



The Chandra Source Catalog 2.0

F. Civano (CfA/CXC)

On behalf of the *Chandra* Source Catalog team

Christopher Allen¹, Craig S. Anderson¹, Jamie A. Budynekiewicz¹, Douglas Burke¹, Judy C. Chen¹, Francesca Civano¹, Raffaele D'Abrusco¹,

Stephen M. Doe², **I. Evans**, Janet D. Evans¹, Giuseppina Fabbiano¹, Daniel G. Gibbs II¹, Kenny J. Glotfelty¹, Dale E. Graessle¹, John D. Grier¹, Roger M. Hain¹, Diane M. Hall³, Peter N. Harbo¹, John C. Houck¹, Jennifer Lauer¹, Omar Laurino¹, Nicholas Lee¹, J. Rafael Martinez-Galarza¹, Michael L. McCollough¹, Jonathan C. McDowell¹, Warren McLaughlin¹, Joseph B. Miller¹, Douglas L. Morgan¹, Amy E. Mossman¹, Dan T. Nguyen¹, Joy S. Nichols¹, Michael A. Nowak⁴, Charles Paxson¹, David A. Plummer¹, Francis A. Primini¹, Arnold H. Rots¹, Aneta Siemiginowska¹, Beth A. Sundheim¹, Michael S. Tibbetts¹, David W. Van Stone¹, and Panagoula Zografou¹

¹Smithsonian Astrophysical Observatory

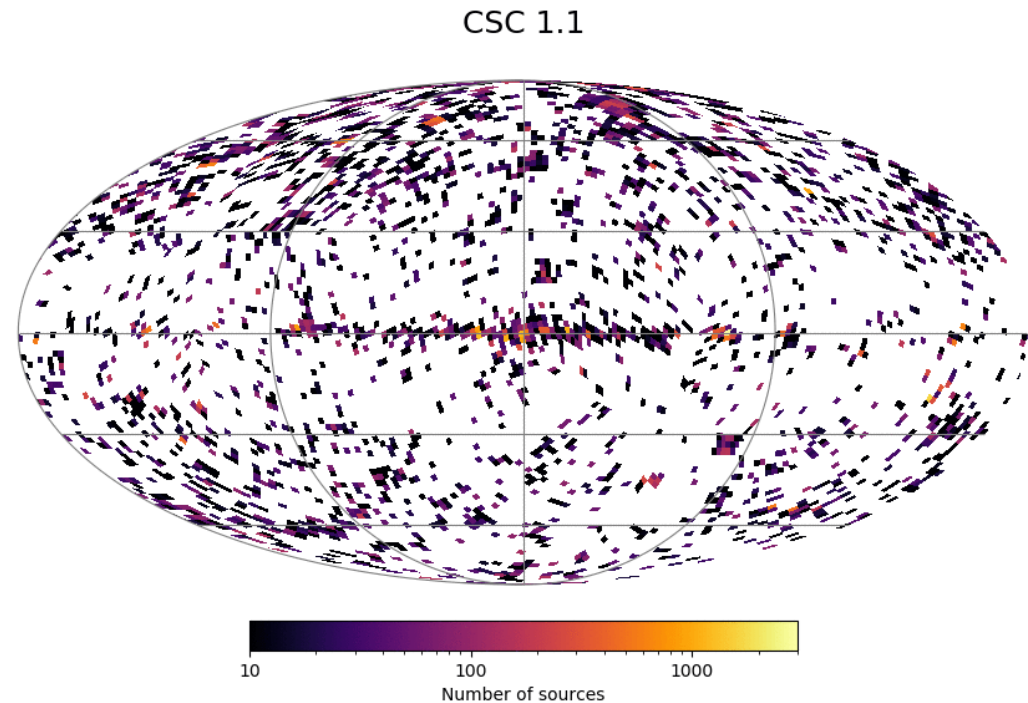
³Northrop Grumman Mission Systems

²Formerly Smithsonian Astrophysical Observatory

⁴MIT Kavli Institute for Astrophysics and Space Research

CSC 2.0 and CSC 1.0

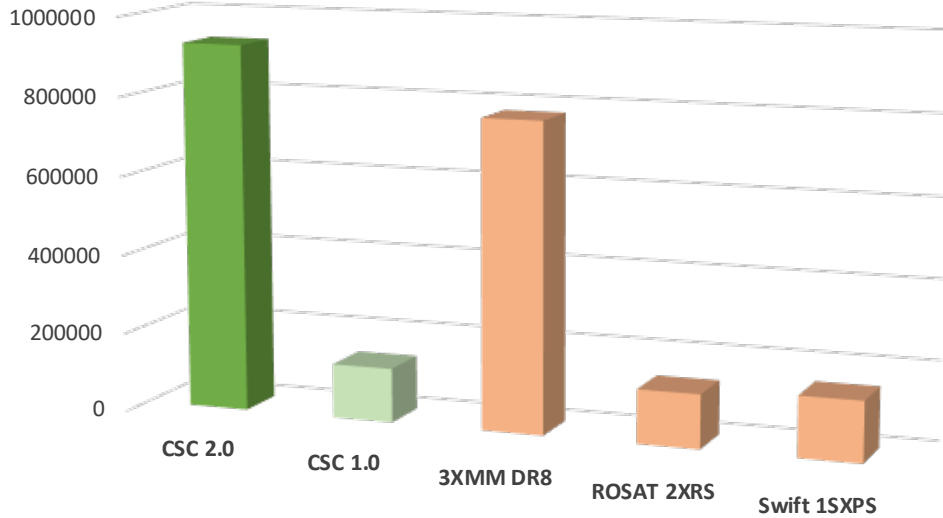
	CSC 1	CSC 2
Individual obsids	5110	10,382
Obsid years	1999-2009	1999-2014
Total exposure		245.8 Ms
longest exposure	190 ks	5.8 Ms
Counts on-axis	~10	~4-5
Number of sources	106,586	317,167
Number of detections	158,071	928,280



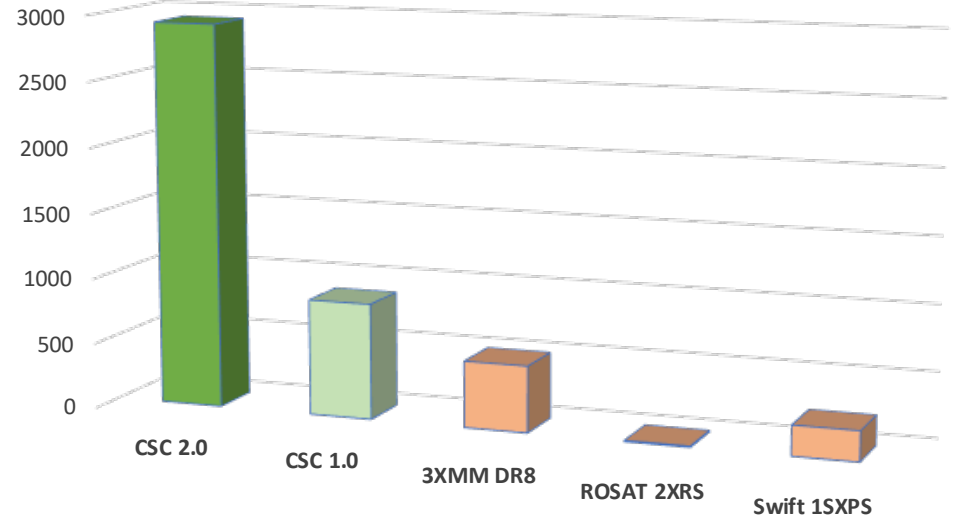
~550 deg²
Area covered
~1.3% of sky

Comparison with other catalogs

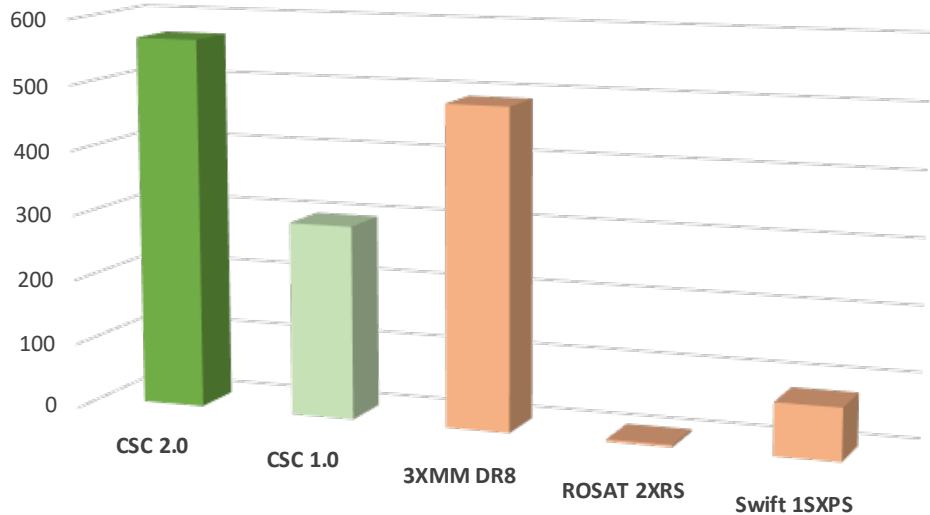
Total Observation Detections



Peak Source Density in 10' Diameter



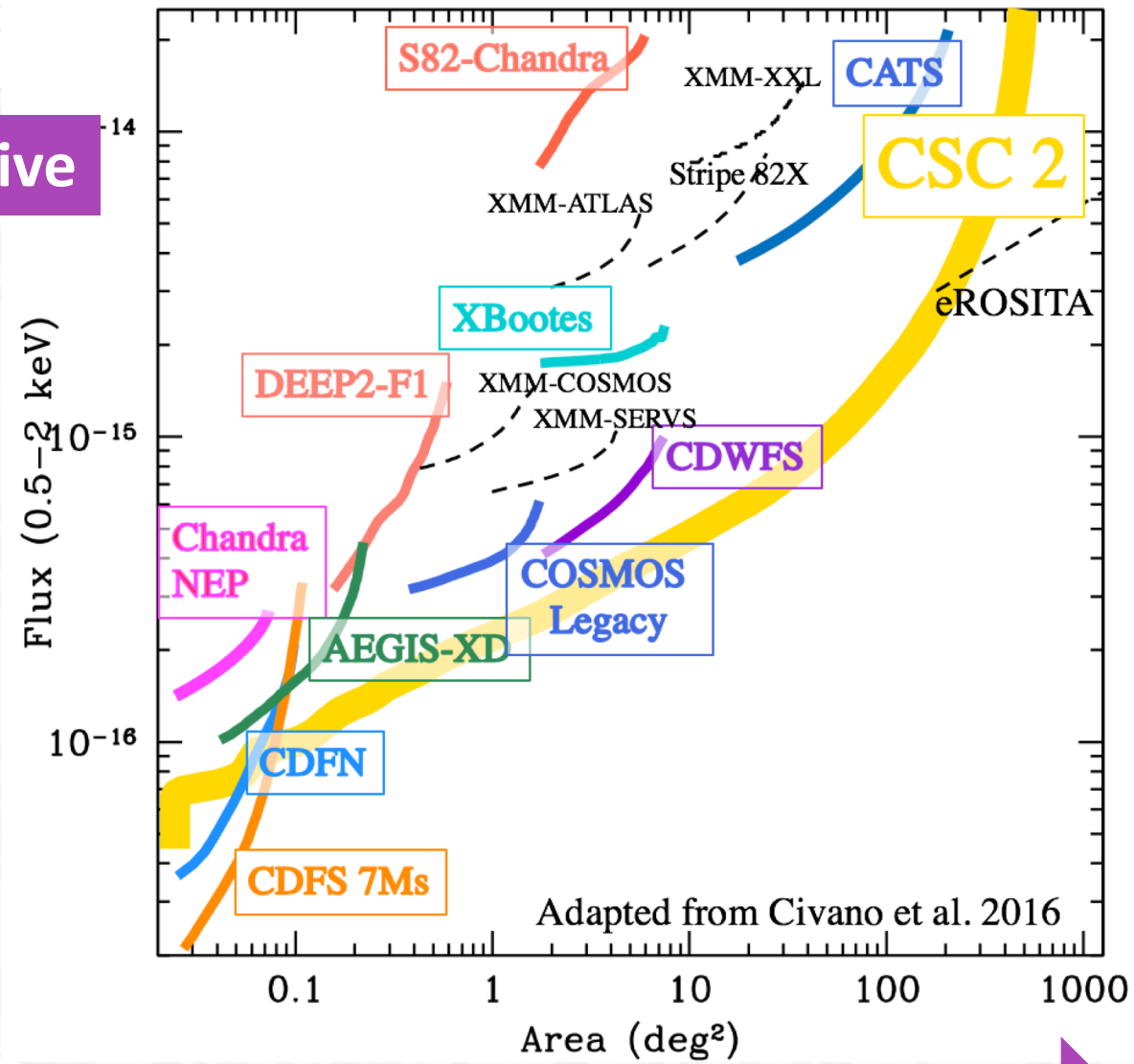
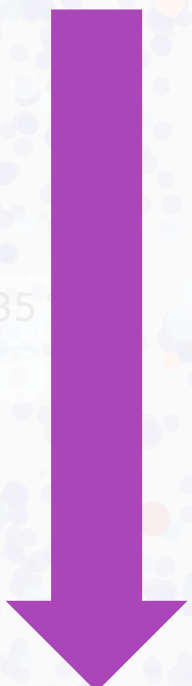
Average Source Density



CSC 2.0 as a survey

CHANDRA
SOURCE CAT

More sensitive



~550 deg²
Area covered

LARGER AREA

100
1000
ons per stack

1 2 5
Observations p

CSC 2.0 features



- **Source detection on stacked observations**

New source detection approach

- Wavelet detection with “permissive” parameters *plus* entirely new Voronoi tessellation algorithm for both background determination *and* source detection
- Maximum likelihood estimator grades candidate detection and improves on-axis detection limit to ~ 5 net counts for exposures < 15 ks
- MCMC draws provide relative astrometry position error *ellipses*
- Aperture photometry PDFs computed using Bayesian algorithms
- Multiple observations grouped by multi-band Bayesian Blocks algorithm to improve S/N even for variable sources (properties archived for each block)
- Integrated multi-band limiting sensitivity computed on $4'' \times 4''$ pixels

● 100
● 1000
dots per stack

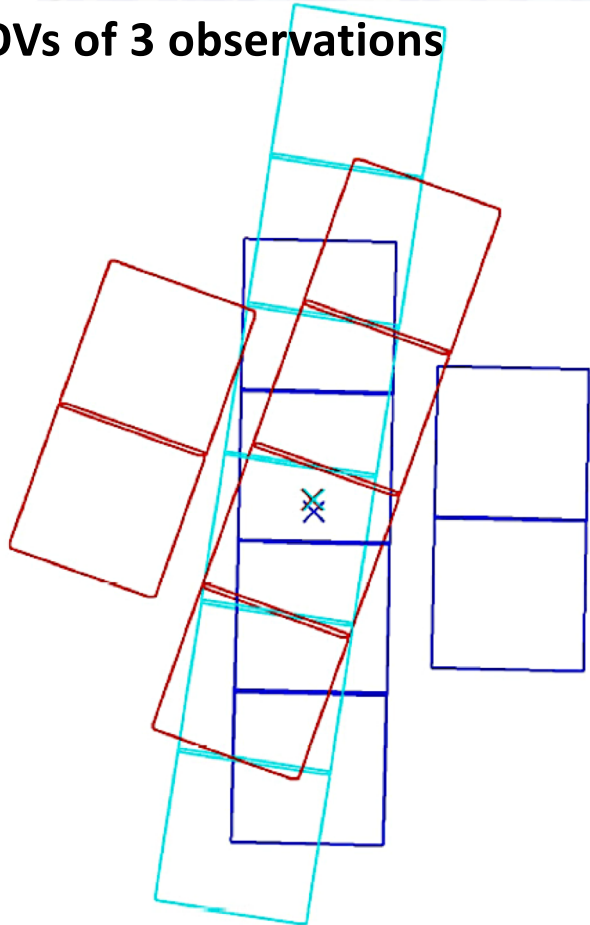
-75° F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

