

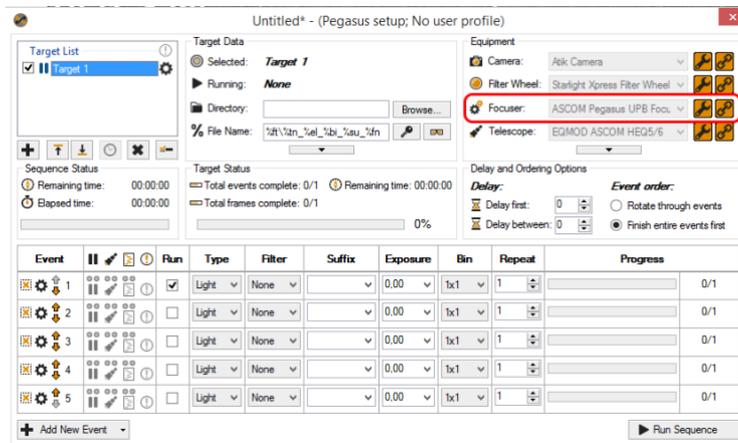


AUTOFOCUS USING SEQUENCE GENERATOR PRO (SGPro)

Pegasus Focus Products in combination with ASCOM6 driver allow easy, quick and precise telescope autofocusing. In this tutorial we are using Sequence Generation Pro (SGPro) as our main imaging and focusing program.

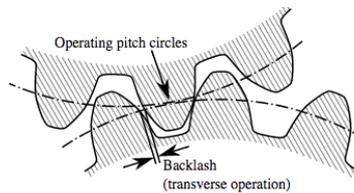
Connect to your equipment:

- Download and install the appropriate Pegasus ASCOM6 driver (FocusCube, Dual Motor Focus or Ultimate Powerbox).
- Open the Sequence Generator Pro (* In our example we use v3.0)
- Select Pegasus ASCOM Driver under Focuser section and click the “gearbox” icon to connect



Set your backlash:

Backlash or play, is a clearance or lost motion in a mechanism caused by gaps between the parts. Every mechanical geared setup has some backlash. When you are moving your focuser in, the gear teeth should be in full contact at all times. However, when you are moving your focuser out, your gear teeth may end up floating between contacts of the teeth. Going past the point where you want to end up and then immediately going back in will ensure that your teeth are in contact when done so there will be no slipping and a very accurate movement.



Problems in autofocusing can arise:

- If you are using a Crayford focuser and there is slippage
- Rack and pinion focusers might also introduce some backlash
- If your backlash compensation isn't large enough to go past the floating point.

Pegasus Motor is very accurate and equipped with a high resolution, high torque gearbox. Motor has a step Angle of 7.5 degrees and gear ratio of 1:120. This means that each step of the motor is translated to $7.5 \text{ degrees} / 120 = 0,0625 \text{ degrees}$, a tiny movement!

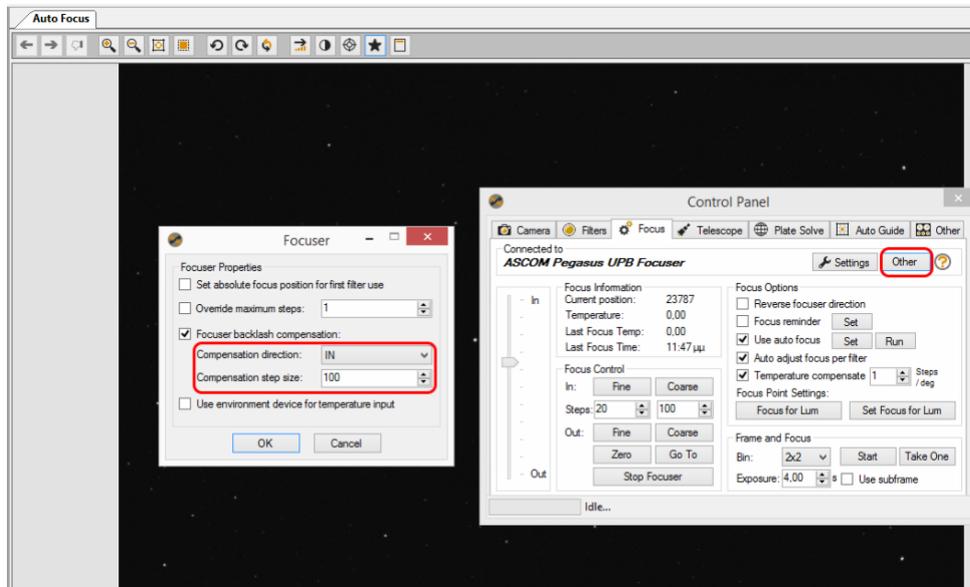
An average backlash value of the Pegasus Motors along with the backlash of your focuser is 100 steps. You might think that these steps are too many but considering the resolution of the motor they are not!

