Chandra X-ray Center

CIAO

Jonathan McDowell

I will report on CIAO (user software) and the standard processing pipeline software, which come into being thanks to:

CXC Data Systems team:
software design, development. operations/archive, etc.

CXC Science Data Systems team:
requirements, documentation, testing, helpdesk,
interface with science community

Your SDS Contacts

•Staff changes:

M. Karovska (PSF/convolution expert) and
N Bonaventura (helpdesk/docs) left SAO team in late 2012
J Davis (MARX, mkrmf,...) and J Houck (catalog, ISIS) left MIT team last month

Current team:

- Jonathan McDowell - Management, data model, coords

Antonella Fruscione (½)	– SAO dep.lead, Docs and Release lead
Aneta Siemiginowska -	Sherpa, Astrostatistics
Doug Burke -	Scripts, Infastructure (Crates/Chips/DM), Releases
Frank Primini -	HRC, Catalog, Photometry, Source Detection
Kenny Glotfelty -	Helpdesk, scripts, docs, legacy expertise
Nick Lee	Helpdesk, scripts, docs
Mike Nowak	MIT lead, Catalog, timing, responses
Dave Huenemorder	Gratings, responses
Glenn Allen	ACIS (e.g. acis_process_events)
unassigned:	MARX

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Community Support: Downloads, Documentation, Helpdesk

CIAO 4.5 Downloads

CIAO 4.5 is the current supported release.

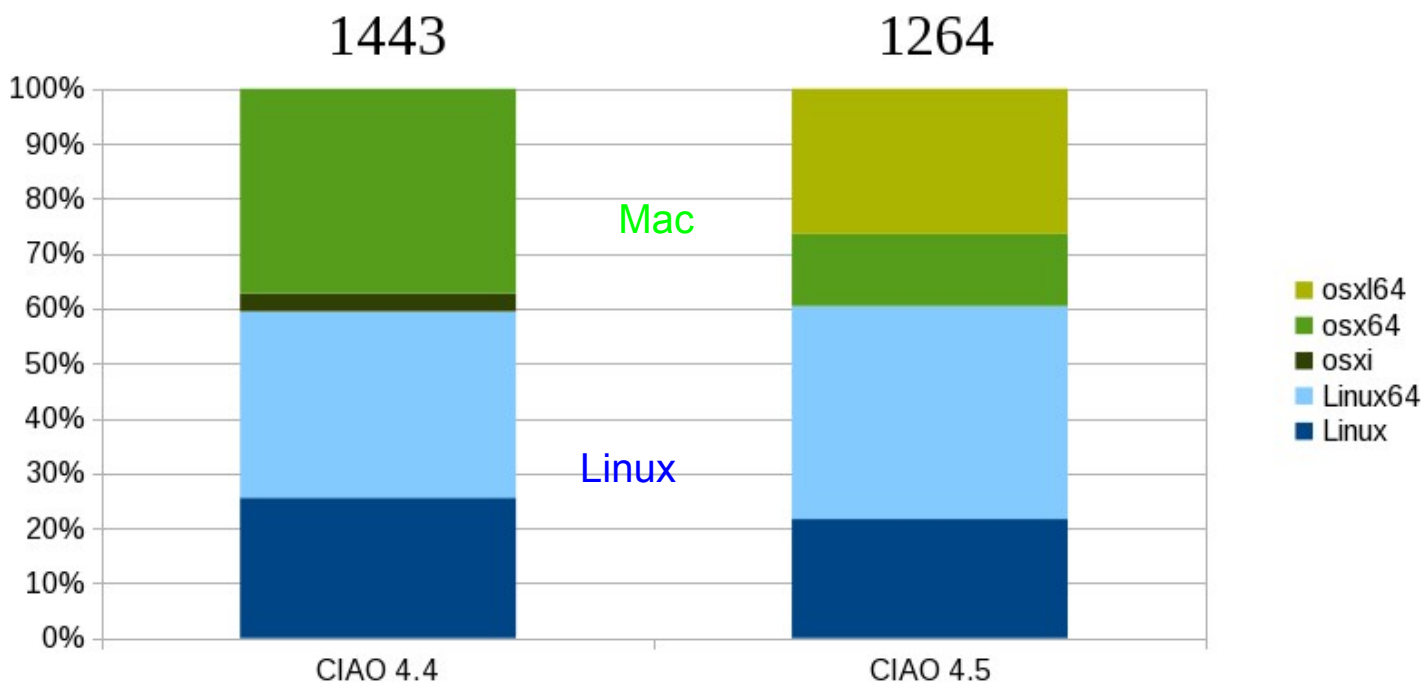
Downloads of CIAO 4.5 (released 2012 Dec 13)

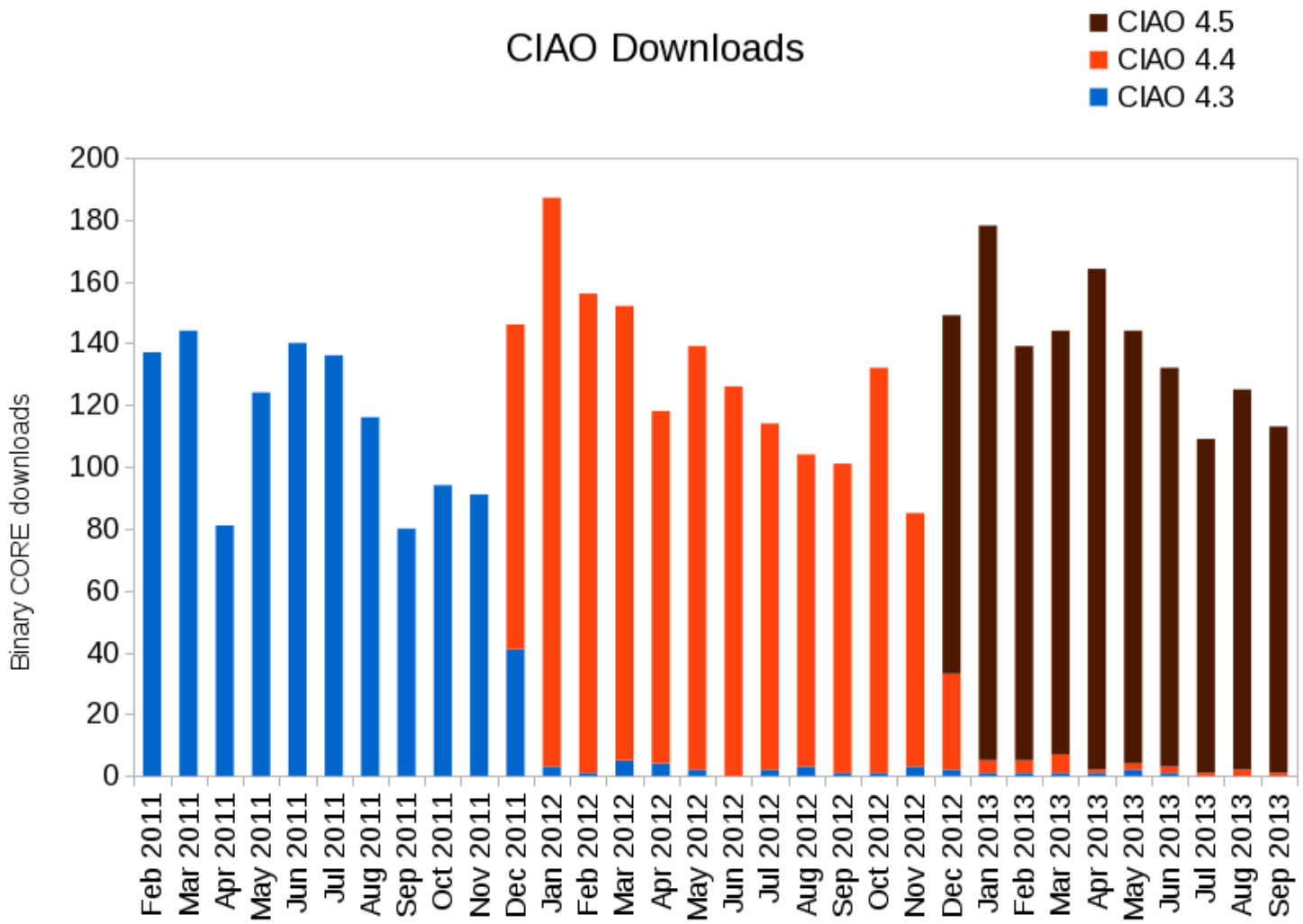
	Dec 13-Sep 30
Linux	764 (274 were 32-bit)
Mac	500 (166 Lion, 334 MLiion)
Source build	161
Total	1425

Downloads continued for last year's CIAO 4.4 release which we keep available (and which was the prime release until Dec 13)

	Sep 2012 to Sep 2013
Linux	222
Mac	153
Source	44
Total	419

CIAO 4.4+4.5 downloads within period: 1844


1443
1264
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Mac
Linux
CIAO 4.4
CIAO 4.5
osxl64
osx64
osxi
Linux64
Linux


CIAO Downloads
CIAO 4.5
CIAO 4.4
CIAO 4.3
Binary CORE downloads
200
180
160
140
120
100
80
60
40
20
0
Feb 2011
Mar 2011
Apr 2011
May 2011
Jun 2011
Jul 2011
Aug 2011
Sep 2011
Oct 2011
Nov 2011
Dec 2011
Jan 2012
Feb 2012
Mar 2012
Apr 2012
May 2012
Jun 2012
Jul 2012
Aug 2012
Sep 2012
Oct 2012
Nov 2012
Dec 2012
Jan 2013
Feb 2013
Mar 2013
Apr 2013
May 2013
Jun 2013
Jul 2013
Aug 2013
Sep 2013

CIAO Documentation

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- Tested, documented and updated reports on known software bugs, advertised bug updates

- Documented DS releases, CALDB releases and CIAO script updates (release notes, threads, why topics)

- Improved various threads and explanations following user feedback via helpdesk, emails and conferences

Community Support

- Helpdesk: 359 new tickets (Sep 1 2012 – Sep 30 2013),
  - Median time to first ticket answer 0.5 hour
  - Median time to final answer 2.7 hr - longest this time was 40 days (required research to demonstrate user's approach infeasible)
  - Answers generated 19 new bugs, 5 RFE, 8 new docs
  - » what were the bugs? examples:
  - » - plots flip when printed
  - » - error in CALDB file headers
  - » - sherpa restore command issue on Mac OSX 10.8
  - » - problem reading non Chandra images with rotations
  - 82% did not require scientist or DS support (cf 72% last time)
  - 6 open sherpa/Chips tickets deferred to CIAO 4.6 release
  - We also get direct contacts to SDS scientists outside the helpdesk system, at the rate of several per week

