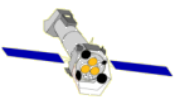


Pipeline Status

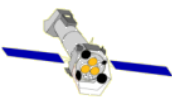
Pedro Rodríguez on behalf of PPS team

XMM-Newton Users' Group Meeting
ESAC, May 17, 2018

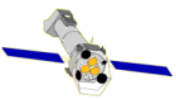


Outline

- Current status
- Development activities
- Bulk reprocessing

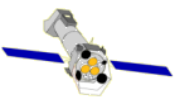


- Pipeline released on late December 2017 based on SAS16.1
 - Flaring background filtering for spectral products optimized per source
 - Pile-up diagnostics numbers in headers of spectrum files
 - PILEFRAC from count rate (2015, A&A, 581,A104)
 - SNLG_OTM, DBLE_OTM ratio of observed-to-model for single and double patterns
 - Footprints for EPIC observation according to EPIC combined exposure map
 - Response matrix and effective area for RGS second order spectra
- Pipeline operations
 - Smooth data processing, ACDS data exchange and screening
 - Try to fix ODFs that result in pipeline failure (TM drop/corruption, operational issues, TCX generation...)



Development activities

- General
 - Instrumental background from new SAS task evqpb
 - **"Clean spectral" images (inst. background subtracted, exposure corrected, color coded)**
 - Background spectrum for EPIC sources
- Source Products (target)
 - **New binning for EPIC light curves**
 - **EPIC light curves into a single file, all exposures and energy bands**
 - **OM light curves into a single file, all exposures and filters**
 - Delivery of EPIC response matrices with spectral source products
 - **Pile-up "free" EPIC-pn spectra**
 - ~~➤ Barycentric time correction => orbit as pps product~~
 - **Variability tests (see SSC presentation)**
- Catalogues
 - **Bad pixels in MOS cameras**
 - In-band fluxes from count rates
 - **Source detection in overlapping fields (see SSC presentation)**
 - Time resolved source detection (Transients)



Bulk reprocessing

Processing Software

SAS17+
Calibration files CCF
Pipeline modules

Infrastructure

~14,000 ODF
~3GB/obs => 40TB
~3 h/obs (4cpu, 32GB)

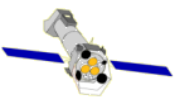
Clean list of clean ODF

Science content
Re-constituted orbit data (microseconds)
Correct Time Correlation Files (~100revs)
Fix housekeeping data
Split mosaic observations

Management

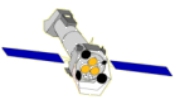
Optimization of resources
Automatic re-issue jobs for certain failures
Bookkeeping
Quality control

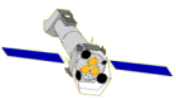
Validation



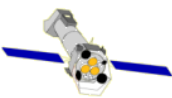
Summary

- Smooth daily processing
- Fix problems spotted in screening
- Improve spectral images
- Produce light curves suitable for analysis on different scales
- Minimize pile-up effects in spectral products for bright sources
- Expand variability tests
- Reduce number of spurious sources
- Prepare for bulk reprocessing

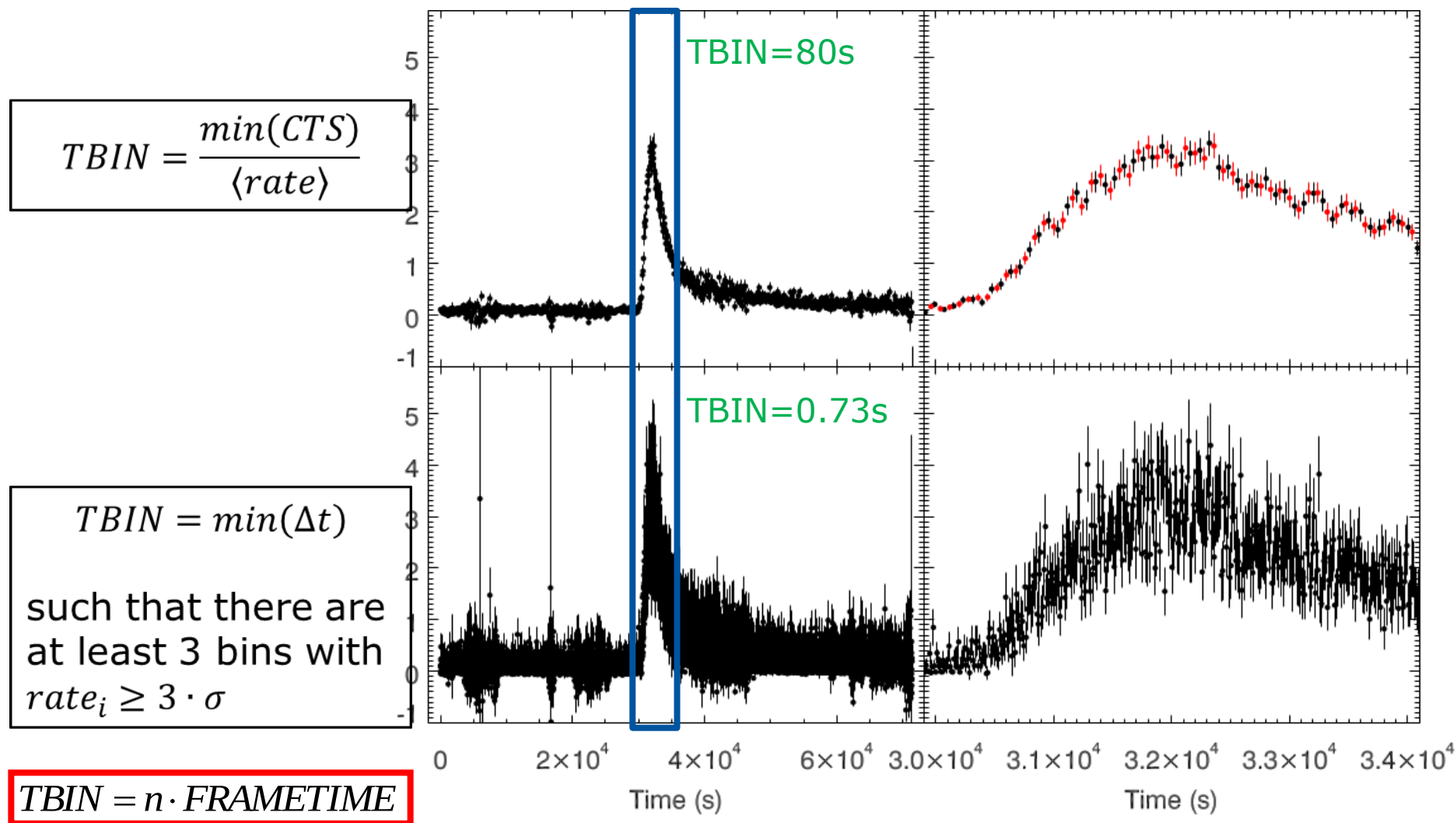


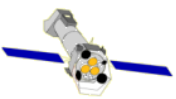


ADDITIONAL MATERIAL



Sampling time in EPIC light curves





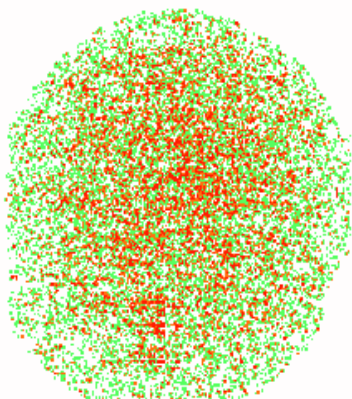
Badpix method for MOS

emchain/emproc

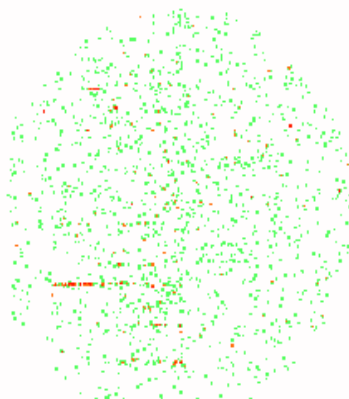
1. embadpixfind includedeadpixels=Y
2. embadpixfind finddead=Y incremental=Y (flaring filter)
3. embadpixfind finddead=N incremental=Y (PHA < 150)

Test on 261 observations

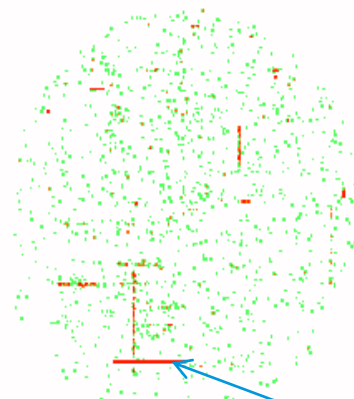
Common
(18291)



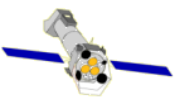
Only in **test**
(1618)



Only in **current**
(2461)



~550



Barycentric correction

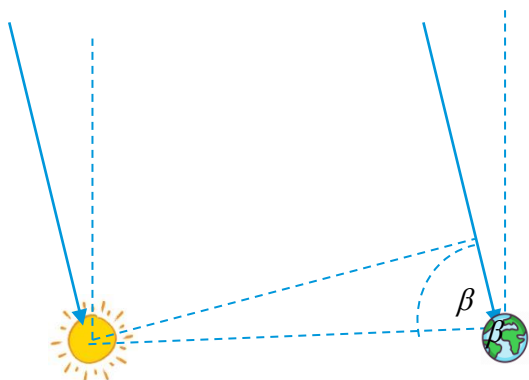
Geometric correction:

$$\Delta t = \frac{r}{c} \cos(\beta) ; \beta \text{ solar aspect angle [70-110 deg]}$$

