The New Epson V850 Pro Scanner – Note on Methodology and Expectations

One of the key challenges doing a product review is to set the context and the objectives so that readers' expectations are aligned with the content of the review. The audience range is broad – from casual scanning of family memories for the Internet to those producing gallery-quality prints from professional archives. The latter's demands on equipment are of course far more exacting. The context of this review falls somewhere in-between, so it could well frustrate people at either end of this spectrum, but the remainder of you may find it useful. My primary question about the Epson V850: "Is it <fit for purpose> in the stated context?"

There are three key considerations that inform the boundaries or context of this evaluation: (1) image size, (2) colour "accuracy" and (3) area of sharpness.

(1**) Image size**: Print size affects magnification, which affects perceived sharpness. The size limit of the prints I make to evaluate results is 11x17 inches printed on 13x19 inch sheets. While this is larger than many people would ever print (and many don't print at all), it's smaller than a lot of gallery work, and may not be large enough to reveal all the resolution differences between devices that would show on larger magnifications of the same files. Sharpness and resolution for larger magnifications can be inferred from high-resolution displays, but it's less reliable than seeing it in print. My observations are real up to 13x19 sheets of paper. I also show numerous 100% magnifications of full-resolution scans for comparison.

(2) **Colour Accuracy**: The original media isn't accurate relative to the scenes they captured, and no scanning device I've ever used, regardless of profiling, produces a totally faithful rendition of the media – if one could even quantify the comparison accurately. My objective is to achieve believable colour that can be successfully edited in a pre or post-scan workflow to produce convincing results. I dwell very little on "out of the box" colour accuracy, but that said, scans embedding egregious, and especially complex colour imbalances will be more difficult to correct in a post-scan workflow, so scanners and scan software that can easily come closer to an acceptable result at the scan stage are advantageous, though not always critical.

(3) **Perceived sharpness**: If your nirvana is crisp detail corner to corner, you'll find it evaluated in the section on colour positives. For negatives, the "Apartment Image", just about fills the frame with well-focused bricks and balconies in sun and shade. The other photos I use in this review have certain properties that lent themselves to selection for the purposes stated in the review, but they won't inform too much about sharpness at the frame borders. You'll find large parts of the image area covered with evaluation-worthy detail in these photos, which should suffice for all but the most demanding full-frame coverage requirements. I wish I had a scanner resolution target (such as the LSI USAF 1951) designed to measure resolution from corner to corner, but I haven't found one that is industry-standard, so I also use the current USAF 1951 for comparative evaluation of perceived resolving power; regardless of its limitations, it's useful for comparative purposes.

The New Epson V850 Pro Scanner

Very much like its predecessor the Epson V750 Pro scanner (hereafter "V750"), the V850 combines the utility of a flatbed scanner with substantial film-scanning capabilities (the primary emphasis of this review). The document window measures 9x12 inches, hence not long enough for scanning US Legal sheets, but more than adequate for US Letter and A4 media. It has the same sensor and lens configurations as the V750, but uses more environmentally friendly LED rather than LCD illumination, requiring virtually no warm-up time. Other noteworthy differences between the two models are: all but the 35mm slide holders are equipped with anti-Newton glass, the holders are more robust, they are capable of more refined adjustment for focus (five steps are possible rather than two) and rather than bundle the Fluid Mount Accessory, Epson bundled a second set of identical frames (for productivity enhancement – you can load the second while the first is in the scanner); the Fluid Mount Accessory is an option available for purchase. The frames are for 35mm film strips, 35mm slides, 120 size film strips, a holder for 4x5 sheet film and a scanning guide for 8x10 inch sheet film. The scanner has an infrared channel for dirt and scratch identification using software supporting this feature (such as SilverFast's iSRD).

The "optical resolution" of the scanner remains a specified maximum 6400 PPI. "Optical resolution" means: "maximum scan resolution of the CCD elements, using the definition of ISO 14473" (viz. Epson). ISO 14473 defines optical resolution as the fundamental sampling rate of the scan sensor. According to the ISO, "…. this standard also does not consider image quality, nor does it provide or use related test targets". (Those who want more information about ISO 14473 may buy a download of the standard from the ISO website.) Given this definition, we need to do our own research on what image quality the scanner delivers – a whole other story that occupies most of this review. For other hardware-related information, as well as differences between the V800 and V850 bundles, please visit the Epson website.

From a photographic user perspective, the key questions of interest are whether it can produce sharp scans, be colour-managed, work efficiently, and the merits of the supporting software options provided in the package, including any of their up-grade possibilities.

The provided software includes EpsonScan, which bundles Digital Ice for debris identification, SilverFast SE+ (SilverFast SE in the V800 bundle), and X-Rite i1 Scanner. I'll be discussing the relative merits of these applications and their upgrades in this article. EpsonScan and SilverFast SE+ are alternative scanning applications, while i1 Scanner is for profiling the scanner (colour management). Use of this software is optional, because both EpsonScan and SilverFast SE+ have bundled profiles for this scanner that do the job quite well. To anticipate the colour management discussion further below, making a custom profile for an individual scanner has the advantage of accurately profiling the behavior of the individual unit, which could vary within manufacturing tolerances from one unit to the next, and

more especially over time for any single scanner. For example, after some years of use I found it absolutely necessary to re-profile my Nikon SC5000ED, otherwise whites were being rendered as pale orange. No idea why; however, a new profile solved the problem. See Figure 1 below to appreciate the usefulness of having a profiling capability ready at hand.

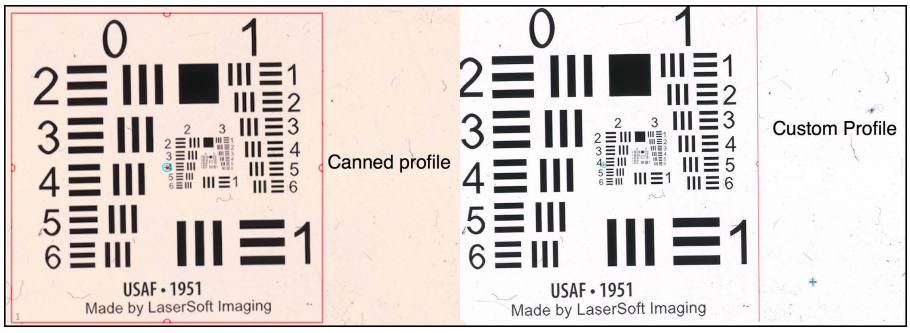


Figure 1: Canned Versus Custom Profiles: the actual media is black on white.

Dynamic Range (DR)

Epson's specs indicate that the scanner's DR is 4.0, which is high, as those familiar with this metric for scanning would know. DR is a measurement of the scanner's ability to capture the tonal range of the media. Epson had the DR of the V700 tested by NSTL (National Software Testing Laboratory) in 2006 using the methodology of ISO 21550 and have published the full test report on the Epson website for the V850, hence those findings apply to this scanner as well given the similarity of the technology between these models. As I cannot outdo the NSTL on such testing, this will be the only mention of DR *per se*; however, I do report on the practical work I've done for revealing shadow detail using real photographs in this article, and as you will see, it is impressive.

Reflective Scanning (Prints and Documents)

While reviews of scanners on photography websites generally say little about document or reflective scanning, as this is a multi-purpose scanner I mention how this works. We can create scans of printed photos (**not recommended** if the original transparent positives or negatives are available) or scans of printed documents. Figure 2 shows why it is better to scan the original transparencies or negatives rather than prints made from them. The resolution, tonal gradation and shadow detail are just better working from the negatives. But looking at Figure 2, I must say, I was very pleasantly surprised by how good the reflective scan is, meaning two things: (i) the print itself was very well made – indeed the case (a state-of-the-art mini-lab using Fuji Crystal Archive in Ritz Photo's erstwhile flagship store at L and 18th in Washington DC, 2002), and (ii) the Epson V850 is a very respectable reflective scanning device.

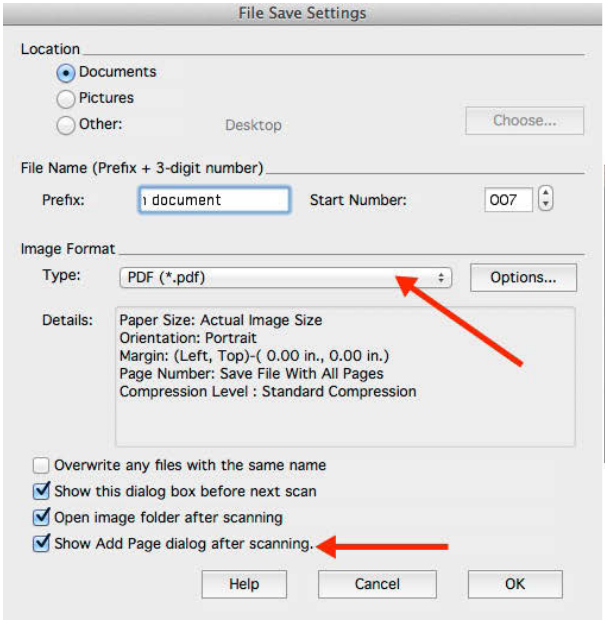
Figure 2: Reflective vs. Transparent Scans (100% preview crops); Apartment Photo

Both versions were scanned in the same scanner using the same software (SilverFast 8), with no image editing (except in the case of the negative, for which I had to select the correct Negafix profile for the film – more on that below). The resolution for the print is 1200 PPI, which makes a 13x19 inch print at 360 PPI, and for the film – 6400 PPI which makes a 16x25 inch print at 360 PPI. (There was no point scanning the print at higher than 1200 PPI, given the limitations of the media being scanned.) To get an idea of the reflective scan quality, Figure 2a is a full view JPG from the scan of the 4x6 inch print. This photo has the merit of showing whether there is real detail almost from edge to edge and corner to corner, as well as across much of the tonal range, hence why I like using it as part of my evaluation suite.

Figure 2a: Full scanned print (reflective) – Apartment Photo

It could be jazzed-up with a bit of added saturation and exposure, but you get the main idea: it's very much as good as can be expected for a reflective scan of a small printed photo.

Looking at printed document scanning, EpsonScan supports document scanning efficiently, because it allows for the creation of multi-page documents within one file; those who have the full-featured Adobe Acrobat program can also do this through Acrobat, which pulls-up EpsonScan for actually doing the scanning. Figure 3 shows the basic document scan settings in EpsonScan that enable this, and Figure 3a one of the resulting pages in Acrobat. I selected a page from a camera manual because of the fine line drawings, showing how well the Epson V850 scans in all the detailed line drawing along with the text. I set the scanner to 360 PPI and 16-bit grayscale for this test.



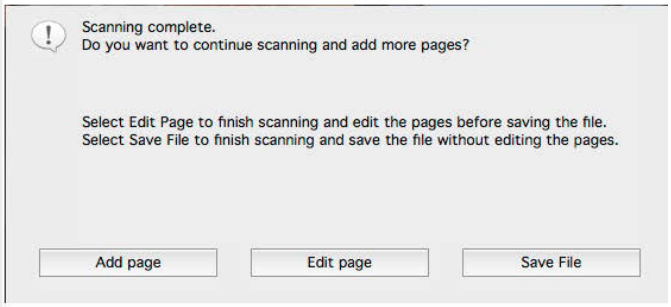


Figure 3. Making a PDF file with EpsonScan and the Epson V850 Scanner

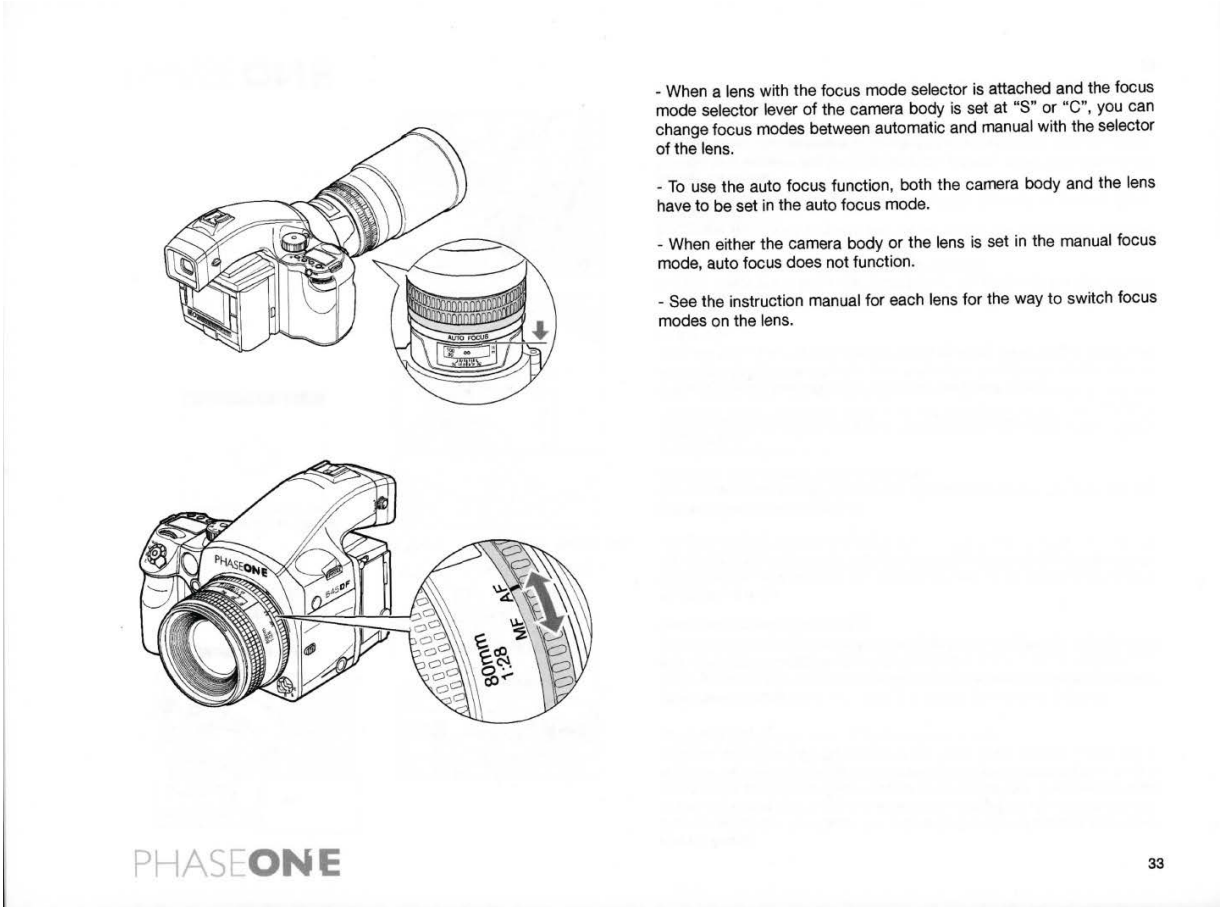


Figure 3a. Scanned document page opened in Acrobat

EpsonScan provides page-wise editing capability before completing the save of the scanned file. I printed the page of Figure 3a in my Epson Workforce Pro 4530 multi-function office printer using ordinary photo copy paper and compared the print with the original scanned media. It's every bit as clear; if anything, the line drawings are a bit more distinct in the scanned PDF print. **Bottom line**: this scanner is no slouch at creating top-quality reproductions of colour or grayscale reflective media.

We now turn to transparency scanning. This has three main branches and several key areas of interest. The main branches are colour positives, colour negatives and black and white negatives (in my case for the latter: medium format). The key areas of interest are colour management, image quality (resolution, sharpness, tonality) and processing efficiency. Colour management via ICC profiling is not possible for negatives. SilverFast has an elegant solution for this called "Negafix".

Colour Management

As colour management is a primary set-up condition, let us start with that. There is ample material available on the meaning and importance of colour management, so we won't rehash it here, save to say that the scanner can be used either with its

bundled profile for the task at hand, or with custom profiles that users make for their individual scanners. Epson provides two choices for scanner colour management: (i) X-Rite i1 Scanner mentioned above, or (ii) after installing SilverFast SE+ provided in the V850 scanner bundle, the user may visit the SilverFast website and cross-grade this software to SilverFast Ai 8 Studio for $79.00 US ($99.00 US if cross-grading from SE in the V800 bundle). This top-of-the-line version of SilverFast, amongst other things we'll review later, provides a highly automated and effective scanner profiling process that I have appreciated for many years, and all the more so recently after going through the paces of using X-Rite i1 Scanner.

Profiling a scanner characterizes how the device interprets colour, including grayscale. To do this, you need a target consisting of a bunch of colour patches (including grayscale) and a reference file, which contains the correct numerical values of the patches in the target. Hence the target and its reference file need to be correctly matched. You scan the target and then the profiling software measures the scanned values of the patches, compares them with the correct values from the reference file, and records the differences. The computer's colour management module (CMM, Colorsync) uses that information to adjust the colours the scanner provides from scanning the media such that the output will be approximately colour-correct.

You would think it feasible (and indeed it is) to design a user-friendly workflow for doing this, but there isn't much happiness from X-Rite with the bundled i1Scanner; I found their claims of simplicity downright misleading, and the process convoluted; but after all is said and done, it produces good results. Equally good results can be had from profiling with SilverFast Ai 8 in a fraction of the time and bother. I'll run through both processes.

Starting with X-Rite, which is the bundled product, the back of the CD case says: "i1Scanner creates custom profiles quickly and easily. Simply scan the included IT8 target (reflective or transparent) and follow the on-screen wizard. The software automatically detects and crops the target and then creates the profile. Give it a name, save it and you're done. It's that easy to get more accurate color from your scanner." Well, it isn't – in fact, far from.

Here's what I had to do (after opening the software and loading the target) in two stages, first to find and install the reference file, second to make the profile:

(1) Read the name of the reference file on the target. I see it is MONT45-2014-01.
(2) Locate the reference file – for OSX 10.9 they say it should be in Library>Application Support/Monaco or X-Rite/IT8 Targets. I go there and it isn't.
(3) If it's not there the wizard tells me to go to the Monaco website to locate it. When you use their suggested URL to get there, you are confronted with 11 options for drilling down to it. It could be the 9th or the 1st.

(4) The 9th seemed most likely because it says <Reference Files>, but no luck there, so I went to the 1st, and sure enough I got to a prospective link.
(5) The last one on the list looks like it. So click, and finally we get to the page from which the 2014 reference file can be downloaded.
(6) Download the correct reference file and add it to the list of other MONT_Transmissive files already on my hard drive, none of which latter I shall need for this purpose.

From here on, there is a 14-step process for creating the profile using EpsonScan and i1Scanner with the V850 scanner:

1) In i1Scanner start the target scan and loading process.
2) Open EpsonScan (so we have two applications working on the same purpose now) to set-up the target scan, carefully following the configuration instructions for EpsonScan as stated in i1Scanner.
3) In particular, go to Colour Configuration in EpsonScan and make sure Color Management is set to OFF.
4) Generate a Preview thumbnail in EpsonScan.
5) Change from Preview to Normal view in EpsonScan.
6) Click Scan, which triggers the File Save settings, click OK and the target gets scanned.
7) Drag the scanned target file to the i1Scanner target window, click Load Image
8) Click Auto-Crop, which is supposed to correctly frame the part of the target image needed for the profiling, but this fails, so do it manually.
9) Place the crop marks at the indicated four corners in the target image, using the mouse to click and drag. This placement is finicky and must be precise otherwise profile creation cannot happen.
10) Examine the resulting placement of the green squares on their respective patches to make sure the coverage is convergent, and adjust the corner crop marks as needed.
11) Click Next.
12) Load the reference file by clicking on the associated button, which brings up the reference file list, from which you select the correct one.
13) Enter a name for the profile. Select the version type (2 or 4).
14) Click Name and Create, and the profile is made.

Well, we've just been through a 20-step process to make a profile using X-Rite software. This takes a heap of time. For those interested, I have provided a set of sequential screen grabs in Annex 1 illustrating the process. This may help those wishing to use this software to save some of the (too much) time I put into it.

Turning to the SilverFast process for creating a scanner profile, firstly you need to cross-grade your SilverFast 8 SE+ version to the Ai Studio version, as mentioned above, and buy a target from LaserSoft Imaging. The process is straightforward on the SilverFast website. If you want the process to work quickly and automatically, which is its signature benefit, you'll need a SilverFast target because they are bar-

coded to automatically pull-up the correct reference file, all of which are installed under-the-hood with the "Ai" application version.

