NURO Quick Start Guide

by Kathy DeGioia Eastwood
Last update: 7/29/09

Starting Up

Plan on arriving at the telescope about 45 minutes before sunset.

1. Unlock the door to the dome, and prop it open with the big, scientific rock. This will help the air circulation.

2. In the control room, turn on the monitors for the MOVE computer, the Scopecam, and anything else that got turned off. Turn on the intercom.

3. Log into Pegasus using the *obs31* username and the password that is pasted on the monitor.

4. The mail program will start up. Cancel the connection request, and quit the mail program.

5 . Go into any workspace, say Workspace 1[1] by clicking on the upper left "Spaces" box. Start up Firefox by double-clicking on the icon. The program will open at the Lowell Sign-In page. This is a safety feature started by Lowell to keep track of observers on the Mesa. You should use the sign-in button to sign everyone in at the beginning of the night, and then sign-out at the end of the night. (Otherwise you may have people panicking and thinking that you have been injured during the night.)

6. Go to Workspace 2 by clicking on the second workspace box. Hold down the "X" application button in the dock along the bottom. Holding it down will give you an Applications menu. Use the applications menu to start an *xgterm* window.

7. Inside the *xgterm* window, start up IRAF by typing *cl*.

8. Use the X button application menu again to start up a *ds9* window. Move the *ds9* window to the upper right corner.

9. After IRAF is running, go to the *cl>* prompt and type
cl> cd nurodata

10. Go to Workspace 3, and use the X button application menu again to start up an *xterm* window. At the prompt, type
pegasus201% telnet nasacam

[1] The "Spaces" icon is in the dock at the bottom of the screen. It looks like a rectangle divided into four smaller rectangles.

You will be prompted for a login and password; use the same ones you used for Pegasus.

11. At the nasacam prompt, start both ds9 and LOIS by typing
nasacam% ds9 &
[As you may recall, the & indicates that the program will run in the background and will not keep your window busy.]

After the ds9 window starts up, move it to the upper right corner of the screen. Then type
nasacam% lois &
This will start up the LOIS System Console window (lower screen).

12. Click the Configure button, which is in the LOIS System Console window. This will also open the NASAcam Camera Control window (upper left), 31inch Telescope Control window (below the Camera Control window; this may need to be nudged up), and the Filter Control window (between the Telescope Control window and the LOIS System Console window.)

Now check the configurations. Hopefully the correct choices are already chosen: tel_31, NASAcam, NASAcam_filt, and DS9/XPA. Type in the names of the observers and the name of your institution (NURO/school) and then click Start. (This can be very slow. Don't touch anything while waiting!)

13. Click the Storage button, which is in the LOIS system console window. The correct path should be
/lois_data/data/NURO/YYYMMDD
where YYYYMMDD is the year, month and day of the UT date corresponding to the night of data. This string will be the name of the directory, and with a decimal point, i.e. YYYYMMDD., is also the NURO convention for the root file name. Most people start with extension 000 at the beginning of the night. After you have checked the pathname, put in the root file name and extension number, click *Apply*.

Back in the iraf window, do a
cl> cd YYYYMMDD
to view the night's images.

14. In the LOIS System Console window, type
LOIS% source buietools.tcl
LOIS% source nuro.tcl
These commands *must* be typed in the order shown.

15. In the LOIS System Console window, type
LOIS% allopen
This command opens the dome, initializes the dome, initializes the filter wheels, and generally gets everything ready for observing.

16. **BIASES:** Typically the next step will be to do biases, typically about 25 of them. Using the Camera Control window, choose Bias under Frame type. Put in 0 for the exposure time, and 25 for the number of exposures. Click Go.

