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CCD Spectrograph Control Program version 1.12

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June 8, 2003

1 Introduction

This program controls the CCD camera attached to the spectrograph on the 1.9-m telescope via a standard SAAO interface card and a Merlin crate. It is intended to run under Real Time Linux on a PC. The code is written entirely in C and makes use of the Xforms library for the observer's graphical interface.

In order to present a uniform interface to observers, the program should be run within the KDE window manager(WM). This is ensured if the instructions below are followed carefully. If you want to use some other window manager, the results are not guaranteed, though the program will probably run successfully.

1.1 Log On

If the KDE WM is running you are probably in the right place to proceed. If in doubt, exit to the login prompt. Then log on as follows (you type the boldface items):
host login: **spect**
Password: (consult local expert)
startx
In about 20 seconds a blue background will appear, probably with one **xterm** window, and an icon bar at the bottom of the screen (see the Appendix for a brief description of the icons). If there is no **xterm** window, click on the shell icon at the bottom of the screen.

If necessary, create a subdirectory using whatever name you like. Change to that subdirectory. It is important that you do this every time you start the program since various useful files pertaining to your run that it requires will be stored.
(**mkdir abcd**)
cd abcd

In the **xterm** window, start the program by typing:
RunSpect
The **Startup Panel** will appear. Fill in the details of your run, or amend them as necessary. Click on **Continue** and the **Main Panel** will appear. That is where you take control of the spectrograph camera1. The various panels are described in the next few sections.

A Note of Warning: When exiting any window displayed by the spectrograph program, you can use only the appropriate Exit or Quit button on that panel. If you try to exit via the usual buttons at the top left and right (X) of a window then nothing will happen - the program has been instructed to ignore those exit routes. If the program hangs up, the only remedy is to switch off the power to the PC and reboot - this will take a while ($\sim$ 5 minutes) since first the disk will be checked for inconsistencies and errors.

This program is relatively new, so there are probably still some bugs in it.
Please report any bugs you find, or suggest any changes or additions to jwm@saao.ac.za.

2 Startup Panel

The **Startup** Panel displays the details of the current observer's run, and allows various items to be changed prior to starting the control program proper (Fig 1). Most of this information is incorporated in the FITS headers of data files (see section 8).

At the beginning of an observing run, a template panel is shown containing dummy values which should be replaced to reflect the details of the current run. When the panel is closed, the current information is stored in a file in the user's subdirectory. On subsequent logins, the current values are shown in all fields, and will probably not require adjustment.

The contents of the various entry fields and details of how to change them are given in the following section.

2.1 Data fields

These should be checked carefully each time you start up, in particular the **Next File** field. The only time you can change the items on this panel is at start up.

Observer The observer's name can be entered here. This is recorded in the FITS header and displayed on the Main Panel as described later. The Backspace and Delete keys can be used, or the field can be highlighted by positioning the cursor, pressing and holding down the left mouse button, while sliding the mouse left or right as appropriate; the field will be highlighted in reverse video. Start typing and the highlighted area will be replaced by the new entry. Pressing Enter will move the cursor down to the next entry field (Run No.).

Telescope This is a popup menu, and the only relevant entry is 1.9-m.

CCD This is a popup menu. The CCD currently (2003 April) used on the spectrograph is SIT1.

Run No. This is a running number which characterises the observing run. Look in the log book for the appropriate value, which should be entered in the window. The number should lie in the range 0 - 999.

Next File This is the part of the output file number that increments automatically as successive images are stored. Images are saved in the **/data/image** subdirectory (which is normally mounted on the **/data/image** directory on **s74**. Files are automatically transferred to **s74** ; images are not normally

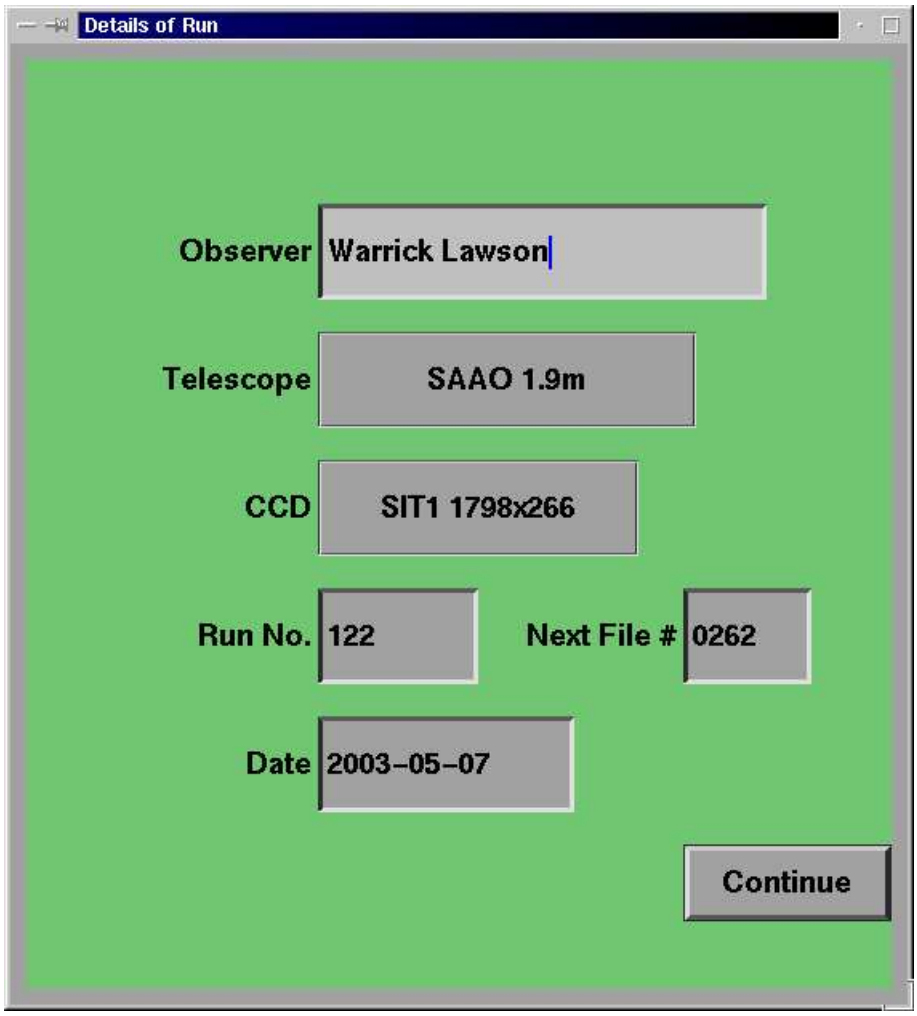

Figure 1: Setup Panel for CCD Spectrograph control program

stored on the control computer's disk). The number ranges from 1 to 9999. File names have the form, **aXXXyyyy.fits**, where XXX is the run number and yyyy is the running file number, which is incremented every time a new file has been written.

Date This is read from the control computer and should not normally need to be changed. Change the date if necessary, but make sure the format is as in the figure.

2.2 Completion

Once all data are entered and you are satisfied, press **Continue** to carry on, or **Exit** to abort the process. The data are saved in a file "**setup_data.dat**" in the observer's subdirectory. It is thus important to start the control program from this subdirectory on subsequent occasions for the data to be recovered properly.

