CHANDRA
X-RAY OBSERVATORY

CIAO Documentation

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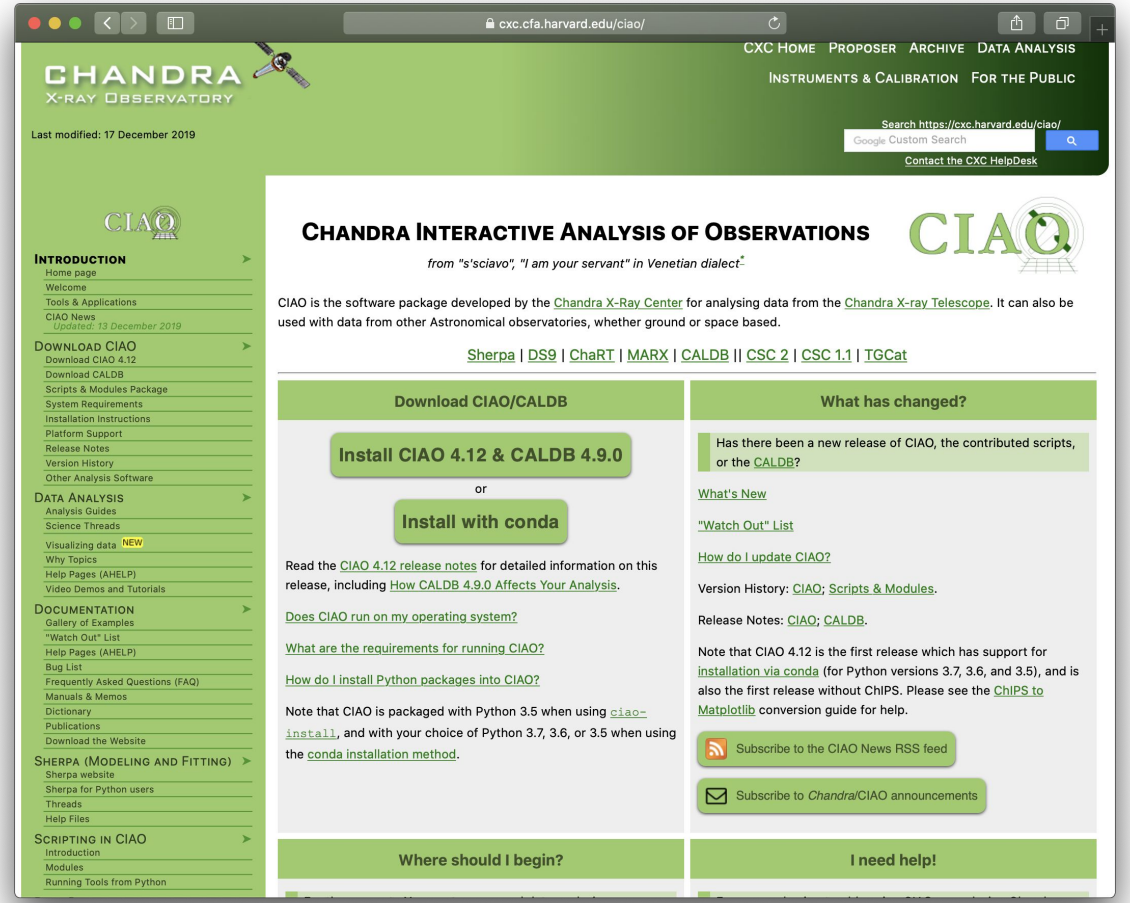
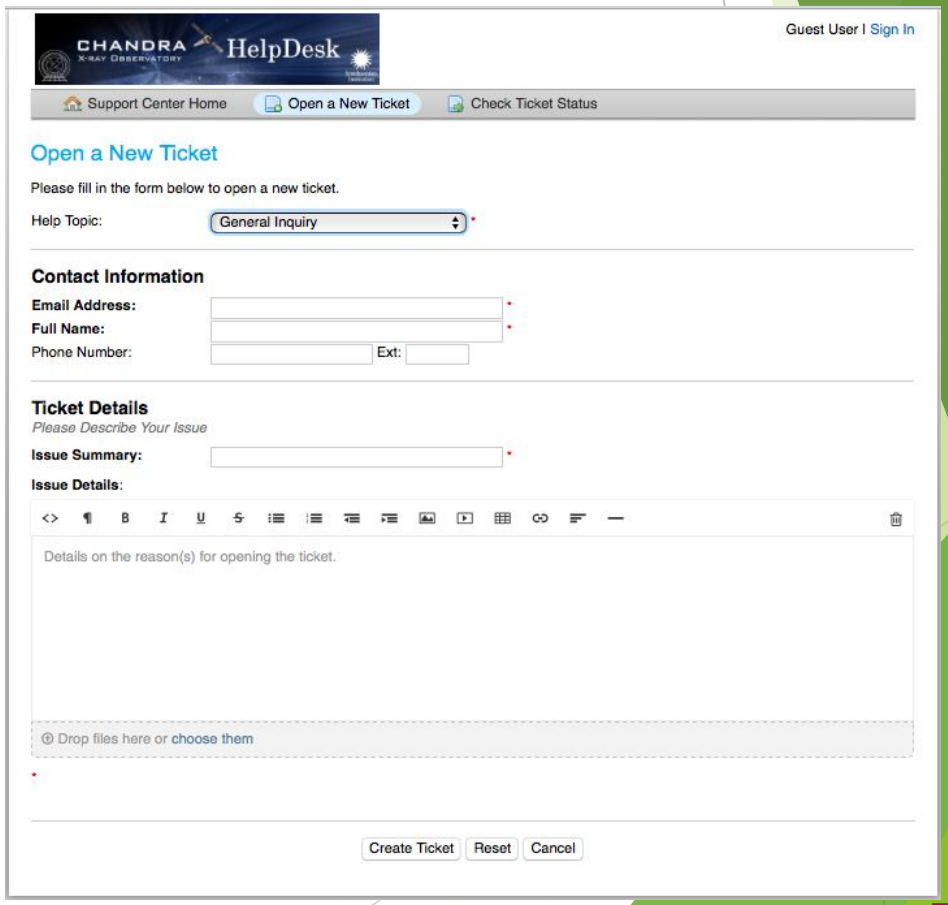
CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

