



# **Lens Back Focus Procedure v0.5**



# Confidentiality

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This document and any attachments have been prepared by Cooke Optics Ltd. The contents are confidential and must not be communicated in whole or part to any other party without the prior written approval of Cooke Optics Ltd.

## Introduction

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Cooke Optics Ltd has received several requests from various customers with regard to the Back Focus factory calibration procedure, used in-house. Cooke Optics Ltd uses an MTF process which is detailed in the following document.

We do not recommend shimming the lenses to adjust for back focus. The main reason being that astigmatism can be created, and also the distortion and shading maps can be misaligned as a result of changing the shim stack. Most camera lens mounts have shimming capability - and so it is always recommended to shim the camera first to avoid altering the factory calibrated shim stack on the lens. However, Cooke realises there are scenarios where shimming the camera lens mount is not ideal - and asks that our customers first record the factory calibrated shim stack before any alterations are made, and to keep the factory calibrated shim stack reading on file so that customers can revert back to the factory shims after a rental job is completed.

It is important to record and track the original factory calibrated shim stack if you wish to re-shim lenses. By recording the original factory calibrated shim stack for your lenses, you will minimise the risk of needing to return the lens for a service request.





## Anamorphic Lens Shimming Statement

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Cooke Optics Ltd advises NOT to adjust the back focus shim stack on Anamorphic lenses as this will adversely affect the optical performance - introducing astigmatism to the lens.

Adverse effects to the factory calibrated distortion and shading maps will also occur. It is recommended to check the camera FFD is accurate.

However, if an Anamorphic lens absolutely requires shimming it is imperative that the reseller/rental house accurately document any changes to factory calibrated shims - and ensure that those changes are kept on record for later use. By documenting the shims that were installed originally in the factory, it should be possible for the reseller/rental house to revert back to original shims if needed. Only certified optical technicians at the reseller/rental house should perform the procedure. It is essential to take note of which factory calibrated shims are installed before making alterations.

If factory calibrated shims are not documented before adjustment, this may result in additional factory calibration, cost, and time delays. Cooke Anamorphic lenses are already calibrated to within +/- 6 micrometer (0.006mm) tolerance and as such, Anamorphic lenses are already calibrated to match each other very closely. A torque setting of **7lb/in** should be applied to all PL mount lenses.



## Spherical Lens Shimming Statement

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Cooke Optics Ltd advises NOT to adjust the back focus shim stack on Spherical lenses as this can affect the optical performance - introducing astigmatism to the lens.

Adverse effects to the factory calibrated distortion and shading maps will also occur. It is recommended to first check the camera FFD is accurate.

However, if a Spherical lens absolutely requires shimming it is imperative that the reseller/rental house accurately document any changes to factory calibrated shims - and ensure that those changes are kept on record for later use. By documenting the shims that were installed originally in the factory, it should be possible for the reseller/rental house to revert back to original shims if needed. Only certified optical technicians at the reseller/rental house should perform the procedure. It is essential to take note of which factory calibrated shims are installed before making alterations.

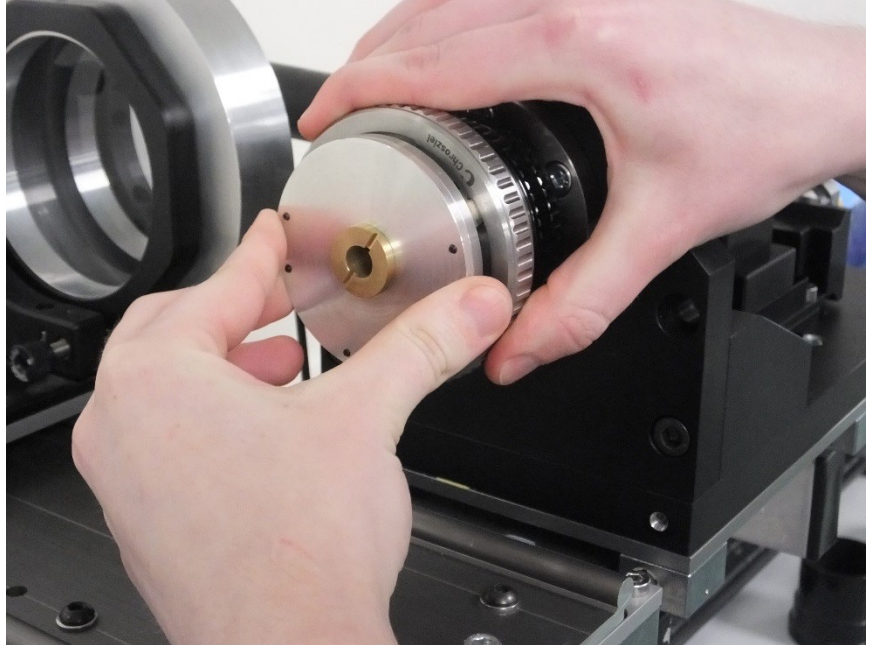
If factory calibrated shims are not documented before adjustment, this may result in additional factory calibration, cost, and time delays. Cooke Spherical lenses are already calibrated to within +/- 6 micrometer (0.006mm) tolerance and as such, Spherical Lenses are already calibrated to match each other very closely. Only if absolutely necessary, then shimming can be possible up to +/- 25 micrometer (0.025mm) - providing that pre-installed factory calibrated shims are recorded before any changes are made. A torque setting of **7lb/in** should be applied to all PL mount lenses.

