(EPIC) Source Detection & Catalogues

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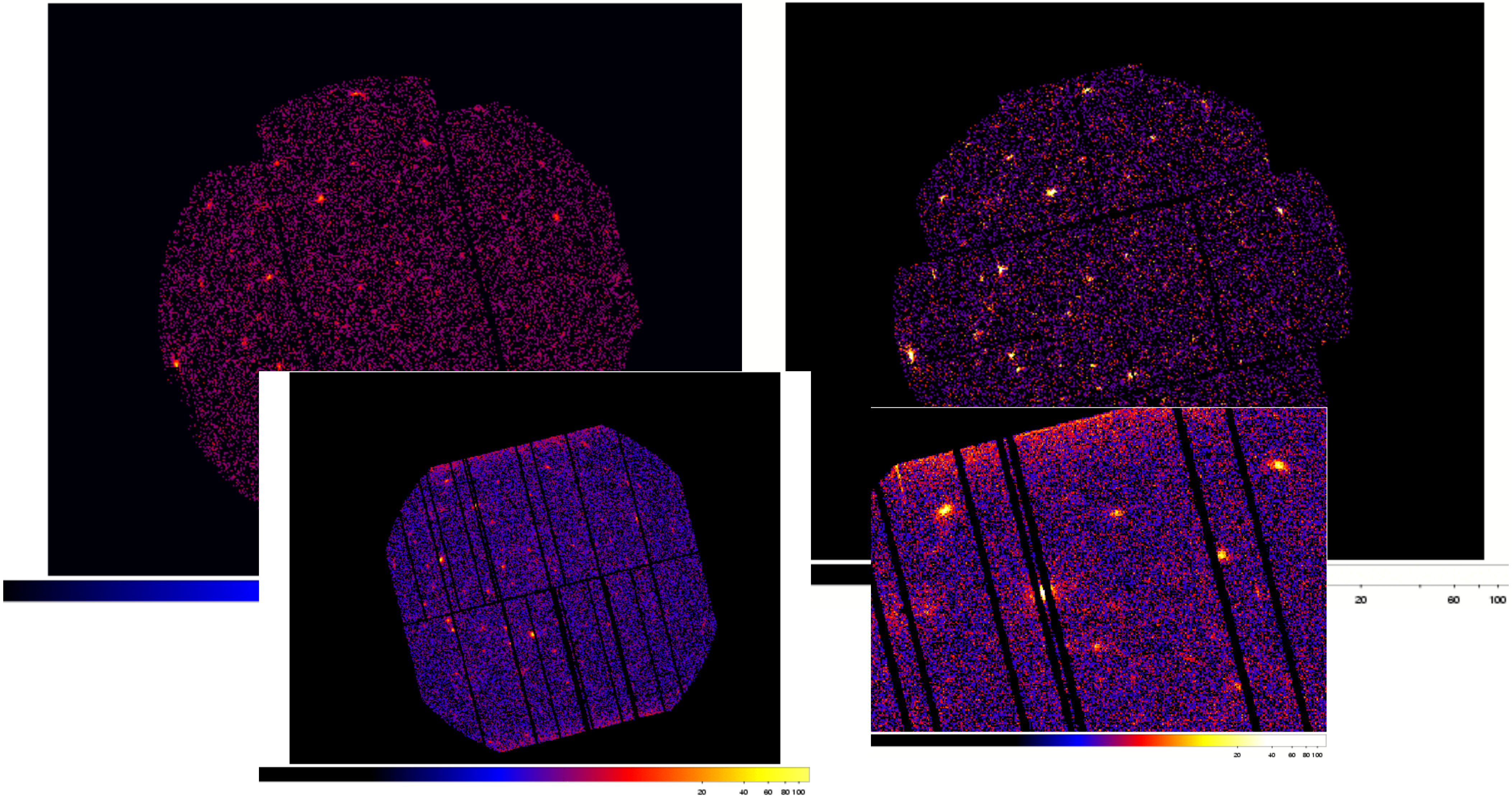
(with main contributions from G. Lamer, AIP, and A. Read, UoL + SSC)

In the beginning there are images

Image production from events lists = collapsing events onto X-Y plane



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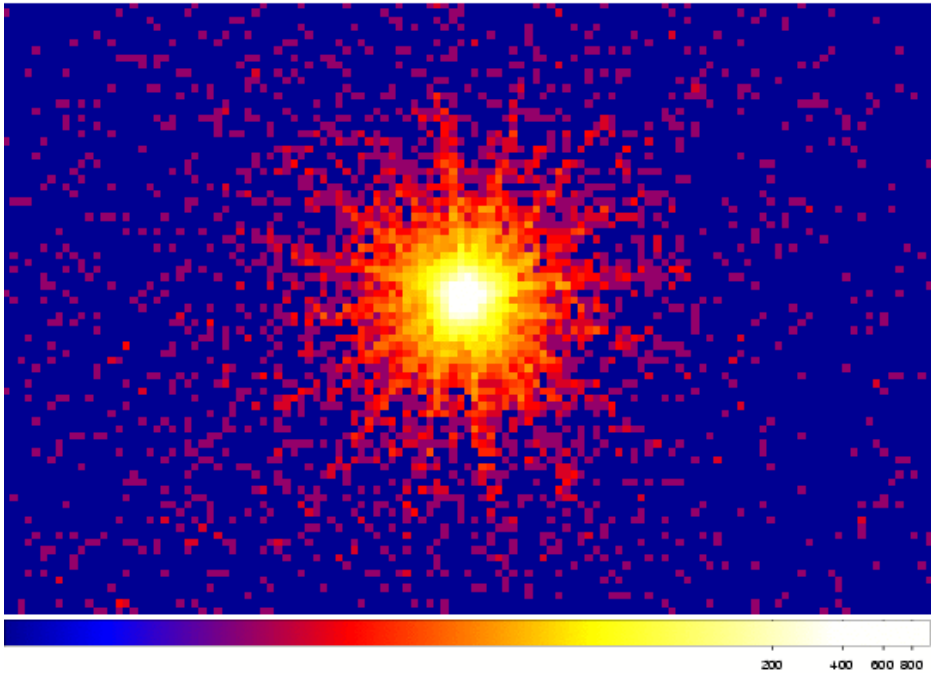
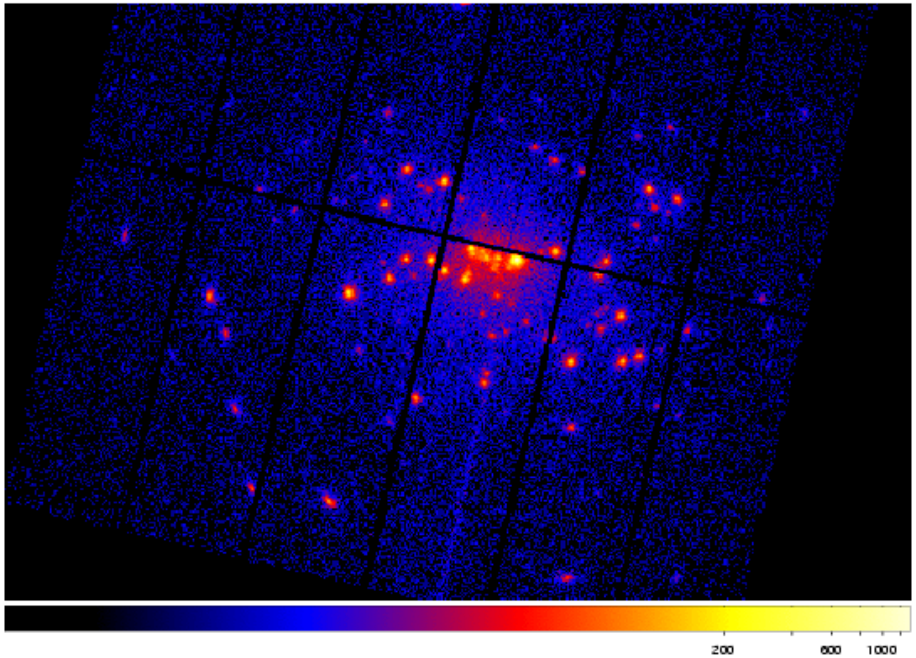




Source searching

>> source searching means basically looking for
* **significant fluctuations,** which are
* **compatible with sky sources**,
* lying on top of *more* or *less* **smooth distributions**,
* avoiding to get *fooled* by **detection defects**

>> goal:

to **maximize** source detection sensitivity
minimizing number of fake detections

SAS source searching: preparatory steps

Looking for (small) fluctuations on top of distributions

>> **maximization of S/N ratio** for sources to be found

... cleaning calibrated event lists against flaring periods

>> produce high energy background lightcurves

+ define a threshold + produce GTIs

... taking into account the different source spectral characteristics

>> apply **band-passes** for deriving corresponding **images**

Source searching: preparatory steps

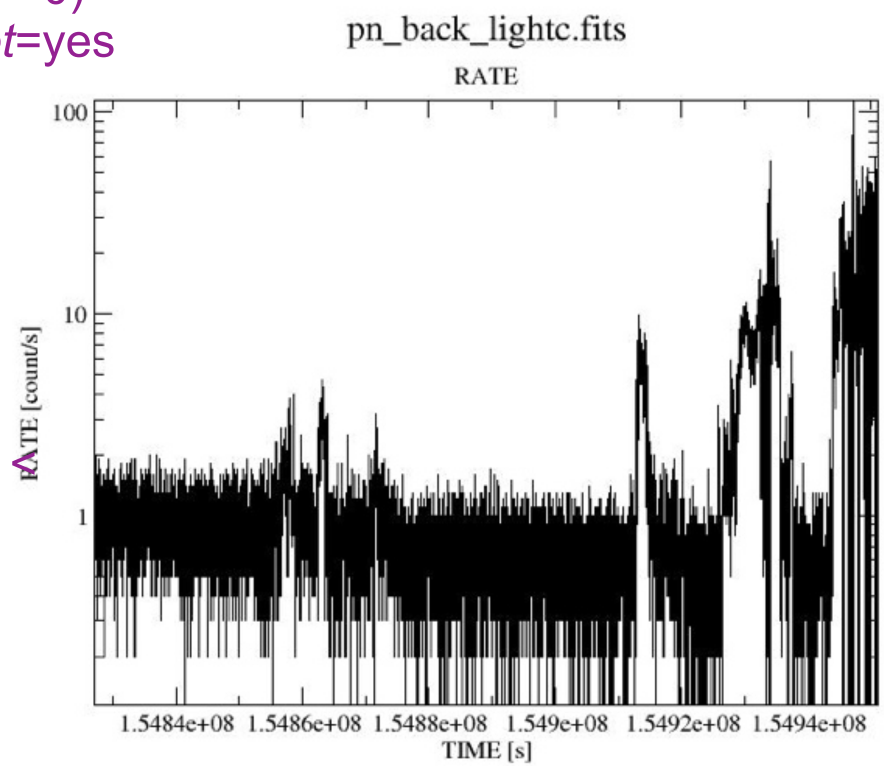
esa

>> produce high energy background lightcurves

evselect *table*=PNevt:EVENTS
expression='#XMMEA_EP&&(PI>10000)&&(PATTERN==0)'
rateset=**pn_back_lightc.fits** *timebinsize*=10 *withrateset*=yes
maketimecolumn=yes *makeratecolumn*=yes

+ define a threshold

dsplot *table*=pn_back_lightc.fits *x*=TIME *y*=RATE &



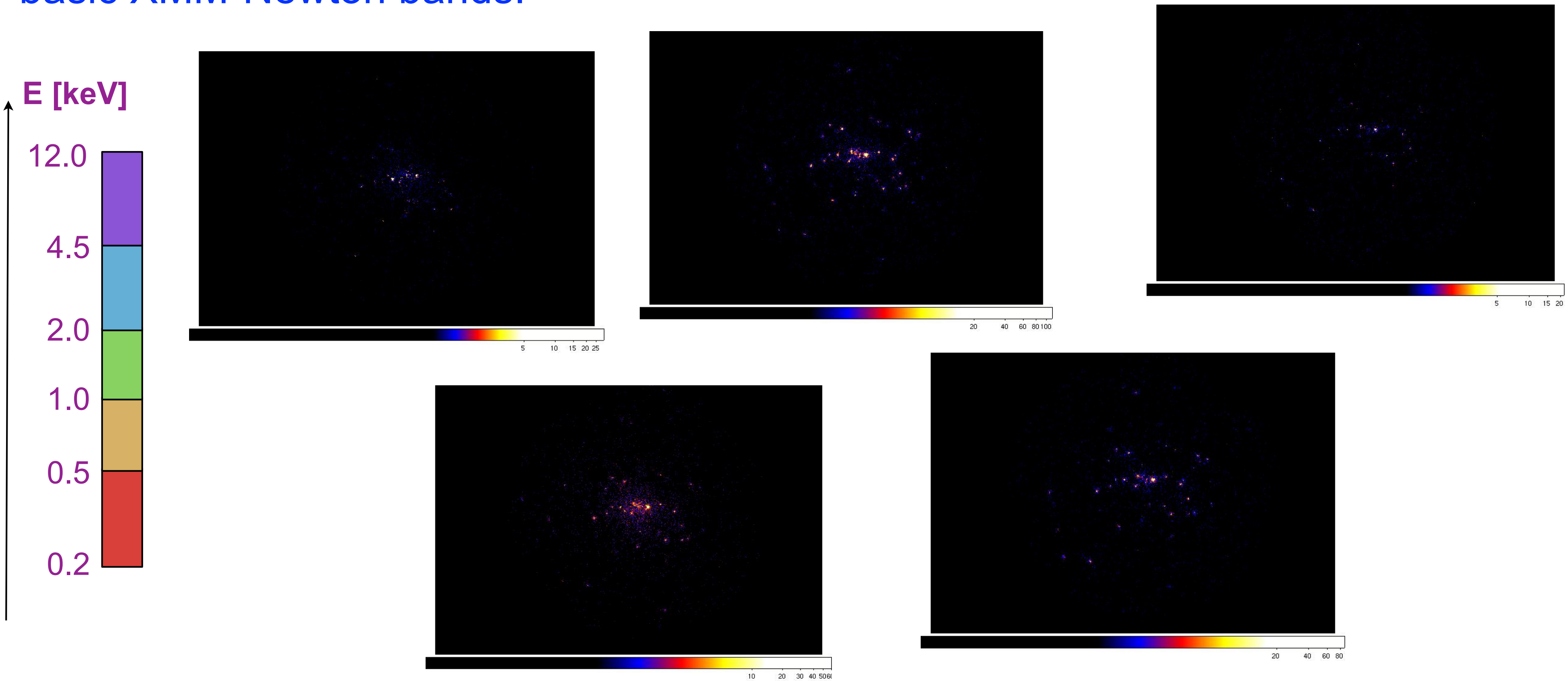
+ produce GTIs

tabgtigen *table*=pn_back_lightc.fits *expression*="RATE <
1.50" *gtiset*=**pn_back_gti.fits**

