



CIAO

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- The CXC CIAO Team
 - CXC Science Data Systems
 - Leads: Jonathan McDowell, Mike Nowak (SAO, MIT)
 - CXC Data Systems
 - Lead: Janet DePonte Evans
 - CALDB
 - CALDB scientist Dale Graessle

CIAO

- Chandra Interactive Analysis of Observations
- First release in 1999 (CXO launched on Shuttle)
- New CIAO4.0 release has significant changes (Aneta's talk)
- Same code base as pipeline that makes the archive products
- I will talk briefly about what's new in tools and calibration
- Aneta will discuss the new scripting and infrastructure

CIAO

- CIAO 4.0 released 2007 Dec 14
 - CIAO 3.4 (released 2006 Dec) still available
- CIAO 4.0.1 patch released 2008 Feb 22 with enhancement to ObsVis
- CIAO 4.0.2 patch soon, for Leopard support on Mac Intel (not Mac PPC)
- Recent changes in Chandra data analysis:
 - ACIS dead area correction in ARF, e.g. psextract
 - TGAIN updated to 2008 Jan
 - HRC degap file improved
 - mkacisrmf: uses average dither from asofile to map WMAP in det coords to chip coords, improving registration
 - dmimg2jpg: improved log scaling
 - Text files supported in dm tools (dmcopy/dmllist on ASCII tables)

