Chandra X-ray Center

Science Data Systems

Jonathan McDowell

Chandra X-ray Center

COVID-19: SDS SAO staff hybrid working (typically 2 days/wk remote)

Team: McDowell, Fruscione (1/2), Siemiginowska, Burke
(SAO scientists: CIAO, Sherpa, Docs, HRC, Catalog, User support)
Glotfelty, Lee, Joye, Cranmer (1/2)
(SAO computer specialists: Docs, User support, scripts, DS9)
Huenemoerder, Guenther, Principe, Nynka
(MIT scientists: Gratings, ACIS, PSF, V&V, Catalog, Sherpa, User support)

Overview:

Ensure the science community can turn data products into science papers:

Define, test and support CIAO - the Chandra user data analysis package
User support for data analysis
Maintain and improve science algorithms, data products
Simplify and codify evolving best practices for analysis (scripts, threads)

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Community Support:

Downloads,
Documentation,
Helpdesk

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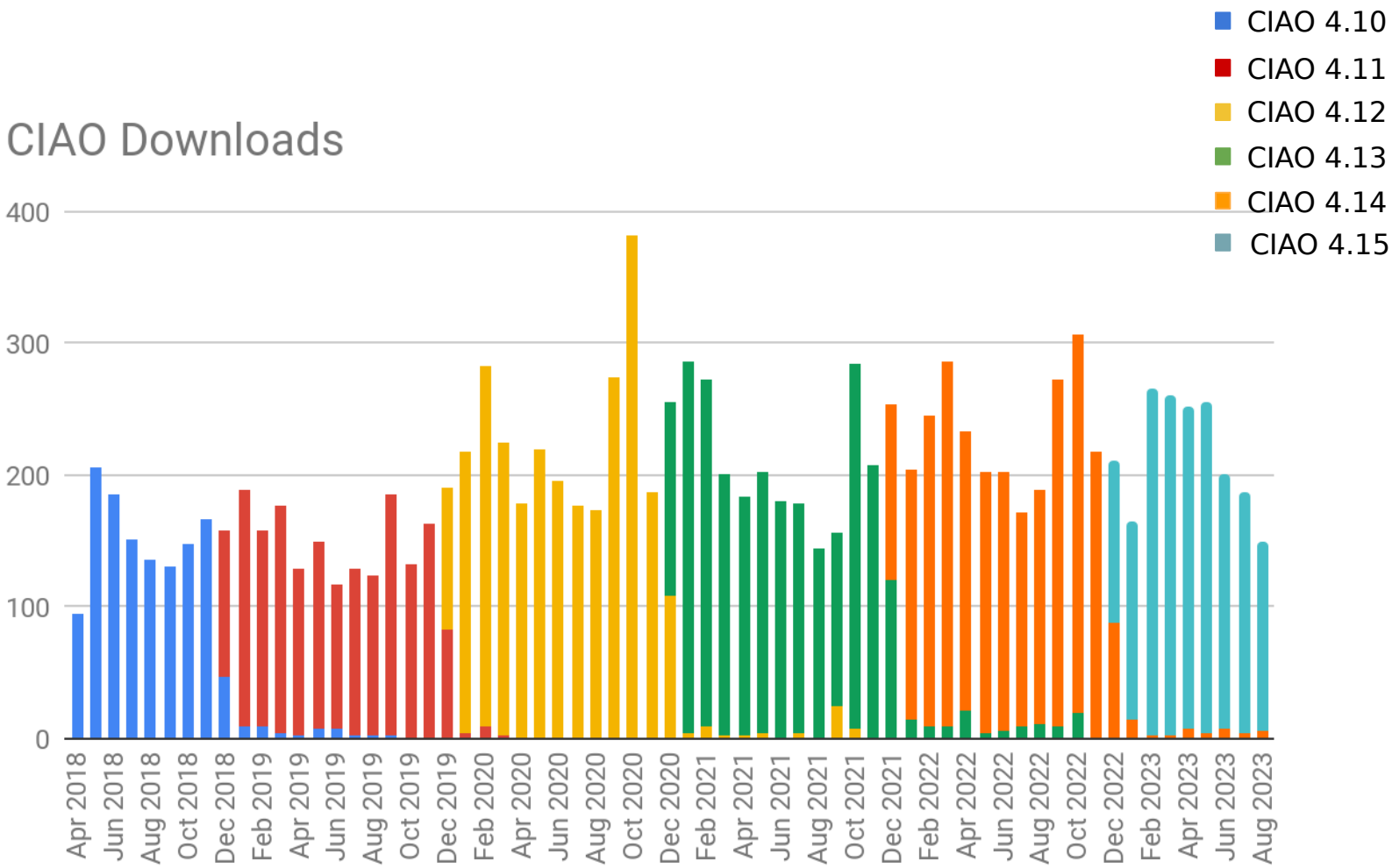

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Downloads (lifetime)

OS	CIAO 4.14	CIAO 4.15
Linux	1627	1082
macOSX	1059	767
	2686	1849
Source	43	5
Total	2729	1854

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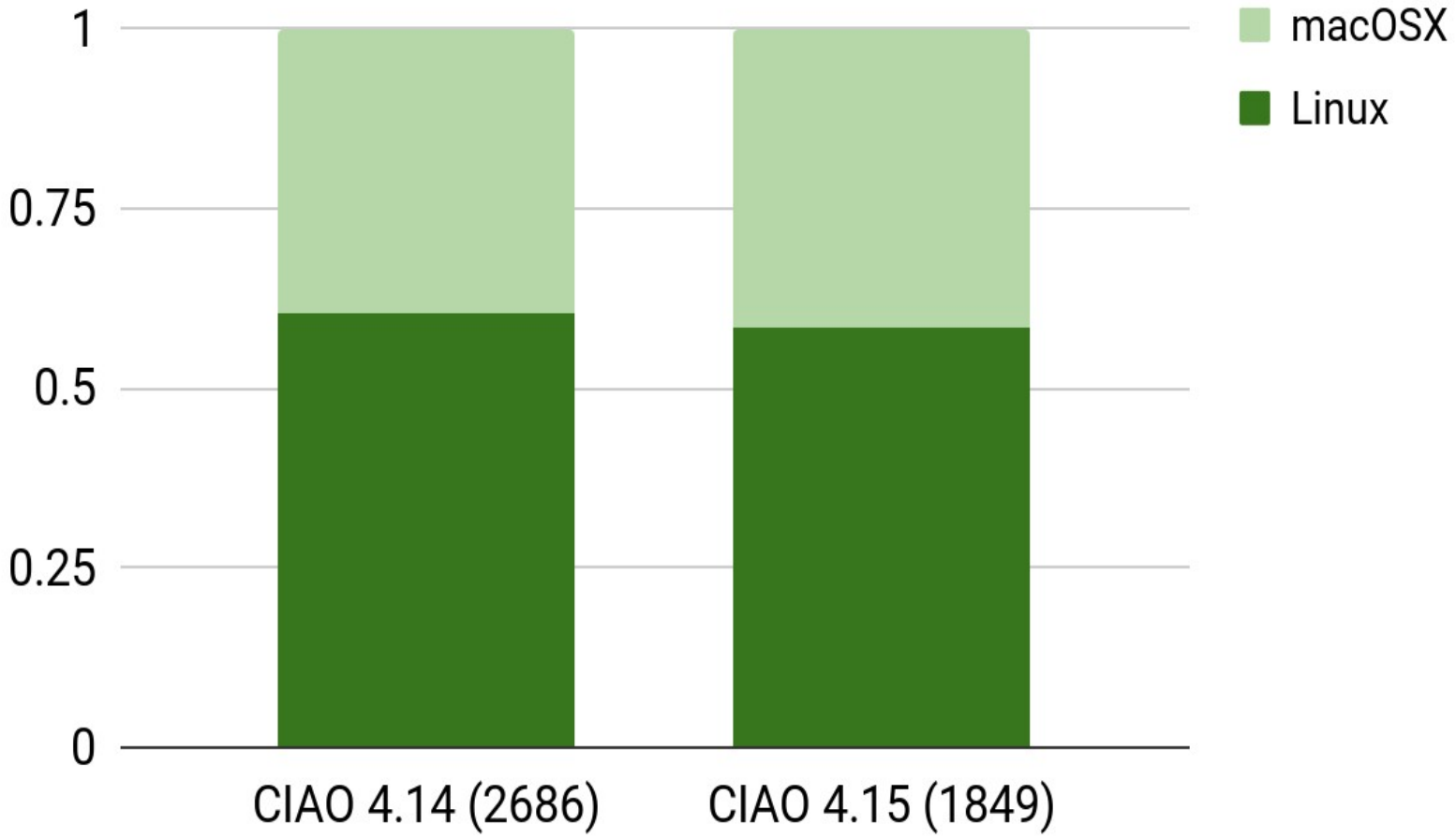
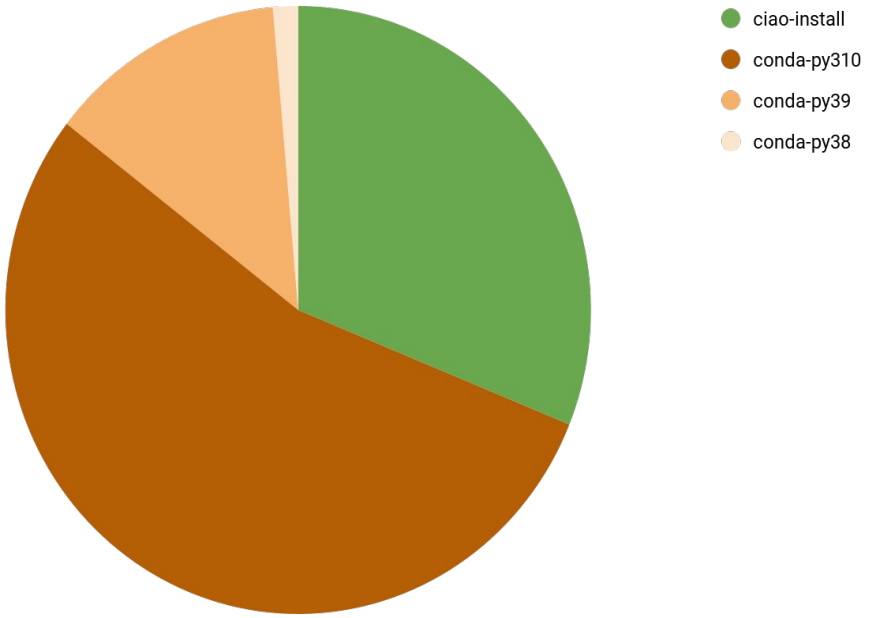
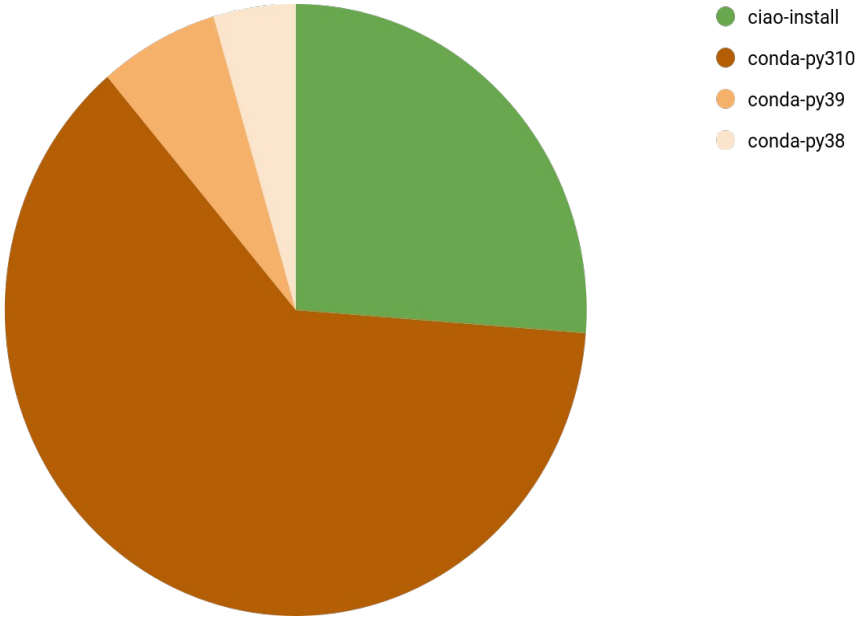
Download by OS



CIAO 4.15 Installation Options



Linux



Mac

The default python version for the conda installations keeps changing. We now explicitly recommend users use Python 3.10 unless they specifically need an older version.
ciao-install vs conda fractions are similar to last year.

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Documentation

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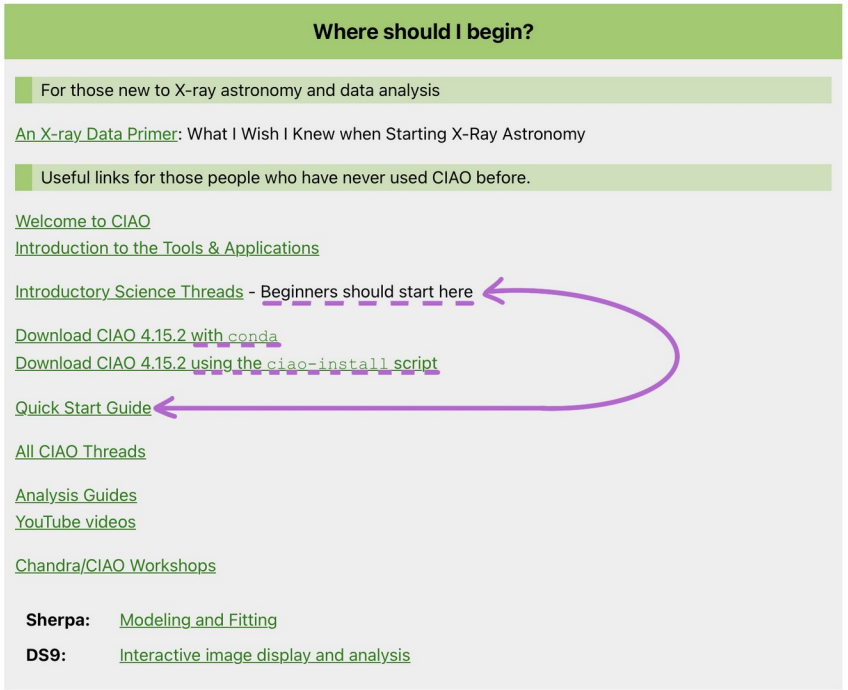
Documentation

- Routine CIAO 4.15 website roll out.
- Google searches kept sending users to old version of CIAO pages, so the old versions have been removed with redirects to the current version.
    - Only CIAO 4.14 and CIAO 4.15 are available.
- New data caveat about using wcs_match or reproject_aspect with method=rst (rotate, scale, translate) and possibility of getting data products with different pixel sizes. Use method=trans instead.
- New threads:
    - srcflux plugins
    - mean energy map (statmap)
    - building XSpec user-models for Sherpa [resurrected and rewritten]
- Updated several docs to highlight the change to the default dither parameters.
- Based on user experience updated the CIAO conda installation instructions
    - Instruct users to use Python 3.10 by default
    - Provide explicit instructions for ARM/M1/M2 users on how to use CONDA_SUBDIR environment variable.

