# 74-inch Instrument Change Notes: SpUpNIC ON

(D. Carter 13 November 2015) (W. Koorts 10 December 2015) (M. Rust 21 February 2016) (A.C. Mulaudzi 05 April 2016) (A.C. Mulaudzi 18 May 2016) (W. Koorts 02 June 2016) (D. Carter 05 September 2016) (W. Koorts 26 Sep 2016) (A.C Mulaudzi 05 June 2020) (K. Titus 26 September 2023)

Checklist:

Items to check	Checked
TCS74v3 PC TCS program closed	
TCS74V4 PC TCS program up and running	
Instrument on telescope	
Instrument selector auto-guider mounted & connected	
Lodestar rear-of-slit camera mounted & connected	
PLC comms connected	
Science CCD comms connected	
All subsystems powered up	
Functional tests, PLC:	
• Offset guide mirror IN/OUT	
• Comparison mirror IN/OUT	
• Arc Lamps 1 & 2 ON/OFF	
• Slit illumination ON/OFF	
• Hartmann shutters A & B IN/OUT	
• Rear of slit mirror IN/OUT	
• Grating angle adjustment	
• Slit width adjustment	
• Filter wheel selection	
Functional tests, Science Detector:	
• CCD readout – bias frame	
• CCD readout – ARC image	
Functional tests, TCS:	
• Auto-guider reset/position initialize	
• Acq. Focus reset/position initialize	
• Acq. Camera imaging – view the slit	
Functional test, rear-slit viewing camera:	
• Image shows the slit	

TODO: CLI startup & general computer interaction
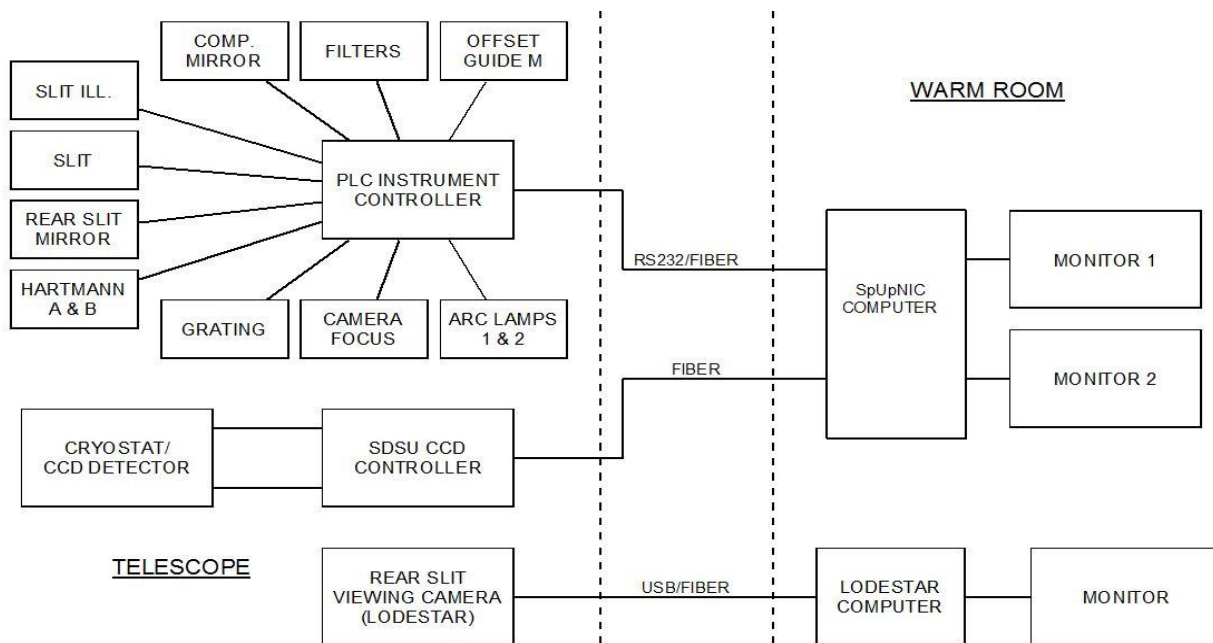
Note: Keyboard/mouse peripherals have been omitted for clarity

Overall Block Diagram

Vacuum Pumping and LN$_2$ filling:

1. The day before, connect the vacuum pump using the 500mm long (shorter) vacuum hose (see Fig. 1) and pump-down overnight.
2. The next morning, check that the vacuum got down to the 10^{-6} mbar range.
3. Shortly before mounting the instrument, while still vacuum pumping; start filling the cryostat with LN$_2$. NB! Ensure that you keep on wiggling & lifting the blikkie (funnel) regularly to prevent the tube from freezing up.
4. After the first flask, close the cryostat vacuum valve and stop the pump.
5. Continue filling slowly until full, indicated by LN$_2$ boiling in the outer funnel. When full, using a glove, quickly remove the inner funnel and dump the excess LN$_2$ back in the filling flask.
6. Disconnect the vacuum hose and blank off the cryostat valve using a blanking plate and clamp.

Fig. 1: Connecting the vacuum pump

In the Warmroom:

1. Ensure that TCS is locked out by turning the TCS Lockout switch on the mimic panel to ON state (see Fig. 2). TCS Control indicator will flash as a warning that the TCS is locked out (i.e. the telescope cannot be controlled remotely).
2. Ensure that the telescope is switched OFF.
3. Close the TCS program on the TCS74v3 PC.
4. Remove the 2 HDMI, 1 usb (for keyboard and mouse), acquisition camera usb and the PLC 9way ribbon cable from TCS74v3 and move it to TCS74V4 PC.

