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# The Survey Science Centre report to the XMM-Newton Users Group

Natalie Webb

# Topics

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- SSC and XMM2ATHENA activities
- 4XMM-DR12(s) (and DR13)
- Selected activities in detail
- XMM2ATHENA project update
- Future catalogues and products
- Summary



- Regular teleconferences with 8 SSC & XMM2ATHENA points of contact
- Continued SAS task development + support
- Continued data products screening
- Ongoing source identification activities (machine learning, ...)
- Enhancement of catalogue servers
- New version of the FLIX sensitivity estimator, including latest 4XMM data
- Updating XMM-SSC and XMM2ATHENA webpages
- Continued input into SAS and pipeline development via monthly SAS-CCB and SASWG meetings
- Fitting of all spectra & identifying long and short term variability
- Systematic exploitation of OM data (with X-ray sources)
- Test version of new stacked catalogue
- Outreach projects
- Release of 4XMM-DR12 & 4XMM-DR12s, 28<sup>th</sup> July 2022

XMM2ATHENA

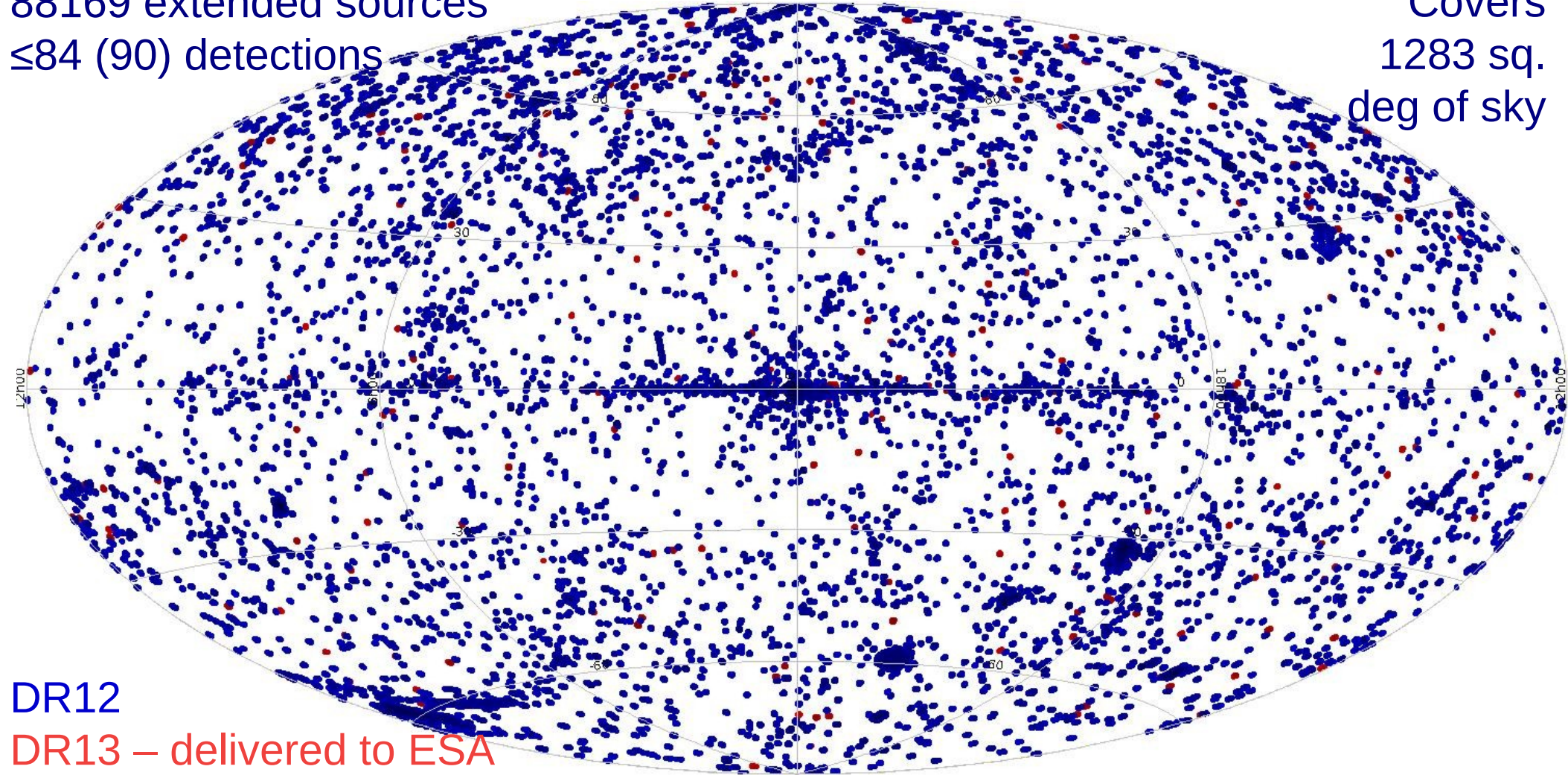


# 4XMM-DR12 (13)



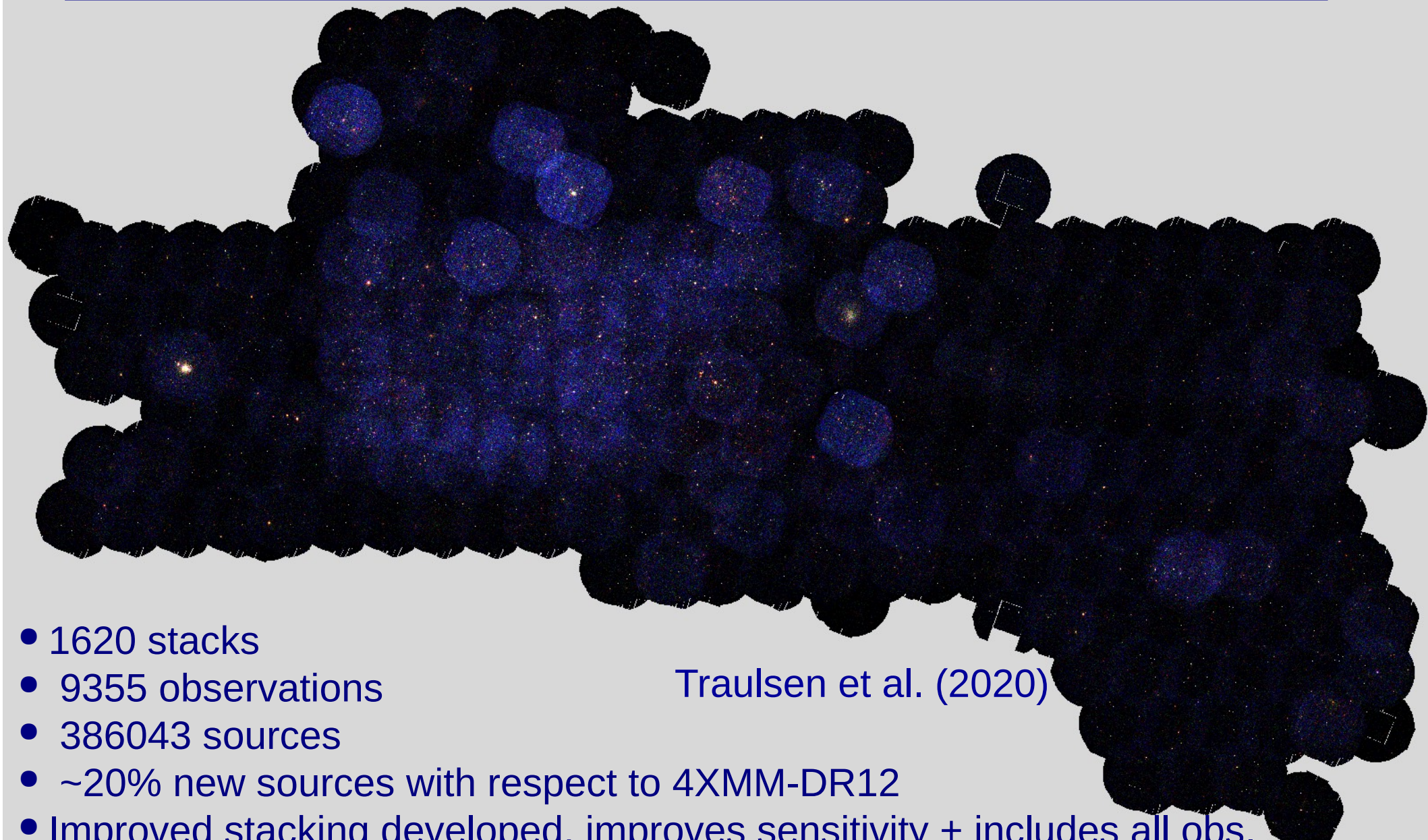
DR12: 939270 detections (+44678 DR13), 630347 unique sources (+26650)  
336776 (36%) sources with spectra & lightcurves      Release: 28<sup>th</sup> July 2022  
88169 extended sources  
≤84 (90) detections