- Review, revision, and reorganization of introductory documentation from the perspective of a total beginner to ensure clarity and accessibility for all levels of x-ray astronomy experience
    - We acknowledge the demographic shift in Chandra users from primarily experienced users who might have previously worked with data from Einstein Observatory, ROSAT, etc. to a more significant fraction of users for whom Chandra is their first x-ray observatory
- New staff member (Cranmer) practiced data analysis with CIAO, Sherpa, and ds9 following introductory threads in preparation for assisting with SDS HelpDesk tickets and testing

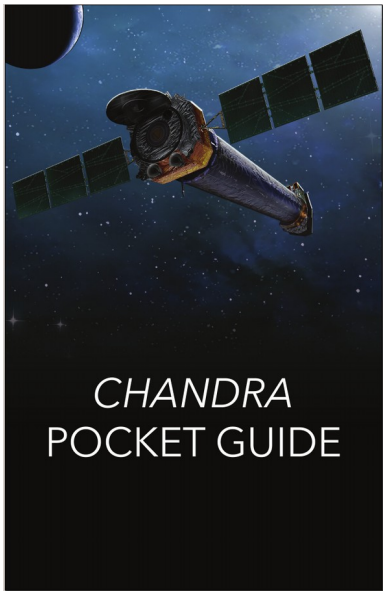


Chandra Pocket Guide

cxc.harvard.edu/cdo/pocket_guide.pdf

Many conference attendees would comment that as introductory material the CfP and POG are overwhelming.

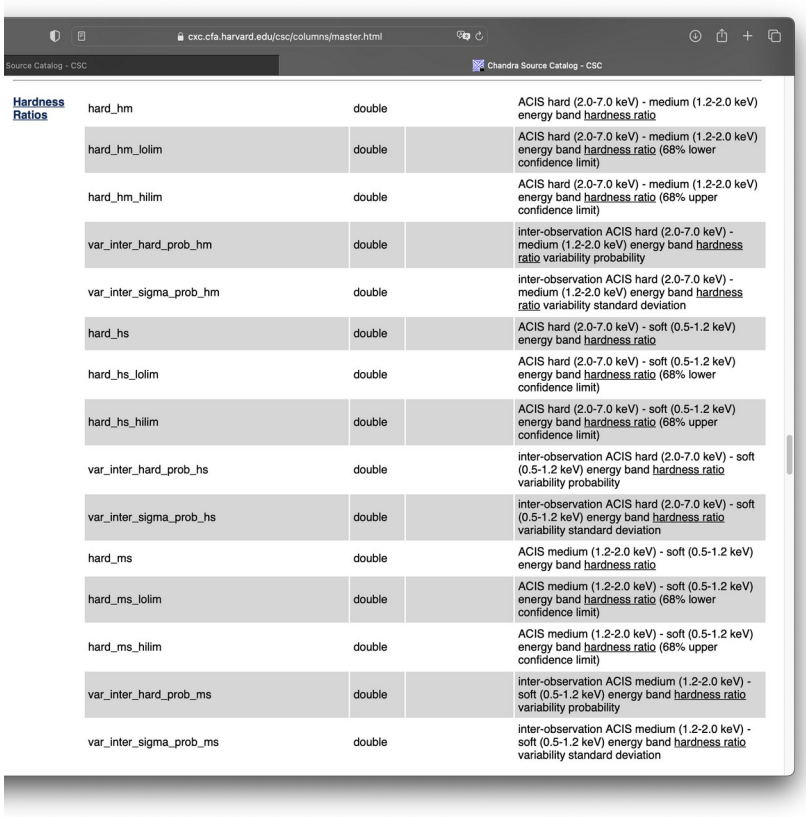
- Designed to be a quick overview and reference for new users in the scientific community.
- Provide summary of the available instruments so that you can understand what you're looking at an event file.
- Provide overview on the types of observing programs and science being done with recent observations.
- Provides basic considerations about the spacecraft an observer needs to account for when writing a proposal.
- Provides information about accessing and using data.



Made available at the Albuquerque AAS in June 2023

CSC Column Descriptions

Prototype approach to providing more column descriptor information with pop-up tooltips when available.



Hardness Ratios	hard_hm	double	ACIS hard (2.0-7.0 keV) - medium (1.2-2.0 keV) energy band hardness ratio
	hard_hm_lolim	double	ACIS hard (2.0-7.0 keV) - medium (1.2-2.0 keV) energy band hardness ratio (68% lower confidence limit)
	hard_hm_hilim	double	ACIS hard (2.0-7.0 keV) - medium (1.2-2.0 keV) energy band hardness ratio (68% upper confidence limit)
	var_inter_hard_prob_hm	double	inter-observation ACIS hard (2.0-7.0 keV) - medium (1.2-2.0 keV) energy band hardness ratio variability probability
	var_inter_sigma_prob_hm	double	inter-observation ACIS hard (2.0-7.0 keV) - medium (1.2-2.0 keV) energy band hardness ratio variability standard deviation
	hard_hs	double	ACIS hard (2.0-7.0 keV) - soft (0.5-1.2 keV) energy band hardness ratio
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	hard_ms	double	ACIS medium (1.2-2.0 keV) - soft (0.5-1.2 keV) energy band hardness ratio
	hard_ms_lolim	double	ACIS medium (1.2-2.0 keV) - soft (0.5-1.2 keV) energy band hardness ratio (68% lower confidence limit)
	hard_ms_hilim	double	ACIS medium (1.2-2.0 keV) - soft (0.5-1.2 keV) energy band hardness ratio (68% upper confidence limit)
	var_inter_hard_prob_ms	double	inter-observation ACIS medium (1.2-2.0 keV) - soft (0.5-1.2 keV) energy band hardness ratio variability probability
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Helpdesk

Helpdesk Stats

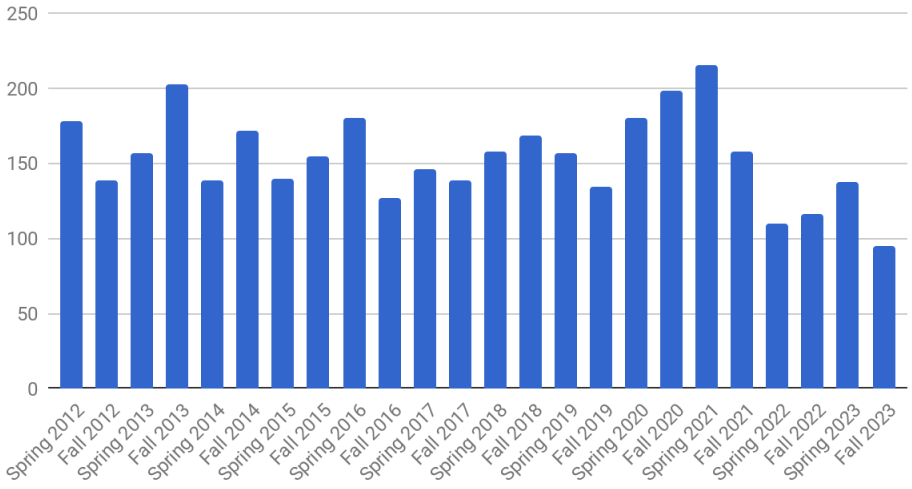
	2021-09-01 to 2022-08-31	2022-09-01 to 2023-08-31
Time period [months]	12	12
Number of TIckets	233	264
Median time to 1st contact [hrs]	1.45	1.53
Median time to close [hrs]	15.92	14.85
Maximum time to close [hrs]	1728.2	1346.4

Longest ticket was about user trying to recreate mkpsf's PSF library using MARX. Ticket opened before end-of-year holidays in 2022 and extended into 2023.

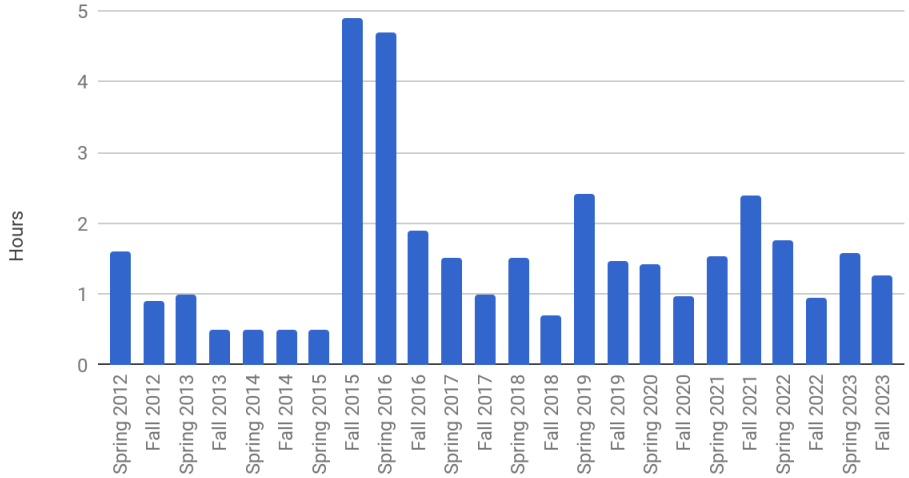
One ticket from 15 May 2023 is currently still open and has over 75 iterations. User is trying to resolve Chandra and XMM backgrounds. Quote from the user "xmm helpdesk people asking about this, but they stopped replying to me"