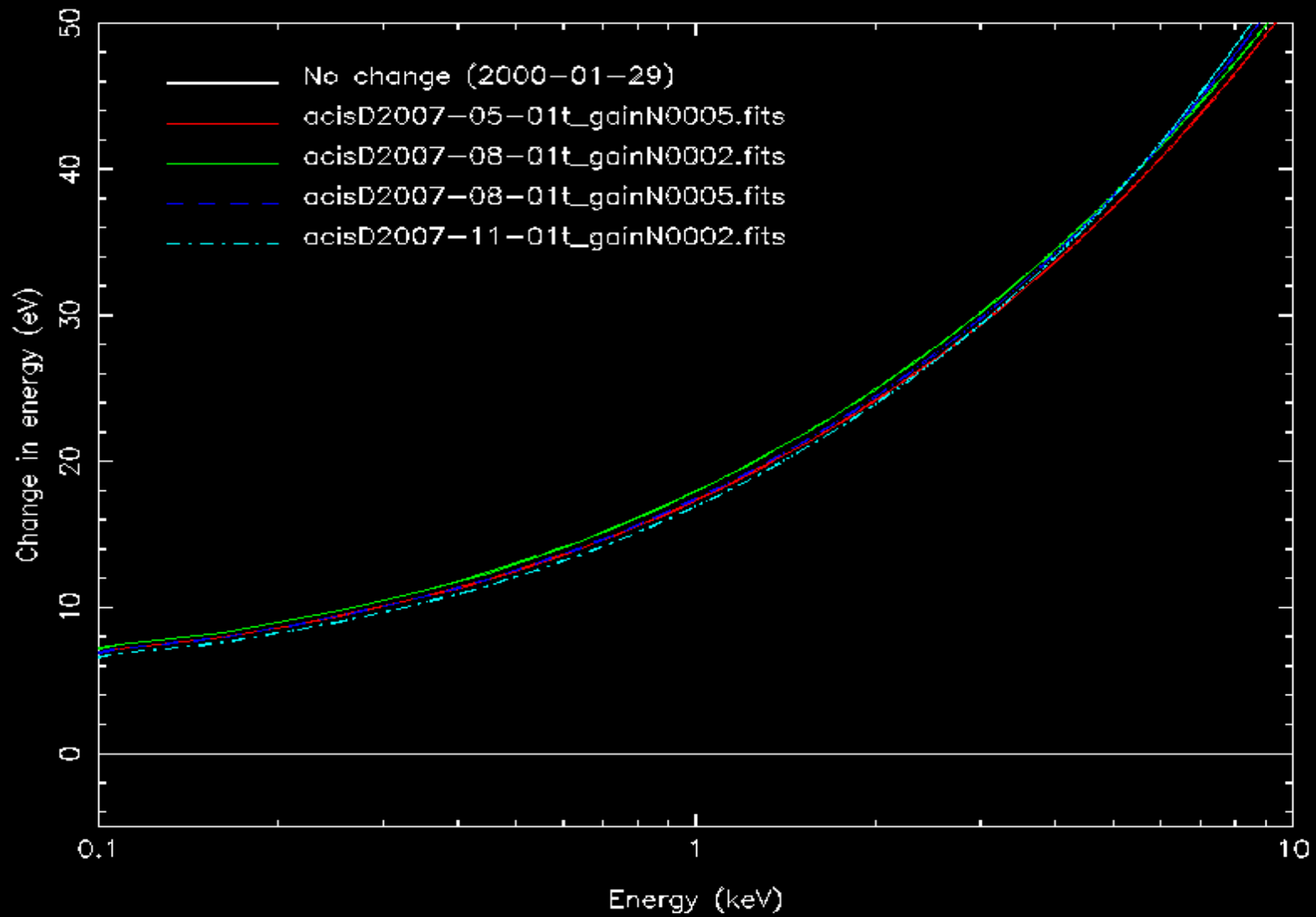
Archival analysis post Repro 3

- Archive reprocessing complete (except for 1999 data)
- Makes reanalysing data a lot easier: calibrations are good, so a lot of the complicated footnotes in the old threads no longer apply
- 1999 data not yet reprocessed. This includes -110C ACIS data, for which new gain files are being released - users may wish to reprocess these

Analysing Repro 3 ACIS imaging data

- Remove afterglow correction and run hot pixels - NOT NEEDED (but: new afterglow code in prototyping)
- `acis_process_events`:
 - VFaint data still needs `check_vf pha`
 - TGAIN correction for recent data only
 - CALDB 3.4.1 TGAIN epoch 30: 2007 May 1- Jul 31
 - CALDB 3.4.2 TGAIN epoch 31: 2007 Aug 1 - Oct 31
 - CALDB 3.4.3 TGAIN epoch 32: 2007 Nov 1- 2008 Jan 31 (release imminent)
 - CTI correction - NOT NEEDED (already applied)
 - Contam correction has not changed, 2004 extrapolation still used
- Aspect known processing offset correction NOT NEEDED (applying `reproject_aspect` to incorporate external astrometry can still be useful)
- Eliminate high background times - still recommended (`analyse_ltrcv.sl`, soon to be upgraded)