# Calibration

1.

Fit the datum tool to the PL mount interface (52.00mm) within 10 microns.

Ensure the datum tool is seated against PL mount interface and the alignment pin is located correctly.



2.

Power on the illumination source for the auto-collimator graticule, using the rotary knob.

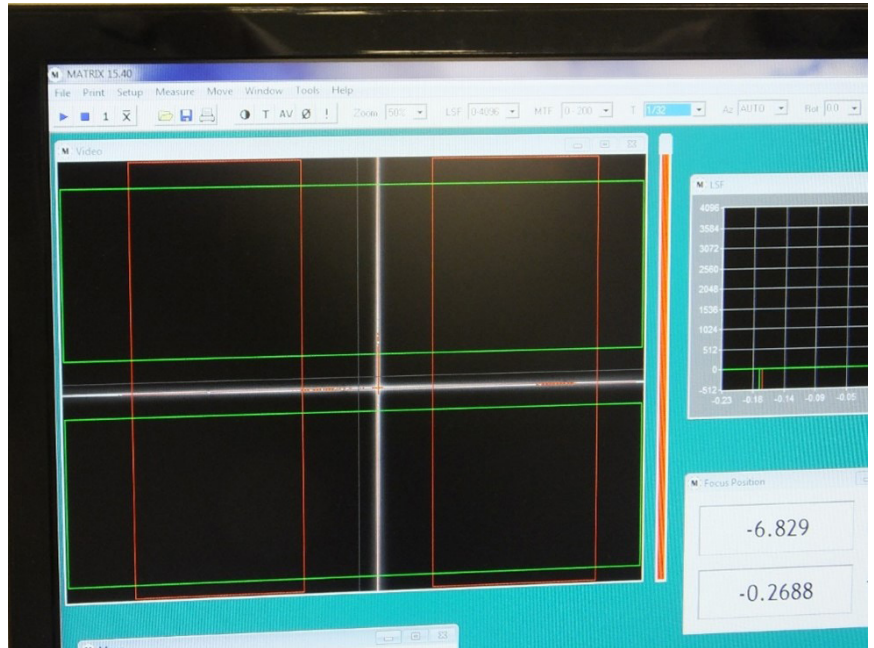


# Calibration

3.

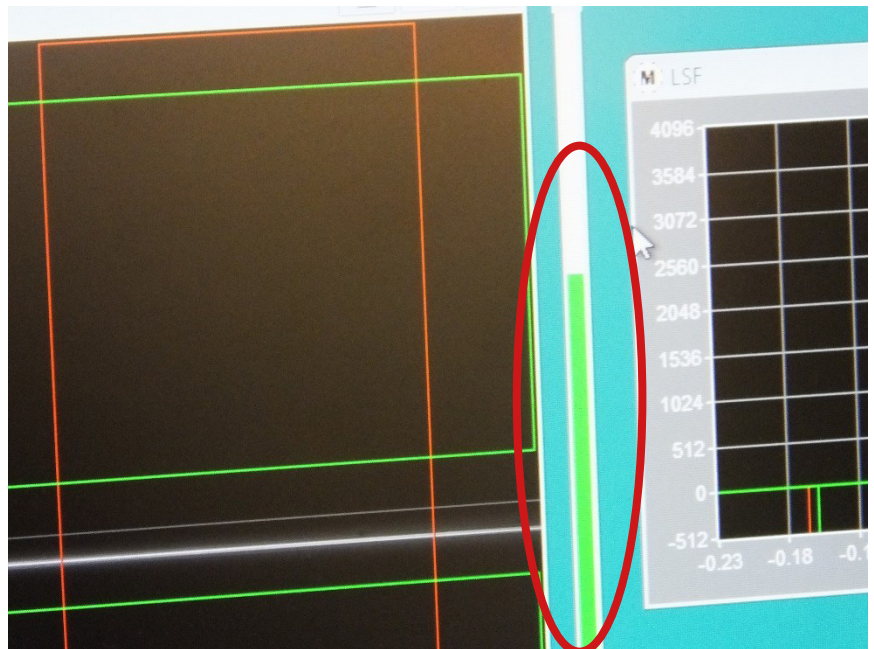
The top left window of the software will now display a cross hair image.

