

Operation of the NEWFIRM Guider for OAs

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1. Introduction

Guiding with NEWFIRM uses two dedicated cameras mounted on the instrument and accessing two guide fields via X-Y stages. System setup, guide star identification and acquisition, and guiding is done by the Observing Assistant. There are three components to the guider software system:

- i. Display and guide star selection tools. These display the science field and the guide probe fields superposed on the Digital Sky Survey, and allow selection of a guide star by the guider probes. They are started from icons on mocha.
- ii. Camera engineering console. This is a set of GUIs and a command line window running inside a VNC viewer. These are used for camera setup (intensity, contrast, exposure time) and probe setup (field position, focus, astigmatism correction). The VNC viewer can be run on tan or mocha at the operator's convenience.
- iii. Digital TV guider controls. The same as for other 4m guiders, for operations on the digitized guider image: guiding on/off, marker positioning, guide box size and location, etc.

Camera initialization will typically be done, or at least checked, at the start of the night. Guide star selection and guider operation are continuing activities throughout the night.

The two guider fields are rectangular, one on the north side and one on the south side of the square science field, with a small gap in Dec between the science and guider fields. A guide probe can access any position within its guide field. Guided dithered offsets are enabled; however, the guide star must stay within the accessible field at all dither positions. This may constrain guide star selection and/or dither pattern, which may need discussion with the observers.

Probe	Position	Total field size	Guide camera field size	Offset from science field center to guide field center	
				RA	Dec
1	south	26.8 ' (RA) x 4.4 ' (Dec)	2.34 ' (RA) x 1.6 ' (Dec)	TBD	-17.43 '
2	north			TBD	18.11 '

Probe 1 is on the *south* side of the science field and Probe 2 is on the *north* side. The raw analog video signals are displayed on two monitors above and to the left of the operator's console. Probe 1 is displayed on the left hand monitor and Probe 2 is displayed on the

right hand monitor. The center monitor displays the digitized image with guide box, etc. overlaid.

The guide camera field of view is small, 75 x 90 arcsec. At present, telescope pointing errors when moving from one part of the sky to another can be larger than this field of view, so a pointing check at a new target position is strongly advised before attempting to use the guide star selection tool to position the guide probe. Blind searching for a guide star with such a small field is tedious and strongly discouraged.

The telescope pointing *must be zero'd at the center of the science FOV*, where the four IR arrays meet, for the guide star-finding software to work correctly.

2. Initialization before the start of the night

I will assume that guider power is on and that the camera setup engineering console (item (ii) above) is up and running. For restart of this, see Section 5 below. All of these initialization actions can be done in full daylight, since seeing stars isn't necessary for any of them. However, the interactive selection of guide stars using the DSS display will only work if the telescope is tracking.

2.1 Open guider tools.

Open the DSS display and guide star selection GUI on mocha by clicking on the icon "Newfirm-Guider". You should see two items pop up:

- An SAO Image DS9 display showing a star field, with file name dss_search.fits
- A GUI called nfgdr_ds9.tk, with various buttons and fields for data entry

Open the digital TV guider control on mocha by clicking on the icon "Restart Guider".

- The GUI "TV Guider" pops up; this should already be familiar to you from other instruments

Position these tools on whatever monitor/desktop combination is convenient for you.

2.2 Initialize probe positions

Go to the camera engineering console, which is running inside a VNC viewer. We will be using the largest GUI, and the command line window. Move the windows inside the VNC viewer so that both are visible.

The largest GUI, labelled "Newfirm Guider Engineering GUI", has a series of four columns across the top labelled x axis, y axis, faxis, a axis; and a second set labelled the same way. These represent the two probes. Probe 1 is the left hand set; Probe 2 is the right hand set.

x and y are the stage positions. f is focus (a z axis stage) and a is astigmatism corrector (a cylindrical lens in a rotating mount).