ccd=7 x=232 y=501

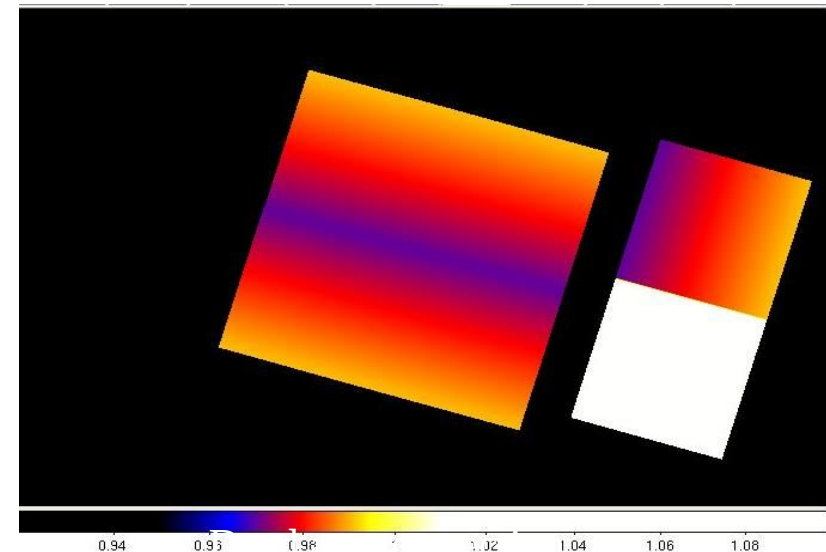
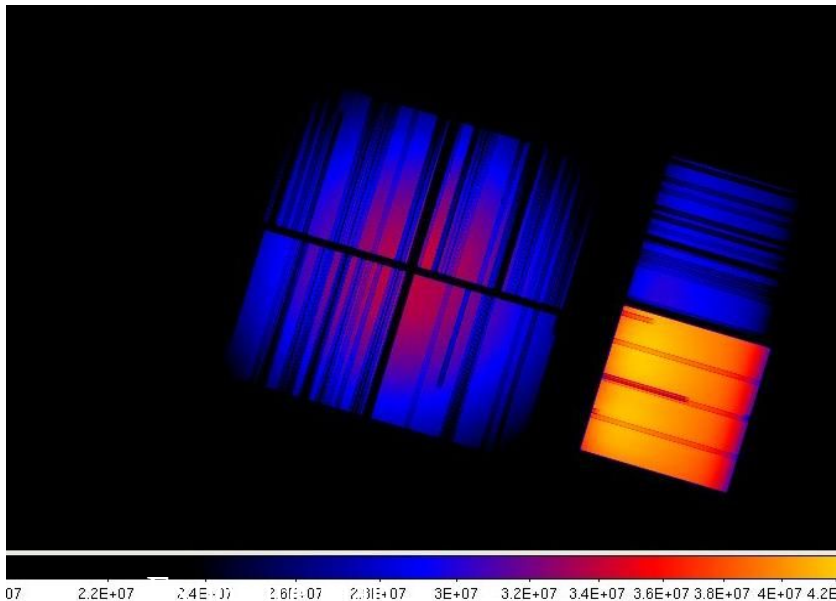


Cosmic ray afterglow update

- `acis_run_hotpix` (in pipeline) misses some faint (4-7 count) afterglows that can then show up in `wavdetect` as spurious faint sources
- `acis_detect_afterglow` can be run to eliminate these, but it can also delete real x-ray events
- afterglow events will be close together in time - we can use this to distinguish them from a steady source - Glenn Allen is prototyping a new algorithm
- For more details, see the 'why topic' on afterglow:
 - <http://cxc.harvard.edu/ciao/why/afterglow.html>

Dead area correction

- ACIS takes a frame of data (usually for 3.3s)
- ACIS on board software removes cosmic rays, detects events
- Cosmic ray removal causes “dead area”, reduces effective area by a few percent (2 to 4 percent); FI chips only
- Correction incorporated in ARF and exposure tools; is now on by default (but not in merge_all)



Filtering text files: Data Model Ascii Kernel beta release

- Filtering columns:
 - `dmcopy "sample.dat[col3=11:20][cols col4,col5]" copy.dat"[opt kernel=text/simple]"`
- Making a FITS file from a text file
 - `dmcopy sample.dat sample.fits`
- Handling a variety of text formats
 - `dmcopy 'data.csv[time=100:200][opt sep=","]' "data.tex[opt kernel=text,sep=&]"`
- Support for a multi-table (multi-extension) text format equivalent to a FITS bintable file, "DTF" (Data Text Format)
 - TTYPE, TUNIT, etc. in header
- Support for fixed format files for Fortran fans: DTF-FIXED
 - TBCOLn and TDISPn header keywords
- See: `ahelp dmascii`



Chandra Source Catalog

- <http://cxc.harvard.edu/csc>
- Ian Evans (project lead), Frank Primini (SDS science lead)
- Goal: complete source list for all public imaging observations
- Catalog will continue to grow as mission continues
- Chandra will cover about 1 percent of sky
- Release 1 - first public data this summer, complete release later in year, limitations:
 - no coadding of fields (so deep survey sources not seen)
 - only point and mildly (less than 1/2 arcmin) extended sources
 - some messy fields excluded (e.g. Cas A)
 - HRC may not be included (to be decided)
- Currently running on subsets of archive and tweaking algorithms

