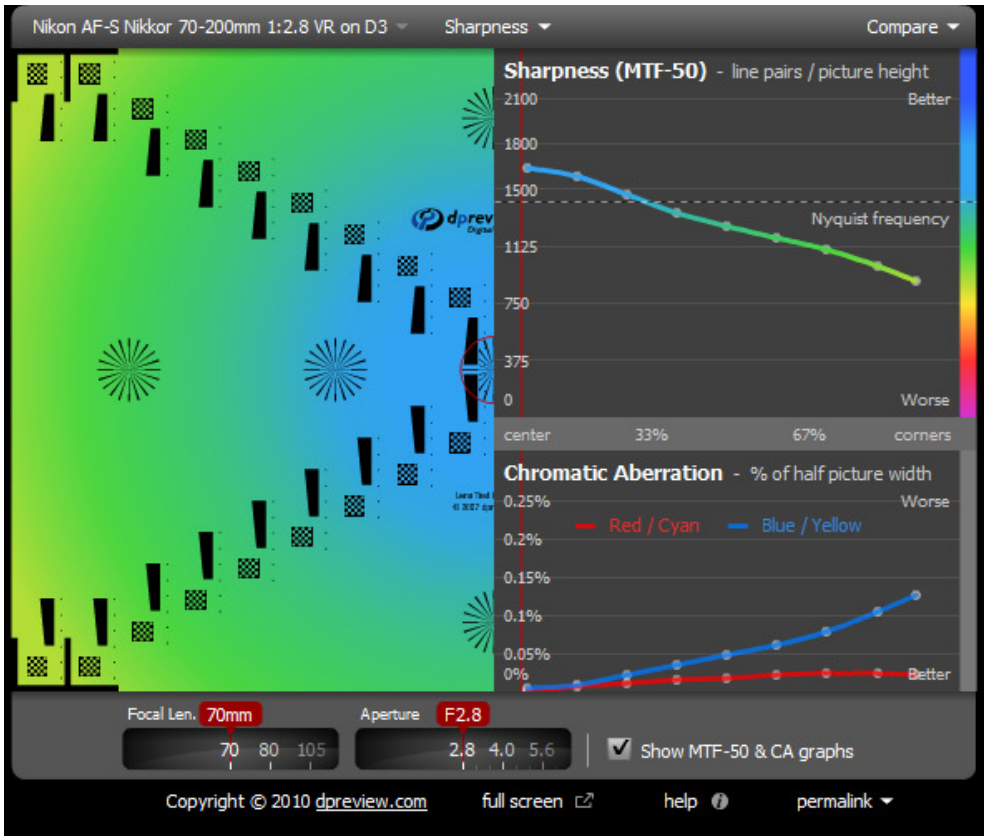
5. Test results

Studio Tests - 35mm full frame

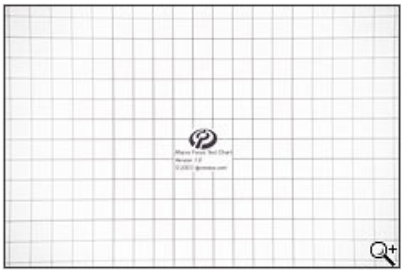


NOTE the line marked 'Nyquist Frequency' indicates the maximum theoretical resolution of the camera body used for testing. Whenever the measured numbers exceed this value, this simply indicates that the lens out-resolves the sensor at this point - the calculated MTF values themselves become meaningless.

The 70-200mm VR gives a less than sublime performance on FX, essentially doing a very good impression of a lens which was optimized primarily for the DX format. Corner sharpness and falloff (or in this case, more correctly vignetting) are especially problematic, but distortion and chromatic aberration are also less well controlled on the larger format.

