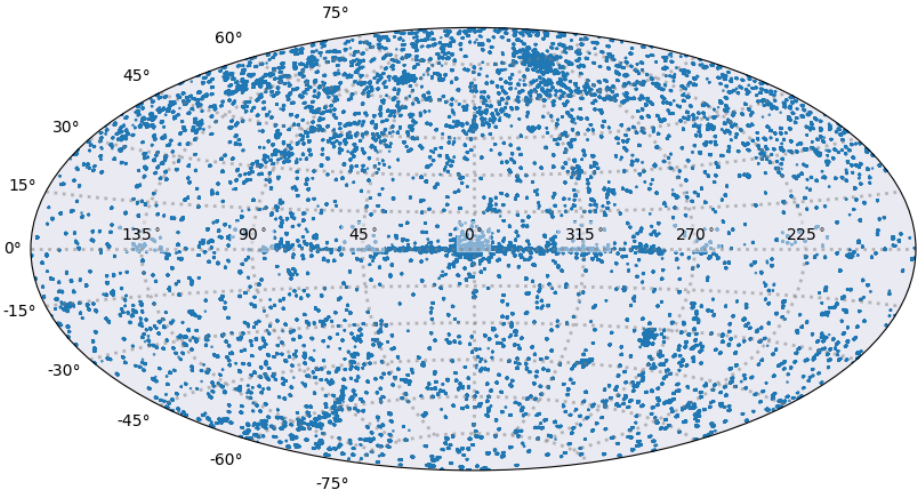
Jonathan McDowell

After 18 years Chandra has observed about 1% of sky

CSC1.1 (2010) 106,586 sources
Wavelet detect on single observations, no co-adding
Public data to end of 2009
Fields with large extended sources omitted
Published as Evans et al 2010 ApJS 189, 37
Primini et al 2011 ApJS 194,37

CSC2.0 (2017/18) 315,887 sources (TBR)
Wavelet + Max Likelihood detect on co-added observations
Public data to end of 2014
Fields whose aimpoint is within 1' are combined into 'stacks'
Overlapping stacks are processed together



Usage Statistics

Current Release

- Catalog version: 1.1; Released: 2010 Aug 10
  - 106,586 master sources
  - 158,071 source detections
  - 5,110 observations with at least one detected source
- Subset of master source properties are available via HEASARC Browse, NED, and Vizier services
  - Usage statistics reported below do not include accesses via these services

Usage Statistics

Release 1.1	Reporting Period 2015 Sep 01 – 2016 Mar 31	
	Number	**% Non-CfA**
CSCview catalog browser initializations	112 /month	92%
CSCview catalog browser properties searches	229 /month	93%
Command-line (CLI) searches	1865 /month*	65%
VO cone searches	6501 /month	~100%
CSC Sky in Google Earth	582 visits/month	

* Excludes 20K searches (~ all non-CfA) from 2016 March

CSC:

5 bands

u 0.2–0.5 keV
s 0.5-1.2 keV
m 1.2-2.0 keV
h 2.0-7.0 keV
b 0.5-7.0 keV

2 apertures:

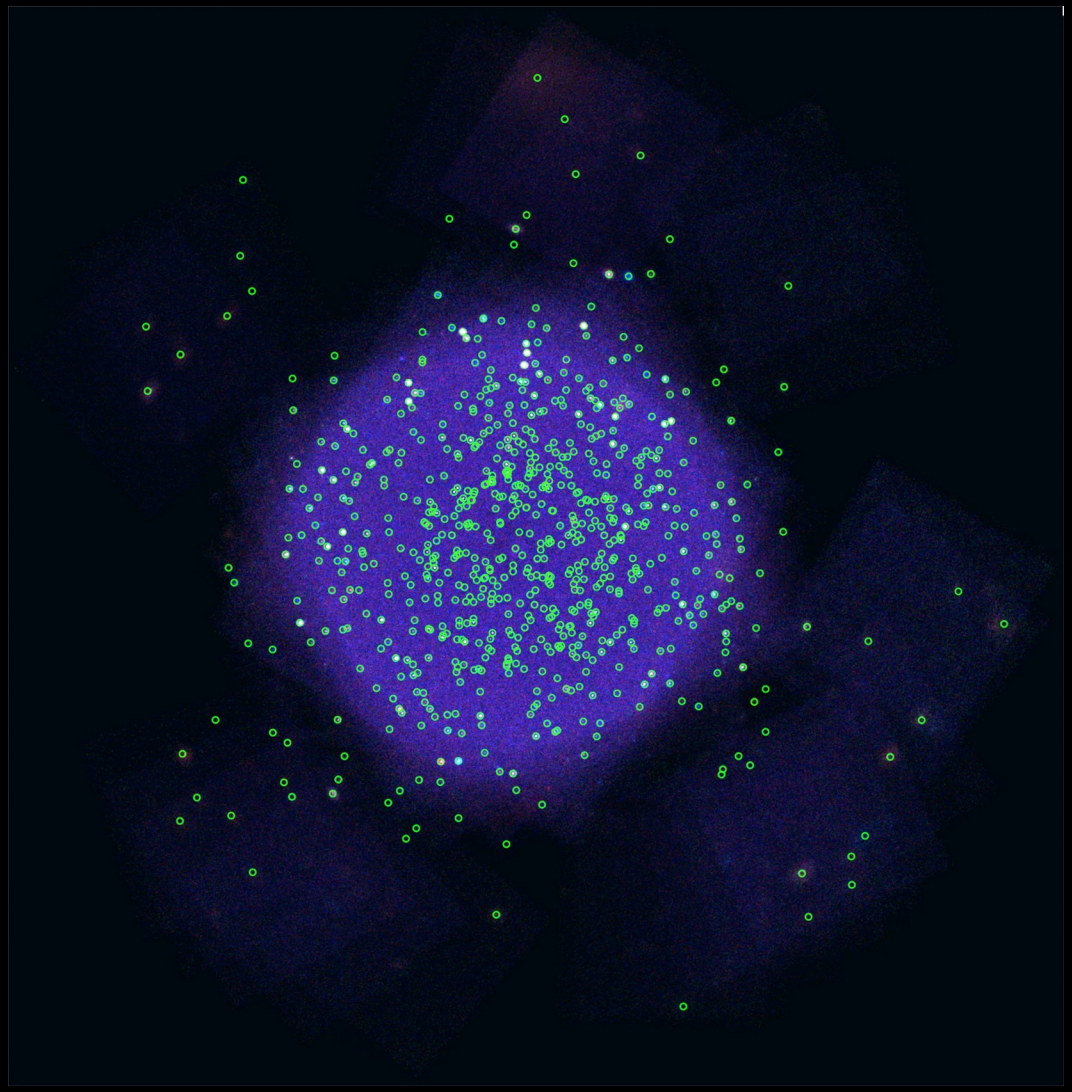
- detection aperture determined by wavelet detect
- aperture containing 90% of flux