Chandra Source Catalog

- Position, error
- Count rates in 90 percent ECF aperture
- Hardness ratios
- Flux estimates, confidence intervals
- Extent estimate (compared to SAOTrace PSF)
- Variability estimates (Kuiper, KS, Gregory-Loredo)
- Flags: pileup, chip edge, confused region, etc.
- Associated products: events, pha, region file for each source
- Global products: limiting sensitivity maps

BACKUP SLIDES - CSC

- BACKUP SLIDES

Limiting sensitivity maps

- Frank Primini developed method
- Add Poisson noise to model background map
 - Use tabulated PSF model to determine 90 percent aperture radius at each pixel
 - Find count rate that gives $\text{SNR}=3$ for a point source at that pixel given the PSF size and background estimate.

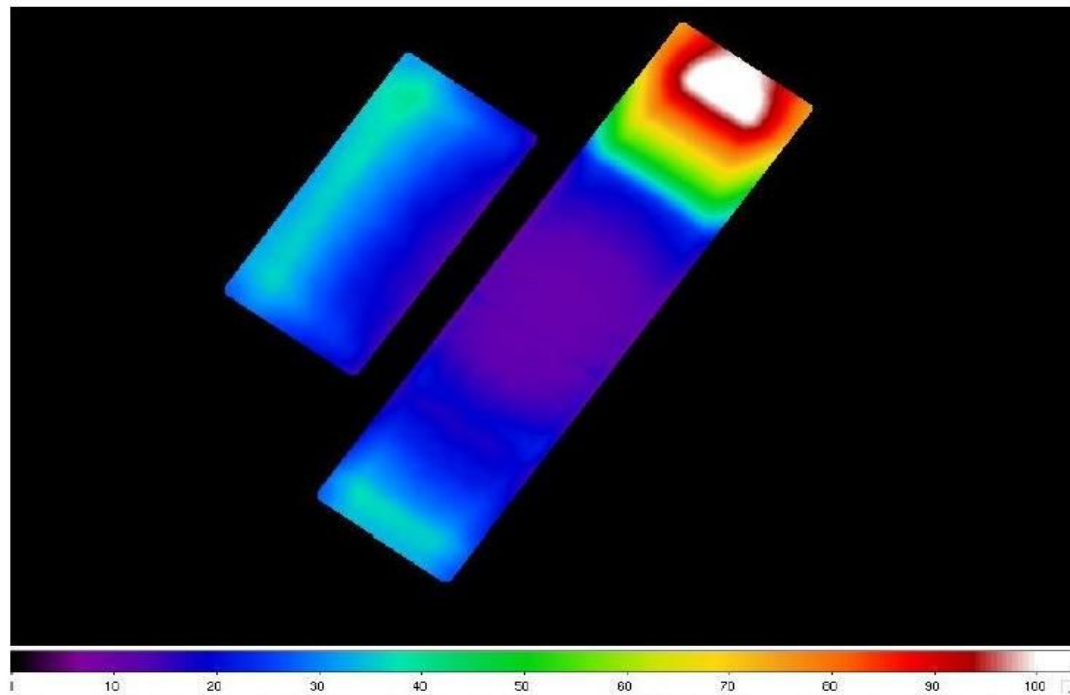


Figure 4.1: Net Counts Limiting Sensitivity Map for OBSID 786, broad band, blocking factor = 4

