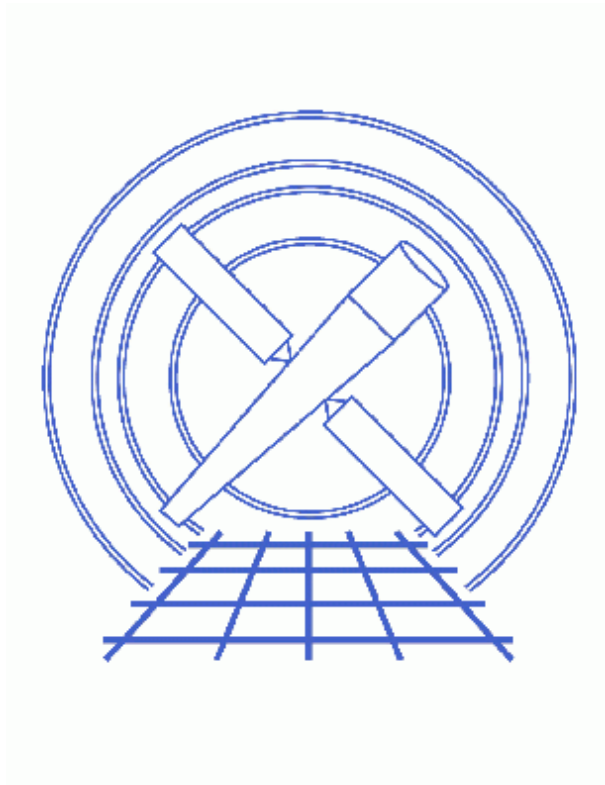


Remove the acis_detect_afterglow Correction



CIAO 4.1 Science Threads

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CIAO 4.1 Science Threads

Overview

Last Update: 12 Jan 2009 - reviewed for CIAO 4.1: no changes

Synopsis:

An afterglow is the residual charge from the interaction of a cosmic ray in a CCD. Some of the excess charge is captured by charge traps and released in a few to a few dozen subsequent frames. If afterglow events are not removed from the data, they can result in the spurious "detection" of faint sources.

A new method for identifying afterglow events, namely the ACIS hot pixel tools, was introduced to SDP at version DS 7.4.0 to try to avoid discarding a significant fraction of real x-ray events. Before using the hot pixel tools, the afterglow status bits in data that were processed with `acis_detect_afterglow` must be reset so that they may be recomputed. After running this thread, users should complete the [New ACIS Bad Pixel File: Identify ACIS Hot Pixels and Cosmic Ray Afterglows thread](#).

Be sure to read the [Cosmic-Ray Afterglows why topic](#) and [the caveats section of this thread](#).

Purpose:

To reset the [status bits](#) 16 through 19, removing the effects of the `acis_detect_afterglow` processing. How to examine the events marked as afterglows is also shown.

Read this thread if:

- you are working with any ACIS observation, including grating data, processed with an SDP version *lower than* DS 7.4.0.
- if your source is [piled](#) and you intend to model the pileup; read the [Pileup Talk](#) for more information, in particular [Data Preparation and Caveats](#).

If your data have gone through [Reprocessing III](#), you **do not** have to run this thread. [Get Started](#) shows how to check the software version used in processing your data.

Related Links:

- Analysis Guide: [ACIS Data Preparation](#)
- [Acis_detect_afterglow's Effect on HETGS Spectra](#)

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

Get Started

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

File types needed: evt1

To see which processing version was used on the data:

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

Since the ASCDSVER is lower than DS 7.4.0, it is necessary to run this thread. Note that the version numbering changed after version R4CU5UPD14 to the "DS" system, starting with DS 6.0.0.