Long Term Helpdesk Trends

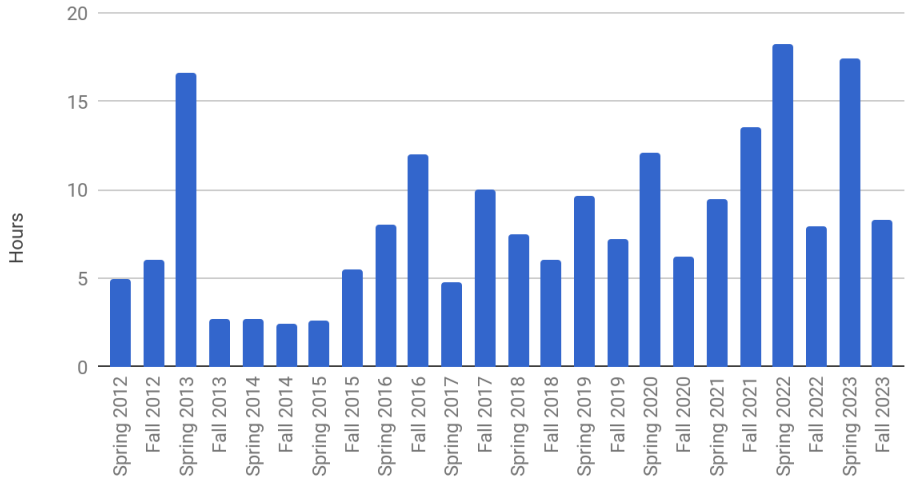
Number of Tickets



Time To Answer



Time To Close



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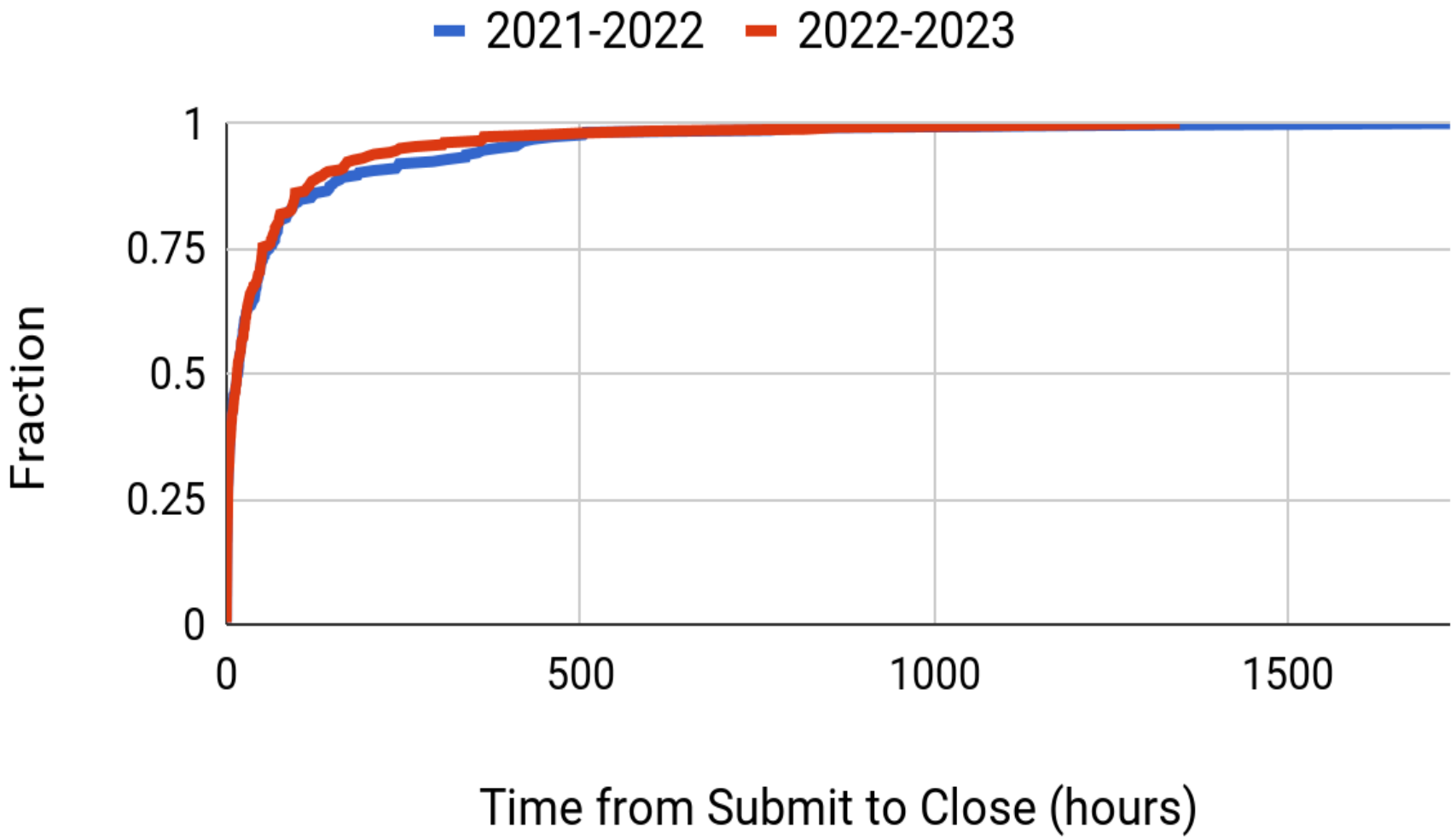
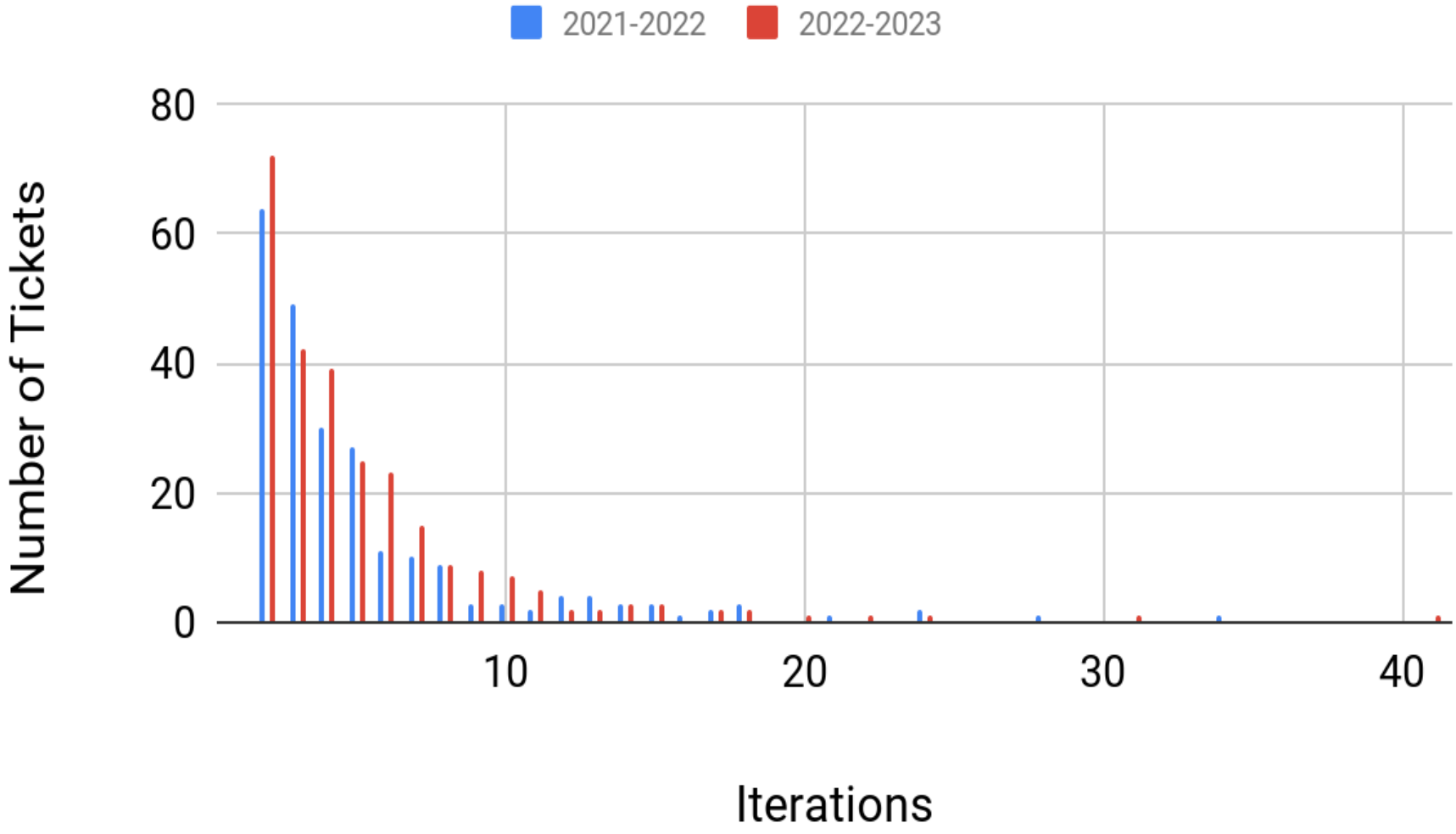
Ticket Aging



Iterations per Ticket



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Helpdesk

Examples of Bugs

- Problem with tcl/tk using ciao-install edition on macOS causing problems with plotting using matplotlib and DAX tasks (e.g. sherpa model editor)
- Obsvis does not support web access through proxy servers (calibration file download fails)
- merge_obs problem with CC mode and with some fractional binsizes.
- Issue with mismatch pixelsize when using wcs_match or reproject_aspect with method=rst (scale differs)
- Problem with missing 'file' utility on HEASARC's SciServer causing problems with crates.
- dmfilth (and others) issue with WCS coordinate units (deg vs. degree)

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Community

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Community Outreach

AAS 241

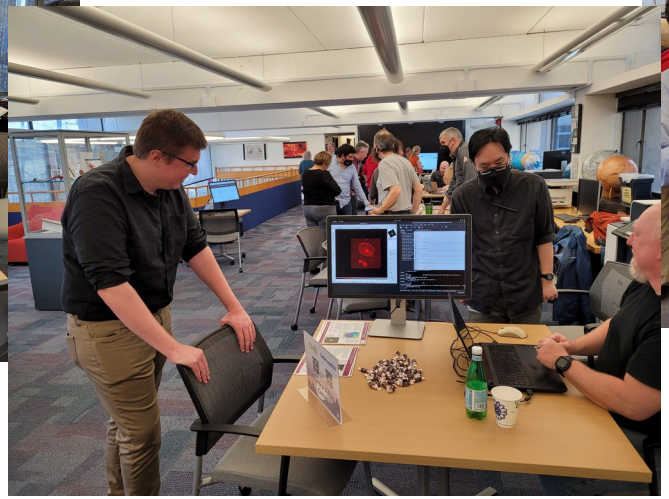
Planned CIAO workshop at Jan AAS was cancelled due to low registration.

Evaluating other options to interact directly with the community.

Community Outreach

CfA DEMOFEST (Apr 11)

Local event to highlight various software projects underway at the CfA. Chandra was well represented; SDS supported demos for CIAO, ds9, and Sherpa, next to DS' catalog and archive demos



Community Outreach

American Physical Society - April Meeting

CDO/SDS supported Chandra booth: lots of traffic and interactions

Students at the booth from the University of San Diego

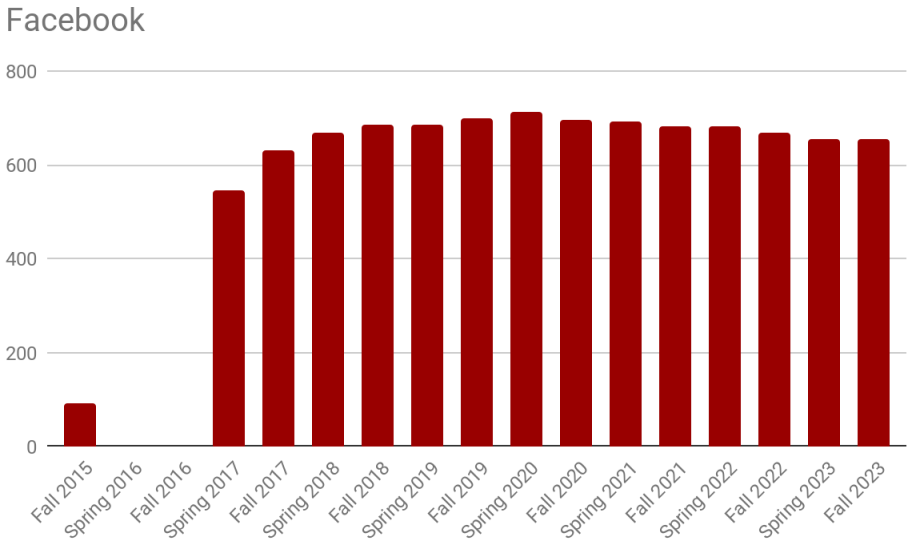
Community Outreach

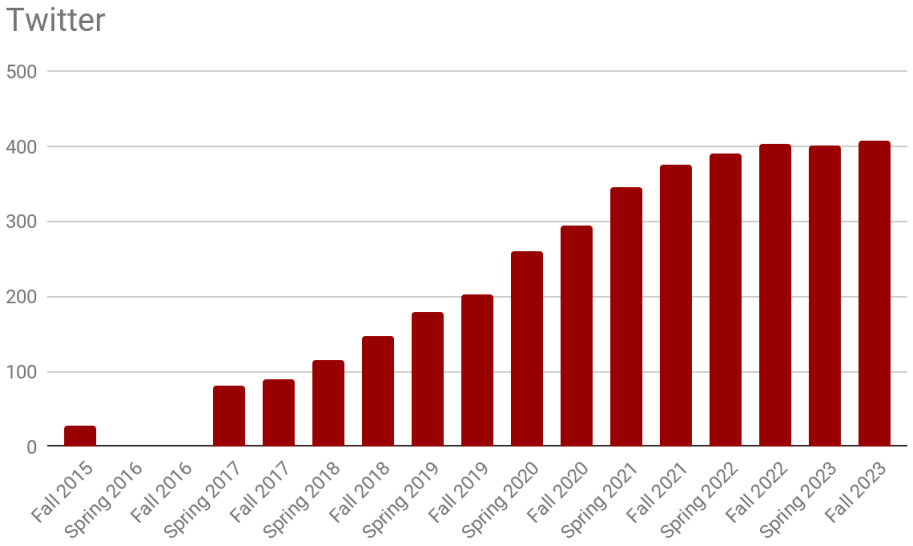
AAS 242 - June Albuquerque Meeting

CDO/SDS supported Chandra booth, a lot of traffic and many repeat visitors.

< one daily visitor: “I LOVE Buttons!!!” >

Social Media





Facebook	ChandraCIAO	655 followers (-1)
Twitter	@chandraCIAO	408 followers (+8)

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CIAO 4.16 and Scripts Overview

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CIAO 4.15

- Routine collection of bug fixes and enhancements including support for atypical observing modes like HRC-I + HETG.
- Updated to latest off the shelf packages including SAOImage DS9 v8.4.1
- Collection of new and updated contributed scripts.
- Available for Linux and Mac (intel binaries only, ARM requires Rosetta2)

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CIAO Patches

- CIAO 4.15.1
  - Upgrade ds9 to 8.4.1 to fix issue with plotting
  - Upgrades to support newer version of NumPy
- CIAO 4.15.2
  - Updates to ObsVis to correct pointing error and dither box sizes

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CIAO 4.16 planning:

- Continued bug fixes
- Support for native Mac ARM builds
- a_p_e
  - temperature dependent cti - discussed later
  - check_vf keyword
- mkosip tool for specialized order sorting
- Continued OTS updates including ds9 8.5
- Additional new and updated contributed scripts.

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ciao_install

As per the prior CUC recommendation, CIAO 4.16 will only be available as conda packages.

A new ciao-install script is being developed to provide much the same look and feel as the current version but under the hood uses the conda repositories and mechanisms to install CIAO.

We expect to have this replacement for ciao-install in the December release. Those CUC members who prefer ciao-install to conda are encouraged to give feedback.

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Contributed Scripts

4.15.0 - December 2022

- Scripts to support ‘acis_extract’ functionality: psf_contour, bkg_fixed_counts
- New aplimits scripts to compute upper limits for false detections and missed detections.
- specextract updates to how the response position is determined.

4.15.1- January 2023

- New color_color script calculates hardness ratios for varying model parameters.
- Updates to convert_xspec_user_model (support “udmget” models).
- Several bug fixes and enhancements.

4.15.2 - June 2023

New get_dither_parameters script to compute dither parameters.
Updates for convert_xspec_user_model to support more features of the XSPEC XCM file format.
More bug fixes and enhancements.

4.15.3 - August 2023
specextract - fix for extracting spectra from blank sky background files.
Added support for additional CSC data products to search_csc scripts.

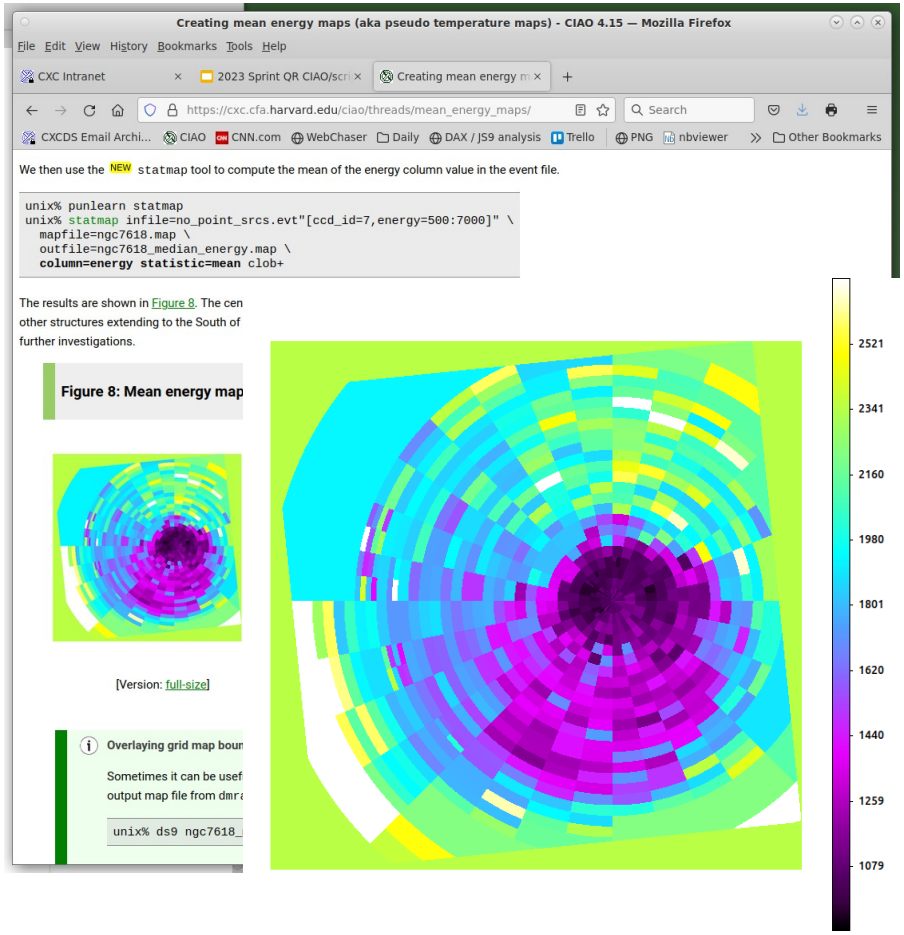
statmap

(Scripts 4.15.0)

Uses output from existing tools (e.g. dmradar) that partition an image into different regions (a ‘map file’).
Takes an event file and the map file,
and calculates an image whose pixel values are ‘averaged’ over each region
and are the mean, median, sum, min or max of the column values in that region.