17. **FLATS:** To do twilight flats, click on Show User Buttons in the LOIS window. This should open up a new window that displays Ed's scripts. The script called *nuroflats* will keep checking the sky brightness, and actually take the flats as soon as the sky is dark enough. Before executing *nuroflats*, use the MOVE command UI (Uniform Illumination) to send the telescope to a spot about 90% from the sun. If the dome following is off, use the DM toggle to turn it on. Most observers prefer to turn the tracking off during twilight flats; UI automatically turns it off. If you prefer to have the tracking on, you can use the toggle command TR to turn the telescope tracking on or off.

Next to the button labeled *nuroflats*, fill in the desired values. "Type" refers to either "dusk" or "dawn". Choosing "dusk" will do the flats in order of increasing filter wavelength. Choosing "dawn" will do the flats in order of decreasing filter wavelength. In the *nframes* box put in the number of flats you want per filter (typically 5), and then for each filter type in either "yes" or "no", depending on whether you want flats for that filter. After filling in all the values, click the *nuroflats* button and let the computer worry about what time to start the flats. (This routine does keep LOIS busy, so you probably shouldn't run the script until just after sunset.)

18. **FOCUSING:** Focusing the telescope is now very easy. There are 24 different focus routines available, one for each hour of Right Ascension. To focus the telescope, check the Local Sidereal Time on the MOVE monitor. Choose the hour of RA closest to the LST. If that RA is approximately 16 hours, then at the LOIS prompt type
LOIS% focus16

The focus routine finds a star near the RA in question, steps through various values of the secondary's position and takes a sub-image of the star at each focus value. The routine then chooses the focus value that produced the image with the smallest FWHM. If the telescope started badly out of focus, you may have to run the focus routine twice.

You can ignore the following error message:
Error! ins-filter function failed!
It is just complaining that it can't move to a particular filter when it's already there.

What to do if the focus star isn't centered in the image, i.e. if the telescope pointing needs tweaking:

Go to the nearest bright star by using the GS (Guide Star Catalog) command in MOVE. Enter "T" for a star near the telescope's location. Enter 2,3 for the magnitude range; this will give you the nearest star between second and third magnitude.

Use the ds9 cursor to get the approximate coordinates of the center of the star. At the LOIS prompt, type

LOIS% centerobj X Y
where X Y are the coordinates you just looked up for the star.

Do another test image to make sure the star is actually centered. When you are happy, go to the MOVE computer and type *UC* to Update the Coordinates, and then U to verify the update.

19. **Which Way is Up.** In order to re-display the ds9 window such that North is at the top and East is at the left, use the Zoom menu to choose "Rotate 90 degrees".

Observing

Now you are ready to observe. Here are some of the most common MOVE commands. Note for young observers: the notation <CR> means "carriage return", which is what we now call the ENTER key.

DM Toggles the DoMe following on and off.
TR Toggles the TRacking on and off.
CO Allows user to enter COordinates, then sends the telescope there.
PM Lists the five Previous Moves of the telescope, and allows you to send it to any one of those.
ZE Sends the telescope to the ZEnith.
HO Sends the telescope to the HOme position.
OL Allows you to create or modify a file (Observing List) of coordinate positions.
OF Opens a particular Observing File.
RF Lets you specify the number of the object in the open observing file, and sends the telescope there (Read File). Enter "1" for the first object in the file, etc.
RM Relative Move. If you want to recenter your object, this commands allows you to move the telescope in a specified direction in units of arcseconds.

To make a test exposure, use the NASAcam Camera Control window. Set the exposure time, and click the Test button. Every test image overwrites the previous test image. To look at the test exposure with imexamine, go to Workspace 3 and type
cl> display test 1
cl> imexamine
The most useful commands in imexamine for checking the focus are "r" and "e". The command "a" will do aperture photometry on the star in question. Don't forget to use "q" to get out of imexamine.

To take an exposure that will automatically be saved, use the NASAcam Camera Control window. Set the frame type to Object, type in the name of the object, set the exposure time and number of exposures, and click the Go button.

