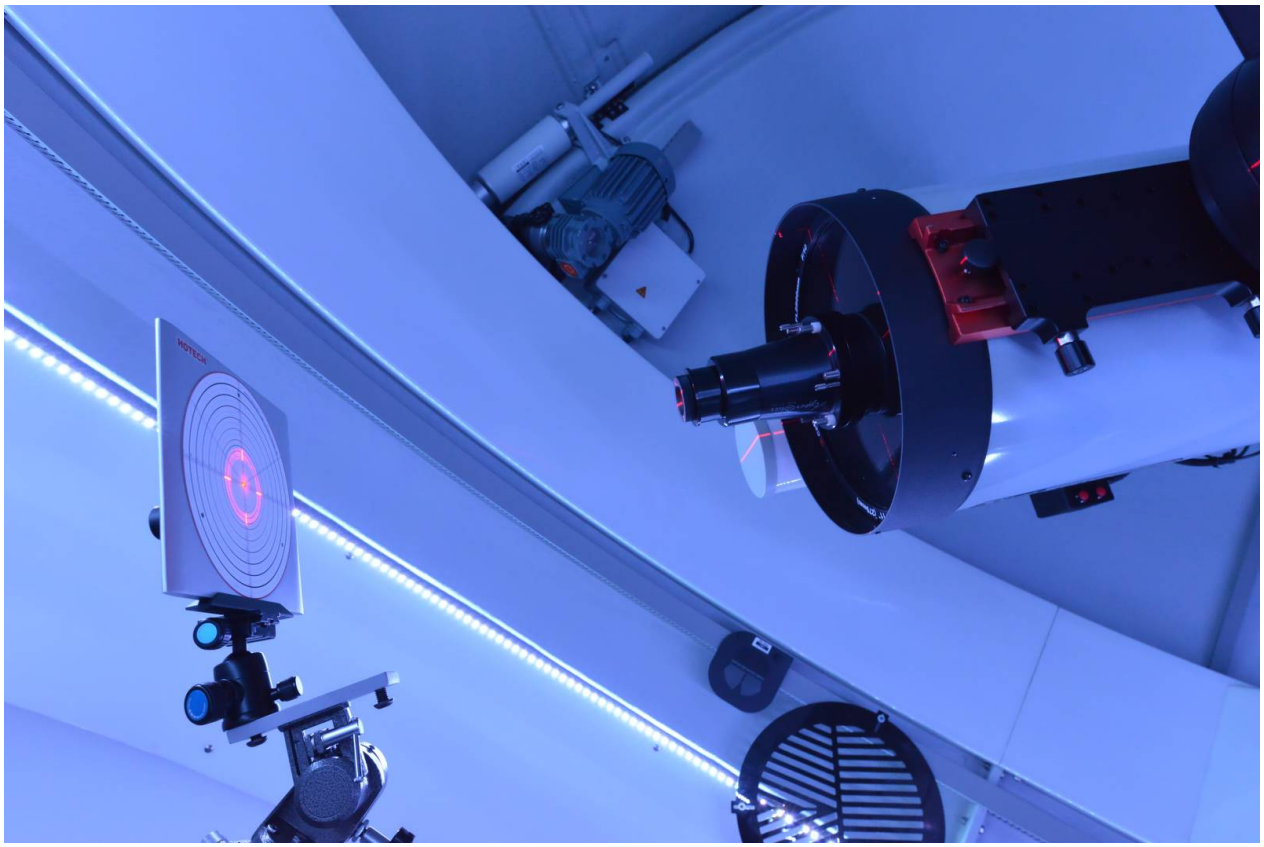
New HoTech laser collimator demystifies the HyperStar

If you search for HyperStar + Frustration in Google, you will quickly find something similar to this: "I have literally wasted HOURS over several nights trying to fix my HyperStar collimation and it is simply impossible ".

This is the main reason why in many forums you can regularly find HyperStar owners who after a few months opt for selling it in spite of the fact that this is a great piece of equipment. The extremely high speed, f / 2, on a SCT, makes the heart of every astrophotographer beat faster. But the path to success is a very narrow one. The collimation process has to be performed at night and it is quite complex as there are too many variables in play – mainly the HyperStar tilt and its centering. Without much help available, many astroimaging enthusiasts finally decide to give up.

But now the HoTech laser collimator makes an accurate HyperStar collimation possible. This tool allows us to perform the collimation at any time of the day. The collimation is done in real time - without the need to refocus every time a collimation screw has been adjusted.