An example usage is to get the mean energy of the events thus creating a mean energy map.

Not actually a "temperature map" but can help guide more detailed analysis.



https://cxc.cfa.harvard.edu/ciao/threads/mean_energy_maps/

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color_color

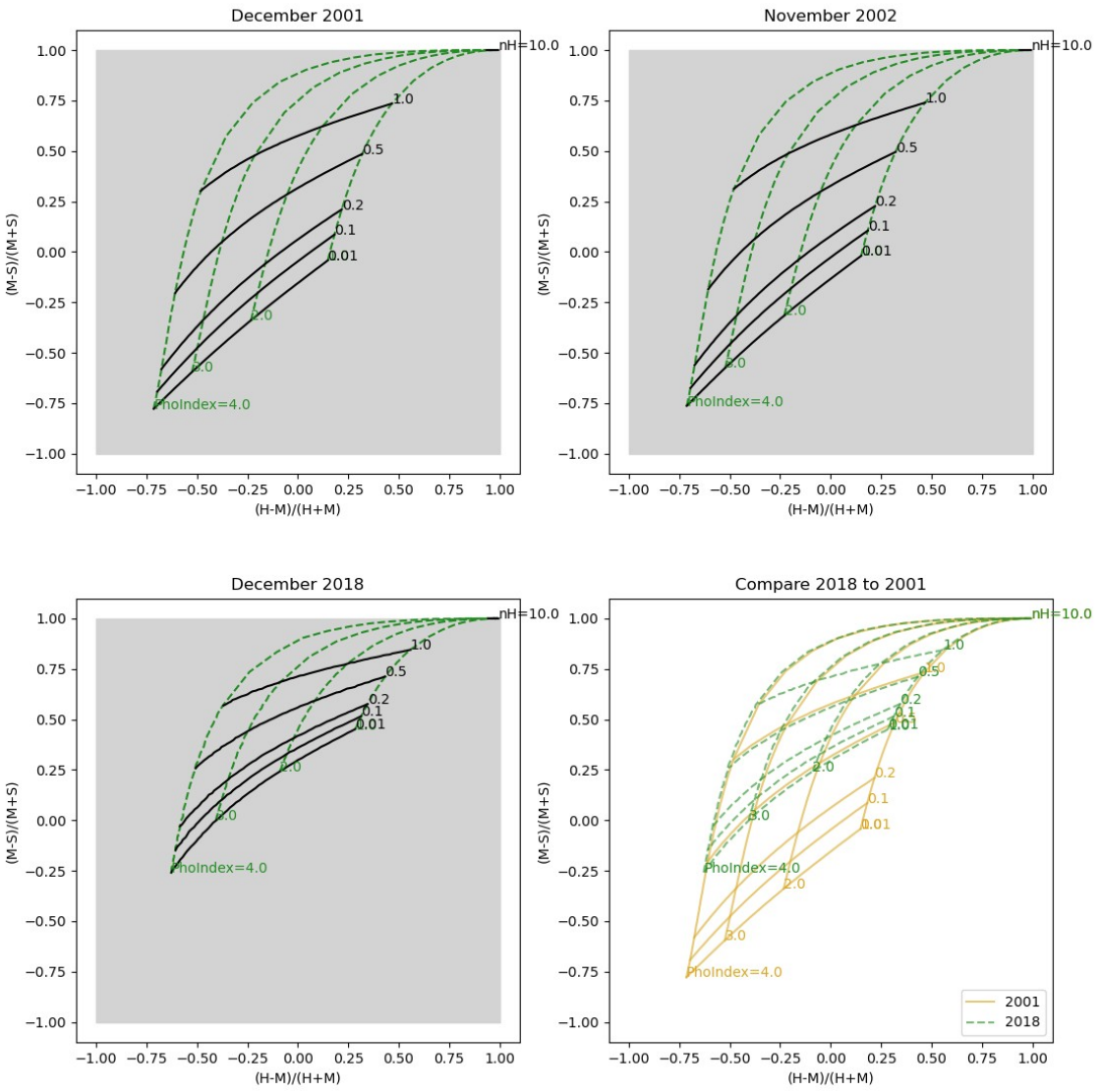
(Scripts 4.15.1)

Computes predictedhardness ratios from 3 energy bands for a specified spectral model and response files, as a function of the model parameters.

Can be used to approximate model parameters for low count sources.Can also help in choosing optimized energy bands

Absorbed powerlaw

Example showing color_color diagrams for an absorbed powerlaw using standard CSC energy bands for the same source imaged in 2001 (obsid 3040), November 2002 (obsid) and 2018 (obsid 21355). The later color_color diagram is compressed due to the effects of the contamination on the detector efficiency.



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get_dither_parameters

(Scripts 4.15.2)

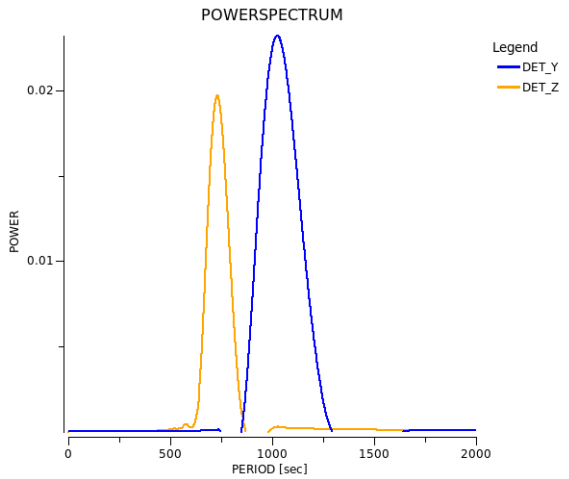
The operational change to the dither amplitude and period has an effect on some users doing timing analysis and when using scripts like acis_streak_map.

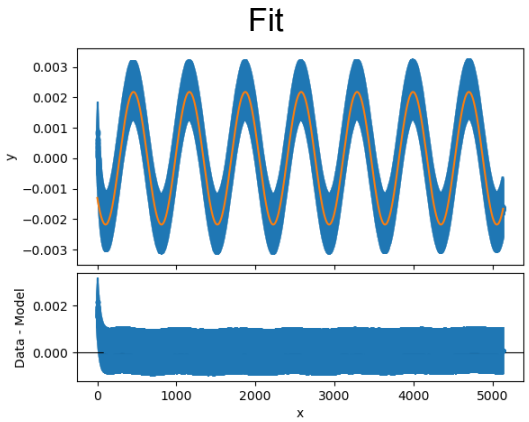
The commanded dither parameters are at best not easily available in any data products. The planned values are available from OCAT/Chaser though in a few instances they are incorrect.

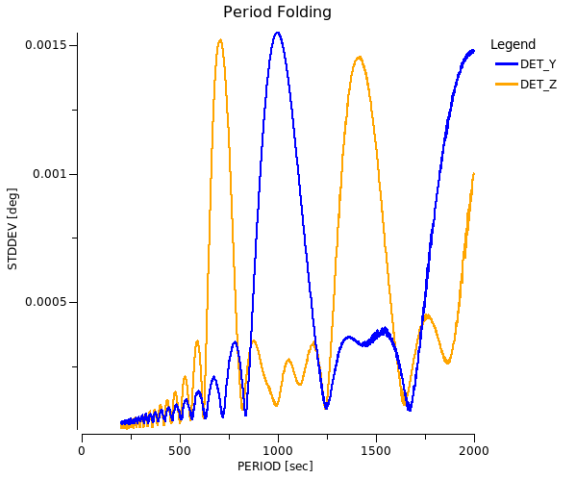
This script analyzes the aspect solution to compute the observed dither amplitude and period and sends the results to the screen.

```
Results:
        Amplitude       Period
        [arcsec]        [sec]
DETY    8.241           1000.000
DETZ    8.284           708.000
```

Different Algorithms







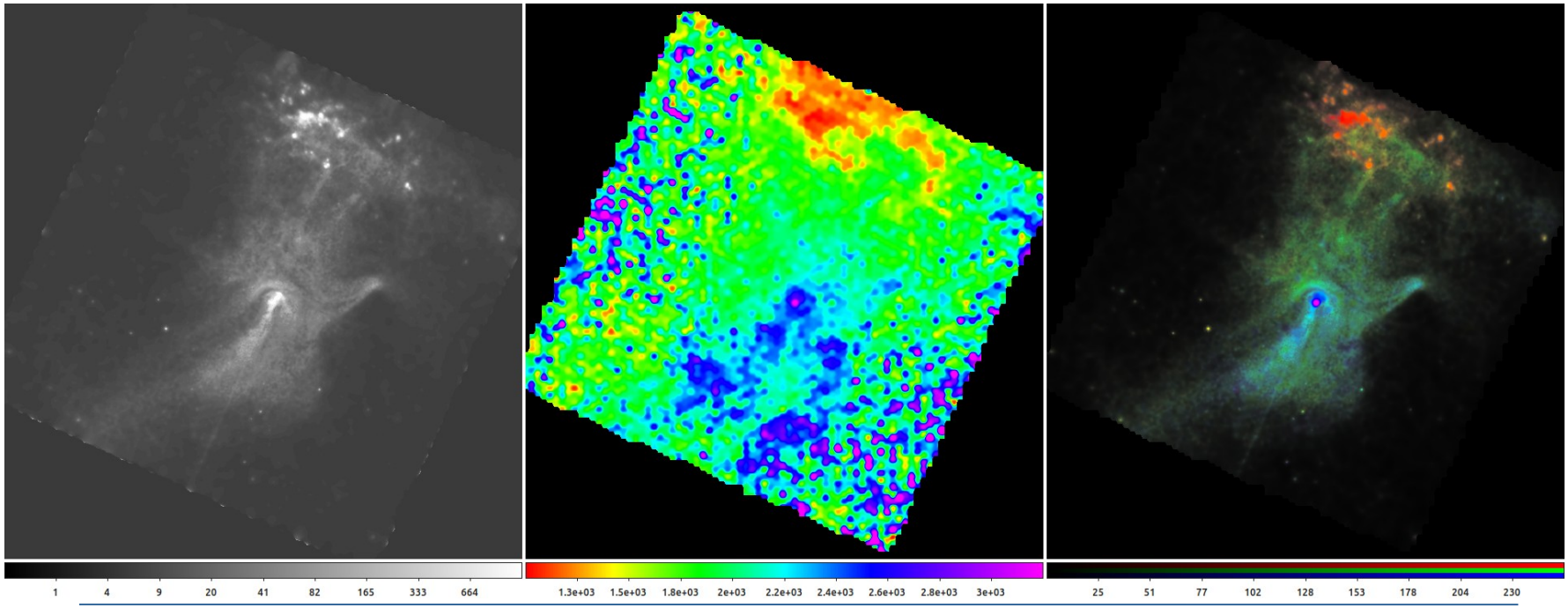
Algorithm	Pros	Cons
Powerspectrum (FFT)	• Fastest	• Least accurate
FIT	• Most accurate	• Generally slowest (by a lot)
FOLD	• Highly accurate (generally +/- 5sec)	• Can be slower than fitting for short observations.

energy_hue_map

(Work in progress)

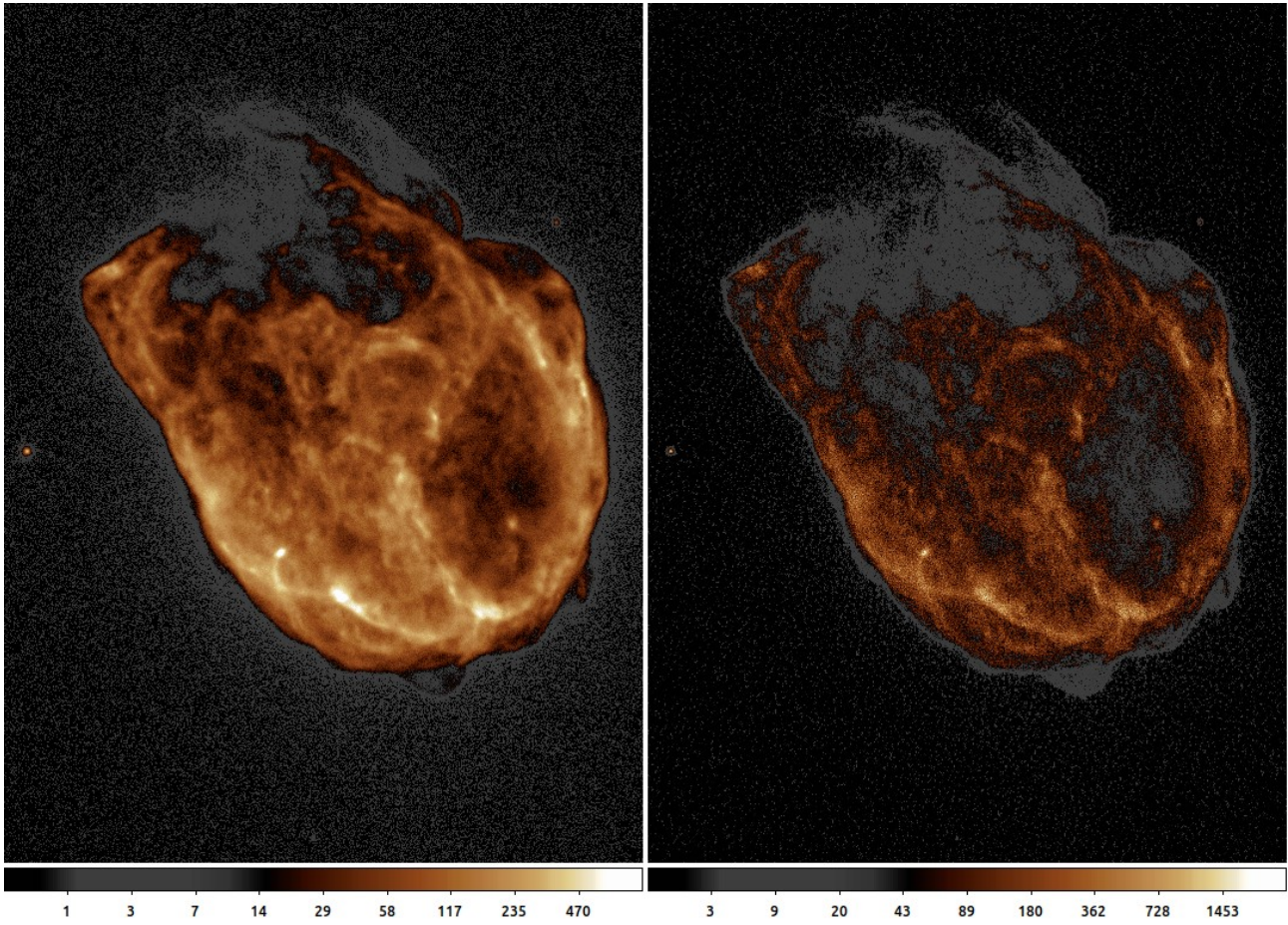
Evaluating a technique to create "true" color images, not "tri-color" image.