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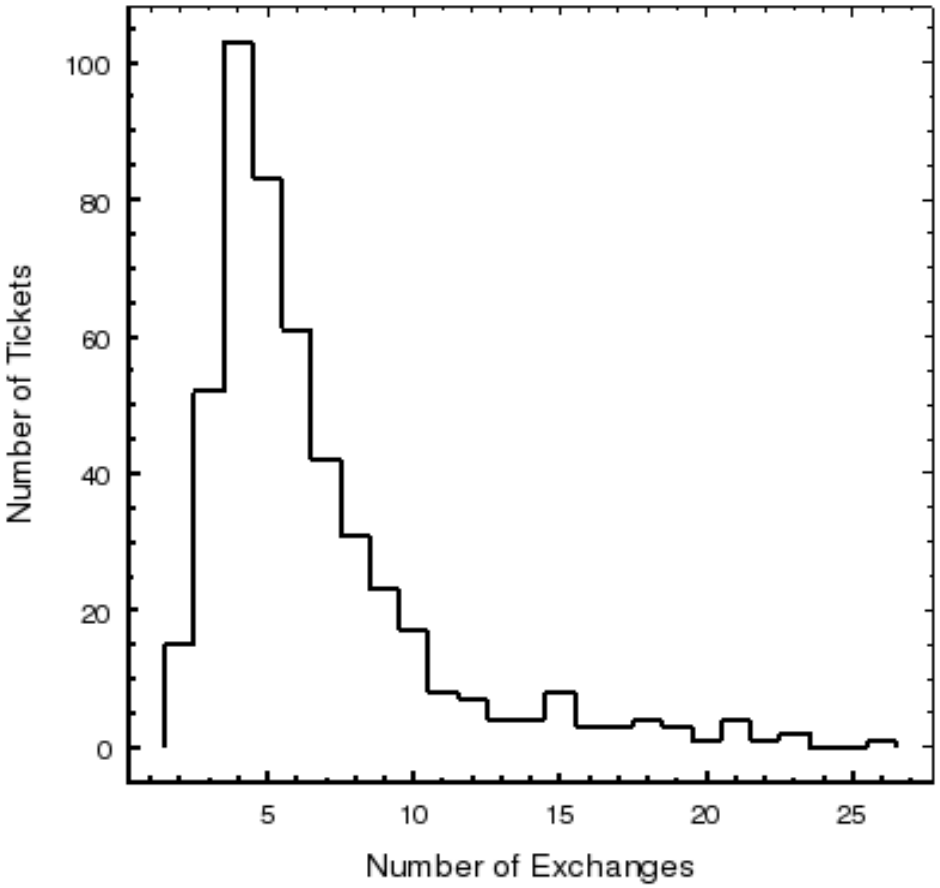
25% of tickets related to Sherpa

For 13% the answer pointed users to existing documentation

8% involved bugs

...

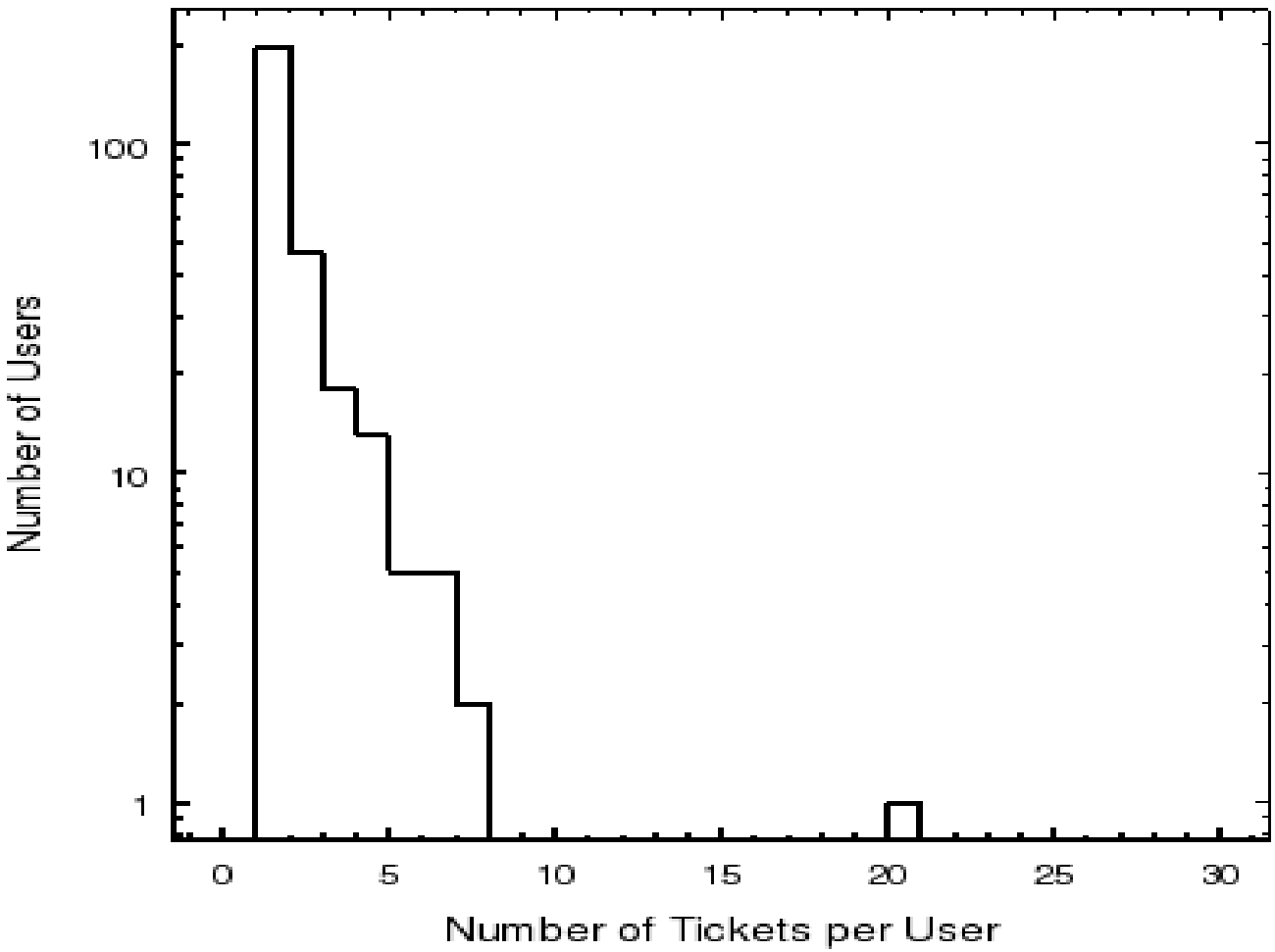


Helpdesk:

Most tickets have 4 user interactions -

1) User asks question
2) Gets message saying ticket has been assigned
3) We contact user with proposed answer
4) User confirms resolution

Most of the tail to many interactions is due to a couple of (problematic) users


100
10
1
Number of Users
0
5
10
15
20
25
30
Number of Tickets per User

Community Support

- 9th CIAO workshop was held Apr 22-23, 2013
  - Introduction to X-ray data analysis and the CIAO package
  - Workshop descoped due to low attendance
    - 3 grad students, 3 postdocs, 1 programmer
  - Mainly hands-on sessions – low impact on CXC staff
- We provided sample analysis exercises but encouraged attendees to bring their own data if they had any
- Session was productive. Good feedback from attendees and useful notes for improving on-line documentation.

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CIAO 4.6 Overview

CIAO 4.5 Release

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- CIAO 4.5 was released in Dec 2012
  - Described in previous CUC
  - Maintenance release
  - Added grating zero order tool for pipeline
  - Improvements to header keyword handling

*

CIAO Release

•CIAO 4.6:

Data Systems about to deliver Beta 2 drop

- SDS will test, give feedback
- Release in December as usual after further cycle of testing and documentation

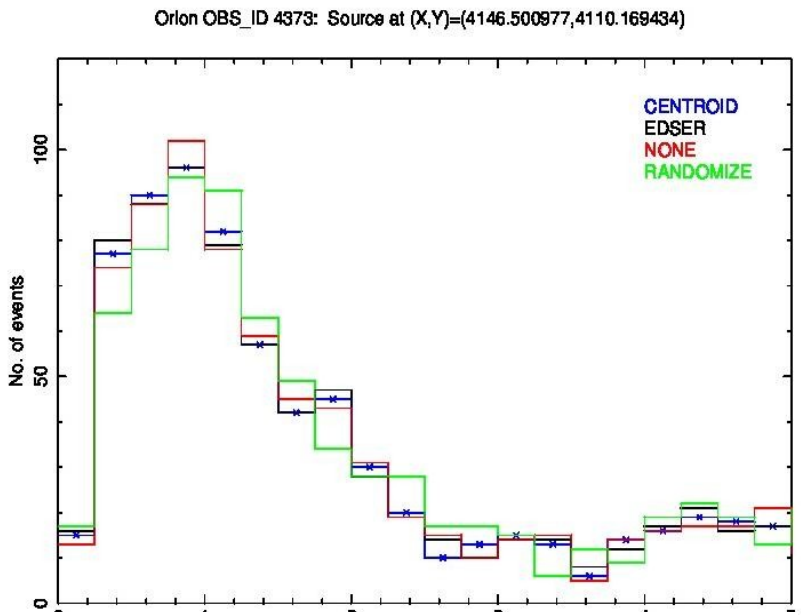
Content:

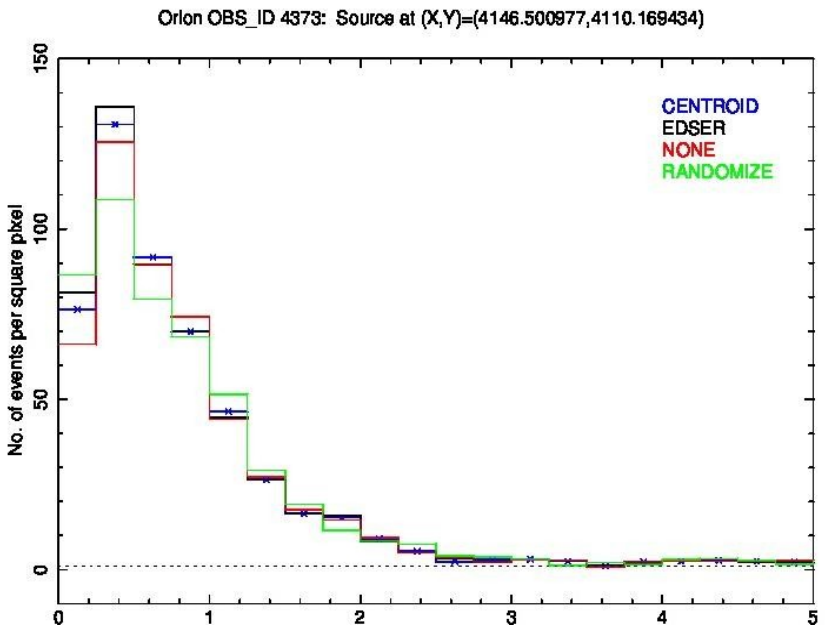
- Sherpa bug fixes
- Sherpa template models
- Tool bug fixes

