

Mees Observatory telescope checklist

Last revised 4 September 2023 DMW

This guide is meant to be used as a cookbook, not for light reading, or as a tutorial in observations. Have it at hand at the beginning of observations or tours. Always **follow the steps as they appear in these pages, as you would a recipe**. Even if you usually remember everything, it will still prove useful to follow the written steps.

Please call Kelly (215-622-1703) or Dan (585-414-1004) to be talked through any problems you have with telescope or instruments.

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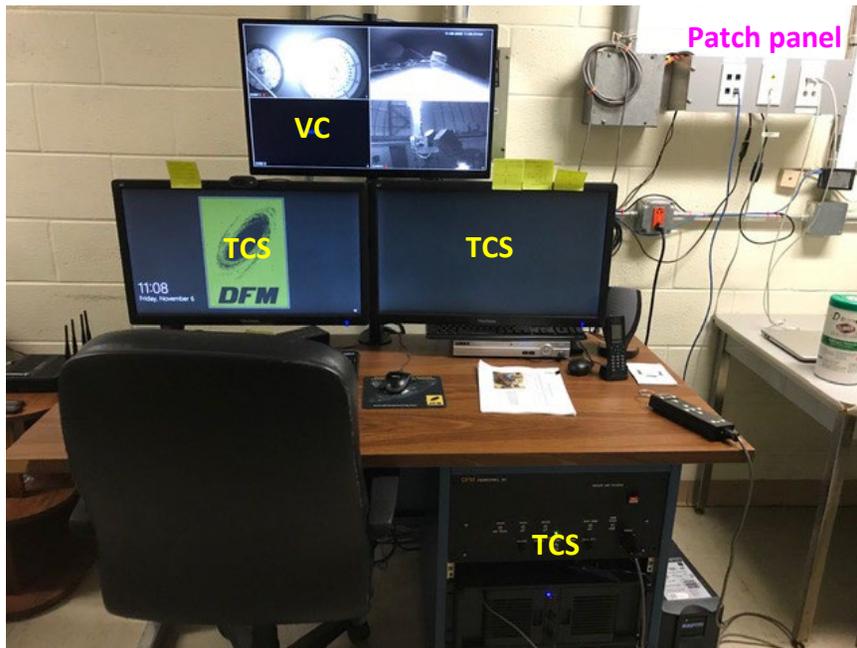


Figure 1: The Mees Observatory **telescope control system (TCS)** console, with its computer and three monitors. Uppermost is the video-camera (VC) monitor screen, which is connected to the DVR below and behind the right-hand TCS monitor. Also labelled is the patch panel at the end of data cables from the telescope and instruments.

I. Telescope startup

The telescope and most of its systems stay on all the time, to facilitate remote access to the TCS and remote observations. If all is well you will find that

- All the circuit breakers are switched on, the TCS rack is plugged in and powered on, and the TCS computer is up and running.
- The output of four video cameras is on display, on a monitor independent of the TCS.
- The weather station program WeatherLink is running, with your choice of displays on the TCS monitor (Figure 2).
- The telescope is pointing at zenith, with the cover closed.
- Both dome shutters are closed, and the dome is parked in its home position at an azimuth of 100.5 degrees.

If the outdoor relative humidity is greater than 95% according to the weather-station readout (Figure 2), STOP. You may not open the dome or the telescope cover until the relative humidity is below 95%.

If the relative humidity is below 95% – and of course if the weather is promising in other respects, with low (< 15 mph) wind speed, no precipitation in sight, and clear skies on the way – you may proceed.

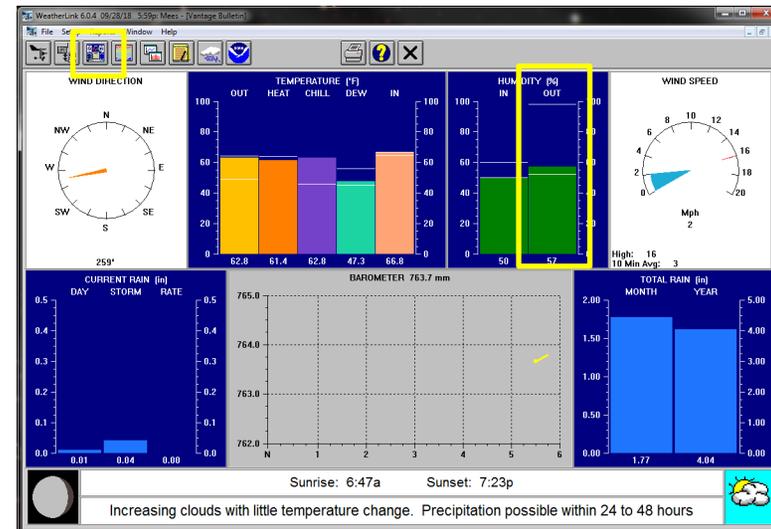


Figure 2: Current conditions at the Mees weather station, which is displayed by pushing the **Bulletin Window** banner button (indicated). Note the indoor and outdoor relative humidity values. The weather station itself is on top of the utility pole, across the driveway from the dome's loading dock.

Our weather station pushes its data to Weather Underground. Check it out on www.wunderground.com, in which it is known as personal weather station KNYNAPLE17.

Basic safety

Know how to use the **fire extinguishers**: pull the pin, squeeze the handle, aim, sweep the base of the fire, remove/escape, call 911.

There is a **first-aid kit** in the control room. Use it to stabilize injuries; call 911 in case of severe ones.

Keep **all liquids** far away from the electronics, computers, and network hardware.

1. Check switches on telescope control system front panel (Figure 3). The **HALT MOTORS** button should be in its Out position. All the switches on the upper row (**TRACK/OFF**, **TRACK/AUXILIARY TRACK**, **DRIVES**, **AUTO DOME**, **DOME TRACK**), and the **MTR DRIVER CHASSIS** switch (locking toggle switch between the fuses) should also be in the **UP** position. The lowest row of switches should have the **EAST/WEST** switch on **EAST**, and the **HARD LIMIT OVERRIDE** switch **OFF**. **Important note:** Always be sure that the TCS computer operator does not inadvertently hit any of the switches with their knees.

2. **If, and only if, you find the system completely shut down when you arrive:**
 - a. Turn on all circuit breakers in the breaker box by the front door. (The breakers marked with yellow tape are always on.) For tours, make sure that the solar lights are placed near the bottom stair.
 - b. Plug in the uninterruptible power supply, on the floor to the right of the TCS (Figure 3).
 - c. Turn on system power (middle switch in the lower row).
 - d. Turn on telescope control computer. This computer is the middle item in the TCS rack (Figure 3).
 - e. Let the TCS computer boot into Windows. Check the date and time, visible in the lower right corner of the screen: this should display the current **local** date and time (EST or EDT according to season; not UT).
 - f. Upstairs on the dome floor: make sure the dome motor is switched on, and that its signal switch is set to **REMOTE CONTROL** (Figure 4).



1

Initial switch settings:

Out

U-U-U-U-U

U

U-on-off

Figure 3: The Telescope Control System (TCS) front panel, and the settings that the switches should have when you enter the control room or start the system up from scratch (U = up, D = down).

Also labelled are the TCS computer and its uninterruptible power supply (UPS).

