

GoldFocus

Focusing System

A New Approach to Achieving Critical Focus

By Dave Snay

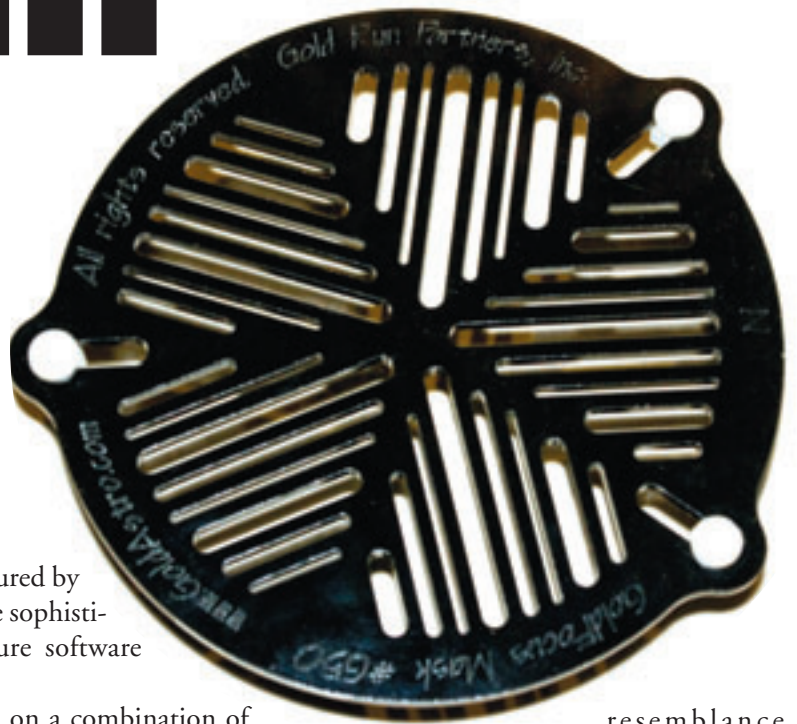
We all know the trials of achieving critical focus for astro photography. At first we think our eyes are good enough to get it right. Then we see that's not true and try various means to verify that we've gotten everything well tuned and ready to go.

I've tried virtually every kind of mask referenced online, including but not limited to strings crossed over the end of the OTA, Hartmann masks and most recently a Bahtinov mask. Many data capture packages include the ability to magnify the image and I've even tried combining that with various masks. There is also the mystical FWHM value

that can be measured by some of the more sophisticated data capture software available.

I had settled on a combination of Bahtinov mask and image magnification followed by FWHM values during data capture to maintain focus. Well those days are gone for me. Enter the GoldFocus Focusing system. It is a combination of a specialized mask and very specialized software that enables you to achieve extremely precise focus in a matter of minutes.

At first glance, the mask looks much like a Bahtinov mask, but the



resemblance ends there. This mask is designed to generate a very specific pattern, see **Image 1**, based on extensive research by Jeffrey Winter, who just happens to hold a PhD in mathematics. I have a nephew that holds one of those degrees, and let me tell you they are incredibly intelligent people. I like to think I'm pretty smart (I am a retired software engineer and Worcester Polytechnic Institute graduate), but I rarely understand my nephew



Image 1 - GoldFocus Spike Pattern

when he starts gettin' all technical on me. The only folks I've worked with that think further out of the box than these

guys are physicists. Debate with them at your own peril!

Back to the GoldFocus system. Upon

opening the box, my first impression is that the masks are very well constructed. They are light enough that they should pose no threat to the current position of your telescope. However, they do not look fragile or cheap. They come "unassembled," meaning you'll have to install the three plastic screws, nuts and sleeves (which are included) that are used to hold the mask in place on the optical tube. If you read the instructions before you do this, you'll be sure to get it right. The key is to insert the screws from the side that has the engraving. More on that in a bit.

Before you put things together – I know, it's hard to wait – install the software and read the assembly instructions, which just happen to be the first thing the software opens after installation. Installation was simple and flawless on my *Windows XP* system. Insert the included disk and install the software as instructed, taking all the defaults. Let it open the readme file when done. It opens it in a

