

## Does DxO Pure Raw Really Work?

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I wanted to find out what DxO Pure Raw (version 2) did with the raw file data so I put together a test that illustrated the differences using a raw file from my A7 III where I had used a low ISO in daylight. What I discovered were three obvious changes. The first two are visible in [RawDigger](#):

1. It combines the two green channels.
2. It promotes the raw data from 14-bits in a single channel to 16-bits in three DNG channels.
3. It adds some clarity and structure and reduces noise at the raw level.

But I could not see any noise reduction at ISO 400 in the 24MP images. It was certainly not worth the time (almost a minute per image) or the space (the resulting DNG was more than twice as big).

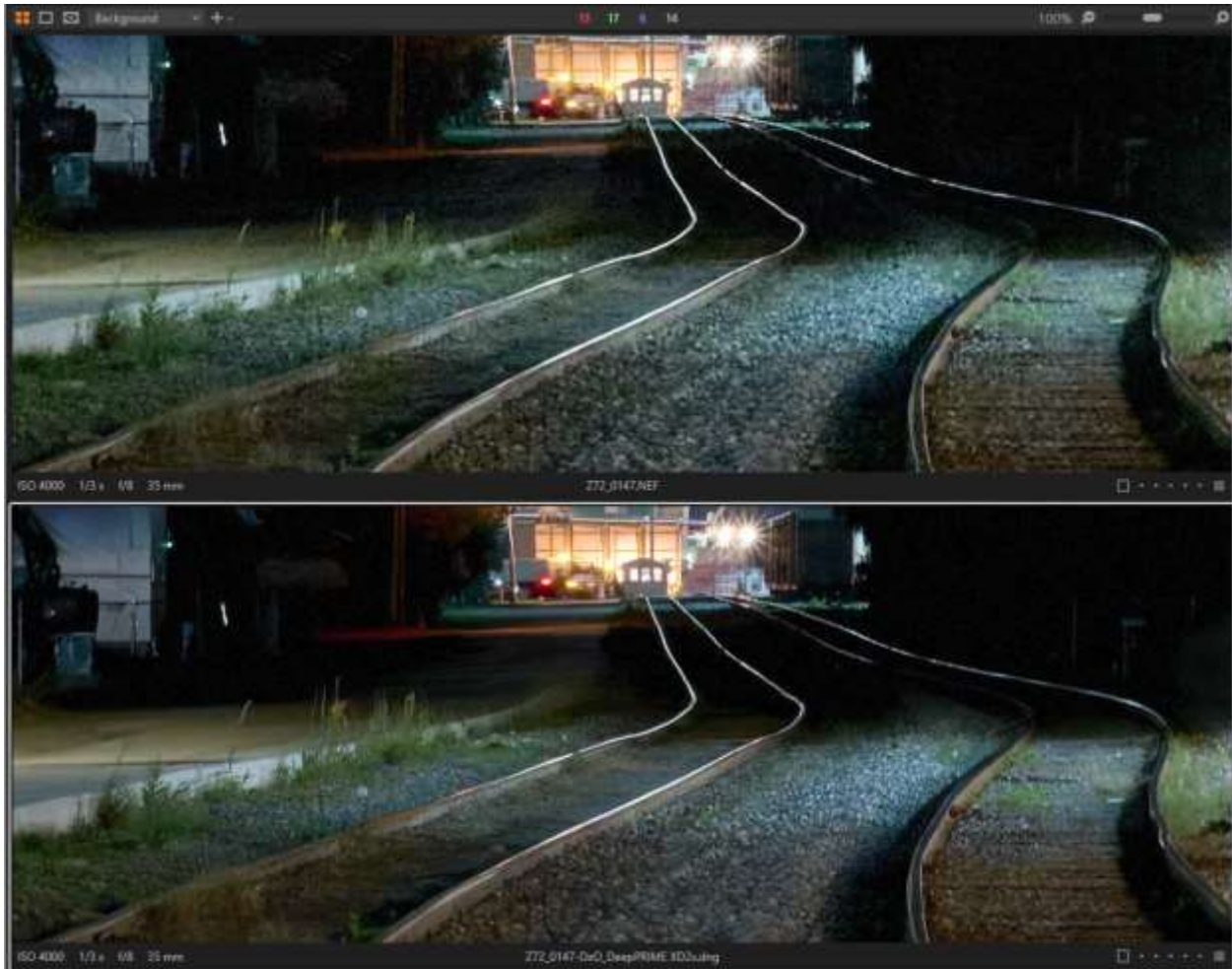
The uncontrolled addition to clarity and structure was excessive. I can get the look of the DNG using Capture One and the original raw file by adding about 50 points of Clarity and Structure (out of 100). I can also get the same default look of the original raw file by subtracting about 50 points of clarity and structure from the DNG version. That was too much. The same would apply to Lightroom. So I set version 2 aside.

Then I learned that there was an upgrade to version 4 with a free trial so I tested to see if it was any better.

In a recent situation at night I took a series of images at ISO 4000 with a Z7 using Highlight Weighted Metering. Since I didn't enlarge them very much for posting, the noise is almost impossible to see on the screen.



I could see it more clearly by pixel peeping the full image at 100%.



Looking at a 46MP (8288x5520) at 100% would fill a 2k display more than 4x. Printing it on 19x13 inch paper with a 1/8" margin would be over 440 dpi, gross overkill.