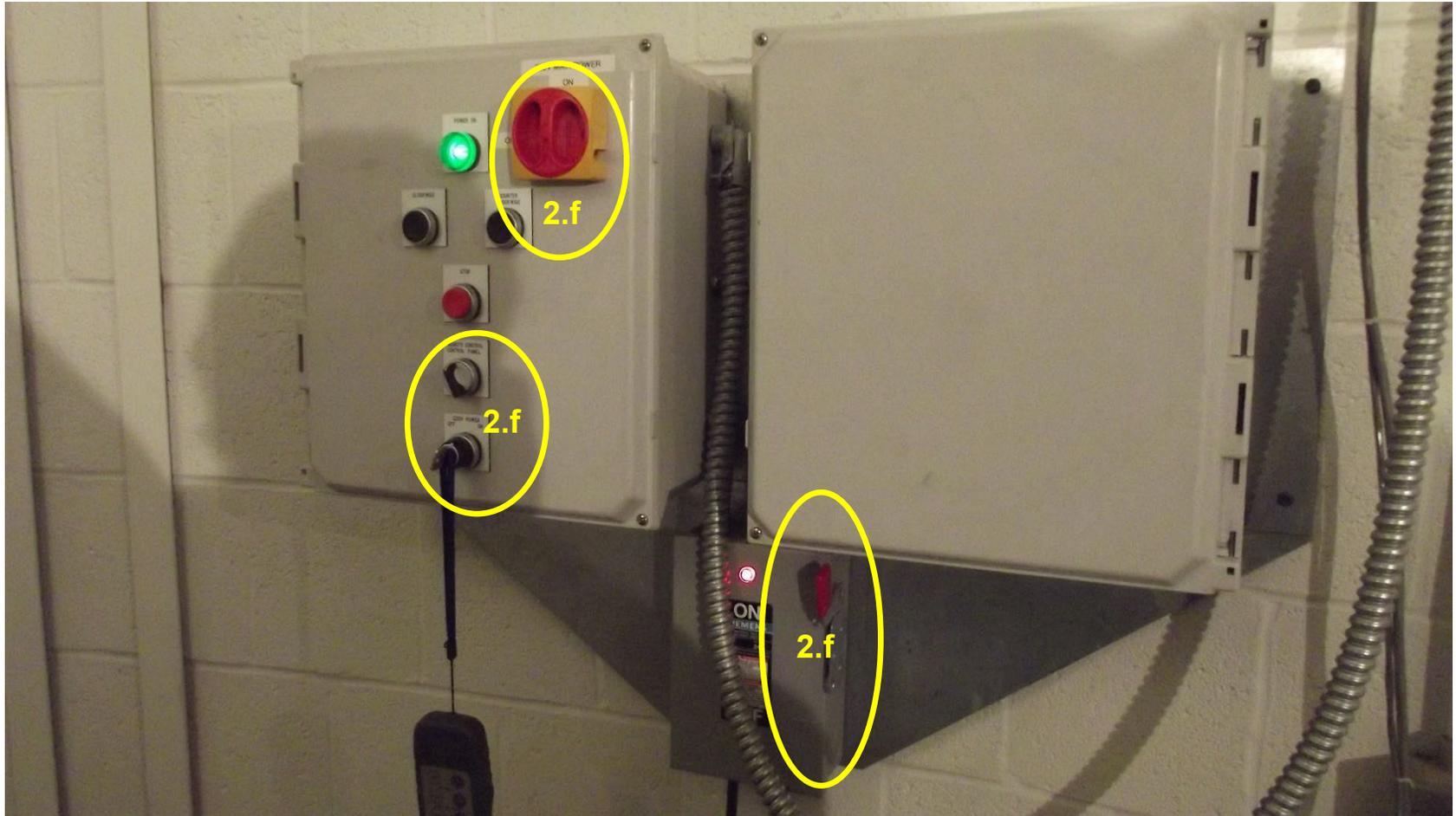


Figure 4: Dome-power connections and switches, which should always be left in the positions indicated.

If necessary: log into the TCS with username **DFM Engineering** and the (long) password written on the whiteboard in the control room.

Otherwise proceed to step 3.

3. Start the telescope control program, TCSGalil, by doubleclicking its desktop icon:



A second or two later, the TCS window will look like it does in Figure 5. The **Focus** value should be that for the CCD camera, somewhere around 3000. The precise value depends upon temperature. The dome azimuth should be around 100.5, **HA** close to zero, and **Dec** close to the observatory latitude, 42°42'. (If it is not, check FAQ #1, below.)

4. Check the **HA** and **Dec** values displayed in the TCSGalil window. Make sure they are close – within a minute or arc or 15 seconds of time – to the values shown on the telescope’s dials (Figure 6), and that **RA** and **ST** have the same values (Figure 5). **If they are not, then do the following:**
 - a. Use the paddle to slew the telescope precisely to zenith, according to the settings on the HA and Dec dials on the telescope’s RA drum (Figure 6). You can do this either from the control room, using the video-camera display of the dials, or from the dome floor, standing right in front of the dials.

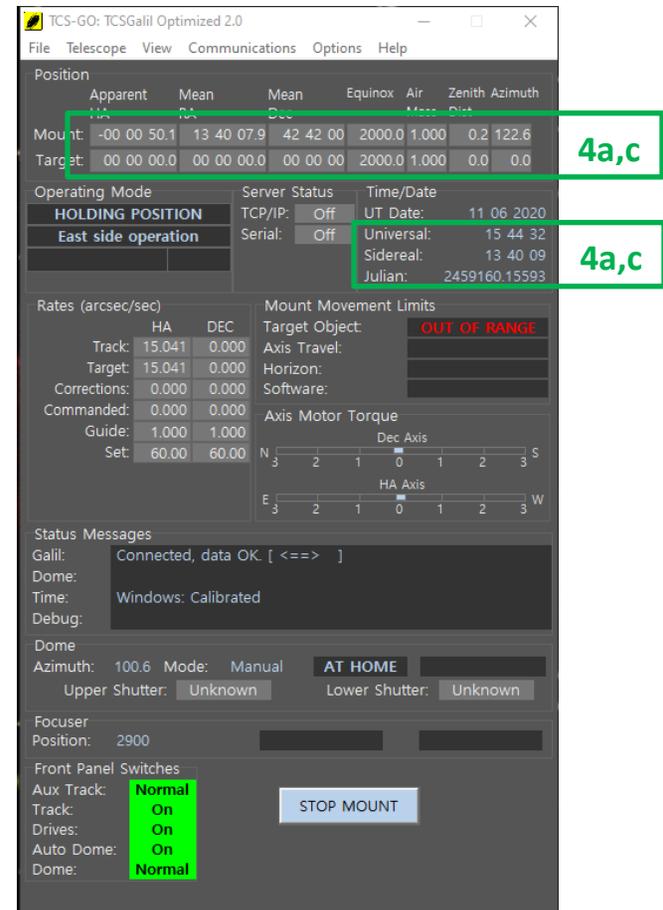
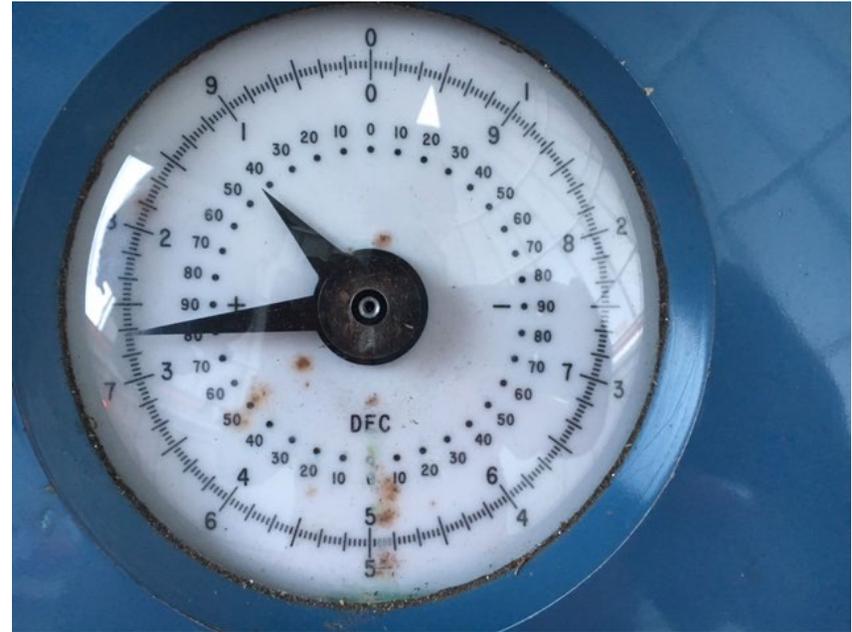