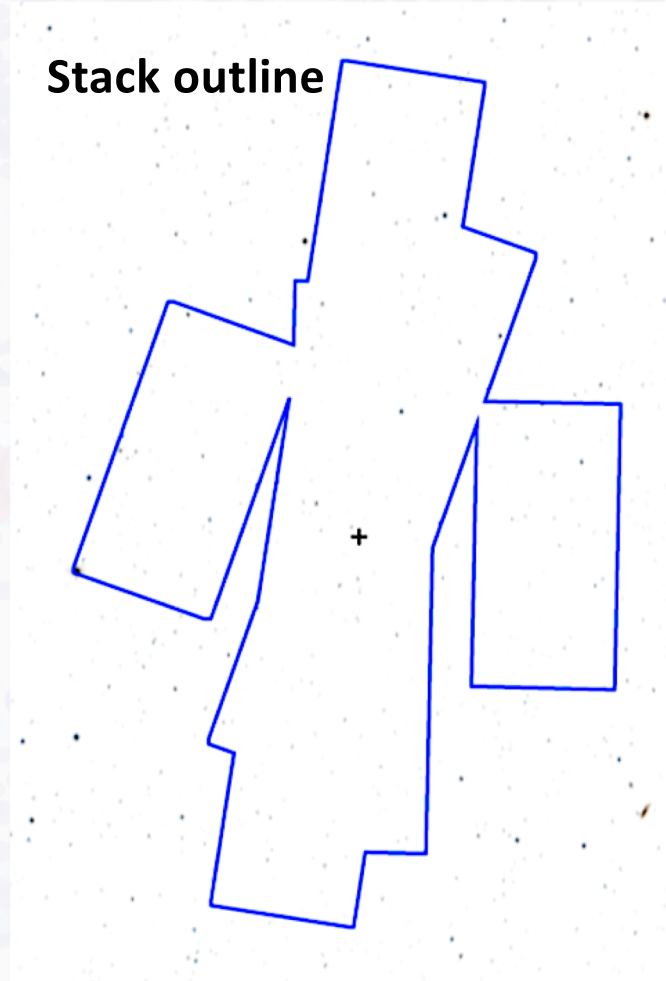
Stacked observations

STACKS: sum of observations with pointings within 1' to increase sensitivity

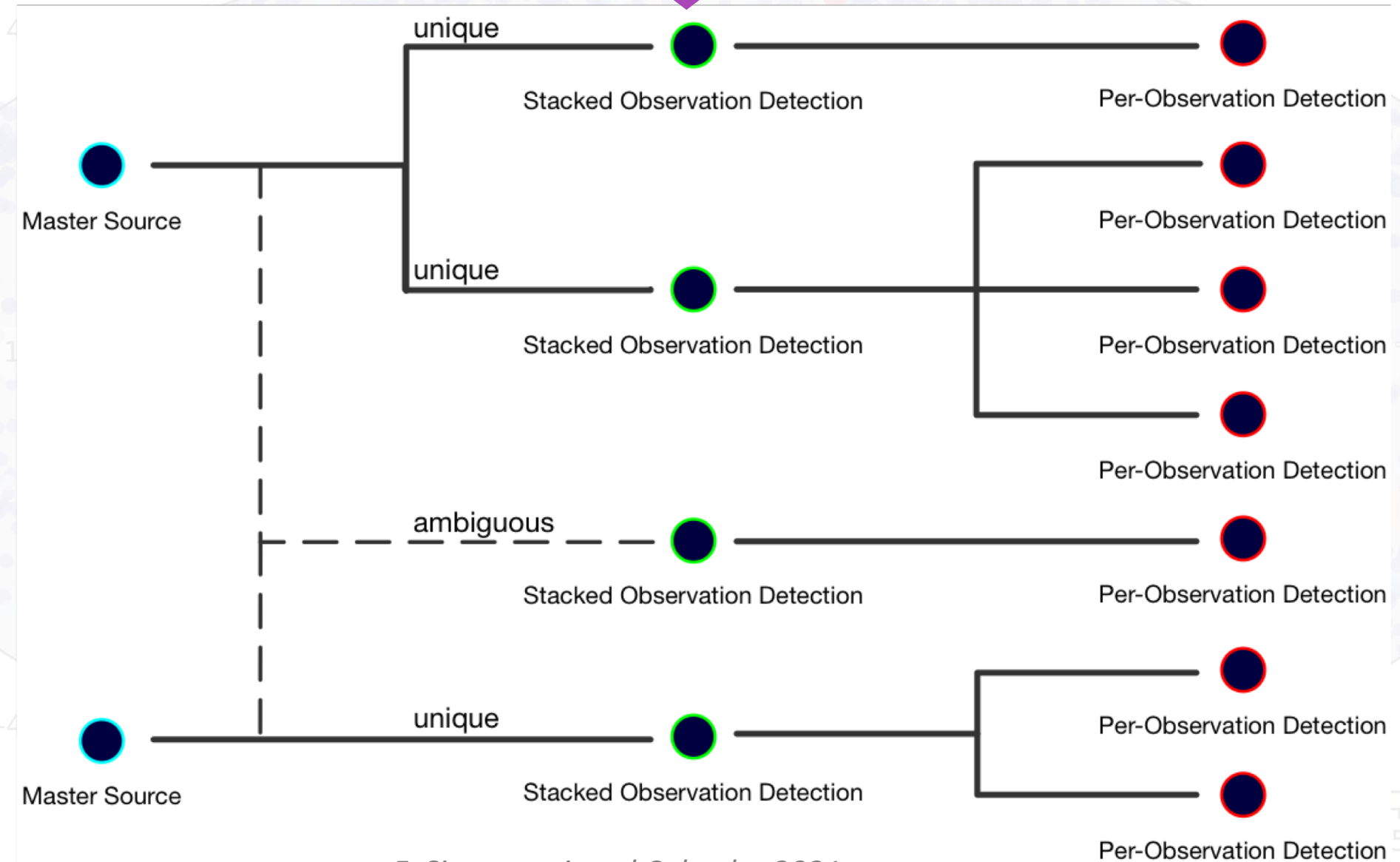
FOVs of 3 observations



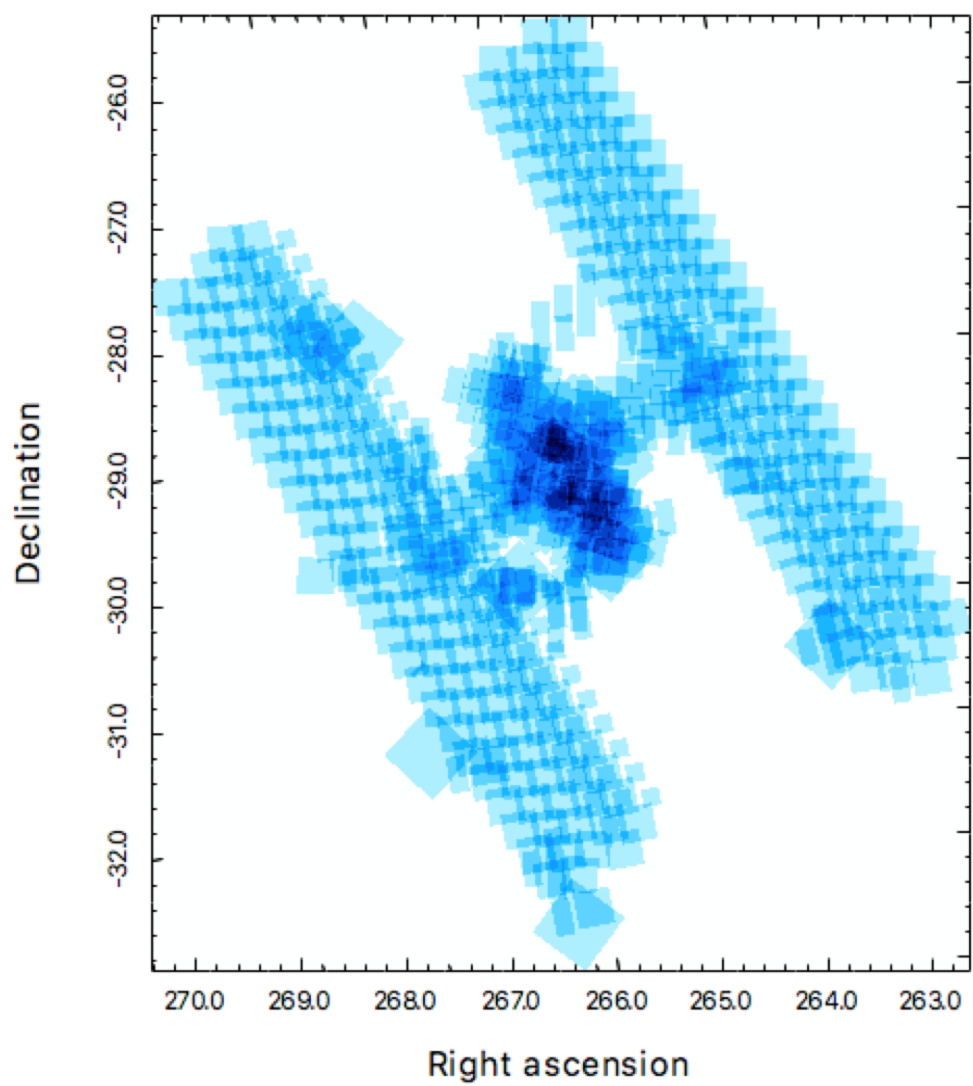
Stack outline



Source detection hierarchy



Example: Galactic Center Area



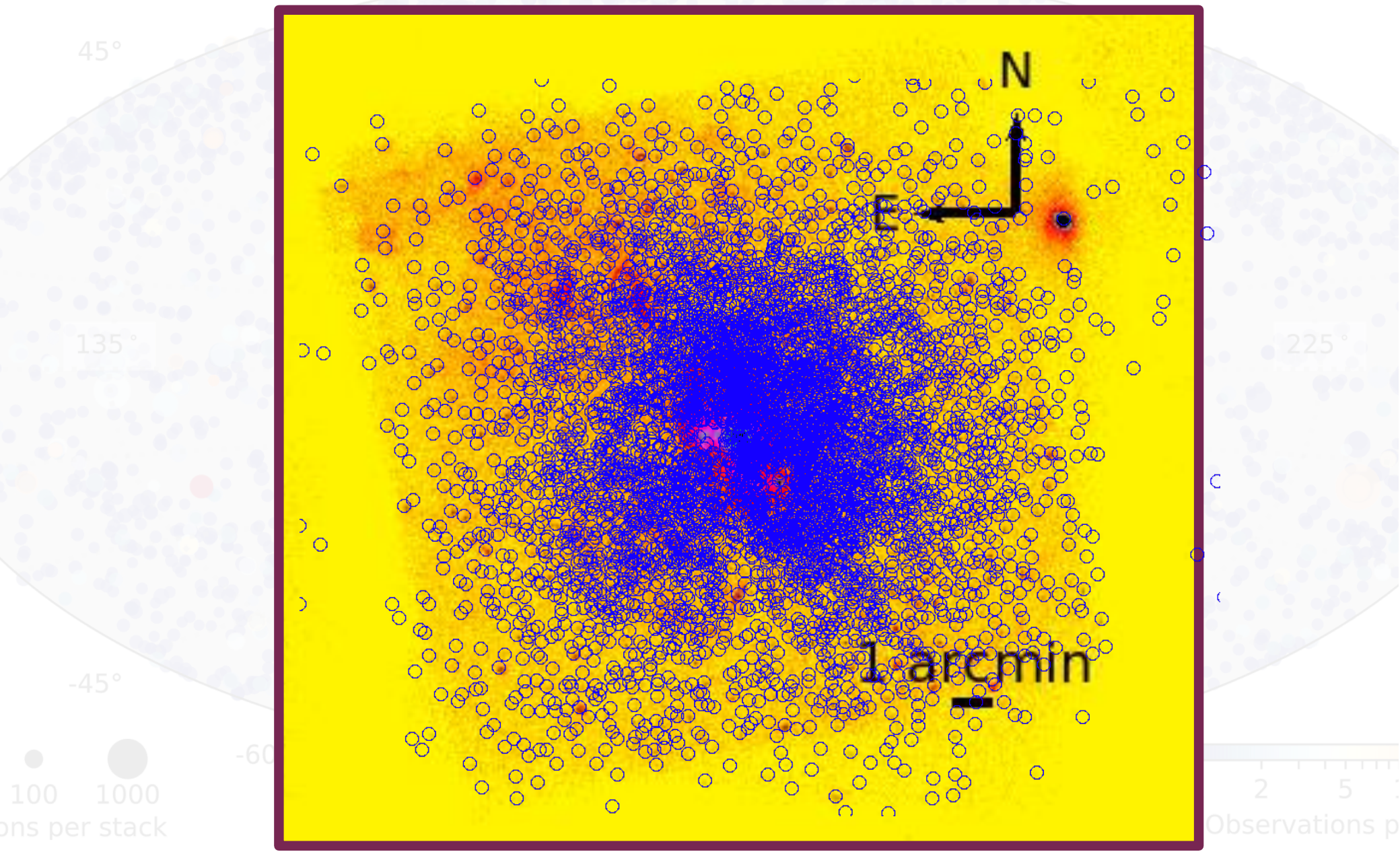
- 534 single *Chandra* observations
- 379 stacks (36 HRC and 343 ACIS)
- Total area covered $\sim 19 \text{ deg}^2$
- Total exposure time $\sim 9 \text{ Ms}$