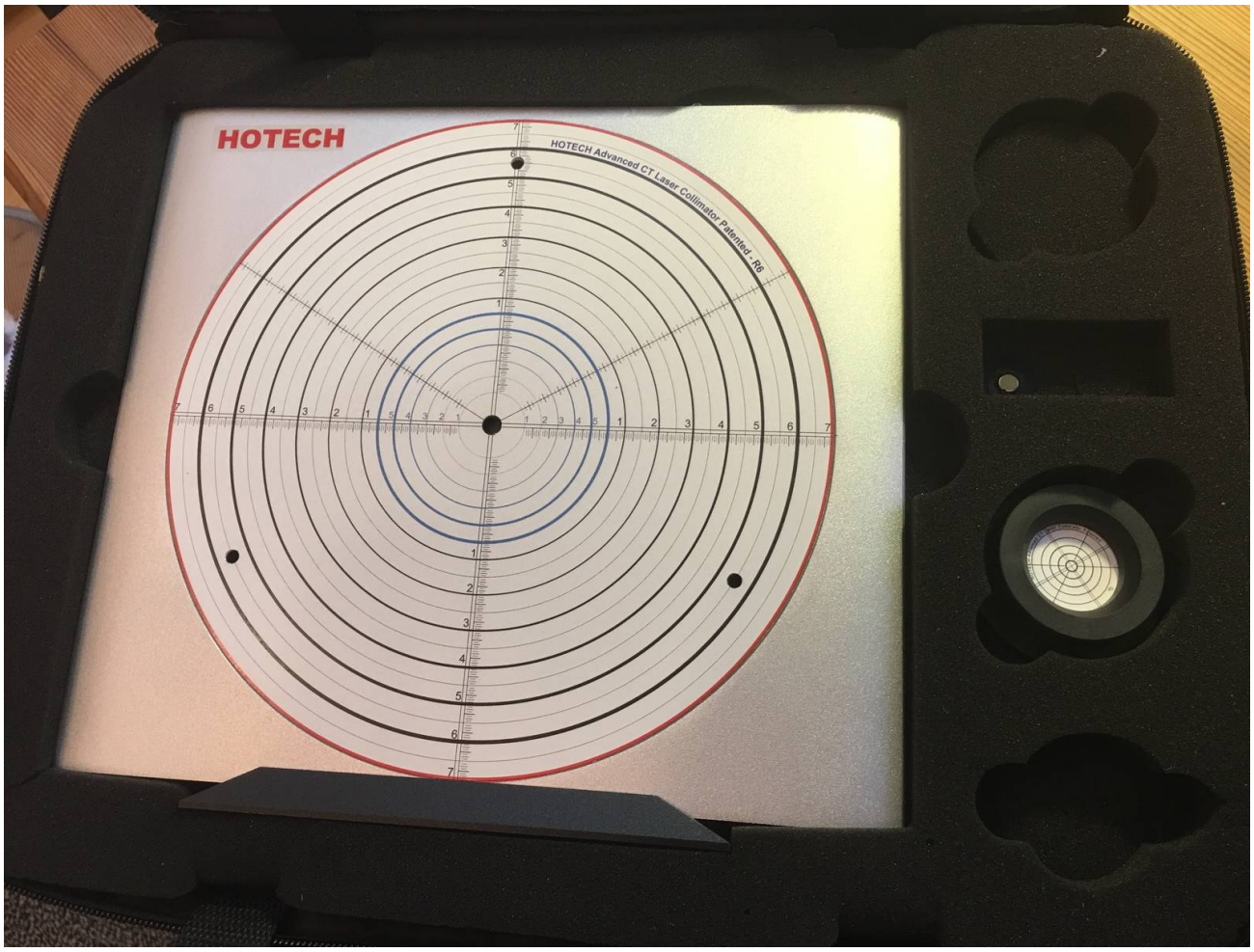
This is the reason why I decided to share my own experience about the collimation of my C11 EdgeHd HyperStar which can be used to supplement the manufacturer's manual.

The collimator is available for different HyperStar versions, from C8 to C14. I've been using my C11 for many years. I purchased my HyperStar about 5 years ago and collimated it during the night. It retained its collimation for a long time after that.

I've always focused the C11 so that the main mirror moves against gravity. I recently started using a motorized focus with temperature control. At this point it turned out that the main mirror moves in the direction of gravity as the temperature drops and the collimation absolutely accurate in order to stay in focus or to adjust correctly as the temperature changes. As this is where the main mirror is located and thus also the direction of the optical axis (mirror shifting), I decided to recollimate the device. At this point in time I ordered a HoTech laser collimator through The Teleskop-Service company

HoTech laser collimator

The collimator is delivered in a sturdy transport bag with a foam insert.



This is for the standard SCT version. You also get an adapter that places a semi-transparent mirror in the focal plane of the HyperStars and a cap with a centering disc. The cap with the centering disc can be used up or down. This is required in the individual collimation steps.

Collimation steps

The collimation essentially consists of two separate tasks:

1. the setup and alignment of the collimator in relation to the main mirror
2. the actual collimation of the tilting and centering of the HyperStar.

The first task is critical, difficult, determines success, and requires a lot of effort. On the other hand, the actual collimation, is fun, quick and easy to accomplish. Finally, with the C11's native focal length of f / 10, you can also collimate the secondary mirror, and center the pull-out at the back (if available).