1. You can let Pegasus Focus Controller do the backlash compensation in hardware
2. You can let SGP compensate the focuser train backlash.

In this example we choose second option. We let SGPro handle the backlash.

➤ Go to SGP -> Control Panel -> Focus Tab and click Other

A Focuser window will appear. Here you can set your backlash compensation. Select **“IN” Compensation direction** and set the **“Compensation step size”**.



How Auto Focus Works:

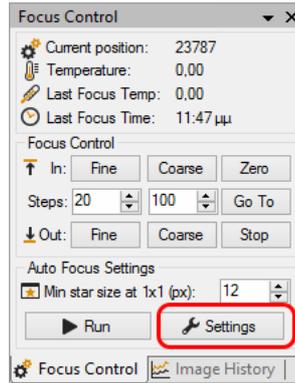
SGPro auto focus works off a notion of "whole image HFR". Under normal circumstances, this will allow you to focus where you are imaging and avoid a costly move to a bright star and then back to target. When auto focus is triggered, it will begin by moving the focuser "out" by $((\text{data points} * \text{step size}) / 2)$ steps.

It will then begin taking AF frames, averaging HFR and then moving in by "step size" until the focus point is recognized. While "Data Points" is user defined it really only defines the number of steps used in the initial outward movement of the AF routine. SGPro is smart enough to recognize trends and automatically extend the number of points you need in order to find proper focus (when "smart focus" is not disabled).

Unfortunately, SGPro does not have a "one size fits all" approach to auto focus and some targets will need to be tuned a bit before they can be let loose. Fortunately, SGPro's AF routine only requires a few settings to get working properly.

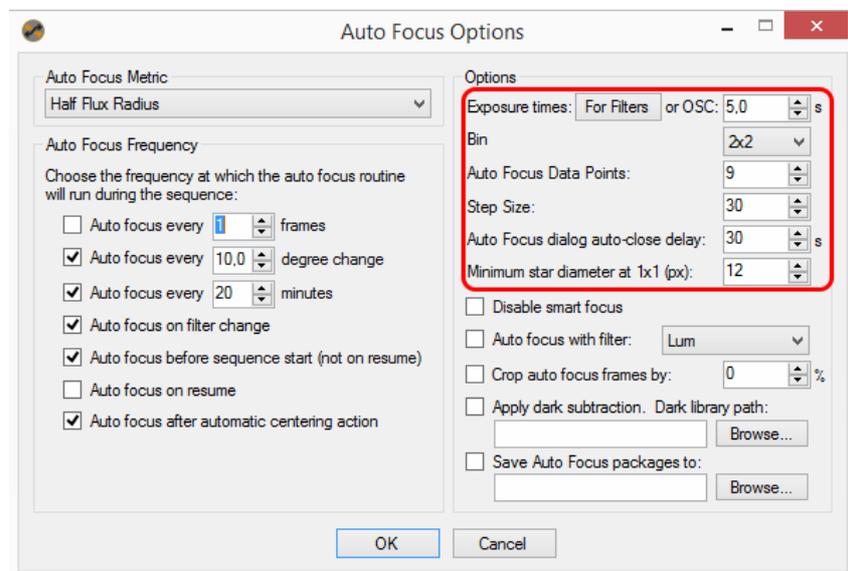
Set Auto-Focus Settings

- Locate the Focus Control Panel and Click Settings



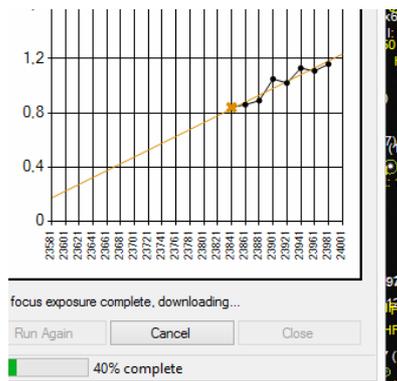
In these settings you need to set:

- Exposure Time and Binning:
 - Set the auto focus exposure time. You need to set a time where you can view a noticeable number of stars in your frame. If you are not sure what to use, **go ahead with eight seconds**.
 - Unless you have a specific reason not to, **use 2x2 binning**
- How many samples (data points) SGP will take:
 - Set the "Auto Focus Data Points" field to represent the number of samples you want auto focus to take during the run. If you choose a value of 9, perfect focus would show a "V" curve with four point outside of focus and four points inside of focus. **If you don't have a specific value in mind for your rig, choose nine points here.**
- Step size to move motor during every sample
 - Your focal length / focal ratio plays important role here. A rule of thumb is to set 30-40 steps.
 - If you can see that you cannot achieve a V shape graph increase your steps.
 - If V shape graph is shallow then increase steps
 - If V shape graph is very deep them decrease steps

