# 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.

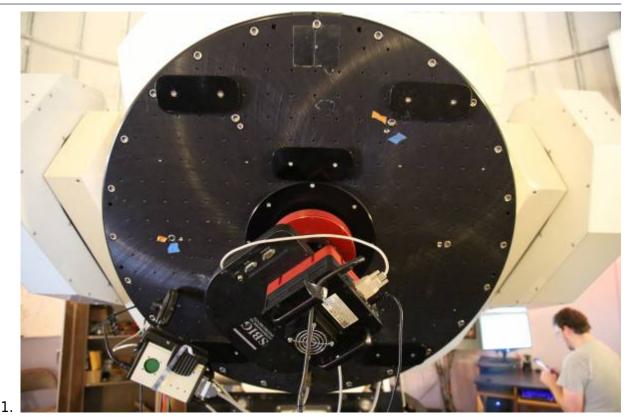
## Check the RA Optical Tape and Read Heads

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:



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.

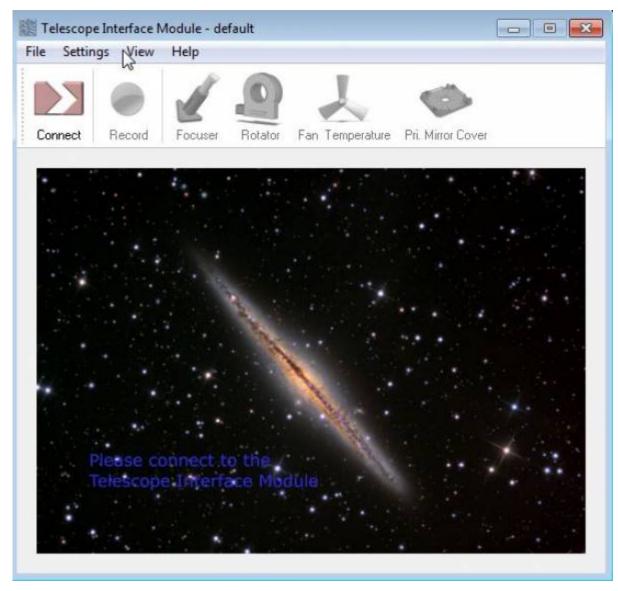
#### Turn on the TIM Unit, Connect, and Open Mirror Covers

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.

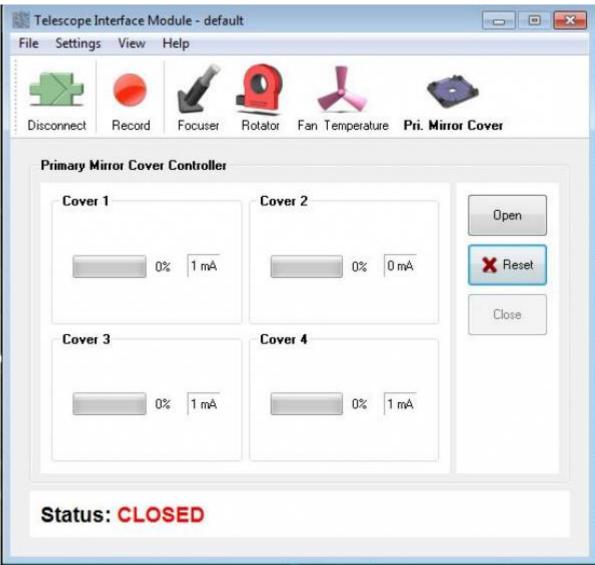
Next on the computer open the RCOS TIM software.

https://lavinia.as.arizona.edu/~tscopewiki/





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

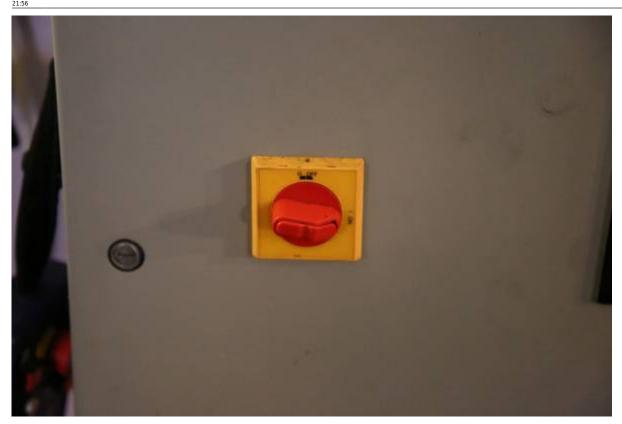


Open the Mirror Covers:

connect Record Focuser	Rotator Fan Temperature Pri. Minn	or Cover
Primary Mirror Cover Controller		
Cover 1	Cover 2	Open
0% 1 mA	0% 1 mA	X Reset
Cover 3	Cover 4	Close
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:

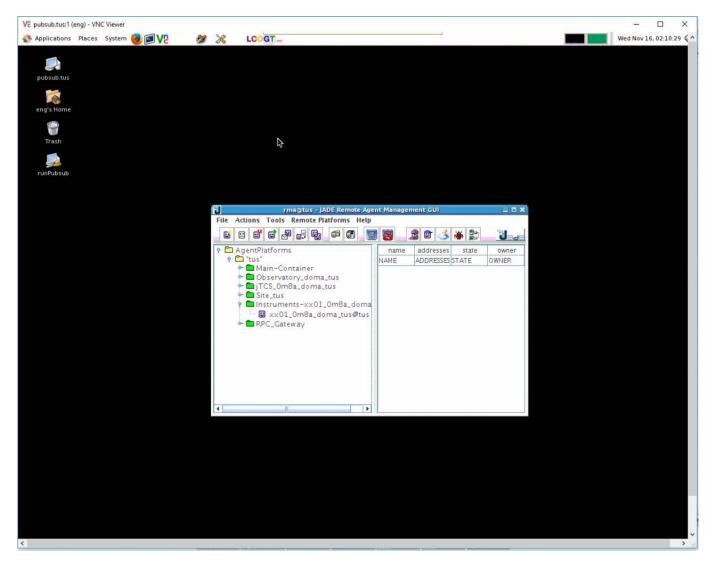
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(It is assumed the user has the password.)

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:

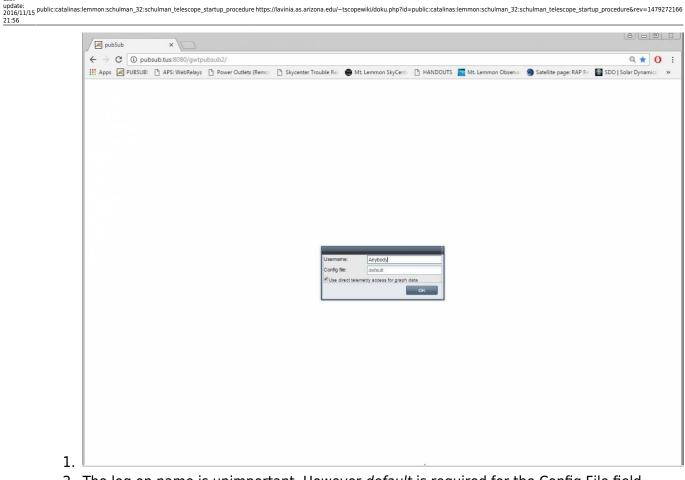


The small icons to the right of processes can be pressed to expand them and reveal the list as shown. Once the "Instruments-xx01\_0m8a\_doma" process is loaded under its section PubSub is ready to communicate with the telescope (and the user). The "RPC\_Gateway" process will not show up until communication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



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  $\rightarrow$  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.

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Tools   Chat (Alan)	tus doma				TUS	Alive 2016-1	1-01 23:20:49 18:44:1
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	Agent State			Overrides		Infrastructure	
	Weather	Okay		Cloud Override	False	Sems Version	
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	Weather Control				4	Battery Voltage	0V
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	Countdown To Open	0 sec		SQM Sky Brightness	0.00 mag/arcsec^2	Topocentric Declination	-16:40:53.857 deg
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	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
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	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
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	All Sky Camera			Humidity Sensor State		Sunset	00:33:00.972 h
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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.

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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).

update: 2016/11/15 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=147927216f 21:56
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ile 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.