To create the profile, implement the following two steps after opening SilverFast 8 and loading the target into the scanner:

1) Make sure "Transparency" is selected as the media type, and select the Positive film type (Figure 4).
2) Click the IT8 Cal button (Figure 5).

SilverFast automatically implements all of the 20 steps listed above (discussing the X-Rite process) in less than a minute, and the profile is complete (Figure 6). You have the option of giving the profile a custom name (Figure 7), if you checked the box for this option in SilverFast Preferences>Auto; otherwise SilverFast will name the profile automatically. Figure 8 shows how the target looks when pre-scanned with the scanner correctly profiled for this media.

Figure 4. Auto IT8 – select media type

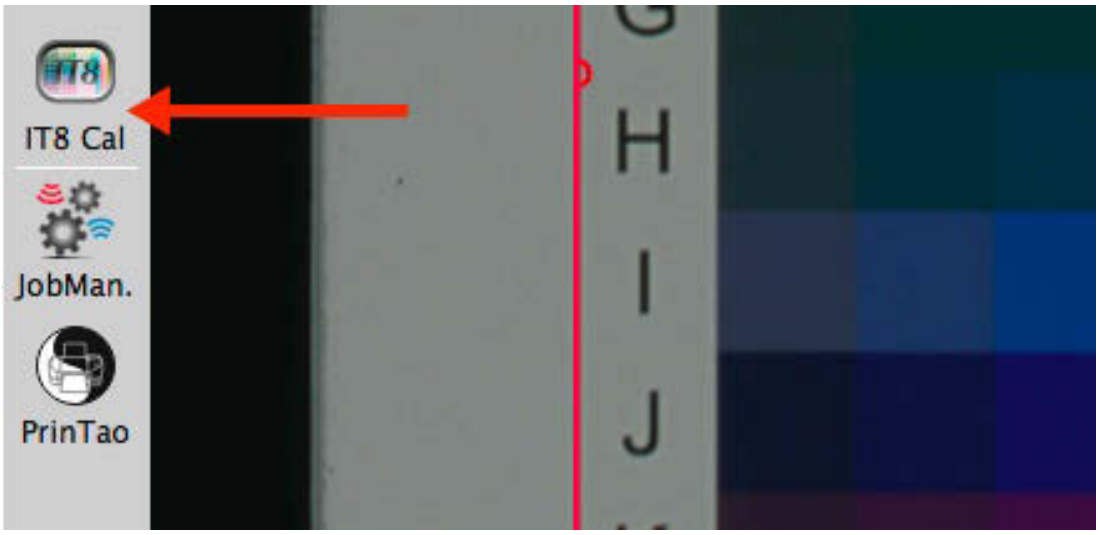


Figure 5. Click on IT8 Cal to profile the scanner

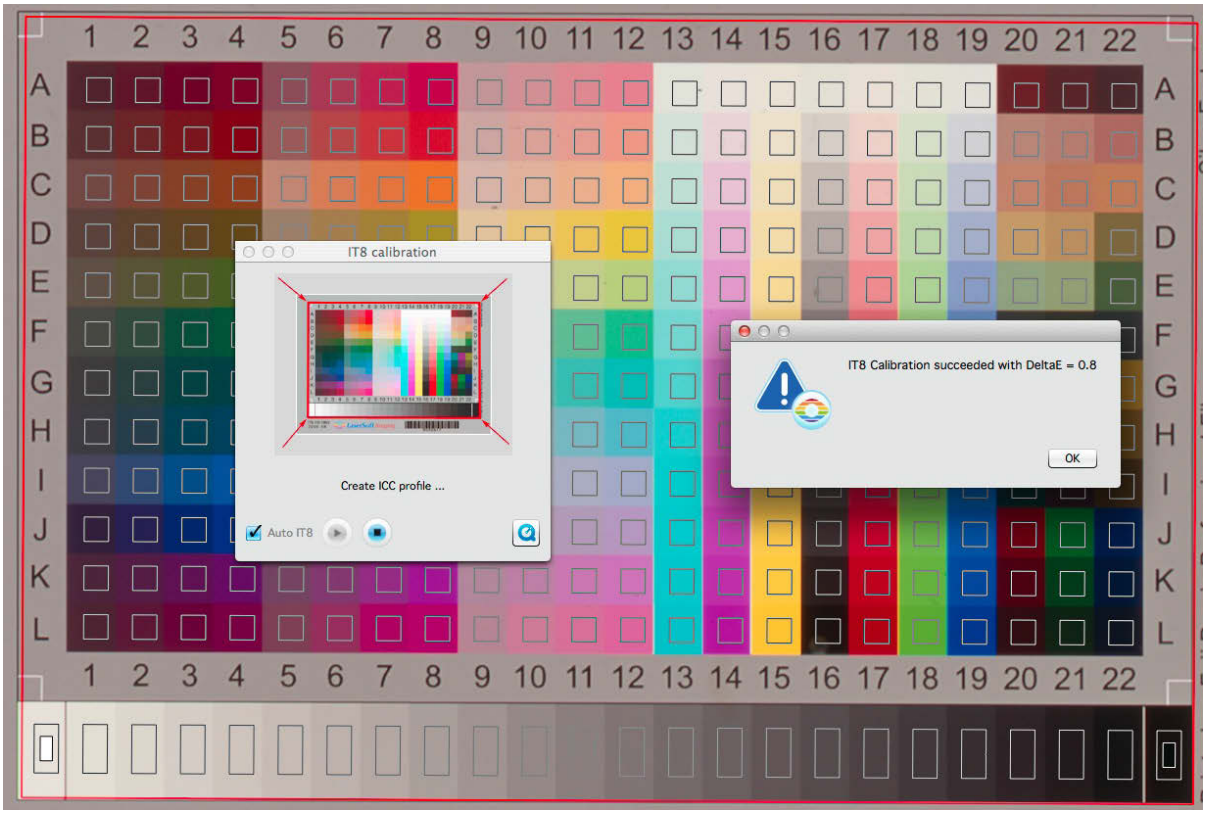


Figure 6. Profiling Complete

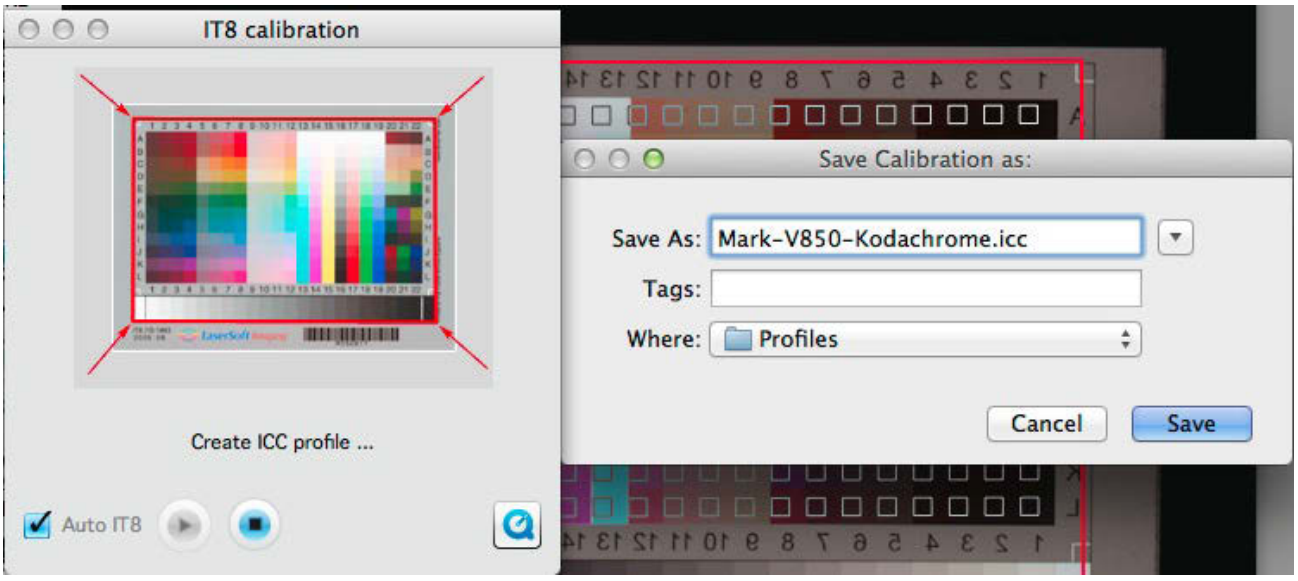


Figure 7. Naming the profile

(Note: Kodachrome targets have become extremely scarce and expensive because they can no longer be manufactured, so unless you already have one, you will be using the SilverFast Positive target and selecting Positive as the film type.)

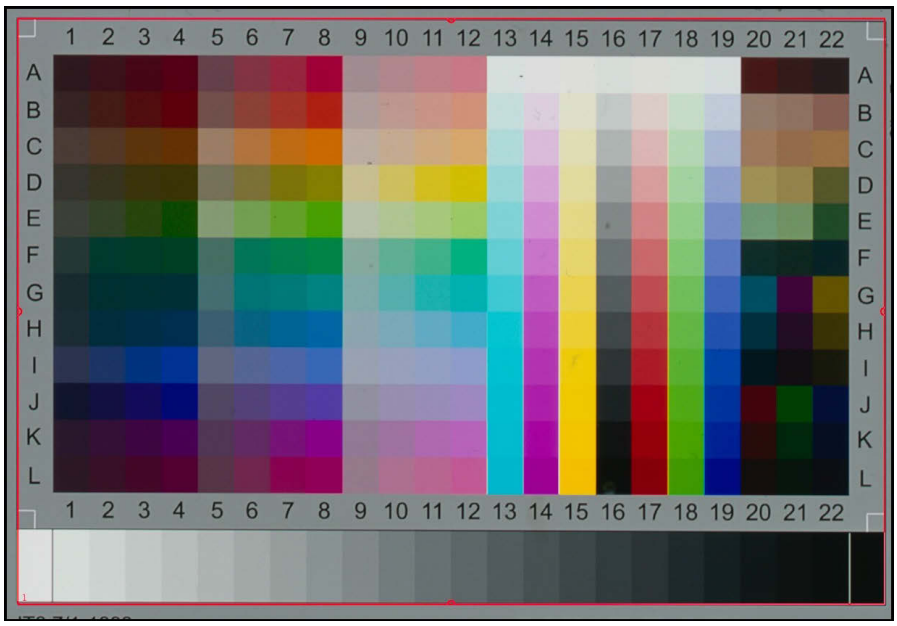


Figure 8. Profiled Outcome

I don't know what your time is worth, but after making several profiles in SilverFast I've recovered the time-value of money for the cross-grade to SilverFast 8 Ai Studio, not to speak of other time-saving features of this software either unavailable or less well-implemented in other scanning applications. I'll get to those later.

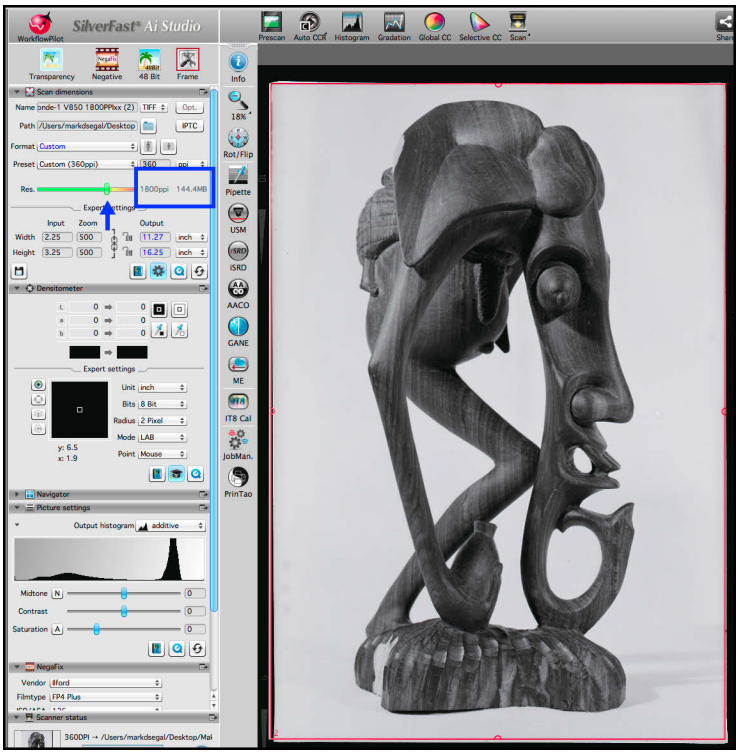
Resolution

As Henri Cartier-Bresson is known to have opined that sharpness is a bourgeois preoccupation, I'll have to confess my bourgeois inclination here. I like disaggregating scanner resolution into three separable considerations: (1) pixels per inch (PPI) that the CCD can record – no resampling, (2) how much fine detail the scanner can render (sharpness judged from a target), and (3) how sharp do the photos look when you've scanned and printed them? For practical purposes, the only one that really matters is (3), but (1) and (2) are supporting factors, so we will look at all of them.

(1) Pixels per inch (Synonymous with SPI – Samples per Inch)

In terms of PPI, the Epson V850 (and its predecessor the V750) is one of the highest currently on the market, with a CCD resolution of 6400 PPI (film holders or fluid mount) or 4800 PPI (reflective or area frame). For comparison with previous (sadly discontinued) high-end prosumer scanners, the Nikon SC5000ED/SC9000ED are 4000 PPI and the Minolta Scan Elite 5400, 5400PPI. Plustek rates its OF 120, now on the market, at 5300 PPI. Let's examine the output 6400 PPI implies:
(E.G. 1) Medium Format Negative 2.25 x 3.25 inches: at 6400 PPI scanning input and an optimal output resolution of say 360 PPI for Epson professional inkjet printers, 6400 PPI scanner input generates [3.25x6400/360] x [2.25x6400/360] = c.

58 x 40 inches, and the resulting file size is about 1.7 GB in 16 bit/channel mode, taking a little over 6 minutes to scan (excluding processing and saving) in the V750 and a little over 4 minutes in the V850 (**useful comparison**: the V850 scanned this format about 1/3 faster than the V750). Hence, if you're not printing posters and you're starting from such media, you can safely scan at much lower input resolution, requiring far less time and storage, *provided* you can decide *before scanning* on the largest output dimensions you're *ever likely* to want. SilverFast's Scan Dimensions dialog has all the input/output information and controls neatly mounted in one place combined with a handy visual guide indicating the optimal scanning resolution relative to your stated output objective (Figure 9).



9. SilverFast Scan Dimensions – Epson V850 scanner

In Figure 9, I start with my 2.25 x 3.25 inch photo, scanning in 48-bit mode (16 bits/channel), and the largest print I want to make is 11x16 inches (same aspect ratio) at 360 PPI. The SilverFast resolution zone bar tells me the outer limit of the *optimal* input scan resolution is 1800 PPI (blue arrow), resulting in a file of 139.5 MB, which by the way took about 2 minutes to scan, vs. 1.7 GB and 8 minutes total for the 6400PPI scan.

Short of making huge prints, the most practical way to compare the 6400 PPI and 1800 PPI outcomes is on display, opened in Photoshop, enlarging the latter to 100% (1 screen pixel per image pixel) and bringing the former to a display magnification whereby the same image area shows in the same size window (in this case 28%). I did this for a section of this photo where the detail is well captured (Figure 10).

Depth of field is pretty shallow, but if you look at the fine scratches in the wood, it's hard to tell them apart and they're reasonably sharp (this is before any sharpening).

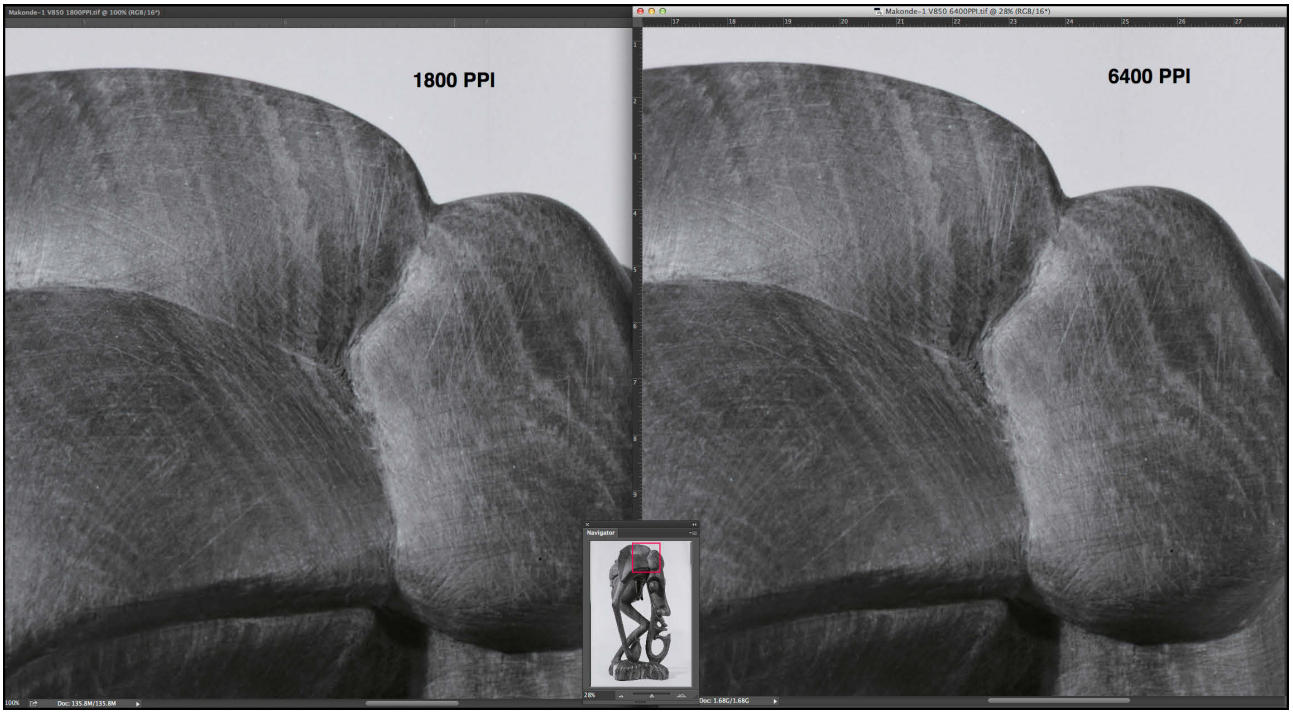


Figure 10: 6400 PPI at 28% versus 1800 PPI at 100% (Epson V850 Scanner)

Basic points so far:

- The Epson V850 has enough native PPI on the sensor to make very large prints from medium format media at optimal scanner and printer resolution without the need for up-sampling the image (i.e. no invented pixels).
- The V850 is faster than its predecessor (mainly, very little warm-up time).
- You don't need massive amounts of resolution for making 11x16 inch prints at optimal scanner and printer resolution. But the V850 gives medium format users a lot of potential to make very large prints in case of need.

(E.G. 2) For a 35mm negative, which is 36mmx24mm, or about 1.42 x 0.95 inches, at 6400 PPI scanner input resolution, the V850 lets you make about a 25 x 16.9 inch print at 360 PPI output resolution to the printer, without up-sampling. As in the above example, if you will never need such large output, you may just as well scan at lower scan resolutions, and use the SilverFast Scan dimensions dialog to help select optimal scanner resolution settings for the combination of print dimensions and printer PPI you need. For example, sending 360PPI to the printer for making a 12.6 x 8.4" print, 3200 PPI input resolution is correct for this scanner. ("Right-sizing" scan resolution is controversial, some claiming that maximizing resolution and then downsampling produces cleaner scans. My research indicates no comparative advantage to this approach.) We'll be looking at 35mm results below.

(2) How much fine detail can the scanner render?

The "scientific" way to evaluate this is to scan a resolution target at the maximum non-interpolated resolution of the scanner CCD (6400 PPI for the V850). The resolution target I use for this purpose is the LaserSoft Imaging USAF 1951 shown in Figure 1 above. This target consists of 7 Groups each having 6 Elements each composed of 6 black and white line pairs (3 pairs horizontal and 3 pairs vertical) in each Element. As the Group and Element number increases, the size of these line pairs becomes increasingly small, and the more technically demanding it becomes for a scanning system to differentiate between the black and white bars in the line pairs. Because this is a well-manufactured standardized target, using the target avoids a host of extraneous capture conditions that come into play with normal photographs (e.g. camera lens quality, depth of field, camera steadiness); but we'll be looking anyhow at real photographs below. The target can be used to compare scanners and to find optimal focus for any scanner with manual focus. SilverFast has an excellent tool in supported scanners to do this fine-tuning reliably. While the appropriateness of this target for digital devices has been critiqued, it is widely used and I have found no other that the industry has generally adopted for this purpose, so regardless of any limitations it may have, I use it too. The main issue I have with it is that the results apply to the middle area of the image, but not the border areas.