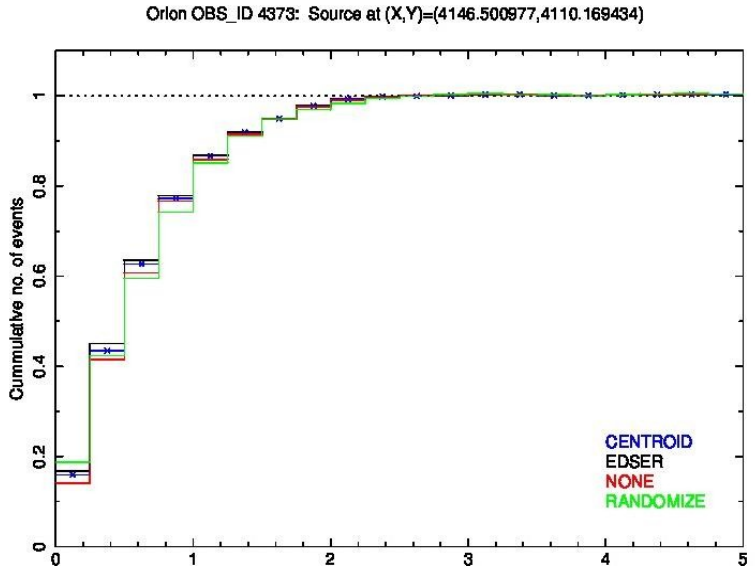
* Usability improvements specified for future releases:
  - make dmcoords, acis tools more robust by using average aspect offset keywords seeded in last reprocessing (next year)
  - make use of new keywords for dead area correction, removes need for users to deal with the ACIS parameter block file, simplifies interface (next year)
  - support RA, Dec regions in arfcorr rather than just pixel regions (CIAO 4.6; multiple helpdesk rqs)
* Improvements/fixes to CALDB blank sky file headers (released during the year)

CIAO and science analysis planning

- CIAO and Pipeline R&D continues for 2013
  - Continue work on 'Delta overclock' ACIS issue for pipeline
    - Testing complete, now in pipeline
  - Improved error calculations in Sherpa
  - Comparing different background estimation methods as part of project to better support extended source analysis
    - Internal memo done, further work planned next year
  - Planning improved documentation for PSF simulation, esp. MARX
    - In work; new ChART plan complete; MARX on hold due to loss of staff
  - Worked on algorithm to adjust ACIS gain using 9.7 keV Au Ly-alpha line
    - Study complete: determined that method not sufficiently reliable due to background variations
  - Added centroiding option to sub-pixel processing (using CTI adjusted pulse heights, and weights proportional to total pulse height)
    - Testing nearly complete, for release in CIAO4.6
  - Tested bias-parity error handling algorithm in acis_build_badpix pipeline tool
    - Further acis_buld_badpix tweaks, on schedule for CIAO4.6





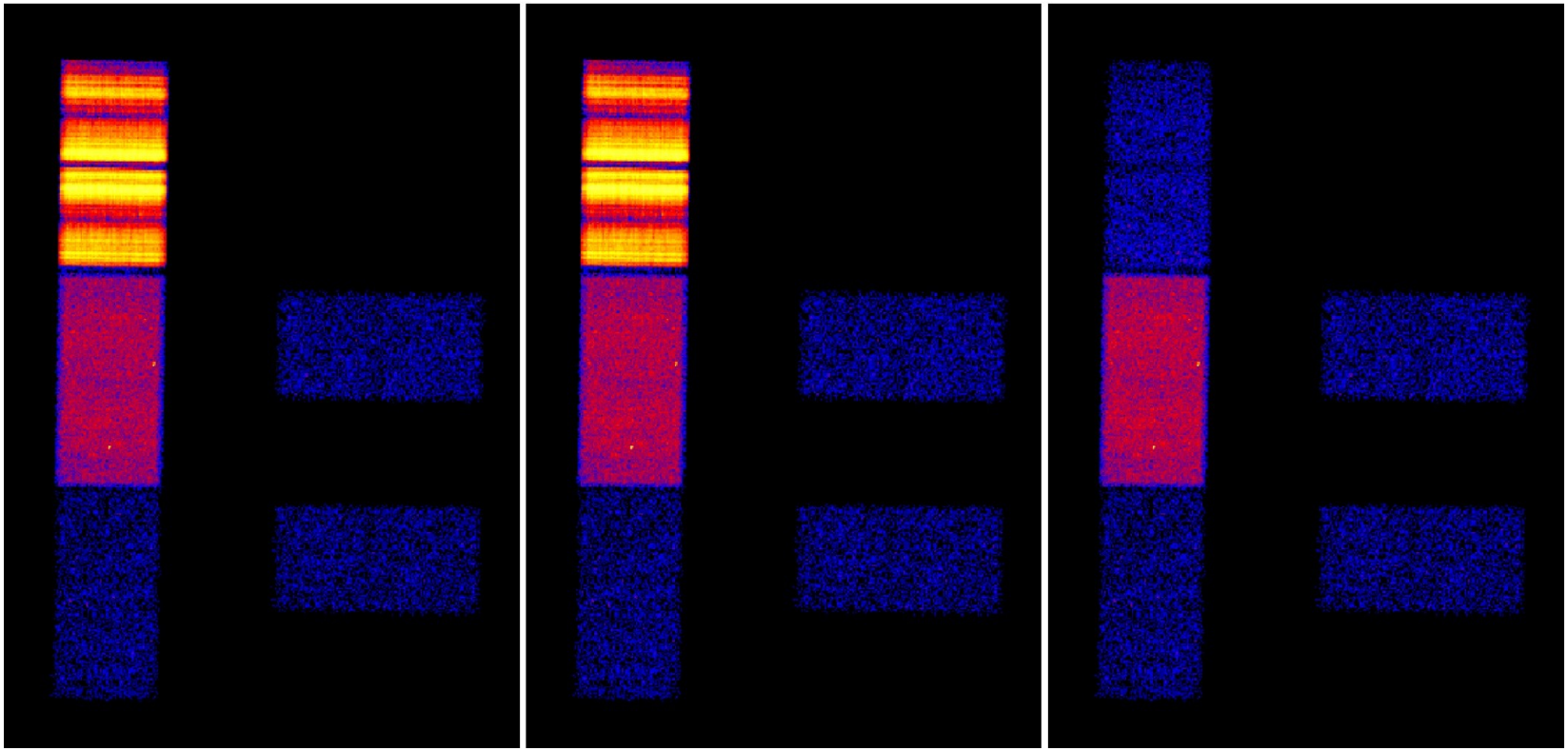


The CENTROID subpixel method is simpler than our standard EDSER method

For these examples we see the CENTROID PSF is close to the EDSER case and both give narrower effective PSFs than no correction or pixel randomization

Destreak algorithm research

OBS_ID 14516



Did not use destreak

Used destreak with
max rowloss fraction=0.00005

Used destreak with
max rowloss fraction=0.5

Some 'extra-streaky' datasets need different value of max rowloss fraction
But can lose real data in adjacent rows
After extensive experiments decided not to change recommended pipeline settings – only a few datasets are not handled well

Analysis Scripts

SDS Contributed Scripts

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Full release content (see http://cxc.harvard.edu/ciao/download/scripts/history.html for details).

Script releases 24 April, 28 June (minor bug fix), 7 August. (kajor)

New features:

Helper scripts for grating extraction regions – tgmask2reg, reg2tgmask

and grating responses – make_tgresp, incorporated in chandra_repro

Catalog search scripts (see later slide)

- simplified command line access for common catalog search cases

specextract major update

- the script now finds the auxiliary files like aspect solution and badpix if they are in the usual places, so you don't have to specify each one by hand This leverages header improvements made in the Repro 4 archive reprocessing. Users can still specify files if they need to.

- the 'correct' parameter has been changed to 'correctpsf' – should not break existing scripts

SDS Contributed Scripts - specextract

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You previously had to do

```
% specextract "repro/acisf06436_repro_evt2.fits[sky=circle(3699.1,4290.5,17.5)]"
  oldsrc yes no bkgfile= bkgresp=no  asp=repro/pcadf268499655N002_asol1.fits combine=no
  pbkfile=repro/acisf268500170N002_pbk0.fits  mskfile=repro/acisf06436_000N002_msk1.fits
  badpixfile=repro/acisf06436_repro_bpix1.fits
```

Now you can just do

```
% specextract "repro/acisf06436_repro_evt2.fits[sky=circle(3699.1,4290.5,17.5)]" newsrc
```

```
% specextract "repro/acisf06436_repro_evt2.fits[sky=circle(3699.1,4290.5,17.5)]" newsrc

Running: specextract
  Version:    12 July 2013
Using event file repro/acisf06436_repro_evt2.fits[sky=circle(3699.1,4290.5,17.5)]
Aspect solution(s) repro/pcadf268499655N002_asol1.fits found.
Bad-pixel file repro/acisf06436_repro_bpix1.fits found.
ACIS parameter block file repro/acisf268500170N002_pbk0.fits found.
Mask file repro/acisf06436_000N002_msk1.fits found.

Setting bad pixel file for item 1 of 1 in input list


Extracting src spectra for item 1 of 1 in input list


Creating src ARF for item 1 of 1 in input list


Creating src RMF for item 1 of 1 in input list


Using mkacisrmf...

Grouping src spectrum for item 1 of 1 in input list

Updating header of newsrc.pi with RESPFILE and ANCRFILE keywords.
Updating header of newsrc_grp.pi with RESPFILE and ANCRFILE keywords.
% sherpa
-------------------------------------------------------
Welcome to Sherpa: CXC's Modeling and Fitting Package
-------------------------------------------------------
CIAO 4.5 Sherpa version 1 Tuesday, December 4, 2012

sherpa-1> load_pha("newsrc.pi")
read ARF file newsrc.warf
read RMF file newsrc.wrmf
sherpa-2> notice(0.5, 7)
sherpa-3> group_counts(20)
sherpa-4> plot_data()
sherpa-5> log_scale()
```

SDS Contributed Scripts – cont.

chandra_repro:
- removed HRC PI filtering following advice from HRC experts – it r
  reduces noise in some cases but not always optimal

download_chandra_obsid
- on request from CDA, added support for mirror sites

merge_obs:
- improved handling of HRC data
- same automatic finding of ancillary files as for specextract
- improved support for DM filters in input filename

SDS Contributed Scripts: In Prep

srcflux

- Goal reported last time: make it easy for astronomers to get a flux for an isolated X-ray source detected in ACIS, or an upper limit at a position

'srcflux evt.fits ra,dec out.fits'

