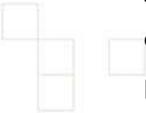


October 2005

DXO OPTICS ENGINE V2

At the heart of DxO Optics Pro's optical correction capabilities, is DxO Optics Engine. This paper briefly describes the DxO Optics Engine and then focuses on the enhancements of DxO Optics Engine V2

DxO Optics Pro and the DxO Optics Engine



DxO Optics Pro is an application that automatically brings out the best possible image from supported Digital SLRs and their lenses. Since version 3.0, DxO Optics Pro addresses a wide range of imaging issues: Noise removal, Exposure and dynamic range optimization, RAW conversion as well as elimination of optical defaults which has been the hallmark of the product from Day 1.

To eliminate optical defaults such as Distortion, Vignetting, Lens softness or Chromatic aberrations, DxO Optics Pro relies on the association of proprietary DxO algorithms with a mathematical model of the camera & lens combination called a DxO Lens Module. This is a unique approach that relies on actual measurement of the camera & lens performance. To produce a DxO Lens Module, thousands of carefully controlled test images are shot, analyzed and processed to produce a model where imaging performance is comprehensively described.

Some of the specifics and benefits of this approach:

- ALL relevant parameters are AUTOMATICALLY taken into account. There might typically be several hundred parameters used by DxO Optics Engine and a DxO Lens Module. Some parameters included might be: Focal length, ISO, Aperture, Resolution, position in the field, camera tone curve, camera settings, local image noise, local detail level, etc.
- Ability to correct extremely complex phenomena such as: non regular distortion, non-uniform lens softness, astigmatism, gray-level dependant vignetting, etc.
- Because DxO Optics Engine is based on real measurements of the hardware performance AND takes into account all relevant parameters, the correction can be performed automatically by the software. This means there are no sliders to adjust image-per-image, no lengthy training, and large batches of images can be processed without human intervention.

- Because DxO Optics Engine works from real camera and lens performance data provided by the DxO Lens Module, image enhancements are not based on “generic” or “average” algorithms.

What's new in DxO Optics Engine V2?

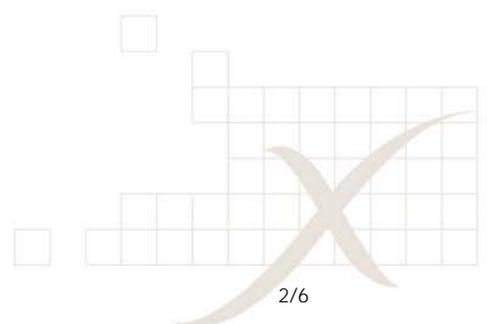
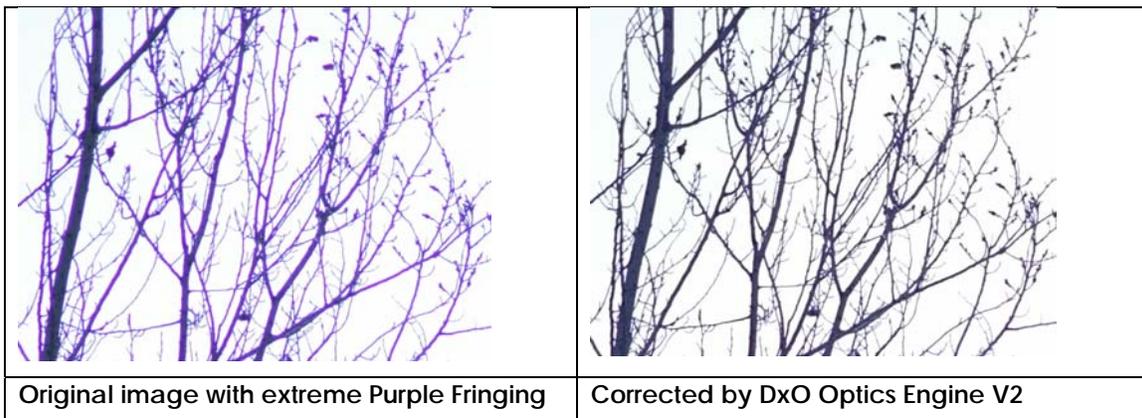
With DxO Optics Pro 3.5, DxO Labs is introducing a major revision of DxO Optics Engine, with a number of enhancements.

