`BAND` is used to refer to a given *wavelength band*, numbered 1 and 2 for NIS, 1 through 4 for GIS.

`DETX` refers to the detector X position. The pair `(BAND,DETX)` has the same function as the pair `(WINDOW,OFFSET)`

`XIX` refers to the X index, i.e., the index of the second dimension of the data array associated with a line window.

`YIX` refers to the Y index, i.e., the index of the third dimension of the data array associated with a line window.

`TIX` refers to the time index, i.e., the index of the fourth dimension of the data array associated with a line window.

5 CDS Quicklook Software

5.1 How to get started

After entering IDL we need to read a FITS file containing science data. If you know the name of the FITS file(s), you may use `READCDSFITS` directly from the IDL prompt (as in Section 4.3 to read in the data.

If you don't know which FITS files you'd like to read in, there are two routines that may be used to browse through lists of observations, `XCAT`, and `PICKFITS`:

Using `XCAT` requires that your system is set up so that `XCAT` can locate the as-run database (see CDS Software Note No. 17).

Using `PICKFITS` requires that you (or someone at your site) use the routine `CFITSLIST` to produce/maintain a list of available FITS files (see the on-line documentation).

Let's assume your're using `XCAT`. Then you'd start by using a command like

```
IDL> xcat,q
```

where `q` is the output parameter, to receive the QLDS.

Select a line with a the desired study, and then select from the rasters in that study. You then select `Read and Exit with QL data structure` from the pulldown menu called `Read & View Current FITS File`. This will read in the FITS file and exit from XCAT, and the variable `q` will contain the Quicklook Data Structure (QLDS), with the data from the selected fits file.

You may also start the Quicklook "Display Menu" directly from `XCAT` by selecting `Quicklook` from the `Read & View Current FITS File` pulldown menu. You may even read several rasters after each other, and have one Quicklook Display Menu for each of them. You may exit `XCAT` without killing the Quicklook Display Menus.

NOTE: To enable `XCAT` and the Quicklook Display Menu to be functioning side by side, allowing *several* files to be read and displayed on screen simultaneously, it is impossible[1] to make the data

[1] well, *virtually* impossible

return through the output parameter q. When terminating the Display Menus spawned by XCAT you have two exit options, Exit and DELETE from memory (free space), and Exit and KEEP in memory (recoverable). If you select the first option, the QLDS containing data from that FITS file will be deleted, freeing the memory allocated to it. If you select the KEEP option, however, the QLDS will be kept inside the Quicklook memory management system. When you get back to the IDL prompt (after exiting XCAT), you should use the command @recover to recover the data. This will return the data structures into global variables a, b, c, d, .. etc (never overwriting any *defined* variables you may have, though), telling you where the data ends up.

5.2 Reading selected line windows only

The amount of data in a FITS file is in practice determined by the number of line windows, the size of the windows, and the number of exposures in the raster sequence. When using READCDSFITS from the IDL prompt a set of keywords is available to retrieve only selected parts of the data set or to automatically read only the data that fits below a certain memory limit. The following keywords are valid:

```
/HEADER   ; read only header information -- no data will be loaded
/SELECT   ; prompts for selection of selected detector data windows
PRESELECT ; list of windows to be read in
MEMLIMIT  ; set to maximum size of memory the data are allowed to occupy
/AUTO     ; reading just those data windows that fit below the memory limit
```

Thus, to read only a selection of the line windows use:

```
IDL> a = readcdsfits('s3300r00',/select)
```

For each single line window the program will ask the user if the window should be loaded into IDL.

When using READCSFITS from a user-written program designed to analyze data from only a few (of many) line windows, a lot of time and memory can be saved by using the PRESELECT keyword, e.g.,

```
PRO my_analysis

    files = ['s5500r00','s5500r01','s5500r02','s5500r03','s5500r04']

    for i = 0, n_elements(files)-1 do begin
        qlds = readcdsfits(files(i),preselect = [0,2]) ;; Pick windows 0 and 2

        <process data from this file>

        delete_qlds,qlds ;; Delete it when you don't need it anymore....
    endfor
END
```

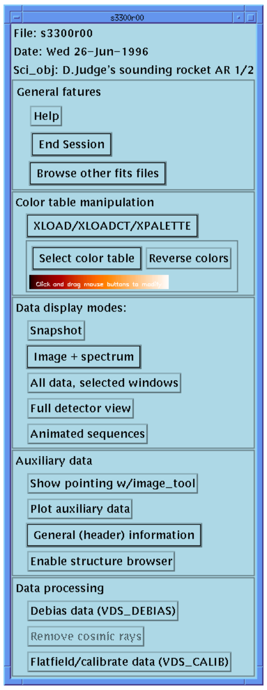

Figure 6: The Display Menu for selection of display modes

5.3 Running QL software from the Display Menu

To start the Display Menu from the IDL prompt after reading in a FITS file, use e.g., `IDL> dsp_menu,qlds`. This call creates a menu covering the most important features available in the Quicklook software (Figure 8). The available options vary slightly depending on the type of raster.

In this mode the user does not need to know anything about the names of different routines. However, the different display routines may be called directly from the IDL prompts without calling `DSP_MENU` first. Examples of how to do this will be given under the description of each display mode and are also listed at the end of the section.

We will now go through the various options in the Display Menu.

5.3.1 General features

`Help`

This option starts a help widget with information on the various options in the Display Menu. The help text is mostly a repetition of the contents of this software note. Select topics from the left hand list.

`End Session`

When the Display Menu is started from the IDL prompt, this pulldown menu has only one option, `Quit Display menu`, which will terminate the menu (and applications started from the menu) and return you to the IDL prompt (unless you have other widget programs running, of course).

