



FoCal for Windows

Version 1.9.10

Auto-Focus Micro-Adjustment Calibration Software

Contents

1	Introduction	10
1.1	Supported Cameras.....	10
1.1.1	Canon	10
1.1.2	Nikon	10
1.2	Canon 5D Mark III / 1DX Support.....	12
1.3	Focal Testing Guide	12
1.4	How this Manual is organised.....	12
2	Installation	13
2.1	Downloading the Software	13
2.2	Installing the Software	13
2.3	Camera Drivers.....	13
2.3.1	Verification.....	13
3	Calibration Target	14
3.1	Which File?.....	14
3.2	Printing the Target	14
3.3	Positioning the Target.....	14
3.4	Lighting the Target	16
3.5	Target Size	17
3.6	Hard Targets.....	17
4	Camera Setup.....	18
4.1	Setup for Canon cameras.....	18
4.2	Setup for Nikon Cameras	20
4.3	Battery Level	20
5	Licensing.....	22
5.1	First Installation	22
5.2	Licensing a New Camera	23
5.3	License Update Limit.....	23
5.4	Manually Adding Cameras	23
5.5	Advanced License Management	24
5.6	Updating the License Online	24
6	Initial Setup	25
6.1	Connecting to a Camera.....	25
6.2	Camera Information.....	25

6.3	Selecting Tools	26
7	Common Test Features	27
7.1	Keyboard Shortcuts.....	27
7.2	Storing and Restoring Camera Settings	27
7.3	Target Setup.....	28
7.4	Changing the Chart Scale	28
7.5	Ignoring Data Points.....	28
7.6	Peak Focus Detection.....	30
7.7	Saving Reports (FoCal Pro).....	31
7.8	Target Optimisation (FoCal Pro).....	31
8	RGB Analysis.....	33
8.1	Overview	33
8.2	How does FoCal's RGB Analysis work?	33
8.2.1	RGB Results and Spectral Content	33
8.2.2	Horizontal and Vertical Results	33
8.3	Display the RGB Analysis Results	34
8.3.1	RGB Analysis Data Display.....	35
8.3.2	Single Colour Channel	36
8.4	Chart Scaling	36
8.5	Keyboard Shortcuts.....	37
9	Target Setup Utility	38
9.1	Using Target Setup.....	38
9.1.1	Target Alignment Icons	41
9.1.2	Things to note about Target Search.....	41
9.2	Target Detection	42
9.3	Focus Points	44
9.3.1	Changing the Focus Point.....	44
9.3.2	Target Search with off-centre focus points.....	45
9.3.3	Target Search while zoomed (Canon)	46
9.4	Focus Controls.....	47
9.4.1	Phase Detect Autofocus.....	47
9.4.2	Contrast Detect Autofocus.....	47
9.4.3	FoCal Autofocus	47

9.4.4	Near / Far Focus	47
9.5	Keyboard Shortcuts.....	48
10	Semi-Automatic Autofocus Microadjustment	49
10.1	Overview	49
10.1.1	Manual Setting Change (MSC) Mode.....	49
10.2	Running the Test	49
10.3	The Semi Automatic Test Window.....	50
10.3.1	AF Image.....	50
10.3.2	Comparison Image (AF Image LiveView).....	50
10.3.3	Indicator Graph	51
10.3.4	Zoom/Fit Button.....	52
10.3.5	Target Optimisation	52
10.4	Suggested Testing Strategy	52
10.4.1	Example.....	53
10.5	Points to Note	56
10.6	Keyboard Shortcuts.....	57
11	Fully Automatic Autofocus Microadjustment (FoCal Plus/Pro)	58
11.1	Overview	58
11.1.1	Manual Setting Change (MSC) Mode.....	58
11.2	Image Display Panels.....	58
11.3	Running the Test	58
11.4	Analysis Information (Pro Version)	61
11.5	Peak Focus Detection.....	62
11.6	Manually Adjusting the Results	63
11.7	Target Optimisation (Pro Version)	65
11.8	Common Test Features	65
11.9	RGB Analysis.....	65
12	Turbo Calibration Test (FoCal Plus/Pro).....	66
12.1	Step 1 – Perfect Focus.....	67
12.2	Step 2 – The TurboCal Test	68
12.3	Common Test Features	69
13	Manual Mode.....	70
13.1	Capturing the Images.....	70

13.2	Using the Test	71
13.2.1	Adding Files	71
13.2.2	Removing Files	72
13.2.3	Images without AF Microadjustment/Fine Tune data	73
13.3	Analysis	73
13.3.1	Analysis Progress.....	74
13.4	Manual Mode in FoCal Pro.....	75
13.4.1	Target Optimisation	75
13.5	Ignoring Points	76
13.6	Analysis at Both Ends of a Zoom Lens.....	77
13.7	Common Test Features	78
13.8	RGB Analysis.....	78
14	Aperture Sharpness Test (FoCal Pro only)	79
14.1	Image Display Panels.....	79
14.2	Setting Up.....	80
14.2.1	Correct Focus	80
14.3	Running the Test	80
14.3.1	Displayed Curves	81
14.4	Quick Mode (Experimental)	82
14.5	Common Test Features	83
14.6	RGB Analysis.....	83
14.7	Expert Settings	83
15	AF Consistency Test (FoCal Pro only)	84
15.1	Overview	84
15.1.1	Manual Setting Change (MSC) Mode.....	84
15.2	Starting the Test.....	84
15.3	Image Display Panels.....	85
15.4	Running the Test	86
15.4.1	Single AFMA	86
15.4.2	AFMA Range	88
15.5	Common Test Features	89
15.6	RGB Analysis.....	89
16	Dust Analysis (FoCal Pro only).....	90

16.1	Using the Dust Analysis tool.....	90
16.2	Setting Up.....	91
16.2.1	Show Results While Running.....	91
16.2.2	Points to Note	91
16.3	Running the Test	92
16.4	Reviewing the data	93
16.5	Common Test Features	94
16.6	Comments on Dust Analysis.....	94
17	Multi Point Focus Test (FoCal Pro only)	95
17.1	Overview	95
17.2	Running the Test	95
17.3	Setting Up.....	96
17.3.1	The MPFT Target	96
17.3.2	Lens Choice	96
17.4	Choosing Focus Points	97
17.5	Target Setup Utility	98
17.6	Running the Test	100
17.6.1	Single AF Microadjustment/Fine Tune Mode	100
17.6.2	Analysis Region Quality	100
17.6.3	AF Microadjustment/Fine Tune Prediction Mode	101
17.7	Failure to lock AF.....	103
17.8	Reviewing the results.....	104
17.9	Common Test Features	104
17.10	Interpreting the results	104
17.10.1	Overall Focus Quality	104
17.10.2	Focus Point Detail	105
18	AFMA (AF Microadjustment/Fine Tune) Change Utility	106
18.1	Using the utility	106
18.1.1	Changing AF Microadjustment Value	106
18.1.2	AF After Change	106
18.2	Live View	107
18.3	Reviewing on the Camera	107
18.4	Keyboard Shortcuts.....	107

19	Camera Information Tool.....	108
20	Camera Settings Save/Load	109
20.1	Overview	109
20.2	Saving Settings	109
20.3	Loading Settings	109
20.4	Points to Note	109
21	Quick AF Microadjustment Calibration (FoCal Plus/Pro).....	111
21.1	Setup	111
21.2	Starting the Test.....	111
21.3	Test Operation	112
21.4	Interpretation of Chart Information (FoCal Pro).....	112
22	File Camera	114
22.1	Enabling the File Camera	114
22.1.1	Supported Tests	114
22.2	Tethered Mode	114
22.2.1	Selecting Tethered Mode.....	115
22.2.2	Opening the File Camera.....	115
22.2.3	Starting a Test	115
22.2.4	Fully Automatic Test Example	115
22.2.5	Tethered Mode Setup Icons.....	117
22.3	Precaptured File Mode	117
22.3.1	Selecting Precaptured File Mode	118
22.3.2	Opening the File Camera.....	118
22.3.3	Starting a Test	118
22.3.4	Aperture Sharpness Test Example	118
23	Manual Setting Change Mode	121
23.1	Target Optimisation (FoCal Pro only).....	121
23.2	MSC in use.....	121
23.3	Adjusting Nikon AF Fine Tune	123
23.3.1	Setting up (BEFORE THE TEST):	123
23.3.2	Adjusting (DURING THE TEST)	124
23.3.3	Nikon Camera HotKey	125
23.4	Adjusting Canon AF Fine Tune (5D Mark III)	127

23.4.1	Setting up (BEFORE THE TEST):	127
23.4.2	Adjusting (DURING THE TEST)	128
23.4.3	Canon Camera HotKey	129
24	Settings Adjusted during Testing	130
25	Program Settings.....	131
25.1	General Settings.....	132
25.1.1	Show All Messages.....	132
25.1.2	Inform of available updates when FoCal starts	132
25.1.3	Show Pre-Test Infor Messages.....	132
25.1.4	Use Canon Legacy Interface.....	133
25.1.5	Show TurboCal instead of QuickCal	133
25.1.6	Upload test results to Reikan / Remove Serial No.....	133
25.1.7	Advanced.....	134
25.2	Test Settings.....	135
25.2.1	Mirror Lockup Delay.....	135
25.2.2	Shutter Count Warning Level.....	135
25.2.3	Test Point Consistency Level (Fully Automatic AFMA Test).....	135
25.2.4	Test Point Amount (Fully Automatic AFMA Test)	136
25.2.5	Validate Target.....	137
25.2.6	Large Target Width	137
25.2.7	Allow IS/VR/OS/VC to be active	138
25.2.8	Don't Confirm MSC AFMA/AFFT	138
25.2.9	Enable Camera HotKey	138
25.2.10	Use RGB Analysis.....	138
25.2.11	Focus Peak Determination	138
25.2.12	Image Capture Mode	139
25.3	Pro Features (FoCal Pro Only)	140
25.3.1	Defocus Method.....	140
25.3.2	Test ISO	140
25.3.3	Test Aperture	141
25.3.4	Colour Temperature.....	141
25.3.5	Do NOT configure Exposure Compensation	141
25.3.6	Do NOT configure Metering Mode	141

25.3.7	Allow Non-Centre Focus Point	141
25.3.8	Display Decimal AF Microadjustment values.....	142
25.3.9	Automatically Save Reports	142
25.3.10	Show report after save.....	142
25.3.11	Show RGB Analysis Data	142
25.3.12	Save Captured Images.....	142
26	Troubleshooting.....	144
27	Reikan Technology Ltd. Software License Agreement.....	145

1 Introduction

FoCal is a software utility originally designed to control a Canon or Nikon DSLR camera and automate the process of choosing the AF Microadjustment/Fine Tune value for the attached lens. FoCal Pro now offers many other features related to quantifying the performance of the autofocus system, lens quality and sensor cleanliness.

1.1 Supported Cameras

FoCal supports the following cameras:

1.1.1 Canon

- Canon EOS 50D
- Canon EOS 70D
- Canon EOS 7D Mark II*
- Canon EOS 7D
- Canon EOS 6D
- Canon EOS 5D Mark III*
- Canon EOS 5D Mark II
- Canon EOS 1D X*
- Canon EOS-1D Mark IV
- Canon EOS-1Ds Mark III¹
- Canon EOS-1D Mark III¹

1.1.2 Nikon

- Nikon D810
- Nikon D800 and D800E* (USB2 recommended with these cameras)
- Nikon D7100*
- Nikon D7000*
- Nikon D750*
- Nikon D700*
- Nikon D610*
- Nikon D600*
- Nikon D4s*
- Nikon D4*
- Nikon Df*
- Nikon D300s*
- Nikon D300*
- Nikon D3*
- Nikon D3x*
- Nikon D3s

¹ Due to the age of the Canon EOS-1D Mark III and Canon EOS-1Ds Mark III, the Canon SDK does not allow use of Mirror Lockup when controlled from a computer. Therefore Mirror Lockup is not used for any of the tests with these cameras.

Cameras marked with a “*” operate in a mode where the camera controlled almost completely by the computer, except for one setting: the AF Microadjustment/Fine Tune setting value. When this needs to be changed, the software will inform you. See section 23 for more details of MSC (*Manual Setting Change*) mode.

1.2 Canon 5D Mark III / 1DX Support

Due to a bug in the camera firmware you may notice that the Canon EOS 5D Mark III and Canon EOS-1D X cameras have no serial number shown in the Camera Selector window. This is expected behaviour and not an error in FoCal – the serial number will be displayed correctly once you start running a test.

1.3 Focal Testing Guide

The companion document – “FoCal Testing Guide” – contains more information about how camera AF systems work and the sort of issue that may be found, as well as the how to correctly setup for using FoCal and hints and tips on getting the best results.

1.4 How this Manual is organised

This manual is organised into a number of basic parts:

Sections 2, 3, 4 and 5 cover the initial setup and how to start using the software. **It is strongly recommended that you read through these sections before using FoCal.**

Section 6 explains some useful features common to most tests.

Section 7 shows how to use the Target Setup utility

Sections 8 - 11 are related to AF Microadjustment tests

Sections 12 - 15 deal with extra tests available for FoCal Pro users.

Sections 16 - 18 deal with useful tools available in FoCal.

Section 20 shows the new *File Camera* allowing tethered/Eye-Fi or manual capture mode of most tests.

Sections 21 is all about the Manual Setting Change mode used for certain cameras (most Nikon cameras)

Section 23 deals with the program settings and it is recommended that you at least look through this section to see the options available for future reference.

2 Installation

This software works on Windows operating system.

2.1 Downloading the Software

You can download the software from the FoCal License Management System which can be reached at www.fo-cal.co.uk/lms.

In order to log in, you will need your registered email address, and your Password as stated in the email received from Reikan on purchase. If you do not have a Password, you can use the PayPal transaction ID specified in the email from Reikan on purchase – *note that this is **not** the same as the transaction ID shown on your PayPal receipt*. You can also set a Password at lms.fo-cal.co.uk.

The downloaded file is a ZIP file which you must decompress (normally by right-clicking on the file and clicking **Extract All**).

In the file, you will see 3 directories:

- **Documentation** – contains software related documentation
- **Software** – contains the software installation files
- **Target Images** – contains the target image file to print

2.2 Installing the Software

The file in the **Software** directory is supplied as a Windows setup package (MSI). To install, simply execute the `setup.exe` file.

Once installed, the software will appear on the **Start** menu under **Programs | Reikan | FoCal**.

2.3 Camera Drivers

The camera drivers must be installed. These are supplied with the camera or installed automatically if using Windows 7.

You will need to connect the camera to the computer with a USB cable, also supplied with the camera.

2.3.1 Verification

For Canon cameras, If the EOS Utility application (supplied by Canon) can connect to the camera, then FoCal should be able to properly communicate with the camera (but ensure that any Canon software is **not** running when starting FoCal otherwise there will be communication problems).

For Nikon, if the camera appears within Windows Explorer or is indicated as connected by the operating system, then it should work with FoCal.

3 Calibration Target

In order to determine the correct AF microadjustment values, the software analyses a special calibration target which is included with the software in the downloaded ZIP file. Note that the software can be made to operate with any image by disabling Target Validation/Optimisation in the settings (so you could for instance use a Spyder LensCal target) but FoCal enables extra features which improve accuracy when used with the special FoCal target.

The target is designed to cover most general test situations when printed at A4 or US Letter. If you need to calibrate long telephoto lenses, you may wish to print the target at a larger size.

If you print the target at A4 or US Letter size, you will not need to make any adjustments in the software. If you print at a different size, you should measure the length as indicated on the printed target and enter the value into the FoCal settings screen (see section 25.2.6) – this will ensure correct distance measurements between the camera and the target.

3.1 Which File?

The target image files are in the “Target Images” directory of the download package. There are 2 targets supplied as both a PDF and a PNG file (so 4 files in total).

FoCal_Target is the target used for all tests *except* the MultiPoint Focus Test.

FoCal_MultiFocus_Target is the target used *just* for the MultiPoint Focus Test.

Printing using the PDF file will result in the best target print quality as this is a vector graphics file which means it can be scaled and will still keep sharp detail. However, not all PDF viewers allow scaling above the supplied page size, and many external print companies won’t accept a PDF for printing.

The PNG file is a bitmap export of the PDF file at 600dpi, and this can be printed up to about 600x900mm without any detrimental effect to the operation of FoCal.

3.2 Printing the Target

Ideally, the target should be printed on *Matte Heavyweight Paper* with an *Inkjet printer*.

When printing with a laser printer, the toner can be quite reflective and may upset the analysis of the image and result in a less reliable result.

Printing on standard (lightweight) paper will work OK, but there can be some issues with the paper curling over time. Also, when using a smaller macro target at close to 1:1 magnification, fibres on the paper can become a significant part of the image and reduce analysis performance.

3.3 Positioning the Target

Accurate positioning of the target is checked by the software for this version, and the Target Setup utility can be used to help with and confirm accurate positioning of the target.

The target should be mounted approximately straight and the right way up (the writing will be upright). It should be mounted on an opaque surface, flat, and perpendicular to the camera:

Target



Different distances to the target can yield different AF micro adjustment results. Due to the way the autofocus system operates in a camera, a single AF micro adjustment value will almost certainly not provide perfect operation at all distances. Each result obtained at a specific distance is valid for that distance. Ideally, you should calibrate at around the “most used” distance. Canon recommend a distance of 50x the focal length (e.g. 2.5m for a 50mm lens), but this will only yield a value correct at 50x the focal length, which may not be appropriate for the lens in question (e.g. a macro lens).

It is also worth noting that the AF micro adjust solution may start to move significantly as the test is run close to Minimum Focus Distance (MFD) of the lens, so it is not advisable to run the test with the camera very close to the target.

It is important that the **target does not move during the test** (the software checks for this and alerts you if there is a problem), so the camera should be mounted on a tripod.

To illustrate, correct target positioning is to ensure the CENTRE focus point through the viewfinder is aimed at the central cross of one of the 3 targets on the page (the red rectangle shows where the centre focus point should be):



CORRECT

Ensure the target is not rotated:



WRONG!

And that the camera is straight on to the target:



WRONG!

3.4 Lighting the Target

As the FoCal tests using the target are designed to calibrate or test the performance of the camera and lens AF system as a whole, it is important that the lighting level and quality on the target is appropriate for the test.

The most important factor in lighting the target is consistency of lighting. The following list shows the Do's and Don'ts of target lighting:

- Do use a light level on the target of EV8 (equivalent to 1/30s at f/2.8, ISO100) or above
- It is recommended that you use incandescent lighting (e.g. halogen lights), or even daylight (diffused or direct)
- Use an EVEN light source which does not cast any pattern on the target
- Do NOT use fluorescent lighting or mains powered LED lighting as these can flicker and cause analysis issues
- Do NOT use daylight on a partly cloudy day when clouds are passing over the sun and significantly changing the light level
- Do NOT backlight the target – for example, don't attach it to a window or lightbox to raise the light level.

3.5 Target Size

In order for the Target Setup distance calculations to work, you will need to ensure that the target image is printed on a full sheet of A4 or US Letter paper as shown in the “Correct” image above.

However, if you are testing a lens where the target size is simply inappropriate (for example a long telephoto lens) you can re-print the target at either a larger or smaller size.

Please bear in mind the following:

- Please use coated printer paper when printing the target at reduced sizes (e.g. heavyweight matte paper) otherwise paper fibres can cause issues with the image analysis.



3.6 Hard Targets

You can now purchase plastic Hard Targets from the FoCal store by navigating to:

`store.fo-cal.co.uk`

The Hard Targets are available in 2 sizes, are solid, flat, matt printed and come with sticky pads to attach firmly to a testing surface. Using a Hard Target will give the best results, removing any risk of target movement, creasing or light shining through the target, all of which can affect the analysis results.

4 Camera Setup

Please read this section carefully:

It is important that the camera is correctly configured for the test. The software will check as much as possible, but by setting up correctly you will reduce the incidence of warning messages and stopped tests.

4.1 Setup for Canon cameras

- **COVER the eyepiece of the camera!** This is very important as the camera is not being used in a normal mode where your eye and head is usually blocking stray light from entering the viewfinder. Failure to cover the eyepiece may result in bad metering and/or failure to achieve focus during the test.
- For non 1-series Canon cameras, you must ensure the camera is in **Av** mode. Unfortunately, the Canon SDK does not (officially) allow you to change the AE Mode, so the software will not be able to run the test if the not in Av mode.
- For 1-series cameras, you should ensure that the custom functions **do not limit** the choice of AE Mode (ensure A/S/M are allowed), or limit the shutter speed, aperture or ISO range. Failure to observe this requirement may lead to unexpected failure to run tests.
- You must also ensure the AF mode is set to **ONE SHOT**² – again, the Canon SDK does not (officially) allow you to change the AF mode. Again, for Nikon this is handled automatically.
- For the Canon 7D, 5D Mark III and 1D X, you should choose the normal single point AF mode (*not* Spot AF) – the software is not able to validate this and the results may be less accurate if you are in the wrong mode.
- If you are using a lens with IS (Image Stabilisation) or equivalent it is recommended that this is switched **off**.
- If you have a lens with a focus limiter (e.g. the Canon 100 f/2.8L IS Macro or the Canon 100-400L IS), please ensure it is set appropriately for the test distance.
- If you are using a battery grip, it is best to remove this as it can cause extra vibration when the camera is mounted on a tripod.
- The minimum light level to run the Fully Automatic test is around an EV of 5 (1/4s at f/2.8, ISO100), but the lighter the environment the more reliable and consistent the AF performance of the camera will be, therefore leading to better results. It is recommended that the light level on the target is around an **EV of 8** (1/30s at f/2.8, ISO100) or above.

² One Shot AF mode is used as it is appropriate for the test. As calibration is of the whole autofocus system, this will improve performance for all autofocus modes.

All other required settings are automatically applied at the appropriate times during the test, and restored when the test completes. When the test is executed, checks are made to ensure the target is correctly positioned and the environment is suitable.

4.2 Setup for Nikon Cameras

- **COVER the eyepiece of the camera!** This is very important as the camera is not being used in a normal mode where your eye and head is usually blocking stray light from entering the viewfinder. Failure to cover the eyepiece may result in bad metering and/or failure to achieve focus during the test.
- If available, the camera USB mode in the SETUP menu must be set to PTP/MTP (and NOT Mass Storage) otherwise the camera will not correctly communicate with the computer and FoCal will not be able to open the camera.
- The Live View mode in the SHOOTING menu should be set to **Tripod** if available (rather than hand-held). This is an important setting to ensure correct operation of tests.
- Check that the focus area in Live View is “Normal” (not face detect etc), and the focus mode is AF-S.
- You must also ensure the AF mode is set to “AF-S” (for single AF mode).
- Ensure AF Fine Tune adjustment is ON (on the camera *SETUP* menu in the *AF Fine Tune* option, ensure *AF Fine Tune On/Off* is set to “ON”).
- If you are using a lens with VR (Vibration Reduction) or equivalent this should be switched **off**.
- If you have a lens with a focus distance limiter switch please ensure it is set appropriately for the test distance.
- If you are using a battery grip, it is best to remove this as it can cause extra vibration when the camera is mounted on a tripod.
- The minimum light level to run the Fully Automatic test is around an EV of 5 (1/4s at f/2.8, ISO100), but the lighter the environment the more reliable and consistent the AF performance of the camera will be, therefore leading to better results. It is recommended that the light level on the target is around an **EV of 8** (1/30s at f/2.8, ISO100) or above.

All other required settings are automatically applied at the appropriate times during the test, and restored when the test completes. When the test is executed, checks are made to ensure the target is correctly positioned and the environment is suitable.

4.3 Battery Level

Each test in FoCal either takes shots or uses the Live View capability of the camera, and when the battery level drops below a certain amount the camera can reject requests for certain power-hungry functionality.

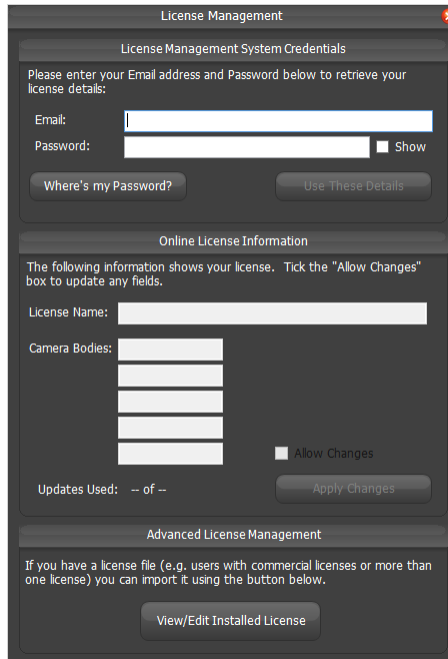
Therefore, FoCal will warn if the camera is below 25% battery and give a critical warning if the camera is below 10% battery. You should replace or recharge the battery if either of these warnings are shown to ensure reliable operation.

5 Licensing

The license for FoCal allows you to use the software with up to 5 specified cameras (which can be a mix of any supported manufacturers). The licensed cameras can be changed a number of times to cater for equipment upgrades over many years of private use.

5.1 First Installation

When you first install and run FoCal, you will be presented with the License Management window as shown below:

The screenshot shows a 'License Management' window with a dark gray background. At the top, it says 'License Management System Credentials'. Below this, it prompts the user to enter their email and password to retrieve their license details. There are input fields for 'Email:' and 'Password:', with a 'Show' checkbox next to the password field. Below the inputs are two buttons: 'Where's my Password?' and 'Use These Details'. The next section is 'Online License Information', which explains that the following information shows the user's license and that they can tick the 'Allow Changes' box to update any fields. It includes input fields for 'License Name:' and 'Camera Bodies:' (with four stacked boxes). There is an 'Allow Changes' checkbox and an 'Apply Changes' button. Below this, it shows 'Updates Used: -- of --'. The final section is 'Advanced License Management', which states that if the user has a license file (e.g., for commercial licenses or more than one license), they can import it using the button below. There is a 'View/Edit Installed License' button.

All you need to do is enter:

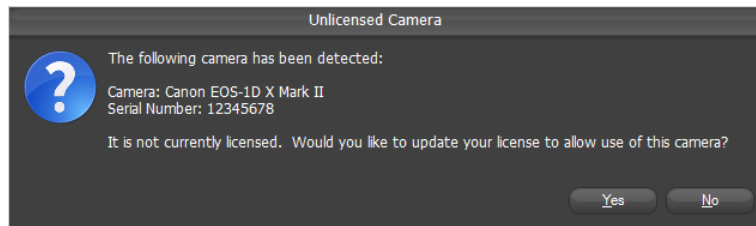
- **Your registered email address.** This is the email address you use to log in to the License Management System at lms.fo-cal.co.uk. By default it's either your PayPal email address or the email address you registered with when you activated a boxed copy of FoCal, but you may have changed it on the website.
- **Your Password.** If you purchased FoCal after May 2014, you would have received your password in the purchase/activation email. **If you do not have a Password, you should use the PayPal Transaction ID that was sent to you in the original purchase email from Reikan.**

If you've forgotten your Password, you can go to lms.fo-cal.co.uk and request a Password Reset Link.

Once you have entered this information, just click the *Use These Details* button and your license will be automatically downloaded from the Reikan License Management System (LMS) and applied to FoCal. The application will quit and when you restart your license will be active.

5.2 Licensing a New Camera

If you connect a camera which is not licensed, you will see the following window appear:



Simply click *Yes* to update your license to allow the use of the camera. FoCal will quit, and when you restart your camera will be licensed.

5.3 License Update Limit

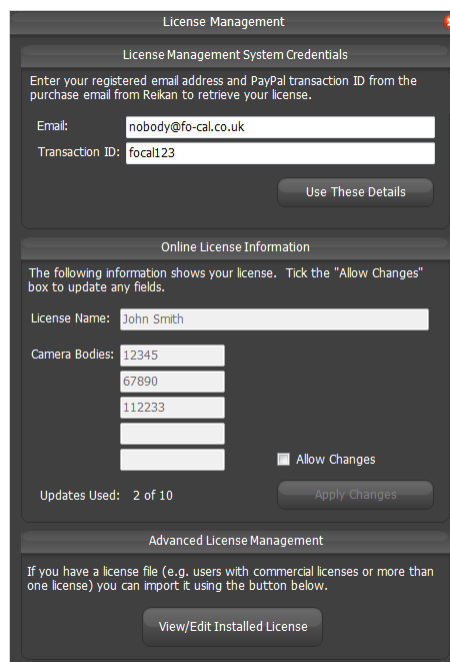
There is a limit to the number of times you can change the license before having to contact Reikan (this is to prevent use outside of the license terms). The limit is high enough to allow private use of FoCal for many years of typical equipment upgrades. If you reach the limit please contact us at support@fo-cal.co.uk.

5.4 Manually Adding Cameras

In order to reduce the number of updates used when licensing new cameras, you can add more than one camera to your license in a single update by using the *License Management* window.

You can access this window by clicking the *About* button then the *License* button.

Your previously entered credentials (Email and Password) will be used to retrieve your online license information when you open the window:



To add new cameras, click the *Allow Changes* tick box, then you can edit the serial numbers that are on the license. You can remove old serial numbers and add new serial numbers. When complete, click the *Apply Changes* button to change your license.

When complete, the following message will be shown:



When you restart FoCal, the specified cameras will be licensed.

5.5 Advanced License Management

For certain situations (e.g. commercial licenses or apply a license from a file) you will need to use the *View/Edit Installed License* button. This will show the license window that was used in previous versions of FoCal, and allow pasting from the clipboard or applying licenses from a file, as well as seeing which options are enabled in the currently applied license.

You will only need to use this option if instructed by Reikan.

5.6 Updating the License Online

You can still update your license online at lms.fo-cal.co.uk – simply log in with your email address and Password (or original PayPal transaction ID if you don't have a Password) and you can make changes to the license.

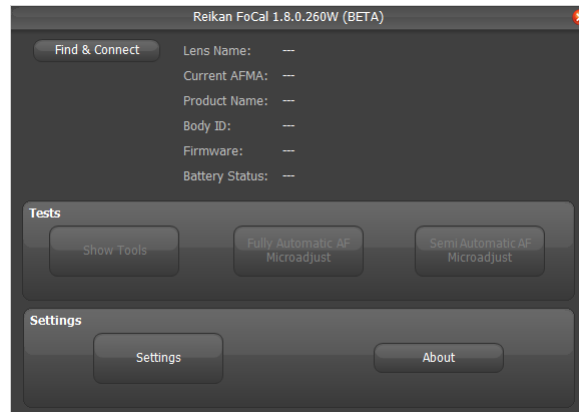
Once the changes are made, you will need to open the *License Management* window in FoCal (click *About* and then *License*) and your updated license will be downloaded.

6 Initial Setup

Before running a test, the target must be setup correctly. The preliminary setup in section 3.3 is required before the more accurate setup can be executed.

6.1 Connecting to a Camera

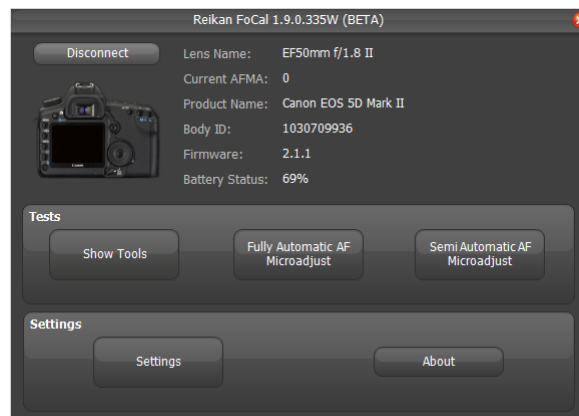
In FoCal 1.8, the camera connection has been simplified. When you start FoCal, you will see the following window:



With a camera connected, click *Find & Connect* to open a connection to the camera.

6.2 Camera Information

Once a camera is opened, the camera information will be shown:



This will show the camera type, the current AF micro adjust value (if available) and other information about the setup.

The Tests panel shows the available tests (this will depend on the license you have installed and the camera that is connected). Further tools are available by clicking *Show Tools*.

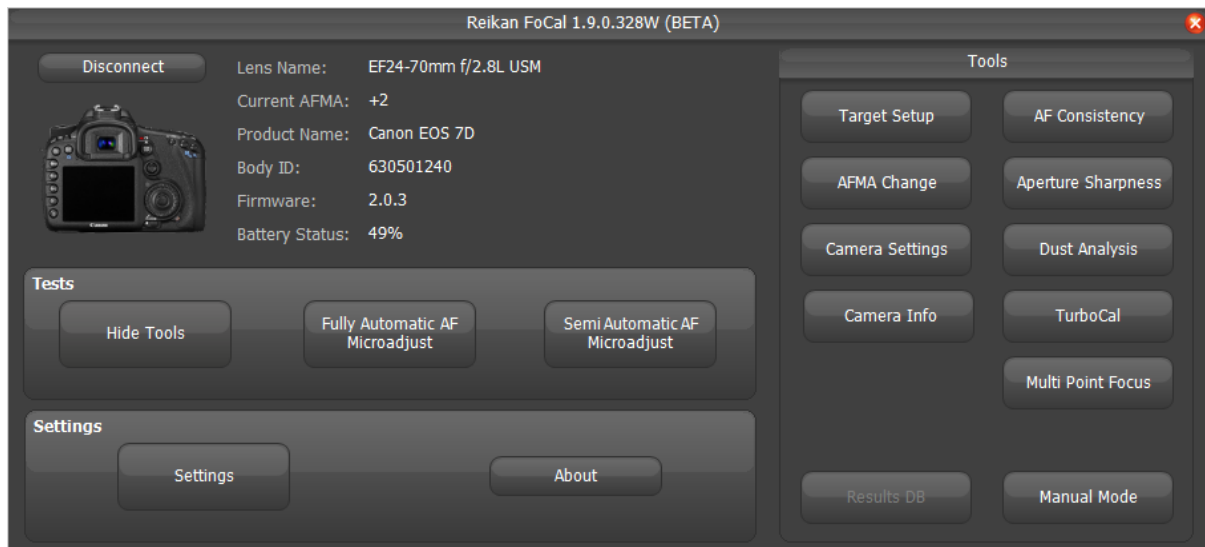
The Settings allows you to change the test settings and get information about the software.



For certain cameras, the Body ID may be shown as *Pending*. This means that the Body ID will be determined during the testing.

6.3 Selecting Tools

Clicking the *Show Tools* button will display a panel containing buttons for a number of utilities and extra tests available from the software:



Note that the *Results DB* test button is a placeholder for a future version and cannot be activated at present.

7 Common Test Features

This section describes common features of FoCal that appear in most tests.

7.1 Keyboard Shortcuts

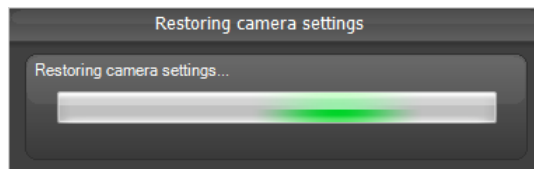
You can access the Settings window from within any test window (when the test is not running) by hitting the “,” key on the keyboard.

From the main window, you can start many functions with the following keys:

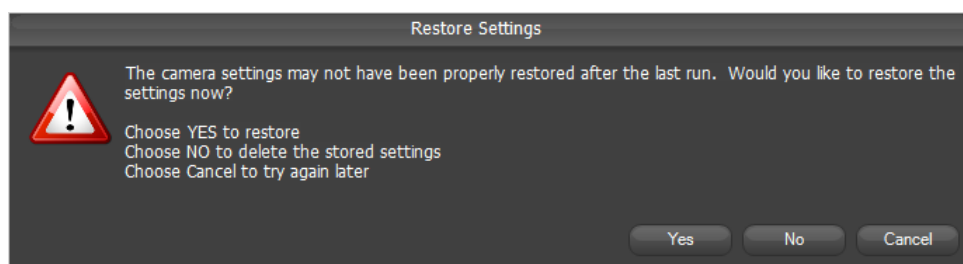
Key	Operation
CTRL+T	Target Setup Utility
CTRL+F	Fully Automatic AF Microadjustment Calibration
CTRL+S	Semi-Automatic AF Microadjustment Calibration
CTRL+C	Autofocus Consistency Test
CTRL+A	Aperture Sharpness Test
CTRL+D	Dust Analysis Test
CTRL+Q	Quick AF Microadjustment Calibration
CTRL+M	MultiPoint Focus Test
CTRL+U	Manual Mode

7.2 Storing and Restoring Camera Settings

When a test is run, several of the camera settings are modified (e.g. aperture, shutter speed etc). Before the test is run, these settings are written to a file on the computer, and when the test is complete they are restored. The following dialog is shown during the restore operation:



If for any reason, the software does *not* restore the camera settings (e.g. there is a problem during execution or the software has to be terminated), then when the application starts the *next* time, it will show the following dialog:



If you choose *Yes*, the settings will be restored as long as the camera serial number matches. If the camera has been changed, the software will not write the settings to the new camera but will inform you of the change, along with the serial number of the camera for which the settings are stored.

If you choose *No* the settings will be deleted and you will have to manually restore the camera (see section 24).

If you choose *Cancel* the settings will remain in the system until you run a new test, at which point they will be overwritten with the current camera settings.

7.3 Target Setup

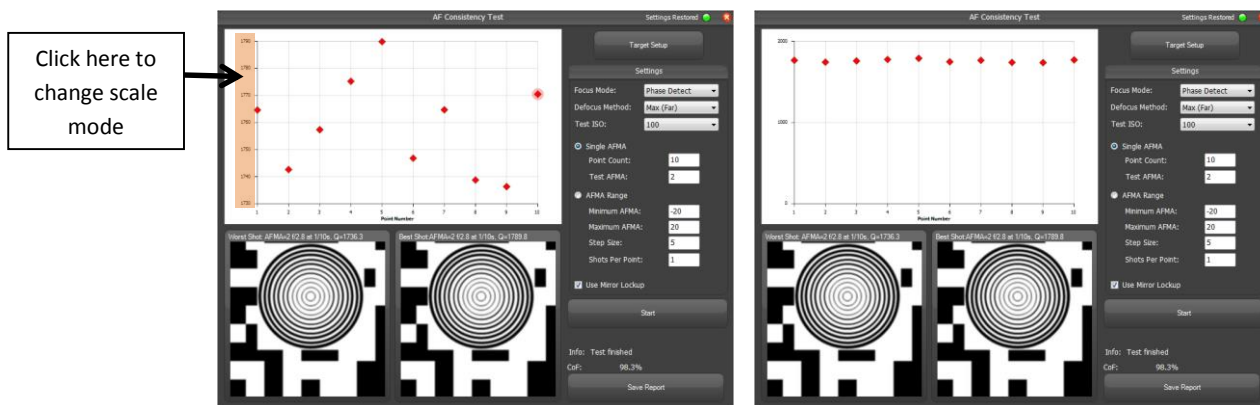
Tests which require the target to be set up correctly will offer the Target Setup utility from a button on the Test window. The Target Setup utility is simple to use, but it's worth reading section 8 to familiarise yourself with how the utility operates.

7.4 Changing the Chart Scale

By clicking on the y-axis numbers of any chart, the scale will change between the following modes:

- *Scaled for Data* – the data will take up most of the height of the chart to give a good view of the relative values of the data points. The chart scale will usually not start from 0.
- *Scaled from 0* – the chart will start at 0, giving a better view of the absolute values of the data.

