Paramount MyT – Part 6 – Accurate Polar Alignment

Ken Sturrock

July 26, 2018

Oh my fair North Star
I have held to your dearly
I have asked you to steer me
To one cloud scattered night
        -Dar Williams

There is the most wonderful thing called Polaris: it's a very high frequency laser
treatment that lifts and tightens the skin.
        -Felicity Kendal

I hope that your rough polar alignment imaging experiment was fruitful. On one hand, I suggested that you try it because I wanted you to see how well you could do with little or no software based refinement. As you saw in the TPoint section, TPoint's capabilities border on magic; it's an incredible software augmentation to an incredible piece of hardware. Yet, it isn't always necessary to spend one's life striving for the perfect TPoint model. Like many things in life, there is a point of diminishing returns and that point will depend on what you've got and what you're trying to accomplish. Part of the art is to find the right balance.

At this point, we are going to look at how to refine your polar alignment based on the TPoint model that you have already built. Now that you have made a model: TPoint knows where in the sky objects should be located, where those objects actually are located, where the mount should be pointing and where it actually is pointing.

Because the Paramounts have precise, and marked, altitude and azimuth knobs, it is possible for TPoint's Polar Alignment Report to tell you how to adjust your mount in order to bring it into precise polar alignment. In other words, this is yet another technique that arises from hardware and software synergy. If you would like to watch the process, please see the later parts of Charles Walker's comprehensive TPoint video or Tolga Gumusayak's APA video, here. Otherwise, read on.

An older approach: The Polar Alignment Report. After you have successfully completed a TPoint model, you can click on the "Polar Alignment" tab at the top of the TPoint dialog box and the SkyX will display the "Polar Alignment Report" which will tell you about the accuracy of your mount's present polar alignment. The report will also give you advice about manipulating the adjustment knobs to bring the mount into better alignment. While this technique can work, it may require additional TPoint runs to confirm the changes that you made.

| Setup | Calibration Run | Model | Polar Alignment | Command Line | ProTrack |

Northern Hemisphere Polar Alignment Report

Important information:

- **MA** is the misalignment of the polar axis of an equatorial mount to the left or right of the true pole.
- **ME** is the vertical misalignment of the polar axis of an equatorial mount with respect to the true pole.
- The elevation report shows the adjustments necessary to align with the *refracted pole*, not the *true pole*.

Azimuth (MA)

Recommendation: Azimuth alignment is excellent. No additional azimuth adjustment is necessary.

Supporting information

MA = 8.9 arcseconds (0.1 minutes) Sigma = 2.7 – Adjust Confidence-High.

For latitude +39° 46' 34", rotate the mount counterclockwise (as seen from above) 11.6 arcseconds (0.2 arcminutes).

Paramount MYT: Loosen the right knob and tighten the left knob 0.1 tics.

Elevation (ME)

Recommendation: Elevation alignment is good enough. No additional elevation adjustment is necessary.

Supporting information

ME is zero.

'Recommended ME' = –64.0 arcseconds (the refracted pole).

ME adjustment to get to above 'Ideal ME': 64 arcseconds (1.1 arcminutes).

The polar axis should be raised 64 arcseconds (1.1 arcminutes).

Paramount MYT: Raise the polar axis 0.6 tics.

| Rough Polar Alignment... | Accurate Polar Alignment... | ☐ Show alternative polar alignments (advanced) |

Now, let's talk about the newer approach. The "Accurate Polar Alignment Tool" (which works with any mount) is now the preferred method to accurately align the mount. This tool will calculate where a specific star should be **if** the mount **were** properly Polar aligned and will slew the mount such that this location is centered in your camera's view. By using the FITS viewer's cross-hair option, you can then adjust the mount in AltAz until the star is moved to the center of the cross hairs.

