

Chandra Calibration Workshop      2002-Nov-06

## Chandra Aspect

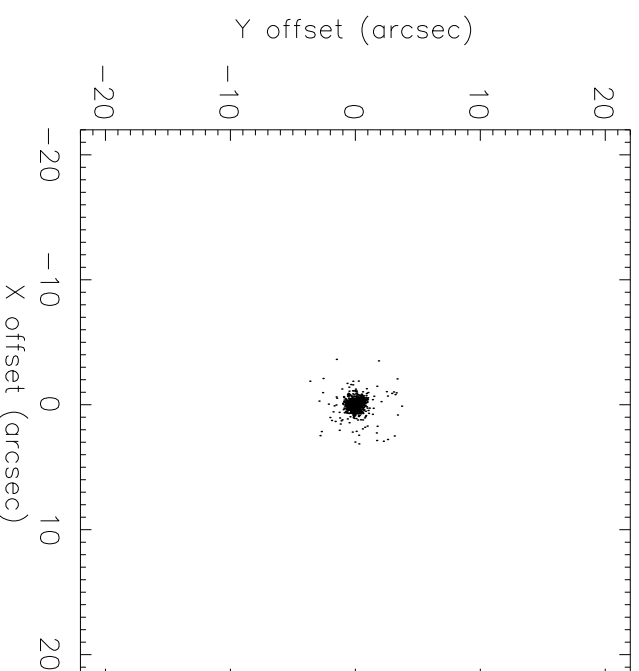
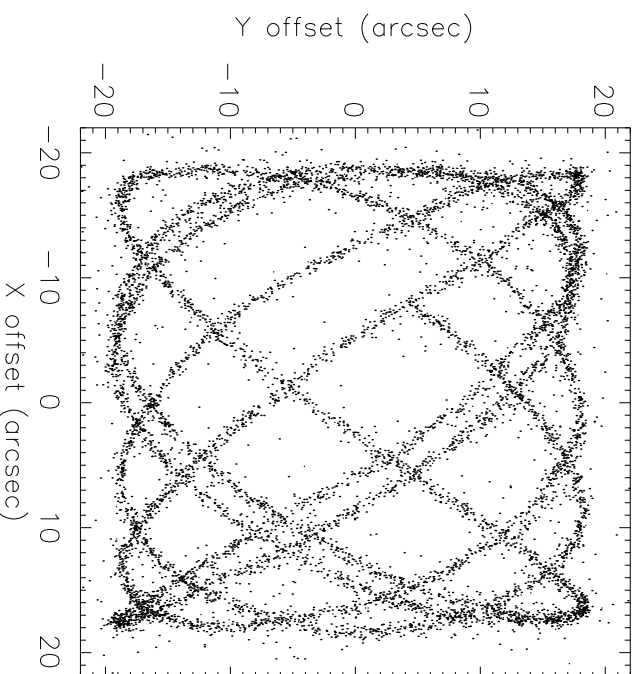
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With contributions from:

Rob Cameron	Margarita Karovska
David Morris	Brett Unks
Mark Cresitello-Dittmar	Maxim Markevitich
Dan Schwartz	TRW/FOOT

## Chandra Aspect

- Aspect solution is a time history of the exact pointing attitude and spacecraft alignment
- Allows conversion from detector pixel coordinate to sky position (RA,Dec), as well as construction of exposure maps



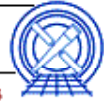
## Resources

Aspect chapter of Proposers Observatory Guide – Description of hardware, aspect processing and products, and operations

Aspect Information page – <http://cxc.harvard.edu/cal/ASPECT/>  
Contains latest information on caveats, calibration, and aspect performance.