The procedure is to scan the target at the maximum non-interpolated resolution of the scanner (the CCD specification) with no editing at all, and then examine the result at 100% or 200% magnification on display. Select the highest Group and Element number for which you can barely resolve black from white in all 6 line pairs (even if the edges are somewhat fuzzy), look-up that Group and Element coordinate on the resolution table provided with the target, and the respective box in the matrix tells you the effective resolution of the scanning system. It is most meaningful to do these tests in a comparative manner, to better appreciate a single result or to know whether it is better or worse than any alternative of interest.

Unlike, for example, the Nikon SC5000ED and the Minolta Scan Elite 5400, for both the V850 and V750, the internal focal length between the lens and the media cannot be adjusted internally, but rather it is done using "raisers" on the frames. The two questions I wanted to answer with this procedure are (1) what are the best focus settings for the V850 frames, and (2) how does the best outcome from the V850 compare with that from my sharpest legacy scanner, or not using a scanner at all and digitizing the film using a camera, as discussed in my recent article for Luminous-Landscape (done with Todd Shaner).

Starting with question (1), a word of explanation about the frames: these frames are one of the major innovations of the V850 relative to the V750. They have "raisers" that can be set in five positions (Figure 11); you need to determine by making and evaluating trial scans which setting delivers the sharpest result for the media you've mounted into the frame.

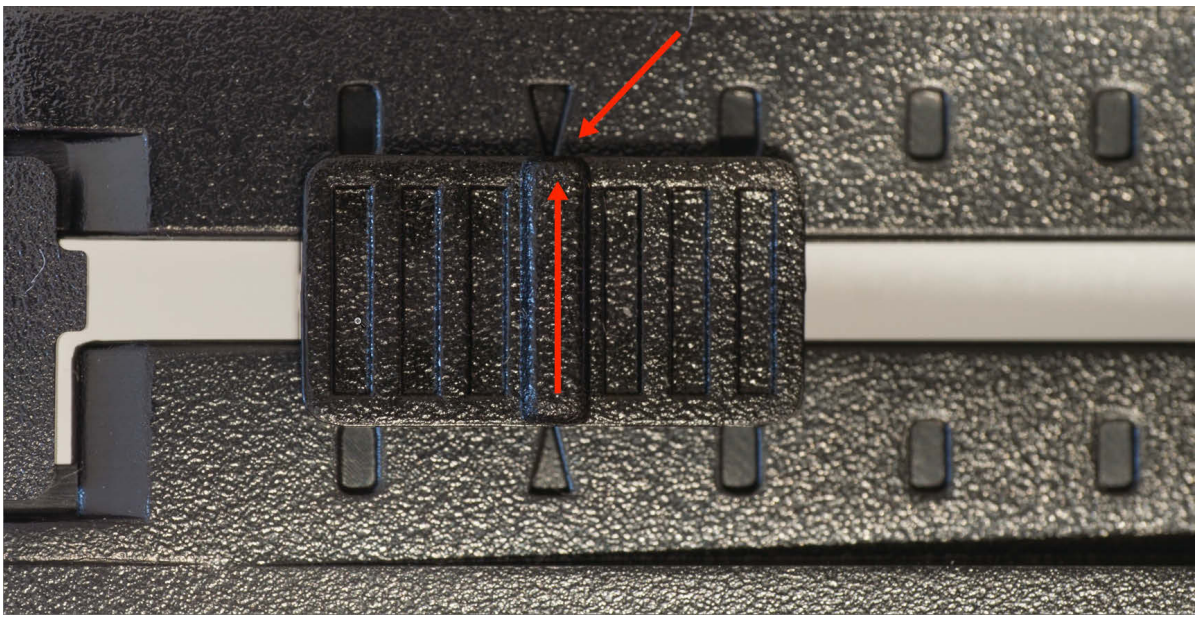


Figure 11. Frame Raiser, shown in position 2 (triangular markers above and below the slider) from left (the default).

Therefore I scanned the resolution target for each setting and determined that the default (position 2) shown in Figure 11 worked best for the cardboard mounted 35mm slide frame. For the strip-film and medium format frames, however, I found notch 4 (two to the right of the red arrows in Figure 12) more satisfying.

For answering question (2), I did comparison scans using the Epson V850, V750, Nikon SC5000ED, Minolta Scan Elite 5400 and to add a bit of spice – a digital camera capture of the target using the set-up described in the above-mentioned article. The results for both sets of tests (choice of V850 frame raiser position and comparison between devices) are shown in Figure 12.

Before turning to the results, a further word of caution is in order. While all the foregoing sounds scientific and straightforward, in practice it isn't quite. There are often (but not always) "degrees of distinctiveness" between these line pairs as you look from one element to the next. As they get smaller they become increasingly fuzzy, but at what point of fuzziness do you stop? Do you stop only where they are very clearly distinguishable giving you low resolution values, or where they are barely distinguishable giving you considerably higher values? This is a judgment call I've been pondering and finally decided that unless one value alone is unambiguous, it's less arbitrary to show the reasonable range, as in the final column of Figure 12.

Epson V850	Manufacturer		Maximum	
Raiser	Specified PPI/dpi	Group	Element	Res Value
1	6400	5	6	2580 ~ 2896
2	6400	5	6	2580 ~ 2896
3	6400	5	5	2299 ~ 2580
4	6400	5	6	2299 ~ 2580
5	6400	5	3	2048 ~ 2299
Epson V750				
+	6400	5	5	2299 ~ 2580
O	6400	5	6	2580 ~ 2896
Nikon 5000	4000	6	1	2896 ~ 3251
Sony A6000	24.1 MP	6	1	3251
Minolta 5400	5400	6	5	4598 ~ 5161

Figure 12. Results of Resolution Tests (PPI)

There were several surprising outcomes here. Firstly, there are technical reasons why in general a flatbed scanner may not deliver the same degree of fine detail from 35mm transparent media that can be had from a high quality dedicated film scanner. Nonetheless, the results above indicate that the revered Nikon 5000 produces target resolution only about 12% better than that of the Epson V850. We'll be examining below whether this difference shows in normal photographs.

Secondly, the 24 MP Sony a6000 camera, sporting the very latest sensor technology and a high quality Zeiss "Makro Touit" 50mm f/2.8 lens paired for this camera, did no better than the Nikon 5000 at its highest end of the range.

Thirdly, the venerable Minolta Scan Elite 5400, which hardly ever gets mentioned in contemporary scanner discussions, produced test resolution far and away better than all of the above.

Finally, not surprising because Epson advised me that this is by design – the tests confirm that the effective resolving power of the V750 and V850 is the same.

(3) Does the Epson V850 deliver a sharp enlargement of a normal photograph from 35mm film?

This discussion can be targeted in two ways; (i) the purpose is simply to show what the scanner produces without any enhancement; or (ii) the scan is the base input for the production of a fully edited photograph and the purpose is to see final outcomes which the scan permits, because in the final analysis, "final" is what matters. As well, this examination should be comparative for reasons mentioned above. We'd best look at all of it.

For this test, I selected a 35mm negative shot hand-held in Angkor Wat Cambodia back in 2004 on Fuji Reala with a Nikon F70 and the high-quality Nikkor 28-105mm lens, having considerable detail (Figure 13, scanned with the Epson V850).

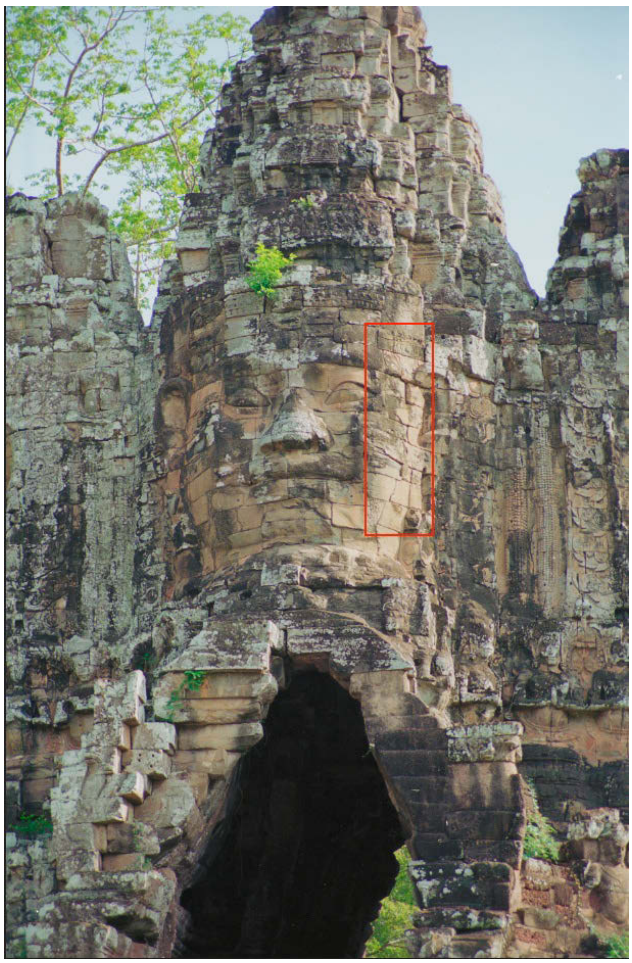


Figure 13. Angkor Wat, 2004 Unedited Fuji Reala Negative Converted in SilverFast

I scanned it at 48-bit (16-bit per channel by 3 channels – R,G,B) in the Minolta Scan Elite 5400, Nikon SC5000ED, Epson V850, Epson V750 scanners and photographed it with my Sony a6000, processing the Sony capture using the "MakeTiff to HDR" procedure described in my Camera Scanning article. The target output size is an image of 11 x 16.5 inches with OUTPUT resolution of 360PPI (for the Epson 4900 printhead); the scanner input resolution is set as closely as the scanners allow[1] without upsampling for those output requirements. I imported the scans and the

[1] Recall that you either hit the maximum non-interpolated input scan resolution, or if below that, the scanners have discrete (step-wise) input resolution settings and SilverFast selects the optimal one; if the step value is not exactly that required, SilverFast selects the nearest above that required and downsamples to the requirement (shedding pixels is better than inventing them). The Nikon is the lowest resolution scanner of the lot, so Lightroom would have had to upsample its file by about 6%. For the others, native resolution was more than sufficient.

camera capture to Lightroom and made the prints from Lightroom, applying Lightroom sharpening.

You can't see the prints over the Internet, so you may take my word for it that the *comparative* sharpness of detail in the prints is very well predicted by the *comparative* results of the scans of the SilverFast Resolution target.

The Minolta scan is definitely the sharpest, followed by the Nikon, then very closely by the Sony a6000 camera (with the Zeiss Touit Makro lens) and the Epson V850/V750 in that order. The results from the V850 and V750 are indistinguishable, much as Epson intended. None of the scanners or camera produced unacceptable image detail. While the Nikon and Minolta are a bit crisper, the V850 is no slouch – especially for a flatbed scanner. So I feel comfortable advising that if you don't have access to one of these discontinued "old master" scanners or a really high quality camera capture set-up, the Epson V-850 will satisfy – and the same for the V750.

I present overleaf screen grabs from a snippet of the Figure 13 photo (the small area inside the red frame) taken at 50% on-screen magnification as viewed in Photoshop CC-2014, to provide a reasonable visual impression of how the prints look to me. Please see Figures 14 (NOT sharpened) and 15 (Capture Sharpened in Photo Kit Sharpener 2 using the low speed 35mm negative film set at Superfine Sharp). This is not the end of the sharpening workflow for these photos; output sharpening would ensue as purposed (in my case for an Epson 4900 printer).

The performance of the Epson V850 for medium format black and white negatives is indicated in Figure 10. There is, however, more to be said about this. No (non-drum) dedicated film scanner I know of scans media wider than 6 cm (2.36 inches), except for the Imacons. That eliminates sizes such as 3 ¼ x 4 ¼ and 4 x 5 inch sheet film negatives which many professional, institutional and advanced amateur archives would hold in abundance – including mine. Enter the Epson V850 or its predecessor the V750. Both come with frames designed for 4 x 5 inch sheet films. The Epson Fluid Mount Accessory is also available for scanning these larger size media. The comparator I can offer in this section of the report is capturing these sheets using a camera set-up – in my case, the Sony a6000 with its Zeiss Touit Makro lens. (Later, I shall be discussing the V850 in the context of the Plustek OF120 and a couple of other "higher-end" models).

For this part of the research, I selected one negative of a series I shot of Makonde ebony wood carvings in Dar es Salaam Tanzania (early 1970s), because they contain ample fine detail and the camera was steadied on a tripod to eliminate shake.

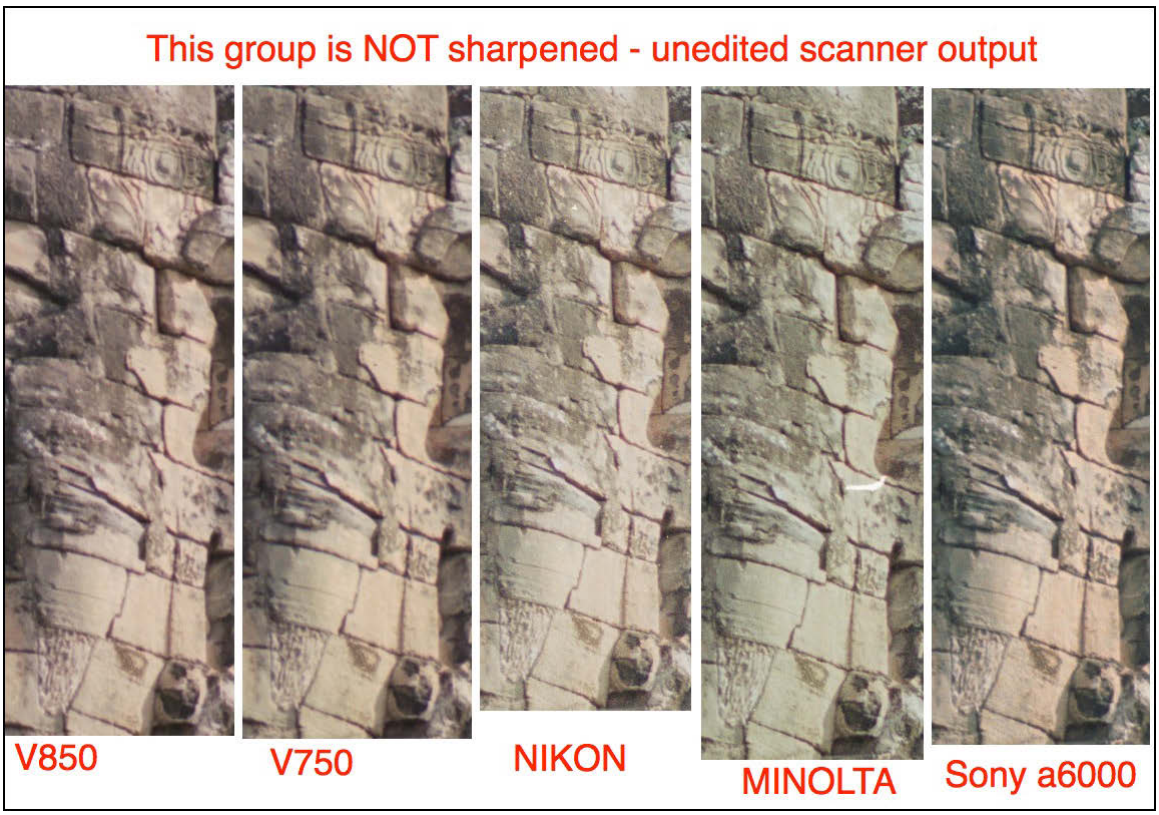


Figure 14. Unsharpened scanner/camera result (red rectangle area of Figure 13)

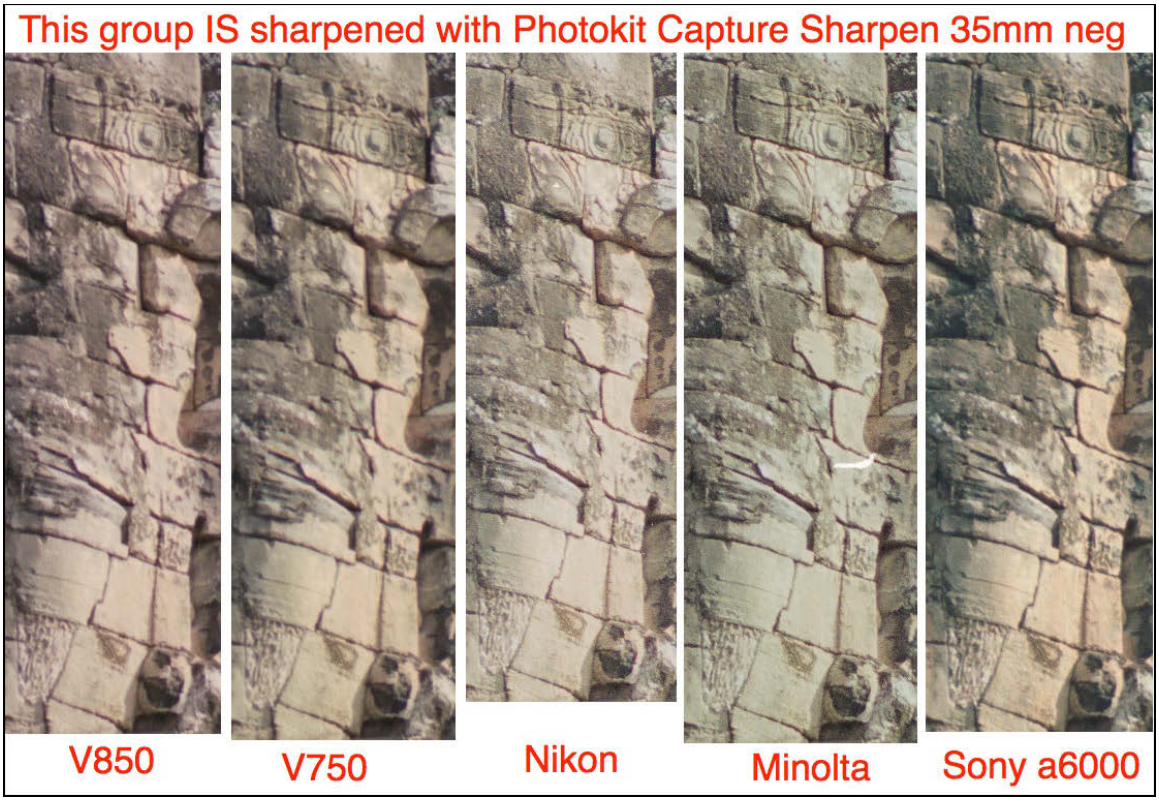


Figure 15. Sharpened scanner/camera result (red rectangle area of Figure 13)

The first challenge dealing with these sheets is that they may not be totally flat, even if stored flat for many years. Most of mine have a very slight curvature or "puffiness" that is visible when lying flat on the glass. While the scanners and the macro lenses do have some depth of field, it is really very slim, so it's best to flatten the media as much as feasible. The usual way of doing this is fluid mounting, but that's a fair bit of time and work, as well as intervention on the media, which I prefer to avoid if feasible, without sacrificing quality. I found a way I like much better: I purchased a 4x5 inch piece of Museum Glass (yes, that is the brand name). It is very clear and non-distorting, thin enough to fit on top of the fluid mount accessory without bumping against the lid, yet just enough weight to flatten the film on the glass. As well, using this glass for both the scanner and camera captures, I did not encounter a problem of Newton rings.

I scanned the selected 3 ¼ x 4 ¼ negative at 3200 PPI in 48-bit colour, despite it being a B&W file, (Figure 16) resulting in a whopping 730 MB file (time: total 7 minutes 15 seconds, of which 6:00 for the scan and 1:15 for processing and saving in the V850, using a mid-2010 MacPro with two 2.66 GHz 6 core hyperthreaded Intel Xeon processors (i.e. 24 virtual cores) and 24GM RAM.