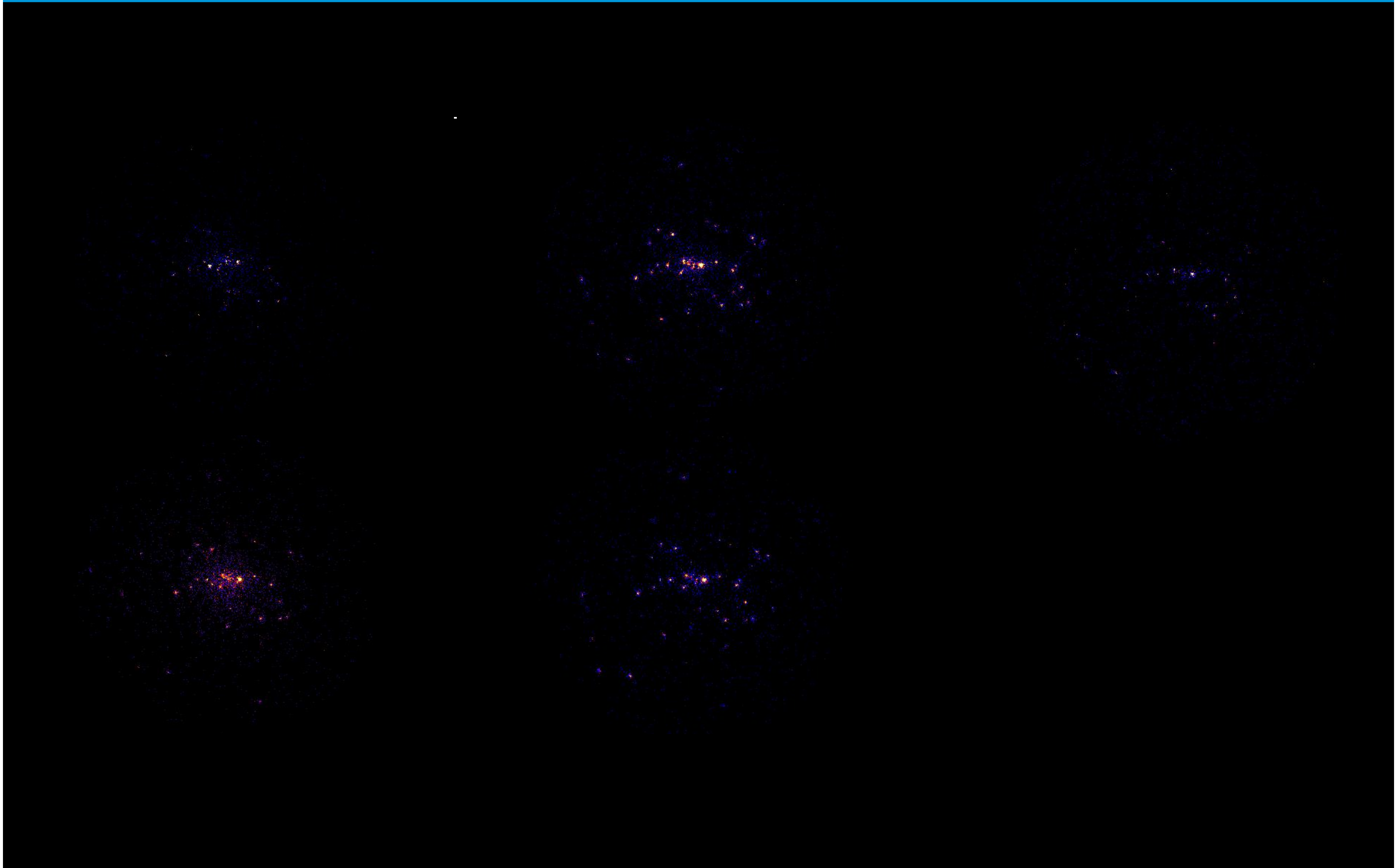
Source searching: preparatory steps

>> apply band-passes for deriving corresponding images

* selection of energy bands depend on the scientific purpose:
- basic XMM-Newton bands:



Source searching: preparatory steps



SAS source detection tasks

Two methods of performing source detection on EPIC datasets:

1) edetect_chain

perl script running all these tasks consecutively

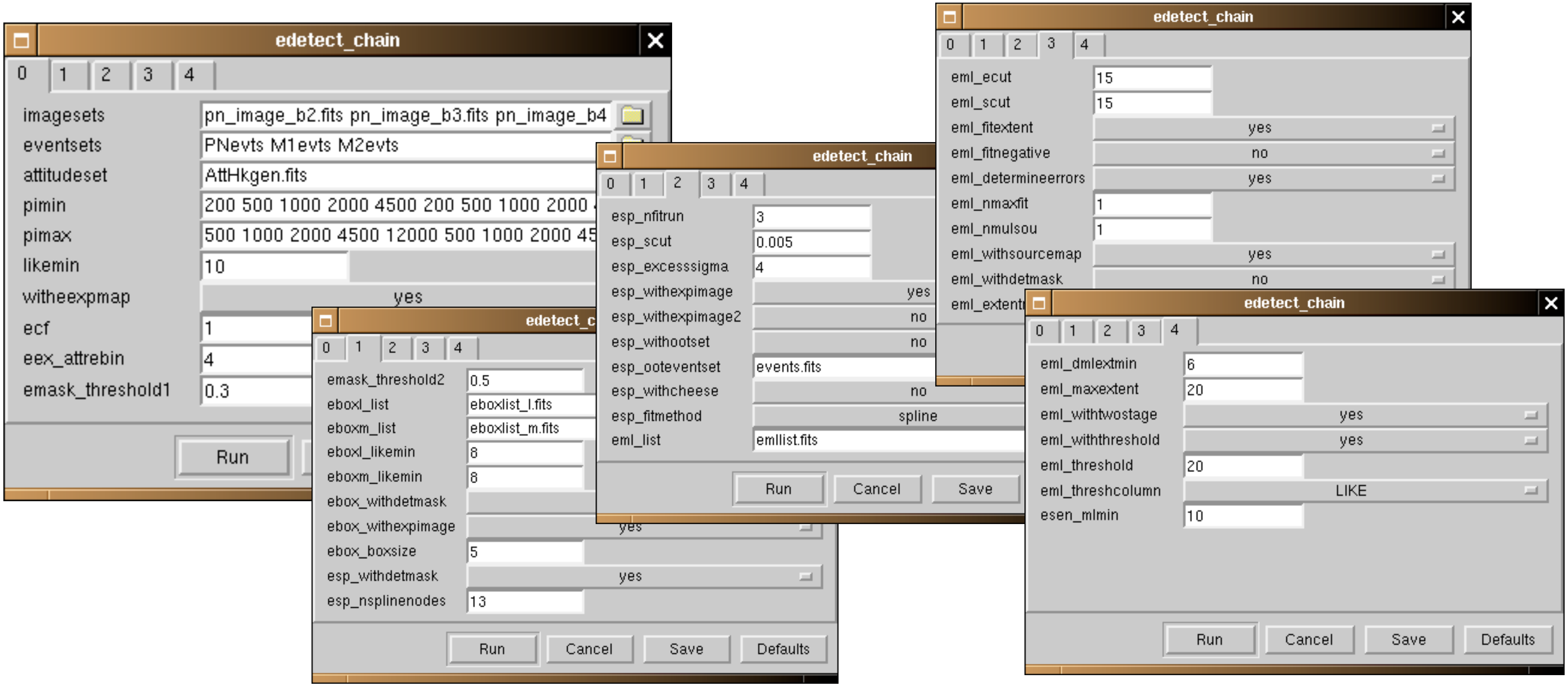
Task	Purpose	input data sets	output data sets
eexpmap	creation of exposure maps	images, attitude files	exposure maps
emask	creation of detection masks	exposure map	detection mask
eboxdetect (local mode)	sliding box detection	images, exposure maps, detection mask	local box list
esplinemap	creation of background maps	images, exposure maps, detection mask, local box list	background map
eboxdetect (map mode)	box detection using bkg map	images, exposure maps, detection mask, background maps	map detect source
emldetect	maximum likelihood fitting	images, exposure maps, detection mask, background maps	final source list
esensmap	creation of sensitivity maps	exposure map, detection mask, background map	sensitivity map

2) ewavelet mexican hat wavelet algorithm for detecting both point and **extended** sources.
Easy to use and efficient, but less reliable source parameters than those from edetect_chain

edetect_chain

edetect_chain is able to work on up to 240 images at one time

→ eg (“PPS approach”): running simultaneously the whole detection chain with 15 input images corresponding to the 5 standard energy bands of each EPIC camera



Source detection tasks 1 x 1

To quantify the significance of detected signals we need to know the observing conditions, eg., how long we have exposed the different parts of the detectors

>> effective exposure time for each detector point

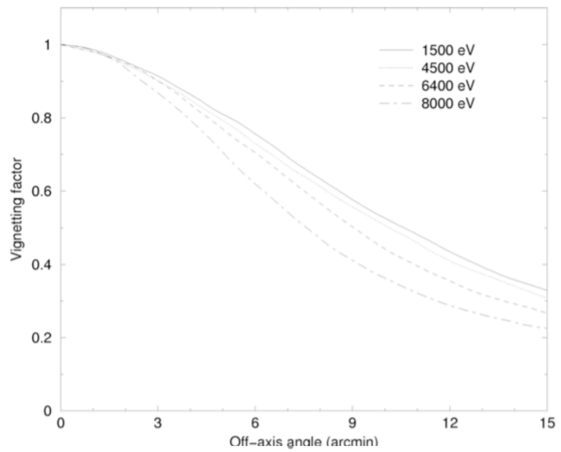
spatial quantum efficiency, filter transmission, mirror vignetting and FOV calculating for each attitude bin the exposure values projected onto the sky

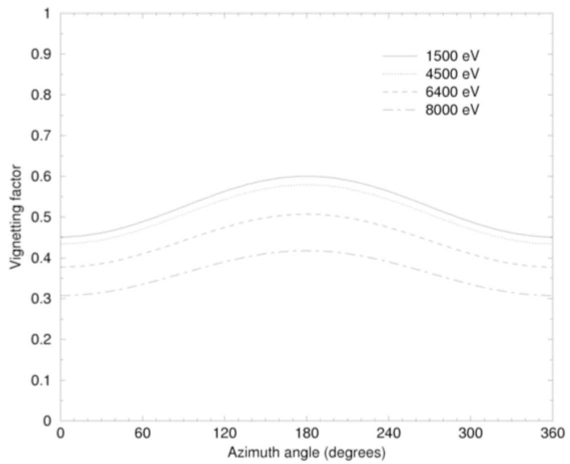
[data taken from Calibration Files]

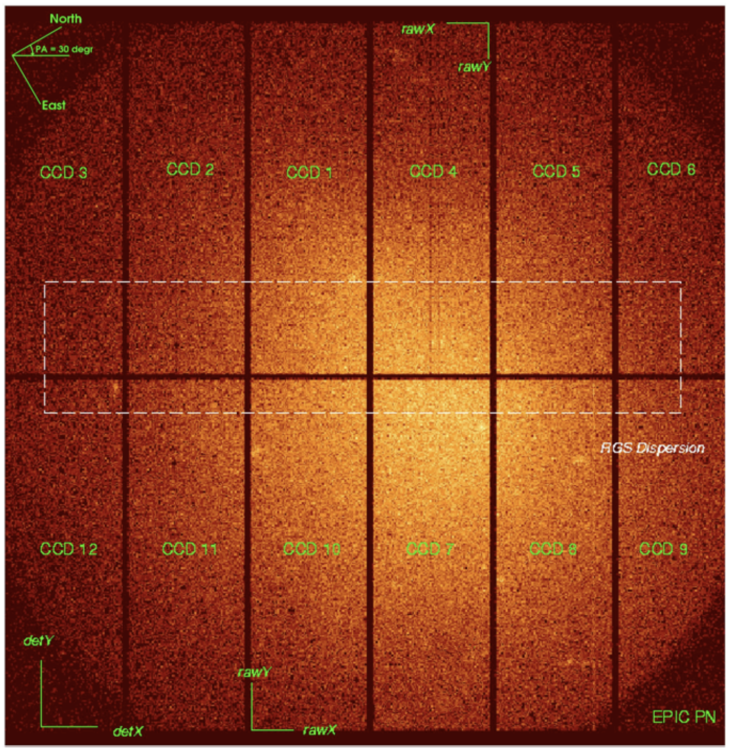
>> **instrument maps** containing **spatial efficiency** of the instrument (unit=[seconds])

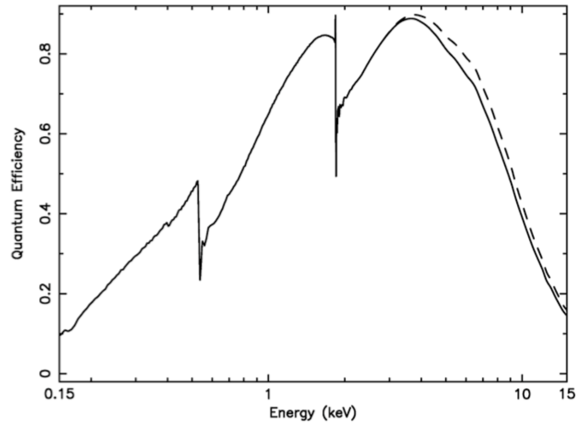
Source detection tasks

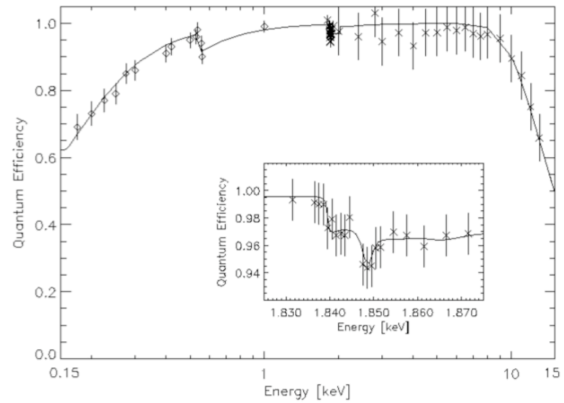
spatial quantum efficiency, filter transmission, mirror vignetting and FOV
calculating for each attitude bin the exposure values projected onto the sky