Covers  
1283 sq.  
deg of sky



DR12  
DR13 – delivered to ESA





- 1620 stacks
- 9355 observations
- 386043 sources
- ~20% new sources with respect to 4XMM-DR12
- Improved stacking developed, improves sensitivity + includes all obs.

Traulsen et al. (2020)

# Slew catalogue

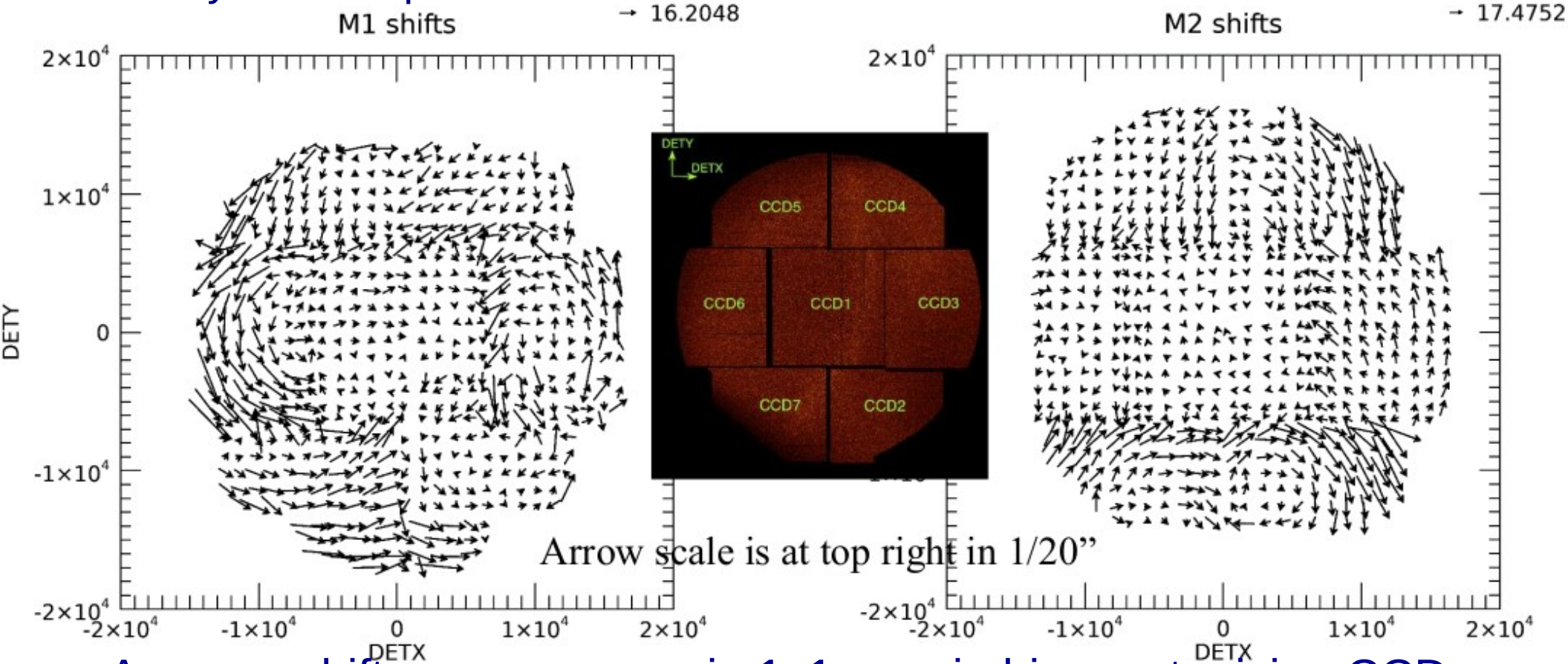
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Endorsement 2022-05-17/14:

- Slew catalogue previously produced by SOC, passed to SSC
- Code received and improved
- Support visit from Richard Saxton (November 2022)
- Data retrieved for next version of catalogue
- Plan to release catalogue later this year
- Subsequent versions to be released with the detection/source catalogue(s)