Before displaying the main control panel, the program checks that the Merlin crate is responding and that the fibre communications link is operating correctly. If there is a problem, there will be an error message, which suggests various actions to take to rectify the problem. Press **OK** on the message panel, whereupon control will be returned to the window manager. On the other hand, if all is well, the **Startup Panel** will disappear, to be replaced by the **Main Panel**.

3 Main Panel

The **Main Panel** allows the observer to interact with the spectrograph, to display images and to plot spectra (Fig 2). The panel comprises four distinct areas which will be described in turn below. The **Status** area at top left shows the details of the current or just-completed exposure; images are displayed in the **Image** area at top right; the extracted spectrum is plotted in the **Plot** area at bottom right; the observer controls the spectrograph and various plotting parameters from the **Control** panel at bottom left.

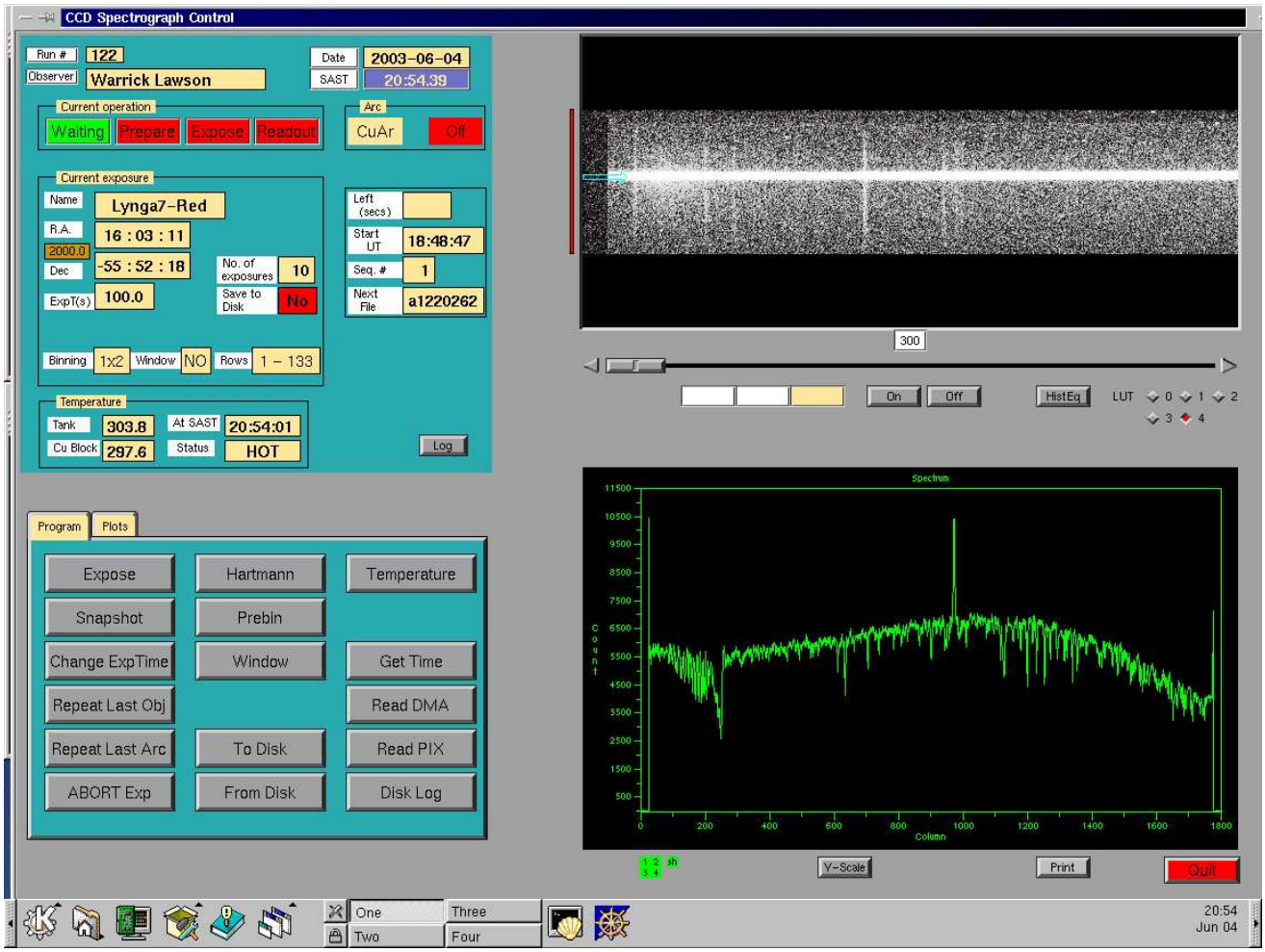

Figure 2: Main Control Panel for CCD Spectrograph.

A small set of indicators beneath the **Plot** area should be green; these are for diagnostic purposes only.

To exit the program click on the **Quit** button at the bottom right of the screen. You will be asked to verify that you meant to do it, to guard against accidental choice of this option.

At startup, a warning message to remind you to set Prebin mode if required will be displayed. You will be able to change the mode later, but you may want to do it at the start for Hartmann tests. Click OK when ready to proceed.

3.1 Status

There are various parts to this area (figure 3). The run number, observer's name, date and current SAST are displayed at the top of the screen. As with the rest of the **Status Panel**, there is no interaction possible. It is an area where information is displayed only.

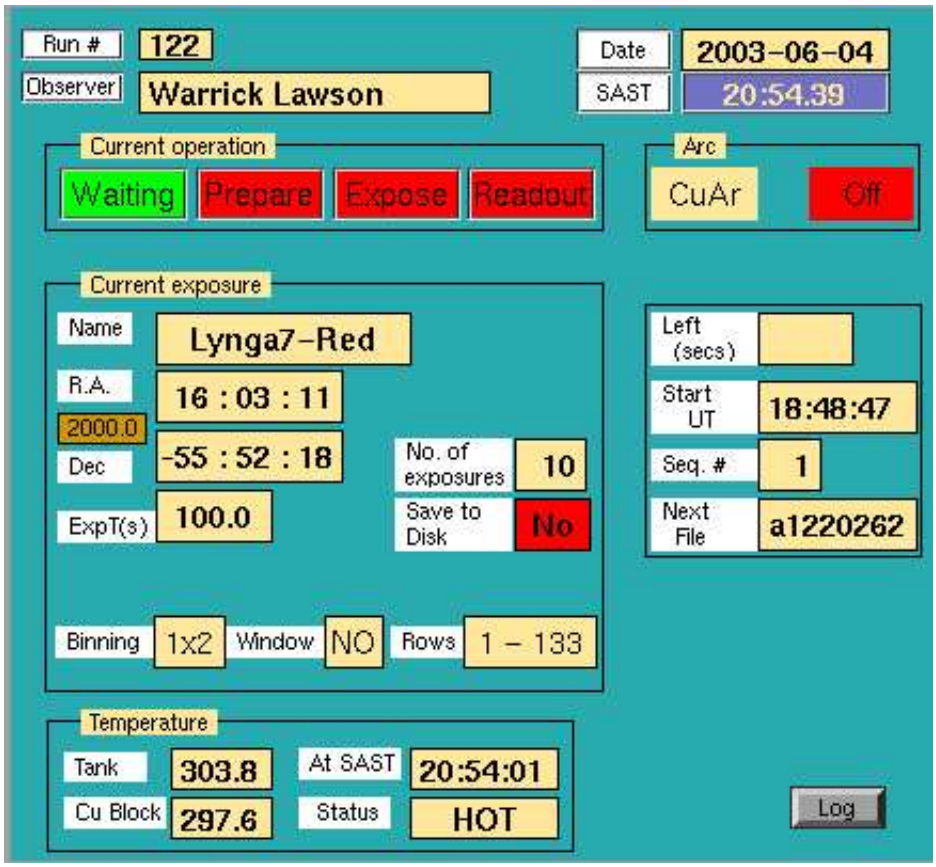

Figure 3: Status Panel.

