


Event Night Steps

These are the steps for setting up, getting on the field, and taking occultation data on event night. These are also good first activities on any practice night. Details of how to do each step are covered in other documents.

1. Assemble telescope

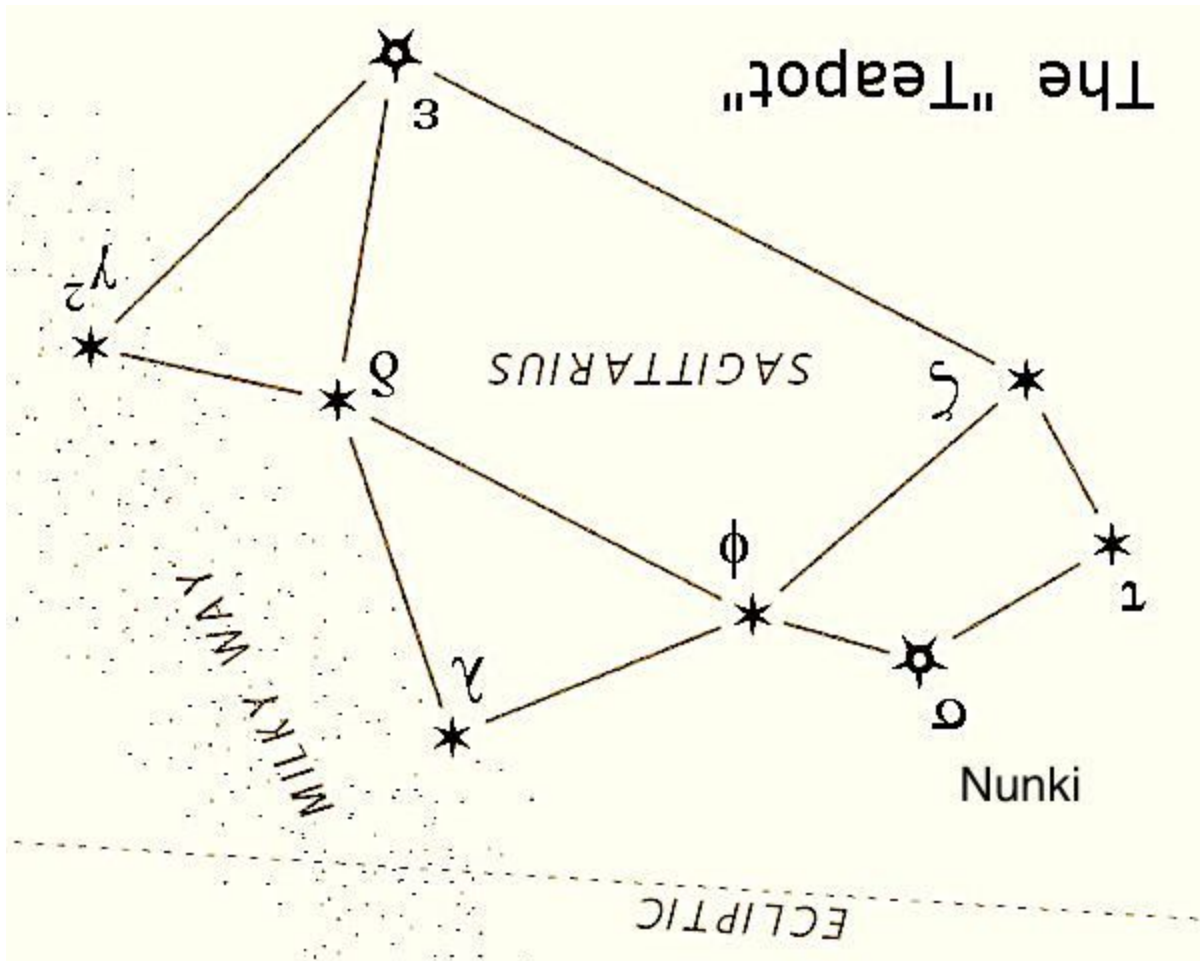
- a. Place gray tarp on ground. Remove telescope mount pieces from box and get the azimuth turntable out.
- b. Check that azimuth base is level. If not, find some nice rocks, wood chips, etc, and make it level now. There is a level in the toolkit. If you do use “found” material to level the base, remember that it must remain perfectly stable for the entire deployment, even as you push, pull and rotate the telescope. So double check that you have made a good, solid foundation that will survive a few bumps.
- c. Screw together wooden mount pieces onto turntable, exhausting all 12 of the identical screws. Ensure that the key on the motor side points up.
- d. Identify remaining two telescope screws They do not look like the ones that were used in step 1c and know their location. The person holding the front (light) end should put these in easily accessible pockets, so that you can grab the screws while continuing to gently hold the front of telescope with one hand.
- e. Insure that the keyway opening on the motor side of the telescope points down. As a team, lift the telescope from front and back. (Person at the heavy, mirror end should grab the interior mirror bracket with their fingers for positive control.) Lower the telescope tube into the base, aligning the motor side slot on the tube with the upward-pointing key on the base. Once settled, team member at the heavy (mirror) end continues to support full weight of telescope in a horizontal position.
- f. Team member who had the secondary end now should locate screws from 1d, *while the other team member continues to hold up the mirror end of the telescope*. Screw long thin screw in vertically in slot with the motor (you may have to jiggle the telescope slightly to get the hole to align), put in short fat screw on opposite side, horizontally into the altitude drive (easier). Tighten both screws firmly but not overly tight.
- g. Gently rotate telescope to vertical. Gently *and partially* unscrew the three silver handle screws on the telescope tube They are prone to falling out, and do not need to be loosened all the way. These screws put pressure on the struts to lock the telescope extension (secondary cage) in place. Once you have loosened the screws extend the secondary cage vertically until you hear **two clicks**. The secondary should hold itself up without help. If you find this is not true, the hex-head detent screw (next to the chrome handle bolt) may need to be tightened. Do not over tighten the detent screw but also be very careful if you ever loosen it. If you go too far, the interior spring will come loose and it’s really

