Using Optec Inc. C-11 FastFOCUS

My first impression and thoughts (a win!)

By Charles F. Olivier III

Aug 2012

2.0

Table of Contents

Preface

I was introduced to astrophotography in 2005 and was hooked ever since. At the time, I was using a CGE mount and a Celestron C-11 (non Edge-HD) as my main setup. During this time there were only a few astronomers that I knew in Washington State that were using a CGE mount. The first person that I'd meet that had a similar setup as mine, as well as an interest in the hobby was Wade Hilmo. Our families went to numerous star parties together, such as Table Mountain in Washington and the Oregon Star Party in Oregon for several years. I was fortunate to meet Wade, as he is very knowledgeable in both astronomy and astrophotography. I credit a lot of my success to him.

As the years went by, my setup grew and increased in complexity to the point where I'd hit the limit of my C-11, I'd ran out of back-focus. At that time, I had a rotator (Pyxis 2")/6.3 focal reducer, AO, Starlight Instrument Barrel focuser, 10-position filter wheel and a ST-2000M camera hanging off the back of my C-11. To automate the focusing, I used Starizona MicroTouch wireless focuser in conjunction with a FeatherTouch focuser on the back of the C-11 (I'd replaced the original focus knob). This was working great for a while, until I started having issues with Mirror shifts. To solve this problem, I'd added a Starlight Instrument Barrel Focuser (short draw tube 1.5") to the back of the C-11. I'd barely had enough back focus to make this work. But to my amazement it worked very well.

In 2010, I had built a new observatory, and I'd upgraded my system to use the new Celestron C-1100 EdgeHD, SBIG-ST11000 + AOL, CGE Pro Mount, and the 3" Pyxis Rotator. I was excited to use the new EdgeHD because it had the ability to lock the mirror in place – thus eliminated any mirror shifts and a flatter field up to 42mm compared to the older C-11. However, in this configuration, I quickly used up all of the back-focus of the EdgeHD. I had no room to insert my Barrel Focuser. So, once again I had to go back to the MicroTouch Focuser/FeatherTouch combination on the back of my C-1100 EdgeHD.

Although, this worked, I felt that I had taken a huge step backwards. Focusing once again was erratic, and there were many times when performing an auto focus using FocusMax that the mirror shift was so great that the focus star shifted far out of the field of view, FocusMax could not re-acquire the guide star. This resulted in many nights of frustration, thus making my automated/unattended acquisition of imaging un-reliable. I'd consulted with Dean at Starizona and we both worked the issue. Although we were able to make the system perform better but still not to the level of reliability that I required (big thanks to Dean for all his help and effort). For my system, there was no easy way around the short backfocus of the C-1100 HD.

At this point, I could not believe that I was thinking about retiring/selling my C-1100 EdgeHD and moving up to a telescope that had more back focus, like the Planewave CDK-12 (but it was considerably more expensive than the 11" EdgeHD). However, in Aug of 2011, I'd read an article that mentioned a new focuser that

mounts at the front of the telescope and focus the scope by moving the secondary mirror in and out. This new focus device for the C1100 was ingenious and Optec Inc. is developing it. I've used many products form Optec Inc. in the past and have been very pleased with their products. After inquiring about the device with Optec, I was very excited and honored to have the opportunity to participate in the beta program. Thank you Optec Inc. & Jim Dickerman!

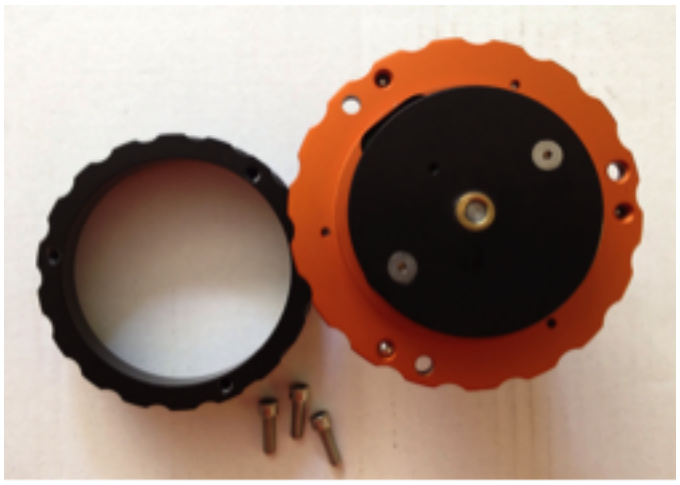
I've been using a beta version of this product now for the past 6 months and have been very pleased with the results. It is easy to install (but you need to be careful when removing and mounting the secondary mirror) and it works extremely well.