Resolution	Central resolution tends to be high across the frame even wide open, however corner resolution is problematic, most notably towards the telephoto end. At 200mm, extreme corners never sharpen up fully, even at F16 - not really an acceptable performance for a professional level lens.
Chromatic Aberration	Chromatic aberration remains low on FX, but is slightly less well controlled towards the corners of the frame at shorter focal lengths when compared to DX. In practice this means a little green/magenta CA may be visible at 70-80mm, but overall there's little to worry about.
Falloff	We consider falloff to become a potential problem when the corner illumination falls to more than 1 stop less than the centre. Here it's a serious issue wide open at all focal lengths, with corner brightness ranging from 2 to 2.7 stops (at 105mm) below centre. However the visual impact is greatest at 200mm, as here the vignetting extends furthest into the frame. Stopping down improves matters, but only gradually; at 105mm, falloff is 1.3 stops even at F11. Again, not really acceptable for a professional lens.
Distortion	Distortion is generally about two-fold higher than on FX, ranging from 1.2% barrel at 70mm, through neutral around 100mm, to -1.81% pincushion at 200mm. Overall slightly on the high side and potentially visible in real-world shots, but unlikely to be an issue for most typical uses of this lens.

Macro Focus



Macro - 197 x 131 mm coverage
Distortion: Slight pincushion
Corner softness: Severe
Focal length: 200mm

In what is becoming something of a theme, the 70-200mm performs noticeably worse in our macro test on FX as compared to DX. Naturally the close focus, working distances and magnification figures remain the same (1.4m, 1.14m, 0.18x), and coverage is 1.5x greater in each dimension.

However on FX , corner softness issues are again amplified dramatically, such that significantly less of the frame is sharp than on DX.

D3 in-camera vignetting control

One of the most obvious issues with this lens when used on the D3 is vignetting, which is unexpectedly high for a telephoto zoom. However help is at hand, in the shape of a new menu option introduced in version 1.10 of the D3 firmware, called Vignetting Control. This has four settings - off, low, medium, and high - and in our Nikon D3 review we demonstrated that this had a noticeably beneficial effect with a couple of wideangle lenses. We therefore decided to see if this feature could reduce the visible vignetting in camera JPEG files, using 105mm F2.8 where vignetting peaks at 2.7 stops, and 200mm F2.8 where the vignetting covers the largest area of the frame.

105mm F2.8, vignette control off

105mm F2.8, vignette control low

105mm F2.8, vignette control normal

105mm F2.8, vignette control high

200mm F2.8, vignette control off

200mm F2.8, vignette control low

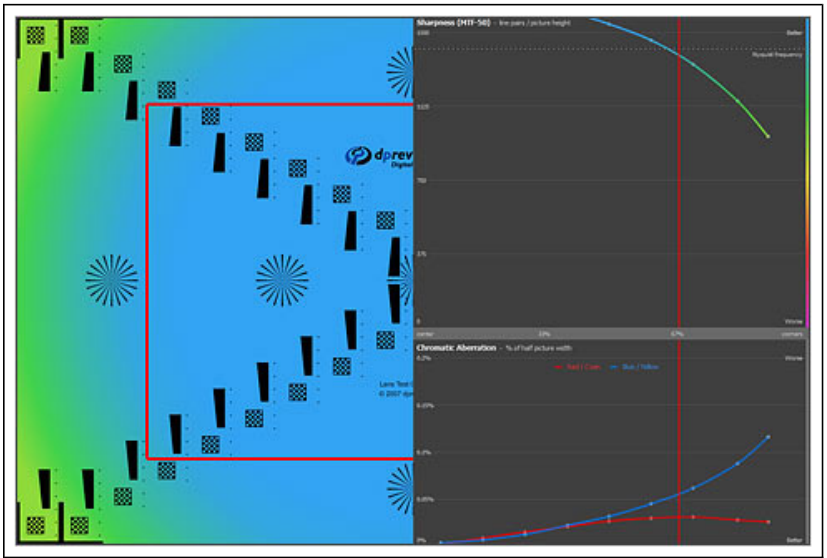
200mm F2.8, vignette control normal

200mm F2.8, vignette control high

As can be seen, the vignetting control system is at least partially successful, and the appearance of vignetting is substantially reduced. However the brightness in the absolute corners doesn't actually change very much, with our measurements showing a reduction of just 0.3 stops. It's also worth pointing out that any firmware or software vignetting correction inevitably comes at the cost of increased noise in the image file; however it's certainly better than nothing.

