Phoenix Technical Manual

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WARNING: This manual describes some low-level commands which can be useful for diagnosing Phoenix issues, but which can be abused and cause much trouble. Do not use these commands carelessly or when very tired, and <u>always</u> check your entry before pressing <cr>.

1. Focusing the Collimator

WARNING – Do not do this without an expert user present. Serious damage to the collimator secondary could result from driving the focus out of range.

This procedure is generally necessary only at the beginning of a telescope session, but one may want to check the focus at the beginning of a new observer start.

The brightest accessible hollow cathode line is at 4763.757 cm^{-1}.   **grat** will compute an encoder setting of -12008. On 11 December 2013, the line was centered on the array at a setting of -10900. This is consistent with an offset of 1100, which is the value recommended now for the offset in the **grat** command.

The bottom slider on the Interface Unit must be positioned so the hollow cathode lamp is in the beam. The position of the middle and upper sliders is not relevant.

filt 11
cvf 1
grat -10900
lyot 4 (at 4-m)
lyot 9 (at 2.1-m)
slit 3
viewer open
settime 2
hlamp on

Use **grat** to center the line in the image. The focus routine will work best if the line is near row 512. Moving the grating position -1000 steps will move the line 450 pixels in the positive y direction.

The technique is to read the current focus position with **focus ?pos**, then offset to 50 smaller, and then 30 larger from that position using the command **focus <x>**, where <x> is the absolute focus position, not a relative offset (i.e., **focus 151.2**). Then move in positive steps and measure the FWHM of the line using 'imexam' and the 'k' key. Do NOT move in negative steps, as there is backlash in the focus mechanism. It is therefore a good idea to move in smaller steps as one approaches a good focus. The line will come to the best focus first on the left side of the image.   When one approaches a good focus, measure the FWHM at the left, center, and right of the spectral line. Step sizes near focus can be as small as 0.1. The best focus possible is about 2.9 pixels, but typical values may be near 3.5 pixels.   Focus does depend of the temperature of the collimator. If you overstep the right focus value, begin again by offsetting to 50 smaller and 30 larger.

When done
hlamp off
Remove the hollow cathode lamp from the beam using the bottom slider on the interface.

2. Alignment of the optical axis – run setup only

WARNING – This is for the run setup team only. No visiting observer should ever undertake this. Done incorrectly serious damage to the instrument and telescope could result.

The purpose of this procedure is to align the optical axis of the instrument with that of the telescope by centering the image of the secondary mirror in the center of the Lyot stop.

filt 8
lyot 15
viewer lyot
slit 9

Open the telescope mirror covers, turn on high dome lights and take an image with an integration time around 10 seconds. The image will show a series of spots (Figure 1, left). Average the X and Y coordinates of sets of four to find the center of the circular pattern. This is the center of the instrumental lyot stop.

lyot 4 (at 4-m)
lyot 9 (at 2.1-m)

Take another image, which should show the central portion of the secondary, including the conical central reflector (Figure 1, right). Measure the center of the cone and compare these coordinates to those of the center of the dot pattern measured above. If these differ by more than about 10 pixels, loosen all but three bolts (marked) between the interface and the instrument. The three bolts that are not loosened should be selected to form an orthogonal three point support. Back off all the push pads and then making adjustments to the bolts and taking images move the image of the secondary center so it matches the instrument lyot stop center derived from the dot image.
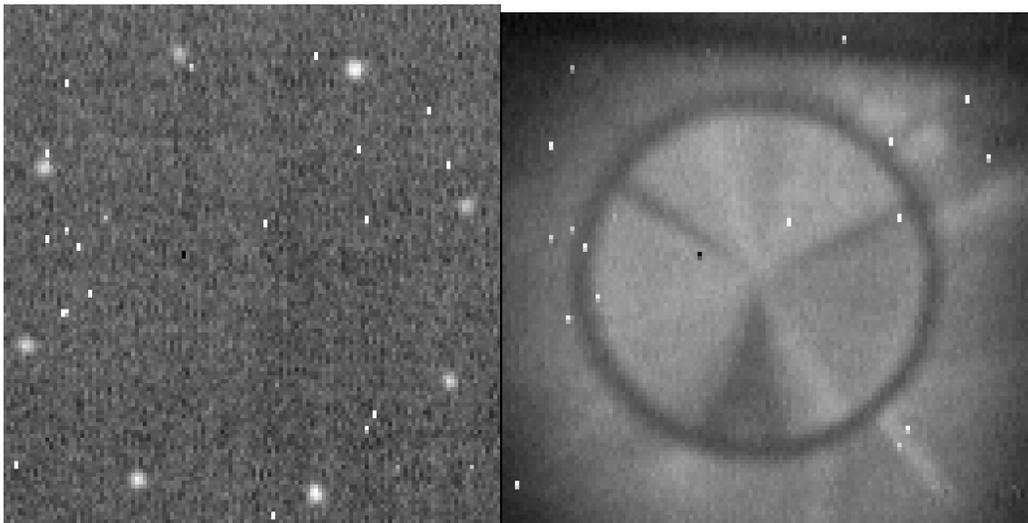