If the image contains red areas on the cross, the camera shutter exposure needs to be adjusted.



4.

Adjust the image brightness until the bar in the software shows visibly as green with no red areas.

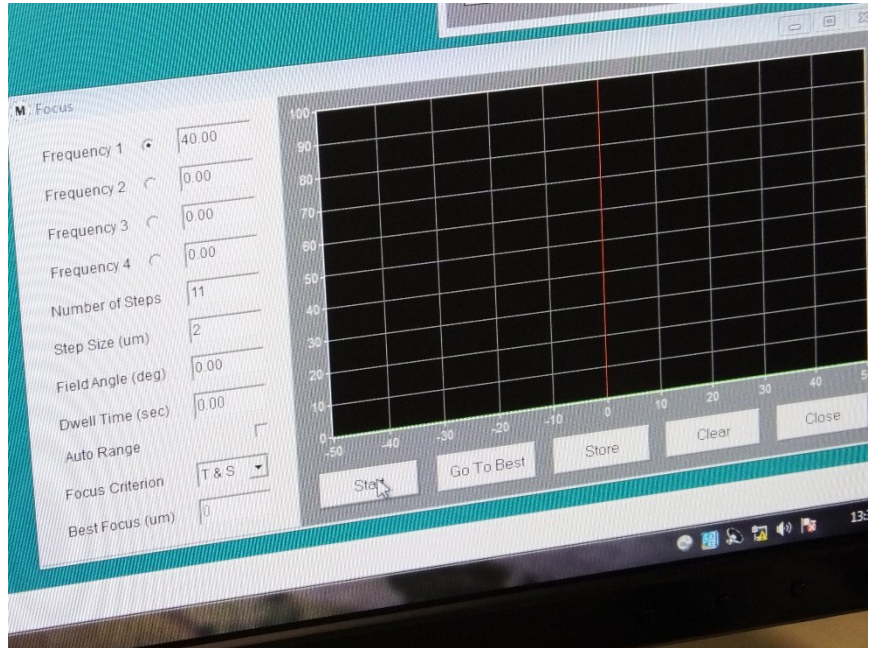




# Calibration

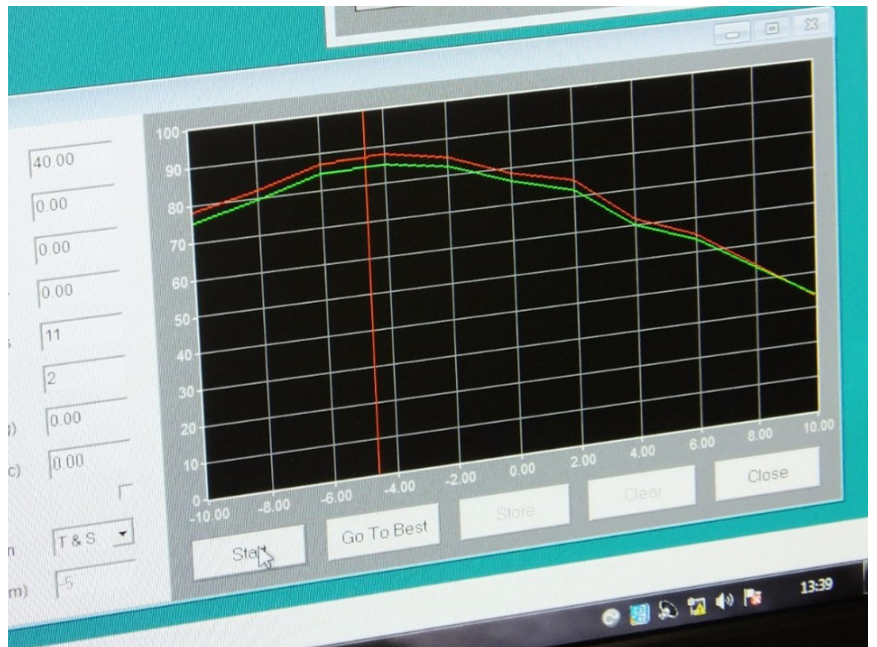
5.

In the "Through focus scan" window (bottom right), set step size to **2  $\mu\text{m}$**  and click start.



6.