Caveats – [http://cxc.harvard.edu/cal/ASPECT/aspect\\_caveats.html](http://cxc.harvard.edu/cal/ASPECT/aspect_caveats.html)

Help desk



# Chandra Aspect

## Absolute astrometry

- Current absolute astrometric accuracy
- Thread to detect and fix aspect offsets
- High-precision astrometry and image reconstruction with Chandra
- Plate scale and relative chip (plate) positions

## General aspect help / information

- Align event files
- ACIS pile-up mimicking bad aspect
- Image reconstruction performance
- CXC aspect processing caveats
- Chandra absolute pointing accuracy

## Papers

15-Nov-00	Kalman filtering in Chandra Aspect Determination (ADASS Poster)	Postscript PDF Poster
27-Mar-00	Initial performance of the aspect system on the Chandra Observatory: Post-facto aspect reconstruction	Postscript PDF
27-Mar-00	Initial performance of the attitude control and aspect determination sub-systems on the Chandra Observatory	Postscript PDF

## Technical notes and Talks

- CIAO workshop aspect viewgraphs
- Chandra Calibration Review: Aspect
- CXC internal aspect page

## Calibration and Performance

- Image reconstruction

([http://cxc.harvard.edu/cal/ASPECT/img\\_recon/report.html](http://cxc.harvard.edu/cal/ASPECT/img_recon/report.html))

Measures the effective blurring of the X-ray PSF due to aspect reconstruction. Latest analysis shows aspect reconstruction introduces an almost negligible blurring, equivalent to a gaussian sigma of less than 0.1 arcsec.

