Spex Software User's Guide
for
BigDog and GuideDog's
IC & XUI applications

Volume One
Software Procedures

1. Introduction & Configuration Files

BigDog is the general name for Spex's spectrograph computing hardware and software applications.
GuideDog is the general name of the Spex's Guider computer hardware and software applications.

BigDog and GuideDog can be thought of as 2 separate systems. Each system has an independent set of array electronics, computer and software application. They provide different function and can be used independently. However, they were design to be used together and are very similar. This guide provides instructions for both BigDog and GuideDog.

BigDog and GuideDog's software each consist of 3 major applications: Instrument Control (IC), X User Interface (XUI), and Data Viewer (DV). This manual describes these programs as a single system, but your must remember the BigDog and GuideDog each has their own IC & XUI.

IC - The Instrument Control application handles the real-time hardware control of the camera assorted electronic and mechanical hardware. The BigDogIC controls the spectrograph, and GuideDogIC controls the guider/imagers.

XUI - A X library based Graphic User Interface used to command the IC. This is the application the observer uses when operating the camera. The is a BigDogXUI and GuideDogXUI, one for each camera.

DV - The IRTF Instrument Data Viewer is the FITS image viewer used with the software. DV can be used with both BigDog and GuideDog. Please refer to the DV user guide for detail instructions.

2.1. Setting Up Sub-Array Parameters

This section describes how to specify sub-arrays. It describes the features and limitation of the sub-arrays.

2.1.1.Features:

Up to 3 sub-array are supported.

The location and placement of the sub-arrays are indicated by the upper-left (x, y) coordinates and its width and height. These coordinates are limited to Quadrant 1. The command 'Array inx x y w h' is used to enter these coordinates to IC. The parameters for this command are:

inx - identifies the sub-array. Values are: 0, 1, or 2
x,y - Give the x,y coordinates of the upper-left corner of the sub-array.
w,h - Indicates the width and Height of the sub-array.

2.1.2 Limitations:

The x, y, w, h of the Array command has the following restrictions:

x - must be a multiple of 16: {16, 32, 48, ..., 464, 480}
y - must be a multiple of 4: { 4, 8, 12, ..., 504, 508}
wid - must be a multiple of 16, but at least 32: { 32, 48, 46, ..., 512-x }
hgt - must be a multiple of 4: { 4, 8, 12, ..., 512-y}

You may specify overlapping subarrays.

The sub-arrays in quadrant 1 are mirrored in quadrant 2, 3, 4.

2.1.3 Using the sub-arrays command / prompts:

You can always specifies subarray by entering the upper (x,y) coordinate and its width and height. Enter them by:

1. Typing in the command 'Array inx x y w h'.
Note when you enter the commands, the software will modify x, y, w, h to be multiples of 4 or 16 according the its limitations.

2. Entering the (x y w h) in the array prompt in the XUI.

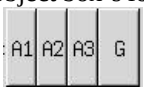
3. You can also toggle between the define sub-array and the full array using the XUI's {SubArrays/FullArray} tabs

2.1.4 Specifying sub-arrays using DV

DV provide an easier way to specify sub-array locations. When DV is executing from the BigDog / GuideDog IC computer, you can specify a sub-array by drawing a box around the pixel and transmitting it location & size to the IC program. Here are the steps to follow:

1. Take a full size image and display it on DV.

2. Specify the area of interest by using DV's Object Box statistic feature. (You drag the mouse with the middle button on the image define the object box.)

3. Select the Stats Tab to view the statistics dialog. Make sure the DPY menu refers to the canvas should the image & object box. (The statistics values show the object box's location and size, plus other information).
4. Now click on one of the Sub-Array buttons 

to set the 0, 1, 2 or Guider sub-array so that it include the object box pixels. DV command the IC so that the selected pixels are included in this sub-array parameter.

Don't forget to specify the number of sub-array using the NumArray command or prompt in the XUI.