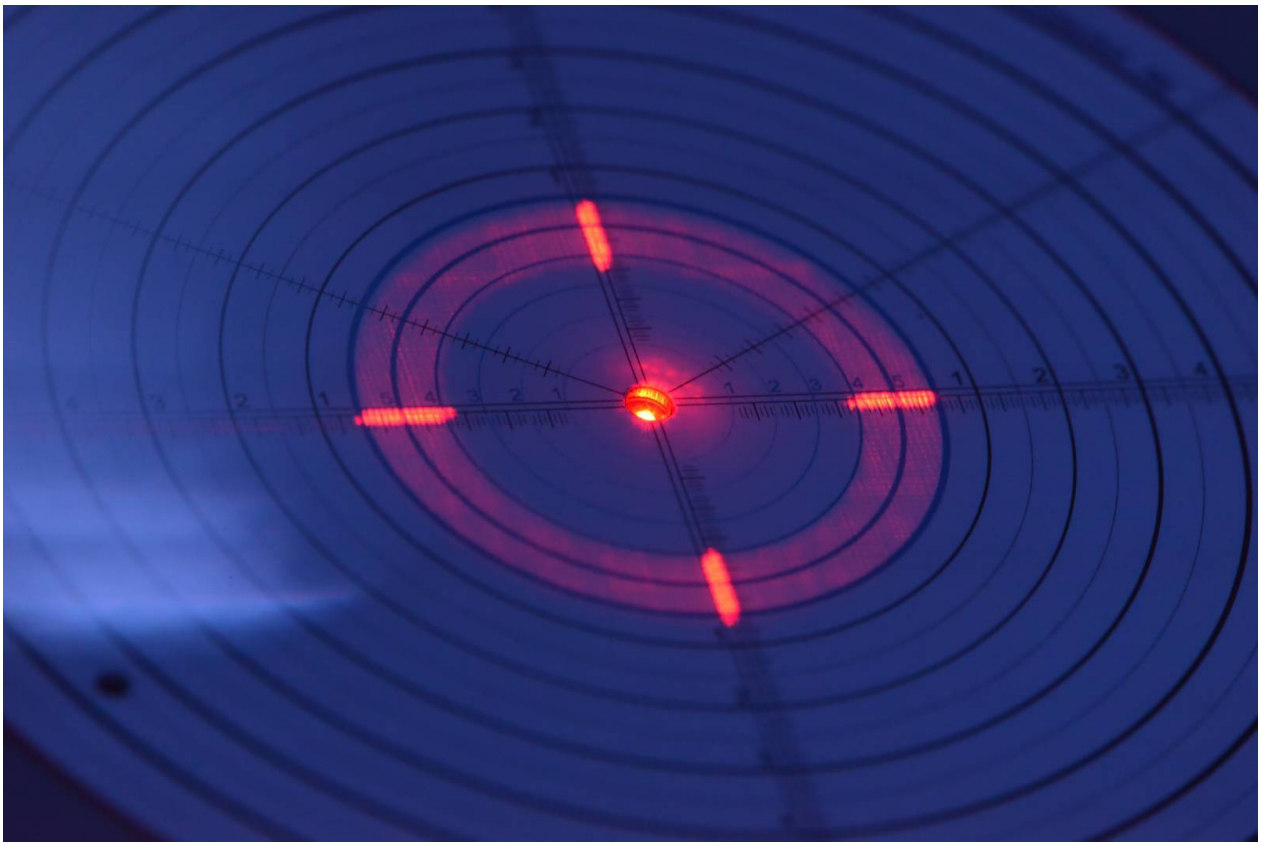
Setting up the collimator

My first attempt was marked by failure. Per manufacturer's recommendation, I placed the collimator on top of a “standard” € 100 photo tripod. After two hours I realized that it is impossible to coalign the collimator and the telescope to the level of accuracy that the collimation requires.

At this point I strongly recommend to use a really heavy and stable tripod equipped with an azimuth mount. A robust and adjustable camera ball head will round off the setup.

Before you place the Hotech Laser Collimator on the tripod, I recommend the following steps:

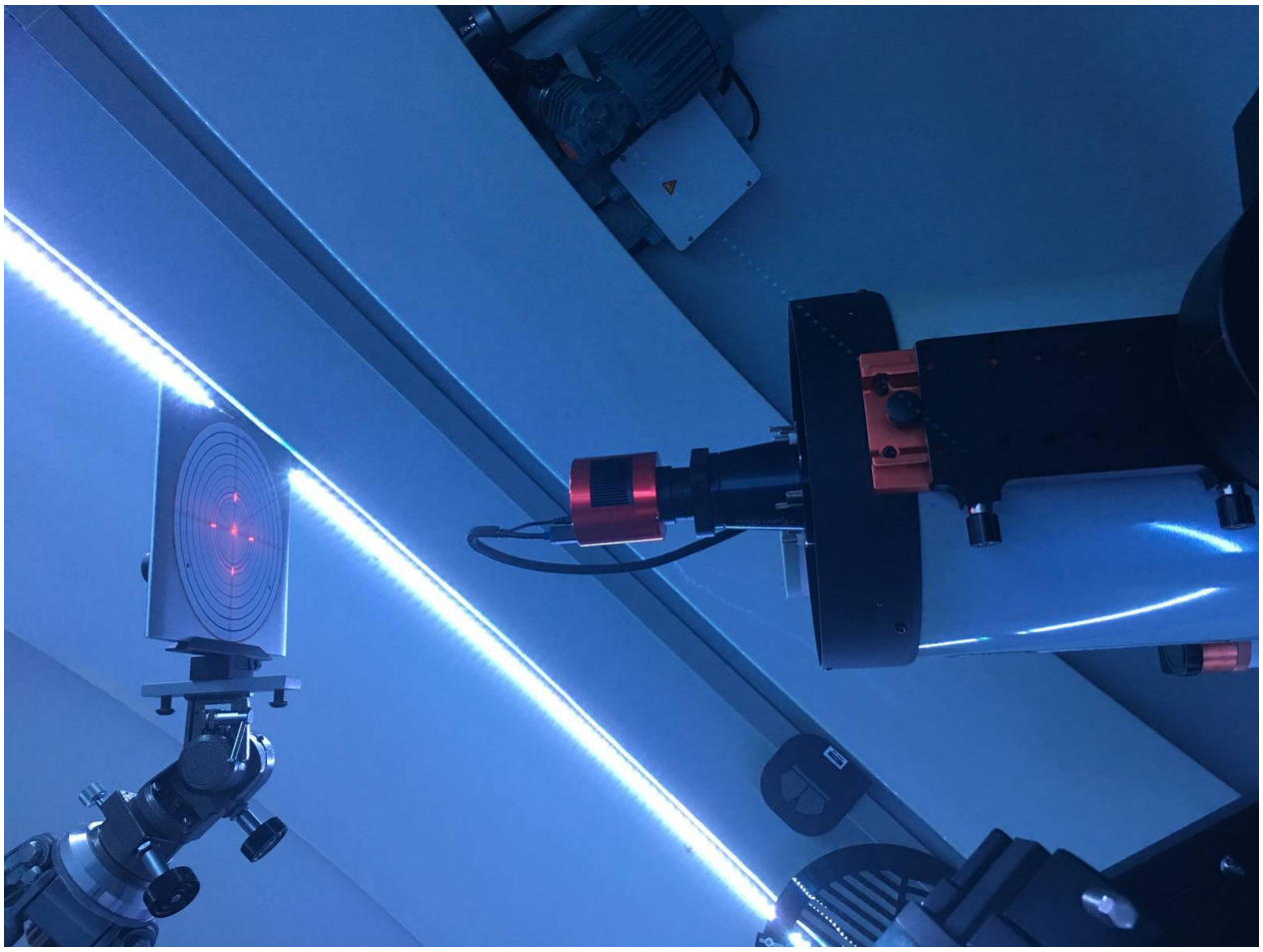
1. Turn on the collimator on mode 1
2. Take the collimator in your hand and align the laser in the direction of the main mirror
3. Move the collimator in a playful way so you can see the reflected cross-hair that will appear at a certain distance (approx. one tube length) and the intra-extra focal cross-hairs. This will give you an idea of where the collimator must placed.
4. At this point you can place the collimator on the tripod and bring it roughly into the starting position:
5. The distance between the collimator and the telescope should be more than one tube length
6. The ring and the cross-hairs should be visible on the collimator