Figure 5: State of telescope after TCSGalil startup. Note that the telescope (“mount”) is pointed near zenith, where it was left by the previous observers; and that the dome has its home azimuth of 100.5°.



4a

Figure 6: Dial settings for telescope accurately pointed to zenith. The Dec dial (upper here, rightmost on telescope) needs to read the same as the observatory latitude, $+42^{\circ} 42'$, as one would expect. The HA dial (lower here, center on telescope) reads about $-0^{\text{h}} 1^{\text{m}}$, instead of $+0^{\text{h}} 0^{\text{m}}$ as one would expect.

- b. Return to TCSGalil, and use the commands in Telescope > Initialization (Figure 7), to tell the telescope mount it's pointing at zenith. That is, set Right Ascension equal to the sidereal time (ST) given on the TCSGalil main window (Figure 5), and Declination equal to the observatory latitude (42° 42' 01").

Note that these coordinates are automatically loaded into the Initialization dialog, so if you press the Apply button within a second or so of its appearance, the telescope position will be updated correctly without the necessity of typing in the ST.

- c. Then verify that this has been done correctly, by comparing ST with the telescope RA on the TCSGalil window (Figure 5). They should be the same, within a second or so; repeat Steps 4a-b if they aren't.

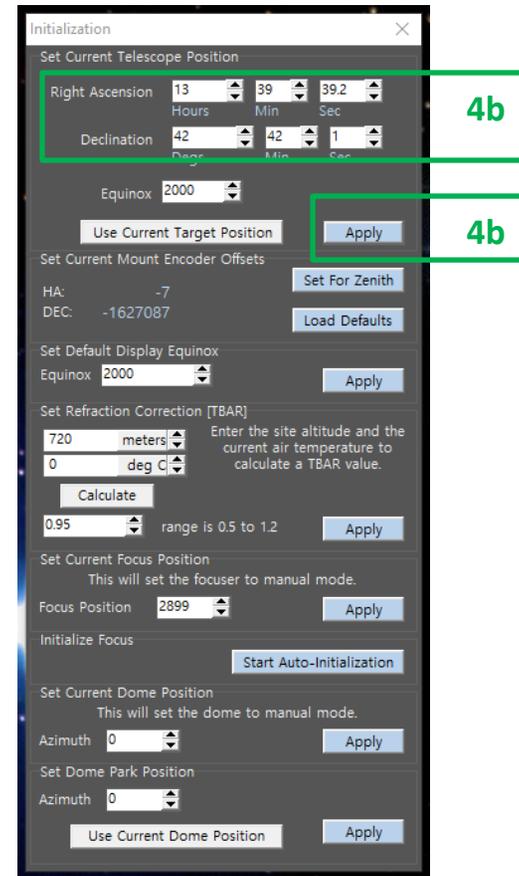
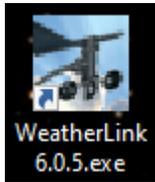


Figure 7: The Telescope > Initialization dialog box. The upper Apply button is the one you're looking for.

5. **If, and only if, it isn't already running** – for example, if the system was completely shut down when you arrived -- open **WeatherLink**, using its desktop icon. Push the banner buttons to get a variety of displays. Particularly useful is the **Bulletin Window** (Figure 8)



6. **Start Firefox**, using its desktop icon. Simply push the **Sign in** button to proceed once Firefox starts. Automatically, six tabbed windows will open. Left to right they are the telescope cover control (**TCC**), the video cameras (redundant for in-person observers), the latest NOAA GOES Band 7 cloud-cover image, the Mees home page, the Mees Wiki, and the IRTF calibration stars (Figure 9). **Do not open the telescope dust cover yet.**



If it's cloudy, stop here, until it's clear.

Monitor the cloud cover in the real time GOES Band 7 satellite image now open in Firefox, and on www.wunderground.com and/or www.weather.com.

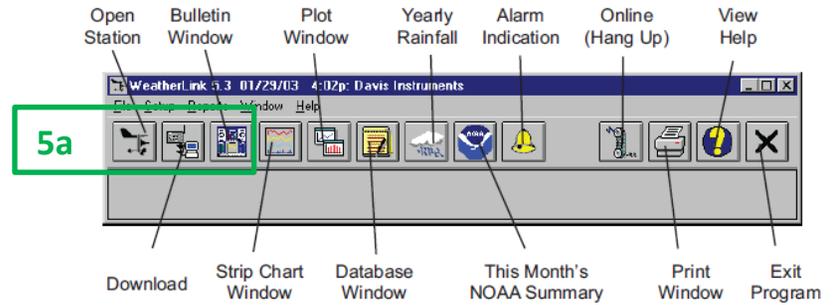


Figure 8: Banner of commands and reports available in WeatherLink.

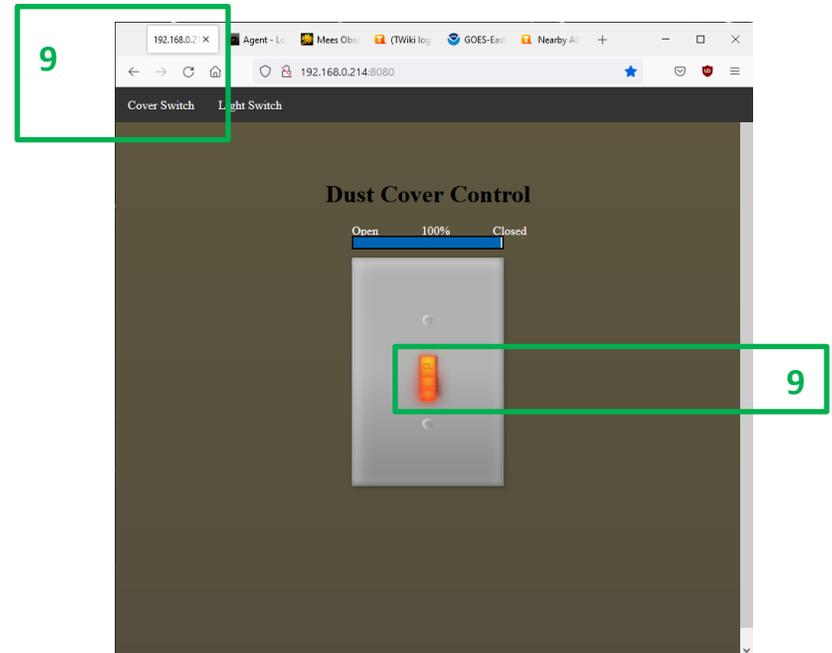


Figure 9: Firefox, with the telescope cover control (TCC, leftmost tab) in the foreground.