Using the mean-energy map as the color hue and the counts as the saturation we can combine them to create "true" color images.



Continuous Variable PSF deconvolution

Evaluating a method to perform Richardson-Lucy deconvolution with a continuously variable PSF (no partitioning of the image into quasi-constant PSF grid). Results look promising, few details TBR.



Results from combined 31 observations of N132D

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specextract

(Scripts 4.15.0, 4.15.2, 4.15.3)

- Rewrite introduced with Contributed Scripts 4.15.0.
  - The original S-Lang to Python conversion of the script has become unwieldy with ad hoc functionality and bug fixes jerry-rigged to the existing code.
  - In the old version, tasks progressed in a linear fashion and were looped over in a single routine
  - Now, tasks are broken down into discrete functions for easier maintainability. This also simplifies parallelization.
    - utilities and lower-level routines moved off into a callable module.
    - front-load parameter testing and input file validations, mostly introduced over the course of CIAO 4.14.

- Update intended to be transparent to users (for the most part).
  - `resp_pos` parameter added
  - `parallel_futures` method added

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specextract – response positioning

The `resp_pos` parameter has been added. It provides the method to refine the unweighted response position and to determine the coordinates used to query `ColDen` for the Galactic neutral hydrogen column density if reference coordinates are not set by the `refcoord` parameter.

- `region` – the center from the user-defined extraction region, the default behavior currently
- `max` – prior `specextract` behavior used the location of the brightest image pixel encompassed by the extraction region.
- `centroid` – the centroided position based on the image pixels encompassed by the extraction region. This method can fail, particularly if used with annuli, and another method must be selected.
- `regextent` – the center of the bounding box encompassing the extent of the extraction region.

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The motivation for `resp_pos`

- For most use cases with most regions a small shift in the input coordinates will not significantly affect the ARF, even near chip edges and bad pixels.

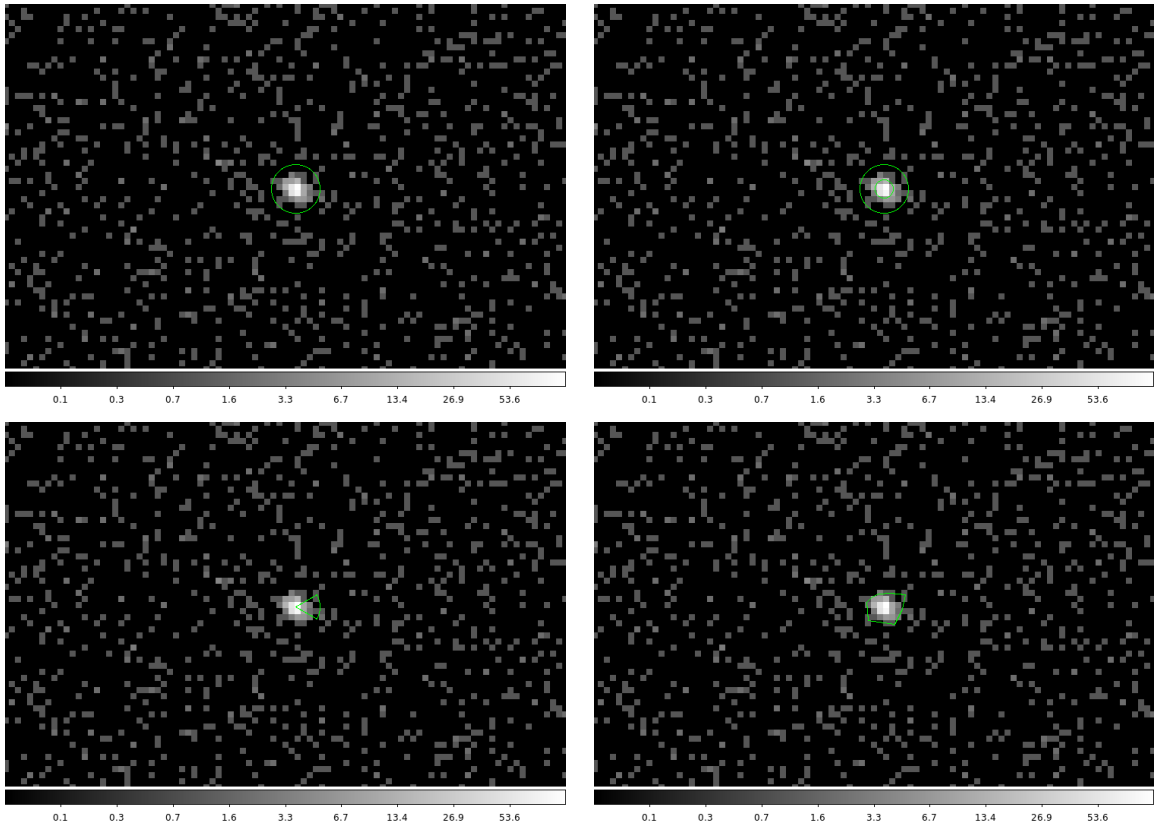
- If PSF aperture correction is applied to the ARF, the same “location-of-max” (`resp_pos=max`) algorithm is used to compute the coordinates used as the location of the PSF via `arfcorr`, where a small shift in the input coordinates can yield large differences in the PSF fraction.

Effect of `resp_pos` algorithms

Example: ObsID 4425 point-like source near the ACIS-S3 aim point

- Reference Coordinates
  RA = 11:33:04.9245
  Dec = +25:53:55.242

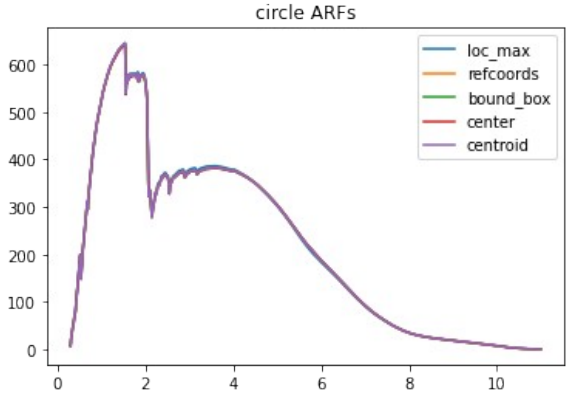
- circle, annulus, pie sector, polygon regions all defined w.r.t. reference coordinates

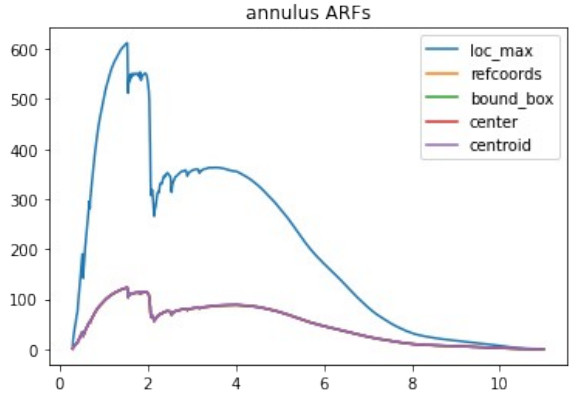


`resp_pos` effects on aperture correction

For regions where the center of the PSF is intentionally omitted (e.g. an annulus to avoid a piled up core), a position shift can lead to the wrong PSF fraction.

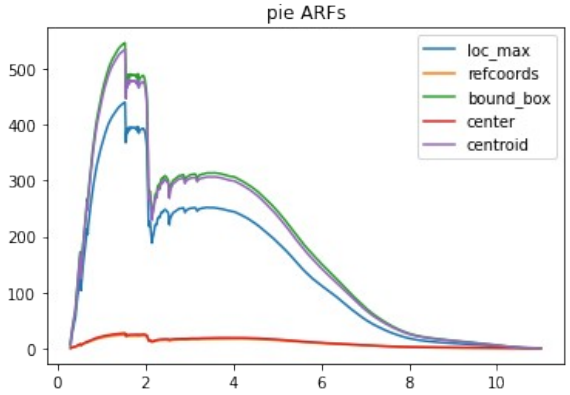
any method will work with a simple circle

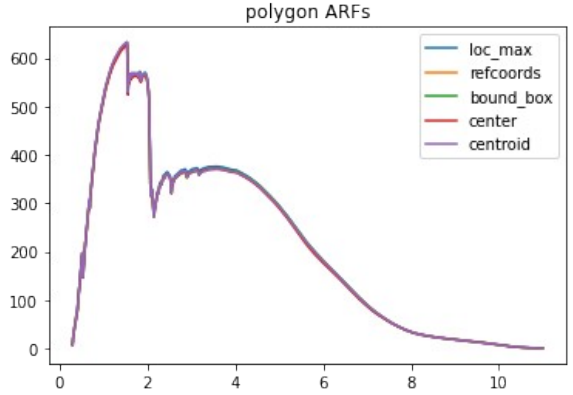




the only algorithm that performs poorly is the current max location.

the pie region demonstrates how much of an affect a small 1-2 pixel shift can make





for this polygon, the results are all about the same. Similar to the circle, since the center is close to the best position, and overall the shape encloses a large fraction of the PSF

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specextract parallelization

- parallelization first introduced in Contributed Scripts 4.14.0, but over time there were sporadic reports of failures in response generation and writing header keywords (via `srcflux` or directly running `specextract`)
  - difficult to replicate since it would randomly occur or might occur on one system but not another using the same OS.

  - problem traced to how tasks were being scheduled to the job queue by the existing parallelization methods in CIAO and not being cleared out of the queue quickly enough upon completion.
    - In particular, the `parallel_pool` method would hang if there are a large number of jobs (>500) queued up, which is not the typical usage of `specextract` by most users, even if the calculation is simple, e.g. `x**2`. The limit is nebulous, since it varies by hardware and OS.
    - `parallel_pool_futures` is a new wrapper to Python's `concurrent.futures` package, which is a contemporary approach to parallelization which has improved scheduling for the job queue.

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specextract parallelization (cont.)

- n.b. there is overhead to scheduling:
  - for a set of simple calculations, `parallel_pool/parallel_map` (the latter is used by *Sherpa*) will be faster than `parallel_futures`, if it does not run into the queuing limit due to its primitive scheduler.
  - it is also possible that by avoiding the job scheduling process, performing the set of calculations sequentially will be quicker than running in parallel.

- The bottleneck in `specextract` parallelization was response generation, which calculated ARFs then RMFs for source then background.
  - the problem is most acute when generating weighted RMFs (and ARFs) over large areas for both source and background.
  - the rewrite addresses this since there is no reason why the source/background and ARFs/RMFs cannot all be generated independently of each other.
  - modifications gradually introduced in 4.14.1 and fully integrated for 4.15.0

- File I/O redundancies inherent to the original parallelization implementation, for simplification purposes, have been eliminated.

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Special Topic: ACIS Extract – Filling the Gaps

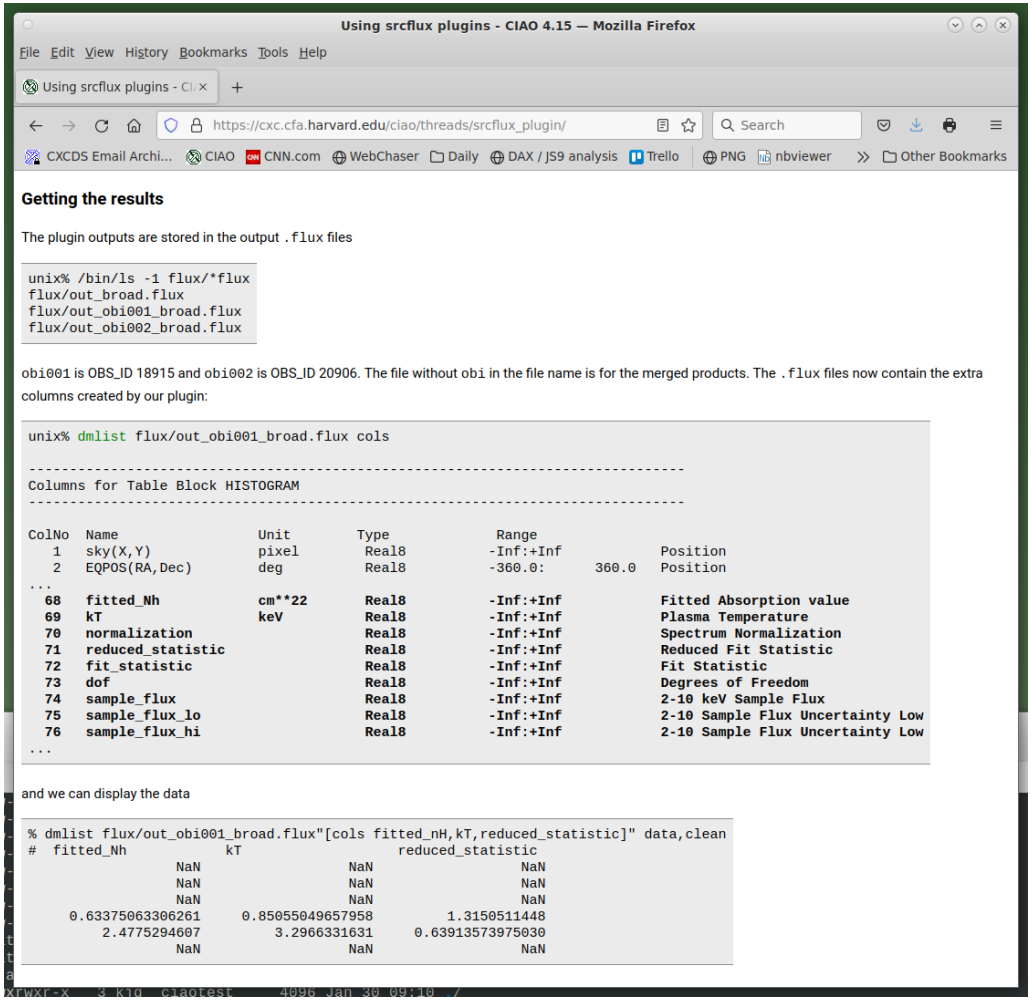
Following up from last CUC report: The Chandra User's Committee asked that the CXC provide the functional currently available in the acis_extract script written by the ACIS IPI team. SDS reviewed the script and noted that the existing srcflux script provides much of the same basic functionality. There were a few gaps that have now been filled:

- Automatically fitting spectra
- "Optimized" source regions based on simulated PSF
- Background with predetermined number of counts

srcflux plugins

Allows users to include additional analysis steps, including fitting spectra, and have the results be collected with the other srcflux properties.