Advanced Chromatic Aberration removal

DxO Optics Engine V1 could remove a specific type of color fringe in the image called lateral chromatic aberration. This type of fringe is an optical phenomenon caused by the different wavelengths (i.e. colors) of light taking different paths within the lens in the same way that a prism decomposes a beam of white light.

DxO Optics Engine V2 can now process a much greater range of color fringes, including so-called “purple-fringing”. This has been made possible by adding to the mathematical model contained in the DxO Lens Module. New algorithms in DxO Optics Engine are now able to detect and suppress unwanted color fringes. Additionally, specific attention is provided to purple color fringes which are particularly noticeable in the image and which tend to often be wider than other types of fringes.

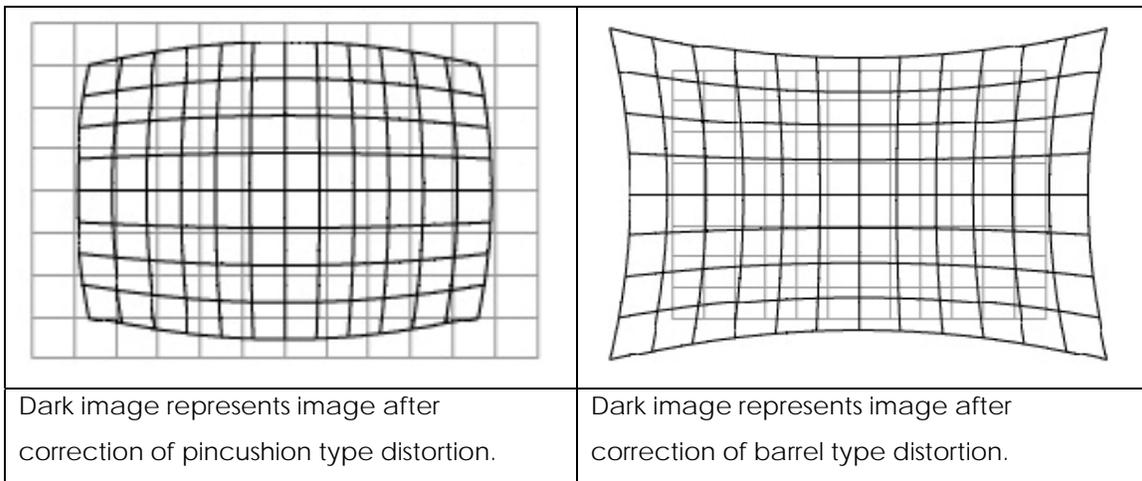
A unique feature of this chromatic aberration removal capability is that it will work on both JPEG and RAW images.



Larger frame capability when correcting distortion

One of DxO Optics Engine's key features is lens distortion correction. To understand the new capability introduced in DxO Optics EngineV2, a reminder about distortion correction may be useful.

Although this is somewhat of a simplification, correcting an image for distortion involves "stretching" (for barrel distortion) or "compressing" (for pincushion distortion) the image by different amounts in different places to achieve a distortion free result. As a consequence of this, an image corrected for distortion is no longer a rectangle. It resembles one of the two figures below:

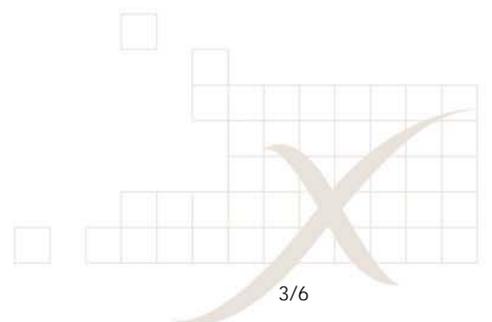


In the vast majority of cases, photographers want the final image to be a rectangle. This is why the distortion corrected image needs to be cropped to produce a rectangular image as output.

- DxO Optics Engine V1 cropped the image so that the final image was the largest possible rectangle of same aspect ratio as the initial image.
- DxO Optics Engine V2 can now go further by producing the largest possible crop even if the final image does not have the same aspect ratio as the initial image. For extreme fisheye lenses, this means up to 40% more image surface can be preserved. The percentage of extra image surface that is preserved will vary depending on focal length and sensor size of the camera & lens combination.

It is of course possible to ask DxO Optics Engine V2 to preserve the initial image aspect ratio as was the case with DxO Optics Engine V1.