At the end of the scan, click "Go To Best"

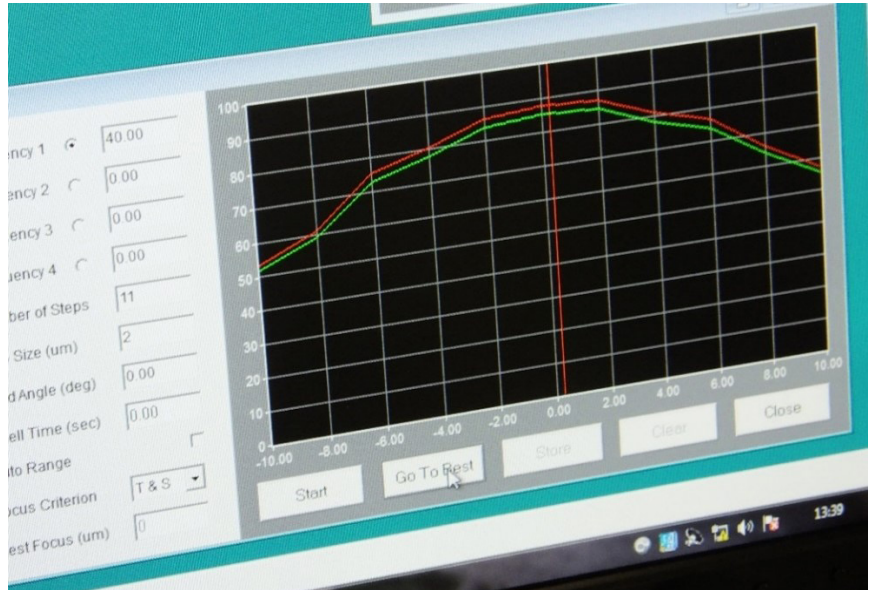


# Calibration

7.

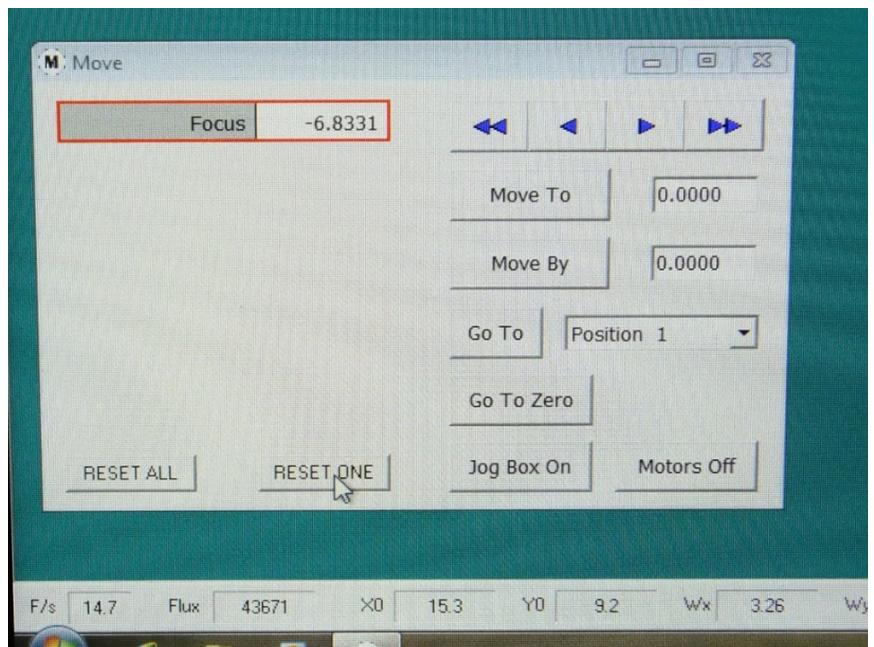
Repeat scan and click "Go To Best" again.

The maximum point of the curve should be shown towards the middle of the "focus" window.



8.

In the Move window, click "RESET ONE"