Current operation refers to the activity in the Merlin/CCD system. Four panels indicate whether the system is quiescent (**Waiting**); preparing the chip for an exposure (**Prepare**) by clearing the image area of residual charge; collecting photons (**Exposing**); returning an image to the control computer (**Readout**). The panel is green when the relevant action is taking place.

The **Arc** box shows the arc currently selected (CuAr, CuNe, or Both) and whether it is off or on. The CuAr arc is selected by default. The arc is switched on and off under program control only.

Current exposure refers to the current exposure (if photons are being collected) or to the last exposure (when **Waiting**). The object name, RA, Dec, equinox and exposure time are displayed on the left side. The number of exposures to be made and whether images are to be stored on disk appear on the right of the box. At the bottom the current binning state, whether the readout is windowed or not and the number of rows that will be read out are recorded. Binning and windowing are mutually exclusive. On the right are displayed the time remaining for the current exposure, the current sequence number when multiple exposures are called for, and the file name in which the **next** image will be stored.

The CCD cryostat temperature is determined regularly, and in any case at the end of each exposure. The results are logged in subdirectory ($\sim$ **/.Tlog**) and displayed in the **Temperature** box on the **Status panel**. The time at which the last measurement was made is also shown, together with an indicator that reads '**Normal**' when the liquid nitrogen tank temperature is within acceptable limits, or '**Hot**' when it goes outside that range. In the latter case, the tank has run out of liquid nitrogen and an attempt should be made to find out why. Provided the CuBlock temperature is less that 240K the tank should be filled immediately. Otherwise, there is a danger of water condensing on the chip so the cryostat should be left to warm up for re-pumping.

The small button labelled **Log** allows a pad to be displayed on which a continuous log of operations is recorded. This is really only useful for diagnostic purposes. When the pad is displayed two buttons appear, one allowing the contents of the log to be printed, the other returning to a display of the **Status** panel.

3.2 Image

The image panel displays a 600 column x 266 row image of the data last read out from the CCD (Fig 4). The small box beneath the mid point of the image shows the number of the central column being displayed (eg. 300 indicates that columns 1 to 600 are being displayed). The slider under the window allows other parts of the image (a span of 600 from the total of 1798 columns) to be displayed.

The small **On** and **Off** buttons control a cursor. When the cross-shaped cursor is on the image, its x,y coordinates (column, row) and the count in that particular

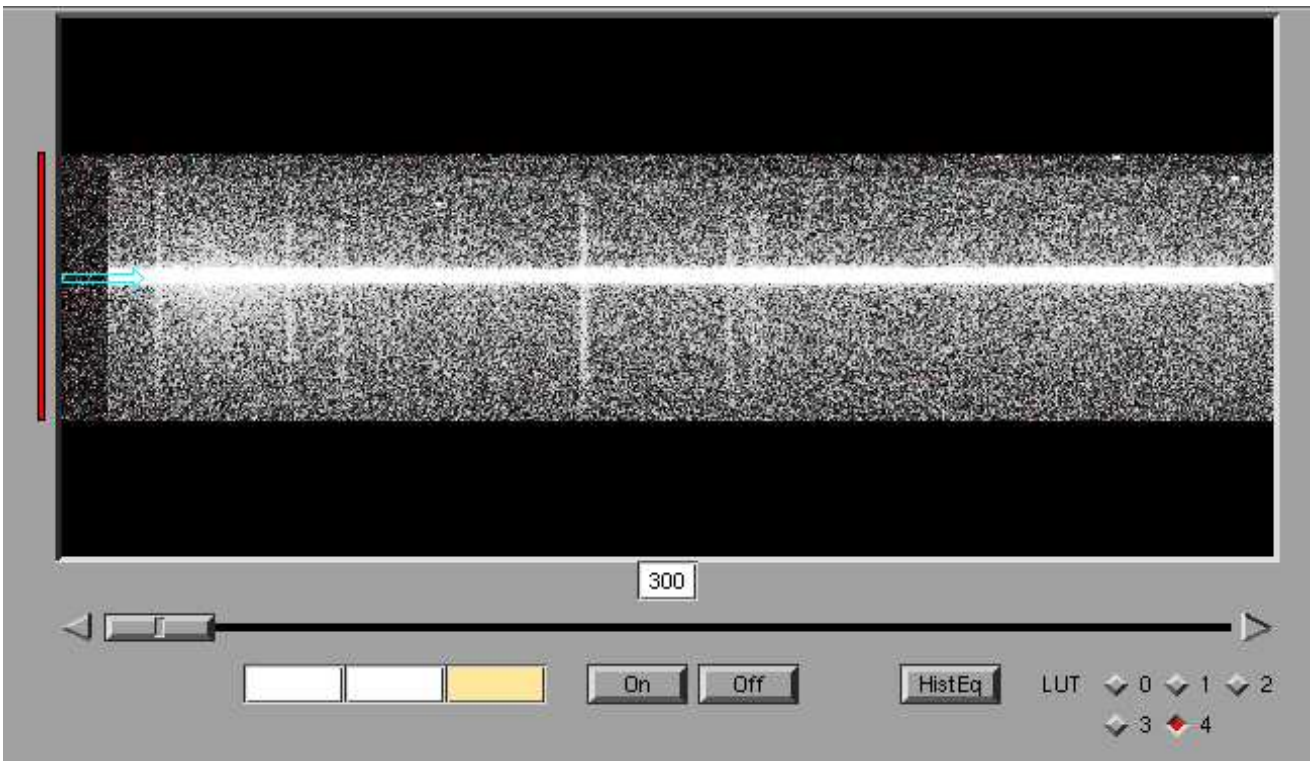

Figure 4: Image Display area.

pixel are displayed in the three boxes to the left below the slider.

The **HistEq** button applies a histogram equalisation lookup table to the image which shows the image at high contrast. The array of buttons labelled **LUT** 0 to 4 allow the image to be displayed with different lookup tables. The basic lookup (0) is simply represents the minimum data value encountered during the readout as black and the maximum as white. The white level is adjusted to represent the maximum count seen so far in the data as the image is being read out. The image is read out and displayed in blocks of 7 rows at a time. A red bar to the left of the image shows where the last row read out is displayed. LUT 1 sets the white level to 512, suitable for very low signals, while for LUTs 1, 2, 3 the white level is set to 2048, 8192 and 32767, respectively. The current LUT is indicated by a red symbol.

The arrow symbol at the left of image shows the currently assumed middle row of the object spectrum; it will only appear after the first readout. This can be changed via the **Plots** panel, described later (section 9).

3.3 Control Panel

This panel (Fig 5) in the bottom left quarter of the screen provides two different functions depending on which of the two tabs, **Program** and **Plots**, is selected (by clicking on the tab using the left mouse button).

