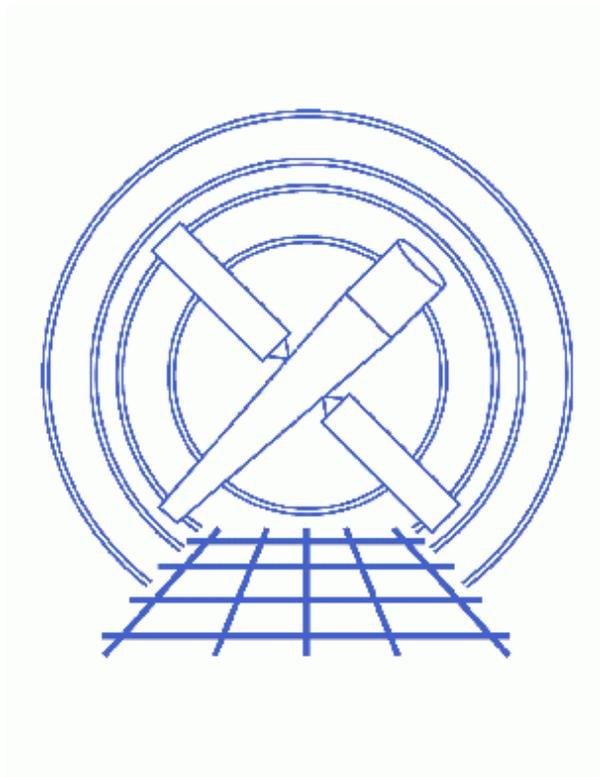


# Obtain Grating Spectra from HETG/ACIS-S Data



## ***CIAO 3.4 Science Threads***

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# Obtain Grating Spectra from HETG/ACIS–S Data

*CIAO 3.4 Science Threads*

## Overview

**Last Update:** 18 Dec 2006 – updated for CIAO 3.4: new calibration files in CALDB 3.3.0; change to wording of tgdetect/dmcopy warning

### Synopsis:

Generate a new PHA2 spectrum file for any HETG/ACIS–S grating observation. The option to destreak the data is included; the destreak tool became part of standard data processing at software version DS 7.3.0.

In CIAO 3.1, the default `rand_pix_size` in `tg_resolve_events` was changed to zero, meaning that randomization is not applied to the coordinate computations. For users whose science requires the improved spectral resolution for resolving line blends or detection of weak features, we recommend reprocessing older data without randomization. (Fluxes of relatively isolated lines are not affected.)

### Purpose:

To ensure that consistent calibration is used throughout the analysis.

### Read this thread if:

you are working with an ACIS/HETG dataset affected by the Calibration Updates. Even if your observation was processed with the newest calibration, you may still wish to complete the last two steps of this thread to destreak the level=2 event file obtained from the pipeline and extract a cleaner spectrum.

### Calibration Updates:

Get Started shows how to check the CALDB version used in processing your data.

- **CALDB v3.3.0** (18 Dec 2006): New OSIP files were added to the CALDB. The new OSIPs include the corrected gain function for ACIS–S1, which has been in the CALDB for some time. They also accurately specify the FRACEXPO column in the output gARF. The How CIAO 3.4 and CALDB 3.3.0 Affect Your Analysis section of the CIAO release notes explains how the files will affect your analysis.
- **CALDB v2.26** (2 Feb 2004): A new OSIP file was added to avoid significant clipping of the negative grating orders, which was present in the previous versions. The new file affects **–110 C data only**; this FAQ shows how to find the focal plane temperature of an observation. Running this thread will apply the new calibration file to the data.
- **CALDB v2.8** (13 Sep 2001): New OSIP files make it possible to analyze –120 degrees S3 grating data with the gainmaps and FEFs that were in the previous CALDB release. If you are working with an observation taken under these conditions, run the Apply an ACIS Gain Map thread before running this thread.
- **CALDB v1.8.1** (7 Dec 2000): New (corrected) order–sorting tables were added to the processing CALDB.

**Related Links:**

- [Analysis Guide for Chandra High Resolution Spectroscopy](#): an in–depth discussion of grating analysis.
- [Continuous Clocking Mode why topic](#): additional information for users working with CC–mode data.
- Why topic: [Desteaking ACIS Data](#)

Proceed to the [HTML](#) or [hardcopy \(PDF: \[A4\]\(#\) / \[letter\]\(#\)\)](#) version of the thread.

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## Data Preparation

This analysis thread starts with the level 1 event file. Before beginning, users may wish to reprocess the data to create a new event file with the most recent calibration applied. Instructions on how to reprocess your data are available in the [ACIS Data Preparation Analysis Guide](#).

If your data was processed with a software version *lower than* DS 7.4.0, it is recommended that you [remove the acis\\_detect\\_afterglow correction](#) and reprocess the data with a [new bad pixel file](#) before running this thread.

[Get Started](#) shows how to check the software version used in processing your data.

---

## Get Started

**Sample ObsID used:** 459 (HETG/ACIS–S, 3C 273)

**File types needed:** evt1; flt1; asol1

In this thread, we assume that all relevant files are in the same working directory.