3 flux methods:

- spectral fits (if > 150 net counts)
- power law fit with normalization free
- model-independent flux using ARF but ignoring RMF

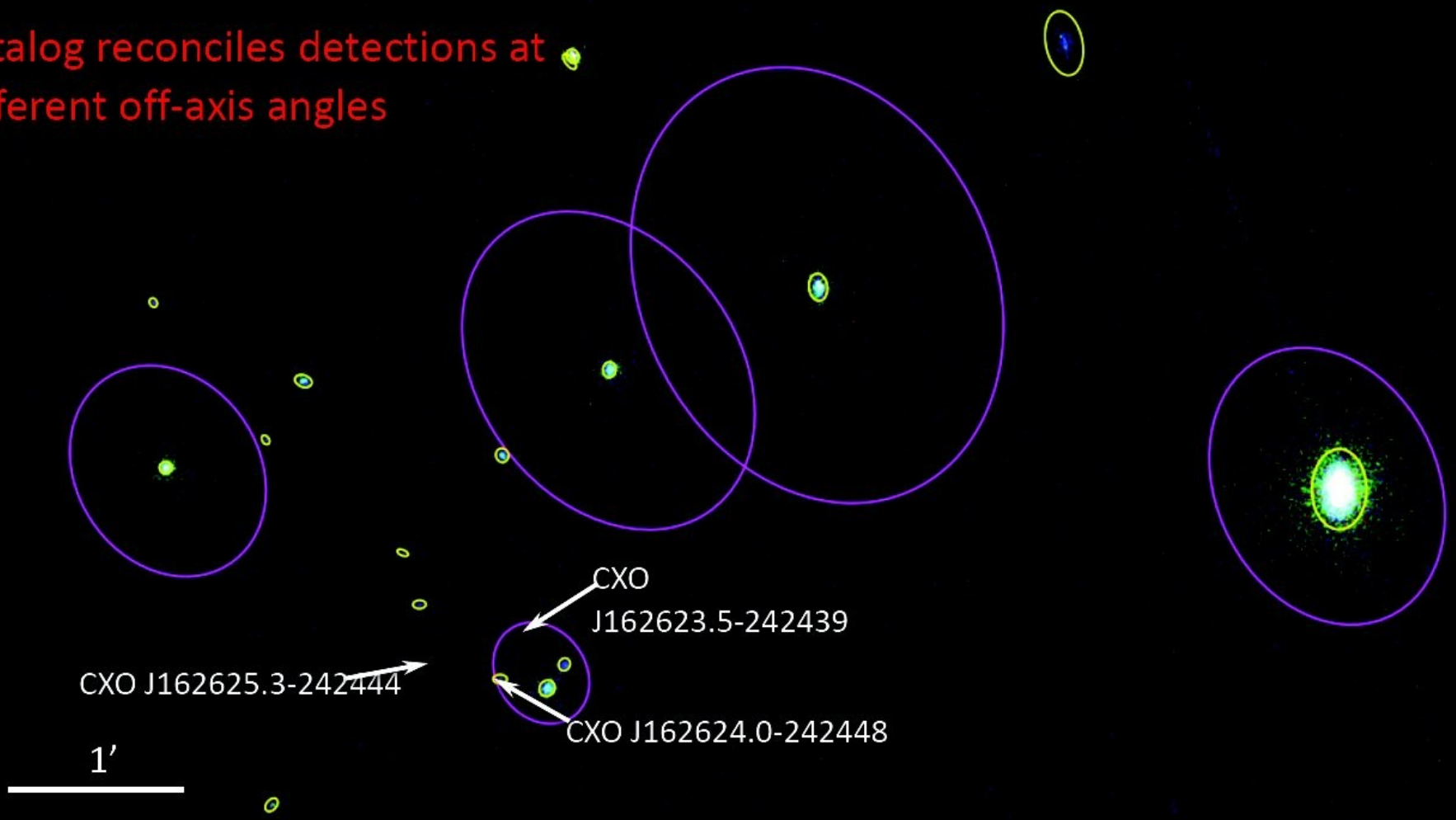
Chandra Deep Field South (81 ObsId – 5.8 Ms)

~1000 Preliminary detections



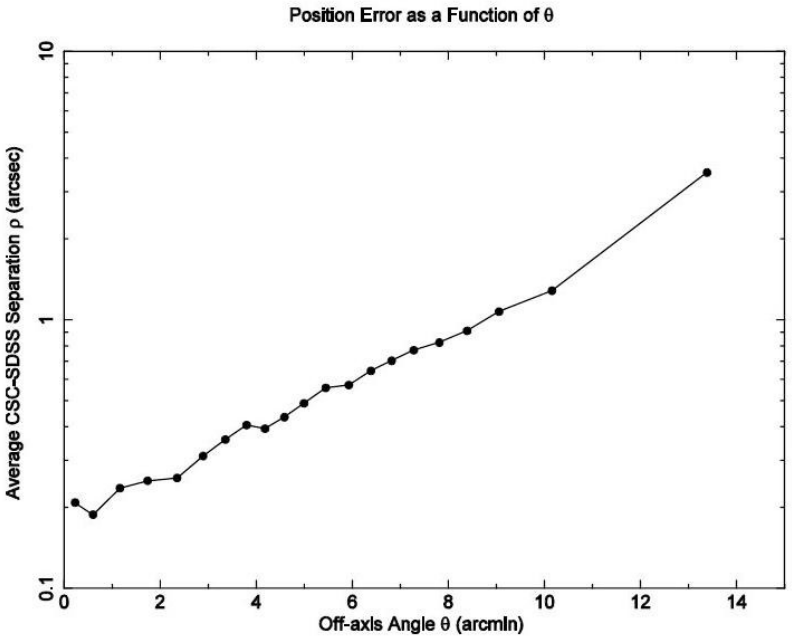
Multiple sources on-axis may be confused in the same field off-axis

