

# Schulman Telescope StartUp Procedure

## Check Internet

Go to the warm room closet and check that all internet cables are plugged in. There is one CAT5 cable that goes to the main observatory computer and another that goes directly to the telescope controller. During lightning shutdown these cables are often unplugged. While in the closet check to see that the StarDot video server is healthy.

## Power up the Main Observatory Computer and UPS's

Plug in and turn on the small UPS that delivers power to the main computer and telescope services (including the TIM unit via the remotely controlled power outlets). Login to the main Windows user account. This is currently labeled "Adam" and the password is the standard "I8...." Next plug in and turn on the larger telescope controller UPS. (Do not turn on the controller yet.)

## Interpret the Telescope Orientation and Clear Manual E-stops

[Check the Telescope Orientation](#) and assess the condition of the telescope. If the current position does not "make sense," consider investigating further before proceeding. If engaged, release any E-stops on the [hand paddle](#), [telescope controller](#), and [dome controller](#). Although it should be in operable state by default, also check the [upper shutter E-stop plunger](#) by visual inspection. If this is inadvertently left pushed in it must be released or software shutter errors will follow. The key should be turned to the "on" position.

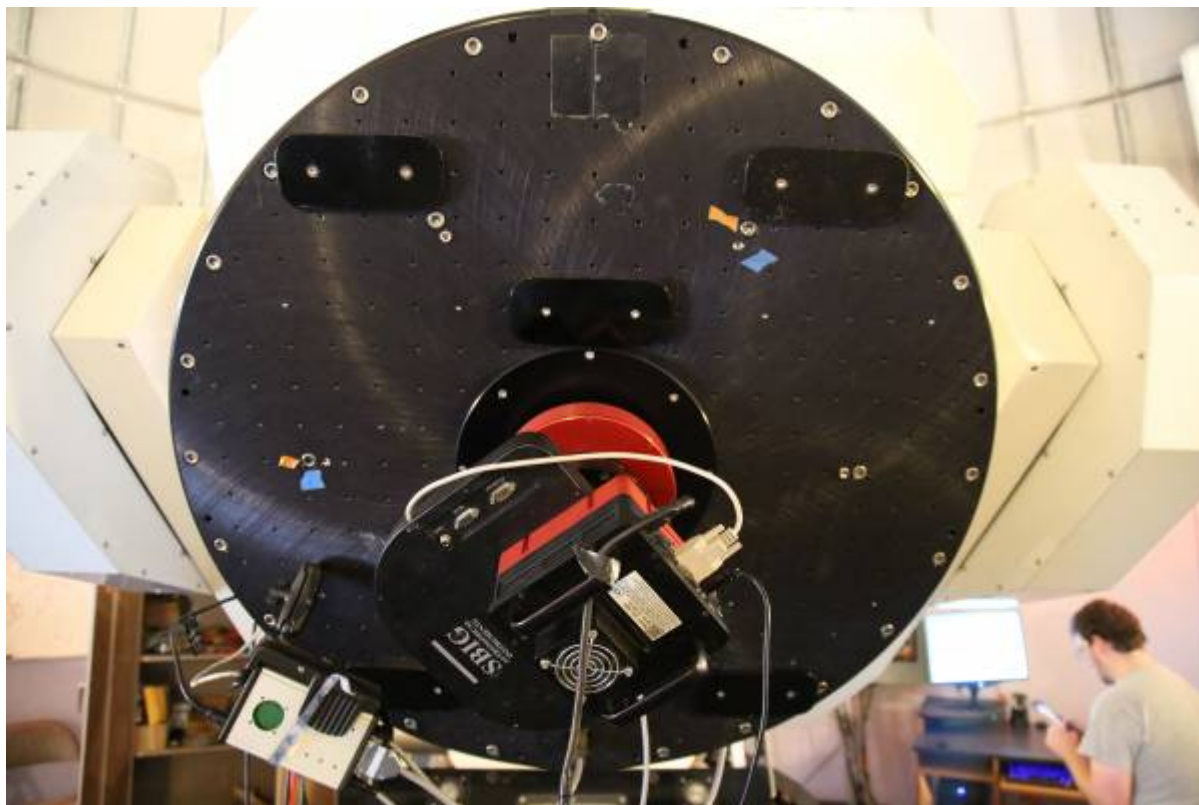
## Check the RA Optical Tape and Read Heads

Before turning on the controller (or moving the telescope for [normal operation](#)) examine the RA axis [optical tape](#) for signs of water condensation or insect "residue." This must be [cleaned](#) before operation. Make certain both the [drive and idler bearings](#) are also free of anything that might be transferred to the optical tape. Look closely at the [read heads](#) and check to make certain they appear aligned without anything in the space between the read head and the tape. (Use a thin Tek wipe or something similar to clear the space and clean the window if necessary.)

## Check the telescope Balance state

As of Fall 2016 the telescope is in a balanced state when the following conditions are met:

1. The CCD camera is attached to the back of the telescope. \* (see note below)
2. There are no extra hardware or eyepieces attached to the telescope (e.g. No eyepieces should be installed in the refractor.)
3. The number of weights and configuration are as in the picture below:



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4. **THE MIRROR COVERS ARE OPEN** This will be done shortly.

#### **Note (Eyepieces)**

The combination of the 31mm Nagler eyepiece and adapter at the back of the telescope is sufficiently close to “balanced” that it is OK to follow the startup process in this state. Being optimized for the CCD configuration permits better success at automation and recovery from errors.

