Curing Back-focus and Front-focus

All new lenses, whatever the brand, are manufactured to fit within a predetermined tolerance range. This range varies between brands and between low-end and high-end lenses (and cameras).

Having spent thousands of dollars on a new lens, the concept that it requires further adjustment to correct for focusing errors is foreign to photographers. Indeed, most professional photographers, if they experience such problems, see them as a task for their camera service centre to fix.

Focusing errors are easy to understand. They are simply variations between the sharpest point of focus determined by the camera's focus system and the actual point of focus a particular lens delivers at the image plane (i.e. at the film or sensor). Errors may be caused by calibration points of the camera's auto-focus system, electronic interfaces of the lens, misalignment of the focusing screen, reflex mirror, or image plane. Another way of looking at it is, focusing errors can be caused by discrepancies between the Image Light Path, the Auto Focus Light Path and the Viewfinder Light Path… see Fig. 1.

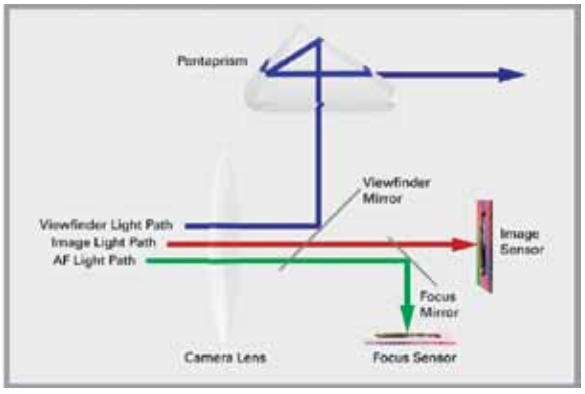

Fig.1: Discrepancies that can cause focusing errors.

The most common errors are front-focusing and back-focusing. Front-focusing error means the sharpest point of the image will be closer than (in front of) the intended focus point. Back-focusing errors result in the sharpest point being further away than (behind) the intended focus point… see Fig. 2.

This can occur when using autofocus (AF) and manual focusing.

When these errors exist, your camera will not be able to consistently deliver critically sharp, detailed images of what you are focusing on when you press the shutter button. You will however, get crisp and sharp images of things that are closer or farther away. You focus on an animal's eye and the back of its head, or its nose, is in focus! Not much help, if you are a wildlife photographer. This is the problem that Rob Galbraith www.robgalbraith.com highlighted dramatically when Canon's 1DMk3 camera was launched, and from which sales of this Canon camera never fully recovered.

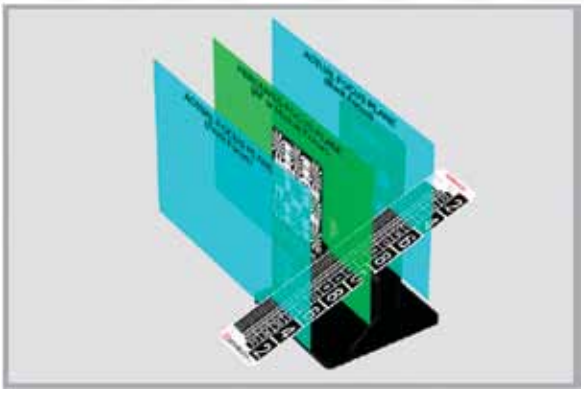

Fig. 2: Focus error results in the actual focus point being back or front focused from the perceived "in focus" point.

Precise focusing is imperative when shooting with long focal length lenses, at wide apertures, and at close distances, because depth of field is very limited (shallow).

Before you can fix focusing errors, you must be able to accurately measure the focus deviations. Once you have this information, you can correct or minimize these errors, for lenses used on that camera, by recalibrating the camera's AF micro-adjustment (built into most current advanced DSLRs). Fig. 3 shows the custom micro-adjustment function being set 15 units backwards for an EF50mm f/1.4 lens on a Canon camera.

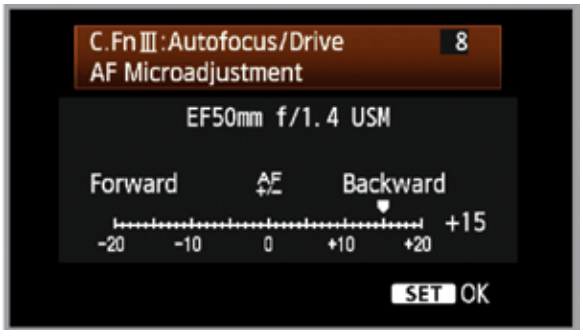

Fig. 3: AF Micro-adjustment function in Canon cameras.