Pictures of the C11 FastFOCUS

On the next few pages, I've included a few pictures of what the device looks like, as well as my experience with this device, and photos using this unique focuser.

Note the 2 bolts pairs spaced 120 degrees apart in the images below. These bolts make collimation a breeze. One bolt is use to tilt the housing in, and the other to tilt it out. I can perform a collimation in the dark in minutes, to within 0.6 arc seconds.

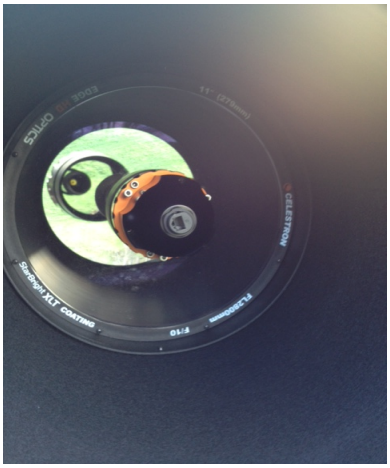

Picture of the housing – mounts on the corrector plate (well built)



The first image below shows the underside of the housing where the secondary mirror is to be mounted. The ring shown in the picture next to the housing is attached to the housing. This allows it to be inserted into the hole where the original secondary mirror bracket was installed on the corrector plate.

During installation, I was concerned that my secondary mirror had to be mounted and aligned in a particular rotational orientation with respect to the primary. My acquired images prove that this concern was unfounded. The acquired images showed no distortions or artifacts.

After the C11 FastFOCUS is mounted to the corrector plate, it sticks out about 4" inches and the original scope cover no longer fits. I'd called and discussed with Dean at Starizona and he'd informed me about an extension tube (Dew Shield) that was made for the Hyperstar by AstroZap. I got one and it works great, see image below.

