# HIRES Setup Instructions:

### Setting Up HIRES

* From tan background, drag & click on HIRES CONTROL MENU
  + Drag over to: START all HIRES GUIs w/ hexpocon
  + Answer questions:
    - "Do you want to continue running the setup script?" type y and return
    - Enter observer names
  + Confirm data directory (/s/sdata125/hires1/20??monDD/)
    - Use the current UT date. (typically one day later than local calendar date), hit enter.
    - Set starting observation number at 1
    - Now appearing on the 3 screens:
      * 1) HIRES dashboard, exposure meter dashboard, terminal
      * 2) XHIRES GUI, dewar level window
      * 3) SAO image: ds9
* Start the iodine cell
  + Select from desktop pulldown: "HIRES control menu > Iodine cell menu > Start Iodine Cell"
  + Cell takes 45 minutes to warm up fully. A warm cell reads:
    - tempiod1 | 65 degrees
    - tempiod2 | 50 degrees  (+/- 0.1 degree)
* Check dewar level:
  + In a terminal type: ln2
  + The dewar level is also visible when using "START all HIRES GUIs" in the window with the XHIRES GUI.
  + Top off dewar (if level is below 70%) by: right-clicking on tan background,
    - drag to "HIRES Control Menu"  and  "Initiate HIRES Dewar Fill"
    - dewar evaporation rate is 5% per hour and auto-refills at 10%. Always try avoid an auto refill.
    - If the dewar is filled after ~2 pm Hawaii Time, then it does not need refilled near sunset.
* Open the Mirror Covers
  + From XHIRES GUI > click ETC > Click OPEN RED
* Set up file names
  + On HIRES dashboard, click on yellow "Start Here" button.
  + Click on "retrieve" to install directory for raw data and frame number.
  + Update "Filename root" with current date and underscore. (e.g. 20180201\_)
  + Click on "Commit" to set values.
* Set CCD parameters
  + CCD Binning: Enter in the left box: X = 3 , Y = 1 or click on "Binning" and pull down to "X3Y1".
  + No Need to set any other params in CCD window.
  + Check/Set OUTDIR: directory for raw data
  + Check/Set OUTFILE: prefix of filenames, i.e. 20180201\_
  + Check CCD readout mode:
    - Gain = "low" (default)
    - Speed = "fast" (default)
* Spectrograph configuration:
  + Slit should read 14.08" (m slitname = opened)
  + Filter1 = clear (m fil1name = clear; using gui okay) (Formerly KV370)
  + Filter2 = clear (m fil2name = clear; using gui okay)
  + Collimator = red (This should always be set by SA)
  + In a terminal:
    - Set collimator focus: m cofraw = +70000; Use 's cofraw' to show value
    - Set camera focus: m cafraw = 0; Use 's cafraw to show value'
    - Move echelle and cross disperser angles with "A" button to positions from last HIRESprv night (get these values from your SA)
* Guide camera configuration:
  + Filters: BG38 + ND0.01 (BG38 is important, ND up to OA)

### Focus and Alignment

* Turn OFF Exposure meter
* Lamp: Th-Ar #2
* Lamp Filter: NG3 filter
* In terminal window:
  + m deckname = D5 (in lehoula window)
* Iodine: Out
* ObsType = Object
* Texp: 10 sec (in brown "CCD" window, enter exposure time. Click "UpdateCCD" )
* Set x-disperser and echelle to values from previous HIRESprv night.
* Click "EXPOSE"
* **Run focus and alignment analysis in IDL**

### IDL> foc,inpfile='jnnnxxxx.fits'

* + Check instructions from focus program and move echelle and cross-disperser as needed.
  + If focus program crashes, you may need to move echelle or cross disperser manually.
  + If note regarding 'Counts in lines too low' appears. Re-position lines manually.
  + Check fwhm focus value returned by the focus program. It should be in the range 2.28-2.40.
    - If the fwhm is greater than 2.40, try changing the cafraw (add 10,000 to the current value). Use the terminal command: m cafraw = 10000. Keep changing the cafraw value in steps of 10,000 until you observe a minimum in the fwhm values. (This should need to be done only rarely.)
* If manual grating moves are needed:
  + Horizontal: +0.001 deg of echelle rot moves lines left by 1 column
  + Vertical: +0.002 deg of X-disp rot moves lines down by 1 row
  + + As a last resort change cafraw or cofraw on command line to focus
    - (using m cafraw= and m cofraw=). Try cafraw first; steps of ~10,000 are needed in cafraw to make any appreciable difference in focus.