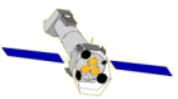
$$\delta(\Delta t) \approx \frac{r}{c} \sin(\beta) \delta\beta$$

Source specific correction

Include S/C position in the PPS products

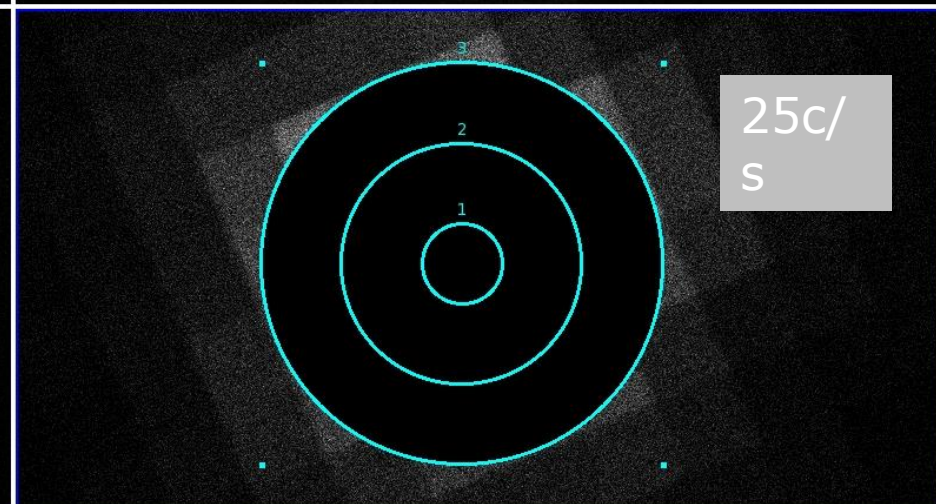
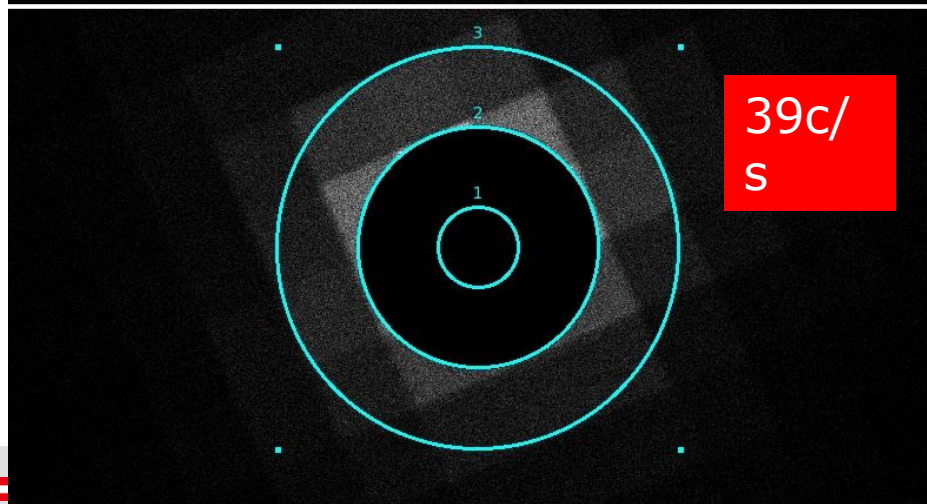
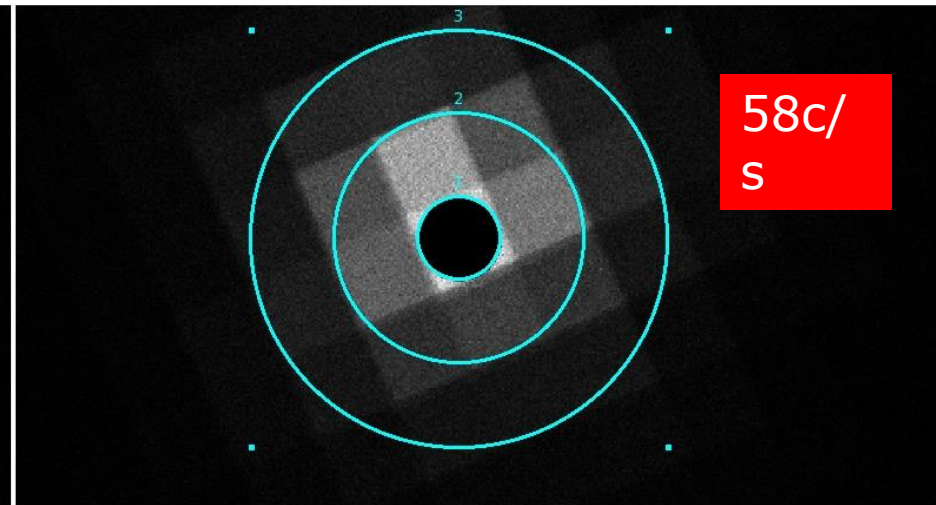
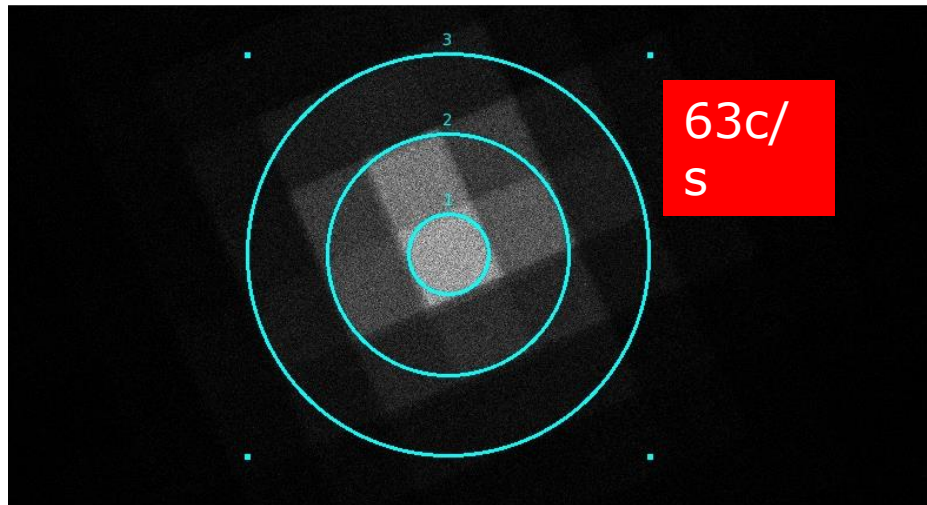


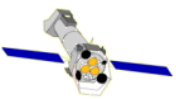
		Differential time correction
Earth motion in a year	[70-110] deg	+/-170 min along year (2months)
Earth motion in 135ks	1.5 deg	~13.4 sec in a 135 ks
EPIC FoV	30 arcmin	~4.3 sec within FoV
Point Spread Function	1 arcmin	~0.14 sec within PSF



EPIC spectra for piled up sources

- Excise core
- Modified response matrix





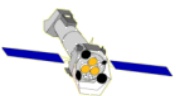
Clean list of clean ODF

- Science content
- Re-constituted orbit data
- Correct Time Correlation Files
- Fix housekeeping data
- Split mosaic observations

Infrastructure

- ~14,000 ODF
- ~40 TB
- ~3800 days of cpu
- < 8Gb RAM/job (90%)