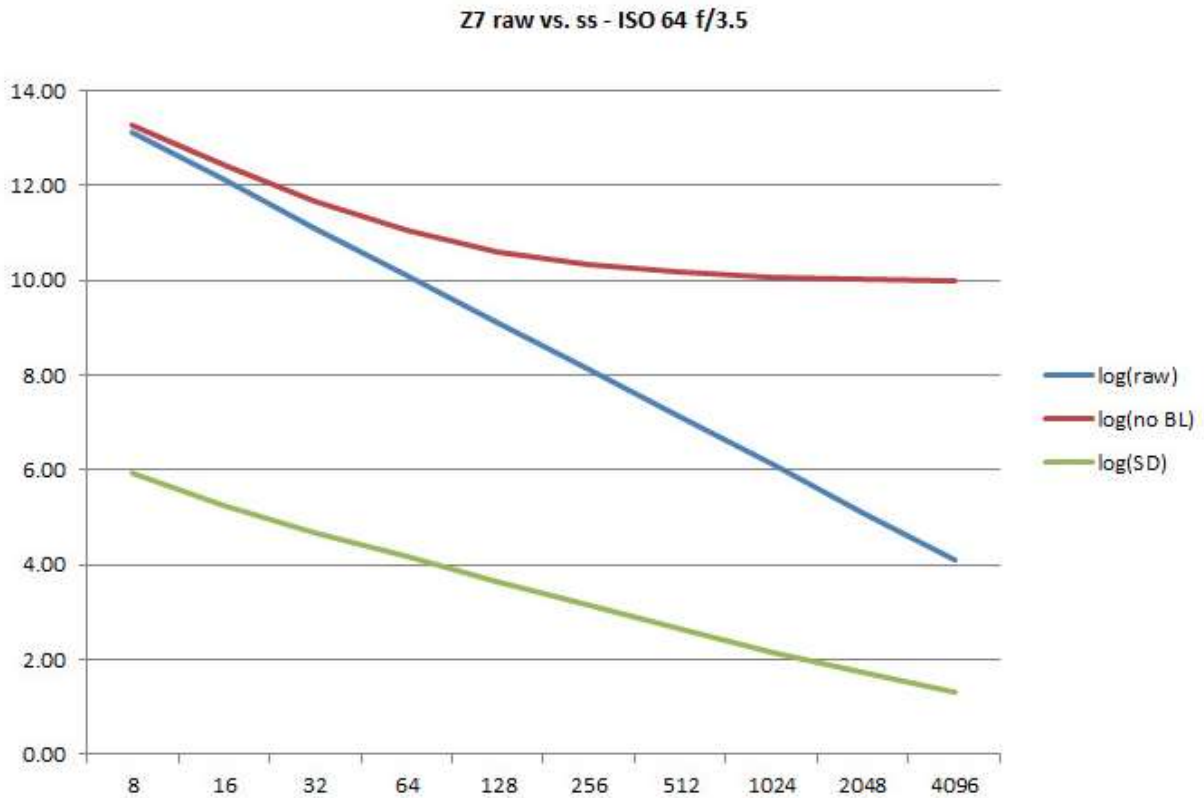
DxO Pure Raw v4 still does the same three things that it did before but the adjustment to clarity and structure (Lens Softness compensation) is now optional as are Vignetting, Chromatic aberration and Lens distortion corrections which can easily be done in Capture One or Lightroom. That leaves noise reduction as the only benefit to be gained. DxO Pure Raw does it better than anyone, but at a cost.

## How does DxO Pure Raw lower the noise?

First a little background.

To facilitate noise reduction, the Z7 raw values stored in the file reach a maximum of 16,383 ( $-1+2^{14}$ ). However, looking at the raw data in RawDigger, the values are limited to 0 through 15,385 (16383 minus 1008), a tiny bit less than a full 14 stops. The noise is mostly in the resulting very small values. The 1008 black level adjustment is specific to the Z7 series and may be different for other models (the Df uses 0 and the A7 III uses 512).

However, the values stored in the raw file may never reach 0. Here is a plot showing what happens.



The vertical scale is the  $\log_2$  shows raw luminance values over 14 stops. The horizontal scale is the inverse of the shutter speed used to record a fixed target at shutter speeds from 1/8s to 1/4096s.

The blue line is the normal response of the raw sensor which is clearly and deliberately linear.

The red line represents the actual numeric values recorded in the raw data from which the 1008 gets subtracted to produce the raw values. Since the base 2 log of 1008 is 9.98, the red line appears that it will get down very close to 10 no matter how high the shutter speed goes.

The green line is a measure of the standard deviation, the actual noise, for both the red and blue lines.

DxO Pure Raw first turns all of the raw values to 16-bit by multiplying them by 4 but the values now range from 0 through 65535 and the black level adjustment is no longer needed. The process of noise

removal becomes much easier for the same reason that you can edit a 16-bit TIFF more successfully than any 8-bit image (fewer rounding errors).

But with more noise in the ISO 4000 file to begin with, the DNG from the Z7 is almost three times as large as the original raw file. This suggests that there is probably some lossless compression applied to the DNG, otherwise, both DNG files might have been closer to 3x as big as the original raw files which contain only one gray channel shared by red, green and blue in a 1:2:1 proportion.

Unlike the adjustments to Clarity and Structure, I cannot replicate the DxO's noise reduction in Capture One using the original raw file.

Noise reduction alone takes over 90 seconds for a 46MP image, about 60 seconds for a 24MP image. If you have a whole bunch of images, you can just add them to the queue and go out to dinner (or just go to bed). The prediction of how long each image will take does not work.

I repeated the original test I did for some images from eight years ago with the A7 II exposed at ISO 400. Even at 100% there was no discernible difference in noise which was zero in the first place.



In the final analysis, you may not really need to use DxO Pure Raw unless you plan to make very large images that were captured at high ISO.

The only exception might be if you crop an image at high ISO because your focal length was too short. Keep in mind that a 50% crop (to double the focal length) reduces the MP to 25% of the original and you are going to enlarge all of the defects along with the noise. You would be better off with a cheap zoom.