### Calibrations

* THORIUM Exposures w/ B5
  + Turn OFF Exposure meter
  + Lamp : Th-Ar #2
  + Lamp Filter: ng3
  + m deckname = B5 (0.85 x 3.5 arcsec, ==> 4.0 pixel projected slit)
    - WARNING: use m deckname=B5, NOT the HIRES GUI.
  + Iodine : Out
  + Exposure : 1 sec (take 1 or 2 at begin and end of night)
* THORIUM Exposure w/ B1
  + Turn OFF Exposure meter
  + Lamp : Th-Ar #2
  + Lamp Filter: ng3
  + m deckname = B1 (0.57 x 3.5 arcsec, ==> 3.0 pixel projected slit)
  + WARNING: use m deckname=B1, NOT the HIRES GUI.
  + Iodine : Out
  + Exposure : 2 sec (take 1 or 2 at begin and end of night)
* Iodine Cell Calibrations w/ B1
  + Make sure cell is fully warmed up (see p.1) before taking these.
  + Turn OFF Exposure meter.
  + Lamp : Quartz2
  + Lamp Filter: ng3
  + Aperture : B1 (0.57 x 3.5 arcsec, ==> 3.0 pixel projected slit)
  + WARNING: use m deckname=B1, NOT the HIRES GUI.
  + Iodine : In
  + Exposure : 3 secs
    - check saturation: < 20,000 counts on middle chip?
    - Check I2 line depth. In center of chip, it should be ~30%
  + column cut with DS9: Region > more... > proj
* Iodine Cell Calibrations B5
  + Make sure cell is fully warmed up before taking these.
  + Turn OFF Exposure meter.
  + Lamp : Quartz2
  + Lamp Filter: ng3
  + Aperture : B5 (0.85 x 3.5 arcsec, ==> 4.0 pixel projected slit)
    - WARNING: use m deckname=B5, NOT the HIRES GUI.
  + Iodine : In
  + Exposure : 2 secs
    - Check saturation: < 20,000 counts on middle chip?
    - Check I2 line depth. In center of chip, it should be ~30%
  + column cut with DS9: Region > more... > proj
* Wideflats
  + Turn OFF Exposure meter
  + Lamp : Quartz2
  + Lamp Filter: ng3
  + m deckname = C1 (0.85 x 7.0 arcsec, ==> 4.0 pixel projected slit)
  + WARNING: use m deckname=C1, NOT the HIRES GUI.
  + Iodine : Out
  + Exposure : 1 sec (check saturation: middle chip should have 10,000 < counts < 20,000)
  + Take 50 exposures at the beginning of the night
  + Check one test exp for saturation (<20k counts), then take multiple exposures with command:
    - exp\_acq 49 ; m lampname=none ; m deckname=C2
    - Concatenates commands to turn off lamp after flats finish