5. Start TCS program on the TCS74V4 PC by clicking TCS icon (little telescope) .

Fig. 2 *TCS LOCKOUT* switch

On the Telescope:

1. Mount the instrument on the telescope (mechanical responsibility)
2. Remove XY-slides control box (see Fig. 7) from the telescope.
3. Install the Instrument Selector auto-guider control box (see Fig 8) and Power on the PLC. The PLC uses the power cable seen in Fig. 12. Do not switch on the AUX power until the Limits and Motor cables are connected to the auto-guider seen in Fig. 11. The AUX power uses the XY-slides power cable seen in Fig. 13.
4. Connect cabling and services:
    a. At the instrument services panel (Fig. 3): Connect (1) the instrument mains supply, (2) compressed air feed, and (3) RS232 comms cable.
    b. Check that the air pressure is 600KPa at the south pier and 300KPa on the instrument (see Fig. 6).
    c. Disconnect Hippo acq. camera USB cable from icron device in ROS & ACQ RESET BOX (see Fig. 9) and connect Instrument Selector acq. camera cable to the port where Hippo acq camera cable was plugged in (see Fig. 10).
    d. Connect the other end of the Instrument Selector acq. camera cable to the auto-guider USB port (See Fig. 11)
    e. Connect USB cable to the Lodestar Rear-of-Slit viewing camera (it connects to the USB/fibre convertor in the fibre box on the east side of the mirror cell).
    f. Connect auto-guider Limits and Motor cables (see Fig. 11).
    g. Dual optical fibre to the SDSU CCD controller. (The SDSU fibre is an individual dual fibre cable fed thru the axis). Note the colour coding for the SDSU fibre (Rx cable connector is marked 'R') (see Fig. 4).
    h. PLC RS232 cable to the RS232 connection point at the NW corner of the mirror cell.
5. Power up:
    a. SDSU PSU (only 3 leds will be on – see Fig. 5)
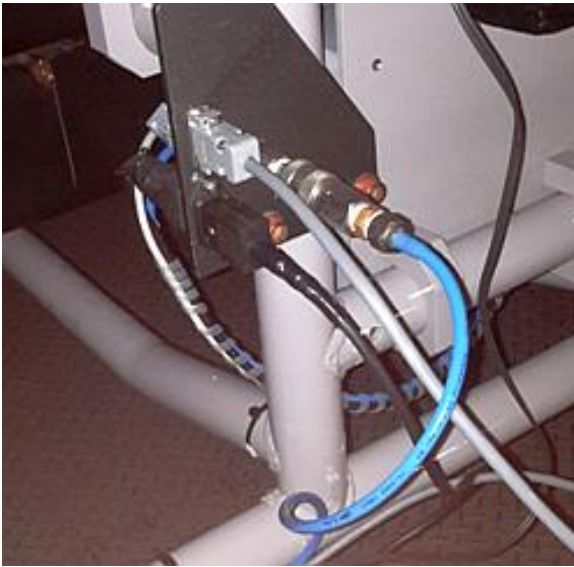   b. Switch on auto-guider AUX power (south side of telescope - see Fig. 13).

Fig. 3: Instrument Services Panel

Fig. 4: CCD Controller Fiber Connections

Fig. 5: SDSU Controller: LEDs all ON indicating operational mode (see note below)
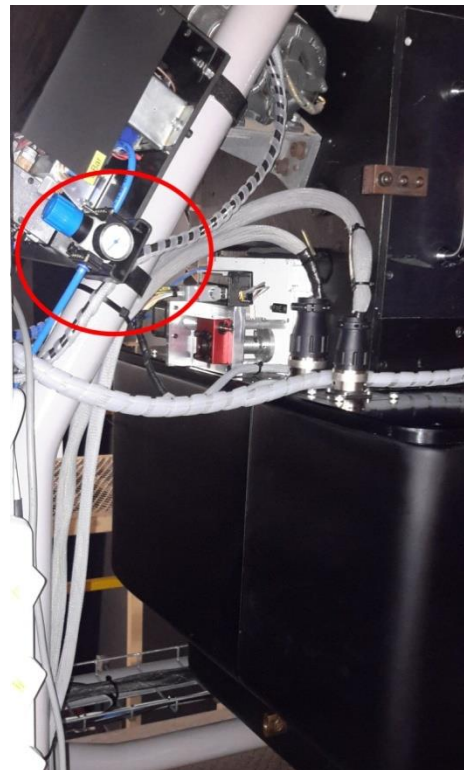

Fig. 6: Instrument Air Pressure Regulator

Note: Fig. 5 shows the SDSU CCD controller after it has been fully initialized. In this state the detector is powered up. After a power up sequence or a reset (hard or soft), only three LEDs will be on – in which state the detector is NOT YET powered up.