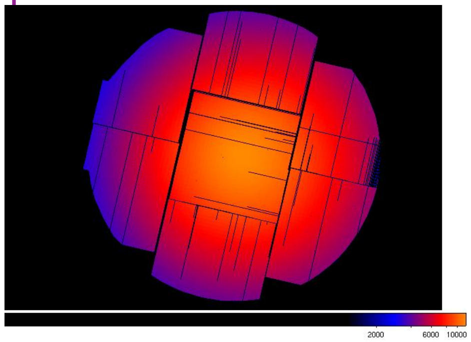
edetect_chain: eexpmap

(PN) example of single task commands issued:

1) create the multiband exposure maps by eexpmap:

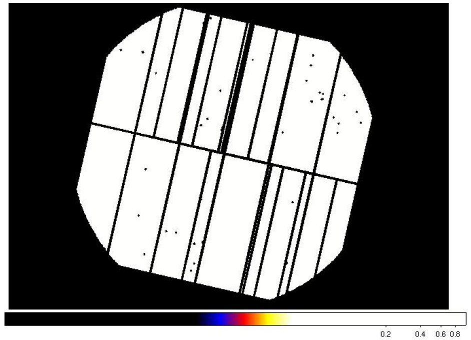
- event energy is assumed to correspond to PI channel boundaries given (parameter *pimin* and *pimax*)
- Bad pixels as listed in the bad pixel extension of the input file are excluded from the instrument maps.
- Depending on flag selections in the image, the surroundings of bad pixels and border pixels are also excluded from the instrument maps.
- output in detector or sky coordinates (same as input image)

eexpmap *attitudeset*=xxxATTxxx.FIT *eventset*=xxxEVLIxxx.FIT *imageset*=xxxIMAGExxx.FIT *pimin*="200 500 1000 2000 4500" *pimax*="500 1000 2000 4500 12000" *expimageset*="**pn_1exp.fits pn_2exp.fits pn_3exp.fits pn_4exp.fits pn_5exp.fits**"



2) create the detection maps
(area defined which is suitable for source detection):

emask *expimageset*=pn_2000.fits *threshold1*=0.5 *detmaskset*=**pn_mask.fits**



Main criterium - valid area is only **area_i** such that:

exposure_i > *threshold1* * MAX(**exposure**)

finding source candidates

Source detection is performed by eboxdetect

3) sliding box detection (local mode):

eboxdetect in “local mode”

a) **source counts** accumulated in 3x3 or **5x5** pixel window (parameter boxsize)
background from surrounding 7x7 or **9x9** pixels (40 or 56 pixels respectively)

Detection of extended sources doubling up to 3 times the pixel size in consecutive runs

Background subtracted source counts calculated applying correction factors to account for respective **fractions** of **source** counts falling on **source and background area**

n = detection box size

Enboxed energy fractions in source / background box: $\alpha = \sum_{n\times n} PSF$ / $\beta = \sum_{(n+4)\times(n+4)} PSF - \sum_{n\times n} PSF$

Raw box counts & raw background counts: $C = \sum_{n\times n} image$ & $Bg = \left(\sum_{(n+4)\times(n+4)} image - \sum_{n\times n} image \right) / ((n+4)^2 - n^2)$

PSF corrected and background subtracted counts: $SC = C - Bg * n^2 \; / \; [\alpha - \beta * n^2 / ((n+4)^2 - n^2)]$

sliding box detection / I - cont.

Detection likelihoods given as:

$L = -\ln p$ p = probability of Poissonian random fluctuation of background counts in cell resulting in ≥ observed source counts

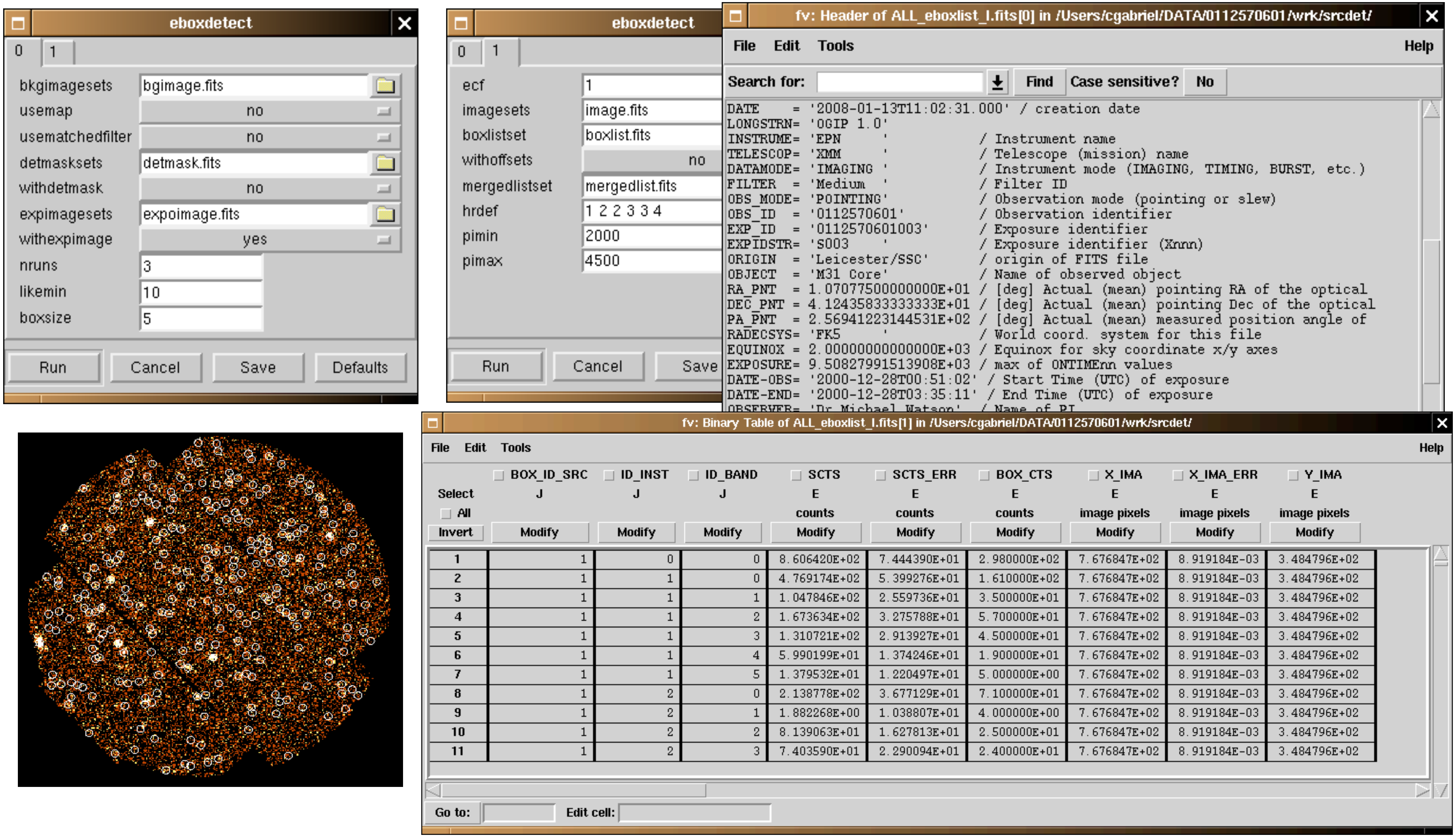
(p using incomplete Gamma function $\Gamma(a,x)$ as function of raw source and raw background counts in the detection box)

In case of simultaneous detection over several bands, likelihoods are added (!) and transformed into equivalent single band detection likelihoods

$$L = \Gamma(n_{band}, \sum_{i=1,n} L_i)$$

eboxdetect ***usemap*=no** *likemin*=10 *withdetmask*=yes *detmasksets*=pn_mask.fits \
imagesets="PNIM_1000.FIT PNIM_2000.FIT PNIM_3000.FIT PNIM_4000.FIT PNIM_5000.FIT" \
expimagesets="pn_1000.fits pn_2000.fits pn_3000.fits pn_4000.fits pn_5000.fits" \
pimin="200 500 1000 2000 4500" *pimax*="500 1000 2000 4500 12000" \
boxlistset=**eboxlist_ local.fits**

eboxdetect > FITS tables



creating background maps

Modelling the background is a **key issue** for source detection

EPIC background has three main components

a) Photons:
- astrophysical, dominated by thermal emission at lower energies (unresolved cosmological sources)
- solar wind charge exchange
- single reflections from out of FOV, out-of-time events, etc

b) Particles:
- soft proton flares
- internal (cosmic-ray induced) background, direct (on CCDs) / indirect (fluorescence of S/C)

c) electronic noise
- bright pixels, columns, etc, readout noise, etc.

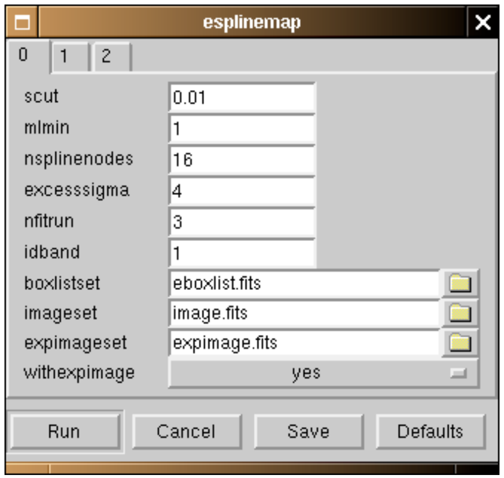
>> complex issue - so far in source detection by default phenomenologically:
2D-spline

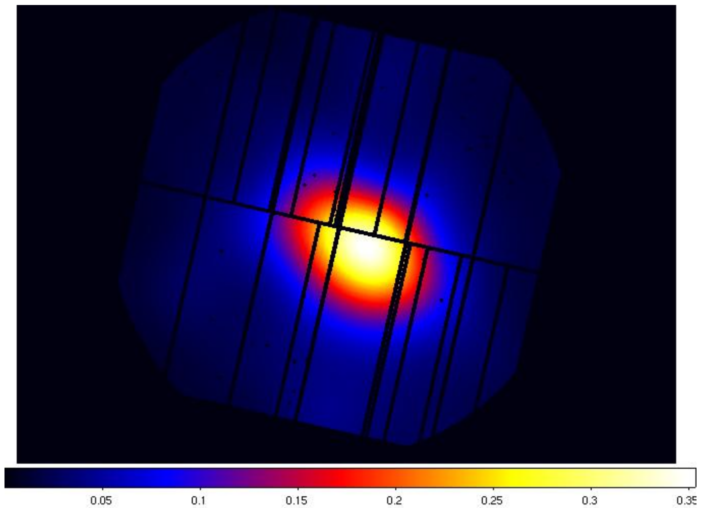
creating bkg maps: esplinemap

4) creation of background maps (done per detector and band)

a) Cutting-out sources (using source brightness dependent radius), esplinemap blanks out areas with sources detected by eboxdetect >> cheesed image
b) n x n (default=12) spline fits >> smoothed background map for entire image

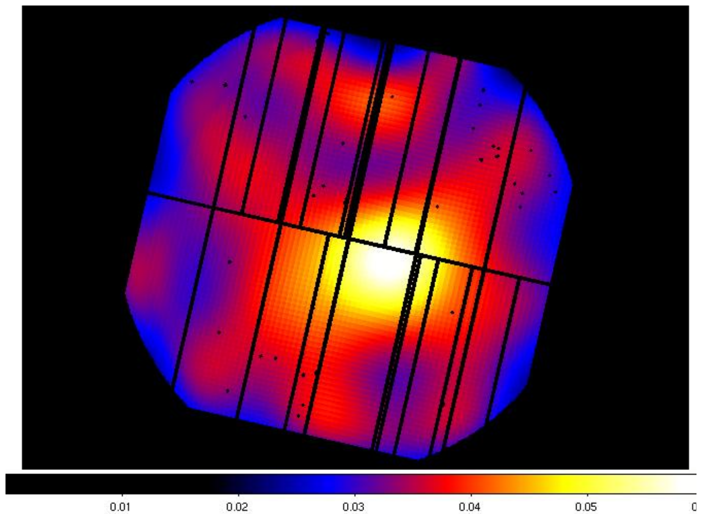
esplinemap *bkgimageset*=pnback_1000.fits *scut*=0.005 *imageset*=PNIM_1000.FIT *nsplinenodes*=***12*** \
withdetmask=yes *detmaskset*=pn_mask.fits *withexpimage*=yes, *expimageset*=pn_1000.fits \
boxlistset=eboxlist_ local.fits





pnback_2000.fits

pnback_5000.fits



eboxdetect in map mode

esa

5) box detection using the background maps

in **map mode** background is taken from background maps determined by **esplinemap**
>> improved detection sensitivity compared to local detection map

eboxdetect *usemap*=yes *likemin*=8 *withdetmask*=yes *detmasksets*=pn_mask.fits \
imagesets=… *expimagesets*=… *pimin*=… *pimax*=... *bkgimagesets*="pnback_1000.fits …" \
boxlistset=**eboxlist_ map.fit**

Output table:

- one raw per input image for each detected source (source table)
- number of summary rows containing broad band results for each EPIC telescope
- combined results for all EPIC telescopes taken together

Source table:

- count rates and source positions including statistical errors + fluxes + ...
- detection likelihoods (per band and total) given for each source

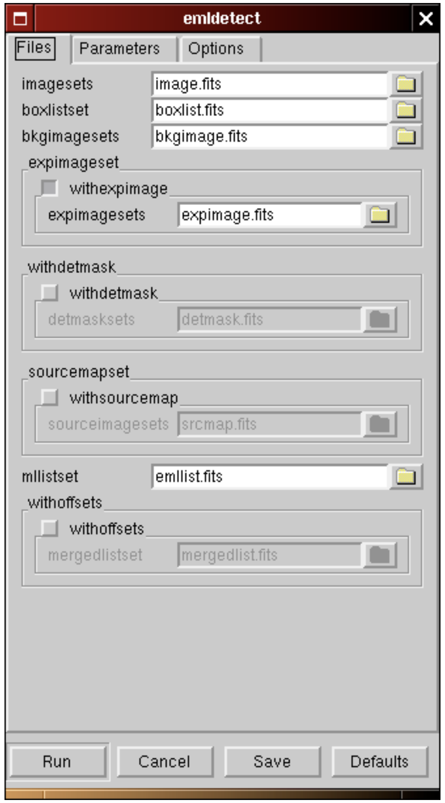
  $l = -\ln p$ with p=probability of random fluctuation of counts resulting in $N_{Counts} \geq C_{obs}$
- if several images inputted then hardness ratios are calculated:

$$HR_i = (B_m - B_n) / (B_m + B_n)$$

max likelihood fit: `emldetect`

6) maximum likelihood fitting for getting final source list

`emldetect` *imagesets*=… *expimagesets*=… *bkgimagesets*=… pimin=… pimax=… \
boxlistset=eboxlist_map.fit *ecf*=“10.596 6.8157 2.0542 0.99483 0.25933” \
mllistset=**emllist.fits** *mlmin*=10 *determineerrors*=yes



Method: **Simultaneous maximum likelihood PSF fit** to source count distribution (convolved with a **source extent model**) in all bands with following free parameters:

- * source location (α, δ)
- * source extent (gaussian sigma)

| constrained to same best-fit value
| in all energy bands of each EPIC

- * source count rates in each band

| individual best-fit value in each band

Second loop for fitting two PSFs to “extended sources” - if better > recalculation

PSF fitting may be performed in **single source** or in **multi-source** mode.
In multi-source mode sources with overlapping PSFs are fitted simultaneously (up to 6)

Energy conversion factors (ECF) supplied for conversion of count rates into correct flux values. **The ECFs depend on filter and pattern selection**

`emldetect` & extended sources

PSF fitting by `emldetect` is most crucial step for characterization of extended sources

Default (also for 3XMM) is the convolution of PSF with a β model for source extent

$$f(x,y) = \left(1 + \frac{(x-x_0)^2 + (y-y_0)^2}{r_c^2}\right)^{-3\beta+1/2}$$

β = 2/3 (canonical for surface distribution of clusters)

Fitting procedure minimizes the C - statistic

$C = 2 \sum (e_i - n_i \ln e_i)$ e= expected model & n= number of counts in pixel i

Detection likelihood for each input image IM is $L_{IM} = C_{NULL} - C_{BEST}$ C_{NULL} is C of Null-hyp.