100 1000
ons per stack



Example: Galactic Center Area

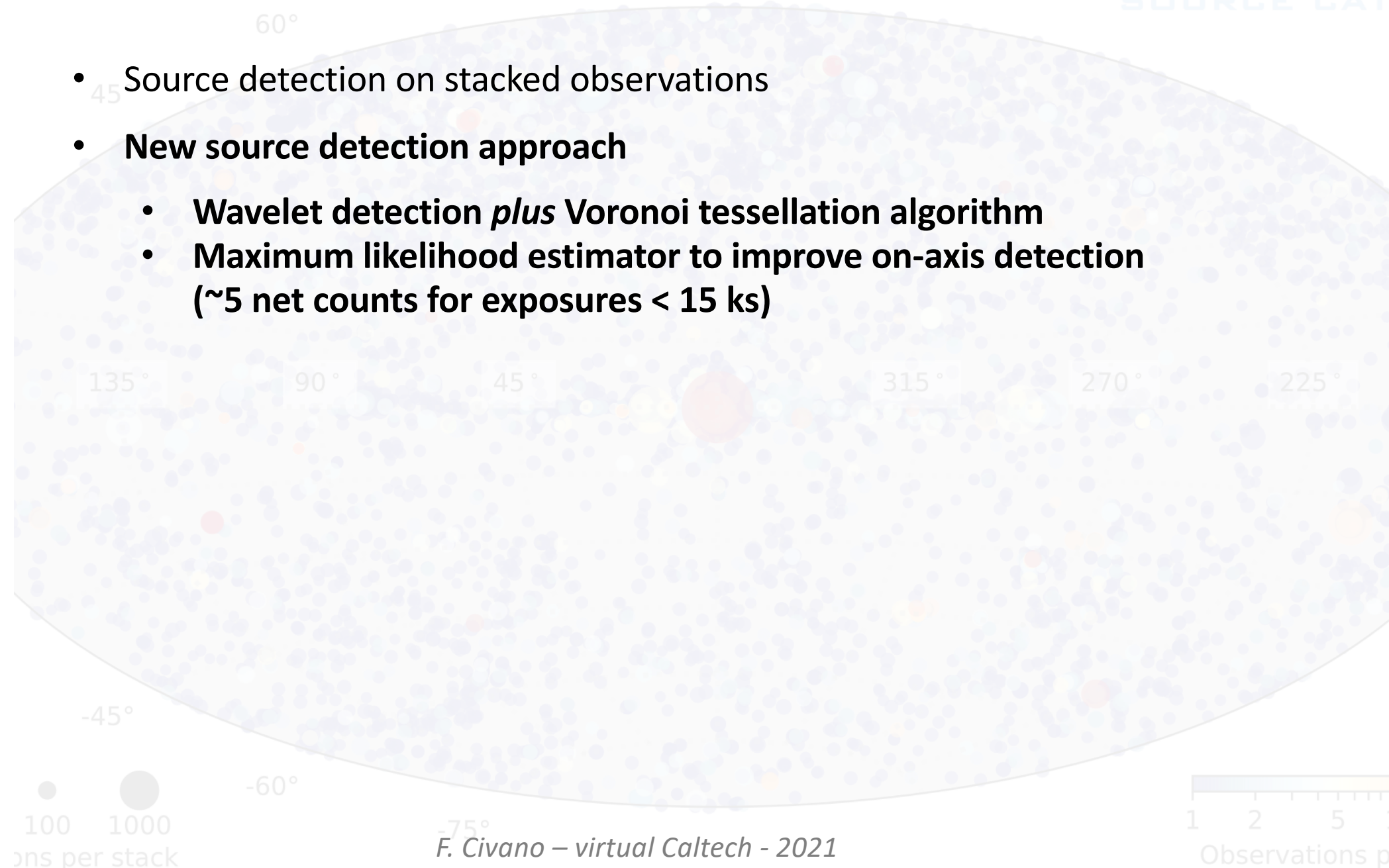
central stack: 71 observations, ~6000 sources



CSC 2.0 features



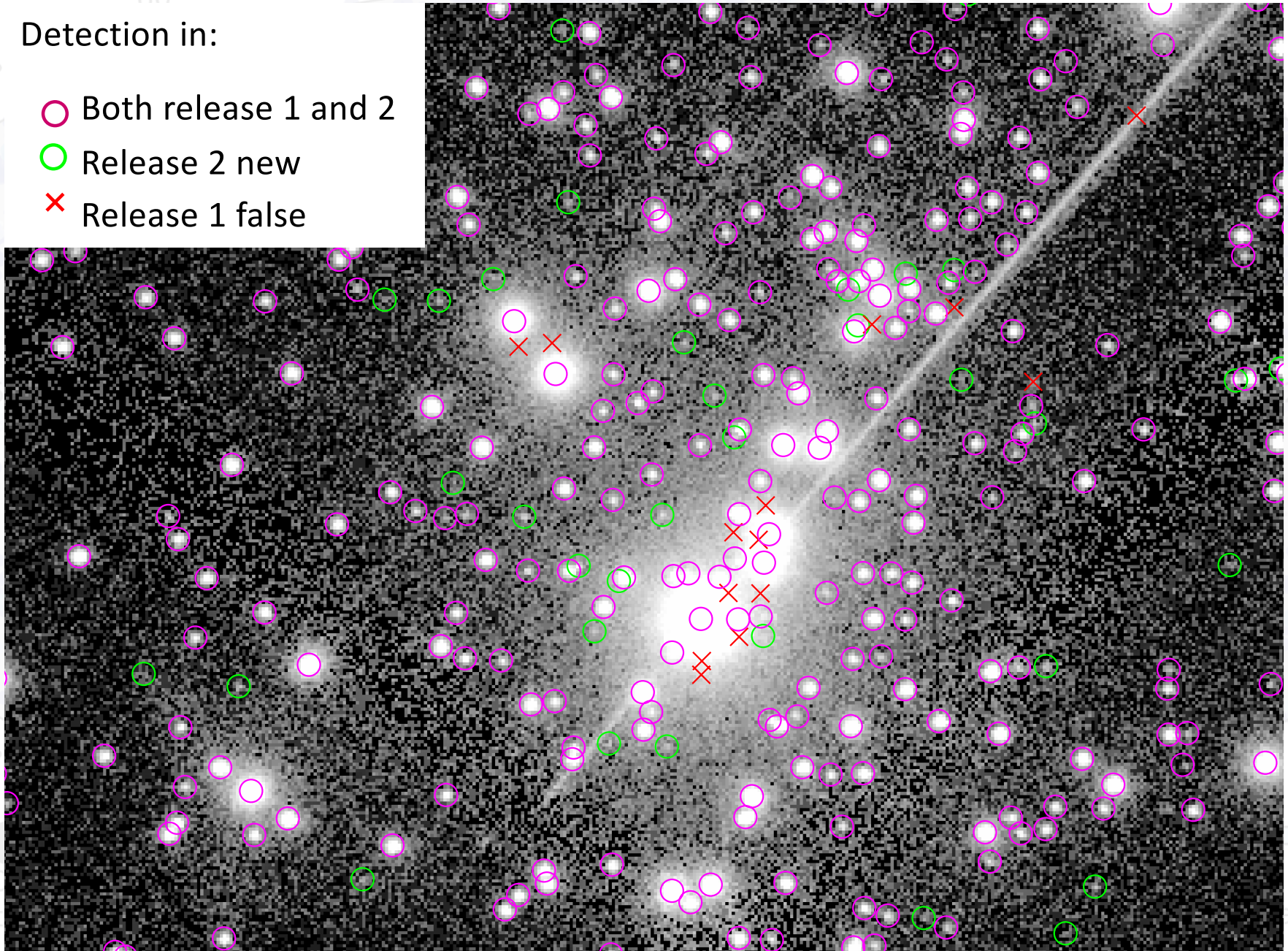
- Source detection on stacked observations
- **New source detection approach**
 - **Wavelet detection *plus* Voronoi tessellation algorithm**
 - **Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)**



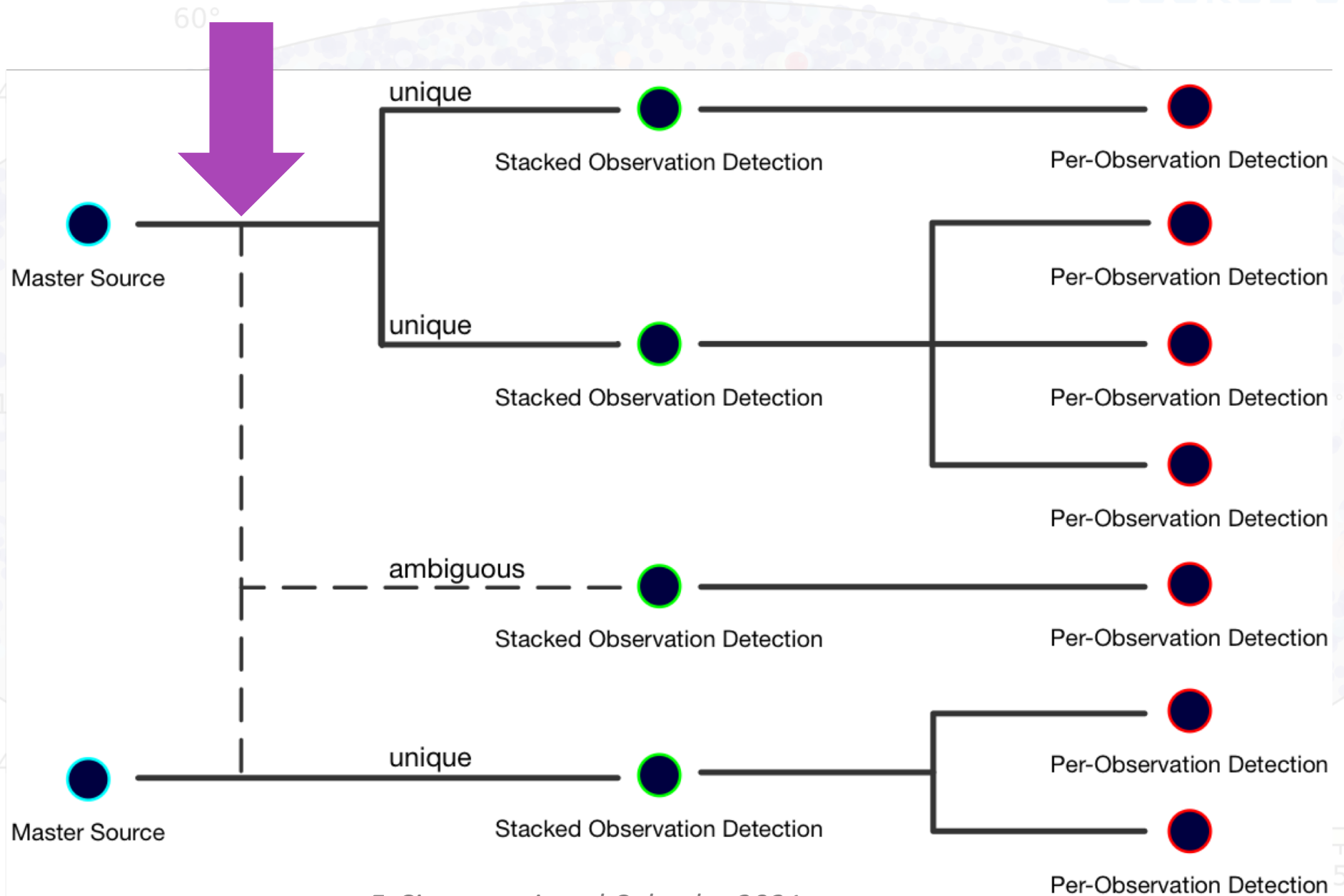
Detection: reaching the faintest sources

Detection in:

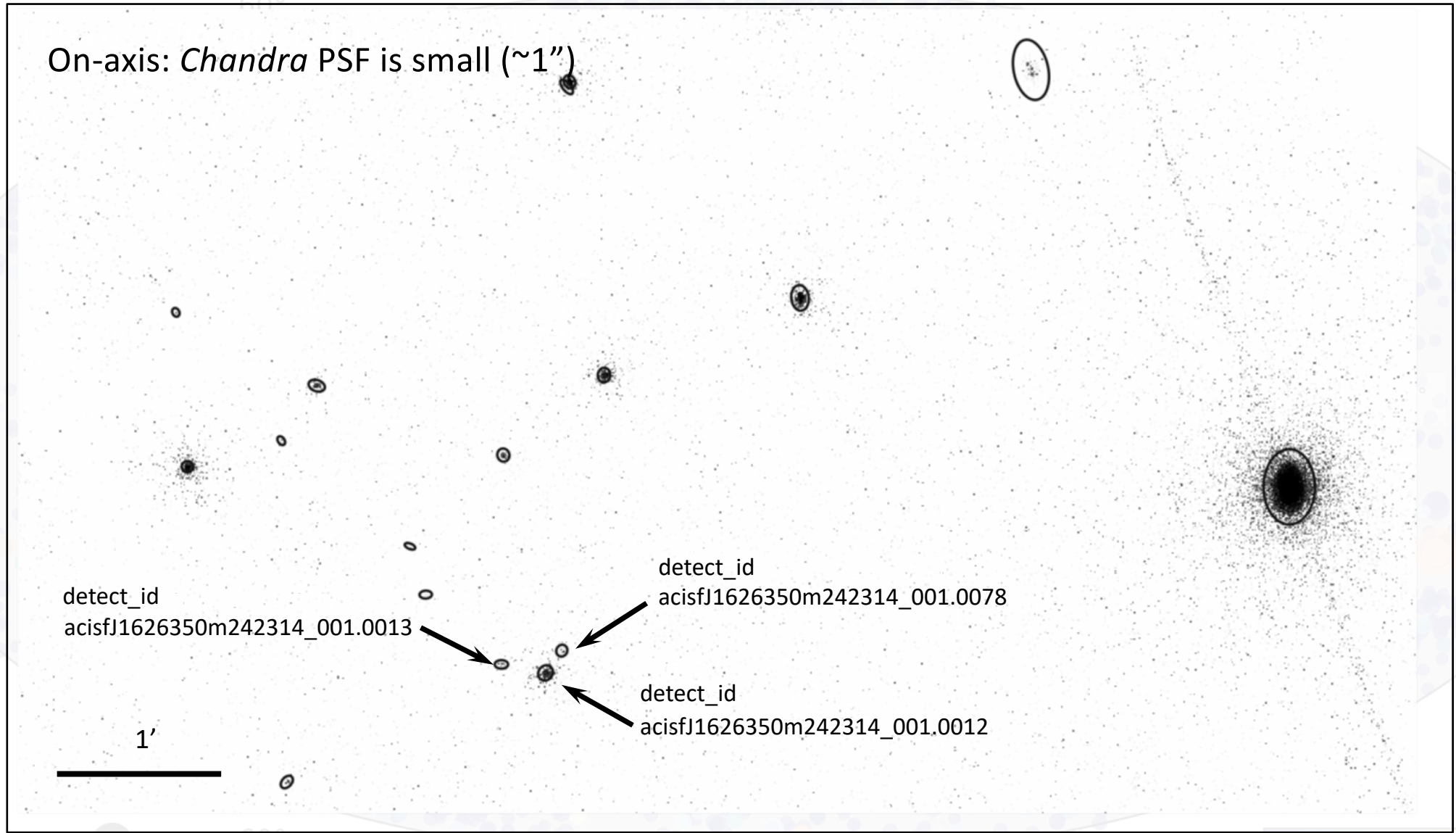
- Both release 1 and 2
- Release 2 new
- × Release 1 false