A neat feature of this function is that once the recalibration is done, it is retained in the camera's memory. When you fit that lens again, the adjustment for that camera/lens combination is automatically activated. Some things in life are free!

Measuring Tools

There have been a number of 'home-brew' attempts to measure out-of-focus errors, all of which have severe limitations or are virtually useless. In my opinion the only precision and certified-for-accuracy hardware based tool worth considering is the LensAlign Focus Calibration System www.lensalign.com

All you need to use this tool are two tripods, a little time, and the computer you normally use for viewing your images.

Fig. 4: LensAlign Pro Plus Ready for Use

There are three versions of the tool, namely LensAlign Lite, – the entry level unit; LensAlign Pro – the heart of the system, and LensAlign Pro Plus – same as LensAlign Pro but includes a long (1200 mm) ruler kit. Fig. 4 shows my LensAlign Pro Plus unit set up on a light tripod and ready for use.

Assembling the unit takes about 10 minutes, but it is important to follow the instructions in the comprehensive User Guide.

There are a number of very helpful video tutorials on the LensAlign website that walk you through the steps on how to use the tool; do have a look at them. You can also download a PDF copy of the User Guide to study before you decide if this tool will be of use to you. The LensAlign Support Forum is particularly helpful and full of constructive input from users around the world.

Using the LensAlign System

The standard test procedure for measuring the focusing accuracy of any lens using the LensAlign system is to position the unit/ruler at a distance from the camera equal to 25X the focal length of the lens under test. I measure this distance accurately, as I generally test lenses having focal lengths between 200mm and 800mm. For future reference I prepared a small reference table in which I recorded the distances for my main long telephoto lenses/two cameras combinations. This short article does not allow me to go into the finer details of the test procedure so I encourage you to view the video tutorials on the LensAlign website. As an example, Fig. 5 shows the result of the initial test on my canon 400mm DO lens.

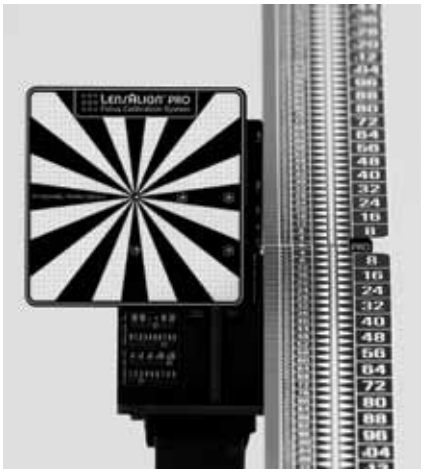

Fig. 5: Initial Result from Canon 400mm DO lens test showing Front Focus

This indicates that the lens, in combination with my 1DMk3 camera, is front focusing – I focused on the target but the resulting image showed the sharpest point to be somewhat in front of the zero mark on the ruler. If the focus was 'spot-on', the ruler's zero mark would be in perfect focus, with the proper depth of field in front and behind the zero. When adjusted using the in-camera micro-adjustment function, the error was quickly corrected. A re-test confirmed this.

Mirror Lock-up and Image Stabilization Effects

If you require proof of the value of mirror lock-up, try a few test runs with and without mirror lock-up activated. You will be stunned at the accuracy of the LensAlign tool in measuring the differences in sharpness.

Most high end lenses have an inbuilt 'image stabilization' or 'vibration reduction' function. If you would like to witness the startling difference in sharpness obtainable by turning off this function when using these lenses on a tripod, run a few tests with IS/VR 'On' and 'Off'. The accuracy of the LensAlign tool in discerning the differences in sharpness left me speechless when I examined the images at even 100% on my computer screen. Never again will I forget to turn off the IS function when using my large lenses on a tripod.

The LensAlign system works exactly as it was designed to do. Its strength is that it is a simple, reliable and repeatable way of verifying you are getting all the image quality your cameras and lenses can deliver. This gives you confidence that your lenses will work as they should during a shoot, focusing with accuracy.

Any out-of-focus images are thus not the fault of the equipment not focusing correctly. No place to hide!