Fig. 7 Hippo XY-slides control box

Fig. 8 Instrument selector auto-guide control box

Fig. 9 ROS & ACQ RESET BOX
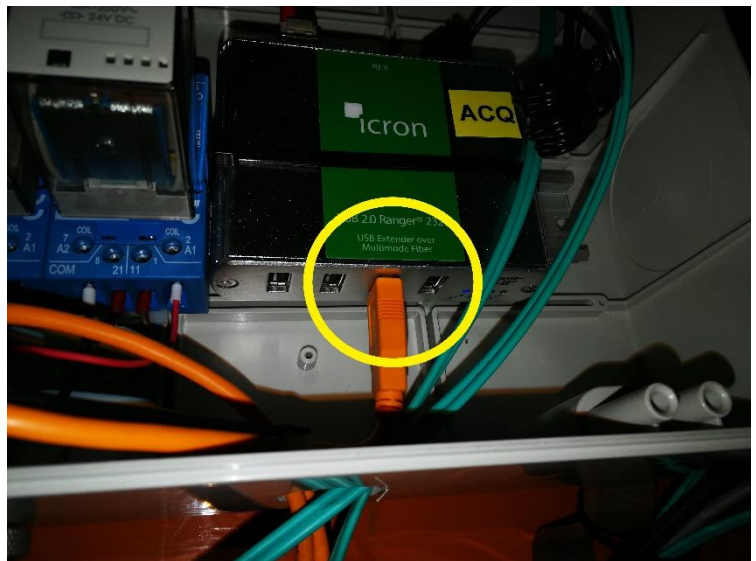
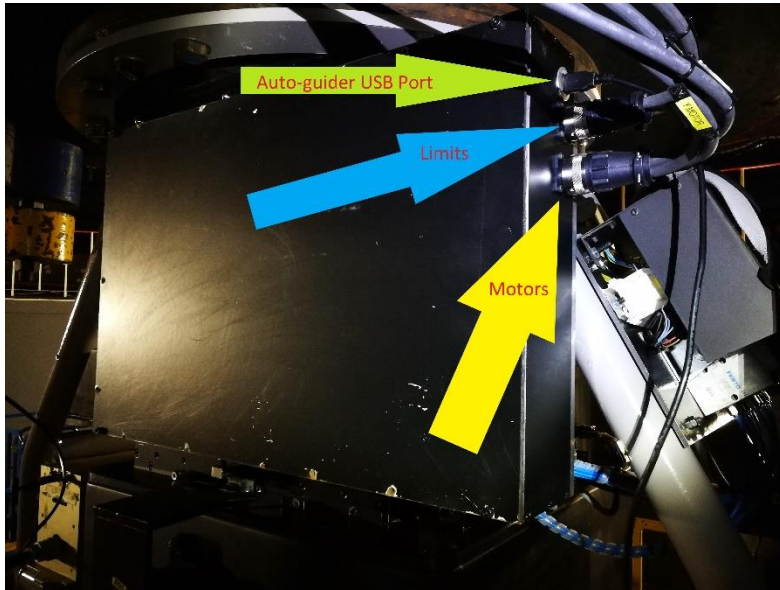**Fig. 10 Port to be used on ACQ Icron device for Hippo and Instrument Selector acq. Cameras**

Fig. 11 Auto-guider with all inputs labeled

Fig. 12 Instrument selector PLC power source

Fig. 13: Hippo XY-Slides and Instrument Selector auto-guider AUX power switch indicated

In the Warm Room:

Install the computer systems as per Fig. 14 below.

Fig. 14: Warm Room Workstation Layout

1. Ensure the following are connected to the back of the SpUpNIC computer (see Fig. 15):
    a. Normal services: dual monitors, keyboard, mouse and LAN
    b. USB to Rear-of-Slit Lodestar camera
    c. RS232 to PLC
    d. SpUpNIC fibre, as marked. When the fibre is correctly connected AND BOTH the computer and CCD controller are powered up, a green LED is ON on the interface. (note by WPK, June 2016: This LED does not seem to work any more).

2. At the back of the TCS-rack, check that the:
    a. RS232 PLC cable is connected to the fibre and that the channel selector switch is set correctly (Fig 16, bottom insert box).
    b. USB connections to both the Lodestar **Rear-of-Slit camera** and the Lodestar **Acquisition camera** are plugged into their USB-to-fibre convertors (Fig. 16, top insert box).