Caveats

At present, the tool `acis_run_hotpix` is being used in the pipeline to identify cosmic-ray afterglows. The results obtained using this tool should be sufficient unless a user is interested in searching for or studying sources that have a small number of counts (i.e. less than about 10). In these situations, it may be advantageous to use the tool `acis_detect_afterglow` (in addition to `acis_run_hotpix`) to try to eliminate afterglows that have only a few events. Some care is required to ensure that `acis_detect_afterglow` does not eliminate a significant number of real x-ray events.

For more information, read the [Cosmic-Ray Afterglows why topic](#).

Examine the Afterglow Events (Optional)

It is possible to display the spatial distribution of events flagged by `acis_detect_afterglow`. Here we have defined a filter that *excludes* cases in which none of the afterglow status bits (16-19, counting from the right, starting at zero) are marked as bad (1). The other bits are filtered on the wildcard "x", which lets either a good or bad value pass. This filter retains the events in which *any* of the afterglow flags have been set to 1:

```
unix% dmcoppy \  
  "acisf00459_000N002_evt1.fits[exclude status=xxxxxxxxxx000xxxxxxxxxxxxxxxxx]" \  
  acis_459_afterglows_evt1.fits
```

In this case, [displaying the file in ds9 \(Figure 1\)](#) shows that the source is clearly visible, meaning that many source photons have been marked as afterglows.