Check the CALDBVER keyword in the header:

```
unix% dmkeypar acisf00459_000N002_evt1.fits CALDBVER echo+
1.6
```

Since this data was processed with a CALDBVER lower than 1.8.1, we need to complete this thread in its entirety.

To see which processing version was used on the data:

```
unix% dmkeypar acisf00459_000N002_evt1.fits ASCDSVER echo+
R4CU5UPD11.1
```

This observation was also processed before `destreak` became part of SDP, i.e. the ASCDSVER is lower than DS 7.3.0. Note that the [version naming convention](#) changed after version R4CU5UPD14 to the "DS" system, starting with DS 6.0.0.

If your data was processed with at least CALDB v1.8.1 but you wish to `destreak` the level=2 event file obtained from the pipeline, skip to the [Run destreak](#) step. Otherwise you do not need to run this thread at all and can go

directly to the [Create Grating RMFs for ACIS-S Observations](#) thread.

## Generate A New Level=1.5 Event File

### 1. Get position of zero-order image (tgdetect)

To find the zero-order location, the tool `tgdetect` is run:

```
unix% punlearn tgdetect
unix% pset tgdetect infile=acisf00459_000N002_evt1.fits
unix% pset tgdetect outfile=acis_459_srcla.fits
unix% tgdetect
Input L1 event file (acisf00459_000N002_evt1.fits):
Input source position(s) file from previous OBI or NONE (NONE):
Output source position(s) file name (root_srcla.fits) (acis_459_srcla.fits):

# DMCOPY (CIAO 3.4): Bad data type in filter string formatting
```

The warning may be ignored; it is due to a minor bug in the Data Model and does not affect the output of `tgdetect`.

The contents of the parameter file may be checked using `plist tgdetect`.

The source list may be viewed over the event file using `ds9`:

```
unix% ds9 acisf00459_000N002_evt1.fits &
```

Overlay the source list: Region-> Load Regions-> `acis_459_src1a.fits[SRCLIST]`.

The following special cases require manual intervention in order to create a new PHA file. *If these problems affect your data, it will be obvious when the source list is displayed on the event file.*

- If the zero order of the source is outside of the default search area (e.g. *far from the aimpoint*), `tgdetect` will not find it. In this case, run the [Correcting a Misplaced Zero-order Source Position thread](#) to identify the correct source position.
- If the zero-order source is *piled*, there is the potential for the centroid to be incorrect due to the "hole" created in the data. Additionally, the zero-order region may have been *blocked* via on-board software to avoid telemetry problems when observing bright sources. For either of these cases, refer to the [Source Position for Grating Data with a Piled or Blocked Zero Order thread](#) for instructions on how to proceed.

### 2. Get region mask (tg\_create\_mask)

The location of the HEG and MEG "arms" needs to be found next, via the tool `tg_create_mask`. This tool creates a region file, `acis_459_evt1_L1a.fits`, that will be used later to mask the image:

```
unix% punlearn tg_create_mask
unix% pset tg_create_mask infile=acisf00459_000N002_evt1.fits
unix% pset tg_create_mask outfile=acis_459_evt1_L1a.fits
unix% pset tg_create_mask input_pos_tab=acis_459_srcla.fits
unix% tg_create_mask
Input event file or stack (acisf00459_000N002_evt1.fits):
```

```
Output region file or stack (acis_459_evt1_L1a.fits):
Input table with zero order positions or stack (acis_459_srcla.fits):
Observed grating type (header_value|HETG|HEG|MEG|LETG) (HETG|HEG|MEG|LETG|header_value|HEADER_VALUE) (head
```

The contents of the parameter file may be checked using `plist tg_create_mask`.

### 3. Run `tg_resolve_events`

The tool `tg_resolve_events` is now used to assign grating events to spectral orders, using the detector energy resolution for order separation:

```
unix% punlearn tg_resolve_events
unix% pset tg_resolve_events infile=acisf00459_000N002_evt1.fits
unix% pset tg_resolve_events outfile=acis_459_evt1a.fits
unix% pset tg_resolve_events regionfile=acis_459_evt1_L1a.fits
unix% pset tg_resolve_events acaofffile="@pcad_asol1.lis"
unix% tg_resolve_events
Input event file or stack (acisf00459_000N002_evt1.fits):
Input region file or stack (acis_459_evt1_L1a.fits):
Output event file or stack (acis_459_evt1a.fits):
Input aspect offset file (@pcad_asol1.lis):
```

It is important to note several things here:

- In some cases there will be more than one `asol1.fits` file for an observation. *All* the files must be input to the `_acaofffile` parameter *in chronological order* (the time is in the filename, so "ls" lists them in order), either as a comma-separated list or as a stack (see `ahelp stack` for more information). For example, here we used:

```
unix% more pcad_asol1.lis
pcadf063874624N002_asol1.fits
pcadf063875522N002_asol1.fits
pcadf063902942N002_asol1.fits
```

- The tool may issue a warning of this form:

```
# tg_resolve_events (CIAO 3.4): The following error occurred 10000 times:
dsTREUNKNOWNINCOLERR -- WARNING: Not loading data from unrecognized level 1.5 input column.
```

This warning may be ignored, and is explained in [this FAQ](#).