Once it's clear, you may proceed as follows.

7. On the **Telescope > Misc.** window, select the **Dome** tab (Figure 10). Open the dome: push the upper shutter's **Open** button, wait for the upper shutter to open, then push the lower shutter's **Open** button. (The upper shutter must be opened before the lower, and closed after the lower.) You can watch the process best on **Camera 3** or **Camera 4** on the video-camera screen.

Important: **always open the dome before you open the telescope dust cover, and always close the telescope dust cover before you close the dome.**

8. Also on the **Dome** tab (Figure 10), select **Track Telescope** from the **Dome Mode** dropdown box (it starts off as **Manual**), and push the Apply button. Verify that this change is also reflected in the main TCSGalil display (Figure 5); the **AutoDome** and **Dome** "front panel switches" in this pane should have turned from red to green, and to read as **On** and **Normal** respectively. If they are not, repeat, making sure you push **Apply**.
9. On Firefox, select the leftmost, **TCC** tab. Click on the cartoon light switch to open the telescope dust cover (Figure 9). Once started it won't take long; you can monitor progress on the **Cover** web page, or on Video Camera 2.

If you will be leading a tour, slew the telescope to a position from which you can reach and remove the shower-cap cover of the 6" finder telescope.

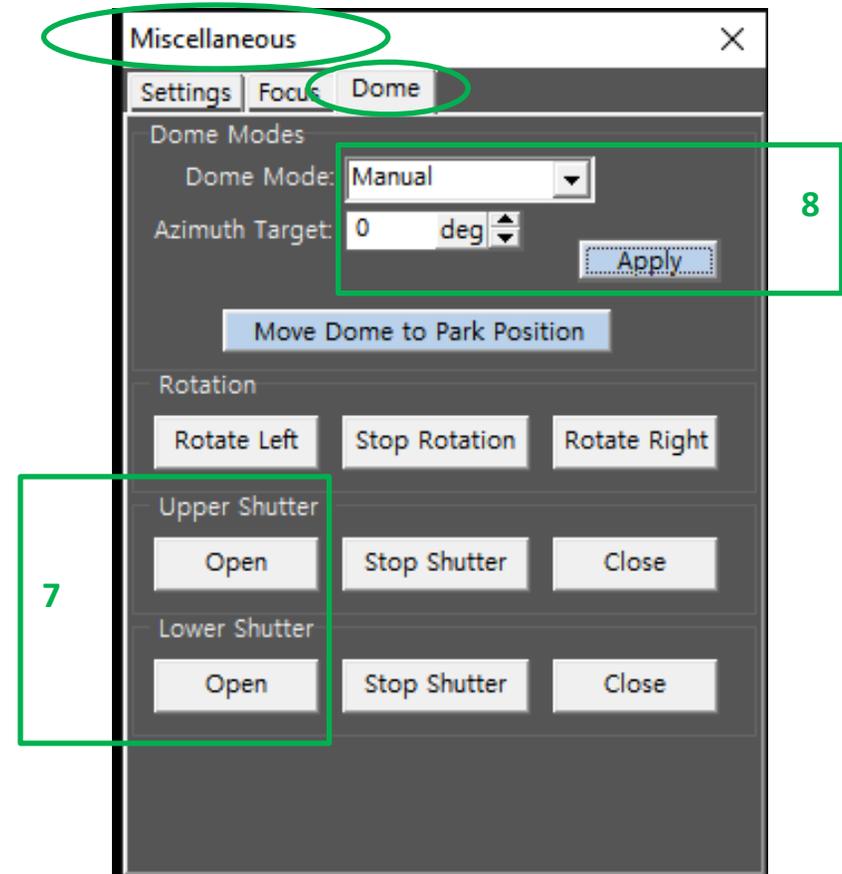


Figure 10: The **Dome** tab of **Telescope > Misc.**, by which one opens and closes the dome shutters, and sets the dome mode to track the telescope. Again: always open the upper shutter before the lower, and close it after the lower.

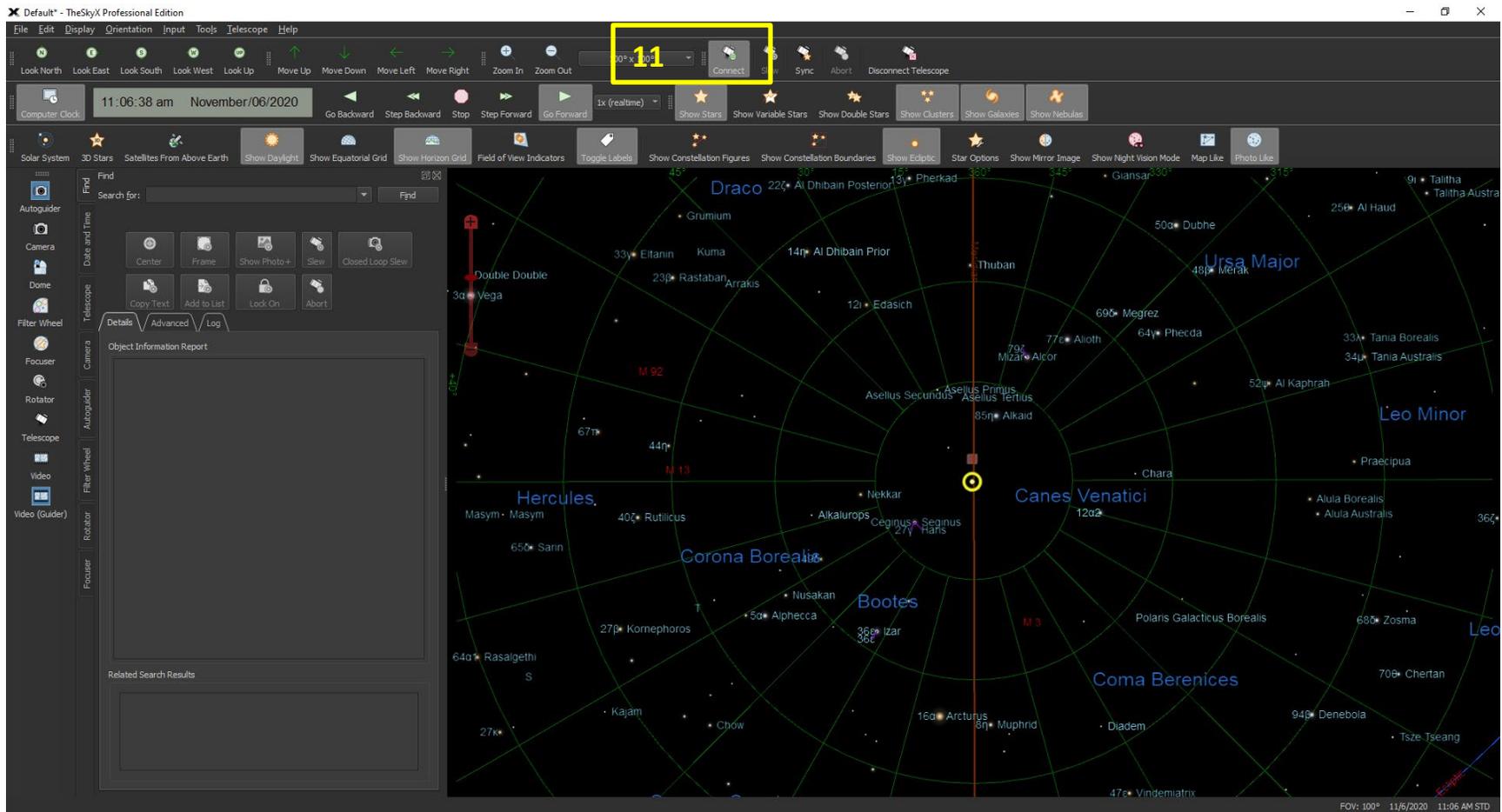


Figure 11: TheSky X just after startup. The **Connect** button has been pushed; the yellow circular target shows where the TCS thinks the telescope is pointed.