#### Observations of Stars

* Iodine: IN (check I2 temp: 50C)
* ~30 min before sunset:
  + top off LN dewar if necessary (definitely refill if level is < 100.0... drops ~5% per hour)
* Within kvnctel VNC session
  + From blue background click and select K1 Guider Eavesdropping > Start Observer UI
  + From blue background click and select K1 Telescope Status  Menu > FACSUM
  + From blue background click and select K1 Telescope Status  Menu > XMET
* Start exposure meter.
  + Click on the upper left button "System Start" on exposure meter.
  + Click on "Arm" in upper left of right panel to start target monitoring.
  + Default exposure level is 250000, equivalent to SNR ~200
* Set max exposure time as appropriate (in HIRES Dashboard CCD ExpTime)
  + Expected Exposure time: At V=8, S/N=300 in 300 seconds
  + Allow for longer than nominal exposure times in case of clouds
* Open HIRES hatch
* Check with OA that "slit guiding algorithm" is being used.
* Add a "fiducial mark" at the position of the star by right clicking the magic guider snapshot at the desired location
* Double check:
  + Iodine temperature is 50/65C, and iodine is running
  + vertical angle mode is on and set to 0.
  + Filter #1 is "clear"
  + Filter #2 is "clear"
  + TV filters are "bg38" and "nd\_0.01"
* Iodine: IN
* Start observing bright stars up to 20 min before 12 degree twilight:
  + m deckname = C2 (0.85 x 14.0 arcsec)
  + If seeing is > 2.0", then begin observing only 10 minutes before 12deg twilight and use B5.
  + Likewise if seeing > 2.0" at the end of the night, use B5 in twilight and end 10 minutes after 12deg
  + WARNING: use command line to change deckers, NOT HIRES GUI
  + Generally, do not observe stars fainter than V~11 in twilight(morning or evening).
* During/after -2-degree twilight:
  + m deckname = B5 (0.85 x 3.5 arcsec, ==> 4.0 pixel projected slit)
    - WARNING: use command line, NOT HIRES GUI
* Poor seeing > 2 arcsec
  + Stick to V < 10 stars (throughput)
  + Use B5 decker. Sky subtraction does not work well when stellar PSF fills the slit (seeing > 2.5").
* Telescope wrap limits
  + From the south wrap, moving through the west, the north limit is an azimuth of 325 degrees.
  + From the north wrap, moving through the west, the south limit is an azimuth of 235 degrees.

#### Target List

* Inform the operator which script you will use and open MAGIQ to start guider and view target list.
  + From pulldown background menu,
  + Guider Eavesdropping > K1 MAGIQ Menu > Start MAGIQ ObserverUI
  + Once the OA has loaded the list, click on 'Map OA starlist' from dropdown on MAGIQ (Useful for planning observations.)
  + Use the middle mouse button to highlight the next target to observe.

**Handoff protocol for partial nights**

* Setup HIRES in the afternoon, however settings might get changed by first half observer.
  + Check the filename prefix
  + Set cofraw, cafraw, echelle and cross disperser to the correct positions.
  + Set the frame number to follow the last wide flat.
  + Run through the HIRES setup instructions

#### End of Night Procedure

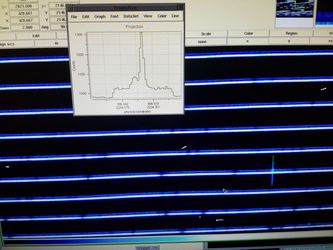
* Turn off exposure meter.
* Close the hatch
* Take B1/B5 [iodine exposures.](#HIRESSetupInstructions:-Calibrations)
* Take B1/B5 [thorium exposures](#HIRESSetupInstructions:-Calibrations).
* Turn off lamps, but leave everything else open, if not last night of run

**Shutdown Sequence**

* On last night of a run run the following:
  + From background pulldown, HIRES control menu > End of Night Shutdown

#### Tips, Tricks, & Troubleshooting

* Cross-disperser Oscillations:
  + If cross-disperser values are oscillating, reset by right-clicking  blue background and going to HIRES Control Menu > Stop Cross-disperser Oscillation.
  + Avoid moving cross-disperser by increments > 0.5 to help prevent oscillations. Move in multiple steps if needed.
* Useful link with extra HIRES info:
  + <http://www2.keck.hawaii.edu/inst/hires/startup.html>
* In ds9, if the mouse, clicking and dragging is zooming, instead of drawing a cross section, choose Edit→Pointer



* When using the C2 decker, always be careful to center the star on the slit. The image above shows a scenario where the star drifted or jumped during the exposure creating two spectral traces.

#### Useful directories:

* data: /s/sdata125/hires1/2011apr31/ ;insert proper date:
* snaps: /s/nightly1/11/08/30 ; where 11/08/30 is yr/mo/dy