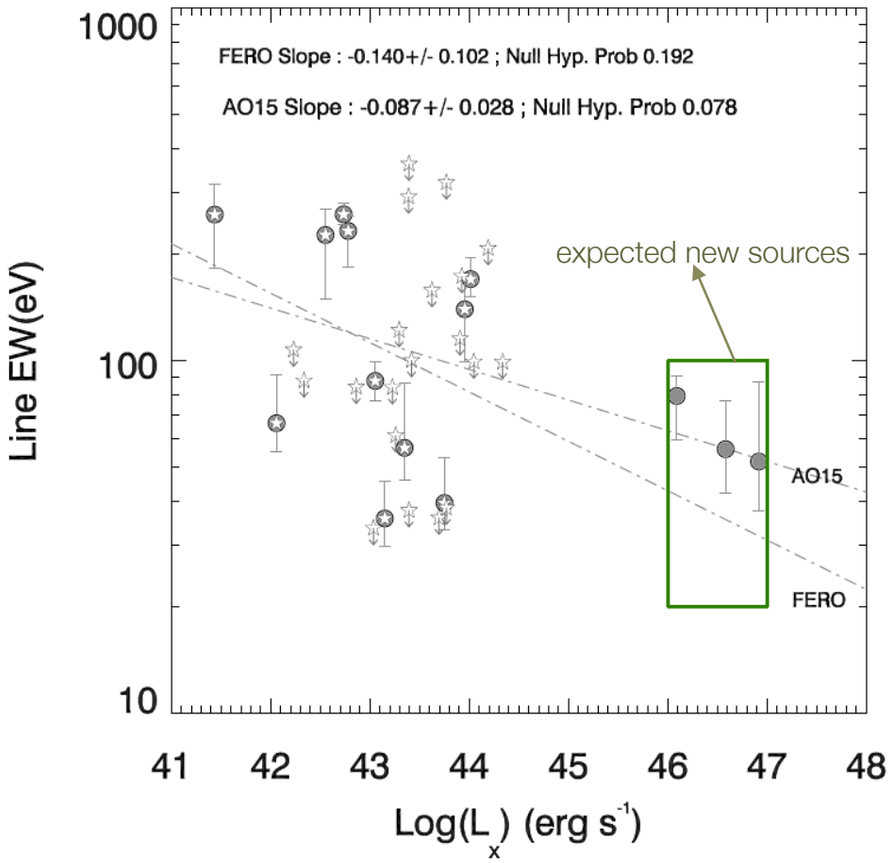
All spectral packages allow you to simulate spectra, using any of the models in their spectral libraries (e.g., **`fakeit`** in XSPEC)

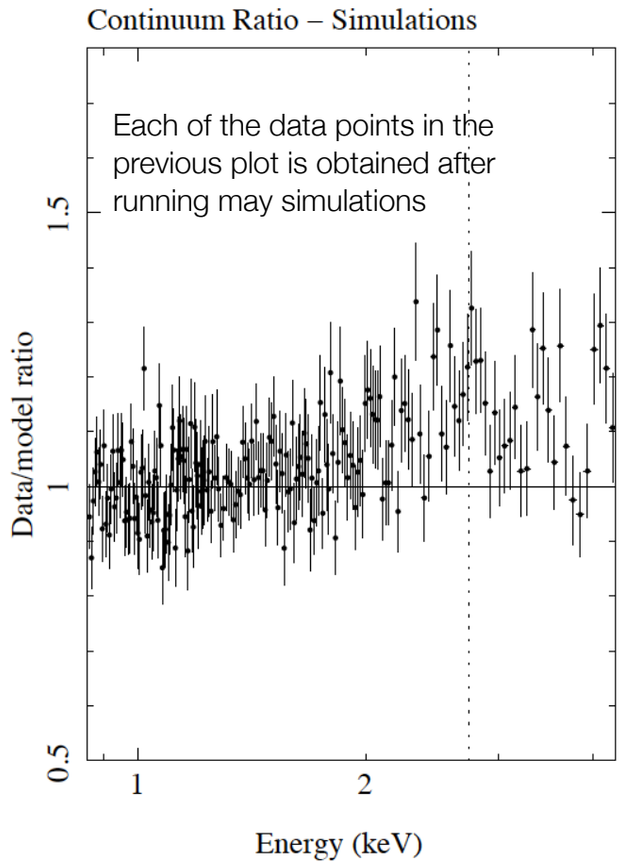
Use them to simulate the results of your experiment