10. Start TheSky X, by double-clicking its icon on the left of the left-hand screen.



11. Link TheSky with TCSGalil by using the **Connect** button (Figure 11) or TheSky's **Telescope > Connect** menu command. The telescope position will appear on TheSky's display as a pair of concentric yellow circles.
12. Log into the Mees Wiki, using the tab automatically opened in Firefox. The username and password will autopopulate. Navigate to the online observing logbook (Figure 12), and begin to keep notes of your observing session there. TWiki date-stamps each entry automatically.

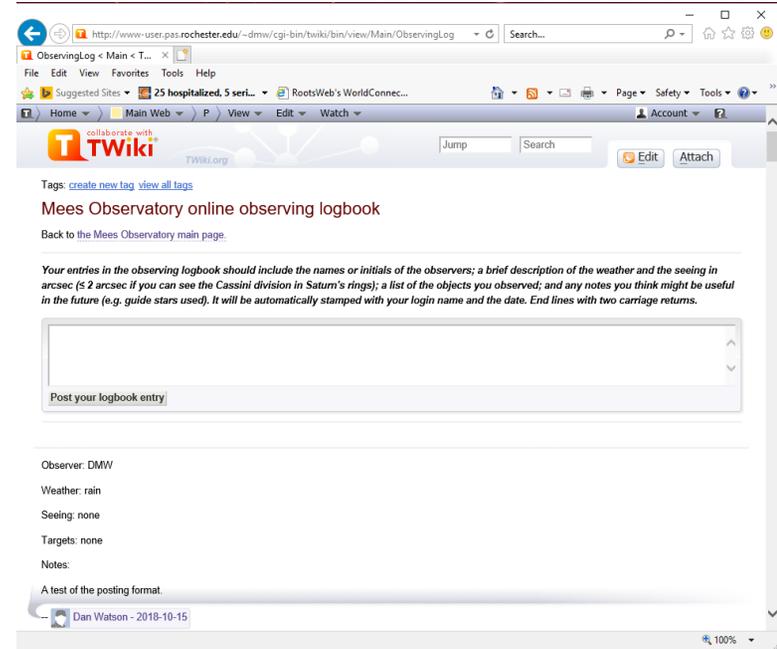


Figure 12: the Wiki's online observing logbook. Follow the instructions to enter notes in the text box provided; press the button at the end of your observing session to post your entry. As it says at the top of the page: type Enter twice at the end of every line to make the entries appear as shown. With only one Enter, the editor will not put any line breaks at all.

13. Initialize the telescope focus, using the TCSGalil **Telescope > Misc. > Focus** tab. Use the most recent value of CCD-camera focus recorded in the Wiki observing logbook, which is also usually written on the whiteboard by the control-room door. This will be a **Target Position somewhere** near 600 microns for most of the summer, if the telescope is set up with the eyepiece and Camera #1.

The focus can also be set with the hand paddles, using **SET** along with **IN** or **OUT** to move the focal position fastest.

Important notes:

Do not keep track of the eyepiece focus separately, or to adjust its position separately within TCSGalil. The CCD camera focus corresponds to the optimal position of the telescope secondary mirror; this optimum focal plane is refocused on the eyepiece observer's retina using the knobs on the mechanical focuser to which the eyepiece is attached.

If the telescope is way out of focus, the image will not look starlike. It will look like a donut: an illuminated image of the primary mirror, with the shadow of the secondary mirror and its supports superimposed.

If you will be observing only with the CCD camera:

Switch to the remote-observing checklist, and start following the instructions at step 15.

If you are about to use the eyepiece:

Move the eyepiece mount's diagonal mirror lever to the Eyepiece position, and proceed.

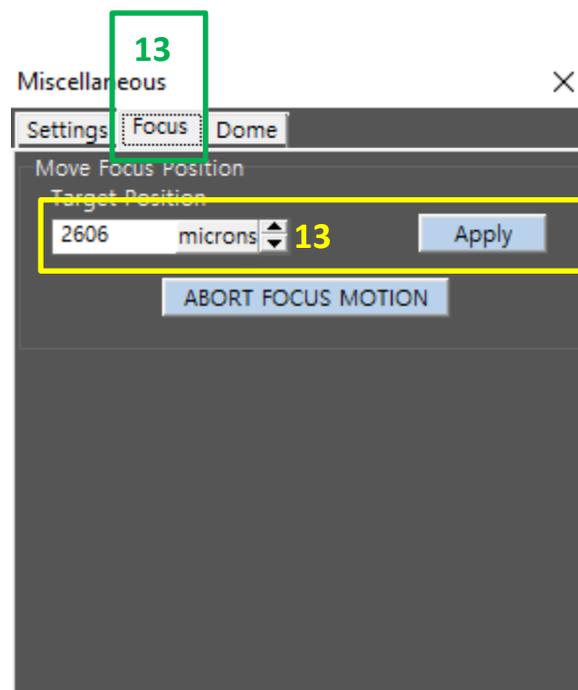


Figure 13: initializing the telescope focus. Note that the target position indicated in the figure is very far from the optimal focus for either of the CCD cameras; a star should look like a donut through the eyepiece in this setting.

14. Make sure, again, that the **TRACK/OFF** switch is set to **TRACK** (switch lever up; see Figure 3).
15. Find a bright star **near zenith** on TheSky's display, click on it to bring up its information under the **Find** tab – the topmost tab with label appearing sideways, near the left edge of the window (Figure 14). You can also reach this tab from the keyboard, if TheSky's window is selected, by typing **Cntl+F**. Make sure that the star's **Altitude** is larger than 20° . **Never** target a lower altitude than 20° .
16. Point the telescope to this star by clicking the **Find** tab's **Slew** button, and by confirming this command appropriately. If you know the name of a star or other object at which you want to point, enter its name in the **Find** tab's Search for text box, and push the **Find** button to its right.
17. Verify that this star is the one you're looking for, and lies in the center of the field, eyepiece or CCD camera. If it does not, move it there with the hand paddle, simultaneously holding down the **SET** button and whichever of the direction buttons is appropriate. You may need to look through the finder telescope, either to convince yourself that it's the right star, or to move the right star into the main telescope's field of view.