# Calibration

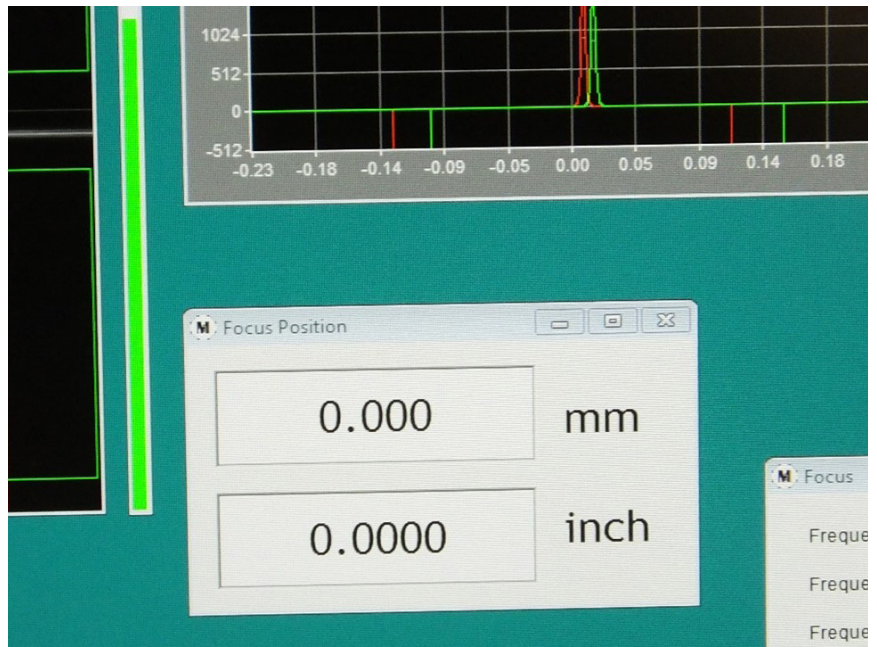
9.

Click OK in the "RESET FOCUS STAGE COUNTER" Confirmation Box.



10.

The focus position box will be set to zero.



# Measuring Back Focus

1.

Mount the lens onto the PL mount.

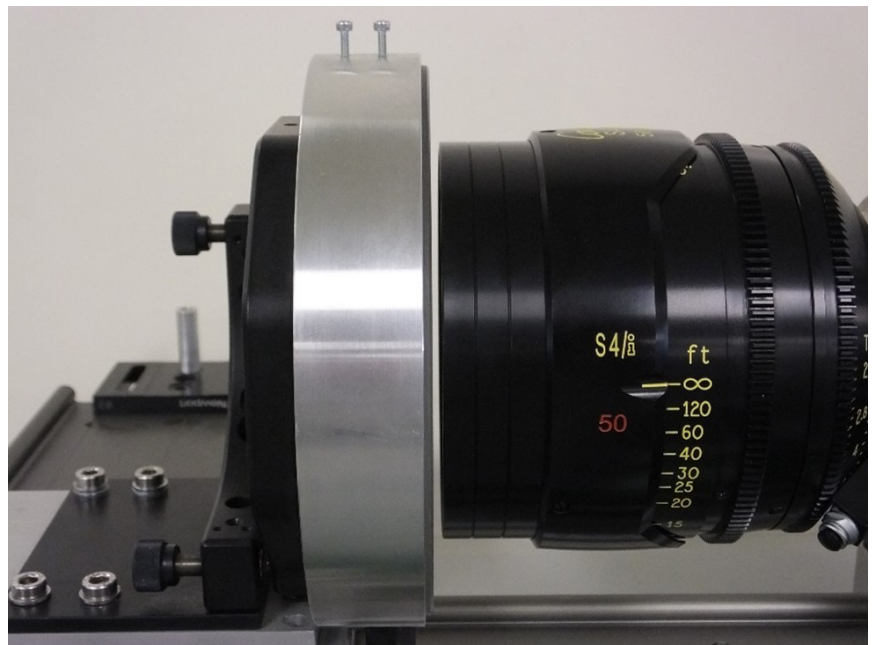
Ensure the PL mount is seated against the PL mount interface and the alignment pin is located correctly.



2.

Position the plane mirror in front of the lens aperture.

Set focus to infinity and iris to wide open.



# Measuring Back Focus

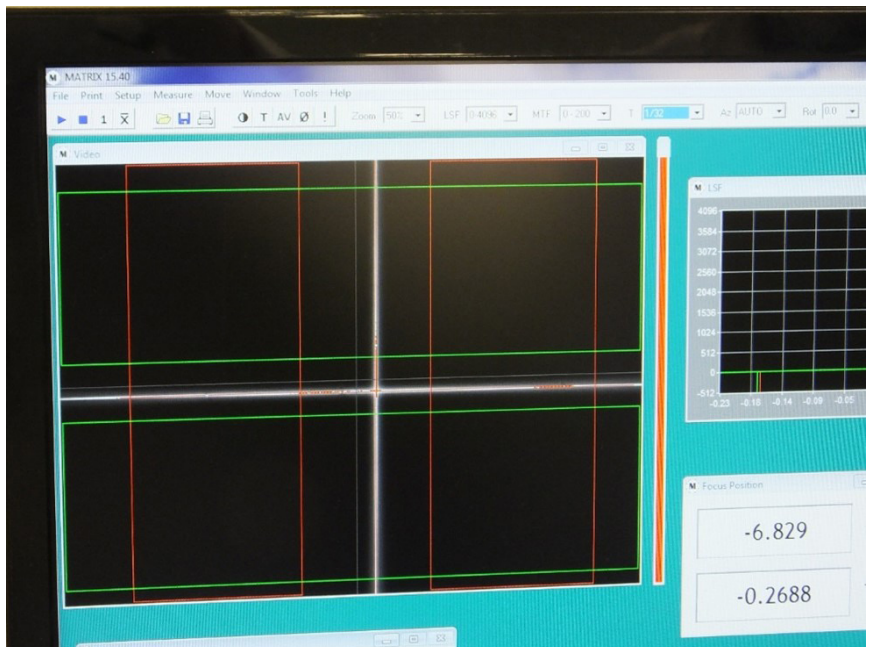
3.