The contents of the parameter file may be checked using `plist tg_resolve_events`.

The created region file, which has been appended to the event file as a block, may be viewed over the event file using `ds9`:

```
unix% ds9 acis_459_evt1a.fits &
```

Overlay the region file that was created by `tg_create_mask` (Region-> Load Regions-> `acis_459_evt1a.fits[REGION]`) and you should see something like [Figure 1](#) .

## Generate A New Level=2 Event File

### 1. Apply grade/status filters (dmcopy)

Filter for bad grades (using ASCA grades) and for bit status:

```
unix% punlearn dmcopy
unix% dmcopy "acis_459_evt1a.fits[EVENTS][grade=0,2,3,4,6,status=0]" \
  acis_459_flt1_evt1a.fits opt=all
```

### 2. Apply GTI filters (dmcopy)

The Good Time Intervals (GTIs) supplied by the pipeline now need to be applied. We simultaneously eliminate an unnecessary column from the output:

```
unix% punlearn dmcopy
unix% dmcopy \
  "acis_459_flt1_evt1a.fits[EVENTS][@acisf00459_000N002_flt1.fits][cols -phas]" \
  acis_459_evt2.fits opt=all
```

Be sure to include the *@symbol* in the filter expression; the command will not be executed properly if it is omitted.

## Run destreak

There is a flaw in the serial readout of the ACIS chips, causing a significant amount of charge to be randomly deposited along pixel rows as they are read out. Although not much coincidence is expected for low-rate/low-exposure sources, ACIS-S4 (ccd\_id=8) is significantly affected by this problem. The destreak tool detects coincidence of events in adjacent pixels along a row, flags probable streak events, and removes them. For details on how the tool works, see the Destreaking ACIS Data why topic.

The streak events are not removed by standard grade, status, or bad pixel filtering, and are therefore still present in the level=2 event file. Figure 2  compares the original level=2 event file (left) and the destreaked version (right).

The ccd\_id parameter should always be set to 8 (the default) to ensure that the destreak algorithm will be applied to the ACIS-S4 chip only. The algorithm should not be applied to chips that do not show streaks like those on ACIS-S4; see ahelp destreak for more information.

```
unix% punlearn destreak
unix% pset destreak infile=acis_459_evt2.fits
unix% pset destreak outfile=acis_459_dstrk_evt2.fits
unix% destreak
Input dataset/block specification (acis_459_evt2.fits):
Output dataset/block specification (acis_459_dstrk_evt2.fits):
```

The contents of the parameter file may be checked using plist destreak.

## Extract a Grating Spectrum (tgextract)

The CIAO tool `tgextract` produces a PHA2 spectrum file from the level=2 event file:

```
unix% punlearn tgextract
unix% pset tgextract infile=acis_459_dstrk_evt2.fits
unix% pset tgextract outfile=acis_459_pha2.fits
unix% tgextract
Input event file (output event file from L1.5 processing) (acis_459_dstrk_evt2.fits):
If typeII, enter full output file name or '.'; if typeI, enter output rootname (acis_459_pha2.fits):
Input ancillary response file name (none):
Input redistribution file name (none):
Source ID's to process: 'all', comma list, @file (all):
Grating parts to process: HETG, HEG, MEG, LETG, header_value (HETG|HEG|MEG|LETG|header_value) (header_valu
Grating diffraction orders to process: 'default', comma list, range list, @file (default):
Output file type: typeI (single spectrum) or typeII (multiple spectra) (pha_typeI|pha_typeII) (pha_typeII):
```

The contents of the parameter file may be checked using `plis tgextract`.

## Summary

This thread is complete; the PHA2 grating spectrum file is named `acis_459_pha2.fits`. You should now proceed to the [Create Grating RMFs for ACIS-S Observations](#) thread.

Parameters for `/home/username/cxcds_param/tgdetect.par`

```
##
## TGDETECT -- Create filter; run celldetect; narrow down detected
##             'zero order' source list; set source id's; match
##             sources to previous OBI source list.
##
## Note: if either "infile" or "OBI_srclist_file" are @lists, only
## the first item on the list is read in; this tool only works on
## one set of input files; if more than one file is listed,
## everything but the first are ignored.
##
      infile = acisf00459_000N002_evt1.fits   Input L1 event file
OBI_srclist_file = NONE                      Input source position(s) file from previous OBI or NONE
      outfile = acis_459_srcla.fits          Output source position(s) file name
#
# output file naming
#
      (temproot = )                          Path and root file name to be given to temporary files
      (keeptemp = no)                        Keep temporary files?
      (keepexit = no)                       Keep exit status file?
#
#
      (zo_pos_x = default)                  Center GZO filter sky X position (default=pixel(ra_nom))
```