3. Switch the telescope ON.
4. Fire up the TCS software and check functionality as follows:
   a. Check that the XY slide initializes.
   b. Lodestar Acquisition CCD camera operational – start exposures, check the readout occurs properly. (Note that on the TCS control monitor the regular control box for the acquisition mirror is empty since it is not present.) If the camera appears not to work – counts of 0 in the image area - exit the TCS program, reboot the camera by removing and re-inserting the USB plug at the back of the TCS computer, restart the TCS software.
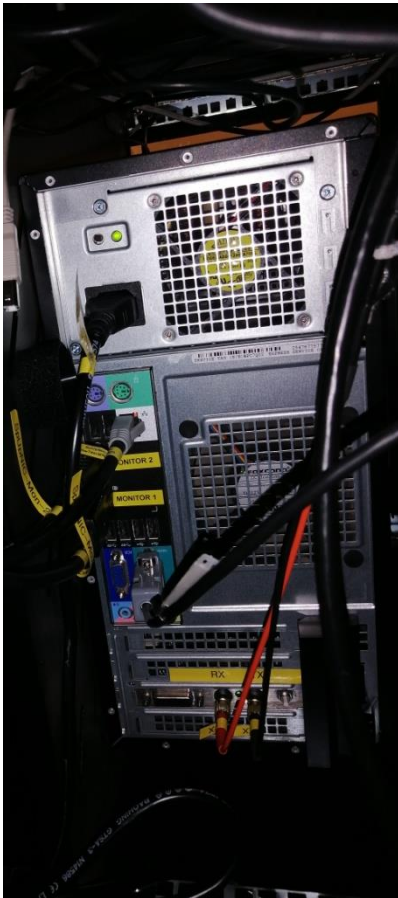
**Fig. 15: SpUpNIC PC back panel and PLC serial connection**
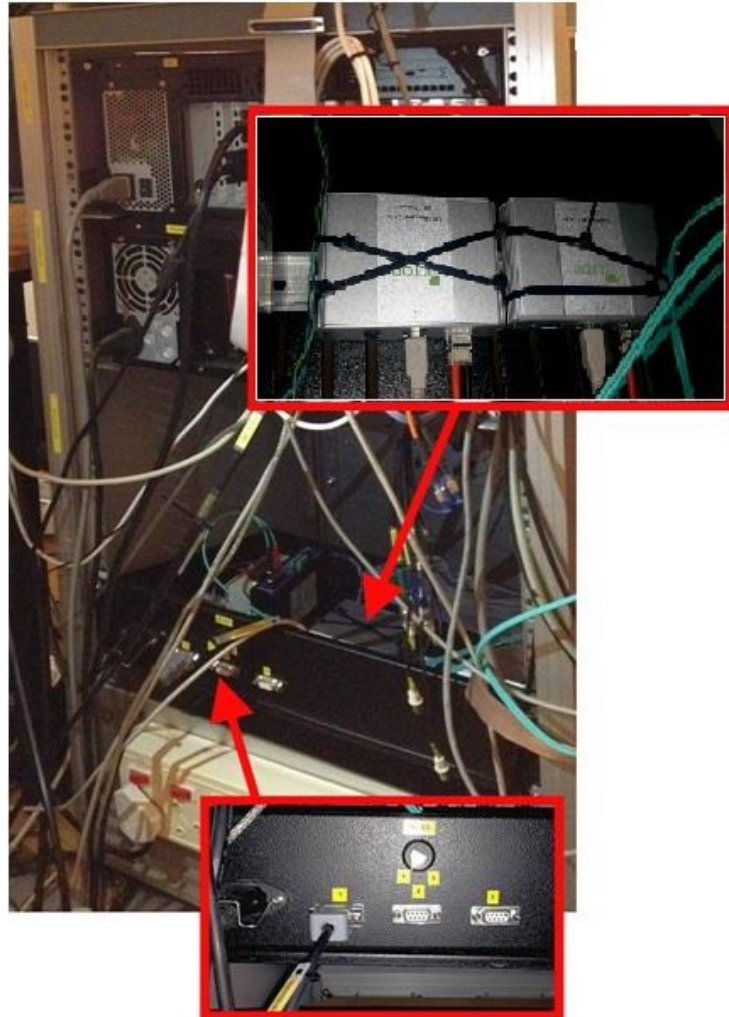
Fig. 16: Back of the TCS rack, showing RS232 connections for the PLC (bottom insert box) and Lodestar rear-of-slit camera (top insert box).

Check out the software/instrument functionality:

1. Power up the SpUpNIC PC (if not already running).
2. Log in: User name: CCD - the usual password.
   a. Open the xterminal
   b. Type start_services – usual password
3. Launch the instrument software by (in the sidebar) single clicking on the two desktop icons
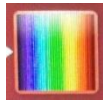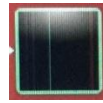
      SpUpNIC   **SpUpNIC QuickLook**

4. Position the Instrument Control GUI (SpUpNIC) on Monitor 1 and the Quicklook GUI (Detector Image display) on Monitor 2.

Note: You will be navigating between three tabs (top-left of Monitor 1) on the SpUpNIC Instrument Control GUI. Figs. 17, 18 & 19 show the Main View, Advanced and Engineering View tabs respectively. (The Config tab is not covered here.)

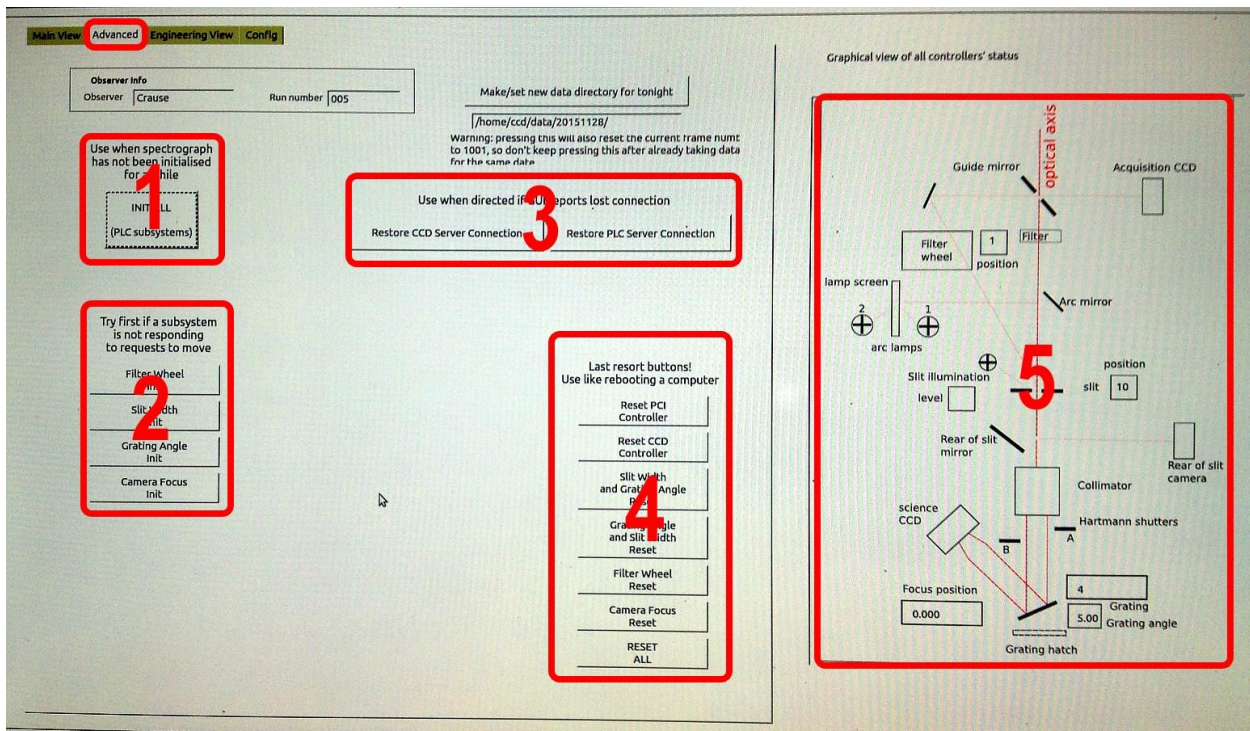**Fig. 17: MAIN VIEW tab of the SpUpNIC Instrument Control GUI**