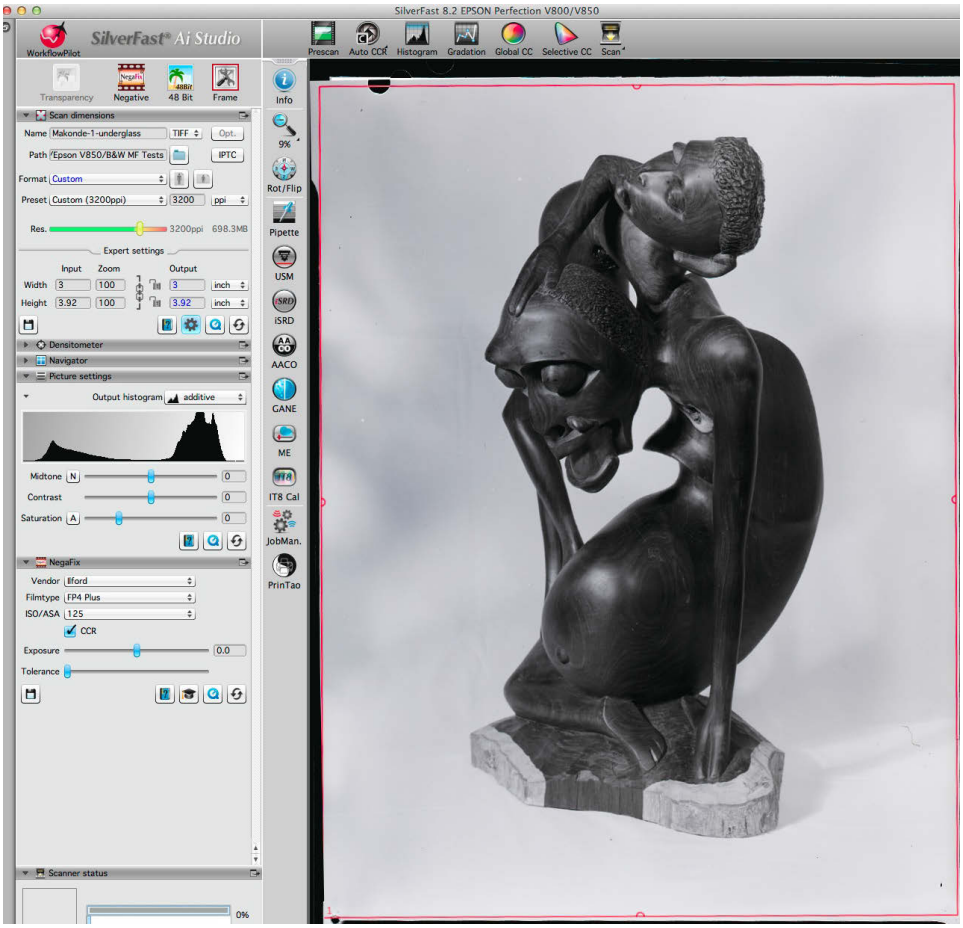


Figure 16. 3 ¼ x 4 ¼ inch negative scanned in SilverFast 8

Opened in Photoshop and resized BUT NOT RESAMPLED for OUTPUT PPI of 360, the resulting print size would be 26.7 x 34.9 inches (Figure 17).

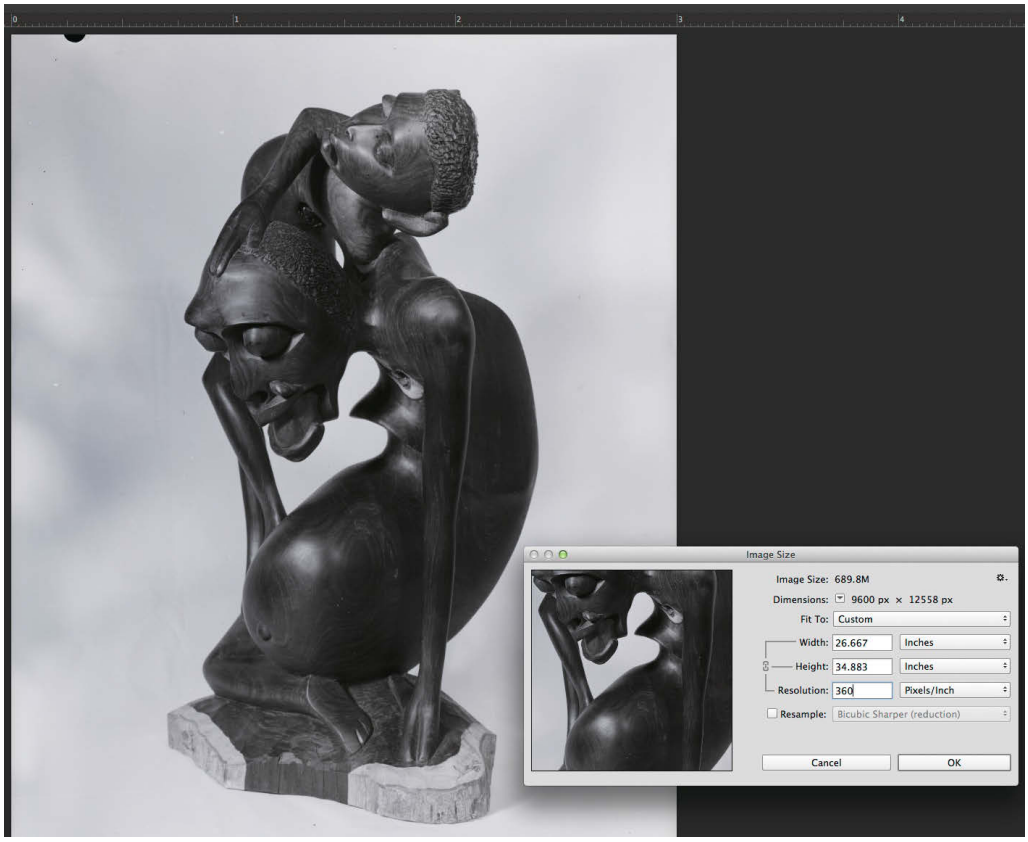


Figure 17. Scan from Figure 16 opened in Photoshop for size check

I made one scan with the negative under glass, and another not under glass. Figure 18 shows a comparison of a snippet at 100% magnification at the pre-sharpening, pre-editing stage. The fine detail of the version under glass is marginally more distinct; hence this is the preferred route for the bourgeois to whom sharpness matters. The extent of the difference is more visible in a large size on a computer display than it can be in this illustration.

The next question is about the quality of detail one can expect from one of these V850 scans once prepped for print, which includes sharpening and tonality adjustments. To approximate a visual impression on display, I did capture and output sharpening in PhotoKit Sharpener Pro 2 (settings: Capture - 4x5 Negative, Narrow Edge; Output: Inkjet Glossy for the approximate 27x35 inch print size). The result in Figure 19 is a small snippet (see Figure 20) magnified to 100%. I did minimal tonal adjustment just to make sure all available detail is revealed for this article. It all fits in the histogram (no clipping) without tonal adjustments, as it was properly converted in SilverFast 8.

Figure 18. Glass cover vs no glass cover of Makonde Scan: 100% magnified snippet

Figure 19. Print-ready snippet from Epson V850, 100% magnification

This demonstrates that the Epson V850 used with the fluid mount accessory and the negative held flat under glass can produce a large well-detailed print.

Figure 20. The red frame is the Figure 19 magnified area (V850 Scan)

Turning to the comparison with a camera scan of the same negative, the first major difference is the total pixel count. The camera limits capture resolution per frame to the MP of the camera, regardless of the size of the media being captured. My Sony a6000 is a 24 MP camera, producing 6000 x 4000 pixels whether the media is 35mm or medium or large format; hence the maximum print size at 360 PPI OUPUT is an 11x 15.5 inch non-interpolated print - smaller without interpolation (or multiple section shots and stitching) than what the Epson V850 can do in a single exposure. The 3200 PPI scan in the Epson V850 is about 12,560 x 9600 total pixels, or about 35x27 inches at 360PPI, and one could scan it even larger. The sharpened result from the camera scan is impressive (Figure 21).

Conclusion: a camera scan using the latest sensor technology and a USD 1000 macro lens can produce a sharper but smaller digital rendition compared with this scanner. However, both look fine and well detailed printed on a 13x 19 inch sheet.

Figure 21. Makonde, snippet of 24 MP Camera Capture
Conversion Technique: C-F Systems MakeTIFF and SilverFast HDR

Shadow Tonality

No discussion of a new scanner would be complete without considering dynamic range – in particular, how good is it for capturing and rendering tonal gradation in the quartertones. This depends partly on the hardware, but very importantly on the software as well. Having done some comparative testing several years ago and produced similar visual information out of really difficult media from scanners having differing DR specs, I decided to set the numbers aside and just see what the scanners and post-scan image editing can achieve, visually.

I have numerous really difficult Kodachrome slides – but my favorite for this kind of evaluation is a photo I shot in Bruges, Belgium in 1958, that I'll call "Bruges Shadowy" (for the curious, it was made at Rozenhoedkaai). It's contrasty, at first appreciation with considerable suppressed shadow detail. So the questions are – (i) just what tonal separation lurks below the surface of such images, (ii) how well do the scanners perform in scraping it up, and (iii) what software best shapes it? The answer to question (i) is "a lot more than meets the eye at first glance". We'll now turn to exploring questions (ii) and (iii) in the context of the Epson V850.
To do this testing I scanned the slide using SilverFast Ai Studio in the Epson V850, the Epson V750, Minolta 5400, and I did a camera raw capture with the Sony a6000 using my set-up described in the Segal-Shaner article referenced above. All of the unadjusted output was moderately underexposed (Figure 22), and even with

exposure adjustment and histogram end-point normalization (Figure 23), none of it sufficiently revealed the tonal separation in the shadows that is possible from this photo; however, none of the histograms displayed any black clipping. I also ran tests with SilverFast Multi-Exposure (for raising shadow detail) on and off, and it made no difference. This doesn't mean multi-exposure doesn't work - I've seen instances where it does – but more importantly, it means that the single exposure is picking-up all the luminance information the media and scanners can provide, which I consider a "plus" for the scanners tested, and for SilverFast.

Figure 22. Bruges Shadowy, Epson V850 opened in SilverFast, unadjusted

Figure 23. Bruges Shadowy, V850, basic exposure adjustment in SilverFast

I haven't found a piece of scanning software yet that really does an easily controllable and optimal job on tonal separation in the deep quartertones (or for that matter in re-building partially blown highlights). "Optimal" here means good

tonal gradation in shadows without looking muddy. For these tasks, Lightroom/Adobe ACR remains unsurpassed. Hence, I imported the Figure 23 image into Lightroom, and moved the Shadow slider to +78 (result: Figure 24).

Figure 24. Bruges Shadowy, Epson V850: Quartertone adjustment in Lightroom

In particular, check the detail in the building walls and the shimmering reflection of water on the under-roof of the bridge, and you will observe the substantial revelation of detail without any of it looking the least bit "muddy". I could have taken this further, but additional quartertone lightening alters the mood – a matter of taste. I further pushed the quartertone brightening for the camera-capture version (Figure 25 overleaf). The same could be done with any of the film scans to similar effect. Luminance results for the Minolta 5400 were similar to all of the above.

For purposes of the Epson V850 review, **the take-home** here is that the scanner scoops up in an editable manner all the quartertone information the media likely contains, and with a combination of good scanning software and good post-capture image editing software, it is possible to produce pleasing, detailed quartertone luminance.

Figure 25. Bruges Shadowy Camera Capture Adjusted in Adobe Camera Raw

Productivity

Save for the few film scanners that provide feed-in adapters for batch scanning rolls of uncut film or numerous mounted transparencies, one real advantage of the flatbed, in our context the Epson V850, is that the holders contain up to 12 mounted 35mm slides or 18 negatives as three strips of up to six each. Using software that facilitates batch scanning, you can save a lot of time and multi-task with this combination, especially as Epson provides two sets of frames with the scanner, such that while one frame is under scanning, you can load the second in queue, then reload the first, and onward.

There is no software on the market I know of that handles batch scanning with the degree of ease and automation available in SilverFast 8. There are two levels of it in SilverFast. At the bundled SE+ level, batch scanning is available. At the Ai Studio level, an additional tool - the Job Manager is available. It allows you to rapidly copy-paste the same settings to any selection of images in a batch for which you want a number of the settings to be the same; furthermore, all the individual and common settings for the batch in the Job Manager can be saved as a group for future use.

Detailed instruction is available on the SilverFast website, as well as in Chapter 11 of my book, so I won't go into all the detail here, save to provide a summary of how it works (after step 5 you may do image-specific edits at will before scanning):

1. Load the media into the holder and place the holder into the scanner.
2. Select the media type (transparency, positive or negative) and do a pre-scan, the results of which will look something like Figure 26.

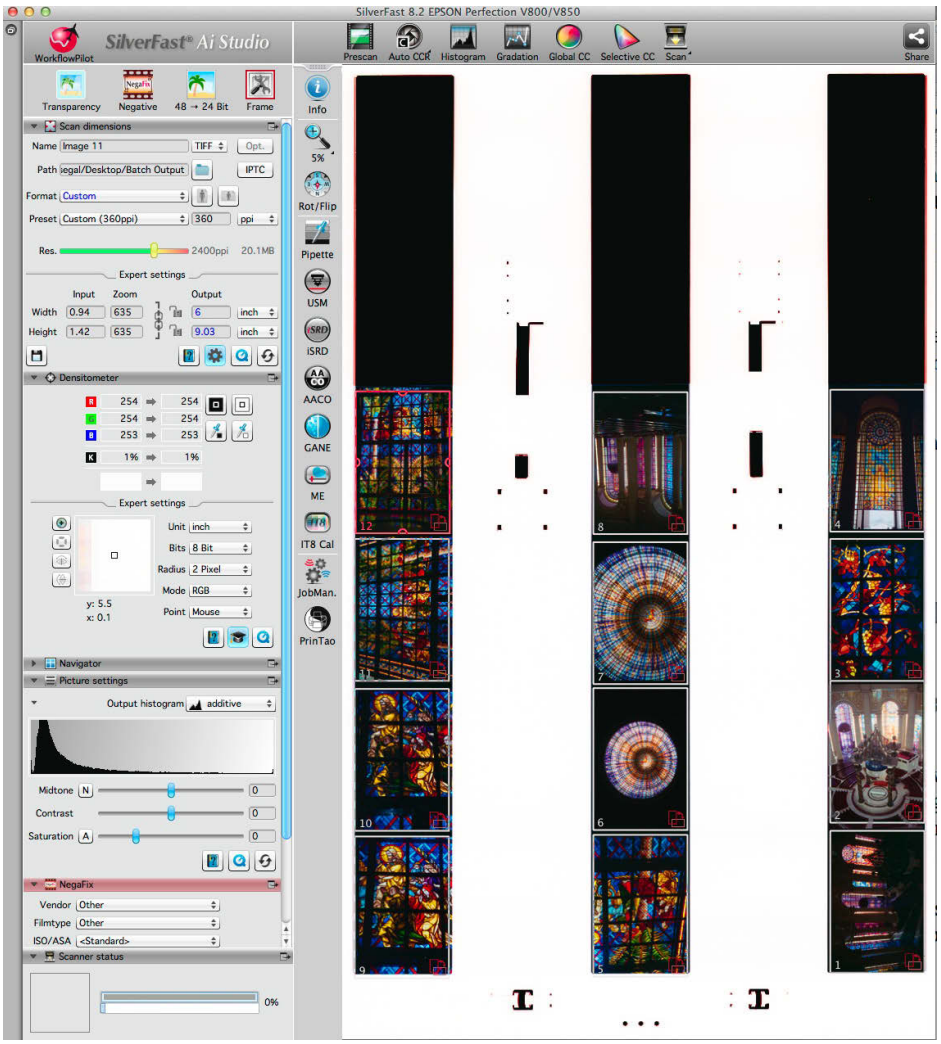


Figure 26. Batch Scan Set-Up in SilverFast 8, Epson V850, 12 negatives

3. Click on Frames>Find Frames>(holder type) and click on the holder type.
4. Within a few seconds, SilverFast identifies and delineates each photo in the frame holder – quite accurately (see red and white frames around each photo in Figure 26). The red frame is the current selection.
5. In the Scan Dimensions panel, where all this is very conveniently displayed in one place, select the destination folder, the output resolution you need and the linear output dimensions you want.
6. Click and hold the scan button and select the Batch Scan option.
7. Another dialog will pop-up (Figure 27) asking you to name the output folder, and name the file sequence (one name will do, as SilverFast automatically numbers the scans sequentially after your chosen name, starting from a number you specify in this dialog).

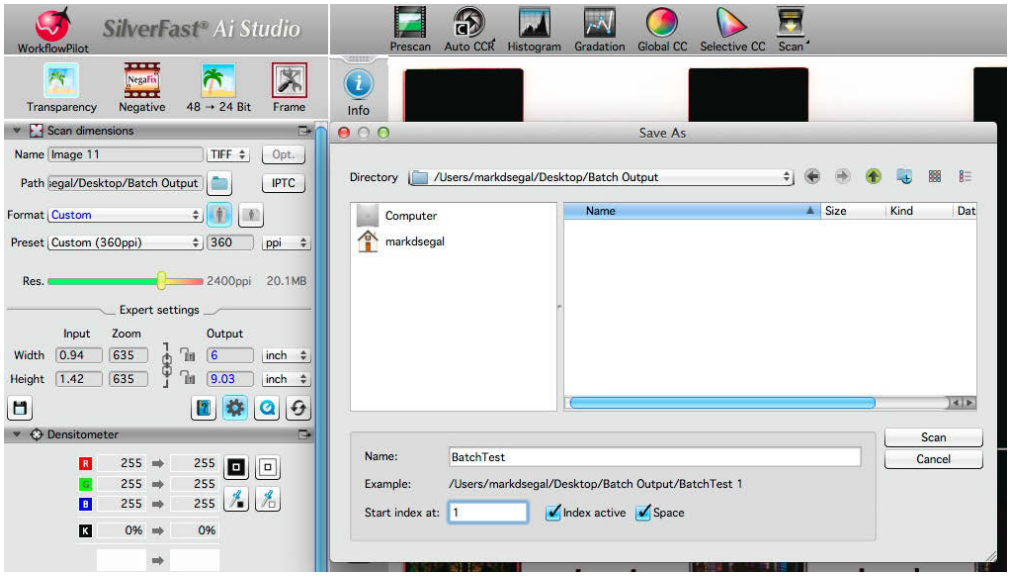


Figure 27. Batch Scan Save Dialog

8. Click on "Scan" and the process begins. It will scan all the frames in the holder, name them and place the results in the selected output folder (Figure 28: red arrow points to scan progress of the current frame; blue arrow points to finished frame saved in designated folder).

You can now go for coffee, or if you're a glutton for punishment like me, you'll work on something else, such as writing this article – (yes, I verify everything I write), while the scanning continues in the background (Figure 28).

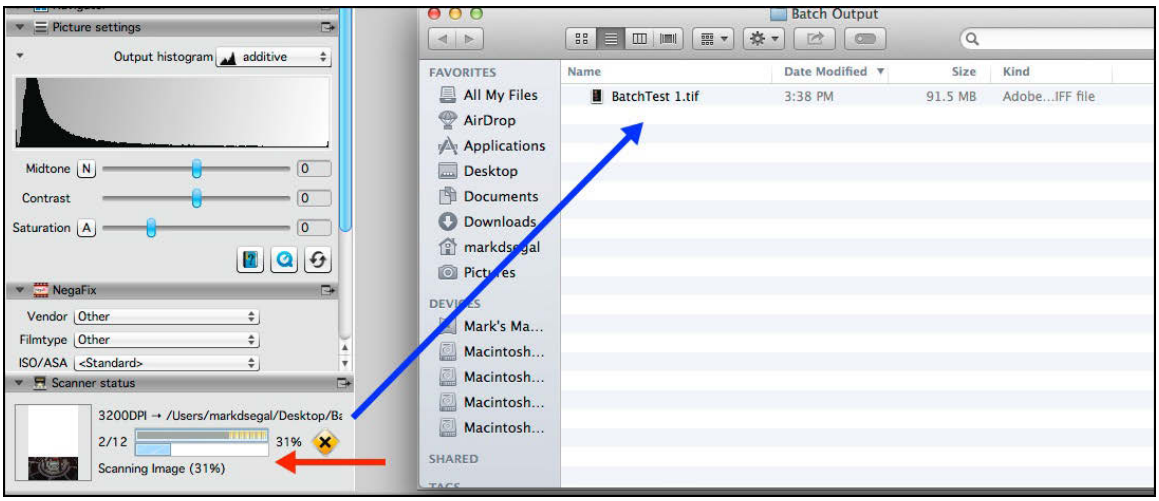


Figure 28. Batch scan progress

But don't go away for too long, because this set of 12 photos, about 90MB each (scanned in 16 bit) took a total of 15 minutes from start to finish of the whole batch.