Coalignment

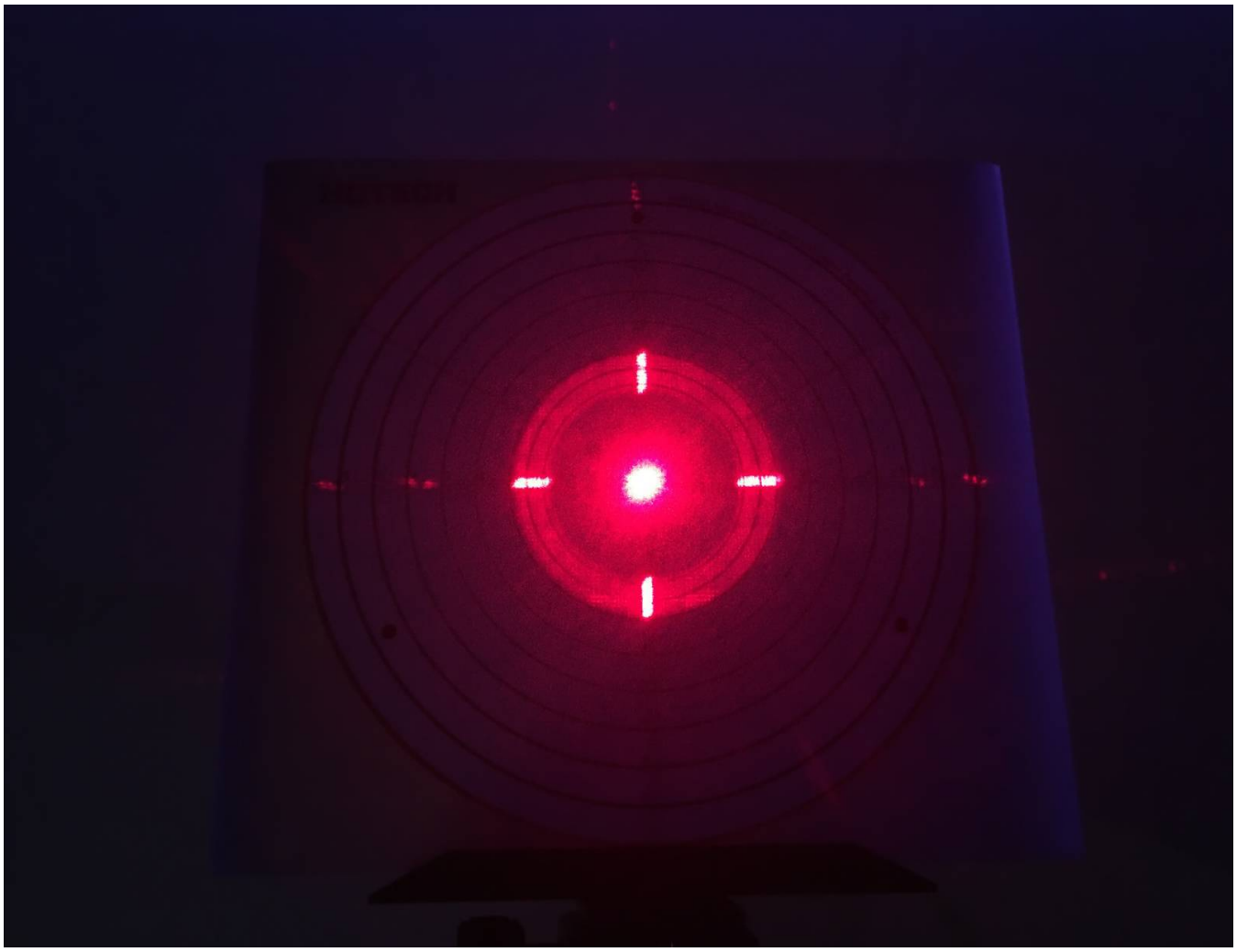
The steps required to coalign the collimator and the telescope are fully explained in the following YouTube video: https://www.youtube.com/watch?v=wgDBktsX3fI The process is the same for the Schmidt Cassegrain telescopes whether using the secondary mirror or the HyperStar.