We are now testing the implemented script and expect to release it at the end of the year. There are many parameters but for simple cases the interface above is all you need:

% srcflux repro/acisf06436_repro_evt2.fits
“03:29:17.6 +31:22:45” mysrc

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```
% srcflux repro/acisf06436_repro_evt2.fits "03:29:17.653 +31:22:44.97" mysrc
srcflux
          infile = repro/acisf06436_repro_evt2.fits
             pos = 03:29:17.653 +31:22:44.97
         outroot = mysrc
           bands = broad
          srcreg =
          bkgreg =
         bkgresp = yes
       psfmethod = ideal
         psffile =
            conf = 0.9
         rmffile =
         arffile =
           model = xsphabs.abs1*xspowerlaw.pow1
       paramvals = abs1.nH=0.0;pow1.PhoIndex=2.0
        absmodel =
       absparams =
           abund = angr
         fovfile =
        asolfile =
         pbkfile =
         mskfile =
        bpixfile =
         ecffile = CALDB
        parallel = yes
           nproc = INDEF
          tmpdir = /tmp
         clobber = no
         verbose = 1
            mode = ql
```

- echoes param choices

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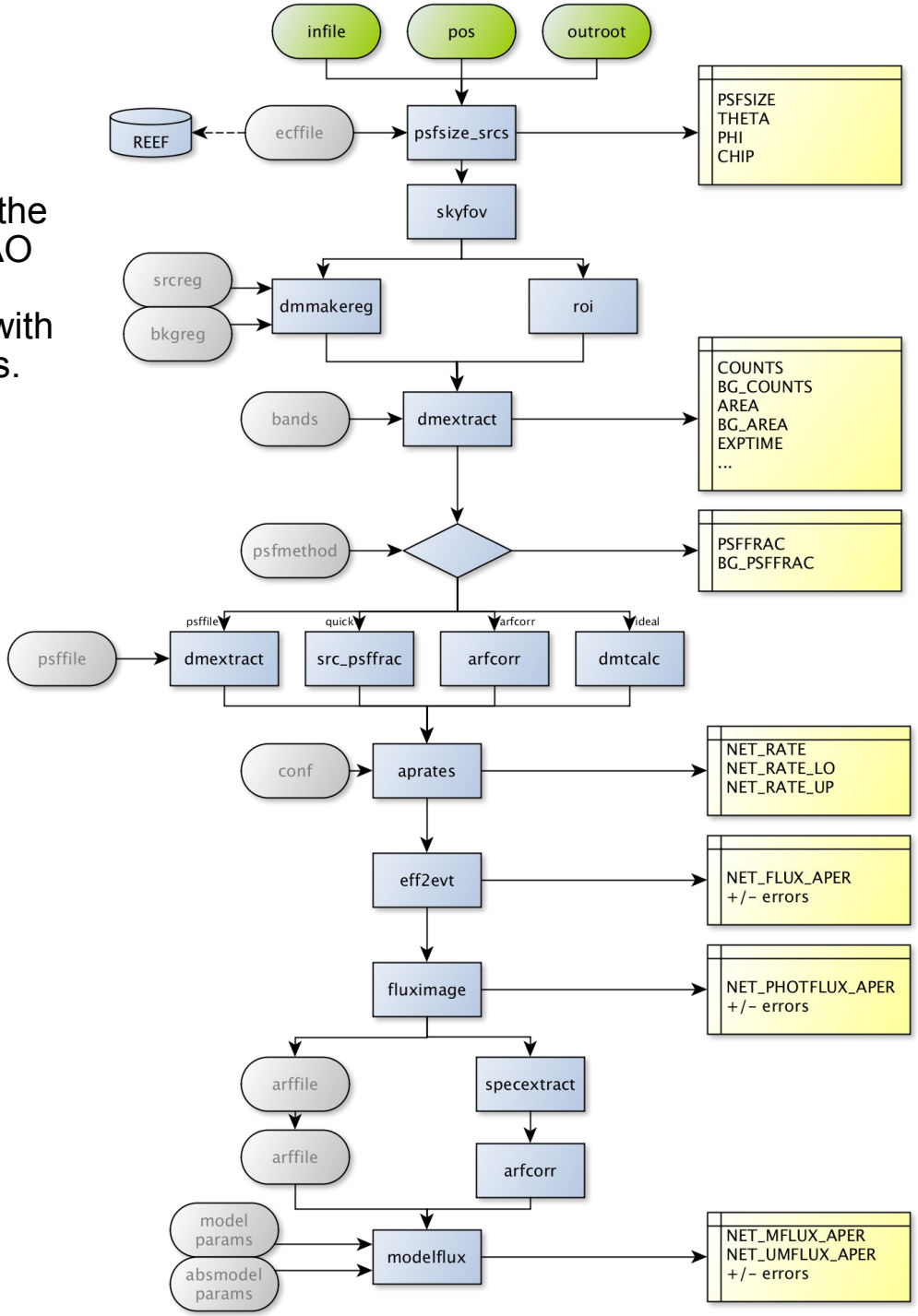
```
Extracting counts
Setting Ideal PSF : alpha=1 , beta=0
Getting net rate and confidence limits
Getting model independent fluxes
Getting model fluxes
Getting photon fluxes
Running tasks in parallel with 4 processors.
Running eff2evt for mysrc_broad_0001_src.dat
Running aprates for mysrc_broad0001_rates.par
Running eff2evt for mysrc_broad_0001_bkg.dat
Making response files for mysrc_0001
Running modeflux for region 1
Adding net rates to output
Appending flux results onto output
Appending photflux results onto output
Computing Net fluxes
Adding model fluxes to output
Scaling model flux confidence limits


Summary of source fluxes

Position                                0.5 - 7.0 keV
                                        Value        90% Conf Interval
3 29 17.65 +31 22 44.9  Rate            0.0609 c/s (0.0587,0.063)
                        Flux            5.43E-13 erg/cm2/s (5.24E-13,5.62E-13)
                        Mod.Flux        5.88E-13 erg/cm2/s (5.67E-13,6.08E-13)

~~~
```

reports progress and results
creates FITS output table for each energy band
file has fluxes and many additional cols with supporting data

srcflux combines
many existing CIAO tools
and scripts and encodes the
logic described in the CIAO
threads to return
count ranges and fluxes with
all appropriate corrections.



srcflux capabilities

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- finds auxiliary files automatically, like specextract

- automatically determines PSF-appropriate extraction region size for source and background, or accepts user choice

- uses one of four methods to apply aperture correction

- runs on multiple energy bands including named CSC bands

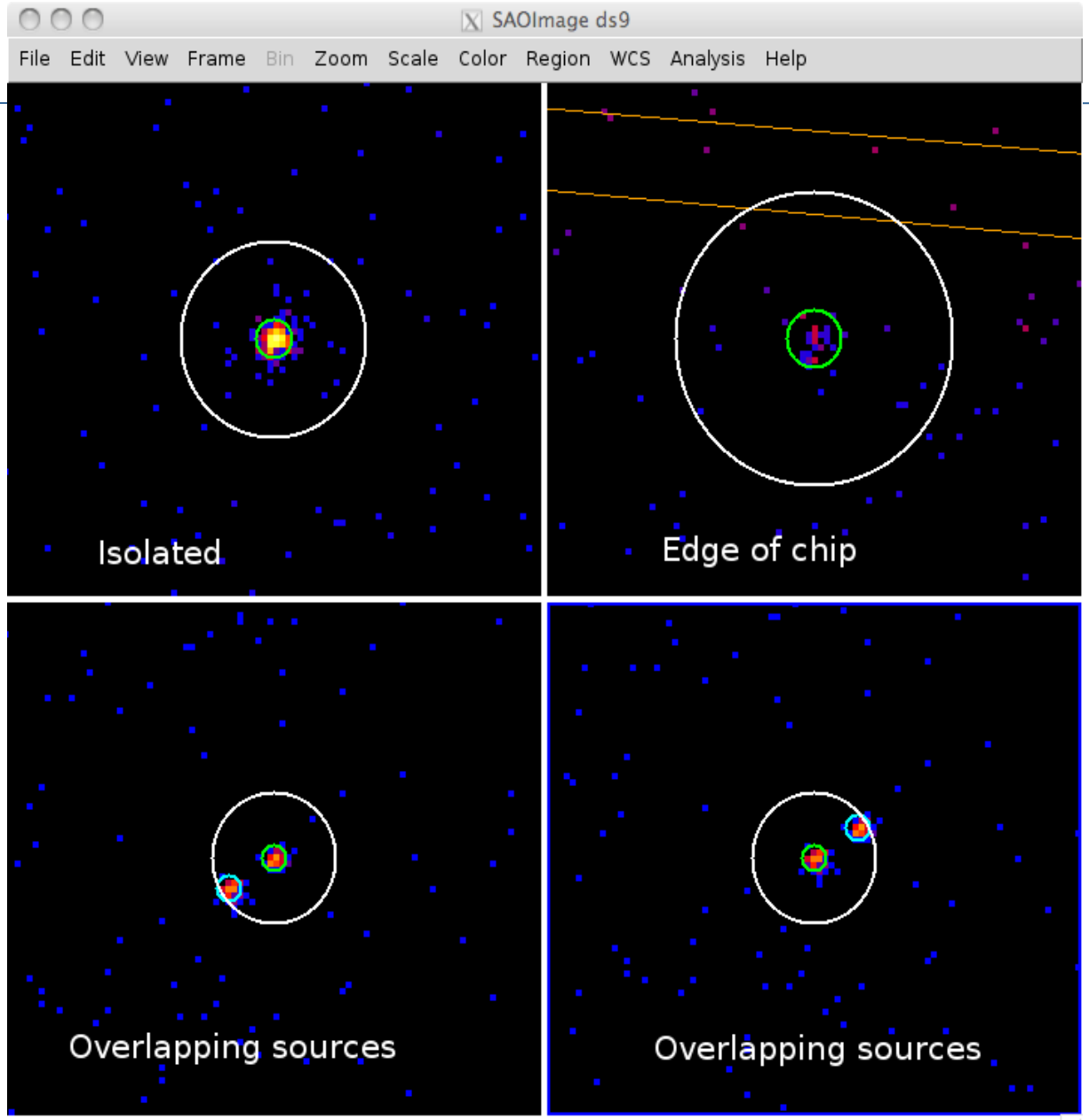
- accepts one position or a list (catalog of sources)

- calculates count rates using aprates method

- calculates fluxes two different ways (specified spectral model and eff2evt method; however, no spectral fit is performed)

- generates spectral reponses for further analysis

Ongoing work: handling of warning flags for hard cases, e.g. chip edge



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Catalog scripts: search_csc

Two scripts:

search_csc, obsid_search_csc

Scripts were developed to allow full access with limited search capabilities to the Chandra Source Catalog from the command line

search by position

search by Chandra ObsId

Access to all Master and Observation properties (columns) and all files.