To quickly see the results, I imported the folder of 12 into Lightroom (Figure 29.)

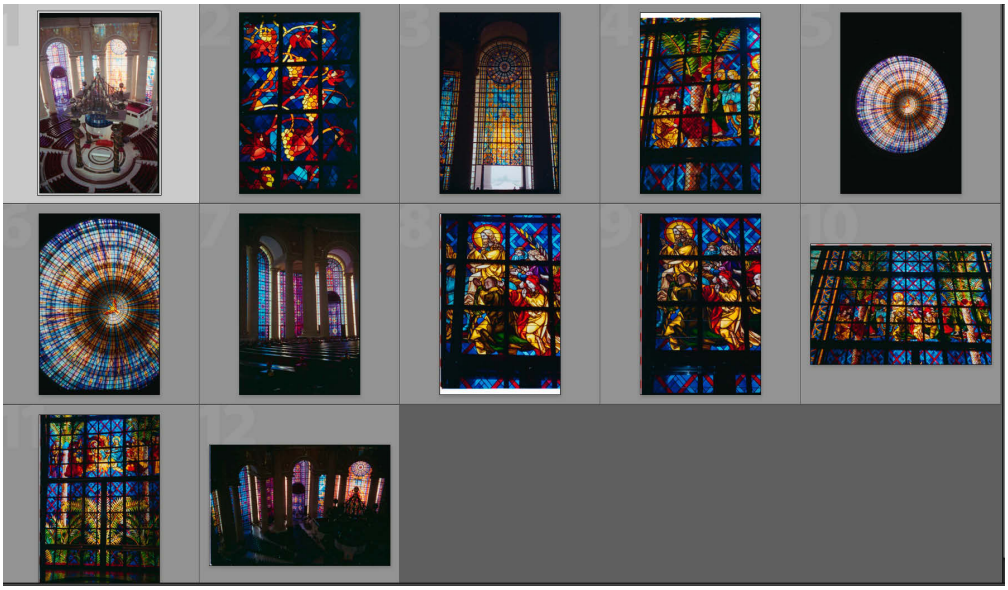


Figure 29. Photos imported to Lightroom (Cathedral in Yamossoukro, Cote d'Ivoire)

The colour that the Epson V850 and SilverFast pulled from these negatives is rich, with no editing whatsoever and to the best of my recollection – quite true to life (Figure 30). It needs little work to finalize.

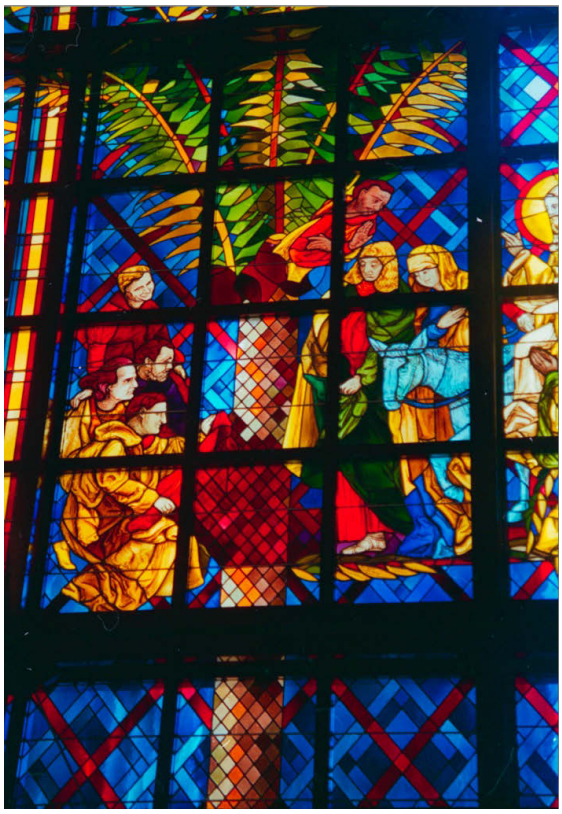


Figure 30. One of 12 Batch Scan results, no editing

The Job Manager (Ai Studio) working in conjunction with batch scanning allows you to apply a common group of edit settings to any selection you make of the photos in the batch, again saving more time. Before committing the scan, you can also add any custom editing per photo and the process will automatically scan each photo in the batch using the bespoke settings.

Summing-up on productivity, the Epson V850 used with SilverFast's automated frame finding and batch scanning capabilities make this combination a productivity beast, and the results are as good as achievable from scanning one photo at a time. This is a real advantage of a quality flatbed scanner used with efficient software.

Software

The V850 comes bundled with three applications: EpsonScan, SilverFast SE+ and X-Rite i1 Scanner. I have already discussed the profiling options and highly recommend cross-grading from SilverFast 8 SE+ to SilverFast 8 Ai Studio for the efficient creation of custom profiles. At $79, combined with the other benefits of Ai Studio, it's well worth the value of time and options. Another benefit of the SilverFast cross-grade is the Job Manager tool discussed just above. Important for maximizing quality when using SilverFast, only the Ai version supports exporting TIFF and PSD files in 3x16-bit (i.e. 48-bit) mode. There are other incremental benefits shown in the summary comparison chart overleaf, issued by LaserSoft Imaging. In that chart near the bottom, "Expert Mode" refers to added controls and features of various tools that are only available in the Ai Studio version.

I have provided detailed guidance on feature differences between the SilverFast versions in Chapter One of my book, and by agreement with LSI, that material is available as a free download from their website. Rather than repeating it here, those interested may download the document at source and decide on the merits of the up-grade; after many years of using this application there is no doubt about it in my mind – get the best they offer, especially with the current pricing, because sooner or later much of it becomes useful; but this is a personal decision based on one's needs.

Comparing the use of EpsonScan versus SilverFast, I recommend EpsonScan for reflective document scanning. For film scanning, while EpsonScan certainly drives the scanner and produces the resolution the scanner is capable of delivering, there is no question that the bundled version of SilverFast, and all the more so the Ai Studio version, provides a much more fulsome, easier approach to scanning, and from my experience, better results out of the box for colour negatives. Anyone buying this scanner will have no shortage of options for software, and what's bundled is free to use, so try both and I think you'll readily see what I mean.

In particular:

- batch scanning from EpsonScan is an obscurantist, laborious process compared with how it's done in SilverFast;

- EpsonScan cannot handle scanner profiling alone;
- Digital Ice Technology provided with EpsonScan is truly primitive compared with SilverFast's iSRD technology, which provides far more control – such as managing size of defect detection and strength of correction as well as Preview, Correction and Automatic modes for granular forecasting of the outcome, and in the Ai Studio version, specific measures for handling Kodachrome. Grayscale images in which there is little or no residual silver halide are amenable to clean-up using iSRD's infra-red technology. Used properly there is no collateral damage, whereas Epson warns users of Digital Ice that it could soften the image. SilverFast needs no such warning, because used properly it doesn't. This is a huge advantage;
- The convenience, customization properties and preview quality of the SilverFast 8 interface make for a better user experience;
- SilverFast's explicit controls over colour negative film profiling and the ability to make one's own custom negative profiles puts it far ahead of EpsonScan in respect of this useful functionality for all people who scan colour negatives;
- EpsonScan's selective colour correction tool is grayed-out;
- And the list could go on.

It seems pretty clear that Epson's approach to the software was to offer its own basic solution that appeals to users who want no more than this, while also bundling another product that opens up much more scope and flexibility in their scanning work. So I expect nothing I'm saying here would come as any surprise to Epson, or to others who have used and appreciated the latest versions of both applications.

I should add one point that is often overlooked in discussions of SilverFast: within each version of the software, there are actually two utilization approaches – the automated WorkFlow Pilot approach, and the Manual Approach. People who want the application to guide their workflow can use the former, and those who don't think they need this would use the latter. In either case you can use the provided tools to adjust each image in a custom manner. With the Ai Studio upgrade, users of the Workflow Pilot can customize the range of tools/options for which the program provides a guided workflow. In this way, SilverFast lets you be both guided and customized to the extent you want rather elegantly. ☺

Bottom line: Seriously consider the up-grade to SilverFast Ai Studio for all your photo work (or use the bundled SE+ version if that meets your needs), and use EpsonScan for reflective document scanning, where it works very well. I'm limiting the scope of the software discussion here to products that are either bundled with the V850 or provide an upgrade path from the bundled product, so that brings me to closure on the software observations.

Figure 31. SilverFast 8 Versions: Key Features Comparison

The Epson V850 versus "The Higher End"

While some may argue that it's unfair to compare a $950 product with others ranging from two to twenty times more expensive, I think it's instructive to know what, if any, quality one "leaves on the table" buying a less expensive scanner. Another merit of such a comparison is that two of the three products discussed here are in current production, so still priced at their original cost and readily available, which is not so for the Nikon 5000 and Minolta 5400 comparators discussed above. They appear in eBay or at Scandig periodically[2]. The higher-end products we'll consider here are the Plustek OF120 (current product, $2000), the Nikon SC9000ED (discontinued), both accepting 35mm to medium format, and the Imacon 848[3] (discontinued, but replaced most closely by the Imacon X5, a faster scanner with similar resolution, modified light diffusion, and a current price of about $20,700; a used Imacon 848 sells in the $6000~$8000 range).

Plustek says the actual sensor resolution of its OF120 model is 11,600 PPI, but they rate the scanner an optical 5300 PPI. When I scanned the LSI USAF-1951 with it, I observed a rating in the range of Group/Element 6/2 to 6/3, the latter a stretch, situating the range at 3639~4096PPI, the latter a stretch, (Figure 32). While the high end is about 23% below the company's optical resolution claim, it still puts the high end of the OF120 range a full 40% above the high end of the V850 range, and this shows in real photographs (Figures 33 and 34).

To remind, this is a 35mm colour negative, scanned in the V850 at 6400 PPI and resized but not resampled for an 11x16.5 inch print at 551 PPI output; and, scanned in the OF120 at 5300PPI for the same size print at 449 PPI output. I magnified each in Photoshop to roughly match for these screen grabs. Both scanners do a decent job with the shadow detail at the right side of the building. Unsharpened, the OF120 is a sharper result for this photo; sharpening reduces the difference between them. While both prints are acceptable, the OF 120 print is somewhat crisper.

I next show comparisons for a segment of the Figure 13 Angkor Wat photo. This time, rather than comparing only the Epson V850 versus the Plustek OF120, I also include the Minolta 5400, as that looks like the best of the lot discussed above in respect of detail rendition across the tonal range.

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[2] It's perhaps worth recalling with these comparisons that while current, the Nikon 5000 and the Minolta 5400, were in proximate price range to the Epson V750/V850. The Nikon in particular has since become very expensive due to its scarcity, reputation and optional batch media holders. The models being discussed in this section are a price quantum above the Epson V850, ignoring scarcity value.

[3] Many thanks to artist/photographer Christopher Campbell of State College, PA, for inviting me to his studio to test the Imacon 848 and Nikon 9000 models. Anything I say here about them is my responsibility!

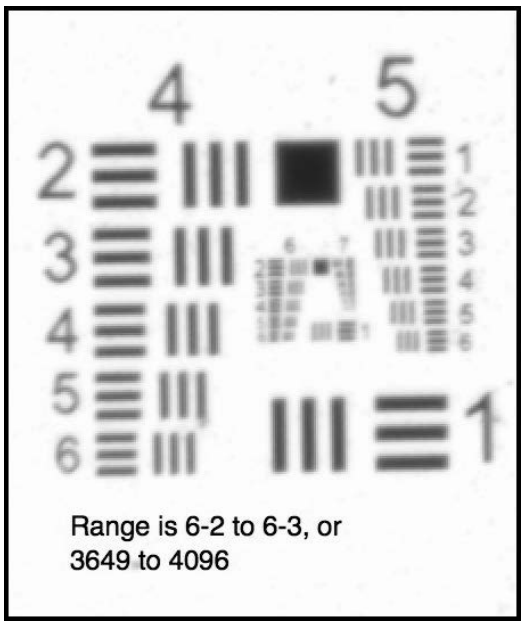


Figure 32. LSI Resolution Target Result for Plustek OF120

Figure 33. Unsharpened (Epson V850 left; Plustek OF120 right)

Figure 34. Sharpened (Epson V850 left; Plustek OF120 right)

Figure 35 shows the comparison for the scans before applying any sharpening, Figure 36 has both capture and output sharpening applied, and Figure 37 adds a gamma reduction to both the V850 and OF120 results, to bring out more shadow detail. This was not necessary for the Minolta 5400 scan.

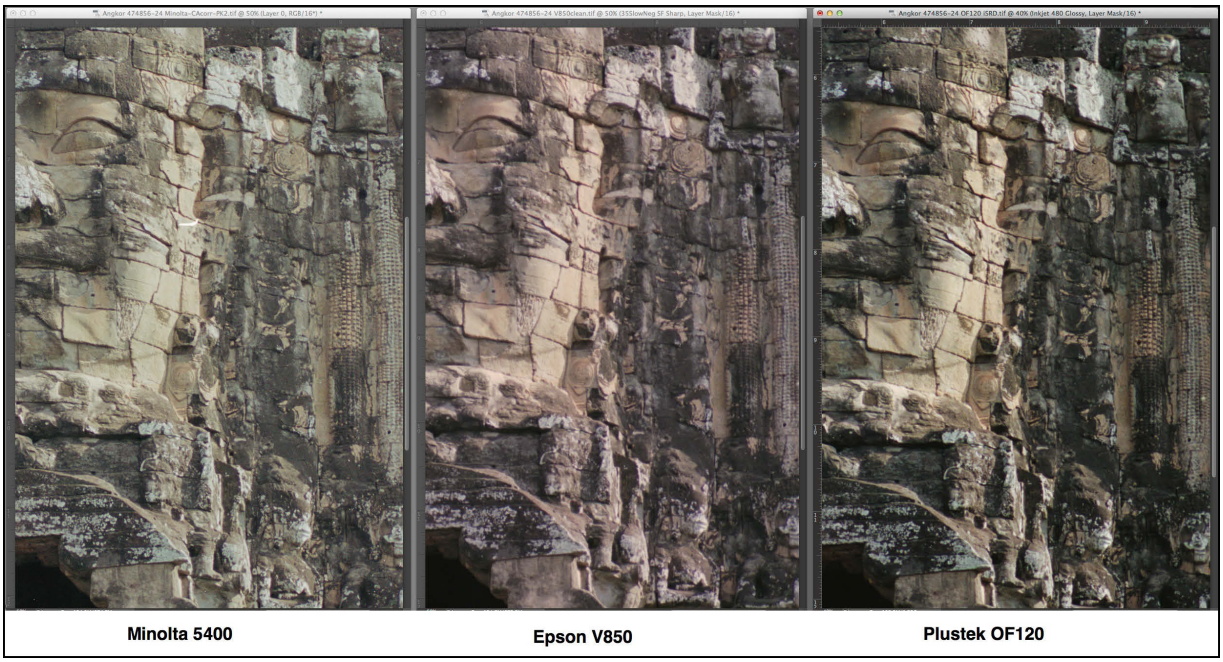


Figure 35. Angkor – three scanners – NOT sharpened

Figure 36. Angkor – three scanners – SHARPENED

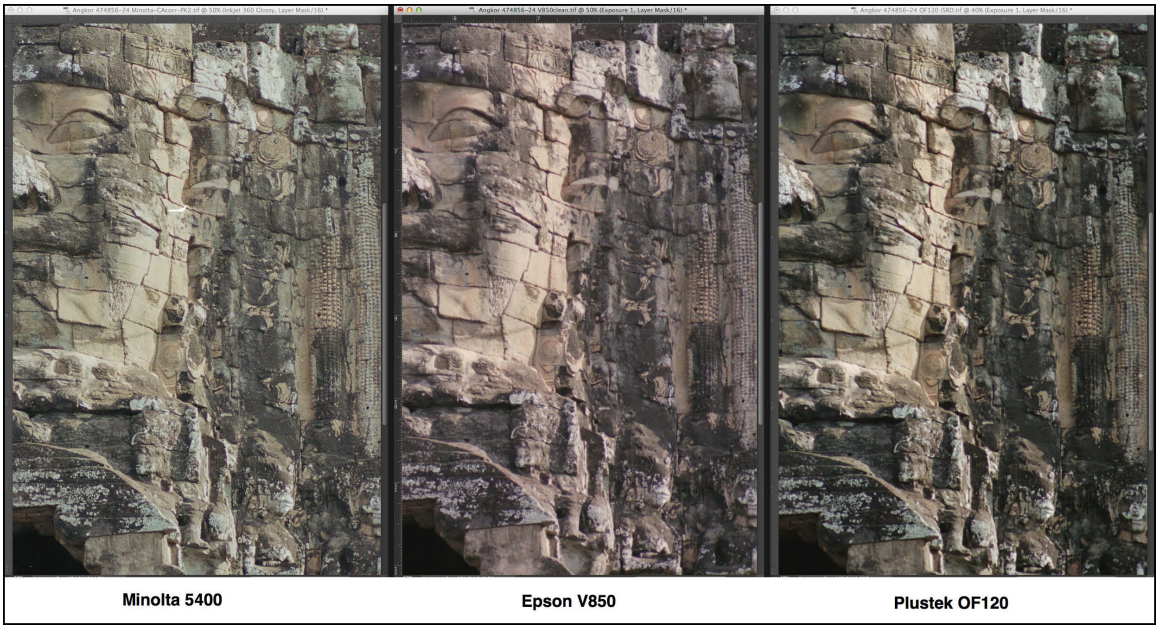


Figure 37. Angkor – three scanners – more shadow detail

Not relevant to shadow detail, there is a hue difference between these renditions, even though the scanner-specific NegaFix profile for Fuji Reala was applied to each. It appears that these negative profiles (remember this is NOT "icc" profiling) did not fully neutralize for the bespoke character of the light source in each of these scanners (perhaps performance variance between LSI's scanners and mine?). This, by the way, indicates an aforementioned advantage of the SilverFast Ai Studio version, as it allows you to customize and save a new negative profile that renders the colours for your specific film/scanner combination to your taste.

Turning to the main purpose of the comparison – detail and tonal rendition, the Minolta 5400 delivered the sharpest, clearest scans of the three. As well, it best rendered the shadow detail unaided. Looking at the sharpened results with the shadow detail boost where needed, (these being the most fit for purpose), the Minolta still emerges best, but the V850 and the OF120 aren't that far behind, the difference between these latter two being quite subtle. I'd give the OF120 a slight edge on highlight detail rendition, but otherwise, the outcomes are fairly similar. Recall, the V850 is about half the price and multi-purpose. This exercise shows that depending on the image, competent post-scan sharpening (my preference: PhotoKit Sharpener 2) can much reduce perceived differences of acuity between scanners.

Turning now to quartertone rendition, I scanned the Bruges Shadowy Kodachrome slide in the OF120. Figures 38, 39 and 40 show three states of the photo: (i) previewed in SilverFast 8 with no adjustments, (ii) exposure and histogram normalized in SilverFast 8, and (iii) shadow tonality improved in Lightroom, respectively.

Figure 38. Bruges Shadowy, no Adjustments from the OF120

The first state of the slide (Figure 38) emerged rather darker than expected, with a moderate blue cast notwithstanding the profile. Correcting this in SilverFast took a few seconds. First I neutralized the colour cast with the "Neutral Pipette"(grey eyedropper), then raised the midtones and highlights with the Histogram and Picture Settings tools (figure 39). I then imported the file to Lightroom for opening the shadows by raising the Shadows slider to +70 (Figure 40). The purpose of all this was to see how the scan in the Plustek OF120 compares with a similar operation starting with a scan in the Epson V850 (Figures 22 to 24).