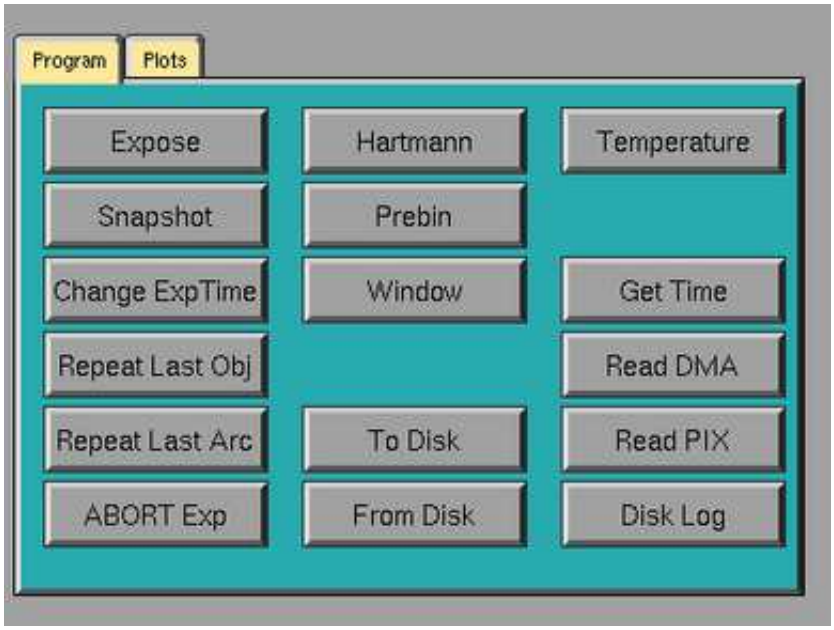

Figure 5: Control panel - Program area.

3.3.1 Program Panel

The **Program panel** is where the interaction with the spectrograph takes place (Fig 5). A number of buttons on the panel allow different types of exposure to be made as well as readout modes to be set. Some of them are discussed in more detail in later sections. The buttons are as follows:

Expose Initiate an exposure. A pop-up screen appears, allowing exposure details to be adjusted. Object names can be selected from a browser window, names can be added or removed, and details can be edited. See section 4 for details.

Snapshot For an exploratory look at a spectrum, a no-frills exposure can be made, the only input being the exposure time.

Change Exp Time With an exposure under way, the exposure time can be changed.

Repeat LastObj To save typing, an exposure with exactly the same details and exposure time as for the last object observed can be done simply by clicking on the button and verifying that you really meant to do this.

Repeat Last Arc As for the previous option, but for an arc exposure.

ABORT Exp Terminate the current exposure prematurely. The image will be lost.

Hartmann For focussing the camera using the Hartmann method.

Window To request that a subset of the total number of rows be read out, unbinned.

Prebin To switch binning on or off. Only 1x1 and 1x2 binning are implemented.

To Disk To save the latest image to disk (for example after a snapshot.)

From Disk To retrieve an image that had previously been obtained with this spectrograph.

Temperature To obtain a measurement of the temperatures in the cryostat. This is useful also as a simple way of confirming that the communications with the Merlin crate are working properly.

Read DMA Read out the chip using DMA block transfers.

Read PIX Read the chip by direct pixel-by-pixel transfers.

Disk Log Display the log file of images saved on disk. A browser window pops up. Click on **Exit** to remove the browser.

3.3.2 Plots Panel

The **Plots panel** (Fig 9) allows various choices to be made regarding which kind of plot is to be displayed (eg. object, object-sky, sky, etc) and also permits various parameters to be set (eg. rows where the object is to be found, rows for the sky, columns to be plotted). This will be described in detail in section 5.

3.4 Plot Area

At the end of a readout, a spectrum obtained from the region specified on the **Plots panel** and indicated by the arrow on the image, is displayed in this area at the bottom right of the screen (Fig 6).

The displayed spectrum can be printed on the printer in the warm room by clicking on the **Print** button. The Y scale can be adjusted by using the **Yscale** button.

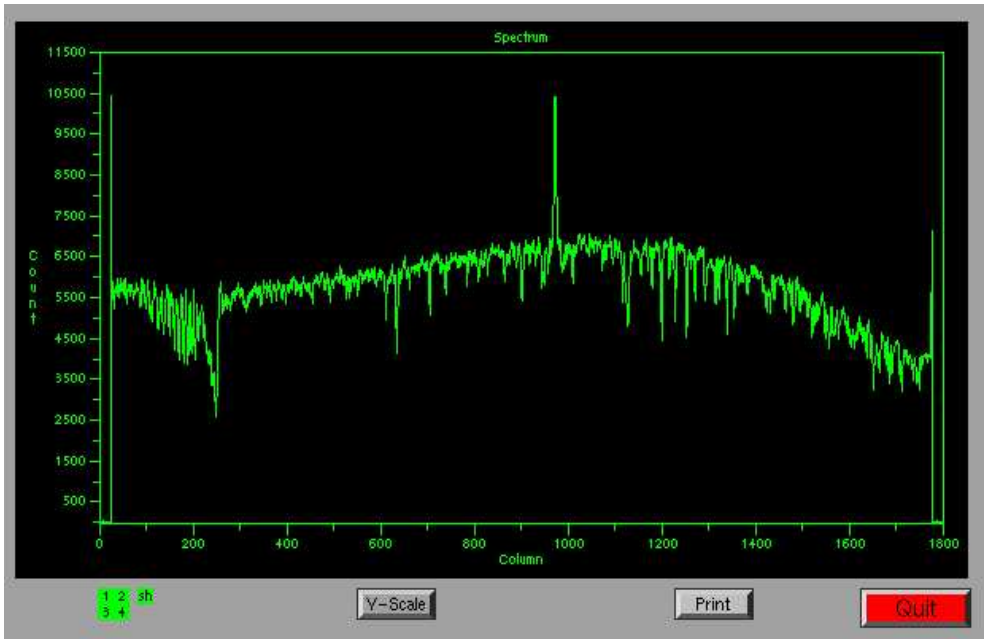

Figure 6: Spectrum plotting area.

4 Making an exposure

Exposures are initiated in several ways, using the buttons at the left of the Program panel. Clicking on **Exposure** will bring up a panel in which details of the exposure are entered. A quick exposure can be done by selecting **Snapshot**, where only the exposure time is required. Two other buttons allow exposures to be made with exactly the same details as for the last example of an object or arc exposure.