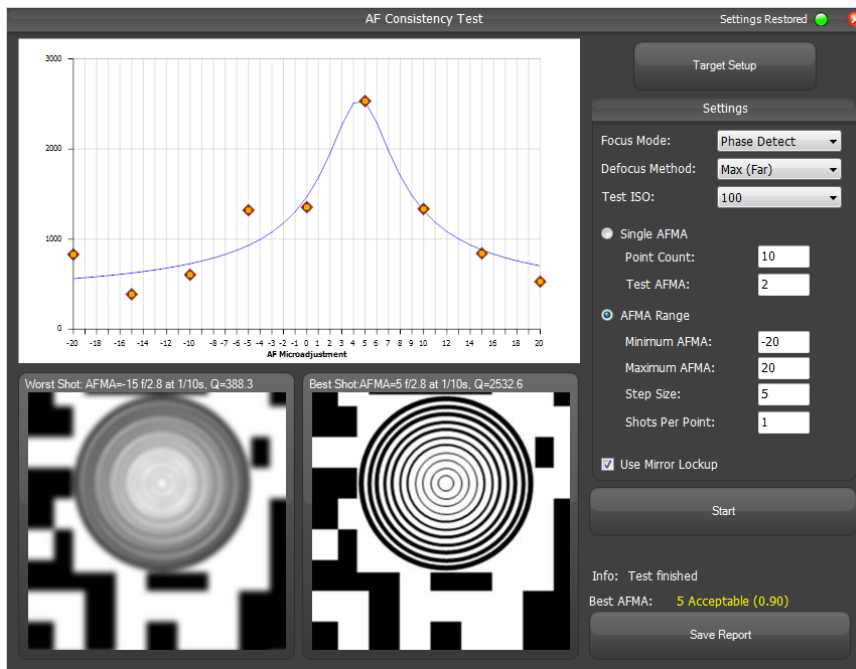
The images below show the same data viewed in the two different modes. On the left is the *Scaled for Data* view, and on the right is the *Scaled from 0* view:



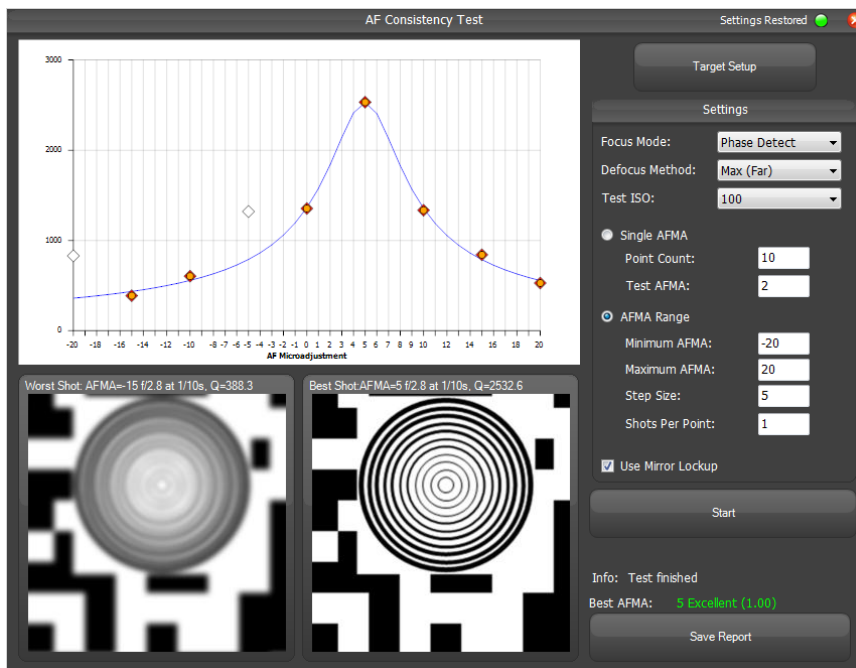
7.5 Ignoring Data Points

Several tests (currently the Fully Automatic test, AF Consistency and Manual Mode) offer the ability to ignore selected data points when computing a final result by right-clicking on the points in the chart.

As an example, the following (simulated) AF Consistency Test shows two obviously erroneous points:



By right-clicking on the two points, they lose their colour and stop being part of the calculation – the result is a much higher confidence calculation:

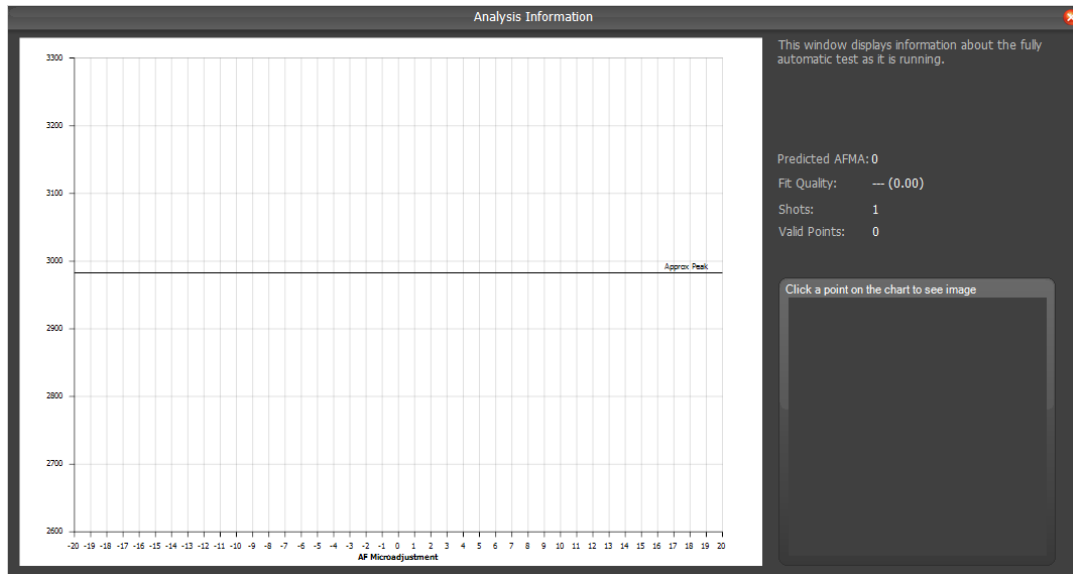


The prediction algorithm does require a both a fair number of points and a good spread of data across the AF microadjustment range to work properly. If too many points are removed, the prediction can become poor and this will be visually obvious.

7.6 Peak Focus Detection

If one of the *Peak Focus Determination* options is selected in the *Settings* window (see section 25.2.11) FoCal will try to determine the best possible focus value that can be achieved by the camera and lens setup.

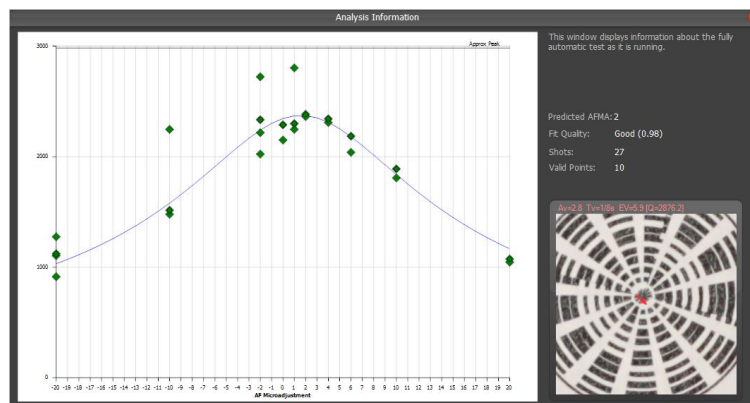
This will be determined during an additional step at the start of the test, and the result will be shown on the chart as a black line:



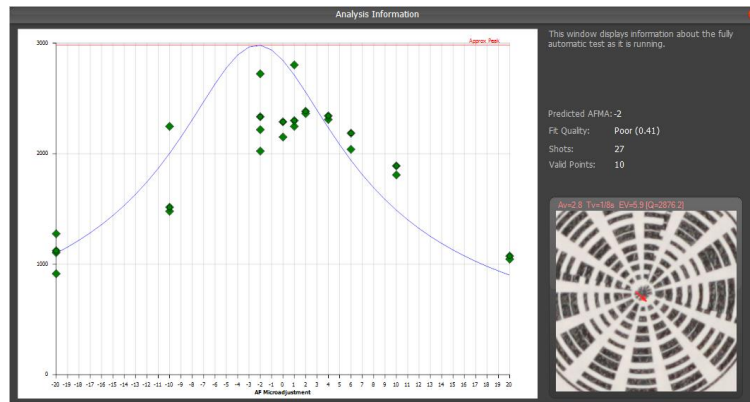
As the test progresses, points will be added in the usual way, and should *generally* all fall underneath this line (here is a small amount of uncertainty in the calculated value, so it is possible that some points may go slightly above this line).

By *left clicking* on the peak line, you can see the captured image displayed.

By *right clicking* on the peak line, the line will turn red and the value will be used in the final determination of the AF Microadjustment/FineTune value. For example, the image below shows the peak line in black (NOT used for the calculation):



By *right-clicking* on the peak line, the line will turn red and be used in the calculation – in this instance it shifts the peak from 2 to -2 but degrades the quality of the result from *good* to *poor* so it would be best to use the results derived without using the peak:



7.7 Saving Reports (FoCal Pro)

When the test is complete, you can click *Save Report*. This will display the Report Options sheet, where you can choose to:

- Include individual point details (uncheck this to create a short summary report)
- Remove the serial number (so you can share the report without any identifiable camera details included)
- Add your own notes to the report
- Save a CSV file of the test data (not supported for all tests)

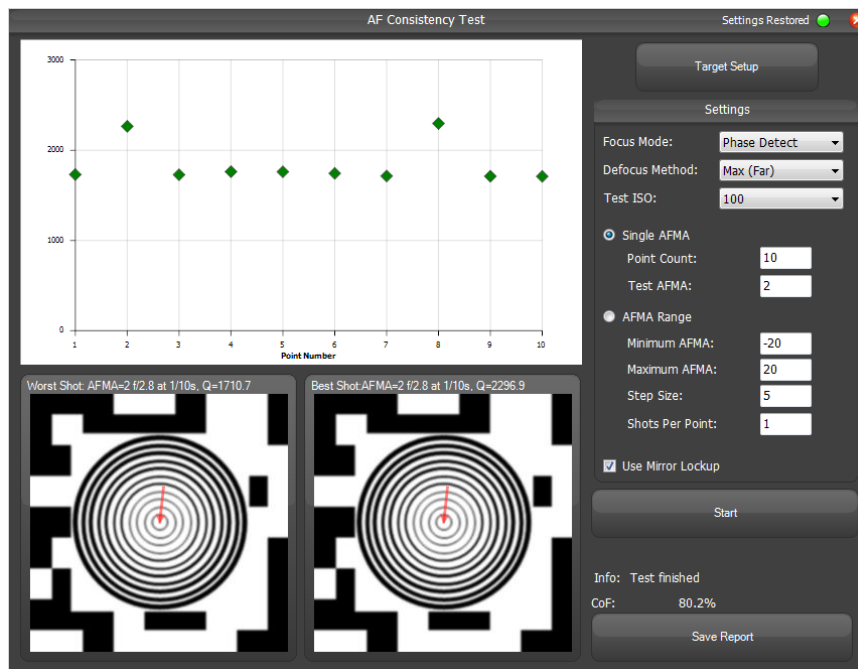
When you have entered any details you wish into the Report Options sheet, you can click *Save* to choose a filename and save the report.

7.8 Target Optimisation (FoCal Pro)

With Target Optimisation activated, FoCal will shift the part of the image that is analysed by a small amount to compensate for any movement of the camera - you can think of it as similar to Image Stabilisation, trying to keep the analysed image stable in the presence of movement. This can be especially important during MSC mode tests where you will have to change settings on the camera and there is a movement risk.

In FoCal 1.5, the Target Optimisation algorithm has been significantly reworked and now actually uses 3 different methods in combination to determine the best position for the analysis area under greatly varying test conditions.

When Target Optimisation is enabled, any chart points will be shown in **green**, and the analysed images will have a small arrow on showing how the analysis region has been moved, as shown in the image below:



If the camera is moved slightly during test shots, Target Optimisation will slightly shift the analysis region and you will see the size and direction of the arrow change. Theoretically, the image should stay identically placed across testing, but there may well be movement of a few pixels if you scan across the images. This will not have a big bearing on the results, and will make the final result much more reliable than if Target Optimisation is not used in the presence of movement.

If you are confident that the tripod, camera and target are absolutely solid and there is no chance of movement, you will get the best result with Target Optimisation switched OFF.

You can enable/disable Target Optimisation from the settings screen (see section 25.2.5)

8 RGB Analysis

8.1 Overview

A new analysis method has been introduced in FoCal 1.9.5 called RGB Analysis - this new analysis method brings a much more consistent result under differing environmental conditions, and also takes into account significantly more information to arrive at a single Quality of Focus result.

8.2 How does FoCal's RGB Analysis work?

The new *Quality of Focus* (QoF) result in FoCal is a combination of 6 different measurements: horizontal and vertical sharpness in the 3 colour channels – red, green, and blue.

It is best to use the new RGB Analysis feature with raw images – by default, this is the configuration that FoCal will adopt. A new raw processing algorithm performs minimal processing on the raw sensor data, keeping the red, green and blue channels isolated. Analysing a JPEG image will not truly reflect the results at the image sensor as the demosaicing algorithm will merge information from all 3 channels, as well as applying non-linear transforms for gamma correction etc.

8.2.1 RGB Results and Spectral Content

The values are combined based on the amount of each colour that is in the analysed image – so if, for example, you analyse under tungsten lighting then the red component of the image will have more weight on the overall QoF value. In this way you may find a slight difference in the analysis results when you calibrate in different environments.

In FoCal Plus and FoCal Pro, you can see the results from the independent channels, which can give an idea of the amount of axial chromatic aberration exhibited by a lens (this is where light of different colours is focused at different planes – in front and behind the sensor – resulting in blurring of individual colour channels).

8.2.2 Horizontal and Vertical Results

Analysing in both horizontal and vertical directions gives the possibility to identify various issues which can affect image quality. The Horizontal-to-Vertical Ratio (HVR) result shown in FoCal is calculated as follows:

$$\frac{\max(QoF_h, QoF_v)}{\min(QoF_h, QoF_v)} * 100 \quad \text{if } (QoF_v > QoF_h), \text{ result is negative}$$

Where QoF_h is the horizontal combined QoF (of all 3 colour channels), and
 QoF_v is the vertical combined QoF (of all 3 colour channels)

In simple terms, the HVR is positive if the horizontal analysis result is sharper than the vertical analysis result.

Note: The HVR result of the RGB Analysis is something that is under development – at present we have limited results to show exactly how to interpret this data. The following information is preliminary and may not reflect the true meaning of the results:

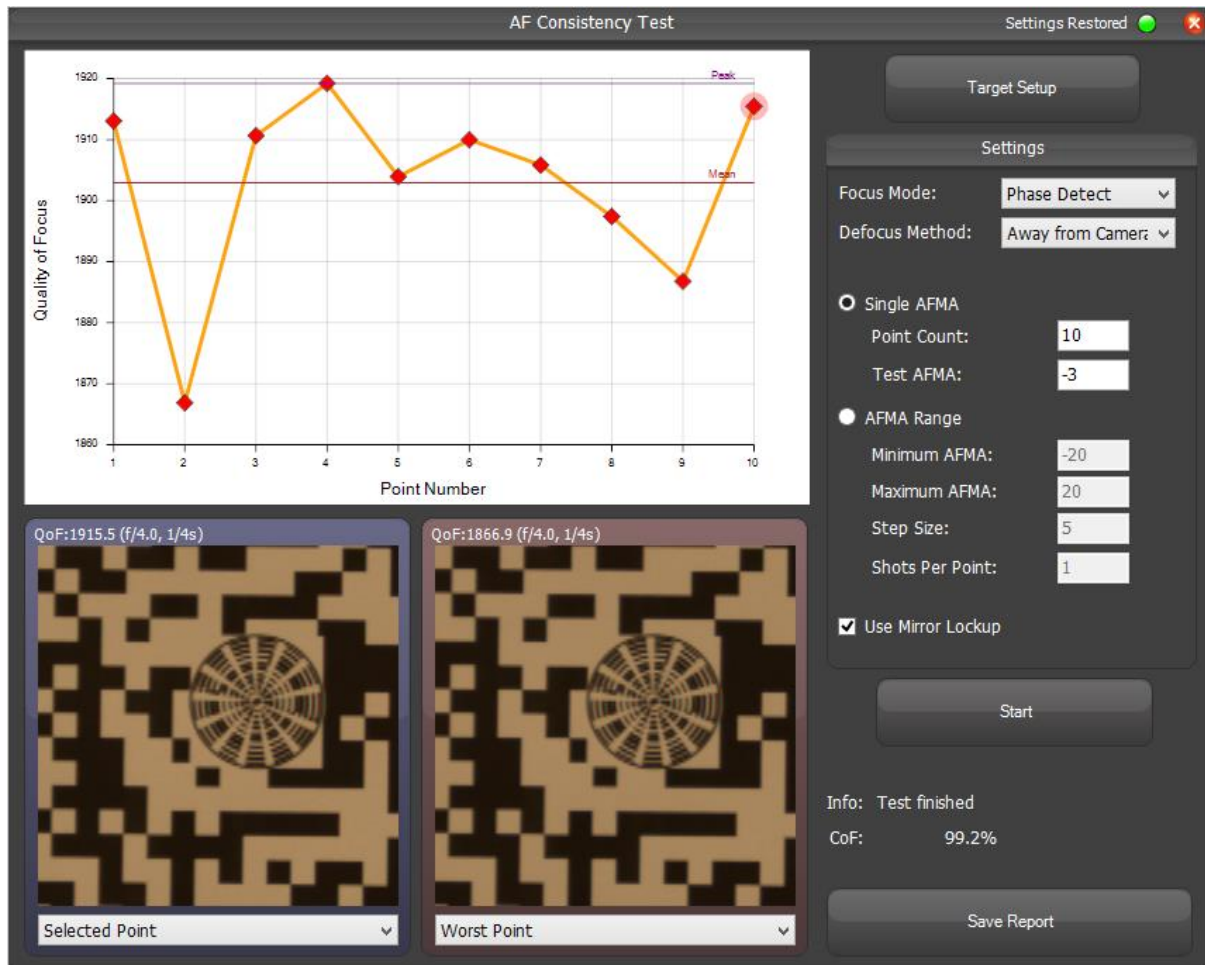
In FoCal Pro, the combined result is shown in the generated PDF report as the mid value of HVR and the range (e.g. $5.2\% \pm 0.6\%$).

Mirror vibration is typically in a vertical plane and variable during a test, so if you find a result where the variation (“±”) value is high (typically greater than 5%) then your setup may be experiencing some vibration.

Lens defects (e.g. misaligned lens elements) can produce a fixed HVR difference with very little variation. As an example, if you have a results that is $14\% \pm 0.8\%$ (so a high mid value and low variation value) then the lens may require a service.

8.3 Display the RGB Analysis Results

By default, FoCal will enable RGB Analysis but will not show the results within the application:



In order to enable the RGB Analysis results, you can either:

- Select the *Show RGB Analysis Data* in the Pro tab of the Settings window
- Hit CTRL+S with the test window open to enable/disable the RGB Analysis Data display.

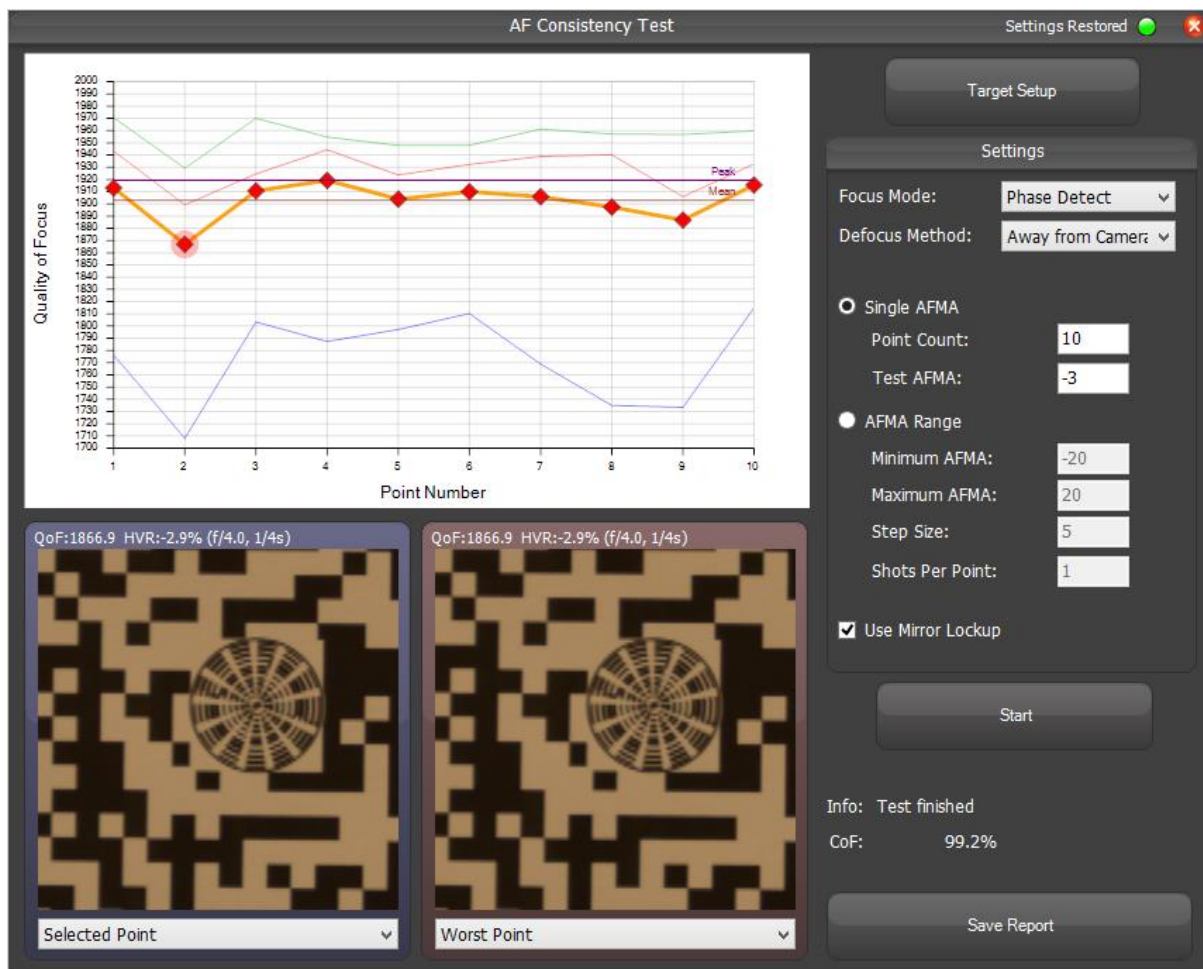
8.3.1 RGB Analysis Data Display

The RGB Analysis Data consists addition *chart* and *panel* information.

On the chart, 3 extra lines are shown – red, green and blue in their appropriate colours. The orange line shows the combined (spectral weighted) result of all 3 channels and both orientations (horizontal and vertical).

The panel text (above the 100% view images) will indicate the HVR.

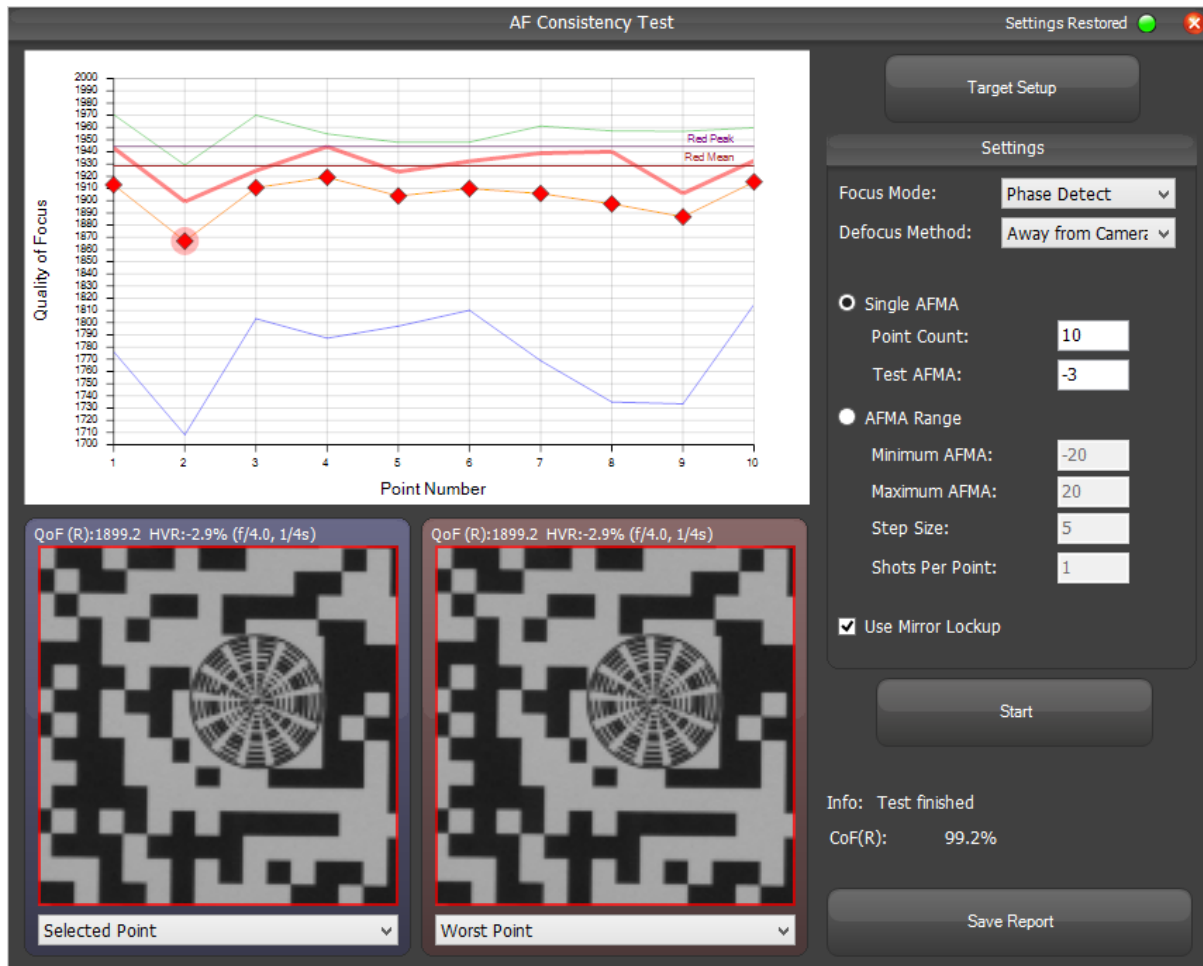
By default, *all* channel information will be selected – so the QoF result will be the combined QoF of all 3 colour channels:



8.3.2 Single Colour Channel

Using the following keys, information about a single channel can be shown:

- CTRL + R – show **red** channel information
- CTRL + G – show **green** channel information
- CTRL + B – show **blue** channel information
- CTRL + A – show all channel information (combined RGB – this is the default)



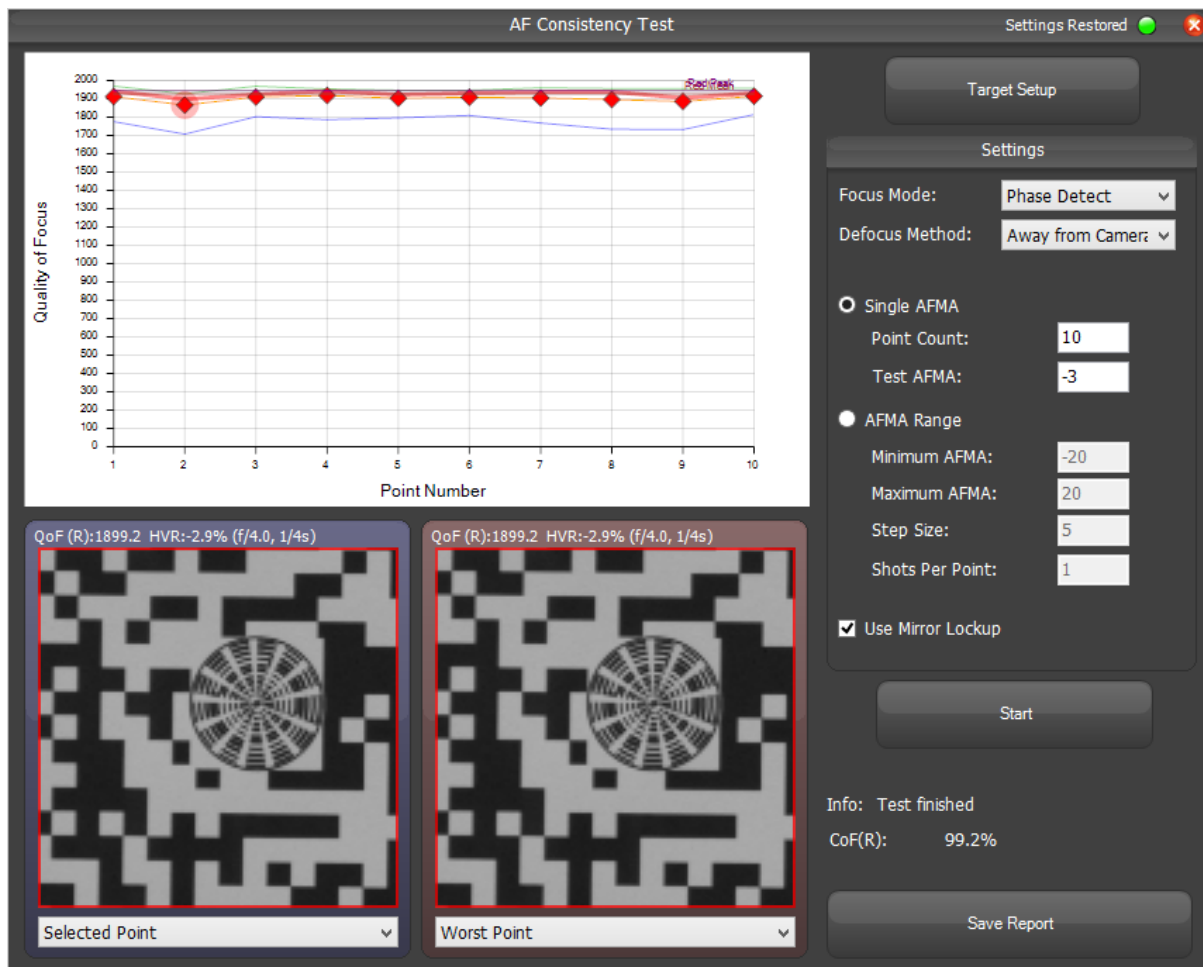
When a single channel is selected, the following changes occurs:

- The appropriate colour channel line on the chart is shown thicker
- The image in the panels shows a border of the appropriate colour
- The image in the panels will appear in greyscale showing the captured brightness of the single channel
- The QoF indication in the panel text shows the single channel QoF value, and indicates the channel (e.g. "(R)" above).

8.4 Chart Scaling

The new RGB Analysis method gives a much more consistent result than the previous analysis used in FoCal, so you may be surprised if you see a chart that spans a large amount of the vertical range of the chart (e.g. the image shown in section 8.3). However, remember that the charts are auto-scaling

to show the details of the data, and if you click the y-axis numbers (as explained in section 7.4) you can show the data as an absolute level which will give a more natural view of the results:



8.5 Keyboard Shortcuts

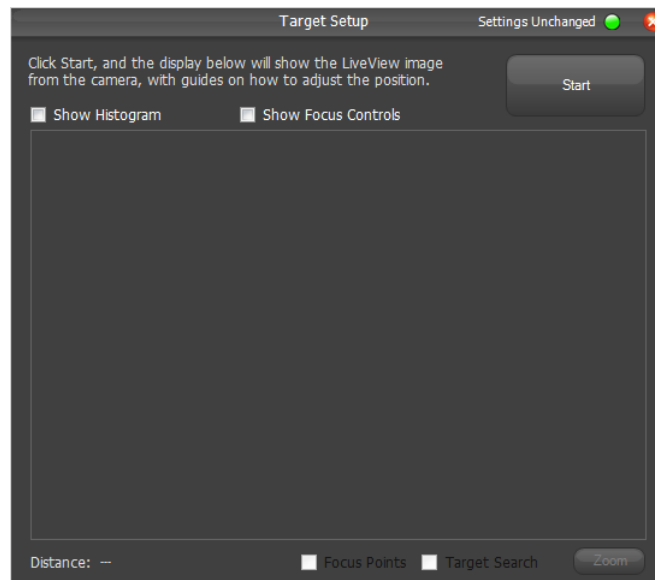
As explained above, the following keyboard shortcuts can be used to control the RGB Data Display in the test windows:

Key	Action
CTRL+S	Show/Hide RGB Analysis Data
CTRL+A	Select all colours (default view)
CTRL+R	Select just red channel
CTRL+G	Select just green channel
CTRL+B	Select just blue channel

9 Target Setup Utility

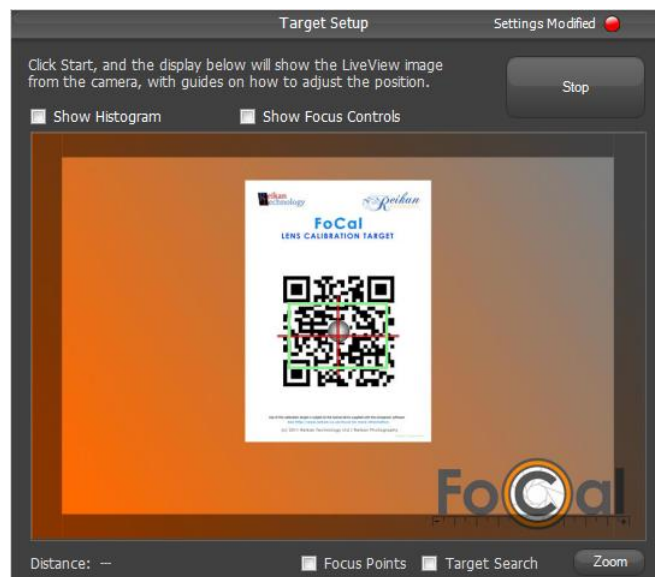
9.1 Using Target Setup

To start the Target Setup utility, click the Show Tools button in the Test panel, then choose Target Setup. The following window will open:



You should ensure the camera is mounted on a tripod at approximately the correct height and with the sensor parallel to the target. Check the centre focus point is approximately pointing at the centre of the target.

Click the Start button on the test to display a LiveView image:



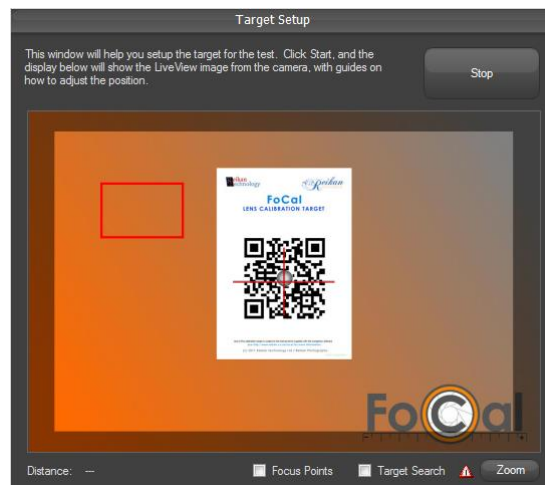
Clicking the *Show Histogram* button will show a small histogram on the LiveView image. This feature will be enhanced in future for pre-test light analysis.

A note about Live View Zoom (for Target Setup and Semi Auto test):

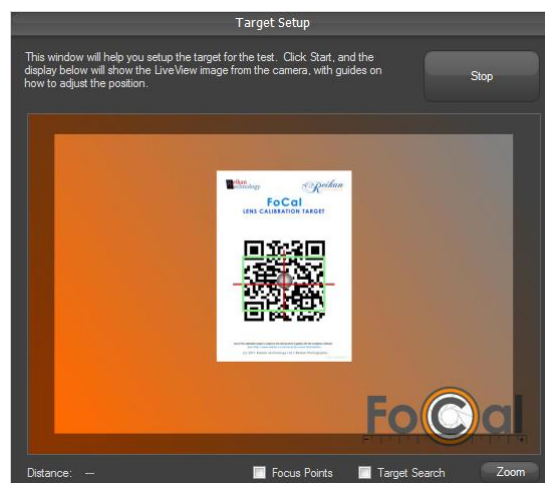
The **Zoom** button allows the LiveView image to be zoomed and returned to normal. **Note that the zoomed view will be of the current position of the Zoom Rectangle on the camera** – this means if you have previously been zooming off-centre, the display in FoCal will be incorrect. The zoom rectangle will be shown in the Live View image in Target Setup if supported by the camera.

For Canon Cameras: To ensure the correct zoom position, enable Live View (this can be done during the Target Setup test on the camera by pressing the normal button on the camera to enable LiveView), and press the joystick controller on the camera – this will centre the zoom rectangle on the centre of the screen.

The following image shows the zoom rectangle off centre, indicated by the red rectangle to the left of the target. A warning icon will also be shown by the Zoom button:



This image shows correct zoom rectangle setup, indicated by the green rectangle centred on the cross-hairs in the middle of the image, and no warning icon by the zoom button:



You should start by visually aligning the target with the centre of the crosshairs.

Clicking **Target Search** will start the target detection. This is a computationally intensive operation, and you will notice some delay in the LiveView image updates when this is running. If you are running on a slow computer, you should adjust very slowly to check confirmation.

When the Target Search is running, indicators will be shown on the screen, similar to this:



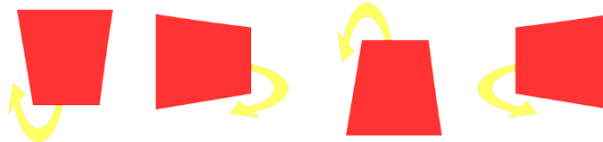
If the target is detected it will be outlined in red. In the centre of the image will be an icon indicating what needs to happen to correctly position the target. The icons have the following meaning:

9.1.1 Target Alignment Icons

The target should be moved in the direction of the arrow:



The target is not parallel to the sensor and needs to be moved as shown:



The target needs to be rotated to be straight:



No target is found:



The target is in the correct position:



You should move the camera and/or target as appropriate to ensure the green tick icon is displayed. You are now ready for running tests.

9.1.2 Things to note about Target Search

The target detection routine is very computationally intensive. It is optimised for small changes in the position once a target is found, but is slowest when there is no target on the screen.

You should ensure the target is in approximately the right position before enabling target search.

If you find the responsiveness too slow to successfully move the camera and get updates, you can un-tick the Target Search box, move as indicated and re-enable to check the position.

Note that the target search **only operated with the special FoCal target**, so if you are using a different target you should **not** enable the option.

9.2 Target Detection

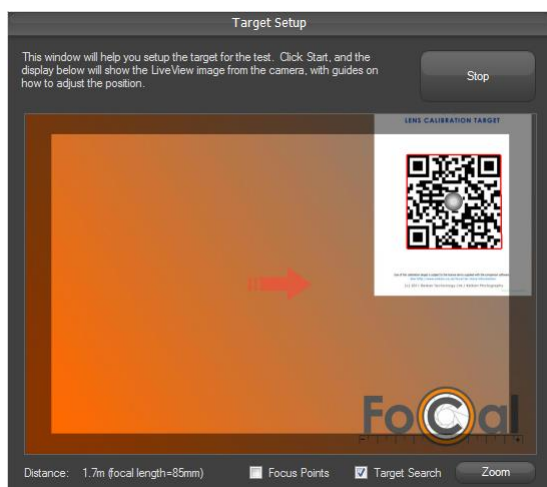
When FoCal detects the target, it is the coded black-and-white square section of the target (shown below) that is used by the software:



This whole black-and-white coded area is detected.

In order for the Target Setup utility to work (and other features that use Target Detection, for example the Target Validation and Target Optimisation options), the image captured from the camera must contain the **complete** coded area shown above within the guides of the utility (approximately 90% of width and height of the image).

The following images show examples of when the target will be detected and when it will not (these are Target Setup examples):

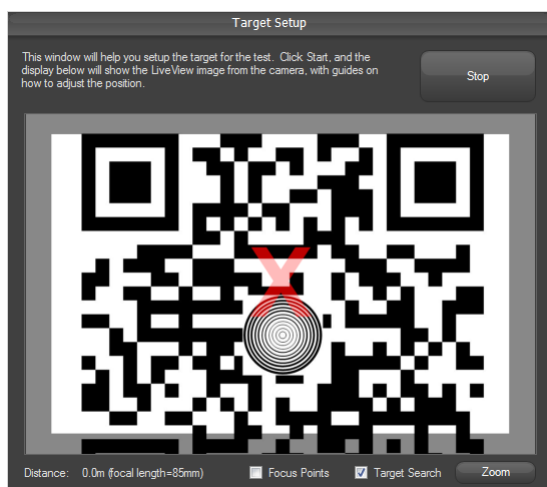


The grey guide around the edge of the LiveView images shows the extent to which the target can be detected. If the *whole* coded area is clear of the outer guides, it will still be detected as shown in this image.