Detection likelihood obeys L = -ln(P) with P probability that source is spurious

Extended likelihood L_{ext} calculated in analogy with C_{NULL} = best fitting point source model

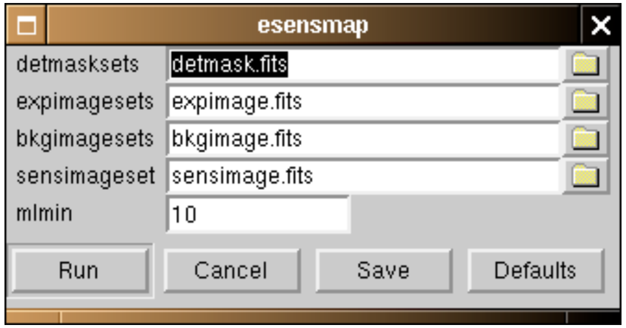
Second fitting loop against source confusion: 2 source models simultaneously fitted (only for brighter sources)

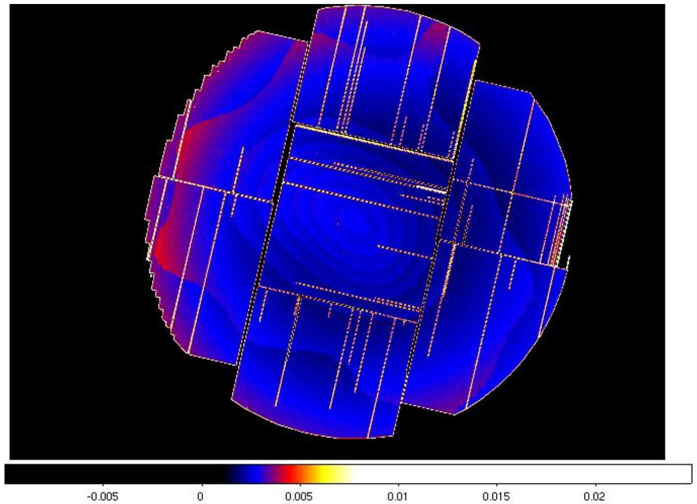
sensitivity maps: esensmap

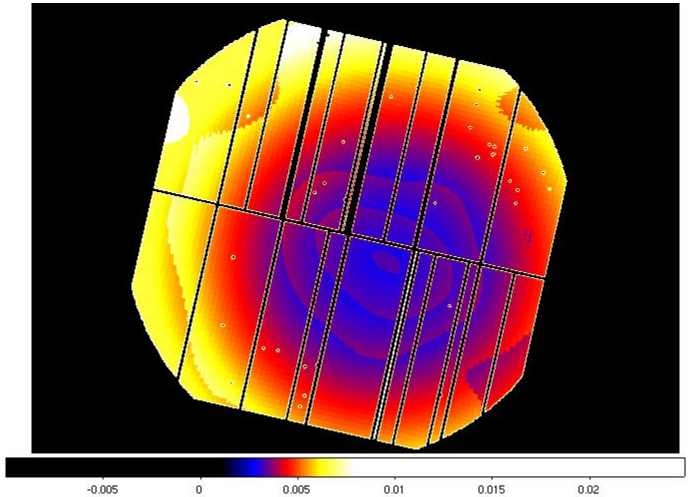
7) creation of sensitivity maps (called for each detector and band)

esensmap *expimagesets*= pn_1000.fit *bkgimagesets*=pnback_1000.fits *detmasksets*=pn_mask.fits \
mlmin=10. *sensimageset*=sens_map1.fits

Sensitivity map == point source **detection upper limits (**vignetting corrected source count rate corresponding to the likelihood of detection as specified in the parameter file) for each image pixel.







position rectification: `eposcorr / catcorr`

off-edetect_chain) ***position rectification using optical catalogues***

correlation with optical source catalogue, checking whether there are offsets in RA and DEC which optimize the correlation

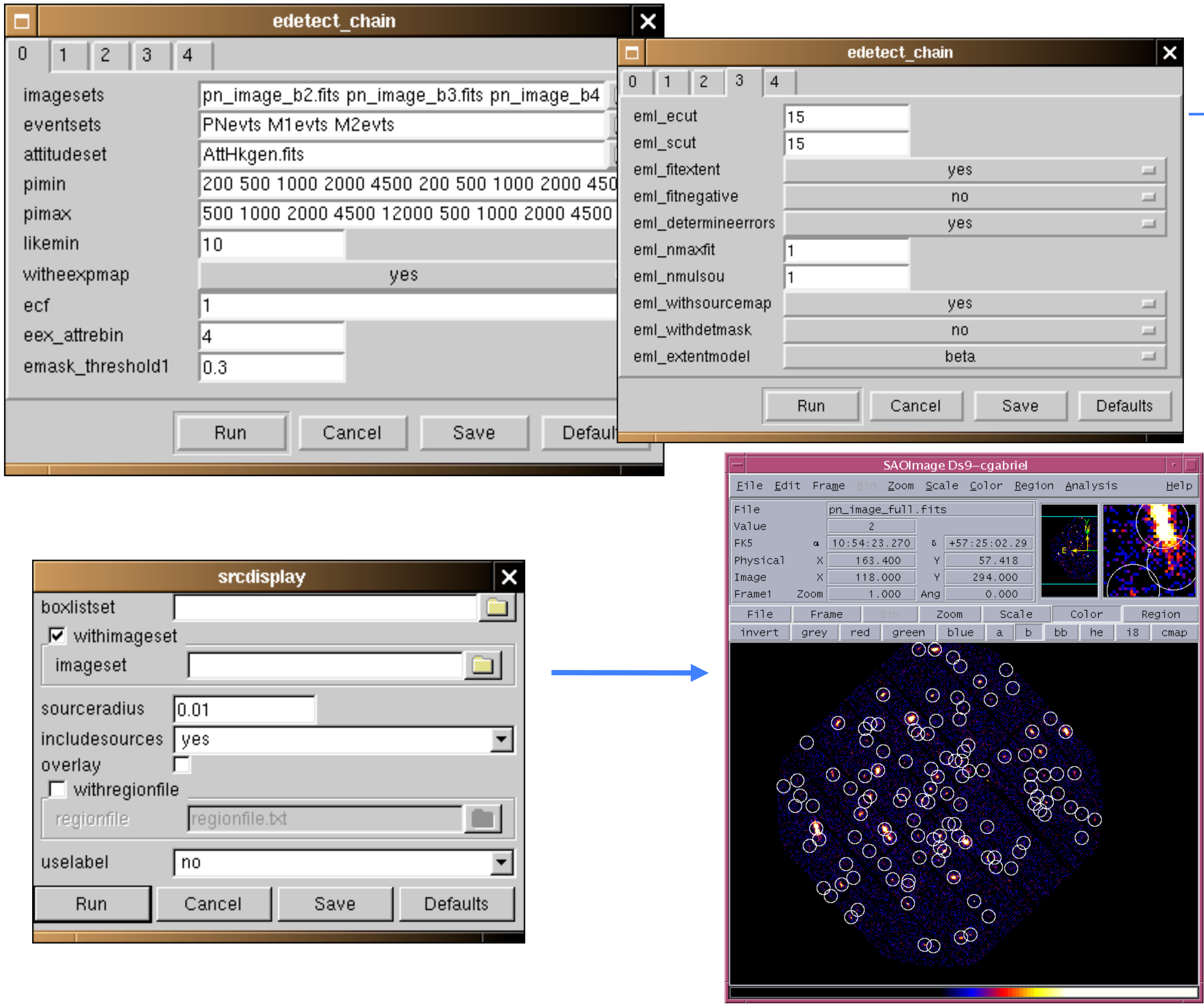
Used in 4XMM-PPS:

`catcorr` *srclistset*=emllist.fits *catset*=catextract.ds *mingood*=10 *minfit*=5 *maxoffset*=10
using not only USNO-B, but also 2MASS and SDSS >> covering 85% of all observations

displaying sources: srcdisplay

esa

edetect_chain -d



source list

srcdisplay -d

Full reprocessing + 4XMM-DR12

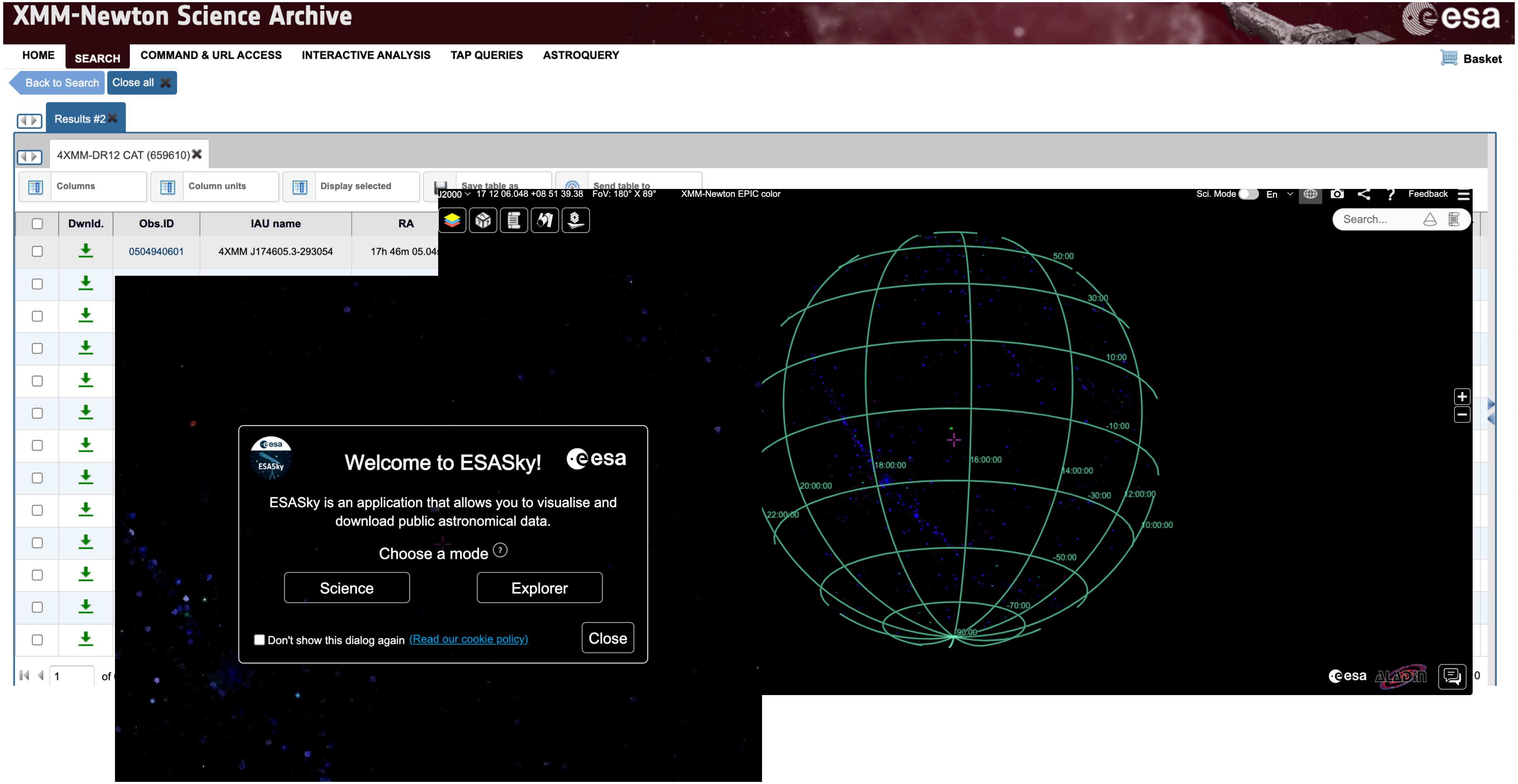
- ESAC finished in mid-2020 the reprocessing of all the XMM-Newton data on behalf of the Survey Science Centre (SSC) @ IRAP (Toulouse) —> 4XMM-DR10
- Uniform archive in terms of processing and calibration
- Since then, 4XMM-DR11 took place in September 2021

4XMM-DR12 catalogue = largest catalogue of X-ray sources
[Webb et al., 2020]

	4XMM-DR12	**4XMM-DR11**	**Increment**
Number of observations	12712	12210	502
Number of 'clean' observations (i.e., observation class < 3)	10543	10247	296
Observing interval	03-Feb-00 -- 31-Dec-21	03-Feb-00 -- 17-Dec-20	1 yr
Sky coverage, taking overlaps into account (≥ 1ksec exposure)	1283 sq.deg	1239 sq.deg	44 sq.deg
Number of detections	939270	895415	43855
Number of 'clean' detections (i.e., summary flag < 3)	821953	787963	33990
Number of unique sources	630347	602543	27804
Number of 'cleanest' (summary flag = 0, not in high-background fields) extended detections	20169	19077	1092
Number of detections with spectra	337058	319565	17493
Number of detections with timeseries	336776	319292	17484
Number of detections where probability of timeseries being constant is $< 1 \times 10^{-5}$	7697	7283	415

- (0.2 - 12 keV) —> $\sim 2.3 \times 10^{-14}$ erg cm^{-2} s^{-1}
- (0.2 - 2 keV) —> $\sim 5.2 \times 10^{-15}$
- (2 - 12 keV) —> $\sim 1.2 \times 10^{-14}$.