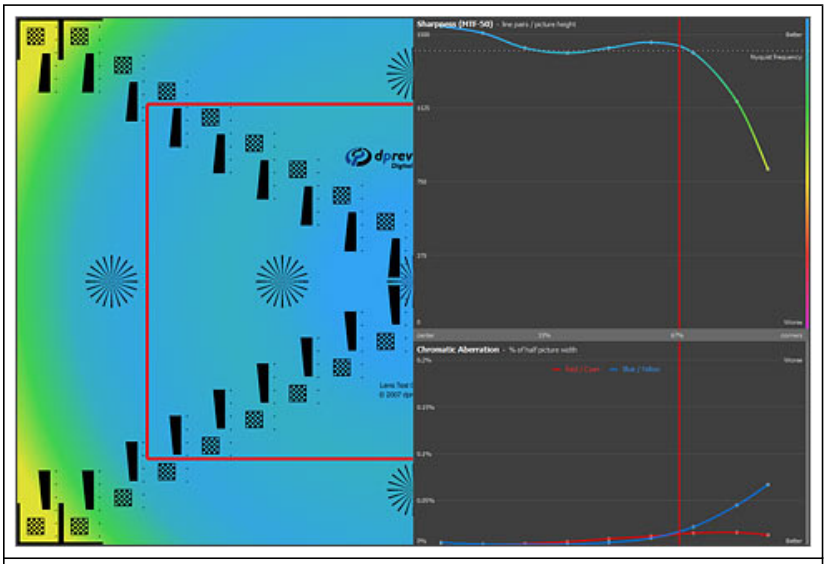
FX vs DX performance comparison

With the disparity between this lens's performance on the FX and DX formats, it's instructive to view the FX data with the DX crop superimposed, and this is shown below (with the red lines indicating the bounds of the DX format area). Time and again the data shows a marked drop-off in performance starting just beyond the DX area (the selected apertures have been chosen simply to illustrate the point most clearly).



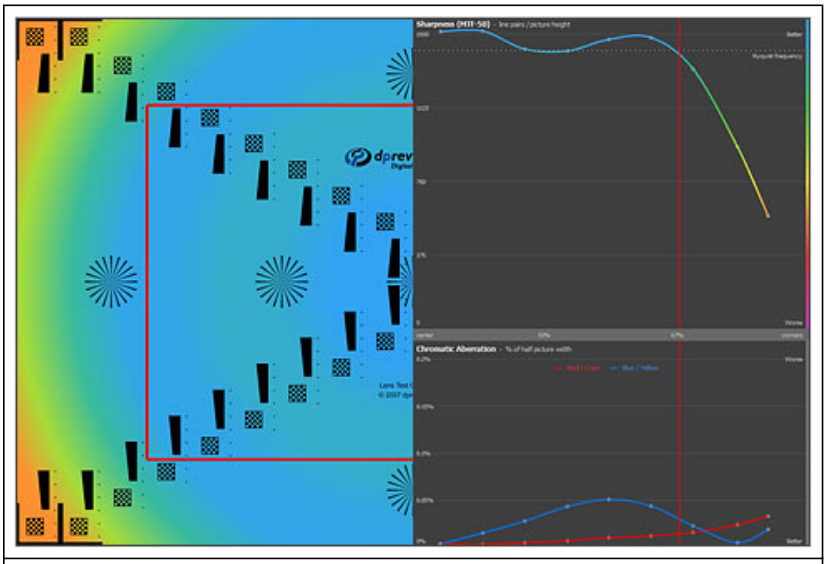
70mm F4, MTF50 + chromatic aberration

At the 'wide' end of the zoom range (70mm and F4), we see a clear drop-off in sharpness just beyond the DX format's imaging area, with a concomitant rise in blue channel CA. However MTF50 in the corners is still pretty high, so it's unlikely this would ever look like a major problem in prints.



