



## CIAO 2.2.1 Threads

[http://cxc.harvard.edu/ciao/documents\\_threads.html](http://cxc.harvard.edu/ciao/documents_threads.html)

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**"Threads" are processing recipes.** They are designed to teach users by leading, step-by-step, through a procedure. Ranging from basic (downloading data) to complex (multi-chip exposure map), each describes the process in the same easy-to-use manner. If you do not find what you are looking for below, try using CIAO's ahelp system (e.g. while running CIAO, type "about" and the subject in which you are interested).

There are currently eight subject categories:

- Introduction
- Data Preparation
- Timing
- Imaging
- Imaging Spectroscopy
- Grating Spectroscopy
- *Sherpa*
- *S-Lang*

Within each category, threads are grouped by instrument (ACIS, HRC) and/or task (making exposure maps, fitting grating data).

Some threads have been made more automated in the form of scripts. Visit the CIAO scripts page ([http://cxc.harvard.edu/ciao/download\\_scripts.html](http://cxc.harvard.edu/ciao/download_scripts.html)) for a more complete description and list of scripts. The threads also contain cross-links to the relevant scripts.

The following threads are designed to work with processing versions later than R4CU5UPD8 or DS6.0.0. Nearly all Chandra data available satisfies this criterion; see the Note on Processing Versions (<http://cxc.harvard.edu/ciao/threads/reprocessed/>) for more information.

Additionally, all the threads are now available in PDF format so that a hardcopy may be created. Click on the link beside the thread ([L][A4]) to download a letter or A4-size document.

- Introduction (Beginners should start **HERE**)
  - How To Download Chandra Data From The Archive [L][A4]
  - See the Data Products Guide for a detailed description of the general content of Chandra data.
  - A Note on Processing Versions [L][A4]
  - A Note on Filenames & Directories [L][A4]
  - CIAO:
    - Introduction to CIAO [L][A4]
    - Starting CIAO [L][A4]
  - Introduction to the Data Model [L][A4]
  - Introduction to Firstlook [L][A4]
  - Introduction to Prism [L][A4]
  - Introduction to ChIPS [L][A4]
  - Introduction to Toolagent [L][A4]
  - Using CIAO Region Files [L][A4]
  - Using SAOImage ds9 [L][A4]
  - A **Complete List** of CIAO tools can be found at the Introduction to Tools page.  
If you are looking for a general topic, try the CXC Search [▶](#), at the top of the page.
  
- Data Preparation
  - See the current Calibration Status Report [▶](#)
  - General:
    - Use Observation-specific Bad Pixel Files [L][A4]  
See also: the `acis_set_ardlib` script
    - Filtering Data [L][A4]
    - Filtering Light Curves [L][A4]  
See also: the `analyze_1tcrv.sl` S-Lang script
    - Create a New Level=2 Events File [L][A4]
  - Coordinates, Astrometry, & Spatial Filtering:
    - Use the New `geom.par` File [L][A4]
    - Improving the astrometry of your data [L][A4]
    - Creating Accurate RA, Dec Coordinates for `src2` Files [L][A4]
    - Using CIAO Region Files [L][A4]
    - How To Restore WCS Info To Images [L][A4]  
See also: the `wscopy` script
  - ACIS:
    - Check the ACIS Data Caveats
    - A Note on CC-mode Observations [L][A4]
    - `acis_process_events`:
      - Apply an ACIS Gain Map [L][A4]
      - Remove ACIS Pixel Randomization [L][A4]

- Apply/Remove ACIS PHA Randomization [L][A4]
      - Clean ACIS Background in VFaint Mode [L][A4]
      - Caveat for acis\_process\_events & Level=2 Event Files [L][A4]
    - ACIS Background Subtraction (Blank-Sky Files) [L][A4]  
See also: the `acis_bkgrnd_lookup` script ; the `lc_clean.sl` S-Lang script
    - Remove the acis\_detect\_afterglow Correction [L][A4]
    - Use Optional ACIS vN0004 QE File [L][A4]
    - Destreak the ACIS-S4 Chip [L][A4]
  - HRC:
    - HRC-I Degap Correction [L][A4]
    - HRC-S Degap Correction [L][A4]
- Timing Analysis
  - A Note on CC-mode Observations [L][A4]
  - Apply Barycenter Correction [L][A4]
  - Create a Phase-binned Spectrum [L][A4]
  - Analysing light curves
    - Lightcurve: Use and Caveats [L][A4]
    - Filtering Light Curves [L][A4]  
See also: the `analyze_ltrcv.sl` S-Lang script
- Imaging
  - Using SAOImage ds9 [L][A4]
  - How To Match the Binning of an Image [L][A4]  
See also: the `get_sky_limits.tar` script package
  - Combining Data from Multiple Imaging Observations [L][A4]  
See also: the `combine_obsid` script
  - Create A True Color Image [L][A4]  
See also: the `color_image` script
  - Create an Image of Diffuse Emission [L][A4]  
See also: the `diff_scripts.tar` script package; the `merge_all.tar` script package
  - Estimate Source Counts in an Image [L][A4]
  - Obtain and Fit a Radial Profile [L][A4]
  - Create a PSF [L][A4]
  - Detecting Sources in Imaging Observations [L][A4]
  - Exposure Maps:
    - Compute an HRC-I Exposure Map and Build Fluxed Image [L][A4]
    - Use `merge_all` Script to Compute ACIS Exposure Maps and Fluxed Images [L][A4]  
See also: the `merge_all.tar` script package
    - Compute Single Chip ACIS Exposure Map and Fluxed Image Step-by-Step [L][A4]
    - Compute Multiple Chip ACIS Exposure Map and Fluxed Image Step-by-Step [L][A4]
    - Calculating Spectral Weights [L][A4]  
See also: the `spectrum.sl` S-Lang script