Set Probe 1 x axis to its home position by clicking the button “home” under the “x axis” column. A message will appear in the console command line window to indicate action in progress,

```
Homing 1 x
And again when the process is done
x is at home
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Wait for both of these messages to appear. Then do the same for Probe 1 y, Probe 2 x, and Probe 2 y.

Home position is in the middle of the X-Y stage range, and is defined by sensing switches. It’s a good place to start.

2.3 Check camera settings

Next, in the camera engineering console, check the camera video settings for nominal values. There are two ways to do this; use whichever you prefer:

- Read the slider values in the GUI labelled “sliders”. Nominal values are
 - Intensity 16
 - Contrast 11
 - Exposure time 0.900 seconds (slider value 26)
- In the command line window, type “showstv <cr>”. This will return a listing that includes these values for each probe, among other things of no immediate interest.

If the settings differ from nominal, change them using the sliders. Do a left mouse click just left or right of the current slider position to change its value by one unit. A click will move the slider, change the displayed value, and generate output in the command line window. The serial communications with the video control units are slow, so this is a tedious process if a large change is required. Be patient. Trying to do a big change all at once doesn’t always work.

2.4 Turn on video displays

Turn on the three TV monitors above and to the left of the operator’s console. The nominal order is, Probe 1 video display to the left; digitized guider image in the center; Probe 2 video display to the right. Activate these pushbuttons on the console to set this up correctly

(Describe location and labels of the pushbuttons, and how to switch either analog input to the frame grabber/digitizer and center monitor.)

2.6 Quick operational check

When the cameras are turned on, properly set for intensity, etc., and the monitors are on and selected, open the Coude Mirror #3 cover via the console pushbutton. This will put ambient light onto the probe cameras. The monitors should each show a very bright display, curving outwards along the left and right sides.

2.7 Initialization summary: before start of night

- ❑ Click mocha icon “Newfirm-Guider” to open DS9 display and guide star selection GUI.
- ❑ Click mocha icon “Restart Guider” to open digital TV guider control GUI.
- ❑ Set probe x and y positions to “home”, one probe and axis at a time.
- ❑ Check camera settings intensity, contrast, exposure time for nominal values.
- ❑ Change settings to nominal using slider controls if necessary.
- ❑ Turn on monitors and set selection pushbuttons to display the video images.
- ❑ Open Coude Mirror Cover #3 and check for light on the monitors.

3. Setup on first star

This involves verifying that the DSS field selection and display is working properly, guide probes are positioning correctly on selected stars, and star brightness and probe focus are adjusted for best results.

3.1 Display and verify pointing check star field

Go to a pointing check star, have the observers center it in the science field using NEWFIRM, and zero the telescope pointing.

The telescope pointing *must be zero'd at the center of the science FOV*, where the four IR arrays meet, for the guide star-finding software to work correctly.

In the guide star selection GUI opened on mocha (nfgdr_ds9.tk), click on
Select guide star from DSS

In the DS9 display window, a DSS star field will be displayed. Superposed on it are the science field of view (large red square) and the guide probe fields (green and yellow rectangles). Green is north, yellow is south.

A small GUI will pop open, with a message about selecting the guide star, and two buttons: “Ignore” and “OK”. Ignore will abort the procedure, while OK will move the probe to a selected position.

Check that the field display is correct. There should be a bright star in the middle (your pointing check star) and the coordinates displayed in the display and in the selection GUI should both match the TCS display.

ERROR condition 1:

Occasionally, for unknown reasons, the initial DSS search comes back with a bad result. The displayed field will not be that of the check star, and the displayed coordinates will be completely different from the telescope pointing. This is usually a star-poor field around 12 hr RA and +32 Dec. To recover,

- Click on “Ignore” in the small GUI. This will halt the guide star selection process.
- Offset the telescope to another star nearby.
- Try again: click on “select guide star” and check results

ERROR condition 2:

The field display shows a bright star but it is offset substantially in RA: There is a mismatch between the coordinate epochs of the display and the telescope. To recover,

- Be sure that the input star position, and the epoch displayed for the telescope pointing on the VDU, are both 2000.0 .

3.2 Check probe positioning

Next, find a guide star with one of the probes—your choice.

- Select one of the guide probe boxes.
- Put the cursor over the brightest star in the box, and left click the mouse. A cursor pops up centered on the star.
- Click “OK” in the small GUI.
- The probe will move. Verify this by checking the probe x and y positions in the camera engineering console GUI. They should now be much different from 0, 0.
- The selected star should appear somewhere in the raw video image, hopefully near center.
- Center the star in the display with the x and y axis motions in the camera engineering console. Enter an offset value in the blue box and click GO; watch how the star moves. 5000 units is a good step size. Unsigned to go to higher values, - sign to go to lower.

3.3 Adjust star brightness and probe focus

Adjust the camera settings if necessary to get an image that’s bright but unsaturated.

- Using the sliders on the camera engineering console, adjust intensity and contrast to get optimal signal strength for guiding in the digital image display.
- Adjust intensity and contrast alternately, one unit at a time up or down.
- Integration time is very “touchy”. Changing this even a minor amount may cause the guide star to disappear from the video display. You will have to adjust intensity and contrast, up or down together, to bring it back to visibility.

Examine the image and adjust focus if it seems necessary. Note: at present the astigmatism correction is not working properly, so the image probably cannot be made perfectly round. To adjust focus, use the camera engineering console

- Find the column “f axis” for the probe you are using (Probe 1, left columns; Probe 2, right columns)
- Enter an offset value in the blue input box, and click the “GO” button

- Offset by 500 unit, signed steps (unsigned to go up, - sign to go back down)
- Go up or down to get the tightest image that you can

3.4 Check for proper autoguider operation

- Select the probe you are working with for the digital guider image display.
- Place the guide box on the star and turn on autoguiding.
 - Use the small “marker” box to position the guide box. “Warp to star” may put the guide box onto the white bar or square at the bottom of the screen.
- Move the telescope a few arcseconds in RA and in Dec. Verify that the guiding function recenters the star in each axis.

3.5 Repeat to check and adjust the other probe

To check the other probe, go back to Step 3.1 and run through these steps again in the other guide probe field.

3.6 Setup on first star: summary

- Display DSS image of pointing check star field; do sanity check on coordinates.
- Position one of the guide probes on a guide star in the DSS image display.
- Select “Go” and verify that it appears in the raw video image of that probe.
- Center star using x and y offsets in camera engineering console.
- Adjust for optimized digital signal using camera slider adjustments for intensity and contrast.
- Adjust probe focus if necessary.
- Check for proper autoguiding by slightly mis-centering the star.
- Repeat procedure for the other probe.

4. Routine operations

During the night, setup on a science field is an abbreviated version of Section 3. It is necessary to do a pointing check with NEWFIRM and zero the telescope coordinates when moving from field to field (more than about 30 degrees). Otherwise, telescope pointing error may interfere with proper probe positioning. After working with the observers to do this,

- Display DSS image of science field; do sanity check on coordinates.
- Select a guide star from one of the guider fields.
- Go to star; center probe with x and y offsets.
- Optimize digital guider signal with intensity and contrast adjustment.
- Begin guiding.

It is a good idea to watch the guided dithered offsetting to be sure that the probe motion compensates fully for the telescope motion, and that the guide star is reacquired and begins guiding promptly.

In general the guide probe motion limit of +/- 2.5 arcminutes in Y (Declination) means that it is wise to choose a guide star as centered as possible up-down (Y direction) in the guide star acquisition box. The observers may also have to restrict the range of their dither motions in Declination in order not to run the star out of range.

5. Restart procedures for the camera engineering console

The NEWFIRM Guider engineering console display runs inside a VNC viewer. The viewer contains several GUIs and a command line window. The GUIs are labelled in their top bar:

STV camera control
Sliders
Newfirm Guider Engineering GUI

And the command line window is labelled

`4meter@nfguider-kp:/usr/local/gui/tclsrc/newfirm`

The VNC viewer can be run on tan or mocha at the operator's convenience. The software is running on a computer called nfguider-kp in the NEWFIRM computer rack, one flight down in the 4-meter computer room.

The expert is Dave Mills. Contact him if these procedures don't seem to work.

This restart is only necessary if either (i) the guider electronics have been power-cycled with the on-off switch in the Cass cage, or (ii) the display computer (tan or mocha) has crashed or suffered some other interruption of service, such as rebooting.

5.1 Identify the error condition

There are two possible conditions:

No VNC viewer displayed on tan/mocha
or
VNC viewer is present, but the GUIs and command line window inside it are unresponsive.

5.2 No VNC viewer displayed

This indicates that the VNC connection to the host computer (nfguider-kp) has been lost. To restore the connection:

- Open an xterm window on display computer (tan or mocha)
- Start the VNC viewer with the command
`vncviewer nfguider-KP:1 <cr>`

password is the 4-m user login password

A VNC viewer will open, containing various GUIs and a command line window.

However, these GUIs will be unresponsive. The control software needs to be restarted. From here, follow the procedure in Section 5.3 below.

5.3 VNC viewer with GUIs is present, but unresponsive.

You need to restart the control software from the command line window in the viewer.

- Locate the command line window. It will have a % prompt.
- Put the cursor in this window. Type <cr> and verify that there is a response.
- Type
 exit <cr>
All the GUIs in the viewer will disappear, leaving only the command line window.
- Hit the up-arrow key
 ↑ <cr>
This should pop up the last command entered in this window at startup,
 /usr/local/gui/bin/wish8.3
- If this is not the command that is returned, delete whatever pops up and type
 /usr/local/gui/bin/wish8.3
- Type <cr> to switch to this directory.
- Restart the guider software with
 source nfgdr_axes.tcl <cr>

The guider will go through an extensive restart and setup procedure that takes several minutes to complete. Several GUIs will appear as outlines or skeletons, without content. Left-click in the top bar of every GUI to activate them and begin the restart procedure for each one. Then leave them alone. They will freeze if you try to move them during the restart procedure. (The procedure will complete OK but the frozen appearance of the GUIs seems alarming!)

5.4 What to look for during the restart procedure

The largest GUI, labelled “Newfirm Guider Engineering GUI”, has a series of four columns across the top labelled x axis, y axis, f axis, a axis; and a second set labelled the same way. These represent the two probes. Probe 1 is the left hand set; Probe 2 is the right hand set.

x and y are the stage positions in the telescope focal plane. f is focus (a z axis stage) and a is astigmatism corrector (a cylindrical lens in a rotating mount).

The software positions each probe at x, y, f, a home position, one probe and motion at a time. The command line window will show messages such as “probe 1 X homing”, “probe 1 X done”, etc. When this procedure is entirely finished, the numbers under all the column headings x, y etc. in the GUI will be zero +/- a few units.

The restart procedure also sets the intensity, contrast, and exposure time of the two camera heads to default values. At present these are not the best on-sky values, and need

to be changed (Section 5.5 below). Messages about setting these values will appear in the command line window.

Watch the TV video monitors also. If you are restarting as the result of a guider power cycle, the Probe 1 and Probe 2 analog video displays will show the SBIG logo (SBIG is the manufacturer of a video control box incorporated into the guider electronics). As the restart proceeds, this will disappear and the screen will go black. A long white bar will appear on screen at bottom left, and a square white cursor will move intermittently across the screen bottom from left to right. This indicates that the serial connection to the video controller in the guider electronics on NEWFIRM is operating properly.

When the restart is completed, the white square will be moving continuously across the screen bottom. Putting light onto the probes by opening Coude Mirror Cover #3 may show a video response. If the screen remains dark, don't be alarmed. Proceed to Sec. 5.5.

5.5 Adjust camera video settings

The video settings are intensity, contrast, and exposure time. It will probably be necessary to increase all three of these on both probes. This can be done in either of two ways:

1. Use the slider controls in the "Sliders" GUI in the VNC viewer. There is a set of sliders for each probe labeled "intensity", "contrast", and "exposure time". The present value of each slider appears as a number above it.
 - a. Do a left mouse click, positioning the cursor just to the right of the intensity slider button. You will see a line appear in the command line window that indicates an increase. The slider will move rightwards, and a new numerical value will appear above it. The response takes a few seconds; be patient.
 - b. Recommended settings for both probes are intensity = 16, contrast = 11, and exposure time = 0.9 seconds (slider value = 26).

The other way to change camera settings is

2. Use the buttons in the STV Camera Control GUI. This has a column of buttons labelled "increase intensity", "increase contrast", etc. for Probe 1 and Probe 2.
 - a. Click on "increase intensity" for Probe 1. You will see a line appear in the command line window that indicates an increase. The response takes a few seconds; be patient.
 - b. Changes to camera settings via these buttons are NOT reflected in the slider controls or the values displayed in the slider GUI. To get the current values for all settings, type "showstv" in the command line window.
 - c. Recommended settings for both probes are intensity = 16, contrast = 11, and integration time = 0.9 seconds.

Now everything is restarted. Open the guider tools on mocha, if necessary (Section 2.1), and proceed to set up on a star (Section 3).

Appendix 1. Error conditions and recovery procedures

This section describes errors that may be encountered during initialization, setup, or guiding, and how to recover from them.

A.1 TV monitors show no video signal or white bar

The guider electronics system is powered off.

- Go down to the cage. Attached to the yellow NEWFIRM truss, and facing the cage door, is an interface plate with three power switches in a row, and various other connectors.
- Flip the leftmost switch, guider power, up to the “on” position. You will hear exhaust fans starting up in the guider electronics boxes around the upper part of the truss.
- Restart the camera engineering console and reinitialize the cameras, following procedures in Section 5 above.

A.2 TV monitors display only the “SBIG” logo

Guider electronics are on, but the cameras have not been initialized.

- Restart the camera engineering console and reinitialize the cameras, following procedures in Section 5 above.

A.3 TV monitors display white bar and square but no video signal from sky

If the horizontal white bar is seen at screen bottom left, and a white square is moving across the screen bottom left to right, then the camera system is running and there is communication with the camera engineering console. Probably the camera settings (intensity, contrast, exposure time) aren't set appropriately for conditions. Integration time is particularly “touchy”; a small change here can make the video signal go dark.

- Use the engineering console sliders to set camera controls to nominal values
 - Intensity = 16
 - Contrast = 11
 - Exposure time = 0.9 sec (slider value 26)
- If in daytime, open Coude Mirror Cover #3. The TV monitors should now show a bright illuminated area.
- If at night, check for a low signal level from the sky, or position one of the probes on a guide star and look for it.
- If nothing is seen, try changing intensity and contrast to higher values. Change them alternately, one unit at a time. Work with one probe at a time.
- If the video signal is completely dark no matter what you do, it is possible that the camera head itself has died. Switch to using the other probe.

A.4 No VNC viewer (camera engineering console) display

The VNC connection to the guider computer has been lost. You need to restore the connection and then reinitialize the cameras.

- Follow the procedures in Section 5.2 and subsequent steps

A.5 VNC viewer with GUIs is present, but unresponsive.

You need to restart the control software from the command line window in the viewer, and then reinitialize the cameras.

- Follow the procedures in Section 5.3 and subsequent steps

A.6 Digital Sky Survey display returns a bogus sky field

After clicking on “Select guide star from DSS” in the guide star selection GUI, the DSS search has returned a bad result. The displayed field isn’t the science target, and the displayed coordinates are completely different from the telescope pointing.

This sometimes happens for the first field selected at the start of the night. If it’s a pointing check star, there will not be a bright star in the displayed starfield. The bogus coordinates will probably be around 12 hr RA and +32 Dec.

