

Schulman Telescope Startup Procedure

Updated 8/4/2022 - Travis Deyoe

The order of operations below is designed for time efficiency. Missing a step could lead to frustration as some steps may feel “out of order” but are designed to reduce down time waiting for things to power on.

Pre-Startup Checks

Pull Off Tarps

The Telescope, Controller, and desk will always be tarped whenever the telescope is put into Lightning Shutdown. They will need to be removed before inspecting or moving the telescope.

Perform your best interpretive dance to appease the tarp gods. If that does not make the tarp fall off you must remove it manually. Folding it up and placing it to the right of the brown cabinet is a nice touch.

Check Telescope Position

Verify the the telescope is not at any limits. If it is or looks “wrong” to you move it manual into a safe position before the next steps. This guarantees that it will be able to successful and safely home in a future step. It's recommended to place it either at [Zenith](#) or the [Park](#) position.

Check Emergency Stops

If engaged, release any E-stops on the Hand Paddle, Telescope Controller, and the MaxDome Controller. They all appears as big red buttons that scream “PRESS ME IN CASE OF EMERGENCY”.



Check the telescope Balance state

The telescope is in a balanced state when one of the following conditions are met:

- The camera is on with a single weight attached at the “top” of the backplate.
- The focuser is on with both eyepiece weights attached on either side of the focuser and there is no weight on the “top” of the telescope.

In either state an eyepiece should be in the 6” refractor and the mirror covers are open (this will be done later in the [this step](#). If neither of these are the state the telescope is in place it in one of the [Configurations](#) now or at the very least before [homing the telescope](#).

Check RA Encoder Tape

Follow the RA [optical tape](#) along the big RA wheel and check for any smudges, bug guts, and so forth. The WEST [read head](#) is active while the east read head is not currently utilized so make sure through the entire motion of the telescope (in RA of course) that there is nothing blocking the reading of the tape on the west side and that there is nothing obstructing the read heads ability to “see” the optical tape.

Make certain both the [drive and idler bearings](#) are also free of anything that might be transferred to the optical tape. There is a bit of felt held in place there that *should* wipe off anything but its best to check still.

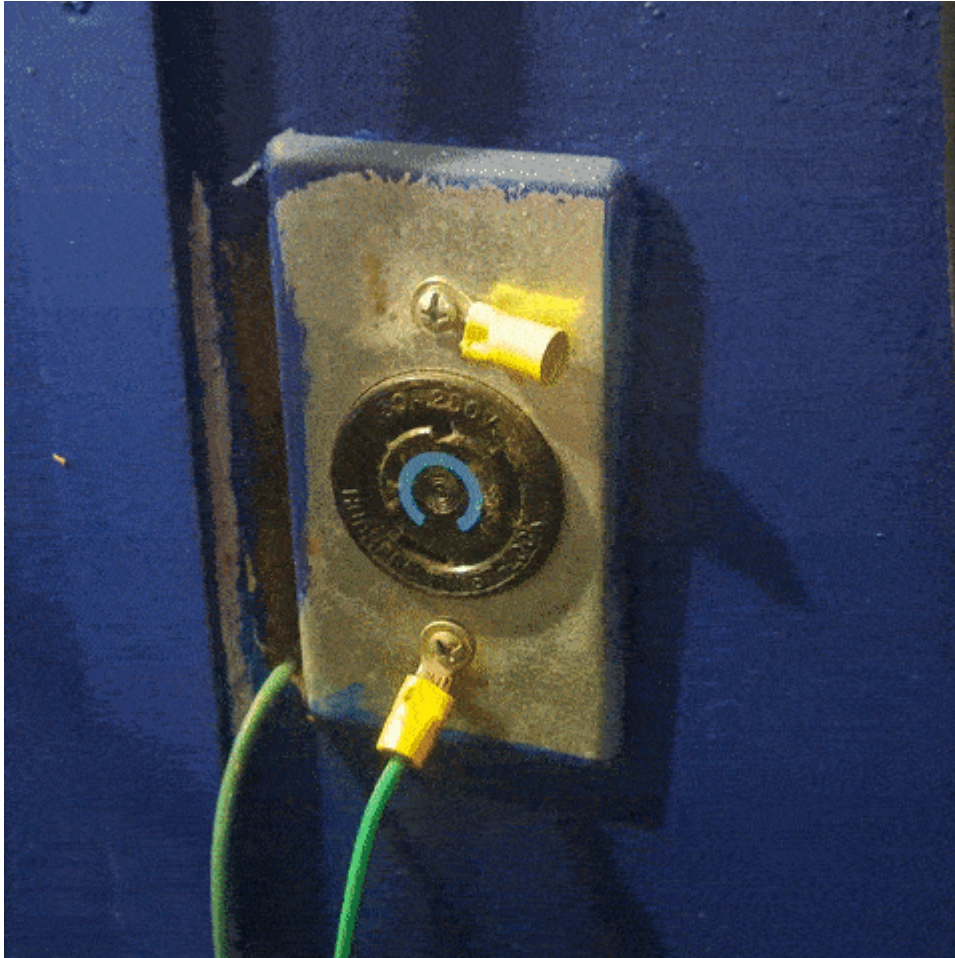
If anything is observed use a microfiber cloth or TEX wipe to wipe it away. 99% isopropyl alcohol may be utilized if necessary. Note that you should only wipe along the narrow length NOT along the circumference of the tape.