Master matching process

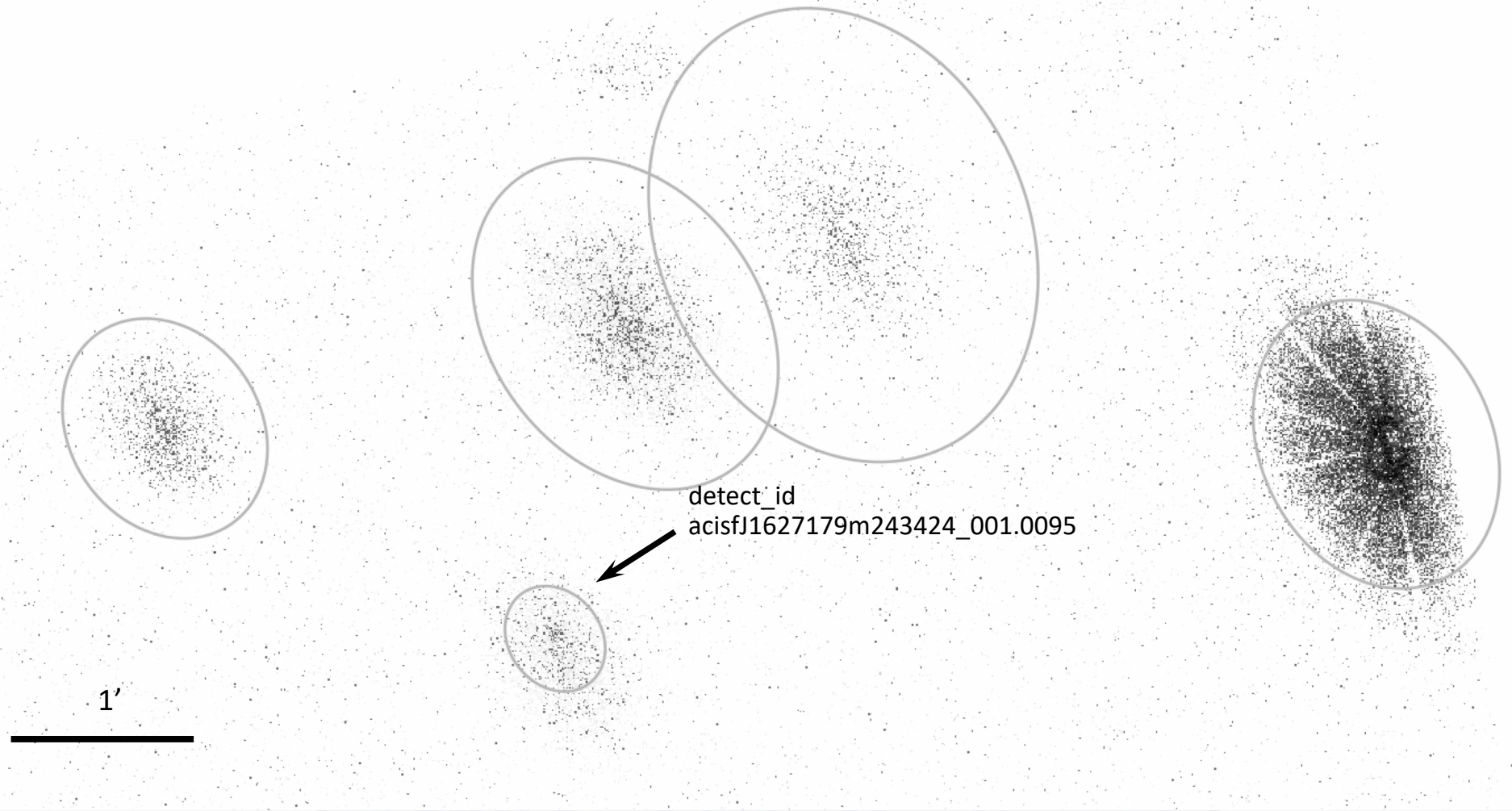


Detections and sources



Detections and sources

Off-axis: *Chandra* PSF is much larger



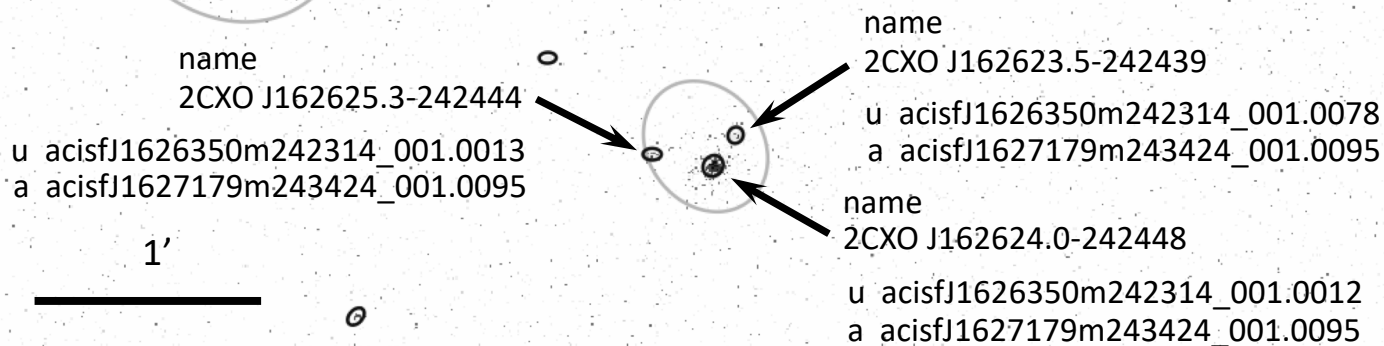
1'

detect_id
acisfJ1627179m243424_001.0095

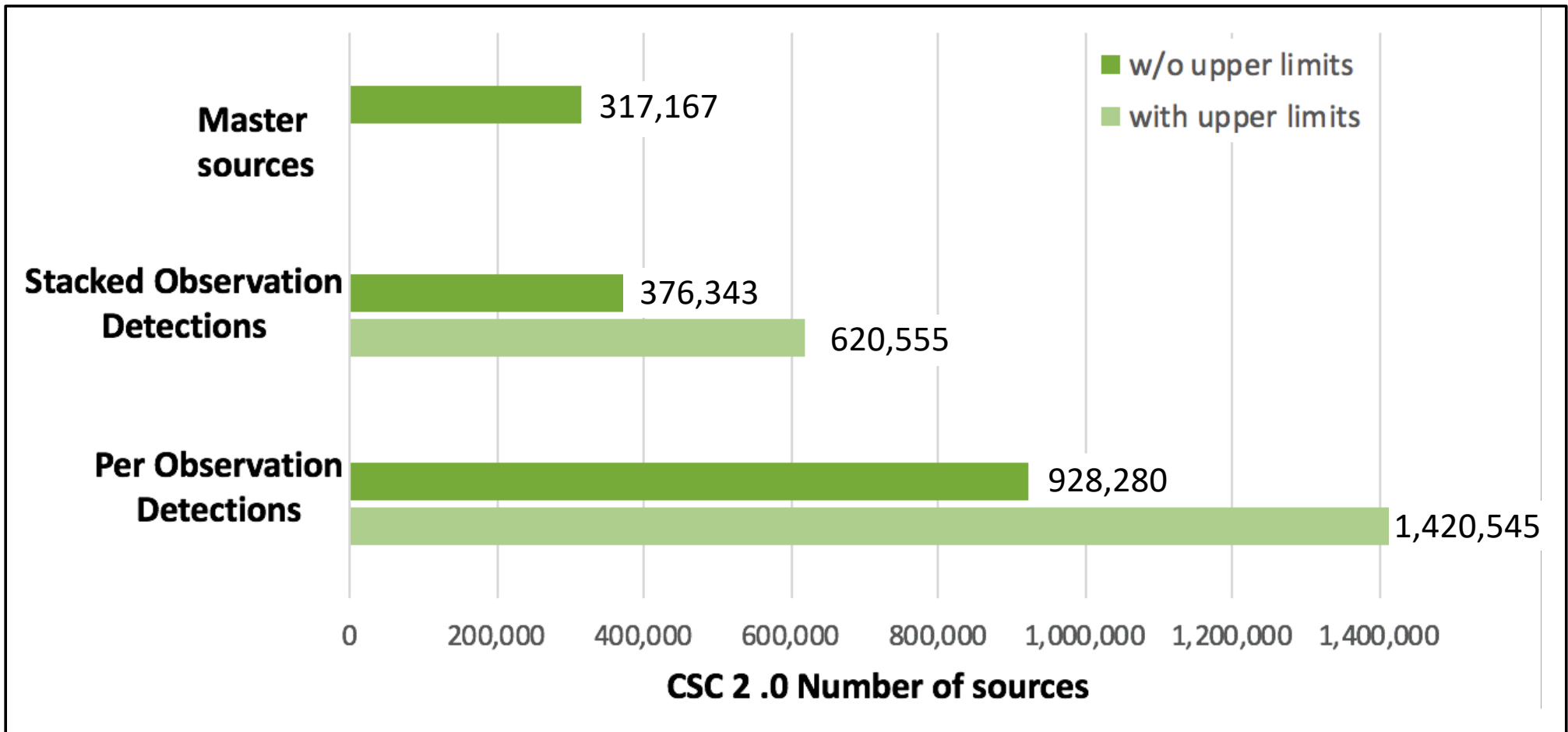
Detections and sources

Multiple sources on-axis may be **CONFUSED** in off-axis observations of the same field

The catalog reconciles detections at different off-axis angles



Master sources and detections



100 1000
ons per stack

-60°

-75°

F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

CSC 2.0 features



- Source detection on stacked observations
- New source detection approach
 - Wavelet detection *plus* Voronoi tessellation algorithm
 - Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)
- **MCMC draws provide relative astrometry position error *ellipses***
- Aperture photometry PDFs computed using Bayesian algorithms
- Multiple observations grouped by multi-band Bayesian Blocks algorithm to improve S/N even for variable sources (properties archived for each block)
- Integrated multi-band limiting sensitivity computed on 4" x 4" pixels

● 100
● 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

CSC 2.0 features

CHAND
SOURCE CAT

- Source detection on stacked observations
- New source detection approach
 - Wavelet detection *plus* Voronoi tessellation algorithm
 - Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)
- MCMC draws provide relative astrometry position error *ellipses*
- **Aperture photometry; multi-band Bayesian Blocks algorithm**

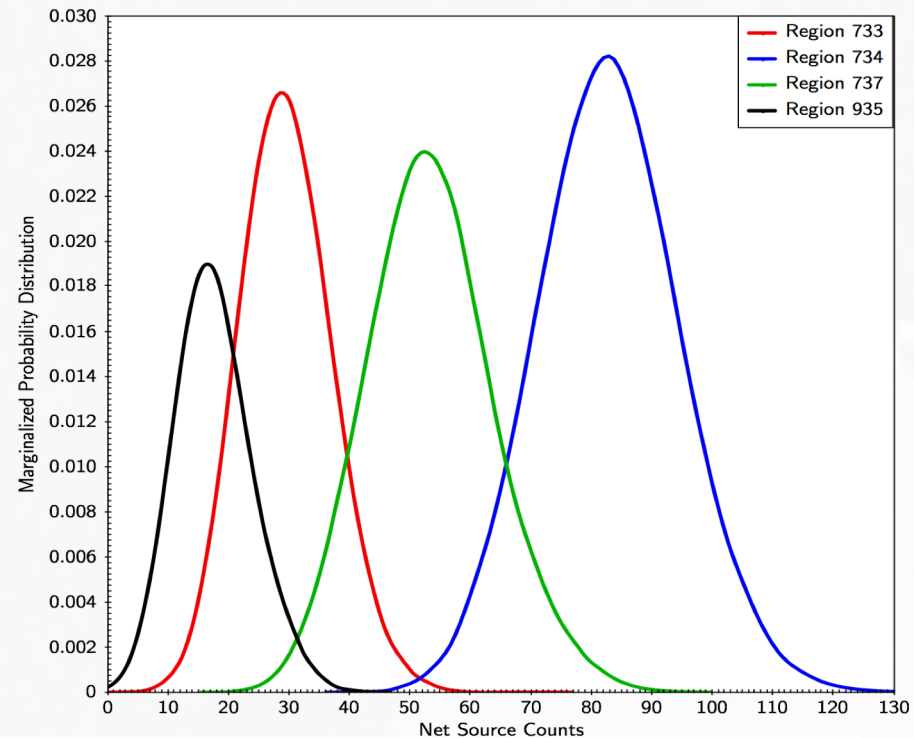
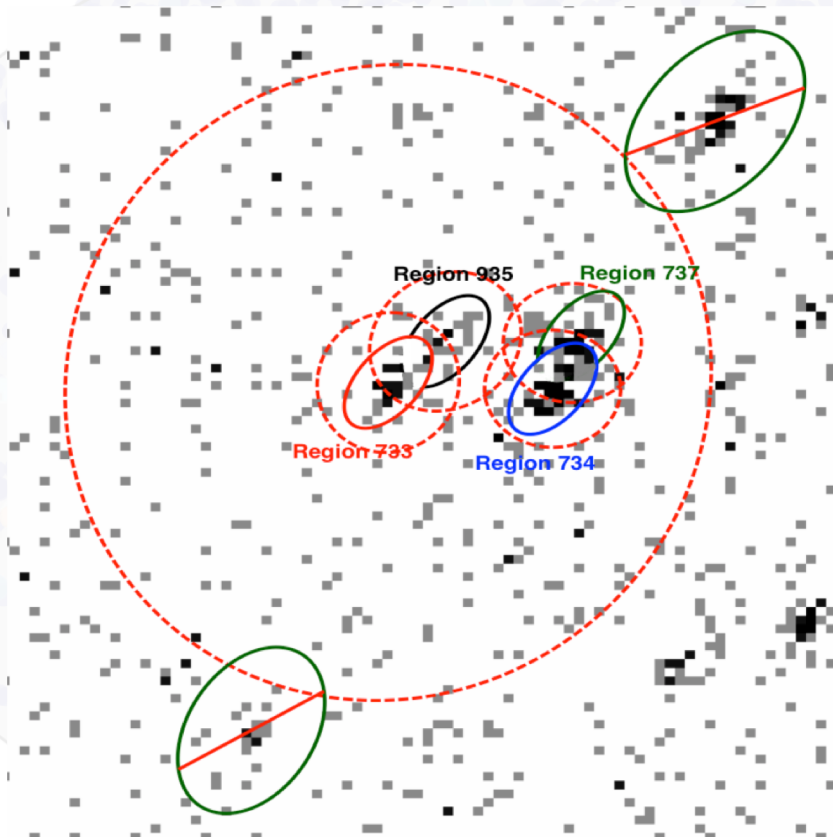
100 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

Source Properties: Aperture Photometry

Fluxes are measured in each observation: Bayesian approach for simultaneous aperture photometry estimation in crowded fields (Primini, F. A. & Kashyap, V. L. 2014)



Photometric PDFs are estimated simultaneously for the overlapping detections

100 1000
ons per stack

1 2 5
Observations p

Source Properties: Aperture Photometry

Bayesian Model

Analyze sources with overlapping apertures, near-by sources, and background simultaneously.