hard to get back in. While maintaining upward pressure on the secondary cage, tighten the handle screws to ensure that the secondary portion of the telescope tube cannot slide. The detent screw is doing most of the work to hold it in place and the handle screw is a back up. It is important to engage the detents, otherwise, the collimation can be affected.

- h. Screw in finder
 - i. Plug in wires for hand paddle, azimuth motor, telescope power. (To make your life happier it when it comes time to remove, slide back the black plastic covers from the ends of azimuth motor's ethernet cable).
 - j. If totally cloudy, orient telescope horizontally to the north. Flip the switch on the side of the telescope to turn it on. Starting from this orientation you can get rough pointing and tracking going without the need for stars. If you are setting up on stars, the starting orientation does not matter.
 - k. *Wait for the telescopes to finish initializing.* Press enter to dismiss warning about pointing telescope at the sun.
 - l. Enter information about latitude, longitude, altitude and time for the telescope. Use universal time for the time, select UT-0 for the offset and do not use daylight saving time.
2. Turn on computer, user is MU69, password is everyone's favorite NH flyby target (only the first letter is capitalized)
 3. Mount camera in focuser using the 2" barrel extender, insuring the mark on the camera is oriented appropriately. The top of the camera is centered on the ventilation slots next to the name of the camera (just QHY174) and should point toward the finder scope. This will not match the rotation of the supplied finder charts.
 - a. Connect GPS antenna to camera and attach antenna to top of secondary cage with built-in magnet.
 - b. Connect the 12V camera power, turn on. You must be able to hear the camera fan running, or the camera is not getting power.
 - c. Connect the USB cable to one of the two USB3 ports on the left side of the laptop (not the USB2 port on the right side), and listen for connect tone on computer
 4. Start SharpCap, load any OCC profile,
 5. Change the settings.
 - a. Load reticle overlay via the icon on the upper right (if desired),

 - b. decrease exposure time to 50 milliseconds,
 - c. drop the gain down a bit.
 - d. Make sure display zoom is on "auto" to show the full frame.
 6. Collimate the telescope (do this only if needed! It is not normal to do this every night.)
 - a. Use the laser collimator to re-align the primary. Do not adjust the secondary unless something very terrible is known to have happened.

- b. Remember that collimation can, and usually will, change the alignment between the finder and the telescope. Expect to have to re-align the finder if you have re-collimated the primary mirror.
7. Once collimated, check boresight of the finder scope, adjust if needed
 - a. Push the telescope around until any bright star is centered on the computer screen
 - b. Without moving the telescope, adjust the finder scope boresight screws until the crosshairs are on the same star that is centered on the computer screen. (To be absolutely sure, esp. if there are several bright stars in the region, this might be a good time for one team member to manually point a green laser pointer at the star while the other member confirms that the laser beam is visible both on the computer screen and in the finder scope).
8. Align telescope → *Brightest Star*.
 - a. Scroll through regions of the sky (North, northeast, east, southeast, etc.) until you find the region in which your first alignment star is presently positioned. Press Enter. Handset will create a list of the brightest stars in that region.
 - b. Scroll through this list until you reach the star you want to use as your first alignment star. Press Enter. Note that you cannot undo the choice of alignment star without power cycling.
 - c. If you wish, loosen both clutches slightly so you can more easily move the telescope around by hand. If you do this, you **MUST** remember to tighten them in the step below. In general, it is possible and advisable to find a clutch setting that holds firm and yet allows you to push the telescope around by hand. Once this setting is found, there is no need to *ever* change this again, even after tearing down and setting up again. Note that there is a definite sweet spot to tightening the clutches. If it is too loose, the motor will not move the telescope. This condition is (mostly) benign. If it is too tight, you will induce non-trivial backlash. In the worst case, you may cause the worm gear to slip on the spur gear. When it is properly set, the telescope will move slowly under motor control with little to no backlash.
 - d. Insure that the SharpCap ZOOM setting is on AUTO.
 - e. Using the telescope hand-paddle (or manually) move the telescope until that first alignment star is centered in the laptop FOV. **Always use the UP and RIGHT buttons on the hand paddle for final movement to center each alignment star.** Your bore-sighted finder scope will be helpful here. **If you loosened the clutches in step 8c, now you must tighten them. Then go back and re-read the advice in step 8c.**
 - f. Now press Enter to inform the hand controller that the telescope is pointing at the star whose name is displayed, i.e. your first alignment star
 - g. Scroll through the list to select your second alignment star, and press Enter. The telescope will now automatically slew to the second star, or reasonably close to it.

