# 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. The screen will turn on when you plug in the large UPS-however it is not yet delivering power. Follow the screen instructions and press the "power" button to start delivering power. (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

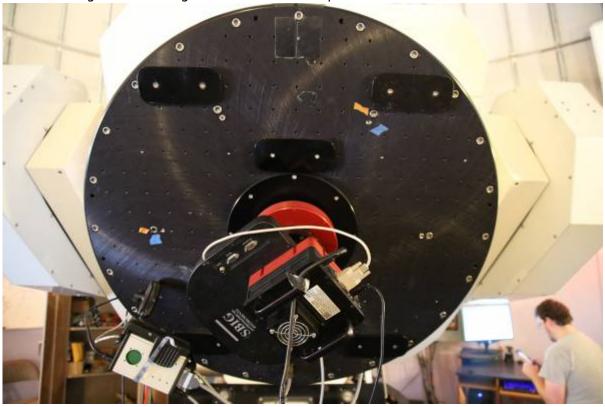
Before turning on the controller (or moving the telescope for normal operation) examine the RA axis optical tape for signs of water condensation or insect "residue." This must be cleaned before operation. Make certain both the drive and idler bearings are also free of anything that might be transferred 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:





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.

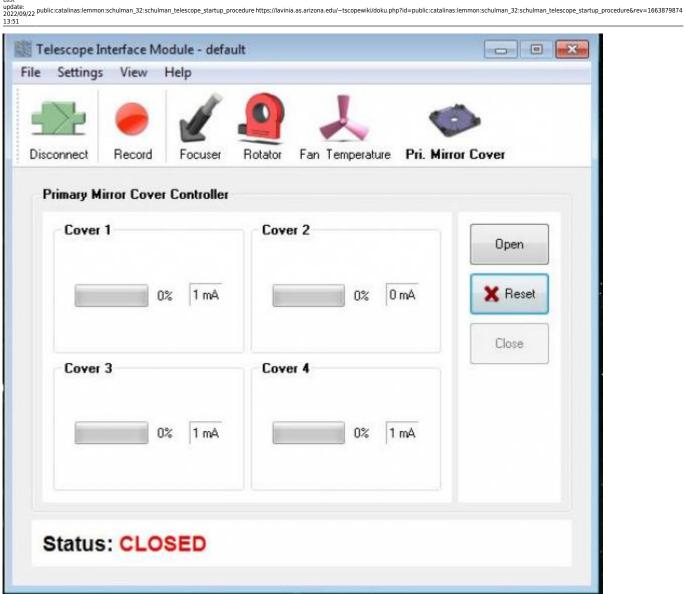
#### Turn on the TIM Unit, Connect, and Open Mirror Covers

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.

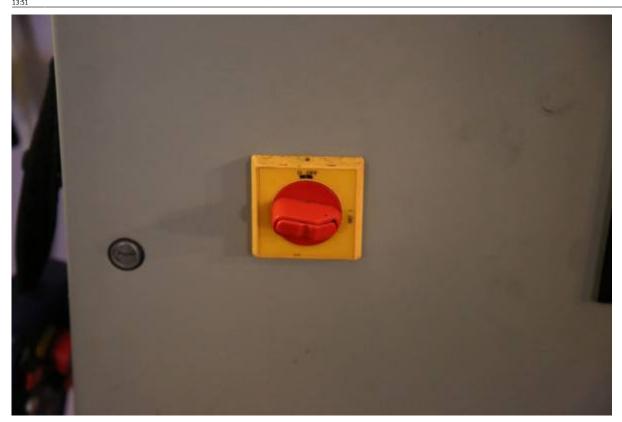


Open the Mirror Covers:

connect Record Foc	user Rotator Fan Temperature	Pri. Mirror Cover
Primary Mirror Cover Contr	oller	
Cover 1	Cover 2	Open
0% 1	mA 0% 1	mA Keset
		Close
Cover 3	Cover 4	
0% 0	mA 0% 1	mA