Combining error ellipses – John Davis

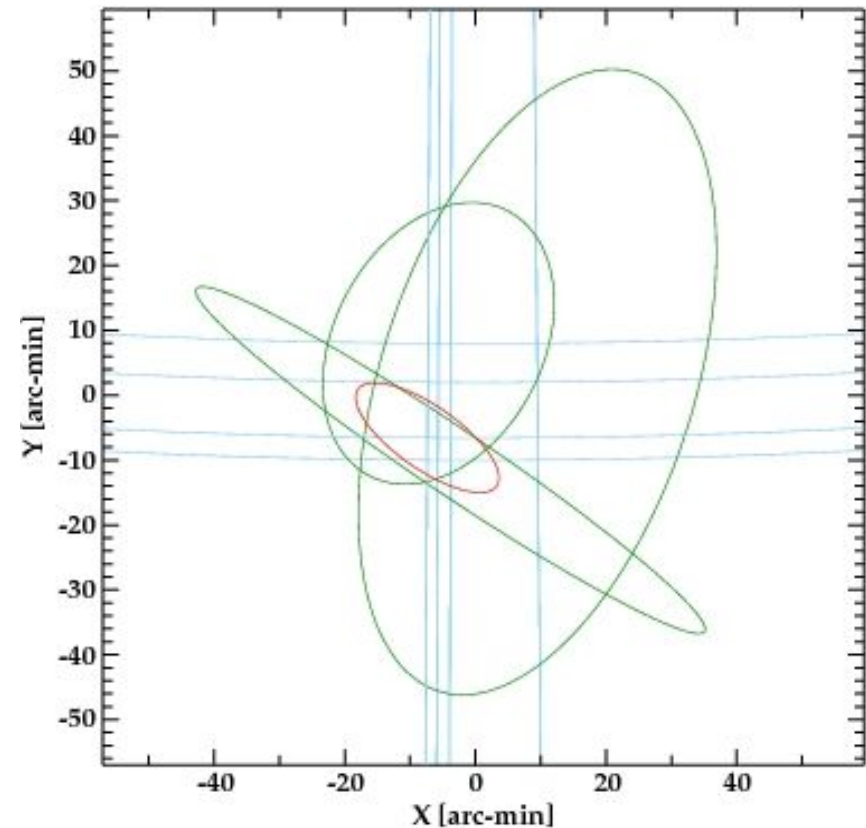
Improved estimate of position and error ellipse

Adopted algorithm used for military targeting

Unbiased estimate assuming no systematic error in positions

Takes spherical geometry into account (works at poles)