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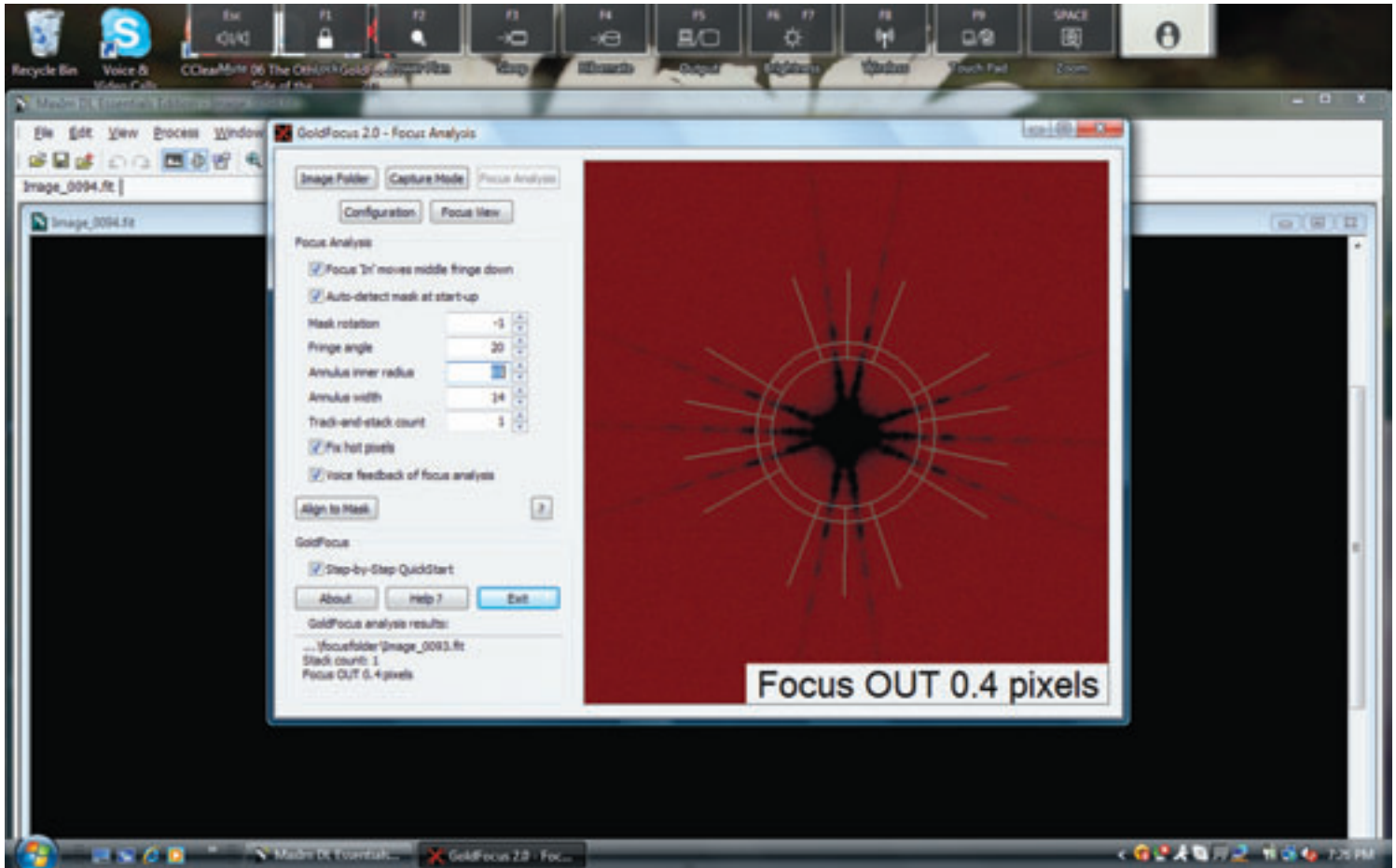


Image 2 - GoldFocus Analysis Window

small window rather than full screen. I'm not sure I wouldn't prefer the full screen because the first thing I did was expand the screen. As I already mentioned, the first pages are assembly instructions. Naturally I had started assembly while the software was being installed. Of course I started out on the wrong foot by attaching the mounting studs from the wrong side. It only took a few minutes to reverse the installation.

After reading the user guide, I realized why it makes a difference which way you install the studs. There is an "N" on the side with the engraving that you use to properly orient the mask during use. Align this mark as closely as possible with the top of your camera, whichever way the camera is oriented. If you do this, and have checked the "Auto-detect mask at startup" option, you'll be in better position to achieve focus quickly.

The mask's diffraction pattern needs to be aligned with the analysis annulus presented by the software and the closer you have the mask and camera oriented, the less adjustment of the software's Mask Rotation value you will need. If you've done this and still find the diffraction pattern and the annulus are not well aligned (it is easy to have things further off than you think when working in the dark with gloves) you can try selecting the "Align to Mask" option, which will attempt to align things for you. If that doesn't get things squared away, the "Mask Rotation" value can be changed to rotate the software's view of the diffraction pattern so that the spikes from the star are aligned with the software's analysis zones. Once you do this, you're on your way to critical focus in minutes regardless of whether you are using equatorial or alt-az mount.