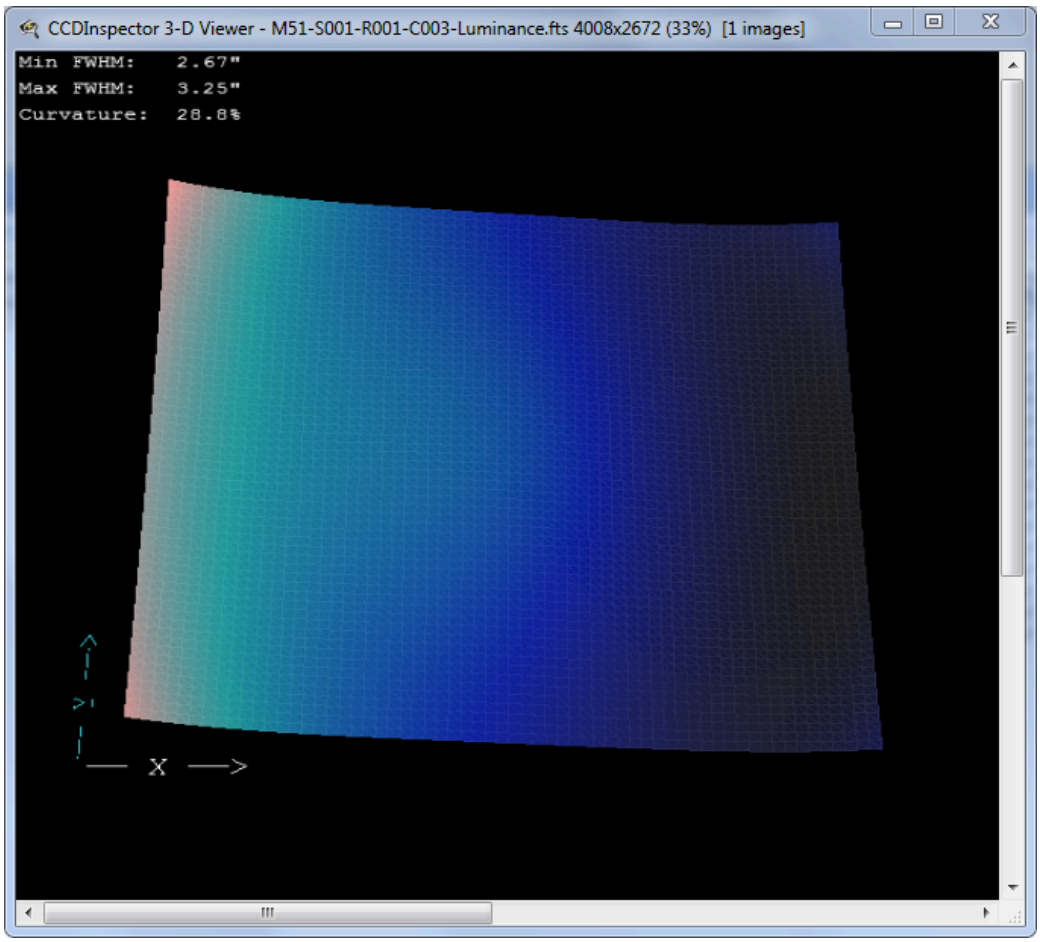


The image to the right shows the focusing unit mounted to the corrector plate. Note: The center of the housing on top contains a socket where the data and power cable connects.

Measurements When Using the Main Mirror to Focus

Previously, I was using Starizona MicroTouch to achieved focus by moving the main mirror of a C1100. Focusing with the main mirror was proving to be a challenge due to mirror shift when focusing. The mirror shift at times was so great that the focus star would move out of the field of view of the camera focus frame (even with a large frame size) and FocusMax was not able to reacquire the focus star resulting in a failed focus attempt. Subsequent retries failed at times as well.

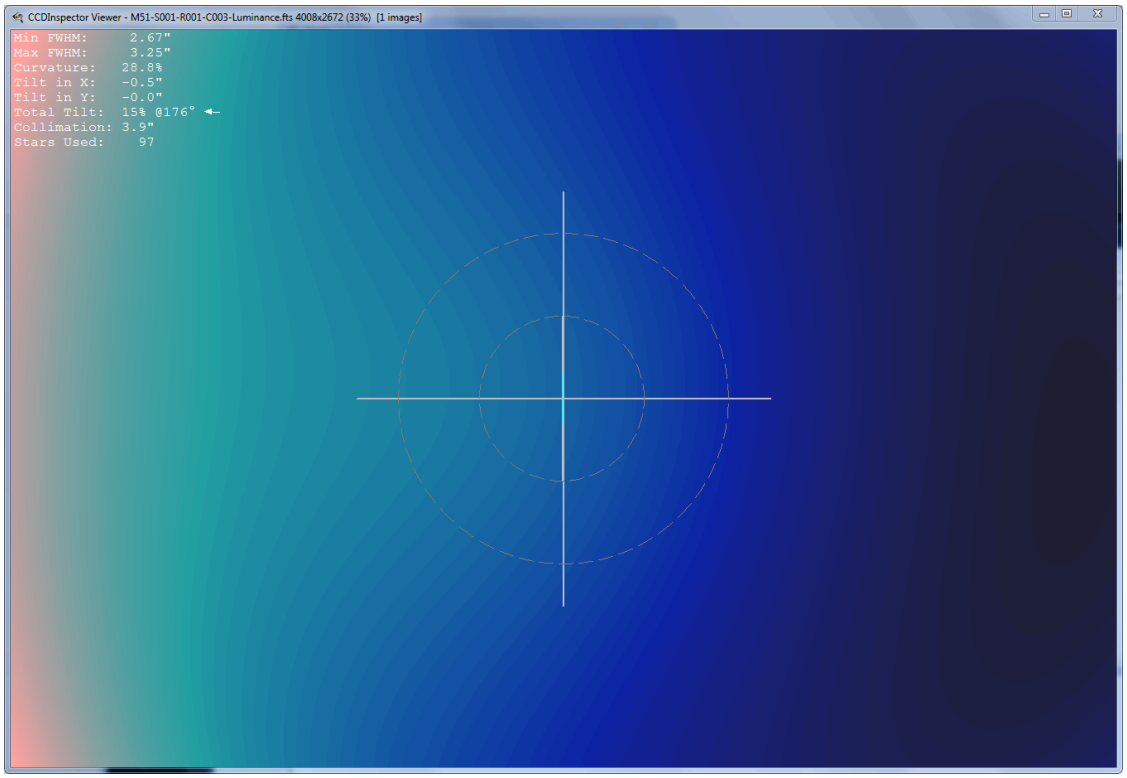
At the time, I did not realized how much of a tilt/shift in the main mirror that was present. Although I did achieve focus, the focal field was not uniform across the image – see image below. Also, the center of focus was shifted to one side of the image. Below is an image that measures the focus using CCD Inspector.