## **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:

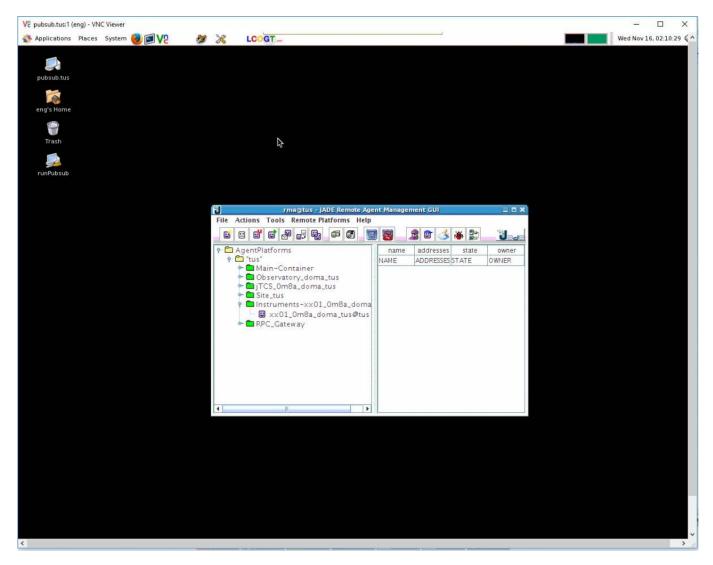
V2 VNC Viewer			
VNC® Vie	wer		Ve
VNC Server:	lune.as.arizona.edu:4260		~
Encryption:	Let VNC Server choose		~
About	Options	Ι	Connect

(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:

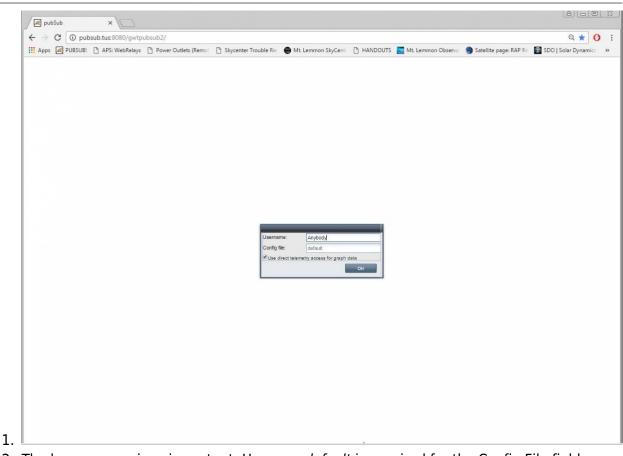


The small icons to the right of processes can be pressed to expand them and reveal the list as shown. Once the "Instruments-xx01\_0m8a\_doma" process is loaded under its section PubSub is ready to communicate with the telescope (and the user). The "RPC\_Gateway" process will not show up until communication 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:



The log on name is unimportant. However *default* is required for the Config File field.
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  $\rightarrow$  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.