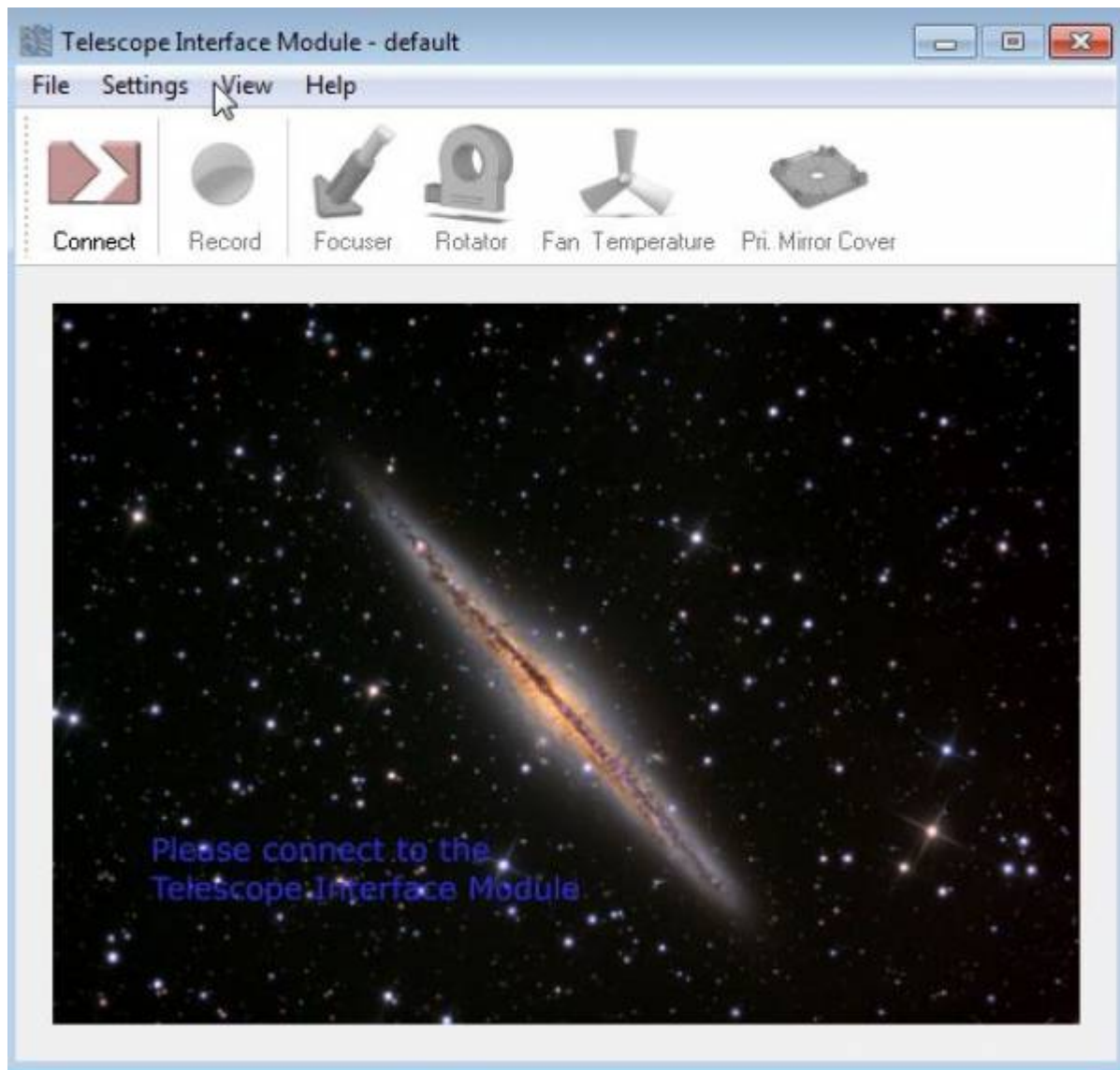
#### **Manually Point the Telescope to the Zenith**

When on site for startup purposes it is OK to move the telescope against the Declination brake to point the telescope vertically ([at the zenith on the meridian](#)). This step is necessary as mountain operations currently (Fall 2016) requires the telescope be pointed “up” before opening the mirror covers. During a recovery event when the controller is one but the telescope needs to be re-homed, opening the mirror covers in other positions will still be OK. Even if the mirror covers do not fully deploy (“Mid Position”)- the balanced state will be achieved and initializing the system can proceed. The mirror covers can then be closed and re-opened later.