Joint posterior for source fluxes and background flux (for single observation):

$$P(s_1 \dots s_n, b | C_1 \dots C_n, B) = K \times P(b) P_{Pois}(B | \phi) \prod P(s_i) P_{Pois}(C_i | \theta_i)$$
$$\theta_i = E_i \times \left[\sum_{j=1}^n f_{ij} s_j + \Omega_i b \right]; \phi = E_b \times \left[\sum_{i=1}^n g_i s_i + \Omega_b b \right]$$

Counts in overlapping regions assigned to brightest source

Master source flux for source s_k in an n -source bundle is determined from the Bayesian block for that source with the largest exposure. In this case:

$$P(s_k | \{C_i^j\}, \{B^j\}) \cong P(s_k) \prod_{j=1}^m \left[P_{Pois}(B^j | \hat{\phi}^j) \times P_{Pois}(C_k^j | \hat{\theta}_k^j) \prod_{i=1, i \neq k}^n P_{Pois}(C_i^j | \hat{\theta}_i^j) \right]$$

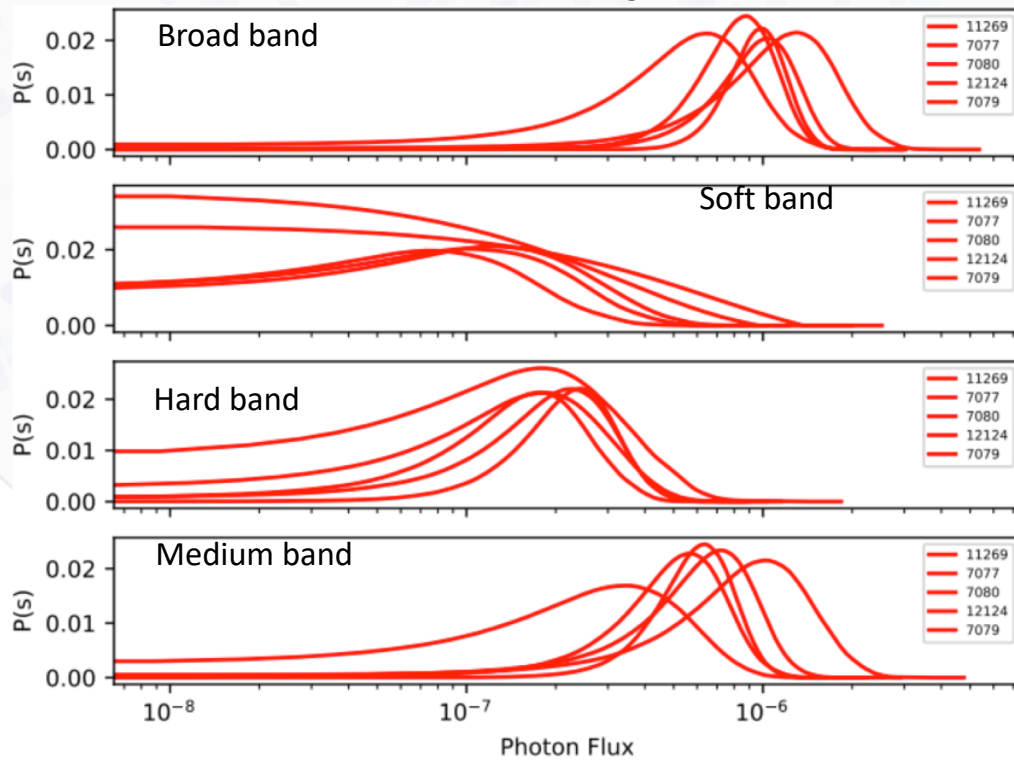
In all cases, a marginalized posterior is obtained for each source are obtained by integration over all other sources and background.

Posteriors optimized and sampled using MCMC in Sherpa.

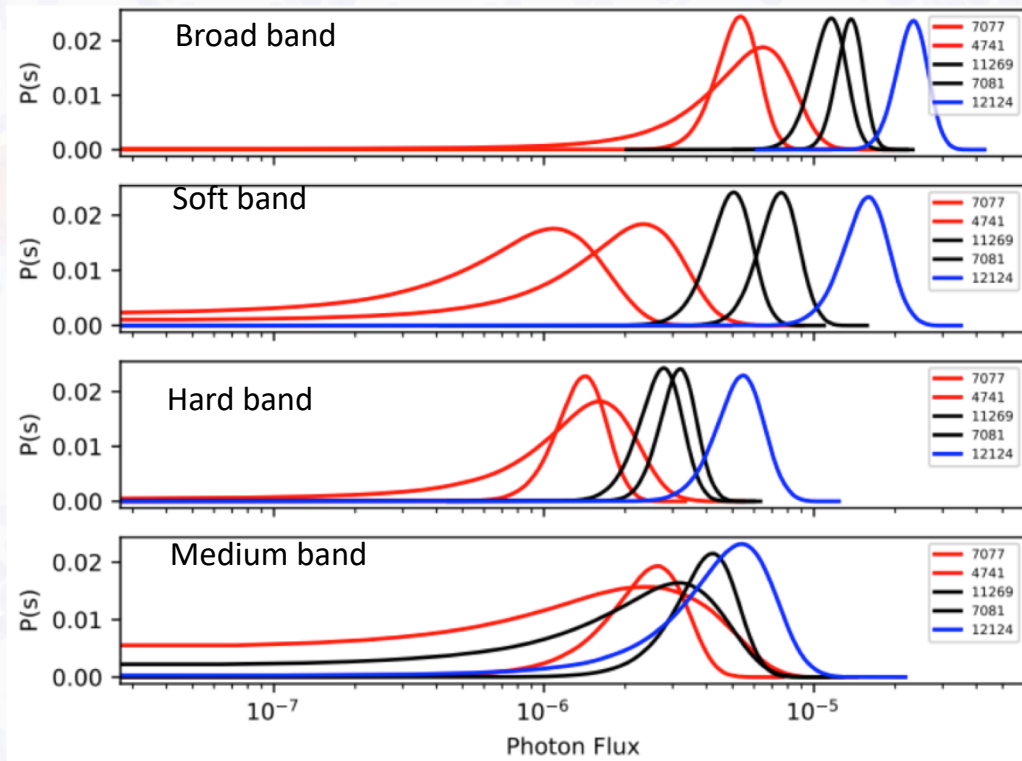
Grouping Observations to Improve S/N

- Multi-band Bayesian Blocks analysis (*Scargle+2013*) on detection fluxes to identify observations that can be analyzed/grouped together
- The combined properties for the longest exposure Bayesian Block are databased, but the properties for *all* blocks are recorded in a FITS data product

2CXO J1219389+291724 — single flux-ordered block



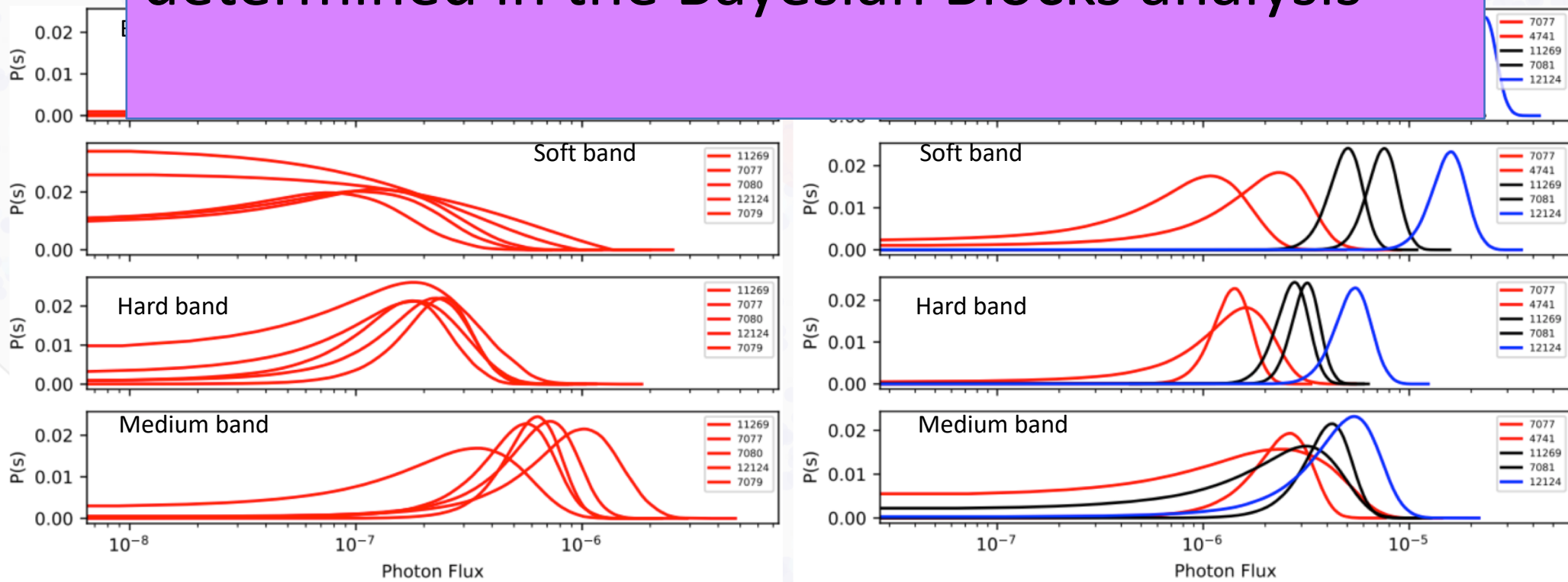
2CXO J1219505+293323 — multiple flux-ordered blocks



Grouping Observations to Improve S/N

- Multi-band Bayesian Blocks analysis (*Scargle+2013*) on detection fluxes to identify observations that can be analyzed/grouped together

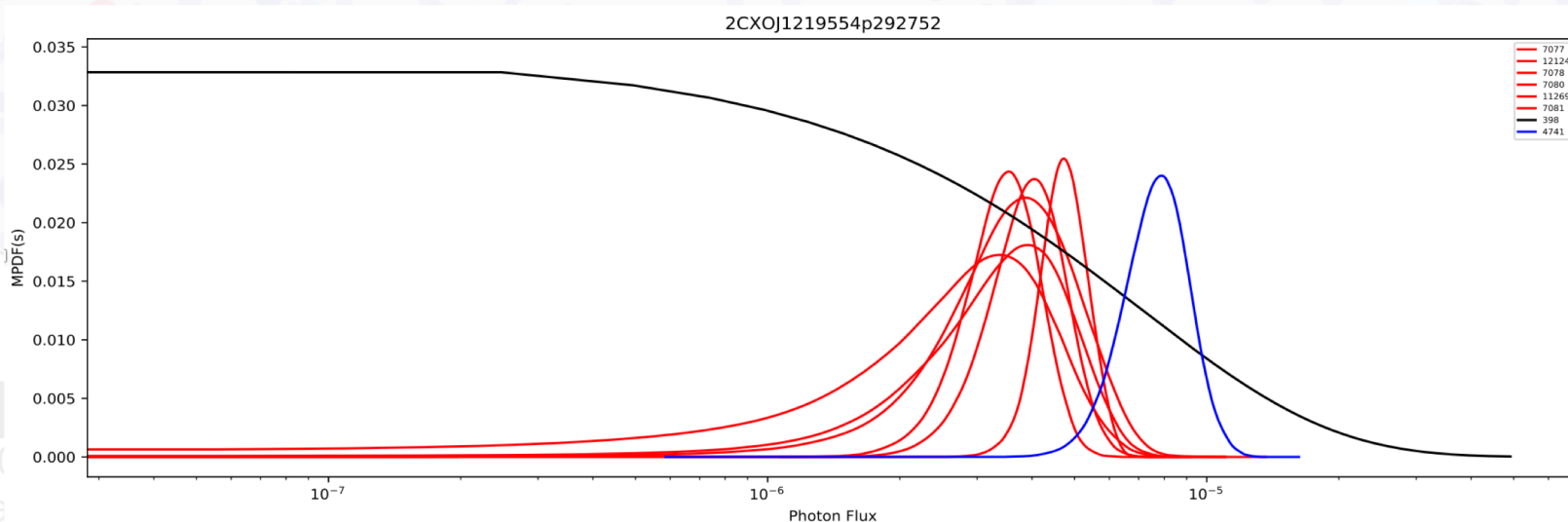
The combined properties for the longest exposure Bayesian Block are databased, but master level fluxes --> the best flux block determined in the Bayesian Blocks analysis



Variability Analysis

CHAND
SOURCE DAT

- **Single observation:** Gregory-Loredo Test: Hypothesis rejection test (i.e., odds ratio of assuming variability vs not assuming it). The probability that events detected are not arriving at a uniform rate. Used to estimate intra-obs variability (pick max prob among stack obsids).
- **Multiple observations:** Inter-observation variability. Variability test is based on a likelihood ratio between the null hypothesis of no variability, and the assumption of variability, when several observations are considered.



2 5
observations p

CSC 2.0 features

- Source detection on stacked observations
- New source detection approach
 - Wavelet detection *plus* Voronoi tessellation algorithm
 - Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)
- MCMC draws provide relative astrometry position error *ellipses*
- Aperture photometry; multi-band Bayesian Blocks algorithm
- **Multi-band limiting sensitivity computed on 4" x 4" pixels**

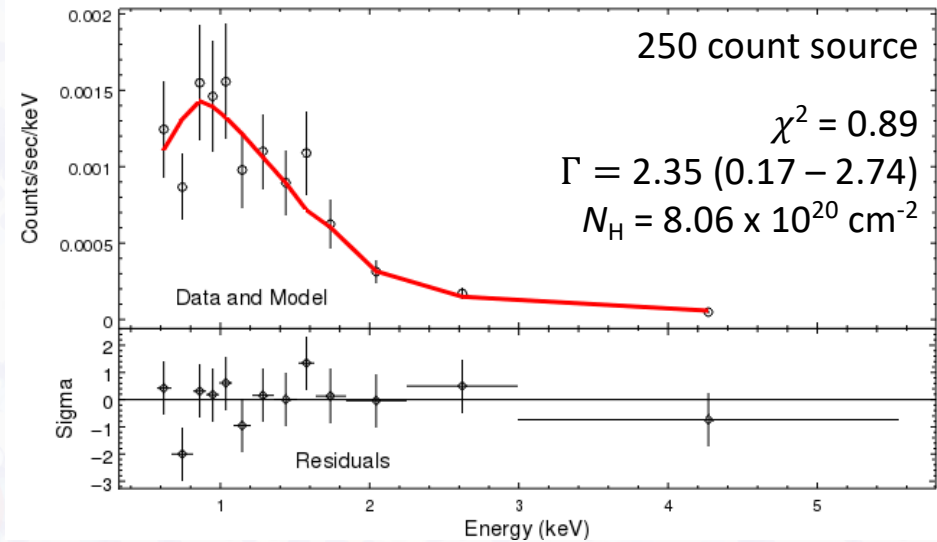
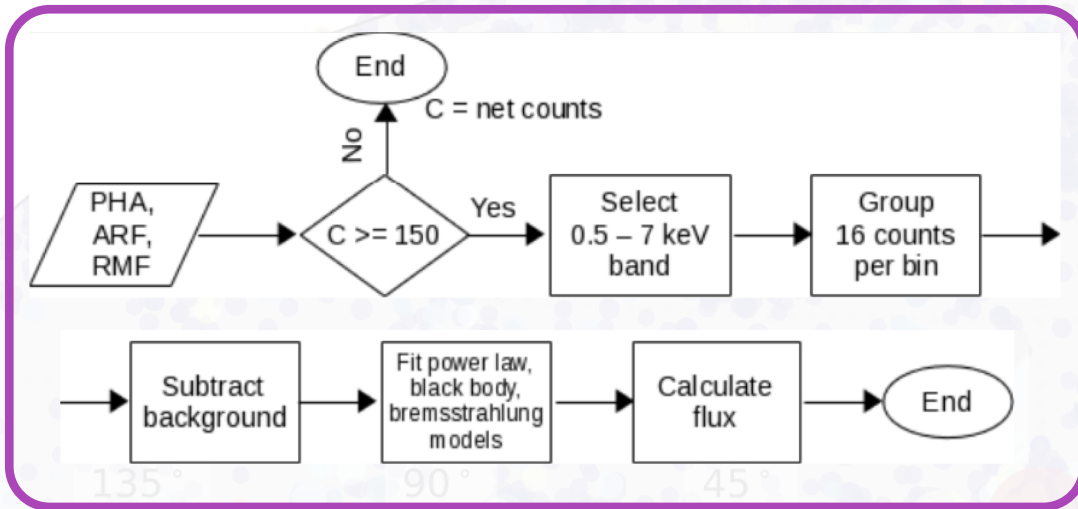
100 1000
ons per stack