4.1 Exposure

The **Exposure panel** (Fig 7) calls for the following details, most of which will be displayed on the status panel when the exposure begins:

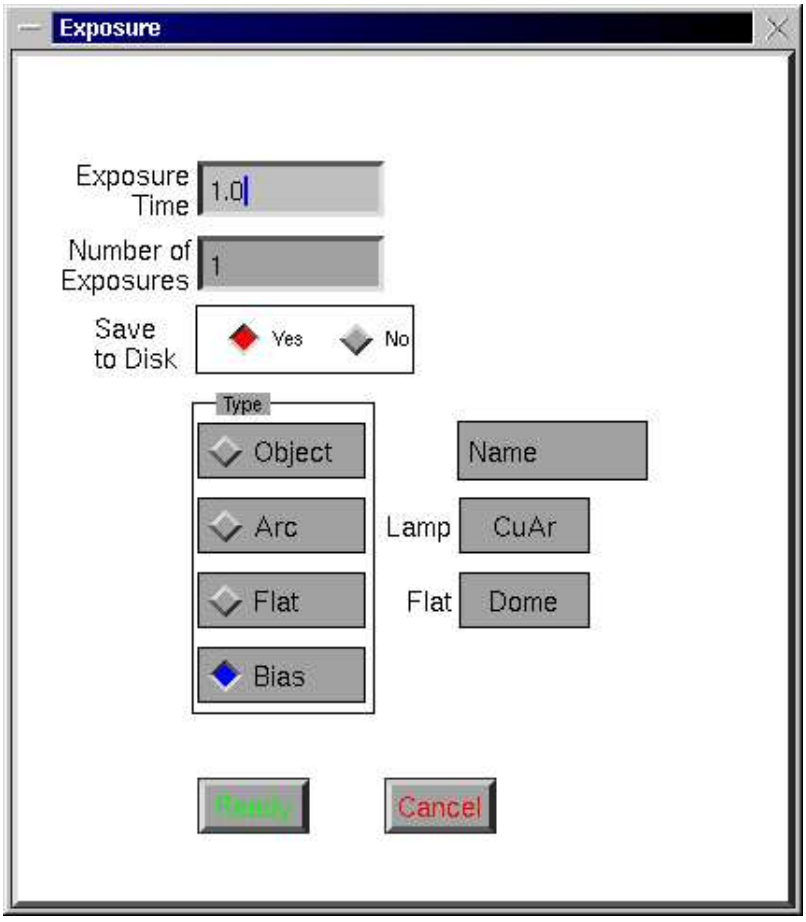

Figure 7: Entry Panel for Exposure Details.

Exposure Time The required exposure time in seconds.

Number of Exposures The number of consecutive exposures to be made on this object.

Save to Disk Select the required option by clicking on the button. It is also possible to save an image at the end of an exposure by using the **To Disk** button on the **Program panel**.

Type Choose one of **Object, Arc, Flat** or **Bias**. If **Object** is selected, a browser window will appear allowing a name and coordinates to be chosen. This is described in detail below. If it is an **Arc**, choose the particular lamp (CuAr, CuNe, Both) from the pulldown menu to the right of the title, **Lamp**. If **Flat** is selected, choose its type (Dome or Sky) from the pulldown next to the title, **Flat**.

Ready/Cancel When everything is set up correctly choose **Ready**. **Cancel** will merely return to the main **Control panel**.

4.1.1 Object details

If there is a file called "**objects.dat**" in your startup subdirectory, its contents will be displayed in a browser window, allowing you to choose the object to observe by clicking on the line with its details (Fig 8).

This browser can also be used to enter new objects, and edit or remove existing ones. The format of a line is, in C notation, "%15s %6.6d %+6.6d %6.1f", or in FORTRAN notation, (A15,1X,I6.6,2X,I7.6,1X,F6.1). A typical line is:

```
T0146-2651     014626  -265100 1950.0
```

Observers can supply their own files conforming to this format, or can enter names and coordinates via the browser. New object names and coordinates are typed in the boxes at the bottom of the browser (which initially contain examples in the proper formats), and the entries are validated before being accepted. It is necessary to click on one of **Add**, **Insert** or **Replace** before the new name is accepted into the body of the browser. Additions and alterations to the file are saved to the original file name and a copy of the old file is kept in "**objects.dat.bak**".

Add Enter Star name, RA, Dec, Equinox, press **Add**. Data will be validated, added to the end of the file, and the line highlighted.

Insert Highlight the line **before** which the new line is to be inserted (by placing the arrow cursor on it and clicking the left mouse button). Enter data as for **Add**, press **Insert**. If no line is selected, put the new line at the top of the list.

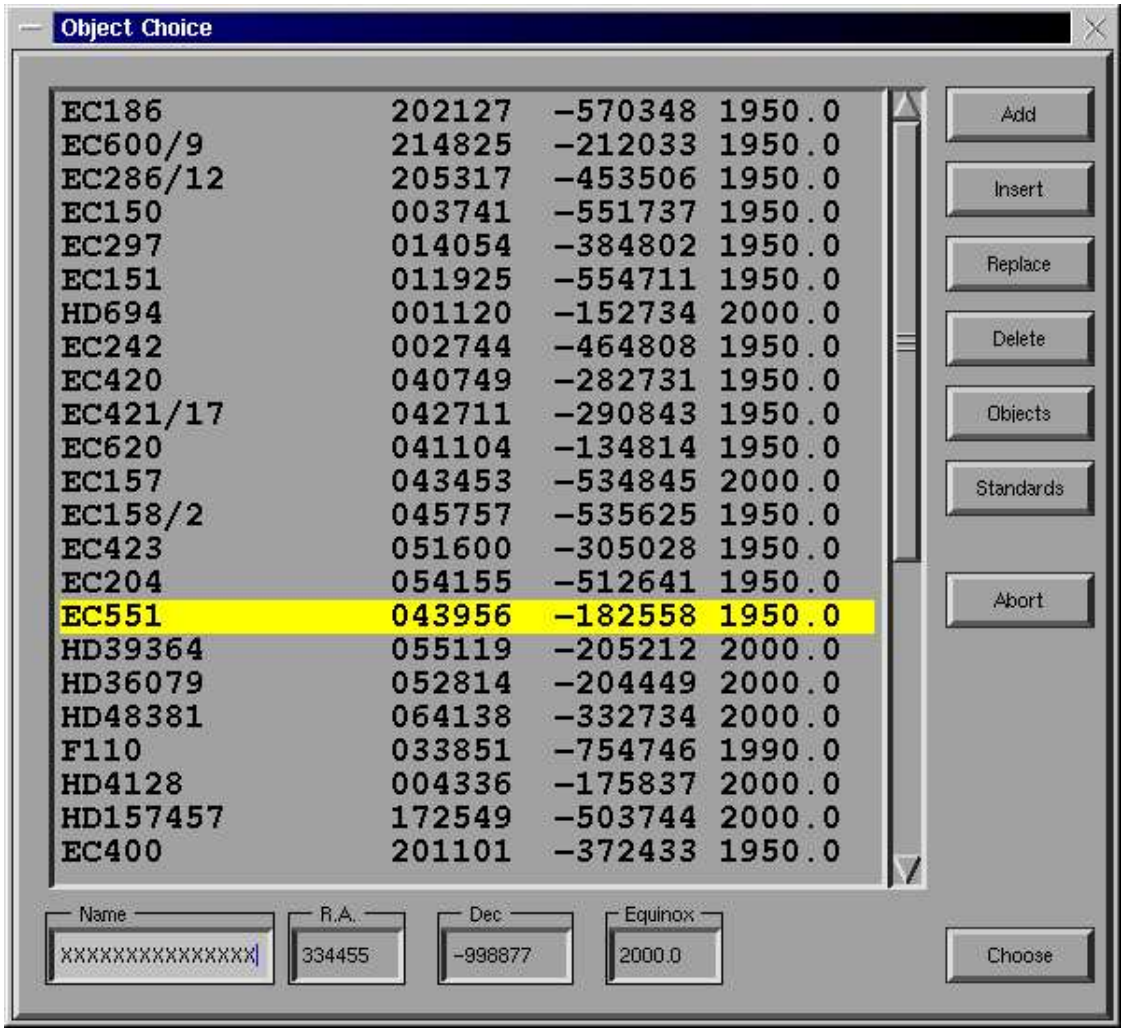

Figure 8: Object name and coordinate browser.