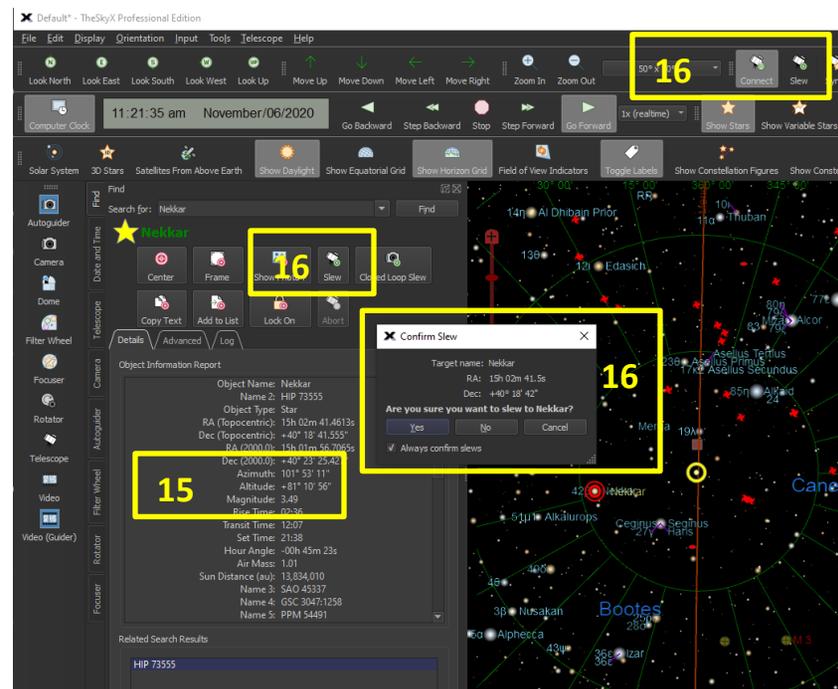


Figure 14: TheSky's **Find** panel, and the confirmation dialogue you get after pressing the Slew button. Here the target, Nekkar, was selected from the sky chart by clicking on the dot representing Nekkar.

Warning: do not point the telescope at Polaris, nor slew the telescope within 10° of the celestial north pole.

If you do, confusing and potentially harmful errors are introduced into the tracking and directional configuration of the system – as would be the case on any nonportable, equatorially-mounted, computer-controlled telescope. See FAQ #3, below, for details.

- When the star centered, update the telescope's idea of this star's position, as illustrated in Figure 15. Push the Telescope button on the left side of TheSky's window. Push the **Synchronize** button (**Sync**, in Figure 15), confirming this choice in the following dialogue box.

After this you should be able to point confidently to any object above the horizon, subject to these limits: **do not try to point the telescope unless the target's hour angle and elevation (Find panel of TheSky; see Figure 14) lie between -9.5 hours and +9.5 hours, and above 20°, respectively.** The TCS monitors should look something like Figure 16.

Any time you laboriously center a star, it is good practice to repeat this step, to sync that star's coordinates.

- For viewing the bright Moon by eye, there is a variable Moon filter (rotatable, cross-able polarizers) in the wooden cabinet where the eyepieces are stored. For viewing nebulae, there is a nebular filter ([O III] 500.7 nm line) in the same spot. To install either, **carefully** remove the eyepiece, screw the appropriate filter on the bottom of the eyepiece, and replace the eyepiece. Don't forget to remove it before you observe a fainter or continuously-emitting object.

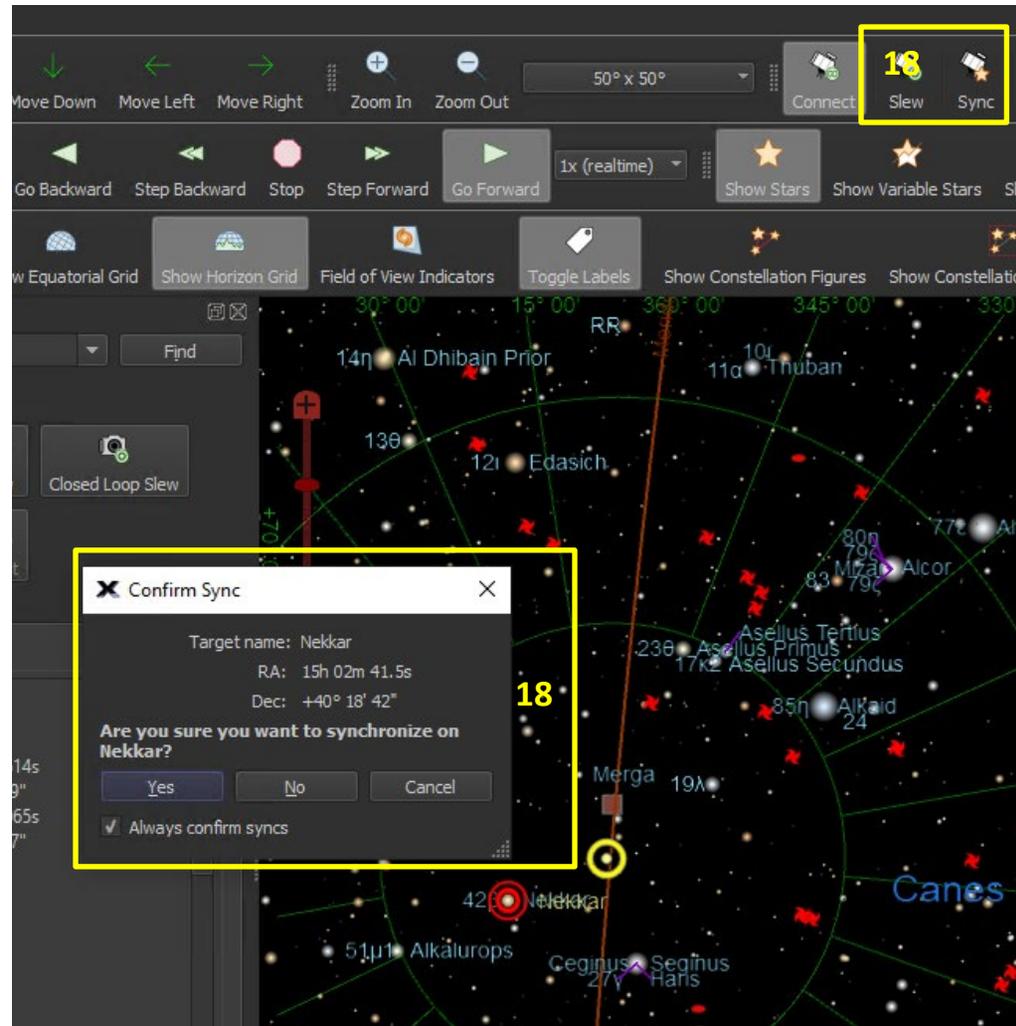


Figure 15: Synchronization of the telescope orientation to a star's coordinates.