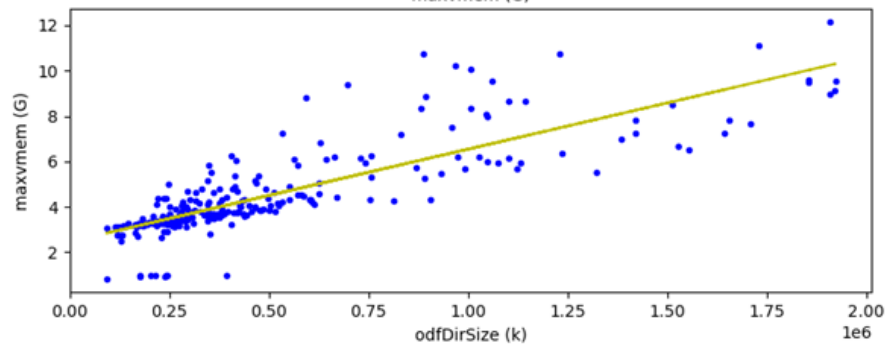
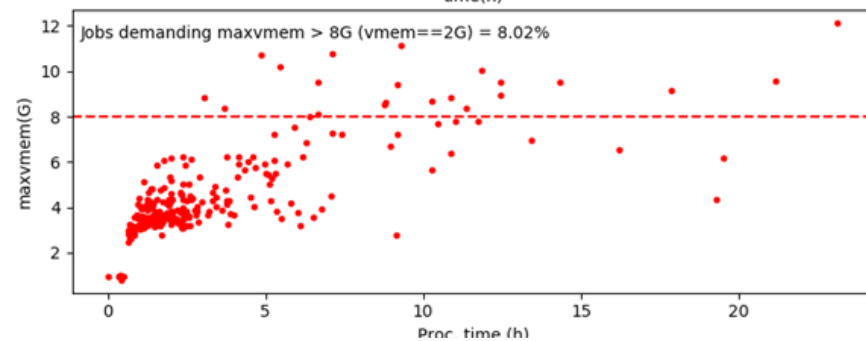
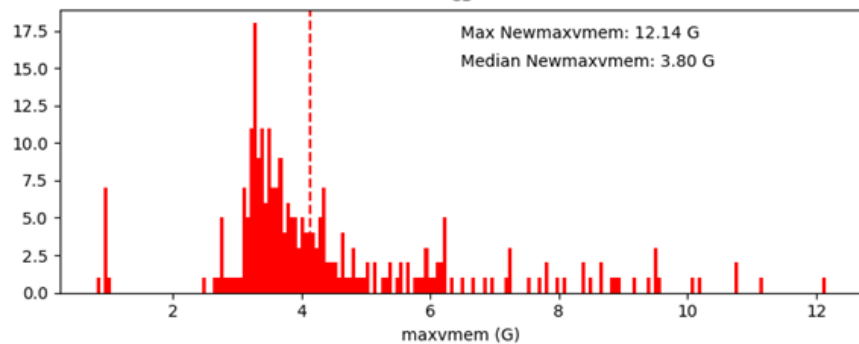
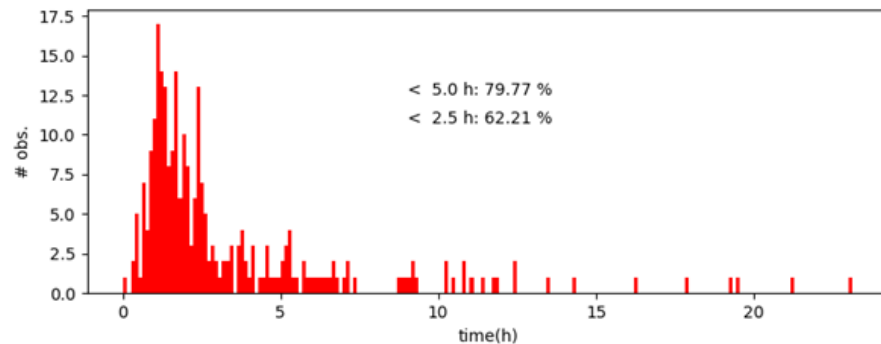
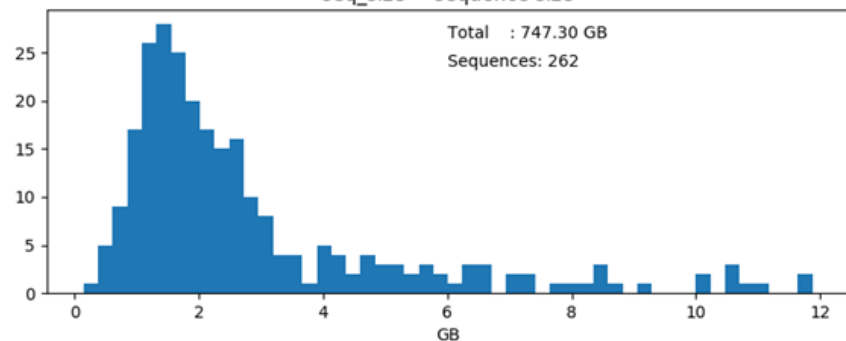
- Management
- Optimization of requested resources
- Automatic re-issue jobs for certain failures
- Quality control

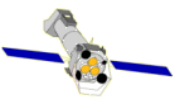


Performance

Stats for last PPS jobs:
PCMS_16
OldSeqs. >= 85492
Observations: 262. newSeqids: 86576 - 86859

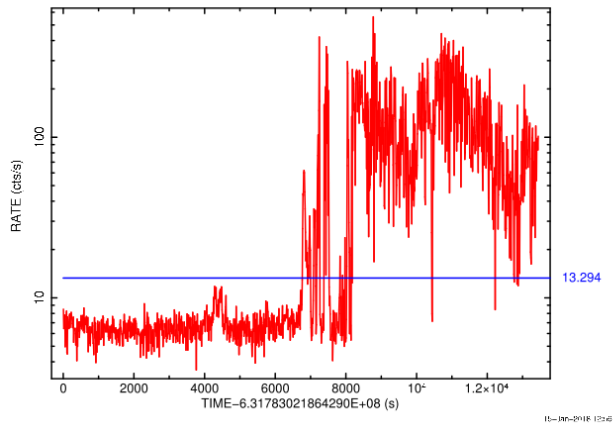
seq_size = sequence size





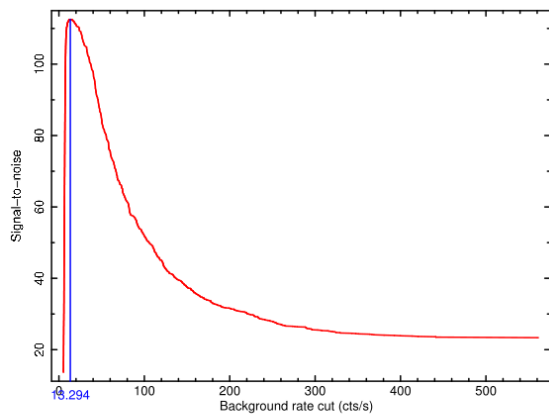
Flaring background filtering per source

Plot of file product/P0800760801PNS003FBKTSR0000.FIT



11-JUN-2018 12:46

Plot of file intermediate/pnEvents-eprn-1-Flare_GT1_SN_diagnostic-S00300000080000



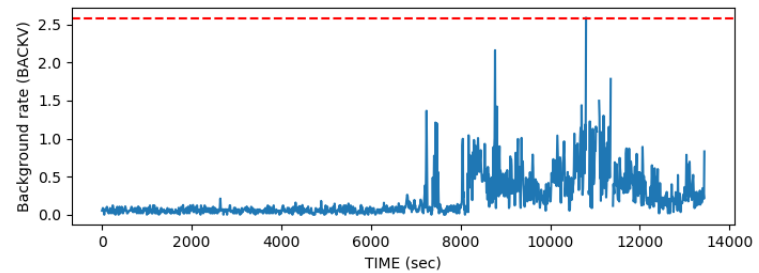
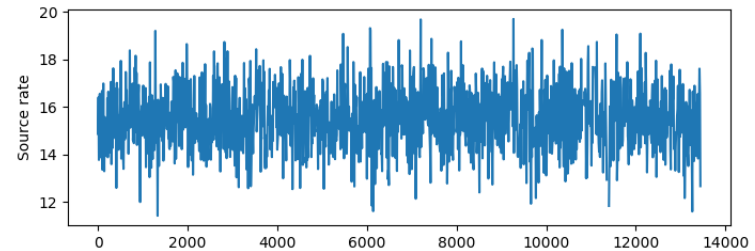
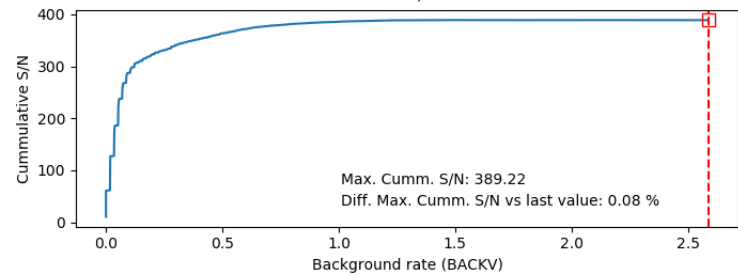
11-JUN-2018 12:46

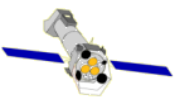
Flaring background filtering
for maximum S/N diagnostic plot

