

A Brief FocusMax Tutorial

FMx 介绍

Here is a brief description on how to get FocusMax working for you nicely:

Slew to a 4th magnitude star...this is actually an important step. Too bright or too dim a star will not give good V-curve results.

找到一颗四等星，这是很重要的一步，星太亮或者太暗不会得到很好的 v 曲线结果

After you connect to your focuser (I use MaxIM for camera/focuser control), find a way to settle it more or less in the middle of its range. My PDF has 7000 steps, so I set it for 3500 to start, right in the middle. Then, use your manual focus to focus things as well as possible. (This will allow the focuser and FocusMax to have equal latitude in and outside of focus). This will be a one-time step.

在你连接到你的调焦器之后（我使用 MDL 控制相机和调焦器），自己找个方法找到调焦器的行程大致中间，我的 PDF 有 7000 步，所以我设置为 3500 步开始，就在行程中间。然后使用手动对焦(不要拧手轮，用对焦软件的 IN, OUT 功能)尽可能的对好焦。（这会允许调焦器和 FMx 在伸缩上有同样的自由度）。以上步骤只需要做一次

In FocusMax (FM), on the setup tab (at the bottom), tell the system if you will be focusing in or focusing out to come to focus. For me, 'in' is better so that the focuser is pulling up against the weight of the camera.

在 FMx 里面，在 setup 标签（软件底部），告诉系统你是要伸还是缩去对焦。对我来说，“缩” IN 是更好的，因为调焦器被相机的重量拉着。（消除齿隙）

Now click on V-Curve at the top, and the V-curve window will pop up. You will see two columns or methods of defining the V-curve parameters. In the first column (called, "end points"), you can specify the start and end points of the V-curve run, along with the step increment. With my PDF, it has 7000 steps. If I were successful at having the initial manual focus point set more or less at 3500, then I might set the start at 4500, and the end at 2500, with maybe a step increment of 50. This will give a V-curve of 40 steps. This first run will be done by specifying the start and end points. (The second method is the "half width" column, and we'll get to that later.)

现在点击软件顶部的 V 曲线，V 曲线窗口弹出。你会看到两列或者两种方法定义 V 曲线的几个参数。在第一列（叫做 终点法），你可以指定 V 曲线的开始和结束点，。沿着步进值的增加。对我的 PDF 来说，大概有 7000 步。如果我成功的得到了初始化的手动对焦点 3500 左右，然后我就可以设置开始点在 4500，终点在 2500，可以设置步进值 50。这会给 V 曲线 40 个步进。指定开始点和终点后，这第一次运行会完成。（第二个方法 半宽法，我们下面给出）

Click on the 'Run' button, and you will start your first V-curve run. FM will start at 4500, measure the half flux diameter (HFD) of the star, subtract 50 position points, do it again, until it gets to 2500...the end of the run. Visually, you will see the "V-curve" on the screen, as it starts out measuring the fuzzy stars, gets sharper as it nears 3500, then gets fuzzy again as it hits 2500.

点击运行按钮，第一次 V 曲线就开始运行了。FMx 会开始于 4500，测量星点的半明度直径（HFD），移动 50 个步进，再做一次，直到来到 2500

At the end of the run, FM will take a moment to calculate the "slopes". The right side of the curve has a slope, and intercepts the '0' on the X axis at the bottom at one value - like 3562. The left side of the slope similarly has a slope, and intercepts the '0' axis at the bottom with a slightly different value, e.g., 3470. This first V-curve run will be sloppy. The difference of where the left and right slopes intersect the X axis is the Position Intercept Difference, or 'PID'. (My FSQ eventually gets to 6-decimal agreement between the left and right slopes, or about a value of 3 for the position intercepts differential or "PID".) It is mere microns away from perfect focus.

运行后，FMx 会用点时间计算曲线的斜度。右侧的曲线有斜度，并且大致截断于 X 轴在底部的 0 位置，比如 3562。V 曲线的左侧同样的也有斜度，截断于于在 X 轴底部的 0 位置，这个会有些许的不同，比如 3470。第一个 V 曲线的运行会有点马虎。交叉于 X 轴的左侧和右侧的斜度有所不同，就是位置交叉差异（PID）（我的 FSQ 最后得到了 6 度的一致，在左侧和右侧的斜度，或者大概 3 左右的 PID 的值）。这离完美的焦点仅仅是微米级的误差了。

Go back to the main window and click on the Focus button on the Focus tab. FM will now do a quick run to do an initial focus. (We are not done! This is just for the next step).