This step focuses on reaching perfect alignment between the collimator and the telescope and it “ignores” the HypersStar attachment. The offset between the centering disc and the HyperStar will later be compensated by adjusting the corrector plate. Therefore, leaving the camera installed on the HyperStar can also be helpful:



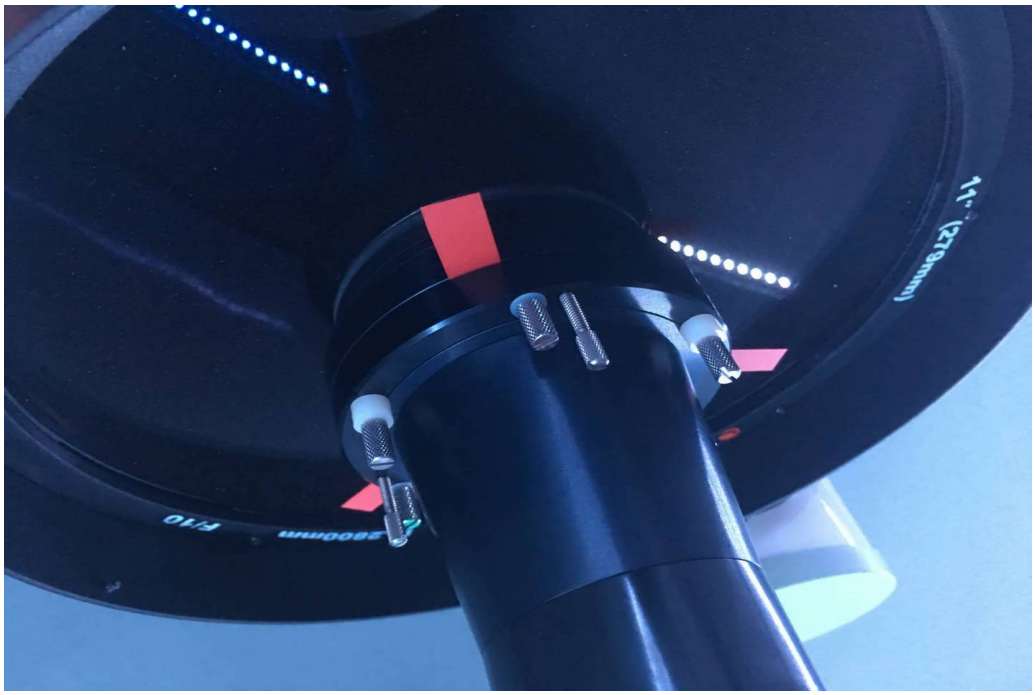
Aligning the collimator is by far the most difficult task and it must be done carefully.

Once the coalignment is reached, you should see a symmetrical circle in mode 1. A cross-hair will show on the axes of the collimator. It is important for the tips of the cross hairs to have the same radius.



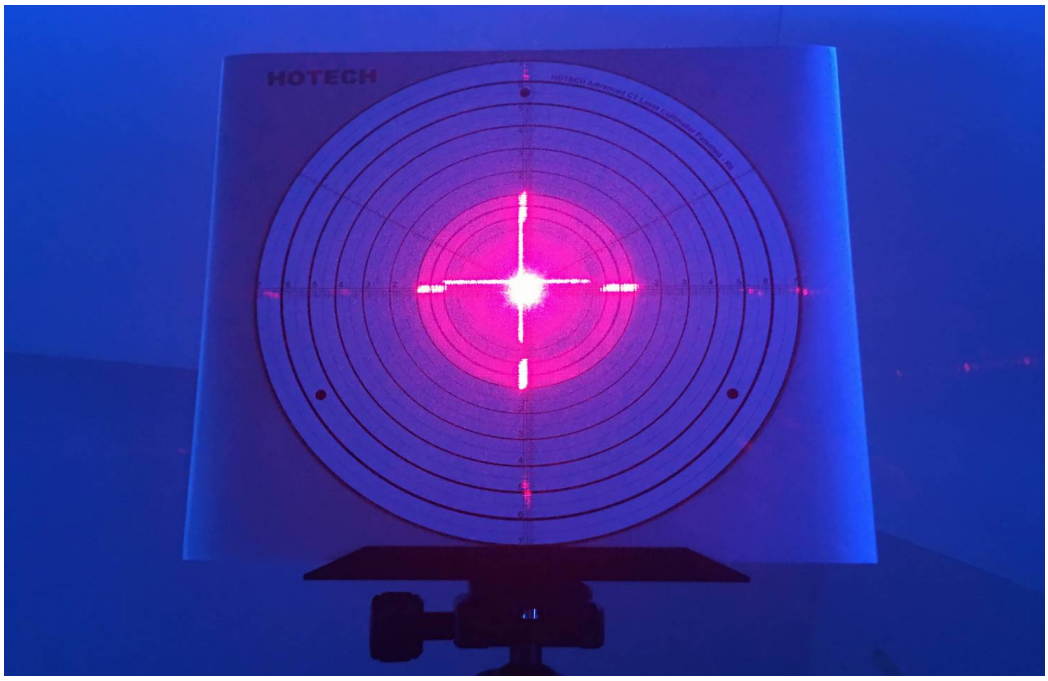
HyperStar Collimation

It is recommended to collimate the HyperStar from its home position. You can do this by using three washers, which can be obtained by cutting mall pieces from a standard plastic file folder (e.g. Leitz flat file). The pieces should have an approximate thickness of 0.2 to 0.3 mm.