Replace Highlight line to be replaced, enter data and press **Replace**. If no line is highlighted, do nothing.

Delete Highlight line and press **Delete**.

Quick Find If you can't find your object in a long list, or simply want to choose it quickly, enter the name in the box at bottom left and press **Enter**. If the object is in the list, the browser will put its details in the boxes at the bottom and highlight the line. This is useful if you want to edit an object's details.

A spectrophotometric standard star file is maintained in the CCD subdirectory (**/usr/local/data/CCD**) and this can be loaded into the browser by clicking on the relevant button. This file cannot be altered.

Click on **Choose** to return the object's details to the program and return control to the **Exposure panel**.

4.2 Snapshot

When this button is selected, a simple panel appears, into which you should enter the required exposure time. If you later decide to save the image to disk, the object will have the name "DUMMY" and coordinates (0,0,2000.0) in the FITS header.

4.3 Changing exposure time

While an exposure is in progress, it may be possible to alter the exposure time. Whether that is possible depends on how long the original exposure still has to run. It takes time to get the Merlin crate to respond to a command, so there is a certain minimum time remaining, beyond which no change can be made. When the **ChangeExpTime** button is clicked, a panel appears which continuously displays the minimum allowed new exposure time. Enter your required value in the box and click on **Ready**. The counter on the **Status panel** will reflect the time now remaining, given the new exposure time.

4.4 Repeating exposures

To save time and typing, the **Repeat Last Object** button will initiate an exposure of an object with the same exposure time, name, RA, Dec, storage to disk option and number of repeats as the last object observed. There can be one or more intervening arc exposures since the last object, but still its details will be used. A panel pops up requesting confirmation to guard against accidental selection. The same considerations apply when **Repeat Last Arc** button is pressed. There can be several intervening object exposures since the last arc.

4.5 Abort exposure

Once an exposure is under way, that is, after the Prepare stage and before Readout commences, it can be terminated prematurely. **The image will be lost.** If you think you might want to save the image, it is better to use **ChangeExpTime** as described above.

5 Plots Panel

The **Plots Panel** can be displayed by clicking on the **Plots** tab on the **Control Panel**. This allows various parameters to be set and several different kinds of plot to be displayed. The panel is divided into several areas (Fig 9).

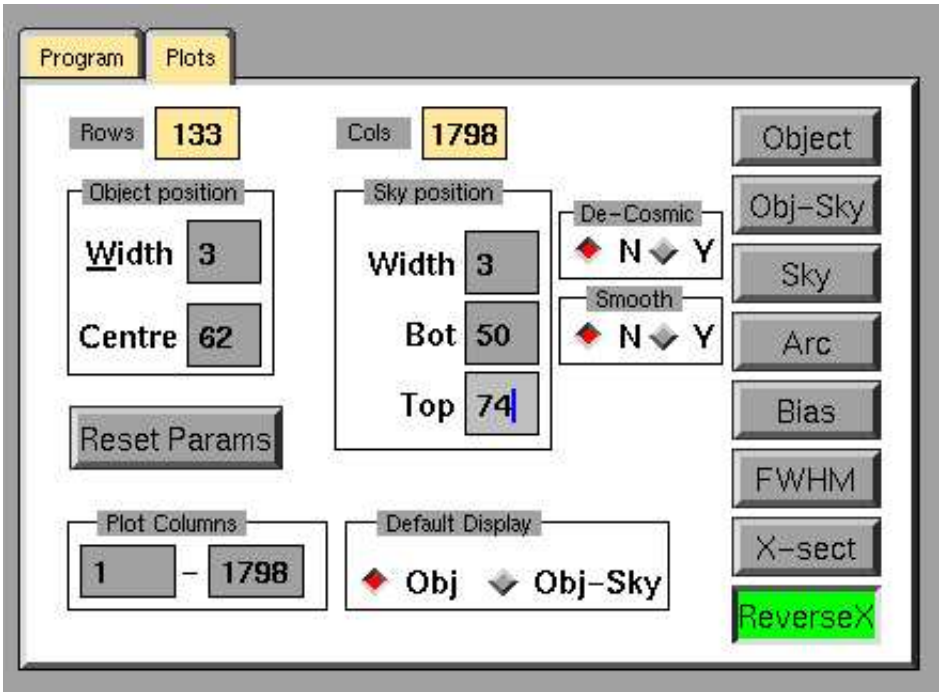

Figure 9: Plots Panel for controlling plotting of spectra.

The contents of the various entry fields and details of how to change them are given in the following section. At the top left of the panel the number of rows and columns in the current configuration are shown.

5.1 Data fields

Object position Two entry windows allow the central row, R_{obj}, and the width, W_{obj}, of the extraction window to be changed. The default values are 131 and 5, or, for prebinned images, 65 and 3.

Sky position Two strips, above and below the object spectrum, are used to determine the mean sky signal per column at the central row of the object

spectrum. Three entry windows allow you to change the width of the strips in rows, R_{sky}, and the central rows of the two strips, T_{sky} and B_{sky}. Default values are 2, 121 and 141 for unbinned, and 3, 60 and 70 for prebinned.

Plot columns As the name suggests the limits for the plot can be specified. It may, for example, be possible to improve the display by excluding a bright artifact at the beginning or ens of the plot. Also useful for getting a closer look at some spectral feature.1

Default Display At the end of a readout, the default spectrum displayed is of the Object alone. This can be changed to Object-Sky.

De-Cosmic Cosmic rays can cause considerable problems for scaling the displayed spectrum. Choosing Y for this option applies a filter to remove cosmic-ray-like spikes. This is only applied when one of the top four buttons is pressed (see next section). This is not always successful. Try reducing the number of columns displayed to exclude the offending spike.

Smooth It may be difficult to see features in weak, noisy spectra. This option allows a smoothing filter to be applied to the spectrum.

ReverseX The SIT1 chip is read out in such a way that the red end is on the left of the display and the plot. It is sometimes convenient to reverse the plot. Click on this button, which will go green. Then click on Object, etc to redisplay the spectrum. The button stays green and plots will be reversed until the button is clicked again.

5.2 Buttons

Object The spectrum extracted from the W_{obj} rows centred on R_{obj} is plotted. The y axis is the total number of counts within the W_{obj} rows and the x axis is column number.

Object-Sky The mean sky level in each column is computed from the W_{sky} rows centred at T_{sky} and the W_{sky} rows at B_{sky}. This is subtracted from the object spectrum computed as above. The total (object-sky) counts are plotted against column number.

Sky The spectra of the two sky regions are plotted on one plot in different colours. The y axis has scale counts/row.

Arc The arc spectrum is plotted. This shows the total counts in the middle third of the slit for an arc exposure. It behaves like the Object button otherwise.

Bias This shows the mean count per pixel in the left and right bias regions (two different colours) plotted against Row number. The standard deviation per pixel in the left bias region is also plotted (lowest line).

FWHM After each arc exposure, the FWHM (pixels) is computed for each line found in the arc spectrum. This button shows FWHM (red symbols) plotted against column number. The green line joins successive points to make it easier to see the progression of values.

X-Sect This button shows the distribution of signal along the columns. For each row, the signal in all columns (except those in the overscan regions) is summed and plotted against row number. The bias is subtracted

Reset Params This resets all parameters described in the previous section to their default values.