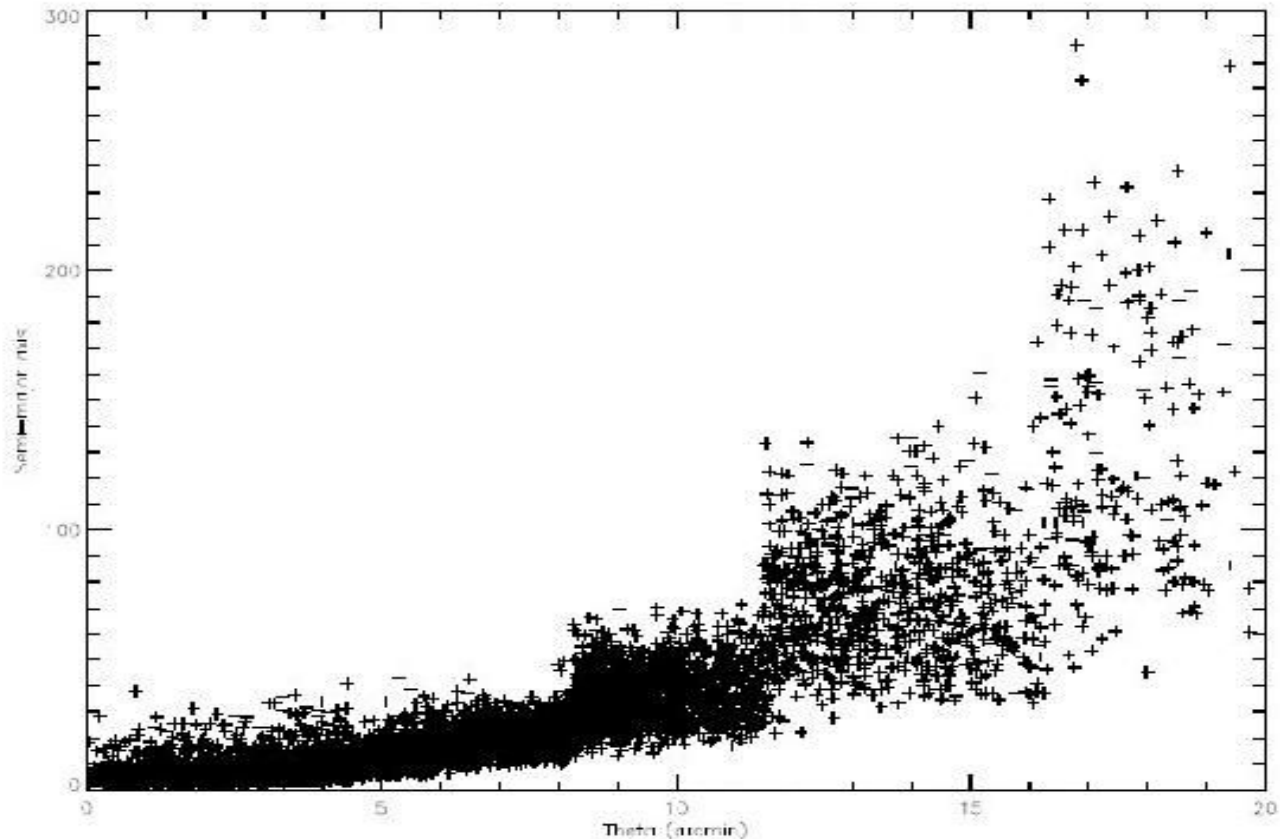
Math memo available



Source extent comparison – John Houck

Wavdetect approach introduces steps associated with the discrete wavelet scales used – hence discontinuities vs off axis angle.

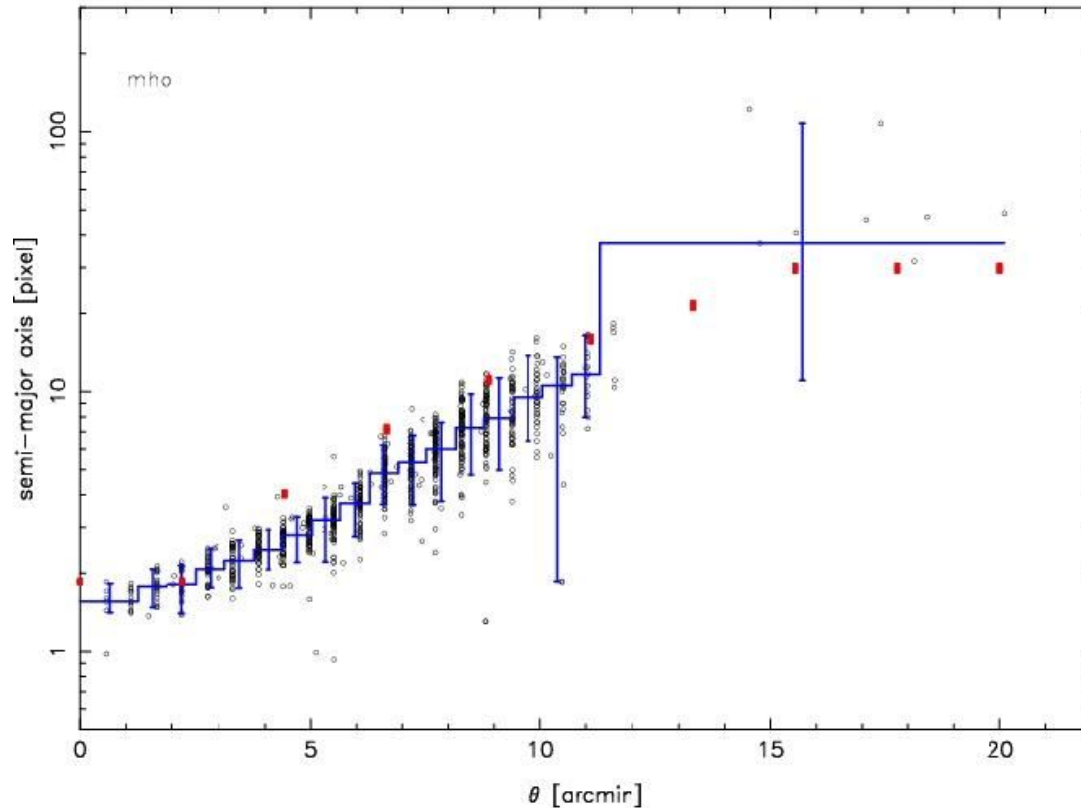
Extent estimates are not accurate; discontinuities in other properties too