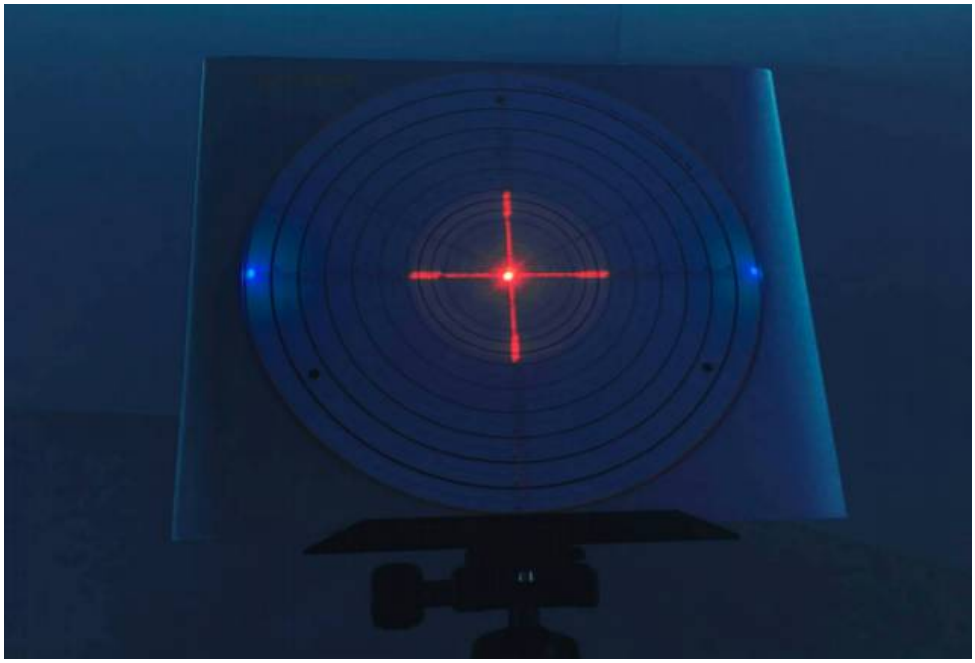


The actual collimation of the HyperStar is very simple. Remove the camera and place the Hyperstar adapter. Start by unscrewing the centering disc from the HyperStar adapter and set the collimator in modes 2 or 3 (three lasers + crosshairs).

Now you can see another cross on the target of the collimator. If the new cross is shifted in relation to the cross of mode 1, then a collimation is necessary.



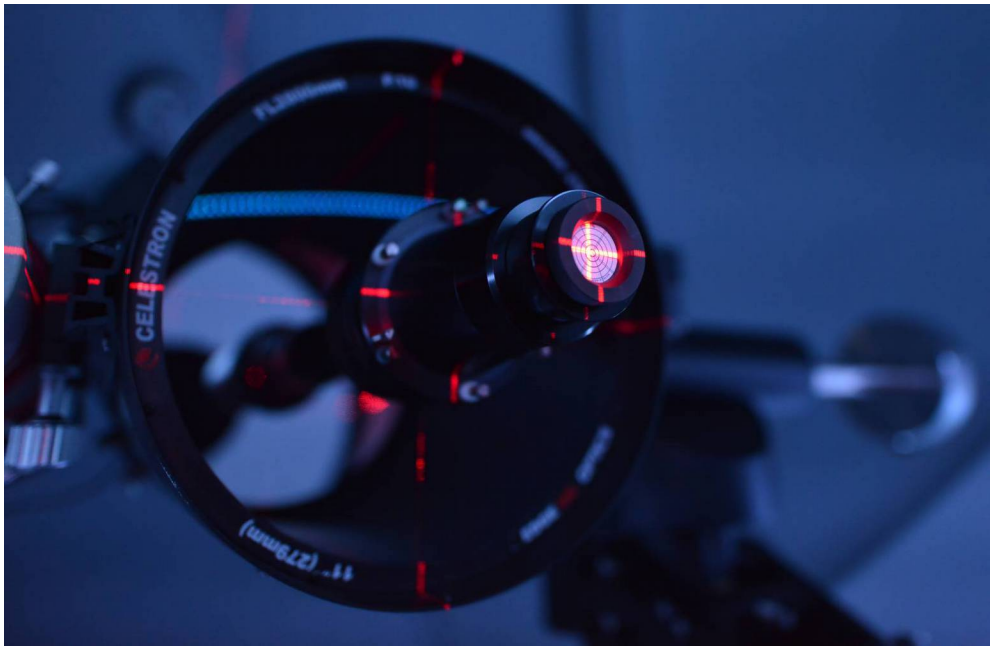
The two crosses must be aligned using the tension and compression screws on the HyperStar.



As you can see, a tedious task can now be done just in a few minutes. At this point you should tighten all screws firmly without deforming anything. The collimation is now complete and, in my experience, it lasts for a long period of time. Now you can also switch the HyperStar and the secondary mirrors without loosing the collimation.

HyperStar Collimation

In this step, the HyperStar and the corrector plate are placed on the optical axis of the main mirror. The cap with the centering disc is now screwed onto the HyperStar adapter and the collimator is still operated in mode 2 or 3 (three lasers + crosshairs). Now you should see a cross in the center and the three focused lasers should appear as a point in the centering disc.