OBS_ID: 0800760801

EPIC SRCNUM: 1

RA,Dec: 13h49m19.4391s -30d18m34.4461s





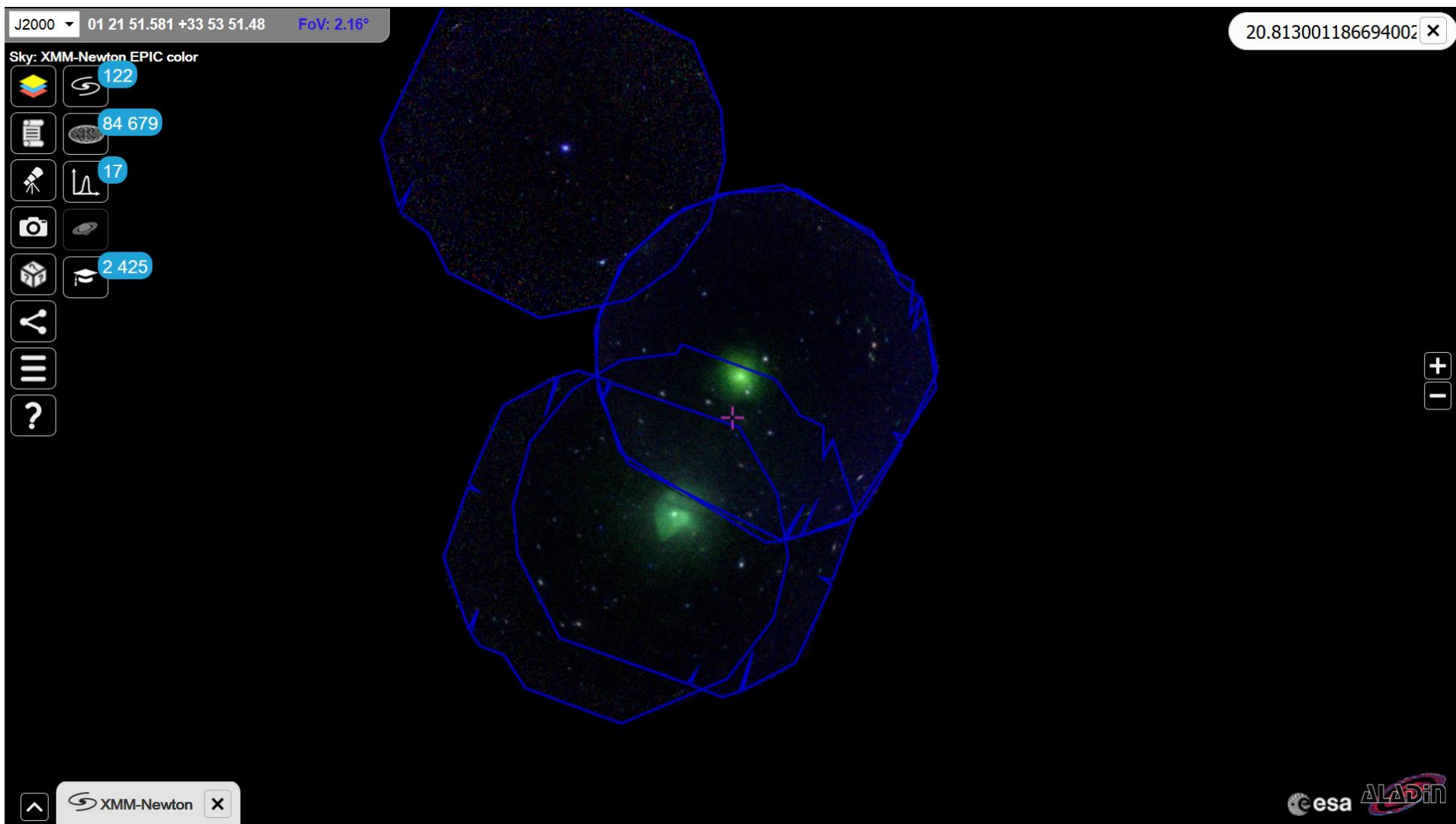
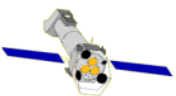
EPIC footprints

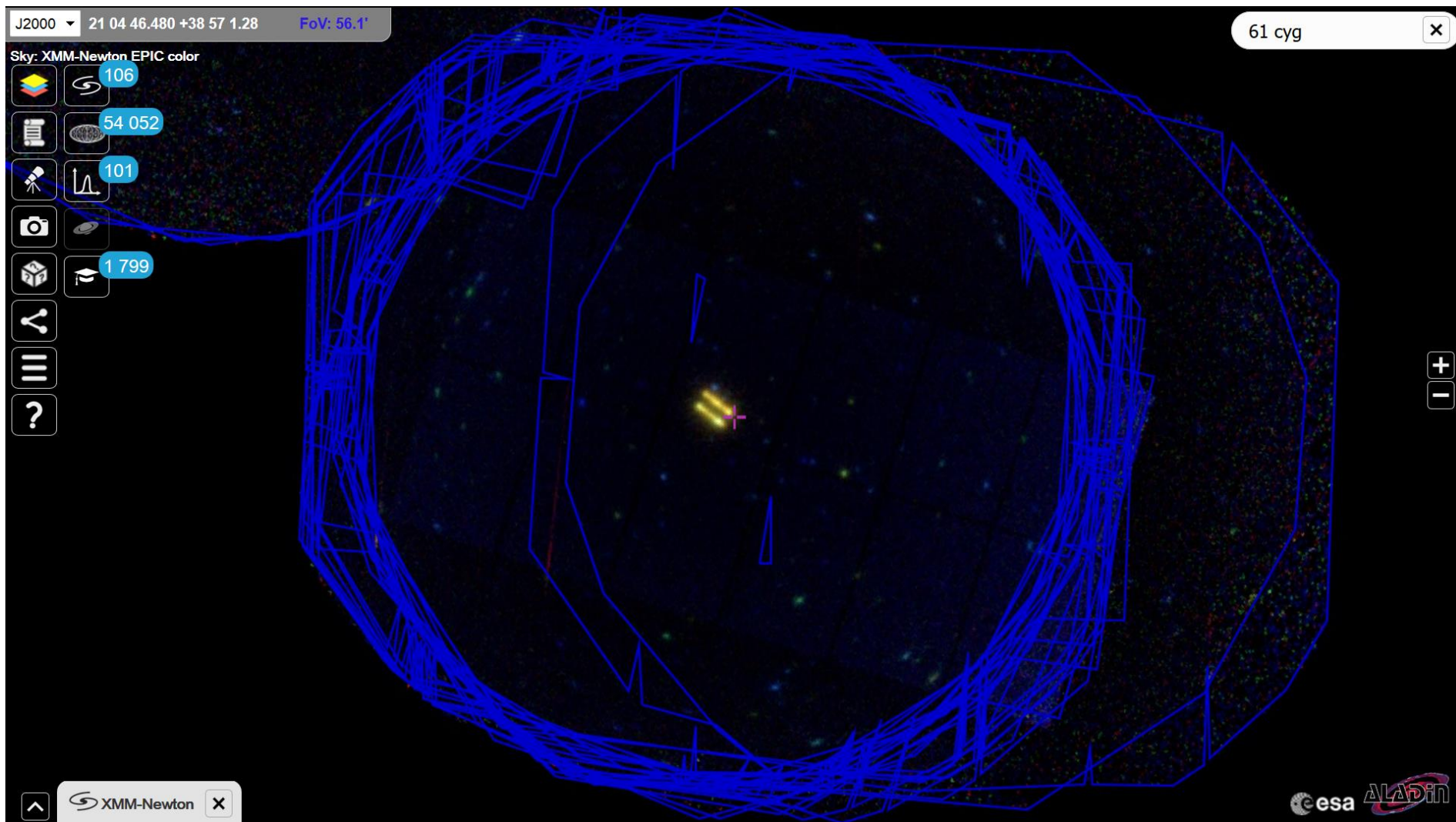
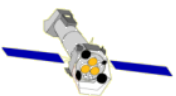
NGC499

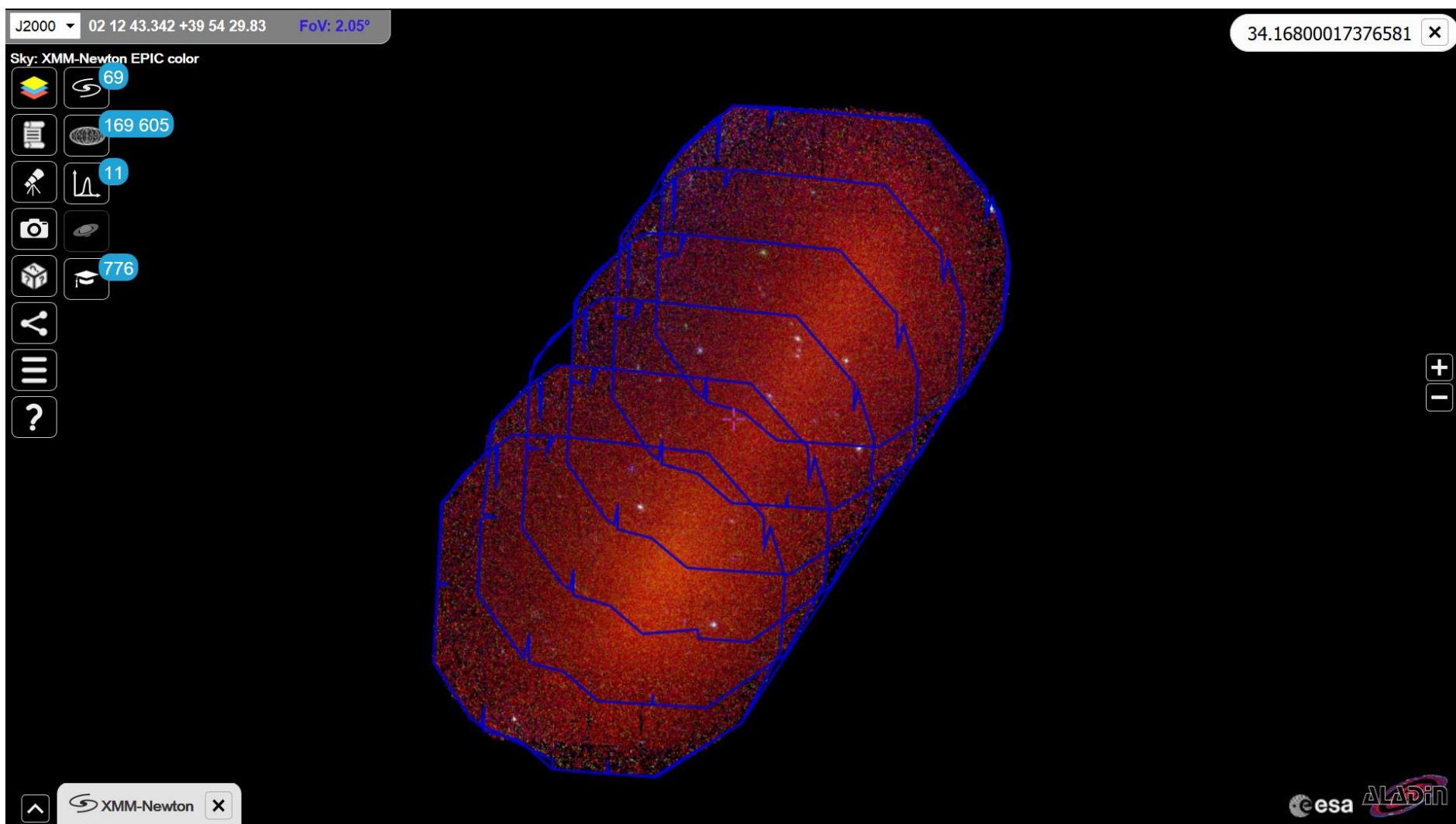
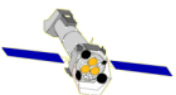
61 cyg

