Chandra X-ray Center

Introduction to CIAO Tools and Applications

CIAO is a data analysis system written for the needs of users of the Chandra X−ray Observatory. Because Chandra data is 4−dimensional (2 spatial, time, energy) and each dimension has many independent elements, CIAO was built to handle N−dimensional data without concern about which particular axes were being analyzed. Also, apart from a few Chandra instrument tools, CIAO is mission independent.

CIAO also needed to be able to filter and project the 4−D Chandra event data to managable sizes and convenient arrays. This has to be done flexibly, so we have built all CIAO tools to take a filtering and binning specification on the command line, making use of a general−purpose regions syntax.

Since Chandra data can be sliced and diced in so many ways, and because the Chandra calibration is spatially and energy dependent, we needed to keep track of just how the data had been filtered and binned, which we do in a "data subspace". The tools keep track of this subspace automatically and allow users to review previous data processing.

The CIAO design allows close interconnection of tools. For example, the output of any of the source DETECT programs can be fed into dmextract to create a summed spectrum which can then be fit in *Sherpa*.

The modeling and fitting tool *Sherpa* is central to the CIAO system. *Sherpa* performs forward fitting of models to data in N dimensions. *Sherpa* includes the "S−Lang" language which can be used for scripting and data manipulation. GUIDE links *Sherpa* results to the APEC/APED plasma database, enabling the identification of spectral lines and the use of their properties in further fitting.

In order to allow users of Chandra data to use pre−existing tools, all CIAO tools read and write several formats, including FITS images and tables (which includes event files) and IRAF imh files.

Altogether CIAO is a powerful system for the analysis of many types of data.

Further Information

- `ahelp ahelp`: an introduction to the CIAO on−line help system.
- Use "`about <keyword>`"> for a list of subjects related to your query (i.e. whatever value you use for <keyword>).
- `ahelp -c tools`: a list of the tools in CIAO.
- `ahelp dm`: a list of topics related to the CIAO Data Model.
- `ahelp dmintro`: an introduction to the CIAO Data Model.
- `ahelp chips`: an introduction to the CIAO plotting package, *ChIPS*.
- `ahelp sherpa`: information on modeling and fitting data with *Sherpa*.
- `ahelp guide`: an introduction to using GUIDE for identifying atomic features in spectra.
- `ahelp gui`: an introduction to the graphical user interfaces available within CIAO.

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