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```

    (zo_pos_y = default)      Center GZO filter sky Y position (default=pixel(dec_nom))
    (zo_sz_filt_x = default)  Size of GZO filter in X pixels (ACIS=400; HRC=1800)
    (zo_sz_filt_y = default)  Size of GZO filter in Y pixels (ACIS=400; HRC=1800)
    (snr_thresh = 40)         SNR threshold to select the detected sources
#
#   celldetect parameters
#
    (expstk = none)           list of exposure map files
    (thresh = )celldetect.thresh -> 3) celldetect source threshold
    (ellsigma = 3.0)         Size of output source ellipses (in sigmas)
    (expratio = 0)           cutoff ratio for source cell exposure variation
    (findpeaks = yes)        find local peaks for celldetect
    (celldetect_log = )celldetect.log -> no) make a celldetect log file?
    (psftable = )celldetect.psftable -> /soft/ciao/data/psfsize20010416.fits) table of PSF size data
    (fixedcell = 15)         celldetect fixed cell size to use
    (fixedcell_cc_mode = 15) celldetect fixed cell size to use for CC mode ACIS data
    (bkgfile = none)         background file, for celldetect
    (bkgvalue = )celldetect.bkgvalue -> 0) background count/pixel, for celldetect
    (bkgerrvalue = )celldetect.bkgerrvalue -> 0) background error, for celldetect
    (eband = )celldetect.eband -> 1.4967) energy band, for celldetect
    (eenergy = )celldetect.eenergy -> 0.8) encircled energy of PSF, for celldetect
    (snrfile = none)         celldetect snr output file (for convolution only)
    (convolve = )celldetect.convolve -> no) use convolutions for celldetect
    (xoffset = INDEF)        celldetect offset of x axis from optical axis
    (yoffset = INDEF)        celldetect offset of y axis from optical axis
    (cellfile = none)        output cell size image file
    (centroid = yes)         compute source centroids in celldetection?
#
#   tgidselectsrc parameters
#
    (snr_ratio_limit = )tgidselectsrc.snr_ratio_limit -> 1) Value of SNR ratio to use as lower limit
    (setsrcid = )tgidselectsrc.setsrcid -> yes) Set src ids in output file?
#
#   tgmatsrc parameters
#
    (max_separation = )tgmatsrc.max_separation -> 3) Maximum allowed separation (arcsec) for sources t
#
#
    (clobber = no)           OK to overwrite existing output file(s)?
    (verbose = 0)            Verbosity level (0 = no display)
    (mode = ql)

```

---

Parameters for /home/username/cxcds\_param/tg\_create\_mask.par

```

##
## TG_CREATE_MASK -- Calculates the mask regions of the grating arms
## for AXAF flight L1 grating data files. The output is a region
## file(s) in sky coordinates.
##
    infile = acisf00459_000N002_evt1.fits  Input event file or stack
    outfile = acis_459_evt1_L1a.fits Output region file or stack
    input_pos_tab = acis_459_srcl1a.fits  Input table with zero order positions or stack
    grating_obs = header_value           Observed grating type (header_value|HETG|HEG|MEG|LETG)
    sA_zero_x = 1                        Source A - x position of zero order
    sA_zero_y = 1                        Source A - y position of zero order
    sB_zero_x = 1                        Source B - x position of zero order
    sB_zero_y = 1                        Source B - y position of zero order

```

## Obtain Grating Spectra from HETG/ACIS-S Data – CIAO 3.4