- Celestial location

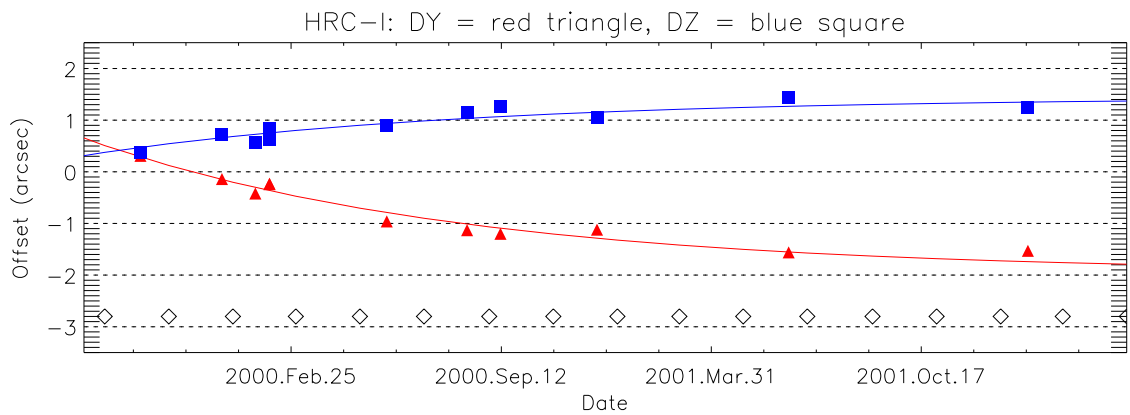
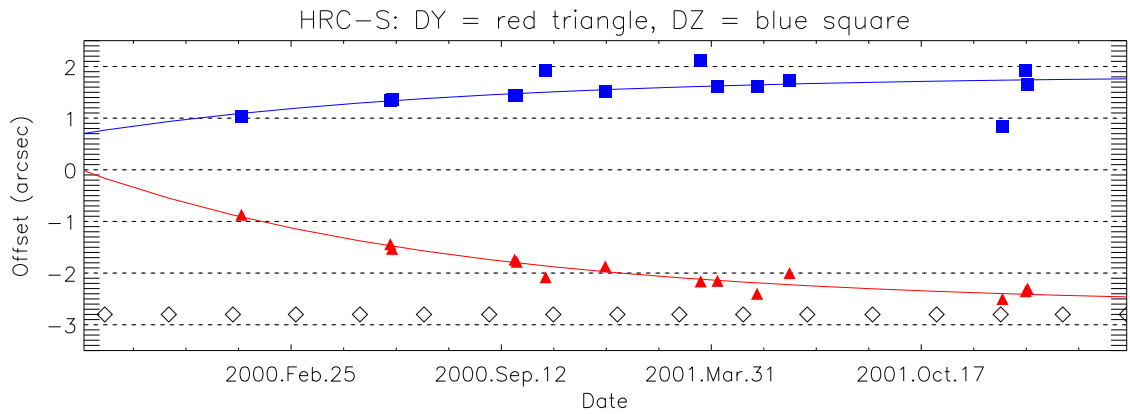
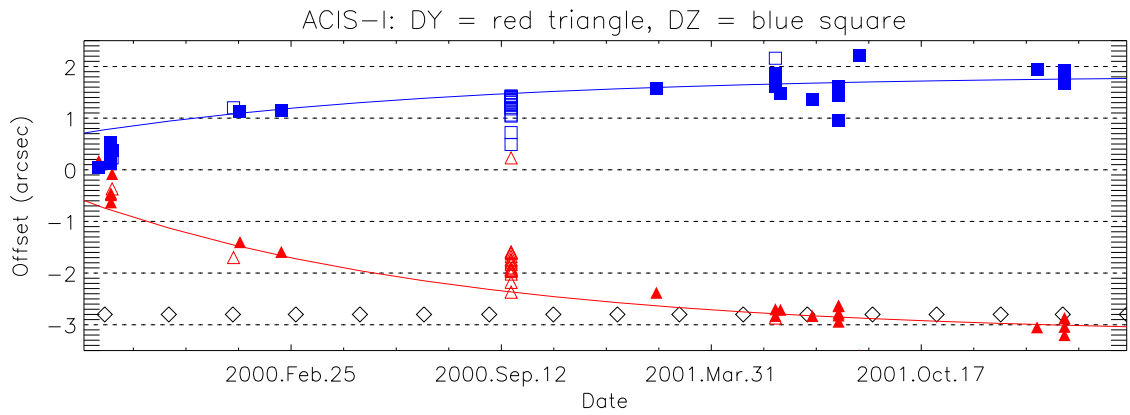
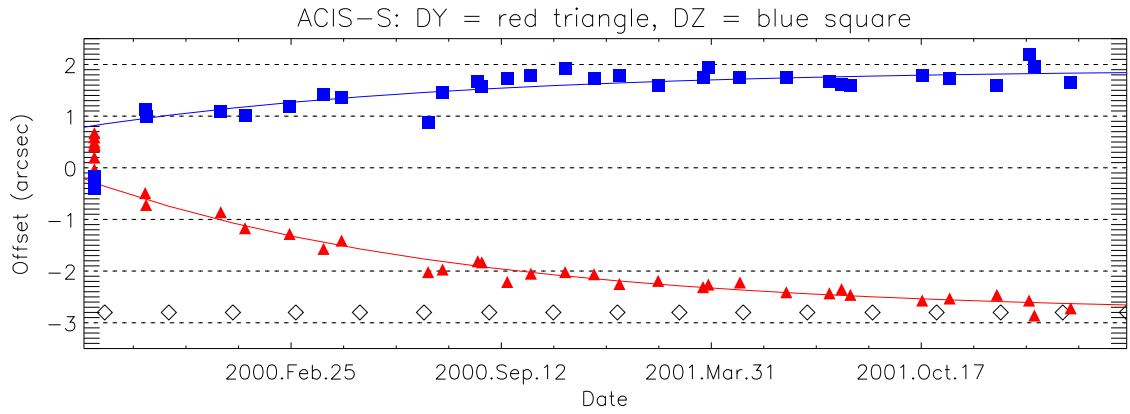
(<http://cxc.harvard.edu/cal/ASPECT/ce1mon/>)