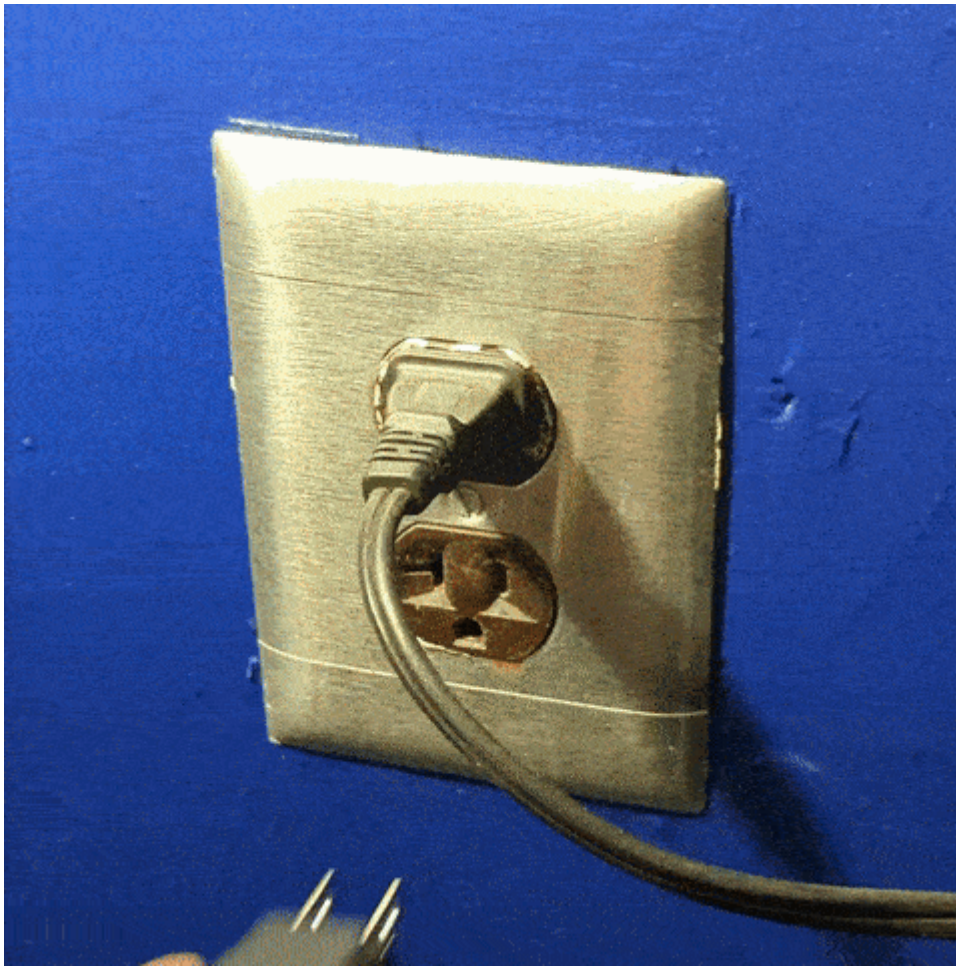
Powering everything on

Now that you have inspected the telescope for safety it is now time to start turning things on.

Power On UPS's

First plug in the Big and Small UPS's to the left of the desk. The BIG UPS should be twisted clockwise after insertion in order to secure it in the socket. The Big UPS powers the larger controller box on the wall above it while the Small UPS powers basically everything else.





Next you must turn on both UPS's. Press and hold the corresponding “on” button for at least a second until you hear a beep then let go. For the Big UPS this will take a few moments as it cycles through some littles (shown in full in the GIF below). The Small UPS will power on quicker.