Fig. 18: ADVANCED tab of the SpUpNIC Instrument Control GUI
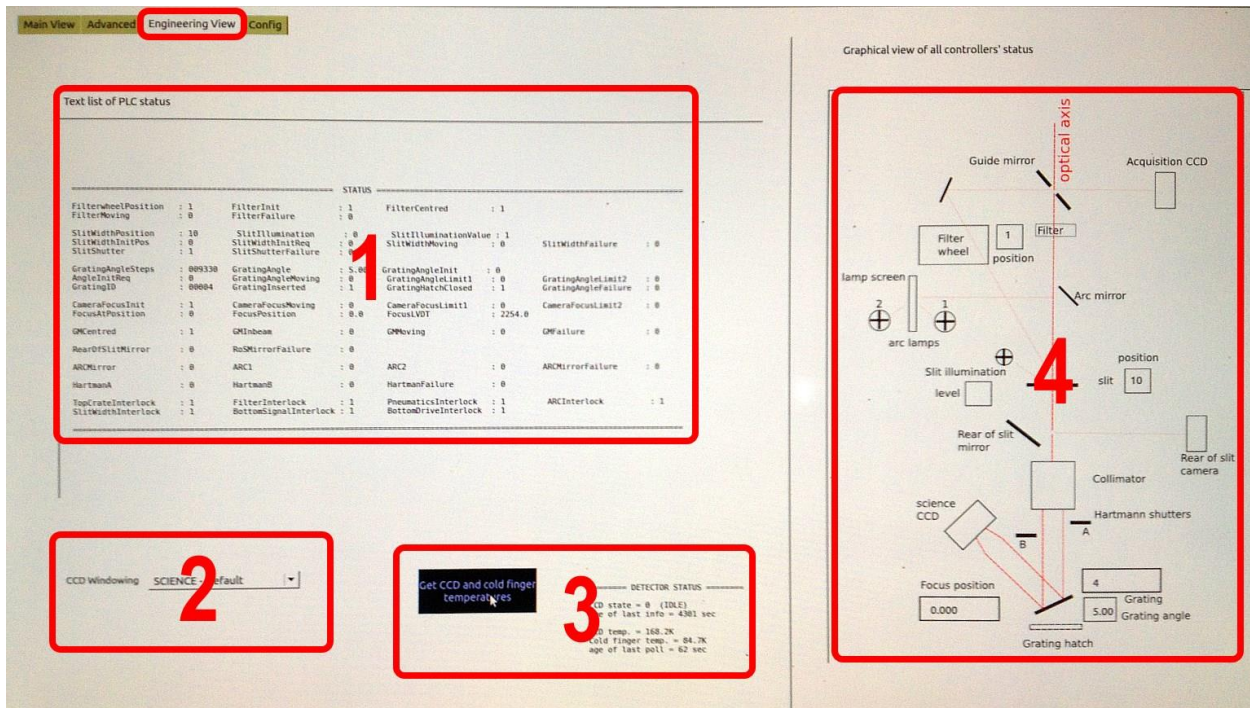