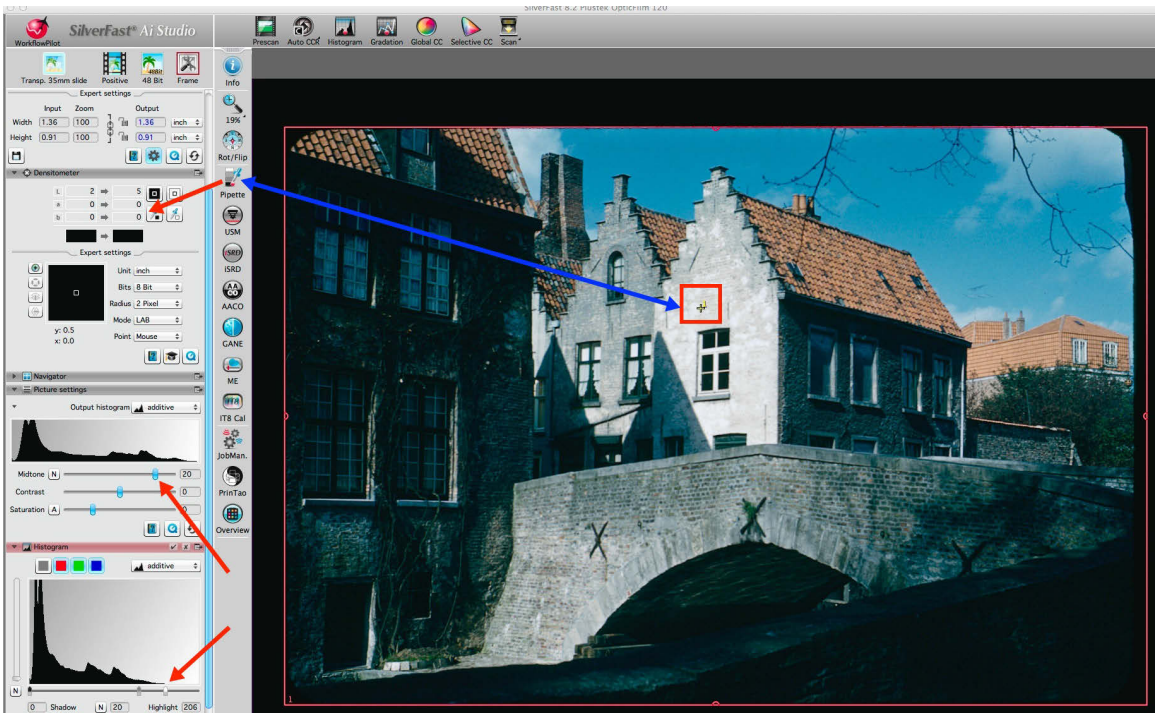


Figure 39. Bruges shadowy, OF120, adjusted in SilverFast 8 (blue and red arrows)

Figure 40. Bruges Shadowy, OF120, quartertones adjusted in Lightroom 5

While the initial scan in the Epson V850 emerged with less of a cast, the main points are that whether from one scanner or the other, the scanners delivered the shadow information, the basic adjustments in SilverFast 8 were easy and successful, and the final treatment of the quartertones in Lightroom brought out the shadow tones with more revealed detail in a pleasing manner – equally good outcomes for shadow tonality between the two scanners – just slightly different image edits.

Both of these scanners handle medium format film, and of particular interest, black and white negatives from 120 roll film. The OF120 cannot handle wider film, whereas the V850 can (up to 8x10 inch sheets), so the comparison here is limited to 2 ¼ x 3 ¼ inch negatives. I have photographs of Makonde carvings from a private collection I made in this format with my erstwhile Graflex (using the roll film back) on a tripod in Dar es Salaam 45 years ago. The detail in the negatives (Ilford FP4 developed in Agfa Rodinal) is impressive and therefore useful for scanner testing. The photo I selected is a good candidate for revealing image detail (Figure 41).

Figure 41. Makonde, Epson V850, 3200 PPI Scan

Resized to 360PPI, but not resampled, the resulting photo dimensions are approximately 19.5 x 29 inches. Overleaf I show results for the V850, V750 and OF120, unsharpened and sharpened for inkjet output, suitably magnified on display to indicate the appearance of a large print. In PhotoKit Sharpener 2, Capture sharpening was set for 6x6 Negatives, Auto Edge Sharpen, and Output sharpening for Inkjet, Glossy at the designated size.

Figure 42. Makonde, 3 scanners, UNsharpened segment

Figure 43. Makonde, 3 scanners, SHARPENED segment

Whether examining the sharpened or the unsharpened versions, all look pretty good on display, and as well on paper (13x19 inch sheets of Ilford Gold Fibre Silk with about 11x16 inch photo dimensions, printed in Lightroom). There is no difference of detail rendition between the V850 and the V750. The OF120 produced slightly more contrast and detail definition, but it's not a world apart. I also made a camera capture of this negative, the fully sharpened detail overleaf (Figure 44). It's a bit crisper than the best of the sharpened results above, but again, not hugely.

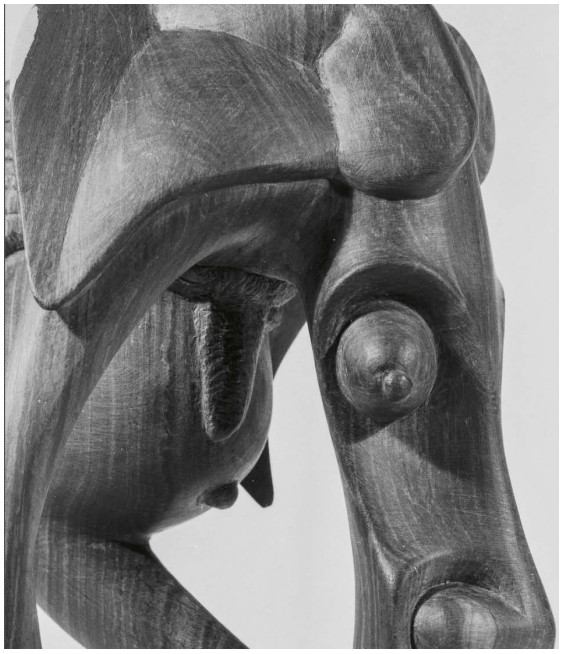


Figure 44. Camera scan of Makonde, sharpened

When it works, the OF120 will produce a sharper 35mm scan than the V850, but I see no major advantage for medium format negatives printed at least up to 11x17 inches actual image size, unless its somewhat higher effective resolution is needed for much larger prints.

Quite apart from the photographic properties of the scans, productivity and convenience will enter into many peoples' choice between alternatives. As mentioned above, the productivity of the Epson V850 combined with SilverFast is hard to beat - certainly not by the Plustek OF120 in any circumstances. I encountered a number of random but critical difficulties using the OF120:

- Loading and previewing the media is very slow given how the mechanical feed of the holders works (or doesn't) inside the machine; whereas for the V850 loading happens as quickly as the user can insert the media into the frame or onto the glass; as well, the SilverFast preview generates quickly;
- Freezes and crashes were frequent, whereas the V850 just worked;
- It can produce improper framing of negatives in the scan overview and preview while the media was properly seated in the frame. At time of writing there were no controls in SilverFast for adjusting the image placement in the scan preview. LaserSoft Imaging advises that a new version release of SilverFast 8 will include a tool in the scan Overview dialog for adjusting the placement of the image in the scan preview. This will be a welcome addition whose functionality will be amenable to evaluation once released;
- I experienced several instances of placing the 35mm negative strip correctly in the holder, but on ingestion and positioning, the negative strip moved out of position;

- The OF120 produced colour inconstancy scanning B&W negatives in 48-bit mode – to an extent not encountered with the other scanners or the camera for the same pieces of film (there were localized areas of the otherwise neutral image having an <a*> value of +3~+4, read in L*a*b* measurement mode);
- It has no manual focus capability, a feature I would have expected in a $2000 film scanner. While the holders are well-built, I did detect some focus trade-off between border and center areas, as discussed further below. This problem is not unique to the Plustek scanner; rather it points to a generic issue of media flatness in scanning work, and what one can do to assure it;
- It can prescan the wrong image relative to the one selected in the Overview; reverting to the Overview and double-clicking the image can fix this;
- It can fail to shut-down when pressing the power button, so I had to unplug it; one wonders why. Press and hold can work;
- It wouldn't batch scan (even though SilverFast documentation says it can); I understand this matter may be resolved with the forthcoming version of SilverFast 8;
- In loading and triggering the frame holder, the transport mechanism grated and crashed (because I misjudged the open space required behind the scanner for the holder to travel out); yes, pilot error, but I was able to recover it by powering down, restarting and doing a "Software Reset" in SilverFast. Don't ask me why that solved it, but it did. It should have an idiot-proof throttle to arrest the grinding and grating in such cases, as it can't be good for the mechanism.

These observations apply to the specific unit of the OF120 I was using. I have no idea how generic they may or may not be to all units of the OF120. This is an important consideration for people evaluating which product to buy. For all of these scanners, and I think for most reviewers, we report our experience based on a "sample of one", which may or may not be statistically representative of the product as a whole. This scanner has received positive reviews on a number of websites.

Turning to the Nikon SC9000ED, this discontinued product of high repute can still be found periodically on the resale market, but it's expensive; it was about USD 1800 when current and used units now fetch from USD 3000 upward. The purpose here is to compare its image quality using the same media tested for the V850.

We first scanned the LSI USAF 1951 resolution target and determined that this scanner's resolution is in the range of Group/Element 6/1 to (at a stretch) 6/2, or 3251~(at a stretch) 3649 PPI. This situates it moderately above the Epson V850.

To compare resolution in real photographs, We look first at the 35mm Apartment photo. The limit of the Nikon 9000 input resolution is 4000PPI, allowing for this photo an un-resampled 10.4 x 15.6 inches at 360 PPI (output). The limit of the Epson V850 input resolution is 6400PPI, allowing an un-resampled image of

16.6x25.2 inches. So, for the same output resolution, the v850 permits a larger print absent resampling. For apparent sharpness, it makes a difference whether you view the outcomes before or after sharpening, because sharpening tends to attenuate apparent differences, and very few of us would normally print unsharpened output. Anyhow, Figures 45 and 46 show a small, magnified section of the unsharpened and the sharpened renditions respectively.

Figure 45. Nikon 9000 (4000PPI) vs Epson V850 (6400 PPI) Unsharpened

Figure 46. Nikon 9000 vs Epson V850 capture sharpened, then output sharpened @ 360 PPI

Comparing these Figures carefully, you can see how in the unsharpened versions, the Nikon 9000 is slightly sharper than the Epson V850, but once both are Capture and Output sharpened, difference of apparent sharpness is subtle.

Turning to the Angkor photo, the outcomes are a bit different:

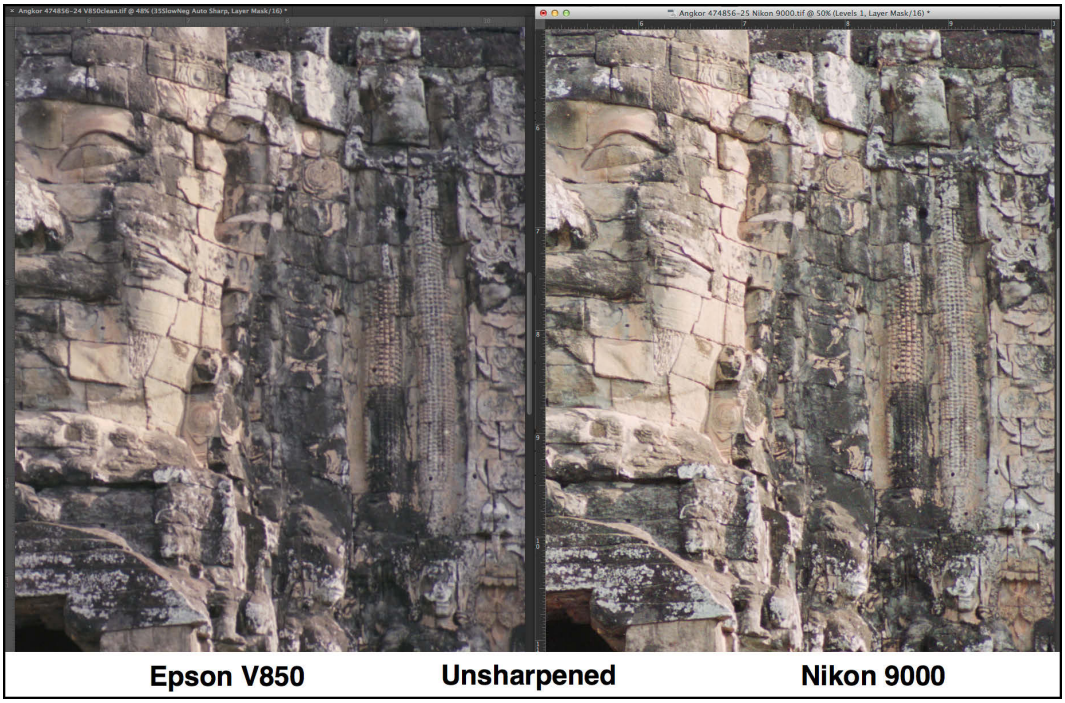


Figure 47. Epson V850 vs Nikon 9000 Unsharpened

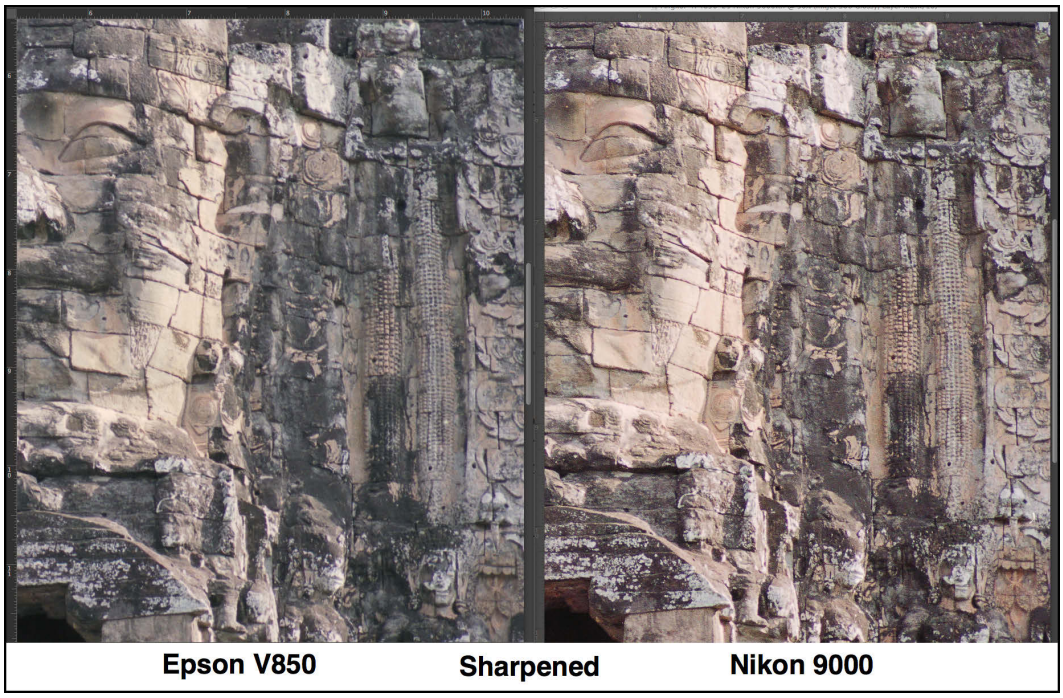


Figure 48. Epson V850 vs Nikon 9000 Sharpened

In the original scans, using SilverFast Ai Studio and the correct Negafix profile for each scanner/film combination, the results had differing luminance and colour characteristics, though in all cases the histograms showed no clipping of either

highlights or shadows. (This by the way also applied to the Apartment photo above.) These differences can be almost edited-away, but I implemented luminance and colour balance edits in Photoshop only just enough to improve comparability for unbiased evaluation of detail rendition.

The main difference between this photo and the previous one is that the Angkor image has a lot of detail in the dark rocks and a more subtle range of contrasts and colour palette. On the whole, whether sharpened or unsharpened, for this photo, the Nikon 9000 produced a sharper outcome with more contrast "out of the box". However, once suitability prepared, the quality of the output from the V850 for these 35mm negatives is respectable.

Turning to medium format black and white (B&W) negatives, I show the Makonde-1 image (2 ¼" x 3 ¼"), comparing the V850 (scanned at 3200 PPI) with the Nikon 9000 (scanned at 4000PPI)[4]. Both were scanned in SilverFast Ai Studio and resized but not resampled to 360 PPI output, producing un-resampled print sizes of 19.5x29 inches (V850) and 23.7 x 35.7 inches (Epson 9000). Figure 49 shows the unsharpened comparison, and Figure 50 the sharpened.

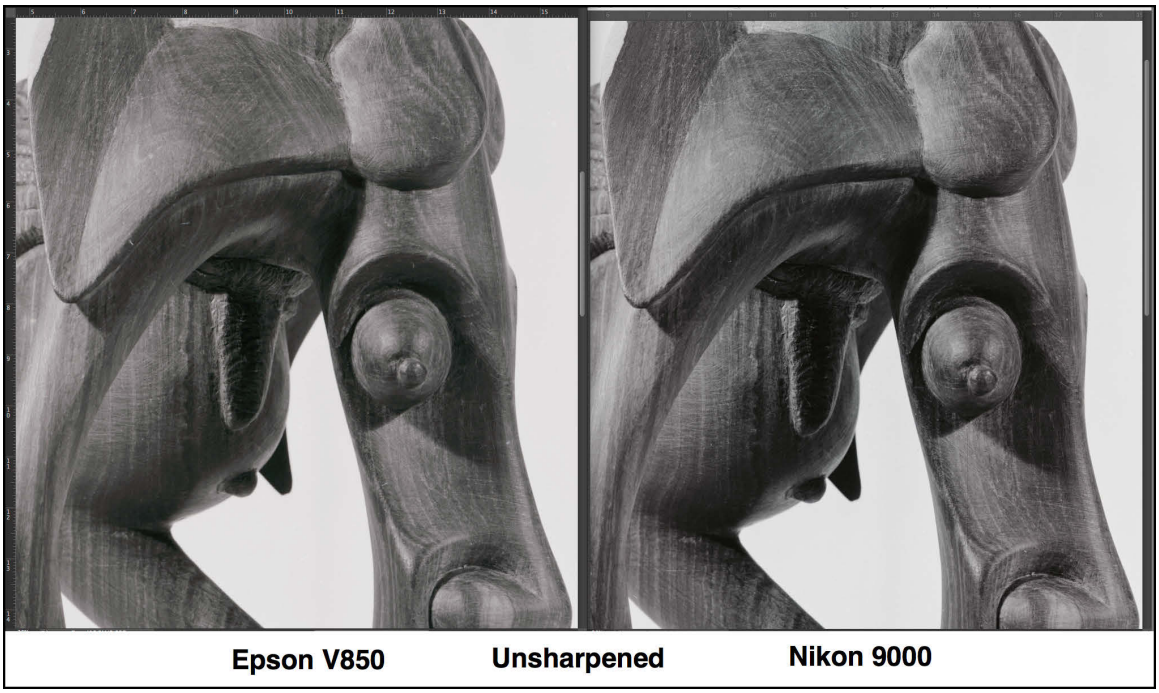


Figure 49. Makonde Epson V850 vs Nikon 9000 Unsharpened

[4] The resolution difference reflects the difference of native resolution scanning steps in these scanners and the most appropriate choice for purposes of this comparison.