Power on the illumination source for the auto-collimator graticule, using the rotary knob.



4.

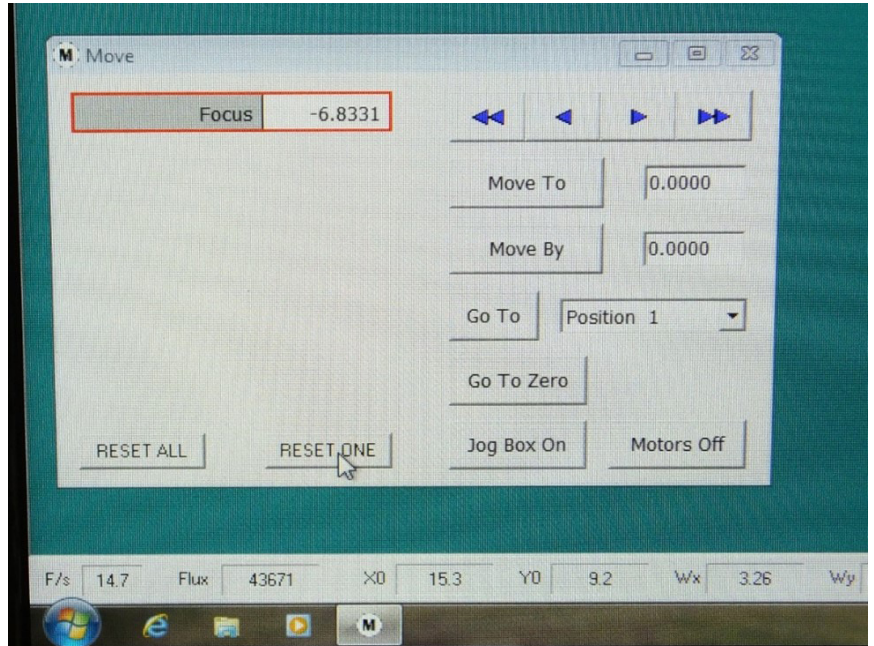
The top left window of the software will now display a cross hair image unless being out of focus.



# Measuring Back Focus

5.

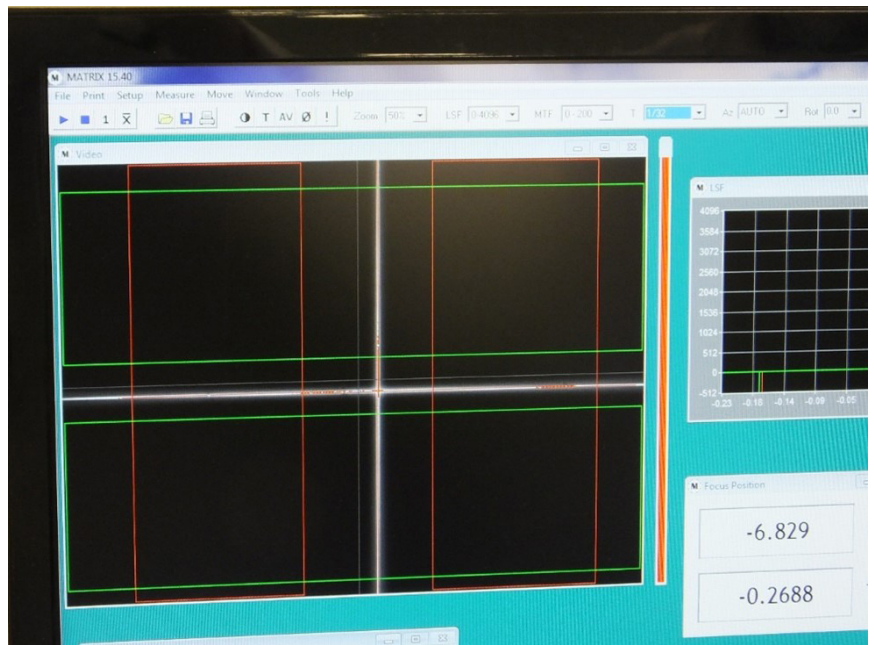
In the case of being out of focus, jog carefully using the single blue arrow until closer to focus.