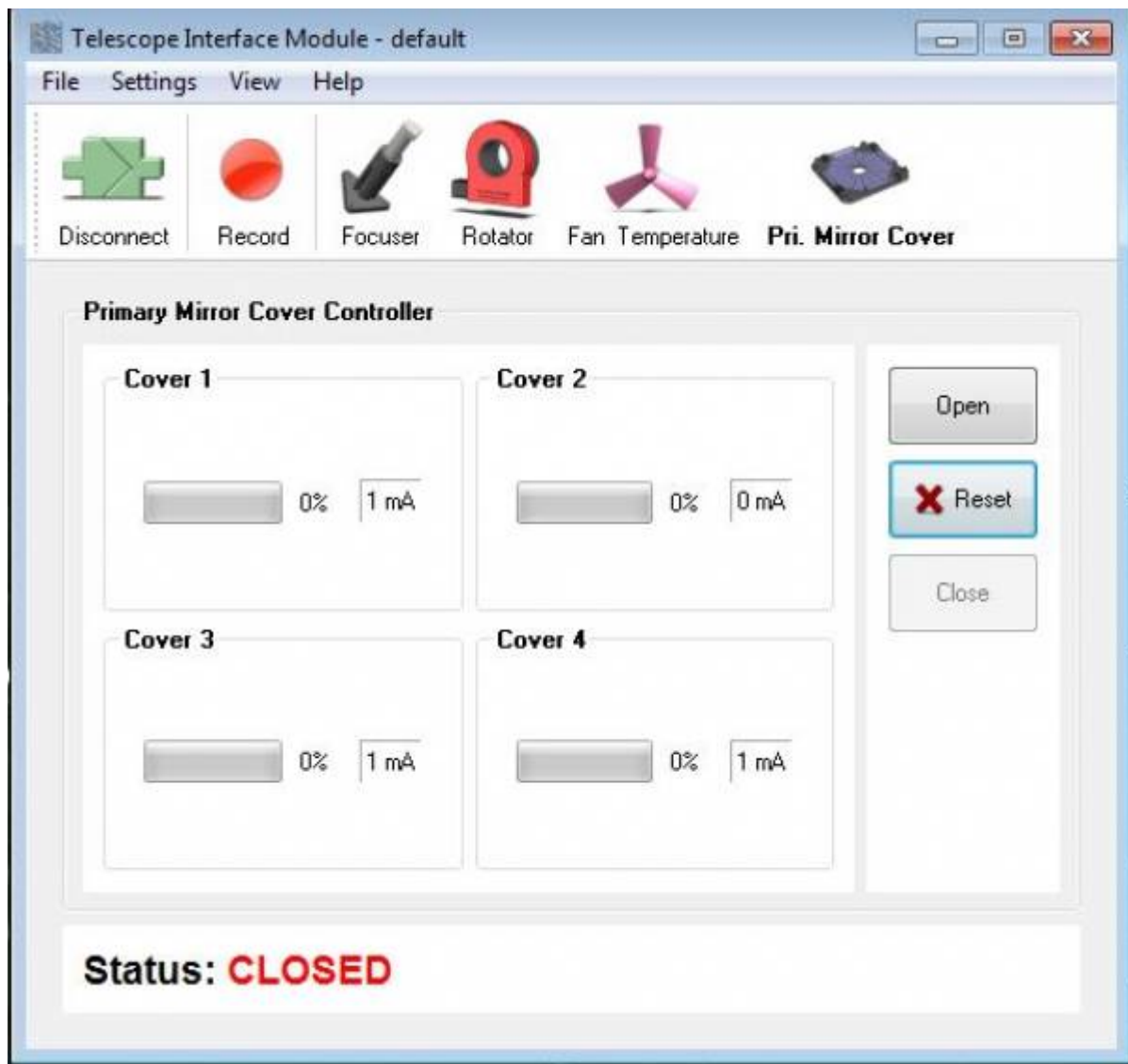
#### **Turn on the TIM Unit, Connect, and Open Mirror Covers**

The [TIM Unit](#) must be turned on in order to open the mirror covers. Before turning it on make certain all [connections](#) are firmly seated into the enclosure. Turn the unit on with the rocker style toggle switch.

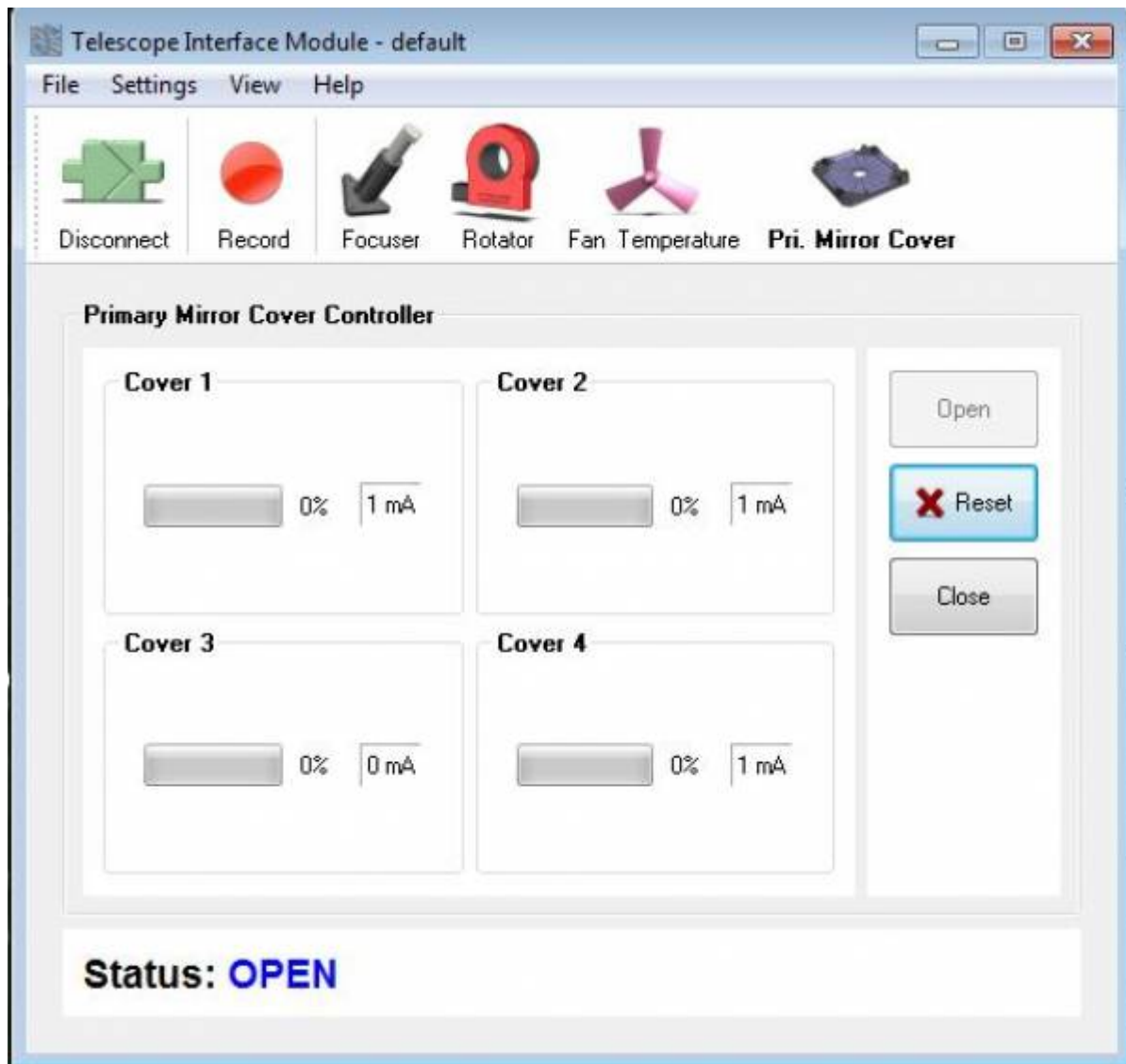
Next on the computer [open the RCOS TIM software](#).