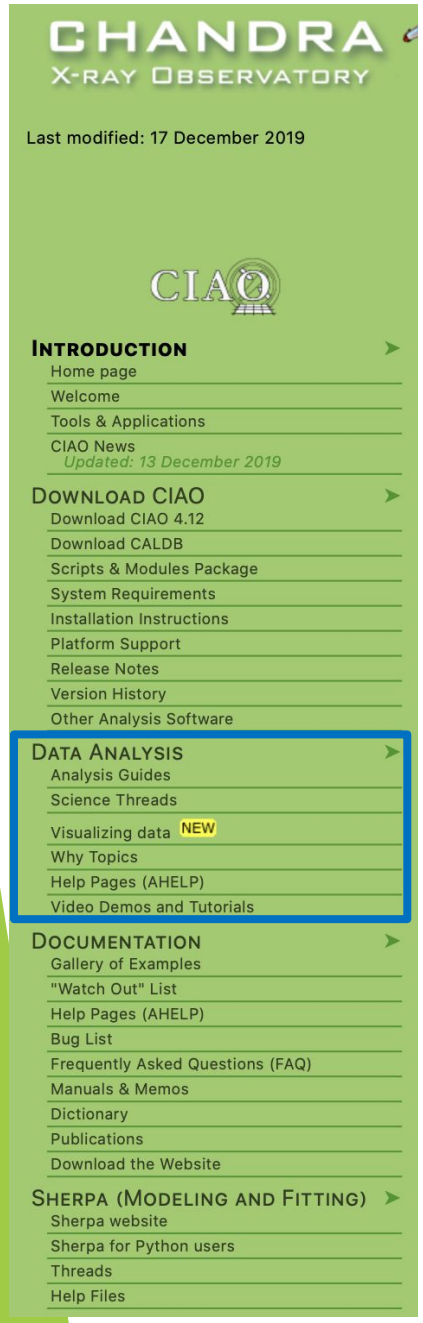
CIAO Documentation

and getting help…

cxc.harvard.edu/ciao



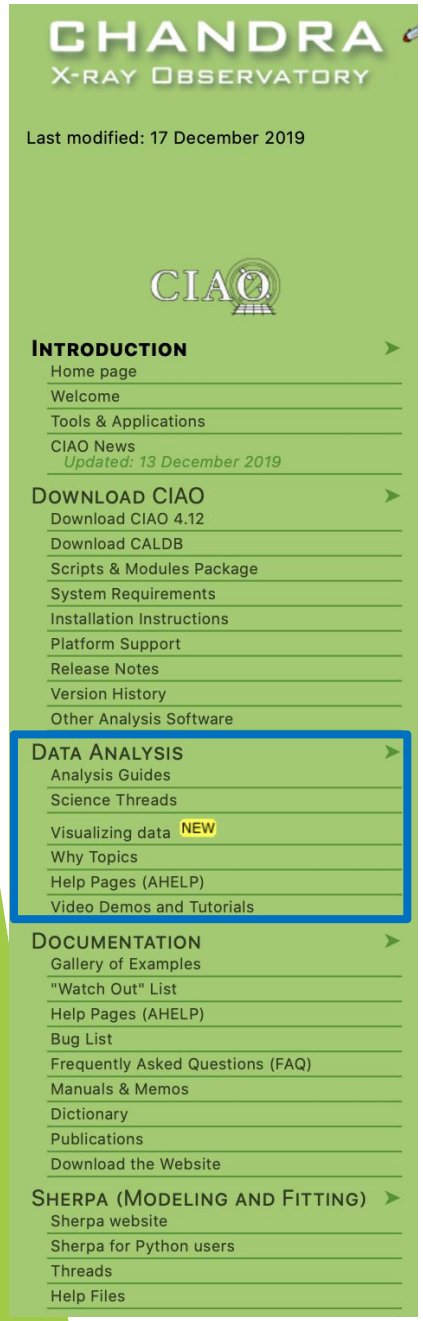




Science Analysis "Threads"

- Science Threads are the most important document type.
  - Over 150 CIAO and Sherpa threads, designed to teach users the approach and concerns that go along with analysis
  - Organized primarily based on science analysis categories
  - Updated and added to as needed; look for "new" and "updated" icon tags

- A thread is *just an example* on approaching a problem.



"Guides" and "Why" Pages

- Analysis Guides are a roadmap to broad categories of analyses.

- Why Topics supplement threads with more detailed information.
  - some topics highlight common pitfalls and nuances in the software
  - others topics discuss aspects of *Chandra* and the data obtained with it
  - some of these topics will also discuss why certain science decisions are made, enabling the user to tailor the analysis to a particular dataset

"ahelp" — *AXAF* Help in CIAO

- CIAO and Sherpa comes with the command-line "`ahelp`" system.
  - `ahelp` has corresponding online counterpart, which is updated between software releases
    [`cxc.harvard.edu/ciao/ahelp` & `cxc.harvard.edu/sherpa/ahelp`]

- Python-environments also supports document strings; Sherpa's primary documentation system.

```
unix% ahelp <toolname>
unix% ahelp <context>
unix% ahelp -c
```

- In Sherpa the string must be in quotes:

```
sherpa> ahelp "toolname"
sherpa> ahelp("toolname")
sherpa> help("docstring")
```

Tip: if you run a tool in the default interactive mode, when prompted for a parameter, entering '?' opens the tool's ahelp file

```
unix% dmextract
Input event file  (): ?
```

