Chandra X-ray Center

AHELP for CIAO 3.4　　**hrc_process_events**　　Context: tools

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Synopsis

Correct HRC event positions, times, PHA, etc.

Syntax

```
hrc_process_events infile outfile badpixfile acaofffile alignmentfile
[obsfile] [geompar] [do_ratio] [do_amp_sf_cor] [gainfile] [ADCfile]
[degapfile] [hypfile] [ampsfcorfile] [tapfile] [ampsatfile]
[evtflatfile] [badfile] [logfile] [instrume] [eventdef] [badeventdef]
[grid_ratio] [pha_ratio] [wire_charge] [cfu1] [cfu2] [cfv1] [cfv2]
[time_offset] [amp_gain] [rand_seed] [rand_pix_size] [tstart] [tstop]
[start] [stop] [stdlev1] [badlev1] [hsilev1] [simlev1] [fltlev1]
[clobber] [verbose]
```

Description

`hrc_process_events' computes detector coordinates for input HRC events. The detector position is determined by applying fine position corrections and degapping corrections to the coarse position specified in the input data (see the "SEE ALSO" section below for the actual algorithm). Raw coordinates, chip coordinates, and sum amplitude of each event are generated as by–products of the detector coordinate calculation and may be output if desired. The tool also applies aspect offset and sim alignment corrections as well as flags status bits of bad pixels when supplied with the appropriate files.

`hrc_process_events' requires one or more input FITS event files as well optional degap, aspect offset, alignment and bad pixel files. It also requires a parameter file containing the parameters given below.

Stacks: The user may specify a single file or a list of files as input to this routine. Hrc_process_events will attempt to process all input files provided to it. If an error is detected in an input file (ie. a data dependency is not met), that file will be discarded and a message will be generated to stderr. When the debug level is greater than two, counts of the number of bad files and events will be maintained and written to the debug log file.

Dependencies: If all of the required dependencies are not met, the input file will be discarded and a message will be output to stderr. The routine will iterate to the next input file if a stack is provided as input.

General

- It is the user's responsibility to ensure that all of the parameters are correctly set. The function will not perform validity checks on the input parameter data other than verifying the existence of the axes in

the eventdef list. Special care should be taken to ensure that columns are specified in the eventdef list if they are desired as output. If a column that is not computed is specified in the eventdef list, the data fields for that column in the output file will contain zero. For instance, if the stop parameter is set to 'none' and the eventdef contains sky coords, they will have a value of 0.

- It does not matter what fields the input event file contains provided that all data dependencies for the selected options are met.
- In order to perform coordinate tansformations, the following fields must exist in the input data: coarse u position, coarse v position, and the six amp values (three for the u axis, and three for the v axis). If the start parameter is set to chip, then chipx, chipy is necessary in lieu of the above mentioned columns.
- The routine will generate as output, an event file containing columns that are listed in the eventdef parameter. One row will be written for each input row (event) successfully processed. Events that are unsuccessfully processed will be placed in the bad event file and a warning message will be output. If the debug level is set to three or higher a count of the number of events that have been discarded will be written to the debug logfile.

Pulse Invarience/Gain Correction: Gain correction will only be applied when an input gain file is provided. The results of this calculation will only be propogated to the output file if the eventdef parameter contains the string "s:pi" as an entry.

Tap–ringing Correction: This correction compensates for distortions in event positions due to ringing in on–board electronics. It will be applied if the parameter "do_amp_sf_cor" is set to "yes" and calibration files containing coefficients for the amp_sf and tapringing corrections are applied. These are specified by parameters "ampsfcorfile" and "tapfile", and default to files in CALDB. In addition, HRC operating parameters RANGELEV and WIDTHRES are required. These are provided in the observation parameter file in standard processing. Alternatively, users may add them as keywords in the event list header (see Example 3, below).

Correct values of RANGELEV are given in the following table.

Date	HRC–I	HRC–S
Before 12/6/1999	90	90
After 12/6/1999	115	125

For WIDTHRES, the value is 3 prior to 10/5/2000 and 2 after that date, for both HRC–I and HRC–S.

For more information on HRC data products please refer to the Data Products Guide.

Example 1

```
hrc_process_events xh101950595_evt0.fits xh101950595_evt1.fits
degapfile=hrci_degap.fits clobber=no
```

Runs `hrc_process_events' to generate coordinate information using a degap file and no aspect or alignment corrections. Do not identify bad/hot pixels and do not overwrite the output file if a file named xh101950595_evt1.fits already exists.