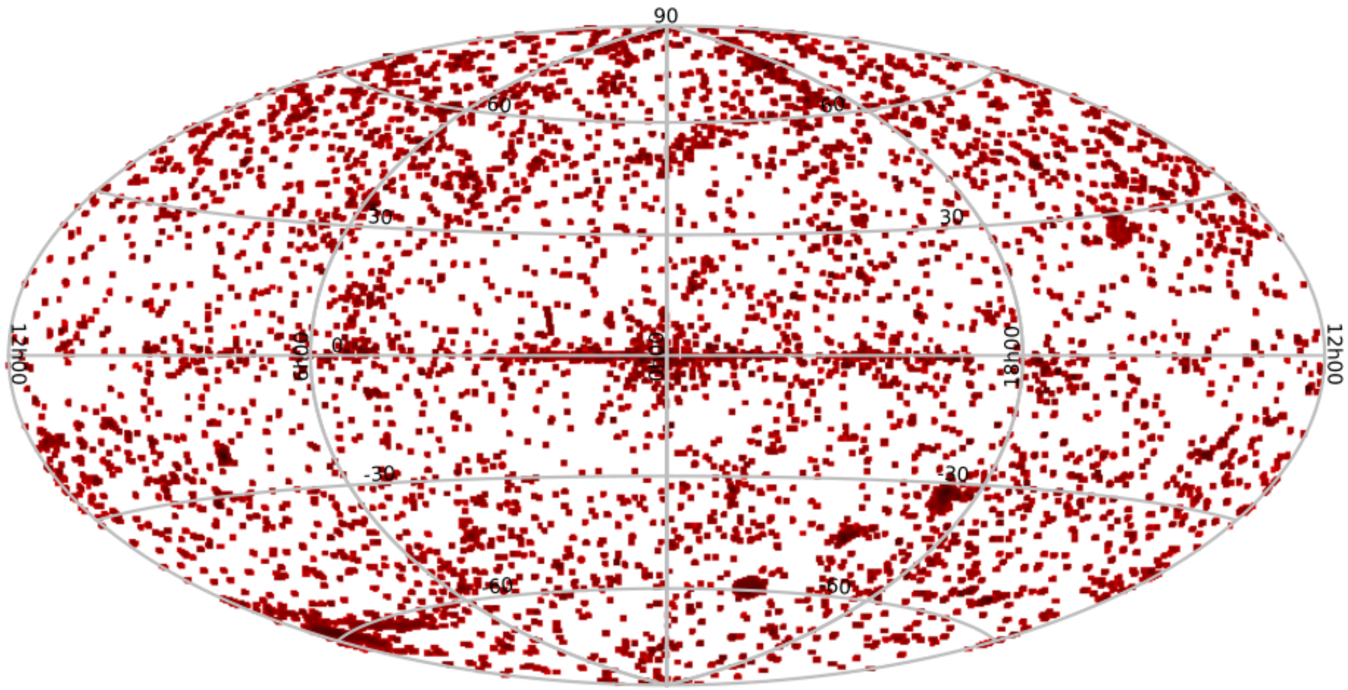
Full reprocessing + 4XMM-DR14



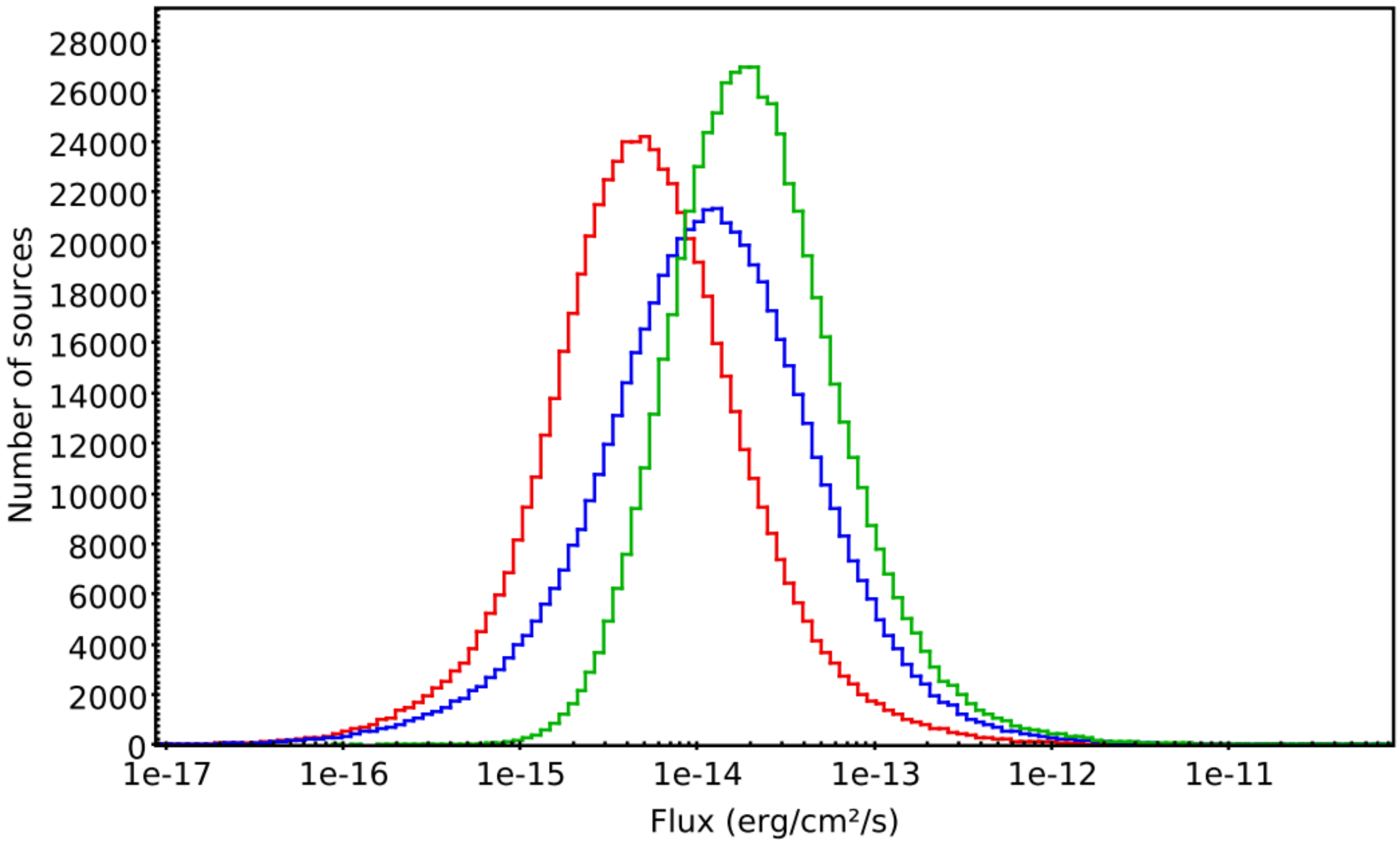
https://sky.esa.int/

4XMM-DR12 properties

- The 4XMM-DR12 catalogue is about 5% larger than the 4XMM-DR11 catalogue.
- In terms of the number of X-ray sources, combining the 4XMM-DR12 and 4XMM-DR12s catalogues gives a catalogue that is similar in size to the Chandra Source Catalogue but 4XMM-DR12+4XMM-DR12s contain twice as many individual sources as the Chandra catalogue



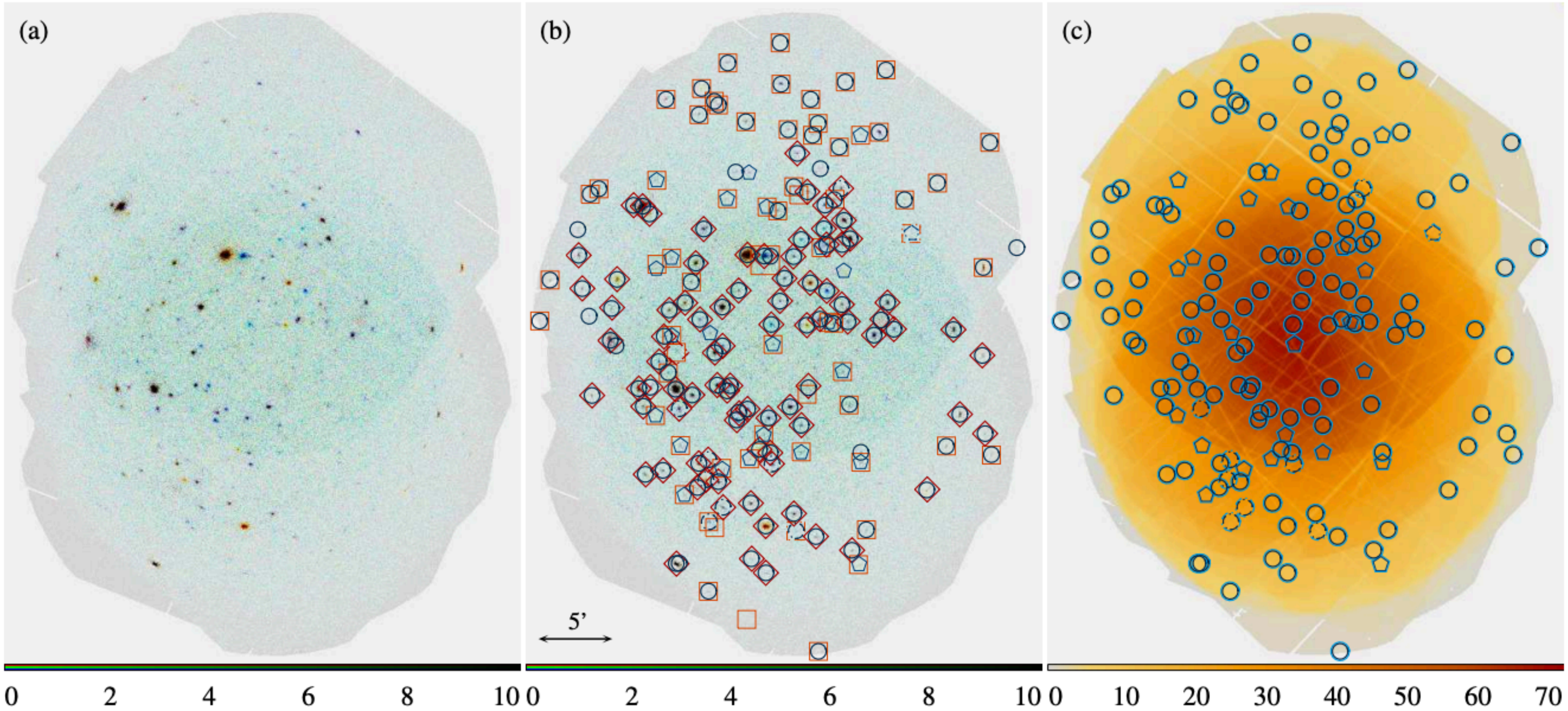
4XMM properties - detection limits



- 0.2-2.0 keV: Red
- 2.0-12.0 keV: Blue
- Total Band: Green

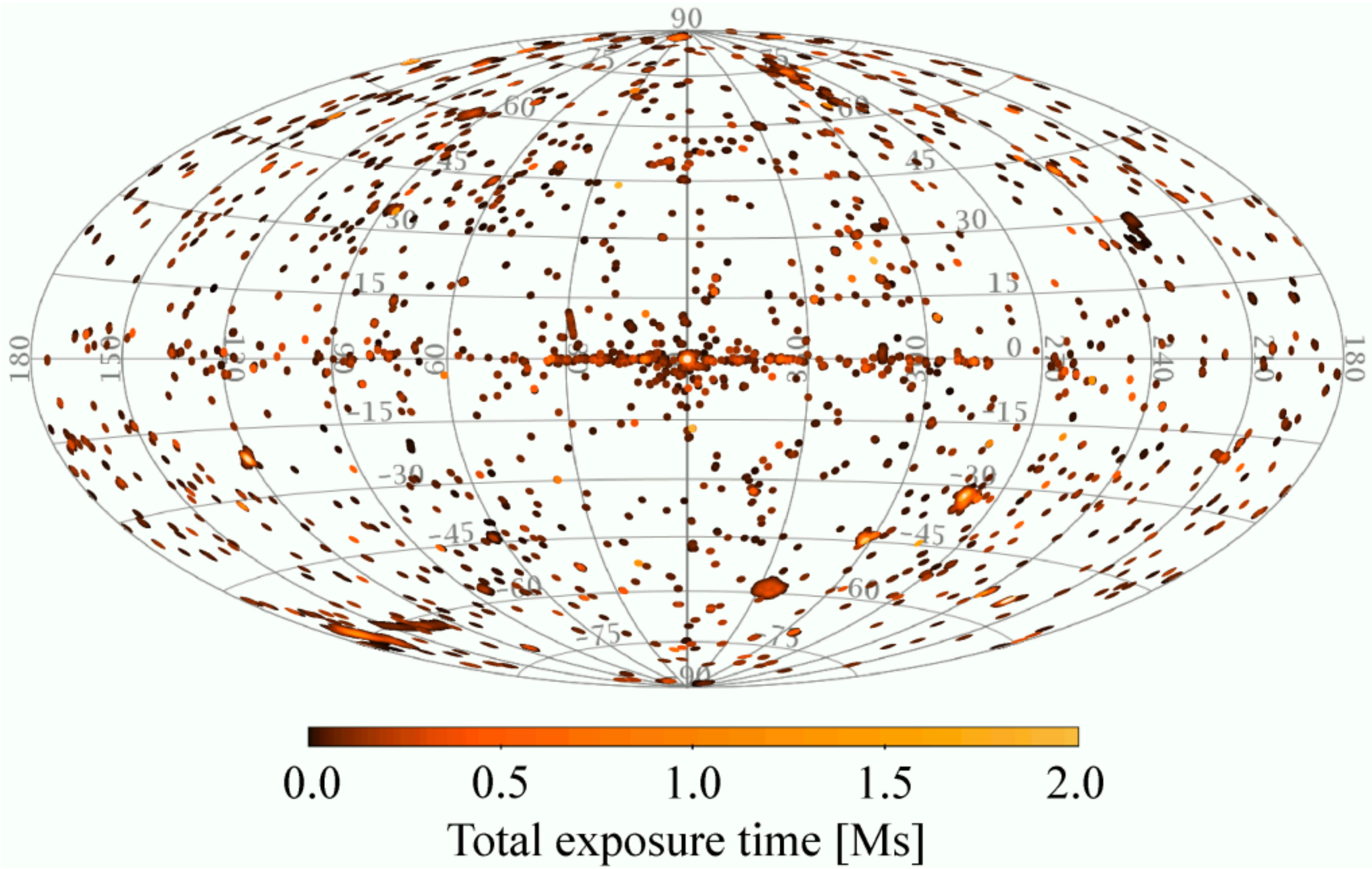
4XMM-DR12 - Stacked Catalogue

- A second independent stacked catalogue is compiled in parallel by the XMM-Newton SSC, called 4XMM-DR9s, where the letter 's' stands for stacked [Traulsen et al., 2020]
- This catalogue lists source detection results on overlapping XMM-Newton observations.
- The construction of the first version of such a catalogue, 3XMM-DR7s, is described in Traulsen et al. (2019).