Figure 1: Image of Lyot spots (left panel) and f/15 secondary (right panel).

3. Low-level Commands

When one starts up Phoenix, one will initially see a yellow Phoenix command window and a red Phoenix Engineering Daemon window. As part of the initialization procedure, one will see a message about connecting to the private network which runs the motor controller (172.17.5.51). At the end of the process, a second Phoenix Daemon window will also show up (Figure 2). This is a residue of the old startup, which was felt to be hazardous to attempt to modify.
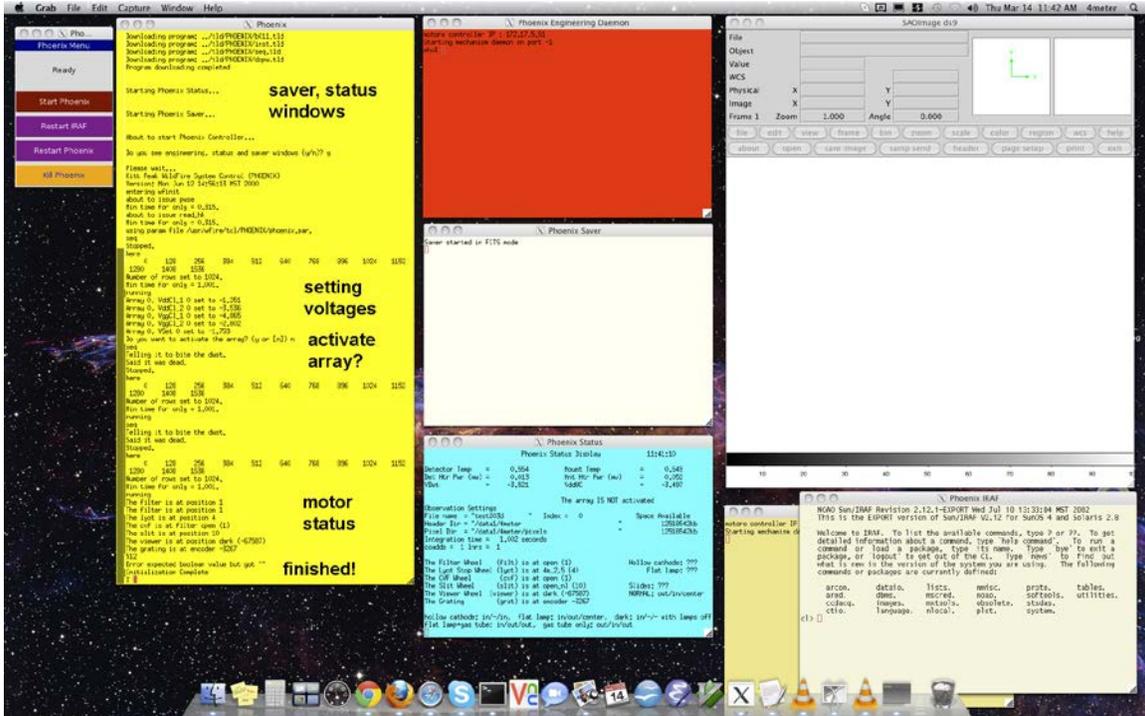

Figure 2: MacMini screen after completion of WildFire startup. The Engineering Daemon window is the red one at top. At the end of the initialization, a second beige Phoenix Daemon window will open up.