Source extent comparison

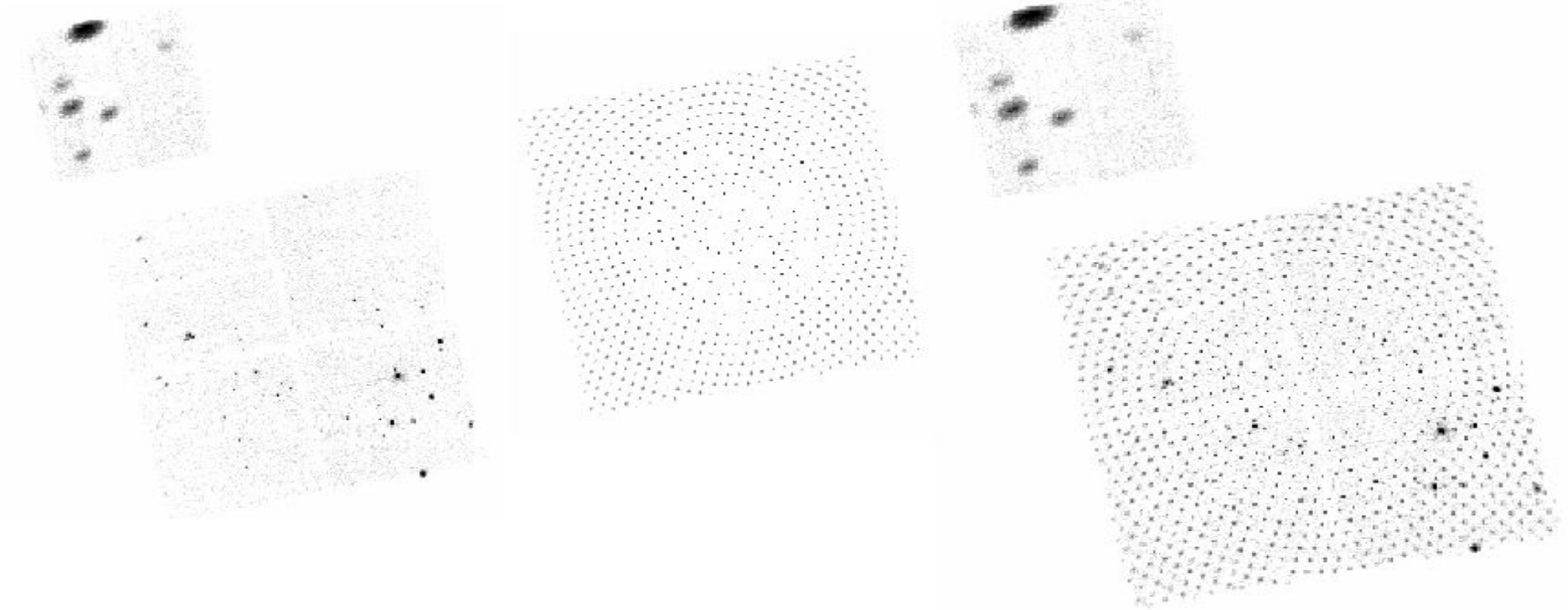
New method (below) is scale free and has no discontinuities; figure shows 1000 simulated 150-count sources (blue line) and nominal SAOSAC PSF extent (red). Method post-processes wavdetect source regions, maximizing correlation with an elliptical wavelet