```

sC_zero_x = 1           Source C - x position of zero order
sC_zero_y = 1           Source C - y position of zero order
sD_zero_x = 1           Source D - x position of zero order
sD_zero_y = 1           Source D - y position of zero order
sE_zero_x = 1           Source E - x position of zero order
sE_zero_y = 1           Source E - y position of zero order
sF_zero_x = 1           Source F - x position of zero order
sF_zero_y = 1           Source F - y position of zero order
sG_zero_x = 1           Source G - x position of zero order
sG_zero_y = 1           Source G - y position of zero order
sH_zero_x = 1           Source H - x position of zero order
sH_zero_y = 1           Source H - y position of zero order
sI_zero_x = 1           Source I - x position of zero order
sI_zero_y = 1           Source I - y position of zero order
sJ_zero_x = 1           Source J - x position of zero order
sJ_zero_y = 1           Source J - y position of zero order
(input_psf_tab = CALDB) Calibration file with mirror psf vs off-axis angle
(detector = header_value) Detector type: ACIS | HRC-I | HRC-S | header_value
(radius_factor_zero = 50) A scale factor which multiplies the app. calculation of the one-sigma width of the HEG/MEG mask
(width_factor_hetg = 35) A scale factor which multiplies the one-sigma width of the HEG/MEG mask
(width_factor_letg = 40) A scale factor which multiplies the one-sigma width of the LETG mask
(r_astig_max_hetg = 0.5600000000000001) Max grating r coord (deg, along the dispersion) for HETG astigmatism
(r_astig_max_letg = 1.1) Max grating r coord (deg, along the dispersion) for LETG astigmatism
(r_mask_max_hetg = 0.992) Max grating r coord (deg) for HETG mask (to support offset pointing)
(r_mask_max_letg = 2.1) Max grating r coordinate (deg) for LETG mask (to support offset pointing)
# -----
# The parameters below are to be set ONLY if the user wants to use their
# own grating mask sizes instead of having the masks automatically generated.
# Only ONE input file, with up to 10 sources, can be processed using the user
# params. @ lists of multiple files can only be done with automated mask
# processing, or by running each file individually with hand set mask sizes.
# To start, you MUST set the following parameters:
#
# > pset tg_create_mask use_user_pars=yes last_source_toread=[letter A -> J]
#
# The parameter last_source_toread should be set to the last source letter
# for which you will enter parameters. If you want to input 2 sources
# (regardless of their source id's), the last_source_toread=B. Sections
# A -> J are for (upto) 10 user specified sources. In each sections,
# each source must have an ID, a zero order center position specified,
# as well as the grating mask width(s). An example with 2 HETG sources,
# with src_id's 6 and 3:
#
# > pset tg_create_mask use_user_pars=yes last_source_toread=B
# > pset tg_create_mask sA_id=6 sA_zero_x=4762.34 sA_zero_y=2344.29
# > pset tg_create_mask sA_zero_rad=35 sA_width_hetg=25 sA_width_meg=28
# > pset tg_create_mask sB_id=3 sB_zero_x=4063.54 sB_zero_y=6346.62
# > pset tg_create_mask sB_zero_rad=45 sB_width_hetg=50 sB_width_meg=75
# (units are all in sky pixels)
#
# NOTE: for Continuous Clocking data (CC mode), the HETG mask does not
# require the s#_width_hetg, since the meg mask will encompass the entire
# data set. HEG event processing in CC mode is done using the next
# tool tg_resolve_events.
# -----
(use_user_pars = no) Use the user defined mask parameters below: yes or no?
(last_source_toread = A) Last source name to be read; character A->J.
# -----
# Source A parameters
# -----
(sA_id = 1) Source A - source id number
(sA_zero_rad = ) Source A - radius of zero order mask

```

## Obtain Grating Spectra from HETG/ACIS-S Data – CIAO 3.4

```
(sA_width_heg = )           Source A - width of heg mask in sky pixels
(sA_width_meg = )          Source A - width of meg mask in sky pixels
(sA_width_leg = )          Source A - width of leg mask in sky pixels
# -----
#                               Source B parameters
# -----
..(through Source J)..
    (geompar = geom)         Parameter file for Pixlib Geometry files
    (verbose = 0)            Verbose level: 0 - no output, 5 - max verbosity
    (clobber = no)           Clobber existing outfile?
    (mode = ql)
```

Parameters for /home/username/cxcds\_param/tg\_resolve\_events.par

```
#-----
#
#   tg_resolve_events.par: Parameter file for the tg_resolve_events program
#
#-----
    infile = acisf00459_000N002_evt1.fits   Input event file or stack
    outfile = acis_459_evt1a.fits           Output event file or stack
    regionfile = acis_459_evt1_L1a.fits      Input region file or stack
    acaofffile = @pcad_asoll.lis            Input aspect offset file
    (alignmentfile = )acaofffile -> @pcad_asoll.lis) Input sim offset file
    (logfile = stdout)                      Output log (NONE|<filename>|stdout)
# The osipfile contains position dependent energy limits based on
# the CCD resolution, used for order-sorting.
# A value of "NONE" means that the file will not be used, and
# that the parameters, osort_hi and osort_lo will be used.
    (osipfile = CALDB)                      Lookup table for order resolving (for acis data only)
#sort_hi, osort_lo specify fractional deviations from the integer
#order which will be included in order-sorting via CCD ENERGY values (PHA).
#eg. osort_lo=0.3, osort_hi=0.2 means that photons with real-valued
#orders between 0.7 < order <= 1.2 will be included in first order,
#1.7 < order <= 2.2 will be second order, etc.
    (osort_lo = 0.3)                        Order-sorting lower bound fraction; order > m - osort_lo
    (osort_hi = 0.3)                        Order-sorting high bound fraction; order <= m + osort_hi
    (grating_obs = header_value)            Observed grating type (header_value|HETG|HEG|MEG|LETG)
    (detector = header_value)              Detector type: ACIS | HRC-I | HRC-S | header_value
    (energy_lo_adj = 1.0)                   Lower Energy limit factor
    (energy_hi_adj = 1.0)                   Upper Energy limit factor
    (time_offset = 0)                       Offset to add to event time to synch w/ alignment data
    (rand_seed = 1)                          Random seed (for pixlib), 0 = use time dependent seed
    (rand_pix_size = 0.0)                   pixel randomization width (-size..+size), 0.0 = no randomization
    (eventdef = )stdlev1_ACIS ->{d:time,i:expno,f:rd,s:chip,s:tdet,f:det,f:sky,s:ccd_id,l:pha,s:pi,
s:grade,s:fltgrade,s:node_id,s:tg_m,f:tg_lam,f:tg_mlam,s:tg_srcid,s:tg_part,s:tg_smap,x:status})
Output format definition
    (stdlev1 = )eventdef ->{d:time,i:expno,f:rd,s:chip,s:tdet,f:det,f:sky,s:ccd_id,l:pha,s:pi,f:en
s:grade,s:fltgrade,s:node_id,s:tg_m,f:tg_lam,f:tg_mlam,s:tg_srcid,s:tg_part,s:tg_smap,x:status})
    (stdlev1_ACIS = {d:time,i:expno,f:rd,s:chip,s:tdet,f:det,f:sky,s:ccd_id,l:pha,s:pi,f:energy,s:grade
s:fltgrade,s:node_id,s:tg_m,f:tg_lam,f:tg_mlam,s:tg_srcid,s:tg_part,s:tg_smap,x:status})
ACIS event format definition string
    (stdlev1_HRC = {d:time,f:rd,s:chip,l:tdet,f:det,f:sky,s:chip_id,s:pha,s:pi,s:tg_m,f:tg_lam,f:tg_ml
s:tg_srcid,s:tg_part,s:tg_smap,x:status})
HRC event format definition string
# -----
    (geompar = geom)         Parameter file for Pixlib Geometry files
```

## Obtain Grating Spectra from HETG/ACIS-S Data – CIAO 3.4