- Click on “Ignore” in the small GUI. This will halt the guide star selection process.
- Offset the telescope to another star nearby, selected from a star cache.
- Try again: click on “select guide star” and check results

A.7 Digital Sky Survey display returns correct field but target object isn’t centered

The field display shows the target but it is offset substantially in RA. There is a mismatch between the coordinate epochs of the display and the telescope. To recover,

- Click “Ignore” in the small GUI to halt the guide star selection process.
- Be sure that the input position, and the epoch displayed for the telescope pointing on the VDU, are 2000.0 . The usual mistake is that the telescope pointing is set to current epoch, e.g. 2008.7 .
- Try again with “Select guide star from DSS”

A. 8 Error: no space left on device

This message pops up in a box when attempting to click on and go to a guide star.

- Reboot mocha
- You may have to go through the guider restart procedures in Sec. 5

A.9 Guide star does not appear on analog TV monitor after probe is sent to it

You have clicked “OK” in the small “go to selected star” GUI, but no star appears in the probe field of view on the TV display.

First check the camera settings for intensity, contrast, and exposure time, and examine the TV monitor for a low level of background sky. See A.3 above. You may already know that everything here is OK, by having used the guider on other fields.

Examine the guider field superposed on the sky field displayed in the SAOimage display. The small box indicating the probe position should have moved to the selected star.

If the probe didn't move as expected, and/or appears to have missed the selected star as seen in the DSS display,

- In the camera engineering console, for the probe you are using, set "x axis" and "y axis" to "home" by clicking on the "home" button for each.
- Try again, beginning with "select guide star from DSS".

If the camera settings are reasonable, background sky level is perceptible, and the probe appears to have moved correctly in the display, then the problem is most likely telescope pointing error. This can be larger than the guide camera field of view. If you have moved the telescope to a different part of the sky since the last pointing check (> 30 degrees change of position),

- Go to a pointing check star near the science target. Have the observers center it in the science field of view, and zero the telescope pointing.
- In the camera engineering console, for the probe you are using, set "x axis" and "y axis" to "home" by clicking on the "home" button for each.
- Return to the science field and try again, beginning with "select guide star from DSS".

If the guide star still doesn't appear, there may be a zero point error in the fixed offset from science field center to probe home position that is used to calculate probe motions. This is most likely in the x axis position, and the star is near the probe position but still outside the small camera field of view. You can switch to the other probe, do a blind search for the guide star, or work without a guide star (which may not be scientifically desirable). To do a blind search:

- Use the "x axis" and "y axis" controls in the camera engineering console for the probe you are working with. Probe 1 is the left hand set, Probe 2 is the right hand set.
- Search first in x. Enter an offset value in the blue box and click "Go". There will be a response in the engineering command line window indicating "motion completed", and the x axis position indicated above the blue box will change.
 - 10000 units is a good step size, equal to a little less than the camera field of view
 - search by 20000 units (two "steps") in each direction, + and -, from the original probe position
- Then offset in y by + or - 10000 units and repeat the search in x.
- You can do a spiral search if you carefully keep track of the relative offset entered for x or y at each step.

- Once the star is found, use smaller steps in x and y to center it on the probe.
- Note the net x and y motions that were necessary to find and center the star. You'll probably be doing this again.
- Turn on autoguiding and proceed with the science program.
- If you have searched +/- 20000 units in x, and +/- 10000 units in y, from the initial probe setting with no luck, you're probably not going to find the star.
- Report the problem in Service, and discuss the other options with the observer:
 - Use other guide probe
 - Switch to a different science field, if there are no usable guide stars in the field of the other probe
 - Work without guiding—keep integration times shorter than 60 seconds to avoid PSF smearing due to tracking error