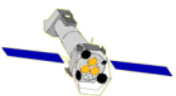
Comet

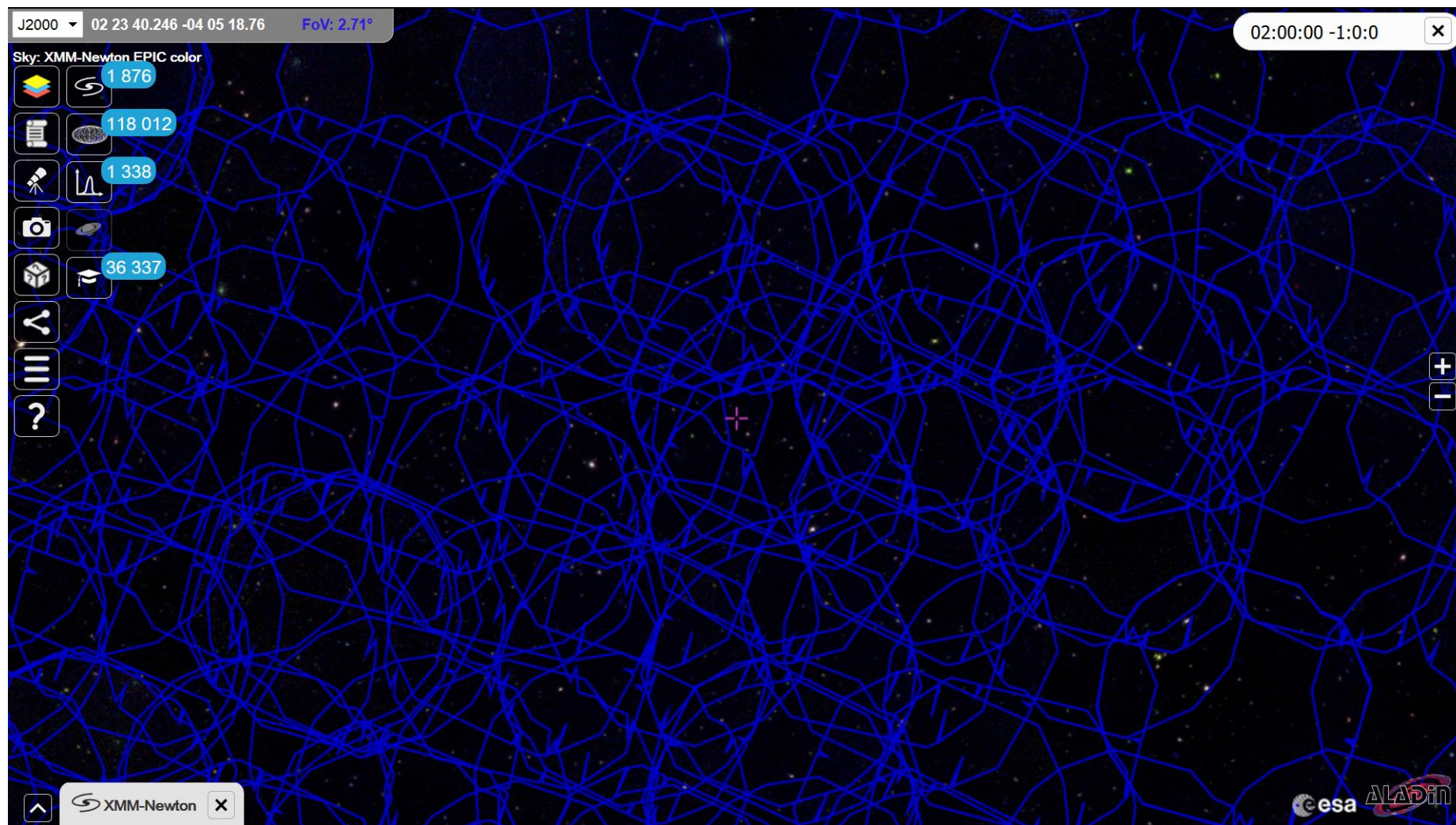
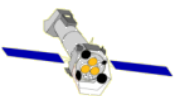
Survey

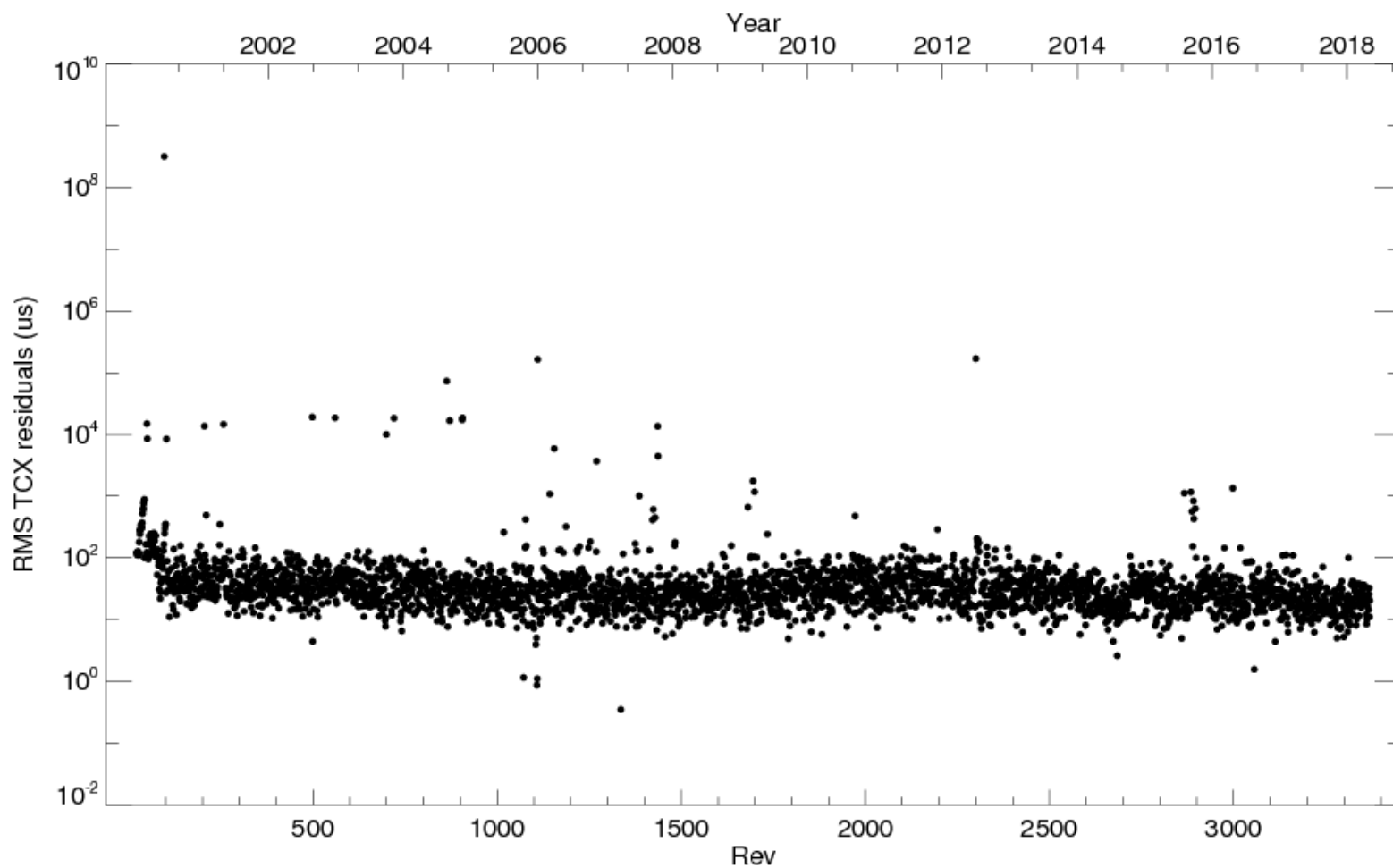
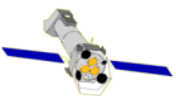