A Typical *Chandra*-user's Focus…

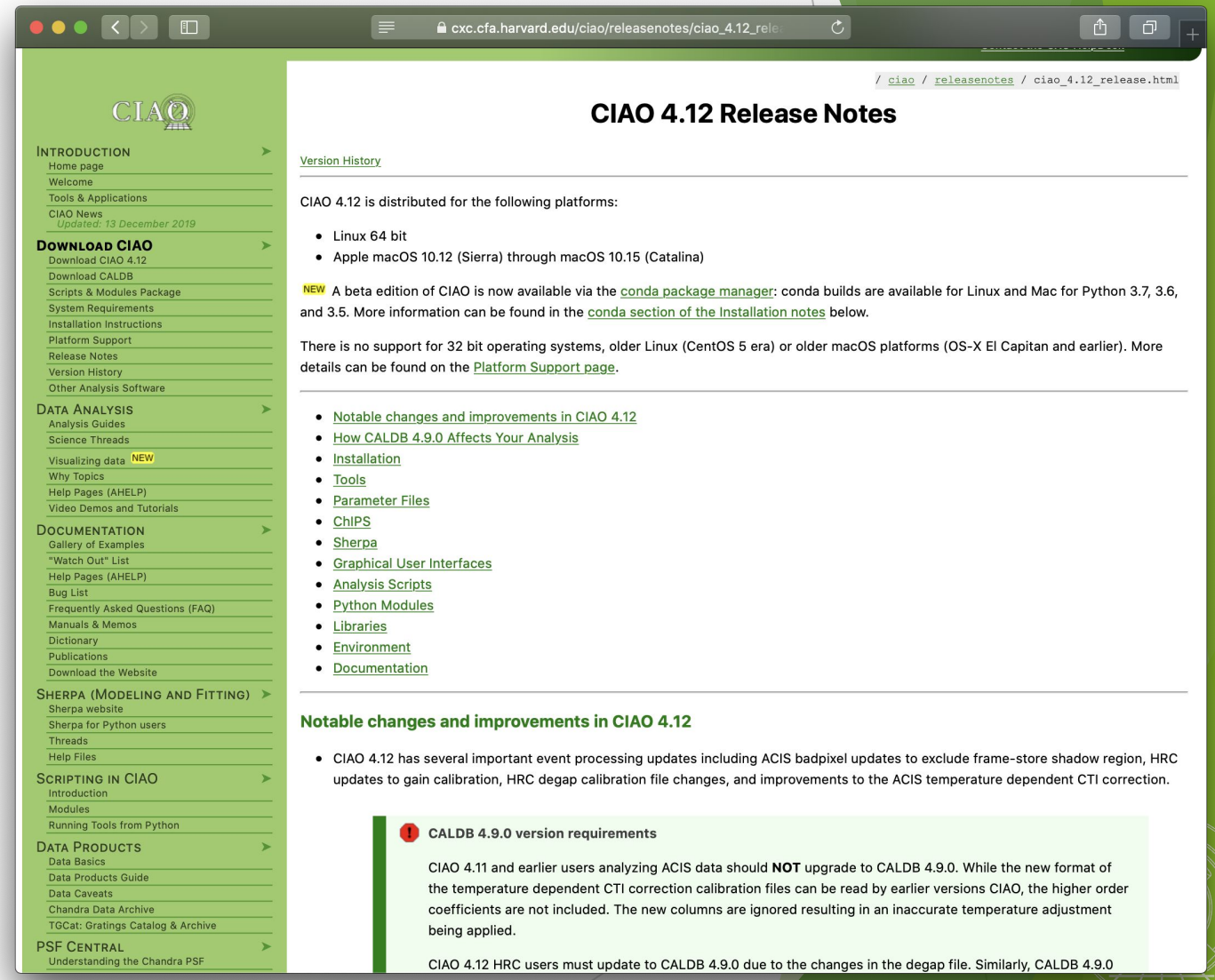
- Threads answer more detailed issues that may affect science
- `ahelps` give the details behind the tool itself

Don't blindly follow the examples verbatim, the threads are not strict recipes!

CIAO Release Notes

- CIAO release notes are revised whenever a new version or patch of a package is updated.
- CalDB components are updated periodically, but will vary from one release to the next.
  - more details on the CalDB can be found at:

    `cxc.harvard.edu/caldb`
- Details of changes to contributed scripts can be seen at: `cxc.harvard.edu/ciao/download/scripts/history.html`



A Word of Caution…

cxc.harvard.edu/ciao

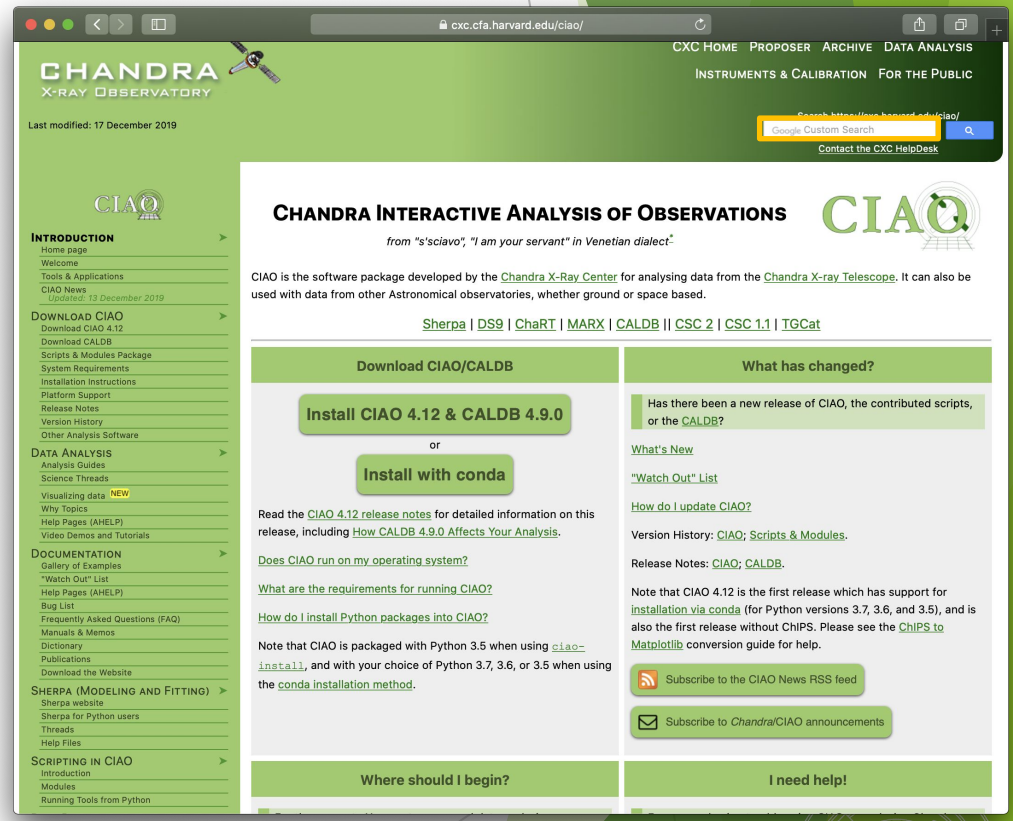
- forwards to the most recent release version of CIAO
  - version-specific website can be found at:

    `cxc.harvard.edu/ciaoX.Y`

- similar address structure for Sherpa pages:

  `cxc.harvard.edu/sherpa`
  `cxc.harvard.edu/sherpaX.Y`

- Be careful with search engine results!