Example 2

```
hrc_process_events xh103254768_evt0.fits xh103254768_evt1.fits
hrci_badpix.fits NONE NONE gainfile=hrci_gain.fits logfile=debug.txt
verbose=3 eventdef="{d:time,s:chipy,d:sky,s:pi}"
```

Runs `hrc_process_events' to generate an output file containing time, chip, sky, and pi columns. Create a log file named debug.txt with moderate detail. Use the hrci_badpix.fits badpixel file and the hrci_gain.fits gain correction file. Do not apply aspect or alignment corrections.

Example 3

```
dmhedit hrcf00998_000N002_evt1.fits filelist=none operation=add
key=RANGELEV value=125
dmhedit hrcf00998_000N002_evt1.fits filelist=none operation=add
key=WIDTHRES value=2
hrc_process_events hrcf00998_000N002_evt1.fits new_evt1.fits
hrcf00998_000N002_bpix1.fits.gz hrcf00998_000N002_aoff1.fits.gz
do_amp_sf_cor=yes
```

Runs `hrc_process_events' to generate a new level 1 event list with amp_sf and tap–ringing corrections applied. Since this is an HRC–S observation taken on 12/20/2000, RANGELEV=125 and WIDTHRES=2. These values are added to the input header using `dmhedit' prior to running hrc_process_events.

Parameters

name	type	ftype	def	min	max	reqd	stacks
infile	file	input				yes	yes
outfile	file	output				yes	
badpixfile	file	input	NONE			yes	yes
acaofffile	file	input	NONE			yes	
alignmentfile	file	input				yes	
obsfile	file	input	NONE				
geompar	string		geom				
do_ratio	boolean		yes				
do_amp_sf_cor	boolean		yes				
gainfile	file	ARD	CALDB				
ADCfile	file	input	NONE				
degapfile	file	ARD	CALDB				
hypfile	file	ARD	CALDB				
ampsfcorfile	file	ARD	CALDB				
tapfile	file	ARD	CALDB				
ampsatfile	file	ARD	CALDB				
evtflatfile	file	ARD	CALDB				
badfile	file	output					
logfile	file	output	stdout				

Example 2   3

instrume	string		hrc–i				
eventdef	string						
badeventdef	string						
grid_ratio	real		0.5	0.0	1.0		
pha_ratio	real		0.5	0.0	1.0		
wire_charge	integer		0				
cfu1	real		1.0				
cfu2	real		0.0				
cfv1	real		1.0				
cfv2	real		0.0				
time_offset	real		0.0				
amp_gain	real		75.0				
rand_seed	integer		1	0	32767		
rand_pix_size	real		0.0				
tstart	string		TSTART				
tstop	string		TSTOP				
start	string		coarse				
stop	string		sky				
stdlev1	string						
badlev1	string						
hsilev1	string						
simlev1	string						
fltlev1	string						
clobber	boolean		no				
verbose	integer		0	0	5		

Detailed Parameter Descriptions

Parameter=infile `(file required filetype=input stacks=yes)`

Stack of input event files [FITS format]

The input can be a single or a stack of event file(s) from any level (L0, L1, L1.5, L2). If the input is a stack, the files listed should be in an ascending time order. For one or multiple input files, there should be only one single output file.

Parameter=outfile `(file required filetype=output)`

Output FITS event file

There's only one single output file from this tool.

Parameter=badpixfile `(file required filetype=input default=NONE stacks=yes)`

A single or a stack of existing bad pixel files

This is an auto parameter which is used to provide the tool with a list of hot/bad pixels. Events which fall on a hot/bad pixel will have a status bit set to indicate such.

Parameter=acaofffile `(file required filetype=input default=NONE)`

Existing aspect offsets. FITS file or NONE

Aspect offset file used to compensate for spacecraft movements during an observation. If more than one input file is used, then the files should be in chronological order.

Parameter=alignmentfile `(file required filetype=input)`

Existing alignment. FITS file or NONE

This parameter is used to provide the tool with values used to adjust the mirror position via SIM alignment (flight) or dither (XRCF) values. If more than one input file is used, then the files should be in chronological order.

Parameter=obsfile `(file filetype=input default=NONE)`

*Existing observation parameter *.PAR file (uncompressed) or NONE.*

This value specifies the name of the observation parameter file to seed the output event file header with. If the value is not "NONE", the keywords from the specified file are copied to the output file's header.

Parameter=geompar `(string default=geom)`

The name of the Pixlib Geometry parameter file.

Parameter=do_ratio `(boolean default=yes)`

yes/no

Option to either execute or omit the performance of ratio validity checks (sum of amps to pha ratio and grid charge ratio) on the processed events.