# Astrometry

- Small systematic position shifts identified for some MOS CCDs



Average shifts over sources in 1x1 arcmin bins, not mixing CCDs

- Work done to understand shifts and improved calibration to be provided
- Expected to be inserted into CCFs
- Can improve some positions up to almost 1"



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°101004168

# Flix – sensitivity estimator



- Fortran code rewritten to solve bugs, improve performance, facilitate maintenance
- Data reorganised on server
- Processing time halved
- No further time-outs
- Now accepts large requests via files

XMM-NEWTON SURVEY SCIENCE CENTRE

## FLIX

Sensitivity Estimator

Enter coordinates to estimate sensitivity **CALCULATE**

Supported coordinates format: 12h34m56.2s -08d24m20.6s  
12:34:56.2 -08:24:20.6  
12.345 -13.678 **Settings**

Or upload a file with a list of coordinates **File format**

Choose file No file chosen **UPLOAD**

HOME WEB SERVICES DOCS LINKS ABOUT

23h57m14.928s 56d43m38.3016s **CALCULATE** **Settings**

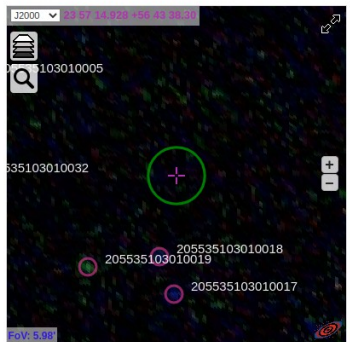
HOME WEB SERVICES DOCS LINKS ABOUT

### NEWS

**03** Apr 2023  
New version of FLIX available! Changes include:  
• performance improvements (processing time divided by 2)

### WEBSITE OVERVIEW

This website provides experimental access sensitivity estimator for XMM-Newton data by the XMM-Newton Survey Science Centre is based on XMM Data Release 17 data



Query coordinates: 23h57m14.928s +56d43m38.3016s

Detection maximum likelihood threshold: 10

Radius of circle for flux estimation: 30"

Nearest sources in XMM catalogue:

- 205535103010018 (88.12")
- 205535103010017 (125.83")
- 205535103010019 (135.14")
- 205535103010032 (224.88")
- 205535103010005 (234.0")
- 205535103010012 (245.67")

Average detection threshold - band 8: 1.9e-14 erg/cm2/s

Average encircled flux - band 8: 5.4e-14 erg/cm2/s

Observations of this field at different epochs Download full results as: FITS

Obsid	Date Obs	Axis Offset (arcmin)	Instrument	Filter	Exposure (sec)	Detection Threshold - band 8 (erg/cm2/s)	Encircled Flux - band 8 (erg/cm2/s)
0553510301	2008-06-21	0.0	M1	Medium	11968	2.12e-14	8.13e-14 ± 1.36e-14
			M2	Medium	18112	1.98e-14	5.59e-14 ± 1.14e-14 <a href="#">More bands</a>
			PN	Medium	4752	1.57e-14	2.46e-14 ± 8.33e-15