6.

The top left window of the software will now display a cross hair image unless being out of focus.

If the image contains red areas on the cross, the camera shutter exposure needs to be adjusted.

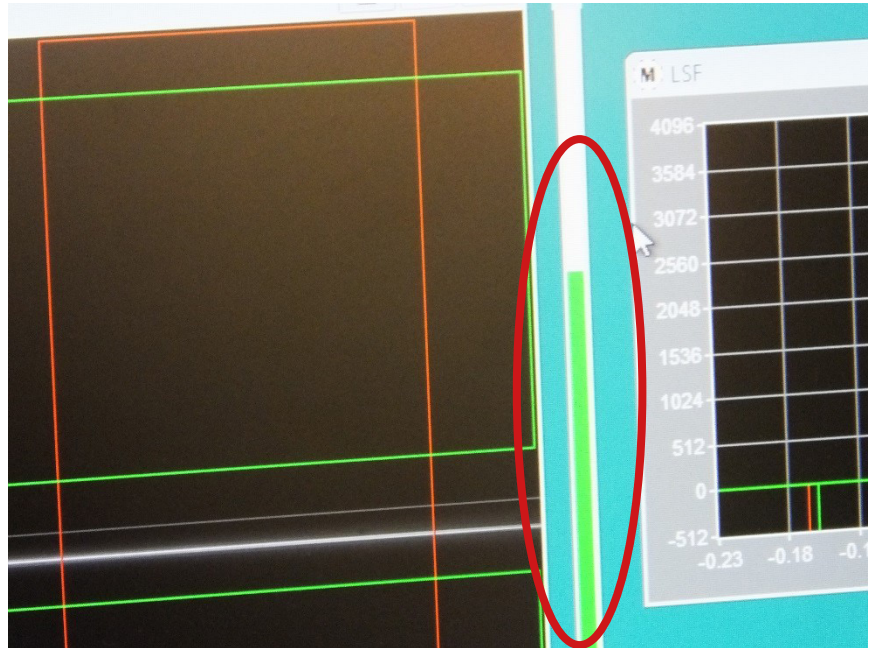


# Measuring Back Focus

7.

Adjust the image brightness until the bar in the software shows visibly as green with no red areas.

If necessary, adjust the positioners on the plane mirror mount to centre the cross.



8.

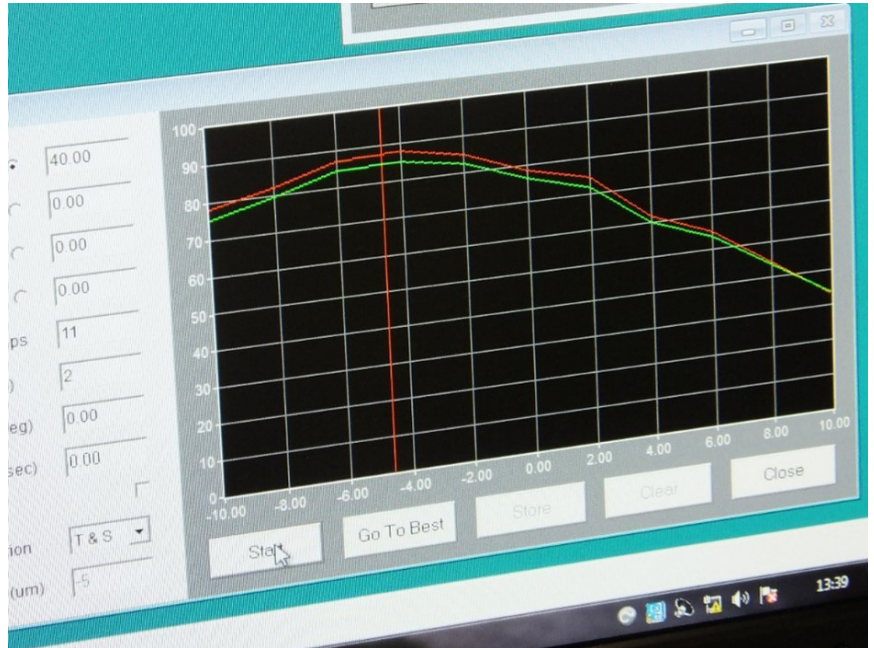
In the *“Through focus scan”* window (bottom right), set step size to **5 μm** and click start.