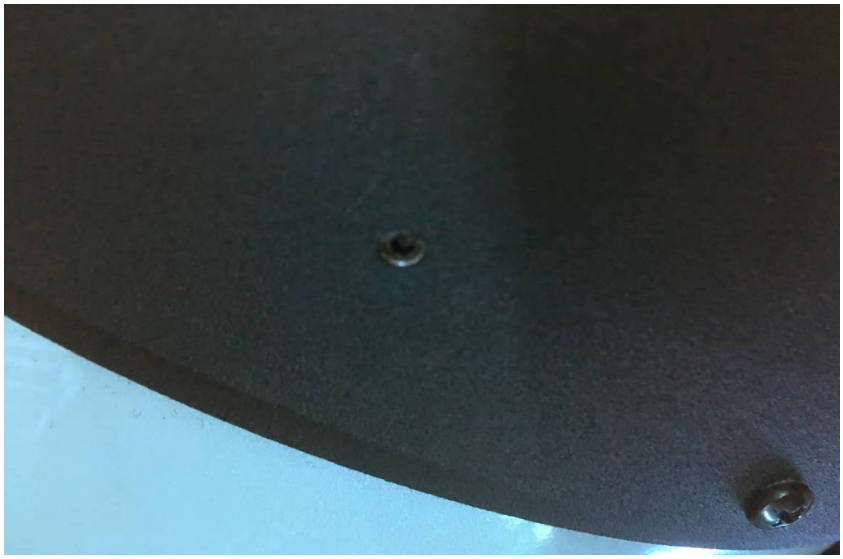


If the point is in the middle of the centering disc, then the collimation is done. Otherwise the corrector plate must be adjusted.

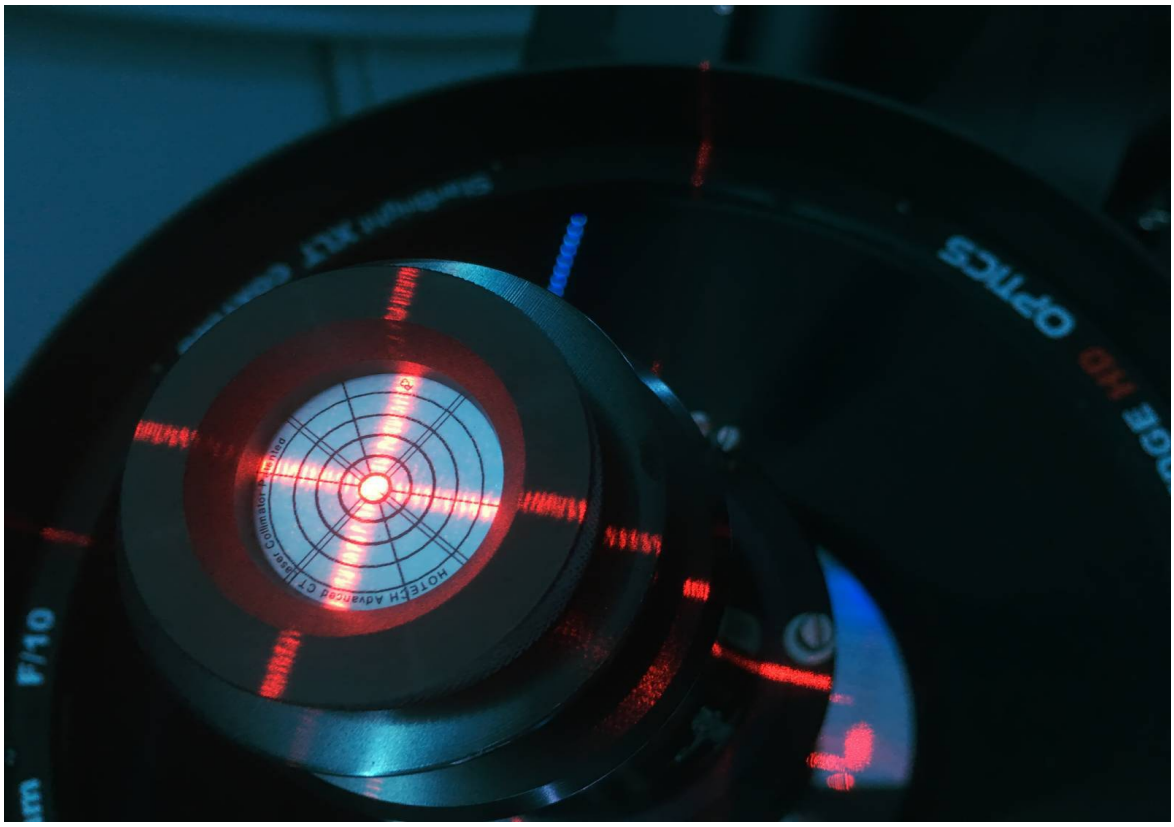
If your telescope is a Celestron Edge HD, the corrector plate can be adjusted fairly easily. If you own a different SCT model, you should contact HoTech for advice.

On the Celestron Edge HD the corrector plate is held by a frontal ring that is fixed with eight screws.

Use a small Phillips screwdriver to loosen the screws so that the ring is on the corrector plate no longer exerts any pressure. Then you can adjust the corrector plate alignment using the four Allen screws located on the side of the tube.



The direction in which the corrector plate has to be moved can be seen on the centering disk.
Loosen two of the allen screws, then adjust the corrector plate using the opposite screws. Once the cross is centered, tighten the eight screws that hold the plate to the ring, then slightly loosen the Allen screws so that no mechanical tension can arise.



The HyperStar collimation is now complete.