<http://flix.irap.omp.eu/>



XMM-Newton Users Group  
10-11th May 2023, ESAC  
Natalie Webb, IRAP, Toulouse

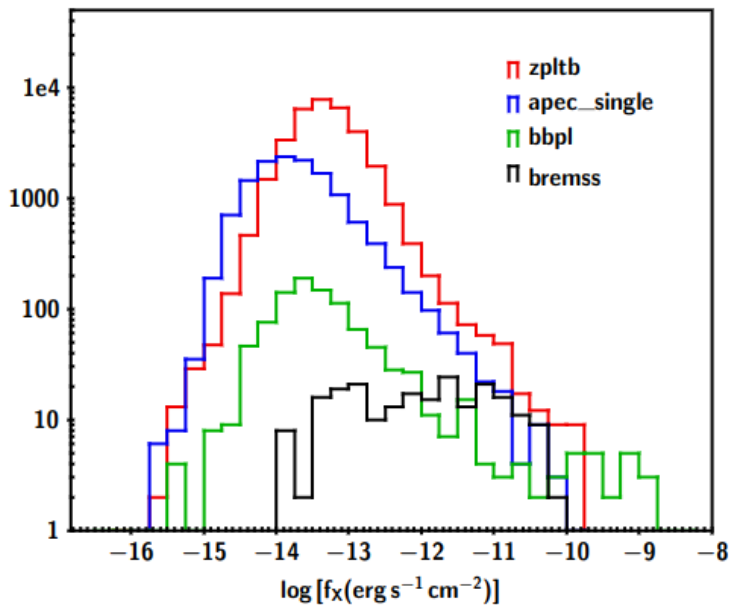
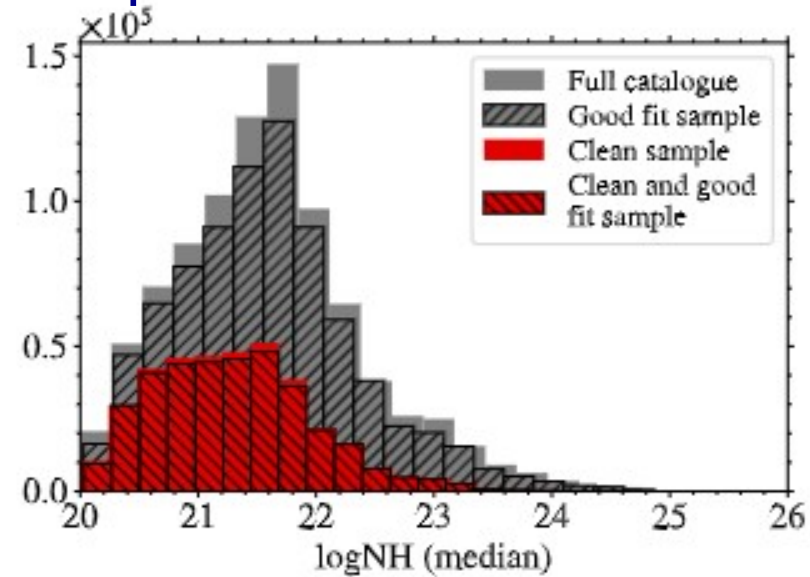
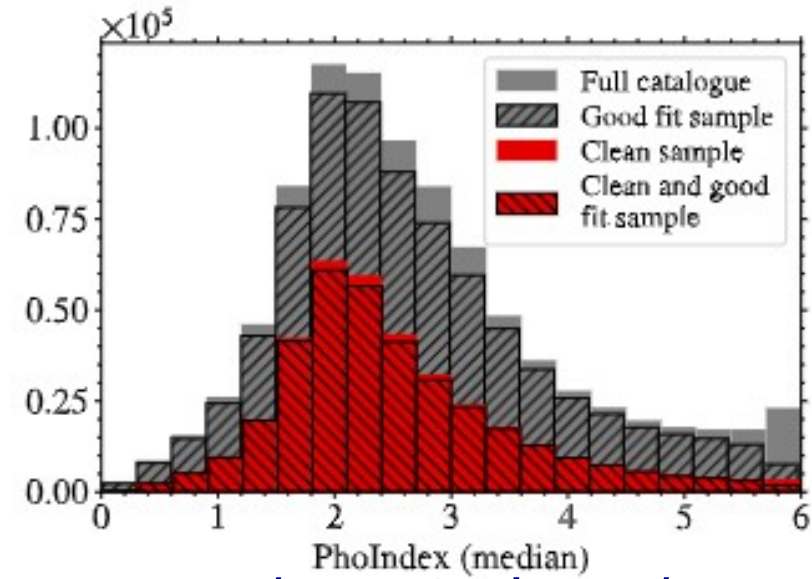