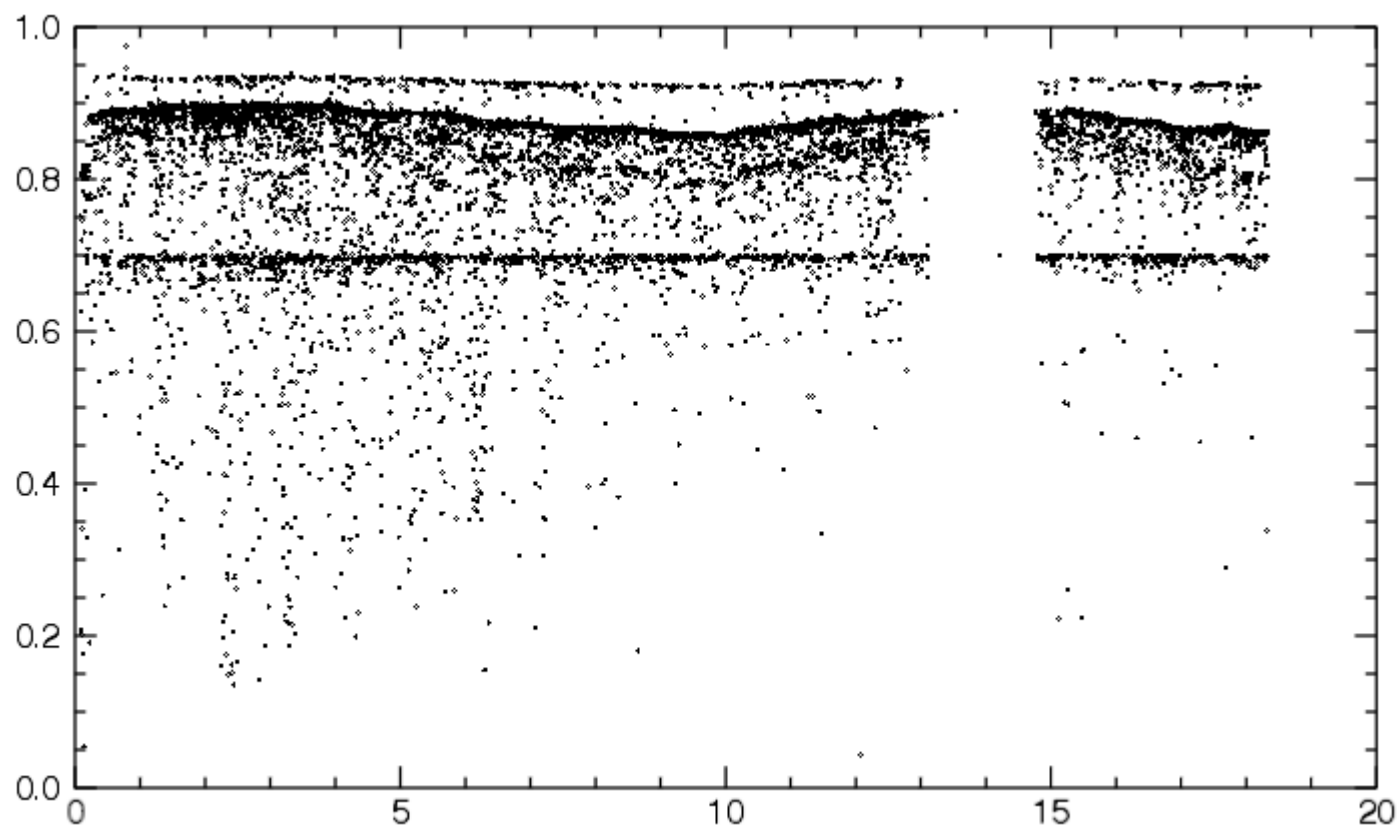
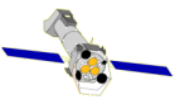


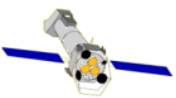






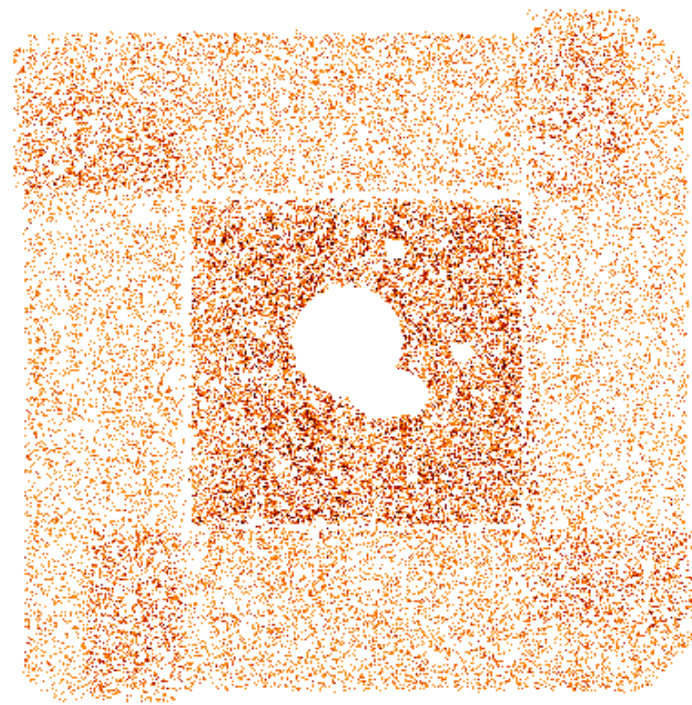
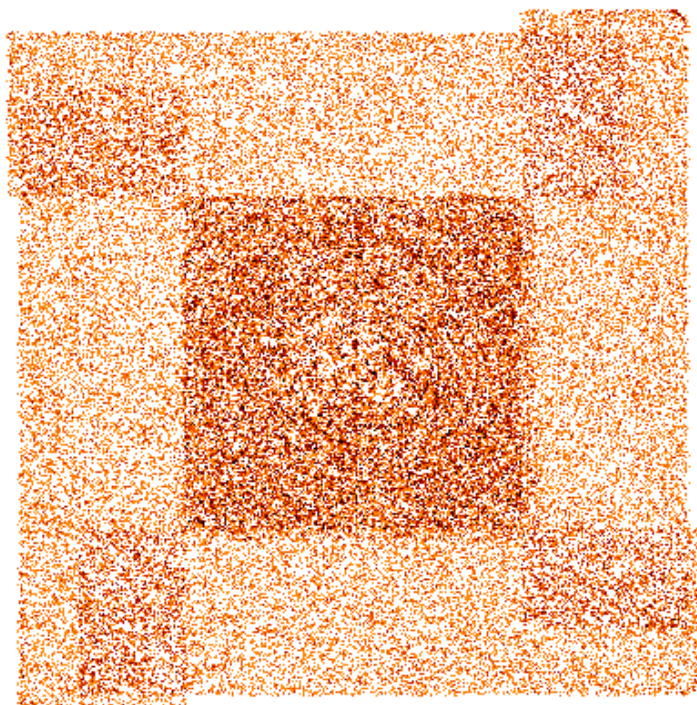