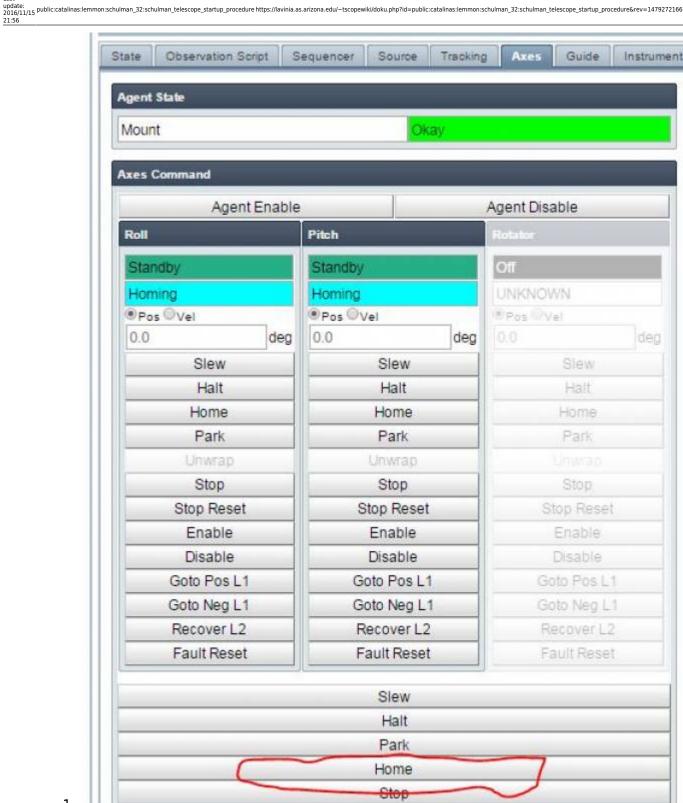
#### Homing the Schulman Telescope

The telescope must be homed before it can be operated.

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

Mount						
	Okay	Suspend @ 2016-11	-16.024			
ixes Command		anaberia of seve as				
Agent Enable		Agent Disable				
Roll	Pitch	Rotator				
Standby	Standby	Off				
Unhomed	Unhomed	UNKNOWN				
Pos      Vel	Pos  Vel	(6 Pos Ovel				
0.0 deg	0.0	eg 0.0	d			
Slew	Slew	Slew				
Halt	Halt	Halt				
Home	Home	Home				
Park	Park	Park	Park			
Unwrap	Unwrap	Unweat	Unwrag			
Stop	Stop	Stop	Stop			
Stop Reset	Stop Reset	Stop Res	Stop Reset Enable Disable			
Enable	Enable	Enable				
Disable	Disable	Disable				
Goto Pos L1	Goto Pos L1	Goto Pos	L1			
Goto Neg L1	Goto Neg L1	Gota Neg	L1			
Recover L2	Recover L2	Recover	L2			
Fault Reset	Fault Reset	Fault Res	set			
	Slew					
	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.



- 1.
- 1. The most important tabs are Source, Axes, and Tracking. Only the Source tab will be illustrated here as it is where controls for moving the telescope are found.
- 2. The top center of the Source tab has a section labeled "Source Selection." This is the section for the telescope movement controls.

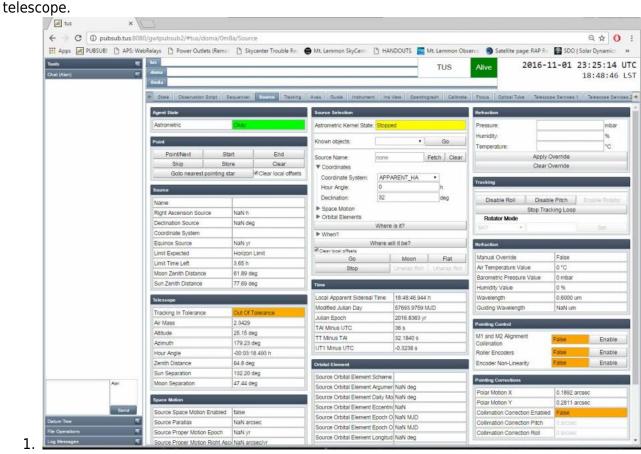
1.

3. Under the "Coordinate System" select "Apparent HA." This is typically the engineering method for moving the telescope to particular positions. "Alt\_AZ" (Altitude, Azimuth) is another. Please read the section on Astronomical Coordinates Review for more information on the range of values for this coordinate systems.

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	Hour Angle	-00:03:18.496 h	UT1 Minus UTC	-0	3238 s		Roller Encoders	False	Enable
	Zenith Distance	64.8 deg	Orbital Element				Encoder Non-Linearity	False	Enable
	Sun Separation	132.20 deg	Source Orbital Element	Scheme		_			
Alan	Moon Separation	47.21 deg	Source Orbital Element		N deo		Pointing Convetions		
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4. Now input an Hour Angle and Declination that corresponds to the desired position. Shown below is the input for Zenith. Press the "GO" button that is below the coordinate systems to move the

1.



5. Once the telescope reaches the desired position it will be tracking at the sidereal rate. Note that "Astrometric Kernal State" is green and reads "Tracking." In addition the "Tracking Tolerance" field reads "In Tolerance."