The overlay marker shows which way to move the camera to correct the setup.



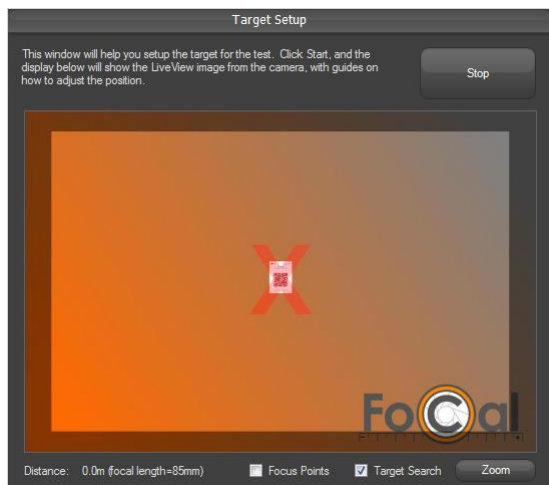
Again, this target is detected as the coded area is completely within the central section.



But when zoomed, not all of the target can be seen so it is no longer detected.



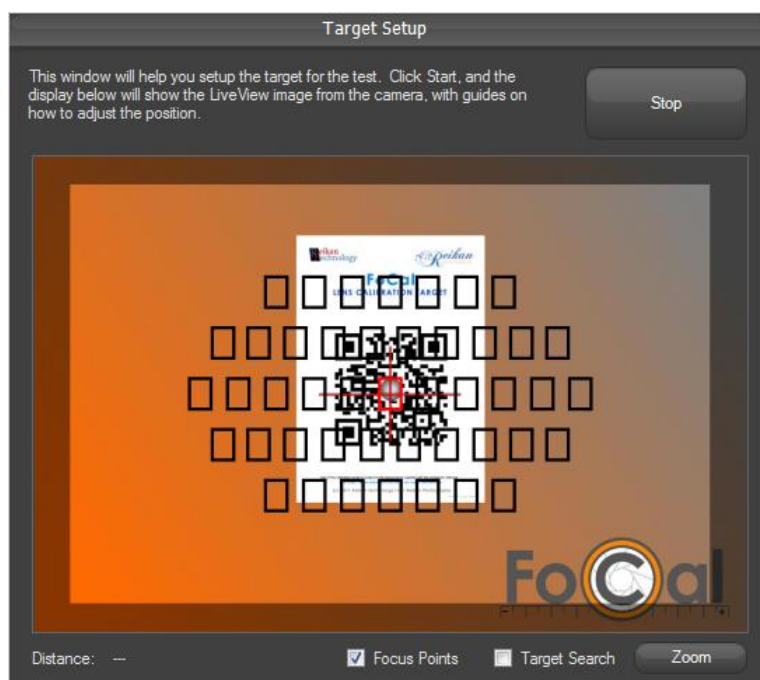
Again, although this target is a good size, the coded area crosses the guides and is not completely within the detection region so it cannot be detected.



Finally, if the target is too small in the image, it will not be detected. If this is the case, either move the camera closer to the target or use a bigger printed target.

9.3 Focus Points

From FoCal 1.5, you can use non-centre focus points with both Canon and Nikon cameras. You can display the Focus Points from the camera on the Live View image by clicking the *Focus Points* check box at the bottom of the window. The currently selected focus point is indicated with a red square:



Note that no focus points are displayed when the image is zoomed.

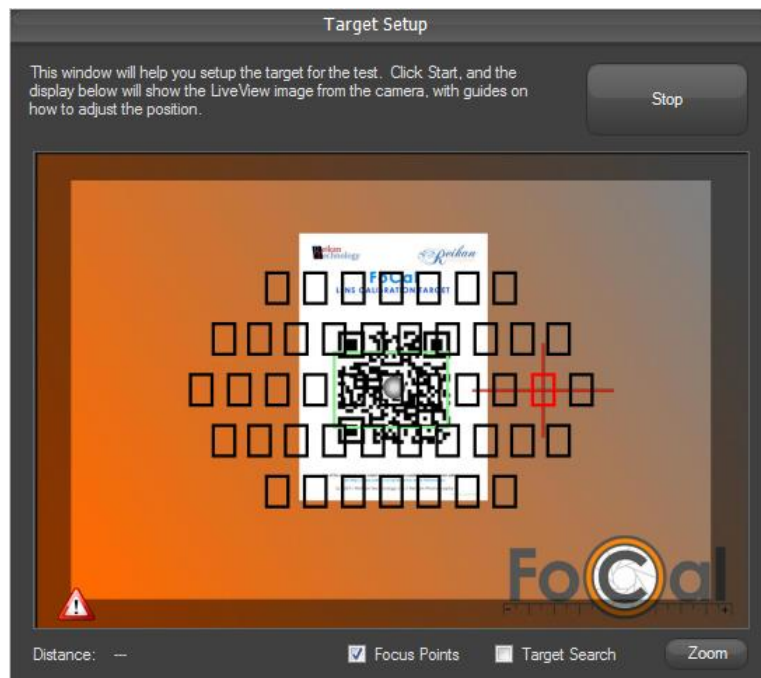
9.3.1 Changing the Focus Point

With FoCal Pro, you can change the focus point used for the analysis (see section 25.3.7). When this feature is enabled, by clicking on a selectable focus point you will be able to select it.

As you move over the focus points, they will be highlighted in yellow. Note that although *all* focus points are highlighted in yellow as you move over them, you cannot necessarily select all the points – it depends on the mode the camera is in. In the example above (which shows the focus point

arrangement for the Canon EOS-1D Mark IV) in certain modes only the inner or outer focus points are selectable. If you click on a point which is not selectable, it will not highlight in red and the focus point will not change.

As using an off-centre focus point is an advanced feature that can have a serious impact on the results, a warning indicator will be shown on the bottom left of the Live View screen if this is selected:



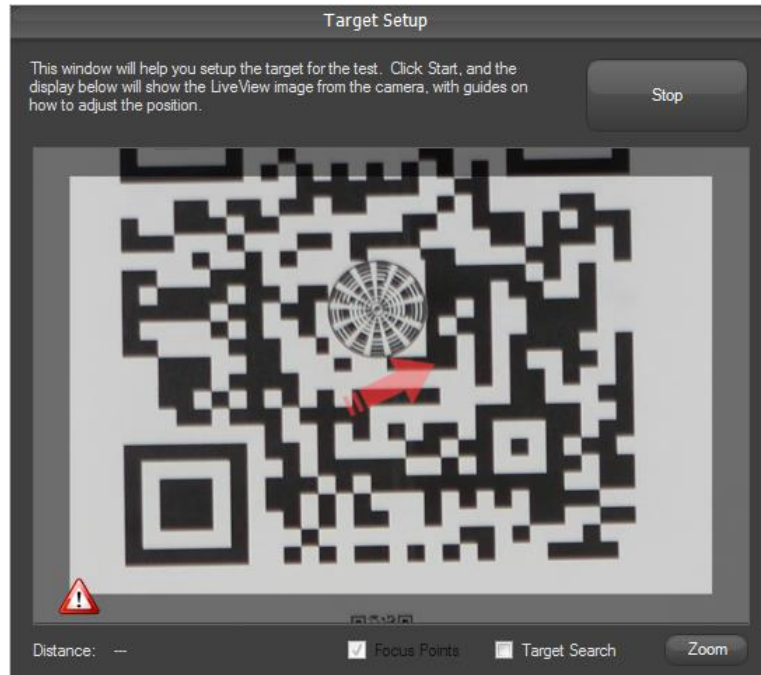
9.3.2 Target Search with off-centre focus points

When an off centre focus point is selected, the cross-hair indicating the centre of the analysis region for tests will move as indicated in the image above. Clicking **Target Search** will fade the focus points and indicated how the camera should be moved in order to align the target.

9.3.3 Target Search while zoomed (Canon)

In zoom mode on Canon cameras, the image shown in FoCal is the contents of the zoom rectangle on the LiveView screen of the camera, and this may NOT be covering the appropriate point in the image to display the crosshair.

If this is the case, the Target Setup image will show an arrow which indicates how the LiveView zoom rectangle should be moved:

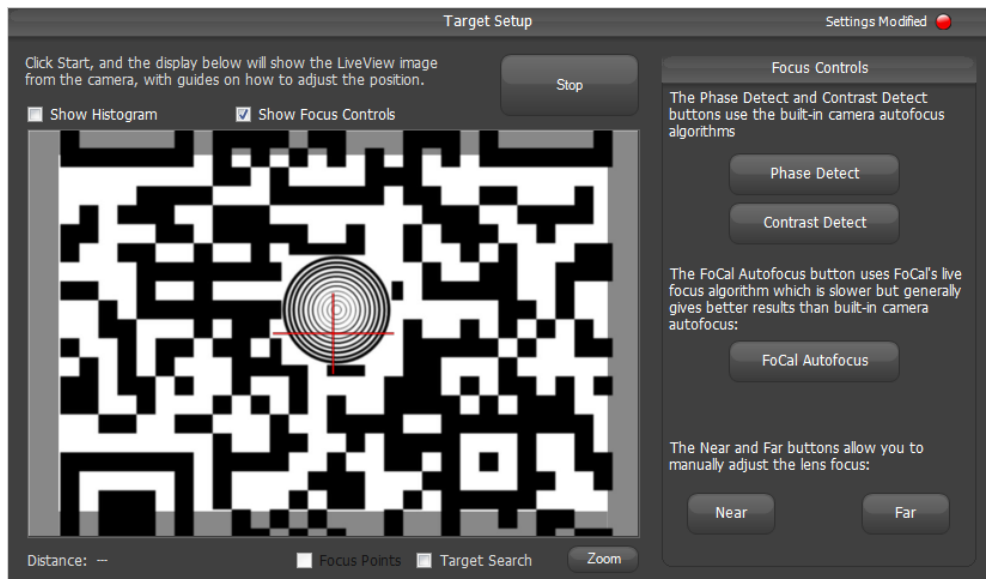


To move the zoom rectangle on Canon cameras, simply enable LiveView on the camera by pressing the appropriate button (this *can* be done while the Target Setup utility is running), and use the joystick on the camera to move the zoom rectangle. The Target Setup utility image will change as you move, and the crosshairs will come into view when you are in the appropriate position.

You should then move the camera on the tripod to align the centre of the target with the crosshairs.

9.4 Focus Controls

By clicking the *Show Focus Controls* button you will see the Focus Controls panel to the right of the LiveView image:



The LiveView image will be automatically zoomed when you click the *Show Focus Controls* button. You then have the following tools available:

9.4.1 Phase Detect Autofocus

This will trigger a Phase Detect autofocus operation using the camera's standard algorithm. The mirror will drop and a standard "quick" autofocus operation happens, then you will see the LiveView image again once the operation is complete.

9.4.2 Contrast Detect Autofocus

This will trigger a Contrast Detect – also known as "Live" - autofocus operation using the camera's standard algorithm. The LiveView image will stop updating during the focus operation, and will continue again when the focus operation is complete.

9.4.3 FoCal Autofocus

The *FoCal Autofocus* button will trigger an algorithm built in to FoCal. This typically takes about 5-10 seconds to achieve focus, but will almost always be better than the camera's standard Phase Detect or Contrast Detect autofocus algorithms.

9.4.4 Near / Far Focus

If you want to adjust the focus a little, you can use the Near and Far buttons to move the focus point in either direction, and see the results immediately on the LiveView image.



Note that for **Nikon** cameras, you must ensure that Tripod is selected in the SHOOTING menu Live View mode if this option is available. You should also ensure that focus mode *in Live View* is AF-S and normal Area.

9.5 Keyboard Shortcuts

Target Setup can be controlled using the keyboard with the following keys:

Key	Action
H	Show/Hide Histogram
F	Show/Hide Focus Controls
T	Enable/Disable Target Search
Z	Toggle Zoom state
P	Trigger Phase Detect Autofocus
C	Trigger Contrast Detect Autofocus
A	Trigger FoCal Autofocus
, (Comma)	Move lens small step towards camera
. (Period)	Move lens small step away from camera

10 Semi-Automatic Autofocus Microadjustment

10.1 Overview

The Semi-Automatic Autofocus Micro adjustment Test allows you to quickly and easily compare the performance of the camera and lens at various micro adjustment values. You are in control of the settings, but there's no need to keep changing camera menu items – all this is done for you.

10.1.1 Manual Setting Change (MSC) Mode

With certain cameras, AF Microadjustment/Fine Tune cannot be changed from the computer, so you will be prompted to manually change the setting on the camera. See section 18 for further details.

10.2 Running the Test

To start the Semi-Automatic Autofocus Micro adjustment Test, click the appropriate button in the Tests panel. The following window will open:



10.3 The Semi Automatic Test Window

The components of the Semi Automatic Test window are detailed below.



10.3.1 AF Image

The image on the left of the screen shows the LiveView capture immediately after a phase-detect AF operation has been performed.

Underneath the left image are controls for phase-detect autofocus. Clicking the **Focus** button will trigger an AF operation. **AFMA Near** and **AFMA Far** will adjust the microadjustment value one point in each direction, or bigger changes can be done with the slider underneath.

10.3.2 Comparison Image (AF Image | LiveView)

The right image is a composite image with a left and right side, and a slider bar than can be moved to show more or less of one image.

On the left side is a copy of the static *AF Image* (described above), and on the right side is the live *LiveView image*. Immediately after an AF operation (performed by clicking the **Focus** button), both the left and right images will be the same.

Underneath are two buttons (**Focus Near** and **Focus Far**) for adjusting the lens focus while the LiveView image is shown in the smallest possible increment. There are 2 very important things to note about this small increment:

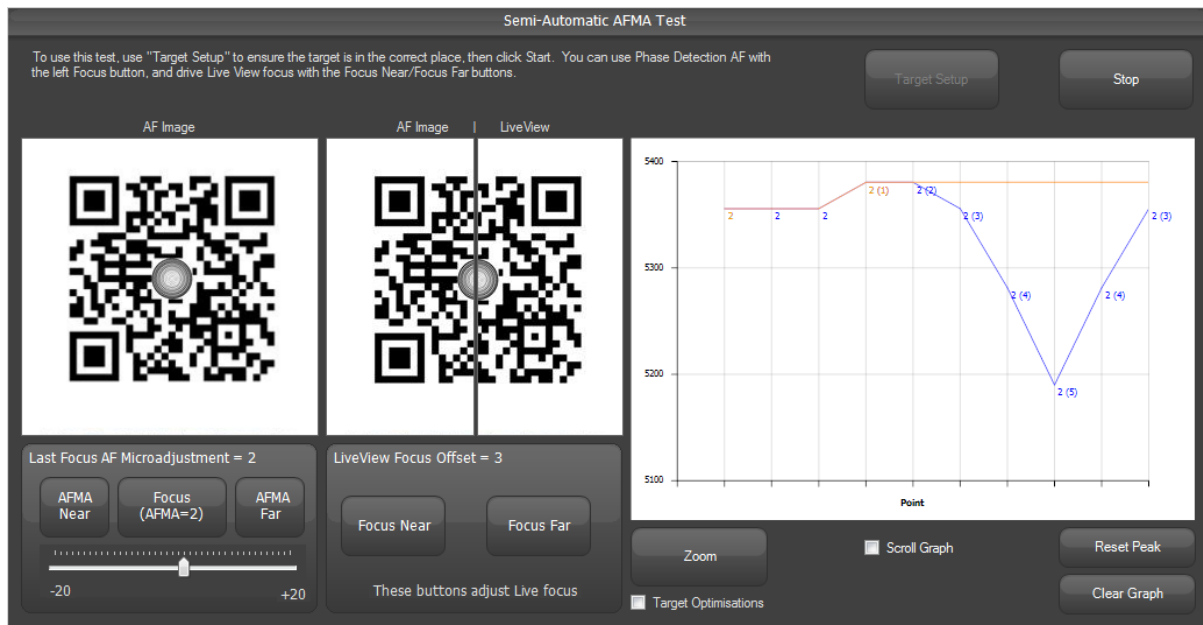
- First, it is in no way related to an AF microadjustment change. It may be larger, it may be smaller, and it depends on the lens that is attached.
- Second, the change is not necessarily the same in both directions – therefore clicking once **Focus Near** and then once **Focus Far** cannot be assumed to put you back in the same position.

A full explanation of the testing strategy is given below.

10.3.3 Indicator Graph

On the right side of the window is the indicator graph. This shows a measure of the sharpness of the image on the right side of the *Comparison Image*.

Each time an operation is performed, a marker is added to the graph to show what happened at that point:



The graph displays 2 sets of information. The blue line indicates the current sharpness of the image (the higher the line, the sharper the image). The orange line indicates the peak so far.

Markers are added on both lines when an operation is performed. If the graph is in Scroll mode (Scroll Graph is ticked), the graph will show 200 points and change as the Live View image changes. If the Scroll Graph checkbox is not ticked, the graph will display 10 points, adding a new point each time one of the **Focus**, **Focus Near**, or **Focus Far** buttons are clicked.

If a focus operation is performed (with the left hand **Focus** button), the marker will indicate the AFMA value for the focus (the number gets bigger as the focus shifts further from the camera - +20 is focussing further away than -20).

If the live focus is shifted (with the **Focus Near** or **Focus Far** buttons), the focus shift will be indicated in brackets after the AFMA value (again, “far” will increment the value, “near” will decrement).

As an example, if you trigger a focus operation with AFMA=3, a “3” marker will be added to both lines. If you then click the **Focus Near** live-focus button, a “3 (-1)” indicator will be added.

Note that clicking **Focus Near** and **Focus Far** and equal number of times will cause the bracketed value to return to 0 but still be displayed (e.g. “3 (0)”) – this is important as it indicates that it is *not* the same position as having performed an AF operation at AFMA=3.

Clicking **Reset Peak** will make the peak line match the current value and continue from there.

Clicking **Clear Graph** will clear all information from the graph and start again.

10.3.4 Zoom/Fit Button

The Zoom/Fit button will zoom the LiveView image which will usually allow better determination of sharpness. Note that when clicked, it will only affect the live image (the right side of the *Comparison Image*) until a new **Focus** operation is performed, and then all images will be updated.

10.3.5 Target Optimisation

The **Target Optimisation** checkbox (Pro version only) uses knowledge about the target to make minor adjustments to the analysed image and allow better determination of sharpness.

10.4 Suggested Testing Strategy

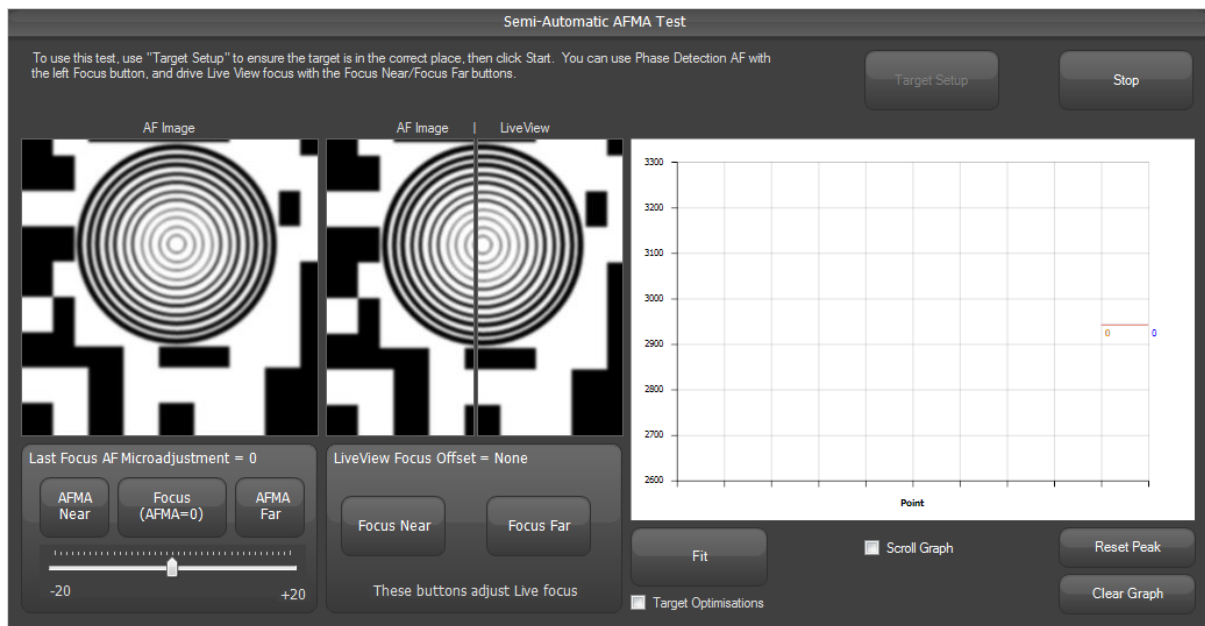
The basic usage of the Semi-Automatic test is as follows:

1. Click **Focus** to focus on the target and get data about the quality at that AFMA value.
2. Using the **Focus Near** button, slightly shift the focus and see if the quality improves (both visually by looking at the left and right side of the *Comparison Image*, and by looking at the data point on the graph).
3. If clicking **Focus Near** button improves the result, shift the AFMA value by clicking the **AFMA Near** button (next to **Focus**).
4. If, however, the **Focus Near** button made the image quality worse, refocus (click **Focus**) and retry from step 2 with the **Focus Far** button.
5. Keep repeating until the chosen AFMA value cannot be made better by using either **Focus Near** or **Focus Far** buttons. You have now found the optimum value, and this can be programmed into the camera using the camera menu after the test.

10.4.1 Example

The following series of screenshots show an example of determining the AFMA value for a lens.

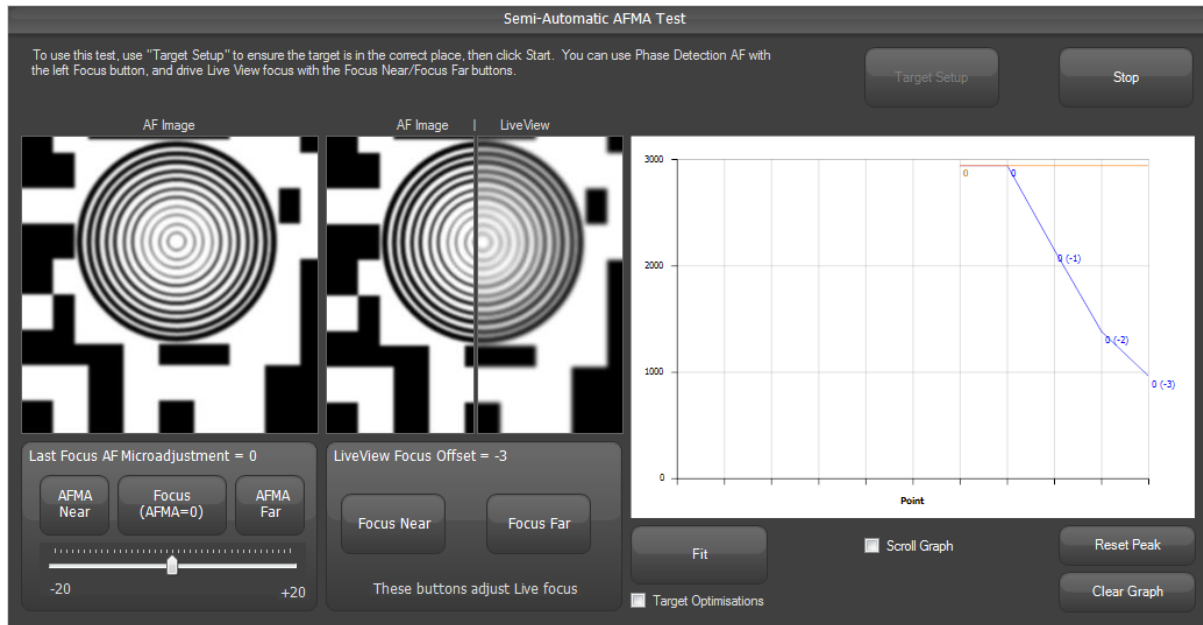
10.4.1.1 Initial Focus



It is generally advisable to click the **Zoom** button in order to get the best detail from the LiveView images. You will need to ensure the tripod you are using is sturdy and there is no vibration of the camera during the test.

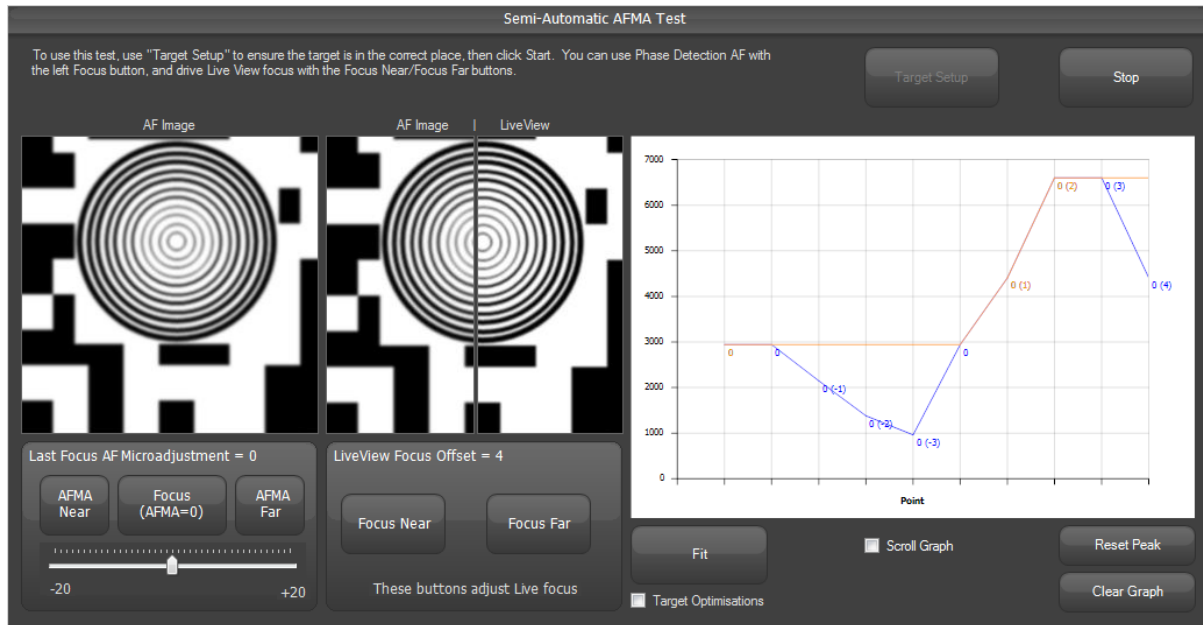
First, with the current AFMA value of 0, the **Focus** button is clicked. The camera focuses, and the indicator on the graph ("0") shows no change in quality (note that this is simulated data, so there is likely to be a bit of movement on the graph for real data).

10.4.1.2 See if focussing nearer is better



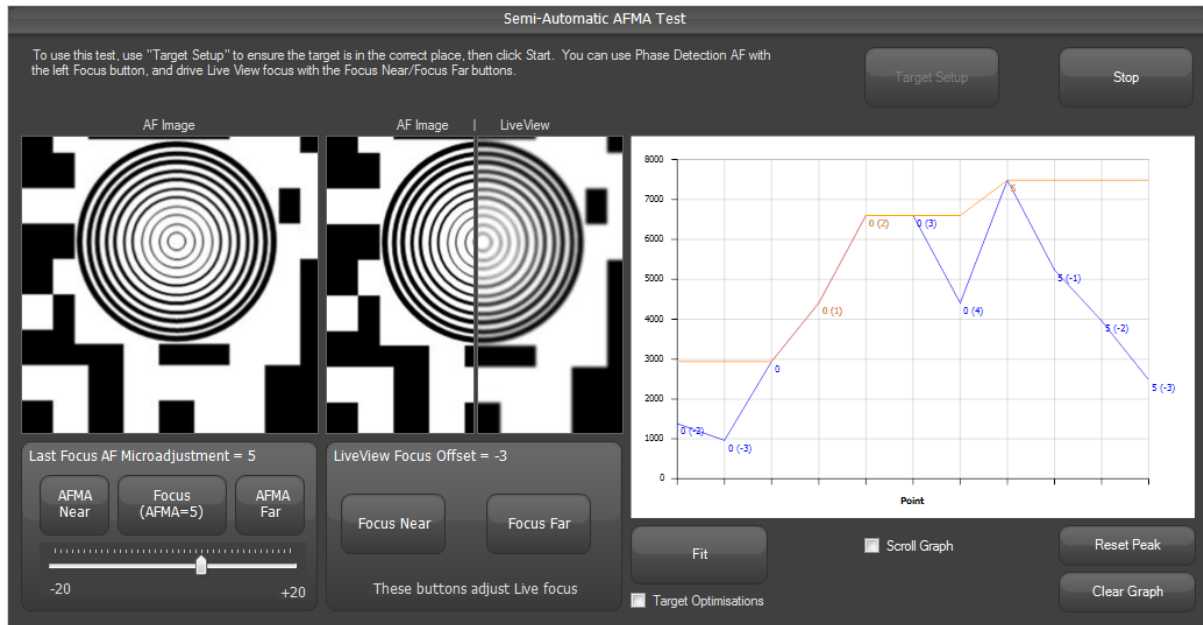
Clicking the **Focus Near** button a few times shows the quality of the image degrading – you can see this visually from the right side of the comparison image (it gets less sharp), and the blue line on the chart drops away from the current peak (orange line).

10.4.1.3 See if focussing further away gets better



Re-focusing (click **Focus**), and trying in the other direction by clicking **Focus Far** shows an improvement in quality. The blue line pushes the orange peak line up the graph until the 4th click of the **Focus Far** button, where the blue line start dropping. This indicates that the perfect focus point is somewhere in the “far” half of the AFMA scale, and as it took a few clicks of the **Focus Far** button to reach it, a guess would be a few AFMA steps.

10.4.1.4 Try a new AFMA value



Clicking **AFMA Far** a few times (in this case, setting AFMA to +5), the **Focus** button is then clicked to refocus.

The point on the graph labelled "5" shows the point where the AF was finished, and indicates that the quality is around the peak line achieved from the previous tests.

Clicking **Focus Near** a few times shows a degradation in quality, indicating we are now moving away from the best image quality. To confirm the setting, refocus (click **Focus**), and try **Focus Far** – if the AFMA setting is correct, you should see degradation in this graph as well.

10.5 Points to Note

It is important to realise that the sharpness value indicated in the graph is heavily dependent on light level. The camera should be used with Exposure Simulation **disabled**, but this can lead to slight steps in the brightness of the image when the external lighting changes.

Ideally, you should run the test under fixed bright lights (not fluorescent or LED lights as these flicker and can affect the results).

This test will also show the performance of the AF system of the camera. Under good lighting conditions, you would expect multiple clicks of the **Focus** button to yield exactly the same results (both visual sharpness in the comparison image, and the same point on the graph). But you will notice in reality that there is some error in the AF system. The results will always be approximately the same under good light, but rarely identical.

10.6 Keyboard Shortcuts

Target Setup can be controlled using the keyboard with the following keys:

Key	Action
P	Trigger Phase Detect Autofocus
Z	Toggle Zoom state
S	Toggle Scrolling state
R	Reset graph peak
C	Clear graph
T	Toggle Target Optimisation state
1	Move AFMA setting towards camera
2	Move AFMA setting away from camera
, (Comma)	Move lens small step towards camera
. (Period)	Move lens small step away from camera

11 Fully Automatic Autofocus Microadjustment (FoCal Plus/Pro)

11.1 Overview

The Fully Automatic Autofocus Microadjustment Test allows you to quickly and easily calibrate the camera body and lens by automatically taking full resolution shots and analysing to determine the best AFMA value, then programming the camera with this value. In good light, the test will calibrate a camera/lens combination in approximately 60 seconds.

11.1.1 Manual Setting Change (MSC) Mode

With certain cameras, AF Microadjustment/Fine Tune cannot be changed from the computer, so you will be prompted to manually change the setting on the camera. See section 18 for further details.

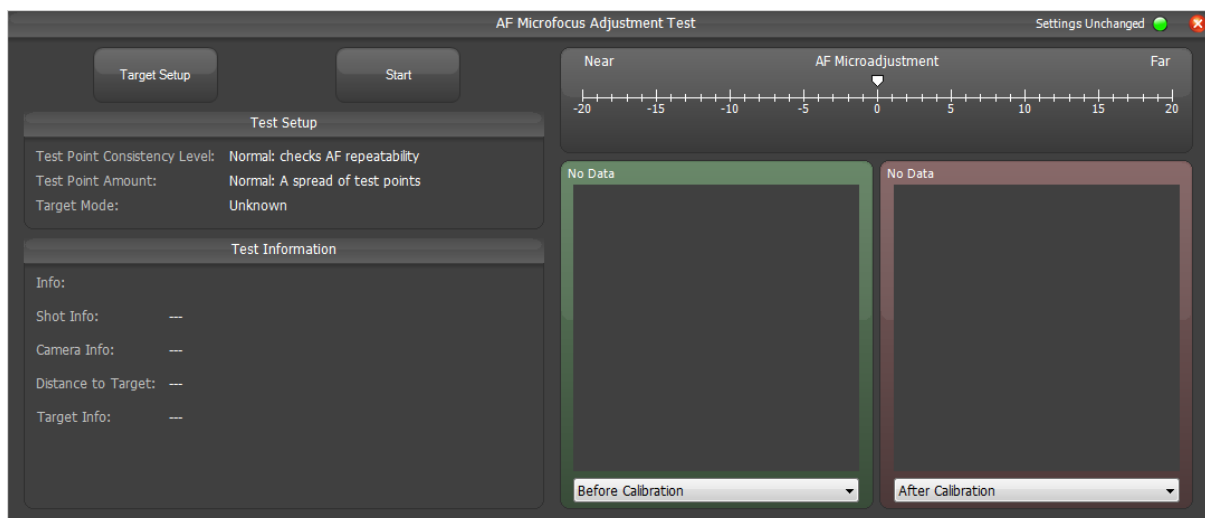
11.2 Image Display Panels

The panels can be made to show images from the list below, and the colour of the border reflects the current selection:

- Green = Before Calibration
- Red = After Calibration
- Blue = Selected Point (FoCal Pro only)

11.3 Running the Test

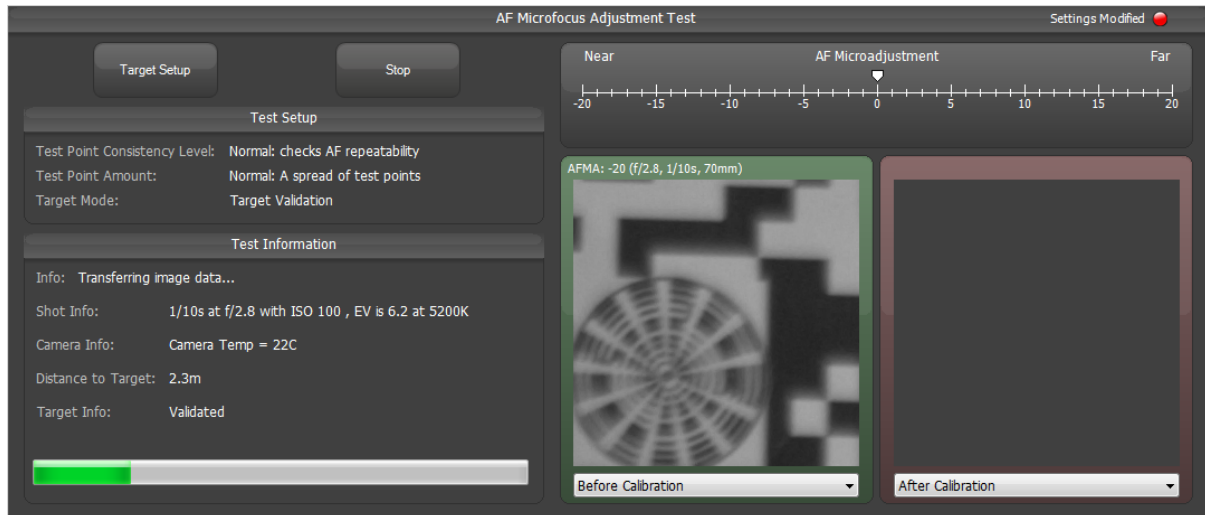
To start the Fully Automatic Autofocus Microadjustment Test, click the appropriate button in the Tests panel. The following window will open:



On the left is the Start button, and information about the progress and setup of the test. On the right side is a gauge indicating the predicted AFMA value as the test is running and two panels which will show 100% crops of the analysed region at the start and end of the test.

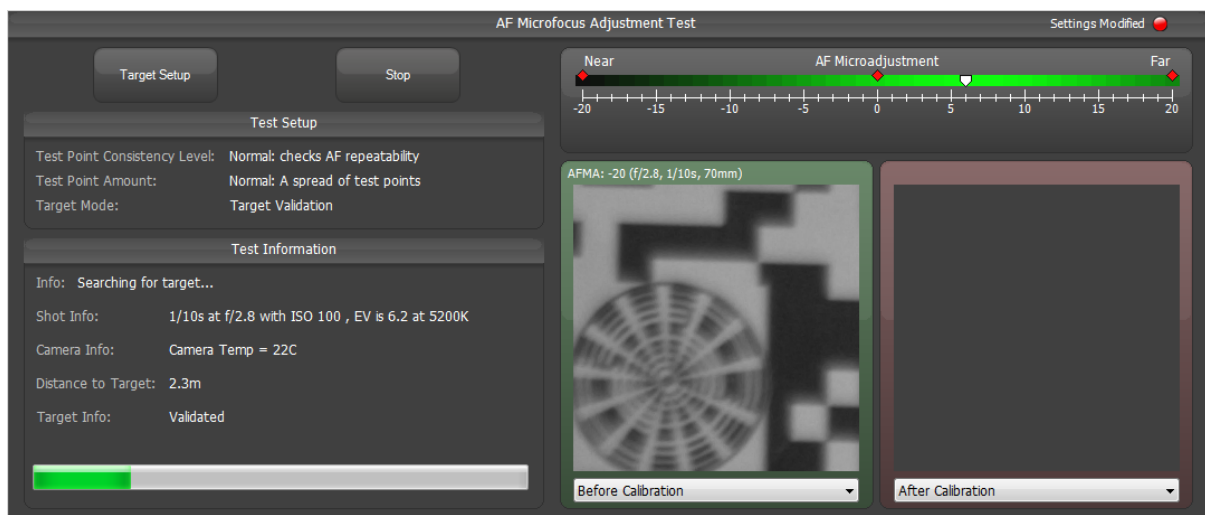
Depending on the accuracy settings (see section 25.2.3, the test will typically run in between around 20 and 40 shutter actuations. If no value can be found within the Shutter Count Warning Level (see section 25.2.2), you will be alerted and offered the option to abort or continue the test.

The first shot taken will show the “Before” shot, indicating the current AFMA. The image shown is a 100% crop of the analysed region of the image at the test aperture (widest for FoCal Plus, but can be changed in FoCal Pro).

