

Video Collimation using an Aline, iPhone and iPad

I have followed on Cloudynights.com with great interest the adventures of newbies and oldbies helping each other with collimating scopes and volunteering my (hopefully helpful) suggestions now and again. Of particular inspiration, I noticed Vic Menard often assists individuals who, by taking a photo through a collimation cap (e.g., the Rigel Systems Aline) of the scope mirrors they're collimating and post it on cloudynights.com, Vic would download the photo, add colored rings showing how the focus draw tube, secondary, and primary should line up and suggest what tweaks were needed to achieve collimation.

This has always struck me as a great idea except for this process relied on static snapshots and iterated on cloudynights.com. As helpful as this is to illustrate how to improve collimation, collimation is a dynamic activity not a static one. There are a couple of devices offering "live video" collimation, some which will superimpose collimation guide rings onto the live image (e.g., wifi-Aline), but are all a bit pricey and have their pros and cons. So I set off to investigate how to make a dynamic, affordable alternative for live video collimation just using an iPhone or Android phone. And what follows demonstrates it is an eminently affordable and effective doable do to achieve these 3 foundation requirements.

- Live video of the optical components to be collimated
- Displaying the live video on a larger screen
- Ability to superimpose collimation guide rings on the live image

So let's start with the first which requires 3 components.

- 1) Aline collimation eyepiece
- 2) Cell phone
- 3) Cell phone holder



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For the testbed, I procured me a 4.5 inch F4 newt from ebay as short focal length Newtonians have very tight requirements on collimation. As an aside, note this is a real newtonian **not** one of those short tube “newts” with a built in Barlow (aka Byrd-Jones lens) that stretches the focal length out by a factor of 2 so it can use a cheaper spherical primary instead of a true parabolic primary. Check the focal length, if it’s around 900-1000 mm and the telescope tube is only half that length – stay away! But I digress.

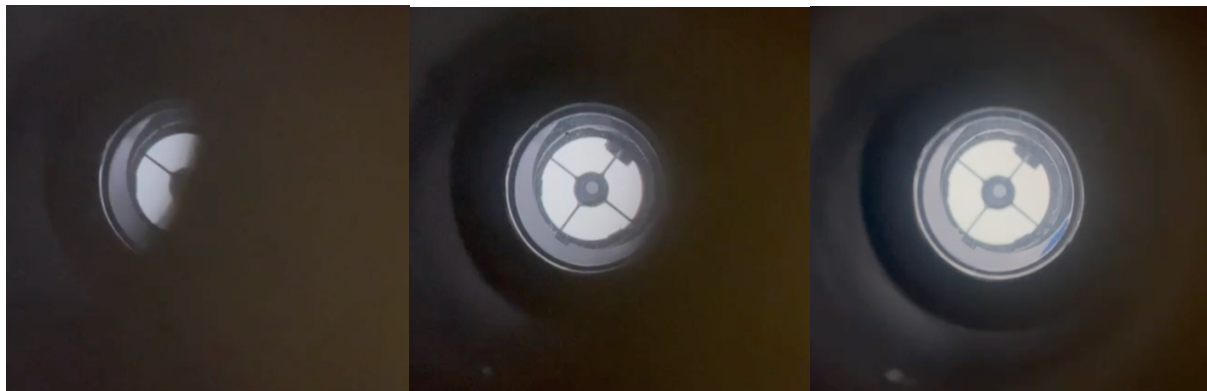
Here is the testbed put all together with an iphone peeping through the Aline collimation eyepiece and the to the focuser racked all the way in.



Moving the camera lens around the Aline peep hole until vignetting is minimized is the best way to make sure the camera is centered in the Aline peep hole. A short video of that is posted here.

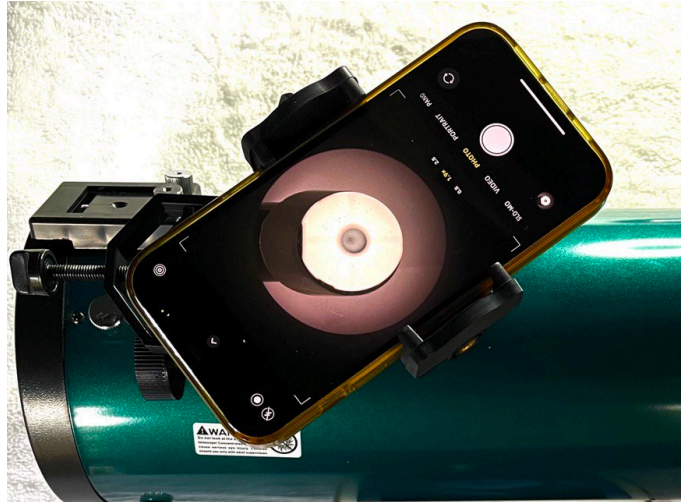
https://www.youtube.com/shorts/Q9agFOKFu_A

Three stills from the video show how minimizing vignetting centers the camera lens in the Aline’s peep hole.