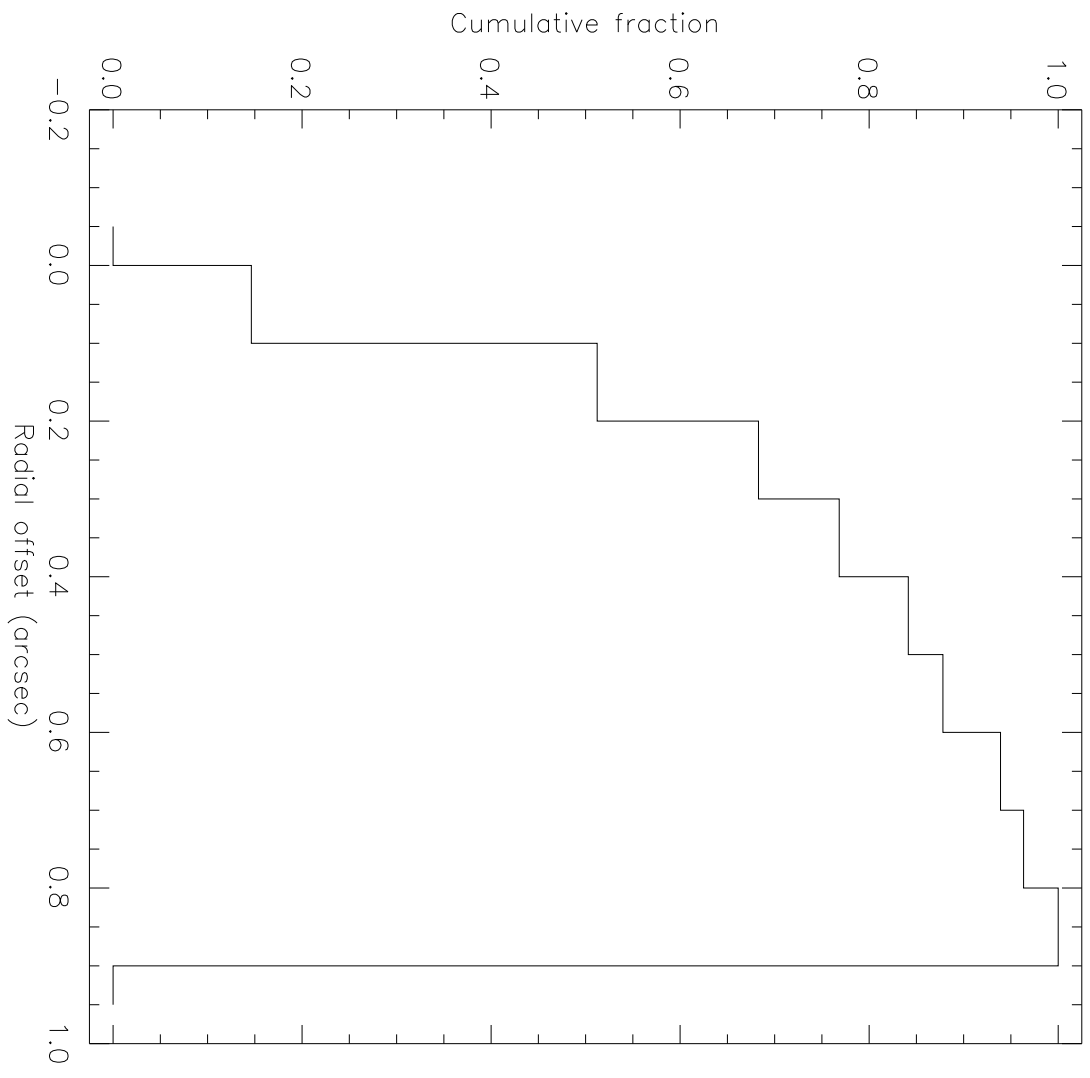
Measures absolute accuracy of Chandra X-ray source locations. Based on observations of point sources with accurately known coordinates, the source location error circle (90%) has a radius of 0.6 arcsec.

**CAVEAT:** Offsets exist in some observations. A tool has been developed to easily correct these offsets. See CIAO thread: [http://cxc.harvard.edu/ciao/threads/arcsec\\_correction/](http://cxc.harvard.edu/ciao/threads/arcsec_correction/)

## Celestial location calibration

- A select set of observations were reprocessed with alignment files from early in the mission.
  - Moderately bright (but not piled) point sources with accurate optical astrometry.
  - Observed at the nominal SIM-Z position
  - within 2 arcmin of the HRMA optical axis, with most being observed on-axis.
- Your mileage may vary:
  - Observations at large off-nominal SIM-Z can suffer additional residual aspect offsets of up to 1 arcsec.
  - Sources at HRMA off-axis angles greater than  $\sim 3$  arcmin may have additional offsets due to PSF blurring and asymmetry, and plate scale uncertainties (see “Plate scale and relative chip (plate) positions” page)