Connect to the TIM unit and navigate to the "Primary Mirror Covers" tab.



Open the Mirror Covers:



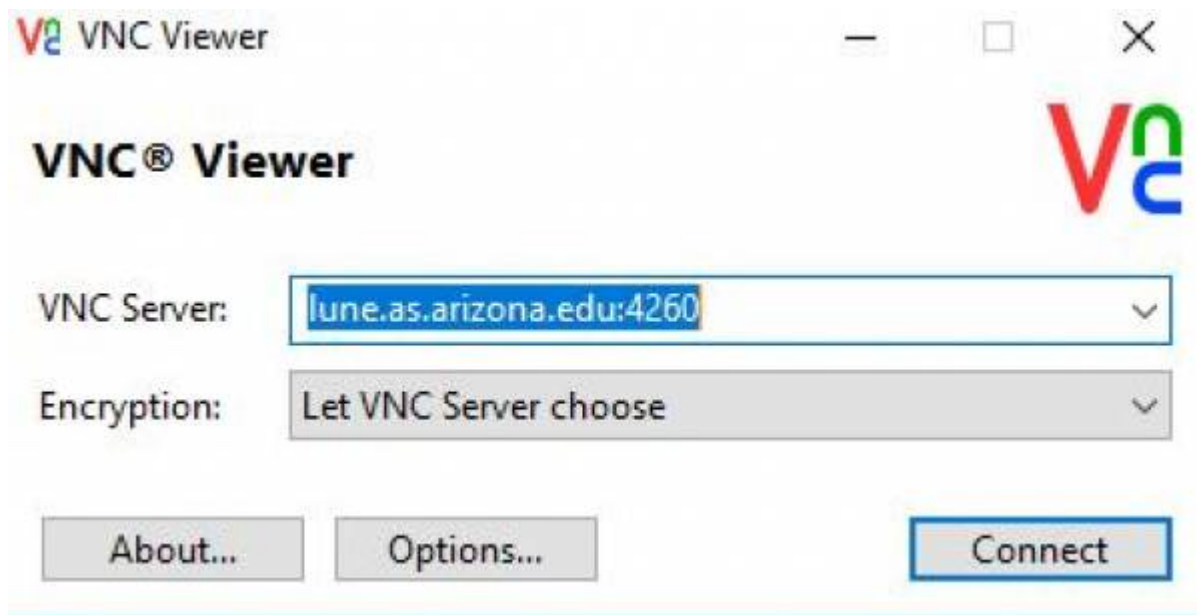
### Turn On Telescope Controller

Turn the red switch to the “on” position. Fans and other noises will be heard as the system comes on. Wait for 3 minutes for the Mic and PubSub internal computers to boot. Generally when the MIC completes booting the drives/servos are alive and holding the telescope (listen for them).



## Connect to the PubSub Machine using VNC

Open [VNC](#) and type the address to PubSub shown below:



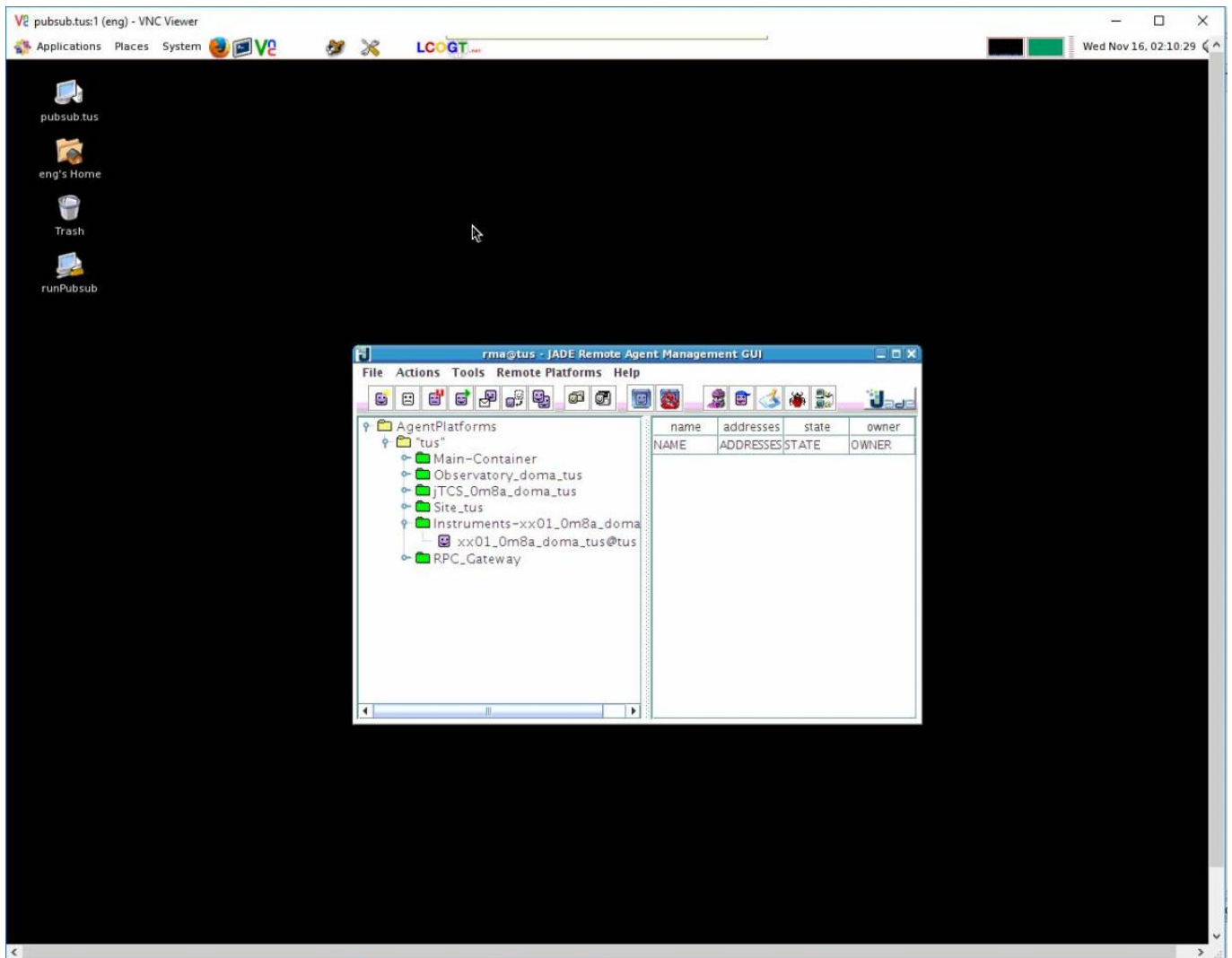
(It is assumed the user has the password.)