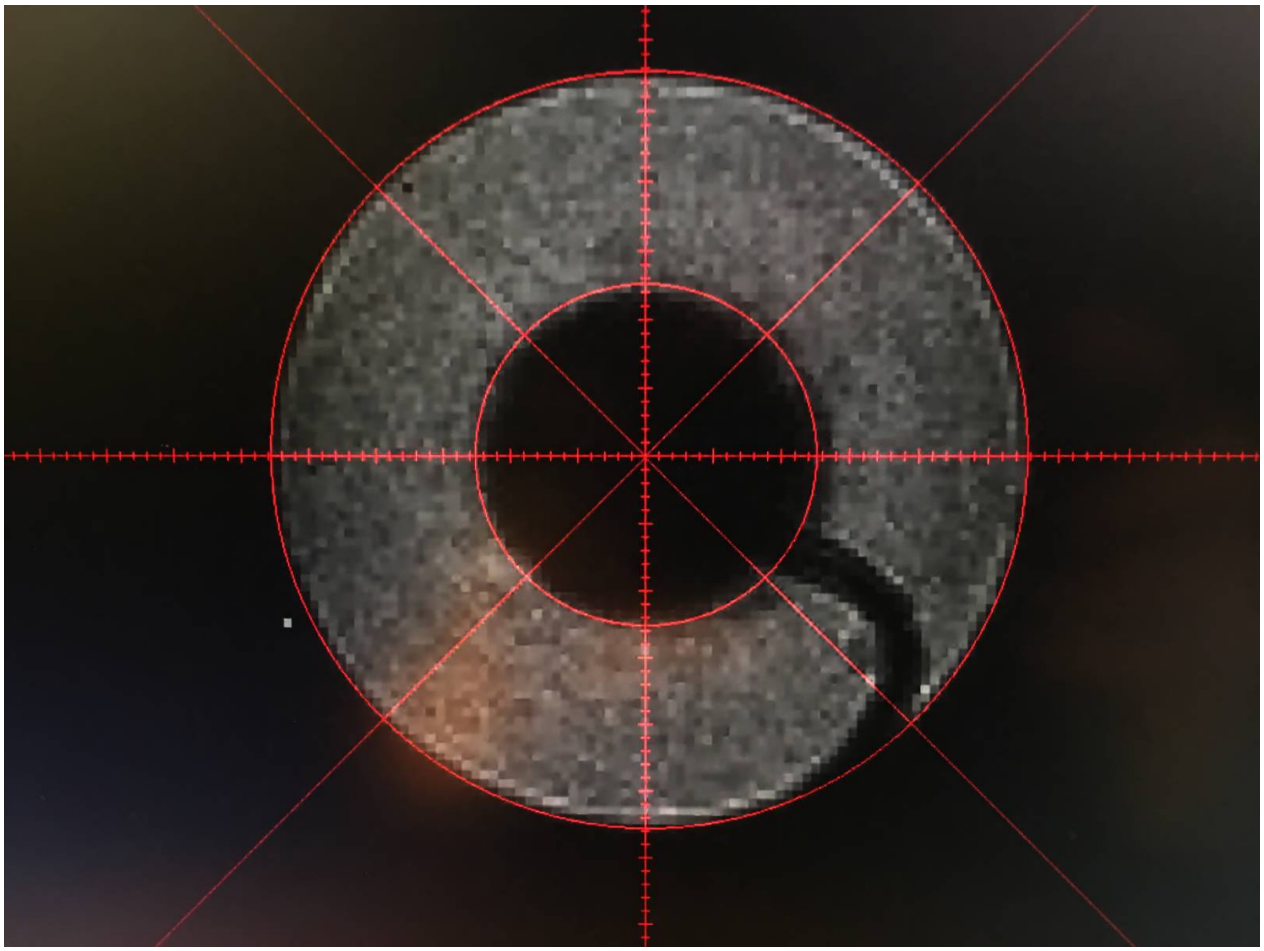
Collimation of the secondary mirror for operation at F / 10

If it was necessary to move the corrector plate (even if only for test purposes), it is also recommended to check or collimate the secondary mirror. To do this, place the secondary mirror in place of the HyperStar. The HyperStar attachment is no longer required. The cap with the centering disc must be installed at the visual back. The semi-transparent mirror enables the collimation of the secondary mirror.

Turn on the collimator in mode 2. The three reflected laser beams are directed onto a concentric circle brought with the same radius. The rear extension can also be centered separately. Please refer to the manufacturer's YouTube video for a detailed description of the collimation process.

Field test

Once the above steps have been taken, we must test the collimation under the stars. Begin by defocusing a bright star and examine its shape using the freeware Astroraster 1.0.



You can also check the collimation, using software such as CCDInspector or the WaveformEstimator in PixInsight.

In my case I connected the full format Atik to the C11-HyperStar and took an image of a star-rich field.

You may go to the following links to see the image in full resolution.

https://www.astrobin.com/355026/?nc=user
https://www.astrobin.com/full/355026/0/?real=&mod=

According to Celestron, the C11-HyperStar is calculated up to a chip diagonal of 27 mm. With appropriate flat field calibration data and a well collimated HyperStar it can also be successfully used with full frame cameras.

I wrote a thread on this topic at astronomie.de:
http://forum.astronomie.de/phpapps/ubbthreads/ubbthreads.php/topics/1084187/45mm_Chip_am_C11-Hyperstar#Post1084187

Closing

With this new type of laser collimator, HoTech offers the troubled HyperStar user a valuable tool.
The effort is worth it, because the collimation remains stable over time and the optics provide high quality images at breakneck speed. And I hope with this document helps many HyperStar users and the word “frustration” disappear from the HyperStar searches on the internet forever!

Andreas Bringmann

https://www.astrobin.com/users/equinoxx/