Catalog reconciles detections at different off-axis angles

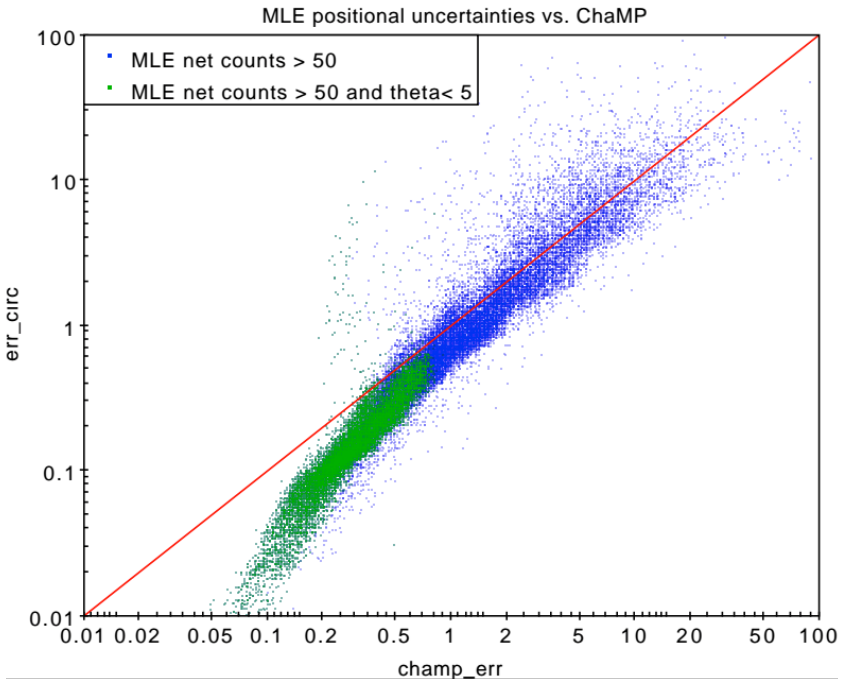


CSC1/2 Positional Uncertainties

CSC1 comparison with SDSS: better than 1" (within 8" off axis)



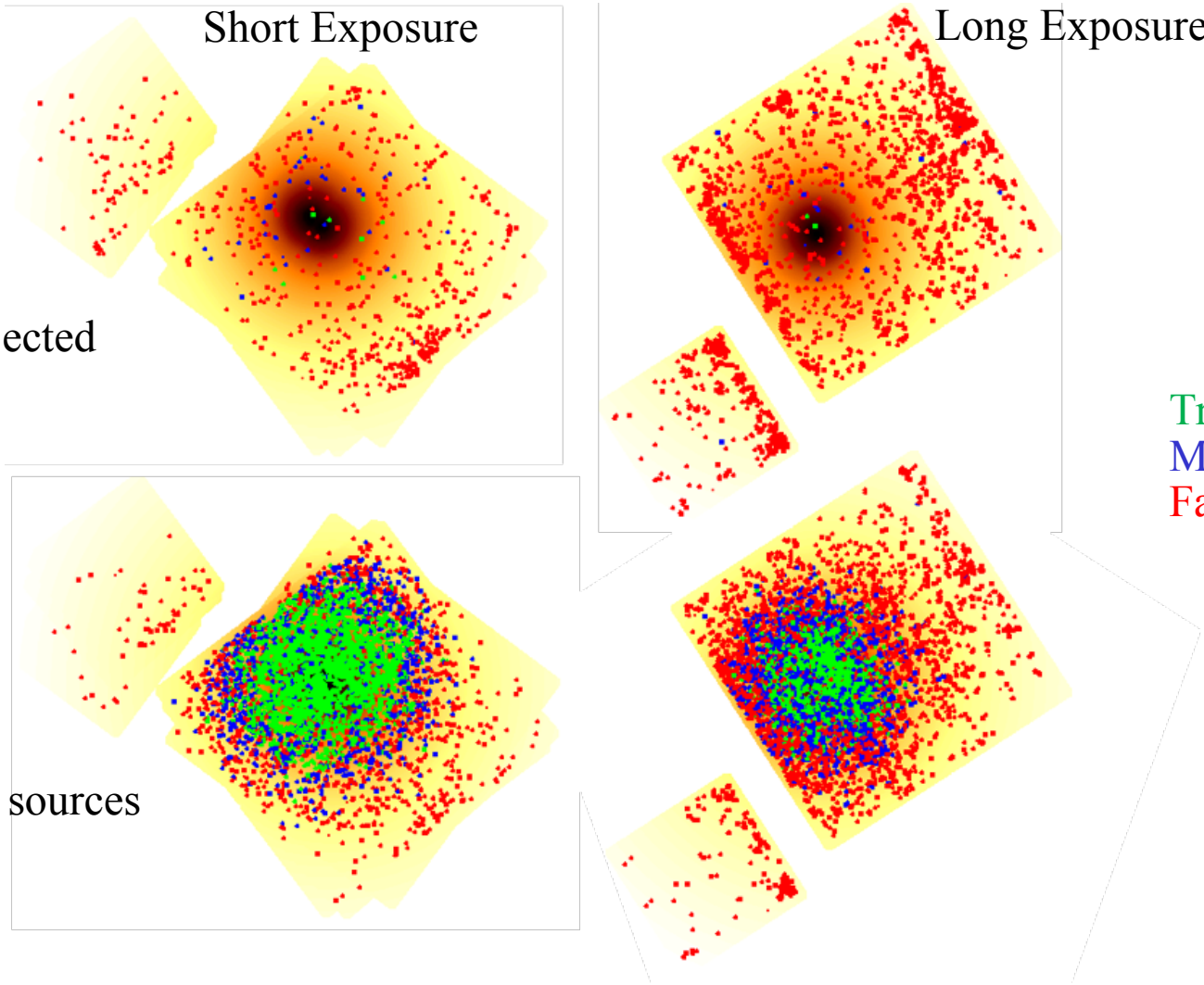
CSC2 estimate: better than CSC1



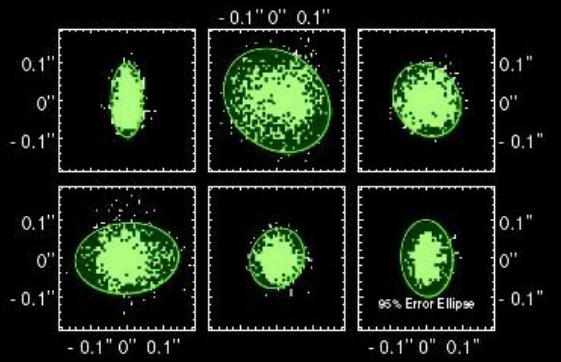
CSC2 internal position errors are smaller than the ChaMP errors used in CSC1 for sources with $\gtrsim 50$ net counts and $\theta \lesssim 5$ arcmin

This plot does not include the absolute catalog astrometric position uncertainty (~0.16 arcsec for CSC1)