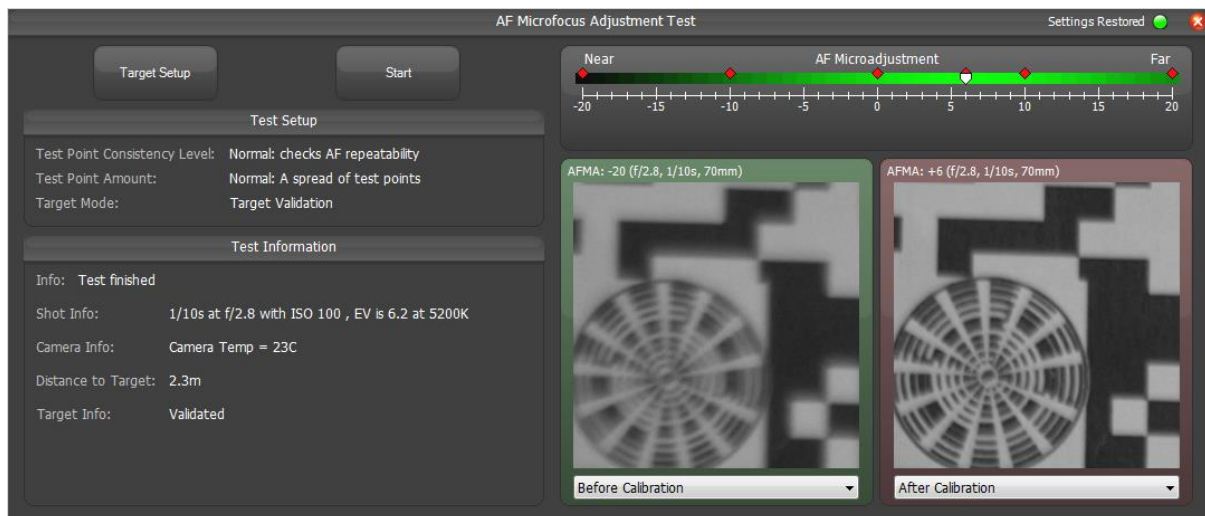


After a few shots, the pointer in the gauge on the right side of the screen will indicate the best AFMA so far. If the quality of the prediction drops, the indicator bar will turn from green to yellow, and eventually to red. If the indicator is yellow or red it indicates poorer quality AF performance from the camera and/or lens and the quality of the final result may be compromised.

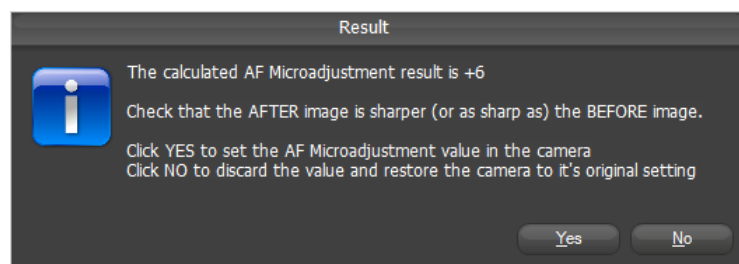
As the test progresses, diamond markers will be shown on the gauge at the top right of the window – these indicate the AF Microadjustment/Fine Tune values that were used for the test shots.



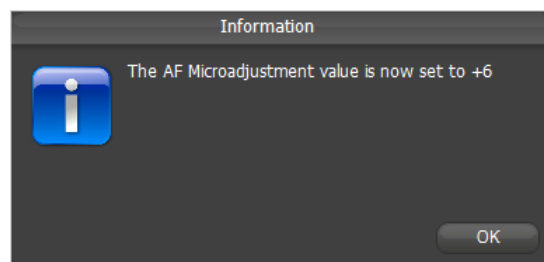
When complete, the new results are compared to the original value and the images are displayed at the right of the screen.



A message box will be shown with the results, giving the option to write the new AFMA value to the camera or not:



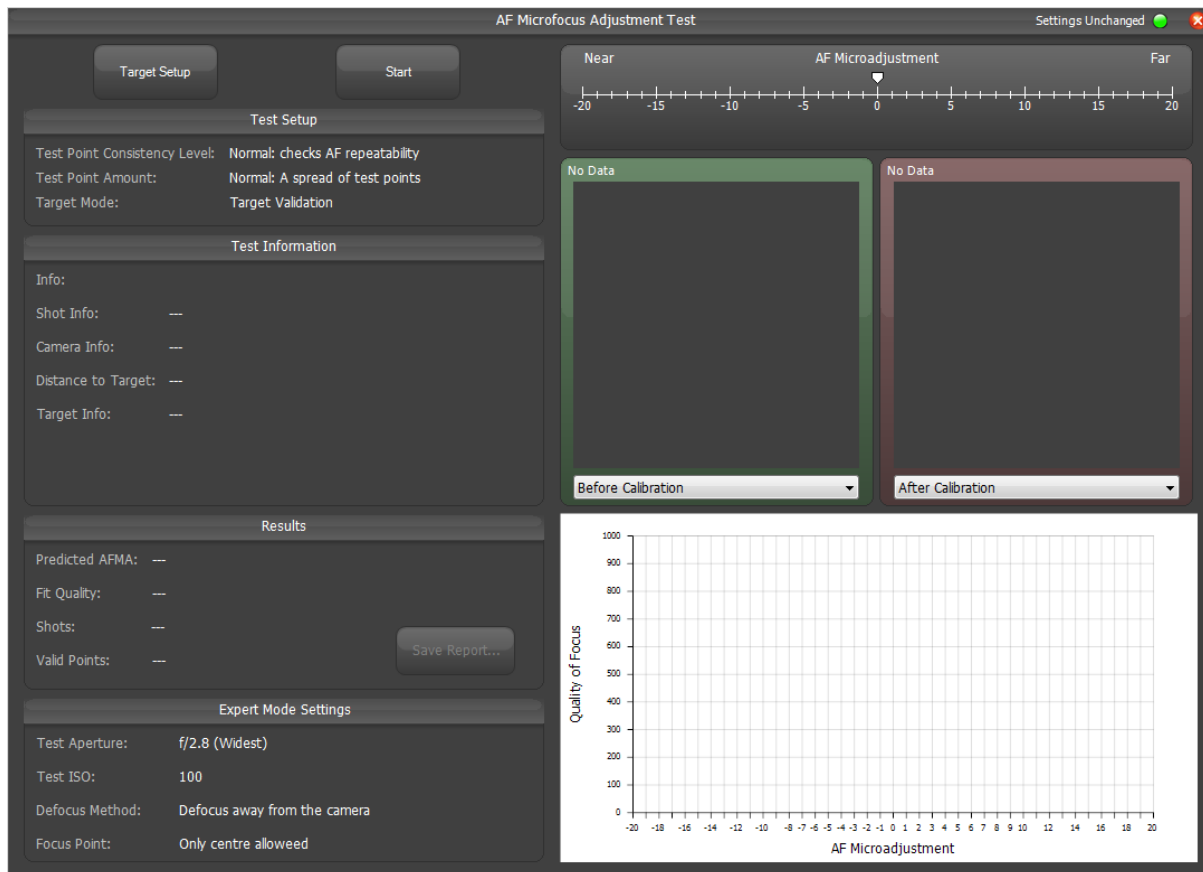
If the best value of AFMA is already currently set, this is indicated:



It is possible for the software not to be able to settle on a value – in this instance, it will set the most likely predicted value, but it would be worth rerunning the test if this happens.

11.4 Analysis Information (Pro Version)

The Pro version of FoCal offers detailed information about the results captured by the test. If your copy is licensed for Pro features, you will see extra section at the bottom of the Fully Automatic test window:

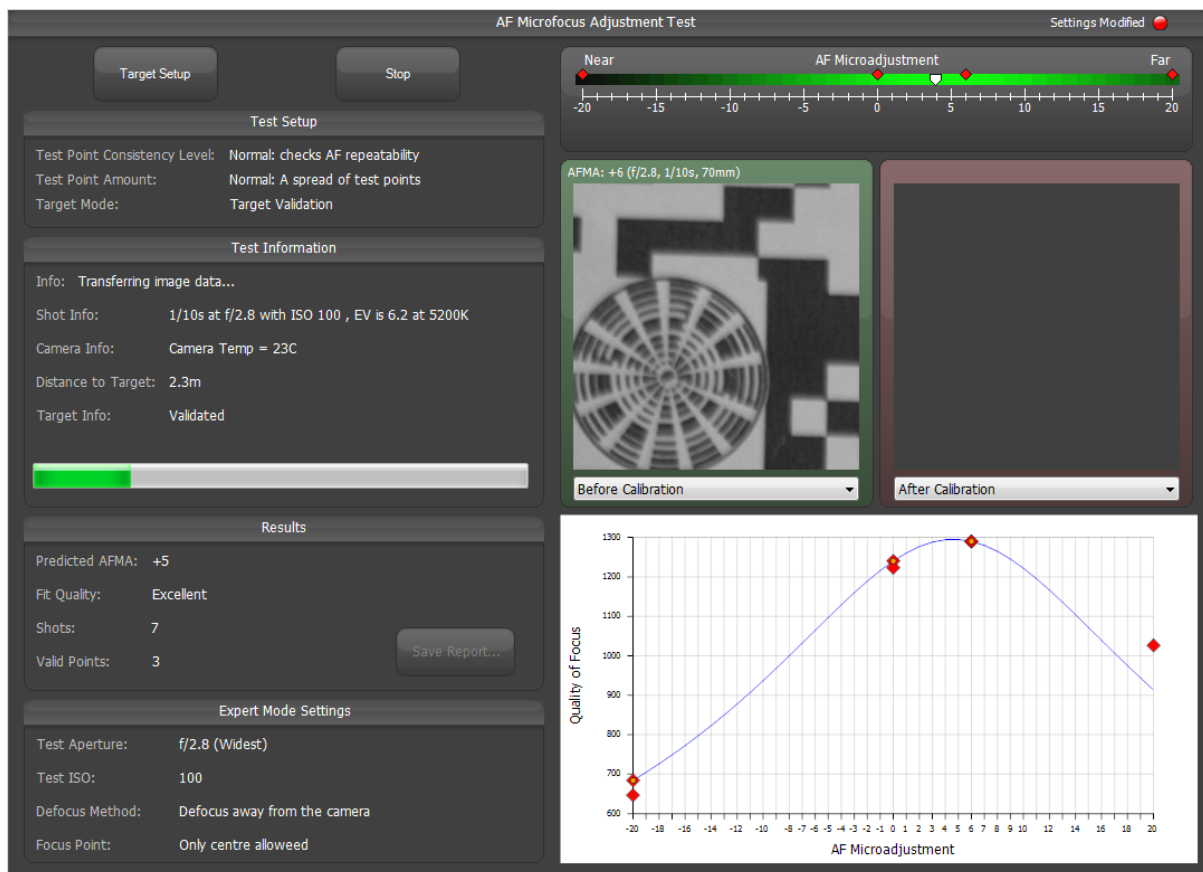


The indicators on the right show the current Expert Mode settings, with warning indicators if the setting has been changed from the recommended (this is to ensure that you are aware you are operating with expert settings).

During execution of the test, graph will be populated with information about the shots taken. Highlights are as follows:

- Along the bottom of the graph is the AF Microadjustment/Fine Tune value, and on the vertical axis is the QoF value which increases with the quality of the image.
- Each individual shot is shown with a red marker
- In the validated test mode, the orange markers will indicate the most likely “correct” AF result (this tries to iron out inconsistencies in the AF performance of the camera and lens)
- The curve indicates the predicted location of the best result – the highest point on the curve should be the best AF Microadjustment/Fine Tune value along the bottom of the chart.

By clicking on a point on the graph, the analysed image taken at that point will be shown, so you can use this feature to review the shots taken during the test.

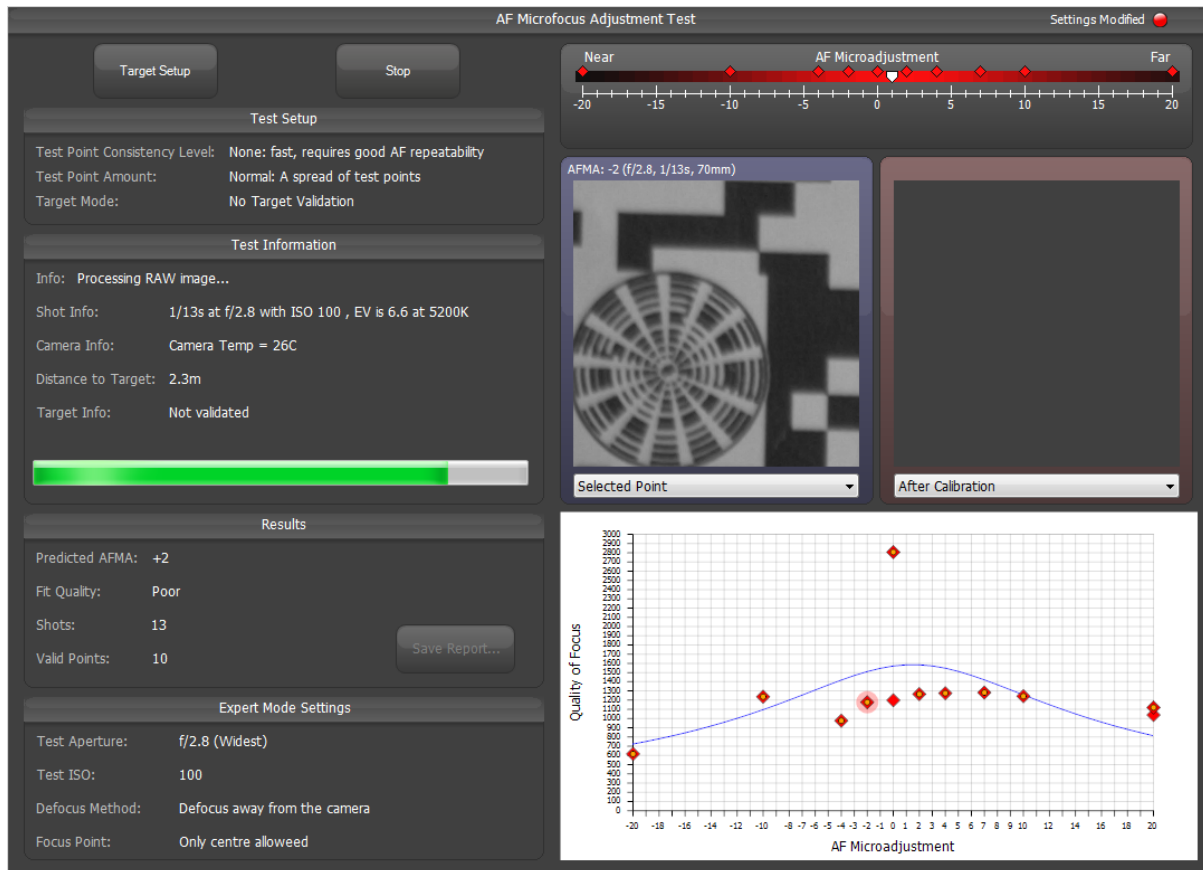


11.5 Peak Focus Detection

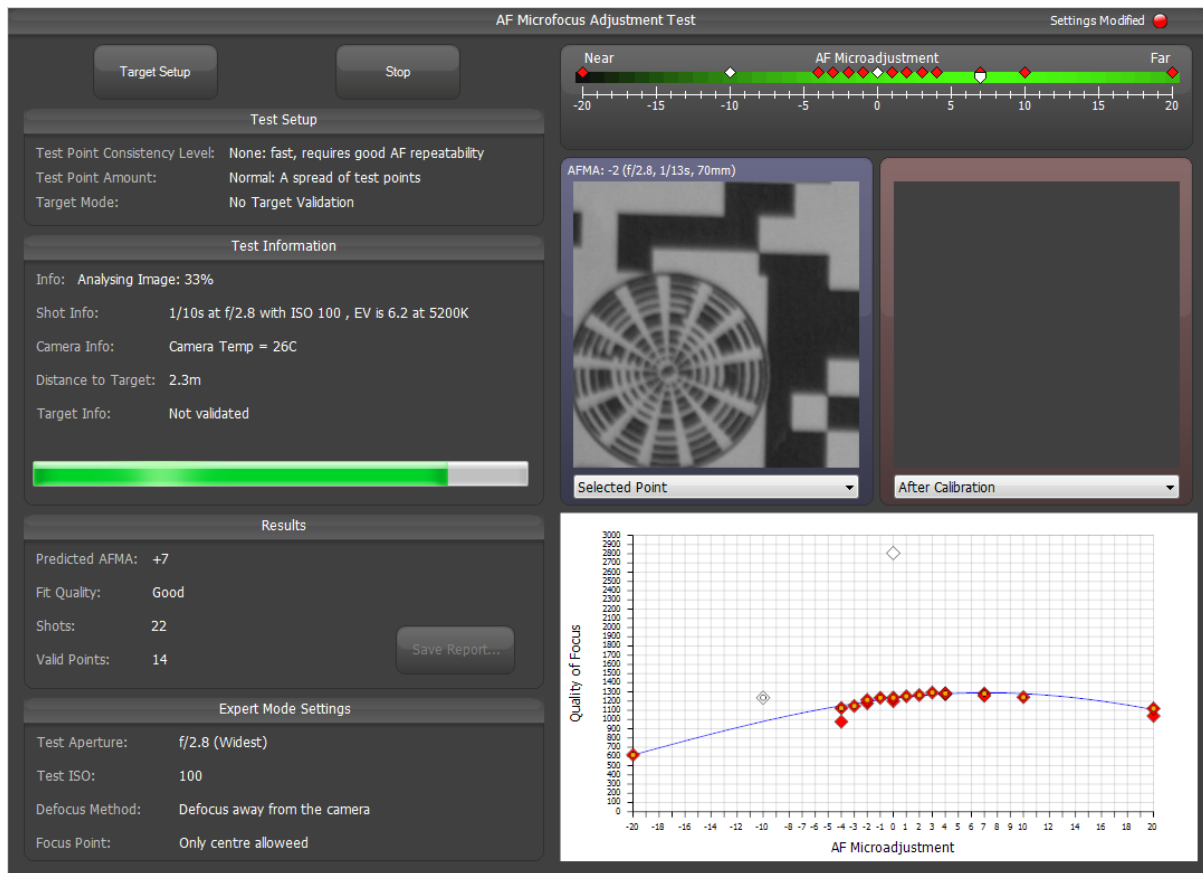
See section 7.6 for information about the Peak Focus Detection function.

11.6 Manually Adjusting the Results

With AF Consistency Validation enabled, the test results are generally representative of the AF performance of the camera. However, sometimes you may end up with some obviously erroneous results when reviewing the chart. The example below shows a run with no Consistency Validation, and with a few points deliberately altered to mess up the data:



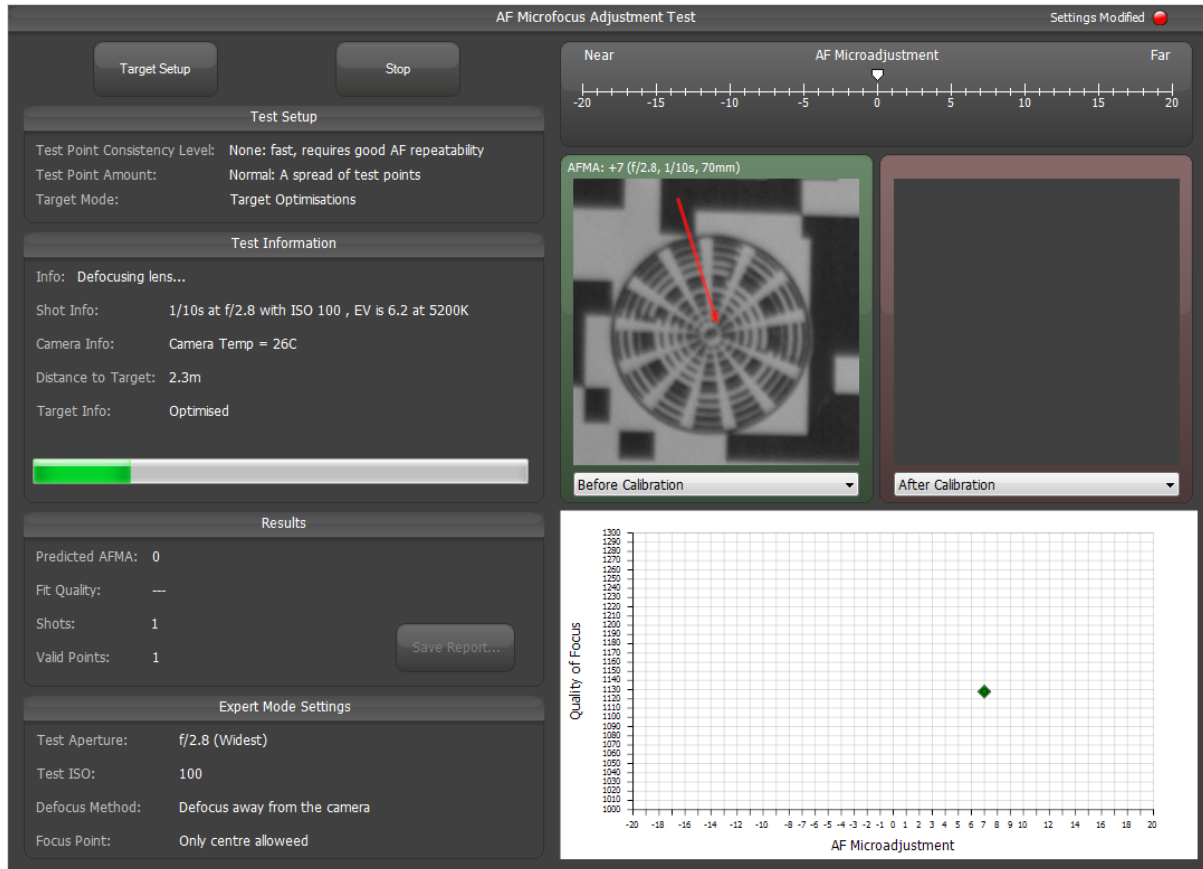
The predicted AF Microadjustment value is +2 but the quality is *Poor*. You can ignore points by right-clicking on the point, and when ignored they will have no colour. By ignoring some points on the example above, the fit can be changed to *Excellent* with high confidence in the AF Microadjustment of +7:



Points can be ignored during the test as well as when reviewing the data afterwards. Each time a point is ignored or re-enabled, the prediction is recalculated so you can see the effect of removing individual points on the result.

11.7 Target Optimisation (Pro Version)

If Target Optimisation is enabled (see section 7.8), a red arrow will be shown overlaid on each analysis image you review. This arrow shows the how the analysed region has been moved in order to optimise the analysis:



All data point markers (on both the gauge and the chart in the Analysis Info window) will be shown in **Green** if optimised.

11.8 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

11.9 RGB Analysis

RGB Analysis brings extra functionality to this test. You can read more details in section 8.

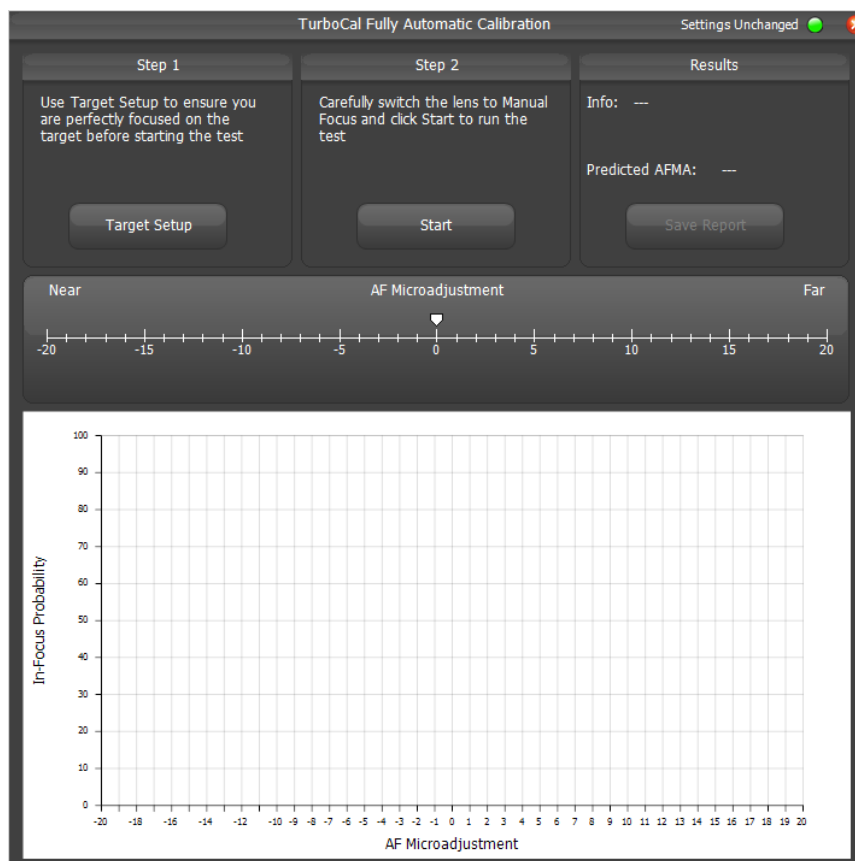
12 Turbo Calibration Test (FoCal Plus/Pro)

The Turbo calibration test allows you to calibrate a Canon camera without even taking a shot!



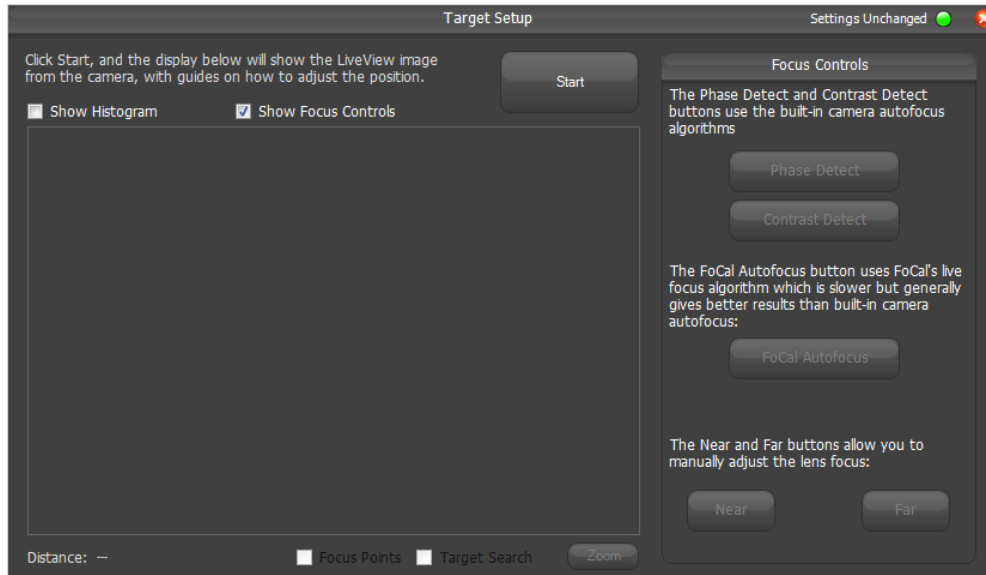
This test is currently only available for Canon cameras as the necessary information is not reported by Nikon cameras. If you are using a Nikon camera, you can untick the “Show TurboCal instead of QuickCal” option in the Settings window which will make the QuickCal test available (see section 18).

To start the test, choose the *TurboCal* option from the Tools panel on the main window:

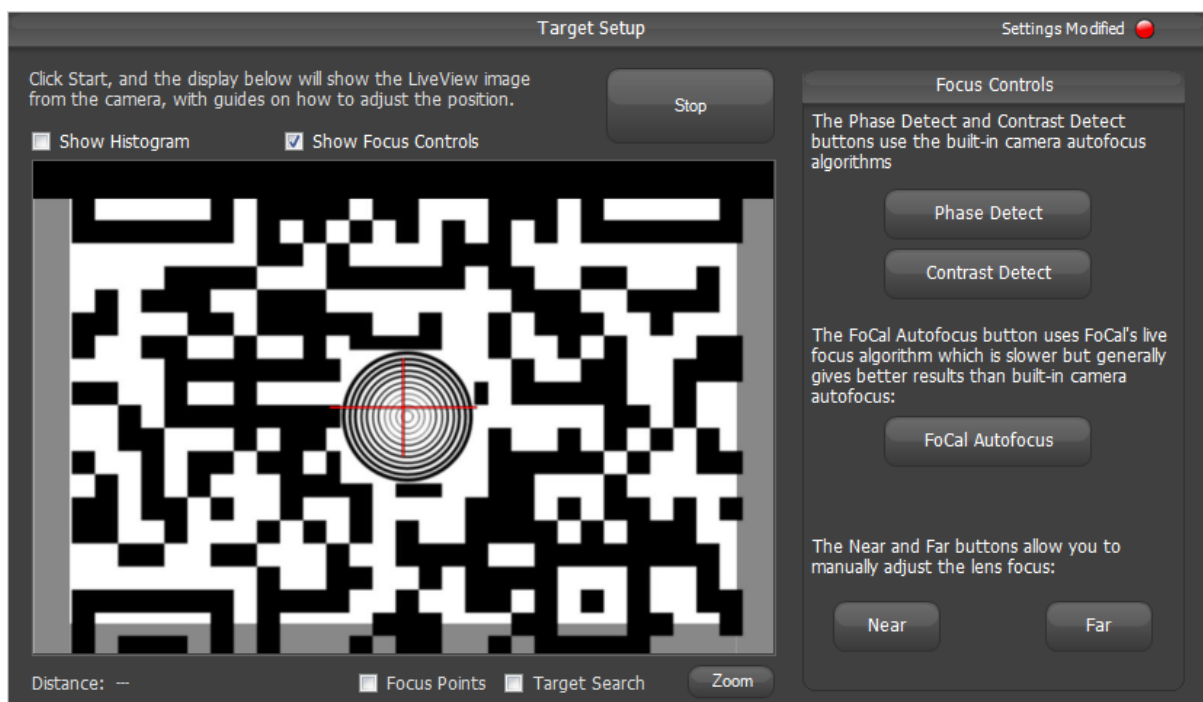


12.1 Step 1 – Perfect Focus

For the TurboCal test, it is critical that you start with perfect focus on the target. To do this, click the *Target Setup* button in the *Step 1* panel on the TurboCal test window. This will show the Target Setup tool with the Focus Controls panel already opened and ready:



Click the *Start* button and you will be shown the LiveView image from the camera, zoomed to 100%. Align the image approximately with the centre of the target:



The focus quality should be good as a phase-detect autofocus operation is run before the Target Setup tool starts showing LiveView images, but to get accurate results from the TurboCal test you need to ensure the focus is at the absolute best point possible.

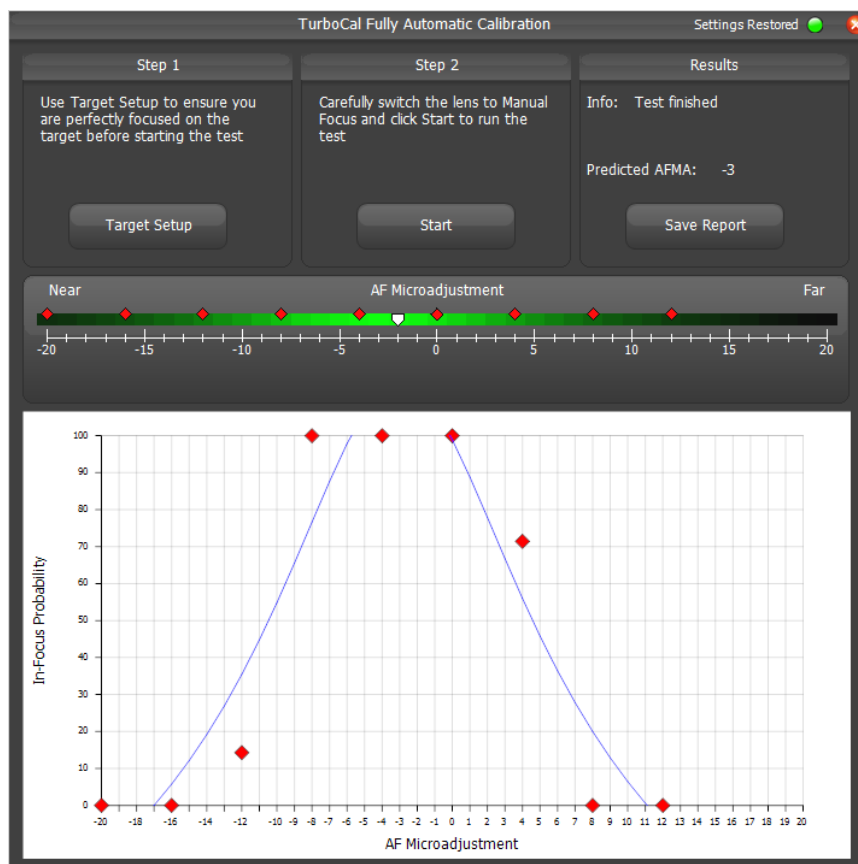
You can do this in a number of ways:

- Click the *FoCal Autofocus* (recommended), or *Contrast Detect / Phase Detect* button and wait a few seconds for the focus operation to complete.
- Use the *Near* and *Far* buttons to confirm that the image you see is the best possible. To do this, click the *Near* button a few times and watch the quality of the image – it should start to blur a little. Then use the *Far* button to improve the quality and keep going until you see it start to blur a little again. Finally, use the *Near* button again to move back to the perfect position.

Once you are happy that the focus is as good as possible, you can click the *Stop* button and close the *Target Setup* utility window.

12.2 Step 2 – The TurboCal Test

To run the test, you must put your lens in Manual Focus mode – this will involve **very carefully** switching the small AF/MF switch on the lens to *MF*. Once this is done, you can click the *Start* button in the *Step 2* panel. The test will run and when complete you will see a result similar to the following:



The result is an AF Microadjustment of -3.

Note that the blue prediction line will never fit perfectly with the data points, but it does predict the correct value for AF Microadjustment.

12.3 Common Test Features

Please see section 7 for details on saving reports from the TurboCal test.

13 Manual Mode

Manual Mode allows the analysis and predictions algorithms to run on a series of image files obtained manually.

13.1 Capturing the Images

It is very important to realise that the Manual Mode feature will only be able to give a good predicted AF microadjustment result if the captured input files are correct. In order to capture the image files the following points should be noted:

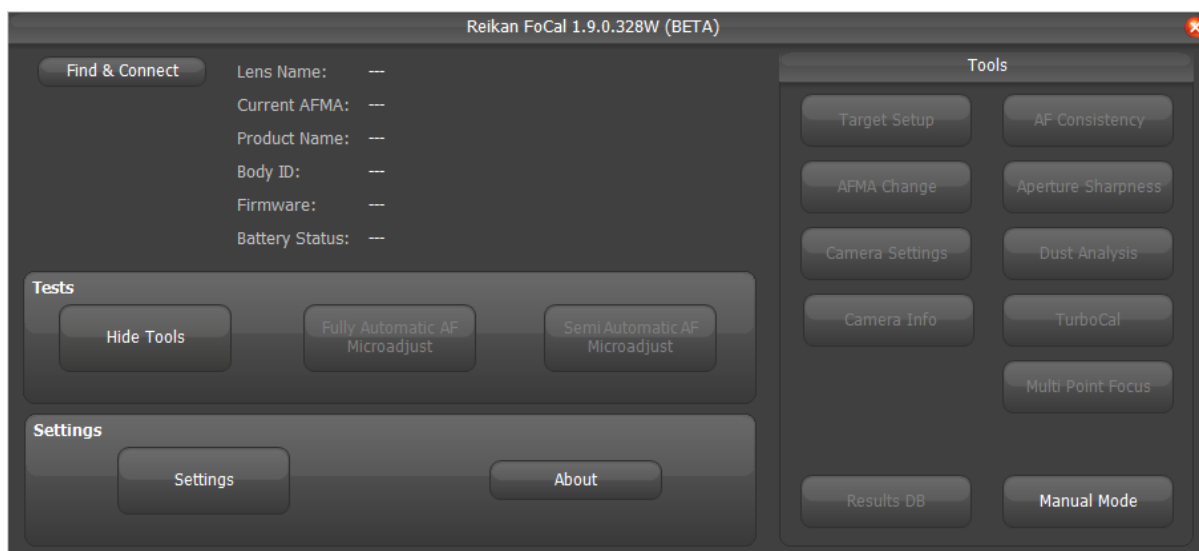
- Ensure the camera is setup to take the largest JPEG or Raw format files.
- Put the camera in Aperture Priority mode (Av), select the **widest** aperture and choose spot metering mode with an exposure compensation of **+1 EV**.
- Ensure the **centre** focus point is used in **one shot** AF mode.
- Ensure any stabilisation (IS, VR, OS etc) is switched **OFF**.
- Use a tripod and good, consistent lighting for the test
- Carefully aim the camera at the target as specified in section 3.3
- Use mirror lockup and ideally a remote release. If a remote release is not available, use the 2 or 10 second timer mode
- “Mess up” the focus between each shot – manually move the focus to infinity so the AF system has to run properly for each shot.
- When changing settings on the camera menus, be careful not to move the camera in between shots.

Take a number of shots at different AF Microadjustment/Fine Tune values – for example take shots at -20, -15, -10, -5, 0, +5, +10, +15 and +20, and it is advisable to take multiple shots at each AF Microadjustment/Fine Tune values in order to remove the effects of AF inconsistency (Manual Mode uses the same AF consistency validation as the Fully Automatic test).

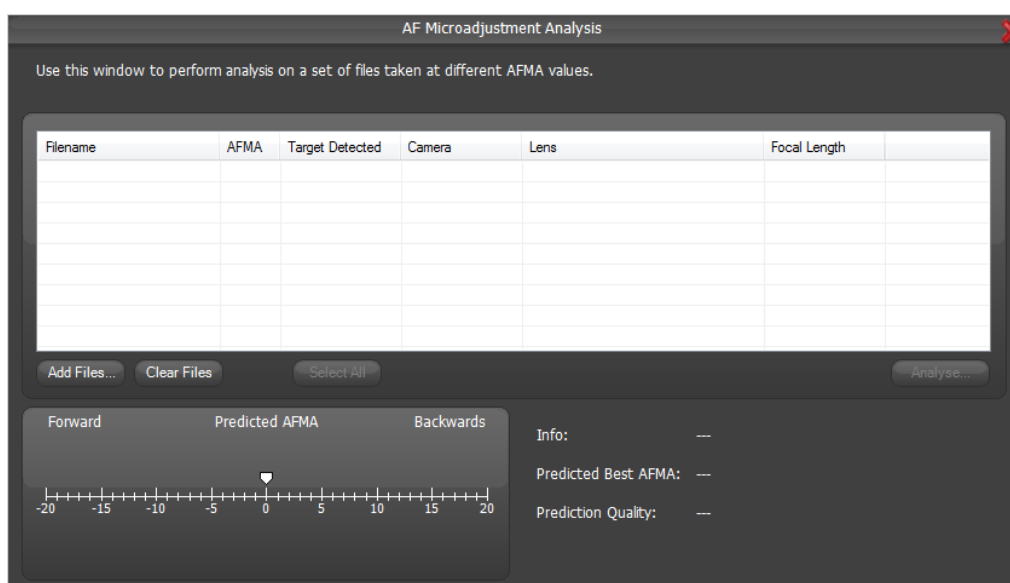
The analysis formula in FoCal requires at least 3 points in order to work, but will give a reliable prediction from about 5 or 6 points.

13.2 Using the Test

To open the test, click the *Show Tools* button on the main Tests and the Manual Mode button will be visible both with and without a camera connected.



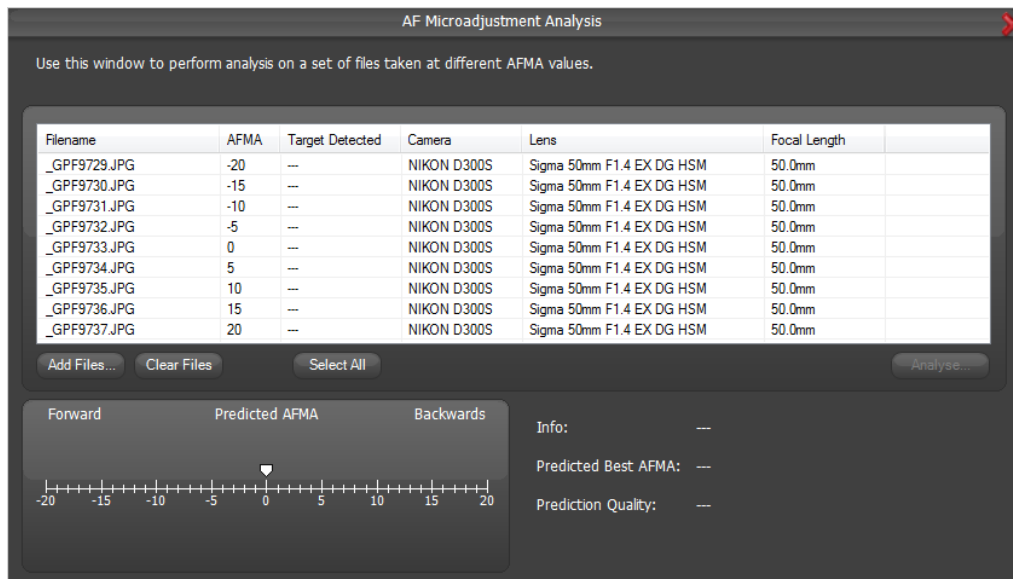
The following window will be shown (for FoCal Standard/Plus license holders – there are extra options for FoCal Pro which are explained in section 13.4):



13.2.1 Adding Files

To add files, click the “Add Files...” button and choose the files you wish to analyse. You can add multiple files at this stage by using CTRL or SHIFT and clicking extra files in the standard way within Windows.