2.1.5. The Sub-array Setup window on the XUI

The XUI displays a sub-array setup diagram. A picture representing the 4 quadrant in the device is display. In Quadrant 0, the number and location of the sub-array are displayed using colored boxes, the colors magenta, green, and blue indicate the position for Array0, Array1, and Array2. In quadrants 1, 2, and 3 the gray boxes represent the pixel mirrored by the sub-arrays in quadrant 0.

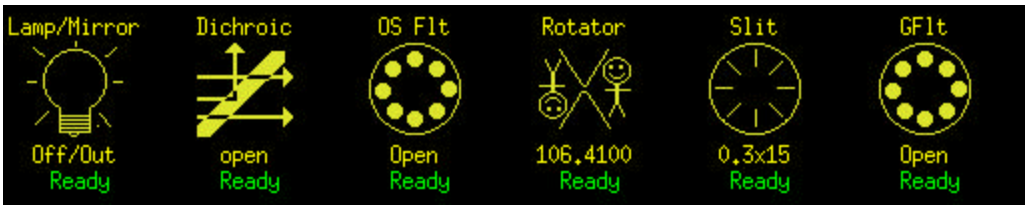
2.2. Setting up the mechanisms

Before the light travels to the array, it passes thought various mechanisms – Lamps, filters, slits, grating, mirrors, etc. This section describes how to initialize and position these mechanisms.

Because Spex has 2 array, the some to the mechanism are shared between the guide and spectrograph. And some are unique. This figure illustrates the path the light take to reach either array.

2.2.1. The XUI mechanism display.

On the XUI screen, there is a set of icons representing the devices in the light path. The device name is display above the icon, while the setting and status are display below the icons. The spectrograph XUI and guider XUI just displays the mechanisms for its array. There is an example of the Guider's mechanism display:



Note that the order of the devices from left to right mimics the actual device encounter by the light path before reaching the arrays.

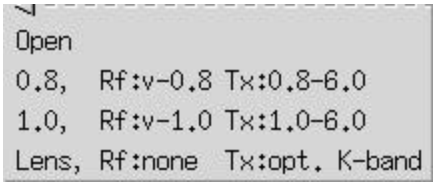
2.2.2. Initializing the motor

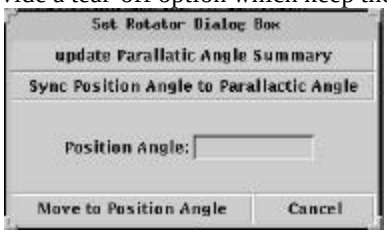
You may need to initialize the device if any are in an Error state, or for some reason you need to re-homed. Go to the Setup Parameters. You should see these buttons. Selecting a button will cause the XUI to issue the Initialization command for that mechanism.

For example, selecting the 'Osf.Init' button will issue osf.init command to the IC. This will initialize OSF motor electronics and re-home the device.

2.2.3. Positioning the mechanism

Clicking on any of the icons in the XUI mechanism display will bring up a pop-up menu or dialog, which allows you to select a position for that device. This example of the dichroic popup is a typical of the pop-up menus. Just selection a position using the mouse. Also note, these menus provide a tear-off option which keep the menu visible in an on screen window.





Also shown is the rotator dialog. The rotator (and its dialog) is unique since it is a continuous device (no discrete positions). There are a few method of positioning the rotator:

1. Press the 'Sync Position Angle to Parallactic Angle' button. This will set the rotator's position angle to be synchronized with the telescope's parallatic angle (based on HA,Dec)
2. Enter the desired position angle in the 'Position Angle' text prompt and select the 'Move to Position Angle' button.

3. The button 'update Parallatic Angle Summary' queries the TCS for its HA,Dec position and update the Parallactic Angle summary on the spex status window.

3.4.5. Detailed information on the mechanism

The Spex technical document 'Mechanism' provides a much more detail information on each mechanism. Figures, tables, and description of the positions, commands, and physical connections are included.