Both UPSs will immediately supply power to their output plugs so no further button pressing is

necessary.

Power On Controller and Desktop computer

The big gray box on the wall is the Controller. Turn it on by turning the large red switch on the bottom left of the Controller box to the right (clockwise). Assuming the UPS was powered on in the last step Fans and other noises will be heard as the system comes on.



Now is also when you should turn on the Desktop computer. It is under the desk behind the little door on the left. The power button is the same color as the computer case so in a dimly lit room (like it most likely is now without the dome open) you may need a light to find it.

Power on TIM Unit

The TIM unit is a small gray/black box on back of the telescope just below where the camera or eyepiece is installed. There is a standard power switch on the left side to turn it on.

Check Controller Ethernet Cable

While the Controller and Desktop are powering on (the Controller takes about 15 years to do so) go into the warm room. Now go into the closet. There is a grey ethernet cable labelled "Controller". Plug this into the switch on the right wall and confirm there are the happy internet lights on the switch.



Desktop Tasks

Procced back to the desktop computer which should be fully powered on. Login to the computer (standard SkyCenter password). The next few task will all be done on this computer.

Open Mirror Covers

Open the [RCOS TIM software](#) from the desktop link or toolbar quick link.



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



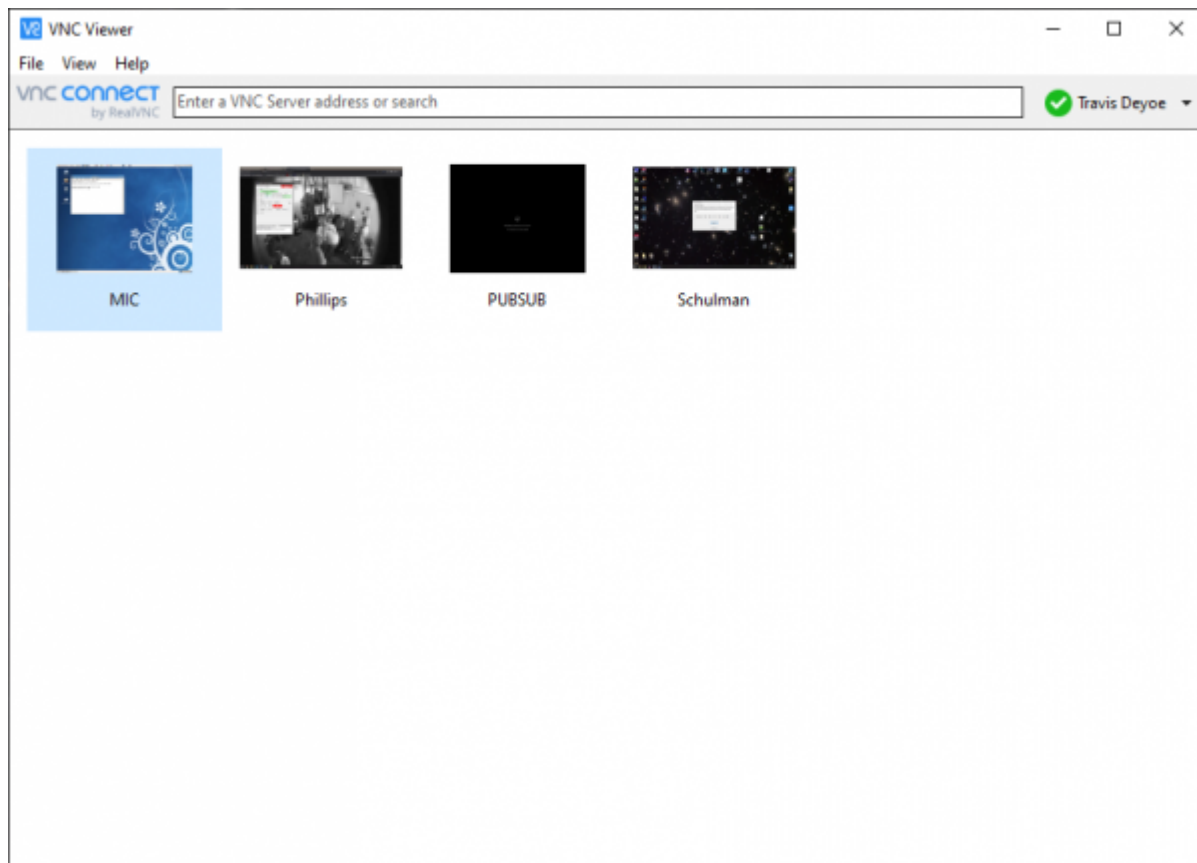
Open the Mirror Covers:



If the mirror covers aren't opening correctly or the current stays high (over 1000milliamps) then there is a problem. Abort the opening (or closing) and follow [this procedure](#)

Remotely connect to MIC and PubSub

Launch [VNC Viewer](#). It will appear on the middle right of the desktop (or just search it in the start menu). You will now want to remotely connect to the MIC and PubSub computers that run the Controller. This is what VNC Viewer does so just double click on the MIC and SUBSUB links in VNC Viewer and it will open a window of each.



Verify MIC and PubSub time

NOTE: At this time PubSub is dumb and will display a “Logout” screen. Click that button and it will display an empty desktop. To find the actual desktop you will need to use the file manager in the Programs menu (top left of the screen)

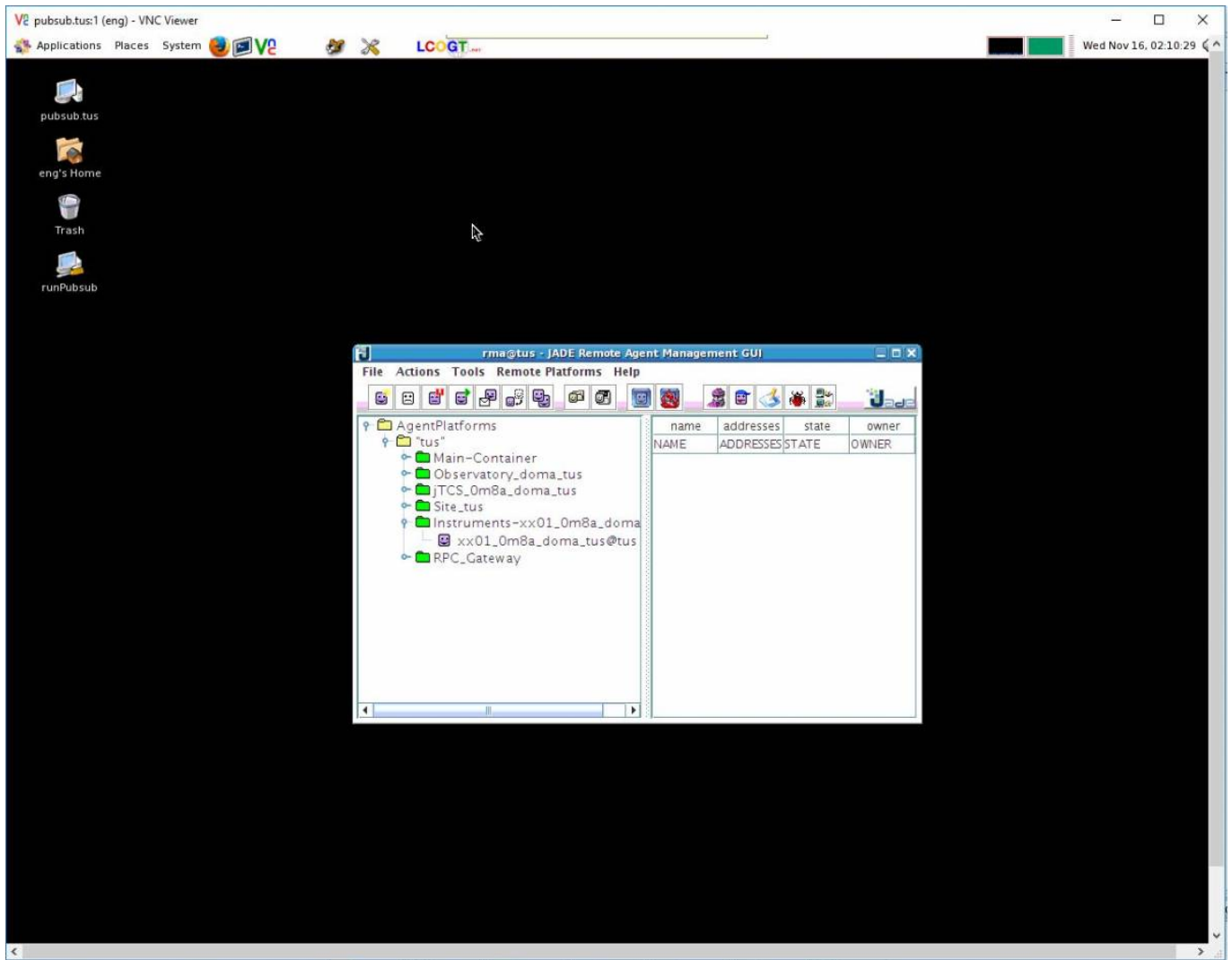
Make it so you can view the top right of both screens next to each other and confirm that the two computers times are within about 5 seconds of each other. If they are not you must perform the following task: [Sync Controller Times](#).