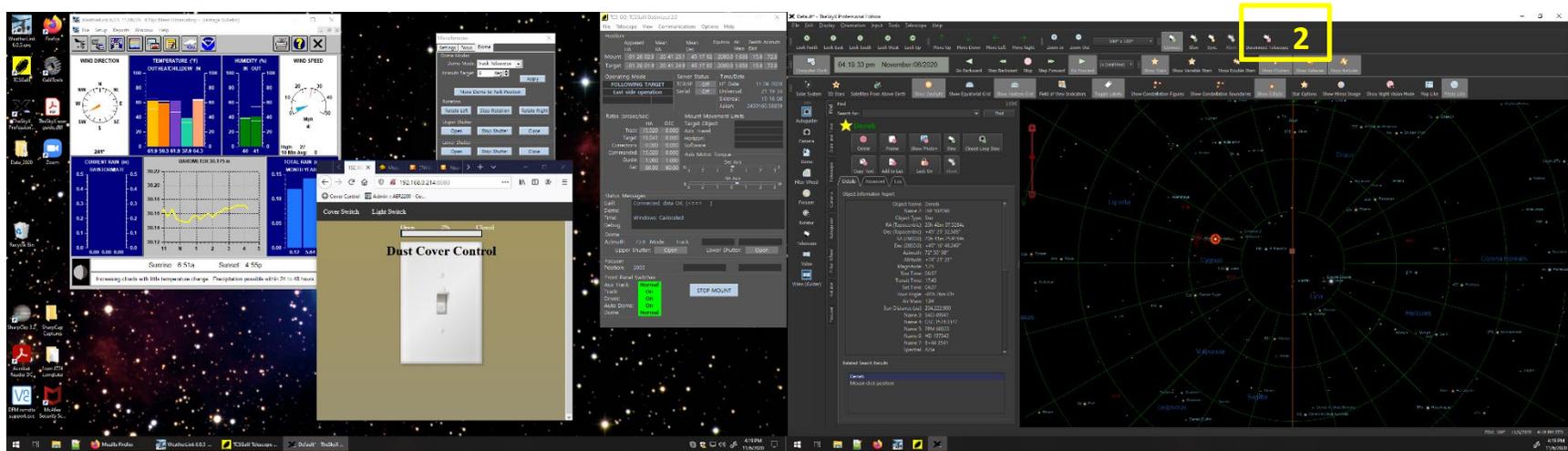


Figure 16: TCS monitor displays for the happy telescope.

II. Telescope shutdown

1. Move the eyepiece's diagonal mirror out of the beam, by swinging its lever to the CCD Camera position.
2. Disconnect the telescope from TheSky, using the appropriately-labelled button at upper right (Figure 16).
3. Shut down TheSky (**File > Exit**). The rest of the shutdown steps use TCSGalil.
4. Close the telescope dust cover, using the **TCC** tab's cartoon switch on Firefox (Figure 9). It's important that this be done **before** closing the dome shutters. If you took off the finder telescope's shower-cap cover, put it back.
5. Slew the telescope to zenith, using the **Stow Mount at Zenith** button in **Telescope > Movement > Offset/Other** (Figure 17). Make sure that the telescope's final position is within an arcminute or two of zenith, as indicated on the dials (Figure 7).

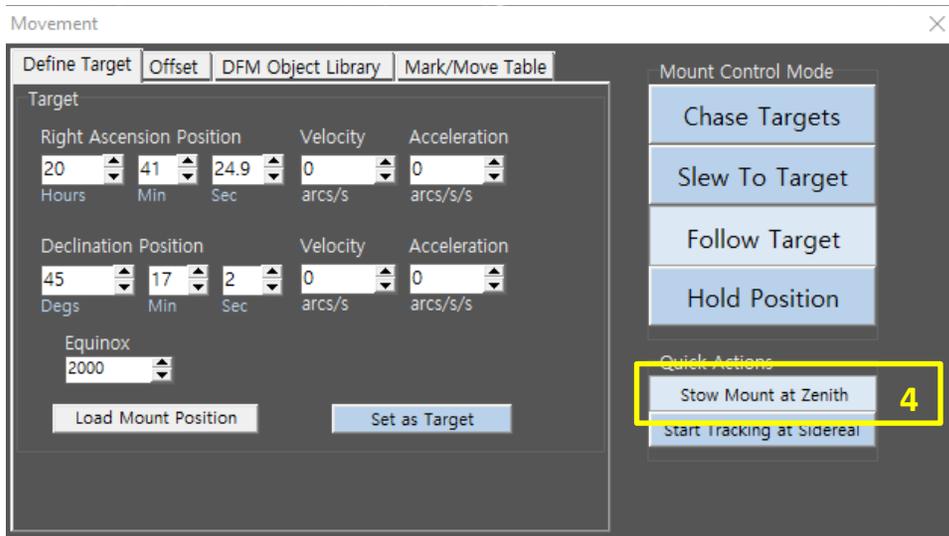


Figure 17: The TCSGalil **Telescope > Movement > Offset/Other** dialogue, and its **Stow Mount at Zenith** button.

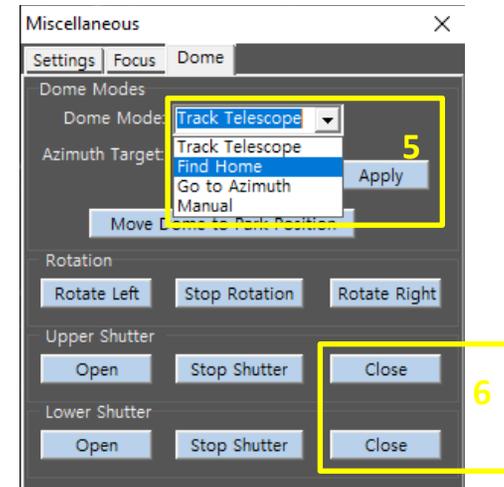


Figure 18: Using **Telescope > Misc. > Dome** to send the dome **Home**, and to close the dome doors.

6. Send the dome to its **Home** position by flipping the **DOME TRACK/HOME** switch on the TCS front panel to **HOME**, and switching it back to **DOME TRACK** immediately. (See Figure 3.) You may also send it **Home** by choosing **Telescope > Misc. > Dome > Dome Mode > Find Home**, as in Figure 18. Verify that the dome lands at azimuth 100.5°, which places the dome doors close to, but not quite, directly over the deck doorway.
7. Now close the dome doors: in **Telescope > Misc. > Dome**, push **Close** for the lower shutter (Figure 18). When this is done, push **Close** for the upper shutter. (Remember, the upper shutter is opened first, and closed last.) You can watch progress on Video Cameras 3 and 4.
8. Verify that both shutters are closed all the way, and that the door to the deck is closed and locked.
9. Shut down TCSGalil.
10. Complete and post your entry in the online observing logbook before logging out of the Wiki. The logbook is a good way to report any problems to Kelly, Dan, Kurt or Carol. Also report to them via logbook posts which supplies might be running low, especially flashlight batteries, coffee, tea, hot cocoa, *etc*. In the rare event that the internet connection is down, type your logbook entry into a text file, and save it to the TCS computer desktop. We'll transfer it to the log later.

11. Shut down Firefox.
12. Do **not** shut down the computer, nor WeatherLink, nor the TCS electronics, nor the uninterruptible power supply. Do not push the **HALT MOTORS** button in. Do not unplug anything. Do not turn off the breakers.
13. If there's any chance that outside temperatures will drop below freezing: make sure that the space heaters in the walls on either end of the control room, in the storage room, and in the bathroom, are **not** switched off.
14. Make sure that **ALL** the doors to the rooms inside the dome are all **open in the summer**, and **closed in the winter**.
15. Did the loading dock get icy while you were observing? If so, deice it, using the ice-melting compound found in the storage room just inside the front door. Don't walk on the dock or stairs until the ice is melted.
16. Turn off all the lights, including the red porch light.
17. Lock the front door behind you.
18. Is it 2:30 AM or later? If so, **go to the Gannett House and sleep for at least four hours before proceeding to the next step**. This important safety rule will be enforced rigorously.
19. If you went into the Gannett House, make sure that its doors are locked. Pay special attention to the double patio doors as these have a somewhat unusual lock: one has to pull up on the handle, in order to enable the lock latches. Test these doors to **make sure they're locked**.
20. Make sure the gate is locked securely behind you.