Initially the desktop will be blank (black). Start PubSub processes by pressing the tool utility icon at the top of desktop. It is circled in the image below:





This will clear the database and give everything a clean start. Eventually (a few minutes) the “JADE” agent will load and the desktop will look like the below:

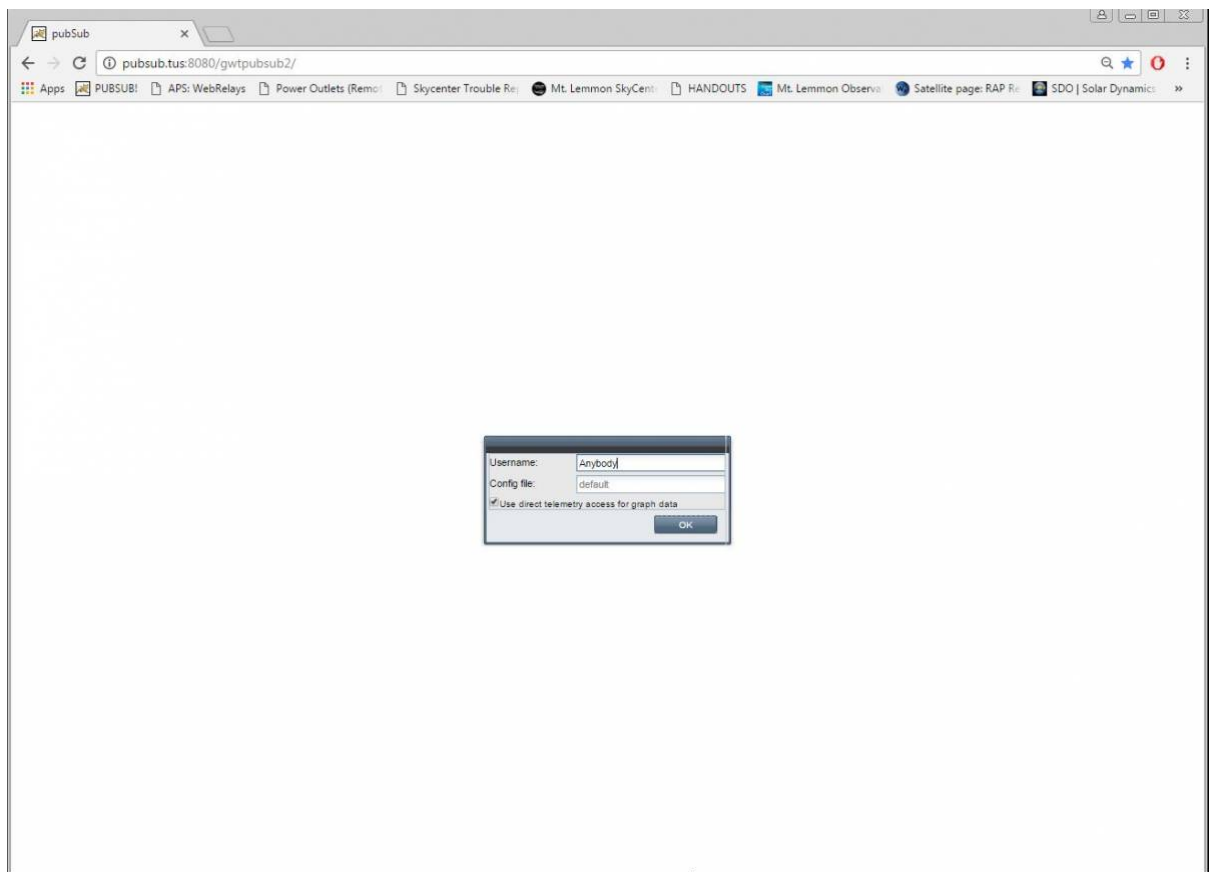


The small icons to the right of processes can be pressed to expand them and reveal the list as shown. Once the “Instruments-xx01\_0m8a\_doma” process is loaded under its section PubSub is ready to communicate with the telescope (and the user). The “RPC\_Gateway” process will not show up until communication to PubSub through the web browser commences. This is in the next step. It is OK to close the VNC window.