- Calculating Statistics of Images [L][A4]  
See also: the `sstats.sl` S-Lang script
- Reprojecting Coordinates of a Solar System Object [L][A4]
- Notes on Chandra Astrometric Accuracy ▶
- Imaging Spectroscopy
  - Extract ACIS Spectra for Pointlike Sources and Make RMFs and ARFs [L][A4]
  - Extract ACIS Spectra for Pointlike Sources and Make RMFs and ARFs Step-by-Step [L][A4]
  - A Note on HRC Spectra [L][A4]
  - Weighting ARFs and RMFs:
    - Weighting ARFs and RMFs: multiple sources [L][A4]  
See also: the `show_wgt.sl` S-Lang script
  - Change the Grouping Scheme of a Previously-grouped PHA File [L][A4]
  - Displaying the FEF Regions Covered by a Source [L][A4]  
See also: the `regions.sl` S-Lang script
- Grating Spectroscopy
  - Visit the Chandra Grating Analysis Page ▶
  - Visit CIAO's spectroscopic library, the ATOMDB ▶
  - Examining PHA2 Files [L][A4]
  - Correcting PHA2 Header Keywords [L][A4]
  - Change the Grouping Scheme of a Previously-grouped PHA File [L][A4]
  - Correct tgdetect Source List [L][A4]
  - ACIS:
    - Obtain Grating Spectra from HETG/ACIS-S Data [L][A4]
    - Obtain Grating Spectra from LETG/ACIS Data [L][A4]
    - Obtain Grating Spectra for Multiple Sources - ACIS [L][A4]
    - Create Grating RMFs for ACIS-S Observations [L][A4]
    - Compute HETG/ACIS-S Grating ARFs [L][A4]  
See also: the `fullgarf.tar` script package
    - Compute LETG/ACIS-S Grating ARFs [L][A4]  
See also: the `fullgarf.tar` script package
  - HRC:
    - Obtain Grating Spectra from LETG/HRC-S Data [L][A4]
    - Obtain Grating Spectra from LETG/HRC-I Data [L][A4]
    - Obtain Grating Spectra for Multiple Sources - HRC [L][A4]
    - Create Grating RMFs for HRC-S Observations [L][A4]
    - Compute LETG/HRC-S Grating ARFs [L][A4]  
See also: the `fullgarf.tar` script package
    - Compute LETG/HRC-I Grating ARFs [L][A4]

- Fitting Grating Data in Sherpa [L][A4]
  - Create PHA Background File for Use in XSPEC [L][A4]
    - See also: the `tg_bkg` script
  - GUIDE: Fitting and Identifying Spectral Lines [L][A4]
  - Extract Coadded and Grouped Nth-Order Source & Background Spectra and ARFs [L][A4]
  - Add Grating Spectra and Average ARFs [L][A4]
  - Create A Color Spectrum [L][A4]
- *Sherpa*
    - General:
      - Sherpa Usage Overview [L][A4]
      - Sherpa Threads: Getting Started [L][A4]
      - Introducing Sherpa: ASCII Data, Errors, and Single-Component Source Models [L][A4]
      - Sherpa Data Visualization [L][A4]
      - Customizing Sherpa plots [L][A4]
      - Visit the The Harvard-CfA Astronomy and Statistics [page](#)
    - 1-D Data:
      - Fitting Spectral Data: PHA Data & Responses and Multi-Component Source Models [L][A4]
      - Fitting Spectral Data: With/Without Independent Background Responses [L][A4]
      - Fitting Spectral Data: Simultaneously Fitting Two Datasets [L][A4]
      - Refining A LEVENBERG-MARQUARDT Fit With SIMPLEX [L][A4]
      - Simulating 1-D Data: The Sherpa FAKEIT Command [L][A4]
      - Analysing sources affected by pile-up
        - Fitting Spectral Data: Using A Pileup Model [L][A4]
        - A comparison, for low pileup fractions, of the pileup models [in Sherpa](#) and Xspec with that in ISIS.
    - 2-D Data:
      - Fitting Spatial (2-D) Data: FITS Image Data and Multi-Component Source Model
      - Fitting Spatial (2-D) Data: Using an Exposure Map [L][A4]
      - Fitting 2-D Image Data: Using A PSF Image As The Convolution Kernel [L][A4]
    - Grating Data:
      - Fitting Grating Data in Sherpa [L][A4]
      - GUIDE: Fitting and Identifying Spectral Lines [L][A4]
  - *S-Lang*
    - CIAO and S-Lang [L][A4]
    - Customizing Sherpa plots [L][A4]