A.10 Guide star appears on the analog video monitor but not the digital guider monitor

First, check to see that you have selected the correct analog input to the digital guider. It may be set to the other guide probe.

The digital guider needs a stronger signal than the raw analog display for the star to appear. You need to turn up the intensity and contrast on the probe camera.

- Using the sliders on the camera engineering console, increase the intensity and contrast to get a brighter digital star image.
- Adjust intensity and contrast alternately, one unit at a time.
- Integration time is very “touchy”. Changing this even a minor amount may cause the guide star to disappear from the video display. You will have to adjust intensity and contrast, up or down together, to bring it back to visibility.

A.11 Digitized star signal is too strong or weak for optimum guiding

Adjust the camera settings to get an image that's bright but unsaturated.

- Using the sliders on the camera engineering console, adjust intensity and contrast to get optimal signal strength for guiding in the digital image display.
- Adjust intensity and contrast alternately, one unit at a time up or down.
- Integration time is very “touchy”. Changing this even a minor amount may cause the guide star to disappear from the video display. You will have to adjust intensity and contrast, up or down together, to bring it back to visibility.

A.12 Guide probe did not follow star completely on dithered offset

The probe failed to recenter on the guide star. There are two types of failures depending how far the probe missed the star.

A.12.1 Near miss. Star may be on the edge of the guide box, or up to a couple of box lengths away.

We don't know what causes this, but the problem is probably with the guide probe motions rather than the telescope motions.

- Move the guide box to the star and resume guiding. Don't move the telescope!
 - Use the small "marker" box to position the guide box. "Warp to star" may put the guide box onto the white bar or square at the bottom of the screen.
- Watch the next dither motion to be sure that the guider recenters on the star and guides at the new guide box position.
- Tell the observers what has happened. They may wish to flag that exposure.
- Enter the event in service with UT time and telescope position, so we can look at the guider log and try to figure out why this happens.

A.12.2 Complete miss. The star may be visible off to the side or corner of the camera field of view, or it may be completely outside the field of view.

The probe has a finite range of motion, 28 arcmin in X (RA) and 5 arcmin in Y (Dec). The guide star has probably moved out of range. The probe has moved as far as it can and then hit a limit and stopped. Refreshing the DSS guider display will show this.

If the star is visible somewhere in the guider field,

- Move the guide box to it and resume guiding. Don't move the telescope!
 - Use the small "marker" box to position the guide box. "Warp to star" may put the guide box onto the white bar or square at the bottom of the screen.
 - Tell the observers what is happening. They may want to flag this exposure.
- If the next dither motion brings the star back within range of the probe, it may recenter on the star and guide *at the guide box position you just defined*. This is OK. Watch what happens on the next dithers, however.
- Or, the probe may position the star *at the original guide box position*. Move the guide box to it and resume guiding. Watch what happens on the next dithers. Keep the observers informed about what is going on.
- If the star moves completely out of the probe FOV, go to the next procedure.

If the star is no longer visible in the guider field,

- Check to see that the autoguider has gone into its "no signal" condition and is not sending guiding corrections to the telescope.
- Tell the observers what has happened. They may elect to continue and see if the guide star is reacquired on the next dither, or to abort the observing sequence.
- If the next dither motion brings the star back within range of the probe, it may recenter the star correctly and resume guiding. For a "near miss", follow A.10.1 procedure.
- If the star isn't recovered by the probe, turn off the autoguiding and tell the observers what has happened.

- They may decide to continue unguided, to abort the exposure sequence and try a different guide star, or to go to a different science field.

In general the restrictive probe motion limit in Y (Declination) of +/- 2.5 arcmin means that it is wise to choose a guide star as centered as possible up-down (Y direction) in the guide star acquisition box. The observers may also have to restrict the range of their dither motions in Declination in order not to run the star out of range.