Launch Pubsub software

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.

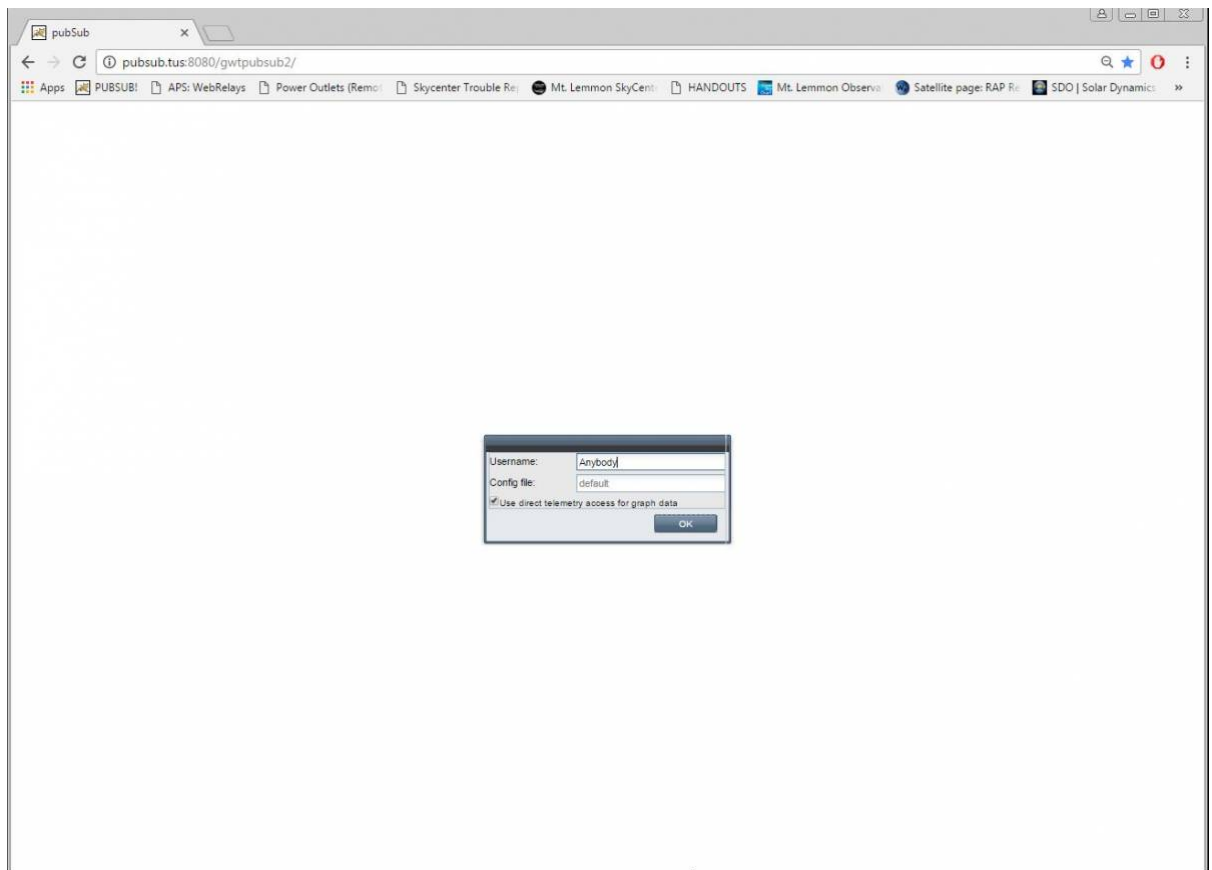
From Pubsubs Desktop folder double click on the “Clear and Restart Pubsub” program. This will open both a Terminal window and a GUI. The gui will slowly populate with a list of items. **Do not process until all those below show up**

- Main-Container
- Observatory_doma_tus
- Site_tus
- jTCS_0m8a_doma_tus
- Instruments-xx01_0m8a_doma
- (RPC_Gateway) ← only shows once connected (via [this step](#)) to the controller, will not show initially

