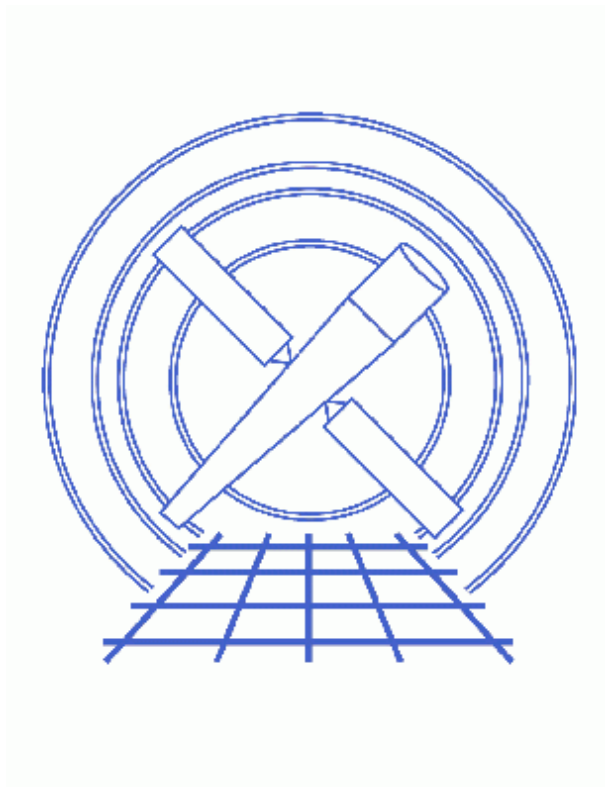


Remove ACIS Pixel Randomization



CIAO 3.4 Science Threads

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Remove ACIS Pixel Randomization

CIAO 3.4 Science Threads

Overview

Last Update: 1 Dec 2006 – updated for CIAO 3.4: removed use of "rand_pha=no" in `acis_process_events`, as most users should keep the PHA randomization (see the [Apply/Remove PHA Randomization thread](#)); CIAO version in warnings

Synopsis:

The CXC standard data processing ([SDP](#)) randomizes the positions of events detected within a given pixel. This randomization is done to remove the instrumental "gridded" appearance of the data and to avoid any possible aliasing affects associated with this spatial grid. The default randomization is adequate for most users.

Purpose:

To generate a new level=2 event file with the pixel randomization removed. Disabling pixel randomization can somewhat improve the resolution of on-axis Chandra sources. This procedure may be useful for users interested in closely-spaced point sources in a crowded field or closely-spaced features in an extended source.

Read this thread if:

you are working with an ACIS observation and would like to remove the randomization. Be aware that there are no calibration products appropriate for data processed with the randomization disabled.

Related Links:

- Analysis Guide: [ACIS Data Preparation](#)
- [Apply the ACIS CTI Correction](#) thread: it is strongly recommended that you reprocess imaging data with this new calibration which became part of [standard data processing](#) in DS 6.11. Note that the CTI correction is on by default (`apply_cti=yes`) in the `acis_process_events`.

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

Get Started

Sample ObsID used: 1838 (ACIS-S, G21.5-09)

File types needed: evt1; evt2 (optional); flt1; asol1; bpix1

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If you created a new bad pixel file by running the [Create a New ACIS Bad Pixel File: Identify ACIS Hot Pixels and Cosmic Ray Afterglows thread](#), use that file in this analysis. Otherwise, use the `bpix1.fits` file from the Archive.

This thread can also be run directly on the level=2 event file for *imaging data*; see the [Running on Level=2 Event File section](#) for details. If you are analyzing *grating data*, however, you *must* run this thread on the level=1 event file.

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

Related `acis_process_events` threads

There are other threads that should be considered, since they may affect how `acis_process_events` is run. *The [Create a New Level=2 Event File thread](#) shows how to combine all of these options into a single run of `acis_process_events`.*

- [Apply an ACIS Gain Map](#)
- [Apply the Time-Dependent ACIS Gain Correction](#)
- [Apply/Remove PHA Randomization](#)
- [Apply the ACIS CTI Correction](#)

Generate A New Level=1 Event File

Determine the `eventdef` parameter

The `eventdef` parameter specifies the names and data types of the columns in the output event data file. Four predefined strings are included in the parameter file for `acis_process_events`:

READMODE	DATAMODE	event mode	eventdef string
TIMED	(V)FAINT	timed exposure (very) faint	stdlev1
TIMED	GRADED	timed exposure graded	grdlev1
CONTINUOUS	CC(33)_FAINT	continuous clocking (3x3) faint	cclev1
CONTINUOUS	CC(33)_GRADED	continuous clocking (3x3) graded	ccgrdlev1

If you are unsure of the event mode of your observation, the information can be found in the `READMODE` and `DATAMODE` values stored in the file header:

```
unix% dmkeypar acisf01838_000N001_evt1.fits READMODE echo+
TIMED

unix% dmkeypar acisf01838_000N001_evt1.fits DATAMODE echo+
FAINT
```

This is a timed exposure faint observation, so the proper `eventdef` parameter is "stdlev1." The full parameter

syntax of each eventdef string may be found in [plist acis_process_events](#).