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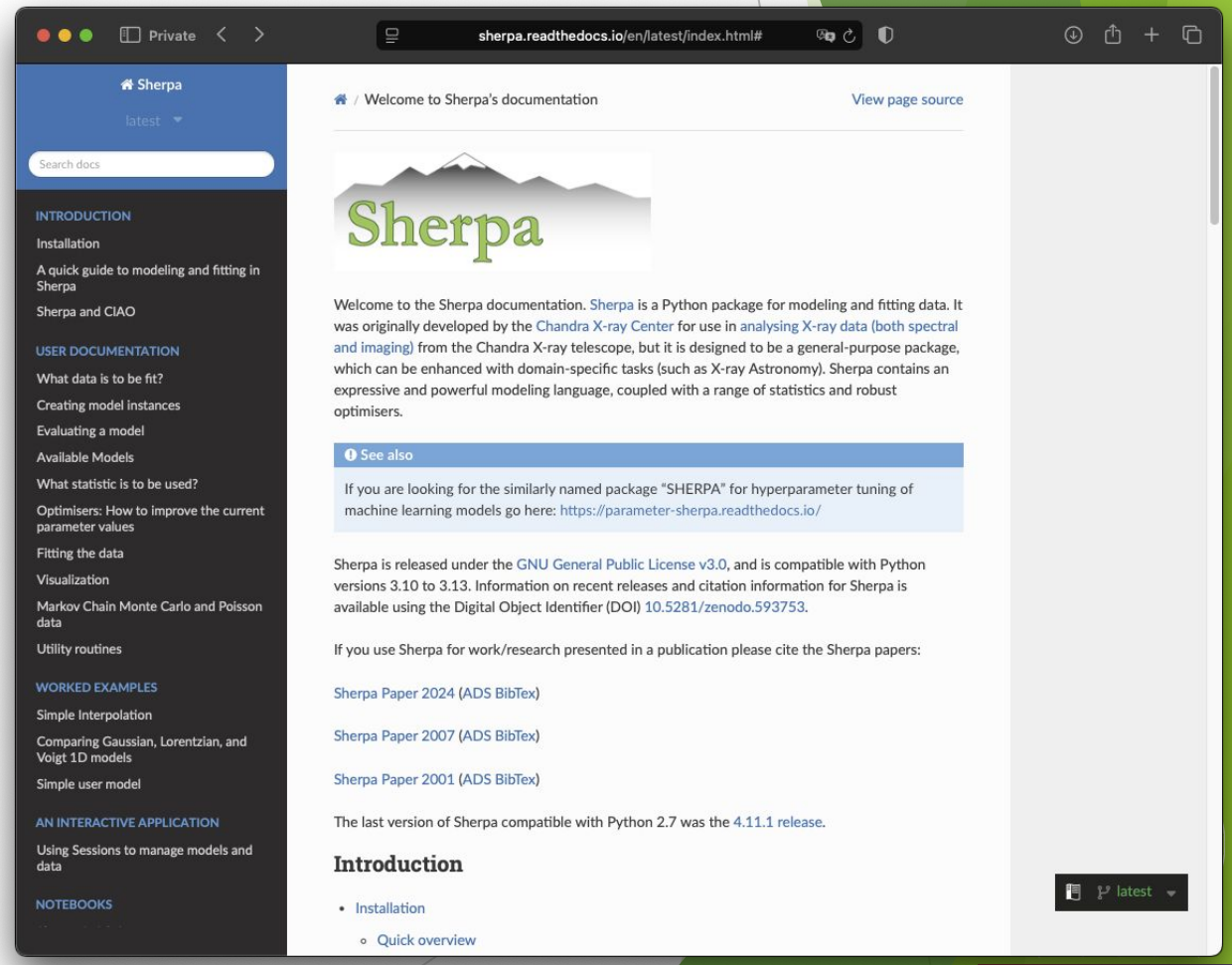
Alternative Sherpa Documentation

sherpa.readthedocs.io

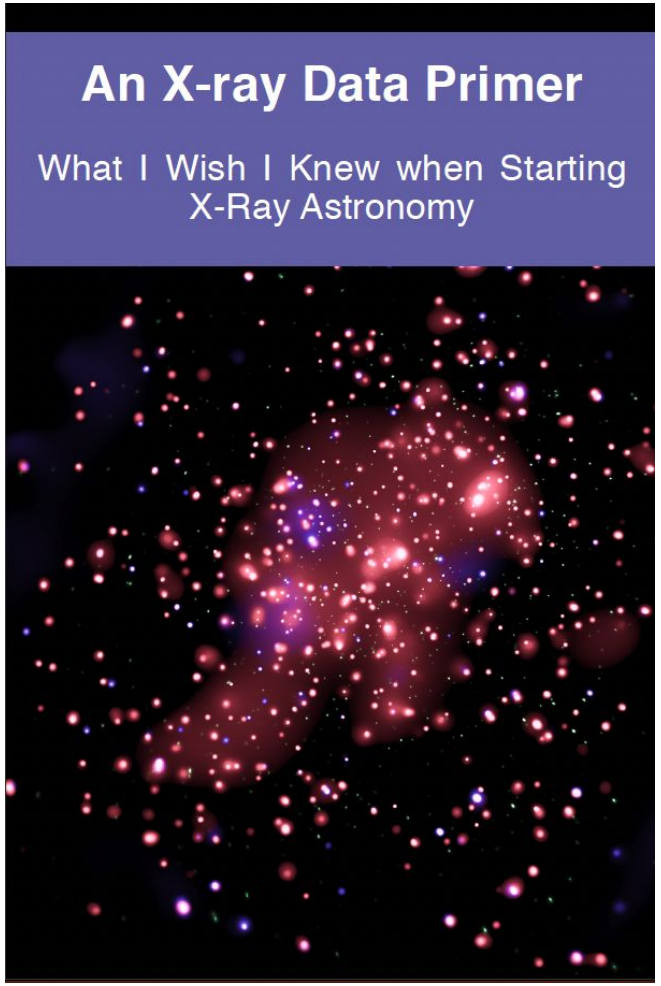
- More Pythonic and technical, derived internal Python docstrings in the underlying Sherpa source code.
- Includes discussion of the lower-level 'machinery' that lets Sherpa work that is otherwise "hidden from view" to the user in CIAO's Sherpa environment.