## Access the LCOGT GUI

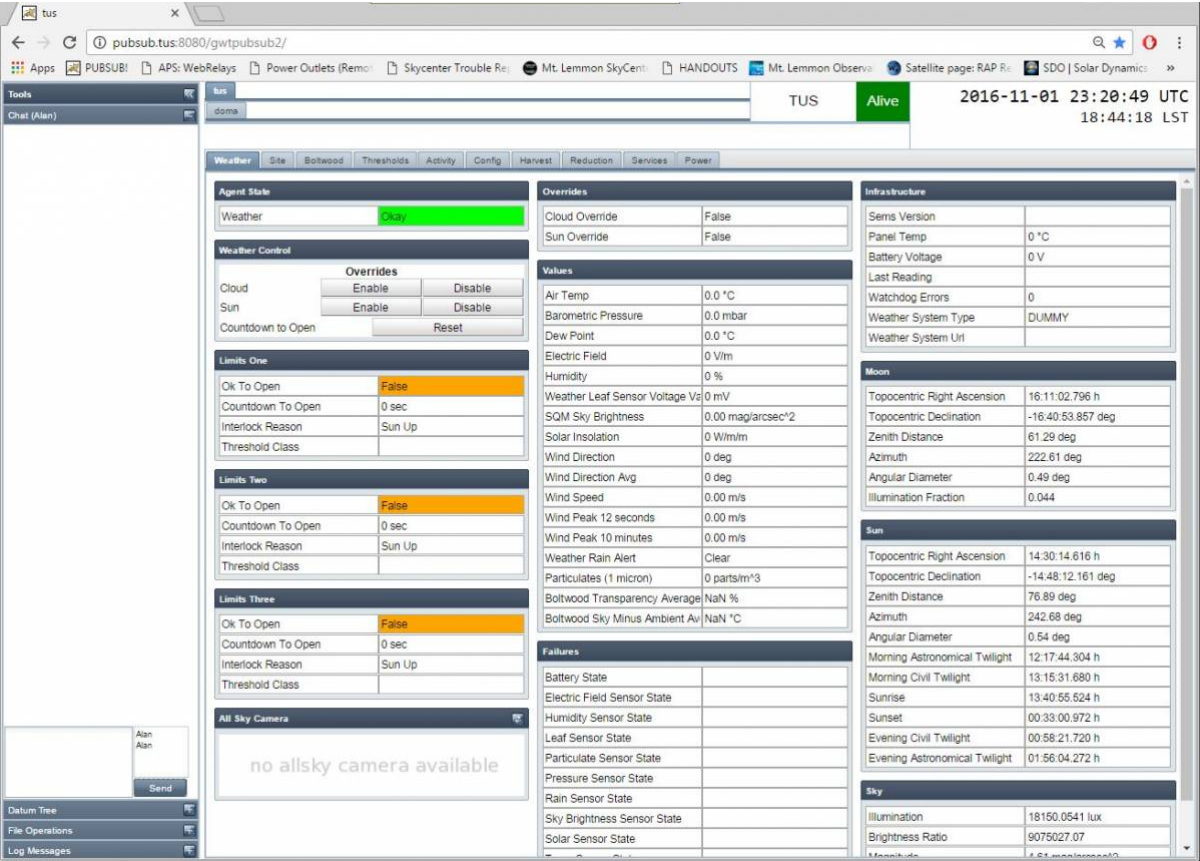
Now that the system is up and running with drives, servos, and PubSub- access the LCOGT GUI:

1. Open the [Chrome Browser](#) and click the quick link labeled PubSub (leftmost icon). You will be presented with the screen below:

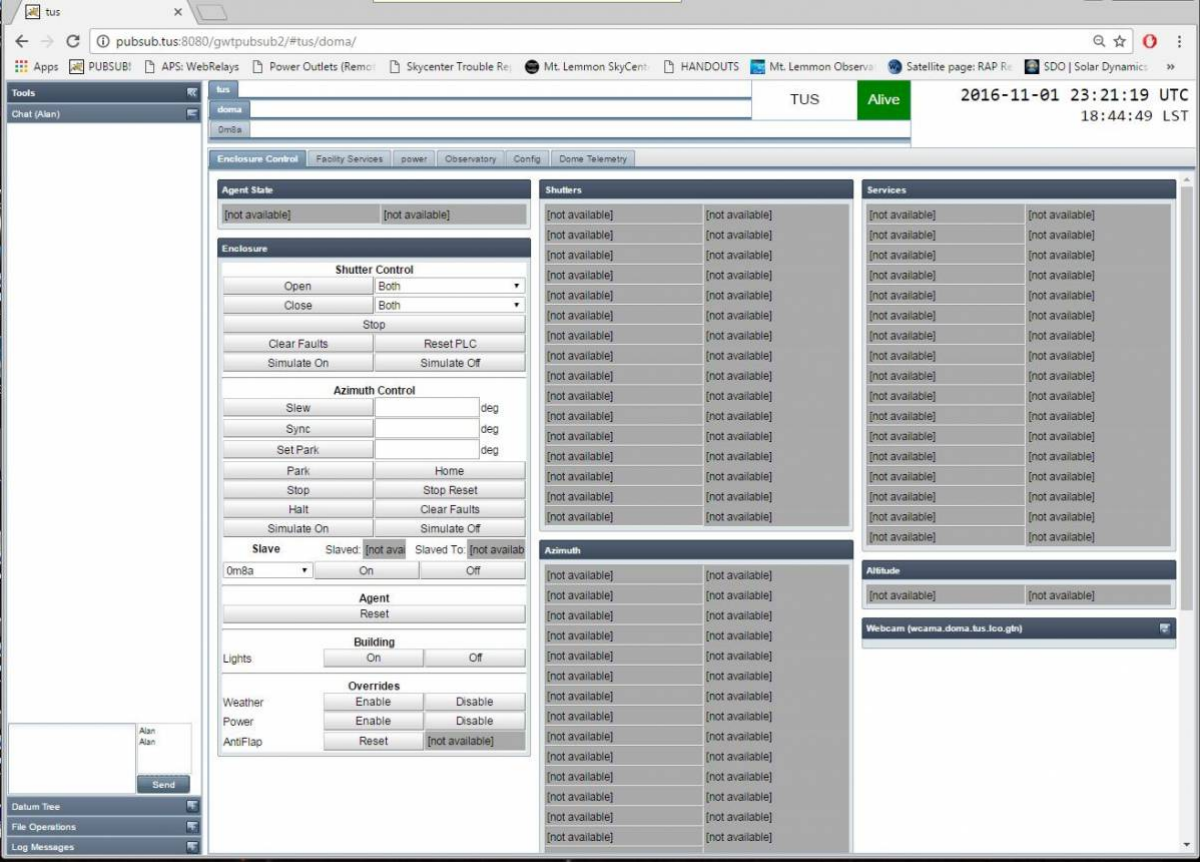


1. The log on name is unimportant. However *default* is required for the Config File field.
2. Press the “OK” button to continue.
2. Wait for PubSub to send all of the data to the browser. It will take 2-4 minutes. If you simply have a blank/white screen → going back to PubSub through VNC may be necessary to make certain it is setup correctly.
3. Once the GUI comes up you will be presented with the Site heads up information. Note the small tab is labeled “tus.” This stands for “Tucson.” None of the capabilities on this screen are currently in use.





4. Click on the tab beneath “tus” to expose the information under the “doma” tab. The LCOGT software can be used to control multiple telescopes at a site. Our single site has a single telescope in the “A” dome which is roughly “doma.” Again this functionality is not being used.



5. Finally click on the “0m8a” tab to expose the controls for the Schulman Telescope. This tab roughly translates to 0.8m a (or first 0.8m telescope).

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The screenshot shows the TUS web interface with the following data tables:

Tracking	
Disable Roll	Disable Pitch
Enable Rotator	
Stop Tracking Loop	
Rotator Mode	
SKY	Set

Other States	
Astrometric Kernel State	Stopped
Astrometric	Okay
[not available]	[not available]
Container State	Okay
Agent Count	10

State	
Astrometric	Okay
[not available]	[not available]
Mount	Okay
Mount State	Okay
Config	Okay
InstrumentSelector	Okay
Monitor	Okay
[not available]	[not available]
Paddle	Okay
SdbAgent	Okay
[not available]	[not available]
[not available]	[not available]
TestAgent	Okay
[not available]	[not available]

Instrument State	
xx01	Okay
Agent Alive Time	67344 s
Repository Revision	6a5404e

Description	
Mount Type	1
Current Message Queue Size	
Astrometric	0
[not available]	[not available]
Axes	0
Config	0
InstrumentSelector	0
Monitor	0
[not available]	[not available]
Paddle	0
SdbAgent	0
[not available]	[not available]
[not available]	[not available]
[not available]	[not available]

Software Revision	
Astrometric	3b4d9fe
[not available]	[not available]
Axes	3b4d9fe
Config	3b4d9fe
InstrumentSelector	3b4d9fe
Monitor	3b4d9fe
[not available]	[not available]
Paddle	3b4d9fe
SdbAgent	3b4d9fe
[not available]	[not available]
[not available]	[not available]
[not available]	[not available]

Behaviours	
Astrometric	133
[not available]	[not available]
Axes	93
Config	18
InstrumentSelector	22
Monitor	9
[not available]	[not available]
Paddle	31
SdbAgent	10
[not available]	[not available]
[not available]	[not available]
[not available]	[not available]

Software Repository Path	
Astrometric	issue-5613-2
[not available]	[not available]
Axes	issue-5613-2
Config	issue-5613-2
InstrumentSelector	issue-5613-2
Monitor	issue-5613-2
[not available]	[not available]
Paddle	issue-5613-2
SdbAgent	issue-5613-2
[not available]	[not available]
[not available]	[not available]
[not available]	[not available]

6. Take note of the color of the fields in the column on the left in the above image. They should all be green when the telescope is ready to be used. The “astrometric kernal” can be “yellow” when the drives are not tracking. If the telescope is tracking, this will also be green. If you come to this tab/screen quickly after rebooting PubSub, you may see fields such as “Mount State” indicate “initializing.” This is OK provided that the agent does eventually initialize the drives and the field goes to green after a minute or two.

## Homing the Schulman Telescope

The telescope must be homed before it can be operated.

- Go to the Axes tab. Note that the axes are **Unhomed**.

The screenshot shows a software interface for controlling telescope axes. At the top, there are tabs: State, Observation Script, Sequencer, Source, Tracking, **Axes**, Guide, and Instrument. Below the tabs, the 'Agent State' section shows 'Mount' and a green 'Okay' button. A timestamp 'Suspend @ 2016-11-16 02:52:49' is visible. The 'Axes Command' section is divided into 'Agent Enable' and 'Agent Disable' modes. Under 'Agent Enable', there are three columns: 'Roll', 'Pitch', and 'Rotator'. Each column has a status indicator (Standby in green, Unhomed in yellow), a position/velocity selector (Pos/Vel), a numerical input field (0.0), a unit (deg), and a list of control buttons: Slew, Halt, Home, Park, Unwrap, Stop, Stop Reset, Enable, Disable, Goto Pos L1, Goto Neg L1, Recover L2, and Fault Reset. Below these columns, there are additional buttons: Slew, Halt, Park, Home, and Stop.

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2. Press the large *HOME* button (circled below) to move both axes simultaneously to the home position. See [Telescope Orientation](#) for the correct position.