```
(verbose = 0)           Verbosity level of detail (0=none, 5=most)
(clobber = no)         Clobber outfile if it already exists?
(mode = ql)
```

---

Parameters for /home/username/cxcds\_param/destreak.par

```
infile = acis_459_evt2.fits  Input dataset/block specification
outfile = acis_459_dstrk_evt2.fits Output dataset/block specification
(max_rowloss_fraction = 5.0e-5)  Maximum fraction of avg streaks/node/frame
(num_sigma = 1.0)              Sigma value for determining streak threshold
(filter = yes)                 Discard tagged events
(mask = [status=0,grade=0,2:4,6]) Filter to select candidate streak events
(ccd_id = 8)                   CCD ID to filter
(ccd_col = ccd_id)             CCD ID column name
(node_col = node_id)           Node ID column name ('none' for single node)
(exptime = -1)                 frame time (s) (reads EXPTIME if no pos. value given)
(countfile = )                 filename for event row-count distribution
(fracfile = )                  filename for cumulative streak contam function
(timefile = )                  filename for exposure time lost per row
(verbose = 0)                   Debug Level(0-5)
(clobber = no)                  Clobber existing file
(mode = ql)
```

---

Parameters for /home/username/cxcds\_param/tgextract.par

```
##
## TGEXTRACT -- create 1D spectrum(a) table file(s) from the
##           L1.5 output event list
##
infile = acis_459_dstrk_evt2.fits Input event file (output event file from L1.5 processing)
outfile = acis_459 pha2.fits  If typeII, enter full output file name or '.'; if typeI, enter output
#
# tg_srcid_list parameter explanation...
# - "all" will process all the sources id's found in the event list
# - a comma list is a comma separated string list of all the
#   sources to process, ie:
#   "1,2,5,7"
# - @file is a pointer to an ascii file which contains a comma
#   separated list of the id's to process
#
tg_srcid_list = all           Source ID's to process: 'all', comma list, @file