5.3 Interaction with Plots

If the left cursor button is pressed while the cursor is in the **Plot** area at the bottom right of the screen, the x and y coordinates of the arrow tip are displayed in a yellow box at the top left corner of the plot.

A hard copy of the plot can be obtained by pressing the **Print** button below the plot. Plots reside temporarily in **/tmp/sp_plot.ps** until overwritten by the next one. They can be saved by going to another page of the WM, starting an **xterm** and renaming the file.

5.4 Y Scale

The default y scale might be unsatisfactory for a number of reasons (eg, a cosmic ray produces a large spike, whose peak count is much larger than that of the programme object and determines the scale). This can be remedied by using the button below the plot. After clicking on **Yscale** (the button will change colour to green), place the cursor on the plot at the level corresponding to the required minimum for the plot (press left button to see the count level), and then press the **Esc** button on the keyboard. Next, move the cursor to the required maximum count and press **Esc** again. The **Yscale** button will revert to grey. Finally, press the relevant button on the **Plots** panel (**Object** or **Object-Sky**) to display the plot with the new scaling. To revert to the default scale, press the relevant button again.

6 Hartmann Test

The Hartmann test is used to focus the spectrograph camera. It is necessary to take two successive arc exposures with first one half of the beam occulted and then the other half. The mean shift between spectral lines in the two exposures indicates the distance and direction from the ideal focus. Clicking on the **Hartmann** button on the **Control panel** reveals the panel shown below (Fig 10).

The exercise can be done in prebinned mode, which should speed it up considerably. Choose **Prebin** 1x2 before selecting **Hartmann**.

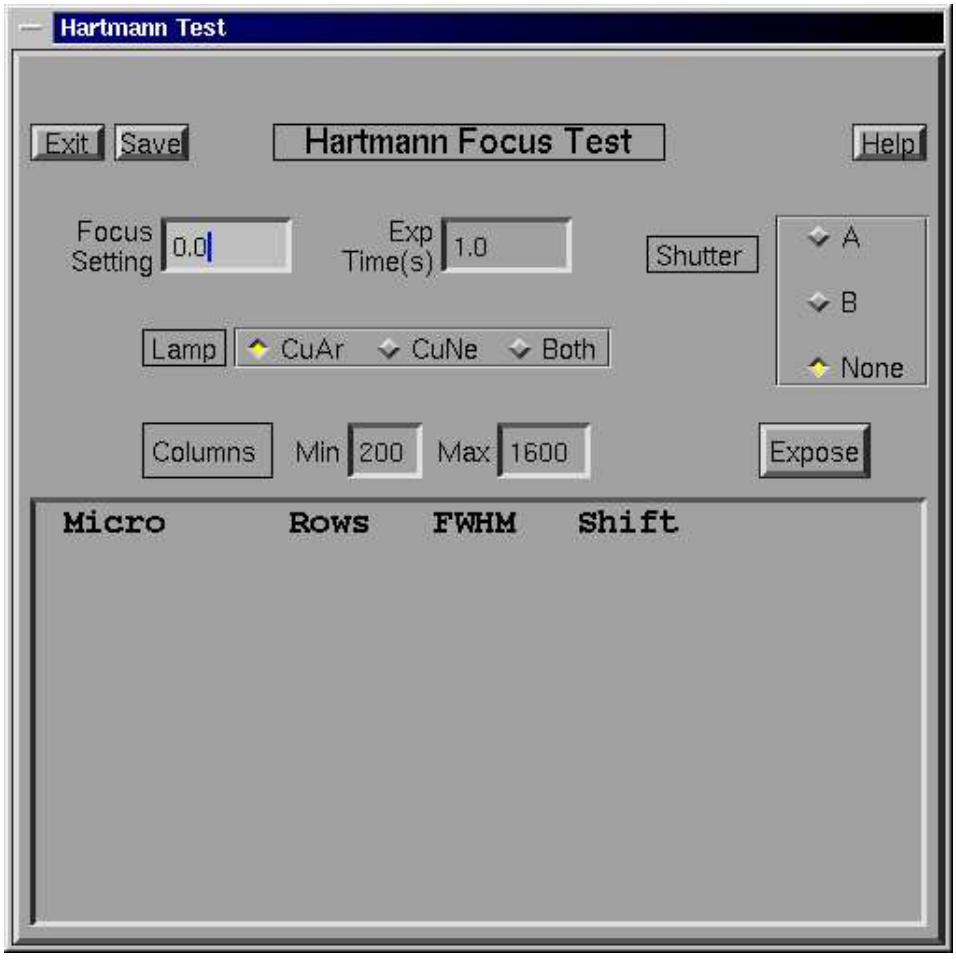

Figure 10: Setup Panel for Hartmann Tests

The contents of the various entry fields and details of how to change them are given in the next section.

6.1 Data fields

Focus setting The reading (mm) on the focus micrometer. Always change the micrometer reading in the same direction, preferably towards lower readings, to avoid backlash problems.

Exp Time(s) Arc exposure time in seconds.

Lamp Make sure the lamp you want is installed and then click on the relevant button.

Columns The column numbers between which the calculations will be done. The default values should avoid problems with the ends of the spectrum, but it might be necessary to alter them to avoid or include lines at the ends.

Shutter Once the relevant shutter has been inserted, click on that particular button. The program will ensure that the buttons are selected alternately, but it is up to you to make sure the actual physical setup matches what has been selected.

To start an exposure click on **Expose**.
If in need of help, click on **Help**, whereupon a panel will appear, showing details of the Hartmann procedure.
To save the contents of the results pad, click on **Save**; data will be stored in file of the form "**Hart_2003_04_11.log**", where the actual numbers will represent the current date, in your current directory.
When finished with the Hartmann test, click on **Exit**.
After the second exposure, the line shift is calculated and the result displayed on the pad. The calculation is done for the middle third of the slit. The mean FWHM of the arc lines is also recorded on the pad at the end of each pair of exposures.

6.2 Procedure

Decide what exposure time you will use.
Decide what arc lamp(s) to use.
Select range of columns to be used (normally only changed for testing or to include/exclude a line).
Choose grating and set to appropriate angle.
Set slit width to 150 micron.
Switch off all lights on the observing floor to avoid stray light entering the spectrograph camera.

Use Hartmann shutter A to block half of beam.
Obtain Arc exposure.
Remove shutter A and insert shutter B to block the other half of the beam.

Obtain second arc exposure.

The program cross-correlates the two images to find the mean relative shift in line positions. Only the selected range of columns is used in the calculation.
With the detector at focus, the shift is zero. The shift changes sign from one side of focus to the other.
Result is shown for the middle third of the slit.

Change the focus **micrometer** setting to a *more positive* value to change the **relative shift** in the *negative* direction. A change of +0.1 in micrometer reading changes the relative shift by about -0.25. Aim to get the final absolute value of A-B to be around 0.03 or less. When changing the focus setting, first release the two clamps by using the knurled knobs; always approach the setting from the same direction, preferably by screwing the micrometer downwards against the spring; finally tighten the clamps.

7 Data Storage

Image files are saved into the **/data/image** directory. This directory is normally NFS mounted on s74, allowing data reduction to be done on that computer without interfering with the control program. If the NFS mount has not been done, the images will stay on the computer where the control program resides. To check the status, type:
df
and you should see something like the following, where the last line tells you that the image directory is indeed mounted on s74.

```
Filesystem           1k-blocks      Used Available Use% Mounted on
/dev/hda2               521780    115740    379536  24% /
/dev/hda6             14049536    483128  12852724   4% /data
/dev/hda1               513776       208    513568   1% /dos
/dev/hda5              4032092   3615180    212088  95% /usr
s74:/data/image        8016832   5557888   2051700  74% /data/image
```

Image files have names in the form, **aXXXyyyy.fits**, where XXX is the run number and yyyy is a running number that increments automatically after each image is saved.

