The "Data Model" and the Data Manipulation Tools

More info and examples can be found in:

Data Manipulation Users Guide:
http://asc.harvard.edu/ciao2.0/download/doc/manual_dm.ps

Introduction To the Data Model *thread:*
http://asc.harvard.edu/ciao2.0/threads/dm_intro.thread.html

Also by doing "ahelp" on the following subjects:

dm, dmintro, dmsyntax, filtering, binning, dmimages, region, dmcols, dmimfiltering

- The CXC analysis and processing software is built on a common versatile interface library called the CXC Data Model (or just DM).

- The DM provides users with a powerful built-in data filtering and binning capability.

- The name “Data Model” reflects the fact that the interface can be used on data files of different format (all described by a single abstract description - the same “model”) in a transparent way.

- As of CIAO2.0.2, the format supported by the DM library include: FITS, IRAF QPOE and IRAF IMH.

- An important characteristic of the DM is that ANY program that asks for a data file name as input, will accept a virtual file string which will cause the program to see a filtered version of the file in question.

- The "virtual file" syntax is also commonly used to create on disk a filtered version of the input file.

- Another important characteristic of the DM is that all columns of event lists are treated "equally": for example binning is allowed not only in spatial coordinates but also in e.g. time, or energy coordinate, giving the ability of creating multidimensional images in space-energy, or space-time, etc.

SUMMARY OF MAIN DATA MODEL PROPERTIES:

FORMAT INDEPENDENT

POWERFUL FILTERING AND BINNING

USAGE OF “VIRTUAL FILES”

Data Manipulation Tools

The four DM "core" tools are:

dmlist: list contents or structure of a file

dmcopy: filter and bin tables and images

dmextract: make a histogram table file (e.g. PHA file) from a table column

dmgti: create custom Good Time Intervals (GTIs) from a constraint expression

The full list of DM tools in CIAO 2.0.2. includes also:

dmappend - Append multiple blocks/extensions to an existing output file
dmarfadd - Add multiple ARF files together , weighting by exposure time
dmcontour - Make contour regions from a 2-D image
dmcoords - Convert between Chandra instrumental coordinate systems
dmgroup - Group a specified column in a table
dmhedit - Edit data model file headers
dmimg2jpg - Make a color JPEG image from three image files
dmimgcalc - Perform arithmetic on images
dmimghist - Make histogram of values in a 2-D image
dmkeypar - Retrieve information about a keyword from an input file
dmmakepar - Write header keywords to a parameter file
dmmakereg - Create a FITS region file from an ASCII region description
dmmerge - Merge two or more compatible tables into one
dmpaste - Add new columns to a table
dmreadpar - Add parameters from a .par file to a file header
dmrega2fts - Convert a grating ASCII region into a FITS format
dmregrid - Rebin a stack of 2 dimensional images
dmsort - Sort a table block on a given column
dmstat - Compute standard statistics for the column in a table or image
dmtcalc - Define new table columns as functions of old ones
dmtype2split - Create a type 1 file for specified rows of a type 2 file
dmwritefef - Create a FITS Embedded Function (FEF) file from ASCII files

DATA MODEL SYNTAX

- All CIAO tools use the DM library and therefore accept as input "virtual files" described using the DM syntax.

- In the DM context a "virtual file" is represented by a filename followed by a series of optional qualifiers in square brackets [ ]:

filename[block][filter][columns/binning][options][newblock]

Note that:

- the order of the qualifiers matters, however ...
- not all qualifiers need to be present always

where:

block - is the "section" of the file to use

filter - is the filter to be applied

columns/binning - specifies either the columns from a table to be included in an output table or the binning. When binning the data to generate an n-dimensional image, the range and binsize (min:max:bin) must be specified.

options - a sequence describing special options for the DM library

newblock - the name for the new block in the output file, default is the block used from the input file

Examples of "virtual files":

- Select the first three columns of the EVENTS block by number:

acisf01843N001_evt2.fits[EVENTS][time=84245787:84247000][cols #1,#2,#3]

or by name:

acisf01843N001_evt2.fits[EVENTS][grade=0,2,3][cols time,ccd_id,node_id]

after filtering in time or grade

- Bin an events file to create a PI spectrum for a specified region (input of dmextract):

acisf01843N001_evt2.fits[sky=region(mysrc.reg)][EVENTS][bin pi=1:1024:1]

or an image (input of dmcopy):

acisf01843N001_evt2.fits[EVENTS][pha<100][bin x=320:480:4,y=320:480:4]

In the examples above:

block: [EVENTS]

filter: [time=84245787:84247000]
[grade=0,2,3]
[sky=region(mysource.reg)]
[pha<1000]

columns/binning:
[cols time,ccd_id,node_id]
[cols #1,#2,#3]
[bin pi=1:1024:1]
[bin x=320:480:4,y=320:480:4]