Fig. 19: ENGINEERING VIEW tab of the SpUpNIC Instrument Control GUI

5. Test the CCD functionality as follows:
    a. On the Main View, Panel 4 (Fig. 17) set "Exposure Type" to BIAS, "# Exposures" to 1, and click "Expose". The CCD raw image should look something like Fig. 20, with an average count around 600 (mouse-over image).
    b. Check the CCD temperatures (Engineering View tab, Panel 3 (Fig 19): CCD 167.8K, cold finger 85K (both ±0.5K). At the first fill the cold finger takes ~20 minutes to reach 94K then another ~1 hour to settle at 85K, and the CCD takes ~3 hours to reach 167K.
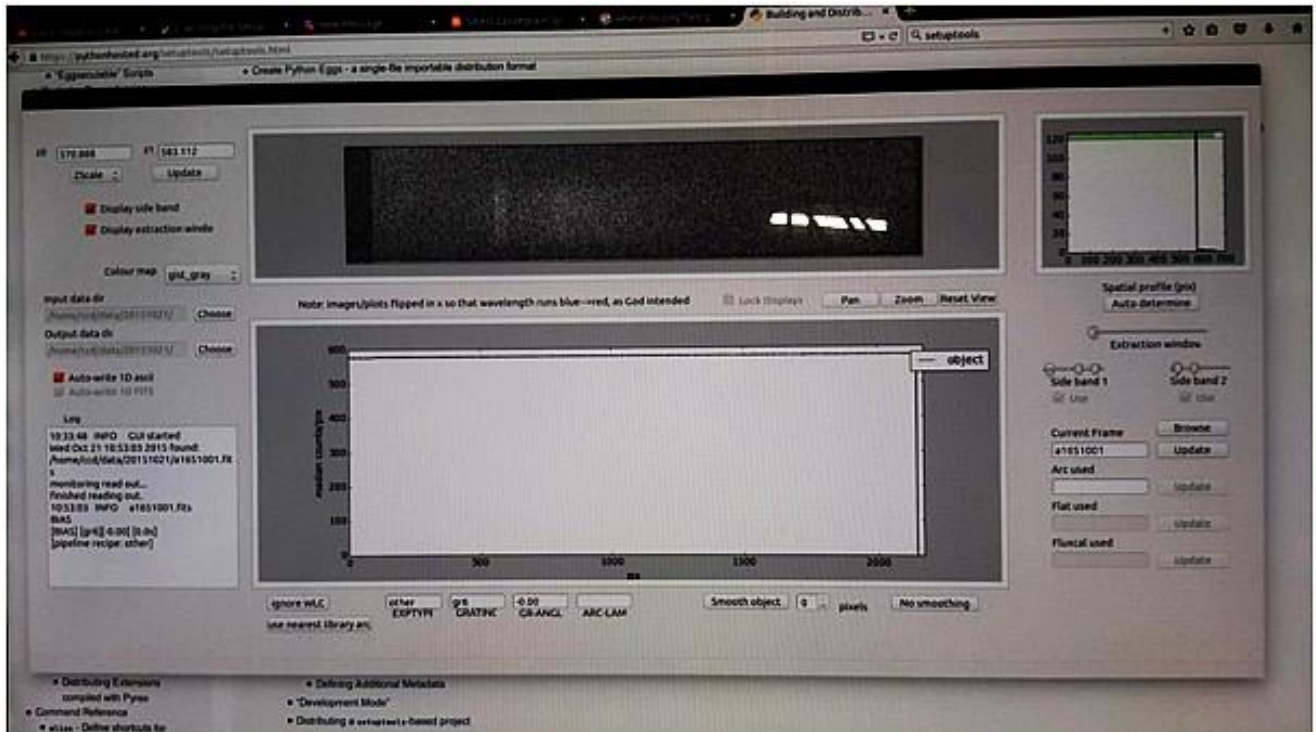

Fig. 20: Typical CCD display as it appears on Monitor 2

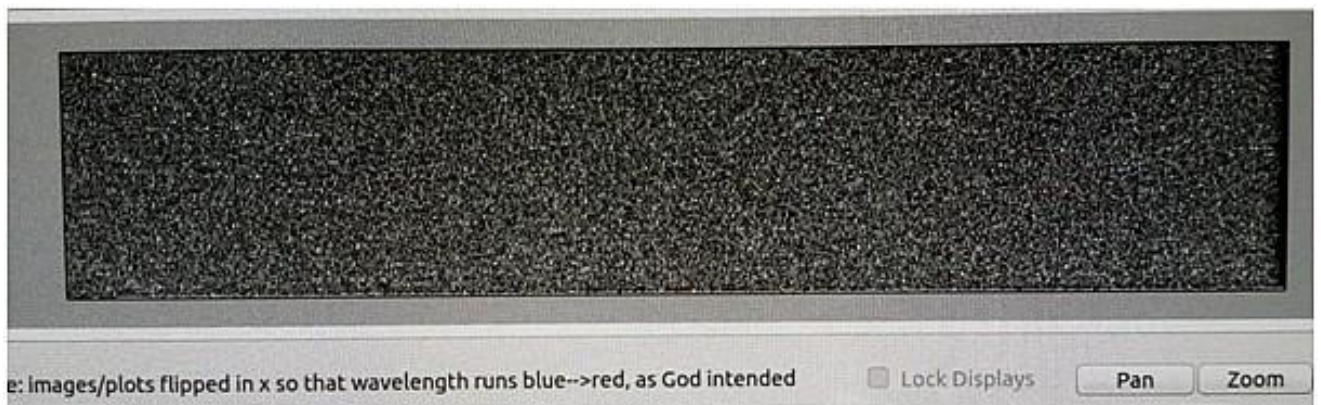Raw Image in the top pane, transect through the spectrum in the lower pane

Fig. 21: Appearance of CCD Bias image at 167K operating temperature

6. Initialise the PLC controlled mechanisms: Advanced tab, Panel 1 (Fig. 18) click the "INIT ALL – PLC subsystem" button to initialise the PLC system.
7. **Check the instrument moving parts**. Note that items a–f are best checked by clicking directly on the relevant items on the Main View tab, Panel 6 (Fig. 17):
   a. Move the offset guide mirror IN/OUT of beam.
   b. Move the comparison ARC mirror IN/OUT of beam.
   c. Switch the ARC lamps (1 & 2) on/off.
   d. Check the slit illumination: with guide mirror OUT beam use the acquisition camera viewing system to check the slit illumination on/off control.
   e. Check the Hartmann Shutters (A & B) operation (ignore warning – it will disappear after a few seconds).
   f. Check the rear of slit mirror.

   The following three items are operated from the Main View tab, Panel 2 (Fig. 17). Select a value/number and click "Go". NOTE: it may be necessary to 'RESET' and 'INITIALIZE' these mechanisms on the 'ADVANCE' tab of the GUI. If so, refer to the document "GRATING ANGLE WORKAROUND" on the electronics web page

   g. Change the slit width.
   h. Change the grating angle
   i. Select different filters.