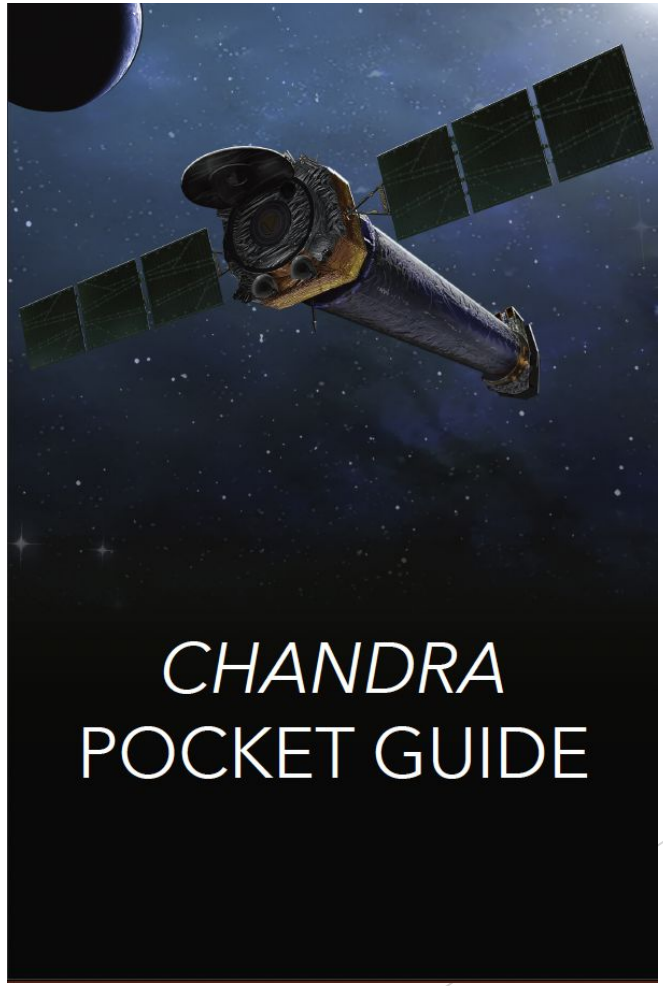


X-ray Data Primer & *Chandra* Pocket Guide

cxc.harvard.edu/cdo/xray_primer.pdf

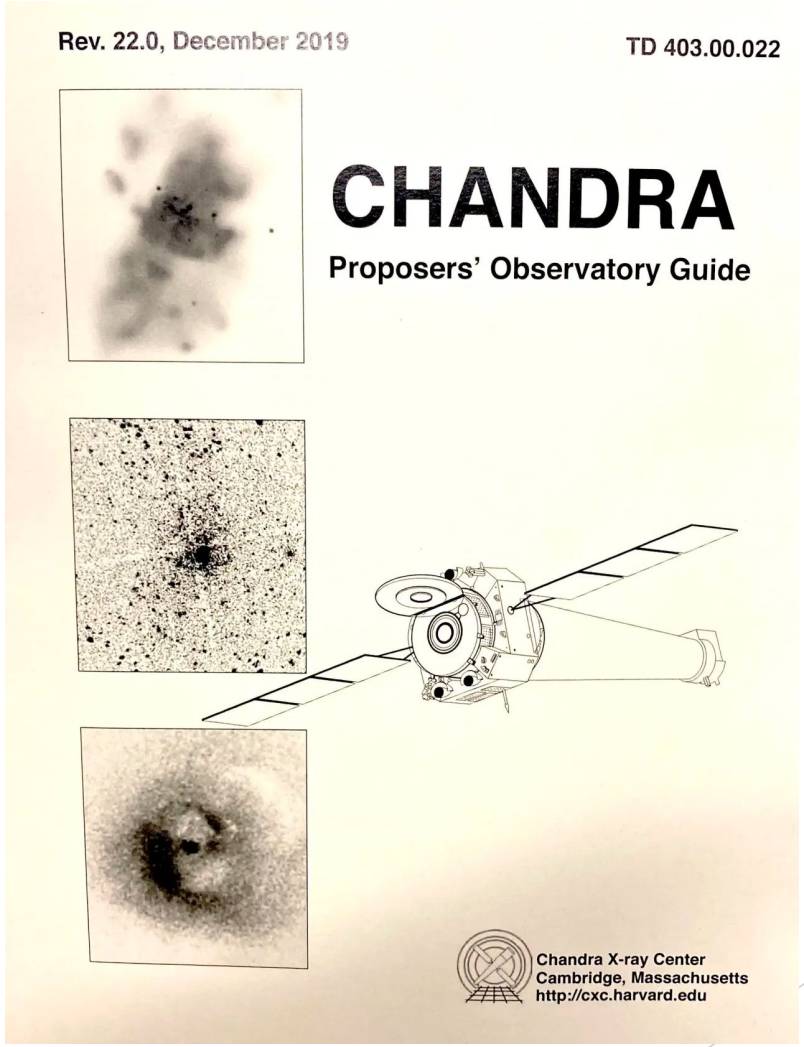
cxc.harvard.edu/cdo/pocket_guide.pdf





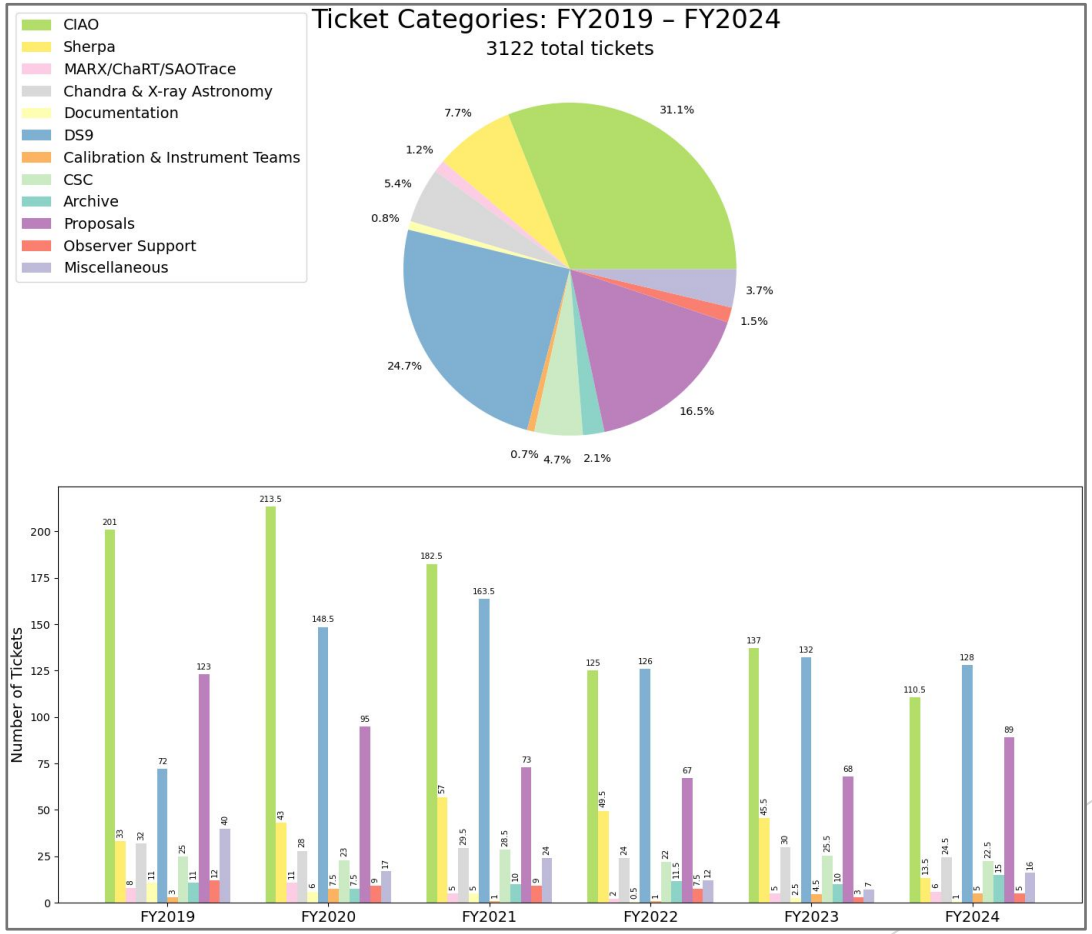
Proposers' Observatory Guide (POG)