Before we begin with the tool, however, consider slewing the mount so that the OTA is pointing to zenith. The reason for this is because the APA tool lists alignment stars by effectiveness as well as distance from the current mount pointing location. If your mount is close to the horizon (or any obstacles) then the nearest suitable stars may be very low on the horizon or behind an obstacle. If the tube is at Zenith, then you can more easily select a star using Zenith and know that the "nearby" stars are likely to be high-in-the-sky. In order to slew to Zenith, you can simply type "Zenith" (no quotes) into the Find field, find it and then slew to it.

Although you can evoke the "Accurate Polar Alignment" tool by pressing the button at the bottom of the TPoint window, I find it's less confusing to close the TPoint window and then open the APA Tool from under the Tools menu.

After clicking through some instructions, you'll be presented with a list of candidate alignment stars. You may have to re-size the window to see the list. You'll generally want to pick a (visible from your location) star from the top of the list for maximum accuracy. You can then right-click on the name of the star that you want to use and choose "Closed Loop Slew" from the pop-up menu.
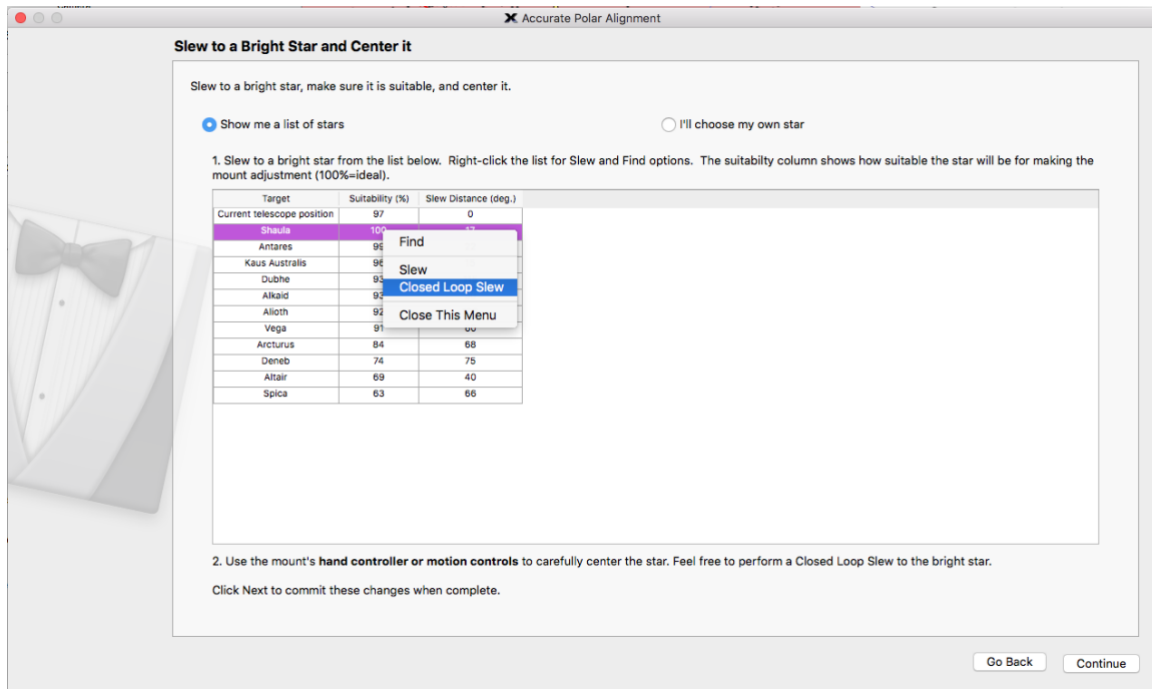
After the mount executes a CLS to the star, you'll need a way to monitor the star's position in the FOV while you adjust it. The easiest way to do this is to click on the imaging camera's "Focus Tools" tab, set the exposure (and delay) to something short and ensure that "Take Images Continuously" is checked.