Note: Dark blue/black is in focus and the lighter the color the more out of focus that the image is. In the image above, it can be seen that the left part of the image is out of focus with respect to the right side.

Mirror Tilt Measurement

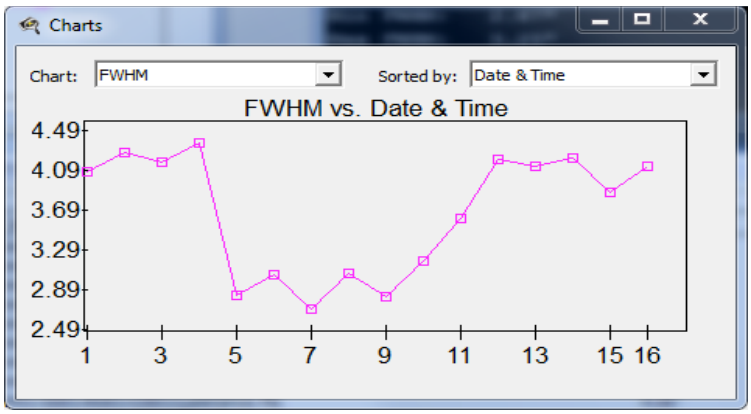
Using the same image, CCD Inspector was used to measure the total tilt in the system. CCD Inspector reported a tilt in the system of about 15%. In the image below, it is clearly seen that the part of the image that is in focus is not in the center as it should be, but is shifted to the far right.



Another benefit of the C11 FastFOCUS is that collimation is much easier, and more accurate. Previously, I was able to collimate to within 2.0 to 3.9 arc seconds. Using the C11 FastFOCUS I was able to achieve a results of 0.6 arc seconds easily.