8. Do an **ARC test exposure**:
   a. Slit width 1.5" (slit setting 11).
   b. In the Main View tab, panel 2 (Fig. 17) check which grating is currently mounted and set the corresponding grating angle as per table 1:

Table 1: Suitable grating angle for a reasonable ARC exposure

Grating Number	Angle
4	+5°
5**	-3°
6	+11°
7	+15°
8	+12°
9	+1°
10	-7°
11	+7°
12	+14°

** Note: for grating 5 use lamp 1 (CuNe)

   c. Main View tab, panel 6 (Fig. 17): Click on lamp 2 (CuAr) and the Arc-mirror will move In-beam automatically. **NB:** For grating 5, use lamp 1 (CuNe).
   d. In Panel 4 (Fig. 17): Select "ARC" from the Exposure Type drop-down menu, type "10" seconds as exposure time and click "Expose".

e. Check that ARC lines are visible (see Fig. 22). Note that the appearance of the transect panel graph depends on user selection of which row is used.

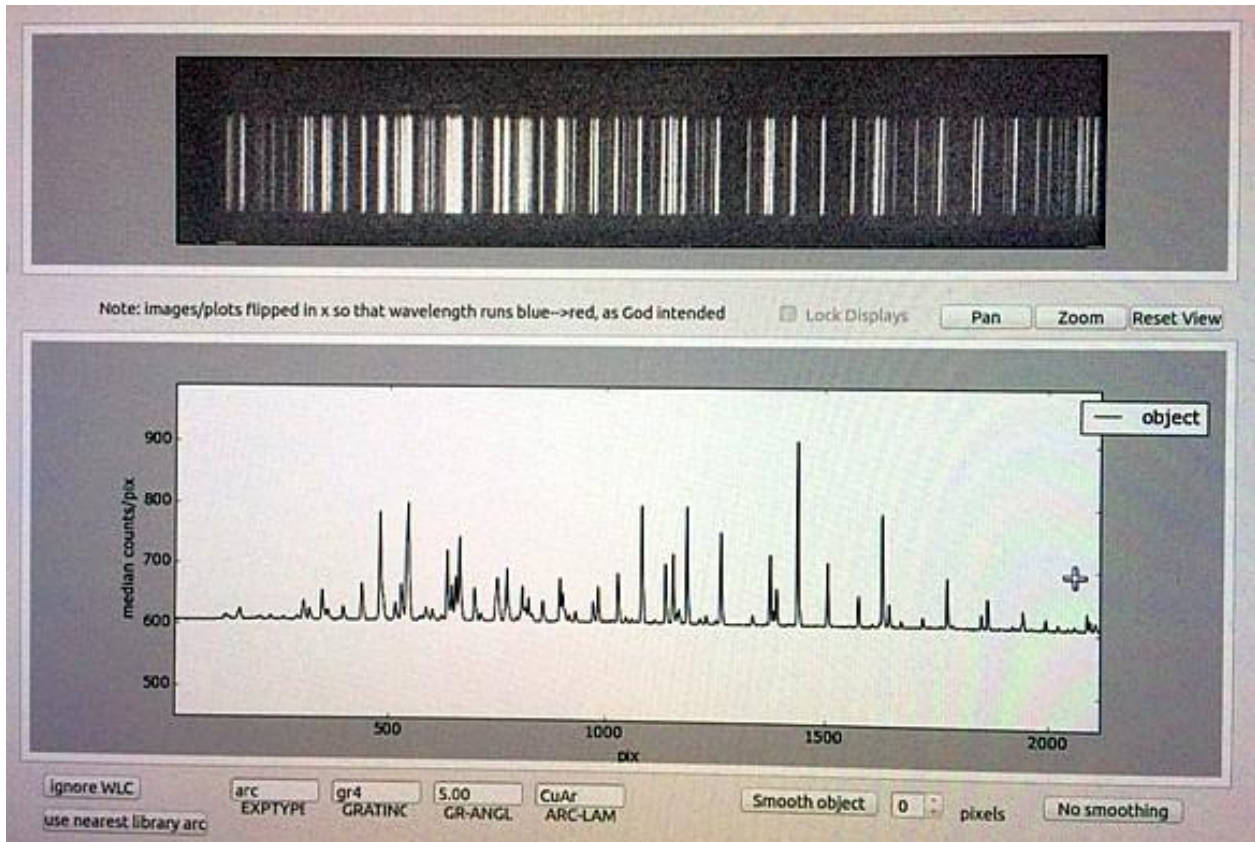f. **Very important**: Switch OFF the Arc lamp by clicking it in panel 6 (Fig. 17).

Fig 22: Screenshot of arc image with grating 4

9. Check the Lodestar **Rear-of-Slit camera** by single clicking its sidebar icon (Fig. 23):

Fig. 23 Lodestar Icon

   a) Open the Slit.

   b) Switch on Slit Illumination.

   c) Put the Rear-of-Slit mirror In-Beam.

   d) Enter '2' in the EXPOSE box (Fig. 24).

   e) Click the "CONTINUOUS" button to take a run of 2 second exposures.