← → C ① pubsub.tus:8							् ★ ।
Apps 🛃 PUBSUB! 🗋 APS: V	WebRelays 🗋 Power Outlets	(Remo: 🗋 Sk	ycenter Trouble Rep	🖨 Mt. Lemmon SkyCenti  🗋	HANDOUTS 🔝 Mt. Lemmon	Observa 🕘 Satellite page: RAP Re	SDO   Solar Dynamic
Tools   Chat (Alan)	tus doma				TUS	Alive 2016-1	1-01 23:20:49 18:44:1
	Weather Site Boltwoo	od Thresholds	Activity Config	Harvest Reduction Services	Power		
	Agent State			Overrides		Infrastructure	
	Weather	Okay		Cloud Override	False	Sems Version	
				Sun Override	False	Panel Temp	0 °C
	Weather Control			Values	4	Battery Voltage	0V
		Overrides				Last Reading	A DESCRIPTION OF THE OWNER OWNER OF THE OWNER
	Cloud	Enable	Disable	Air Temp	0.0 °C	Watchdog Errors	0
	Sun	Enable	Disable	Barometric Pressure	0.0 mbar	Weather System Type	DUMMY
	Countdown to Open		Reset	Dew Point	0.0 °C	Weather System Url	
	Limits One			Electric Field	0 V/m		
		-		Humidity	0 %	Moon	
	Ok To Open	False		Weather Leaf Sensor Voltag	e Val0 mV	Topocentric Right Ascension	16:11:02.796 h
	Countdown To Open	0 sec		SQM Sky Brightness	0.00 mag/arcsec^2	Topocentric Declination	-16:40:53.857 deg
	Interlock Reason	Sun Up		Solar Insolation	0 W/m/m	Zenith Distance	61.29 deg
	Threshold Class			Wind Direction	0 deg	Azimuth	222.61 deg
	Limits Two			Wind Direction Avg	0 deg	Angular Diameter	0.49 deg
	Ok To Open	False		Wind Speed	0.00 m/s	Illumination Fraction	0.044
	Countdown To Open	0 sec		Wind Peak 12 seconds	0.00 m/s		a December 20
	Interlock Reason	Sun Up	S	Wind Peak 10 minutes	0.00 m/s	Sun	
	Threshold Class	Sun Op		Weather Rain Alert	Clear	Topocentric Right Ascension	14:30:14.616 h
	Threshold class			Particulates (1 micron)	0 parts/m^3	Topocentric Declination	-14:48:12.161 deg
	Limits Three			Boltwood Transparency Ave	rage NaN %	Zenith Distance	76.89 deg
	Ok To Open	False		Boltwood Sky Minus Ambien	t Av NaN *C	Azimuth	242.68 deg
	Countdown To Open	0 sec				Angular Diameter	0.54 deg
	Interlock Reason	Sun Up		Failures		Morning Astronomical Twlight	12:17:44.304 h
	Threshold Class	- Sur Op		Battery State		Morning Civil Twilight	13:15:31.680 h
				Electric Field Sensor State		Sunrise	13:40:55.524 h
	All Sky Camera			Humidity Sensor State		Sunset	00:33:00.972 h
Alan Alan				Leaf Sensor State		Evening Civil Twilight	00:58:21.720 h
	no alisky	camera		Particulate Sensor State		Evening Astronomical Twilight	01:56:04.272 h
Send	i lio ansky	camera	avanabic	Pressure Sensor State			
				Rain Sensor State		5ky	
	F			Sky Brightness Sensor State		Illumination	18150.0541 lux
File Operations	<del>7</del>			Solar Sensor State		Brightness Ratio	9075027 07

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.

$\epsilon \rightarrow c$	Dubsub.tus:8080	)/gwtpubsub2/#	#tus/doma/						२ 🛧 🚺
🚻 Apps 😹 P	UBSUB! 🗋 APS: Web	Relays 🕒 Powe	er Outlets (Remo	🖻 S	kycenter Trouble Re	Mt. Lemmon SkyCent	💾 HANDOUTS 🔜 Mt. Lem	mon Observa 🛛 🎯 Satellite	page: RAP Re 🛛 📓 SDO   Solar Dynamics
Tools	रर	tus					ти	S Alive	2016-11-01 23:21:19 0
Chat (Alan)	5	doma					10	Juive	18:44:49
		Om8a							
		Enclosure Contro	Facility Servic	pes por	wer Observatory Con	fig Dome Telemetry			
		Agent State				Shutters		Services	
		[not available]	2	Inot av	vailable]	[not available]	[not available]	[not available]	[not available]
		[Proto a tonica of		C. State		[not available]	[not available]	[not available]	[not available]
		Enclosure				[not available]	[not available]	[not available]	[not available]
			Shutter	r Control		[not available]	[not available]	[not available]	[not available]
			pen	Both	•	[not available]	[not available]	[not available]	[not available]
		CI	lose	Both	•	(not available)	[not available]	[not available]	[not available]
		-		top	-	[not available]	(not available)	[not available]	[not available]
			r Faults Iate On	-	Reset PLC Simulate Off	[not available]	(not available)	[not available]	[not available]
		Simu	iate On		Simulate Oil	[not available]	(not available)	[not available]	[not available]
				h Contro		[not available]	[not available]	[not available]	[not available]
			ilew		deg	[not available]	[not available]	[not available]	[not available]
			sync	_	deg	[not available]	[not available]	[not available]	[not available]
			t Park		deg	[not available]	[not available]	[not available]	[not available]
			ark	-	Home	[not available]	[not available]	[not available]	[not available]
			itop Halt		Stop Reset	[not available]	[not available]	[not available]	[not available]
			late On		Clear Faults Simulate Off	[not available]	[not available]	[not available]	[not available]
		Slave	Slaved: [	not avai	Slaved To: [not availab	Azimuth		[not available]	[not available]
		0m8a	• Or		Off	[not available]	(not available)	Altitude	
				gent		[not available]	[not available]	[not available]	[not available]
		1		eset		[not available]	[not available]		
		Building		[not available]	[not available]	Webcam (wcama.	doma.tus.lco.gtn)		
		Lights		On	Off	[not available]	[not available]		
		-				[not available]	[not available]		
		Weather		rrides able	Disable	[not available]	[not available]		
		Power		able	Disable	[not available]	[not available]		
	Alan Alan	AntiFlap	Re	eset	[not available]	[not available]	[not available]		
						[not available]	[not available]		
	Send					[not available]	[not available]		
Datum Tree						[not available]	[not available]		
File Operations						[not available]	[not available]		
Log Messages	5					[not available]	[not available]		