# Measuring Back Focus

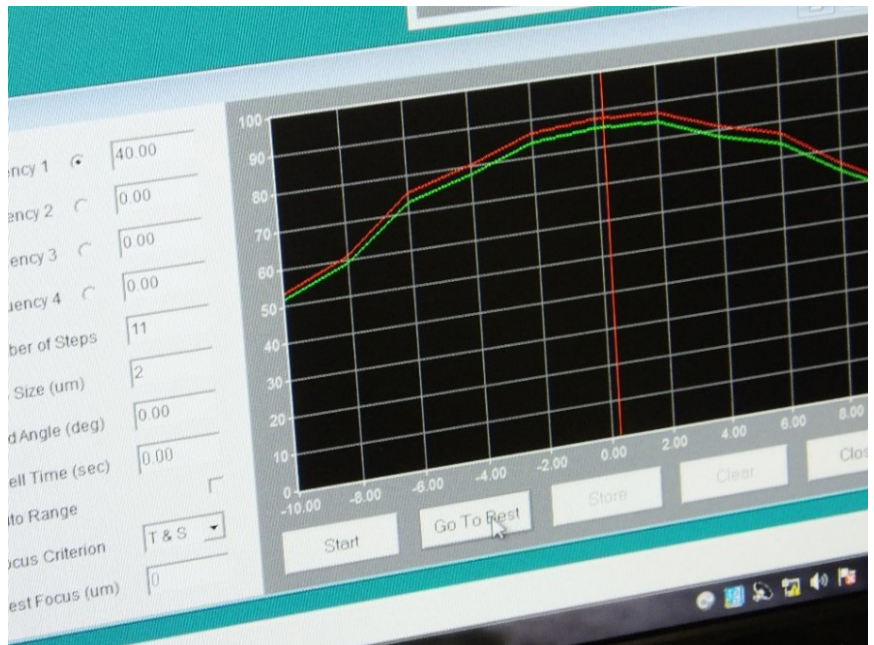
9.

At the end of the scan, click "Go To Best"



10.

Repeat scan and click "Go To Best" again.

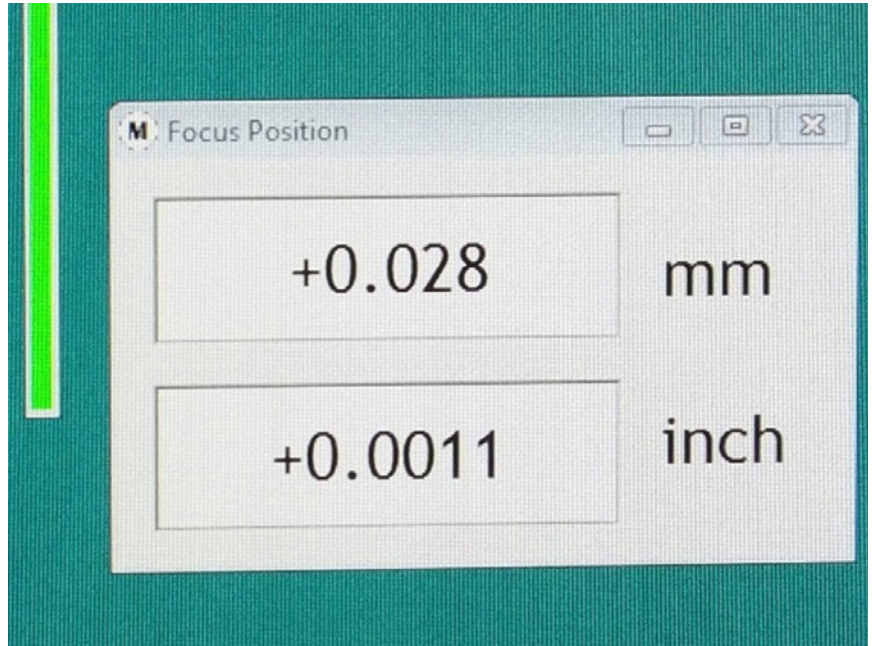




## Measuring Back Focus

### 11.

The focus box now displays the back focus error in metric and imperial.



### 12.

A positive number requires PL mount shims to be added, a negative number requires PL mount shims to be removed.

Once the adjustment has been made, re-fit the mount applying a **7lb/in** torque setting to the screws.

If modifying the shim stack on a lens, document the factory installed shims before modification. See both **Anamorphic Lens Shimming Statement** and **Spherical Lens Shimming Statement** at the start of this document.



V0.5