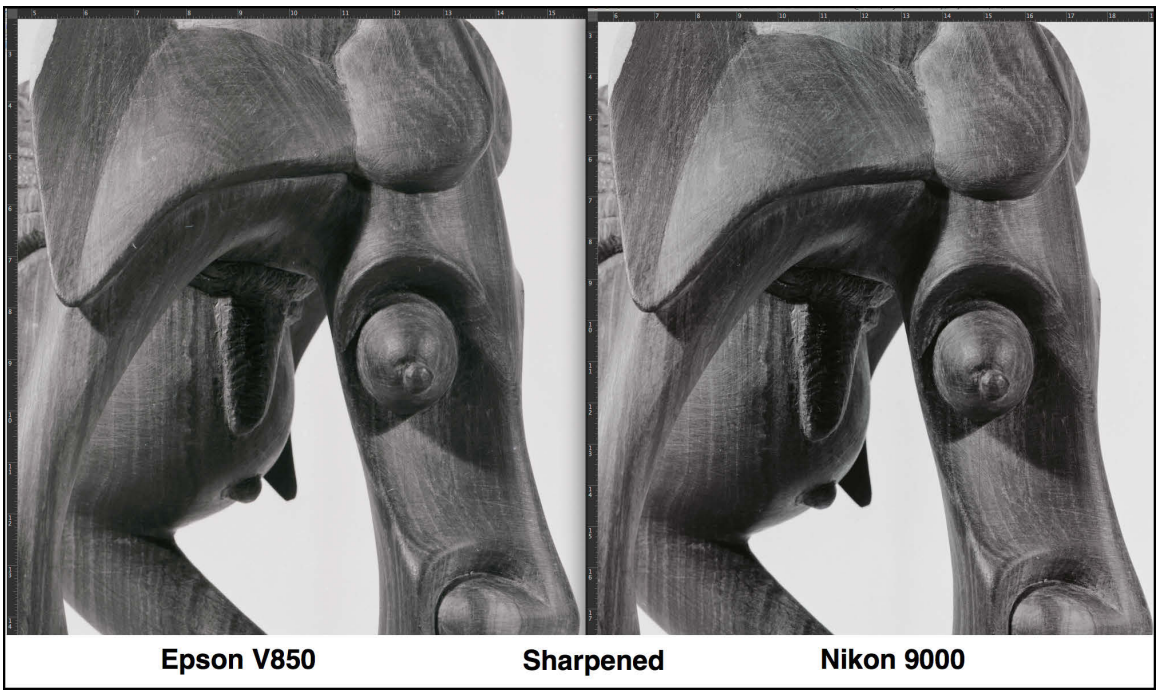


Figure 50. Makonde Epson V850 vs Nikon 9000, sharpened

Whether unsharpened or sharpened, the Nikon 9000 has an edge on the Epson V850 due to higher contrast and better rendition of fine detail. Seen in print, both outcomes look very good. For medium format work, looking at these comparisons, you'd have to think hard before buying a used Nikon 9000 for at least three times the price of a new Epson V850.

Turning to rendition of shadow tones, I also scanned the Bruges Shadowy photo in the Nikon 9000. Its performance was no different from what we've already observed in the other scans of this image, except that as I had also noticed for the previous photos scanned in the Nikon 9000, this scanner produced a more exposed (lighter) result than the others did, all using SilverFast 8 with the same settings for the media being scanned. When we scanned Bruges Shadowy in the 9000, we performed very basic luminance settings in SilverFast 8 (normalizing the histogram by adjusting its end-points to the limits of the image luminance range). The outcome is that shown in Figure 51. The left wall and the underside of the bridge still needed a shadow boost, best done in Lightroom (Figure 52). The Lightroom adjustments were to adjust Shadows to + 79, Blacks to -22 (producing a combination of good visibility and pleasing contrast in deep shadow areas) and Highlights to -15 (reducing glare from the light gray building façade in the center).

Ignoring the slight difference of colour balance between Figures 52 and (repeated) Figure 24 overleaf, you can appreciate the similarity of deep shadow treatment possible from the initial renditions of both scanners.

Figure 51. Bruges Shadowy Nikon 9000 from SilverFast 8

Figure 52. Bruges Shadowy Nikon 9000 after further edits in Lightroom 5.7

Repeat Figure 24 result from Epson V850 with SilverFast 8 and Lightroom 5.7 edits

The final scanner comparison in this review – and truly this is more for intellectual interest than an "apples to apples" test of the Epson V850, because the comparator is so far out of range – I look at what the Imacon Flextight 848 did with the suite of evaluation photos. The Imacon 848 scans 35mm media up to stated 8000 PPI (we'll see below the effective PPI from the USAF test). It is discontinued and when the odd one appears in the resale market it sells upward of USD 6000. The Hasselblad Flextight X5 replaces it, a faster scanner of similar capability, and it now sells new at B&H for USD 20,700. So, depending on whether you buy used or new, is it from 6 to 20 times better than an Epson V850? I don't think we can relate pixels to dollars quite so nicely, but we can develop a "feel" for the matter.

The USAF 1951 target scan indicates Group/Element 6/6, or 5793 PPI. No, it is not the 8000 PPI formal resolution of the ISO standard, but it is the highest effective resolution of any device seen in this review. The next highest was the Minolta 5400 at 5161 PPI (maximum); hence, the Imacon has only 12.2% higher effective resolution – and twice the effective resolution of the Epson V850. This speaks for what an amazing deal that Minolta scanner was – at least in respect of PPI resolution per dollar, if I may put it that way.

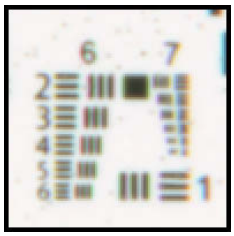


Figure 53. Imacon 848 USAF resolution target test result

We can scan 35mm at 8000 PPI without harming image quality, as I do for test purposes, but this result tells me the resolution of all those pixels won't exceed the equivalent of 5793 PPI. So if I don't need the extra pixels for the final photo size (an 8000PPI scan output at 360 PPI will produce a print of about 21x30 inches from the 35mm Apartment photo), I could just as well scan at around 5800 PPI (giving me about a 15x22 inch print at 360 PPI output.

This scanner does not use SilverFast – it has its own FlexColor scanning application. The scan of the Apartment negative produced an image with a very distinct yellow cast; for example, areas that should be about neutral show bx values in a range of +13 ~ +19. Hence I opened the photo in Photoshop and used the Blue Levels mid-tone slider to vastly reduce the influence of yellow. This is to facilitate comparing the Imacon and Epson V850 results – not to be overly distracted by hue variations between them.

Figures 54 and 55 show a segment of the Upton apartment photo, unsharpened from both the Epson V850 and the Imacon 848 respectively.

Figure 54 Apartment, Epson V850 @ 6400 PPI, unsharpened

Figure 55. Apartment, Imacon 848 @ 8000 PPI, unsharpened

As you will know by now, this is a segment less than a fifth of the total image, magnified on display (in this case 50% for the Imacon and 66% for the Epson V850 scanners). These magnifications are more realistic for predicting the appearance of prints say up to 13x19 inches than would be conveyed by 100% magnifications, but for interest I shall provide further below a couple of 100% snippets for these scans. Spending a moment more on the figures 54 and 55 results, predictably, the Imacon results are sharper and the shadow detail is better "out of the box"; but at this level of magnification, we aren't looking at a "night vs. day" comparison, which is a very interesting outcome considering the price difference. Let us see how these figures fare with Capture and Output sharpening (PhotoKit Sharpener 2).

Figure 56. Apartment, Epson V850 SHARPENED

57. Apartment, Imacon 848 SHARPENED

The figures above provide a reliable perception of what the full photos look like printed on 13x19 inch sheets. The Imacon result is for sure a bit crisper and the shadow detail out of the box more distinct, but the Epson V850 result really isn't a world apart in this range of print size.

Turning to 100% screen magnification, Figures 58 and 59 show sharpened snippets, this time the subject coverage a bit different because the magnification is the same but the pixel dimensions are not.

Top: **Figure 58**. 100% magnification from Epson V850 scan at 6400 PPI;

Bottom: Figure 59. 100% magnification from Imacon 858 scan @ 8000 PPI;

At this magnification, the Imacon scan looks decisively sharper with better shadow detail out of the box.

However, there is a factor here that I haven't discussed yet - "film grain". For photos of brick texture or similar, and with such a high-resolution scanner, it is useful to talk about grain. The problem is that for such photos one can mistake film grain for image detail because certain scanners are very adept at picking-up both. Clearly the Imacon is one such scanner, and the Minolta 5400 not far behind. The granular appearance of window glass and frames in Figure 59 is not image detail, it's grain, and shows much more from the Imacon than from the Epson V850, with its less granular acuity.

So in a practical workflow context, the next question is what to do about the grain, and what impact does that have on the sharpness of the resulting image, as obviously, the more pronounced the grain, the more grain reduction the photo may call for. There isn't much apparent grain in the Epson V850 scan; however, there is in the Imacon scan seen at 100% magnification – but not at the lower magnification of Figure 57. This indicates that perhaps one would ignore the grain and enjoy the full unedited detail for moderate sized enlargements, but reduce grain and lose some detail for the biggest print dimensions – or reduce grain only on smooth areas.

My favorite grain reducer for scanned film remains Neat Image. Other noise programs such as Topaz Denoise, Lightroom's noise tools and Noiseware are also very good, but Neat Image provides a sensible palette of refined controls and works particularly well for film (even though all these filters are designed for digital device noise, not film grain). I made a custom profile for the Imacon/film combination I'm working with, and applied it to the Imacon scan in Photoshop. This is a very judgmental, manual process, because there is no escaping the need to decide about the tipping point between reducing grain and impairing image detail when adjusting the strength of application.

The procedure is to first make a duplicate image layer to hold the noise reduction just above the Background layer, then make a custom noise profile and evaluate it in the Profile Preview (figure 60). As long as the "Profile Quality" is greater than 75% it is considered fine. Mine is 88%.

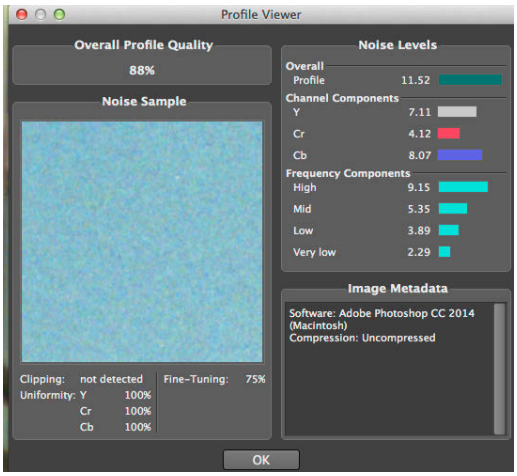


Figure 60. Noise profile quality reading

Then I manually fine-tune the noise reduction settings to keep them as weak as possible before film grain starts to show prominently in smooth areas (sky, window glass). Then click Accept to reduce noise on the selected Background copy layer. Then do Capture and Output sharpening for the resized (but not resampled) photo. The following suite of figures shows the comparative results.

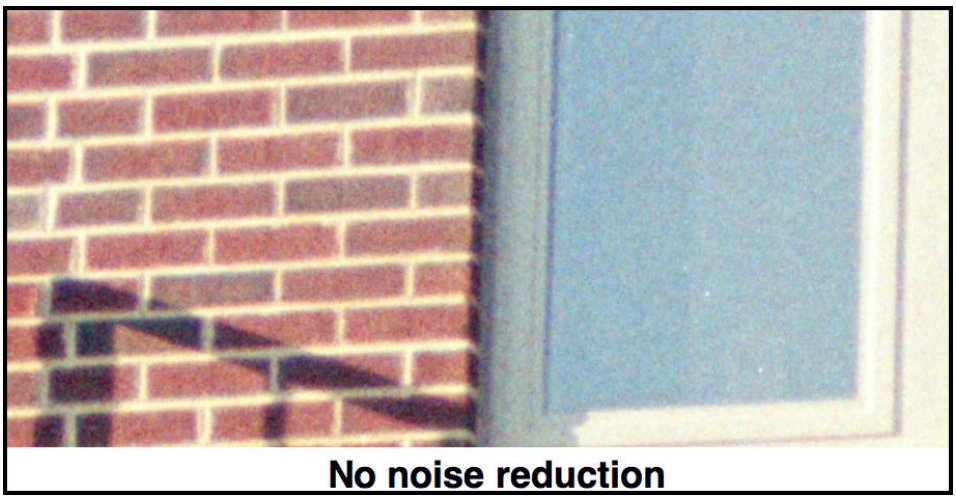


Figure 61. Imacon 848, 8000 PPI, 100% magnification before noise reduction

Figure 62. Imacon 848, 8000 PPI, 100% magnification, noise-reduced, sharpened

Figure 63. Epson V850, 6400 PPI 100% magnification

The point of this exercise is that while the Imacon picks up more film grain than the Epson V850, by the time you reduce the grain ever so carefully, the apparent sharpness of the cleaned-up Imacon version is only slightly more distinct and

slightly cleaner than that of the Epson V850 rendition without any grain reduction. As well, shadow detail from the Imacon out of the box is better, but as we've seen in the Bruges Shadowy image, much of that is enhanced with editing. I'll conclude the noise discussion by suggesting that depending on the film, the grain may be tolerable without noise reduction for moderate enlargements, but worth reducing for very big enlargements when scanning with the highest-end equipment such as an Imacon 848. Even with careful work, some loss of image detail obtained at great cost with such a high-end scanner is likely to occur, reducing but not eliminating the image quality difference between the moderately-priced and the very expensive scanners. Considering it is a relatively low-cost flat-bed scanner, this comparison (that some would never dream of making) indicates the Epson V850 will fare pretty well with 35mm media for a great many peoples' requirements of image quality.

As the Angkor image is a different kind of photo with different evaluation factors, I turn to having a look at how it fared in the Imacon 848. This time, I'll cut straight to the bottom line and show the sharpened versions for both the Imacon and V850 scanners, the full photo in figure 64, and a segment in figure 65. No grain reduction is applied to either rendition.

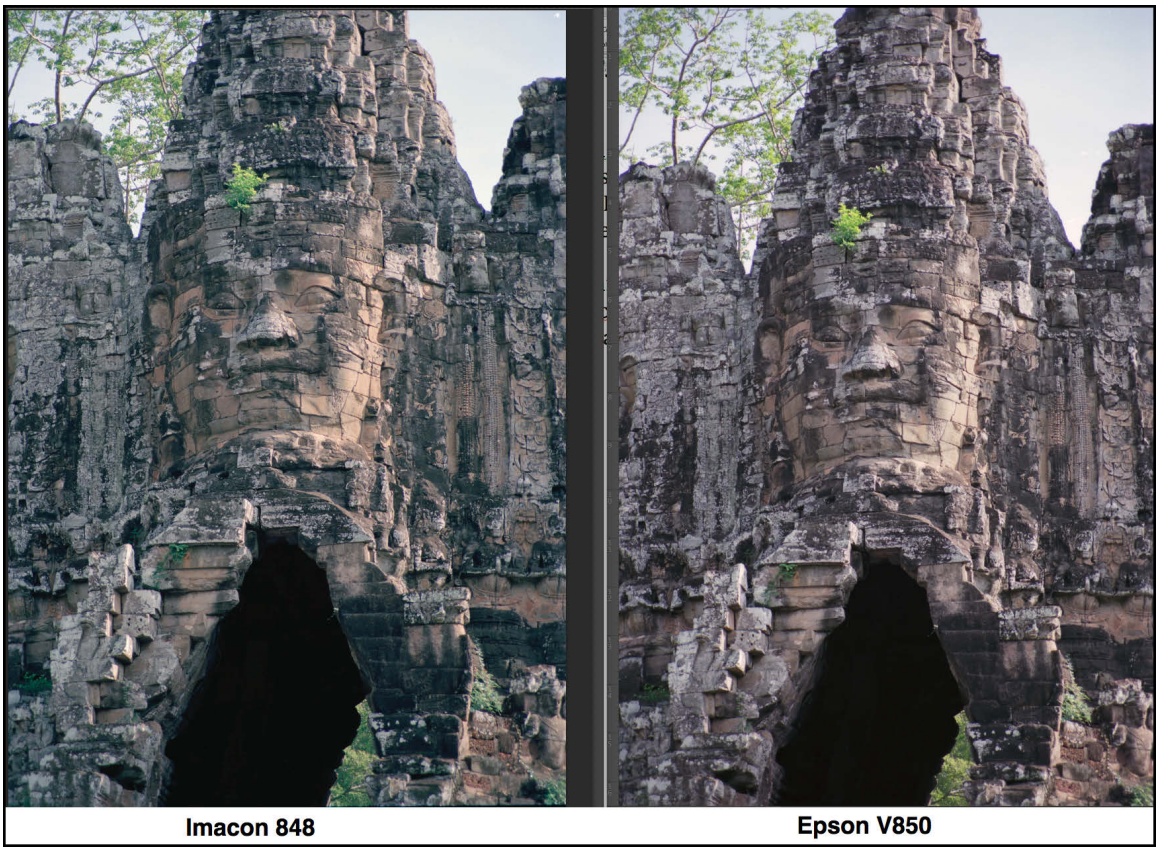


Figure 64. Full view, Imacon 848 vs. Epson V850, sharpened

If you're thinking they don't look too different at this magnification, you're right. I did implement minimal hue and tonal adjustments to facilitate unbiased sharpness

comparison, as the Imacon scan emerged with a distinct yellow cast and heavier contrast. Further refinement would be necessary for a fully corrected image from either scanner, but that isn't the purpose here.

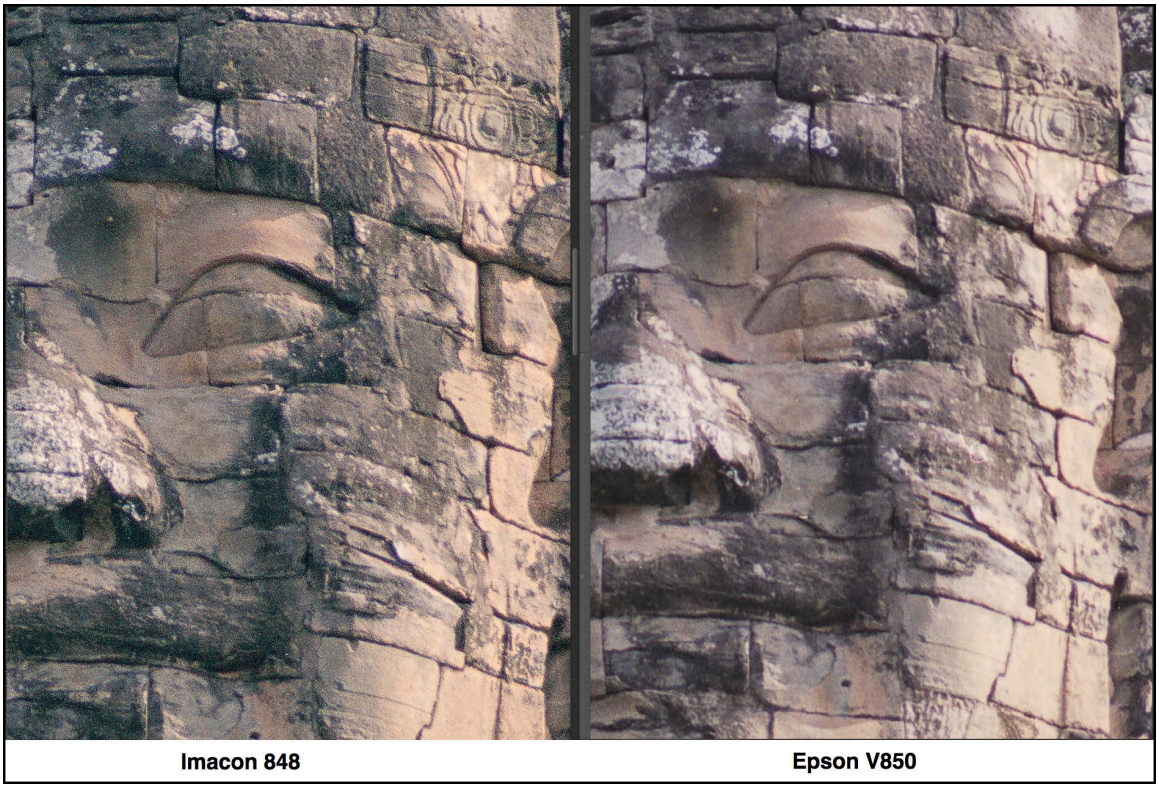


Figure 65. Angkor Segment, Imacon 848 vs. Epson V850, sharpened

This segment is about three inches (length) of what would be a 17 inch high enlargement printed at 360 PPI. Even after making some mental adjustment for what moderate grain reduction would do to the Imacon version (which I would not recommend for this particular photo, because the print looks better without it), the Imacon renders fine detail somewhat better than the Epson V850, but the difference, again, is not night and day, and for most peoples' needs, most likely not worth 20 times the price difference. The Imacon remains recommended for those who need the ultimate in fine image detail from 35mm media in very big prints.