Parameter=do_amp_sf_cor `(boolean default=yes)`

yes/no

Option to perform amp_sf correction or not. By default this correction is turned on. In order to use it, a keyword RANGELEV needs to be present in the evt1 event header. If it's not, the program reports an error.

Parameter=gainfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or file name.

Filename of the gain image to use in computing the energy of an event from the PHA of an event. Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "GAINFILE" will contain the name of the file actually used.

Parameter=ADCfile `(file filetype=input default=NONE)`

Existing ADC correction. FITS file or NONE

This file contains the gain correction factors to apply to the amp values. If a file is provided, the correction is performed.

Parameter=degapfile `(file filetype=ARD default=CALDB)`

CALDB, COEFF, NONE, or file name

This parameter specifies how to apply degapping corrections. If set to NONE then values of 1 are used for the linear degap values and 0's are used for quadratic correction factors. If COEFF is specified then the values cfu1 and cfv1 are used for linear and cfu2 and cfv2 are used for quadratic correction factors. Alternatively a degap. FITS file may be provided, but it is the users responsibility to make sure that the file contains the appropriate entries for hrc–i or hrc–s data.

Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "DEGAPFILE" will contain the name of the file actually used.

Parameter=hypfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or file name

This file contains the coefficients for the hyperbolic test. If set to NONE then no hyperbolic test is applied.

Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "HYPFILE" will contain the name of the file actually used.

Parameter=ampsfcorfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or filename

A file of coefficients needed to apply a correction to the AMP_SF column in the event structure. AMP_SF is used in deciding which events to correct for the tap ringing problem.

Parameter=tapfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or file name

This file contains the coefficients for the tap ring correction. If set to NONE then no correction is applied.

Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "TAPFILE" will contain the name of the file actually used.

Parameter=ampsatfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or file name

This file contains the coefficients for the saturation test. If set to NONE then no saturation test is applied.

Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "AMPSATFILE" will contain the name of the file actually used.

Parameter=evtflatfile `(file filetype=ARD default=CALDB)`

CALDB, NONE, or file name

This file contains the coefficients for the flatness test. If set to NONE then no flatness testing is performed.

Users can specify "CALDB" to automatically look up the file appropriate for the observation date; the header keyword "EVTFLATFILE" will contain the name of the file actually used.

Parameter=badfile `(file filetype=output)`

Output bad event file [FITS format]

File name to use when generating a bad event file. Events which can not be correctly processed (ie. invalid tap positions) are output into this file.

Parameter=logfile `(file filetype=output default=stdout)`

Nonexistent file or 'stdout'

This hidden parameter allows the user to generate a debugging log file if the verbose parameter (see below) is set to a non zero value.

Parameter=instrume `(string default=hrc-i)`

hrc−i, hrc−s, or hsi

This specifies the instrument that the data was collected with.

Parameter=eventdef `(string)`

String of form: {type:colname,type:colname})

This hidden parameter allows the user to specify the columns that will exist in the output event file. The default valus of this parameter is a redirection to the standard level 1 hrc eventdef specified by the stdlev1 parameter.

Parameter=badeventdef `(string)`

String of form: {type:colname, type:colname})

This hidden parameter allows the user to specify the columns that will exist in the output bad event file.

Parameter=grid_ratio `(real default=0.5 min=0.0 max=1.0)`

double precision real

charge ratio

Parameter=pha_ratio `(real default=0.5 min=0.0 max=1.0)`

double precision real

pha ratio

Parameter=wire_charge `(integer default=0)`

(−1, 0)

option to enable or disable the center wire test (−1 = off)

Parameter=cfu1 `(real default=1.0)`

double precision real

first order correction factor for u axis

Parameter=cfu2 `(real default=0.0)`

double precision real

second order correction factor for u axis

Parameter=cfv1 `(real default=1.0)`

double precision real

first order correction factor for v axis

Parameter=cfv2 `(real default=0.0)`

double precision real

second order correction factor for v axis

Parameter=time_offset `(real default=0.0)`

real number

offset which needs to be added to the event file to synch it up with the fam (dither) data.

Parameter=amp_gain `(real default=75.0)`

real number

amp gain

Parameter=rand_seed `(integer default=1 min=0 max=32767)`

0, positive integer

This value determines the seed value for the pseudo–random generator used in integer rounding (if rand_pix_size is not 0.0). A value of 0 indicates use of clock time as the seed.

Parameter=rand_pix_size `(real default=0.0)`

This parameter specifies the range of the randomization values applied to the coordinate computations. The value can be either 0.0 or 0.5. If it is set to 0.0 (the default), randomization will not be performed.