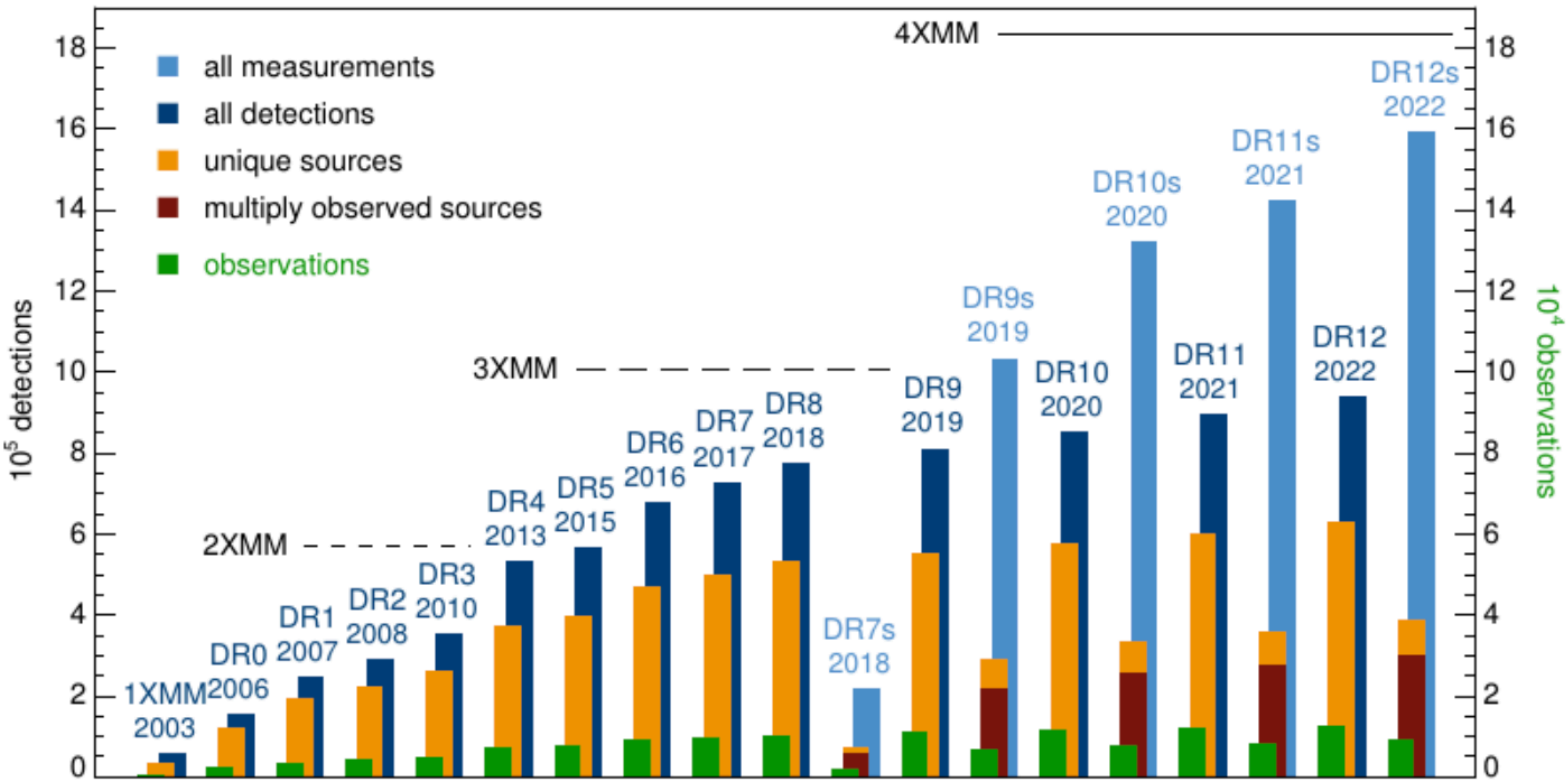


4XMM-DR12 - Stacked Catalogue

- Most of the stacks are composed of 2 observations and the largest has 372.
- The catalogue contains 386043 sources, of which 298626 have several contributing observations.
- Stacking observations allows yet fainter sources to be detected in sky regions observed more than once,



XMM-Newton Catalogue: in numbers



Detecting sources in overlapping fields

Main example for overlapping fields is the Mosaic Mode

Basic definitions:

- series of stable pointings with EPIC cameras in FF / Window mode, continuously taking data (same filter)

- only 1 PN offset map, taken by first pointing

- angular offset between pointings within [0.2 - 60] arcmin

- shortest integration time per pointing = 1500 sec

- whole observation included in one ODF - if observation not possible within one revolution, then several obs's.

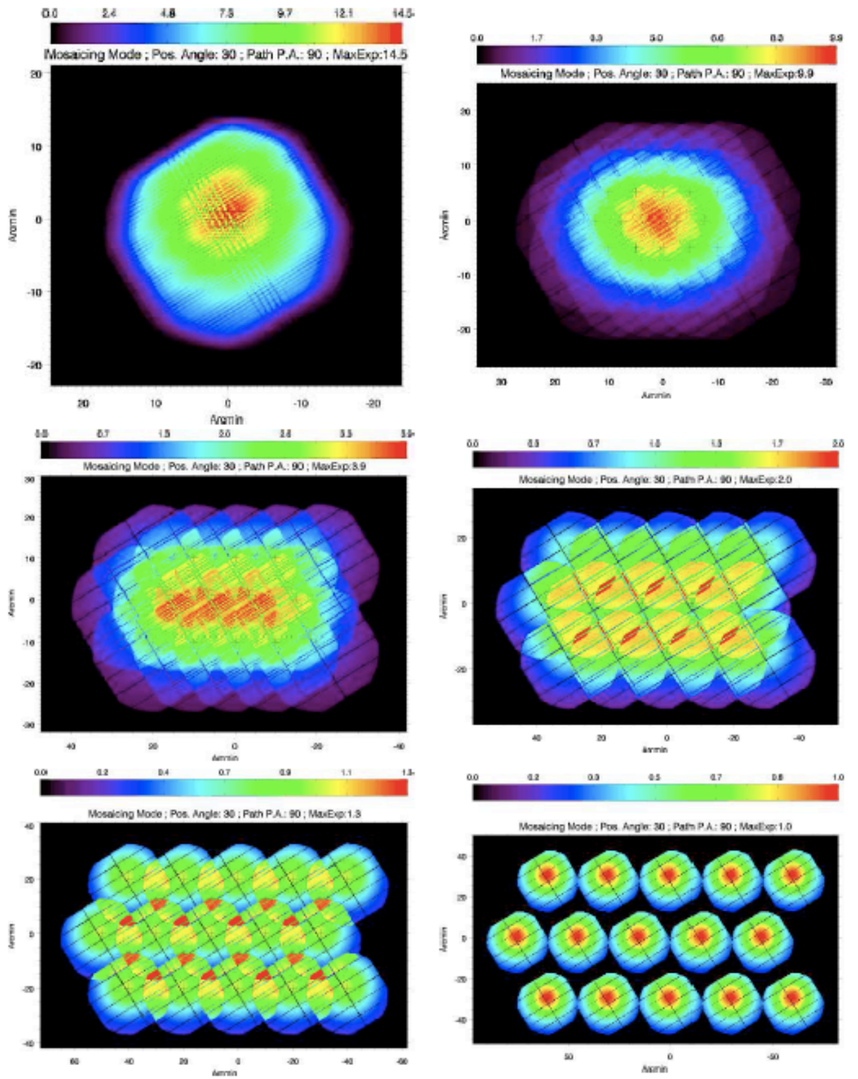


Figure 1: These figures simulate the EPIC-pn effective exposure maps achieved for a mosaic consisting in 5x3 individual pointings and for different angular offsets (1,5, 10, 15, 20 and 30 arcmin). The duration of a single pointing is taking as unit for these exposure maps. The relative position angle of the instruments has been arbitrarily set to 30degrees.

Simulated exposure maps of a 5x3 mosaic taken for angular offsets of 1.5', 10', 15', 20' and 30' with flat exposure per pointing, ignoring slews.

From P. Rodriguez TN

Mosaic mode: analysis

Question to SAS / PPS:

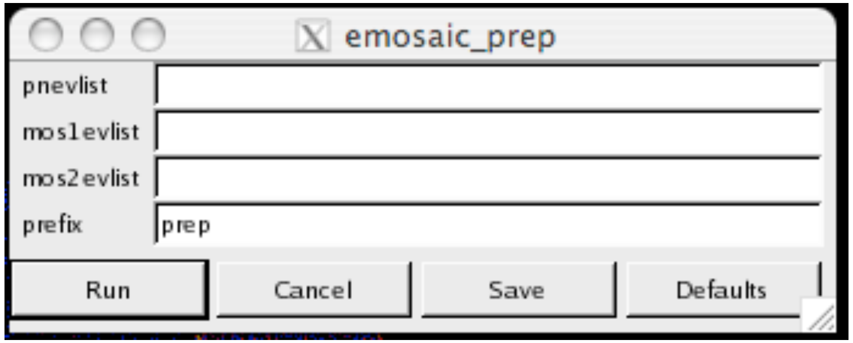
- how to treat this data?
- definitions:
    - separate data corresponding to different pointings as if they were different exposures (ignoring slews)
    - treat them coherently for source detection, eg. one call to eboxdetect (map mode) and emldetect

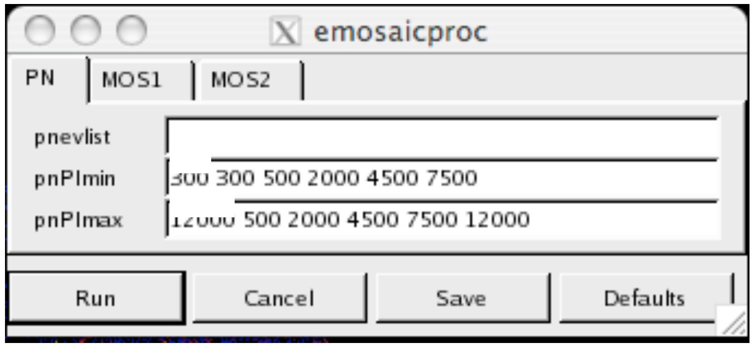
Our PPS scheme: separate mosaic ODF into n single pointing ODFs >> process them "normally"

Our SAS scheme:
>> normal reduction to large single event file (epicproc)
>> separation of events from different pointings
>> one event file per point per instrument through emosaic_prep
>> coherent source detection of (overlapping) chosen fields through emosaicproc

Source detection working with all EPIC data (memory ~ map size can become an issue)

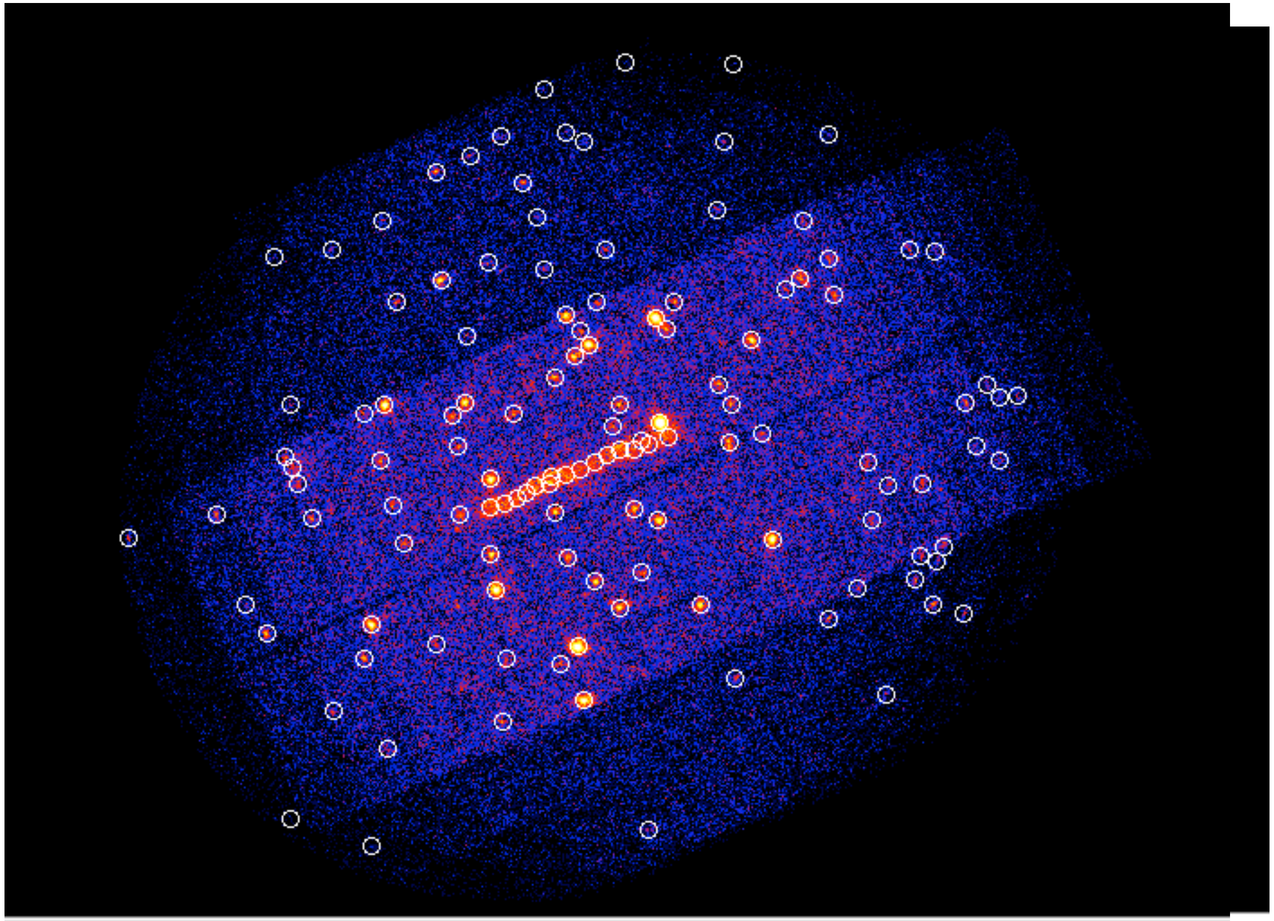
>> GUIs





Mosaic mode - results - one mosaic

Jupiter observation 0200080701 - 4 pointings:



Detection using 3 spectral bands for each pointing and instrument, [400-1000], [1000-2000] and [2000-10000] eV

>> 36 images combined for eboxdetect (map mode) and emldetect

Problems with mosaic mode data:

> number of pointings can be large
>> **enormous** needs of memory
> combination of not overlapping data **not necessary** at all

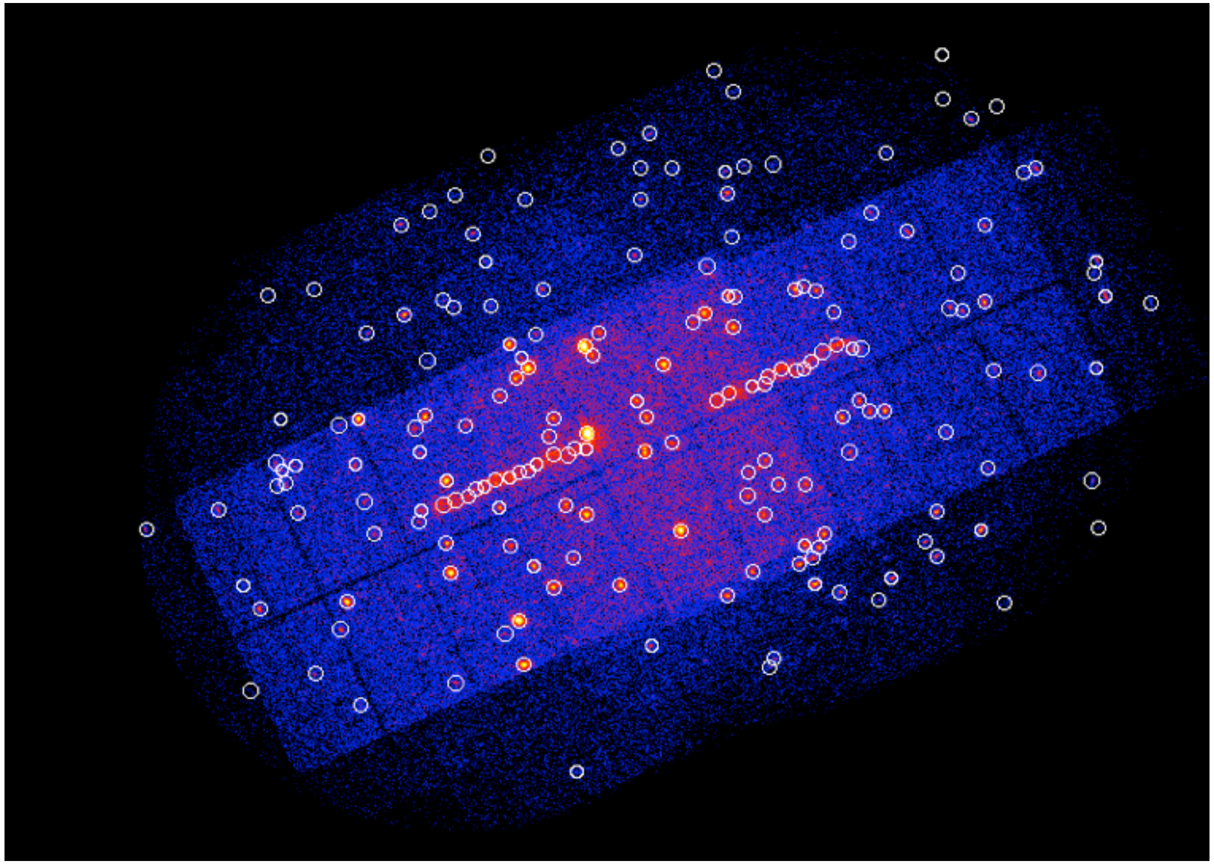
>> decision about which points to be combined and how to do recombination of source lists left to the observer

Remember - right combination:
- more efficient source detection instead of WRONG source detection (wrong LHs if no separation)

>> so far no PPS implementation

Mosaic mode - results - combining ODFs

Jupiter observation 0200080201+ 0200080701 - 4+4 pointings:



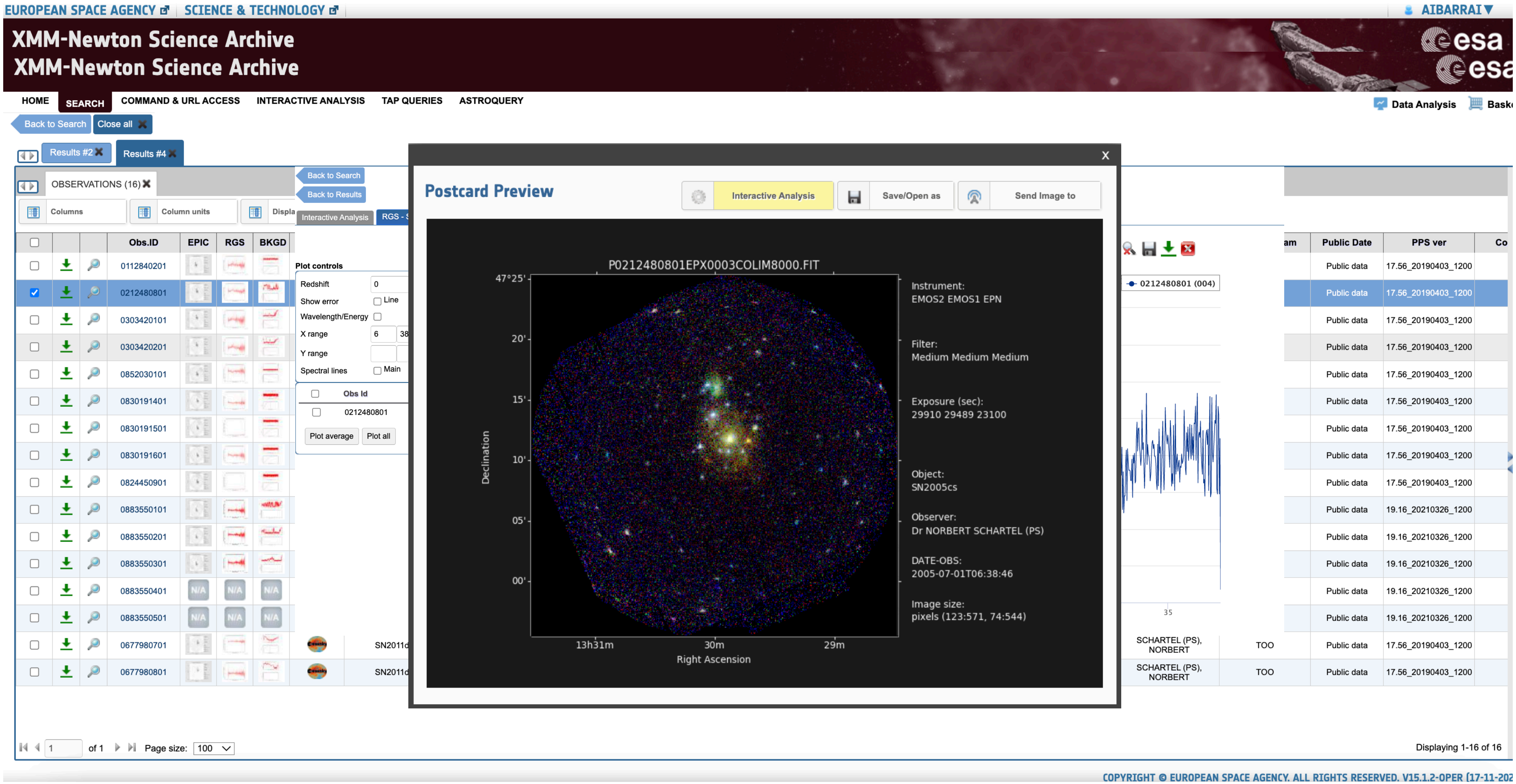
>> can be used by any overlapping observations, also with single pointing obs's taken at different times

Also using 3 spectral bands for each pointing and instrument, [400-1000], [1000-2000] and [2000-10000] eV

>> 72 images combined for eboxdetect (map mode) and emldetect

How to get XMM-Newton data? The XSA

https://www.cosmos.esa.int/web/xmm-newton/xsa



How to get XMM-Newton data? The XSA

https://www.cosmos.esa.int/web/xmm-newton/xsa

The XMM-Newton Astroquery Module

1. INTRODUCTION

The module **astroquery.esa.xmm_newton** is a python interface for querying the XMM-Newton Science Archive (XSA) web service.

2. USAGE

Once python is installed you can do:

```
pip install --pre astroquery
```

or if you have a previous astroquery version installed:

```
pip install --pre --upgrade astroquery
```

More details can be found in astroquery instructions:

https://astroquery.readthedocs.io/en/latest/

3. EXAMPLES

See: https://astroquery.readthedocs.io/en/latest/esa/xmm_newton.html

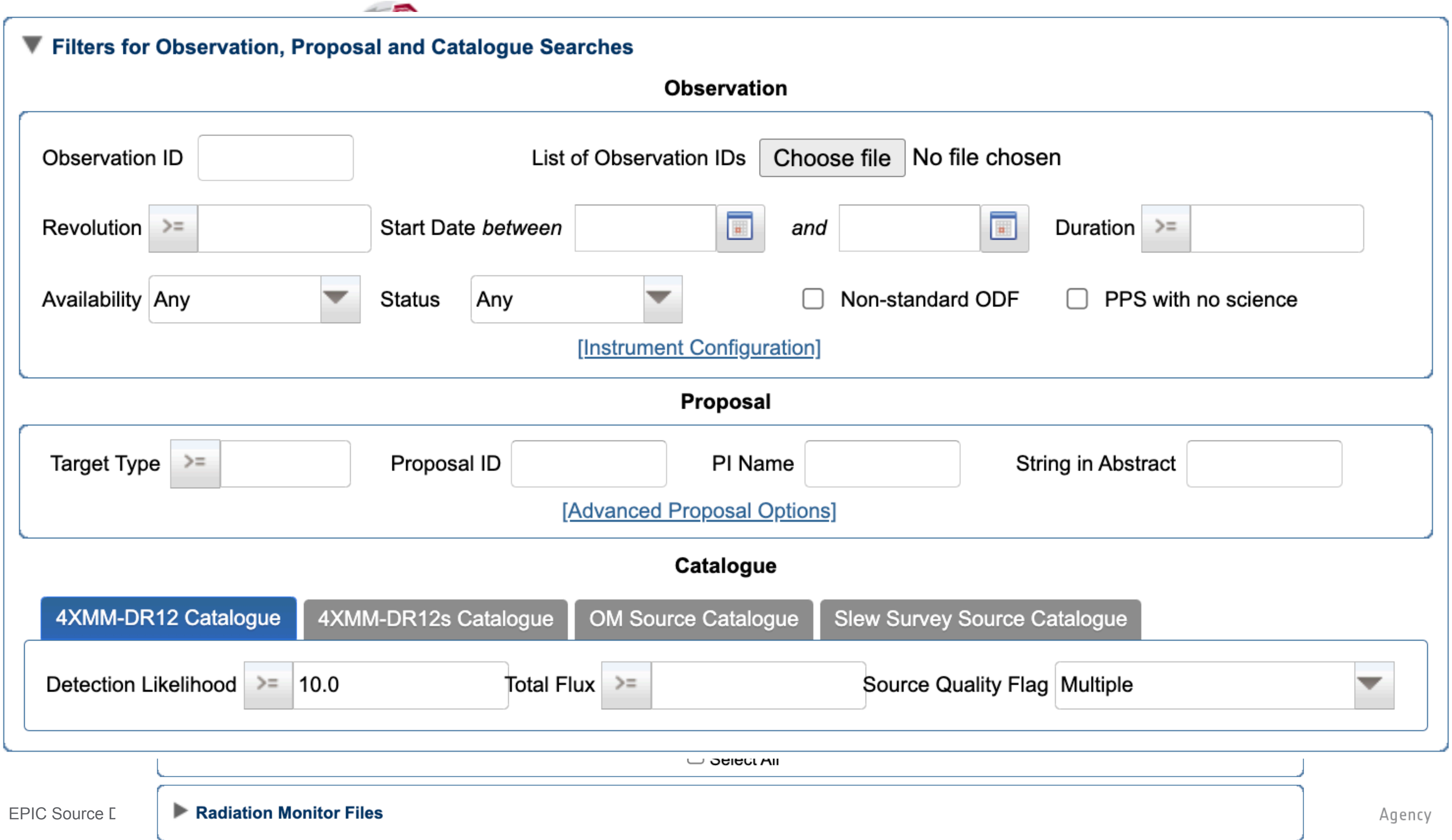
1. Getting XMM-Newton data:

```
>>> from astroquery.esa.xmm_newton import XMMNewton
>>>
>>> XMMNewton.download_data('0505720401',level="PPS",extension="PDF",instname="M1",filename="result0505720401.tar")
INFO: File result0505720401.tar downloaded to current directory [astroquery.esa.xmm_newton.core]
```