4.1. Movie Mode

The BigDog and GuideDog systems implements a Movie Mode called Big.Movie and Gd.Movie. This movie mode enables the observer to collect a series of sub-array images and steam those images to disk. The spex acquistion system contains two 4 MB DRAM buffers. In movie mode, the sub-array images are acquired and copied into these DRAM buffers. When a DRAM buffer is filled, the data is written to disk as 3D FITS files. Having 2 DRAM buffers allows spex to continue acquiring images while saving to disk, thus allows for continuous streaming of data. A series of 4 MB FITS 3D image are created until the observer stops the acquisition.

The BigDog and GuideDog system operates asynchronously. You can execute Big.Movie and Guide.Movie simultaneously but their start time cannot be synchronized. To correlate the start times of the individual images, the acquisition system can time stamp each sub-array image. The time stamps are obtained from GPS synchronized timer board and should be acturate to better than a millisecond. Additional information on how the time stamp are done is located in the *Spex User's Guide, Volume Two, chapter 4, GPS Time Stamp and Array Timing Information*.

Note GuideDog is a one-quardent array (512x512). BigDog normally images 4 quadrants (1024x1024), but for BigMovie mode, only data from quadrant 2 is recorded.

Because the imaging electronic can produce data faster that the Sparc host can save to disk, care must be taken when setting up the subarray sizes and integration time.

4.1.1 Movie Mode Procedures.

1. Using Basic Mode, set up sub-array size and location, Itime and coadds:

   Select Basic Mode.
   Setup your subarray. If using Big.Movie, the movie data acquired will only be from quadrant 2 of the array.
   Setup your Itime and Coadds. As stated earily, the data acquisition can overwhelm the SPARC hosts saving the data. To insure smooth operation you must limit itime based on the subarray width and height. The relationship between itime and subarray size is: (w*h)/524288 <= itime.
   The following table illustrates the suggested minimum integration time for various array sizes:

Width	Height	Minimum Itime (save to local disk /data)	Minimum Itime (save to network disk /scrs1)
512	512	0.500	1.000
256	256	0.125	0.250
128	128	0.031	0.063
96	96	0.018	0.035
64	64	0.008	0.016
32	32	0.002	0.004

   If you wish to timestamp your data with the GPS timer boards, select '

   Take a basic image to confirm setup.

   Once you are satisfied with the setup, switch to movie mode.

2. Specify the data path.

   Spex data is normally saved on stefan:/scrs1 using a network mounted disk. It is very convenience to keep the image on stefan as you can review the movies as they are written to disk without impacting the spex computers. However, better

performance can be achieved by writing movie data to a local connect instrument disk. Using the minimum Itime table above, specify the data path:

/scrs1/yourname – network disk.
/data/yourname – local disk.

3. Taking Movies:

Switch to Movie Mode.
Select GO to start.

Once movie mode begins, you can monitor it by keeping track of the files saved. Also after each files is save the last image of the 3D FITS file is display on the local display.

4. Movies Files

Spex movie files can be identifed by the .movie extension. If you are using the GPSTime option, and .time file is also produced. The .time is a text files. Each line time stamp a frame in the .movie file using the follow format:

Index mm:ss.ssssss

Here is an example:

0 06:01.913268
1 06:02.051313
2 06:02.189362
3 06:02.327412
4 06:02.465460

Since spex produces 3D FITS, you can use your favorite tool to view the movie or extract frames from the file. For example, IDL.

The irtf has a movie2fits utility program installed on its workstation. This program can be used to extract the individual FITS files from the spex movie files. Example:

Moviefits –S filename0001.movie

Also you can use DV to review you movie files. In its Open File dialog window highlight the movie files. Clicking the 'MovieRead' button reads the 1st image of the .movie file into a buffer. Clicking on the ' to repeatedly read and display each image until all the image are displayed.