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With iPhone camera lens aligned and centered in the Aline peep hole, The live video from the iPhone looking straight down the optics is a lot easier to see than peeping through the Aline visually.



And the live video image can be zoomed in to fill the iPhone screen and focus and brightness adjusted to produce a quite nice live video image of the focuser draw tube, secondary and primary. On a short scope like this one, it's possible to view the live video image on the iPhone while adjusting the collimation screws. But the live video image is small, collimation guide rings are lacking, and it would be impossible to view while at the same time adjusting primary collimation screws on a larger/longer telescope.

1) Which brings us to the 2nd requirement: displaying the live video on a larger screen. What would be ideal is if the iPhone video image could be broadcast real time to another device with a larger screen -- an iPad for example. Apple doesn't natively support Airplay from an iPhone to an iPad. That sent me on the search for an app that does support that broadcast capability and I found one that works across multiple platforms (Apple, Android, Windows, etc...).

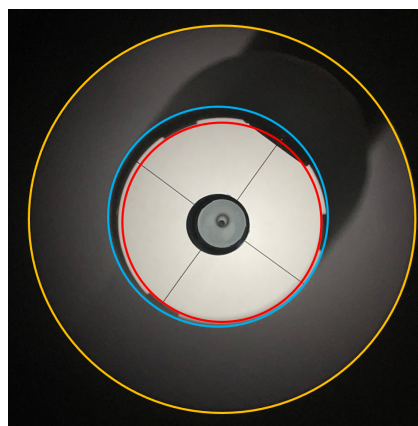
<https://www.airdroid.com/cast/>

And best of all, it works like a charm! I give it solid 5 thumbs up! So now my video collimation testbed becomes; aline + cell phone holder + iPhone + iPad

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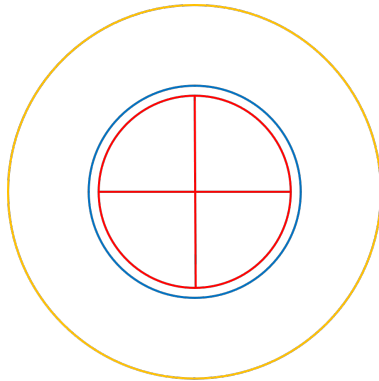
- 2) Using the zoom capability on both on the iPhone and the iPad the live video image of the optical components can be expanded to fill the iPad screen providing a nice big flat image. So far, so good. But now onto the 3rd requirement: Ability to superimpose collimation guide rings on the live image. That turns out to be pretty easy too requiring only a plastic transparency sheet for inkjet or Laser printer and Powerpoint.
- 1) First capture an image from the camera and send it to your computer.
- 2) Open Powerpoint and import the image into a blank slide. You can crop off any excess black parts and scale to fit the slide.
- 3) Use Powerpoint to draw circles (of different colors) matching the focus tube, secondary and primary diameters. Note for the scope I'm using, the secondary and primary are identical (matched) in diameter, so I use the inside edges of the primary mirror clips for the primary mirror collimation guide ring.



- 4) Copy this slide into another slide in Powerpoint and delete the background image leaving the three properly sized collimation guide rings.

