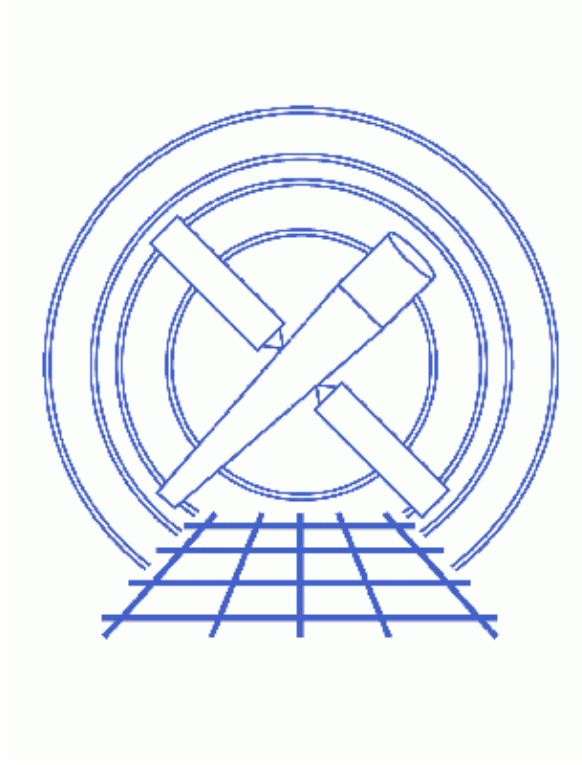


# Using dmcoords to Convert between CHIP and SKY Coordinates



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

# Table of Contents

- *Background Information*
- *Accounting for the Mean Offsets*
- *Verifying the Results*
- *History*

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# Using dmcoords to Convert between CHIP and SKY Coordinates

*CIAO 3.4 Science Threads*

## Overview

*Last Update:* 1 Dec 2006 – reviewed for CIAO 3.4: no changes

### *Synopsis:*

`dmcoords` does not automatically take into account drifts in the Chandra geometry when calculating sky coordinates. These drifts were negligible near the beginning of the mission, but have grown to the order of 10 arcseconds and so cannot be neglected.

### *Read this thread if:*

you are running `dmcoords` to convert from sky to chip coordinates or from chip to sky coordinates.

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

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## Background Information

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

*File types needed:* evt2; asol1

To connect sky and chip coordinates, we need to take into account not only the celestial pointing direction (RA and Dec) of the telescope optical axis, but also the position of the instrument bench in the frame of the telescope mirror.

- the motion of the SIM which puts ACIS or HRC in the focus at a particular location
- the time–variable bending of the telescope tube and other drifts in the Chandra geometry.

This latter correction is measured by the fiducial optical system and is contained in the aspect solution ([asol1.fits](#)) files as columns `dy` and `dz`, giving shifts in mm of the focal plane relative to the optical axis. These values change very slowly over the course of an observation (about one or two pixels); it is taken into account in the calculation of sky coordinates in the pipeline by [acis\\_process\\_events](#).

Because the mean values of `dy` and `dz` were also small early in the mission, `dmcoords` does not by default take them into account. However, five years into the mission the mean value has now grown to the order of 10 arcseconds and so cannot be neglected.

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## Accounting for the Mean Offsets

To get an accurate chip to sky conversion with `dmcoords`, one must determine the mean offsets and supply them to the tool. You can do this very simply by providing the aspect solution file (`pcad_asol1.fits`) in the asolfile parameter:

```
unix% pset dmcoords asolfile="pcadf084244404N001_asol1.fits"
```

This lets `dmcoords` pick up the correct conversion from the aspect solution.

In some cases there will be more than one aspect solution file `asol1.fits` file. *All* the files must be input to the asolfile parameter, either as a list or as a stack (see ahelp\_stack for more information).

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## Verifying the Results

You can check the results by finding a bright source (for good statistics) and using `dmstat` on the events in the event file. Then check that the results agree with those given by `dmcoords`. Since `acis_process_events` has always applied the full aspect solution correction, including the  $dy/dz$  correction, the chip and sky coordinates for individual photons in the event files are fine – the problem only arises in `dmcoords` when you are trying to predict positions.

```
unix% dmstat "acisf01838N001_evt2.fits[sky=circle(4070,4249,14.024608)][cols chip]"
chip(chipx, chipy)[pixel]
  min:      ( 336 353 )           @:      ( 1278 391 )
  max:      ( 395 412 )           @:      ( 1649 2567 )
  mean:   ( 365.80169554 382.8641725 )
  sigma:    ( 12.5906856 12.709801407 )
  sum:      ( 1984840 2077421 )
  good:     ( 5426 5426 )
  null:     ( 0 0 )

unix% pset dmcoords asolfile=pcadf084244404N001_asol1.fits
unix% dmcoords acisf01838N001_evt2.fits x=4070 y=4249 option=sky mode=h
unix% pget dmcoords chipx chipy
371.0480782140089
381.5545050249841
```

The discrepancy is about 5 pixels. Compare this to the results obtained from `dmcoords` without the aspect solution:

```
unix% punlearn dmcoords
unix% dmcoords acisf01838N001_evt2.fits x=4070 y=4249 option=sky mode=h
unix% pget dmcoords chipx chipy
374.6091485412975
391.6940783299734
```

The difference is greater than 10 pixels without the aspect solution applied.

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## History

30 Nov 2004 updated for CIAO 3.2: new `asolfile` parameter in `dmcoords`

09 Dec 2005 reviewed for CIAO 3.3: no changes

## Using dmcoords to Convert Coordinates – CIAO 3.4

01 Dec 2006 reviewed for CIAO 3.4: no changes

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URL: [http://cxc.harvard.edu/ciao/threads/dmcoords\\_displace/](http://cxc.harvard.edu/ciao/threads/dmcoords_displace/)

Last modified: 1 Dec 2006