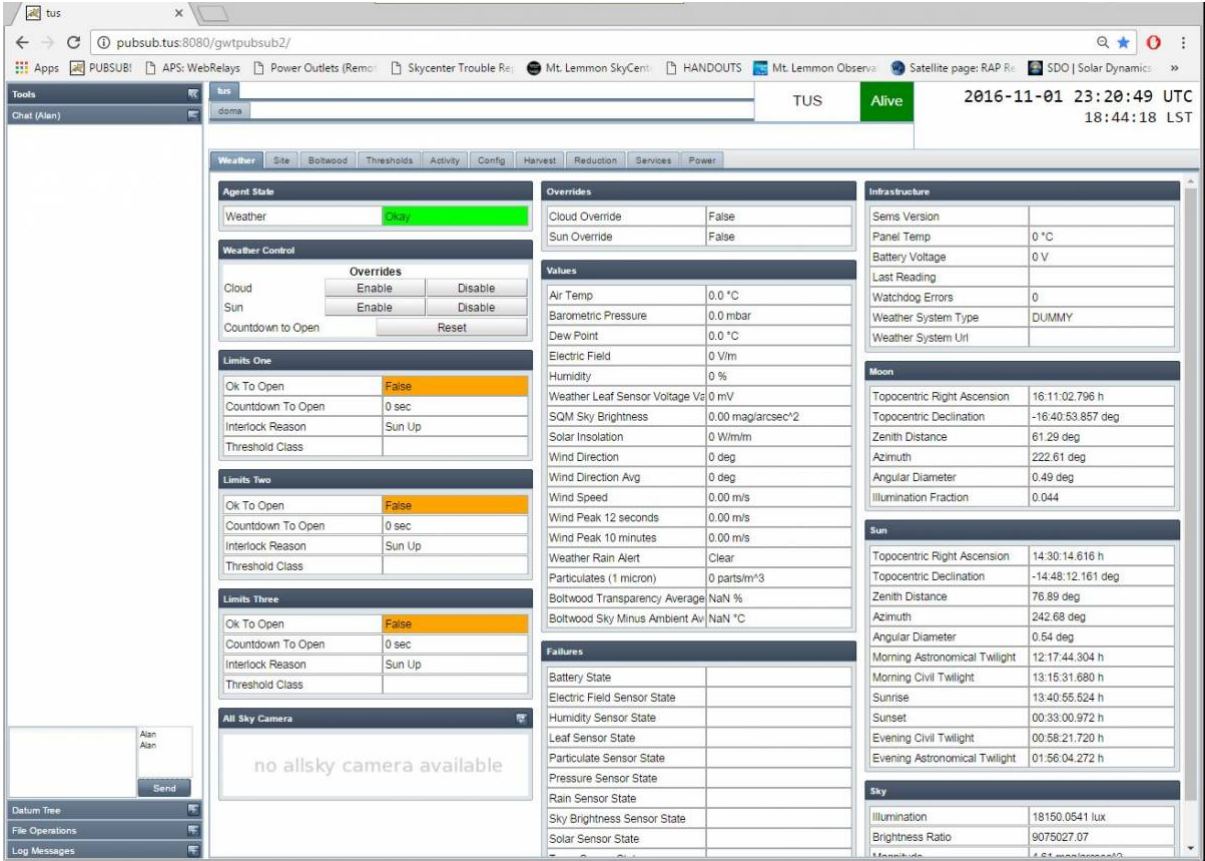
Access the LCOGT (PubSub) GUI

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

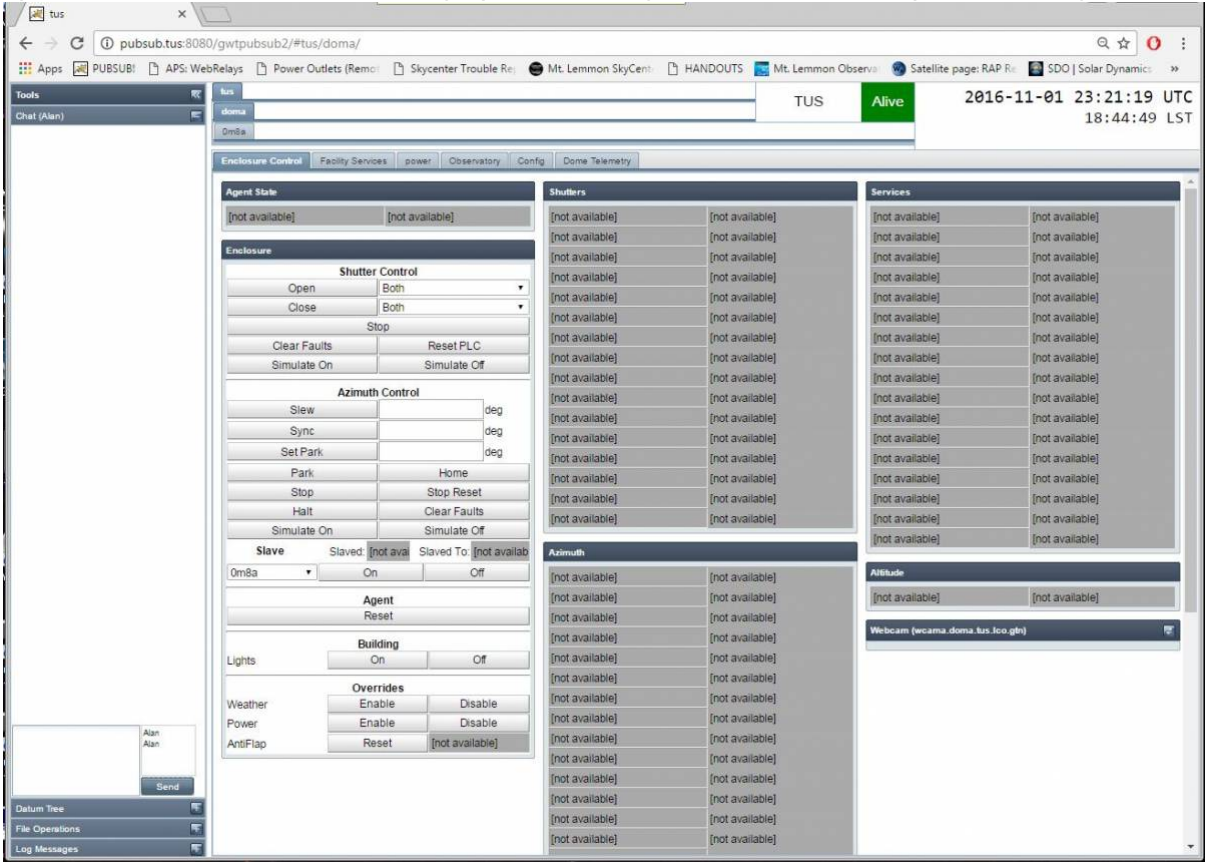
1. Open the [Chrome Browser](#) and click the quick link labeled PubSub (leftmost icon). You will be presented with the screen below:



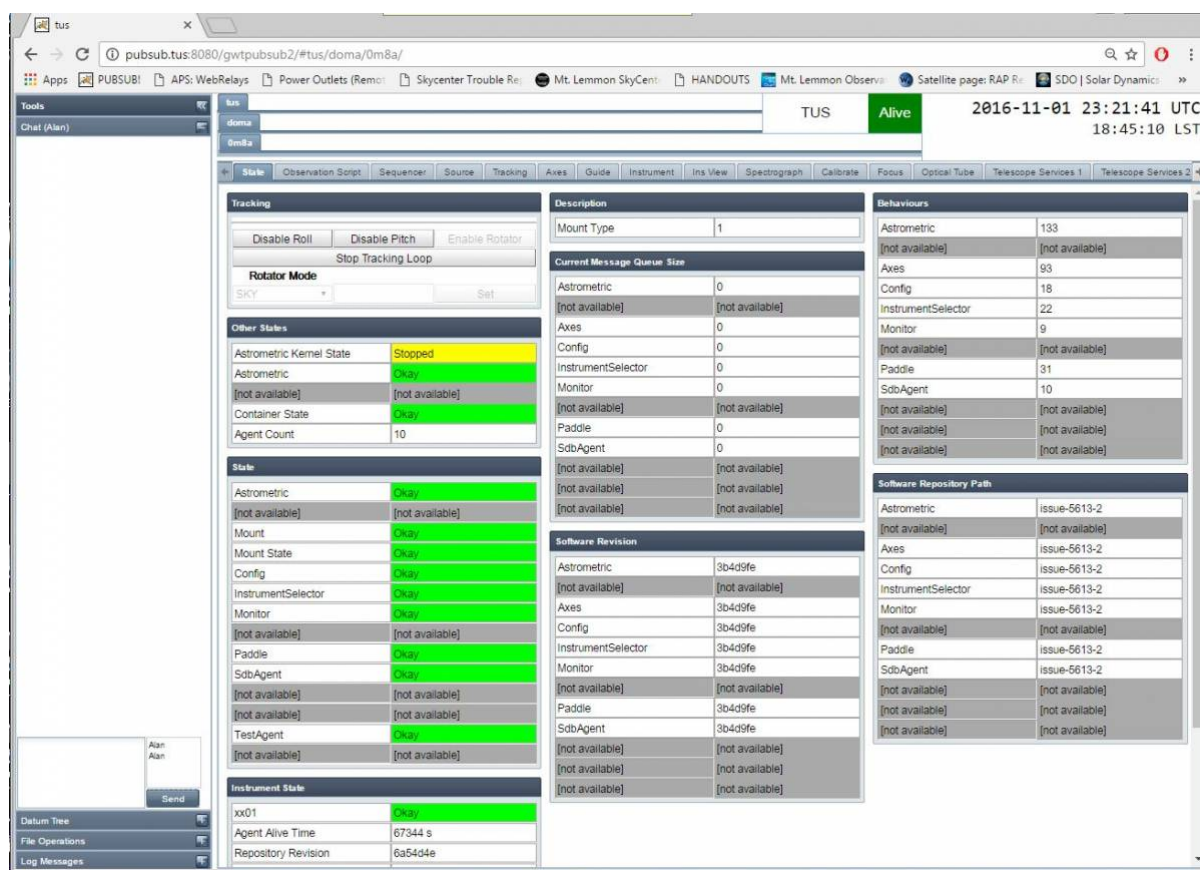
1.
 2. The log on name is unimportant. However *default* is required for the Config File field.
 3. Press the “OK” button to continue.
2. Wait for PubSub to send all of the data to the browser. It will take 2-4 minutes. If you simply have a blank/white screen → going back to PubSub through VNC may be 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 “dome” 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 “dome.” 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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- 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 the 'Axes Command' panel in the Telescope Control Software. The panel is divided into two main sections: 'Agent Enable' and 'Agent Disable'. Under 'Agent Enable', there are three columns: 'Roll', 'Pitch', and 'Rotator'. Each column has a status indicator (Standby or Unhomed), a position/velocity selector (Pos/Vel), a numerical input field (0.0), and a unit (deg). Below these are buttons for Slew, Halt, Home, Park, Unwrap, Stop, Stop Reset, Enable, Disable, Goto Pos L1, Goto Neg L1, Recover L2, and Fault Reset. The 'Home' button is circled in the original image.

- 1.
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 a software interface for controlling 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. The 'Axes Command' section is divided into 'Agent Enable' and 'Agent Disable' columns. Each column contains three sub-sections: 'Roll', 'Pitch', and 'Rotator'. Each sub-section has a status field (e.g., 'Standby', 'Homing'), a position/velocity selector (radio buttons for 'Pos' and 'Vel'), a numerical input field (e.g., '0.0'), a unit label (e.g., '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. A red hand-drawn 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:

The screenshot displays the 'Axes' tab in the Telescope Control Software (TCS) interface. At the top, a navigation bar includes tabs for State, Observation Script, Sequencer, Source, Tracking, Axes (selected), Guide, and Instrument. Below this, the 'Agent State' section shows 'Mount' and 'Okay'. The 'Axes Command' section is divided into 'Agent Enable' and 'Agent Disable' tabs. Under 'Agent Enable', there are three columns: Roll, Pitch, and Rotator. Each column has a status indicator (e.g., 'Okay' for Roll and Pitch, 'Off' for Rotator), a 'Halted L1 Positive Limit' warning, and a position/velocity input field (e.g., '0.0 deg'). Below these are buttons for Slew, Halt, Home, Park, Unwrap, Stop, Stop Reset, Enable, Disable, Goto Pos L1, Goto Neg L1, Recover L2, and Fault Reset. At the bottom, there are additional buttons for Slew, Halt, Park, Home, and Stop.

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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

Apps

PUBSUB!

APS: WebRelays

Power Outlets (Remot

Skycenter Trouble Re

Mt. Lemmon SkyCent

HANDOUTS

Mt. Lemmon Observ

Satellite page: RAP R

SDO | Solar Dynamics

Tools

Chat (Alan)

tus

doma

0m8a

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

PointNext

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	3.66 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

Stop

Moon

Flat

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:

Humidity:

Temperature:

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

Datum Tree

File Operations

Log Messages

Alan

Send

5.

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

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