When added, the AF Microadjustment values will be read from the files (Canon and Nikon camera files) if available:



Note that at present, files which do not contain a valid AF microadjustment value cannot be used in this test.

You can add more files later if you decide you want more detail.

13.2.2 Removing Files

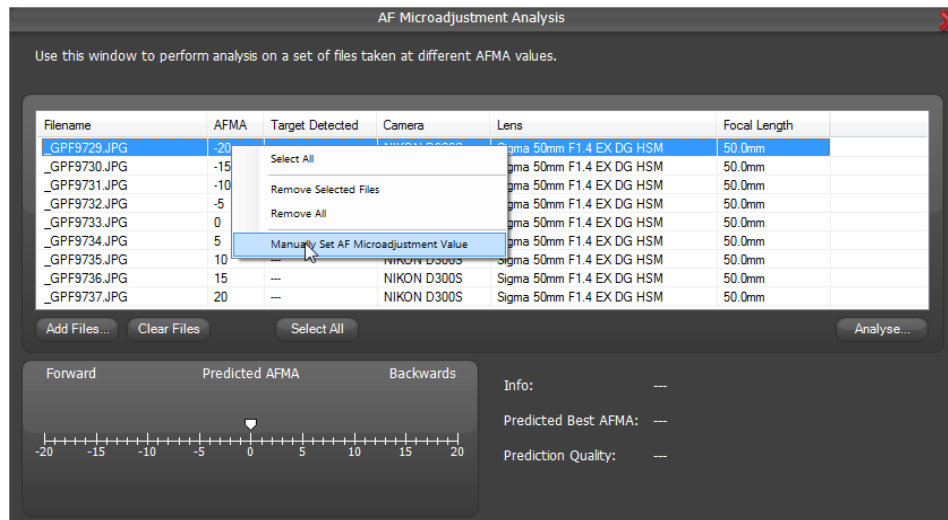
Click “Clear Files” to remove all the files from the list and start adding new files.

Alternatively, you can select a number of files (by clicking on the first file, then further files while holding either CTRL or SHIFT in the standard Windows manner) and right click in the list to show a menu which allows you to remove the selected files from the list.

13.2.3 Images without AF Microadjustment/Fine Tune data

Under certain circumstances (e.g. camera firmware bugs like on the Nikon D300), the AF Microadjustment/Fine Tune information stored in the image file can be wrong or unavailable.

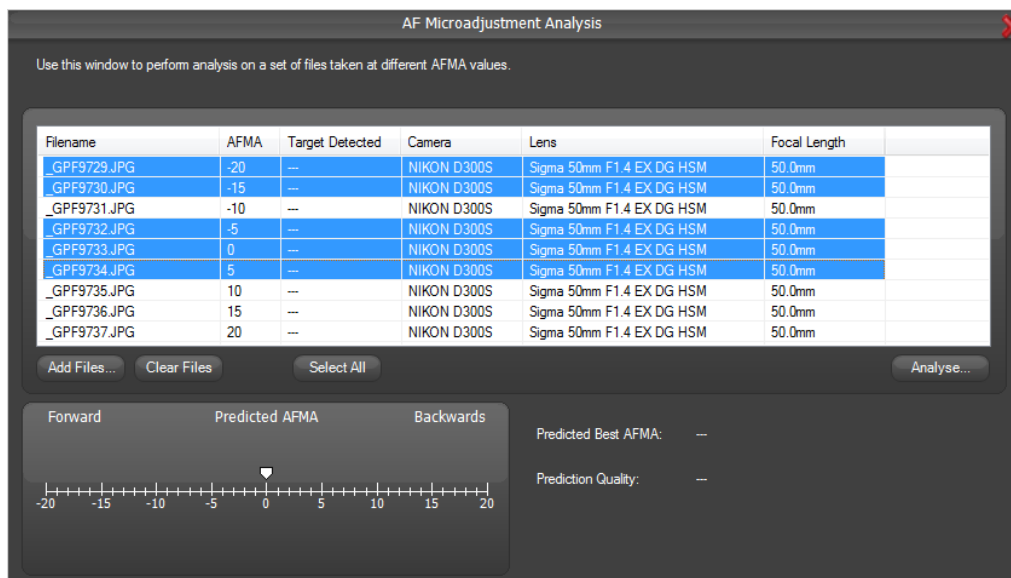
You can specify a value for the file by right-clicking on the file entry in the Manual Mode file list, choosing *Manually Set AF Microadjustment Value* and choosing an appropriate value. Once this is done, this value will be displayed in the AFMA column and used for the analysis.



13.3 Analysis

Analysis occurs on the files which are selected, so in the “Add Files” stage you can add files from different cameras and lenses, then just select a batch of the same setup for analysis. You can only analyse a selection of files taken with a single camera and single lens at any one time – FoCal will warn you if you select files with more than 1 camera or lens.

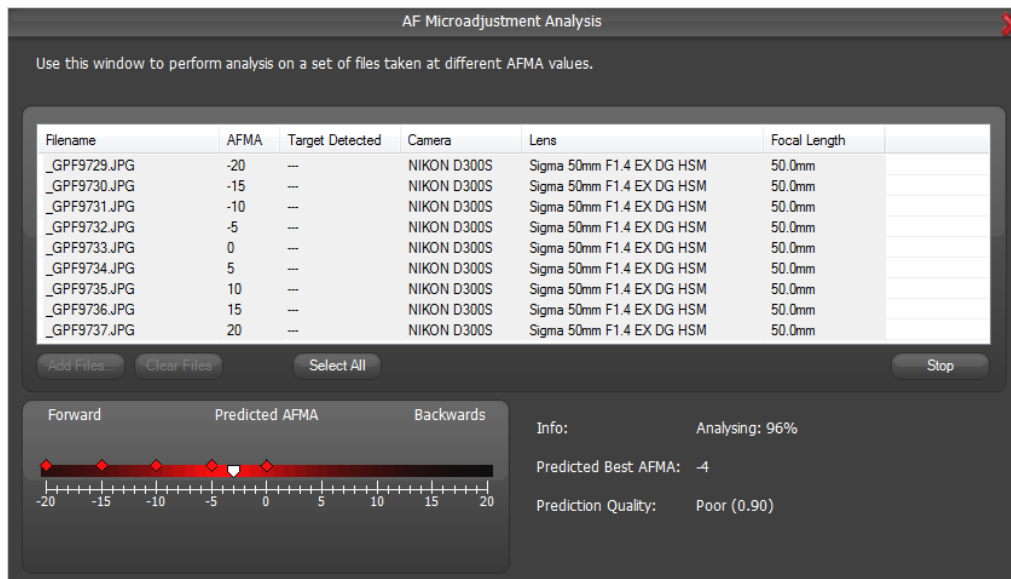
The example below shows a selection of files – only those highlighted blue will be analysed:



To select all the files in the list, click “Select All”.

Click “Analyse” to start the analysis of the image files.

The analysis can take a little time, and the information is updated as it is processed:



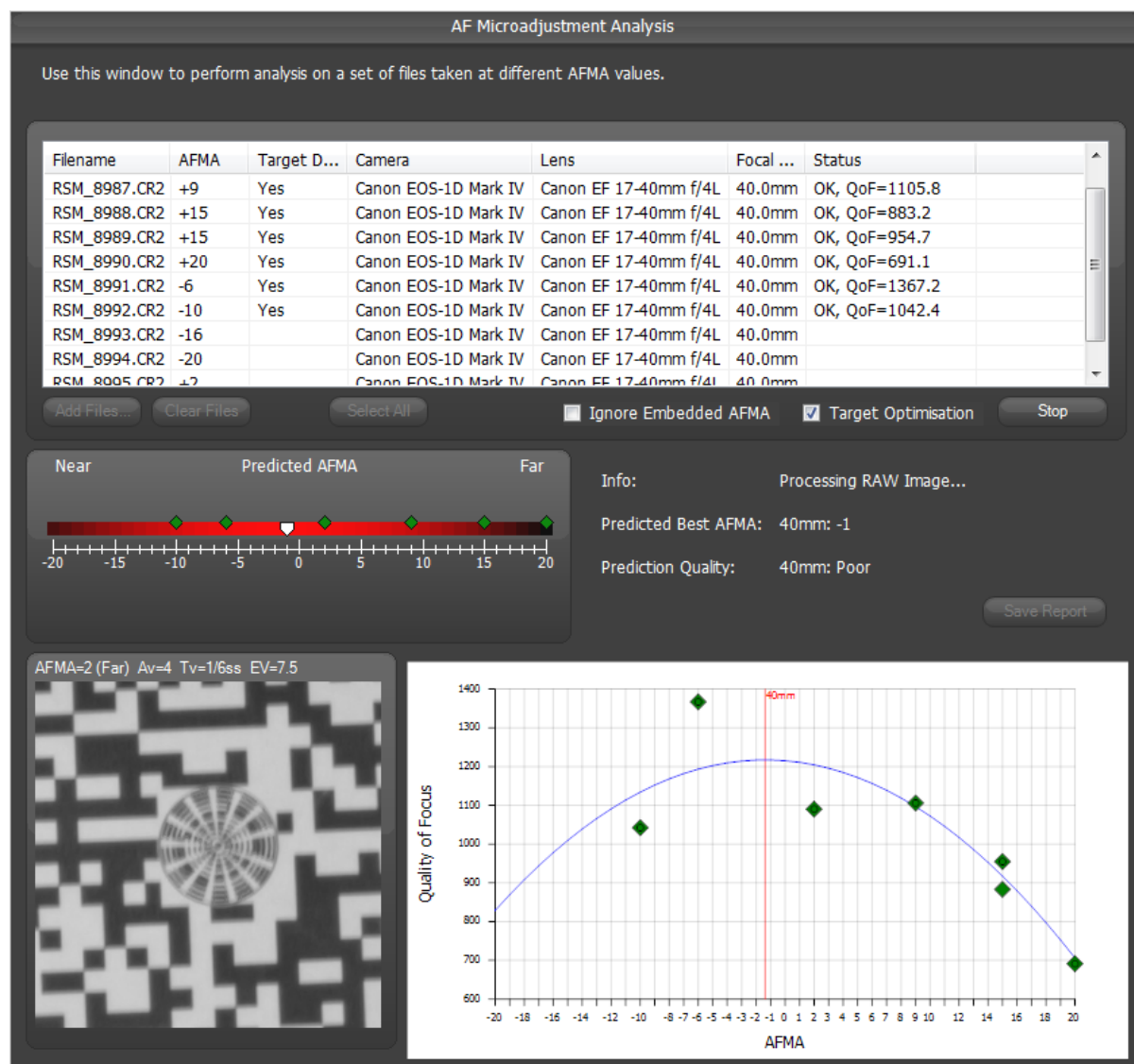
13.3.1 Analysis Progress

Please note that the analysis information is updated **as it is determined**. The result can only be as good as the information supplied, so you may well notice that the result goes through stages of poor quality as the supplied points do not fit to a sensible prediction.

The quality of the final result is indicated by the “Prediction Quality” measure (from Excellent to Unacceptable), and the colour of the indicator bar (Green is good, yellow is acceptable and red is poor).

13.4 Manual Mode in FoCal Pro

If you have a FoCal Pro license, there is more information on the screen, giving the ability to see the test results as the images are analysed and review the images/data, as well as selectively ignore test points and also output a PDF report.



The top section of the window is exactly the same as described in section 13.3. The lower section gives a view of the result prediction and allows review of the images supplied.

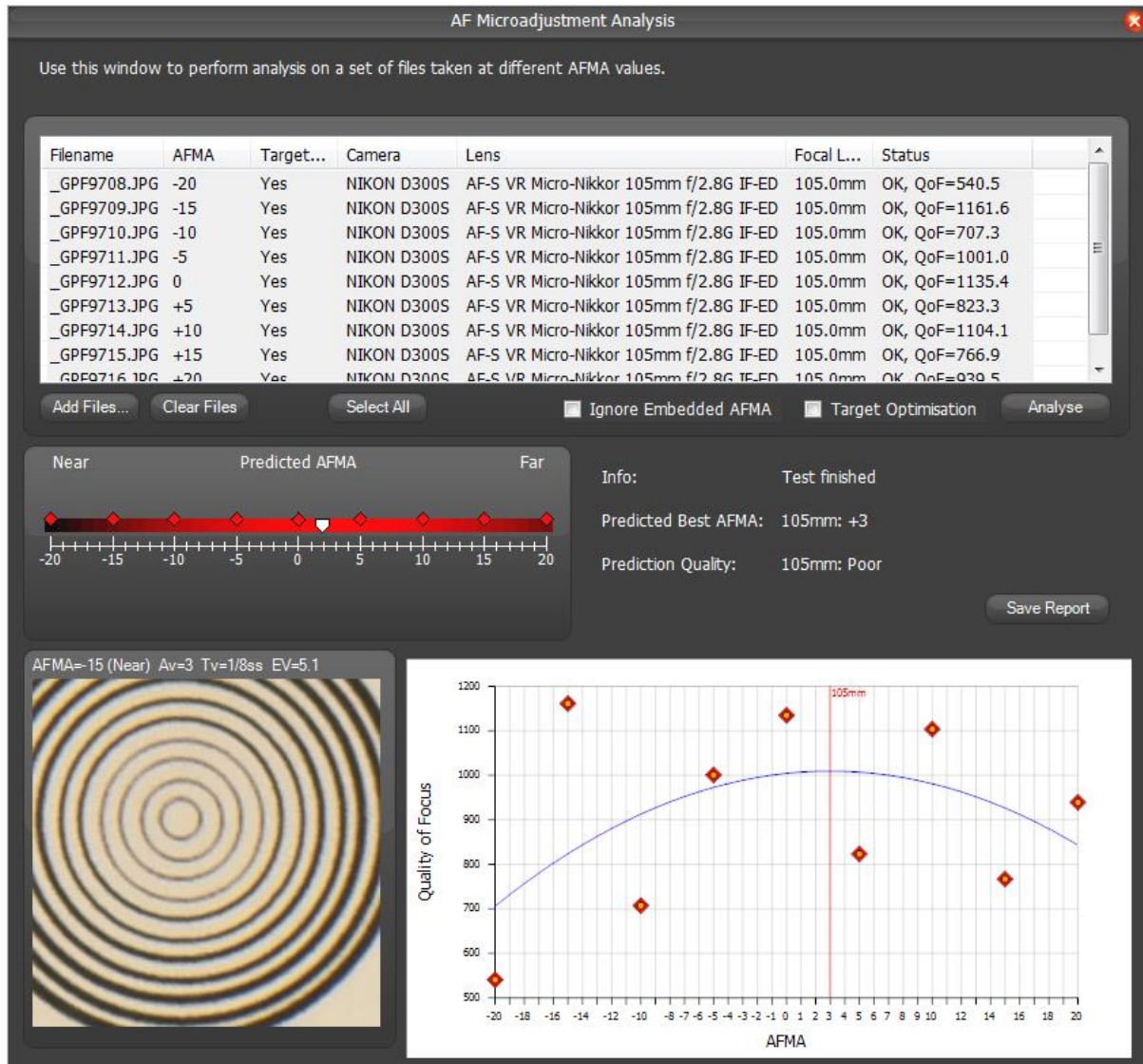
Clicking on any point of the graph with the left mouse button will show the image analysed in the window on the left.

13.4.1 Target Optimisation

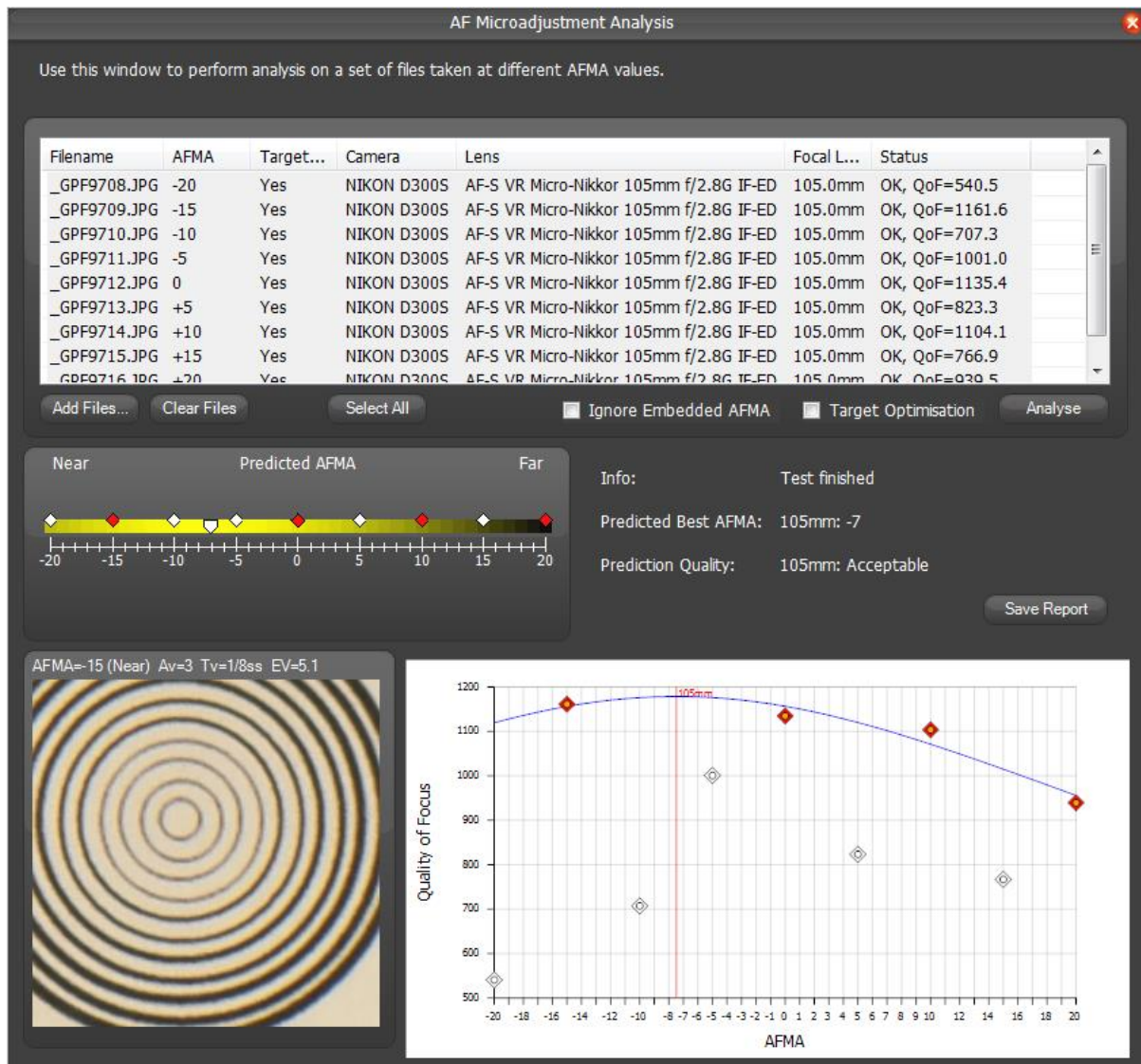
Selecting target optimisation will make the algorithm attempt to detect the target in the image, and correct for slight changes in position of the setup as the shots were taken. Any points that could be optimised are indicated in **green** on the graph, and un-optimised points are shown in **red**.

13.5 Ignoring Points

If, after getting some test data, you can see a pattern in the points but there are some obvious problem points, these can be ignored and the prediction recalculated. In the example below, the points initially appear fairly randomly spread, but reviewing the images (by left-clicking on the graph points) show a number that suffer from motion blur where the camera was vibrated during shooting (probably due to not using a remote release or timer when taking the shots):



By reviewing the points, any which show signs of motion blur can be removed by right-clicking on the point in the graph. The point will lose its colour and the prediction will be recalculated using all the other points. Below is the result with all points showing motion blur removed:



Whilst over half the points have been removed, there is still enough to make a good prediction of the peak AF Fine Tune result at -7 (a large change from the +3 suggested when the test was initially run with all the points).

You can restore a point simply by right clicking again.

13.6 Analysis at Both Ends of a Zoom Lens

The FoCal Manual Mode test can run two sets of analysis within the data captured for different lens focal length. To use this feature, simply supply shots taken at a spread of AF Microadjustment/Fine Tune values at two different focal lengths and select *all* the images into the test – the software will analyse the files, group into focal lengths and produce the results as shown:



In FoCal Pro, the vertical lines on the chart indicate the focal length that the result applies to. For all versions, the Predicted Best indicator will show two values for the tested focal length – in the example above, 40mm has a best AF Microadjustment value of -2 and 17mm has a best value of -6.

13.7 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

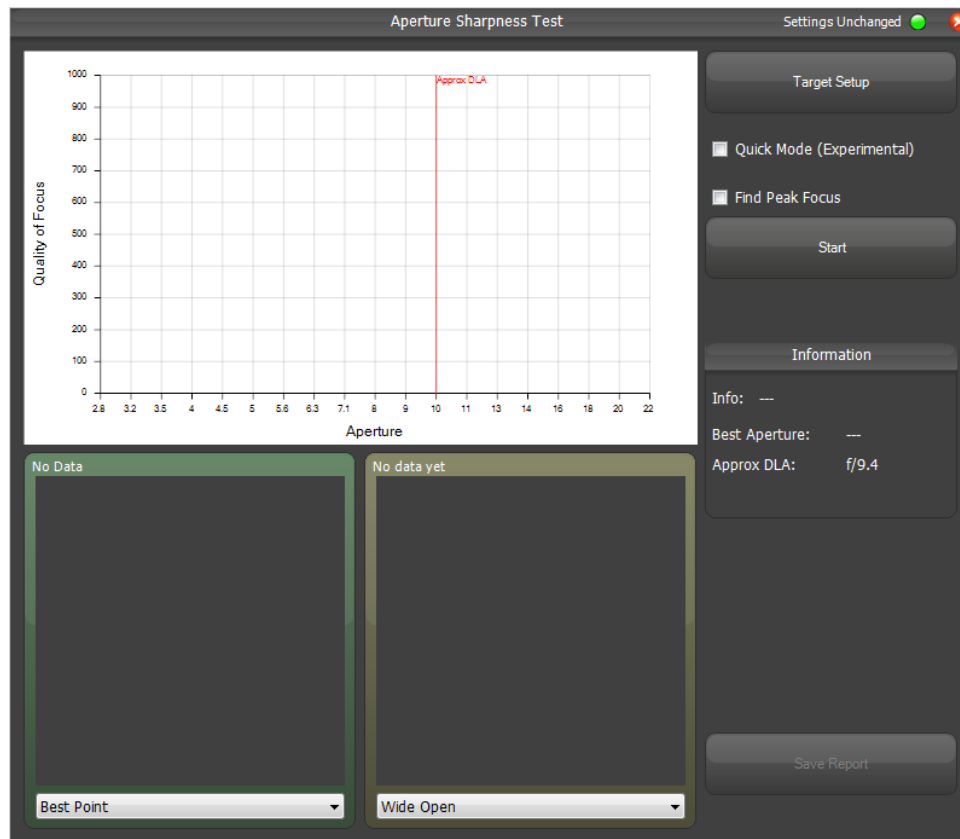
13.8 RGB Analysis

RGB Analysis brings extra functionality to this test. You can read more details in section 8.

14 Aperture Sharpness Test (FoCal Pro only)

The Aperture Sharpness test allows you to determine which aperture of the lens you are using gives the sharpest image by taking test shots across the full aperture range and analysing the results.

The test is accessed from the *Show Tools* button. Clicking the *Aperture Sharpness* button shows the following window:



The red vertical line indicates the approximate *diffraction limited aperture* (DLA) – this is the first point at which the effects of diffraction start to be noticed at a pixel level and from here towards the smaller apertures (larger f numbers) the quality will degrade.

The *Save Report* button is only available in FoCal Pro.

14.1 Image Display Panels

The panels can be made to show images from the list below, and the colour of the border reflects the current selection:

- Green = Best Point (image with the best QoF measurement)
- Red = Worst Point (image with the worst QoF measurement)
- Yellow = Wide Open (the image captured with the lens wide open)
- Blue = Selected Point

14.2 Setting Up

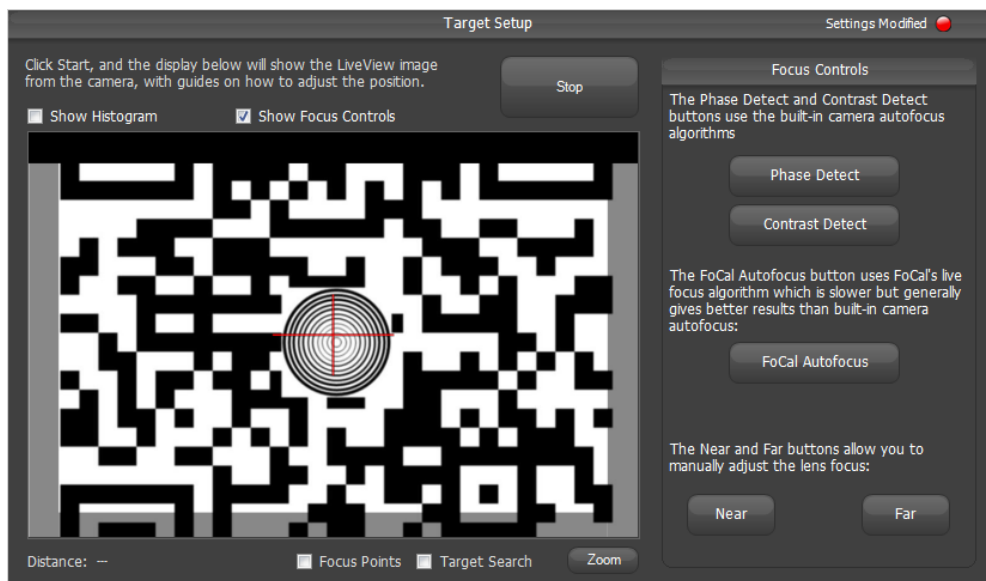
The test uses standard FoCal target (although you can use another target if the Target Validation option is set to Off – see section 25.2.5). You should use the Target Setup utility to ensure the camera is in the correct place.

14.2.1 Correct Focus

In order to get valid lens aperture sharpness indications, it is very important that the lens be correctly focused on the target as best as possible.

14.2.1.1 Manually Focusing

The *Target Setup* tool includes a Focus Control panel which is automatically displayed when you click *Target Setup* from the Aperture Sharpness test window:



See section 12.1 for details on how to achieve perfect focus with the Target Setup tool.



Note that if you use the Target Setup tool, you must ensure the Find Peak Focus button is disabled on the main test window otherwise the focus will be altered before the test is run.

14.2.1.2 Automatic Focus

FoCal has a *Find Peak Focus* option which uses a special algorithm to determine the best focus point.



For ultimate confidence in the test results, you should manually focus the lens before the test using the Near/Far options in the Target Setup window, or by manually focusing the lens by hand while reviewing the magnified Live View image on the camera.

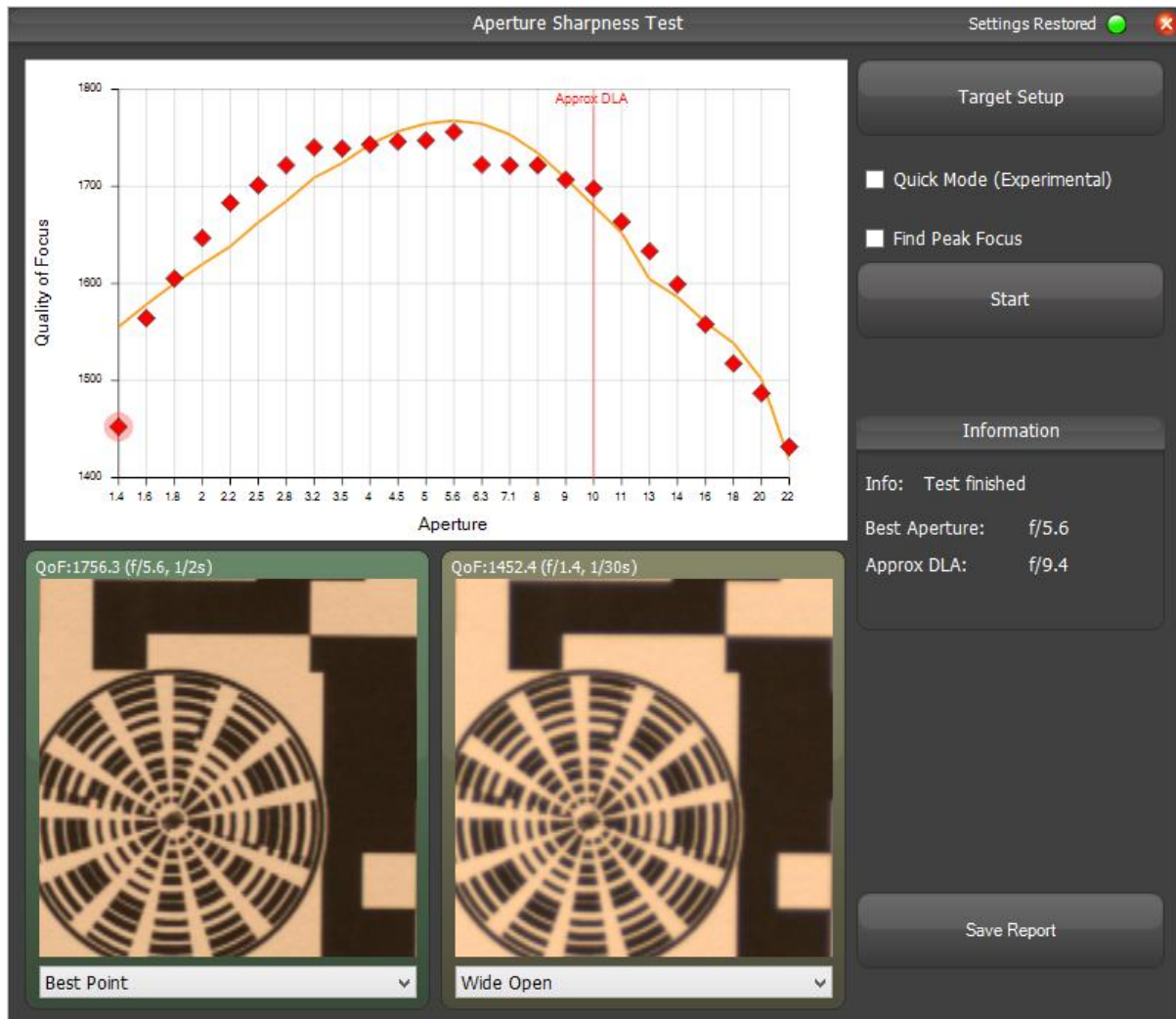
14.3 Running the Test

Click *Start* to commence the test.

The camera will take a number of shots, starting at the smallest aperture. In low light levels, this shot can take 20-30 seconds, so expect delays of this magnitude as the test starts to run. The aperture is widened as the test runs so the shot time decreases.

As the test runs, the shot just taken will be shown in the left panel, and the quality of the shot will be indicated in the graph. The graph will extend from right to left as more shots are added.

When the test is complete, the window will show the best and worst images with the associated information, as well as the best aperture in the *Information* panel on the right of the window.

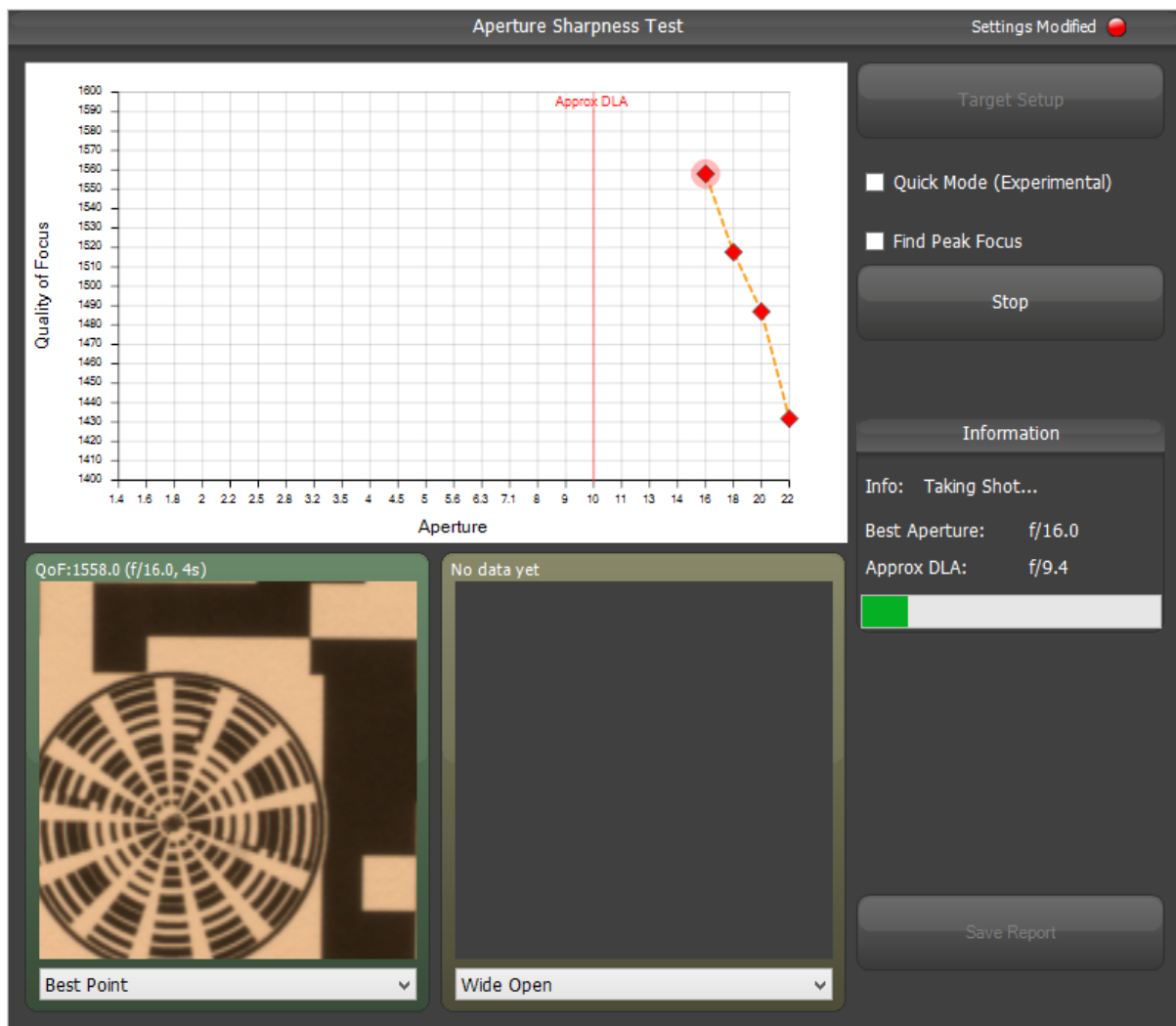


By clicking on any of the markers on the chart, the shot can be reviewed in the left panel.

If Target Optimisation is enabled, the image display will show an arrow indicating the shift in analysis region and all optimised points will be shown in green on the chart.

14.3.1 Displayed Curves

As the Aperture Sharpness tests runs, the captured data is processed and a curve is fitted to the data points. This is then used to calculate a theoretical peak sharpness value (which may not be a selectable aperture value).



For the first few points captured, there is not enough information to fit the curve so the line is shown dotted (see below). But once there is enough data, the line turns solid and the theoretical curve is fitted.

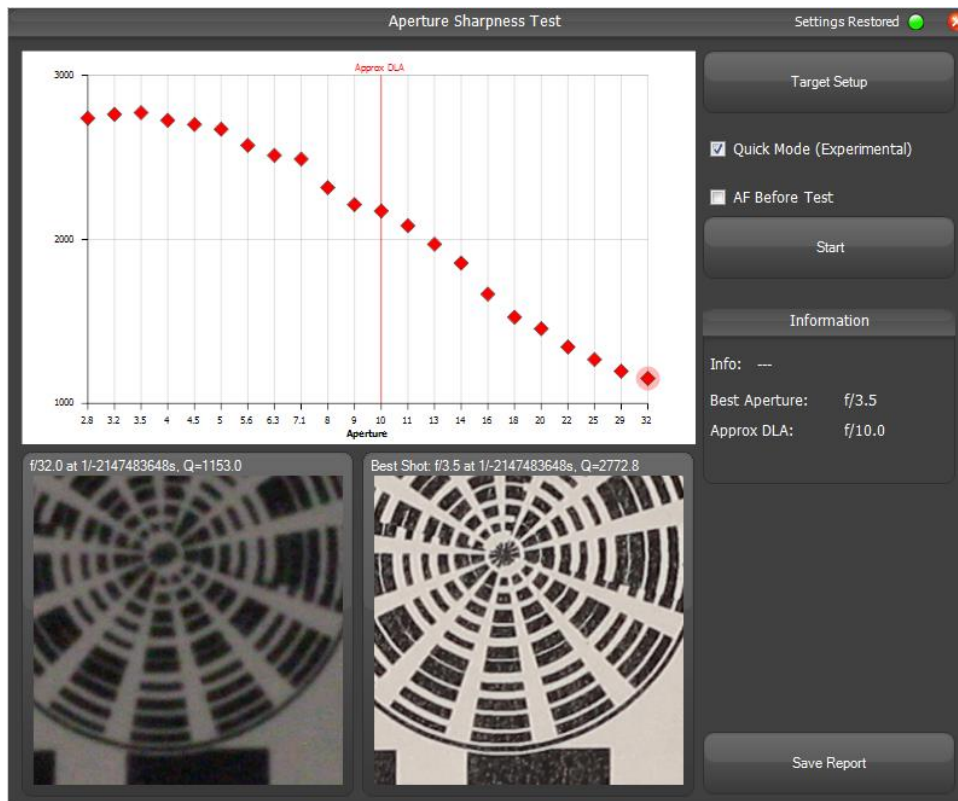
Note that this is an experimental feature in FoCal 1.9.5 and the curve fit may not be quite perfect for the data. The data points are still shown in their absolute positions, and the QoF value is shown in the panels when points are selected. This feature will be enhanced over future versions of FoCal.

14.4 Quick Mode (Experimental)

Quick Mode allows the Aperture Sharpness test to be run with Live View captured images, which means that only one shutter actuation is required and the test runs significantly quicker.

Using sophisticated image analysis, even very noisy Live View images (such as when capturing at the narrowest aperture) can be successfully used within the test. It is advisable to use a high light level when running in Quick Mode to ensure reliable results.

To enable Quick Mode, simply click the *Quick Mode* tick box at the top of the window and start the test as normal.



Please ensure you have **Exposure Simulation enabled** on Canon cameras when running this test, and be aware that the results may not be quite as accurate as running a full test.

The smallest aperture images may appear darker than the other images and could also have slightly erroneous results, but the general shape of the curve (especially at the more important wider apertures) should be accurate.

14.5 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

14.6 RGB Analysis

RGB Analysis brings extra functionality to this test. You can read more details in section 8.

14.7 Expert Settings

The Expert Setting of test ISO will be applied during this test, so if you are finding that the shutter speed is longer than 30 seconds for the earlier (smaller aperture) shots, you can raise the ISO level. See 25.3.2 for more information.