If the Display Menu has been started from XCAT or PICKFITS, there is an option to `Exit and DELETE from memory (free space)`, or `Exit and KEEP in memory (recoverable)`. See Section 5.1 for an explanation of these options.

`Browse other fits files`

You may use this menu to start XCAT or PICKFITS from a Display Menu, to inspect other FITS files without having to terminate all the running widget programs.

5.3.2 Color table manipulation

`XLOAD/XLOADCT/XPALETTE`

Use this menu to start color table manipulation programs. If you do not require extraordinary control over the color table, however, we recommend using the widgets just below. You may select a color table directly from the pulldown menu. You may also adjust the BOTTOM, GAMMA and TOP parameters (as used in XLOADCT) by clicking and dragging the mouse with the left, middle and right buttons inside the color bar area.

5.3.3 Data display modes

`Snapshot`

The snapshot program is a very useful program to produce a quick snapshot of the "what did I get in the field of view" type, written by Bill Thompson. It will also produce hardcopies of what you get on screen. The program has to be run as *modal*, however, so you need to exit from Snapshot before you can do more from the Display Menu. From the IDL prompt: `xcds_snapshot,qlds`.

`Image + spectrum`

This option starts DSP_WAV, a program that displays images of the observed area by taking a slice through the data windows at a given dispersion pixel. You may move around, zoom in/out etc in the image(s). You determine the number of simultaneous data windows to be displayed when selecting from this pulldown menu. It also displays the actual spectrum/line profile from the current point. From the IDL prompt: `dsp_wav,qlds [,nwindows]`.

`All data, selected windows`

This option is very useful for spotting "events" (like sudden changes in intensity/line position etc from one exposure to another) in a dataset. It prompts you to select the line windows to be displayed, and then displays *all* the exposures of those windows in a single draw window. Since the draw window can be very large, it may not work properly without having the DEVICE,RETAIN=2 feature enabled in IDL. For the GIS, single exposures are not images, so instead slit scans (normally north-south) are displayed as images. This program is not as useful with e.g., GIS data, or NIS data taken with a full spectral readout. From the IDL prompt: `dspexp,qlds`.

`Full detector view`

This option starts the program DSPSPEC, which shows the data from the line windows placed at their respective detector positions. For the NIS it shows images of the detector at a given exposure, for the GIS it shows plots of the spectrum acquired at a given exposure.

`Animated sequences`

This option starts `DSP_MOVIE`, a program originally designed to view NIS wide-slit observations staring at a single point with many exposures. This is still the main purpose of the program, but as long as you have a raster containing 3-dimensional data, it's possible to make animated sequences of various types, which is sometimes nice to highlight certain features in the observations. From the IDL prompt: `dsp_movie,qlds`

5.3.4 Auxiliary data

`Show pointing w/image_tool`

This option starts the program `DSP_POINT`, which starts `IMAGE_TOOL`, passing on pointing information from the FITS header. This enables you to get an overview of the position where the observations were taken. From the IDL prompt: `dsp_point,qlds`

`Plot auxiliary data`

This option starts the program `DSP_AUX`, where the various auxiliary data such as pointing, time elapsed since start of the raster etc may be plotted. From the IDL prompt: `dsp_aux,qlds`

`General (header) information`

This menu is used to start `DSP_INFO`, which shows some of the information available in the QLDS. There are three options to choose from, displaying general information, (line) window information, and auxiliary data information.

`Enable structure browser`

Pushing this button will make a pulldown menu called `Structure Browser` appear below it on the Display Menu, and then the `Enable structure browser` button will disappear. The `Structure Browser` works the same way as `XPL_STRUCT` (see Section 2.2). It is disabled initially to speed up the creation of the Display Menu.

5.3.5 Data processing

`Debias data (VDS_DEBIAS)`

This option is of course only available for NIS data. It will subtract the bias from the NIS data, but only if the raster includes readout of the background windows.

`Remove cosmic rays`

This option (available soon) starts `XCDS_COSMIC`, a program allowing you to select various methods of removing cosmic rays.

`Flatfield/calibrate data (VDS_CALIB)`

This option calls `VDS_CALIB` to apply flatfield corrections etc to the data. See `XDOC,'vds_calib'` for details.

5.3.6 When the QL Software crashes

If a QL display routine crashes, the widgets may remain but no interaction is possible and all control is returned to the IDL prompt. In cases like this it is sometimes possible to continue as if nothing happened by typing

```
IDL> retall
IDL> xmanager
```

This is often be sufficient to restart the the xmanager and the widgets become active again.

Sometimes, however, the software keeps on crashing. Killing all the widgets manually, and returning to the main level IDL prompt will normally cause any QLDS supplied to a Quicklook program to appear lost. The data are, however, still stored inside the Quicklook data management system. To recover the data after a crash, do as follows:

```
IDL> q = readcdsfits('testdata3.fits')  ; Read fits file into structure q
IDL> dspspec, q          ; Call DSPSPEC

 --- Assume the session crashed here for some reason ---

IDL> retall
IDL> xmanager

 --- Crashing continues...

IDL> @recover              ; Looks for all possible stored QLDS's
```

On the screen you will see the following output:

```
This is the QuickLook recovery procedure

A QLDS has been found, placing it in the global variable 'a'
% Compiled module: QLDS_FETCH.
QuickLook recovery finished
One data structure was found and recovered
```

The data structure has been restored (but note that it's now called a instead of q and you can continue working on the data.

5.4 Data display modes

We will now describe a few of the features available in some of the display programs.

5.4.1 Image + spectrum

This program displays both spatial images and individual spectra. The images are formed by taking a slice through the line window data arrays at a given dispersion pixel index (corresponding to a