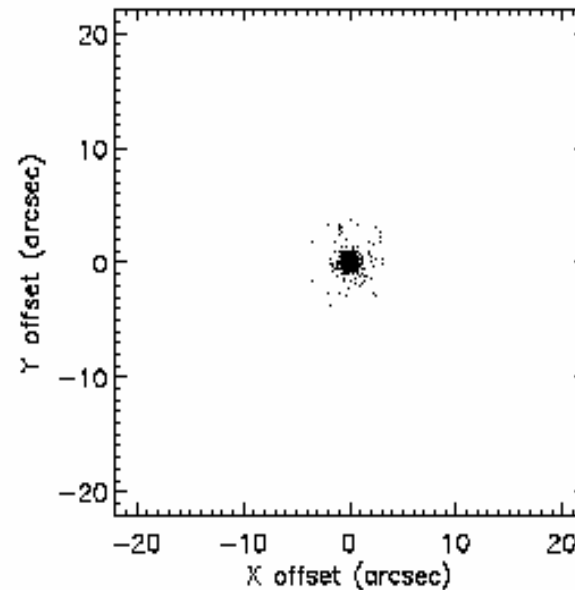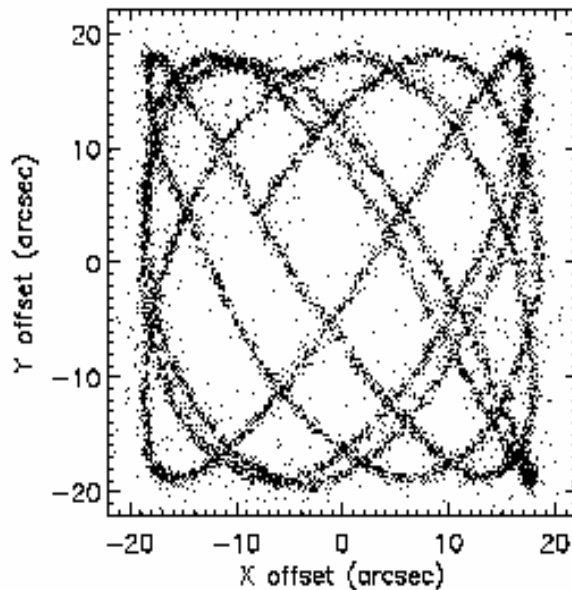# Aspect Issues

Tom Aldcroft

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`

Help desk

Chandra X-ray Center

About Chandra | Archive | Proposer | Instruments & Calibration
Data Analysis | Newsletters | HelpDesk | Calibration Database

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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

20-Jun-02	Stellar Photometry using the Chandra Aspect Camera (AAS poster)	Postscript
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

- Chandra Calibration Workshop: Aspect viewgraphs (2002-Nov)
- CIAO workshop aspect viewgraphs
- Chandra Calibration Review: Aspect
- Long term spacecraft alignment drift
- CXC internal aspect page

Calibration and Performance

- **Image reconstruction**

  `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 0.07 arcsec.

- **Celestial location**

 `http://cxc.harvard.edu/cal/ASPECT/celmon/`

  Measures absolute accuracy of Chandra X-ray source locations. Based on observations of point sources within 2' with accurately known coordinates

  Source location 90% error circle has a radius of 0.64 arcsec.

  CAVEAT: To achieve this level of accuracy one must follow the thread described in the next slide