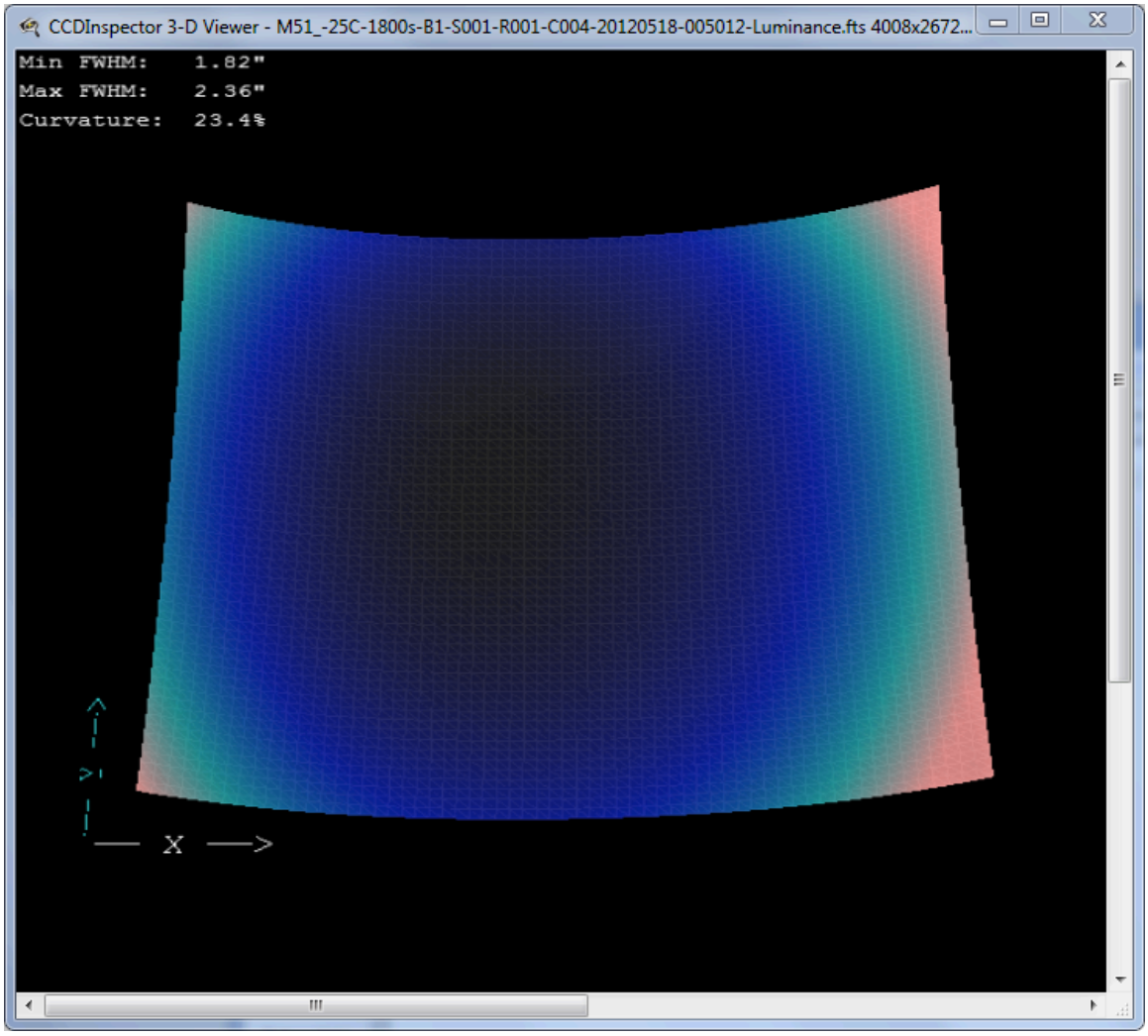
FWHM Measurement over time

FWHM was measured to be about 2.6 to 4.4 arc seconds over 16 images.



Measurements using the C11 FastFOCUS

For these measurements, I used the same object, and image under similar seeing conditions, and within a week of my previous tests. I'd configured FocusMax to focus using the C11 FastFOCUS and it performed very well. Average focus times for my system were about 73 seconds. From the image below, it is easily seen that optimum focus is in the center of the image as it should be, and because my system has some vignetting and curvature, my images are slightly out of focus near the corners.

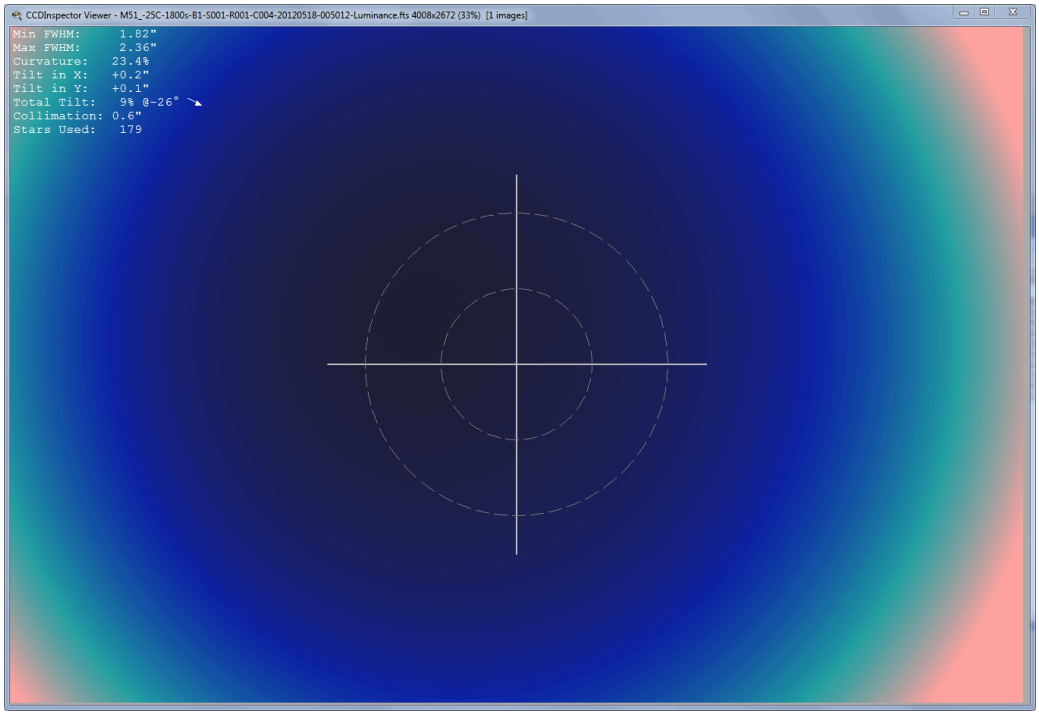


NOTE: I've ran CCD Inspector on many other images during the past six months, analyzed the results, and they were fairly consistent given the seeing conditions.