8 FITS header

A typical FITS header produced by this program is as follows:

```
SIMPLE  =                    T         /
BITPIX  =                   16         /
NAXIS   =                    2         /
NAXIS1  =                 1798         / columns
NAXIS2  =                  266         / rows
OBSERVAT= 'SAAO    '                   / observatory source
TELESCOP= 'SAAO 1.9m'                  /
OBSERVER= 'Ramatholo Sefako          ' / observer
INSTRUME= 'SIT1 CCD'                   /
DATE-OBS= '2003-02-05'                 / UT date
OBJECT  = 'DOMEFLAT                  ' /
IMAGETYP= 'object'                     / IRAF image type
RA      = ' 00:00:00'                  / ra
DEC     = '+00:00:00'                  / dec
RA_OBS  =               0.0000         / ra in degrees
DEC_OBS =              +0.0000         / dec in degrees
EPOCH   =               2000.0         / Equinox of RA,Dec
UT      = '12:00:49'                   / UT at Exposure start
ST      = '20:34:00'                   / Siderial time at Start exp
MJD-OBS =          52675.50057         / JD-2400000.5 at Start exp
EXPTIME =                1.051         / integration time in secs
SECZ    =                0.000         / Air mass at start exp
TRIMSEC =  '[  26:1774,   1: 266]'     / Useful part of data
BIASSEC =  '[   4:  21,   1: 266]'     / Overscan region
BSCALE  =                  1.0         / DATA=BSCALE*INT+BZERO
BZERO   =                32768         /
GAIN    =                  1.0         / e-/ADU
RDNOISE =                  6.5         / e-(rms) read noise
CCD-TEMP=                308.4         / CCD Cu block temperature
COMMENT =
BI-FLAG = '    '
END
```

9 Observing Check List

9.1 Log on

Starting from a plain text screen
login: **spect**
Password: (consult local expert)
startx
KDE window manager should start. If there is no **xterm** start one using the shell icon at the bottom of the screen. Click on the **xterm** window.

9.2 Checks

Check that the image directory is NFS mounted on s74
df
Check that your working subdirectory exists. If not, create it (**mkdir xxxx**). Change to your working directory
cd xxxx
Start the program
RunSpect
Enter Run details if necessary (Section 2)

9.3 Object List

Data entry is speeded up if you have a file named **objects.dat**, containing names and coordinates of your programme objects, in your working directory. This file can be created by running the main program, choosing **Exposure**, clicking on **Object** and entering details directly into the browser. Alternatively you can produce the file with your own program or editor provided it conforms to the format specified in Section 4.

9.4 Focus camera

The camera is normally focussed in the late afternoon using the Hartmann test. The procedure is outlined in Section 6.

A KDE Window Manager

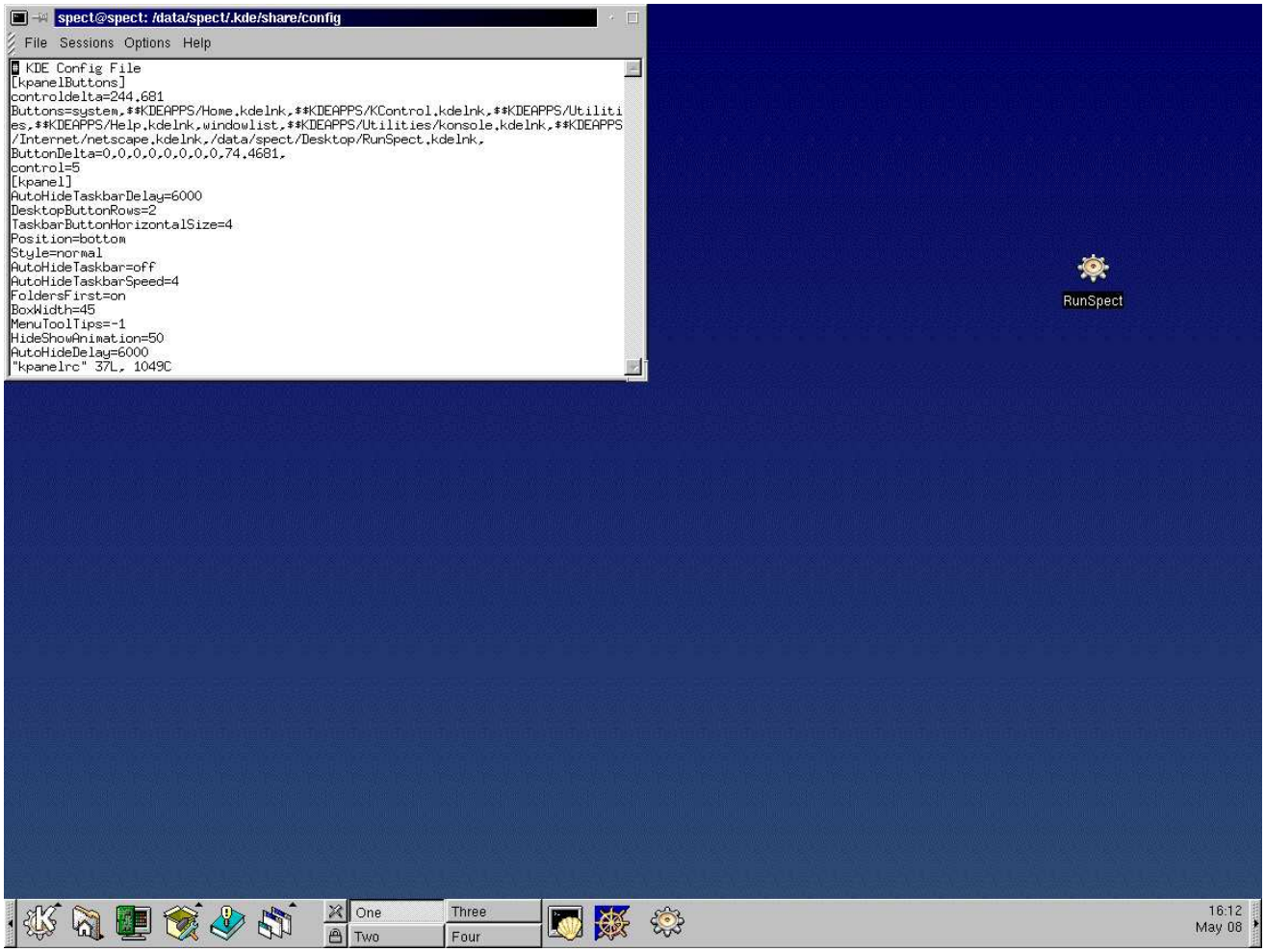

Figure 11: KDE Startup window.

At startup, the screen should look like the figure above (Fig 11). If the **xterm** is missing, start one by clicking on the **Shell** symbol at the bottom of the screen. You can move to different (one of four) pages by clicking on one of **One, Two, Three, Four** at the bottom of the screen. It is not recommended to start other programs while the control program is running, though it may be useful to have another **xterm** running on another page.