Distribution of Aspect Offsets
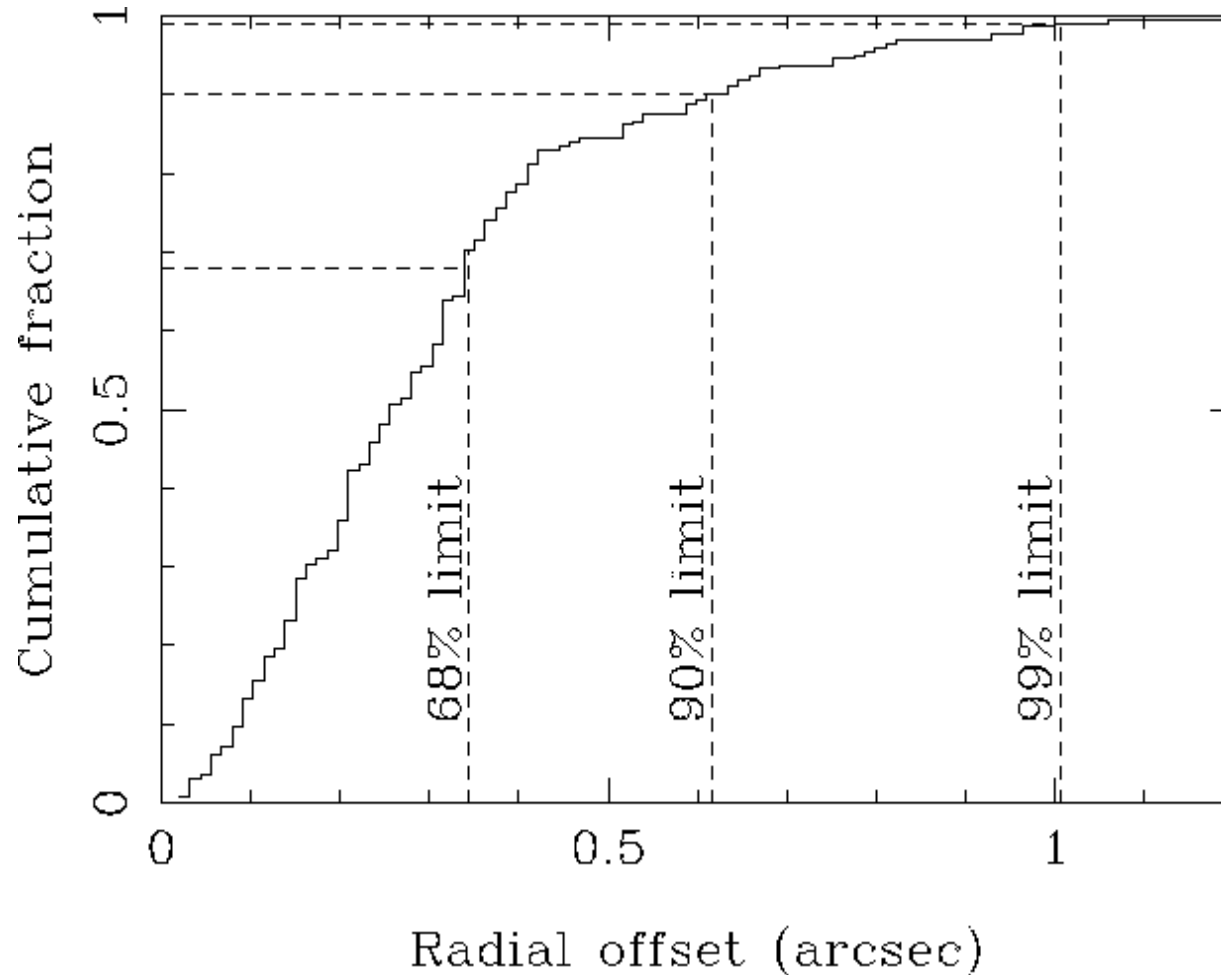
Improving Astrometry of your Data

- *Chandra data in archive frequently have aspect offsets up to 2" due to uncertainties in boresight calibration at time of processing*

- *If astrometry is a concern, ALWAYS follow the "Improving Astrometry of your Data" thread for each observation:*

  http://cxc.harvard.edu/ciao/threads/arcsec_correction/

- *Thread uses a web-based tool to compare calibration data used for processing to current (best) calibration and produces simple* **dmhedit** *commands that modify the coordinate kewords in event file*

- *Following this thread will give absolute coordinates good to 0.6" (90%)*

- *A perl script is available to facilitate batch mode correction of many obsids*

  http://cxc.harvard.edu/cal/ASPECT/fix_offset/fix_offset.cgi

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 even more

- 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 +/-0.3 arcsec (90% confidence, Sgr A* field), +/-0.15 arcsec (Hubble Deep Field), and +/-0.1 arcsec (Orion Nebula cluster).

- Details available:

  `http://cxc.harvard.edu/ciao/threads/arcsec_correction.thread.html`
  `http://cxc.harvard.edu/cal/ASPECT/improve_astrometry.html`