



# CIAO 2.2 Tools & Applications

[cxc.harvard.edu/ciao/intro\\_tools.html](http://cxc.harvard.edu/ciao/intro_tools.html)

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## Chandra Instrument Tools

acis_detect_afterglow	Identify and flag cosmic ray afterglows
acis_fef_lookup §	Determine the FEF file and filter needed for a source position
acis_process_events	Produce/update ACIS coordinates, PI, GRADE, STATUS, etc.
acisreadcorr *	Flag out-of-time events from a bright source
add_grating_orders §	Add together spectra from different grating orders
add_grating_spectra §	Add together grating spectra (e.g. MEG * HEG)
asp_apply_sim +	Add the SIM offsets to the optical axis offsets
asp_calc_offsets +	Compute offsets from nominal pointing
asphist *	Bin the aspect into a 3D histogram of duration vs pointing
destreak	Identify/remove "streak" events that are generated by noise in the electronics
hrc_process_events	Correct HRC event positions, times, PHA, gain, etc.
psextract §	Extract the spectra and compute the arf and rmf for a given source region
tg_create_mask	Create a region file to define spectrum sky boundaries
tgdetect	Locate 0-order in image
tgextract	Extract the grating spectrum (wavelengths or energy)
tg_resolve_events	Assign grating coordinates (dispersion distance) & order sorting

## Instrument Response Tools

mkarf	Generate an ARF for Chandra images
mkexpmap	Generate a Chandra imaging effective exposure map
mkgarf	Generate a Chandra Grating ARF for one detector element
mkinstmap	Generate a Chandra instrument map (area vs. position)
mkpsf	Extract a point spread function (PSF) image
mkgrmf *	Create an OGIP-style RMF appropriate for spectral analysis of grating observations
mkrmf	Create RMF from a FEF file on a given 2D grid plane
mkwarf *	Create an ARF representing an extended source or multiple sources
rmfimg *	Turn an RMF into a 2D image that includes WCS information

## Source Detection

celldetect	Use an adaptive "sliding cell" to search for sources
vtpdetect	Voronoi Tessellation and Percolation (VTP) source detection
wavdetect	Mexican-Hat Wavelet source detection (wtransform*wrecon)

## Data Model Tools

dmappend	Append multiple blocks/extensions to an existing output file
dmarfadd	Add multiple ARF files together weighting by exposure
dmcontour	Make contour regions from a 2D image

dmcoords	Operate on Chandra coordinate systems
dmcopv	Filter and bin tables and images
dmextract	Make a histogram table file (e.g. PHA file) from a table
dmfilth *	"FILl in The Hole"; create background maps by excluding source regions from the image
dmgroup	Group a specified column in a table, with various options
dmgti	Create a Good Time Interval from input Mission Time Line
dmhedit	Edit datamodel file headers
dmimg2jpg	Make color JPEG image (or EPS) from three image files
dmimgcalc	Perform arithmetic on images
dmimghist	Make histogram of values in a 2D image
dmimgthresh *	Set all values in an image above/below a certain limit to a new value
dmjoin *	Join two files whose sampling is different
dmkeypar	Retrieve information about a header keyword
dmllst	List contents or structure of a file
dmmakepar	Write header keywords to a parameter file
dmmakereg *	Convert a region string to a CXC FITS region file
dmmerge	Merge two or more compatible tables into one
dmpaste	Add new columns to a table
dmreadpar	Add parameters from a .par file to a dm compatible file header
dmregrid	Rebin a stack of 2 dimensional images
dmsort	Sort a table
dmstat	Compute centroid, means, median, sigma, total
dmtcalc	Define new table columns as functions of old ones
dmtree2split	Create a type 1 output file for specified rows of a type 2 file
reproject_events *	Regrid an event file (or stack)to a common tangent point

## Miscellaneous Analysis

aconvolve	Convolve an N-Dimensional image
acrosscorr	Compute auto or cross correlation of images
apowerspectrum	Compute power spectrum of an N-Dimensional image
axbary	Compute barycentric corrections to event times, GTI and headers
csmooth	Adaptively smooth a 2D image
get_src_region	Output regions that have counts higher than background
lightcurve	Bin source and background events by specified time interval
sso_freeze	Generate a set of coordinates that is centered on the moving target

## Parameter File Tools

paccess	Identify location of parameter file
pdump	List command line sequence of parameter values, one parameter per line
pget	Get parameter file value(s)
pline	List command line sequence of parameter values
plist	List parameter file values
pquery	Simulate parameter interface querying mechanism (useful for scripts)
pset	Get parameter file value(s)

## Stack Tools

stk\_build      Expand a stack listing  
stk\_count      Count the number of entries in a stack  
stk\_read\_num   Return the n-th element in a stack

## Applications

chips          Generic plotting package  
filtwin        Interactive filter tool and launch pad for data analysis  
firstlook      Quick access to Chandra datasets  
guide          Sherpa plug-in to analyze spectral data  
prism \*        Graphical file browser with editing capabilities  
sherpa \*       1D & 2D modeling and fitting application  
taskmonitor   Display/log output when command-line tools are run from a GUI  
toolagent      Set the parameters of a CIAO tool before running it from a GUI

\* - new or significantly improved in CIAO 2.2

§ - “tool-like” scripts that are now included in the standard CIAO distribution

+ - included in CIAO 2.2, but no longer needed due to enhancements in asphist

- All tools take advantage of the data model I/O layer which provides advanced filtering and history (aka subspace) mechanisms.
- The applications chips and sherpa provide the scripting power of S-Lang to the users. This allows for arbitrary manipulation (and creation!) during the analysis session.
- The various GUIs also share a common session thread that allows users to save and restore entire data analysis sessions. These sessions can also be shared between investigators at different institutes.

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