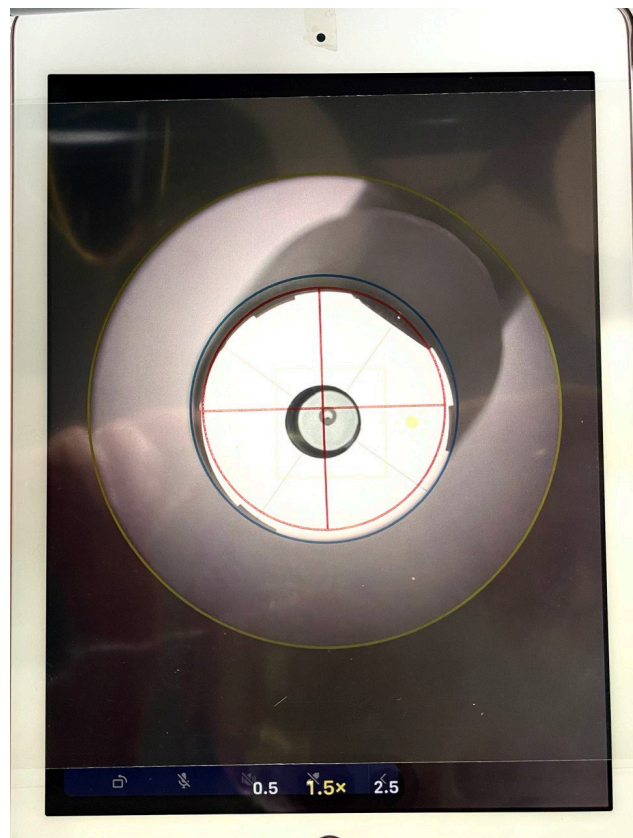
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- 5) In Polverpoint, **Align** all three rings both **center** and **middle** and **Group**. Crosshairs for the primary collimation guide ring are also useful.



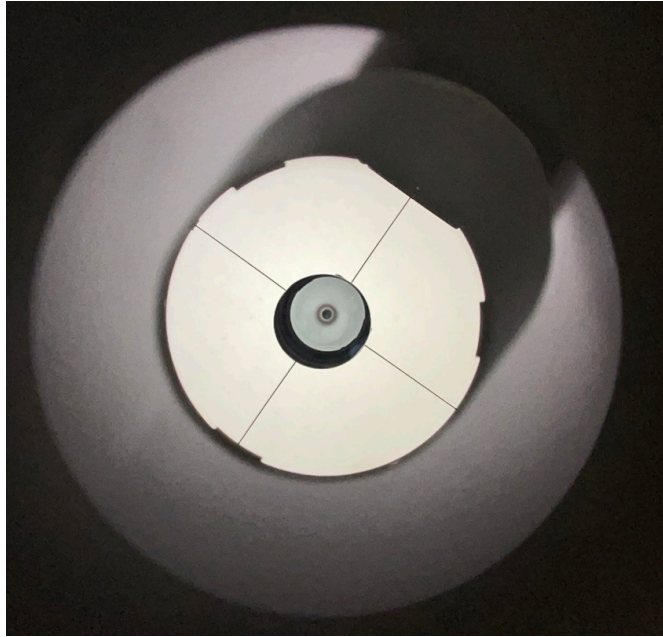
- 6) Print the slide on a plastic transparency sheet and *voila* an collimation guide rings overlay ready to use.

Lay the overlay on the ipad using a couple of squares of tape to hold it into place. Adjust the live video image zoom and position on the ipad to match diameter align the outer ring with the focuser draw tube. No need to touch the camera (other than initially to focus and adjust brightness) Which avoids introducing any wiggles or jiggles to the camera. On my testbed, it's clear both the secondary and primary need adjustment.

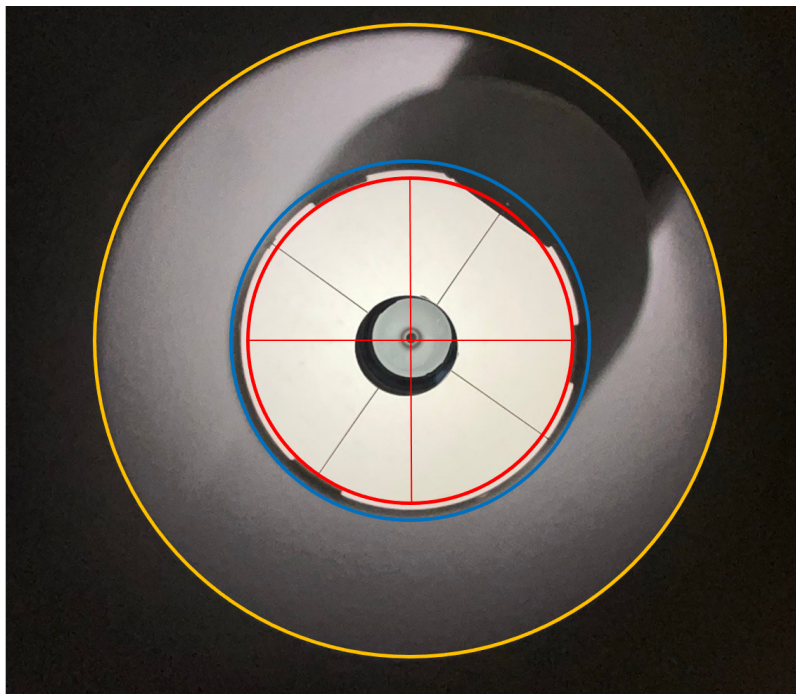


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After some twiddling with the secondary and primary, collimation screws, its starting to look pretty pretty good. Here's what it looks like with the collimation guide rings overlay removed (i.e., straight from the camera).