Parameter=wire_charge (integer default=0)

Parameter=tstart `(string default=TSTART)`

TSTART or some other keyword name

The name of the header keyword containing the time of the first event in this file. It is used as the lowerbound of a temporal filter on the event file.

Parameter=tstop `(string default=TSTOP)`

TSTART or some other keyword name

The name of the header keyword containing the time of the last event in this file. It is used as the upperbound of a temporal filter on the event file.

Parameter=start `(string default=coarse)`

coarse, chip, tdet

The start of the coordinate transformations. This should be set to coarse. Chip is supported for MARX data.

Parameter=stop `(string default=sky)`

none, chip, tdet, det, sky

The end of the coordinate transformations. This determines the extent of the coordinate transformations that are executed by hrc_process_events. It should generally be set to sky. If a value of none is specified, coordinate transformations are not executed.

Parameter=stdlev1 `(string)`

This string specifies one of the pre−defined sets of column names and data types that can be used to control the information written to the output file. eventdef=")stdlev1" is equivalent to eventdef="{d:time,s:crsv,s:crsu,s:amp_sf,s:av1,s:av2,s:av3, s:au1,s:au2,s:au3,l:raw,s:chip,l:tdet,f:det,f:sky,s:pha,s:pi, s:sumamps,s:chip_id,x:status}".

Parameter=badlev1 `(string)`

This string specifies one of the pre−defined sets of column names and data types that can be used to control the information written to the output file. eventdef=")badlev1" is equivalent to eventdef="{d:time,s:crsu,s:crsv,s:au1,s:au2,s:au3, s:av1,s:av2,s:av3,s:pha}".

Parameter=hsilev1 `(string)`

This string specifies one of the pre−defined sets of column names and data types that can be used to control the information written to the output file. eventdef=")hsilev1" is equivalent to eventdef="{d:time,s:crsu,s:crsv,s:au1,s:au2,s:au3,s:av1, s:av2,s:av3,s:chipx,s:chipy,s:tdetx,s:tdety,s:x,s:y,l:fpz, s:pha,s:vstat,s:estat}".

Parameter=simlev1 `(string)`

This string specifies one of the pre−defined sets of column names and data types that can be used to control the information written to the output file. eventdef=")simlev1" is equivalent to eventdef="{l:tick,i:scifr,i:mjf,s:mnf,s:evtctr,s:crsu, s:crsv,s:au1,s:au2,s:au3,s:av1,s:av2,s:av3,s:tdetx,s:tdety, s:pha,s:vstat,s:estat}".

Parameter=fltlev1 `(string)`

This string specifies one of the pre−defined sets of column names and data types that can be used to control the information written to the output file. eventdef=")fltlev1" is equivalent to eventdef="{d:time,s:crsv,s:crsu,s:amp_sf,s:av1,s:av2,s:av3, s:au1,s:au2,s:au3,s:chipx,s:chipy,l:tdetx,l:tdety,s:detx, s:dety,s:x,s:y,s:pha,s:sumamps,s:chip_id,l:status}".

Parameter=clobber `(boolean default=no)`

Overwrite output event file if it already exists?

A value of yes indicates that the tool will overwrite an existing output file if the file already exists. A value of no causes the tool to exit with an error message if the file already exists.

Parameter=verbose `(integer default=0 min=0 max=5)`

Verbose level

Option to enable or disable the logging of debugging information to a datafile or standard output (specified by the logfile parameter). A value of zero disables the logging and nonzero numbers indicate the degree of detail to log with five being the most detailed and one the least.

CHANGES IN CIAO 3.4

IRAF QPOE Files

Support for IRAF QPOE files has been removed from CIAO.

CHANGES IN CIAO 3.3

Aspect solution files

An error is printed if the input aspect solution file(s) are not in chronological order.

Parameter File

The kernel parameter has been removed.

CHANGES IN CIAO 3.1

Default value of rand_pix_size parameter

In CIAO 3.1, the default value of the rand_pix_size parameter was changed from 0.5 to 0.0. This means that, by default, randomization IS NOT applied to the coordinate computations.

Bugs

See the bugs page for this tool on the CIAO website for an up−to−date listing of known bugs.

See Also

chandra
> eventdef, level

tools

> acis_process_events, acisreadcorr, axbary, hrc_build_badpix, hrc_dtfstats, reproject_aspect, reproject_events, sso_freeze, tg_resolve_events, wcs_match

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URL:
http://cxc.harvard.edu/ciao3.4/hrc_process_events.html
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See Also