- h. If the second alignment star is not perfectly centered on the laptop screen (or, more likely, not yet visible on the laptop screen) use the finder scope and the buttons on the hand controller to move the scope towards the second alignment star until it appears on the laptop screen, then center it on the laptop screen. (You may want to adjust the "Rate" on the hand controller but this is normally not necessary.)
 - i. Press "Enter" on the hand controller. You should see the message "Alignment Successful" on the hand controller.
9. Go to Nunki (sigma Sagittarius) (*Named Stars* menu item). Nunki is the brightest star in the outside handle of the teapot. Center Nunki on the screen.



10. Go to Utility Menu
- a. Find "PAE" (Pointing Accuracy Enhancement) in the menu and hit enter
 - b. Display now reads "PAE Correction." Hit enter. You will see it bring up the name "Nunki" on the screen and it will blink for a few seconds. When the blinking stops **you must press Enter one more time** for this update to be complete. You don't

get any other confirmation of what you've just done. **If you leave this menu without pressing enter, the re-alignment on Nunki will not be completed.**

11. Go to occultation star
 - a. User Menu (stars should have already been programmed in)
 - b. Select object number corresponding to the occultation star. Note RA/Dec of occultation star:
 - i. **July 17 star 19:00.0 -20:40**
 - c. If you do not see a user object with this RA and Dec, you will need to create one.
 - d. Slew to field, do not delay unnecessarily between this step and the previous. (PAE improvement from Nunki should bring you to the field, but does not improve tracking in any way, if you have found the occultation star, you are done and should not leave the field. If you are unsure about the field, return to Nunki. If the telescope centers Nunki, the PAE in step 10 was successfully updated. If not, try the PAE step again.
 - e. Upon reaching the area, some recognizable part of the field should be visible in the image. If not, don't panic and try moving around a little bit before getting more aggressive.
 - f. Center target star
12. Load the appropriate SharpCap profile as directed by Marc. The "FASTOCC" profile is the preferred profile (200 msec exposure, 5 frames/sec). If clouds make it difficult or impossible to see the star using the FASTOCC profile you may switch to the slower OCC profile (500 msec exposure, 2 frames/sec). **Always initiate your SharpCap captures using frame count, never by elapsed time.**
13. Using "Start Capture" take the appropriate amount of data, depending on whether this is a **short practice night**, a **full practice night**, or the **event night**. Monitor the start and stop times and insure that your capture does in fact take the expected number of elapsed minutes. Also monitor for dropped frames and report all of this information on the log sheet.
 - a. On practice night of July 13/14, take 10 minutes of data from 14 JUL **03:45** UT to 14 JUL **03:55** UT
 - b. On **short practice night** of July 14/15, take 10 minutes of data from 15 JUL **03:45** UT to 15 JUL **03:55** UT. This will be **3000 frames** if using the FASTOCC profile, or **1200 frames** if using the slower OCC profile.
 - c. On **full practice night** of July 15/16, take 45 minutes of data from 16 JUL **03:27** UT to 16 JUL **04:13** UT. This will be **13,500 frames** if using the FASTOCC profile, or **5400 frames** if using the slower OCC profile.
 - d. On **EVENT night** of July 16/17, take 45 minutes of data from 17 JUL **03:27** UT to 17 JUL **04:13** UT. This will be **13,500 frames** if using the FASTOCC profile, or **5400 frames** if using the slower OCC profile.
14. Maintain logsheet

- a. Use the provided logsheet to document each image capture sequence (one line per capture).
 - b. Use the UT time (HH_MM_SS) as shown on the screen at the end of the capture as the label in the left-most column on the logsheet. Don't use an approximate time from some other means. This is used for finding the files, not documenting the time.
 - c. Make sure to write down the observing location (lat/lon/alt) of your site on the logsheet
 - d. Do not use a logsheet on more than one night, start a fresh one each night.
15. During exposures:
- a. DO
 - i. control lighting - laptop screen or flashlights should not shine down into the tube
 - ii. Keep target star near the center. Use the lowest rate possible for guiding. It should be very slow so that there is minimal to no smearing of the image during an exposure. Rate 1 works best most of the time but may not be enough if working near the zenith.
 - b. DO NOT
 - i. walk around (static or tripping hazard)
 - ii. shine flashlights around
 - iii. fully close the lid on the laptop (you need to see the screen to guide, right?)
 - iv. over-guide. Some drifting is ok.
 - c. For the 2-3 minutes around the predicted mid-time, do not guide at all unless it is really, really necessary. Your sensitivity is reduced when you are moving.
16. After data collection is over, tear down and pack up system. While you are doing this you can set up the laptop to copy the data to your memory stick and get this done during tear down and the drive back.
17. Upon returning back to the base hotel, make sure you and your team **check in and turn in your memory stick and logsheet for the night.**