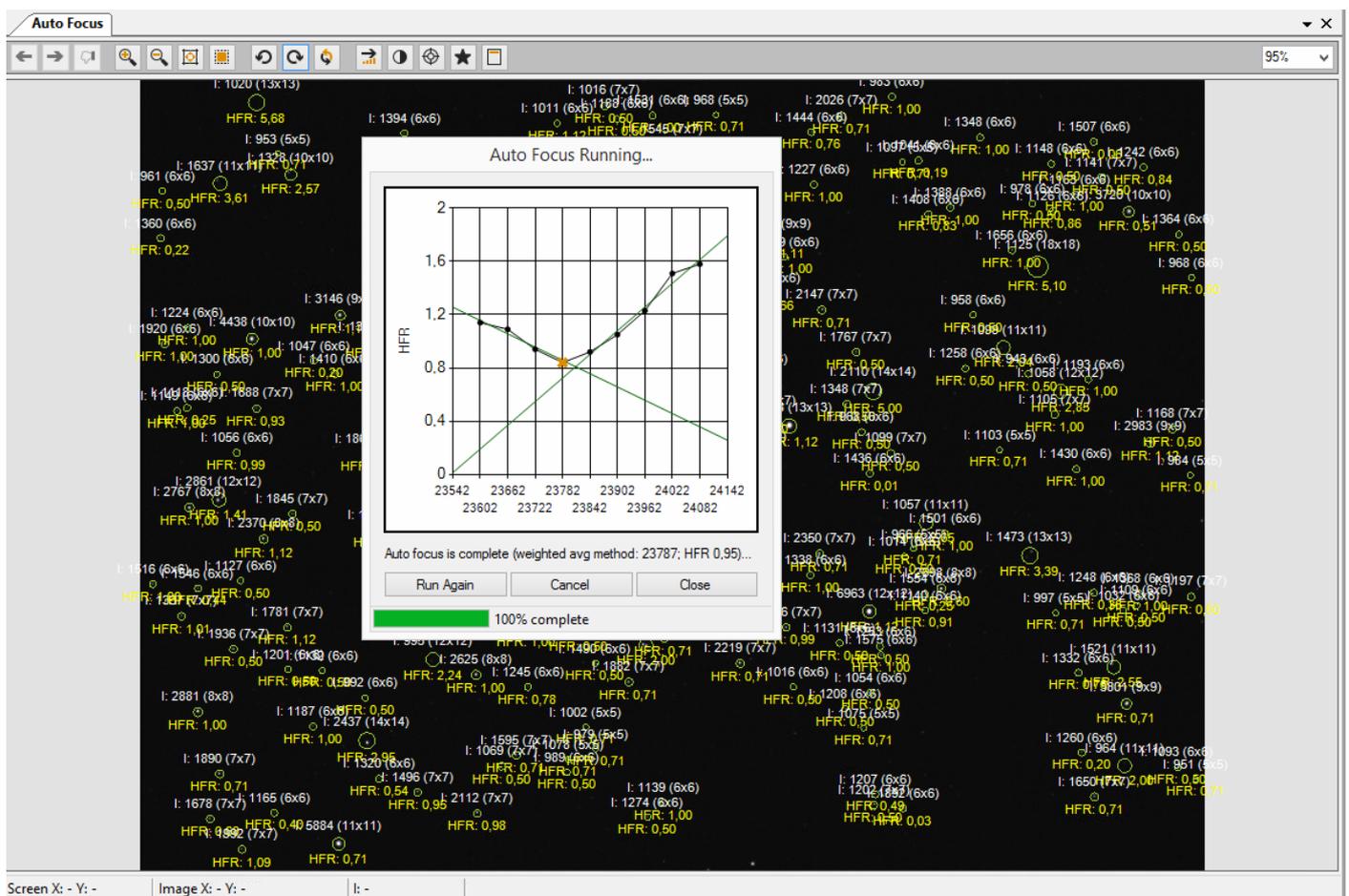


➤ Click **OK** and Click **“Run”**

Autofocus algorithm will run and will start executing all data points / steps you specified earlier.



In the end you should see a "V" and a focus point chosen that is very close to both the HFR and focuser position.



Important Notice for SCT Owners (Motor Focus Kit SCT, FocusCube SCT)

There are multiple step reduction parts in a SCT setup.

- Motor has its own reduction gearbox
- Both pulleys introduce a ratio of reduction
- SCT focus mechanism has also some ratio of reduction
- Keep in mind also that SCT telescopes have a higher f ratio so need larger focus movements for a noticeable focus change.

This means that you will definitely need **bigger** steps than required to a refractor OTA setup. Set 100-150 steps in order to see the V shape curve in autofocus algorithm of SGPro.

Good luck! It is a pretty easy process. More hours available for a quick nap! ☺

Sources:

<http://mainsequencesoftware.com/Content/SGPHelp/SequenceGeneratorPro.html?UnderstandingAutoFocus.html>

<http://cloudynights.com>