Uses CSC command line interface, CDA file browse and retrieve, and the CSC limiting sensitivity services.

search_csc Examples

- List all catalog sources within 1” of a named source

```
% search_csc M81 outfile=none radius=1 radunit=arcsec
...
22 rows returned by query
1 Different Master Source(s).
22 Different Observation(s).

name                    ra              dec             sepn
obsid
CXO J095533.1+690355    148.88805        69.06531       0.23"
5947
CXO J095533.1+690355    148.88805        69.06531       0.23"
5948
CXO J095533.1+690355    148.88805        69.06531       0.23"
5949    ...
```

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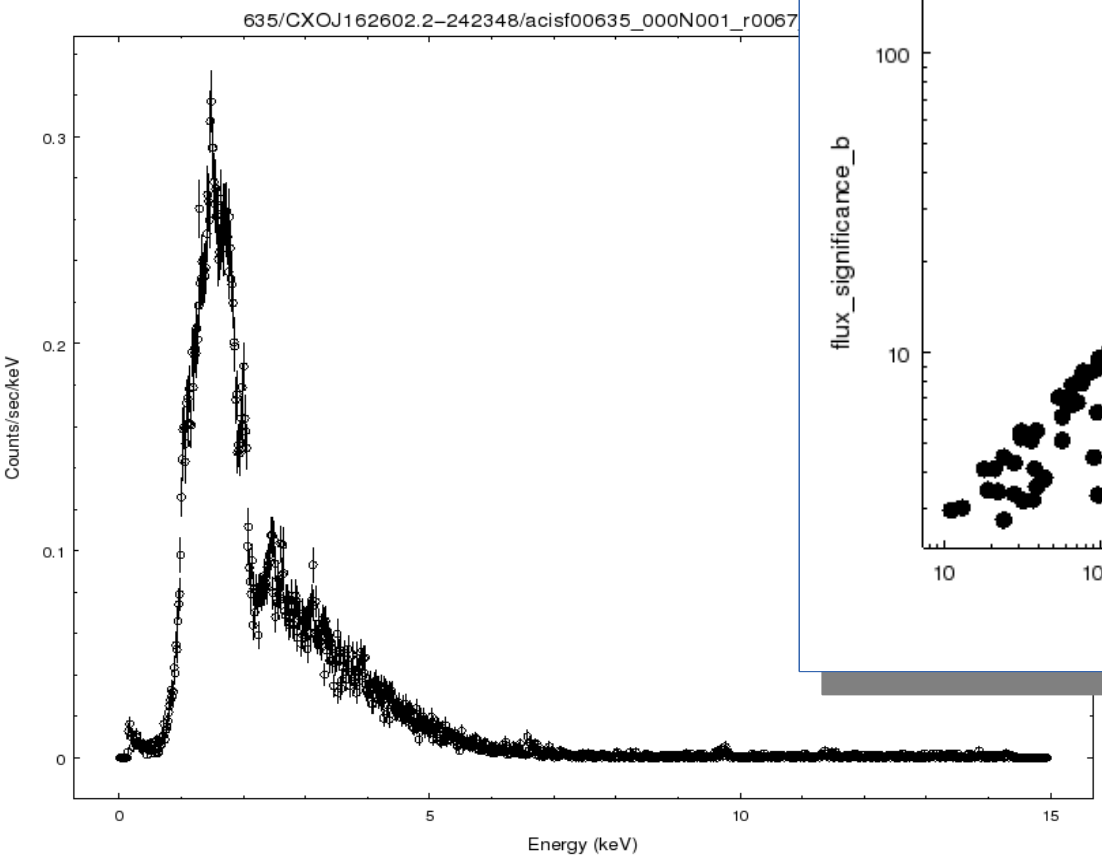
- get catalog-archived PHA and responses for sources in a given obsid plus a table with the source properties

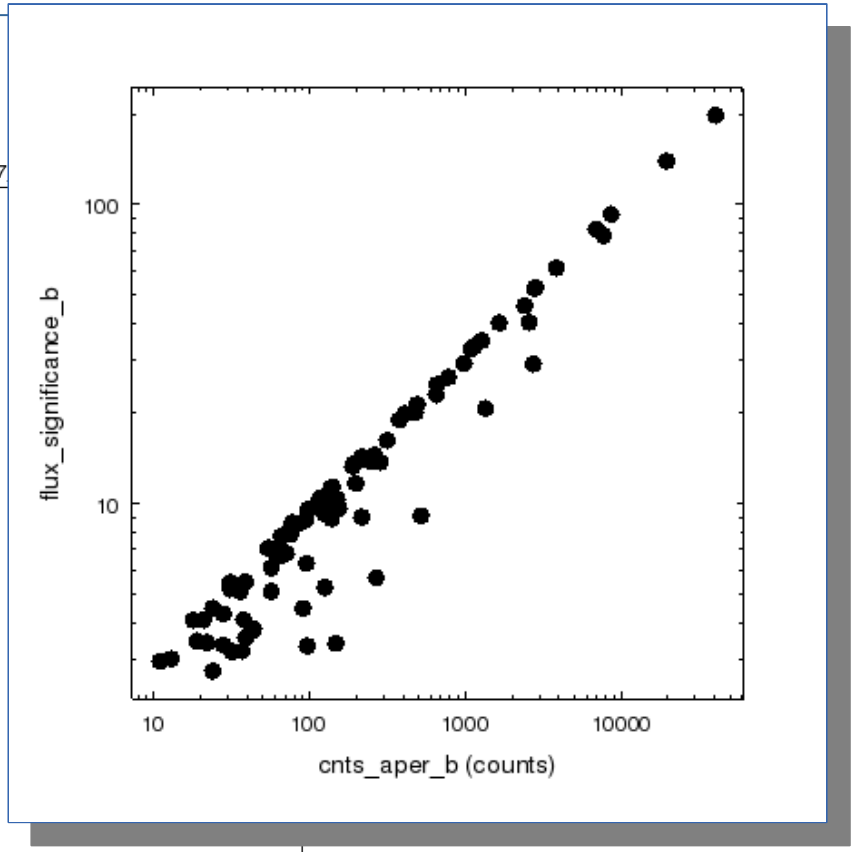
```
% obsid_search_csc 635 outfile=rhooph.tsv verb=0 filetype=pha,rmf,arf
download=ask
Download data for CXO J162602.2-242348 in 00635_000 [y,n,a,q]: y
Download data for CXO J162603.1-242336 in 00635_000 [y,n,a,q]: q

% sherpa
-------------------------------------------------
Welcome to Sherpa: CXC's Modeling and Fitting Package
-------------------------------------------------
CIAO 4.5 Sherpa version 1 Tuesday, December 4, 2012

sherpa-1>
load_data("635/CXOJ162602.2-242348/acisf00635_000N001_r0067_pha3.fits.gz")
read ARF file 635/CXOJ162602.2-242348/acisf00635_000N001_r0067_arf3.fits
read RMF file 635/CXOJ162602.2-242348/acisf00635_000N001_r0067_rmf3.fits
read background file
635/CXOJ162602.2-242348/acisf00635_000N001_r0067_pha3.fits
sherpa-2> plot_data()

% chips
chips-1> make_figure("rhooph.tsv[opt kernel=text/tsv][cols
cnts_aper_b,flux_significance_b]")
```


635/CXOJ162602.2−242348/acisf00635_000N001_r0067
Counts/sec/keV
0.3
0.2
0.1
0
0
5
10
15
Energy (keV)


flux_significance_b
100
10
10
100
1000
10000
cnts_aper_b (counts)

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Sherpa

Sherpa 2013 Development

- Supporting the Users and responding to Helpdesk issues

- the prioritization of work based on Helpdesk.

- Supporting standalone build:
  - DS/SDS work on designing standalone package: see next slide

- Continue work on bug fixes:
  - Science use continuing to grow

- prioritized 66 bugs - 230 open RFEs and issues

62 of these bugs closed as of Oct 3

Further bug fixes being tested in Beta 2 drop

- Finalizing support for template models
  - Testing revised implementation of 1D templates in Beta 2 drop

- Improved modeling of TGCAT/CSC data
  - No progress this reporting period

- Improving Documentation

- use of IPython Notebook (leveraging the OTS)

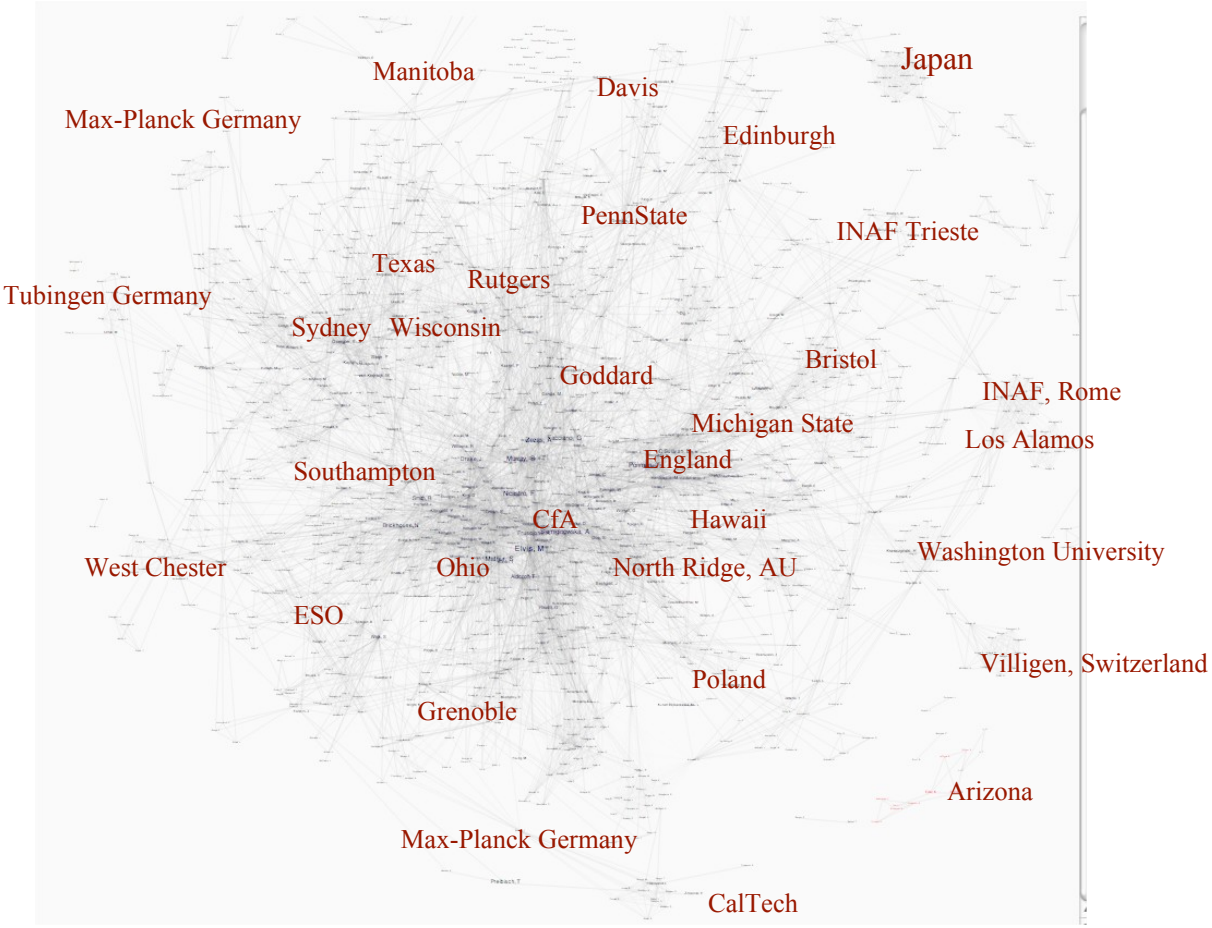
Currently too complicated to install/use in CIAO