During normal use, the Phoenix Daemon windows are not in use and can be minimized by the user if desired. However, it is possible to use this window to enter low-level commands for instrument control and diagnostics.   One may use either of the two Daemon windows for entering commands.

NOTE: The reason for the two windows is that adding a window to the initialization process is fairly simple, whereas deleting one could be tricky, so the conservative approach was to leave both of them active. The red Phoenix Engineering Daemon window was added to come up at the beginning of the procedure, since it can then be used for controlling the instrument power to execute a full-up initialization, described in Section 4.
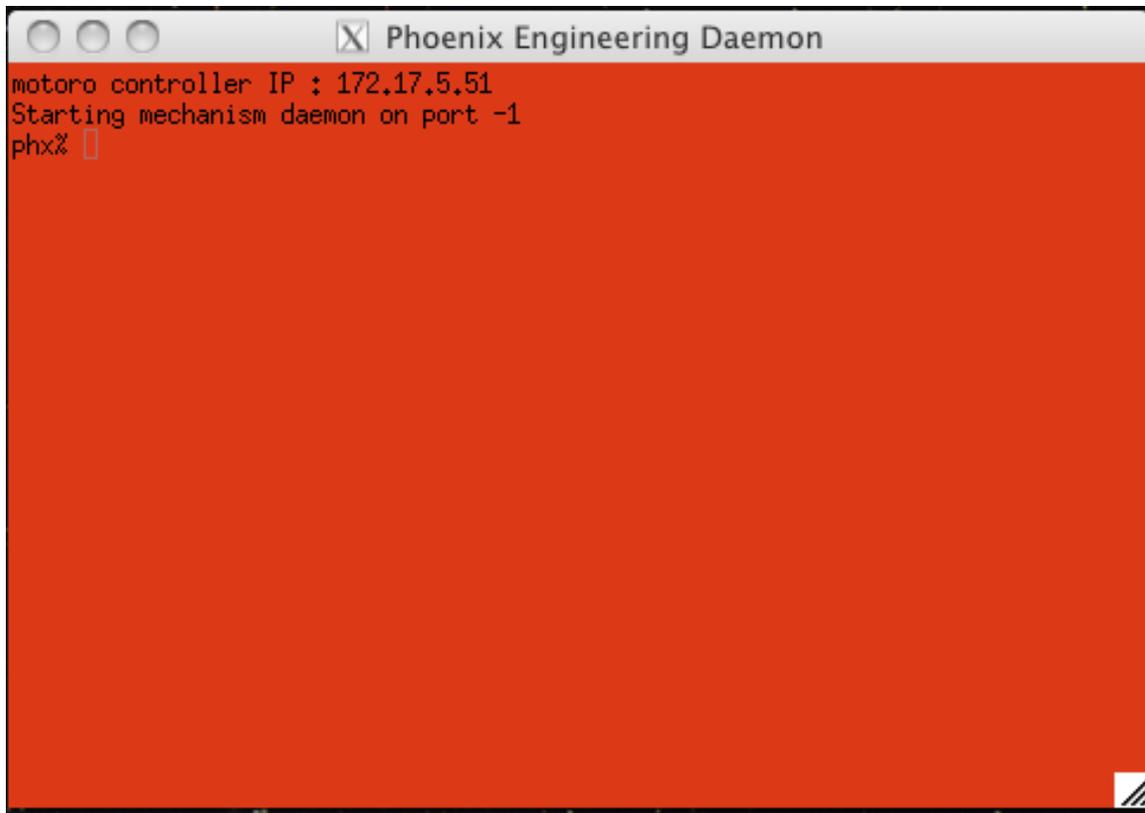
Figure 3: Phoenix Engineering Daemon window after entering <cr>

1. **Bench Temperature Control**: The internal optical bench in Phoenix has a heater circuit to keep the bench from getting too cold, which can cause some mechanisms to fail as well as change the spectrograph focus during a run. This command was originally a daemon command, but was converted to a tcl command to be typed in the Phoenix window when Phoenix was at Gemini South and locked into a constant setting which we have been unable to unlock.

The benchtemp command is currently inactive.