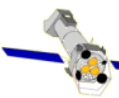


OM Patch flag

- 127 observations
- 2389 exposures
- 254148 detections



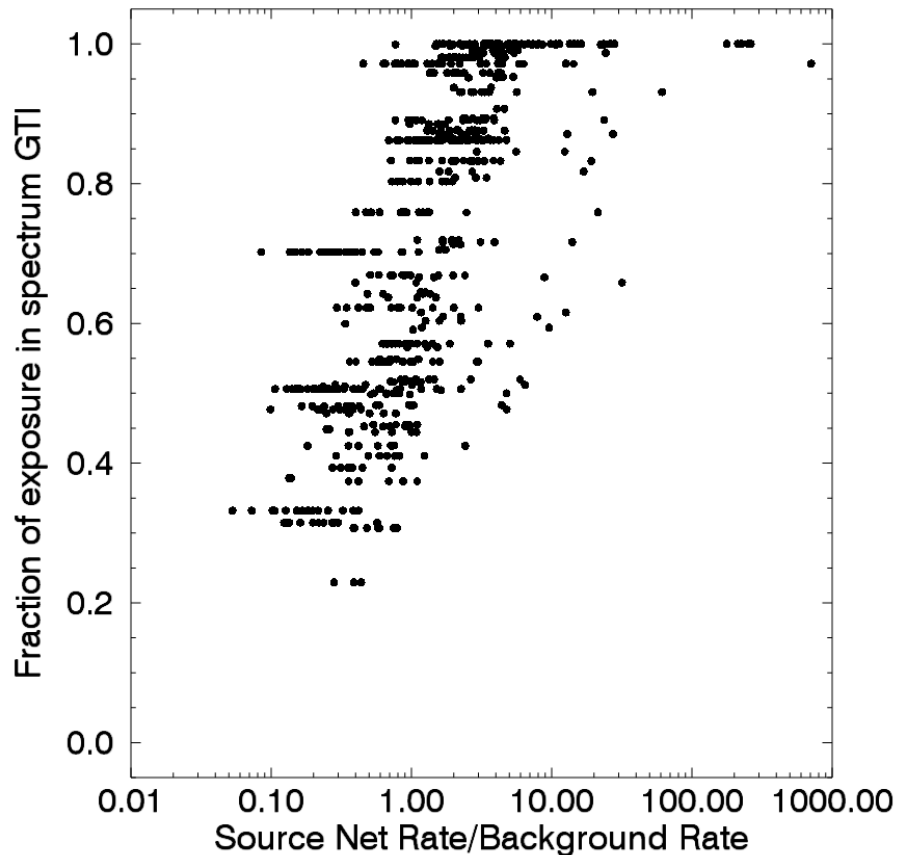
QFLAG=0



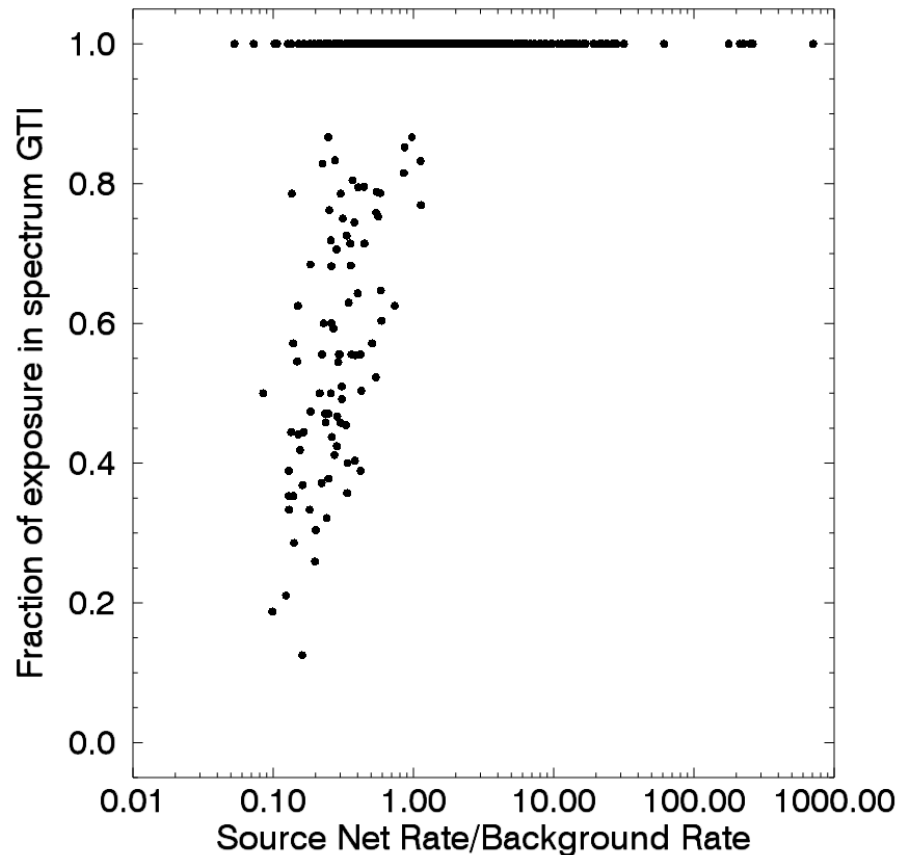
Optimized flaring background filtering per source

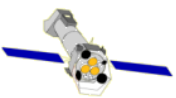
32 Observations ; 672 EPIC spectra with >100 counts

Minimize source detection threshold

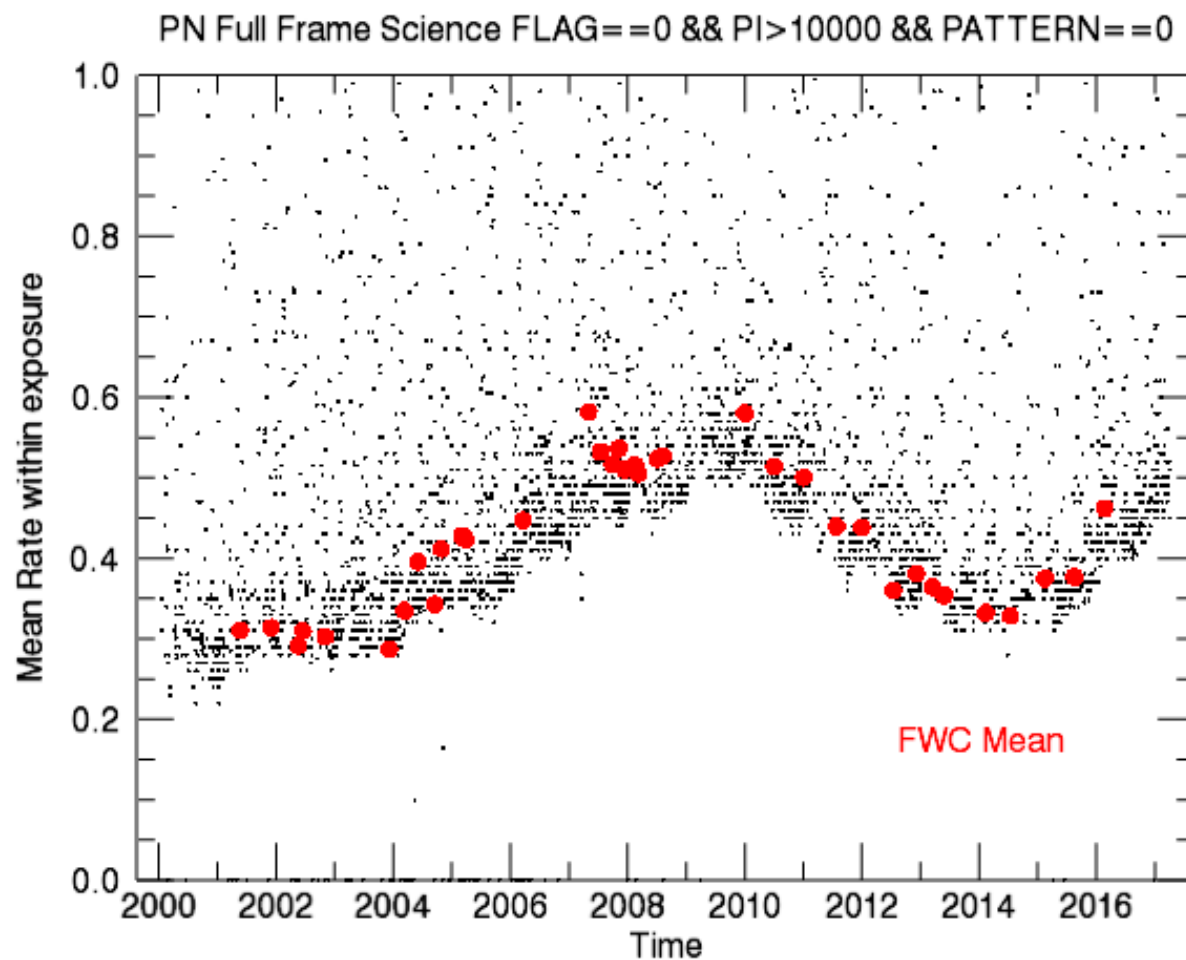


Maximize source spectrum S/N

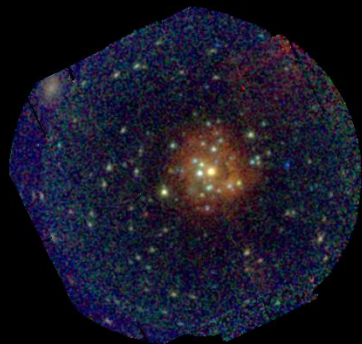




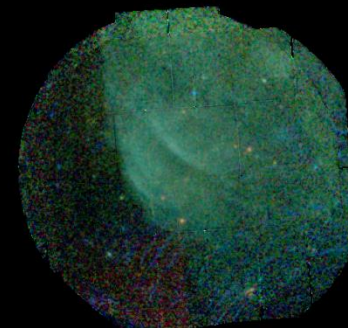
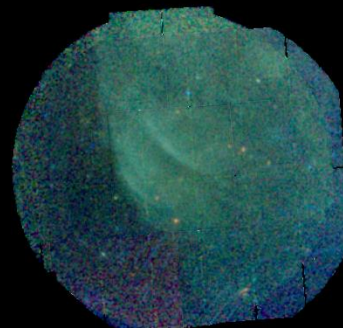
Instrumental background



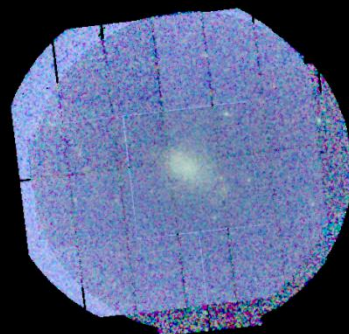
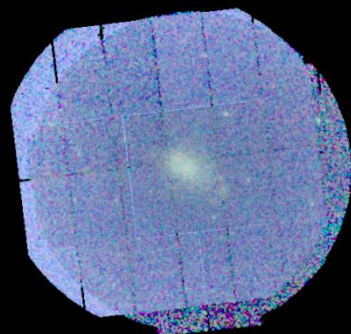
081482 0761620101 M83-ULX1



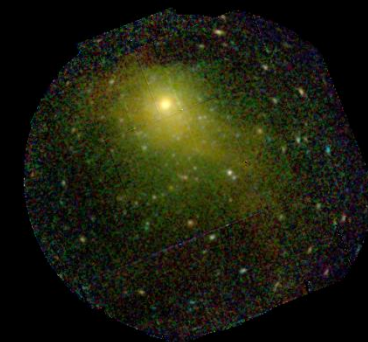
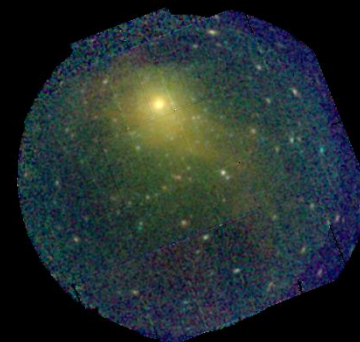
080536 0743030101 RX J1713-South-East



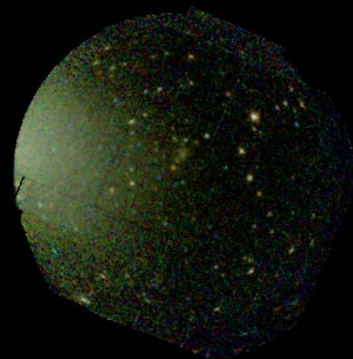
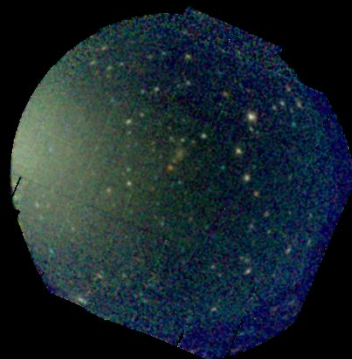
081316 0765011001 MS1111.8