Easy to include in standalone Sherpa

Investigating whether to include supporting packages in a future CIAO

Sherpa Users

A network of authors using Sherpa in their publications. This visual representation is based on 630 publications in ADS:



Standalone Sherpa

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"*Standalone Sherpa*" - users can build and install Sherpa independently of CIAO

Motivation:

- Growing user base:
  - input from ADS search on "Sherpa X-rays" 630 papers
    X-ray analysis from CXO, XMM, RXTE,
  - but also γ-rays, TeV and optical data - Fermi, Magic, HESS, HST, Keck
  - used by CXC in analysis of the spacecraft, engineering and calibration data

- Sherpa advantages:
  - model language + statistics + optimization
  - already integrated into Python environment,
  - no other Python fitting/modeling package with similar capabilities

- Feedback from users
  - via helpdesk, discussions
  - not only questions, but also suggestions, real code contributions etc.
  - how to incorporate users contributions?

Standalone Sherpa – Current prototype

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Lets Python users import Sherpa into their working Python environment:

- important for non-CIAO users

important for making extensions/additions to the released code

Users can download the current standalone Sherpa and follow the directions for building in their software environment:

http://cxc.harvard.edu/contrib/sherpa

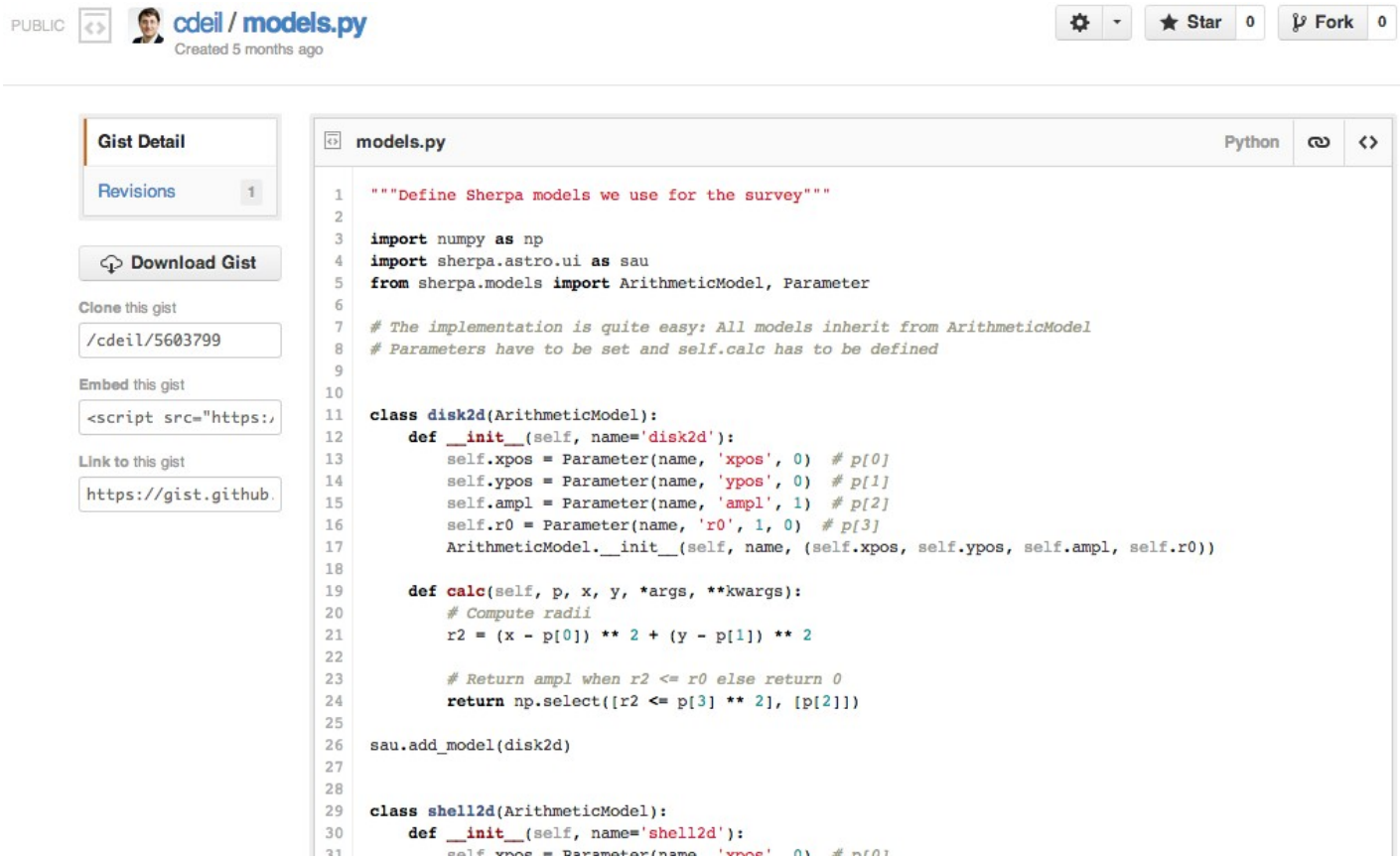
Limitations of current approach:

- We're getting a lot of user issues e.g. with getting the library paths set up right
- Cannot build completely from source
- Must install CIAO if need support for regions, coordinate systems
- Run into problems if user's Python version is different from the one CIAO was built with
- using the CIAO Python may clash with the user's own additional packages
- we should investigate making Sherpa follow the emerging Astropy standard for affiliated astronomy packages in Python

User Contributed Model

Example of a user contribution:

Christopher Deil contributed the code for two models via GitHub.
These models were needed for analysis of HESS data.
Our team reviewed the code and included in Beta 2 for CIAO 4.6 release



Standalone Sherpa: Future path

- We plan an active, open-source community based, code development mode in which code is shared publicly in a GitHub repository
- CXC will retain control of the main branch – require code reviews for proposed changes or additions
- We performed experimental builds of the standard Python distributions for MAC OS10.7 and Linux that could be installed with "pip install sherpa"

  Current version is on:

  https://pypi.python.org/simple/sherpa

- Issues studied:
  - Sherpa dependencies on external packages,
  - Sherpa as OTS to CIAO, and
  - working approaches for standalone Sherpa development in sync with CIAO and github users

- Reviewed design for the infrastructure for an independent Sherpa build. Implementation and testing after Beta 2 code freeze.

Sherpa R&D: LIRA Example

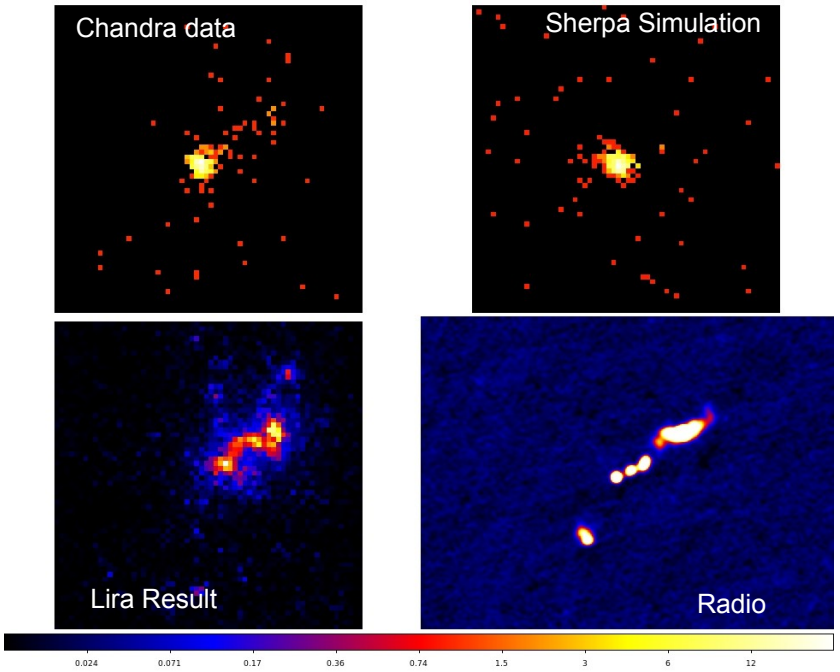
- Result of our ongoing collaboration with the statistics group
- We've been testing it on the Chandra images looking at detecting small scale structures in the vicinity of a strong point source
  - quasar with a jet or extended diffuse emission
- Performs a Bayesian deconvolution/reconstruction of the observed Chandra image using MCMC simulations which allows for statistical evaluation of an "additional" structure present in the image

Example:

1/ Sherpa is used to create a simulated model image of a quasar and a constant background emission with the parameters based on the fit to the Chandra image. The assumed Gaussian model was convolved with the PSF and there was no jet component in the model.

2/ Input the data and simulated images to LIRA to see if there are additional structures present in the image

3/ Lira creates an image at each MCMC iteration and the Lira results show the average image of the extra structure present in the data - in this case a jet which we also detect in the radio band.