https://cxc.cfa.harvard.edu/proposer/POG/



The *Chandra* Helpdesk

The *Chandra* Helpdesk is the primary gateway for users to directly interact with the CXC, receiving ~450-600 tickets annually over the past decade. The vast majority of these interactions concern X-ray data analysis with CIAO/Sherpa and SAOImage DS9.



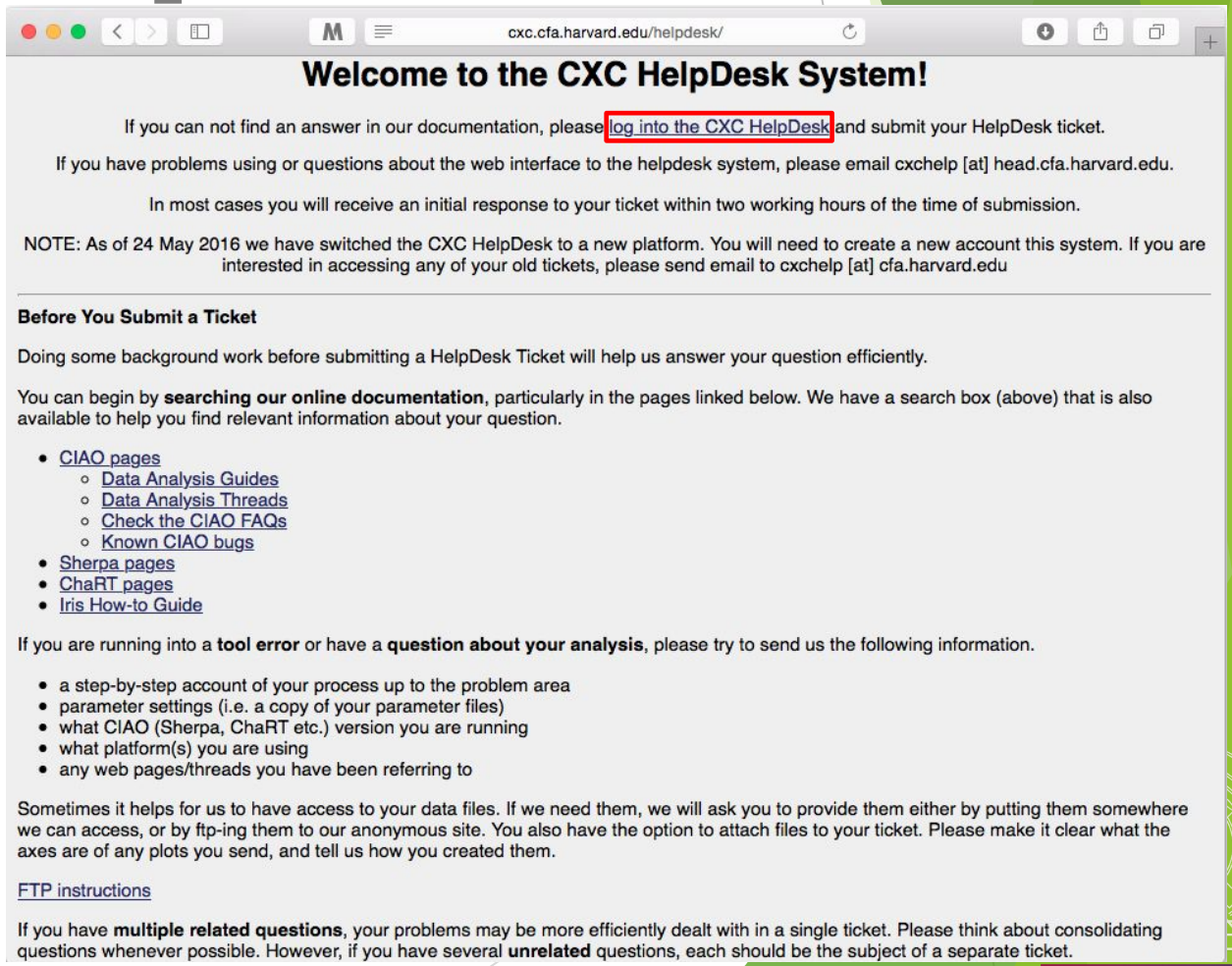
CHANDRA X-RAY OBSERVATORY

The *Chandra* Helpdesk

cxc.harvard.edu/helpdesk

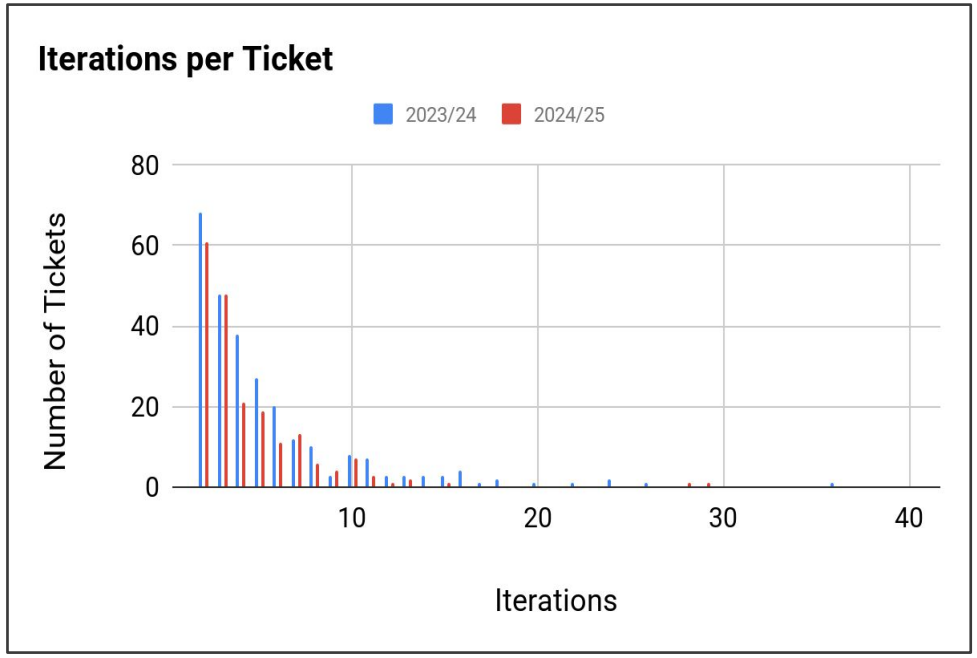
Provides support for:

- proposals & proposal planning
- observation scheduling and issues
- proprietary data
- data archive
- data analysis and DS9



Some Helpdesk Stats…

The Science Data Systems group handles 75-85% of all tickets, including the brief spike around the annual CfP and cost proposal deadlines.



	2023-04-01 to 2024-03-31	2024-04-01 to 2025-03-31
Time period [months]	12	12
Number of TIckets	266	199
Median time to 1st contact [hrs]	1.69	2.72
Median time to close [hrs]	18.00	17.23
Maximum time to close [hrs]	817.4	716.8

Contents of a Ticket

- Software information
  - CIAO version
  - CalDB version
  - Sherpa—stand alone or CIAO distribution
- Platform and operating system
- Question
  - What is the problem or concern encountered?
  - Contextualize the question: what are you trying to do, what is your goal?
    - if referencing a document, include citation beyond just the authors (journal, volume, page)
- What did you do?
  - Describe what you've done and the steps taken
  - Provide commands used
    - copy-and-paste text or provide a log file; no screenshots of terminal, please
  - Include any messages returned by tool, including warning and error messages
  - Provide supporting data files

Finally…

- Please reply back if you're satisfied with the answer/solution so we can go ahead and close the ticket.
- If you have a completely unrelated question, instead of adding to an existing ticket, just open a new ticket.
- Help us help you!
  - the more information you're able to provide up front means a quicker resolution to the concern
- Ultimately, the documentation, software, and helpdesk are meant to help you get to a specific data product.
  - what you do with the data product will be determined by your science goals and judgement
  - doing science is outside the scope of what helpdesk can support
- Your questions and feedbacks also helps us improve our documentation and software

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Ticket Examples

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Real Life Example (good) — I

April 7, 2016 10:39

I was wondering whether there are any tools etc for dealing with correcting an off-axis point source for pileup.

I have been following the pileup guide on the CIAO and Sherpa pages using the jdpileup model, but this seems to be based around an on-axis point source, where all the photons are spread over relatively few pixels. Is there any analogue or guidance for the case where the point source is off-axis, and photons are spread over many pixels (but still with significant pileup)?

A related, probably dumb question (but I am coming to this from particle physics so I am not an expert):