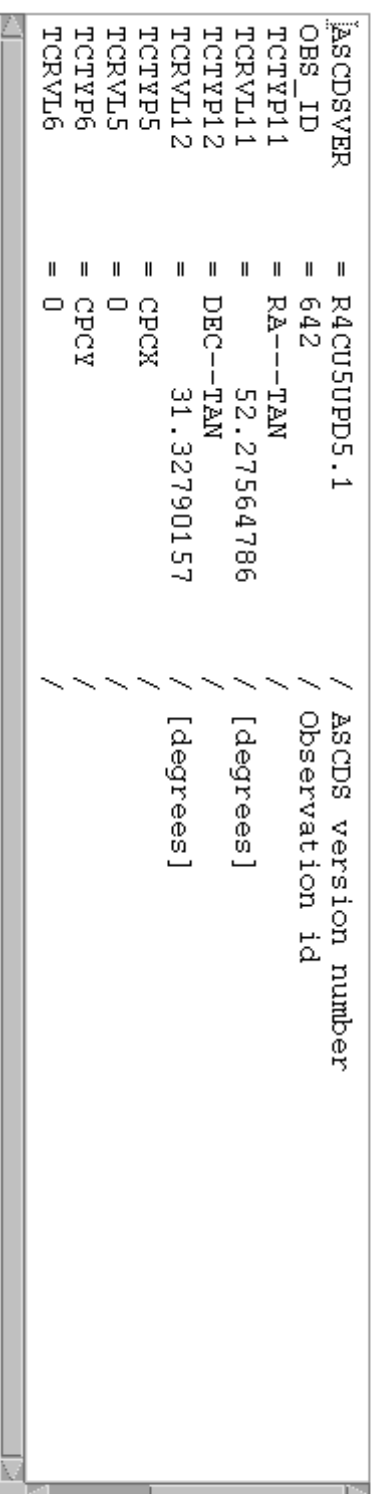




## Fix aspect offset

1. Copy your event file (*evt\_file*) to what will be the new aspect-corrected version
  - o If the file is unzipped already
    - cp *evt\_file* aspcorr\_evt2.fits
    - o If the file is zipped
      - gunzip --stdout *evt\_file* > aspcorr\_evt2.fits
      - o If you only want the central 1.0 arcminute
        - dmcopy "*evt\_file*[events][sky=circle(4096,4096,1.0)"] aspcorr\_evt2.fits
2. In the text box below, cut and paste below the results of doing:

```
dmhist aspcorr_evt2.fits header,raw,clean | egrep '(TCTYP|TCRVL|ASCDSVER|OBS_ID)'
```



Submit Query





## Fix aspect offset

Cut and paste the following commands to fix the event file aspcorr\_evt2.fits

```
punlearn dmhedit
dmhedit infile=aspcorr_evt2.fits filelist=none operation=add \
unit=degrees key=TCRVL11 value=189.211101504764
dmhedit infile=aspcorr_evt2.fits filelist=none operation=add \
unit=degrees key=TCRVL12 value=62.22975563905
dmhedit infile=aspcorr_evt2.fits filelist=none operation=add \
unit=degrees key=RA_NOM value=189.211101504764
dmhedit infile=aspcorr_evt2.fits filelist=none operation=add \
unit=degrees key=DEC_NOM value=62.22975563905
```



## Improving absolute astrometry

- Improved celestial location precision is possible for some observations by cross-correlating detected X-ray sources with high-precision optical, IR, or radio catalogs.
- This technique has been used to achieve absolute astrometry accurate to  $\pm 0.3$  arcsec (90% confidence, Sgr A\* field),  $\pm 0.15$  arcsec (Hubble Deep Field), and  $\pm 0.1$  arcsec (Orion Nebula cluster).
- Details available in CIAO thread:

[http://cxc.harvard.edu/ciao/threads/arcsec\\_correction/](http://cxc.harvard.edu/ciao/threads/arcsec_correction/)