2. **Interface Control:** When Phoenix was used on Gemini South, access to the instrument was very difficult, so remote control was established for as many of the functions possible. The range of commands can be viewed by entering **help inter** in the Saver/Daemon Reports window (Figure 4):
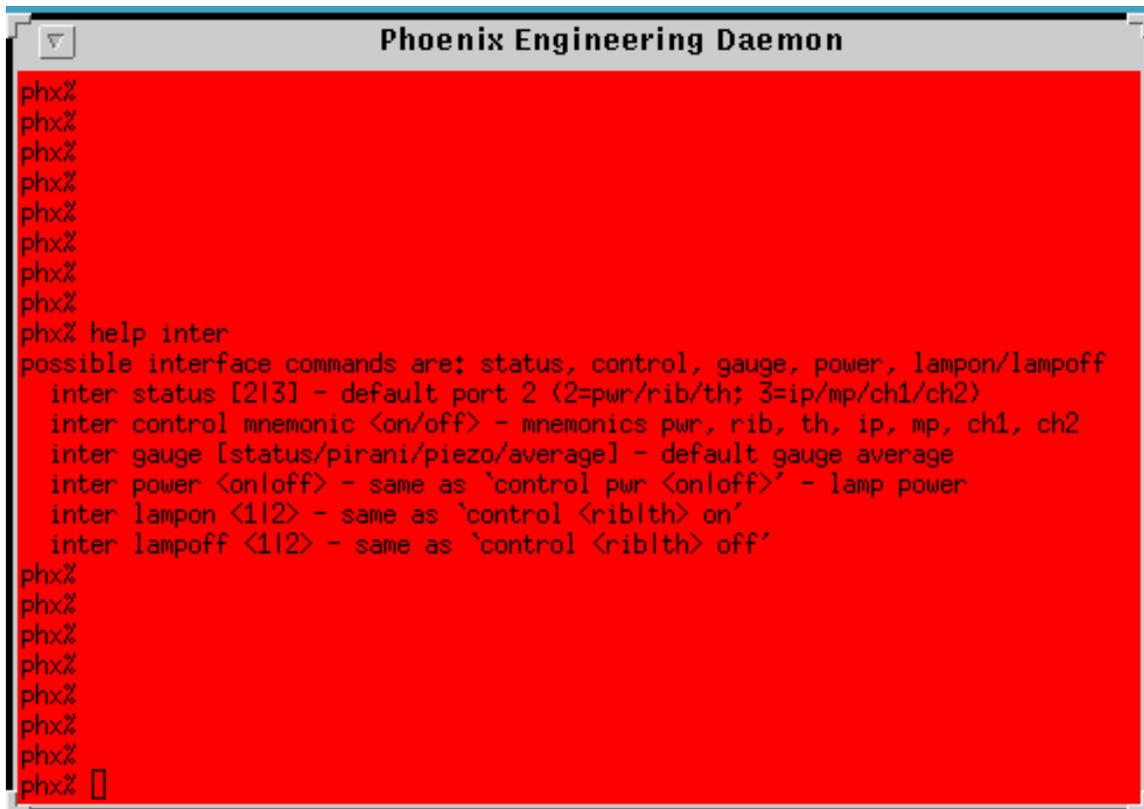
Phoenix Engineering Daemon

```
phx%
phx%
phx%
phx%
phx%
phx%
phx%
phx%
phx% help inter
possible interface commands are: status, control, gauge, power, lampon/lampoff
  inter status [2|3] - default port 2 (2=pwr/rib/th; 3=ip/mp/ch1/ch2)
  inter control mnemonic <on/off> - mnemonics pwr, rib, th, ip, mp, ch1, ch2
  inter gauge [status/pirani/piezo/average] - default gauge average
  inter power <onloff> - same as 'control pwr <onloff>' - lamp power
  inter lampon <1|2> - same as 'control <rib|th> on'
  inter lampoff <1|2> - same as 'control <rib|th> off'
phx%
phx%
phx%
phx%
phx%
phx%
phx%
phx% []
```

Figure 4: Illustration of the **help inter** command.

Note that all of the interface commands are preceded by **inter**. Some of these commands are no longer applicable with Phoenix at Kitt Peak and others can be implemented through the safer tcl commands in the Phoenix window. Other commands which permitted remote housekeeping monitoring are now superseded by the ability to VNC into the host computer screen and issue the nominal tcl commands.