Run acis_process_events

Since it is necessary to recalculate the coordinates when removing the pixel randomization, we need to supply the proper [aspect solution](#):

```
unix% punlearn acis_process_events
unix% pset acis_process_events infile=acisf01838_000N001_evt1.fits
unix% pset acis_process_events outfile=acis_1838_new_evt1.fits
unix% pset acis_process_events badpixfile=acis_1838_new_bpix1.fits
unix% pset acis_process_events acaofffile=pcadf084244404N001_asoll.fits
unix% pset acis_process_events eventdef=")stdlev1"
unix% pset acis_process_events rand_pix_size=0.0
unix% acis_process_events
Input event file or stack (acisf01838_000N001_evt1.fits):
Output event file name (acis_1838_new_evt1.fits):
aspect offset file ( NONE | none | <filename> ) (pcadf084244404N001_asoll.fits):
```

There are several things to note:

- In some cases there will be more than one asoll.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).
- You may see a warning about the number of event islands that contain one or more bad pixels:

```
# acis_process_events (CIAO 3.4): The following error occurred 26941
times: dsAFEBADPCNTERR -- WARNING: Event island contains 1 or more bad pixels.
```

It is explained in [this FAQ](#) and may be ignored.

- It is important to note the unusual syntax of the eventdef parameter; the tool will not access the predefined string if the leading ")" is missing (see [example 6](#) of ahelp parameter).

The content of the parameter file may be checked using [plist acis_process_events](#).

The new level=1 event file is named `acis_1838_new_evt1.fits`. See the [final section](#) of the ACIS Gain Map thread to generate a new level=2 event file.

Running on Level=2 Event File (Optional)

Since removing the pixel randomization does not affect any of the status, grade, or time filters, it may be run on level=2 *imaging data*. If you are analyzing grating data, you must run this thread on the level=1 event file, then complete the appropriate ["Obtain Grating Spectra"](#) thread to create a new level=2 event file.

In this case, several additional parameter are set so that `acis_process_events` does not try to randomize PHA (`rand_pha=no`), calculate the PI channels (`calculate_pi=no`), or compute event grading (`doevtgrade=no`). A level=2 event file is used as input, and it is not necessary to re-apply the bad pixel file:

```
unix% punlearn acis_process_events
unix% pset acis_process_events infile=acisf01838N001_evt2.fits
unix% pset acis_process_events outfile=acis_1838_new_evt2.fits
```

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```
unix% pset acis_process_events acaofffile=pcadf084244404N001_asoll.fits
unix% pset acis_process_events \
    eventdef='{d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:t-det,f:det,f:sky,l:pha,f:energy,l:pi,s:fltgrade}'
unix% pset acis_process_events rand_pha=no
unix% pset acis_process_events doevtgrade=no
unix% pset acis_process_events gradefile=None
unix% pset acis_process_events calculate_pi=no
unix% pset acis_process_events rand_pix_size=0.0
unix% acis_process_events
Input event file or stack (acisf01838N001_evt2.fits):
Output event file name (acis_1838_new_evt2.fits):
aspect offset file ( NONE | none | <filename>) (pcadf084244404N001_asoll.fits):
# acis_process_events (CIAO 3.4): WARNING: The time-dependent gain adjustment to PHA
    will not be (re)computed or removed because doevtgrade=no.
# acis_process_events (CIAO 3.4): WARNING: The values of PHA, ENERGY, PI, FLTGRADE
    and GRADE may be inaccurate because doevtgrade=no.
# acis_process_events (CIAO 3.4): WARNING: The values of ENERGY and PI may be
    inaccurate because calculate_pi=no.
```

Note that a custom "level 2" `eventdef` parameter is specified. The reason for this is explained in the ["Why is my level 2 event file larger than the one from the pipeline?" FAQ](#).

The warnings are expected, and are triggered as a result of the `doevtgrade` parameter setting.

The new level=2 imaging event file is `acis_1838_new_evt2.fits`.

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