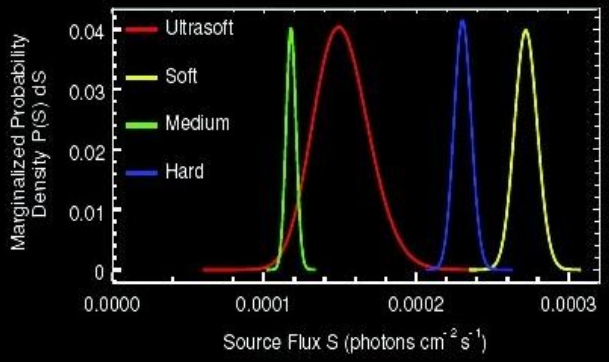
ACIS Likelihood Threshold Calibration



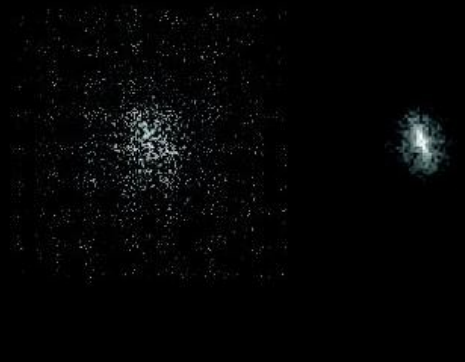
Detections from multiple simulations overlayed on PSF map



Position error ellipses with position confidence MCMC draws



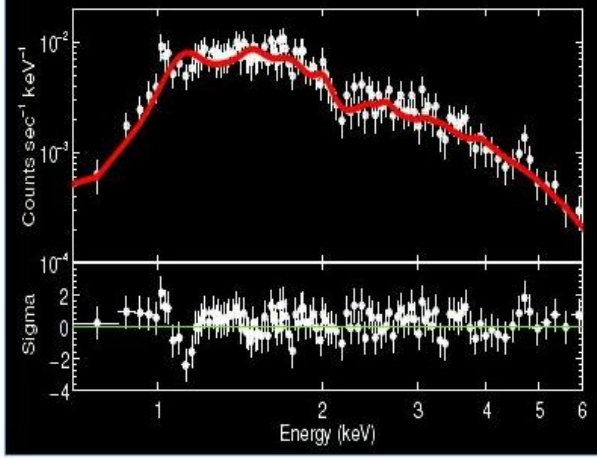
Multi-band X-ray aperture photometry with
Bayesian probability density functions



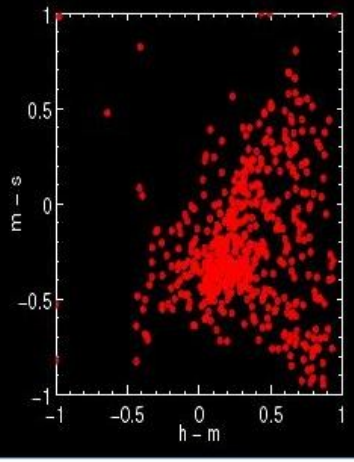
Source extent and local PSF models for every source and energy band

Source properties — all have associated upper and lower confidence bounds

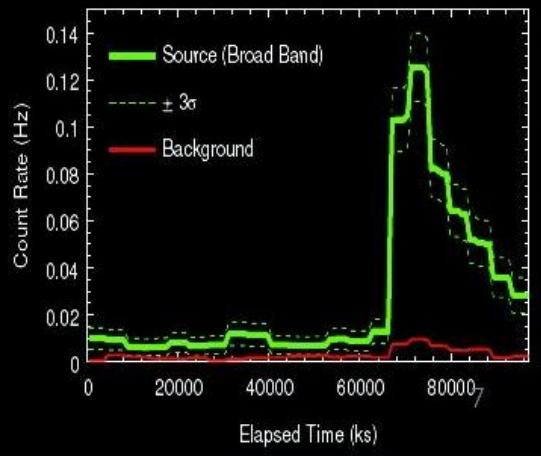
Spectral model fits and fluxes determined using multiple models (>150 cts)