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		Zenith Distance	64.8 deg	Orbital Element			Encoder Non-Linearity	False	Enable
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- 1000 - 1010-	Dent	Source Space Motion Enabled	false	Source Orbital Element Epo	0010100000		Collimation Correction Enable		
atum Tree le Operations		Source Parallax	NaN arcsec	Source Orbital Element Epo	th O NaN MJD		Collimation Correction Pitch	B arcsiec	
	10	Source Proper Motion Epoch	NaN yr	Source Orbital Element Long			Collimation Correction Roll	D alcostc	

6. In order to keep the telescope at a particular position the Tracking must be stopped. Press the

1.

"Stop Tracking Loop" in the "Tracking Section" to the right of the coordinate systems. Once pressed the state of the system will be as the below:

and the second sec		0/gwtpubsub2/#tus/doma/0ml								Q # 0
Apps 🙀 PUBS	UBI 🕒 APS: We	bRelays 📋 Power Outlets (Remo	Skycenter Trouble Re	Mt. Lemmon SkyCenii [	3 HANG	DOUTS	Mt. Lemmon Ob:	erva 🧐 Satellite page:	RAP Re 🔤 SDO	0   Solar Dynamic: )
net (Alen)	स म	tus doma Bridia			_	_	TUS	Alive 20	16-11-01	23:22:24 U 18:45:54 L
		State Observation Script S	equences Source Tracking	Axes Guide Instrument	Ins Vi	ew Speci	rograph Calibrate	Focus Optical Tube	Telescope Service	s 1 Telescope Service
		Agent State		Source Selection				Refraction		
		Astrometric	Okay	Astrometric Kernel State:	Stopped			Pressure:		mbar
				2002/02/02/02/02/02/02/02/02/02/02/02/02				Humidity:		96
		Point		Known objects:			Go	Temperature:		°C
		Point/Next Sta		Source Name:	none		Fetch Clear		Apply Override	
		Skip Sto	And the second sec	▼ Coordinates					Clear Override	
		Goto nearest pointing st	ar Clear local offsets	Coordinate System:	ICRS		•	Tracking		
		Source		Right Ascension:	0.0		h			
		Name		Declination:	0.0		deg	Disable Roll	Disable Pitch	Enable Rotator
		Right Ascension Source	NaN h	Space Motion					top Tracking Loo	p
		Declination Source	NaN deg	Orbital Elements	Where is	s it?		Rotator Mode		
		Coordinate System		▶ When?				1 364 A. 1		Set.
		Equinox Source	NaN yr		here will	it be?		Refraction		
		Limit Expected	HA Lower Limit	Clear local offsets GO		Moon	Flat	Manual Override	False	
		Limit Time Left	0.00 h	Stop		Inwrae Rol		Air Temperature Value	0 °C	
		Moon Zenith Distance	61.50 deg	1.00 Kee			- In Standard Standard	Barometric Pressure V	alue 0 mbar	il .
		Sun Zenith Distance	77.17 deg	Time			3	Humidity Value	0 %	
		Telescope		Local Apparent Sidereal T	Time	18:45:55.26	i0 h	Wavelength	0.6000	um
		Tracking In Tolerance	Out Of Tolerance	Modified Julian Day		57693.9739	MJD	Guiding Wavelength	NaN u	m
		Air Mass	2.3445	Julian Epoch		2016 8363	ут	Painting Control		
		Atitude	25.14 deg	TAI Minus UTC		36 s	-			
		Azimuth	179.32 deg	TT Minus TAI		32.1840 s		M1 and M2 Alignment Collimation	False	Enable
		Hour Angle	-00:02:54.704 h	UT1 Minus UTC	1	-0.3238 s		Roller Encoders	False	Enable
		Zenith Distance	64.9 deg	Orbital Element			27	Encoder Non-Linearity	False	Enable
		Sun Separation	132.16 deg	Source Orbital Element S	cheme					
	Alan Alan	Moon Separation	46.76 deg	Source Orbital Element A		NaN deg		Pointing Corrections	11000000	
		Space Motion		Source Orbital Element D	and a state of the			Polar Motion X	0.1892	1
	Send			Source Orbital Element E	CONTRACTOR INC.			Polar Motion Y	0.2811	arcsec
um Tree		Source Space Motion Enabled	false	Source Orbital Element E	poch O	NaN MJD		Collimation Correction	Contraction of Charlins of Charles	
Operations		Source Parallax	NaN arcsec	Source Orbital Element E	poch O	NaN MJD		Collimation Correction	and a local diversion of the local diversion	
Contraction of the	1.1	Source Proper Motion Epoch	NaN yr NaN arcsec/yr	Source Orbital Element L	onoitud	NaN deg		Collimation Correction	Roll 0 arcsa	

2. The "Astrometric Kernal" reads "Stopped" and the "Tracking Tolerance" field reads "Out of Tolerance."