Now, press the "Take Photo" button and watch the screen while you adjust the mount with its alt/az adjustment knobs. **Do not move the mount with the hand control or the electric motors.** Use the mechanical adjustment knobs. When the star is on the cross hairs, re-tighten the altitude knobs, abort the imaging loop and go back to the APA tool's window.
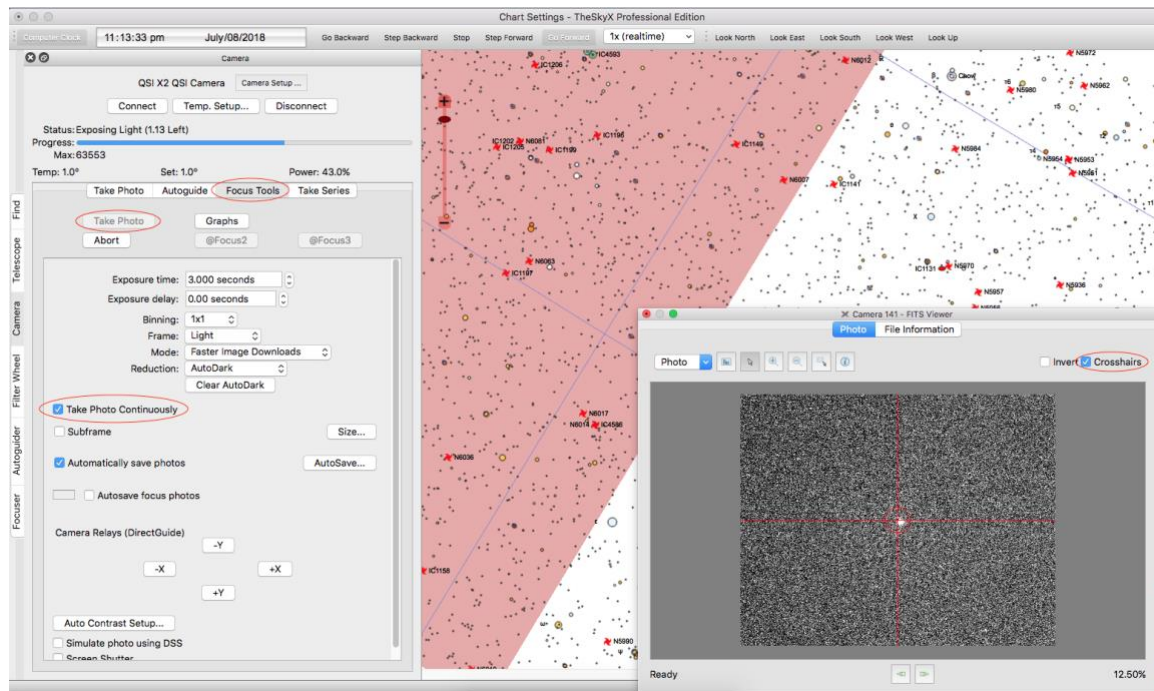
If the mount's rough Polar alignment was reasonable, and your instrument's FOV is not too small, then the star should have appeared within the FOV and you would have simply adjusted the alt/az knobs until the star was centered. On the other hand, if your mount is poorly aligned and the FOV is small, then you may need to use the adjustment directions from the Polar Alignment Report to move the star into the FOV so that you can then interactively place the star on the cross hairs. You can follow the directions in the Polar Alignment Report. In many cases, you'd loosen the opposite knob and then tighten the specified knob the correct number of ticks. An alternate approach is to loosen the opposite knob the recommended number of ticks and then tighten the other side until snug.

Once the star is centered, continue through the buttons so that the TPoint model will be updated to reflect your new alignment. If you're concerned or distrustful, you can test your polar alignment by taking a picture of a star and then snapping another star several minutes later to see if the star is more-or-less in the same position. You can also fire up guiding, open the graph and see if the mount guider has to continuously push the mount in the same direction over time. Finally, as an extreme measure, you could create a new TPoint model and see what the Polar Alignment Report indicates.

Remember, however, that perfection is illusive. Don't spend time chasing perfection when "good enough" is "good enough".