2.1 Mnemonics – All of the commands use abbreviations for the functions.

> pwr – the Phoenix lamp controller power
> rib – the flatfield lamp ("ribbon" in Gemini parlance)
> th – the ThAr hollow cathode lamp
> ip – the Phoenix Instrument Power
> mp – the Phoenix Motor controller power
> ch1 – coldhead #1
> ch2 – coldhead #2

2.2 Status – retrieves the status of the functions.

> inter status 2 – status of the lamp controller power, flatfield lamp, and ThAr lamp
> inter status 3 – status of the instrument, motor controller, and coldhead power

2.3 Control – controls the status of the functions. These can be really dangerous. For example, **inter control ch1 off** will turn the power to coldhead #1 off. This should be followed by **inter status 3** to see if the coldhead is in fact off, since the control command does its job silently with no echo if it works properly. *(The remote coldhead control was disabled during the emergency repairs in December 2013 and will not be available for a while).*

Many of these commands are redundant with tcl commands. For example, **inter control th on** is the same as **inter lampon 2**, but either can be done using the much safer **hlamp on** command in the Phoenix control window.

2.4 Gauge – controls the Pirani vacuum gauge, which is no longer installed on Phoenix

In summary, all of the interface commands can be carried out using the **inter control** and **inter status** commands, and those involving the lamp control can be done using the regular Phoenix commands. These low-level commands can be useful in diagnosing possible cooling problems with the cold heads.

3. nuke_whale – this extremely low-level command will cause the monitor display to shrink to a bright white spot in the middle of the monitor screen and slowly fade away.

4. Remote Phoenix Startup

The Heurikon DSP boxes for Phoenix at both the 2.1-m and 4-m telescopes are now plugged into remotely controllable power outlets. In combination with the initial Phoenix Engineering Daemon window which now appears with the initial 'startwf' command, this makes it possible to carry out a full initialization of Phoenix from a remote site, provided one has the site password necessary for operating the remote power switch. (If you do not have the site password, you should not be reading this).

The full initialization of Wildfire is described in Section 4 of the Phoenix User Manuals for both the 2.1-m and 4-m telescopes, so this will not be repeated here (unless a demand materializes).

IMPORTANT – The low-level commands for controlling the lamp, instrument, or coldhead power will not override the panel switches on the boxes. The Instrument Power and Motor Controller power switches must be "on" and the Lamp Controller switch in the "computer" position for remote control to work. In addition, an on-site person must have verified that the fibers are properly connected, with no red error LEDs lit on either the Instrument Power or DSP box.

A full Wildfire initialization involves starting up the DSP, computer, and instrument power in the correct sequence. In particular, the DSP must be power cycled to clear out any hung processes, then the computer (royal or khaki at the 2.1-m and 4-m, respectively) must be rebooted with the DSP turned back on, but the Instrument Power off. Finally, the Instrument Power must be turned on at the appropriate stage of the Wildfire initialization.

This procedure works best from a VNC session to one of the MacMinis, but can also be done using a remote ssh session.

1. Start up the Wildfire session:
      a. ssh into royal/khaki as 2meter/4meter and enter 'start_phoenix_vnc' from the command line. Use the regular mountain observer password.
      b. VNC into royal:1 or khaki:1 as 2meter/4meter and enter 'start_phoenix_vnc' from the X window.
      c. On the MacMini, double-click on the 'Phoenix' icon to bring up the start menu and click on the 'Start Phoenix' button.