回到主窗口。在对焦标签上点击对焦按钮，FMx 会开始一个快速的运行，做一次初始化的对焦（我们没完成呢，这仅仅是为了下一步）

FM does NOT sniff around the bottom of the curve/tip of the V to "snoop" for the best focus position, as one might logically think. It instead uses one side of the V-curve slope...figures out where it is on that slope, and calculates the best focus position. According to the authors, this is far more accurate than the first method.

FM will do an initial focus run...and populate this value into the V-curve window in the "Half Width" column, in the "Center" value.

FMx 并不会围绕着曲线/尖端的底部去探究最好的对焦位置，一般人会这么想。相反它只使用了 V 曲线斜率的一边。。。找出在斜率的什么位置，并且计算最佳焦点位置。根据作者说，这远比第一种方法更准确。

FMx 会做一次初始化的对焦，并且把这个焦点值填入 V 曲线窗口中半宽列，在中央值那里。

Remember method # 2 two from above? Time to use it. For this, and all subsequent V-curve runs, we will allow FM to populate the "Center" value with the last focus value, and tell it the step value to use. So, if the focus point (Center) were to be 3500, and the half width is 1000 (amount on each side of focus), with a step size of 50, then again you would have 40 measurement points on your next V-curve.

记得提到过的第二种方法不？该用它了！为了这个和所有以后 V 曲线的运行，我们会允许 FMx 把最后对焦的值填入中央值，并且告诉它该用什么步进值。所以，如果对焦点（中央值）是 3500，并且半宽值是 1000（围绕着焦点的每一边），步进值是 50，那么你在下次做 V 曲线。又会得到 40 个测量点

Run the next V-curve. After you have done one or two V-curve runs, increase both the width (e.g., 1500 instead of 1000), and decrease the step size (from 50 to 20). This will increase the range over which the focus is being measured, as well as the number of points on the curve. This will lead to more accurate results. You will need a minimum of 12 good V-curve runs to get a good V-curve model!

运行下一个 V 曲线。在你已经做了一个或者两个 V 曲线后，增加宽度（比如从 1000 增加到 1500），并且减少步进值（从 50 减少到 20）。这会增加对焦点的测量范围，也会增加 V 曲线的测量点。这会带来更准确的结果，你会需要最少 12 个好的 V 曲线运行结果，来建立一个好的 V 曲线模型！

You will notice that the wider your selection, and the smaller step size you use, the more accurate will be your V-curve, and the more closely will the left and right sides of the V's intercept '0' at the same point. After you have done 12-14 V-curves, you can delete the original,

unaccurate, ones. Keep the good, accurate, ones.

你会注意到，你选择的越宽，步进值越小，你的 V 曲线越准确，并且 V 曲线的左右边越交叉于 0 点。在你做了 12-14 个 V 曲线后，你可以删除原始的，不准确的。保留好的，准确的。

This whole process is one-time. Once you have a set of V-Curves, FM will generate superlative, repeatable, focus results.

If you ever change your system, like adding in a reducer, you need to go under "file" to create a new system profile, so that the data from the two different setups does not get mixed up with one another. You can load the appropriate V-Curve file for each setup that you have.

所有的过程只需要一次。一旦你有了一个 V 曲线结果的集合，FMx 会生成最高级的，可重复的焦点结果。

如果你改变了你的系统，比如添加了一个减焦镜，你需要在 file 下建立一个新的系统档案，这样两个不同设置才不会混在一起。你可以为你每个拥有的设备组合载入适当的 V 曲线文件

For those of us with temperature-finicky scopes like an FSQ or TOA, frequent refocusing now becomes easy. I slew to my target, calibrate the scope for autoguiding. I then slew to a nearby 4th magnitude star (there are plenty, after all), and do a focus run. (This is not a V-curve run, we did all of that already.) A focus run takes about a minute. Since I use TheSky6, I just click on the "Slew Prior" button, and the scope goes right back to the target object. Whenever I want to refocus, I just click on that "Slew Prior" button to switch between my target object, and the 4th magnitude star. You can use CCDAutopilot or ACP to fully automate this entire process.

为了那些对温度过分敏感的镜子比如 FSQ 或 TOA，经常性的重新对焦变得更容易了。我移动到我的目标，为了自动导星进行校准。然后我移动到附近一颗 4 等星（还好 4 等星有不少），做一个对焦（不是 V 曲线的运行，我们已经做过这些啦），一个对焦过程大概有 1 分钟。自从我使用 TheSky6 后，我只需要点击“移动回原来目标”按钮，望远镜就回到之前的目标。无论何时我想要重新对焦，我只需要点击“移动回原来目标”按钮，就能在我的目标和对焦用的 4 等星之间切换。你可以用 CCDAutopilot 或者 ACP 去完全的自动化的做这整个过程！