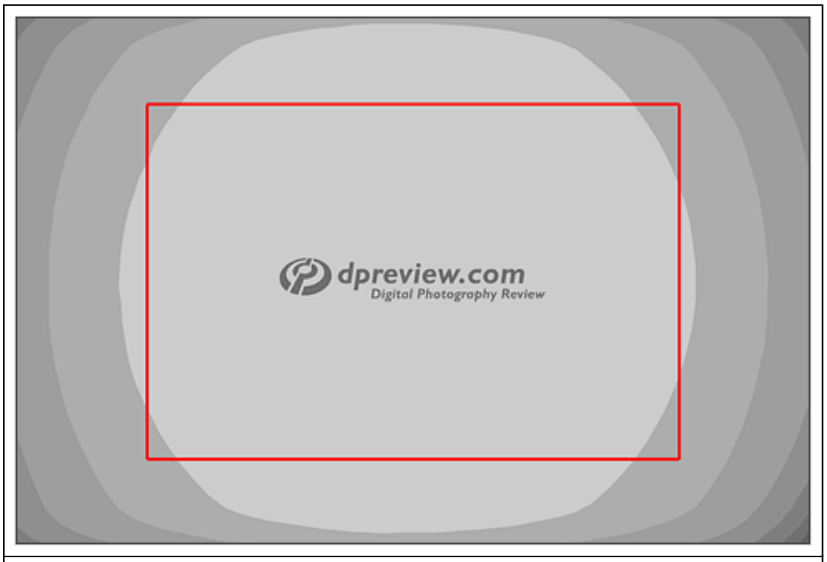
105mm F2.8, MTF50 + chromatic aberration

Towards the middle of the zoom range, here's the MTF and CA data at 105mm F2.8. Sharpness falls sharply once outside the DX format area, again accompanied by a rise in blue/yellow CA; this is starting to look like it could be genuinely problematic.



200mm F4, MTF50 + chromatic aberration

Moving to the telephoto end, here's the data for 200mm F4. The drop in corner sharpness is now quite precipitous, and will certainly be of concern to critical users (and most worryingly, the corners never really sharpen up fully at any aperture). To be fair though, chromatic aberration is very low in the corners of the frame.



200mm F2.8, falloff

Finally, and perhaps most tellingly, here's the falloff profile at 200mm F2.8; as usual the first band outside the central area indicates 2/3 stop falloff, and remaining bands are 1/3 stop intervals (and it must be pointed out that this choice of data presentation does somewhat accentuate the appearance of the issue). Here we can see broad areas of falloff just beyond the DX sensor area, which are often clearly visible in real-world shots.

Overall, we can only conclude that Nikon optimized the design of the 70-200mm VR specifically for the DX format, maintaining extremely high performance on the smaller sensor, but in the process producing a lens which doesn't cover the FX format in an entirely satisfactory fashion. Indeed the vignetting issues with this lens are probably related directly to the long, slim barrel design, and the positioning of the the rear element which is recessed almost 2.5cm from the mount (noticeably deeper than in the Canon, Sigma or Tamron lenses); it's not difficult to guess why the other manufacturers opted for wider diameter lens barrels.

It's important to understand that these issues with the 70-200mm VR are not in any way inherent to the FX format, or a general characteristic of full-frame lenses; indeed Canon's 70-200mm F2.8 L IS USM takes the opposite approach, and appears to be optimized for full frame at some expense to APS-C performance. So what we see is simply a reflection of Nikon's design decision for this specific lens, and which can easily be understood in the historical context of the market situation when it was introduced. Now that the context has changed with the introduction of the D3 (and the strong possibility of higher resolution FX models to follow), we'd suggest that Nikon really need to produce an updated version of this lens, re-optimized for full frame.