This is a remarkable improvement for my system when compared to focusing using the main mirror. I've also notice that the focus was much tighter (more accurate and good collimation) and my FWHM improved significantly (60% on average and 140% best for my system giving my seeing conditions).

Mirror Tilt Measurement

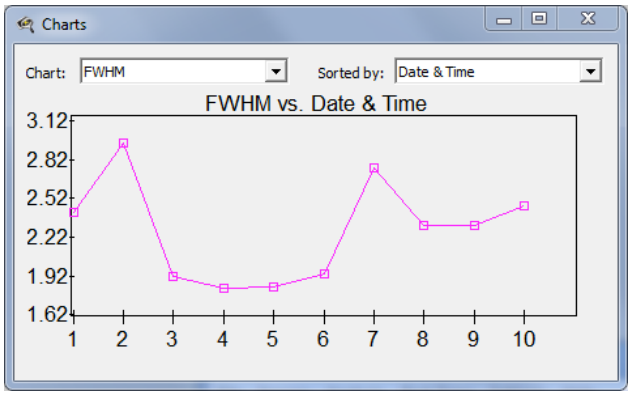
Using the same image above, I'd used CCD Inspector to measure the total tilt in the system. CCD Inspector reported a tilt in the system of about 9%. Optimum focus is almost dead center (slightly skewed to the left).



Another benefit of the fast focuser is that I can achieve very good collimation in minutes. Without the FastFOCUS I was measuring a value of 3.9 arc seconds for collimation. Using the C11 FastFOCUS I was able to achieve a results of 0.6 arc seconds. Also, there was a reduction in the tilt by 40%.

FWHM Measurement over time

FWHM from about 1.8 to 2.9



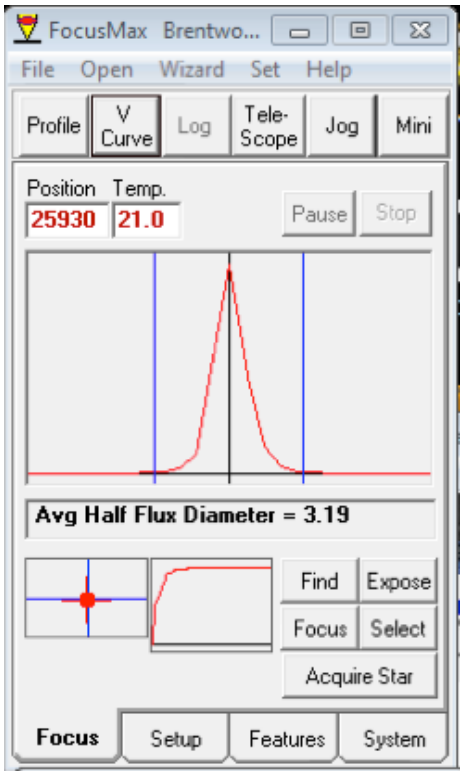
With the C11 FastFOCUS, I'm able to see an improvement of approximately 0.8 to 1.5 in the measured FWHM. From my experience and for my system, I am seeing about an improvement of 1 FWHM on average in my images due to better collimation and