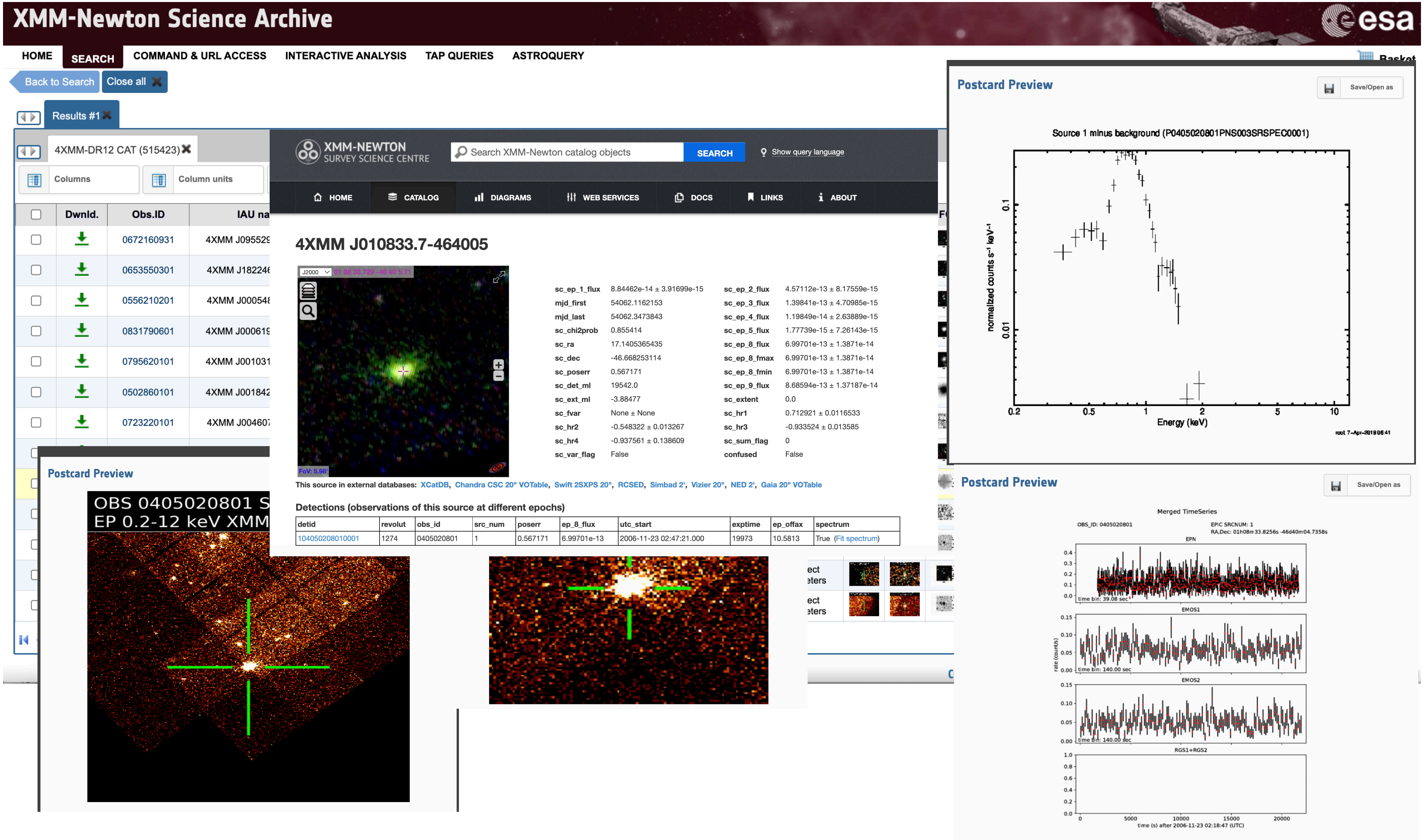
This will download all PPS files for the observation '0505720401' and instrument MOS1, with 'PDF' extension and it will store them in a tar called 'result0505720401.tar'. The parameters available are detailed in the API.

For more details of the parameters check the section 3.4 at:

How to get 4XMM data? The XSA



All the individual sources detected



detid	revolut	obs_id	src_num	poserr	ep_8_flux	utc_start	exptime	ep_offax	spectrum
104050208010001	1274	0405020801	1	0.567171	6.99701e-13	2006-11-23 02:47:21.000	19973	10.5813	True (Fit spectrum)

How to get (elsewhere) 4XMM data?

esa

http://xmm-catalog.irap.omp.eu/

XMM-NEWTON SURVEY SCIENCE CENTRE

J010833.7-464005 SEARCH | Show query language

HOME | CATALOG | DIAGRAMS | WEB SERVICES | DOCS | LINKS | ABOUT

QUERY RESULTS: 4XMM-DR12

Download sources as FITS | VOTable | CSV
Download detections as FITS | VOTable | CSV

Search around 17.1405, -46.6681 with radius 1arcmin in: Chandra CSC VOTable, Swift 2SXPS, RCSED, Simbad, Vizier, NED

IAUNAME?	N_DETECTIONS?	SC_DET_ML?	SC_EP_8_FLUX?	SC_EXTENT?	SC_POSERR?
4XMM J010833.7-464005	1	19542.0	6.99701e-13	0.0	0.567171

Page 1 of 1

XMM-NEWTON SURVEY SCIENCE C

Search XMM-Newton catalog objects SEARCH

Search the XMM-Newton source catalog. Query can be any column name and constraint on its

HOME | CATALOG | DIAGRAMS | WEB SERVICE

QUERY RESULTS: 4XMM-DR12

Download sources as FITS | VOTable | CSV
Download detections as FITS | VOTable | CSV

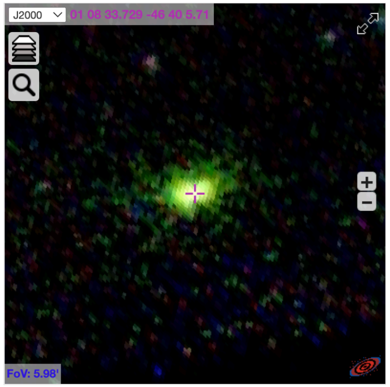
Search around 263.719479259, -32.6498225497 with radius 1arcmin in: Chandra CSC VOTable, Swift 2SXPS, RCSED, Simbad, Vizier, NED

IAUNAME?	N_DETECTIONS?	SC_DET_ML?	SC_EP_8_FLUX?	SC_EXTENT?	SC_POSERR?
4XMM J041942.1+555957	4	31000.5	1.27225e-12	0.0	0.22803
4XMM J041953.1+554817	4	184.578			
4XMM J042018.4+555550	4	714.724			
4XMM J042026.6+555943	4	173.909			
4XMM J041959.0+561329	4	518.148			
4XMM J041944.3+555545	4	318.063			
4XMM J041917.5+555905	4	247.938			
4XMM J042017.6+555856	4	226.462			
4XMM J042004.0+555631	4	72.0847			
4XMM J041938.4+560415	3	20.742			
4XMM J041937.2+560351	4	60.7821			
4XMM J042056.0+555357	3	40.0853			
4XMM J041933.9+555730	4	66.6149			

NEWS

28 Jul 2022

4XMM J010833.7-464005



sc_ep_1_flux	8.84462e-14 ± 3.91699e-15	sc_ep_2_flux	4.57112e-13 ± 8.17559e-15
mjd_first	54062.1162153	sc_ep_3_flux	1.39841e-13 ± 4.70985e-15
mjd_last	54062.3473843	sc_ep_4_flux	1.19849e-14 ± 2.63889e-15
sc_chi2prob	0.855414	sc_ep_5_flux	1.77739e-15 ± 7.26143e-15
sc_ra	17.1405365435	sc_ep_8_flux	6.99701e-13 ± 1.3871e-14
sc_dec	-46.668253114	sc_ep_8_fmax	6.99701e-13 ± 1.3871e-14
sc_poserr	0.567171	sc_ep_8_fmin	6.99701e-13 ± 1.3871e-14
sc_det_ml	19542.0	sc_ep_9_flux	8.68594e-13 ± 1.37187e-14
sc_ext_ml	-3.88477	sc_extent	0.0
sc_fvar	None ± None	sc_hr1	0.712921 ± 0.0116533
sc_hr2	-0.548322 ± 0.013267	sc_hr3	-0.933524 ± 0.013585
sc_hr4	-0.937561 ± 0.138609	sc_sum_flag	0
sc_var_flag	False	confused	False

This source in external databases: XCatDB, Chandra CSC 20" VOTable, Swift 2SXPS 20", RCSED, Simbad 2', Vizier 20", NED 2', Gaia 20" VOTable

Detections (observations of this source at different epochs)

detid	revolut	obs_id	src_num	poserr	ep_8_flux	utc_start	exptime	ep_offax	spectrum
104050208010001	1274	0405020801	1	0.567171	6.99701e-13	2006-11-23 02:47:21.000	19973	10.5813	True (Fit spectrum)

How to get (elsewhere) 4XMM data? XCatDB

https://xcatdb.unistra.fr/4xmmdr12/

Unique Sources | Individual Detections

4XMM-dr12 Interface - Observatory of Strasbourg

- DB content - Contact - Landing Page - b

Access to the 3XMM catalogue (contain all detections)

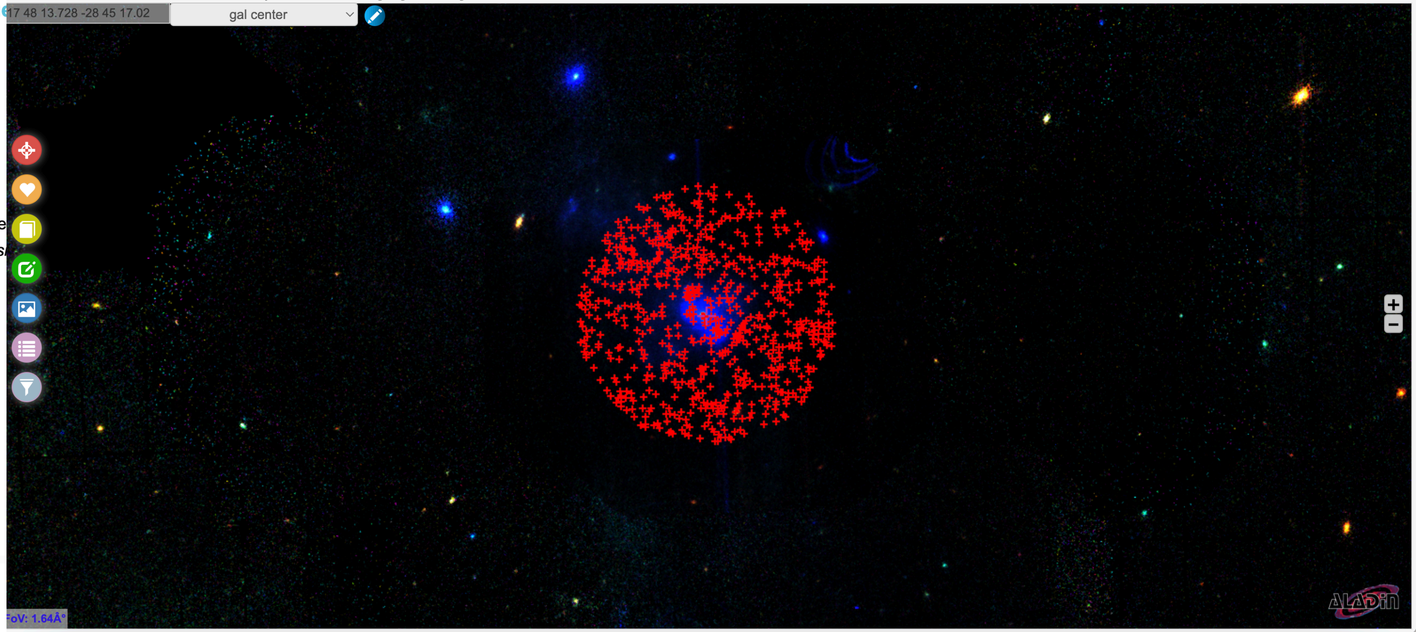
The XCatDB: Strasbourg Interface of the 4th XMM-Newton Catalogue

- **Content**
  - **Possible identifications** of all EPIC sources in archival catalogs
  - **630347 sources** compiled from **939270 detections** in 12712 observations
  - EPIC **spectra**, EPIC **time series** and other useful **previews**.
  - Optical **Finding Charts**
  - read more on the SSC *Web pages*
- **Additional Data and Features**
  - **Online spectrum fitting** Select sources with spectra click on below any spe
  - **Search by region** (Individual detections only) Open the query editor on the *Pos*
- **Data Access**
  - Click on Unique Sources to browse detections
  - Click on Individual Detections to browse unique sources
  - Click on Sky Browser to browse the VO sky with Alix
- **Other Interfaces:**
  - *XSA* at ESA's XMM-Newton SOC
  - *XCAT-DB* at the SSC institute, Observatoire Astronomique, Strasbourg
  - *Browse* at HEASARC NASA GSFC
  - *The IRAP catalogue server*
  - *LEDAS* at the SSC institute, University of Leicester

4XMM-dr12 - Alix Sky Viewer - Observatory of Strasbourg

- DB content - Classical Interface - Contact- Landing Page - SSC Page

17 48 13.728 -28 45 17.02 | gal center



Show 2 entries

Showing 1 to 1 of 1 entries

Selection of Unique Sources

4XMM J010833.7-464005 Detection Plots

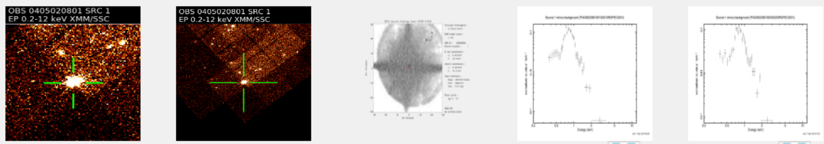
01:08:33.73-46:40:05.7 ± 0.5672arcsec

Good detection (0)	Point Source
Det ML 19542.0000	Not variable
7.00E-13 ±1.39E-14 erg/sec/cm2 (0.2 12keV)	
HR1 0.7129 HR2 -0.5483 HR3-0.9335 HR4 -0.9376	

1/1

01:08:33.73-46:40:05.7 ± 0.1363arcsec More...

Observation 0405020801	23/11/2006 2:47:21
Good detection (0)	Point Source
Det ML 19542.0000 (0.2 12keV)	Not variable
7.00E-13 ±1.39E-14 erg/sec/cm2 (0.2 12keV)	
5459 ±80 counts	
HR1 0.7129 HR2 -0.5483 HR3-0.9335 HR4 -0.9376	



EP 0.2-12KeV | EPw 0.2-12KeV | CA FChart | M1 Spec. | M2 Spec.

Possible Source Identifications