If I reduce the pileup fraction for a source by choosing a region with a central area of high pile-up excluded, (i.e. to extract from the wings of the point spread function), does specextract know about how the point spread function behaves well off-axis, and the way the higher energy photons are spread out than the lower energy ones? I presume the answer is yes, but like I said this is a new subject for me :)

Real Life Example (good) — I — comments

- I was wondering whether there are any tools etc for dealing with correcting an off-axis point source for pileup.

  Clear question that's to the point.

- I have been following the pileup guide on the CIAO and Sherpa pages using the jdpileup model, but this seems to be based around an on-axis point source, where all the photons are spread over relatively few pixels. Is there any analogue or guidance for the case where the point source is off-axis, and photons are spread over many pixels (but still with significant pileup)?

  Puts question into context, and for the case that he's interested in.

- If I reduce the pileup fraction for a source by choosing a region with a central area of high pile-up excluded, (i.e. to extract from the wings of the point spread function), does specextract know about how the point spread function behaves well off-axis, and the way the higher energy photons are spread out than the lower energy ones?

  Puts forward an analysis idea in clear terms and asks for verification that a script can account for this case.

Real Life Examples (bad) — I

- August 15, 2016 13:42

  Good morning I am new to CIAO, and when loading the file of SN2015G just as shown in the introduction of ciao I get an error message saying it was unable to download the fits. Do you know why this could happen?

- October 30, 2015 14:11

  Hi, I am trying to make a nicer image for publication using the following thread. (http://asc.harvard.edu/ciao/threads/diffuse_emission/). I made a merged image by combining 3 ObsIDs using merge_obs tool. I then used exposure corrected image and followed above thread. It either gives "# dmfilth (CIAO 4.7): WARNING: Skipping bkg region #51 - no data (region outside image boundary?)." error or the output image (diffuse.img) is not fill the point sources.

Real Life Examples (bad) — I — comments

- Good morning I am new to CIAO, and when loading the file of SN2015G just as shown in the introduction of ciao I get an error message saying it was unable to download the fits. Do you know why this could happen?

  No, more information is needed. What ObsID is the user looking at? What file are they using? Which introductory page are they referring to and what tools and commands are being used? What is the actual error message that's seen?

- I made a merged image by combining 3 ObsIDs using merge_obs tool. I then used exposure corrected image and followed above thread. It either gives "# dmfilth (CIAO 4.7): WARNING: Skipping bkg region #51 - no data (region outside image boundary?)." error or the output image (diffuse.img) is not fill the point sources.

  While a description of steps are provided, what were the actual commands used? No files provided to test on to see the problem the user's concerned about.