# Spectral fitting



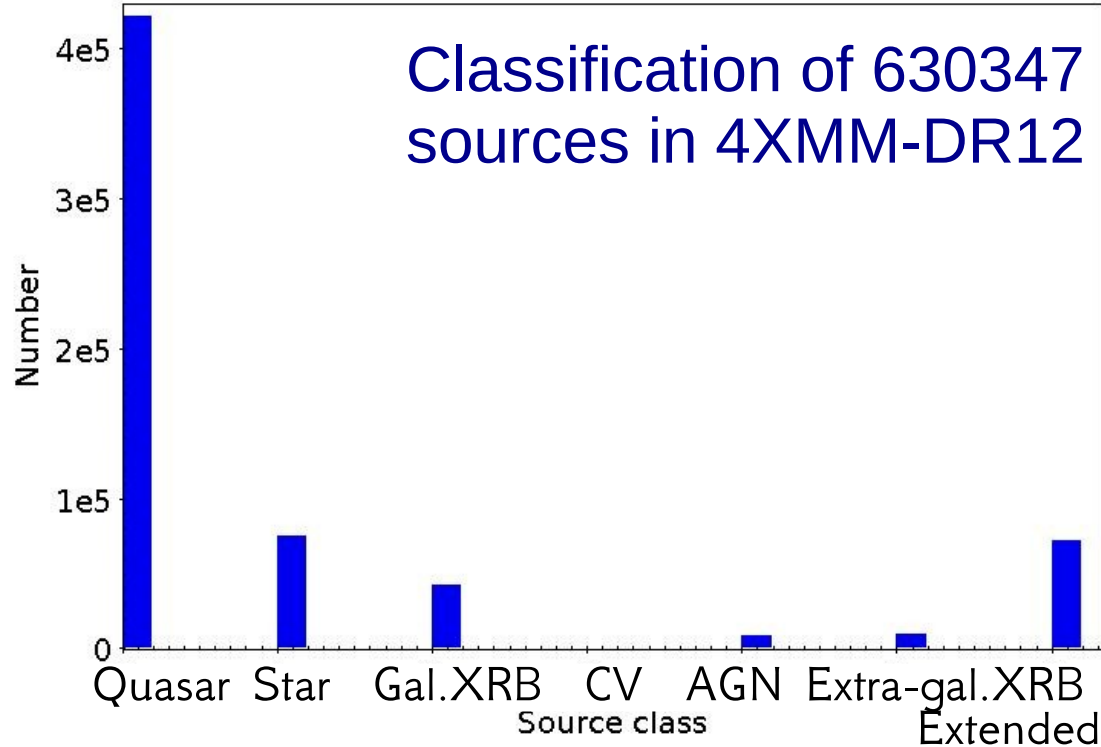
- Bayesian fitting (BXA, Buchner+14)
- Simple fit to all extracted spectra
- Fit to stacked spectra
- Fit to all sources, even without extracted spectra
- Classified sources with photometric redshifts: physically motivated fits
- All catalogues available: <http://xmm-ssc.irap.omp.eu/xmm2athena/>



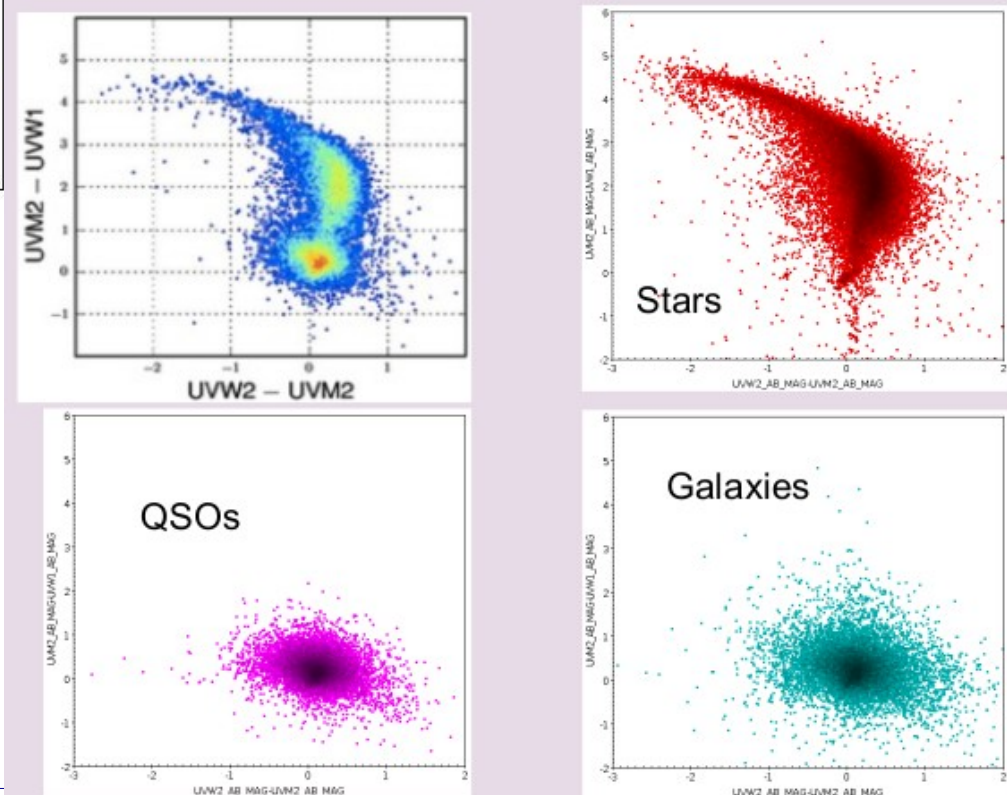
Class	Model name
AGNs	redshifted powerlaw
Stars	one-temperature apec
XRBs	blackbody powerlaw
CVs	bremsstrahlung