To assess how good it is, I sent this image to my computer and imported it into a powerpoint Slide and overlaid the collimation guide rings from its powerpoint slide onto it, doing the necessary amount of zoom and alignment to match against the focus tube, secondary and primary images.

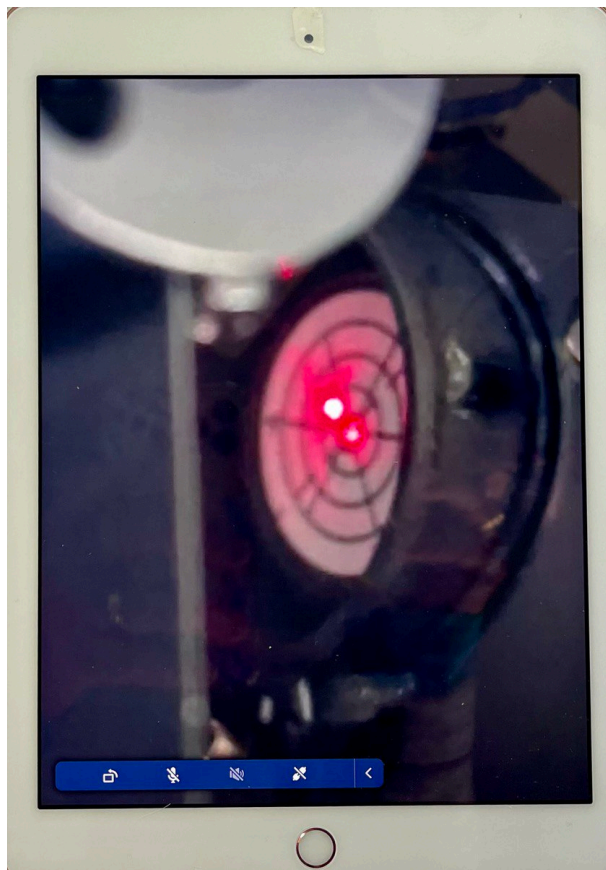


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Confirming the collimation is pretty pretty good but probably needs another pass to center the Aline peep hole perfectly on the crosshairs . All all in all a solid proof of concept meeting the three requirements

- 1) Live video of the optical components to be collimated
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Now anything else? Oh Yeah, I know you're wondering about laser collimators. We do love us some laser collimators. Clamp your iPhone where it can peep into the telescope tube and see the bottom of the focuser draw tube, insert your laser and turn it on. Here's an example using my trusty 25+ year old Tom Noe laser collimator.



The laser return isn't hitting the center of the laser port but that's because I tilted the laser collimator in the focuser so the return would show up separate from the laser exit port for "illustrative" purposes.

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Conclusion

Does it work? **Yes.** It meets all 3 requirements

- Live video of the optical components to be collimated.
- Displaying the live video on a larger screen
- Ability to superimpose collimation guide rings on the live image

Plus one more

- Ability to see a laser collimator return.

All the steps are pretty easy to perform and working from a large flat “live” video image of the optics is way easier than squinting by eye through the Aline (still the most marvelous collimation eyepiece if I do say so myself) peep hole. The ability zoom and to adjust focus and brightness to improve the image quality is another big plus.

Carrying an iPad to the back end of a large/long newt while adjusting the primary collimation screws is a whole lot easier than having to run back and look in the collimation eyepiece or at the iPhone stuck in the focuser after every turn of the screw. And just think how much easier it will be to view the laser beam return on an iPad rather than squinting at it in the focuser from 8-10 feet away!

And best of all, ***its affordable!*** Everybody has a cell phone with a camera, the marvelous Aline collimation eyepiece is quite affordable as is a cell phone camera holder which you probably already have. However the most important tool for that ties it all together and make live video collimation work is Airdroid cast.

<https://www.airdroid.com/cast/>

Which supports Mac/Android/Windows phones, tablets and computers and is **FREE**. It is simple and easy to use and rock solid on connecting and broadcasting images from the iPhone to the iPad.