Real Life Examples (good) — II

January 27, 2015 18:29

Hello, I am following the HETGS grating spectra thread (http://cxc.harvard.edu/ciao/threads/spectra_hetgacis/index.html)

I am encountering a SIGSEGV error

```
===
-bash-4.1$ ciao
ERROR: The current environment is configured for:
CIAO 4.6 Monday, December 2, 2013
bindir : /nfs/cxc/a1/linux-x86_64/opt/packages/ciao-4.6/bin
CALDB : 4.5.9

Variables used:
i=13850
SPECOUT=hetgs_spectra
flt=13850/secondary/acisf13850_000N001_flt1.fits.gz

-bash-4.1$ dmcopy "$SPECOUT/$i\_evt1a_flt.fits[EVENTS][@$flt][cols -phas]"
$SPECOUT/$i\_evt2.fits
# 5961: Received error signal SIGSEGV-segmentation violation.
# 5961: An invalid memory reference was made.
# 5961: segmentation fault: DMCOPY (1) is: exit_upon_error->NULL
===
```

I am attaching the evt1a and the flt file.

Real Life Examples (good) — II — comments

- I am encountering a SIGSEGV error

  The user describes the problem encountered.

- ```
  CIAO 4.6 Monday, December 2, 2013
  bindir : /nfs/cxc/a1/linux-x86_64/opt/packages/ciao-4.6/bin
  CALDB : 4.5.9
  ```

  Provides the software and CalDB version used.

- ```
  -bash-4.1$ dmcopy
  "$SPECOUT/$i\_evt1a_flt.fits[EVENTS][@$flt][cols -phas]"
  $SPECOUT/$i\_evt2.fits
  # 5961: Received error signal SIGSEGV-segmentation violation.
  # 5961: An invalid memory reference was made.
  # 5961: segmentation fault: DMCOPY (1) is:
  exit_upon_error->NULL
  ```

  She defines the files and variables used; the command executed; and the entire error message returned by the tool.

- I am attaching the evt1a and the flt file.

  Includes all the files used leading to the problem.

Real Life Examples (bad) — II

- December 1, 2014 14:58

  I saw a chandra specialist did wavdetect in an uniqe way. He used dmcopy to make fits file for every single CCD, then he ran wavdetect for every fits file. Do you know that is for what? Is it better to run wavdetect on a single ccd?

- July 6, 2010 14:51

  Hi,
  I've attached a script for you, i need help with the sherpa script...
  thank you

Real Life Examples (bad) — II — comments

- I saw someone use `wavdetect` in an unique way. He used `dmcopy` to make FITS files for each CCD, then he ran `wavdetect` for each file. Do you know why he did this?

  Without context and seeing exactly how he filtered the data, it's impossible to say why he did what he did. The user is better off asking the person directly. Be explicit!

  Is it better to run `wavdetect` on a single CCD?

  Too general of a question that's a judgement call which only the user can answer. "Better" is relative, with the trade offs that come with any computational problem.

- I've attached a script for you, I need help with the Sherpa script...

  What does the user think is wrong with the script? What result does it return that's wrong?

Real Life Examples (good) — III

June 5, 2013 13:06

CIAO version 4.5
CALDB version 4.5.5.1

Trying on both a Macbook Pro (OS 10.8.3) and Linux (Ubuntu 12)
=======
I am trying to take a general survey of quasars Chandra archive. I have been going through a list of obsids, but am finding some issues with determining which chip the target point source is on. I have noticed in the past that the CCD_ID listed in the evt2 file fits header does not always agree with the actual chip id that the target is on.

For example, with ObsID 3472 (and HETGS observation):

```
>> evt2=`ls primary/*evt2*`
>> dmkeypar $evt2 CCD_ID echo+
4
```

But I know the zeroth order of the source is centered on chip 7.

If I open the evt2 file in ds9, I can overlay a region centered on the point source. When I then use the Analysis -- CIAO -- Coords -- Chip tool, it returns chip 7.

However, if I move the region to a different part of the image that is clearly a different chip, the Coords--Chip tool still returns 7. This makes it very difficult to check what is printed as CCD_ID in the header, making it very difficult to automate the process. Please help!

Real Life Examples (good) — III — comments

- CIAO version 4.5
  CALDB version 4.5.5.1
  Trying on both a Macbook Pro (OS 10.8.3) and Linux (Ubuntu 12)

  The user provides software information and shows which platforms she's encountered the issues on.

- I have noticed in the past that the CCD_ID listed in the evt2 file fits header does not always agree with the actual chip id that the target is on.

  Primary concern concisely stated.

- ```
  >> evt2=`ls primary/*evt2*`
  >> dmkeypar $evt2 CCD_ID echo+
  4
  ```

  But I know the zeroth order of the source is centered on chip 7.

  Shows what she did, given a specific ObsID, and what is returned by the tool, which contradicts what she knows about the observation.

- If I open the evt2 file in ds9, I can overlay a region centered on the point source. When I then use the Analysis -- CIAO -- Coords -- Chip tool, it returns chip 7. However, if I move the region to a different part of the image that is clearly a different chip, the Coords--Chip tool still returns 7.

  The user also describes another problem she sees in DS9: what was done, what was returned, and what she finds confusing.
  ```

Real Life Examples (bad) — III

- November 26, 2009 10:47

  Hello
  I use dmextract to get the light curve for a point source in ACIS data, and I have been received these warnings:
  # dmextract (CIAO 4.1): WARNING: Input file, "acis_dstrk_evt2.fits[ccd_id=2,sky=region(source.reg)]", has no rows in it.

  # dmextract (CIAO 4.1): WARNING: Input file, "acis_dstrk_evt2.fits[ccd_id=2,sky=region(back.reg)]", has no rows in it.

  I am sure about the ccd id and source.reg, back.reg. I don't know what my mistake is .

- July 8, 2010 15:43

  You know what I'm doing, it's Cassiopeia A, all I need is to get the energy spectrum... The way u said worked... I used specextract and got the files i needed... but then something seems to be not right with sherpa script. I thought i was supposed to get a clear one like the ones from Mrk 421, but I don't understand it...

Real Life Examples (bad) — III — comments

- `"acis_dstrk_evt2.fits[ccd_id=2,sky=region(back.reg)]", has no rows in it.` I am sure about the `ccd_id`, `source.reg`, and `back.reg`. I don't know what my mistake is.

  The files named in the error/warning messages aren't provided. The problem is that with generic file names, an ObsID is needed to begin an investigation. This problem is compounded if generic region names are also used in the command-line syntax, in which case the contents of the region files need to be provided too.

- You know what I'm doing, it's Cassiopeia A. All I need is the energy spectrum... the way you said worked... I used `specextract` and got the files I need...

  The user assumes the ticket will be assigned to the same support staff member, so they don't provide any details for the question.

  something seems not to be right with the Sherpa script. I thought I was supposed to get a clear one like the ones from Mrk 421, but I don't understand it...

  What seems wrong with the Sherpa results? What does "clear one" mean? What doesn't the user understand?