# Classifications



## Classification of OM sources



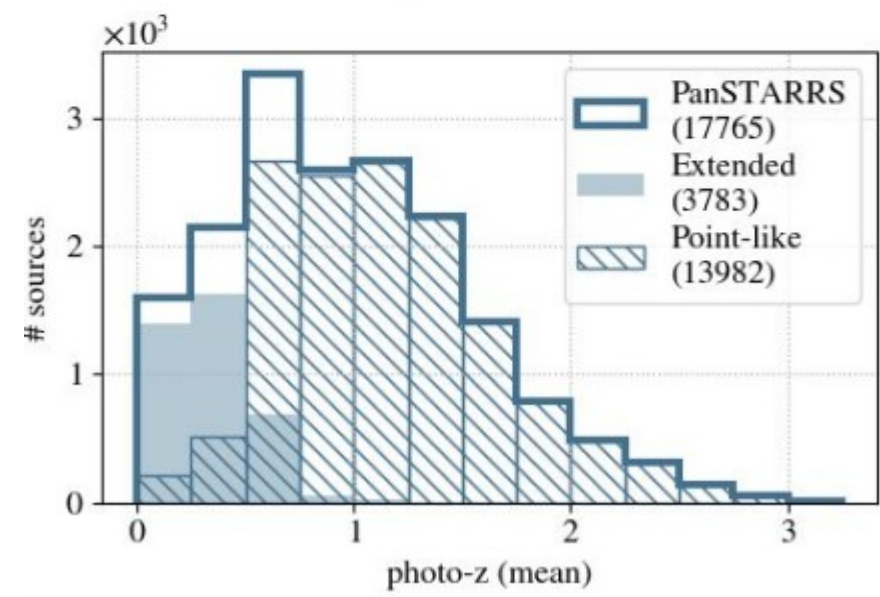
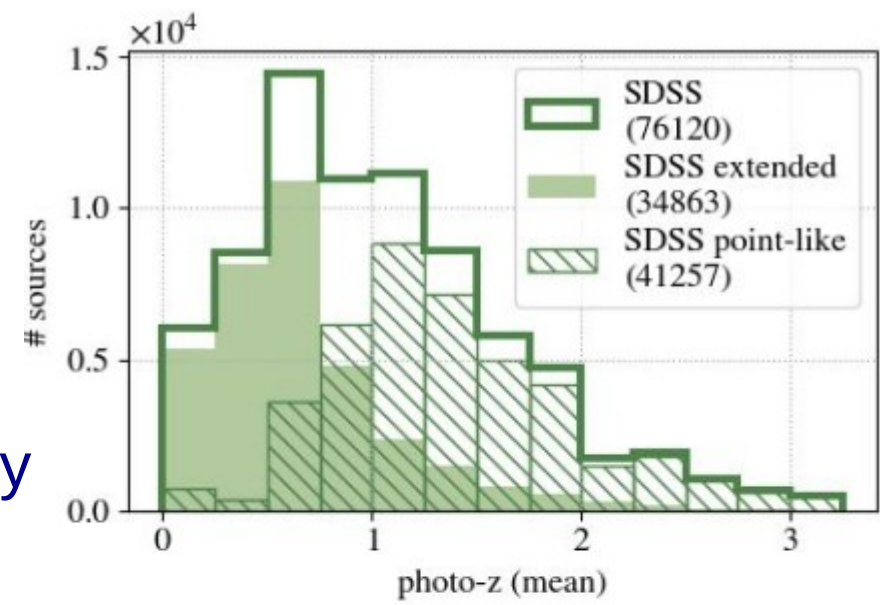
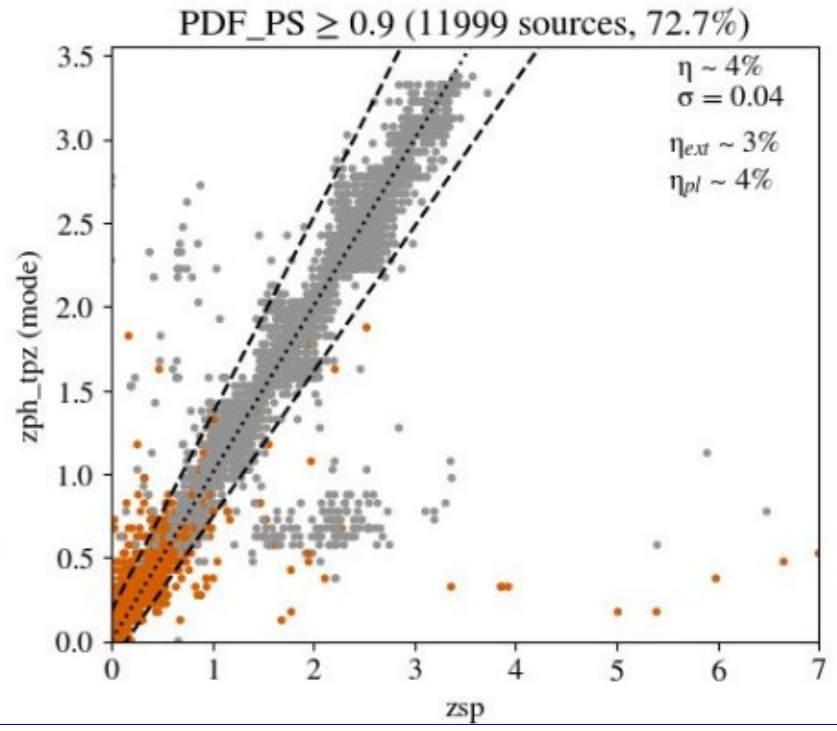
Tranin et al. (2022, 2023)