CSC 2.0 features

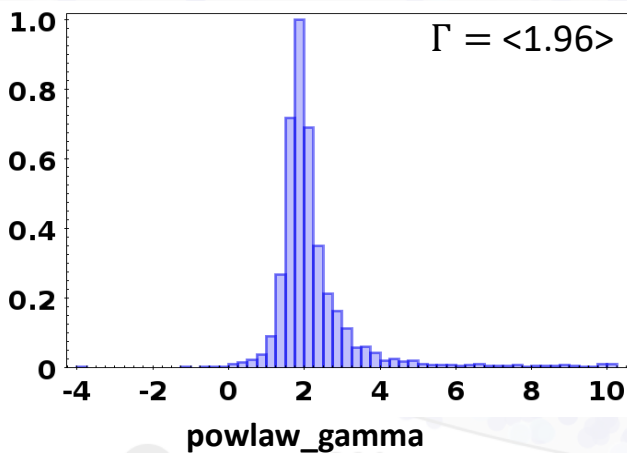
- Source detection on stacked observations
- New source detection approach
 - Wavelet detection *plus* Voronoi tessellation algorithm
 - Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)
- MCMC draws provide relative astrometry position error *ellipses*
- Aperture photometry; multi-band Bayesian Blocks algorithm
- Multi-band limiting sensitivity computed on 4" x 4" pixels
- **Spectra extraction of ALL DETECTIONS and spectral analysis**

100 1000
ons per stack

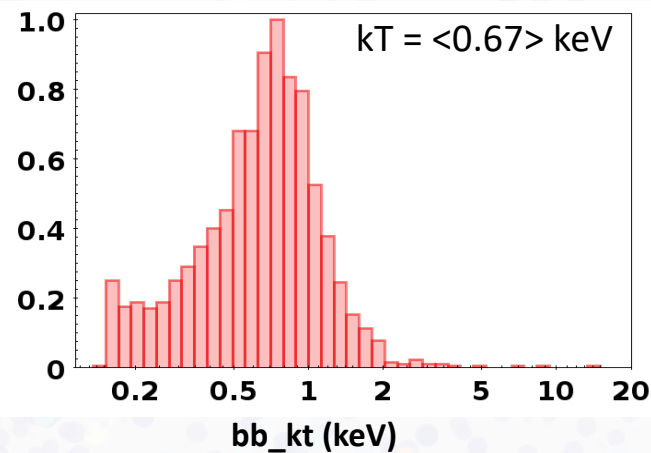
Spectral Analysis



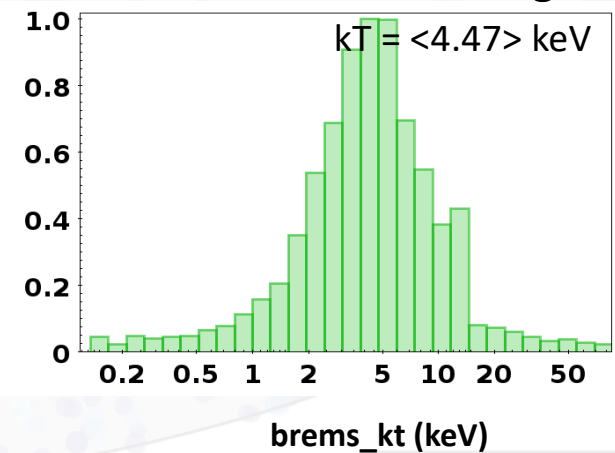
Abs. power law



Abs. black body

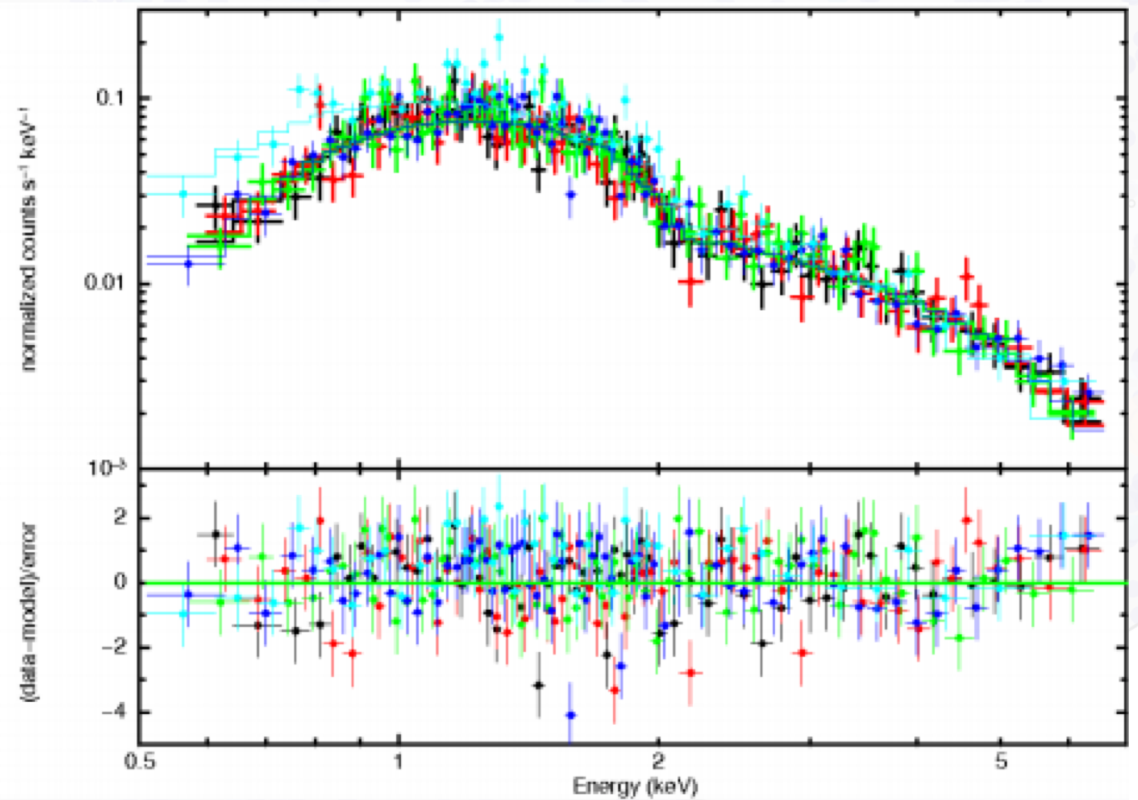
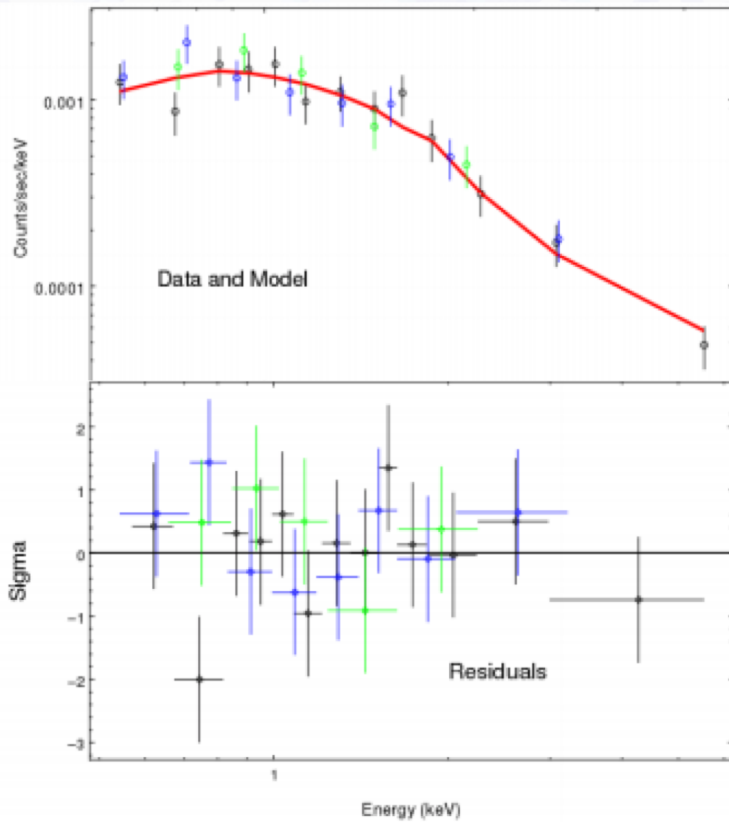


Abs. bremsstrahlung



Joint Spectral Fits

- Sources that are observed multiple times are grouped by the Bayesian blocks analysis
- All spectra in the block are simultaneously fit



CSC 2.0 features



- Source detection on stacked observations
- New source detection approach
 - Wavelet detection *plus* Voronoi tessellation algorithm
 - Maximum likelihood estimator to improve on-axis detection (~5 net counts for exposures < 15 ks)
- MCMC draws provide relative astrometry position error *ellipses*
- Aperture photometry; multi-band Bayesian Blocks algorithm
- Multi-band limiting sensitivity computed on 4" x 4" pixels
- Spectra extraction and spectral analysis
- **Extended emission properties**

100 1000
ons per stack

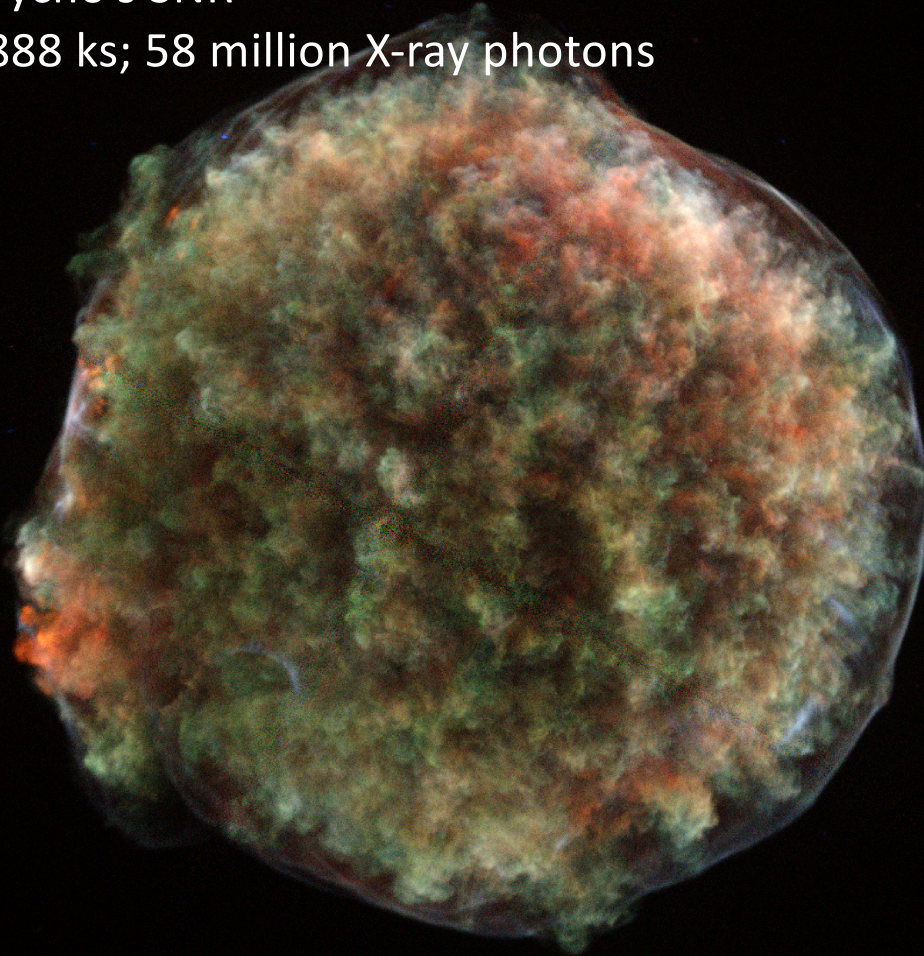
-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

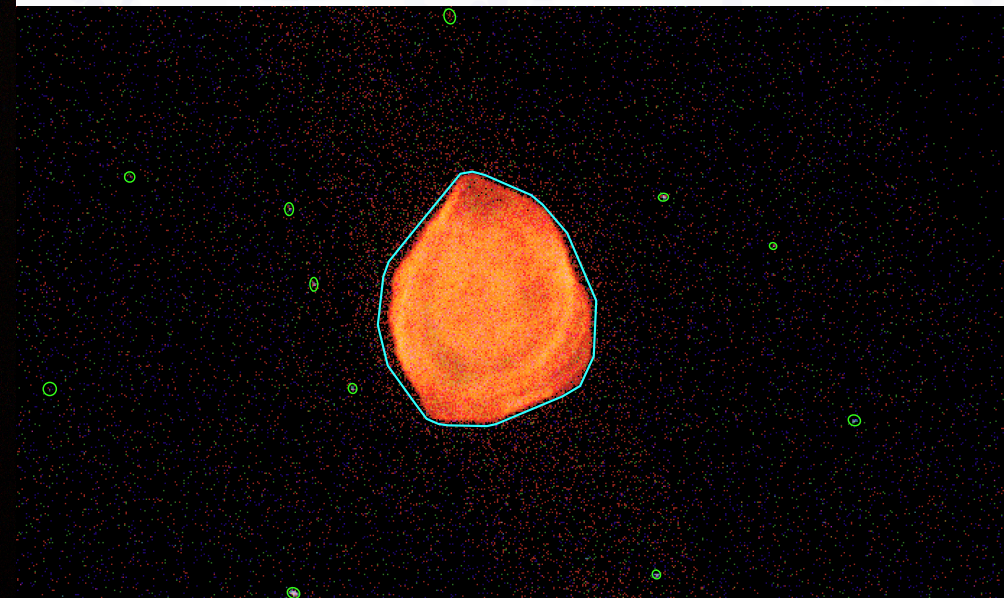
Extended sources (>30")

Tycho's SNR

888 ks; 58 million X-ray photons



- 1,299 highly extended sources
- SNRs, cluster of galaxies, extended galaxies, jets, etc.
- Photometric properties are integrated over a convex hull bounding region
- Fluxes and regions are provided



100 1000
ons per stack

-60°

-75°

F. Civano – virtual Caltech - 2021

1 2 5
Observations p

Databased properties

CHAND
SOURCE CAT

Master Source Properties

- Source name, position and position errors, significance, source flags, multi-band deconvolved extent, multi-band aperture photometry (photon and energy fluxes, spectral model fluxes [multiple spectral models]), hardness ratios, spectral model fits [multiple spectral models], multi-band intra- and inter-observation temporal variability

Stacked-Observation Detection Properties

- Position and position errors, multi-band significance, detection flags and codes, multi-band deconvolved extent, multi-band aperture photometry (net counts and count rates, photon and energy fluxes), aperture parameters, hardness ratios, multi-band intra- and inter-observation temporal variability

Per-Observation Detection Properties

- Detector position, multi-band significance, detection flags and codes, multi-band raw, PSF, and deconvolved extent, multi-band aperture photometry (total counts, net counts and count rates, photon and energy fluxes, spectral model fluxes [multiple spectral models]), masked aperture parameters, spectral model fits [multiple spectral models], multi-band intra-observation temporal variability

100 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

Science-Ready FITS Data Products

~25 million files, ~32 TB

Observation Data Products

- Observation event list, aspect solution and histogram, bad pixel map, FoV, pixel mask
- Multi-band images, background images, exposure maps