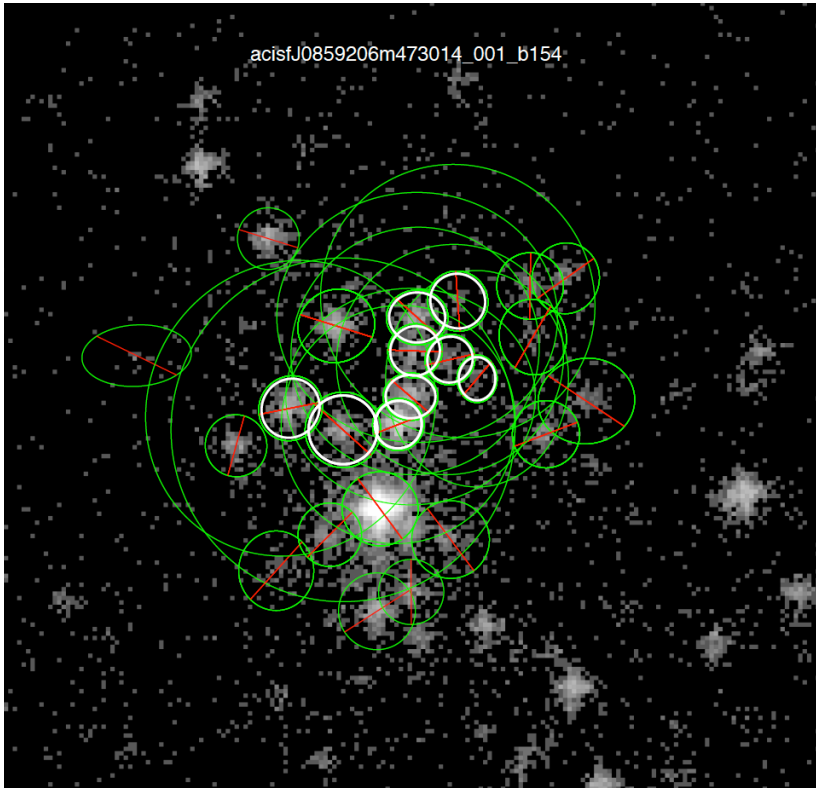
Hardness ratios



Intra- and inter-observation variability measures and light curves

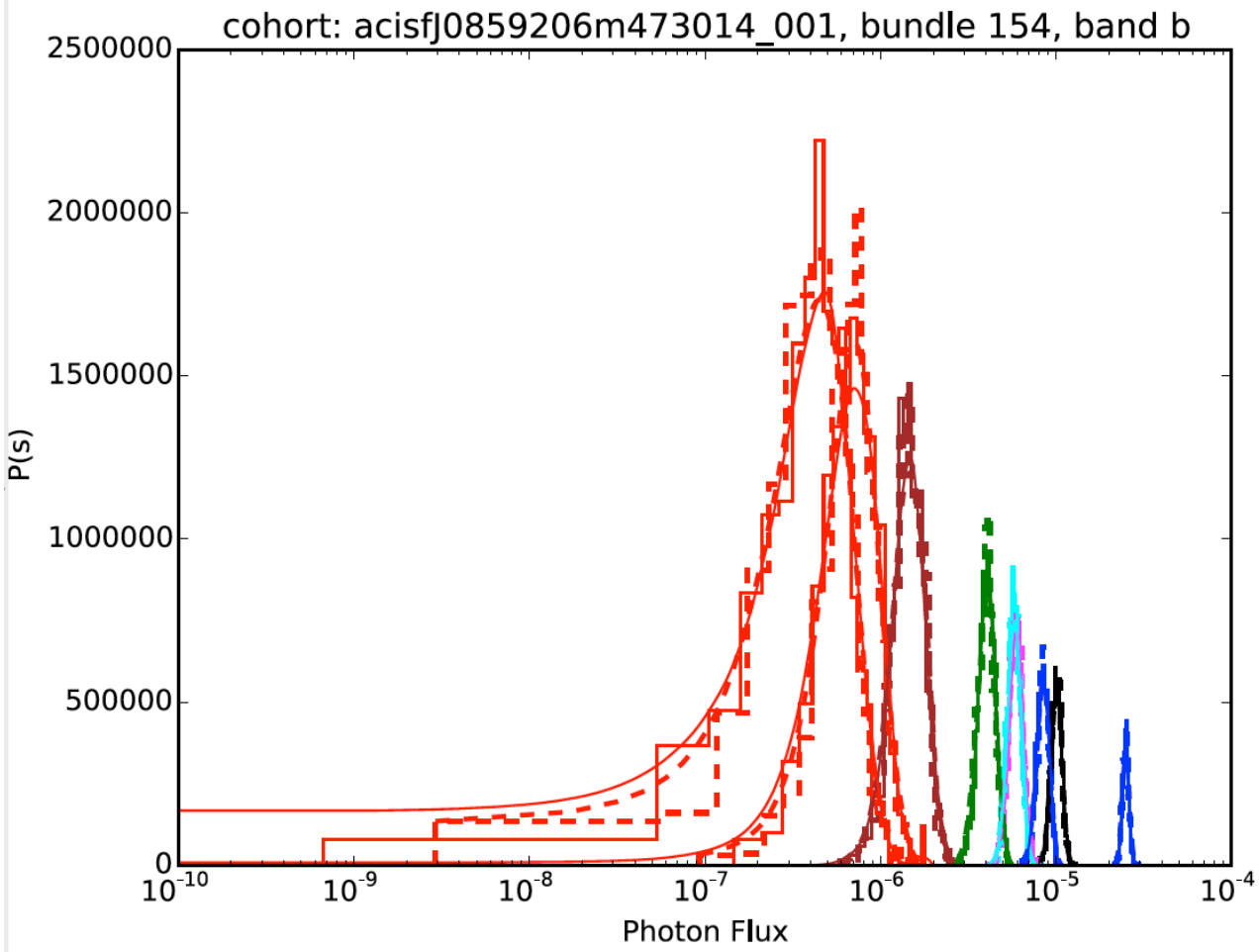


Example of Aperture Photometry Extraction



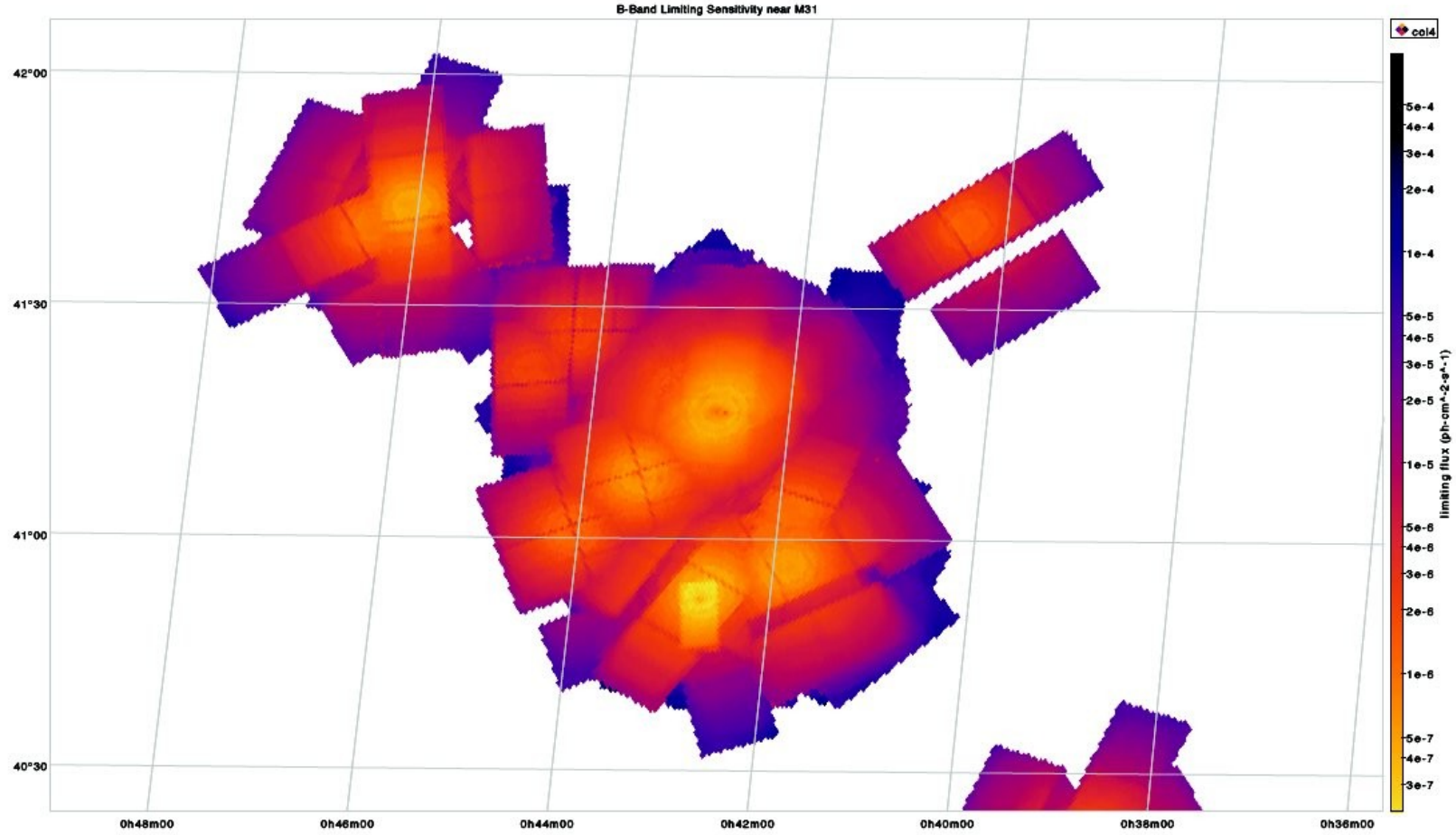
- Simultaneous photometry estimation in crowded field
  - Based on Primini, F. A.; Kashyap, V. L. 2014, ApJ, 796, 24
- Algorithm checked against simulations
- Pipeline results verified against published algorithm