# Spectral simulations

Courtesy i. de la Calle, ESAC

## Example from an unsuccessful proposal:



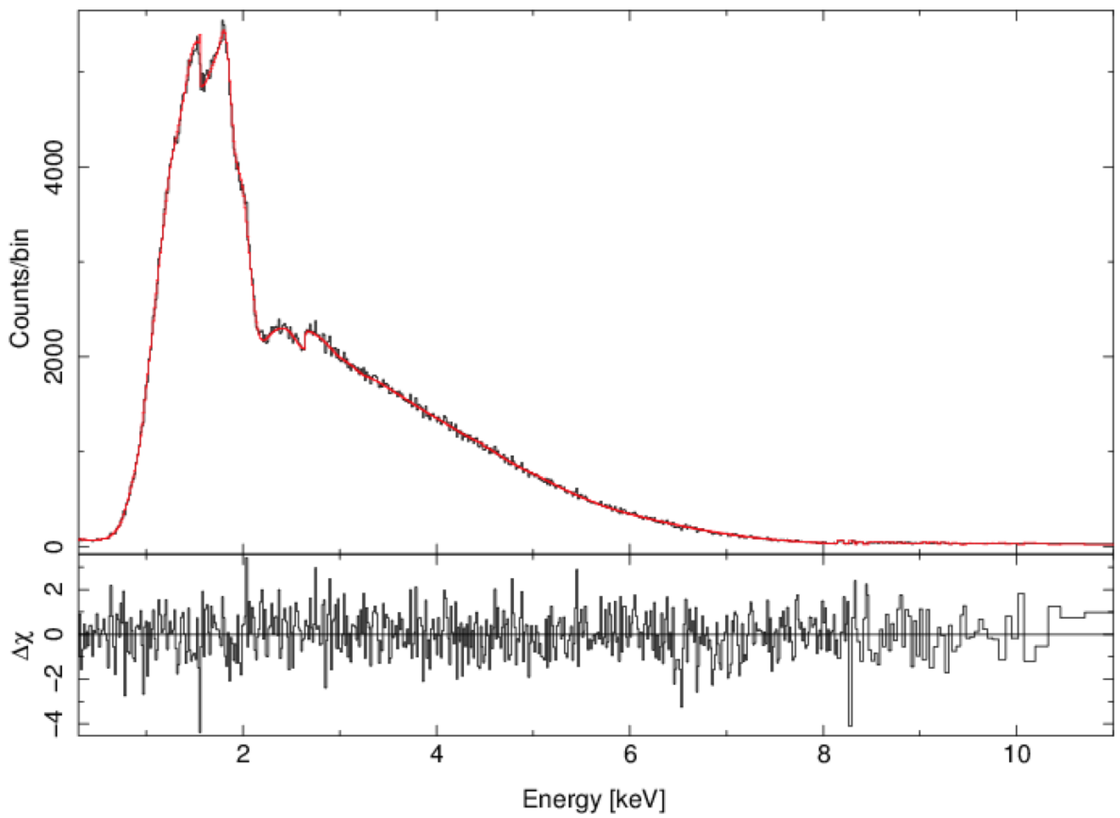

All spectral packages allow you to simulate spectra, using any of the models in their spectral libraries (e.g., **`fakeit`** in XSPEC)

Run as many as needed - and put your simulations in context

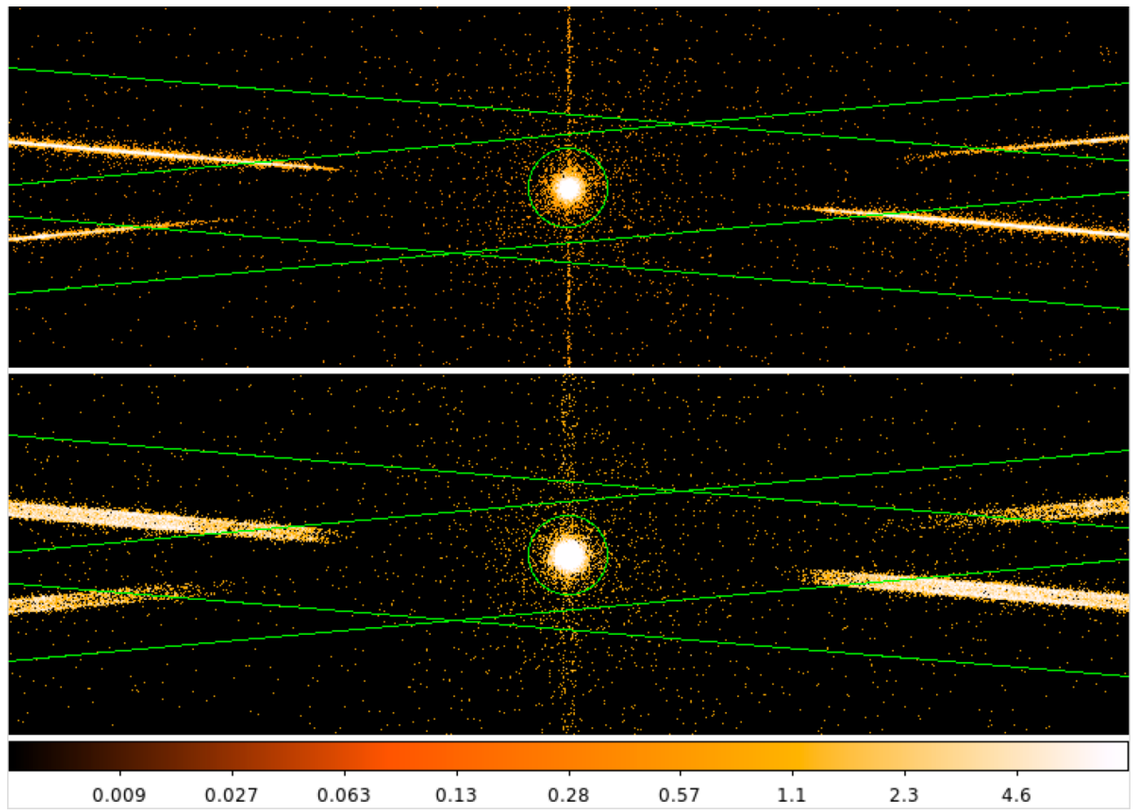
# The ultimate resource for the expert simulator

`MARX` home page: `http://space.mit.edu/CXC/MARX/index.html`

**`MARX`** is a full ray-tracing simulator, to create event lists of any Chandra instrument/grating combination for a source of any possible shape and spectrum




Simulation of an ACIS source affected by pile-up




Simulation of a HETG point-like vs.extended source

# If you fail …

- … do not despair! "Oversubscription factors" (submitted/ accepted proposal ratio) are usually very large - hard to get time!

- You will receive feed-back from the panel. Not always very useful, but occasionally it may help you understand the areas for improvement

- Decisions depends on the panel members - and they human beings! Another panel may have different views next time, try again!