Users are provided with several examples including spectral fits, timing analysis, computing source extent, upper limits using the new aplimits scripts, etc.



https://cxc.cfa.harvard.edu/ciao/threads/srcflux_plugin/

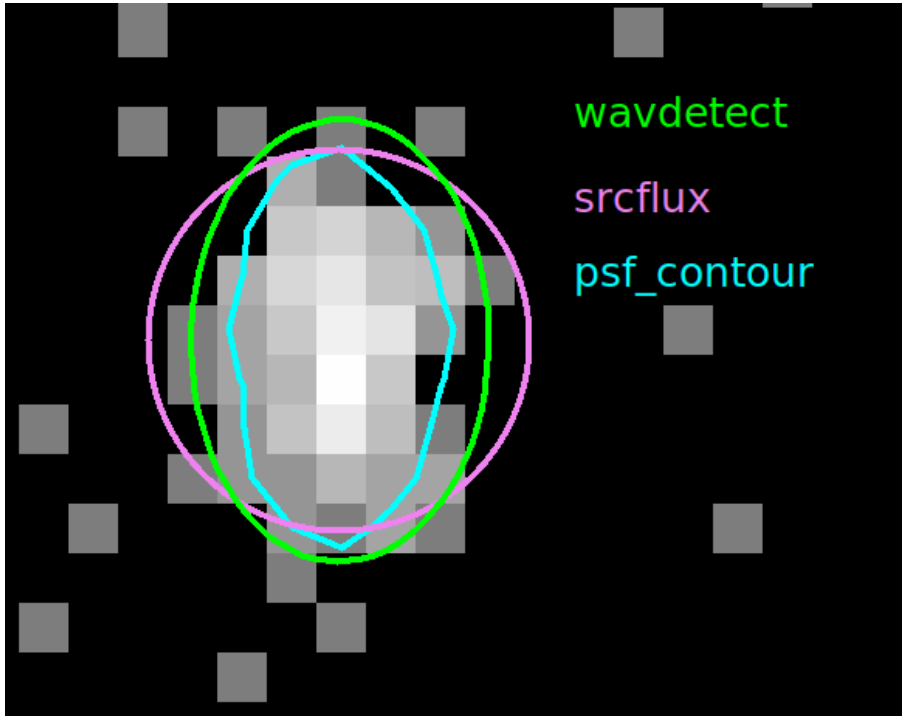
psf_contour

(Scripts 4.15.2)

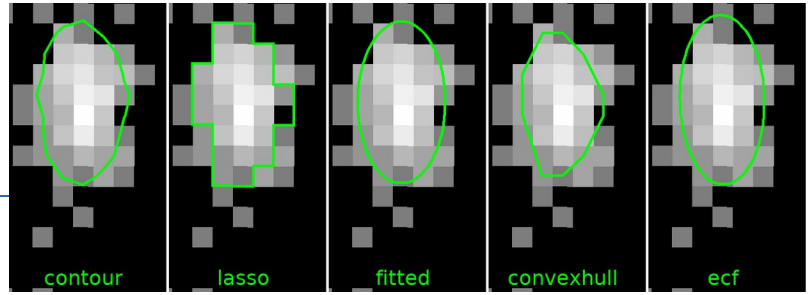
New script that simulates the PSF at each source locations using MARX and calculates a region that encloses a specified ECF.

Overlapping regions are shrunk until they no longer overlap (or threshold is met)

Has options to create polygon contour, city-block "lasso" contour, ellipse fitted to contour, convex hull around contour, or ellipse determined from PSF.



Example requesting region to enclose 90% of the PSF @ 1.0keV.



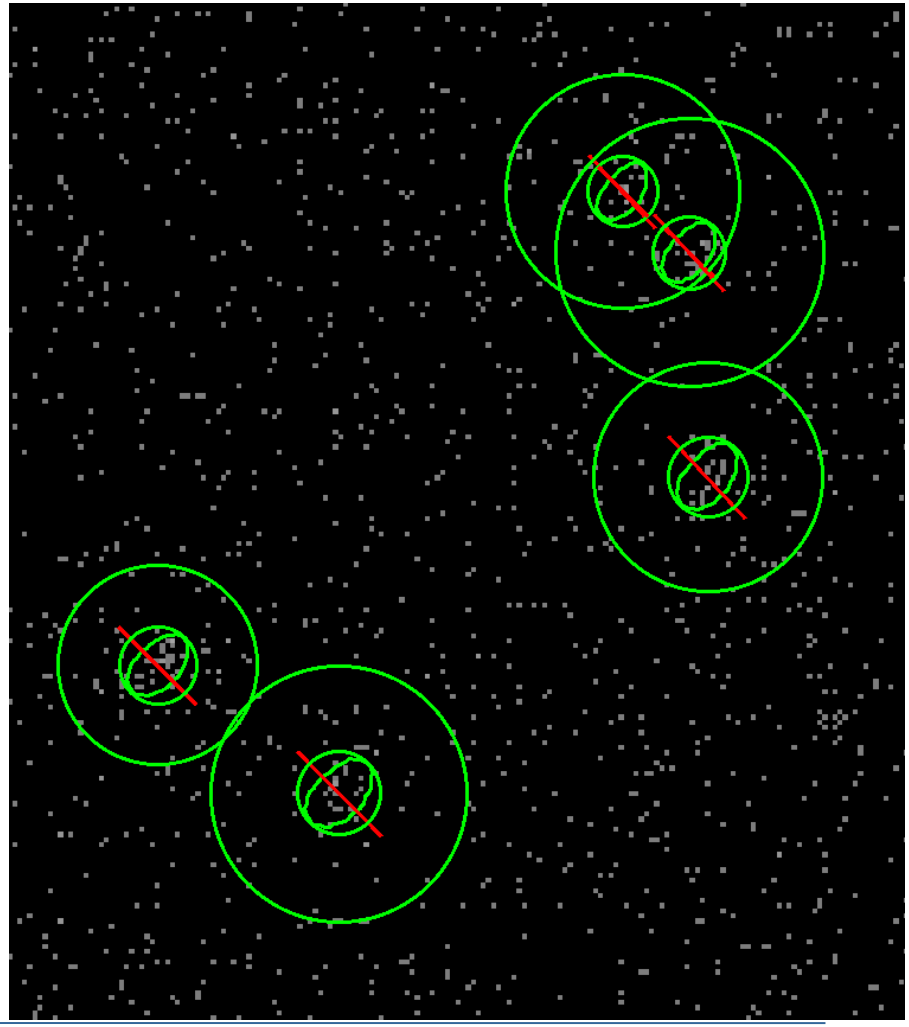
bkg_fixed_counts

(Scripts 4.15.2)

Create background annuli excluding sources that enclose a specified number of counts.

FOV file can be input to accounts for edges. Readout streak region can also be input to be excluded from background.

This example uses the contour polygons from psf_contour as the source regions. They are excluded from the background annulus whose inner radius is 95% PSF ECF @ 1.0 keV and outer radius enclosed 50 counts.



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Sherpa

Sherpa Development 2023

- Sherpa 2023 releases:
  - 4.15.1 May 18, 2023
  - 4.15.2 planned for October 10, 2023
  - CIAO 4.16 release in December 2023 will include the changes from both releases.

- 4.15.1 May 2023 Release highlights:
  - Enhancements:
    - further improvements to filtering/grouping including reporting a filter change in the UI
    - fake_pha can be called with a list of ARF/RMF names
    - added linewidth option for line and histogram plots
  - Documentation changes:
    - improved documentation for templates, plot_pvalue
  - Infrastructure changes:
    - dropped support for Python 3.8
    - experimental support of Python 3.11
    - supported versions of Xspec are 12.12.0 - 12.13.0
  - Several bug fixes:
    - various updates to notice/ignore and group/ungroup code
    - fixed issue with show_bkg, binning in 1D histogram, cache errors in TableModel class

- *44 Sherpa Pull Requests (PR) including 12 bug fixes.*

Full Release Notes:

- *https://github.com/sherpa/sherpa/releases*
- *https://zenodo.org/record/7948720*

Sherpa 2023 Development for 4.16

Details, including code changes and issues, are available on GitHub: https://github.com/sherpa/sherpa

System updates

- add python 3.11, drop python 3.8 (work to support Python 3.12 and NumPy 2.0 not in 4.16)
- add support for XSPEC 12.13.0 and 12.13.1 (CIAO 4.16 will include XSPEC 12.13.1)
- continued update of code to use modern Python features and capabilities

Filtering and grouping

- notice/ignore reports changes in energy filter (4.15) and this has now been extended to grouping and set_analysis commands
- group_counts/snr/... commands automatically use the existing filter to restrict the domain of the grouping

Plotting

- work to allow multiple plotting backends (such as for example newer HTML/JavaScript frameworks)
- plan to include a bokeh backend (https://bokeh.org/) in 4.16 which support interactive plots in notebooks
- as part of this work addressed a few outstanding issues

Simulations

- a number of changes related to simulation: fixes to fake_pha, improving RMF creation, and writing out ARF and RMF files.
- ongoing work to rationalize the use of random numbers and to take advantage of changes in NumPy

Data flow

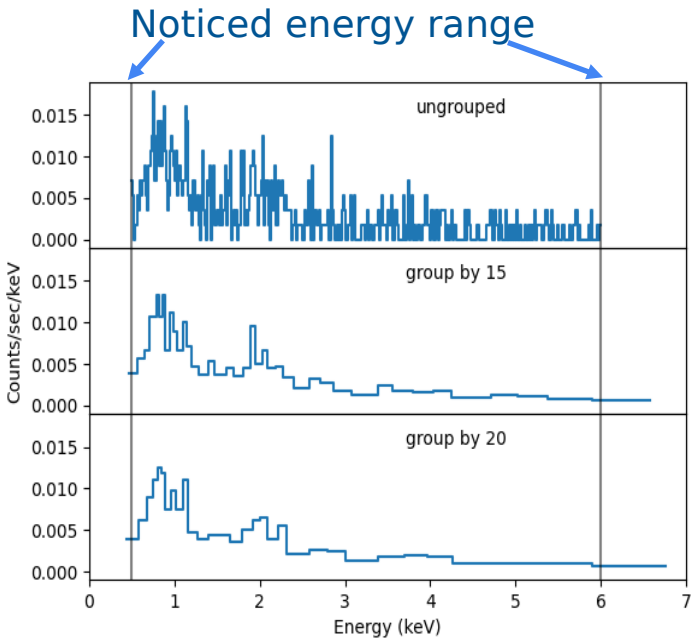
- improvements to data serialization, both for the "save to a Python script" save_all command and the binary format used by save and restore, and other minor fixes for users of the various save_xxx commands

Documentation

- to ensure the documentation for Sherpa is valid, add support for "documentation tests", where the code snippets used as examples in the documentation are included in our automated tests (this is a large project and only some examples are currently tested)

Sherpa 2023 Development for 4.16

group_counts/snr/... commands automatically use the existing filter to restrict the domain of the grouping



CIAO 4.15: Filter can change when grouping changed

In [20]: **notice(0.5, 6)**
dataset 1: 0.00146:14.9504 -> 0.4672:6.57 Energy (keV)
In [21]: **group_counts(20)**
dataset 1: 0.4672:6.57 -> 0.438:6.7598 Energy (keV)

CIAO 4.16: Keep the filter unchanged when grouping

In [26]: **ungroup()**
dataset 1: 0.00146:14.9504 Energy (keV)
(unchanged)
In [27]: **notice(0.5, 6)**
dataset 1: 0.00146:14.9504 -> 0.4964:6.0006
Energy (keV)
In [28]: **group_counts(15)**
dataset 1: 0.4964:6.0006 Energy (keV) (unchanged)
In [29]: **group_counts(20)**
dataset 1: 0.4964:6.0006 Energy (keV) (unchanged)

Using Sherpa in Astronomy Research

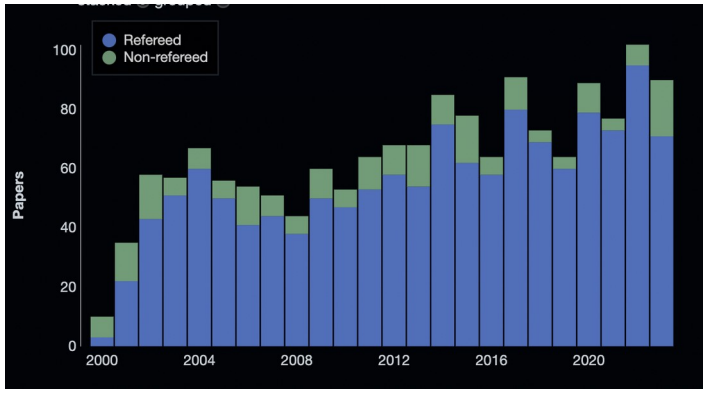
1559 publications in ApJ, AJ, MNRAS, A&A and others use Sherpa (since 2001 and including astro-ph abstracts)
https://ui.adsabs.harvard.edu/public-libraries/X6orMXwpRtSPy8x1uiiRMg