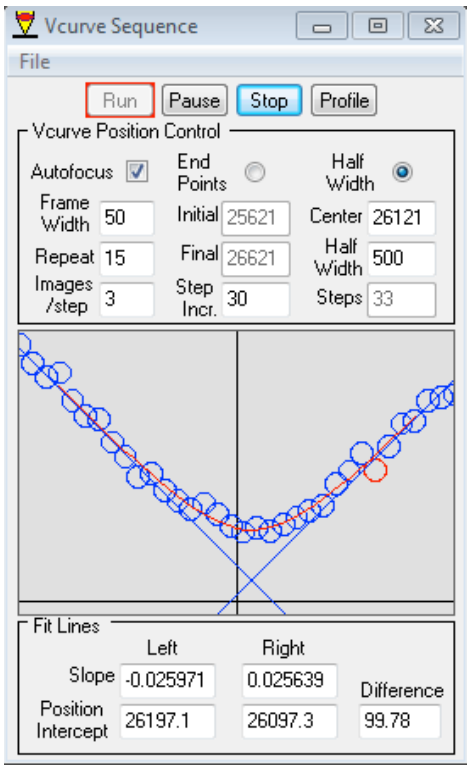
more precise focusing using the C11 FastFOCUS (given my system and seeing conditions). In addition, FocusMax is able to complete its focus run successfully in about 73 to 150 seconds (A big win for my automated system - I still need to do some more tweaking with FocusMax).

Sample Focus Max Run

Below are my results from a sample FocusMax run using the latest version of FocusMax (v3.6.0.77). I am able to achieve excellent focus given my light polluted skies. I have notice that the latest version of FocusMax (v3.6.0.77) has features that is making a difference for me resulting it a tighter focus. On a good night with steady skies, I've measured my seeing (FWHM) to be about 1.7 arc seconds during the summer with high humidity (During the winter, I'm expecting the seeing on a good night to be about 1.0 arc seconds).

For my system, when running v-curves, a step incrment of about 30 is providing me with the results. However, I am still experimenting as well as learning the new features in FocusMax v3.6.0.77. Below are results from an actual focus run.





Final thoughts

- Easy to install
- Easy to collimate (much better and faster than using the existing method)
- Easy to configure with FocusMax
- Main mirror can now be locked in place
- No diffraction spikes that I can see from the cables to the C11 FastFOCUS
- A nice alternative to those of us that are running out a back focus
- Focus steps are small (Rock solid. In use for over 6 months and ran over 600 successful focus runs with FocusMax – No issues.

I love it! Thanks Optec!

Images

The next 4 images were taken using the C11 FastFOCUS. As you can see, the results are outstanding.

M27 Dumbbell Nebula Aug 2012 -- LRGB

Aug 2012
Celestron C1100 EdgeHD
Mount Astrophysics
LRGB (30 mins Subs, 10 Hours L, 4 hours R, 4hours B, 4 hours min G),
Binned 1x1, SBIG 11000M
Refocus every 30 mins and on filter change.
SBIG AO-L, Pyxis 3" Rotator
Stacked with CCD Stack
CCDStack data reject and RGB combine, and Photoshop CS3 final processing.

M27 Dumbbell Nebula -- RGB

June 2012
Celestron C1100 EdgeHD
Mount Astrophysics
RGB (20 mins Subs, 120min R, 120 B, 120 min G), Binned 1x1, SBIG 11000M
Refocus every 45 mins and on filter change.
SBIG AO-L, Pyxis 3" Rotator
Stacked with CCD Stack
Process using PixInsight 1.7 (Still a work in progress. I'd performed a quick calibration and a simple RGB combined – What's left, final processing of RGB, adding in both the Ha and Luminance)

M51 RGB

M51
March 2012
Celestron C1100 EdgeHD
Mount Astrophysics
RGB (20 mins Subs, 120min R, 120 B, 120 min G) Binned 1x1, SBIG 11000M
Refocus every 45 mins and on filter change.
Stacked with CCD Stack
Process using PixInsight 1.7
(Remaining work: More work on the RGB, Add luminance and Ha – A luminance of M51 is shown on the next page)

M51 Luminance

M51
March 2012
Celestron C1100 EdgeHD
Mount Astrophysics
L (4hours, 20 mins subs) Binned 1x1, SBIG 11000M
Refocus every 45 mins and on filter change.
Stacked with CCD Stack
Process using PixInsight 1.7
Image is slight over processed

IC434 Horsehead Nebula Ha

Oct 2011
Celestron C800 Edge HD
Mount Astrophysics
Using a Starlight Instrument Barrel focuser
Camera: SBIG 8300M, 2” Pyxis Rotator
Borg 50mm guidescope
Ha (8 hours, binned 1x1, 30 mins subs, -30C)
CCD Stack.
No flats used because none were taken at the time.