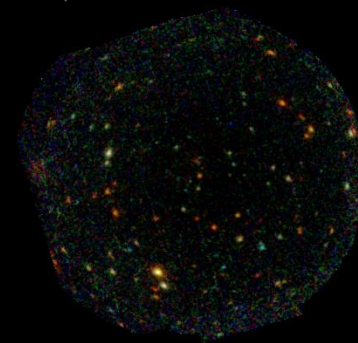
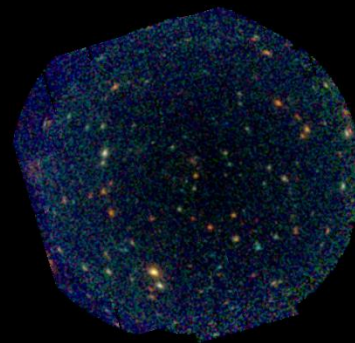
083395 0761630101 NGC 4472

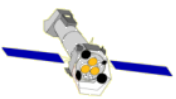


081416 0760340201 CGCG 384-028



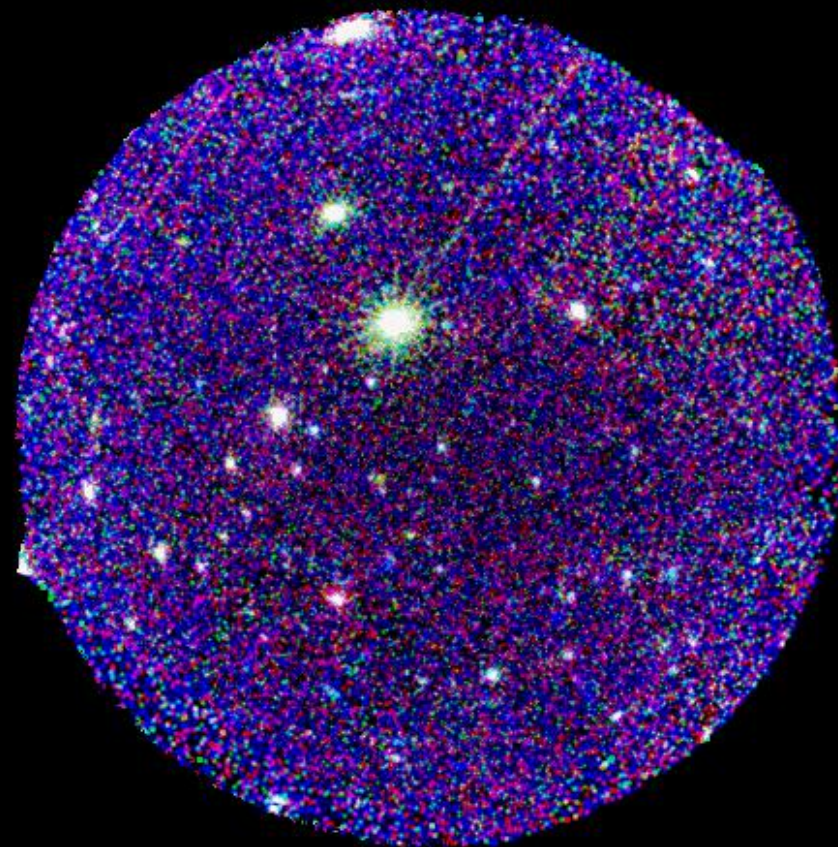
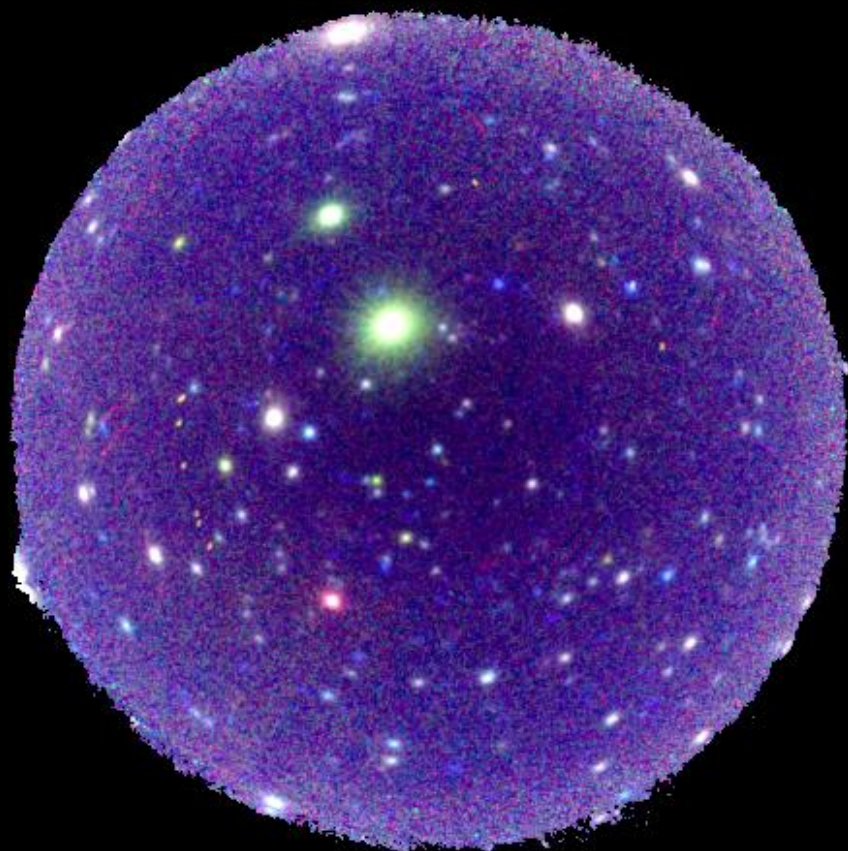
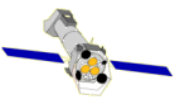
081212 0761920801 Praesepe

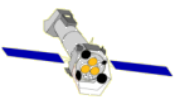




Under Analysis

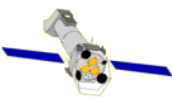
- Treatment of noisy MOS CCDs
- Model independent counts to flux conversion factors
- Production of “fluxed” images
- Response matrices for piled-up sources
- Source detection on stacked observations





Current development activities

- SAS17 testing and validation
- Delivery of EPIC response matrices from XSA
- Apply barycentric correction to events arrival times
- “Shortest meaningful” time bin in EPIC lightcurves
- Compute EPIC light curves for different energy bands
- Collect all EPIC lightcurves for a single source into a single file
- Collect all OM lightcurves for a single source into a single file per filter
- Provide estimate of the instrumental background based on Filter Wheel Closed data
- RGS response matrices for second order spectra
- Extend stacking of OM data to Low/High resolution data

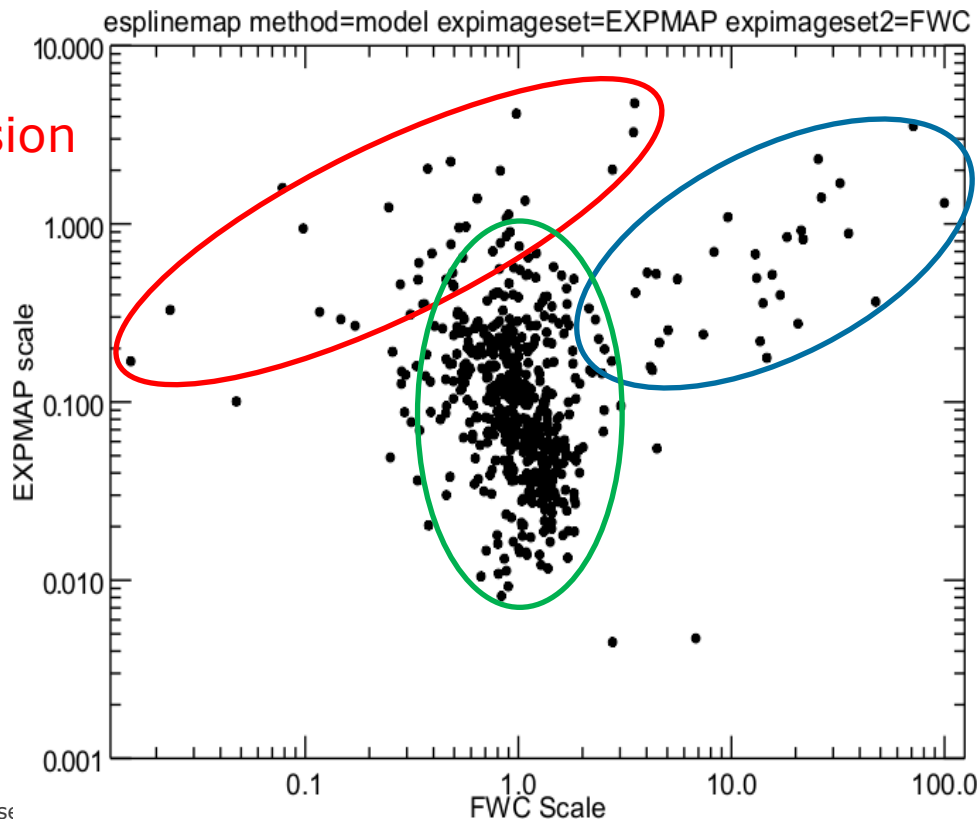


Quiescent background: evqpb (II)

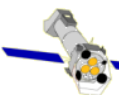
Test:

- Create images from FWC events file with same FLAG, PI and GTI as in pipeline for bands 1-5
- `esplinemap fitmethod=model expimageset=FWC expimageset2=expmap`

Extended emission



High background



sa