Fluxes from Probability Density Estimation



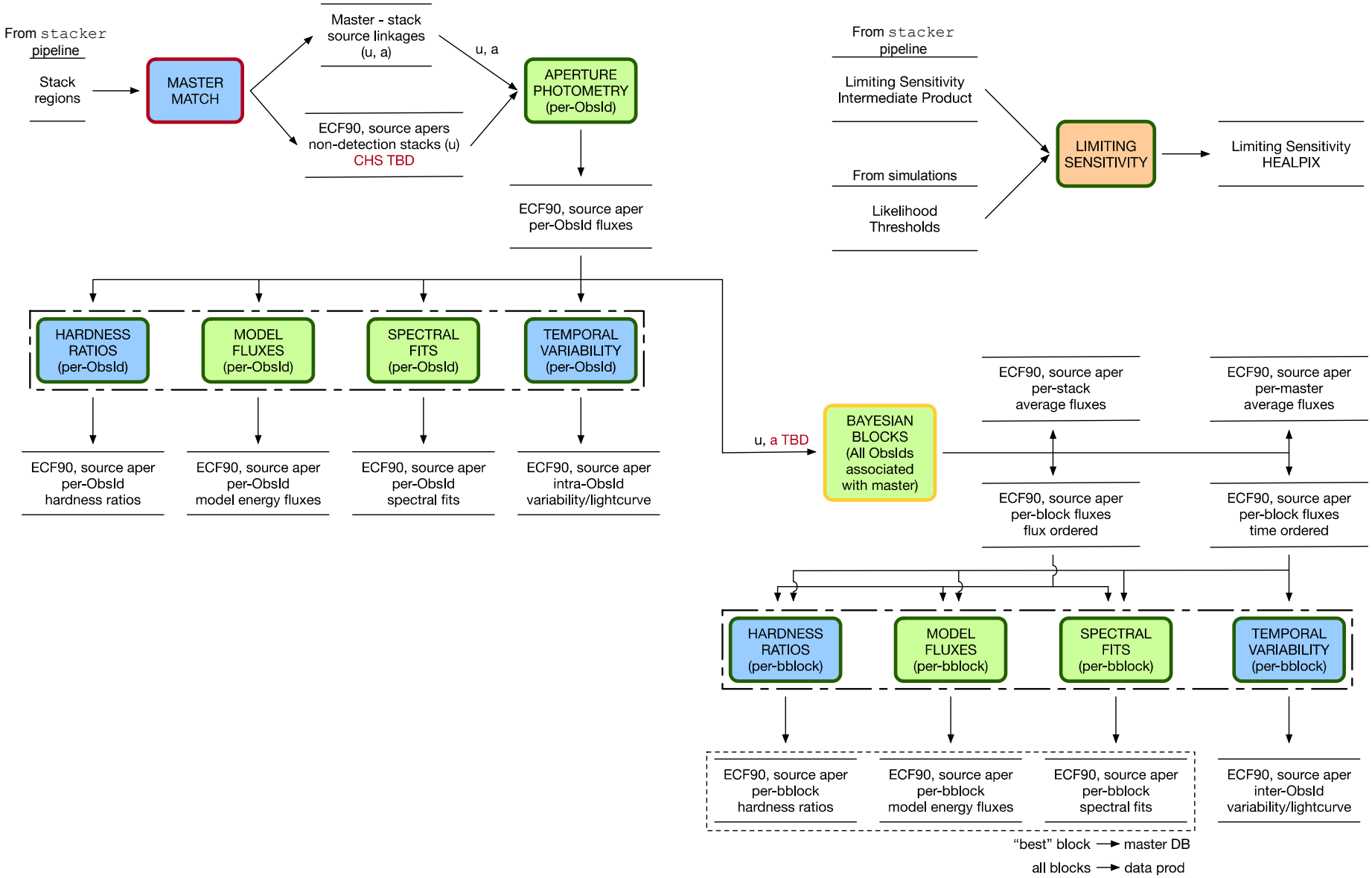
Limiting Sensitivity Map

- For an observed)portion of the sky, we provide our best estimate of the *lowest value of the flux that would have been detectable* as a source in our catalog



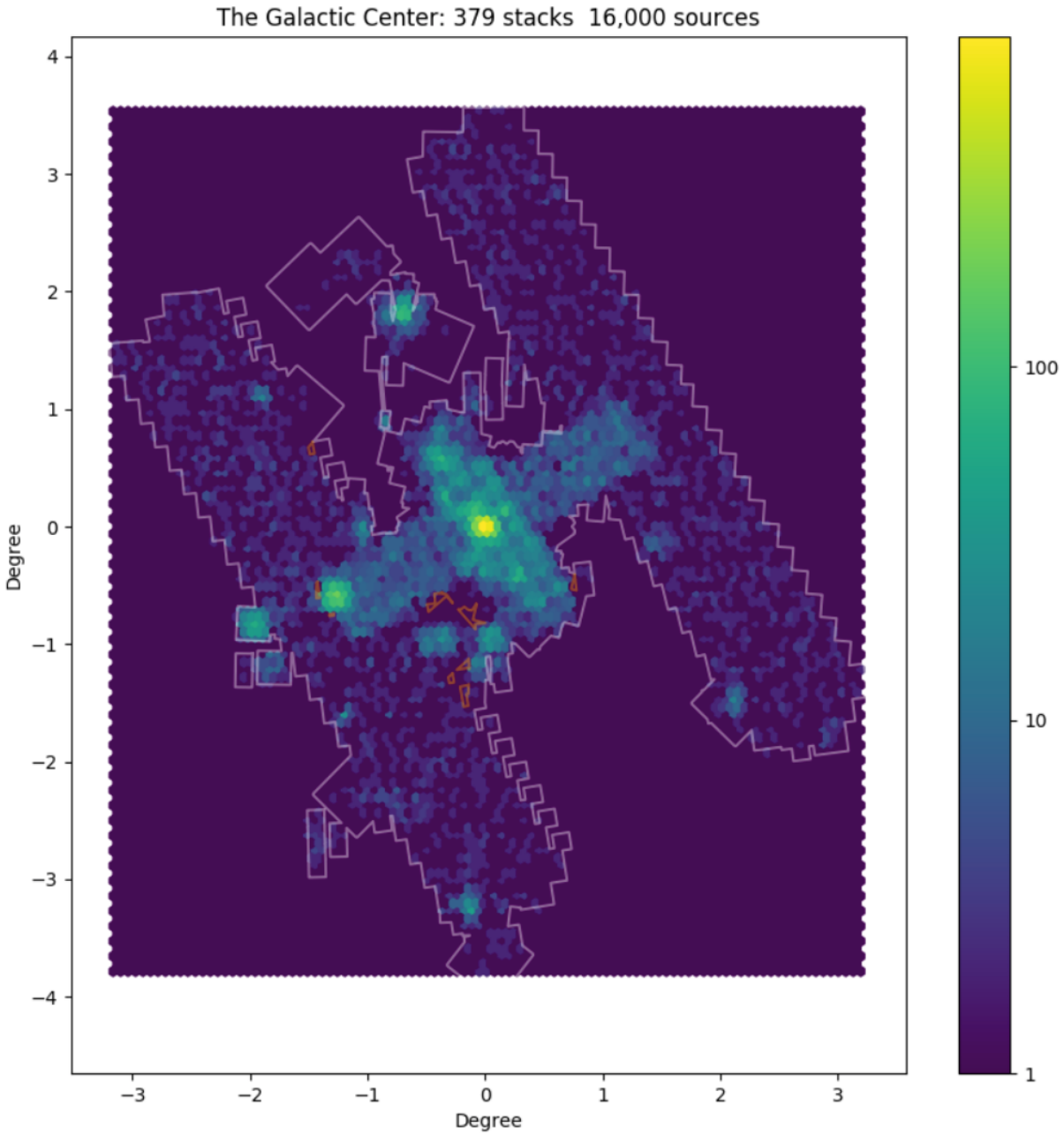
(Preliminary Map for CSC v2; F. Primini, priv. comm.)