The following example shows the various options:

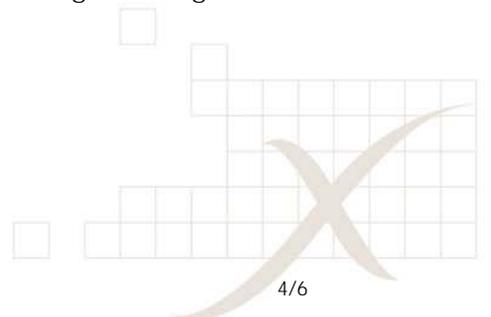


<p>Initial image</p>	
<p>DxO distortion correction with crop preserving initial aspect ration.</p> <p>DxO Optics Engine V1 DxO Optics Engine V2</p>	
<p>DxO distortion correction with crop maximizing image surface finally available.</p> <p>DxO Optics Engine V2 only</p>	

Increased image detail in Lens Softness correction

DxO Optics Engine V1 introduced a novel and breakthrough method of improving lens sharpness based on the performance data provided by the DxO Lens Module. In a nutshell, this feature acts locally and considers local image sharpness (amount and type - i.e. ability to correct problems like astigmatism) as well as local image context (local detail level, local noise level) to produce a sharper image with no artificial artifacts. It should also be noted that this feature is optimized to work with the other DxO Optics Pro features, for example DxO Raw conversion and DxO Noise removal.

DxO Optics Engine V2 introduces a new version of this feature which concentrates on improving the level of high frequency detail. The result is an image with a greater level of detail without artifacts.



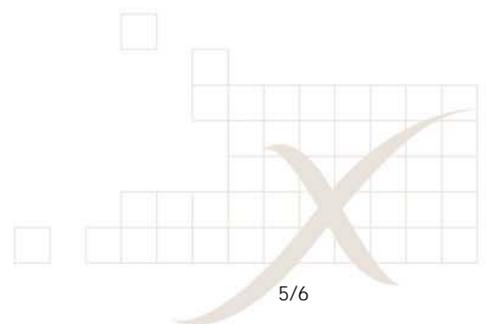
Whole image



Image crop without DxO Optics Pro processing.



Image crop with DxO Optics Pro processing, including improved Lens Softness elimination introduced in DxO Optics Engine V2.

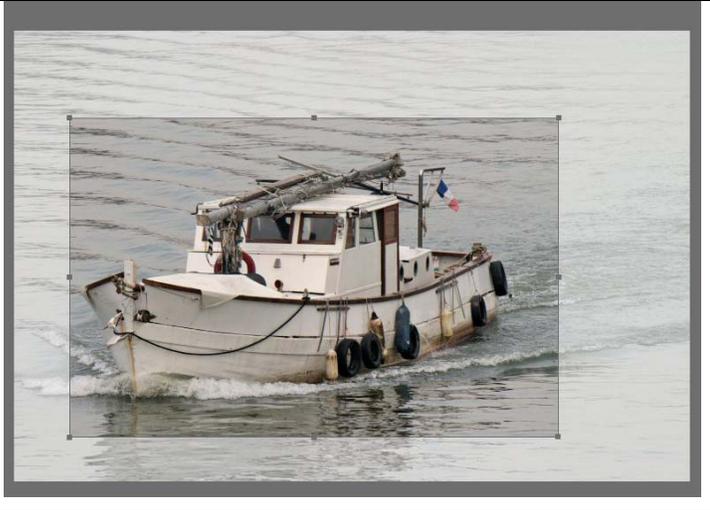


User-defined image crop functionality

Although distinct from the automatic algorithms in DxO Optics Engine, the ability to manually define a crop of the image has been added in order to improve workflow for photographers.

The crop can be of any aspect ratio, or the aspect ratio can be constrained to that of the original image.

Crop function is now enabled in
DxO Optics Pro



About DxO Labs and its DxO Technology

DxO Labs is a software company developing image generation and enhancement technologies. We provide reliable off-the-shelf solutions for serious amateurs and professional photographers, photography journalists and experts as well as companies in the imaging business such as digital camera or cameraphone vendors, mobile operators, and printing or photofinishing professionals. The company's patented DxO technologies, the DxO Technology Foundations, are the result of state-of-the-art academic mathematical research. The DxO Technology Foundations comprise a set of software components to generate images or correct major imaging defects, such as color, contrast, blur, various optics faults, JPEG artifacts, etc.

For more information, visit DxO Labs online at www.dxo.com

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