Stacked-Observation Data Products

- Stack event list, FoV, merged detection list
- Multi-band images, background images, exposure maps, limiting sensitivity

Detection Region Data Products

- Detection region stack and observation region definitions, event lists
- Multi-band per-stack and per-observation images, exposure maps, position error MCMC draws, aperture photometry PDFs
- Multi-band per-observation PSFs, light curves
- Per-observation PHA spectrum, RMF, ARF

Source Level Data Products

- Aperture photometry PDFs, per-Bayesian block properties (aperture photometry fluxes, model energy fluxes, spectral fits, hardness ratios)

100 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

Catalog Access

<http://cxc.cfa.harvard.edu/csc/>



← → ↻ Not Secure | cxc.cfa.harvard.edu/csc/ 🔍 ☆ 🔄 📄 ⓘ 👤 ⬆

📱 Apps 📍 Google Maps 🏦 Bank of America 🌿 Belmont Savings 📁 Astro 📁 OPS 🌐 webTA: 📡 SAO/NASA ADS C... 📁 Other Bookmarks

CHANDRA X-RAY OBSERVATORY 

Last modified: 24 October 2019

CXC HOME PROPOSER ARCHIVE DATA ANALYSIS

INSTRUMENTS & CALIBRATION FOR THE PUBLIC

Search <http://cxc.harvard.edu/csc2/>

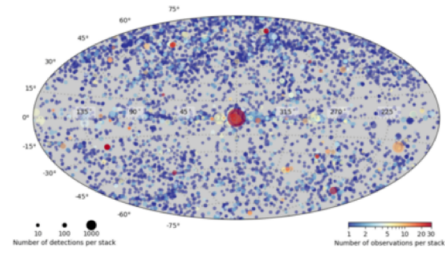
Google Custom Search 🔍

Contact the CXC HelpDesk

Chandra Source Catalog Release 2.0 (CSC 2.0)

[What's New?](#) | [Watch Out](#)

The Chandra Source Catalog (CSC) is the definitive catalog of X-ray sources detected by the [Chandra X-ray Observatory](#). Version 2.0 (CSC2) is the second major release of the catalog, and represents a significant improvement with respect to version 1.1 in terms of sky coverage, sensitivity and capabilities. CSC2 includes measured properties for **317,167 unique compact and extended X-ray sources** in the sky, allowing statistical analysis of large samples, as well as individual source studies. Extracted properties are provided for **928,280 individual observation detections** identified in 10,382 *Chandra* ACIS and HRC-I imaging observations released publicly through the end of 2014. CSC 2.0 also includes—as an "alpha" release—photometric properties for 1,299 highly extended ($\geq 30''$) sources, together with [surface brightness polygons](#) for several contour levels. There are [approximately 1,700 columns](#) of tabular data with pertinent information about each source across 5 bands (broad, hard, medium, soft, and ultra-soft) for ACIS and 1 band (wide) for HRC (see the [energy-bands page](#) for the definition of these bands), and 40 [data products](#) per source. The total size of the archive is close to 36 TB.



The locations, in Galactic coordinates, of the CSC 2.0 detections. The size of each symbol is proportional to the logarithm of the number of sources detected in the [stack](#), while the color encodes the number of closely-located observations.

CSC Data Access

- [CSCview](#) (help)
- [Quick Search](#) NEW
- [View in WWT](#)
- [CIAO scripts](#)
- [Virtual Observatory](#)

CSC Homepage

- About the Catalog**
 - [Overview](#)
 - [Catalog Organization](#)
 - [Catalog Release Views and Database](#)
 - [Access Views](#)
 - [Catalog Statistical Characterization](#)
 - [Caveats and Limitations](#)
 - [Version History](#)
- Creating the Catalog**
 - [Observation Selection](#)
 - [Catalog Processing](#)
 - [Data Products](#)
 - [Chandra Data Archive](#)
- Using the Catalog**
 - [Threads](#)
 - [CSCview GUI](#)
 - [CSC CLI](#)
 - [Data Access](#)
- Catalog Columns**
 - Master Sources Table:
 - [alphabetical](#) | [by context](#)
 - Stacked Observation Detections Table:
 - [alphabetical](#) | [by context](#)
 - Per-Observation Detections Table:
 - [alphabetical](#) | [by context](#)
- Column Descriptions**
 - [Position and Position Errors](#)
 - [Source Flags](#)
 - [Source Extent and Errors](#)
 - [Energy Bands](#)
 - [Source Fluxes](#)
 - [Source Significance](#)

What is CSC 2.0? Explore CSC 2.0 using the World Wide Telescope How do I access or download CSC 2.0? Are there any caveats for CSC 2.0? What properties are available in CSC 2.0? Is my favorite source in CSC 2.0?

How do I find the flux of a source? How do I cite CSC 2.0?

100 1000
ns per stack

1 2 5
Observations p

Data Access

<http://cxc.cfa.harvard.edu/csc/>

CHAND
SOURCE DAT

- The CSCview application
- Quick Search: the CSC web interface **NEW**
- View in the World Wide Telescope
- CIAO scripts
 - search csc
 - obsid search csc
- Using Virtual-Observatory interfaces
 - Astronomical Data Query Language
 - Cone search
 - Table Access Protocol
 - Simple Image Access Protocol

100 1000
ons per stack

1 2 5 :
Observations p

For a quick view: WWT

CHANDRA SOURCE CATALOG 2.0

Sources: 315880 (100.0%)

Select nearest source

Enter Name or Position:

Optical (DSS)

Show Popular Places

Hide Stack Outlines

Hide CSC 2.0 Sources

Load XMM Sources

Show Milky Way outline

Full screen Hide banners

Help Credits

Source: 2CXO J055033.8-682416

[Copy source name to clipboard](#) [Search nearby: NED or SIMBAD](#) [Zoom to source](#)

α : 5^h 50^m 33.83^s δ : -68° 24' 16.8" (ICRS)

<u>95% confidence position error ellipse</u>	1.29" by 0.56" at 129°
<u>Galactic n_H column density</u>	$6.59 \times 10^{20} \text{ cm}^{-2}$
<u>Aperture-corrected flux (broad band)</u>	$7.964\text{e-}16 \text{ erg cm}^{-2} \text{ s}^{-1}$
Lower confidence limit	2.172e-16
Upper confidence limit	1.376e-15
<u>Source significance (S/N)</u>	2.61
<u>Hard/Medium band hardness ratio</u>	0.075
Lower confidence limit	-0.3467
Upper confidence limit	0.4329
<u>Medium/Soft band hardness ratio</u>	-0.0412
Lower confidence limit	-0.4029
Upper confidence limit	0.3929
Number of ACIS observations	1
Number of HRC observations	0

Please **review** the current [caveats](#) for source properties in CSC 2.0.

SAMP to DS9 or TOPCAT

For a quick search: web search

← → ↻ Not Secure | cda.cfa.harvard.edu/cscweb/index.do ☆ 🌐 📄 ⓘ 👤 📁 Other Bookmark

📄 Apps 📍 Google Maps 🏦 Bank of America 🌿 Belmont Savings 📁 Astro 📁 OPS 🌐 webTA: 📄 SAO/NASA ADS C... 📄 Other Bookmark



Chandra Source Catalog 2.0 Quick Search



A quick search interface to the [Chandra Source Catalog](#).
Full search capabilities are available via the [CSCview application](#).

[Home](#)

Single Cone | Crossmatch

by coordinates

by name

Right Ascension
 value in decimal degrees in [0, 360) or equivalent in sexagesimal in HMS or DMS

Declination
 value in decimal degrees in [-90, 90] or equivalent in sexagesimal in DMS

Search Radius
 arcmin value in: [0, 60]

Display
 Rows

[Search](#)

Data Retrieval: CSCView

The screenshot displays the CSCView interface with several key components and annotations:

- Standard queries:** A red box highlights the 'Standard Queries' list on the left sidebar.
- Properties to be retrieved:** A red box highlights the 'Result Set' list in the center, which includes properties like 'name', 'ra', 'dec', and various flux and significance parameters.
- Criteria to search on: ADQL queries:** A red box highlights the search criteria input field, showing a query: `(significance >= 5.0)`.
- List of properties that can be selected:** A red box highlights the 'Source Properties' tree on the left, which lists various astronomical parameters such as 'Position Error: Ellipse', 'Source Significance', and 'Spectral Hardness Ratios'.
- Cone search and cross-match:** A red box highlights the 'Position Search' section at the bottom, which includes radio buttons for 'By Name', 'By Coordinates', 'Cone', and 'Crossmatch', along with input fields for 'Name', 'Resolver', 'Radius', and 'Units'.

At the bottom of the interface, a table displays the results of the search:

Table	Name	Datatype	Units	Description
Master Sources	err_ellipse_r0	double	arcsec	Major radius of the 95% confidence level position error ellipse
Master Sources	err_ellipse_r1	double	arcsec	Minor radius of the 95% confidence level position error ellipse
Master Sources	err_ellipse_ang	double	deg	Position angle (ref. local true north) of the major axis of the 95% confidence level error ellipse



Data Retrieval: CSCView

CSCView

Chandra Source Catalog: Current Database

Catalog Query Results Products

Retrieved tabular properties

Select FITS data products here

Select	name	ra	dec	err_ellipse_r0 (arcsec)	err_ellipse_r1 (arcsec)	err_ellipse_ang (deg)	conf_flag	sat_src_flag	significance	flux_aper_b (erg/s/cm ²)	flux_aper_lolim_b (erg/s/cm ²)	flux_aper_hilim_b (erg/s/cm ²)	flux_ (erg/s)
<input type="checkbox"/>	2CXO J210635.1+233051	21 06 35.16	+23 30 51.47	2.15	1.59	105.3	TRUE	FALSE	6.32	4.014e-15	1.302e-15	6.727e-15	0.00
<input type="checkbox"/>	2CXO J210643.6+232757	21 06 43.66	+23 27 57.10	1.68	0.98	90.1	TRUE	FALSE	7.03	1.467e-14	1.199e-14	1.735e-14	9.3
<input type="checkbox"/>	2CXO J210644.4+233859	21 06 44.43	+23 38 59.96	1.09	0.64	101.1	TRUE	FALSE	13.87	4.081e-14	3.711e-14	4.450e-14	2.5
<input type="checkbox"/>	2CXO J210646.2+232749	21 06 46.26	+23 27 49.41	2.54	1.68	102.3	TRUE	FALSE	6.63	1.123e-14	8.880e-15	1.345e-14	7.1
<input type="checkbox"/>	2CXO J210646.3+233207	21 06 46.31	+23 32 07.25	1.11	0.84	121.4	FALSE	FALSE	7.33	1.016e-14	8.194e-15	1.212e-14	6.8
<input type="checkbox"/>	2CXO J210647.6+232651	21 06 47.64	+23 26 51.01	2.04	1.37	89.2	TRUE	FALSE	5.93	1.564e-14	1.141e-14	1.965e-14	1.2
<input type="checkbox"/>	2CXO J210649.1+233336	21 06 49.15	+23 33 36.02	0.76	0.41	103.1	TRUE	FALSE	16.07	4.965e-14	4.636e-14	5.295e-14	3.4
<input checked="" type="checkbox"/>	2CXO J210651.7+234321	21 06 51.71	+23 43 21.07	1.59	1.15	156.4	FALSE	FALSE	11.72	6.632e-14	5.926e-14	7.337e-14	4.7
<input type="checkbox"/>	2CXO J210652.8+232718	21 06 52.81	+23 27 18.55	1.09	0.88	105.4	TRUE	FALSE	8.31	1.442e-14	1.195e-14	1.675e-14	8.7
<input type="checkbox"/>	2CXO J210653.3+233327	21 06 53.38	+23 33 27.73	0.77	0.46	106.6	TRUE	FALSE	10.25	2.419e-14	2.174e-14	2.665e-14	2.1
<input type="checkbox"/>	2CXO J210654.4+232657	21 06 54.49	+23 26 57.30	1.51	0.87	92.5	TRUE	FALSE	6.81	1.443e-14	1.209e-14	1.663e-14	1.2
<input type="checkbox"/>	2CXO J210654.5+233242	21 06 54.53	+23 32 42.85	0.62	0.51	140.9	TRUE	FALSE	9.34	2.678e-14	2.373e-14	2.965e-14	2.5
<input type="checkbox"/>	2CXO J210656.1+233221	21 06 56.12	+23 32 21.13	0.50	0.50	0.0	TRUE	FALSE	7.67	1.036e-14	8.883e-15	1.175e-14	7.3
<input checked="" type="checkbox"/>	2CXO J210657.0+233407	21 06 57.05	+23 34 07.20	0.44	0.34	131.5	FALSE	FALSE	16.46	4.774e-14	4.469e-14	5.061e-14	3.3
<input type="checkbox"/>	2CXO J210658.0+233110	21 06 58.09	+23 31 10.56	0.82	0.64	125.1	FALSE	FALSE	5.50	6.315e-15	5.038e-15	7.522e-15	4.7
<input type="checkbox"/>	2CXO J210659.5+232907	21 06 59.56	+23 29 07.87	0.86	0.52	95.8	FALSE	FALSE	5.20	7.514e-15	5.994e-15	8.949e-15	7.0
<input type="checkbox"/>	2CXO J210700.3+233152	21 07 00.39	+23 31 52.25	0.42	0.35	121.2	TRUE	FALSE	8.84	7.032e-15	6.124e-15	7.940e-15	0.00
<input type="checkbox"/>	2CXO J210701.2+233153	21 07 01.21	+23 31 53.00	0.47	0.41	104.0	TRUE	FALSE	6.87	6.232e-15	5.290e-15	7.175e-15	5.6
<input type="checkbox"/>	2CXO J210703.1+233022	21 07 03.13	+23 30 22.21	0.32	0.29	94.9	TRUE	FALSE	19.77	6.002e-14	5.705e-14	6.299e-14	3.6
<input type="checkbox"/>	2CXO J210703.7+233234	21 07 03.80	+23 32 34.14	0.47	0.38	107.9	FALSE	FALSE	5.79	6.494e-15	5.355e-15	6.734e-15	4.1
<input type="checkbox"/>	2CXO J210703.9+233113	21 07 03.97	+23 31 13.24	0.58	0.42	115.2	TRUE	FALSE	5.53	5.989e-15	4.882e-15	7.096e-15	4.9
<input type="checkbox"/>	2CXO J210705.9+232844	21 07 05.96	+23 28 44.18	0.61	0.54	95.1	FALSE	FALSE	6.84	7.911e-15	6.675e-15	9.147e-15	5.9
<input type="checkbox"/>	2CXO J210707.2+234358	21 07 07.25	+23 43 58.39	3.73	3.11	151.6	TRUE	FALSE	6.05	1.038e-14	5.588e-15	1.517e-14	4.5
<input type="checkbox"/>	2CXO J210709.6+233536	21 07 09.65	+23 35 36.26	0.80	0.61	152.5	TRUE	FALSE	5.14	4.771e-15	3.737e-15	5.806e-15	4.0
<input type="checkbox"/>	2CXO J210710.3+234100	21 07 10.39	+23 41 00.58	1.83	1.27	151.5	TRUE	FALSE	5.24	1.641e-14	1.142e-14	2.117e-14	1.2
<input type="checkbox"/>	2CXO J210713.4+233351	21 07 13.43	+23 33 51.83	0.35	0.32	144.2	TRUE	FALSE	5.82	4.859e-15	3.963e-15	5.754e-15	3.8
<input type="checkbox"/>	2CXO J210714.8+233145	21 07 14.82	+23 31 45.15	0.30	0.30	0.0	TRUE	FALSE	13.48	3.540e-14	3.277e-14	3.803e-14	3.1
<input checked="" type="checkbox"/>	2CXO J210715.1+233315	21 07 15.14	+23 33 15.30	0.31	0.30	113.4	FALSE	FALSE	12.87	1.903e-14	1.751e-14	2.054e-14	1.2
<input type="checkbox"/>	2CXO J210715.8+233355	21 07 15.85	+23 33 55.56	0.35	0.32	166.6	TRUE	FALSE	5.97	7.011e-15	5.798e-15	8.157e-15	6.4
<input type="checkbox"/>	2CXO J210715.9+233058	21 07 15.96	+23 30 58.17	0.31	0.30	60.9	FALSE	FALSE	8.95	8.337e-15	7.352e-15	9.264e-15	4.5
<input type="checkbox"/>	2CXO J210717.1+232803	21 07 17.19	+23 28 03.28	0.50	0.43	36.7	FALSE	FALSE	8.60	1.025e-14	8.925e-15	1.149e-14	6.8
<input type="checkbox"/>	2CXO J210720.5+233047	21 07 20.58	+23 30 47.69	0.32	0.31	57.1	FALSE	FALSE	8.67	1.061e-14	9.416e-15	1.181e-14	7.8
<input type="checkbox"/>	2CXO J210722.1+233131	21 07 22.14	+23 31 31.43	0.34	0.34	161.5	TRUE	FALSE	5.14	5.146e-15	4.105e-15	6.128e-15	4.6
<input type="checkbox"/>	2CXO J210723.7+233216	21 07 23.76	+23 32 16.15	0.32	0.31	20.1	FALSE	FALSE	6.14	2.872e-15	2.342e-15	3.403e-15	1.0
<input type="checkbox"/>	2CXO J210724.5+233301	21 07 24.56	+23 33 01.01	0.34	0.32	34.1	FALSE	FALSE	5.63	6.440e-15	5.265e-15	7.614e-15	5.4
<input type="checkbox"/>	2CXO J210731.3+233529	21 07 31.34	+23 35 29.92	0.76	0.54	9.8	TRUE	FALSE	6.92	8.721e-15	7.210e-15	1.014e-14	7.0
<input type="checkbox"/>	2CXO J210735.0+234217	21 07 35.09	+23 42 17.82	2.35	1.87	167.4	TRUE	FALSE	5.03	1.322e-14	8.528e-15	1.770e-14	1.1
<input type="checkbox"/>	2CXO J210735.6+233502	21 07 35.62	+23 35 02.11	0.70	0.45	10.6	TRUE	FALSE	6.76	5.990e-15	4.721e-15	7.188e-15	3.7
<input type="checkbox"/>	2CXO J210741.5+232924	21 07 41.53	+23 29 24.92	0.84	0.48	43.1	TRUE	FALSE	12.39	2.104e-14	1.902e-14	2.305e-14	1.3
<input type="checkbox"/>	2CXO J210742.0+233238	21 07 42.07	+23 32 38.38	0.63	0.49	31.7	FALSE	FALSE	8.09	1.332e-14	1.096e-14	1.553e-14	9.8
<input type="checkbox"/>	2CXO J210746.7+233128	21 07 46.75	+23 31 28.44	1.20	0.75	41.9	FALSE	FALSE	8.99	1.069e-14	8.859e-15	1.241e-14	6.3