419 citations to Freeman et al 2001 SPIE paper

24 citations to zenodo releases: DOI: *10.5281/zenodo.593753*

89 research papers published in 2023

7 PhD theses listed in ADS that used Sherpa



Statistics from ADS stats

Using Sherpa in Astronomy Research

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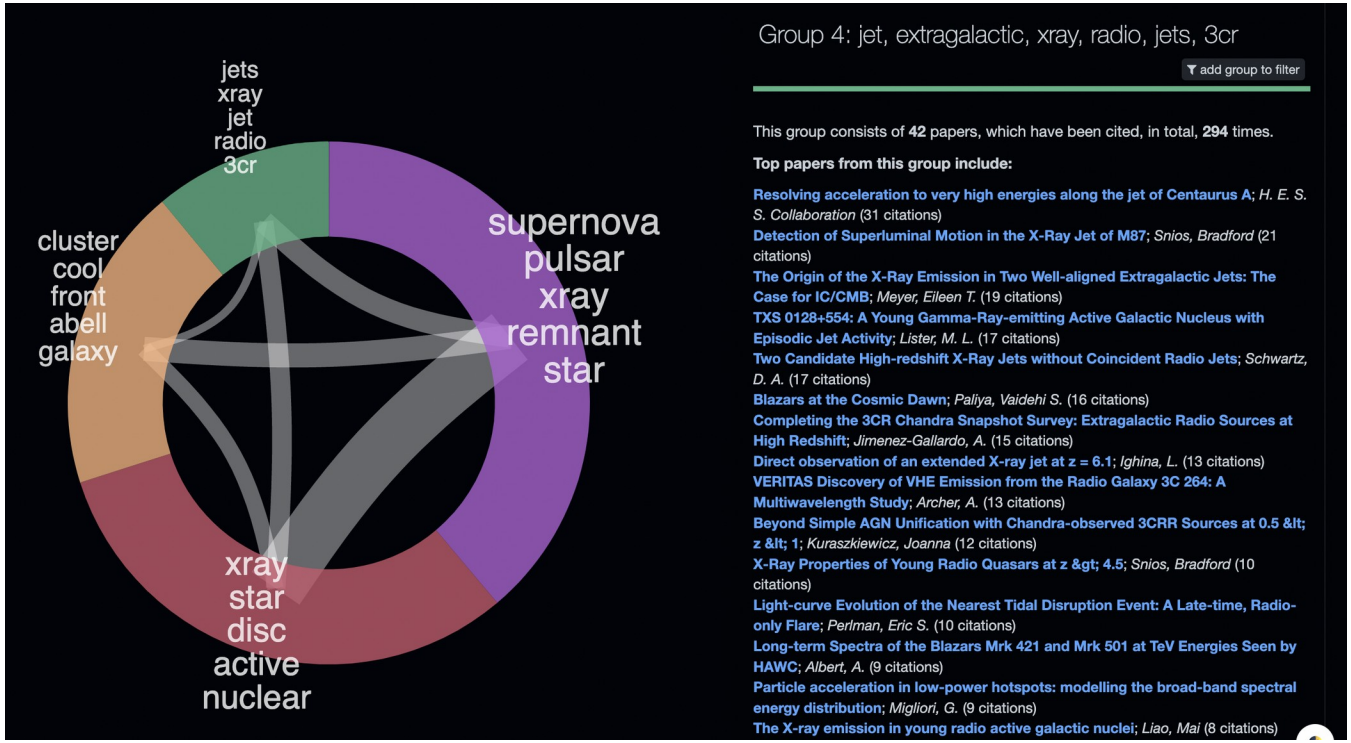
Paper Network in ADS for 400 papers published in 2016-2023



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Instruments/ Gratings

CTI Changes in acis_process_events

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acis_process_events is being updated in DS 10.12 and CIAO 4.16 for compatibility with new ACIS CTI calibration products in anticipation of ACIS operating at warmer focal plane temperatures. Calibrated data products at warm focal plane temperatures and their implementation in CIAO can help relax observing constraints allowing mission planning more flexibility for scheduling. These changes will mostly affect future observations rather than archival data

CTI Changes in acis_process_events

CALDB CTI Table - current format

TOPCAT(64): Table Browser

Table Browser for 64: acisD2020-01-01ctiN0009.fits

	CCD_ID	CHIPX_LO	CHIPX_HI	CHIPY_LO	CHIPY_HI	NPOINTS	PHA	VOLUME_X	VOLUME_Y	FRCTRLX	FRCTRLY	VFT
1	0	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.44173...	0.	0.067479	0
2	1	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.45142...	0.	0.040883	0
3	2	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.42553...	0.	0.089617	0
4	3	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.44428...	0.	0.079609	0
5	4	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.42887...	0.	0.129248	0
6	5	1	1024	1	1024	45	(1.0, 2.0, ...	(1.0, 1.499633...	(1.0, 1.08343...	0.13	0.713325	0
7	6	1	1024	1	1024	45	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.48920...	0.	0.042733	0
8	7	1	1024	1	1024	46	(1.0, 2.0, ...	(1.0, 1.444909...	(1.0, 1.22429...	0.094107	0.560725	0
9	8	1	1024	1	1024	45	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.48680...	0.	0.062289	0
10	9	1	1024	1	1024	46	(1.0, 2.0, ...	(0.0, 0.0, 0.0, ...	(1.0, 1.45976...	0.	0.073173	0

Total: 10 Visible: 10 Selected: 0

CALDB CTI Table - new format CIAO 4.16/ DS10.1

TOPCAT(66): Table Browser

Table Browser for 66: CTI_newformat_newObsIDs.fits

	CCD_ID	CHIPX_LO	CHIPX_HI	CHIPY_LO	CHIPY_HI	NPOINTS	TEMP_LO	TEMP_HI	TEMP_IND	PHA	VOLUME_X	VOL
1	0	1	1024	1	1024	46	148.	161.16	1	(1.0, 2...	(0.0, 0.0, ...	(1.0
2	0	1	1024	1	1024	46	161.16	162.9	2	(1.0, 2...	(0.0, 0.0, ...	(1.0
3	0	1	1024	1	1024	46	162.9	164.65	3	(1.0, 2...	(0.0, 0.0, ...	(1.0
4	0	1	1024	1	1024	46	164.65	166.4	4	(1.0, 2...	(0.0, 0.0, ...	(1.0
5	0	1	1024	1	1024	46	166.4	168.15	5	(1.0, 2...	(0.0, 0.0, ...	(1.0
6	0	1	1024	1	1024	46	168.15	170.	6	(1.0, 2...	(0.0, 0.0, ...	(1.0
7	1	1	1024	1	1024	46	148.	161.16	1	(1.0, 2...	(0.0, 0.0, ...	(1.0
8	1	1	1024	1	1024	46	161.16	162.9	2	(1.0, 2...	(0.0, 0.0, ...	(1.0
9	1	1	1024	1	1024	46	162.9	164.65	3	(1.0, 2...	(0.0, 0.0, ...	(1.0
10	1	1	1024	1	1024	46	164.65	166.4	4	(1.0, 2...	(0.0, 0.0, ...	(1.0
11	1	1	1024	1	1024	46	166.4	168.15	5	(1.0, 2...	(0.0, 0.0, ...	(1.0
12	1	1	1024	1	1024	46	168.15	170.	6	(1.0, 2...	(0.0, 0.0, ...	(1.0
13	2	1	1024	1	1024	46	148.	161.16	1	(1.0, 2...	(0.0, 0.0, ...	(1.0
14	2	1	1024	1	1024	46	161.16	162.9	2	(1.0, 2...	(0.0, 0.0, ...	(1.0

Total: 60 Visible: 60 Selected: 0

The new temp_lo, temp_hi and temp_ind columns allow events within an FP_TEMP range to be treated with a specific correction for CTI without changing the general CTI correction format. Note: values shown are illustrative.

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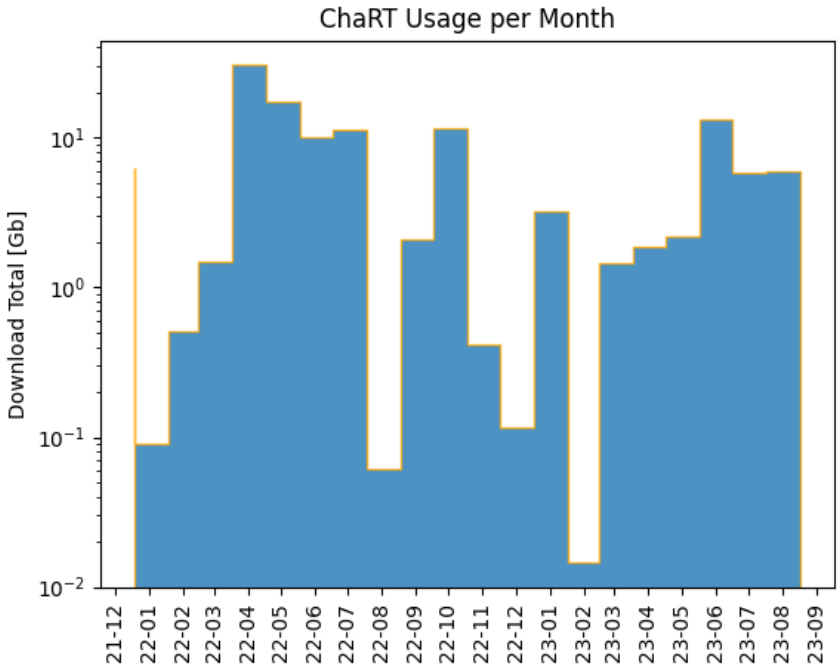
PSF

ChaRT



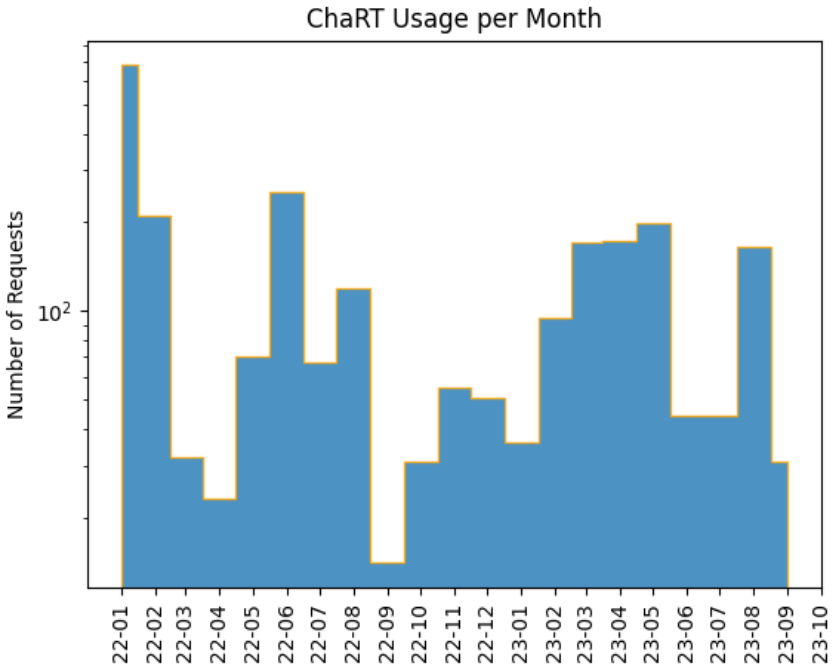
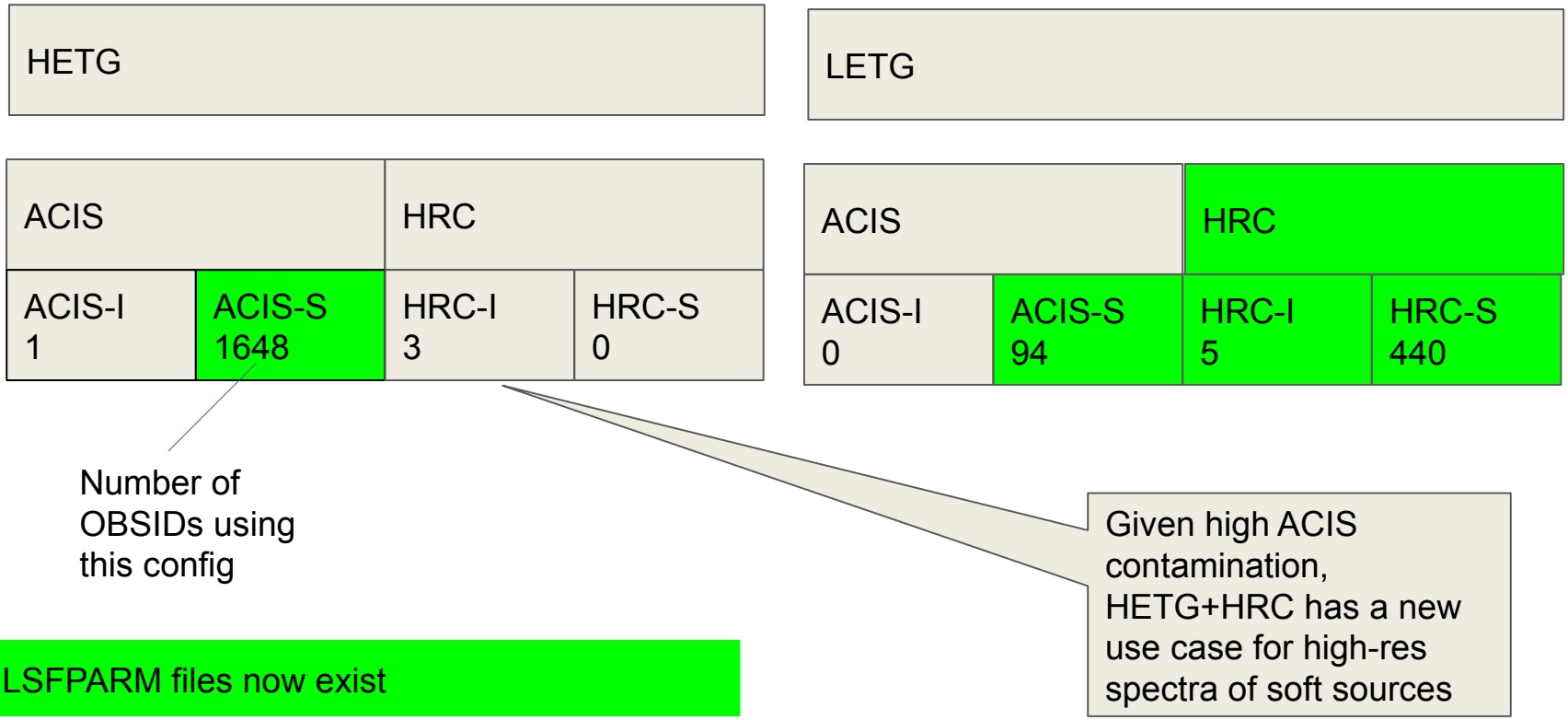


ChaRT web server has been updated to Red Hat 8, CIAO 4.15, and SAOTrace 2.0.5.