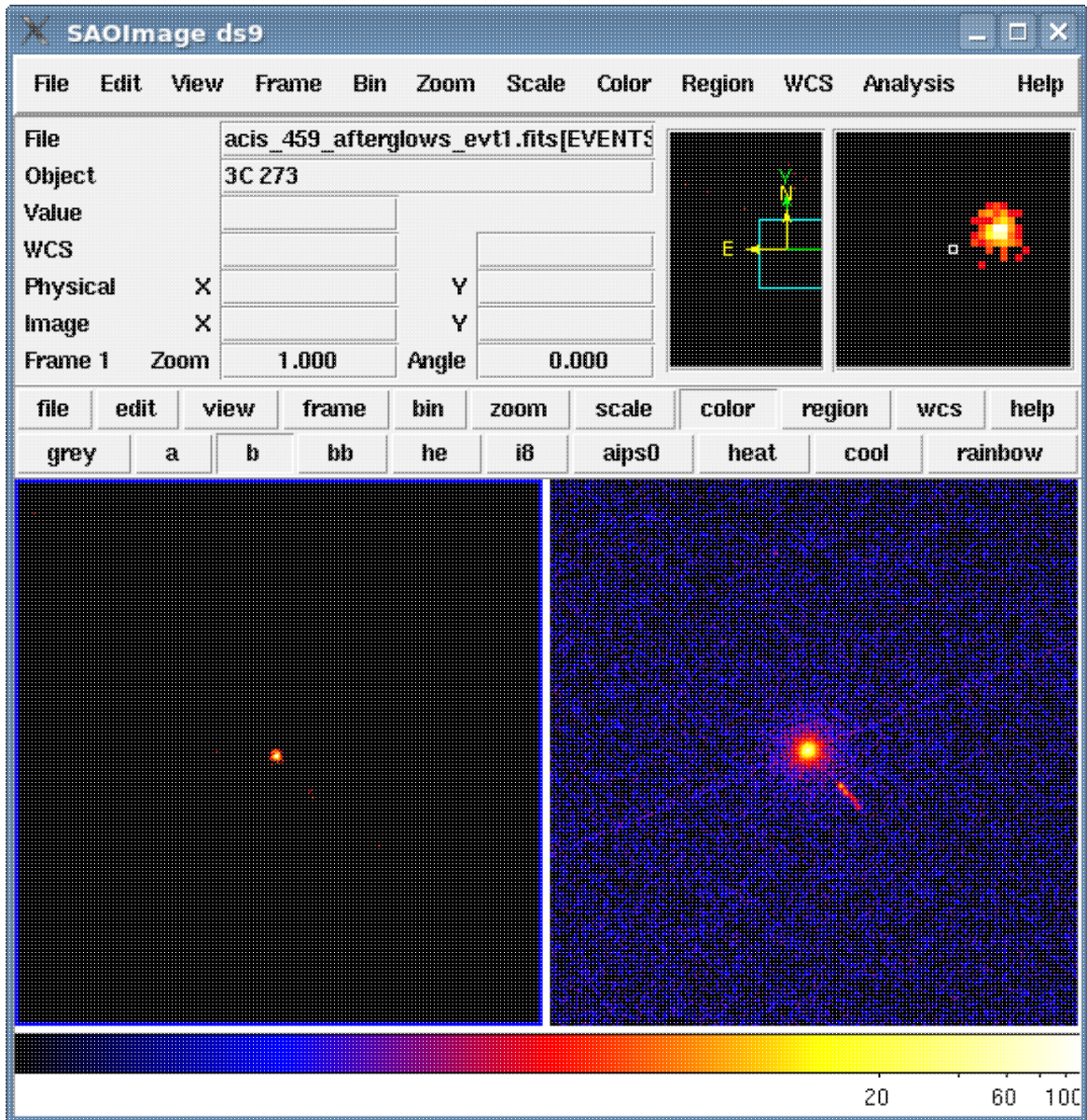


Figure 1: Image of the afterglow events

The afterglow events are in the left frame and the event file is in the right frame. A number of source events clearly have been tagged as afterglows.

Reset the Status Bits

The tool `dmtdcalc` is used to reset the status bits.

The expression selects the afterglow bits (`status=X15F`, `status=X14F`, `status=X13F`, `status=X12F`) and sets them to "0" (False), while retaining the original value of all other status bits (`status=status`). The

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tool counts the bits in the opposite direction (left-to-right vs. right-to-left), so the numbers 15-12 in the expression correspond to bits 16-19.

```
unix% punlearn dmtcalc
unix% pset dmtcalc infile=acisf00459_000N002_evt1.fits
unix% pset dmtcalc outfile=acis_459_reset_evt1.fits
unix% pset dmtcalc expression="status=status,status=X15F,status=X14F,status=X13F,status=X12F"
unix% dmtcalc
Input file (acisf00459_000N002_evt1.fits):
Output file (acis_459_reset_evt1.fits):
expression(s) to evaluate (status=status,status=X15F,status=X14F,status=X13F,status=X12F):
```

Since the file is processed line-by-line, this step can take several minutes to run.

The new output file, `acis_459_reset_evt1.fits`, is a level=1 file with status bits 16-19 set to "0". The content of the parameter file may be checked using [plist dmtcalc](#).

Summary

At this point, users should proceed to the [Create a New ACIS Bad Pixel File: Identify ACIS Hot Pixels and Cosmic Ray Afterglows thread](#) to create a new bad pixel file for their data which contains more accurate afterglow information. After that, the data is reprocessed with [acis_process_events](#) and a new level=2 file must be created. For an overview of the full reprocessing thread, see the [ACIS Data Preparation Analysis Guide](#).

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

```
infile = acisf00459_000N002_evt1.fits   Input file
outfile = acis_459_reset_evt1.fits      Output file
expression = status=status,status=X15F,status=X14F,status=X13F,status=X12F expression(s) to evaluate
(clobber = no)                          Clobber output file if it exists?
(verbose = 0)                             Debug level
(mode = ql)
```

History

- 13 Jan 2005 updated for CIAO 3.2: the thread now shows how to reset the afterglow status bits before applying a new bad pixel file
- 12 Dec 2005 reviewed for CIAO 3.3: no changes
- 01 Dec 2006 reviewed for CIAO 3.4: no changes
- 14 Dec 2007 updated for CIAO 4.0: `kernel` parameter removed from `dmtcalc`; linked to afterglow why topic

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23 Jun 2008 updated image display to place figures inline with text

12 Jan 2009 reviewed for CIAO 4.1: no changes

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

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