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).

Last update: 2022/09/22 public:catalinas:lemmon:schulman_32:schulman_telescope_startup_procedure https://lavinia.as.arizona.edu/~tscopewiki/doku.php?id=public:catalinas:lemmon:schulman_32:schulman_telescope_startup_procedure&rev=1663879874 13:51
--

	N PADS We	Belaur P Power Outlets (Re	mo: Pi Shurenter Trouble Re:	Mt Lemmon ShuCent		Obcenus 🚳 Satellite nane	e: RAP Re 🔤 SDO   Solar Dynamics
Tools		tus		Company of the common subsection of the			
Chat (Alan)	र स	doma			TUS	Alive 2	016-11-01 23:21:41
Crist (Autri)	le 1	0m8a					18:45:10
		+ State Observation Script				1	
		State Observation Script	Sequencer Source Tracking	Axes Guide Instrument	Ins view Spectrograph Calic	orate Focus Optical Tube	Telescope Services 1 Telescope Services 1
		Tracking		Description		Behaviours	
				Mount Type	1	Astrometric	133
			able Pitch Enable Rotator			[not available]	(not available)
		Rotator Mode	Tracking Loop	Current Message Queue Siz	•	Axes	93
		SKY *		Astrometric	0	Config	18
				[not available]	[not available]	InstrumentSelector	22
		Other States		Axes	0	Monitor	9
		Astrometric Kernel State	Stopped	Config	0	[not available]	[not available]
		Astrometric	Okay	InstrumentSelector	0	Paddle	31
		[not available]	[not available]	Monitor	0	SdbAgent	10
		Container State	Okay	[not available]	[not available]	[not available]	[not available]
		Agent Count	10	Paddle	0	[not available]	[not available]
		[hereiter and hereiter and here		SdbAgent	0	[not available]	[not available]
		State		[not available]	[not available]		
		Astrometric	Okay	[not available]	[not available]	Software Repository Pa	th .
		[not available]	[not available]	[not available]	[not available]	Astrometric	issue-5613-2
		Mount	Okay	Software Revision		[not available]	[not available]
		Mount State	Okay	Englishing and an and a second	Transmission	Axes	issue-5613-2
		Config	Okay	Astrometric	3b4d9fe	Config	issue-5613-2
		InstrumentSelector	Okay	[not available]	[not available]	InstrumentSelector	issue-5613-2
		Monitor	Okay	Axes	3b4d9fe	Monitor	issue-5613-2
		[not available]	[not available]	Config	3b4d9fe	[not available]	[not available]
		Paddle	Okay	InstrumentSelector	3b4d9fe	Paddle	issue-5613-2
		SdbAgent	Okay	Monitor	3b4d9fe	SdbAgent	issue-5613-2
		[not available]	[not available]	[not available]	[not available]	[not available]	[not available]
		[not available]	[not available]	Paddle	3b4d9fe	[not available]	[not available]
	Alan	TestAgent	Okay	SdbAgent	3b4d9fe	[not available]	[not available]
	Alan	[not available]	[not available]	[not available]	[not available]		
		Instrument State		[not available]	[not available]		
	Send			[not available]	[not available]		
Datum Tree		xx01	Окау				
File Operations		Agent Alive Time	67344 s				

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.