New LSFPARM files to be made with marx



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Visualization

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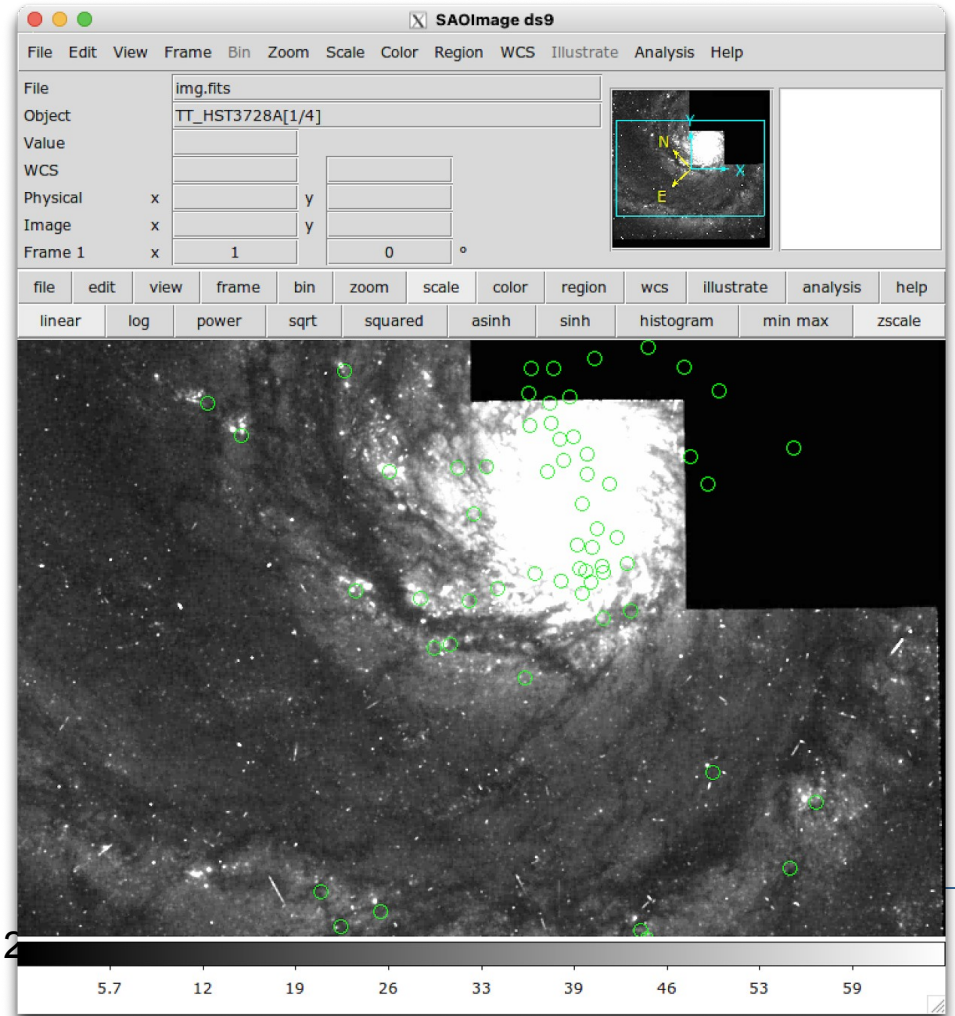
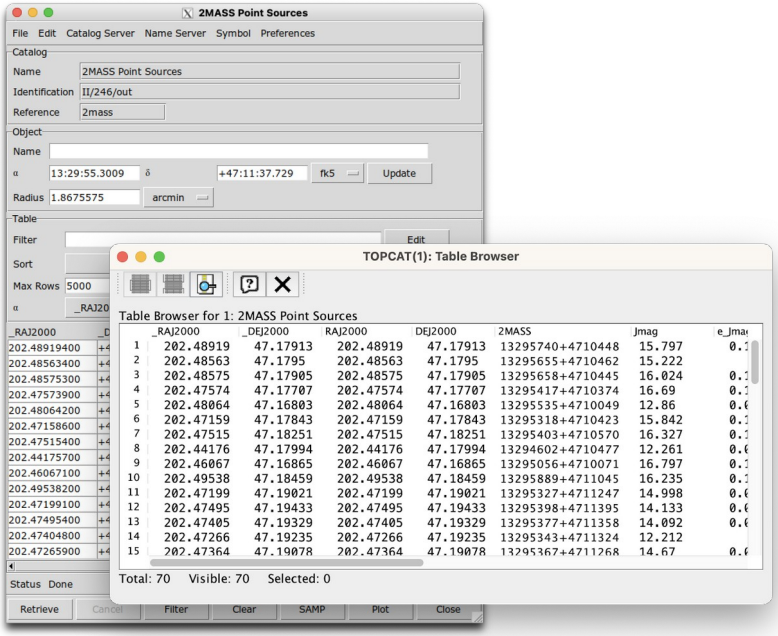
SAOImageDS9

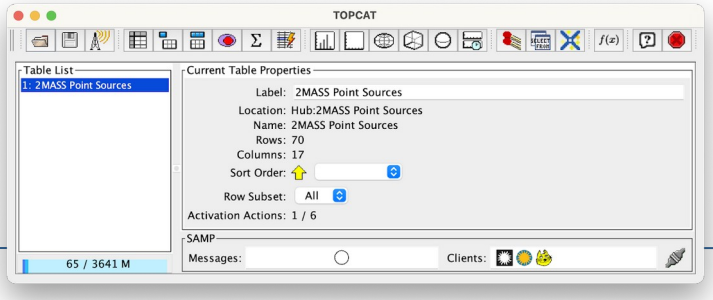
- Releases
  - Version 8.4 - released in Dec 2022 with CIAO 4.15
  - Version 8.5b1 - released in Feb 2023
  - Version 8.5b2 - release in Aug 2023
  - Version 8.5 - released in Sep 2023
- New Features 8.5
  - New Internal IVO SAMP HUB
  - New Internal IVO SAMP Web HUB
  - Improved IVO SAMP Client support
  - MacOS Ventura and Monterey ARM64 ports
  - New Debian, Ubuntu, Fedora ARM64 ports
  - Many improvements and enhancements.

SAOImageDS9 Internal SAMP Hub

Example: using DS9 to exchange VOTable data with TOPCAT; now using internal DS9 SAMP HUB to communicate between programs. Internal hub capability will allow interface with astropy without using (obsolescent) XPA.







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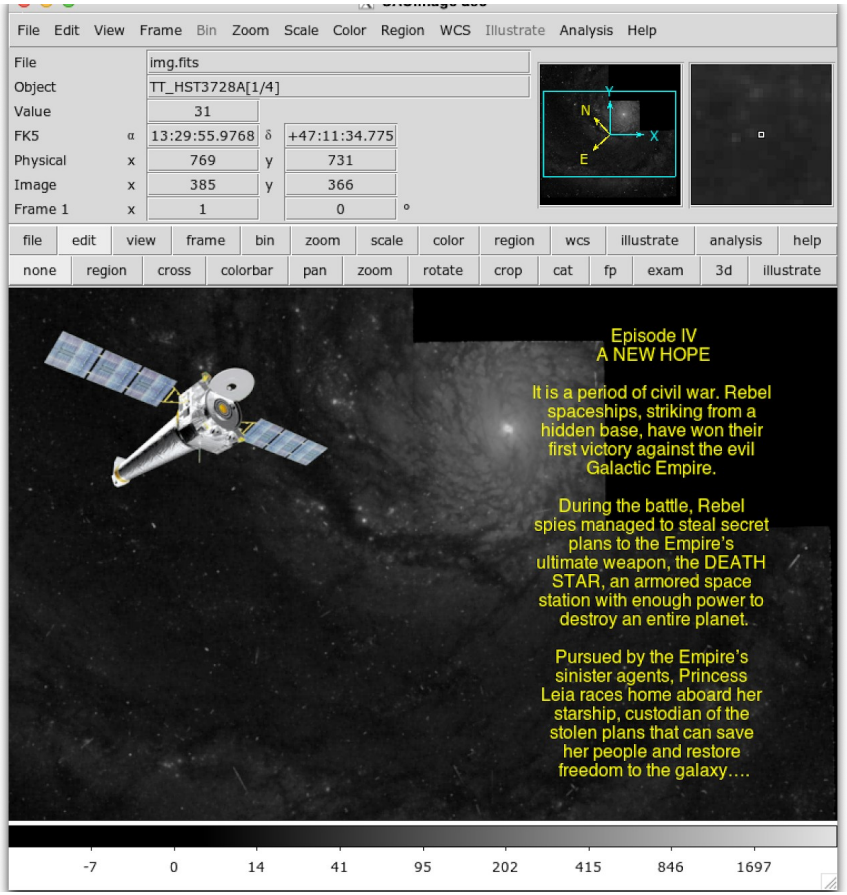
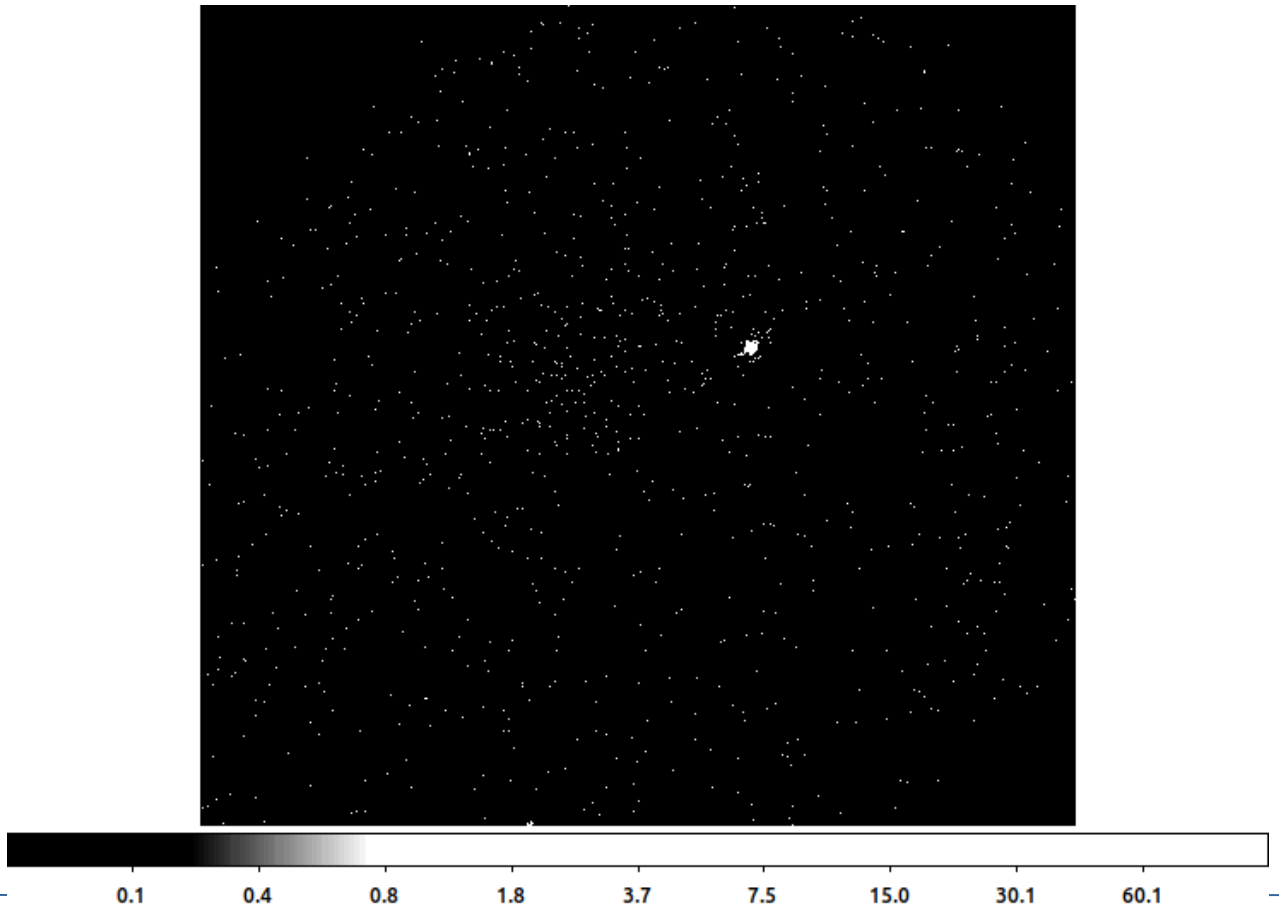
SAOImageDS9 Illustrate Mode



SAOImageDS9 Fade Mode



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SAOImageDS9 - Nov 2022 to Oct 2023

- GitHub Activity
  - 292 Commits
  - 51 Release Note Entries
- Help Desk
  - 95 CXC HelpDesk Requests
- Downloads
  - 29686 unique IP addresses

Advanced Development: Remote Analysis Prototype

Evaluating potential for users to run CIAO remotely via DS9 based on DAX – increasing demand for such a capability to support e.g. undergrads on Windows machines. Users only need to install ds9. Analysis is done remotely with results sent back for display/download. Tasks include

- Plots: Spectra, Lightcurve, Radial Profiles, Generic histograms
- Text: Net Counts, Photometry (srcflux), statistics (min/max/mean)
- Regions: wavdetect, celldetect, etc
- Images: eg csmooth, adaptive binning
- Fitting: spectra, images, radial profiles.