15 AF Consistency Test (FoCal Pro only)

15.1 Overview

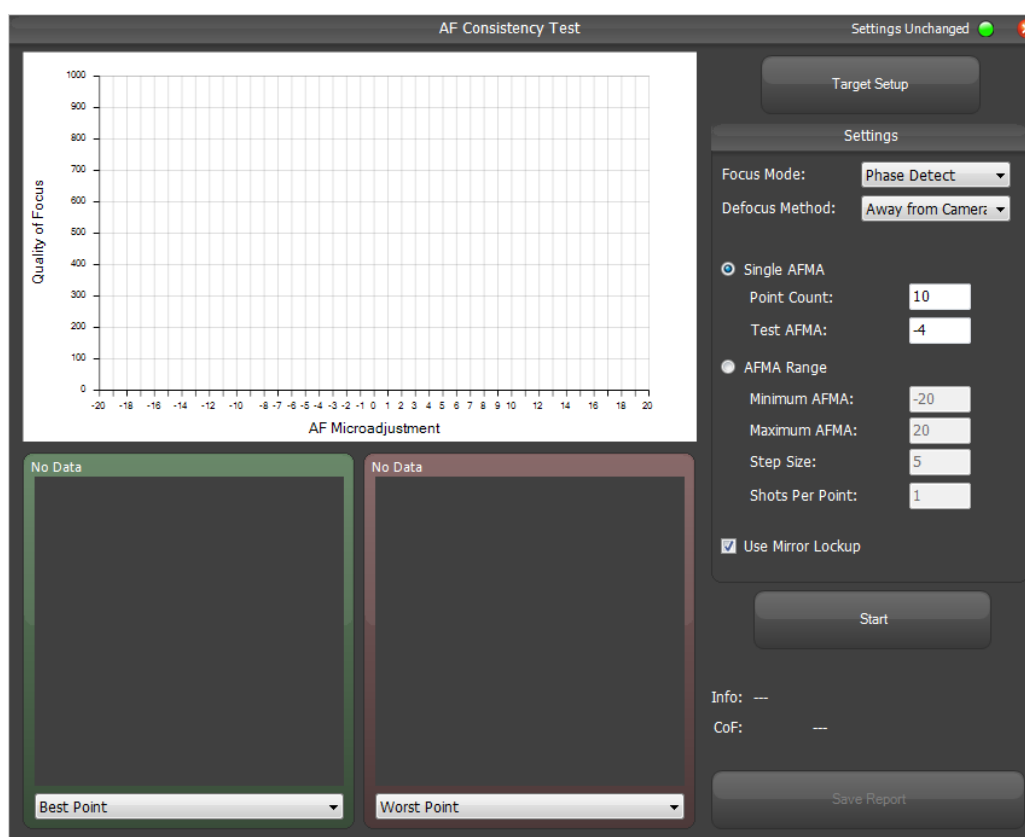
The AF Consistency test allows you to review the consistency of the AF system of the camera across a number of identical shots. It also gives you an opportunity to take single shots across the AF microadjustment range of the camera.

15.1.1 Manual Setting Change (MSC) Mode

With certain cameras, AF Microadjustment/Fine Tune cannot be changed from the computer, so you will be prompted to manually change the setting on the camera. See section 18 for further details.

15.2 Starting the Test

The test is accessed from the *Show Tools* button. Clicking the *AF Consistency* button shows the following window:



Click *Target Setup* if you need to validate the position of the target before running the test.

The Focus Mode determines how the camera will focus each shot. All cameras will offer *Phase Detect* and many cameras will also offer *Contrast Detect* as options.

The Defocus Method is the method used between shots to ensure the AF system runs a full AF procedure. For further information see section 25.3.1.

15.3 Image Display Panels

The panels can be made to show images from the list below, and the colour of the border reflects the current selection:

- Green = Best Point (image with the best QoF measurement)
- Red = Worst Point (image with the worst QoF measurement)
- Blue = Selected Point

15.4 Running the Test

The test can be run in one of 2 modes, selected by clicking either *Single AFMA* (AF Microadjustment/Fine Tune) or *AFMA Range* and choosing appropriate parameters.

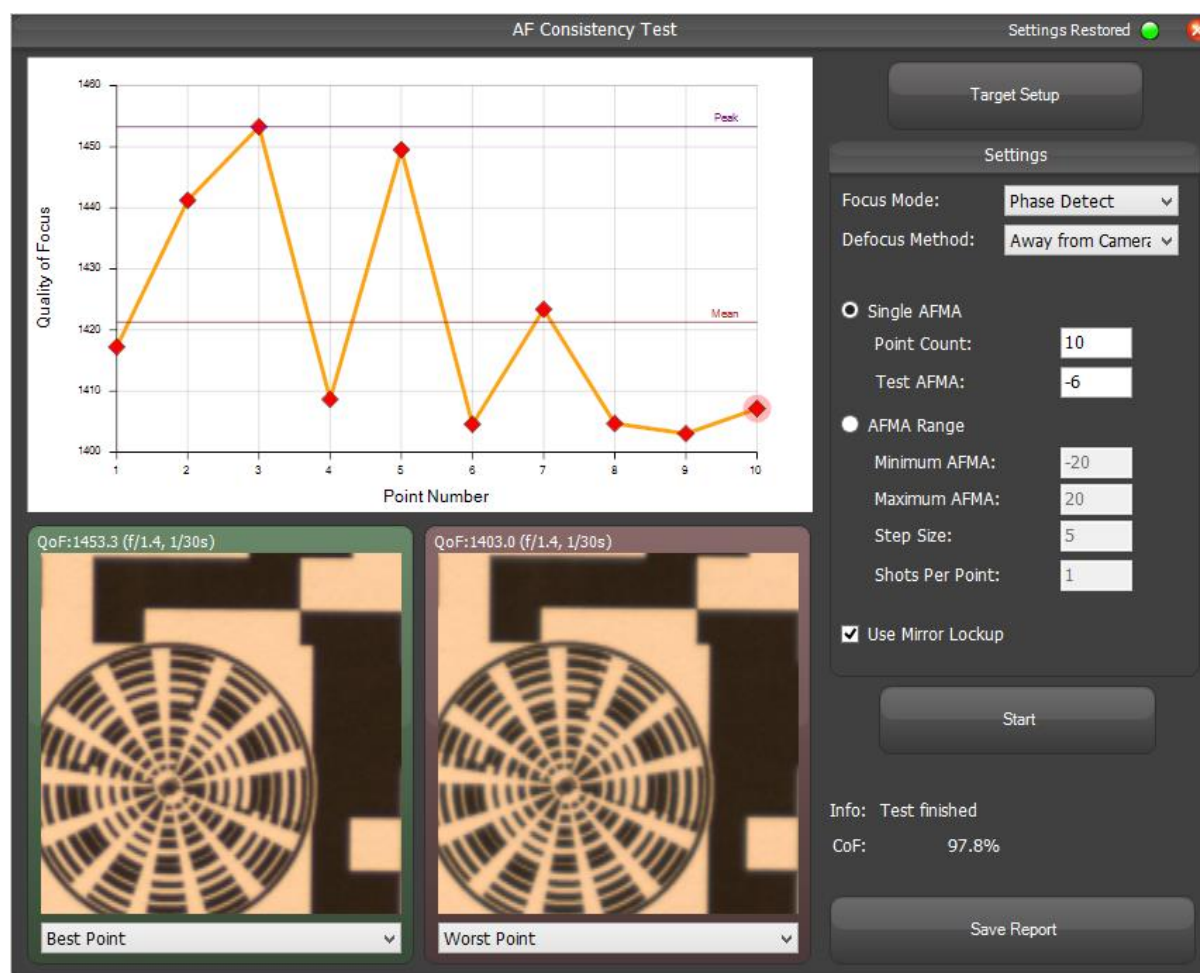
Where supported by the camera, you can also choose between Phase Detect (“Quick”) and Contrast Detect (“Live”) focus methods to compare the quality of the focus using the two different methods.

15.4.1 Single AFMA

Choosing *Single AFMA* will take a number of shots at the chosen AF microadjustment value (*Test AFMA*), defocusing between each shot. Choose the number of shots to take, then select *Mirror Lockup* if available and required (this is not available on cameras that do not support mirror lockup when controlled by a PC).

Finally, click *Start* to run the test.

When the test is complete, the window will look something like this:



Each point can be reviewed by clicking the point on the chart. A clicked point will replace the left hand panel image. Right-clicking a point will ignore this point (it will be displayed white) and update the calculations.

The quality of the AF system as a whole is indicated by the Consistency of Focus (CoF) value. This is the peak-to-mean Quality of Focus (QoF) ratio expressed as a percentage, calculated as follows:

$$\left(\frac{QoF_{mean}}{QoF_{best}} * 100 \right) - 100$$

A theoretically perfect AF system will have all points at exactly the same QoF value, resulting in a CoF of 100%.

Generally, a consistency of above 97% indicates no issue with the AF performance or testing environment. If the value drops below this, you should investigate the test environment – ensure lighting is good, and the camera and target are stable.

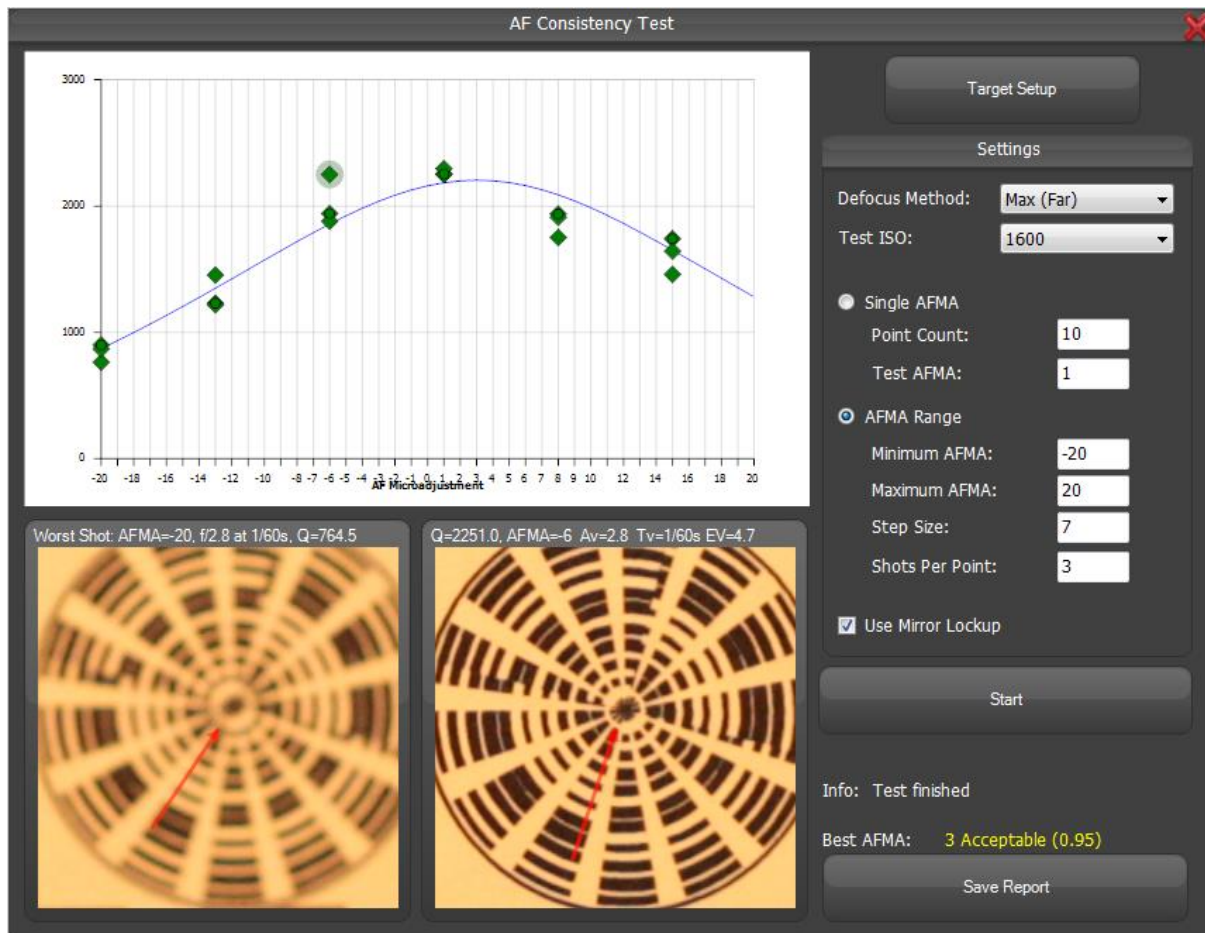
The Peak and Mean values are shown on the charts, and the CoF can be seen visually by how close (vertically) these two lines are.

15.4.2 AFMA Range

Choosing *AFMA Range* will allow you to take a set of shots across a range of AF Microadjustment/Fine Tune values.

Select a starting point (*Minimum AFMA*), an end point (*Maximum AFMA*) and a step size (*Step Size*). You can then choose to take more than one shot at each AF Microadjustment/Fine Tune value by increasing the *Shots Per Point* from 1 to a higher number. Choose whether you want to use Mirror Lockup if available, and finally click *Start*.

When the test is complete, the window will look similar to this:



This example was run between AF Microadjustment values of 0 and 20 with a step size of 5, so all AF Microadjustment values of -0, +5, +10, +15 and +20 were tested, each one with 2 shots (*Shots Per Point* set at 2). The blue line shows the predicted value for the best AF microadjustment/Fine Tune points and the quality of this line is indicated by the colour of the *Best AFMA* result: Green is good, Yellow is acceptable and Red is not good.

Please note: the calculation of the prediction line in this test is not quite the same as the Fully Automatic test. This test simply uses the average of the points at the same AF Microadjustment/Fine Tune to determine the line position, whereas the Fully Automatic tests uses a special algorithm to determine the most likely result for a given AF Microadjustment/Fine Tune point.

15.5 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

15.6 RGB Analysis

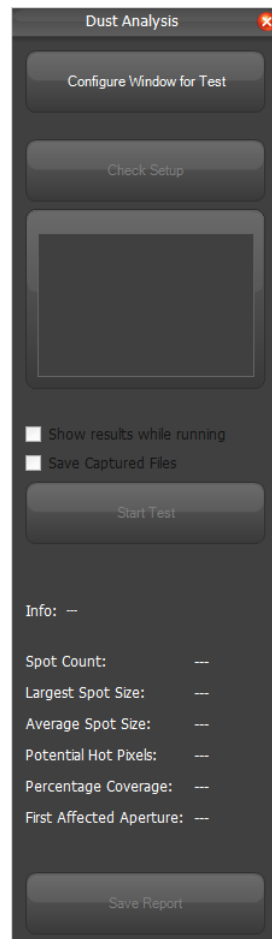
RGB Analysis brings extra functionality to this test. You can read more details in section 8.

16 Dust Analysis (FoCal Pro only)

The Dust Analysis tool will guide you through a quick procedure to quantify the amount of dust on the camera sensor, as well as showing you where the dust will begin to affect the images.

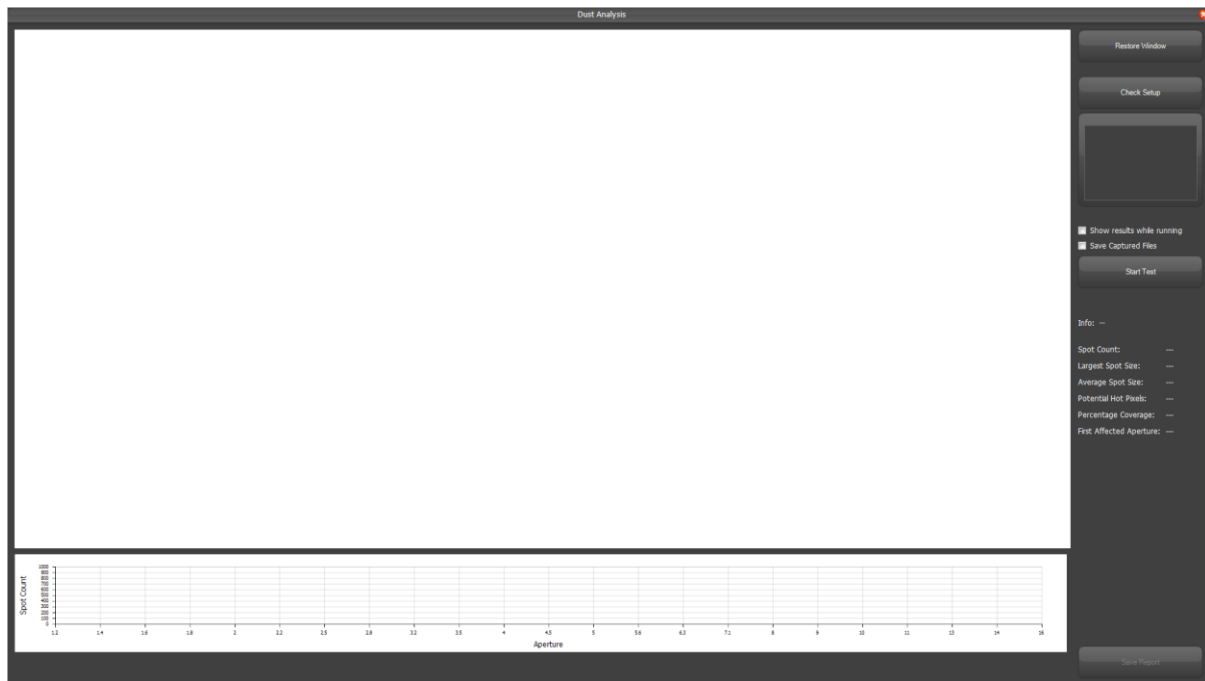
16.1 Using the Dust Analysis tool

The test is accessed from the *Show Tools* button. Clicking the *Dust Analysis* button shows the following window:



16.2 Setting Up

This tool uses the computer monitor as the target, so the camera will need to be pointed at the monitor screen. To configure the window for the test, click the button *Configure Window for Test*. The window will change to the following:



The test area is the large white area on the screen. The camera should be aimed at this rectangle so that the viewfinder shows nothing but this image. It is not essential to use a tripod for this test.

As well as pointing the camera at the screen, you must manually defocus the image, generally by focusing to infinity. If you are using a zoom lens, it is generally better to zoom to the telephoto end. There should be no discernible things in the viewfinder – just out of focus white.

In order to validate the setup of the camera, click *Check Setup*. This will start a Live View session in the small window underneath the *Check Setup* button. The Live View image is analysed to make sure the camera is defocused and aimed at the white rectangle. When the image of the screen is acceptable, a green Tick will be shown, otherwise a red X will be shown.

16.2.1 Show Results While Running

If you are using a different target (e.g. a white wall), you can tick the *Show Results while Running* box. When the test runs, you will be shown the sensor image with the dust spots highlighted, and the chart will update as each shot is analysed.

16.2.2 Points to Note

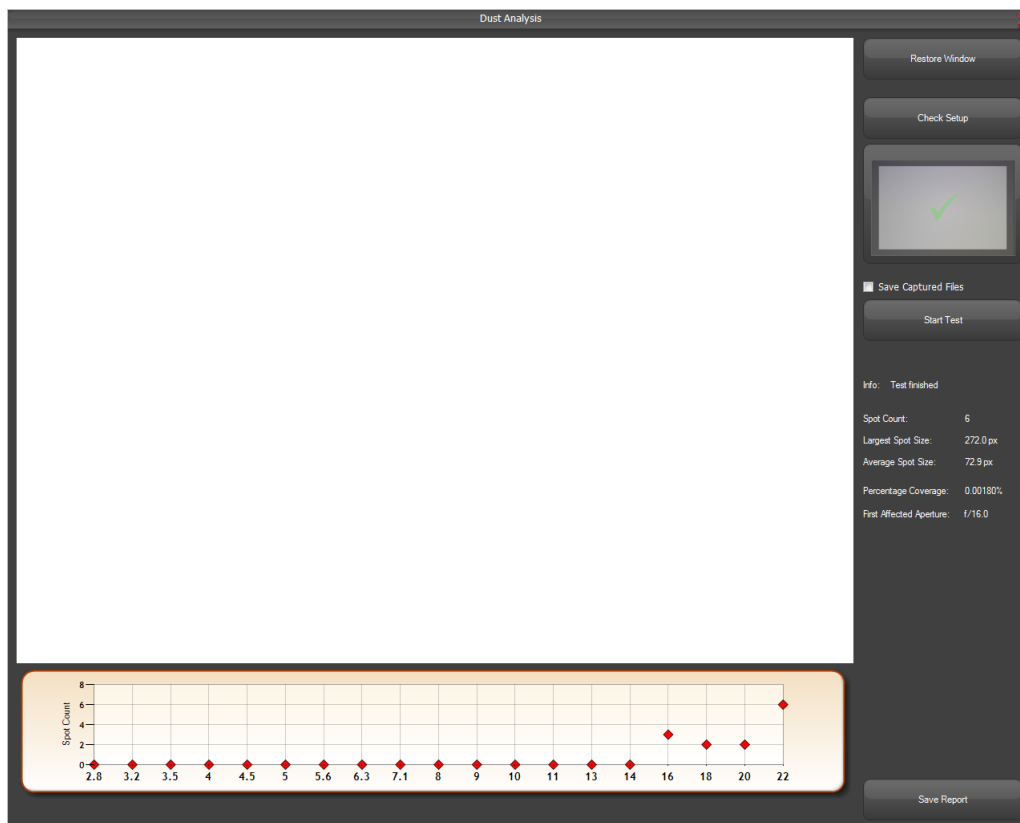
The dust analysis test has some limitations, mainly related to vignetting on certain lenses. It is generally best NOT to use a fast prime for the dust test as the vignetting can be both fairly severe and dynamic across the aperture range. *Remember, this test is for analysing the sensor dust, so actual lens is unimportant to the test results other than for the vignetting.*

If you do use a lens with heavy vignetting wide open, you may never see a green tick on the small *Check Setup* Live View image. This does not necessarily mean you cannot run the test, but it is a warning that you may not get optimal results.

In this case, the dust test can still be useful as you can choose to save the image for manual review.

16.3 Running the Test

Once the camera setup is validated, clicking *Start Test* will begin to take shots across the aperture range and analyse the images. If *Save Captured Files* is enabled, a directory chooser will be presented and you can choose a location for the captured full resolution files to be saved, each labelled with the date and time, aperture, camera model and serial number.

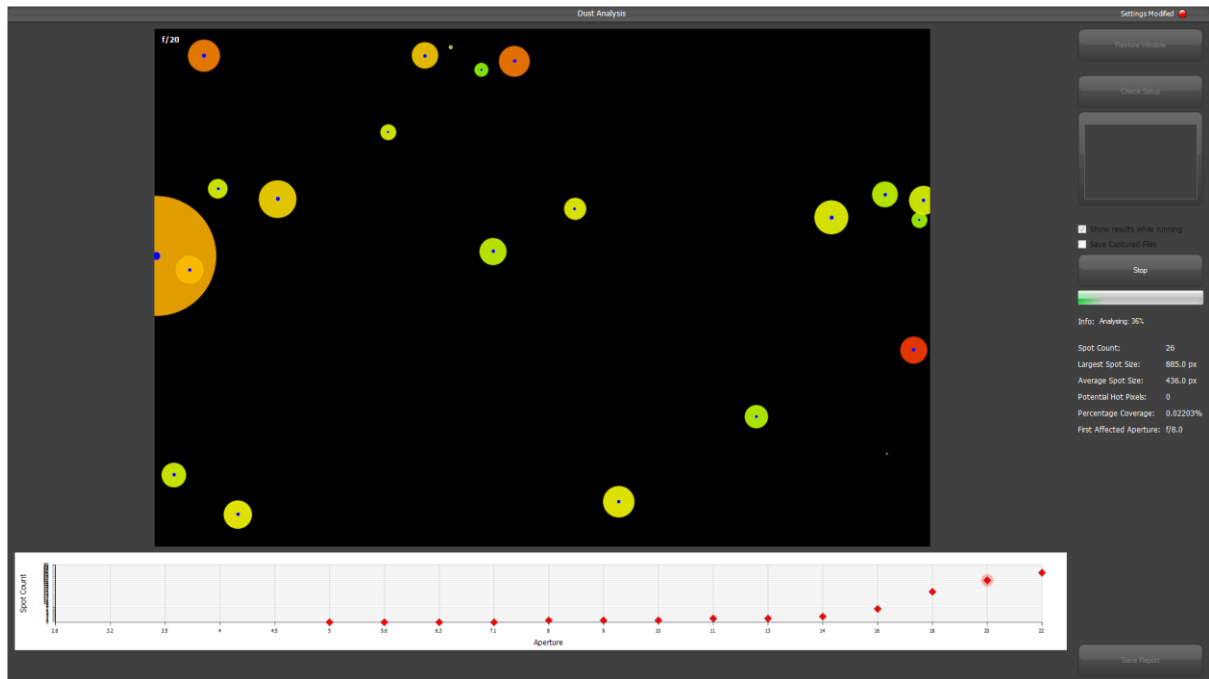


The information panel under the *Start Test* button will show information as the test progresses:

- **Spot Count** is the largest number of spots found so far on any aperture
- **Largest Spot Size** is the total number of pixels covered by the spot. Note that this is *not* the length or width of the spot, but the area.
- **Average Spot Size** is the average size of all the spots
- **Potential Hot Pixels** is a count of the number of possible hot pixels
- **Percentage Coverage** shows how much of the total sensor is wasted to dust
- **First Affected Aperture** shows the first aperture where the spots are noticed by the analysis routine.

16.4 Reviewing the data

Once the test is complete, the data can be reviewed by clicking any point on the graph:



Each detected spot is shown with a **blue** marker. As some of the spots will be very small and not visible on the scaled-down view shown in the window, they are highlighted with a proportionally sized larger circle which will be coloured from red through orange to green depending on the opacity of the dust spot.

A very dark, noticeable dust spot will be shown in **red**, and a very faint dust spot will be shown in **green**.

16.5 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

16.6 Comments on Dust Analysis

The analysis algorithm tries to detect dust spots that are of a size and density to affect images. However, it's important to realise that although the images may show a lot of dust spots, all but the largest will not be particularly noticeable. Even the large ones will only become apparent against a plain area of the image.

As the analysis has a detection threshold, the dust spot count may shift slightly especially at smaller apertures. For instance, in the graph above it appears that f/32 has less visible dust than f/25, but you should consider it that the line is pretty flat above about f/16 so all spots are visible by then.

Remember, this test will show you the worst of your sensor! Don't panic. In the example above, if you mainly shoot at f/14 or below there really is nothing to worry about. But if you shoot a lot of hyperfocal landscapes, you may want to clean the sensor.

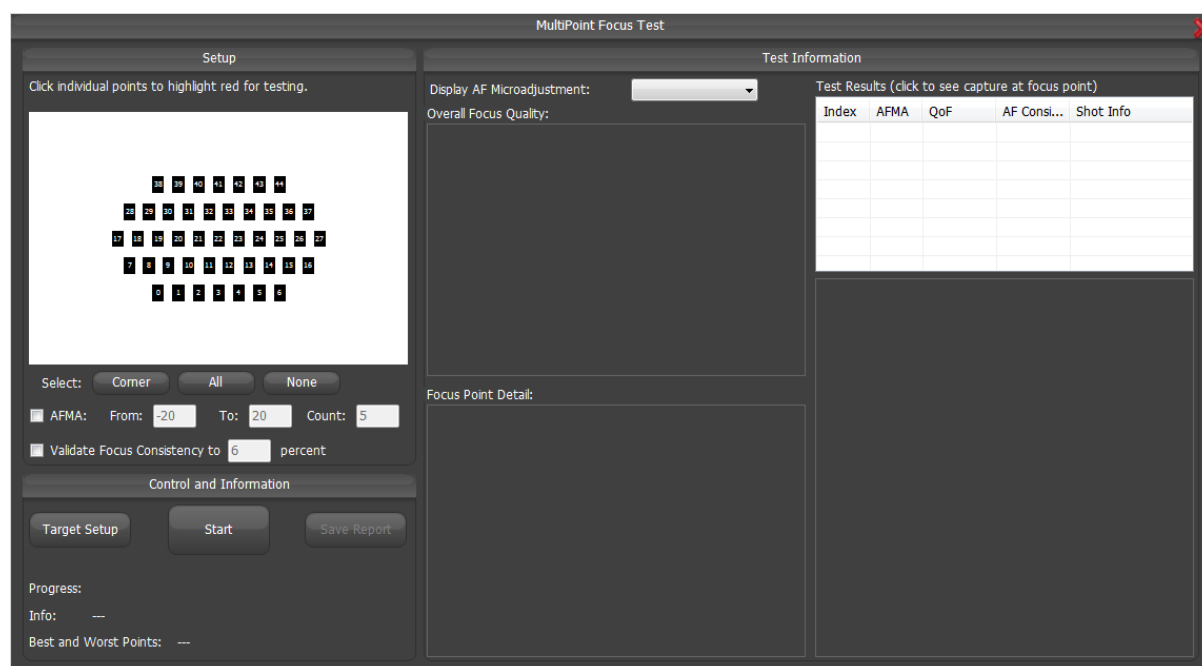
17 Multi Point Focus Test (FoCal Pro only)

17.1 Overview

The Multi Point Focus Test allows you to see any discrepancies in the focus performance of different focus points, as well as allowing basic determination of the best AF Microadjustment/Fine Tune value for each focal point. The test analyses a small region around each focus point in order to reduce the effect of lens field curvature from affecting the measure of AF point performance.

17.2 Running the Test

The test is accessed from the *Show Tools* button. Clicking the *Multi Point Focus* button shows the following window:



The screen is split into a number of sections:

- The *Setup* panel is shown at the top left of the screen and allows you to select the focus points you wish to test and the AF Microadjustment/Fine Tune range for each point. The screenshot above shows the focus points for a Canon EOS 7D.
- The *Control and Information* panel gives you controls to setup the target, start and stop the test and save the report once test information is available. Information about the results is also shown here as the test runs.
- The *Test Information* panel shows you graphical results and allows you to review the data.

17.3 Setting Up

17.3.1 The MPFT Target

The Multi Point Focus Test uses a new target which is designed to allow analysis all over the surface of the target, and also to be appropriate as an autofocus target. The target is supplied as a vector PDF in the *Target Images* directory, with the filename

FoCal_MultiFocus_Target_1r1ns.pdf (and a bitmap PNG file called FoCal_MultiFocus_Target_1r1ns-600dpi.png)

The file can be opened with readily available software such as Adobe Reader, and the content is a vector graphic so can be printed at any size without a loss in resolution.

17.3.2 Lens Choice

The Multi Point Focus Test is designed to test the accuracy of the focus points in the camera, and in order to do this in a valid way the lens should contribute as little as possible to the overall result.

The Multi Point Focus Test target is designed to be analysable at any point, so in order to cover the focus points for a wide angle lens you can use more than 1 printed copy of the target mounted at appropriate places. It is important not to have any white border in the analysed region – see the information in the Target Setup section below for more details.

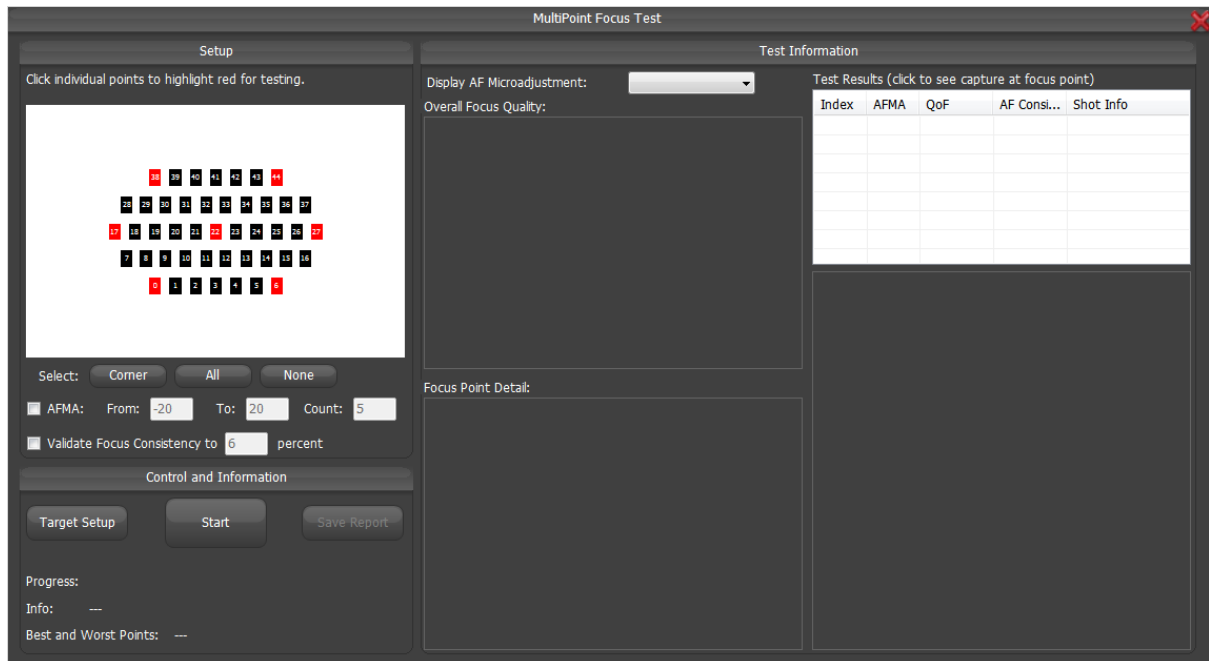
Long telephoto lenses can be susceptible to the effects of vibration so these lenses should be avoided unless you are very confident of the stability of the setup. Poor quality lenses may contribute to poorer performance of the AF system as a whole and result in inconsistent or unreliable results.

17.4 Choosing Focus Points

The *Setup* panel contains a focus point selector which allows you to choose the focus points you wish to test. You should select the points to test *before* running the Target Setup utility as this will influence the overlay markers on the Target Setup tool.

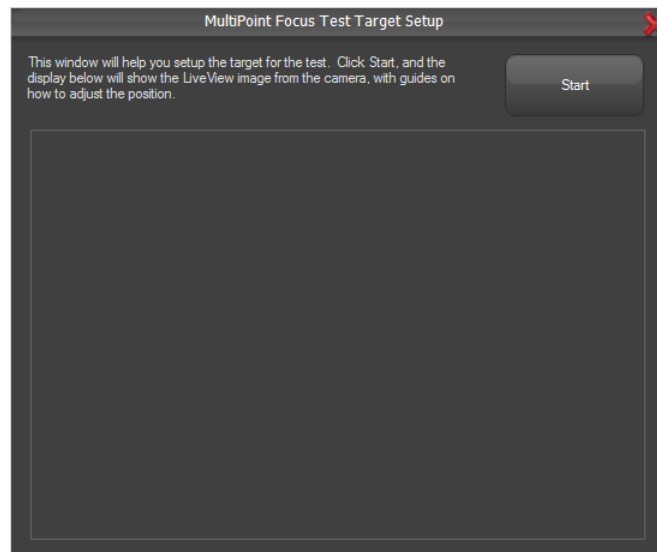
To mark a point for testing click on the point and it will turn red – red shows the point will be tested.

You can use the buttons under the selector to select all points (click *All*), deselect all (click *None*) or just choose the corner points and centre (click *Corner*). The following image shows the corner and centre point selected:



17.5 Target Setup Utility

A Target Setup utility is available for assisting in setup of the target for this test. To use this utility, simply click *Target Setup* on the Multi Point Focus Test window. The following window will appear:



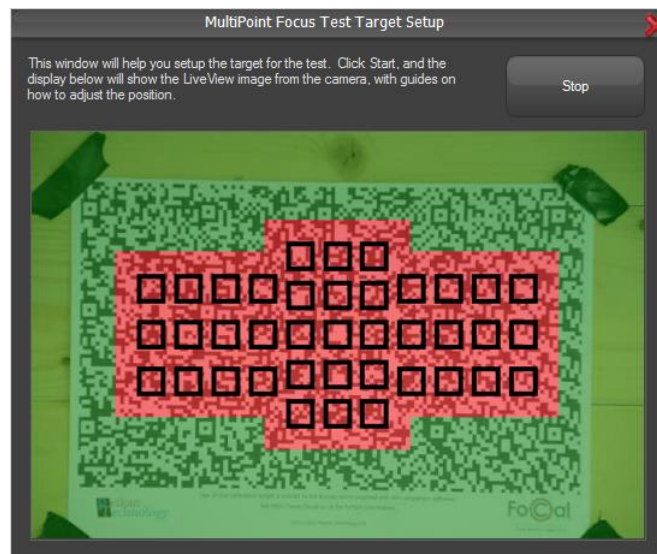
To start the utility, click Start, and you will be presented with a Live View image of the target along with markers to indicate where the target should be. **Note that the markers indicated where the target pattern needs to be under the points selected in the Focus Point Selector in the main window.** For example, if only the corner points are chosen as shown in the screenshot in section 0, the Target Setup overlay will look like this:



The following images give examples of correct and incorrect target positioning.

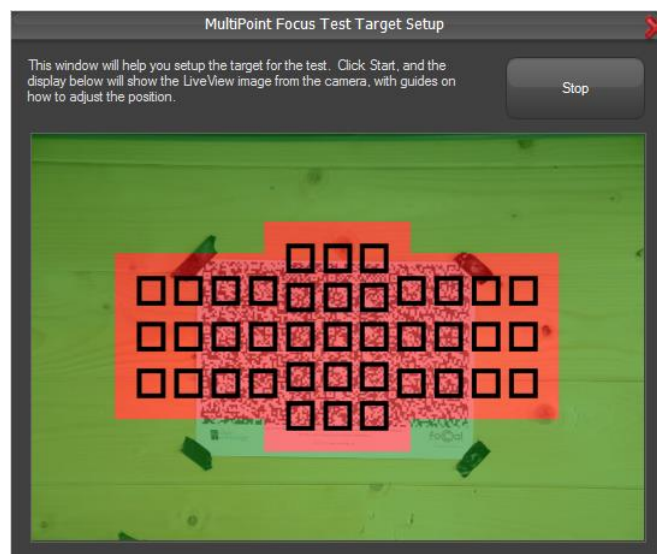
Correct Positioning

The correct position is to ensure that every part of the RED area in the overlay covers the target. As shown below, the target extends into the green area on all sides:



Incorrect Positioning

Some of the red region below falls outside of the target. In this instance, the camera should be moved closer to the target or a longer focal length lens used.



Note that FoCal does not validate the position of the target in this version of the test, so it is important to ensure that target is set up correctly.

When the target is set up correctly, simply hit *Stop* and close the window to return to the Multi Point Focus Test window.

17.6 Running the Test

The test can be run in two modes:

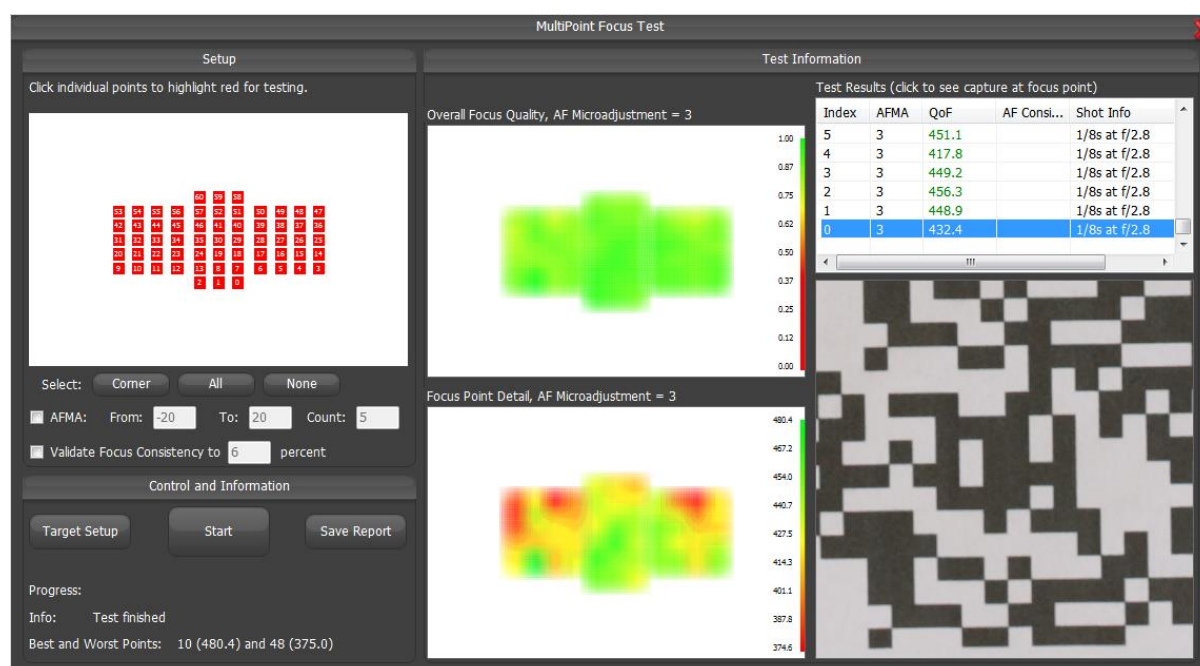
- Single AF Microadjustment/Fine Tune Mode
- AF Microadjustment/Fine Tune Prediction Mode

17.6.1 Single AF Microadjustment/Fine Tune Mode

In Single AF Microadjustment/Fine Tune Mode, the test will not adjust the AF Microadjustment/AF Fine Tune of the camera during the test. All points will be shot with the same setting, so the result shows the combination of the AF performance and the lens performance at specified points. In order to run in Single AF Microadjustment/Fine Tune Mode, you must ensure the *AFMA* tick box is *not* ticked.