Now you are ready to drive home. Be careful of the deer.

III. FAQ: problems you may encounter, and their solutions

1. a. When we started TCSGalil, the telescope coordinates and dome azimuth were way off from zenith and the home position, even though the telescope and dome were oriented to zenith and home.

b. When we started observing, the dome azimuth was way off of the telescope azimuth and didn't track the telescope at all.

These conditions can be produced by starting TheSky X and connecting to the telescope before starting TCSGalil - which briefly was our standard startup procedure. If one starts up this way, then shutting down TheSky at the end of the night will automatically shut down TCSGalil without saving its current telescope and dome coordinates, so TCSGalil will wake up next time thinking that they're oriented where they were before the telescope was sent to zenith and the dome was sent home.

To get out of them, shut TheSky and TCSGalil down, restart TCSGalil, send the dome home (section II, step 5) and redo Section I, step 4b. Then restart TheSky and connect it to the telescope.

2. **The dome can no longer be moved by TCS or its own remote control.** On the dome floor, locate the Dome Radio Control box, mounted on the wall to the right of the dome's power supply boxes (Figure 19). Note the power cable leading from this box to a nearby power outlet. Unplug this from the power outlet, count to ten, and plug it back in. Command of the dome should be immediately restored. If not, repeat the unplug/wait/plug-back-in sequence.

3. **I instructed the telescope to go north but it went south instead (or vice versa).** This is most commonly the result of the **EAST/WEST** switch (Figure 3; see Section I, Step 1) being inadvertently set to **WEST**. It can be fixed simply by switching it to **EAST** again.

It is also possible to create a similar condition by pointing the telescope underneath the north pole, or by slewing the telescope through the pole. If this is what has happened, the telescope's operating mode (see Figure 5) will have changed to **Through the pole LIMIT** instead of **East side operation** and will resist being changed back. The cure is to point the telescope back to zenith - using whichever paddle buttons do that - and



Figure 19: the dome radio-control box.

reinitializing the telescope position accordingly (see Section I, Step 4). At once the normal directions will be restored and the operating mode will revert to **East side operation**.

4. **We accidentally drove the telescope into the horizon limit and now it won't move.** Don't try to fix this: call Dan at 585-414-1004 to be talked through the remedy.
5. **The telescope cover won't move in response to the switch on the Web app.** We presume that this would only bother you at the beginning or end of the observing night. This emergency is what the new black box, mounted just up and right of the telescope dials (Figure 20), is for. Open the red switch cover, flip the switch to the **MAN** position, and then push the **OPEN** or **CLOSE** button, holding it down until the cover is in the position you want. The cover will stop safely when it gets to either end of its travel. Then close the red switch cover again, which will push the switch back to **AUTO**. Describe the whole situation carefully in the observing log. Also make sure Dan, or better yet Rich Sarkis, hears about this failure.

The telescope won't slew to the next target, and gives error message Out of range in TCSGalil. We haven't figured out why this happens yet, but here's a workaround. Turn the **TRACK/OFF** switch on the TCS front panel to **OFF**. Disconnect TheSky from TCSGalil, using the Disconnect command in TheSky's Telescope menu. Then exit TCSGalil (**File > Exit**, or click the **x** in the upper right corner of its window), and restart it again right away. This should restore the telescope's ability to move. Slew to zenith with the paddle, and reinitialize the telescope pointing as in section I, step 4. Tell the dome to track the telescope again, as in section I, step 5. Reconnect TheSky to TCS, as in section I, step 10. Turn the **TRACK/OFF** switch on the TCS front panel back to **TRACK**. Point to a star near zenith, center it, and synchronize the telescope's coordinates on the star's, as in section I, steps 15-18. Record this situation carefully in the observing log and make sure Dan hears about it.

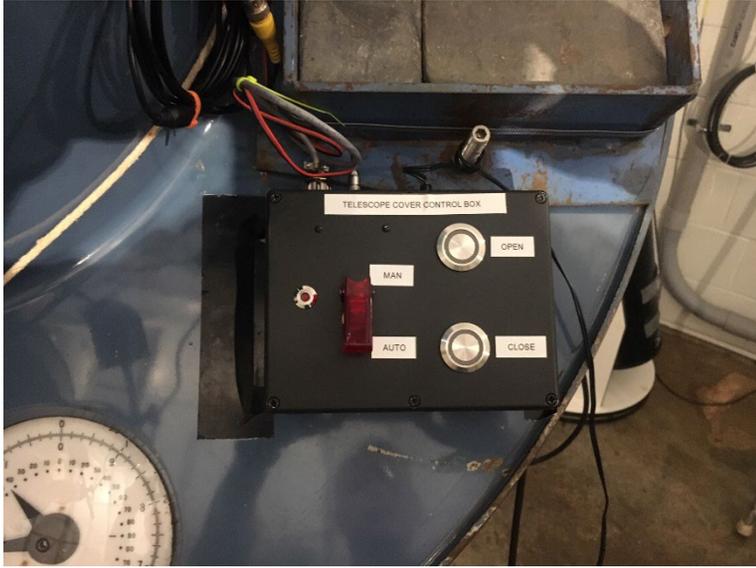


Figure 20: the telescope cover's manual override controls.

6. **We followed a southern planet down to an elevation that was low but not below the limit, only to find when we were done that the telescope wouldn't move north any more.** This is another problem we have not quite got to the bottom of. The workaround is to use the paddle to slew a small distance south, and then north again, not stopping til the telescope elevation is at least 40° or so. Again, record this carefully in the observing log; make sure Kelly hears about it.

7. **The wireless network in the dome won't let me connect my laptop.** Make sure the network you're trying to join is the one named MeesObservatory_Dome-guest, which is intended for all of us to use with our laptops, tablets, and phones, despite the "guest" moniker. The password for this network is written on the whiteboard in the control room. The other network your computer will detect is MeesObservatory_Dome, which is only used by the TCS, camera, and video hardware to connect and share files.
8. **I can't get a cell phone signal, and my phone battery runs out after being at the telescope for a couple hours.** This happens because the observatory has an all-metal exterior, which prevents radio-frequency signals from penetrating into the building. (Google "Faraday cage" to find out why.) Your phone uses a lot of power in its continuous search for a signal, if it's having trouble connecting. If you connect your phone to the wireless network (see FAQ #8) the battery will last longer and you'll still receive texts and emails, though not phone service. If you prop the front door open, you will usually have a 3G or LTE connection indoors, leading to full phone service and the usual battery life, but also leading to an intolerable concentration of bugs in the building. Alternatively, you can set up WiFi Calling, which is a good idea independent of Mees. WiFi Calling installation instructions for iPhone users can be found [here](#). This lets fewer bugs in the building.
9. **The WeatherLink app is not communicating with the weather station.** First click the Bulletin Window button on WeatherLink (see Figure 2, above). If everything loads, great; no further action is required. If not it will also give an error message like "Cannot connect". In this case, power cycle the weather station's relay box on the wall inside the control room:
 - a. Follow the power cable from the relay box – a wall-mounted black box about 8 inches tall, 4 inches wide, on the wall above the sofa in the control room – to the back of the UPS, on the floor to the right of the TCS (Figure 3).
 - b. Unplug, wait ~30 seconds, and then plug it back in.
 - c. Give it a minute or two, and then click on the Bulletin Window button again. The weather report should soon appear as usual.