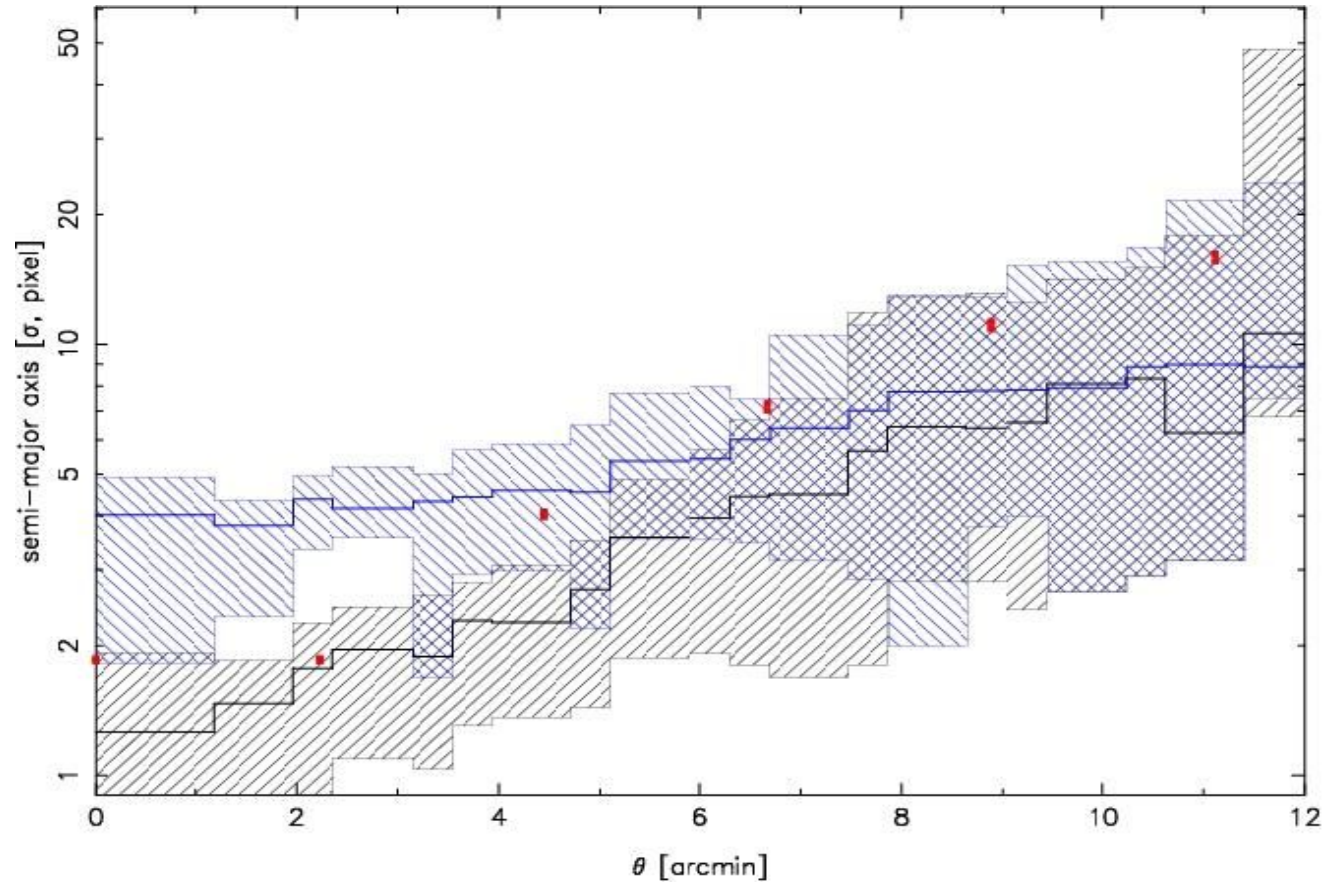
obsid 635 ACS-01236 [100.68 ksec]



Source extent evaluation – John Houck

$$\textit{Data} + \textit{MARX Simulation} = \textit{Test Data}$$





Black line: point sources with 35 counts

Blue line: 2" radius disks with 35 counts

Hatched regions give stat uncertainty range

Distinguishable within 5' off-axis