tg_part_list = header_value   Grating parts to process: HETG, HEG, MEG, LETG, header_value
#
# tg_order_list parameter explanation...
# - "default" is set to process the following:
#   if ACIS:  1, 2, 3, -1, -2, -3
#   if HRC:   -1, 1
# - a comma list is a comma separated string list of the orders
#   the user wants to process, ie:
#   "-5, -1, 1, 3"
# - a range list sets the min and max of the orders to process;
#   all the orders in between, will be processed, ie:
```

## Obtain Grating Spectra from HETG/ACIS-S Data – CIAO 3.4

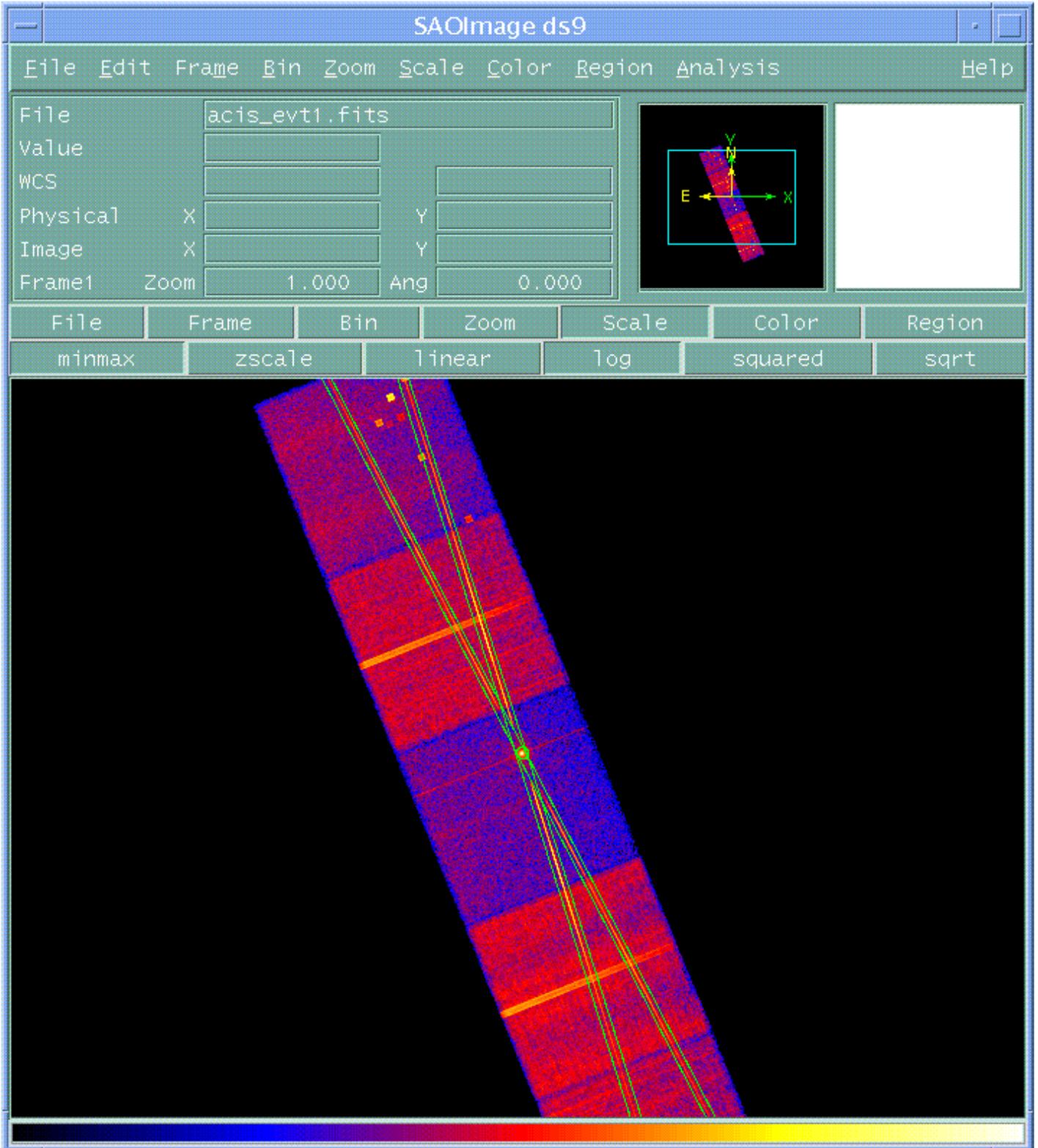
```
#      "-1..5" will do orders from -1 to +5th order
#      a range list can be mixed with comma separated list
#      - @file is a pointer to an ascii file which contains a comma
#      separated list and/or range list of the orders to process
#
tg_order_list = default      Grating diffraction orders to process: 'default', comma list, range list
  ancrrfile = none          Input ancillary response file name
  respfile = none           Input redistribution file name
  outfile_type = pha_typeII Output file type: typeI (single spectrum) or typeII (multiple spectra)
(inregion_file = none)      Input region file.
  (backfile = none)         Input background file name
  (rowid = )                If rowid column is to be filled in, enter name here
  (bin_units = angstrom)    Bin units (for bin parameters below): angstrom, eV, keV
  (min_bin_leg = compute)   Minimum dispersion coordinate for LEG, or 'compute'
  (max_bin_leg = compute)   Maximum dispersion coordinate for LEG, or 'compute'
  (bin_size_leg = compute)  Bin size for binning LEG spectra, or 'compute'
  (num_bins_leg = compute)  Number of bins for the output LEG spectra, 'compute'
  (min_bin_meg = compute)   Minimum dispersion coordinate for MEG, or 'compute'
  (max_bin_meg = compute)   Maximum dispersion coordinate for MEG, or 'compute'
  (bin_size_meg = compute)  Bin size for binning MEG spectra, or 'compute'
  (num_bins_meg = compute)  Number of bins for the output MEG spectra, or 'compute'
