QuickStart for 20in Telescope/LHIRES III Spectrograph

Specifically for ASTR 8600 Course Project, Fall Semester 2011

Software to start on computer:
Maxim DL (CCD control)
Pulse Guide (guiding paddle)
Guide Cam Viewer (marked guidecam on desktop)

Telescope/Dome Control

1. Open Dome (decide on zenith/low opening)
2. Remove covers (**IMPORTANT**: primary cover LAST, and this only AFTER dome is open)
3. Slew to bright star using paddle, center in small finder

4. Track using the guide cam
5. Slew using PulseGuide on computer (after connecting, available in the guide/slew tab)
6. Focus using RCOS TCC (100x for large movements, 25x for small movements). This will be in focus when the star image on the guidecam looks nice and round)
7. Center dome using switch near lights/electronic circuits box
8. Sync telescope (if on correct side of pier) at every location, so that the next slew arrives closer to where you want to be. You can see to V~6 in the small finder without too many problems.

CCD Control

1. Maxim DL – Click on small camera icon at top to bring up camera control window
2. Connect to SBIG Universal (Setup Tab)
3. Set cooling temperature to ~25C degrees below ambient at start of night (should be ~70-80% of cooler power after cooled)
4. Wait for CCD to cool (see bottom of the window)
5. Take test exposures (Expose Tab)
6. Autoexposures for bias, dark, flats (auto tab option)
7. Single exposures for science frames and comp lamps (DON'T FORGET TO SAVE as .fits file)
8. You can make a simple graph of the spectrum obtained using the graph window at the bottom.

9. Typically, 1-2min bright light exposures for flats (aim for 2,000 – 5,000 counts; want 10/grating tilt)
10. Need 10 bias frames (0 sec exposures) per night
11. Want 2-3 darks (of an exposure time greater than or equal to your longest science exposure; typically 30 min = 1800 sec for Spectroscopy Class Project). Can be taken in afternoon before opening.
12. Need one Neon lamp taken after each science exposure, in the same place in the sky.
13. Typically output files are named YYYYMMDD.***.fits, done in UT Date and sequential number. Autoexposures have suffixes such as (bias, dark, flat) to identify what they are.
14. Data are saved in UT subdirectories from the Desktop/Spectra folder
15. You can populate the header by opening Settings>FITS header menu.
16. Set computer time at beginning of night to be the same as the skyscan clock on the desk.

Guide Cam Control

1. To run guide cam, simply double click on the guide cam 'traffic cone' icon on the Desktop
2. Settings for exposure time are done with gray small paddle velcroed on south side of pier.
3. You can make the screen larger if desired, for easier resolution of slit position.
4. Attach a post-it note to the screen on right side of slit in order to visually mark where you want the star to stay. The stellar spectrum should be near the center, and is related to the position along the slit.

5. To Focus Guide cam (if slit looks broader at one point and not like a straight dark line), gently move guide cam in/out of the socket it is held in on the spectrograph. The focused slit looks like a dark line.
6. If there is a large lag in time (> ~1 s) between moving the telescope and seeing things move, turn acquisition on paddle (red button) off (red light appears), turn off by unplugging power, and then restart (including software on computer). Multiple starts/stops (red button on paddle) of acquisition causes hiccups in readout and slows down time between acquisition and display.

Comp Lamps

1. Turn silver knob on spectrograph to the left (counter clock wise).
2. Turn on power switch on spectrograph (guide cam should be very white)
3. If spectrograph is setup properly, the brightest Ne line (at 5852 A) will saturate in a 20 s exposure, but will be centered around pixel 1080 (in X direction). Can test centering with short 2 s exposure.
4. When finished, power off lamp, and return knob to the right (clockwise) position.

Spectrograph Settings

1. In general, the spectrograph should be ready to go with the 2400 grating and 23 micron slit in place and focused before you arrive.
2. If Neon lines are broad in a comp lamp (> 3.5 pixels FWHM), you should focus spectrograph. (Test in afternoon). This is done by small tweaks of the collimator/camera lens in the spectrograph. Remove access panel, gently move it a little bit one way or another. Getting the width small (~3 pixels) will maximize your resolving power in the spectrograph.
3. The micrometer setting with the 2400 grating for this project is 18.10. This setup should place the brightest Neon line at pixel ~1080 in the x direction. If this isn't quite right (off by > 10 pixels), do small movements to get this right. Moving to larger values on the micrometer moves the line to the left (redder wavelengths), smaller values moves it to the right (bluer wavelengths).
4. The reading on the micrometer is close to correct, but there may be small differences in grating tilt if moving to larger or smaller numbers, but the micrometer position should always be within ~0.1 from the nominal 18.10.

Shutdown for 20in Telescope/LHIRES III Spectrograph

Things that could/should prompt closing:

- Technical Difficulties – if necessary, you can call Noel Richardson, preferably before 10 pm. If I can't trouble shoot over the phone, I will likely need to come out to fix it.
- **Dew**. About once per hour, check your vehicle outside to see if dew is starting to form on the windshield. If we are near the dew point, this could cause problems for the optics (we don't want a wet mirror). If dew is forming, please finish your current science exposure and close the dome. Then, you can finish calibration frames and go home.
- Excessively cold temperatures. We haven't tested how well the telescope, spectrograph, and guidecam will continue to operate at near freezing temperatures. The CCD will be ok, as it will need to be chilled below ambient temperature anyways. If you frequently need to warm up in the building, chances are the telescope may be running slower than normal, and you might want to consider going home.

To close, do the following tasks, in this order. The first and second groups can be done simultaneously, and the third group is last. In the following order:

After all science frames and calibrations are finished...

1. In Maxim DL, in the 'setup' tab for CCD control, begin a '**warm up**' of the coolers. Once this is above freezing (0 C), you may **turn off coolers** and then, **disconnect** the camera from the software. (Extremely IMPORTANT)
2. Turn off guide cam acquisition (red button on paddle)
3. Turn off guide cam software
4. Pulse Guide: Disconnect from telescope (in Connect Tab)
5. Close Pulse Guide
6. Once camera disconnected from Maxim DL, close Maxim DL.
7. Copy data to flash drive to bring back.
8. Turn off computer, and power off monitors

1. Park telescope (From Setup in paddle, Mount/Park Options), Park #3.
2. Return telescope covers (Primary Mirror Cover FIRST)
3. Close dome, and park slit of dome over lights where plug to open/close hangs.

1. After all this is completed, power off telescope and mount power supply boxes (next to pier)
2. Unplug the plug in the southwest part of dome (where all power comes from).
3. Turn off all lights at HLCO, except turn the outdoor lights (by door) back on.
4. Close any dome windows, if you opened them.
5. Take any garbage with you. We do not have trash service provided at HLCO.
6. Remember to lock doors, lock gates, and drive safely (watch out for deer!)