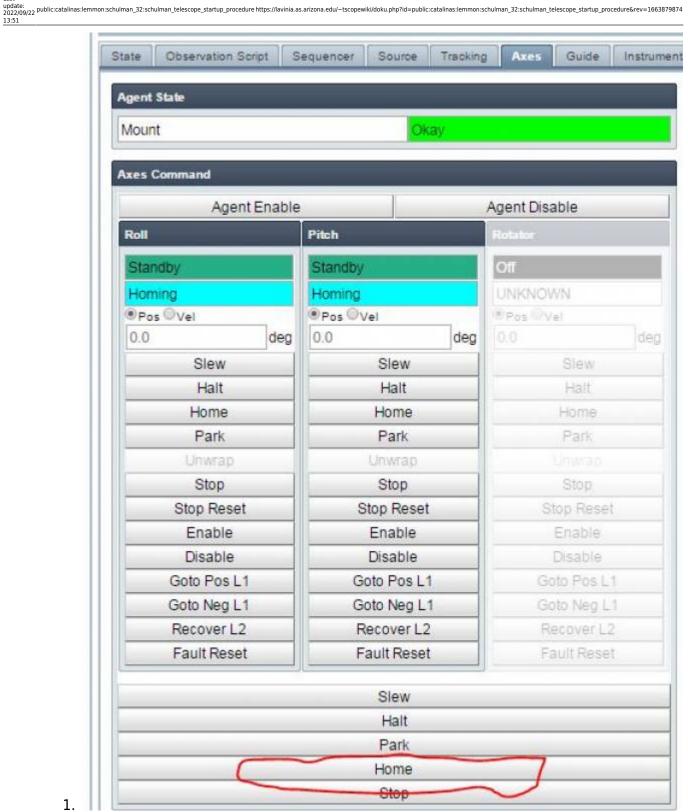
#### Homing the Schulman Telescope

The telescope must be homed before it can be operated.

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

tate Observation Script Sagent State	Sequencer Source	Trackin	g Axes	Guide	Instru			
Mount		kay	uncered @ 20	151116	0.0.50			
Axes Command			uspenu @ zv	10-11-10	96196			
Agent Enable	e		Agent Disab	le				
Roll	Pitch		Rotator					
Standby	Standby		OIT					
Unhomed	Unhomed		UNKNOWN	i.				
Pos OVel	● Pos © Vel		(Pos Ovel					
0.0 deg	0.0	deg	0.0		deg			
Slew	Slew			Slew				
Halt	Halt			Halt				
Home	Home		ŀ	lome				
Park	Park	Park						
Unwrap	Unwrap		0					
Stop	Stop			Stop				
Stop Reset	Stop Res	Stop Reset						
Enable	Enable	Enable			Enable			
Disable	Disable	Disable						
Goto Pos L1	Goto Pos	.1	Goto	Pos L1				
Goto Neg L1	Goto Neg	_1	Goto	Neg L1				
Recover L2	Recover L	2	Rec	over L2				
Fault Reset	Fault Res	et	Fau	it Reset				
	Slew		8 m -		_			
	Halt							
	Park							
	Home							
	Stop							

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



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

Mount			Oka	y.				
Axes Command							_	
	ent Enable	N	1		Agent D	isable		
Roll		Pitch			Rotator			
Okay		Okay			Off			
Halted L1 Positiv	e Limit	and the second second	L1 Positive L	imit	UNKN	OWN		
● Pos ◎Vel		· Pos			Pos			
0.0	deg	0.0		deg			de	
Slew		1	Slew			Slew		
Halt		Halt			Halt			
Home		Home			Home			
Park			Park Par				Park	
Unwrap		Unwrap						
Stop		Stop				Stop		
Stop Res	et	1	Stop Reset		Stop Reset			
Enable		Enable			Enable			
Disable			Disable		Disable			
Goto Pos	L1		Goto Pos L1 Goto			Goto Pos L1		
Goto Neg	L1	Goto Neg L1			Goto Neg L1			
Recover l	.2	Recover L2			Recover L2			
Fault Res	et	-	Fault Reset			Fault Reset		
	-		Slew					
			Halt					
			Park					
			Home					

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.