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Gratings

Improved Gratings EEFRAC

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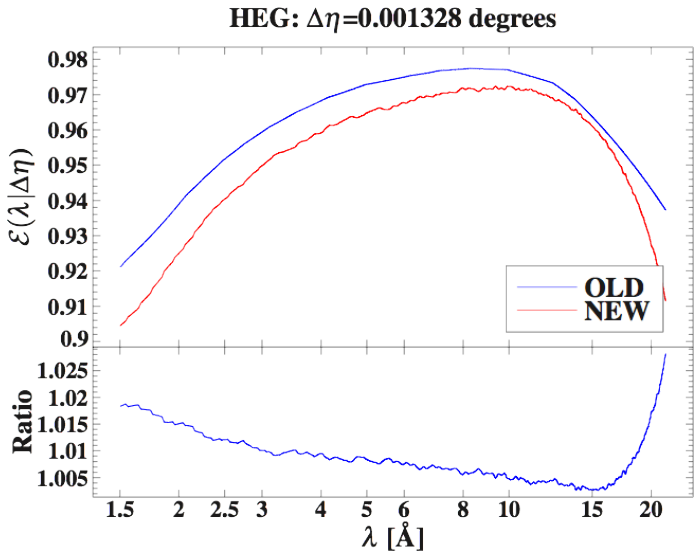
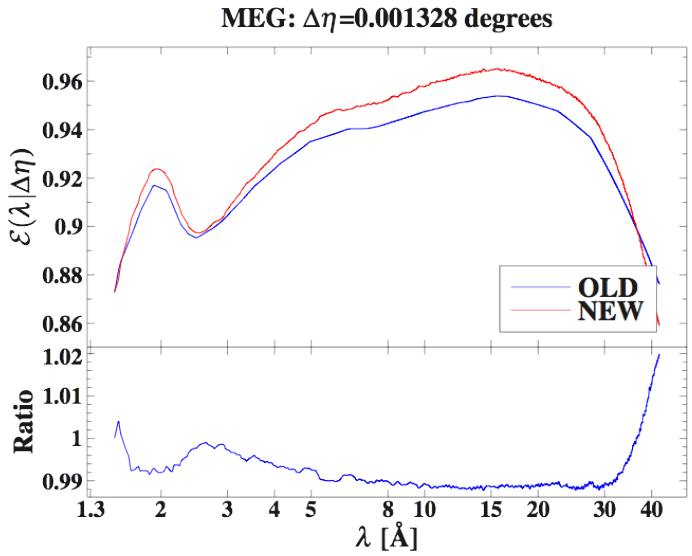
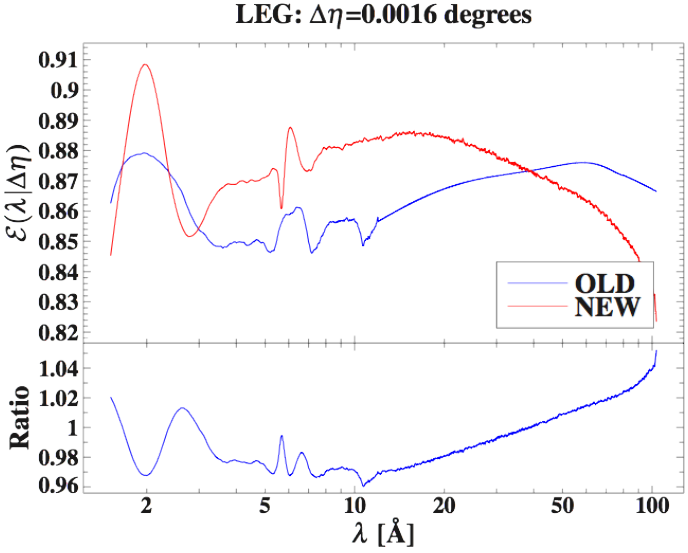
Motivation:

- Encircled Energy Fraction (EEFRAC) for gratings spectra depends upon:
  - Width of extracted region around gratings arms
  - Gratings arm, i.e., HEG vs. MEG
- EEFRAC is incorporated in determination of gratings effective area (applied via gratings RMF)
  - For point sources, different extraction widths should yield identical fluxes
- Current EEFRAC values had issues for wide extractions
  - Line Spread Function (LSF) (gaussian+lorentzian profile) unaltered
  - Integrated LSF=EEFRAC
  - inadequate interpolation led to non-monotonic behavior with width
- SAOTRACE + MARX simulations performed to compute new EEFRAC
  - Wavelengths 1.04 A – 102.35 A (0.01 A steps) simulated
  - EEFRACs calculated, Gaussian smoothed (0.1 A width), and tabulated
  - EEFRACs for standard extraction widths change by a few percent
  - Observed fluxes show less variation with extraction width

Old vs. New EEFRACs

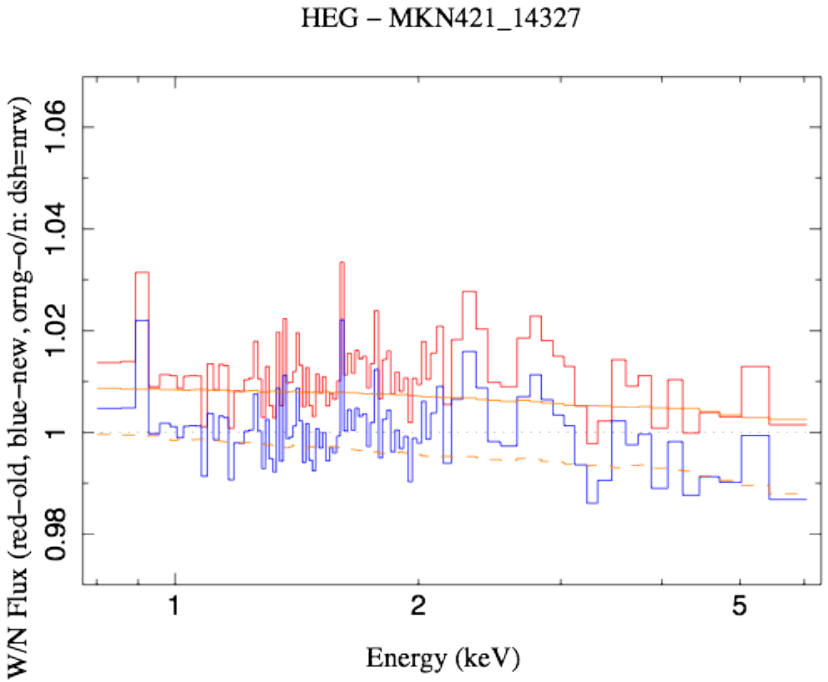


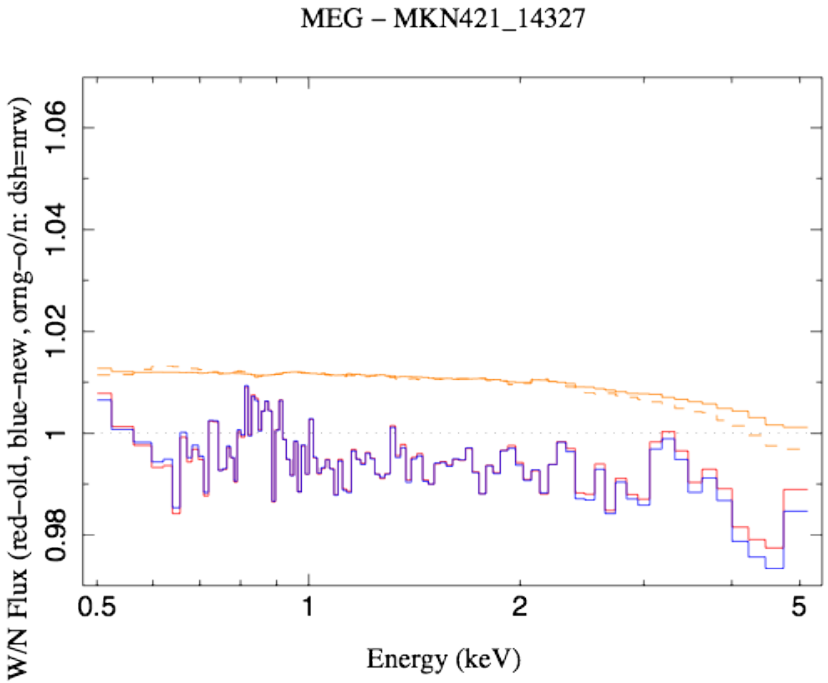




Standard Extraction Widths Enclose 85%-97% of the Energy

Measured Flux vs. Extraction Width





(Flux for Wide Extraction Width)/(Flux for Narrow Extraction Width)

Blue = New EEFRAC Values, Red = Old EEFRAC Values

Orange = (Old EEFRAC) /(New EEFRAC)
(Solid = Wide Region, Dashed = Narrow Region)

Planned Calibration/Analysis Support

- CUC has requested input on calibration/analysis of CC-mode/gratings data

- Individual gratings arms can show seemingly different spectra

- Norbert Schulz is preparing document explaining the differences as a function of: 1) Higher order contamination, 2) "Collapsed" chip backgrounds, 3) Dispersed dust scattering halos

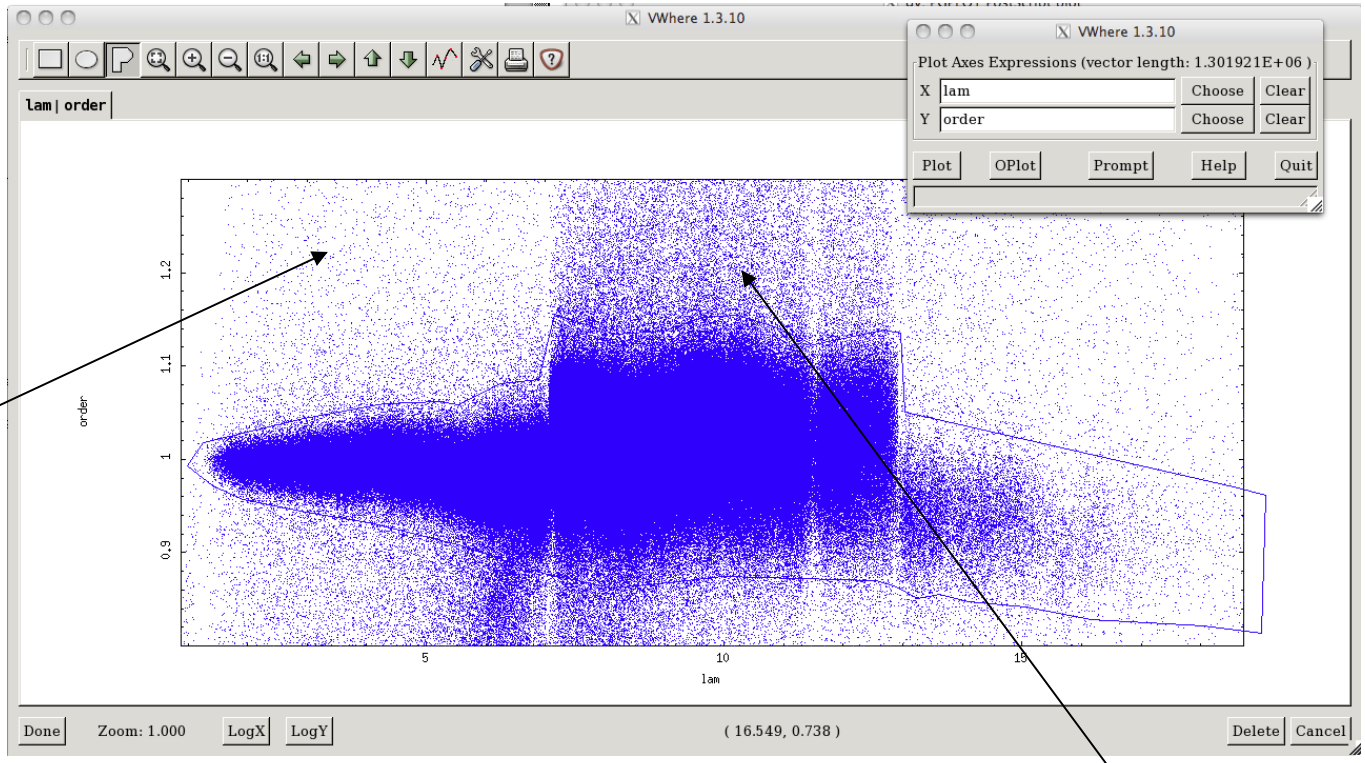
- User advice will include mitigation strategies (e.g., placing two gratings arms off the chips), tools for creating CC-mode backgrounds, and SAOTRACE/MARX simulation threads to estimate dispersed halo contributions.