GoldFocus does not provide data

capture software. It relies on other software to provide images for its use. You simply set your data capture software to take continuous exposures and save them in an easily located "focus" folder. Then you tell GoldFocus where to find them. You select the same folder for focus analysis (the user guide explains the details better than I can) and then follow the on screen instructions. The software not only tells you how close you are to focus, but it also tells you which way to turn the focuser. You can even tell the software that it's got the direction backwards so that it will be correct from then on. The key here is to wait for a few cycles of image capture/analysis between focus adjustments or you'll just chase your most recent change. You can automate this process by enabling the "Track and Stack" feature, located in the "Focus Analysis" section. You can select the number of frames to

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accumulate before each analysis and recommendation. This will help prevent chasing inconsistent seeing conditions, which can wreak havoc with focus attempts.

GoldFocus does its best to choose the brightest star in the field of view for analysis. It is generally recommended that you achieve critical focus using a relatively bright star prior to composing your imaging subject for the night. That works well enough, but if you're like me and have to adjust focus between filter changes (even parfocal filters typically require minor adjustments between changes), then it becomes more useful to focus on a star in the field of view of the target. If there is a star that dominates the field, there is no issue. However, this can be problematic if you're working on galaxy or nebula subjects that don't have a bright star in the field. In cases like this, the software can try to use the center of the galaxy for focus. If you're imaging a nebula that covers the majority of your

field of view, then there may not be a star bright and/or sharp enough to use for focusing.

If your data capture software is capable of saving only a portion of a frame, you're in luck. Simply select a star within the field and have your software save only that portion of the image to the "focus" folder. Also, if you're using a telescope larger than my 80-mm refractor, you are likely to have plenty of choices for focus within your chosen field. Jeff was kind enough to provide me with a mask for my 8-inch SCT. When I use that telescope I never have to search for a star to use for focus adjustment. In fact, the diffraction spike pattern in the larger telescope is very well defined and easier to interpret in the software's analysis interface, as shown in **Image 2**. See the "Focus OUT 0.4 pixels" text in the lower right of the window? That's telling me I'm pretty much as close to perfect focus as I'm going to get. I found anything under one pixel yields very nice images.

One feature I find particularly useful when aligning the annulus with the diffraction spike pattern – when not using the big SCT – is the zoom tool within the Focus View. It doesn't have any effect on the analysis, but it does allow me to see the diffraction spikes more clearly when I'm using a less than ideal star for focusing. Many users will not need this tool because they can and should use the "Auto-detect mask at start-up" option in the Focus Analysis section. If you've got the mask oriented relatively close to celestial north, then this option will allow GoldFocus to orient the analysis annulus (say that ten times fast) to match the diffraction pattern. If you start with that setting and the diffraction pattern you see is not well defined – usually due to using a relatively faint star – then you can zoom in and use the "Mask Rotation" tool to more properly align mask and pattern. If you need to rotate the mask, it helps to understand that the value changes are relative to the 3 o'clock

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position on the mask. So a negative change will rotate the mask counter-clockwise and a positive change will rotate the mask clockwise. There are a few other tools at your disposal in the software, but their use is beyond the scope of this review.

If you're processing your images and find yourself wondering if you could have achieved better focus, then you probably could have done so. GoldFocus is the next step in achieving and maintaining critical focus. There are a couple of enhancements I would like to see. The Mask Rotation value is numeric. I would prefer it be more intuitively labeled left and right or counter-clockwise and clockwise. I would also like to see the software made capable of determining which way you need to adjust the focuser regardless of the type of telescope system you are using. As it is currently implemented, you might have to tell it to reverse its recommendation of in and out of focus depending on whether you are using a reflector or a re-

fractor. It might be possible to determine that if the software is given the configuration of the current hardware. However, if you consider the myriad configurations possible I think you'll agree that it's better that they focused their attention on the analysis requirements.

Both of those enhancements truly are nit picking, but that's all Jeff has left for me to complain about. He has done a very nice job of producing a tool for us in GoldFocus and it is also very reasonably priced at between \$70 and \$145 depending on the size mask you require. There are sizes from 2.5-inches up to 17.8-inches. They can also make custom sizes if you have needs outside these ranges. Unlimited technical service is available, but I really can't imagine why you would need it. GoldFocus is extremely easy to use and the documentation tells you all you need to know for success. It is concise and crystal clear. You can learn more details and order your copy at <http://www.goldastro.com/goldfocus/>. 

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