# Photometric redshifts



- Pipeline put into place for the photometric redshift based on MLZ-TPZ (Carrasco Kind & Brunner, 2013)
- Matching done at the CDS
- SDSS, PanSTARRS & DES photometry
- Compared to redshifts from spectroscopy





## Long term transients :

- Code developed to find long term transients
- Uses 6 additional X-ray catalogues+XMM upper limits
- 0.5 long-term transients (> factor 5) detected per day
- Majority are unknown sources
- Of known objects, the majority are from galaxy centres (TDEs, Changing look, etc)



## Short term transients

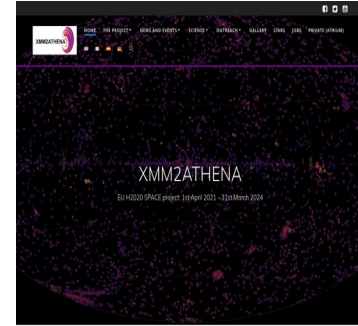
- Code developed to find very rapid transients
- Well adapted to finding variability in sources where no lightcurve extracted (thus no variability evaluation)
- 7529 previously detected sources now shown to be variable
- A quarter are known sources in Simbad
- A few tens of new sources discovered (neutron star candidates, stars, ...)



# Outreach



- Communication through the webpage and social media <http://xmm-ssc.irap.omp.eu/xmm2athena>
- Many talks at local, national and international level
- Numerous outreach activities in different participant's countries
- Papers published
- Many followers on social media  
- ~80 % increase (w.r.t. before the project) in citations to catalogue papers
- Maintained increase in access to our catalogue servers seen in first year





# Summary



- ◆ Continued SAS task development + support
- ◆ Continued data products screening
- ◆ Ongoing source identification activities
- ◆ Enhanced catalogue servers helping to disseminate data products
- ◆ 4XMM-DR12(s) released in July 2022, DR13(s) for this Summer
- ◆ Enhanced pile-up diagnostic for extended sources in DR13
- ◆ Upcoming improvements to astrometry
- ◆ Systematic spectral fitting
- ◆ Many new short and long-term transients
- ◆ Systematic exploitation of OM data with EPIC data
- ◆ Many more new products with XMM2ATHENA
- ◆ 5XMM expected for ~2025
- ◆ Continue to provide XMM-Newton legacy products
- ◆ Raising the profile of XMM-Newton

# Working together to improve XMM-Newton products