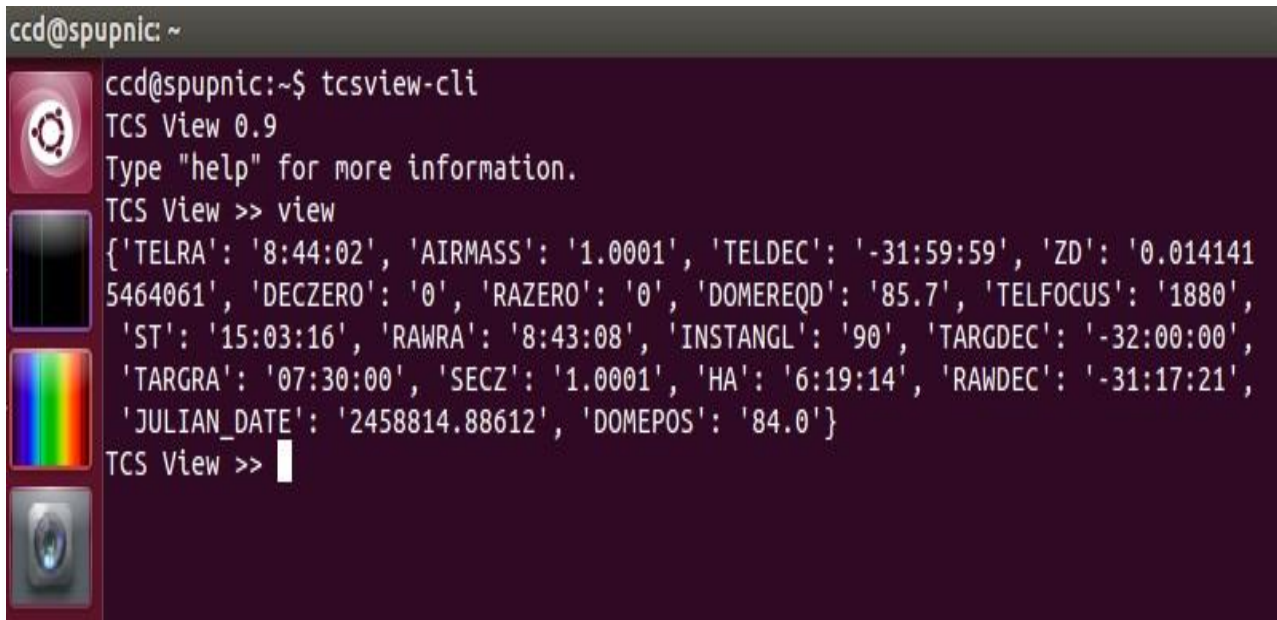   **f)** Click "STOP CONT." to finish when satisfied that there is light shining through the slit.
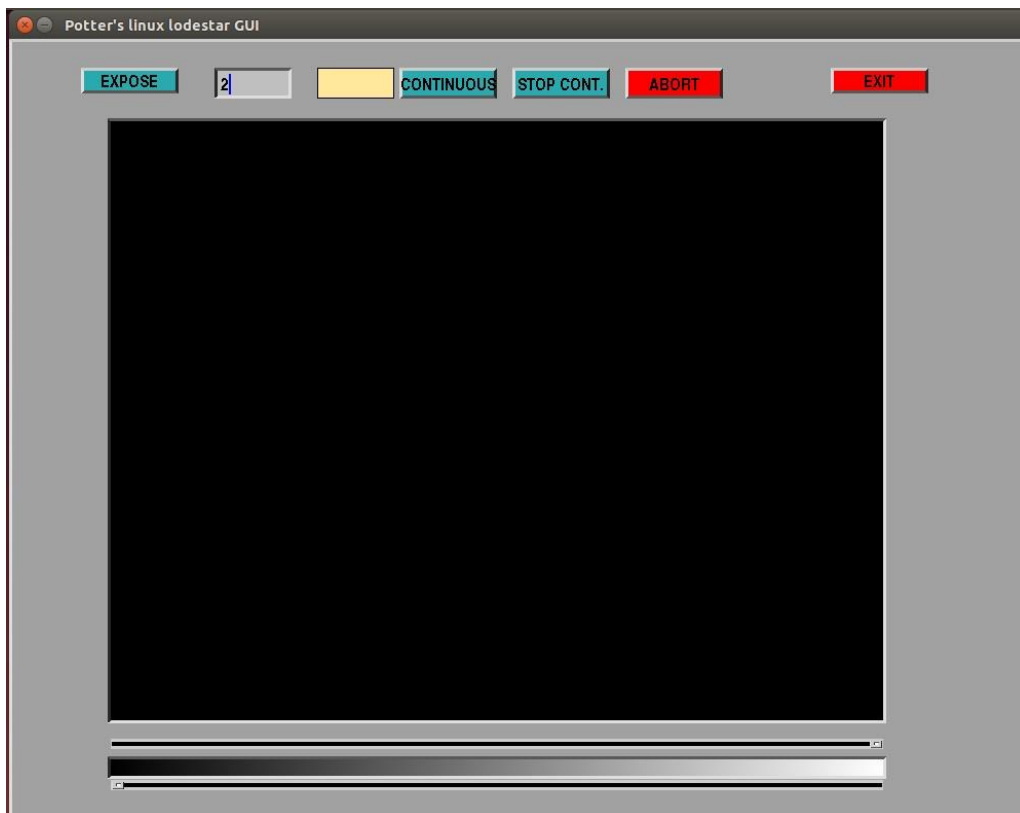
Fig 24: Screenshot of Potter's lodestar GUI

10. Open xterminal: Type weather-cli, then type view, and check   that weather info gets printed. Type q to exit.

Fig 25: Weather Info

11. In a terminal: Type tcsview-cli, then type view, and check that a line of TCS info is printed. Type q to exit.

Fig 26: TCS Info

12. In a xterminal: Type /usr/local/etc, then list files by typing ll (lower case LL), the file tcsview.cfg should be a copy of the file tcsview.cfg.<TEL>, where <TEL> is the telescope (40- or 74-inch) the instrument is mounted on.

Ensure that **TCS Lockout** switch on the mimic panel is set to **OFF** state (allowing remote access of the telescope). The TCS Control indicator will stop flashing.