Source properties in CSC2



Sgr A* Region Source Density

- Sgr A* stacks detections included in pd2
- Map shows detection density (number of detections per pixel)



How to get the data (1):
CSC2 preliminary detections FITS table, available now at cxc.cfa.harvard.edu/csc2/preliminary

CHANDRA X-RAY OBSERVATORY

CXC Home | Proposer | Archive | Data Analysis | Instruments & Calibration | For the Public

Last modified: 21 March 2017

Search http://cxc.harvard.edu/csc2/ — Google Custom Search — Search

Contact the CXC HelpDesk

CHANDRA SOURCE CATALOG

CSC v2 Homepage ➤
- CSC 2.0 pd2 preliminary detections list (September 2017) NEW
- CSC 2.0 pd1 preliminary detections list (March 2017)
- CSC 2.0 pd0 preliminary detections list (August 2015)

CSC v1 Homepage

Chandra Source Catalog Release 2.0 Preliminary Detections List

Note

This is a work in progress! Be sure to read the caveats prior to using these data! The Spring 2016 CXC Newsletter article provides more information on the state of version 2 of the *Chandra* Source Catalog .

Contents

- Data Access
- Column definitions
- Caveats

Data Access

The March 2017 release of the data is available at:

- preliminary_detlist.fits.gz (53.4 Mb compressed and 124.4 Mb uncompressed)

It contains the results of Maximum Likelihood Estimator (MLE) fits to the candidate source detections. The column definitions and Caveats for this file can be found below. The file contains 362182 detections, with 279549 labelled as SRC_QUALITY = 'TRUE' and 82633 (23%) with SRC_QUALITY = 'MARGINAL'. When split by EXTSRC_CLASS, there are 358382 detections with a value of 'POINT', 3183 (0.9%) with 'EXTENDED', and 617 (0.2%) with 'POSSIBLE'. The breakdown by EBAND—the energy band correponding to the measured values—there are 271687 broad band ('b'), 395 ultra-soft ('u'), 26995 soft ('s'), 26524 medium ('m'), 31297 hard ('h'), and 5284 wide (HRC) band ('w') rows; the band definitions are the same as in release 1. There are 354 detections with STREAK_SRC_FLAG = True.

Column Definitions

```
unix% dmlist preliminary_detlist.fits blocks

--------------------------------------------------------------------------------
Dataset: preliminary_detlist.fits
--------------------------------------------------------------------------------

     Block Name                        Type         Dimensions
--------------------------------------------------------------------------------
Block    1:                             Null
Block    2: DETLIST                     Table        48 cols x 362182   rows
```

DETLIST HDU: PRELIMINARY DETECTIONS LIST

Column name	Units	Comment	Example	Data type	FITS format	Notes
DETECT_ID		Stack_id.component	'acisfJ0123456p012345_001.0001'	string	29A	
LIKELIHOOD		Highest source log likelihood	100.0	double	1D	Highest source likelihood
						Values are 'TRUE' or 'MARGINAL'

How to get the data (2):
CSC1 site cxc.cfa.harvard.edu/csc/

Search the CSC website

CHANDRA SOURCE CATALOG

CSC Release 2

Home page

CSC Data Access:

CSCView

CSCview Help

Command-line Interface

CSC Sky in Google Earth

CSC-SDSS Cross-match Catalog

CSC Sensitivity Map Service

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  - Schedule and Status
  - Caveats and Limitations
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  - Chandra Data Archive
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  - Level-3 Files
  - CSCview GUI
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  - Source Observations Table: alphabetical | by context
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  - Source Flags
  - Source Extent and Errors
  - Energy Bands
  - Source Fluxes
  - Source Significance
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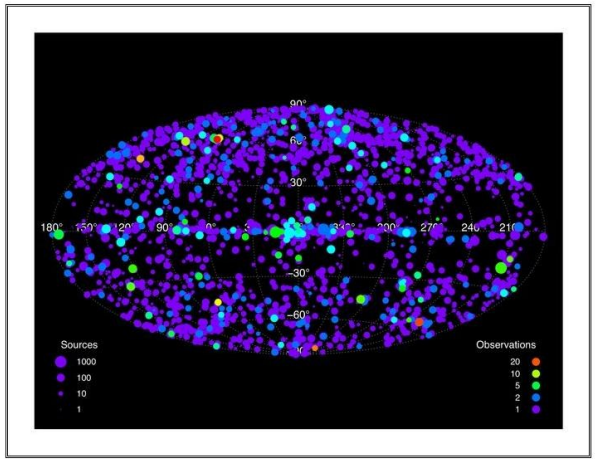
  - Memos
  - Publications
- **Conferences➤**

The Chandra Source Catalog

Click here for information about CSC Release 2

Release 1.1: Point and compact source catalog

What's New? | Watch Out



The locations of observations included in the CSC, in Galactic coordinates (click the image for equatorial coordinates). The size of each symbol is proportional to the logarithm of the number of sources detected in the field, while the color encodes the number of closely-located observations.

The Chandra Source Catalog (CSC) is ultimately intended to be the definitive catalog of X-ray sources detected by the Chandra X-ray Observatory. To achieve that goal, the catalog will be released to the user community in a series of increments with increasing capability. **The first official release of the CSC includes information about sources detected in public ACIS and HRC imaging observations from roughly the first eight years of the Chandra mission. Only point sources, and compact sources, with observed spatial extents <~30 arcseconds, are included. Highly extended sources, and sources located in selected fields containing bright, highly extended sources, are excluded from the first release.**

The CSC contains positions and multi-band count rates for the sources, as well as derived spatial, spectral, and temporal calibrated source properties that may be compared with data obtained by other telescopes. The CSC also includes associated data products for each source, including images, photon event lists, light curves, and spectra.