To make a sequence of exposures, use the *ubvri* button in the User Buttons window. Fill in the number of seconds for the exposure for each filter. Putting in 0 seconds will just skip that filter

Shutting Down

1. Compress your data, and preferably make a copy on your laptop. To compress all the files, go to IRAF window in Workspace 3 and type
*cl> !gzip Jun25**
(or whatever your files are called). You will recall that the "!" in IRAF sends the command out to the unix shell. NOTE: This compressing process is very slow on Pegasus – it can take on the order of an hour to compress a full night's worth of data. You may want to start compressing before the end of the night.

To copy the compressed data to your laptop, ftp from the laptop to pegasus.
> ftp 192.168.0.94
ftp> cd /pegasus/data/NURO/YYYYMMDD
ftp> binary
ftp> prompt
ftp> mget YYYYMMDD.fits*
ftp> quit

2. At the LOIS prompt, type
LOIS% stowit
This will not only shut down the program, but put the telescope and dome to bed, and put the MOVE program to sleep. (The s*towit* program is also available as a button in the User Buttons window.)

3. Sign-out of the Lowell safety net program, and then log out of pegasus. (There is a pull-down menu in the top bar to accomplish this.) Turn off all the monitors and the intercom.

4. Clean up the control room and the public area.

5. Take the kitchen trash out to the closed can in the entryway, and replace the trash bag. You may skip this step if there are no food scraps in the trash.

6. Make sure all the doors to the support building are closed securely; they tend to stick and stay open. Lock both the outside door and the door between the mud room and the inner building.

7. Close and lock the door to the dome.

8. When leaving, make sure that the padlocks on the gate are arranged such that opening either padlock will enable someone to open the gate.

Troubleshooting: What to Do If . . .

1. LOIS crashes (which it will)

Shut down the various LOIS windows, but not ds9. At the nasacam prompt, re-start the LOIS program:
nasacam% lois &
You will need to re-configure using the Configure button, and it is a good idea to check the Storage information again. You will then need to re-source the scripts:
LOIS% source buietools.tcl
LOIS% source nuro.tcl

However, you will not be re-executing the allopen command, since most things are already open. In the filter wheel control window, you will need to click "Home Wheel" for each filter wheel so that they can re-calibrate.

NOTE: Sometimes just restarting LOIS isn't enough. If you have restarted LOIS and you still can't take an image, you will have to reboot nasacam. At the nasacam prompt, type
nasacam% sudoreboot

This will take a while. Be patient. After it reboots, restart both ds9 and LOIS again, etc.

2. MOVE crashes

If the MOVE program or computer crashes, the telescope will lose its pointing, and may get confused and start to run away. Remember that if the telescope starts to run away, hit any key on the MOVE keyboard, or push any button on the paddle.

To reboot the MOVE computer, go out to the downstairs portion of the dome and find the machine (it is labeled.) Hold in the power button until the machine restarts.

Thanks to a hardware update in the fall of 2005, we no longer have to actually put a bright star in the finding scope. There are fiducial switches that will figure out where the telescope is.

a. In MOVE, type IC (Initialize Coordinates). The telescope should execute a few moves, figure out where it is, and do a rough reset of the coordinates.

b. Use the GS command to go to the nearest star in the Guide Star Catalog mini-catalog. You will be prompted to choose whether the PPM star is to be near the current telescope position or near some other position. Choose the current position. Next you will be prompted for the desired magnitude range. Note that a range from 3.0 to 4.0 can be entered as 3,4 or 4,3 or 3.0,4.0 or 4.0,3.0. Entering a single value is equivalent to requesting all stars brighter than that value. Choose something bright, perhaps 5^{th} or 6^{th} magnitude, so that you will be sure you have the right star.

c. After the telescope moves to the GSC star, take a test exposure. Use the camera to make sure the star is centered. If you need to re-center, the command RM is useful for moving the telescope by small amounts.

d. After the star is centered, execute a UC (Update Coordinates) command to reset the coordinates.

If all else fails . . .

Call Ed on his cell phone at 310-8092 at any time.