  (min_bin_heg = compute)   Minimum dispersion coordinate for HEG, or 'compute'
  (max_bin_heg = compute)   Maximum dispersion coordinate for HEG, or 'compute'
  (bin_size_heg = compute)  Bin size for binning HEG spectra, or 'compute'
  (num_bins_heg = compute)  Number of bins for the output HEG spectra, 'compute'
  (min_tg_d = default)      Minimum tg_d range to include in histogram, or use 'default'
  (max_tg_d = default)      Maximum tg_d range to include in histogram, or use 'default'
(extract_background = yes)  Extract the local background spectrum?
(min_upbkg_tg_d = default)  Minimum value of tg_d for the background up spectrum.
(max_upbkg_tg_d = default)  Maximum value of tg_d for the background up spectrum.
(min_downbkg_tg_d = default) Minimum value of tg_d for the background down spectrum.
(max_downbkg_tg_d = default) Maximum value of tg_d for the background down spectrum.
  (geompar = geom)          Parameter file for Pixlib Geometry files
  (clobber = no)            OK to overwrite existing output file(s)?
  (verbose = 0)             Verbosity level (0 = no display)
  (mode = ql)
```

---

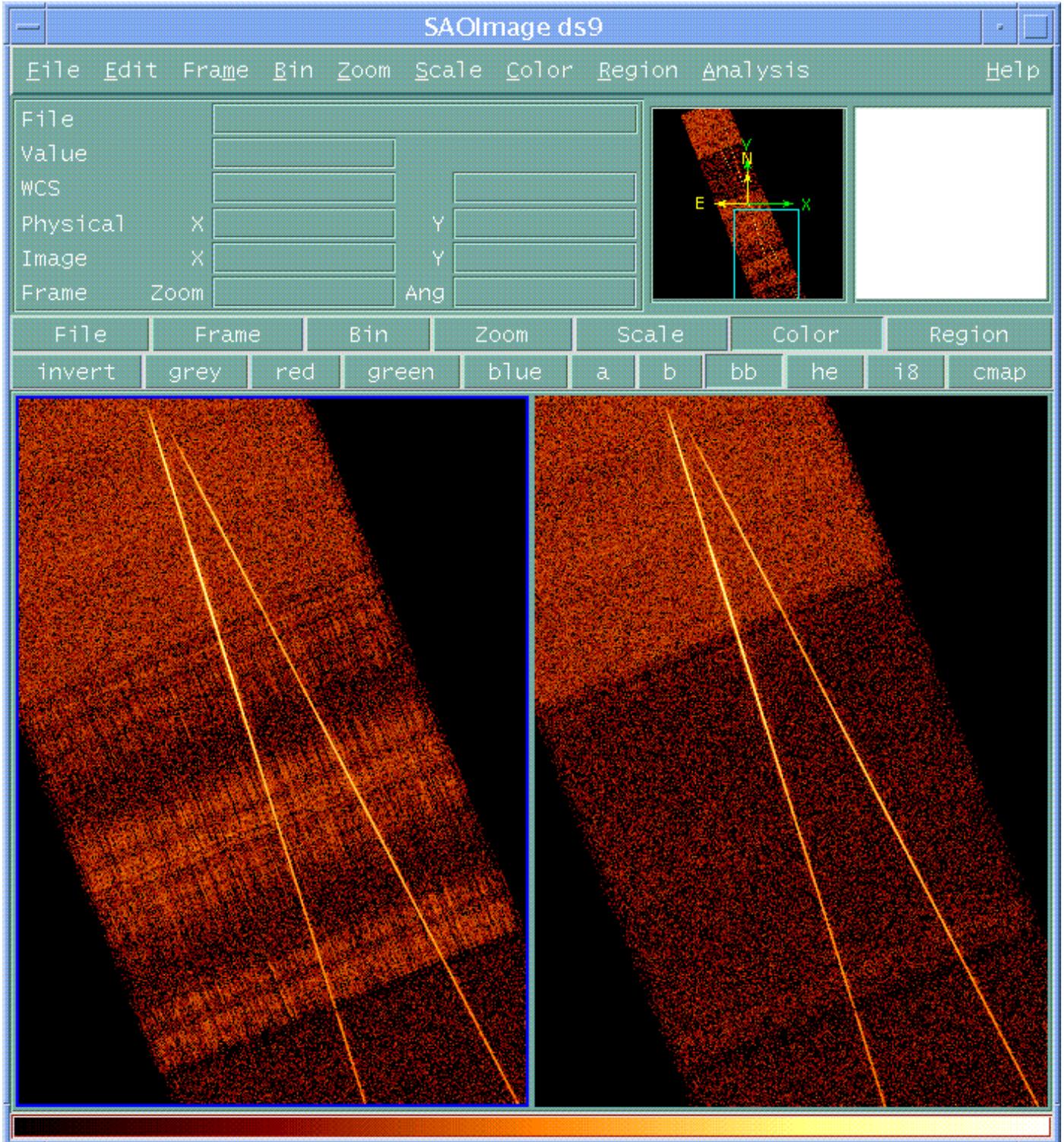
## History

- 16 Dec 2004 updated for CIAO 3.2: minor changes to parameter files
- 14 Jan 2005 created the [Data Preparation](#) section
- 05 Dec 2005 updated for CIAO 3.3: output filenames include ObsID; parameter file changes (kernel parameter removed from all "tg" tools; several changes to the destreak parameter file, including a new default value for the [mask](#) parameter)
- 05 Jan 2006 information on reprocessing included in [Data Preparation](#) section
- 04 Apr 2006 expanded information on special cases in the [Get position of zero-order image \(tgdetect\)](#) section
- 18 Dec 2006 updated for CIAO 3.4: new calibration files in CALDB 3.3.0; change to wording of tgdetect/dmcopy warning

**Image 1: Image with region file overlaid**



**Image 2: Original event file (left) and the destreaked version (right)**



## Obtain Grating Spectra from HETG/ACIS-S Data – CIAO 3.4