The screenshot shows the 'Axes' tab of a telescope control interface. At the top, there are tabs for 'State', 'Observation Script', 'Sequencer', 'Source', 'Tracking', 'Axes', 'Guide', and 'Instrument'. Below these is the 'Agent State' section, which displays 'Mount' and an 'Okay' button. The main section is 'Axes Command', which is divided into three columns: 'Roll', 'Pitch', and 'Rotator'. Each column has a 'Standby' button, a 'Homing' button, a radio button for 'Pos' or 'Vel', a numerical input field (currently showing '0.0'), and a 'deg' unit label. Below the input field is a list of buttons: 'Slew', 'Halt', 'Home', 'Park', 'Unwrap', 'Stop', 'Stop Reset', 'Enable', 'Disable', 'Goto Pos L1', 'Goto Neg L1', 'Recover L2', and 'Fault Reset'. A red circle highlights the 'Home' button in the 'Pitch' column.

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3. Once homed successfully the state field will briefly go to "stopped" and then finally "L1 Positive Limit" in both axes:



**Agent State**

Mount Okay

**Axes Command**

Agent Enable		Agent Disable
<b>Roll</b>	<b>Pitch</b>	<b>Rotator</b>
<span style="background-color: green; color: black;">Okay</span>	<span style="background-color: green; color: black;">Okay</span>	<span style="background-color: grey; color: black;">Off</span>
<span style="background-color: green; color: black;">Halted L1 Positive Limit</span>	<span style="background-color: green; color: black;">Halted L1 Positive Limit</span>	UNKNOWN
<input checked="" type="radio"/> Pos <input type="radio"/> Vel	<input checked="" type="radio"/> Pos <input type="radio"/> Vel	<input checked="" type="radio"/> Pos <input type="radio"/> Vel
0.0 deg	0.0 deg	0.0 deg
Slew	Slew	Slew
Halt	Halt	Halt
Home	Home	Home
Park	Park	Park
Unwrap	Unwrap	Unwrap
Stop	Stop	Stop
Stop Reset	Stop Reset	Stop Reset
Enable	Enable	Enable
Disable	Disable	Disable
Goto Pos L1	Goto Pos L1	Goto Pos L1
Goto Neg L1	Goto Neg L1	Goto Neg L1
Recover L2	Recover L2	Recover L2
Fault Reset	Fault Reset	Fault Reset
Slew		
Halt		
Park		
Home		
Stop		

**Park Widget**

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4. Now go to the *Source* tab and move the telescope out of the limits to a valid sky position. If the telescope is not going to be used immediately typically the telescope is sent to the park position. Remember to stop the tracking loop if observing is not going to start. The zenith position is inputted in the picture below.

pubsub.tus:8080/gwtpubsub2/#tus/doma/0m8a/Source

Tools Chat (Alan)

TUS Alive

2016-11-01 23:25:14 UTC  
18:48:46 LST

State Observation Script Sequencer Source Tracking Axes Guide Instrument Ins View Spectrograph Calibrate Focus Optical Tube Telescope Services 1 Telescope Services 2

Agent State

Astrometric Okay

Point

Point/Next Start End  
Skip Store Clear  
Goto nearest pointing star Clear local offsets

Source

Name	
Right Ascension Source	NaN h
Declination Source	NaN deg
Coordinate System	
Equinox Source	NaN yr
Limit Expected	Horizon Limit
Limit Time Left	3.65 h
Moon Zenith Distance	61.89 deg
Sun Zenith Distance	77.69 deg

Telescope

Tracking in Tolerance	Out Of Tolerance
Air Mass	2.3429
Altitude	25.15 deg
Azimuth	179.23 deg
Hour Angle	-00:03:18.493 h
Zenith Distance	64.8 deg
Sun Separation	132.20 deg
Moon Separation	47.44 deg

Space Motion

Source Space Motion Enabled	false
Source Parallax	NaN arcsec
Source Proper Motion Epoch	NaN yr
Source Proper Motion Right Asc	NaN arcsec/yr

Source Selection

Astrometric Kernel State: Stopped

Known objects: Go

Source Name: none Fetch Clear

Coordinates

Coordinate System: APPARENT\_HA

Hour Angle: 0 h

Declination: 32 deg

Space Motion

Orbital Elements

Where is it?

When?

Where will it be?

Clear local offsets

Go Moon Flat

Stop Unwrap Roll Unwrap Rot

Time

Local Apparent Sidereal Time	18:48:46.944 h
Modified Julian Day	57693.9759 MJD
Julian Epoch	2016.8363 yr
TAI Minus UTC	36 s
TT Minus TAI	32.1840 s
UT1 Minus UTC	-0.3238 s

Orbital Element

Source Orbital Element Scheme

Source Orbital Element Argumer	NaN deg
Source Orbital Element Daily Mo	NaN deg
Source Orbital Element Eccentric	NaN
Source Orbital Element Epoch O	NaN MJD
Source Orbital Element Epoch O	NaN MJD
Source Orbital Element Longitud	NaN deg

Refraction

Pressure: mbar

Humidity: %

Temperature: °C

Apply Override

Clear Override

Tracking

Disable Roll Disable Pitch Enable Rotator

Stop Tracking Loop

Rotator Mode

SKY Set

Refraction

Manual Override	False
Air Temperature Value	0 °C
Barometric Pressure Value	0 mbar
Humidity Value	0 %
Wavelength	0.6000 um
Guiding Wavelength	NaN um

Pointing Control

M1 and M2 Alignment	False	Enable
Collimation	False	Enable
Roller Encoders	False	Enable
Encoder Non-Linearity	False	Enable

Pointing Corrections

Polar Motion X	0.1892 arcsec
Polar Motion Y	0.2811 arcsec
Collimation Correction Enabled	False
Collimation Correction Pitch	0 arcsec
Collimation Correction Roll	0 arcsec

5.
6. Please see the Using the LCOGT GUI and Moving the Telescope section for more information.

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