```
#-----
#
# acis_process_events.par- Parameter file for acis_process_events program
#
#-----
    infile = acisf01838_000N001_evt1.fits    Input event file or stack
    outfile = acis_1838_new_evt1.fits    Output event file name
    acaofffile = pcadf084244404N001_asoll.fits    aspect offset file ( NONE | none | <filename>)
    (apply_cti = yes)                Apply CTI adjustment?
    (apply_tgain = yes)                Apply time-dependent gain adjustment?
(alignmentfile = )acaofffile -> pcadf084244404N001_asoll.fits) sim/fam alignment file ( NONE | none | <filename>)
    (obsfile = NONE)                obs.par file for output file keywords ( NONE | none | <filename>)
    (geompar = geom)                Parameter file for Pixlib Geometry files
    (logfile = stdout)                debug log file ( STDOUT | stdout | <filename>)
    (gradefile = CALDB)                grade mapping file ( NONE | none | CALDB | <filename>)
    (gainfile = CALDB)                acis gain file ( NONE | none | CALDB | <filename>)
    (badpixfile = acis_1838_new_bpix1.fits) acis bad pixel file ( NONE | none | <filename>)
    (threshfile = CALDB)                split threshold file ( NONE | none | CALDB | <filename>)
    (ctifile = CALDB)                acis CTI file ( NONE | none | CALDB | <filename>)
    (tgainfile = CALDB)                gain adjustment file ( NONE | none | CALDB | <filename>)
    (eventdef = )stdlev1 -> {d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:t-det,f:det,f:sky,s:phas,l:pha,l:pi,
f:energy,l:pi,s:fltgrade,s:grade,x:status}) output format definition
    (doevtgrade = yes)                Determine event flight grade?
    (check_vf_pha = no)                Check very faint pixels?
    (calc_cc_times = no)                Estimate the times of arrival for CC-mode observation?
    (trail = 0.027)                Trail fraction
    (spthresh = 13)                Default split threshold level (overridden by values in threshfile)
    (time_offset = 0)                Offset to add to event time field to synch w/ fam data
```

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```
(docentroid = no)           Determine pixel centroid for coord. conversion?
(calculate_pi = no)        perform pha->pi conversion? (requires gain file)
(pi_bin_width = 14.6)     Width of Pi bin in eV
(pi_num_bins = 1024)     Number of values to bin energy into
(max_cti_iter = 15)      Maximum iterations for the CTI adjustment of each event
(cti_converge = 0.1)     The convergence criterion for each CTI-adjusted pixel in adu
    (tstart = TSTART)    header key containing start/default time value
    (tstop = TSTOP)     header key containing time of last event
(clobber = no)           Overwrite output event file if it already exists?
(verbose = 0)            level of debug detail (0=none, 5=most)
    (stop = sky)        end transformations at [chip,tdet,det,tan,sky,none]
(instrume = acis)       axaf instrument- used for instrument parameter file
(rand_seed = 1)         random seed (for pixlib), 0 = use time dependent seed
(rand_pha = yes)        Randomize the pha value used in gain calculations
(rand_pix_size = 0)     pixel randomization width (-size..+size) 0=no randomization
    (stdlev1 = {d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:tdet,f:det,f:sky,s:phas,l:pha,l:pha_ro,
l:pi,s:fltgrade,s:grade,x:status}) TE faint modes event definition string
    (grdlev1 = {d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:tdet,f:det,f:sky,l:pha,l:pha_ro,s:corn_
l:pi,s:fltgrade,s:grade,x:status}) TE graded event format definition string
    (cclev1 = {d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:tdet,f:det,f:sky,f:sky_ld,s:phas,l:pha,
f:energy,l:pi,s:fltgrade,s:grade,x:status}) CC faint event format definition string
    (ccgrdlev1 = {d:time,s:ccd_id,s:node_id,i:expno,s:chip,s:tdet,f:det,f:sky,f:sky_ld,l:pha,l:pha_r
f:energy,l:pi,s:fltgrade,s:grade,x:status}) cc graded event format definition string
    (mode = ql)
```

History

- 16 Dec 2004 updated for CIAO 3.2: use ACIS bad pixel file (`badpixfile` parameter)
- 11 Jan 2005 created [Running on on Level=2 Event File section](#)
- 01 Feb 2005 added note about "Event island contains 1 or more bad pixels" warning
- 20 Jun 2005 CIAO 3.2.2 patch: minor `acis_process_events` parameter change (default value of [threshfile](#) is CALDB instead of NONE)
- 28 Jul 2005 switched to a custom eventdef in the [Running on Level=2 Event File section](#)
- 09 Dec 2005 updated for CIAO 3.3: output filenames include ObsID
- 01 Dec 2006 updated for CIAO 3.4: removed use of "`rand_pha=no`" in `acis_process_events`, as most users should keep the PHA randomization (see the [Apply/Remove PHA Randomization thread](#)); CIAO version in warnings

URL: <http://cxc.harvard.edu/ciao/threads/acispixrand/>

Last modified: 1 Dec 2006

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