Once the target is setup and the focus points picked, just click *Start* to begin the test.

As the test runs, the currently analysed AF point will be shown in green on the focus selector. When data is available, the *Overall Focus Quality* and *Focus Point Detail* charts will start to show detail, and the *Test Results* list will show the shot information and data for each point.



Note that as both the charts show information which is based on all the capture information up to the current time, the content may change significantly during the test as more data is available.

17.6.2 Analysis Region Quality

When each area is analysed, the suitability of the area under analysis is checked. If the area is deemed to be acceptable to give a useful analysis result, the QoF entry in the list at the top-right of the window will be shown in **green**. If there is a potential issue with the analysed region, the entry will be shown in **red**. You should click on each red entry and check the target image to make sure the region is not outside the random target pattern area.

17.6.3 AF Microadjustment/Fine Tune Prediction Mode

In AF Microadjustment/Fine Tune Prediction mode, the test takes a number of shots at each focus point at a range of AF Microadjustment values, and can help determine the best AF Microadjustment at each point. While no camera yet allows you to specify AF Microadjustment values at each focus points, see the spread of values can help determine if there is a problem with your camera or lens.

In order to run in AF Microadjustment/Fine Tune Prediction mode, the *AFMA* tick box should be ticked, and a *From*, *To* and *Step* value supplied:

- The *From* value is the first AF Microadjustment / Fine Tune value to test
- The *To* value is the last AF Microadjustment / Fine Tune value to test
- The *Count* value is the number of AF Microadjustment / Fine Tune points to test spread across the *From* to *To* range defined above.

For example, setting *From* as -20, *To* as +20 and *Count* as 5 will take shots at -20, -10, 0, 10, and 20 for each focus points and build a comprehensive view of the AF Microadjustment / Fine Tune settings for each focus point.

17.6.3.1 Focus Consistency Validation

In order to try to remove the effects of variation in the AF performance of the camera, you can specify a focus consistency percentage. FoCal will keep taking shots until the QoF of 2 shots lie within the percentage defined, at which point the best of the two close values will be taken.

A typical value for this field is 6-8%, but if you want to ensure very tight consistency you can reduce this to around 3%.

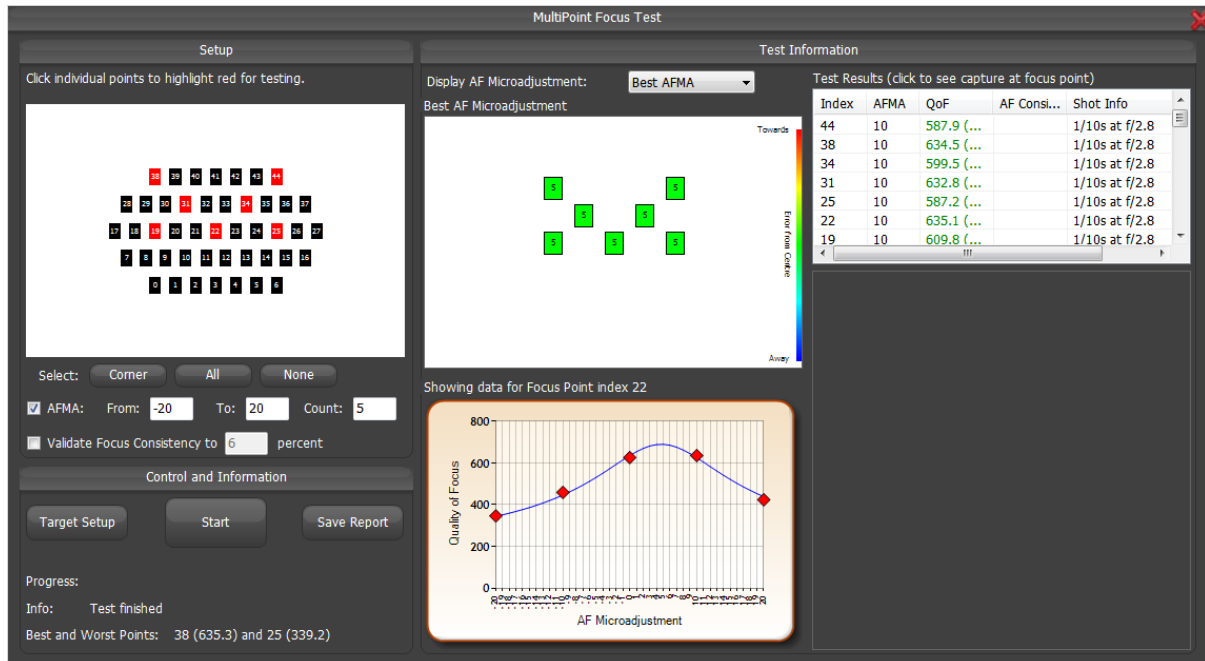
You must activate this setting by ticking the box next to it in order to use validation. *Note that this will increase the number of shots taken to at least 2 shots per selected focus point, and possibly more depending on how consistent the AF system is behaving.*

17.6.3.2 Display AF Microadjustment

When the test is running in AF Microadjustment/Fine Tune Prediction Mode, the results can be displayed in a number of ways depending on the value of the *Display AF Microadjustment* entry:

17.6.3.2.1 Best AFMA (AF Microadjustment/Fine Tune)

If *Best AFMA* is chosen, the top chart shows the focus points with the current best AF Microadjustment/Fine Tune value shown within the points.



The AF Microadjustment/Fine Tune value is indicated within the focus rectangles, and the colour of the rectangle indicates how close the predicted value is to the predicted value of the centre focus point (which is taken as a reference point).

The example above shows 7 tested points, all showing a predicted AF Microadjustment value of +5 and all shown in **green** as each point exactly matches the AF Microadjustment value of the centre focus point.

If the predicted AF Microadjustment/Fine Tune value of the point is nearer to the camera than the centre point, the focus point will be shown progressively redder. Equally, if the predicted value is further from the camera, the point will be shown progressively bluer.

Clicking on an individual focus point will show the results for each tested AF Microadjustment point as shown by the graph in the lower chart area.

17.6.3.2.2 Single AF Microadjustment/Fine Tune

If the *Display AF Microadjustment* list is set to one of the tested values (e.g. -20 as shown below), the results are shown in the same way as for the Single AF Microadjustment/Fine Tune mode of the test – the top shows the *Overall Focus Quality* and the bottom shows the *Focus Point Detail*:



17.7 Failure to lock AF

When the test is running, some cameras and lenses are susceptible to failure to lock on to the target occasionally. If this happens, you will see a message box which explains that you can retry and suggests you slightly move the focus beforehand.

If this happens, try turning the focus ring of the lens (in manual if necessary) one way a little and retrying. If this does not help, then try the other way and retry. Usually the camera will focus within one or two attempts, but if you cannot get it to focus after a number of retries you may have to stop the test and rerun at a slightly different distance from the target or different focal length.

17.8 Reviewing the results

Each individual result can be reviewed by clicking on the line in the *Test Results* list. This shows the image captured at the AF point that was being tested.



17.9 Common Test Features

Please see section 7 for details on changing chart scale, ignoring points, saving reports and other features common to most tests.

17.10 Interpreting the results

The information presented as the test runs is presented in the two charts in the centre of the window (these are also included in the saved report).

17.10.1 Overall Focus Quality

This chart shows each point relative to the *best* point currently analysed:

$$x = \frac{QoF_{max}}{QoF}$$

Where x is the value shown on the chart between 0.0 and 1.0

QoF_{max} is the maximum averaged Quality of Focus (QoF) result from all the points, and

QoF is the QoF value for the point being analysed.

17.10.1.1 Interpreting

For an absolutely ideal camera and lens, this chart should have the same QoF at every point, which would lead to all points having a value of 1.00 and being shown in green. However, where there is a drop in performance compared to the best point, the value shown will start to drop and the point will be coloured towards red.

As all the points are affected by the lens, light level, vibration etc, the effect of these factors is mostly removed by comparing each point to the best point. This means you can draw conclusions

based on the absolute value of the points. Generally, if you have some red points it is indicating a significant drop in quality at these focus points.

17.10.2 Focus Point Detail

Unlike the chart above, this spreads the values for the points across the full range of colours. This means the best point will be shown in green, and the worst point will be shown in red, and all other points somewhere in between depending on their quality.

It's important to understand that in the *Focus Point Detail* chart, red does not necessarily mean bad! If the spread of values is very small, the worst (red) point may still be excellent.

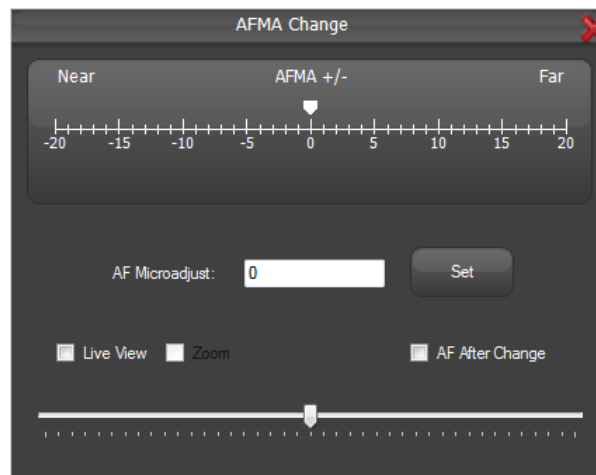
This chart is simply used to show where the best and worst points are. If you notice that there is a definite grouping of good and bad points, and it is consistent across multiple runs of the test, there may be an issue with the AF system.

18 AFMA (AF Microadjustment/Fine Tune) Change Utility

18.1 Using the utility

Please note that this utility **WILL** change the AF microadjustment value in the camera and will **NOT** restore it to the original value. You must make a note of the AF microadjustment value before you start and restore it accordingly before exiting the test.

To start the AFMA Change utility, click the Show Tools button in the Test panel, then choose AFMA Change. The following window will open:



This utility offers 2 ways of changing the AF microadjustment value in real time, as well as the ability to immediately see the effects of the change.

18.1.1 Changing AF Microadjustment Value

To change the AF microadjustment value, you can either:

- Enter a valid value (between -20 and +20) in the text box in the middle of the window and click “Set”, or
- Drag the slider at the bottom of the screen to a new value

The value will be set in the camera, and when the camera reports that it has set the value the window information will be updated. Note that there can be a small delay while the camera applied the new value (so rapidly dragging the slider at the bottom of the screen may cause slow, jumpy updates – this is perfectly normal).

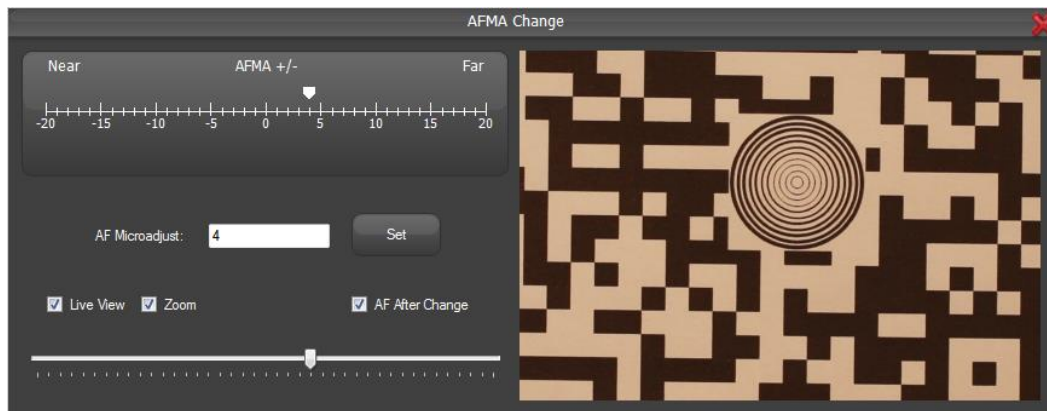
18.1.2 AF After Change

If *AF After Change* is selected, then an AF operation is performed after each change in AF microadjustment value. Looking through the camera viewfinder will allow you to see the effect of the change.

Note that this utility does not apply any camera setting changes, so you must ensure the camera is set up for half-shutter-button-press focussing. If you use purely back-button focusing, the “AF After Change” function will not operate.

18.2 Live View

Clicking Live View will enable Live View on the camera and show the results on the extended window:



Clicking Zoom will zoom into the selected LiveView zoom region.

18.3 Reviewing on the Camera

When the utility is started, the camera menus will be available to use. Navigating to the AF microadjustment settings (which is C.Fn III, Number 5 on both the 7D and 5Dmk2) will show the camera updating as you change the value with this utility.

18.4 Keyboard Shortcuts

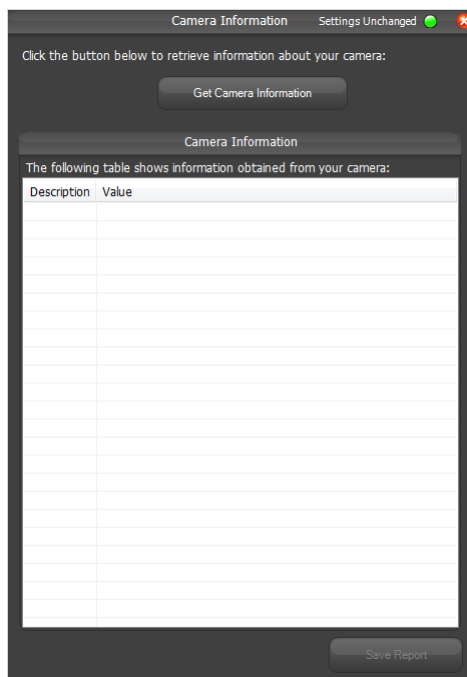
Target Setup can be controlled using the keyboard with the following keys:

Key	Action
P	Toggle “AF After Change” state
Z	Toggle Zoom state
S	Apply the specified value to the camera
R	Reset graph peak
1	Move AFMA setting towards camera
2	Move AFMA setting away from camera

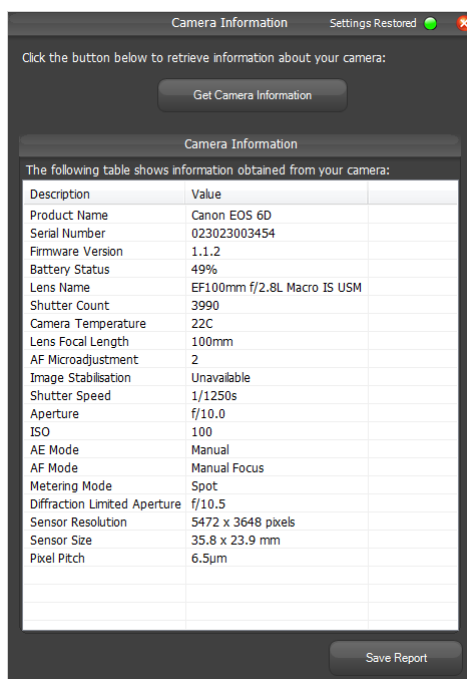
19 Camera Information Tool

The Camera Information tool allows you to see a wealth of information about your camera at the click of a button.

To open the tool, click *Camera Info* from the Tool panel:



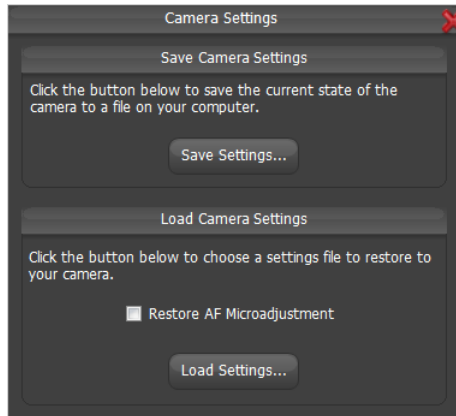
To obtain information from your camera simply click *Get Camera Information*. The camera will take one shot (you may be instructed to change the camera mode to Manual depending on the camera that is connected), and the information will be shown very shortly after:



20 Camera Settings Save/Load

20.1 Overview

The *Camera Settings* button allows you to take a snapshot of the camera settings and save them to disk to allow restoring at a later time. To open the utility, click *Camera Settings* in the Tools panel. The following window will be shown:



20.2 Saving Settings

To save your camera settings, click *Save Settings*. You will be presented with a file-chooser window, and you can specify a file in which to save the settings.

20.3 Loading Settings

To load previously saved camera settings, click *Load Settings*. You can choose a settings file and the stored settings will be applied to the camera.

If you click the *Restore AF Microadjustment* (or *Restore AF Fine Tune*) checkbox before clicking *Load Settings...* the AF Microadjustment/Fine Tune value stored in the settings file will be reapplied to the camera, otherwise all other settings will be applied but AF Microadjustment/Fine Tune will be unchanged.

20.4 Points to Note

There are some points to note with this first version³ of the Camera Settings utility:

- The camera serial number will be validated, so you cannot save settings from one camera and restore to another even if they are the same type of camera.
- Only settings relevant to the operation of FoCal are saved and in some cases on Canon cameras, certain settings values will not be recognised and cannot be restored.
- The image quality setting will only restore the setting for the first card slot on cameras with dual card slots.

³ In a later version of FoCal, the intention is to make this utility save *all* available camera settings to allow you to take a snapshot of the camera state to restore at a later time.

See section 24 for details of the settings that are stored.

21 Quick AF Microadjustment Calibration (FoCal Plus/Pro)

The QuickCal test is made possible due to the accuracy of the mathematics used in FoCal to model the behaviour of the complete AF system. FoCal can use two different ways of calibrating the camera and lens in the same test – one method is fast but cannot be used independently as it does not capture all the information needed to calibrate the system, but when combined with a few known AF Microadjustment/Fine Tune points the result can be quickly determined.

The QuickCal test is new and somewhat experimental– it generally provides good results but as with all tests it is worth checking with some real-world shooting after calibration.

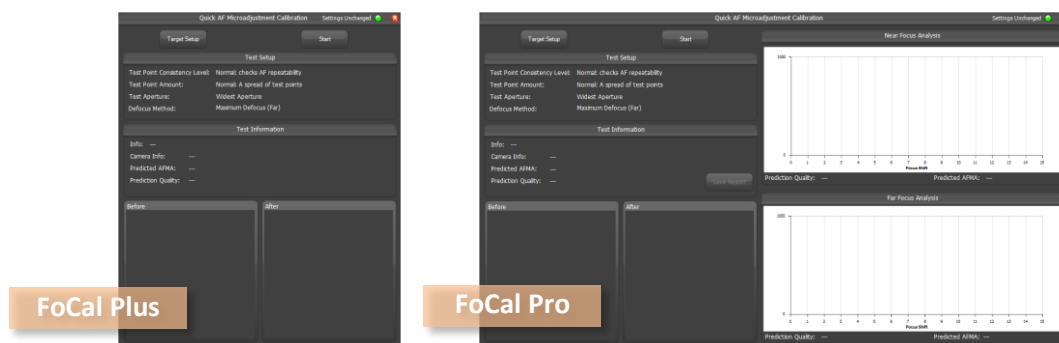
21.1 Setup

The following are important points when using the QuickCal test:

- The QuickCal test makes extensive use of LiveView, so it's very important to ensure the camera is stable and not disturbed during the testing.
- The light level should be constant and bright.
- It is advisable to set the *Test Point Consistency Level* in the Preferences window to **strict**.
- If the camera has an **Exposure Simulation** mode (most Canon cameras) then this should be set to **ON**.

21.2 Starting the Test

To open the test, simply click the QuickCal button on the main window to open the test:

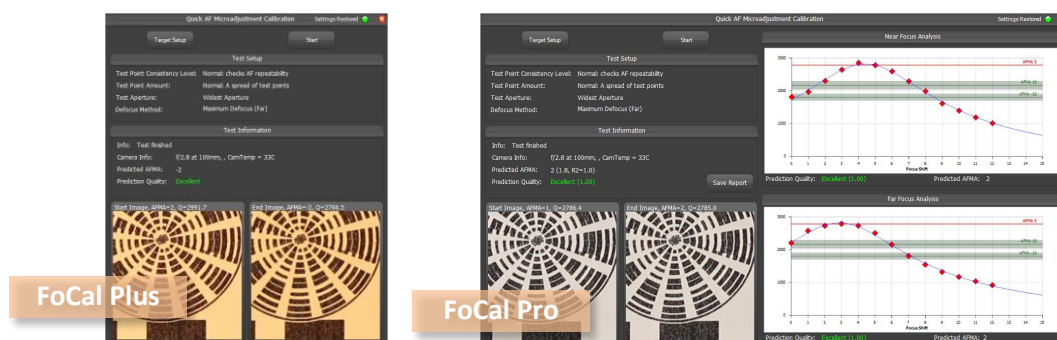


You should use the Target Setup utility to ensure the target is correctly positioned for the test.

To begin the test, click the *Start* button.

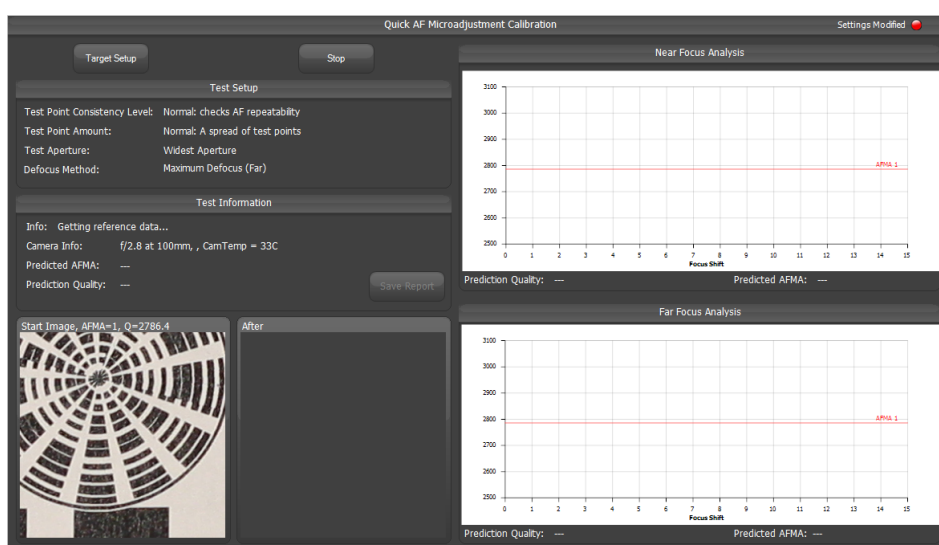
21.3 Test Operation

Once you click *Start*, the test will run to completion and give you a result in the *Predicted AFMA* field. You may be asked for up to 3 changes of AF Microadjustment/Fine Tune – only 2 changes are required for the test, and the third one is so an image can be captured using the final setting and shown once the test is complete.

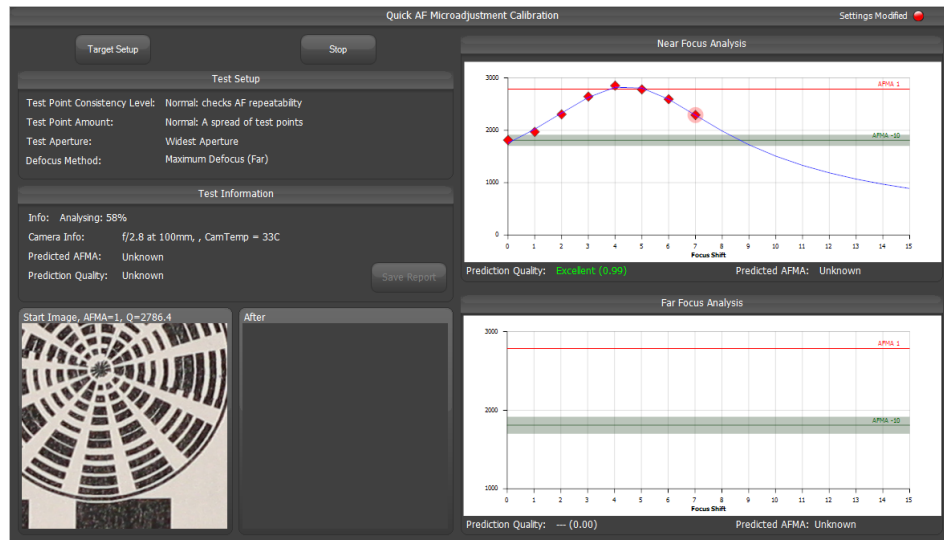


21.4 Interpretation of Chart Information (FoCal Pro)

The test runs in a number of phases. First, it will determine the quality level of the currently set AF Microadjustment/Fine Tune value in the camera so as to be able to present you with a starting image:



Next, the test will change the AF Microadjustment/Fine Tune to a specific value and capture some data from this point (if you are using an MSC mode camera, you will be asked to change the AF Microadjustment/Fine Tune value at this point).

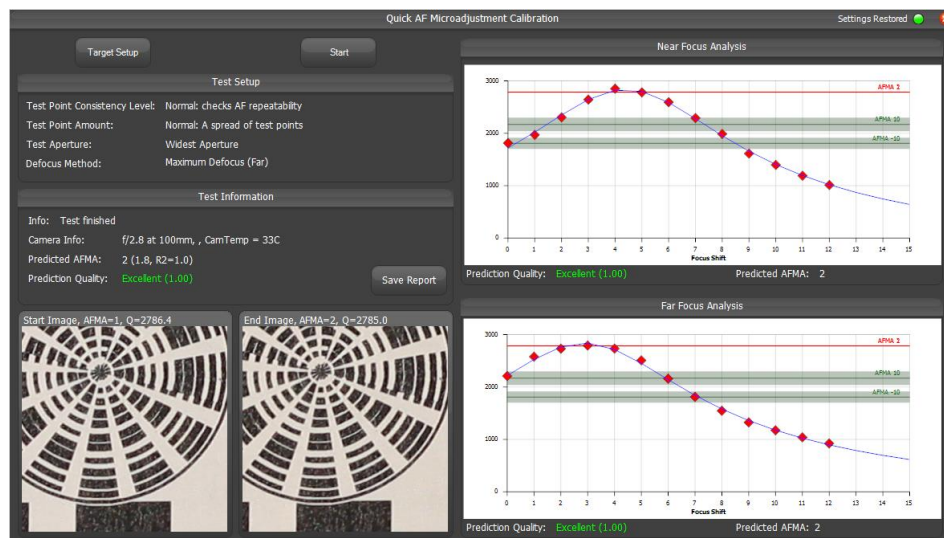


The Quality of Focus value for the specified show will be shown with the green bar in the top and bottom window (the thickness of the bar will depend on the *Test Point Consistency Level* setting).

As this step runs, you will see the quality level displayed on the top graph as the lens is shifted through the best focus position.

Note that you will NOT see any result information at this point.

The above step is then repeated with the second AF Microadjustment/Fine Tune value, and the results will be shown in the same way but on the bottom graph:



Once there are a few points on the bottom graph, you will start to get a result shown, and when all the data is captured the final result will be available.

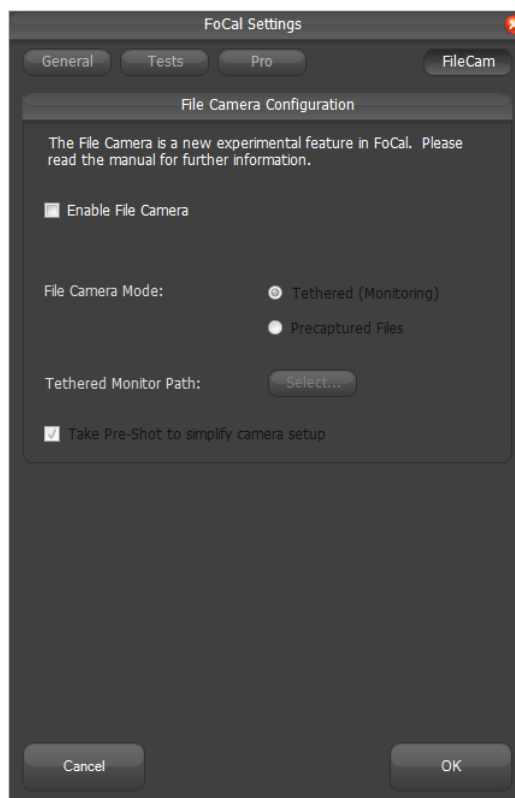
22 File Camera

The *File Camera* is a camera type which gives FoCal the ability to read image files either from a tethered camera (connected by USB, Ethernet, WiFi or any other means but running tethering software outside of FoCal) or captured manually before the test is run.

22.1 Enabling the File Camera

The File Camera is a new feature in FoCal and as such should be considered experimental. It has been developed and tested with a variety of cameras but will be improved and changed over the next few releases.

As an experimental feature, the File Camera is disabled by default. In order to enable it, open the Settings window, go to the File Camera tab and click the Enable button:



22.1.1 Supported Tests

File Camera can currently be used with the following tests:

- Fully Automatic AF Microadjustment
- Aperture Sharpness
- Focus Consistency

Support will be extended in future versions.

22.2 Tethered Mode

In *Tethered Mode*, the File Camera will prompt you to manually set up the camera and take a shot. FoCal will then wait for the shot to be received on the computer by your tethering software (which can include hardware such as an Eye-Fi card) and proceed to analyse then request the next shot.

22.2.1 Selecting Tethered Mode

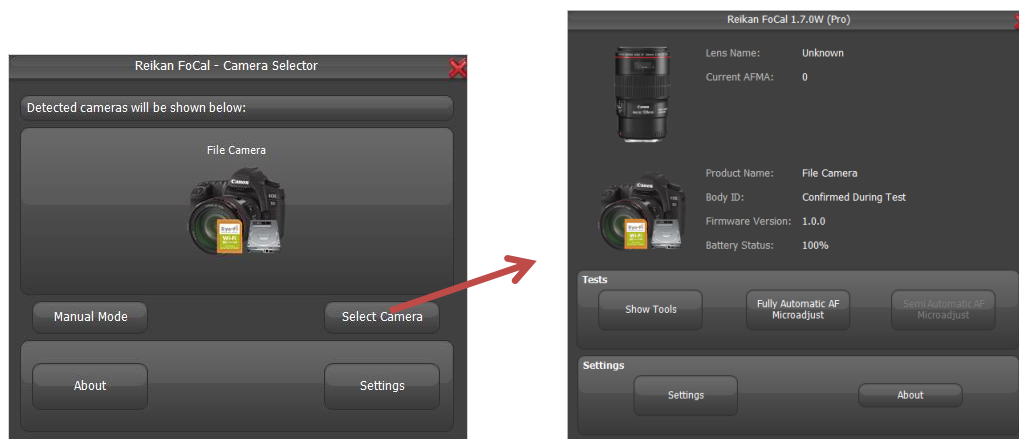
You can enable Tethered Mode by clicking the *Tethered (Monitoring)* button in the Settings window (see above).

You should then specify a directory where any captured images will be transferred to – this will be configured in your tethering software and you should set FoCal to monitor this directory.

If you enable the *Pre-test shot to simplify setup* checkbox, FoCal will prompt you to take a shot at the start of the test which will be used to determine the current state of the camera, and only settings which need to be changed will be indicated.

22.2.2 Opening the File Camera

Once the File Camera is enabled, you need to open it as if you were connected to a real camera. You need to make sure you have no other cameras connected, then when you return to the Camera Selector window you should see the File Camera shown. You can open it in the same way as a real camera:



22.2.3 Starting a Test

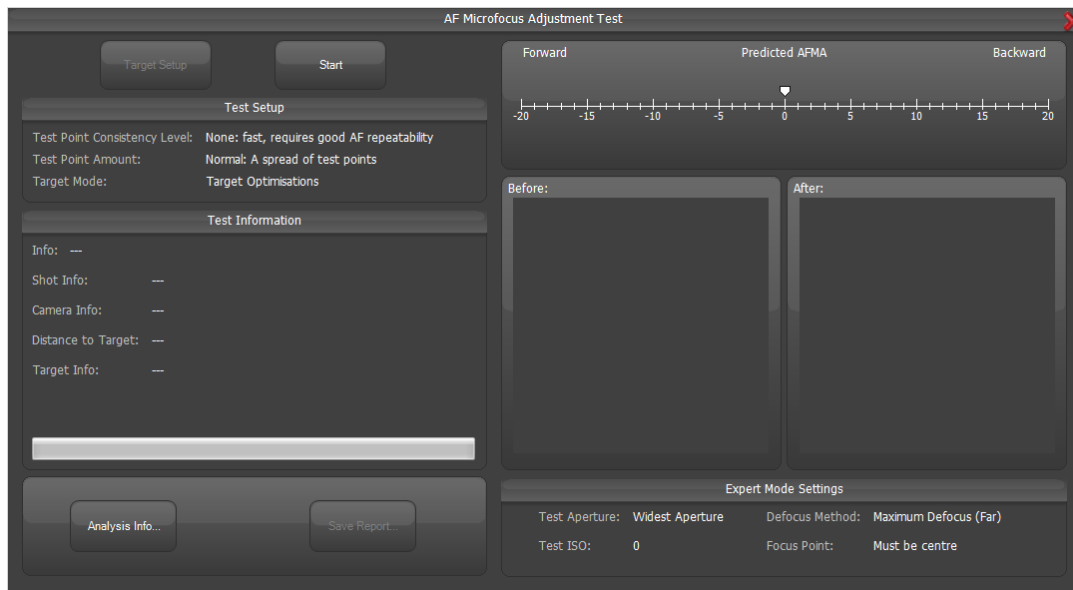
With the File Camera opened, you can start a test in the same way as you would with a real camera.

22.2.4 Fully Automatic Test Example

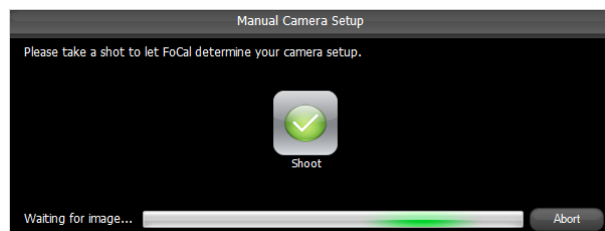
In this example, we will show how to use the File Camera in Tethered Mode for a Fully Automatic AF Microadjustment Test.

- Set up the File Camera to be in Tethered Mode, with the *Pre-test shot to simplify setup* checkbox ticked (see 22.2.1).
- Ensure your tethering software is correctly set up – take a test shot and make sure it appears in the appropriate folder (for example, with an Eye-Fi card you need to use the Eye-Fi utility to configure the card for the WiFi network and destination folder and set the camera to JPEG mode before a transfer will happen).

With the File Camera opened, click the *Fully Automatic* button on the test screen to open the test window:



Click the *Start* button to start the test:



With the *Pre-test shot to simplify setup* option enabled, the first request will just be to take a shot so the current state of the camera can be determined. This will transfer over to the computer, FoCal will analyse the image and tell you how to set up the camera for the next shot:



The icon indicates which setting should be adjusted (see section 22.2.5 for the list), and the text underneath indicates the value to apply to the setting or other information.

Set up the camera as specified in the image. You should also ensure you use Mirror Lockup and a timer mode (or a remote release cable) if you have these features on the camera. Then take the shot.

FoCal will continue to analyse the shots as you take them, and after the first shot the setup display will become very simple with only one or two icons indicating a change of one setting.



The results will be calculated as the test runs in the same way as if you were using a real camera.

22.2.5 Tethered Mode Setup Icons

The icons used in tethered mode have the following meanings:

	Enable AF (on the lens), or set the AF Microadjustment/Fine Tune value as requested
	Set the aperture as requested
	Set to Aperture Priority Mode
	Setup the Shutter Button as requested
	Set the focus as requested
	Defocus the lens
	Set Exposure Compensation as requested
	Enable all focus points
	Set ISO as requested
	Set the image quality to best quality JPEG
	Set the White Balance to Kelvin, and the value as requested
	Set the Metering Mode to Evaluative/Matrix
	Set the Metering Mode to Spot
	Enable the timer or use a remote release
	Set the shooting mode to single shot
	Take a shot

22.3 Precaptured File Mode

In *Precapture File Mode*, you capture a set of files appropriate for the test and FoCall will pick and analyse appropriate files.

For the tests supported you need the following file sets:

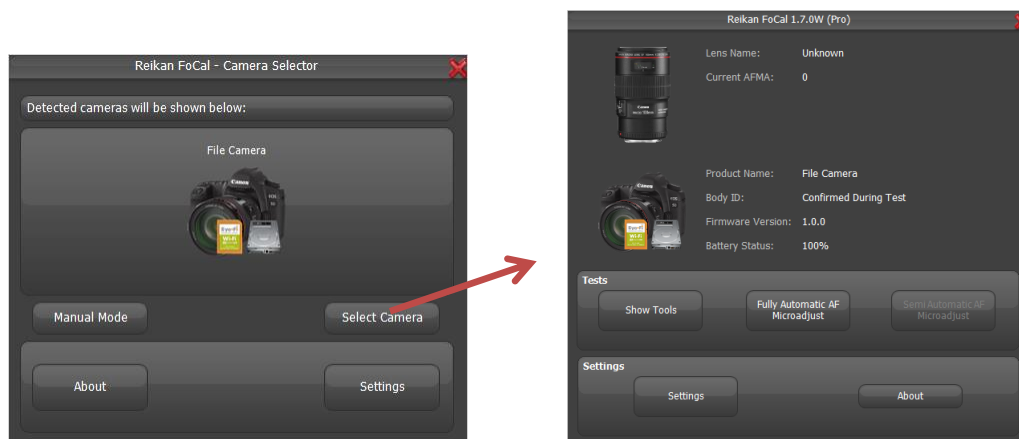
- Fully Automatic requires a spread of AF Microadjustment/Fine Tune values
- Aperture Sharpness requires a spread of Aperture values
- AF Consistency requires all settings to be the same for single AFMA mode, or a spread of AF Microadjustment/Fine Tune values in AFMA Range mode.

22.3.1 Selecting Precaptured File Mode

You can enable Precaptured File Mode by clicking the *File Read Mode* button in the Settings window (see above). There are no other settings to configure for this mode.

22.3.2 Opening the File Camera

Once the File Camera is enabled, you need to make sure you have no other cameras connected, then when you return to the Camera Selector window you should see the File Camera shown. You can open it in the same way as a real camera:



22.3.3 Starting a Test

With the File Camera opened, you can start a test in the same way as you would with a real camera.

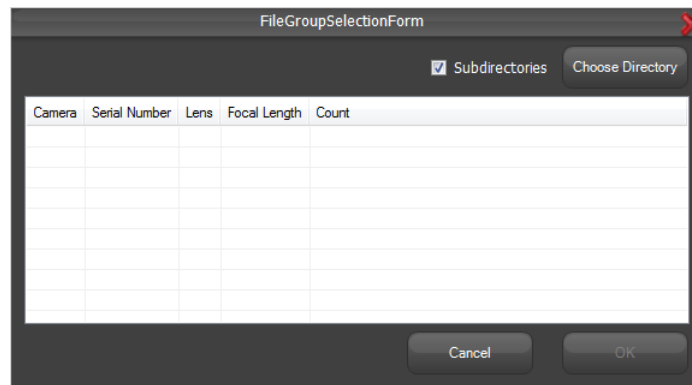
22.3.4 Aperture Sharpness Test Example

In this example, we will show how to use the File Camera in *Precaptured File* mode for an Aperture Sharpness Test.