In any case, you will see the initial complement of windows come up (Figure 5):
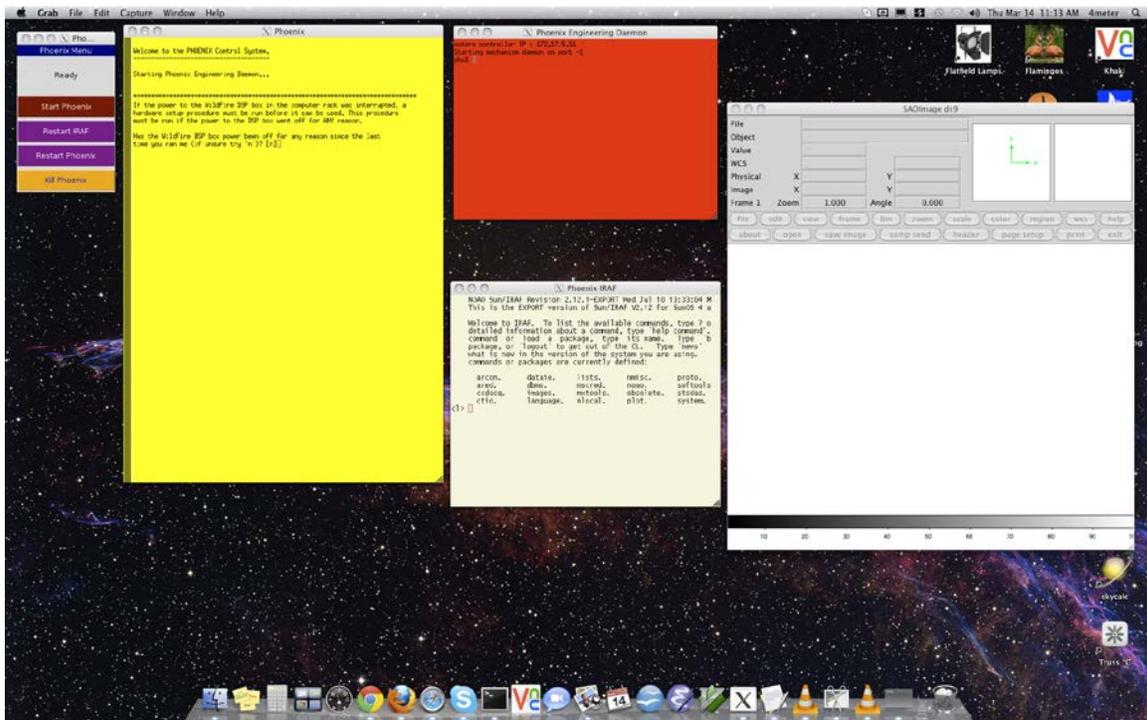
Figure 5: Initial Wildfire windows on startup.

2. In the red Phoenix Engineering Daemon window, hit <cr> to bring up the "phx%" prompt.

3. Turn off the Instrument Power by entering **inter control ip off**. Verify by entering **inter status 3** to make sure the Instrument Power is now off. This step may automatically exit from Wildfire.

4. Exit from Wildfire by clicking the "Kill Phoenix" button if using the MacMini or answering 'n' to the question about whether the computer was rebooted with the Instrument Power off, which will kick you out of Wildfire.

5. Cycle the DSP power by logging into the power controller http://2m-power-4.kpno.noao.edu or http://4m-power-4.knpo.noao.edu, using the login name 'kpno' and the mountain staff password. You will see a screen like Figure 6.

Figure 6: Remote power controller #4 for the 2.1-m. The 4-meter controller is similar. The DSP is outlet #7 at both telescopes.

6. Select "Switch OFF" for outlet #7. The State should shift to OFF. After about 30 seconds, select "Switch ON" and ensure that the State returns to ON. Exit from the webpage.

7. Open a terminal screen on a remote computer and ssh into royal/khaki as 2meter/4meter. Enter 'su' and the staff mountain password to become superuser.

8. Enter 'reboot'. This will kick you out of the ssh session as the computer reboots. Open another terminal screen on your remote computer and 'ping royal/khaki' until you get a response which indicates that the rebooting procedure has completed. *Wait at least another minute to ensure that all aspects of the rebooting have completed.*

If step 7 does not work on royal, enter 'system royal reboot' at the normal prompt.

9. Start up the Wildfire session (as in step 1) using ssh, VNC, or the MacMini VNC session and answer the questions carefully:

a. Enter <cr> to continue from the initial startup window

b. "Has the DSP been turned off since the last time you ran startwf?" y

c. "Was the computer rebooted with the DSP power on and the instrument
power off?" y

You should then see a short flurry of activity ending with a message about configuring the C004 being complete.

d. "Is the instrument power on now" n

e. "Turn on the instrument power and enter <cr> when it is on"

10. At this point, go to the Phoenix Engineering Daemon window and enter **inter control ip on** at the "phx%" prompt. Verify with **inter status 3**.

11. Return to the Wildfire window and enter <cr> in response to the request about turning on the instrument power.

12. The rest of the Wildfire initialization should proceed automatically. **Remember that one should activate the array only if the instrument and detector are cold.**