1.

← → C ① pubsub.tus:808	0/gwtpubsub2/#tus/doma/0m	8a/Source						Q & C
Apps Apps PUBSUB! D APS: We	bRelays 📋 Power Outlets (Remo	Skycenter Trouble Re:	Mt. Lemmon SkyCent	HANDOUTS	Mt. Lemmon Obs	erva 🕘 Satellite page: RAP Re	SDO   Sola	r Dynamics
Tools एर Chat (Alan) 🗲	tus doma OmBa		~		TUS	Alive 2016-	11-01 23 18	:25:14 8:48:46
	* State Observation Script S	equencer Source Tracking	Aves Guide Instrument	Ins Vew Sp	ectrograph Calibrate	Focus Optical Tube Telesco	ipe Services 1	Telescope Ser
	Agent State		Source Selection			Refraction		
	Astrometric	Okay	Astrometric Kernel State:	Stopped		Pressure:		mbar
	Lisenau I		and the second			Humidity:		%
	Point		Known objects:		• Go	Temperature:		°C
	Point/Next St		Source Name:	none	Fetch Clear	Apply	Override	
	Skip Sto		▼ Coordinates			Clear	Override	
	Goto nearest pointing s	tar Clear local offsets	Coordinate System:	APPARENT_H	A •	Tracking		_
	Source		Hour Angle:	0	h			
	Name		Declination:	32	deg	Disable Roll Disab	e Pitch Er	nable Rotato
	Right Ascension Source	NaNh	Space Motion			Stop Tra	cking Loop	
	Declination Source	NaN deg	Orbital Elements	Marca in 10		Rotator Mode		
	Coordinate System		► When?	Where is it?		SKY *		Set
	Equinox Source	NaN yr	a second s	ere will it be?	-	Refraction		
	Limit Expected	Horizon Limit	Clear local offsets	1			Teles.	
	Limit Time Left	3.65 h	Go	Moon		Manual Override	False 0 *C	
	Moon Zenith Distance	61.89 deg	Stop	Unwrap 8	Roll Unwrap Rot	Air Temperature Value Barometric Pressure Value	0 mbar	
	Sun Zenith Distance	77.69 deg	Time			Humidity Value	0 %	
	-		Local Apparent Sidereal T	ime 18:48:46	944 h	Wavelength	0.6000 um	
	Telescope		Modified Julian Day	57693.97	Madelind states	Guiding Wavelength	NaN um	
	Tracking In Tolerance	Out Of Tolerance	Julian Epoch	2016.836				
	Air Mass	2.3429	TAI Minus UTC	36 s		Pointing Control		
	Altitude	25.15 deg	TT Minus TAI	32.1840	s	M1 and M2 Alignment	False	Enable
	Azimuth	179.23 deg	UT1 Minus UTC	-0.3238 \$	3	Collimation		1
	Hour Angle	-00:03:18.493 h	6	1		Roller Encoders	False	Enable
	Zenith Distance	64.8 deg	Orbital Element			Encoder Non-Linearity	False	Enable
Alan	Sun Separation	132.20 deg	Source Orbital Element So	cheme		Pointing Corrections		
Alan	Moon Separation	47.44 deg	Source Orbital Element Ar	gumer NaN deg		Polar Motion X	0.1892 arcsed	
	Space Motion		Source Orbital Element D	aily Mo NaN deg		Polar Motion Y	0.2811 arcsec	
Send	Source Space Motion Enabled	false	Source Orbital Element Er			Collimation Correction Enabled		
Datum Tree	Source Parallax	NaN arcsec	Source Orbital Element El			Collimation Correction Pitch	0 arcsec	
		NaN yr	Source Orbital Element E	boch O NaN MJI	0	Collimation Correction Roll	0 arcsec	

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