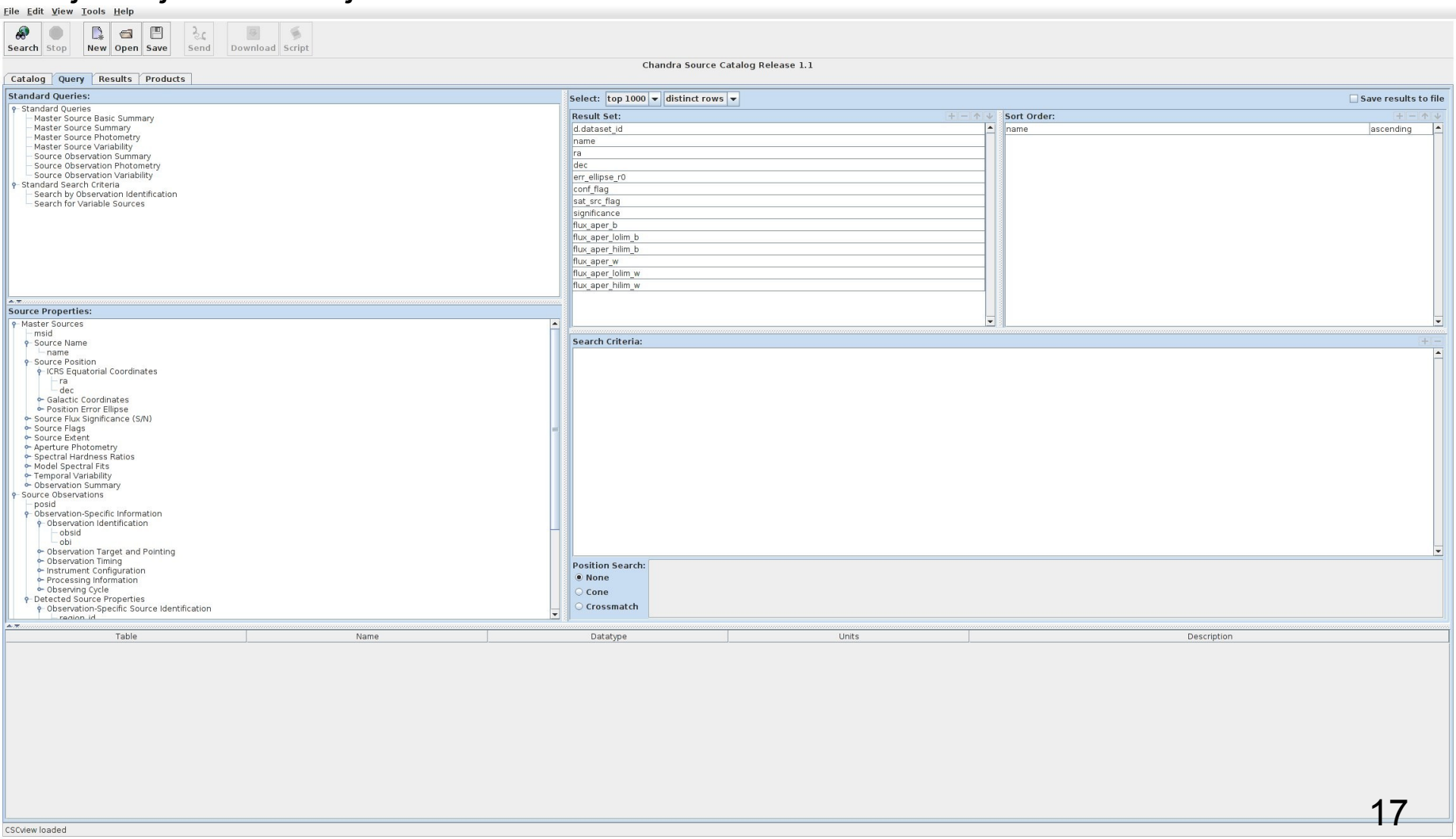
Each distinct source on the sky (i.e., object at a specific RA and Dec) is recorded in a single "master source" table entry and one or more "source observation" table entries. The individual source entries contain the properties of a single detection from a single observation. The master source entry is the best estimate of all the properties of a source, based on the data extracted from the individual source entries. The Catalog Organization page contains further details.

The current version of the catalog is release 1.1. This version includes the information contained in release 1.0.1, plus point and compact source data extracted from HRC imaging observations, and catch-up ACIS observations released publicly prior to the end of 2009. A new version of CSCview is also available with this release.

The CSC-SDSS Cross-match Catalog, the CSC Sensitivity Map Service, and the CSC interface to Sky in Google Earth have been updated as of 24 November 2010 to access release 1.1.

How to get the data (3): CSCView application

CSCView java application:
java -jar cscview.jar



Release 2.0 Catalog Data Products

FITS Catalog Data Products

- Per-Observation Full Field Data Products
  - Event list, exposure corrected image*, background image*, exposure map*, adaptively smoothed exposure map*, aspect solution (incl. fine astrometry updates), aspect histogram, bad pixel map, field of view, pixel mask, extended source region polygons* (multiple contour levels)
- Stack Full Field Data Products
  - Event list, exposure corrected image*, background image*, exposure map*, field of view, limiting sensitivity*, merged source detection list
- Per-Observation Source Region Data Products
  - Region definitions, region event list, region image*, local PSF* (~50K counts), region exposure map*, PHA spectrum, ARF, RMF, light curve*, position error MCMC draws*, aperture photometry PDF*
- Stack Source Region Data Products
  - Region definitions, region event list, region image*, region exposure map*, position error MCMC draws*
- Master Source Data Products
  - Bayesian block aperture photometry PDFs*, Bayesian block spectral fits, Bayesian block model fluxes*, Bayesian block hardness ratios, Bayesian block temporal properties*, master light curve*

* Multiple energy bands

Other Source Catalogs

- Chandra Orion Ultra-deep Point Source Catalog (COUP)
  - http://heasarc.gsfc.nasa.gov/w3browse/chandra/coup.html
- Chandra Multi-wavelength Project (CHAMP)
  - http://heasarc.gsfc.nasa.gov/w3browse/chandra/champpsc.html
- Bootes Field X-ray Point Source Catalog (XBOOTES)
  - http://heasarc.gsfc.nasa.gov/w3browse/all/xbootes.html
- Catalog of AGN in the XMM-Newton Archive (CAIXA):
  - https://heasarc.gsfc.nasa.gov/W3Browse/all/caixa.html
- And many more! Typically, these are ***specialty*** catalogs, can tailor their methods to their science. CSC & 3XMM must work ***everywhere***.