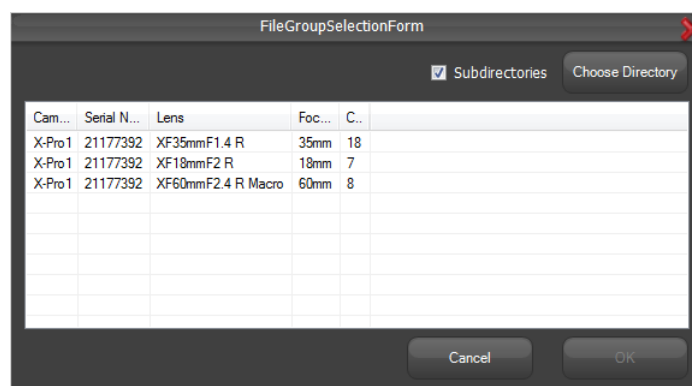
First set up your camera on a tripod, aimed at the FoCal target. Prefocus the camera as best as possible and switch to Manual Focus mode, then take a series of shots across the aperture range using a remote release or timer mode to avoid shaking the camera.

Remove the card from the camera and insert it into the computer running FoCal.

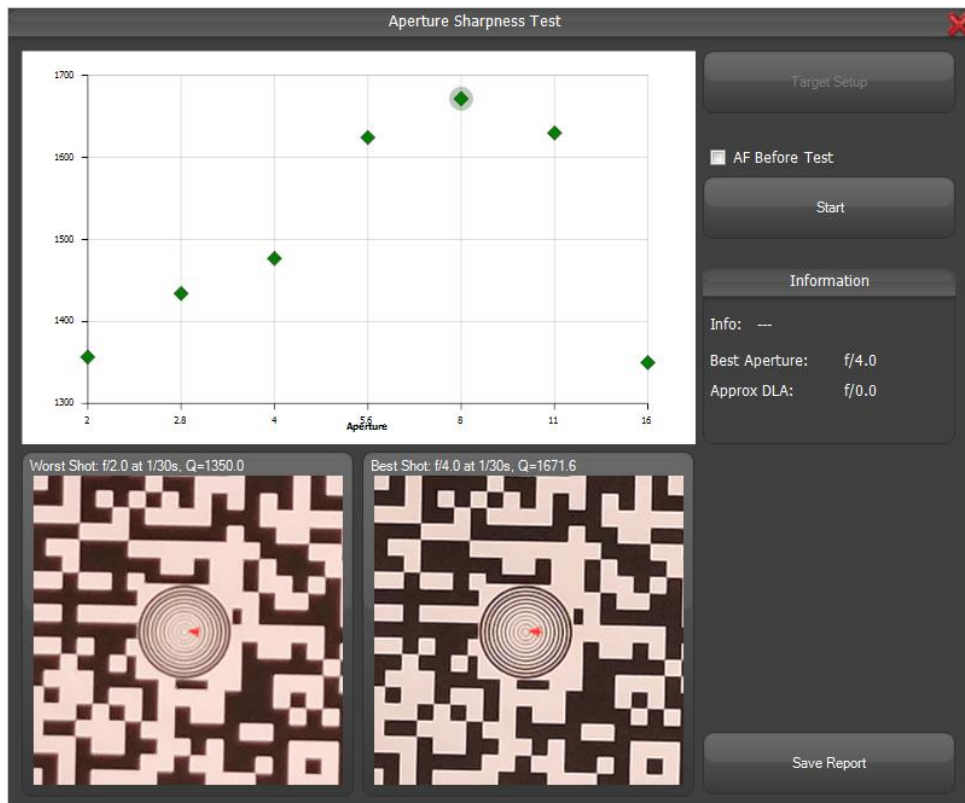
Open the File Camera as explained above, then choose the Aperture Sharpness test and click *Start*. You will be presented with the file group selection window:



Use the *Choose Directory* button to select the directory containing your image files – the directory chooser will open in the last selected location. The files which are appropriate to the test will be determined and grouped together:



Select a group of files by clicking the line and choosing *Accept*. The test will then start running as if a real camera was connected, and you will get the results as the test progresses:



23 Manual Setting Change Mode

In order to completely automate some of the tests in FoCal (namely the Fully Automatic AF Microadjustment Test, the Semi-Automatic AF Microadjustment Test and the AF Consistency Test), the software needs to be able to adjust the AF Microadjustment/Fine Tune setting of the camera.

Unfortunately, Nikon have removed the ability to control this setting from the computer since the release of the D300s in July 2009 and Canon have also removed it from the EOS 5D Mark III and EOS-1D X.

In order to get around this issue, FoCal automatically switches to *Manual Setting Change* (MSC) mode for these cameras. In this mode, you are required to make the AF Microadjustment/Fine Tune change to the camera using the buttons/menu on the camera itself when FoCal informs you to make the change.

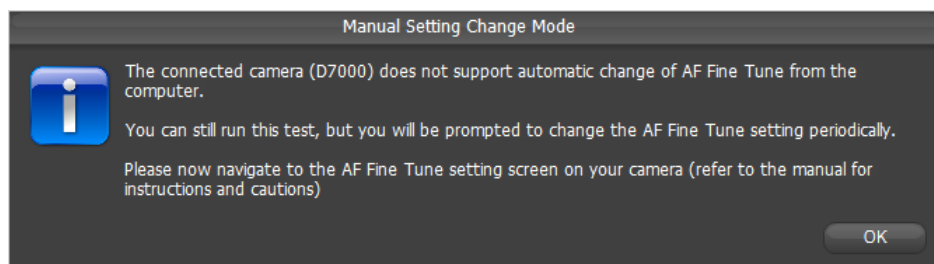
Although this detracts from the completely automatic nature of FoCal, you still get the huge benefits of focus consistency checking and picking a validated representation of the AF result, validation of test environment as the test runs and statistical analysis and prediction as the test runs in order to quickly and definitively find the best AF Microadjustment/Fine Tune result.

23.1 Target Optimisation (FoCal Pro only)

Target Optimisation acts like Image Stabilisation and allows FoCal to compensate for small movements during analysis. If you are using FoCal Pro, it is strongly recommended that Target Optimisation is enabled for cameras running MSC mode. See section 7.8 for further information.

23.2 MSC in use

When you start a test with a camera that must be used in MSC mode, you will see the following information message when you start the test:



You should continue to use the test as normal, but when the AF Microadjustment/Fine Tune value needs to be changed, you will see the following message:



The value shown in the message box is the value you should apply (see next section for details). **It is very important that you do this as carefully as possible so as not to move the camera during the test.**

The following sections show step-by-step details on how to set up and change the AF Microadjustment/Fine Tune values for both Nikon and Canon cameras.

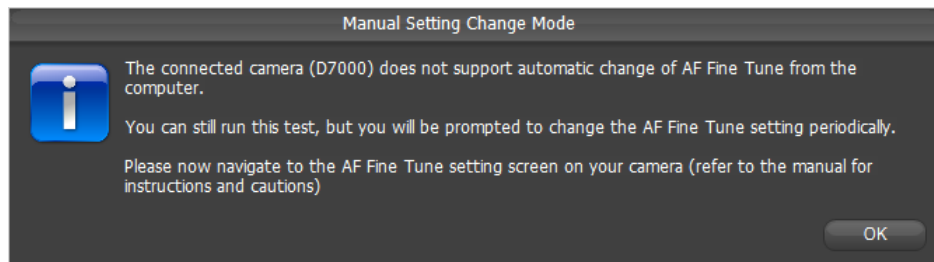
FoCal 1.7 introduces the new Camera HotKey feature which simplifies MSC operation – for further information see section 23.3.3 for Nikon and section 23.4.3 for Canon.

23.3 Adjusting Nikon AF Fine Tune

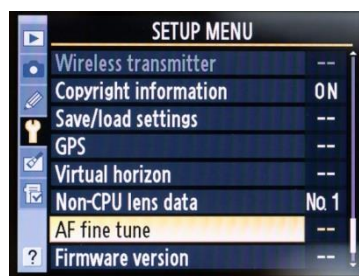
MSC mode is used for certain Nikon cameras. The following screenshots show you how to set the AF Fine Tune value on the camera (these instructions are for the D7000, but they should be very similar for other Nikon cameras that are used in MSC mode):

23.3.1 Setting up (BEFORE THE TEST):

When you see this message on FoCal, you should follow the steps in this section:



First, press the “Menu” button and navigate to the Setup Menu. Close to the bottom of the list is the AF fine tune entry:



Click this and you will see the following screen (assuming AF fine tune is OFF):



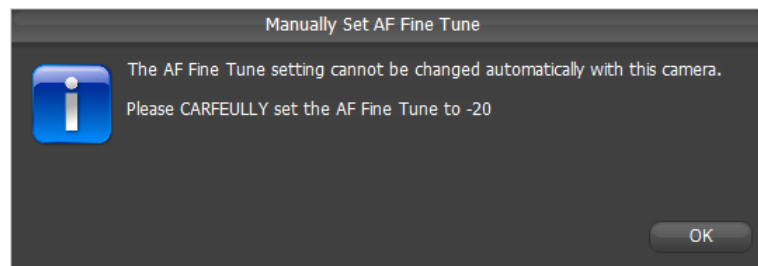
Click on the AF fine tune (On/Off) line and select On:



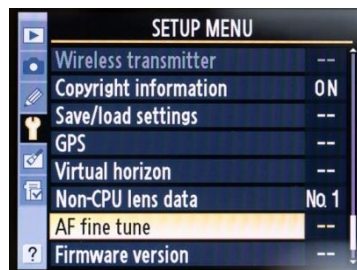
You are now set up ready for the test to run.

23.3.2 Adjusting (DURING THE TEST)

When you start the test, you will see messages like this appearing periodically:



When this happens, go to the camera and press the Menu button – you should appear at this point (assuming you followed the setup steps above):



Click the AF fine tune entry, scroll to Saved value:



Click OK, and you will see the adjustment screen:



Using the up and down arrows, change the value in the box to match the value requested by FoCal, then click OK (in this example, the camera is set to -12).



Once this is done, you can click OK in the FoCal message and the test will continue.

Remember to be very careful with the camera when you do this – try to avoid moving the camera at all.

23.3.3 Nikon Camera HotKey

Please note – the Camera HotKey feature is new and although it has been tested with a wide variety of cameras there may be problems with certain modes (either not responding to the key or falsely triggering when no key is pressed). If you are seeing odd behaviour, please disable the Camera HotKey function in the Settings window (see section 25.2.9).

In order to continue the test in MSC mode, you must tell FoCal that you have entered the new AF Fine Tune value into the camera. You can do this by clicking OK on the dialog box or pressing Enter on the computer, but you can also use the camera HotKey if enabled.

On Nikon cameras, this is the AE-L/AF-L button, shown below:



Once you have entered the correct AF Fine Tune value on the camera, press and hold the AE-L/AF-L button until the dialog disappears from the computer (you will also see the LCD display on the camera flicker a few times). There will be a short delay to let the camera settle once you have taken your finger off the button then the test will continue.

This saves you having to return to the computer after you have entered a new AF Fine Tune value.

*Note: The Camera HotKey feature will only work if the functionality of the key has not been remapped. For Nikon cameras, whichever key actions the **AutoExposure Lock** function will act as the HotKey.*

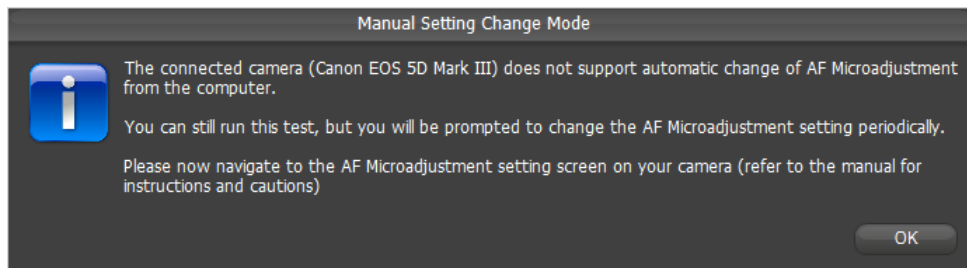
23.4 Adjusting Canon AF Fine Tune (5D Mark III)

MSC mode is used for the 5D Mark III – it is hoped that when the Software Development Kit is released by Canon (mid May 2012) that the camera will be able to be fully controlled.

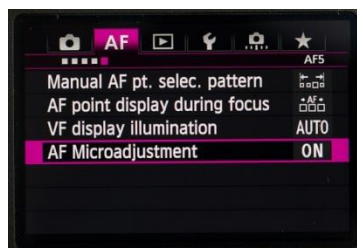
The following screenshots show you how to set the AF Fine Tune value on the camera:

23.4.1 Setting up (BEFORE THE TEST):

When you see this message on FoCal, you should follow the steps in this section:



First, press the “Menu” button and navigate to the AF-5 Menu. Select the AF Microadjustment entry with either the wheel or the joystick:



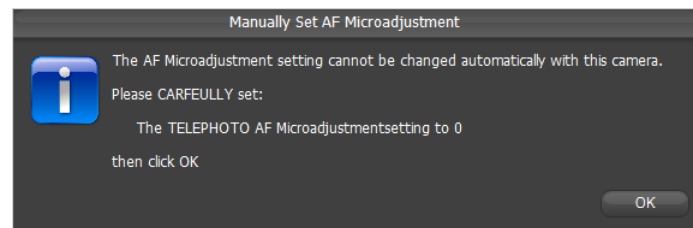
Click SET and you will see a screen similar to the one below (it will depend on which lens you have attached as to what you actually see). Ensure you select *Adjust by lens*:



You are now set up ready for the test to run.

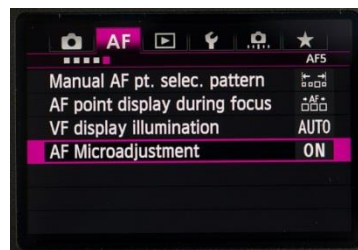
23.4.2 Adjusting (DURING THE TEST)

When you start the test, you will see messages like this appearing periodically:



If you are calibrating a zoom lens, you will be told by FoCal to set the wide, telephoto or both settings as appropriate. For a prime lens (fixed focus), there is only one setting available.

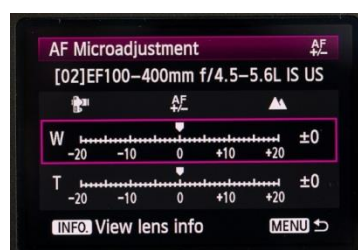
When this happens, go to the camera and press the Menu button – you should appear at this point (assuming you followed the setup steps above):



Click SET on the AF Microadjustment entry:



Then click INFO.:



The above example shows the entries for a zoom lens on the 5D Mark III. Choose either W (if you are at the wide end of the zoom setting), or T (if you are at the telephoto end) – as instructed in the FoCal message box - and click SET:



Dial in the value specified in the software, then click SET again. Finally, click OK on the window on FoCal and the test will continue.

Remember to be very careful with the camera when you do this – try to avoid moving the camera at all.

23.4.3 Canon Camera HotKey

In order to continue the test in MSC mode, you must tell FoCal that you have entered the new AF Microadjustment value into the camera. You can do this by clicking OK on the dialog box or pressing Enter on the computer, but you can also use the camera HotKey if enabled (see section 25.2.9 for the setting to enable/disable this feature).

On Canon cameras, this is a change in Aperture or Shutter Speed value with one click of the top scroll wheel on the camera:



Once you have entered the correct AF Microadjustment value on the camera, move the top wheel one click round to change the Av/Tv value – note that the value must be *changed* for the computer to notice so if the camera is set to one end of the range you must move the wheel in the direction to change the value. The MSC mode request window will disappear and after a short delay to let the camera settle, the test will continue.

This saves you having to return to the computer after you have entered a new AF Microadjustment value.

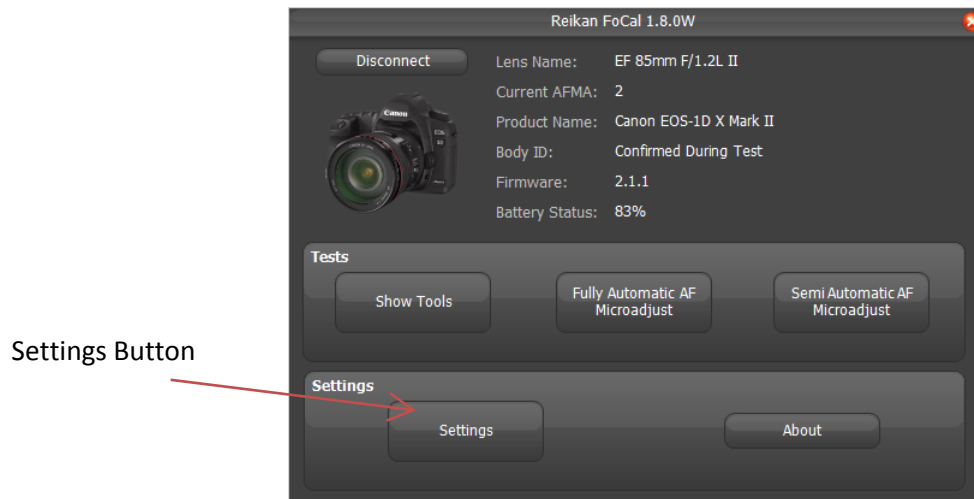
24 Settings Adjusted during Testing

To help with restoring the camera in the case where the settings are not automatically restored, the following settings may be modified during the test:

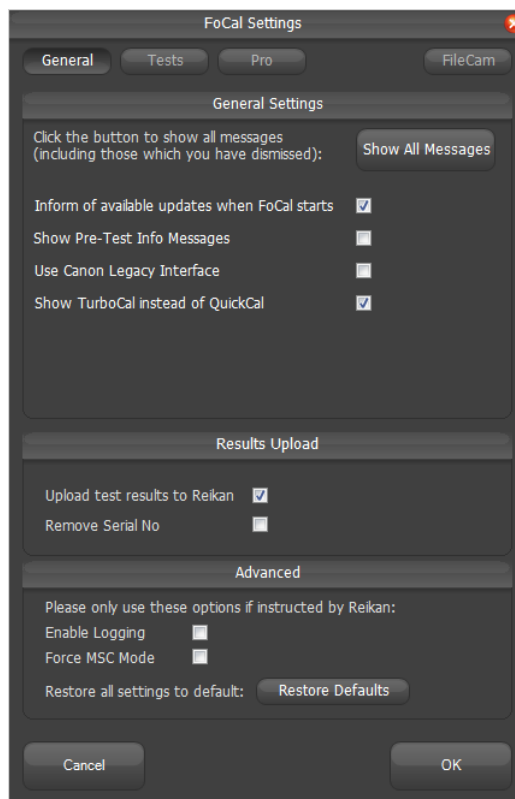
- Image Size (e.g. RAW, Large JPEG/Small JPEG)
- Image Quality (e.g. Fine, Basic)
- Aperture
- Shutter Speed
- ISO
- Metering Mode
- Exposure Compensation
- Drive Mode (e.g. single shot)
- Mirror Lockup (custom function on most Canon cameras)
- Shutter button operation (custom function on Canon)
- White Balance
- Colour Temperature (usually available when White Balance set to K)
- Picture Style

25 Program Settings

Settings for the software are accessible from either the main Test window, or by pressing the “,” (comma) key when most windows are open:



Choosing **Settings** will open the Settings window:



Note: The *Pro* button is only available in FoCal Pro.

25.1 General Settings

25.1.1 Show All Messages

Some information messages in FoCal can be dismissed. If you wish to reset this and show *all* messages (with the option to dismiss selectively as they are shown again), click the **Show All Messages** button. This button is only active if some messages have been dismissed.

25.1.2 Inform of available updates when FoCal starts

If this option is checked, FoCal will check for and notify you of available updates when the program starts. If enabled, a notification will be shown only once in a day.

25.1.3 Show Pre-Test Infor Messages

Before a test is run, FoCal validates certain settings on the camera to ensure the test *can* be run. There are some settings that cannot be checked (e.g. Image Stabilisation being enabled on a lens) so an information message is show.

This message is shown every time a test is started, and when you are familiar with FoCal this can be unnecessary information. By unchecking this box, you can disable the display of information messages.

If there is a confirmed reason why the test will not run (e.g. Exposure mode is incorrect and needs to be changed by the user) then a message will still be shown.

25.1.4 Use Canon Legacy Interface

Canon regularly update the interface files, and FoCal uses the latest available version of this component. However, with updates Canon drop support for older cameras.

If you are having problems with older cameras such as the Canon EOS-1D Mark III and Canon EOS-1Ds Mark III, you can tick this box to use an older version of the Canon interface files.

You will need to restart FoCal for this change to take place.



Note that if this option is enabled, support for the Canon EOS 6D will not be available, and the Canon EOS 5D Mark III and Canon EOS-1D X may not operate correctly.

25.1.5 Show TurboCal instead of QuickCal

TurboCal is a shutterless analysis method introduced in FoCal 1.8, but it only works with Canon cameras. If you connect a Nikon camera, the TurboCal option will be disabled.

By unticking this option, you can choose to use the *QuickCal* test. This test, however, is less reliable than both the TurboCal and Fully Automatic test and it is generally recommended that you use the Fully Automatic test.

25.1.6 Upload test results to Reikan / Remove Serial No

If this option is ticked, when you run a successful Fully Automatic AF Microadjustment test, Aperture Sharpness or AF Consistency test, your results will be uploaded to Reikan. **This does NOT include any images** – just numerical results from the tests.

We have had many requests from people asking if their lens behaves “normally”. The plan for future versions of FoCal is to build up information about the behaviour of various lenses and camera bodies in order to be able to say how *your* particular setup is working in relation to the general set of cameras and lenses available.

The data will also help us at Reikan to identify and fix any potential issues with FoCal itself.

Enabling this feature is entirely optional, but it would be very useful if you could enable it. The only unique identifier we collect is the camera serial number (purely to identify if there is certain behaviour among batches of cameras) – all other data is completely anonymous test results (e.g. aperture, shutter speed, focus quality etc for the test points).

If you are concerned about security, to make the data *completely* anonymous you can tick the *Remove Serial No* button which will stop the serial number being set to Reikan. We would appreciate it if you did *not* tick this box as it leaving it empty allows us to identify behaviour among batches of cameras (those with close serial numbers), but the option is there should you wish to upload data but not be identified.

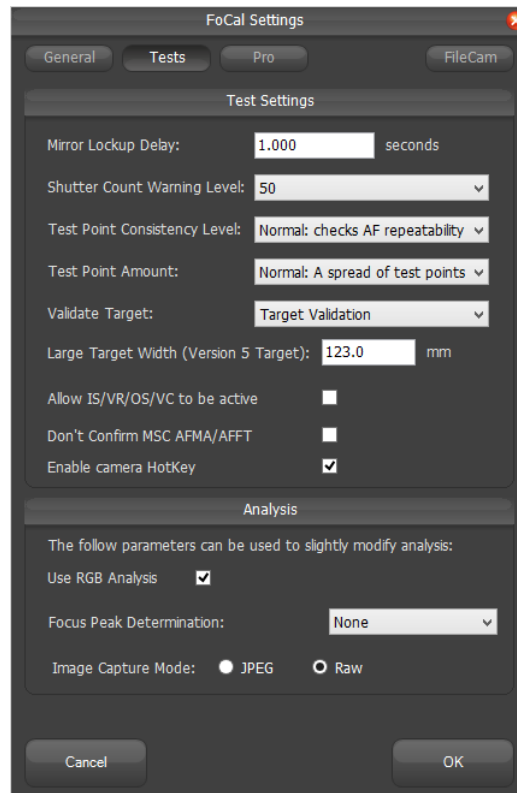
The data is compressed and coded for efficient transfer over the internet and to allow us to validate the data so no bogus data is entered into the database.

25.1.7 Advanced

The advanced options should only be used if instructed by Reikan – these options may have unintended side-effects and cause incorrect program operation if used incorrectly.

25.2 Test Settings

Clicking the **Tests** button at the top of the window will show the Test settings.



25.2.1 Mirror Lockup Delay

The test runs with Mirror Lockup enabled - this is where the mirror is lifted some time before the shutter is fired. The mirror movement can induce vibration in the camera, so the idea is that the mirror is lifted and the delay allows all vibration to settle before the shutter is fired (which vibrates the camera much less) – therefore leading to sharper pictures.

The value in the settings window allows setting of the time between the mirror being lifted and the shutter being fired. It is set to 1 second by default.

Note that this feature is not supported on some cameras (Canon EOS-1D Mark III and EOS-1Ds Mark III), and for those cameras the *Mirror Lockup Delay* field will be ignored.

25.2.2 Shutter Count Warning Level

Due to the iterative nature of the test, it is possible (although very unlikely) that the test may get stuck in a situation where it cannot arrive at a result but continuously tries.

In order to avoid the situation where the test fires unnecessary shutter actuations, when the shutter actuation count reaches the Shutter Count Warning Level, the test will alert the user and allow you to carry on or stop the test.

25.2.3 Test Point Consistency Level (Fully Automatic AFMA Test)

The AF systems of modern cameras are pretty good at consistently focussing at the same point when the conditions do not change, but there are instances where the result can be incorrect. Have you

ever taken a shot where the focus confirmation light/beep has fired, but the shot is quite out of focus?

If this situation occurs during an analysis test like the AF Microfocus Adjustment test, it can disturb the results and end up with the wrong value being chosen.

In order to mitigate this situation, the software can be set to repeat focus and verify that the values are consistent before moving to the next test point. This will make the test take longer, but will increase the accuracy of the test result.

The options available are:

None: fast, requires good AF repeatability

This setting takes a single shot at each test point and assumes the AF reliability is good for all points. In good light, with a camera that is known to focus well, this option should work without issue.

Normal: checks AF repeatability (default)

This setting takes multiple shots until some repeatability is obtained – typically this is just 2 shots, but if an error occurs the shot count will increase. If the values are wildly different across all shots, the test will terminate.

Tight: strict AF repeatability required

This setting is the same as above, but the limits for repeatability are tighter. This will give the most accurate results, but any slight variation in AF on each point may make the test fail.

25.2.4 Test Point Amount (Fully Automatic AFMA Test)

When the fully automatic AFMA test is executed, it takes shots at a number of different AFMA points to determine the best value. If few points are chosen, more reliance is placed on the prediction algorithm – this saves shutter actuations but may result in sub-optimal AFMA values.

Few: Fast but less accurate results

As few points as is possible are used. If the prediction algorithm cannot reliably predict a value, more points will be automatically added, but the quality of the overall result will be lower. This option generally uses the fewest shutter actuations.

Normal: A spread of test points (default)

The normal setting uses slightly more than the minimum amount of points to get better performance from the prediction algorithm. Again, if no reliable result can be predicted during the test, more points will be automatically added.

Many: A high number of test points

This setting uses the highest number of points and should give the most accurate result, but is often unnecessary.

25.2.5 Validate Target

When used with the special FoCal target, the software can validate the test setup to ensure the test will be as reliable as possible.

No Target Validation

If the test is run with a different target than the FoCal target, you will need to select this option. If you have problems with detection of the FoCal target, you could also try this if you are sure the setup is correct.

Target Validation

With this option, the software will check the location and setup of the target in relation to the camera ensure it is straight, upright, parallel and in the right place for the test to perform as well as possible. This reduces the change of an incorrect result due to incorrect target setup.

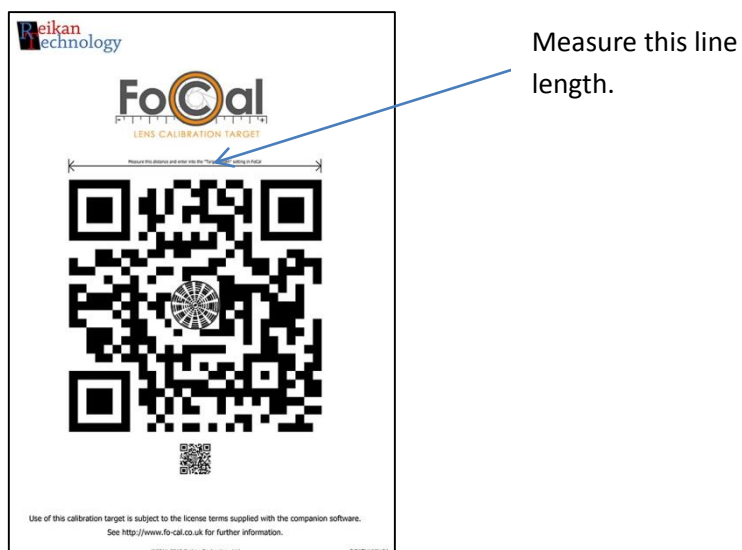
Target Optimisations (FoCal Pro only)

This setting allows the analysis routine to make minor adjustments to the analysed image in order to get the best, most repeatable results. See section 7.8 for further information.

25.2.6 Large Target Width

With the new Version 5 PDF target supplied with FoCal 1.5, you can print the target at any size you wish without any loss of quality.

In order to accurately calculate the distance between the camera and the target, FoCal needs to know the dimensions of the target. You should carefully measure the length of the top of the large target from left side to right side (as indicated by the arrow on the top of the target image), and enter this into the Large Target Width setting:



Once this is entered, FoCal will be able to calculate the distance between the camera and the target for both the large and small target on the page.

If you print the full PDF on either A4 or US Letter paper, the default value of 123mm is acceptable and does not need to be changed.

25.2.7 Allow IS/VR/OS/VC to be active

With this option ticked, you will not be warned about any lens image stabilisation, and no validation will be performed to check whether it is enabled or disabled.

This will allow comparisons of performance with and without stabilisation to determine if there are any issue with the lens stabilisation hardware.

25.2.8 Don't Confirm MSC AFMA/AFFT

Normally in MSC mode (where the user must change the AF Microadjustment/Fine Tune setting on the camera when prompted by the software), the applied value is verified after the test shot is taken to catch the situation where an error was made entering the value requested by FoCal.

Some cameras have firmware issues which can mean the value is misreported by the camera and FoCal will not let you continue the test. If this happens, you can tick this checkbox and FoCal will ignore the AF Microadjustment/Fine Tune value set in the camera.

Use this option with caution and ONLY if absolutely necessary. Where firmware issues are known about (e.g. the Nikon D300), FoCal automatically ignored the in camera value, so this option should not normally be set for any camera.

25.2.9 Enable Camera HotKey

When running with a camera in MSC mode, you can use a special button on the camera in order to confirm that you have set up the camera appropriately.

For Nikon cameras, this is the AF-L/AE-L button (see section 23.3.3 for an example).

For Canon cameras, this is a half-press of the shutter button (see section 23.4.3 for an example).

25.2.10 Use RGB Analysis

This option (selected by default) uses the newer RGB Analysis algorithm (see section 8 for further information).

If you uncheck this box, the original algorithm (from FoCal 1.9.2 and earlier) will be used.

25.2.11 Focus Peak Determination

Optionally run an additional step at the beginning of the Fully Automatic AF Microadjustment Calibration and AF Consistency Test to determine the highest possible value that can be achieved during the test. This will almost certainly give a better result than any single phase-detect or contrast-detect focus operation by the camera.

None

If this option is set to None, all tests will run as normal and there will be no additional step at the start of the test.

Live

In *Live* mode, the software will use LiveView analysis to determine the optimum position of the best focus. This mode is relatively quick – usually completing the focus operation within about 10 seconds – and should get a result within 5% of the maximum peak possible.

Predicted

In *Predicted* mode, the software takes a series of shots at various focus shifts and uses the mathematical model to predict the best focus value. This will generally result in a more accurate value than *Live* mode, but takes 20-30 seconds and 5 shots before the test starts.

This feature may be disabled for some cameras.

25.2.12 Image Capture Mode

Up to and including FoCal 1.7, all analysis was performed on JPEG images from the camera. These images have undergone unknown processing by the camera – including but not limited to demosaicing, vignette and distortion correction, sharpening, contrast adjustment and dynamic range correction. While FoCal has always tried to reduce the effects of this processing by adjusting the camera appropriately, the analysis of JPEG images will always be less than optimal.

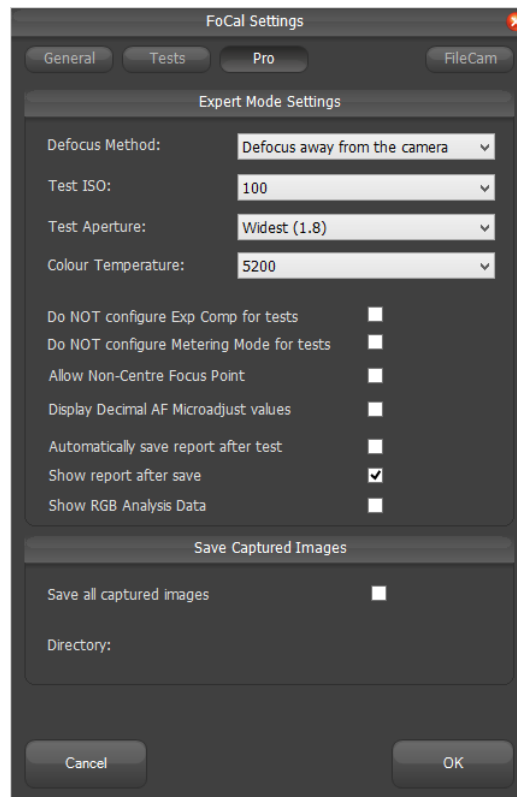
Beginning with FoCal 1.8, analysis can now be performed on RAW images from the camera. This means the RAW data about light levels at the sensor is transferred from the camera to FoCal. A special demosaicing routine is then used which is optimised for FoCal's analysis of Autofocus performance, and this image is then analysed.



Unless you are experiencing problems with the analysis or an excessively high memory use, you should leave the Image Capture Mode setting at RAW.

25.3 Pro Features (FoCal Pro Only)

FoCal Pro offers the user the ability to change some test parameters associated with the tests. When the *Pro* button is clicked, the window displays extra options:



25.3.1 Defocus Method

This option controls the method by which the camera defocuses the image before running the AF procedure.

Maximum Defocus (Near) and Maximum Defocus (Far)

This method defocuses the lens a long way towards infinity or towards the camera between each test point. This will force the AF system of the camera to run a full AF procedure which is more representative of real-world autofocus situations.

Maximum Defocus requires an extra shutter actuation per test point. However, for the Canon EOS-1D Mark III and 1Ds Mark III do not require any extra (with both defocus methods, these cameras require 2 shutter actuations per test point).

25.3.2 Test ISO

If the settings window is opened from the Camera Selector window, the Test ISO and Test Aperture settings will not be available. You must open the camera and choose Settings from the test screen in order that the software can know the ISO and aperture range for the current setup.

This setting adjusts the ISO at which the Fully Automatic test is performed. The default setting is 100.

Changing this value will alter the shutter speed at which the test operates at and may be required for certain situations (e.g. if there is significant mirror vibration at certain shutter speeds with certain body/lens combinations).

It is important to note that raising the ISO will increase the noise in the image, and can lead to less accurate analysis results. It is best to keep the ISO as close to the lowest value as possible.

25.3.3 Test Aperture

If the settings window is opened from the Camera Selector window, the Test ISO and Test Aperture settings will not be available. You must open the camera and choose Settings from the test screen in order that the software can know the ISO and aperture range for the current setup.

This setting adjusts the aperture used for the Fully Automatic test. The default setting is *Widest*.

It is generally suggested that the best aperture for an AF microadjustment calibration test is with the lens open widest – this will give the shallowest depth of field and the biggest difference in analysis results for each test point.

However, under some situations, the analysis may not work optimally at widest aperture – particularly with lenses that are very soft or exhibit strong aberrations at widest aperture.

If this setting is changed, it is best to run as close to wide open as possible.

25.3.4 Colour Temperature

In order to reduce errors caused by slight changes in the camera's determined white balance, FoCal now runs with a pre-set colour temperature, defaulting to 5200K.

If you are lighting the target with Tungsten lights, you may want to change this value to around 3500K to better match the light source.

25.3.5 Do NOT configure Exposure Compensation

By default, FoCal will choose an appropriate exposure compensation to match the content of the target. However, if you find the exposure is incorrect (e.g. the images are too bright and showing signs of degradation), you can tick this box.

When ticked, FoCal will NOT change the exposure compensation and will run with whatever you have set on the camera at the start of the test.

25.3.6 Do NOT configure Metering Mode

Similar to above, FoCal chooses an appropriate metering mode for the test in question.

If you tick this box, the metering mode will not be changed and the test will run with whichever metering mode is set on the camera at the start of the test.

25.3.7 Allow Non-Centre Focus Point

If this option is enabled, the tests can be run with a focus point other than the centre point.

There are a number of good reasons for using the centre focus point:

- It is the most accurate focus point within the AF system (it may be the same accuracy as others, but there are no other more accurate points)
- Light hitting the middle AF sensor travels through the centre of the lens which is optically the best line to take, so you are calibrating the AF system and not being affected by any lens imperfections

However, sometimes there is a reason to use off-centre focus points, and by ticking this box you will be able to do so. You can either select the focus points manually, or use the Target Setup utility to select focus points (Canon cameras only) – see section 9.3.

When this option is enabled, various tests will show warning indicators to ensure you are aware that an off-centre focus point is being used.

Note that the analysis in the Fully Automatic and Semi Automatic tests will occur at the specified focus point. If you select an off centre focus point, you should realign the camera so the centre of the target is over that newly selected focus point for best results.

25.3.8 Display Decimal AF Microadjustment values

The analysis and prediction algorithm introduced in FoCal 1.6 can determine the AF Microadjustment/Fine Tune value to a high degree of accuracy from the data obtained during the test.

Ticking this option will show the AF Microadjustment/Fine Tune value to 1 decimal place during appropriate tests.

25.3.9 Automatically Save Reports

If this option is ticked then when a test completes you will automatically be presented with the Save dialog to choose a filename for saving the report.

25.3.10 Show report after save

If this option is ticked, the saved report is automatically opened using the default PDF viewer.

25.3.11 Show RGB Analysis Data

If RGB Analysis mode is enabled, checking this box will display extra information on the charts and panels within tests. This can also be toggled within test forms with the CTRL+S key combination.

See section 8 for more information about RGB Analysis.

25.3.12 Save Captured Images

This option allows you to specify a directory where all images captured during the tests are stored.

Image saving is compatible with the following tests:

- Fully Automatic AF Microadjustment Test
- Aperture Sharpness Test
- AF Consistency Test

The images are named with the date/time, test type, camera model, serial number, lens name, focal length and relevant test information (for example AF microadjustment value or aperture value).

Please note: the saved images are full size JPEGs from the camera, but there may be some re-compression applied in the computer so whilst the image is representative of the captured image, it may not be identical to the camera shot at pixel level.

This option will stay enabled until you disable it, and each image file can be several megabytes. This feature is intended to be used when necessary, rather than left on all the time.

26 Troubleshooting

Camera Selector window just shows “Searching For Cameras...” when my camera is connected.

Please ensure the drivers are installed. On Windows 7 this should be automatic assuming you have an internet connection. On Windows XP, this requires the installation of the software from the CD that was supplied with the camera.

Tests show a Failed to AF warning

If you are using a test with a focus limiting switch, ensure it is set appropriately for the distance you are running the test at. For instance, with the Canon 100-400L IS lens, you can limit to 1.8m to infinity, or 6.5m to infinity. If it is set at 6.5m and the distance to the target is less than this, the camera will not be able to focus.

The Nikon camera does not open in FoCal

The camera USB mode in the SETUP menu must be set to PTP/MTP (and NOT Mass Storage) otherwise the camera will not correctly communicate with the computer and FoCal will not be able to open the camera.

The lens focus does not move in the Semi-Automatic mode

The Live View mode in the SHOOTING menu should be set to Tripod if available (rather than hand-held). This is an important setting to ensure correct operation of tests.

Canon EOS 5D Mark III fails to focus after using FoCal

Occasionally, the settings on the 5Dmk3 are not properly restored, and you may notice that half-pressing the shutter button does not cause the camera to focus. This is not a problem with the camera – for some tests, FoCal sets the shutter button to Metering Only in order to stop AF activation. To restore, you choose “Custom Controls” in the Custom Function menu of the camera, choose the shutter button and change the setting to “Metering and AF Start”

Target Setup locks up with the Nikon D800

There appears to be an issue with the D800 and LiveView on some USB 3.0 systems. We are unsure if this is due to the USB 3.0 controller, the cable or the camera itself. If you cannot get LiveView to operate correctly (e.g. the Target Setup utility fails to start) on a D800 and you are using USB 3.0, please change to USB 2 – you can use a standard MicroUSB cable to connect to the camera.

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