Product Type	Product Specifier	Format	Description
Bayesian Blocks source properties	bayesblks	FITS table	Bayesian Blocks source properties
Per-Master source region aperture photometry PDF	srcaperphot_b	FITS table	Per-Master source region aperture photometry PDF; ACIS broad energy band
Per-Master source region aperture photometry PDF	srcaperphot_w	FITS table	Per-Master source region aperture photometry PDF; HRC wide energy band
Event List	regev3	FITS table	The source region event file consists of a single FITS format event file for each observation
Point Spread Function	psf_b	FITS image	Per-energy-band local model point spread function images (broad energy band)
Point Spread Function	psf_w	FITS image	Per-energy-band local model point spread function images (wide energy band)
Exposure Map	regevman_b	FITS image	Per-energy-band exposure map images (broad energy band)

SAMP to DS9 or TOPCAT

quarterly1

Chandra X-ray Center x +

Not Secure | cxc.cfa.harvard.edu

Apps Google Maps Bank of America Belmont Savings Astro OPS webTA: SAO/NASA ADS C... Other Bookmarks

CHANDRA
X-RAY OBSERVATORY

Proposer Archive Data Analysis Instruments and Calibration For The Public

Get Chandra Data Chandra Source Catalog HelpDesk CXC Staff CXC Opportunities Announcements Portal About Chandra

Chandra Source Catalog Release 2.0

The second major release of the Chandra Source Catalog (CSC 2.0) is now complete and available for queries and downloads. It contains 317,167 unique X-ray sources (315,868 compact and 1,299 highly extended sources) covering 550 square degrees of the galactic and extragalactic sky.

Read the full announcement [here](#).

10/24/19

Call for Applications for the NASA Hubble Fellowship Program (NHFP)

On behalf of the NASA Astrophysics Division, the Space Telescope Science Institute (STScI) announces the call for applications for postdoctoral fellowships under the NASA Hubble Fellowship Program (NHFP) beginning in the fall of 2020.

[Announcement of Opportunity](#)
Read the full announcement [here](#).

9/3/19

20 Years of Chandra Science Symposium

New in the 5th Announcement:
Regular Registration and Abstract Deadline Friday, 6 September 2019. Please NOTE that the abstract submission and registration processes are separate. Please NOTE that the regular registration fee is valid through September 6th.

[Symposium Website](#)
Read the full announcement [here](#).

9/3/19

Chandra Source Catalog 2.0

Chandra/CIAO Workshop in Hawaii
3-4 January 2020

20 Years of Chandra Symposium
3-6 December 2019

Chandra 20th Anniversary Events

00:00 | 07:11

-60°

100 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

NEW

Multiwavelength Associations (1)

- Systematic cross-match with SDSS, Gaia, ALLWISE, and Pan-STARRS catalogs
- Two similar Bayesian algorithms: Xmatch (A. Rots), NWAY (J. Buchner)
- Cross-match tables will be made available via CXC website and CDS

● ●
100 1000
ons per stack

-75°
F. Civano – virtual Caltech - 2021

1 2 5 :
Observations p

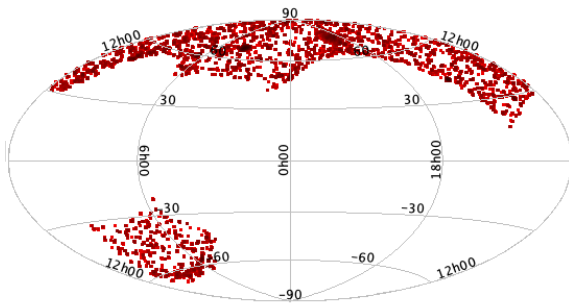
NEW

Multiwavelength Associations (2)

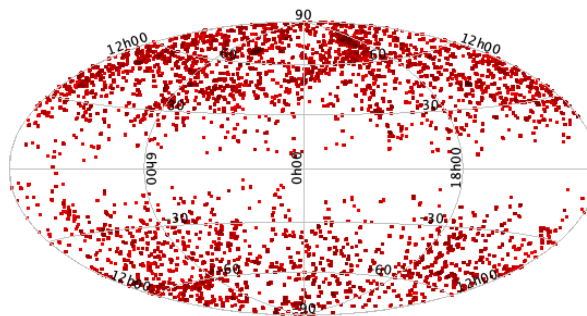
Number of matches at $<10''$ separation:

35k matches	SDSS
92k matches	GAIA
105k matches	PanSTARRS
71k matches	2MASS
124k matches	WISE
32k matches	GALEX

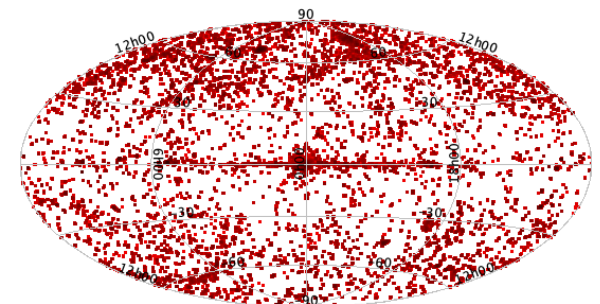
SDSS



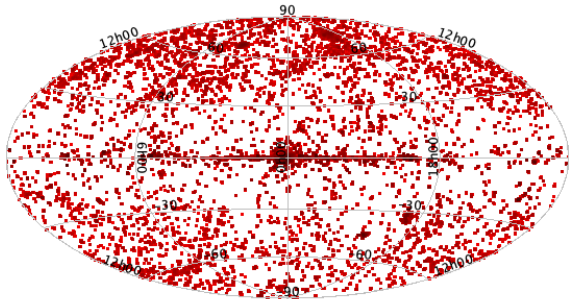
GALEX



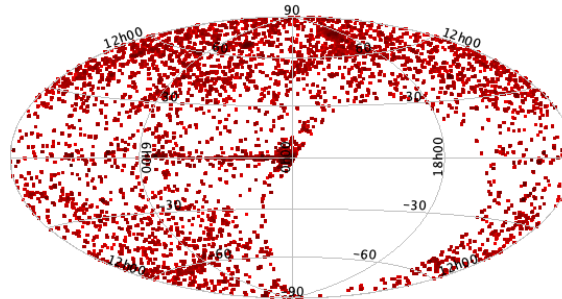
WISE



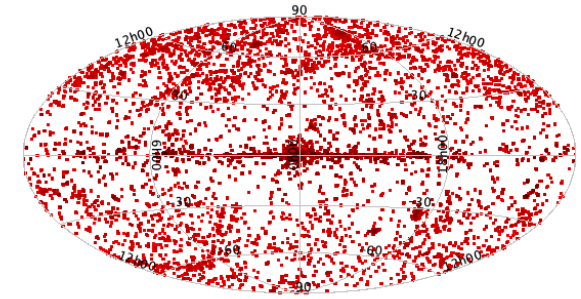
GAIA



PanSTARRS



2MASS



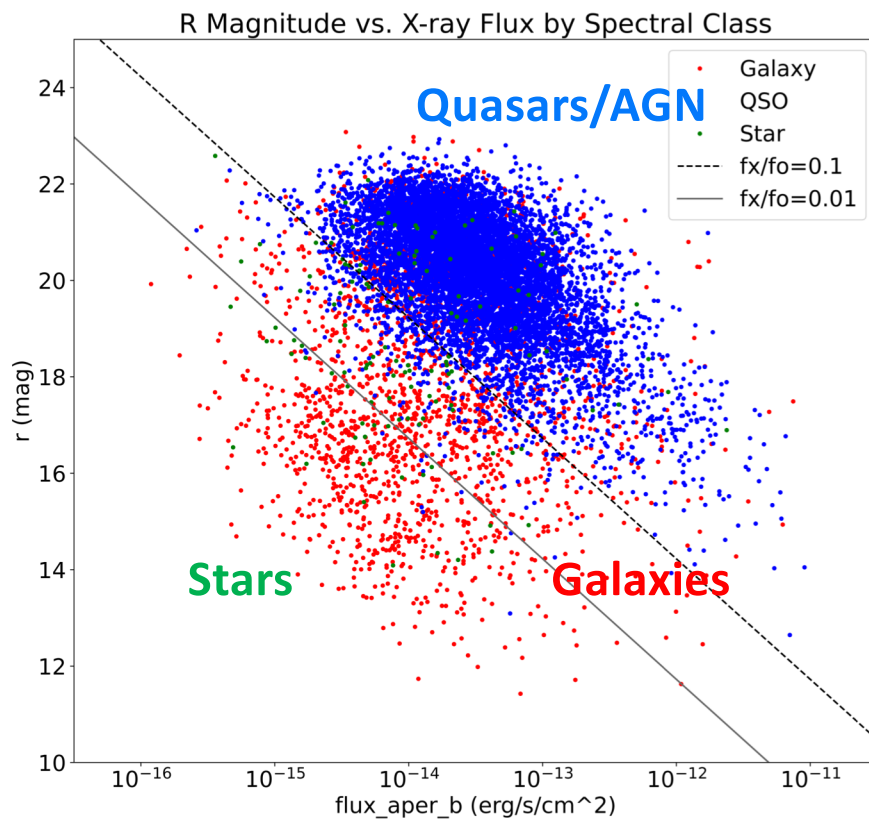
Credit to D-W. Kim, A. Cassity

F. Civano – virtual Caltech - 2021

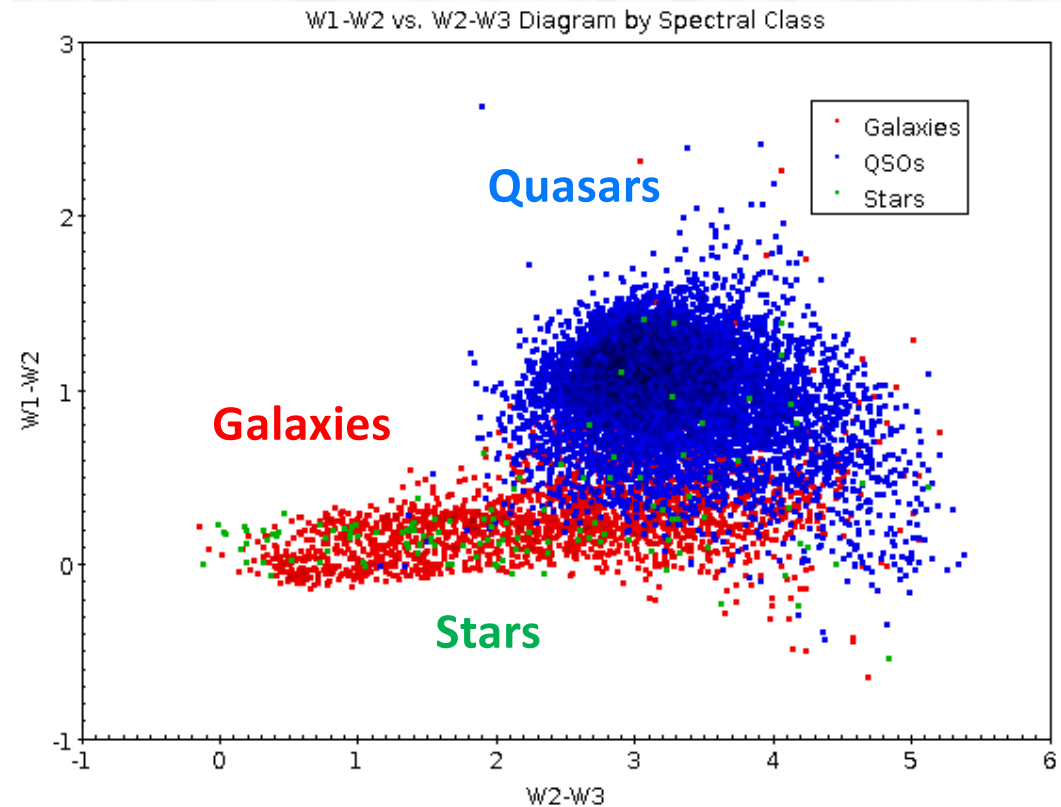
NEW

Multiwavelength Properties

X-ray to optical flux with SDSS classification



WISE colors with SDSS classification



THANKS