- MARX simulations are adequate for most on-axis analyses 2–30 arcsec

- Opportunity to revisit SAOTRACE/MARX simulation threads in general

HETG/CC-Mode Analysis Support

HEG "Order Sorting" Plot – Tool Based Approach to Background Subtraction

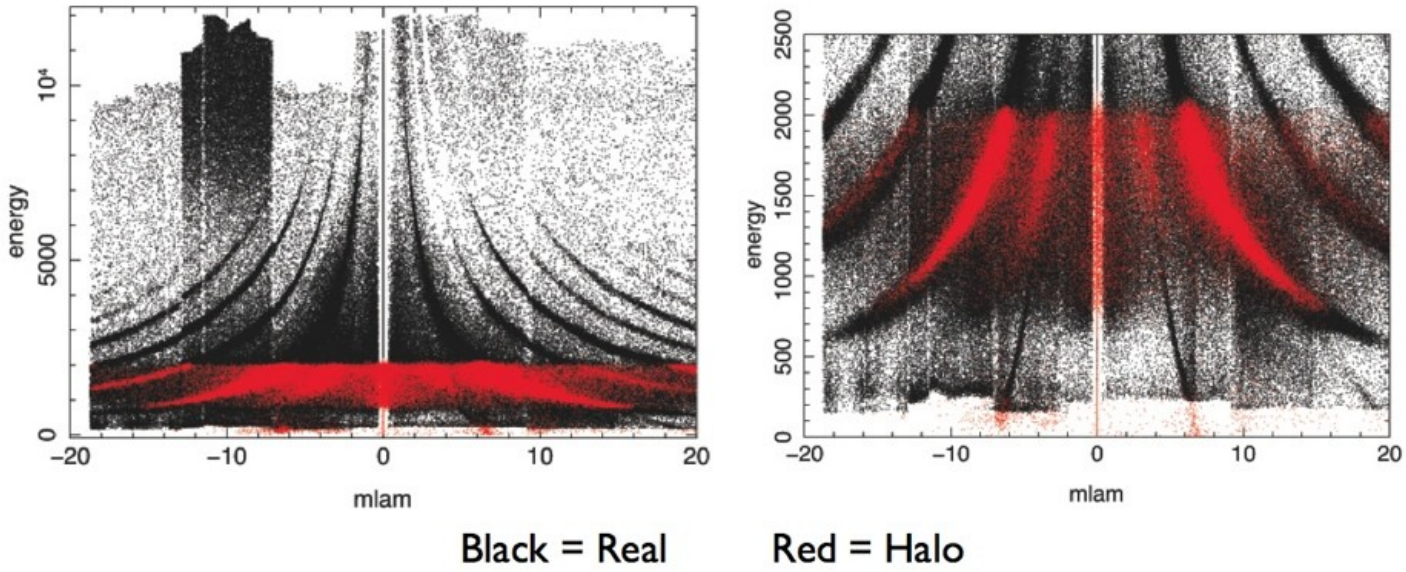


"Collapsed" Background, Amenable to Tool Based Subtraction

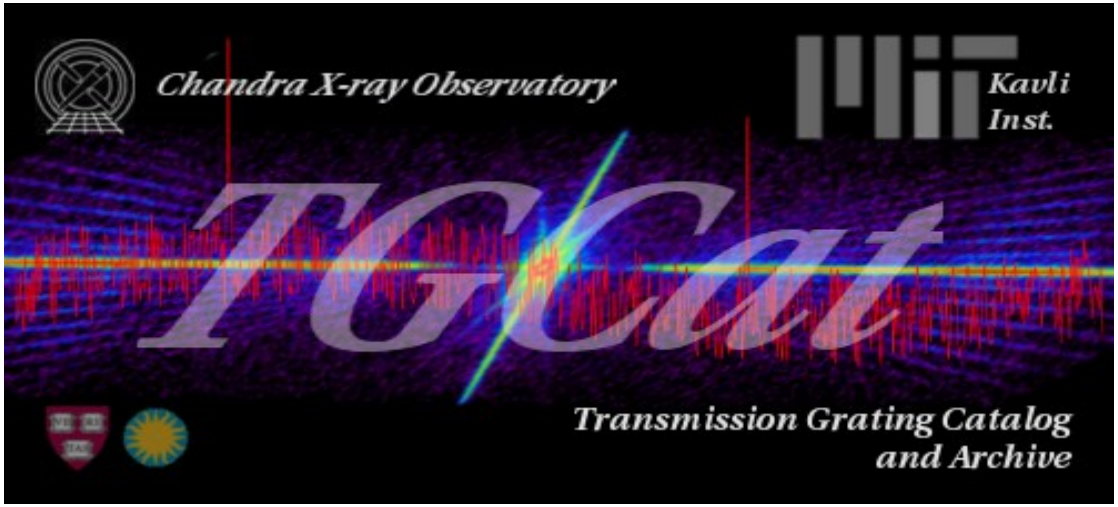
Dust Halo, Requiring SAOTRACE/MARX Thread

Tool Prototype – Estimate Background from "Order Sorting Regions", Analogous to Background Estimates from Spatially Imaged Regions.

Halo



* Black = Same Data as Shown in Tool Prototype.
* Red = Halo MARX simulation, created from fitting 0th Order PSF+Halo, then folding Halo component through MARX and applying standard spectral extraction
* User threads required as each observation is unique



New features going online soon

- Improved search with close-name matching
 - Request form for serendipitous source extract
 - Improved control of plot parameters and batch plotting
- Overplot positions of primary lines

TGCAT QUERY STATS:

 - 11387 queries from 192 ip addresses
 - 17 package and 56 single file downloads total 3.6 GB

TGCAT extracted line fluxes - example

label	wmid	wlo	whi	count_rate	err_count_rate	photon_flux	err_photon_flux	energy_flux	err_energy_flux
meg_band	13.35	1.7	25	2.5472e-1	3.2271e-3	3.2496e-3	5.1701e-5	1.5181e-11	2.9460e-13
heg_band	8.35	1.7	15	2.5443e-1	3.2253e-3	3.1986e-3	4.7121e-5	1.5122e-11	2.9363e-13
csc_b	13.4	2	24.8	2.5165e-1	3.2076e-3	3.1029e-3	4.8653e-5	1.3606e-11	2.2520e-13
zeroth_order	-1	-1	-1	2.0933e-1	2.9255e-3	-1.0000e+0	-1.0000e+0	-1.0000e+0	-1.0000e+0
csc_h	4.1	2	6.2	1.3541e-1	2.3529e-3	2.0634e-3	3.7224e-5	1.1195e-11	2.1883e-13
csc_m	8.265	6.2	10.33	1.0876e-1	2.1087e-3	7.9473e-4	1.5980e-5	2.0412e-12	4.0249e-14
c2500	2.5	2	3	2.6739e-2	1.0456e-3	4.7523e-4	1.9349e-5	3.8038e-12	1.6133e-13
c3500	3.5	3.3	3.7	1.9952e-2	9.0319e-4	2.6456e-4	1.1987e-5	1.5005e-12	6.7940e-14
c7800	7.8	7.4	8.2	1.7744e-2	8.5175e-4	1.1383e-4	5.4678e-6	2.9161e-13	1.4022e-14
Mg12	8.4	8.35	8.45	1.3574e-2	7.4497e-4	8.7910e-5	4.8248e-6	2.0780e-13	1.1405e-14
c5700	5.7	5.4	6	1.3410e-2	7.4047e-4	2.2062e-4	1.2586e-5	7.7062e-13	4.4309e-14
Si13	6.7	6.6	6.8	1.1775e-2	6.9385e-4	7.9575e-5	4.7274e-6	2.3614e-13	1.4037e-14
c4500	4.5	4.3	4.7	1.1775e-2	6.9385e-4	1.9734e-4	1.1673e-5	8.6953e-13	5.1335e-14
c6425	6.425	6.3	6.55	1.0303e-2	6.4904e-4	7.2151e-5	4.5455e-6	2.2304e-13	1.4051e-14
Si14	6.175	6.1	6.25	9.0765e-3	6.0918e-4	6.5833e-5	4.4195e-6	2.1159e-13	1.4207e-14
label	wmid	wlo	whi	count_rate	err_count_rate	photon_flux	err_photon_flux	energy_flux	err_energy_flux
Ca19	3.2	3.1	3.3	8.2180e-3	5.7965e-4	1.0550e-4	7.4414e-6	6.5486e-13	4.6201e-14
Ar17	4	3.9	4.1	8.1771e-3	5.7821e-4	1.1294e-4	7.9861e-6	5.5967e-13	3.9577e-14
Mg11	9.25	9.1	9.4	8.1362e-3	5.7676e-4	8.8688e-5	6.2989e-6	1.9094e-13	1.3555e-14
csc_s	17.565	10.33	24.8	7.4820e-3	5.5309e-4	2.4475e-4	2.6946e-5	3.7047e-13	3.4794e-14
c8800	8.8	8.5	9.1	5.3969e-3	4.6974e-4	4.1183e-5	3.6107e-6	9.2742e-14	8.1126e-15
S15	5.075	5	5.15	4.8654e-3	4.4601e-4	9.0944e-5	8.3466e-6	3.5554e-13	3.2619e-14
c4900	4.9	4.8	5	4.4156e-3	4.2489e-4	8.4368e-5	8.1285e-6	3.4174e-13	3.2945e-14
Ar18	3.75	3.7	3.8	3.7615e-3	3.9216e-4	5.2088e-5	5.4309e-6	2.7575e-13	2.8750e-14
Fe2x	11.2	10.4	12	2.9438e-3	3.4692e-4	5.2770e-5	6.2915e-6	9.4340e-14	1.1194e-14
S16	4.75	4.7	4.8	2.6167e-3	3.2708e-4	5.2491e-5	6.5628e-6	2.1891e-13	2.7369e-14
FeK	[illegible]								

- New feature released
- FITS file of rates in bands for all extractions / Combined with SIMBAD source info