Turning to the Makonde 2 ¼ x 3 ¼ inch B&W negative (last seen full-size in Figure 41), for this comparison it is scanned at 3200 PPI input in both the Imacon and Epson scanners. (3200 is native resolution for this size media in the Imacon, but one could scan this negative to 4800 native in the V850.) As the Imacon version emerged much lighter than it should be (this is an ebony wood carving) and the V850 version a tad dark, I applied moderate mid-tone adjustments in Levels (Photoshop) to both, again to facilitate unbiased appreciation of relative detail rendition. This time I show both an unsharpened (Figure 66) and sharpened version (Figure 67).

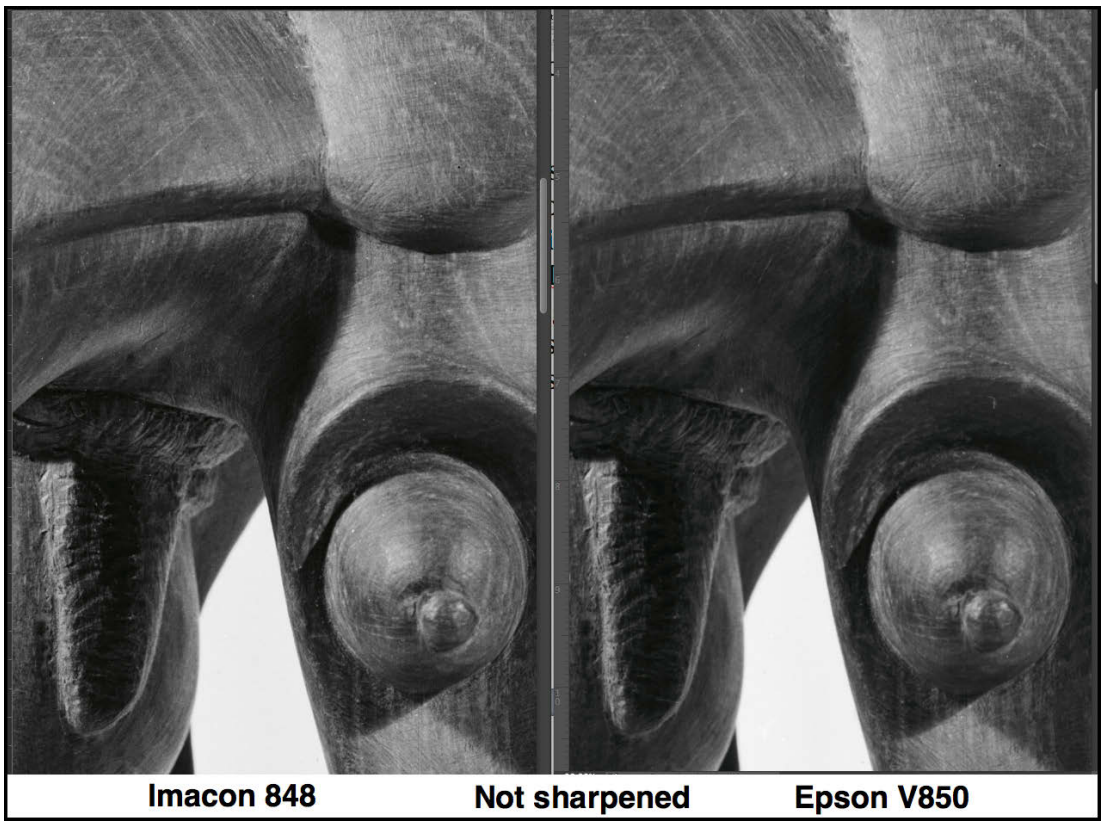


Figure 66. Makonde-1, unsharpened, Imacon vs V850, 3200 PPI

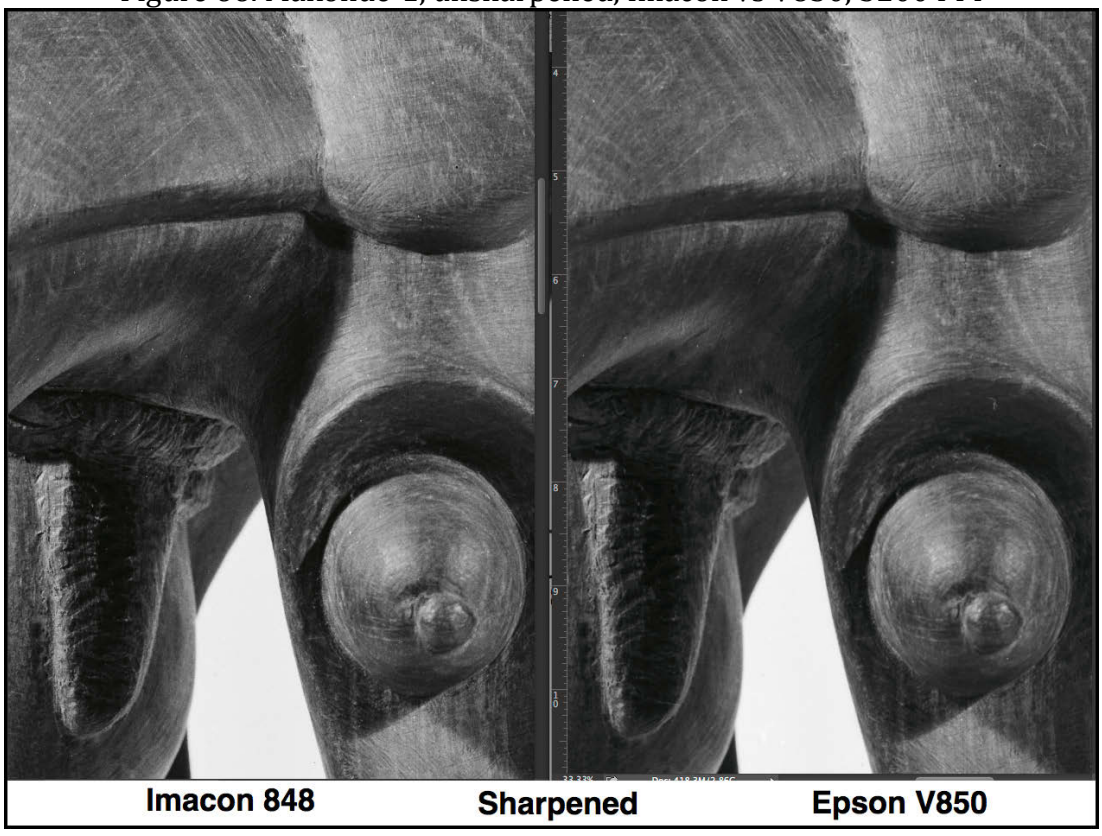


Figure 67. Makonde-1, SHARPENED, Imacon vs. V850, 3200 PPI

Here we're looking at about a 7-inch length of a 29-inch length photo, at 360 output PPI without any resampling. Whether unsharpened or sharpened, the Imacon version looks a tad crisper than the Epson version, but not by much. Seeing the full photos on a 13x19 inch sheet, the difference needs to be looked-for.

Finally, I compare Bruges Shadowy between the Imacon 848 and the Epson V850. Scanned in the Imacon 848 at 8000 PPI with only the very basic luminance and colour balance adjustment in the scanning software, it rendered as seen in Figure 68.

Figure 68. Bruges Shadowy Imacon 848, 8000 PPI no adjustments

Figure 69. Bruges Shadowy, Imacon 848, 8000 PPI, adjusted in Lightroom.

Figure 69 shows the results of importing it into Lightroom and making final luminance and colour balance adjustments there. I increased exposure by 0.45,

boosted Shadows to +84, and rebalanced the colours by adding 13 to Temp and 30 to Tint. Nothing really distinguishes this outcome from that of the other scanners on the same photo, either adjusted or unadjusted. They all emerge from scanning with suppressed shadow tonality, and they all actually contain tonal gradation just waiting to be revealed by the appropriate use of software. This completes the Imacon 848 comparison with the Epson V850. Is it worth 20 times the price? Only the customer knows best!

Very Dark Tonal Distinction

The Bruges Shadowy photo actually isn't the last word on this subject. There's apparently worse and amazingly better to show you! By now, you don't want to be taken through half a dozen scanners and a camera on this point, but because this is a review of the Epson V850, I wish to conclude this article with a flash of insight about its "hidden performance", if I may call it that.

I'm back to the Angkor photo, looking at the bottom. The photo is of an arch, and the "black" section of it is the top left inner wall ,which is really dark (Figure 70). Opened in Photoshop, when I run the eyedropper over it, the Lx value is 1 or so.

Figure 70. Dark inner wall, unadjusted, Epson V850

Never one to be deterred by outward appearances, I selected it in Photoshop, attached a Curves Adjustment Layer to the selection and created an adjustment that vastly brightens and increases contrast at the same time (recall, we want information, not mud). The result is what you see in Figure 71. It's beyond the in-focus range, but there is usable tonal information if you want it.

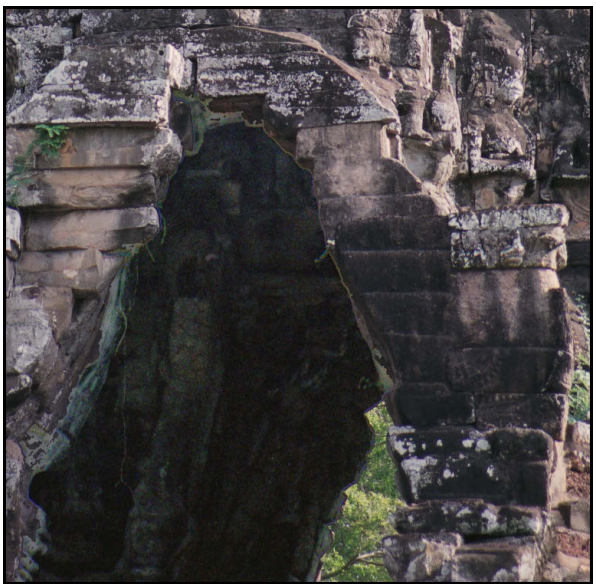
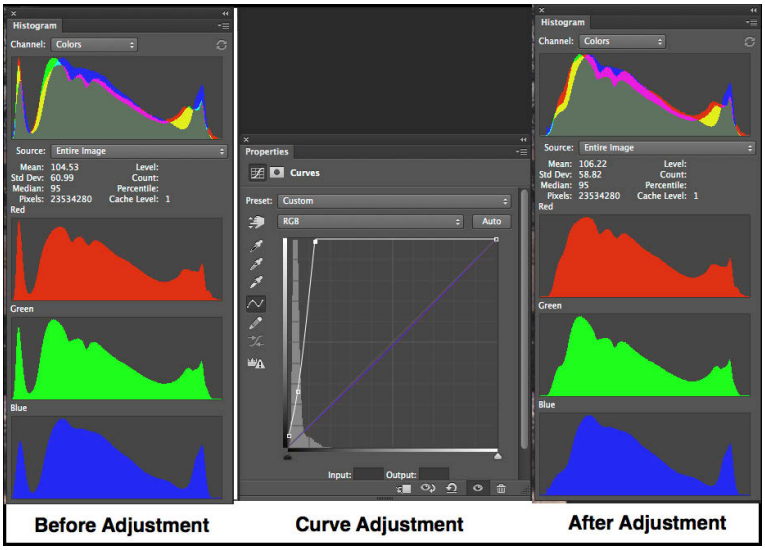


Figure 71. Dark inner wall adjusted, Epson V850

The take-away is that the scanner picks up much more information than may at first meet the eye. (On display it shows yet better.) I knew it was there, because the camera scan showed it by default, and there was a faint glimmer of it in the Minolta and Nikon scans by default, but not in the Epson, the Plustek or the Imacon scans. The Plustek was less amenable to achieving the quality of tonal separation I derived from the V850 using the same kind of Photoshop adjustment, but it was feasible with the output from the other scanners. This "pick-up" (Curves, Figure 72) produced a range of tonal variation on the wall from Lx = 7 ~ 33, instead of 1 without the adjustment.



72. Curves Adjustment in Photoshop for very deep shadow information

Colour Positives and Border vs. Center Sharpness

My friend Christopher Campbell kindly loaned me the photos being used in this section, because I didn't have what I needed. So the photos are copyright Christopher Campbell. The observations I make based on what I see from scanning these photos – indeed everything about the use I make of them is from me alone, so nobody should blame Christopher for anything you read here. OK, let's go.

I haven't said too much yet about scanning colour positives and how the scanners (especially the V850) perform in respect of apparent sharpness from center to edge of the frame. So the purpose here is to look at that. The resolution target (USAF 1951) has been helpful for comparative measurement of resolution at the centers of the images, but not near the borders. Hence I need to rely on scanning and interpreting photographs that were made with high quality film using professional equipment and technique.

There are three photos in this suite:

- **35mm "Tower**": Fuji RDPII, (Fujichrome Provia 100F), Nikon F2 w/ Nikkor 35mm-f/2 lens;
- **6x6 cm "Arches":** Fujichrome Provia 100F Professional, Hasselblad 500C/M w/ Hasselblad 50mm-f/4 CF T* lens;
- **6x9 cm "UM-Dana**" Fujichrome Provia 100F Professional, Arca-Swiss F-line metric camera, 6x9 w/ Rodenstock 55mm-f/4.5 Apo-Grandagon lens.

Before getting into the scanned images, I explain some aspects of the methodology for observing differences and portraying them. In the following, by "smaller prints" I mean up to 13x19 inches, while sizes beyond this are very large or huge prints.

When medium format media is scanned at high resolution, it creates large files, allowing the production of very large prints. Let's put some numbers on this, compared with 35mm enlargements:

Input PPI	Media Size	Output PPI	Print Size (approximate)
4800	2.25x 3.25 in	360	30x43
4800	35mm	360	13x19
6400	35mm	360	17x25

If I make a high resolution scan and blow it up to 100% (1 image pixel/screen pixel) on my display, then make screen grabs of relatively small areas of the whole photo, I'm providing a close-up view of detail that shows what the scanner can do at its maximum or near maximum hardware resolution setting. This information could be valuable to those making very large prints, but even so may not necessarily reflect what the viewer would perceive at normal viewing distance in a print of the related size. The smaller the intended size of the print the more misleading this high magnification of detail at maximum resolution could be. If the objective were to

show what the scanners can produce that is relevant to a context of smaller prints, then it makes sense to show image detail at smaller output sizes and perhaps at lower magnification.

So a reviewer can legitimately approach this in two ways: (A) assume the objective is very large prints and show 100% magnifications of high resolution scans without any resampling to compare hardware performance of the scanners, or (B) assume the objective is smaller prints (say about 11x17 inches on a 13x19 sheet), then downsample the post-scan photo for that size and compare scanner output on this basis, perhaps also using lower screen magnifications, giving the viewer a more realistic impression of what they would see in such prints. I believe (B) is likely more relevant to many more people than (A). For 35mm scans at 4800 PPI the distinction is nearly irrelevant because the non-resampled photo is around the limit of the maximum for my "smaller photo" dimensions. For medium format, I shall be doing some of both, because each tells its own story. In order to implement these options, I printed 11x17 inch photos on 13x19 inch sheets for each scanner of interest, and examined at what I saw on paper relative to what the screen grabs show me. So this was a non-trivial scanning and printing exercise.[5] SilverFast 8 helped, being an efficient and user-friendly scanning application.

The next decision I had to make is whether to show the unsharpened scans, or to show them sharpened for their intended purpose. This article assumes scans are made for printing, and they will be sharpened. If the most important question to you is the same as mine: "What will these scans look like on paper?", seeing the sharpened versions will provide more relevant impressions, so that is what I do. For capture sharpening I'm using PhotoKit Sharpener Pro 2 in Photoshop, not deconvolution sharpening, so if the raw material from the scanner is too poor for such sharpening, sharpness will not be improved. Sharpening options are optimized for each scanner's output to avoid visible halos and harsh transitions.

The comparisons of interest will be to observe center and edge detail rendition from the Epson V850 compared with several other scanners (Plustek OF120, Nikon 5000, Nikon 9000 and Imacon 848). The input scan resolutions are as indicated in the illustrations, generally at the maximum hardware resolution of the scanners, except in the case of the Epson V850 for which I generally provided results at 4800 PPI, to more closely align with the limits of comparator scanners (other than Imacon 848 for 35mm, which is an astounding 8000 PPI, but 3200 PPI for medium format). SilverFast triggers the V850's high-resolution lens for media up to 5.9x9.74 inches.

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[5] I also scanned the photos at various resolution steps to see whether maximizing resolution and downsampling produces perceptibly sharper results than "right-sizing" the scan to start with. Viewed in prints, it doesn't, as I've demonstrated in other publications – e.g. my SilverFast book, so I'll set that issue aside here – it may be the subject of yet another article one of these days, but is a bit off-topic for a scanner review.

Starting with the 35mm Tower, Figure 73 shows the full photo. Christopher selected this photo for my purposes because of all the detail in the brickwork and the fine tree branches on the right and left edges. It's a useful slide for appreciating resolution. I applied a linear contrast curve adjustment to some of the scans to bring all to an approximately comparative luminance.

Figure 73. 35mm Full Photo – Cranbrook School, Quadrangle Fountain

V850 6400 PPI 100% mag; sharpened

Epson V850 4800 ppi Mag 100%; sharpened

Plustek OF120; 5300 PPI mag 100%; sharpened

Nikon 9000 100% mag 4000 PPI sharpened

Nikon 5000 100% mag 4000 PPI sharpened

Imacon 848 8000 PPI Mag 67%; sharpened

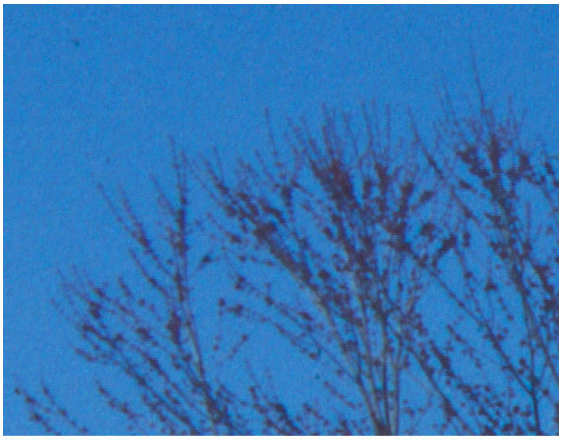
Figures 74~79. (Left to right each row); upper middle of Figure 73 photo

Figures 74 to 79 above are screen grabs of the scans (not downsampled) shown at 100% magnification on display, but then shrunk for inclusion in this format. This procedure actually provides a reasonably decent comparative impression of what this area of the 11x17 inch prints looks like, but the prints still show somewhat less difference than seen in these magnifications.

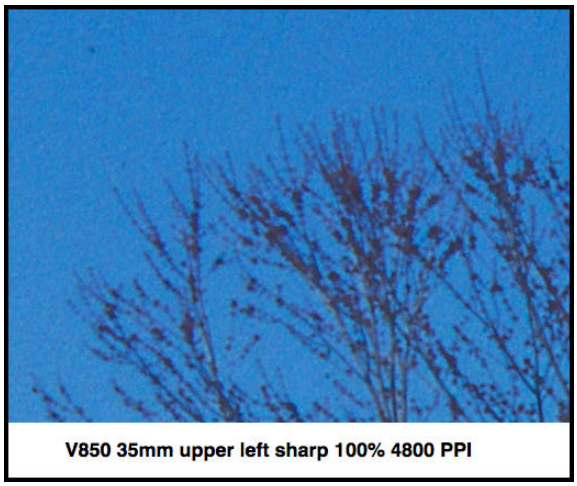
The most interesting observations I can make from looking at the prints and these screen grabs are as follows:

- The Epson V850 and the Plustek OF120 are somewhat less sharp than the others. Looked at in print, they are both acceptable. There is very little to distinguish between the Epson V850 results at 6400 vs 4800 PPI.
- The V850 scans needed more sharpening than did the results from the dedicated film scanners.
- The Nikon 5000 and the Imacon 848 results are the sharpest of the lot, but the Nikon outcome shows more grain than does the Imacon. The Nikon 5000 has a reputation for this effect with 35mm positives. It can be mitigated using a good noise reducer on the most visible areas where one would want to mitigate the grain (for example, the sky in this case).

The edge area I selected (Figures 80 to 85) contains small twigs at the upper left side of the photo, obviously at considerable distance from the photographer. The procedures for preparing and making the screen grabs are as above.



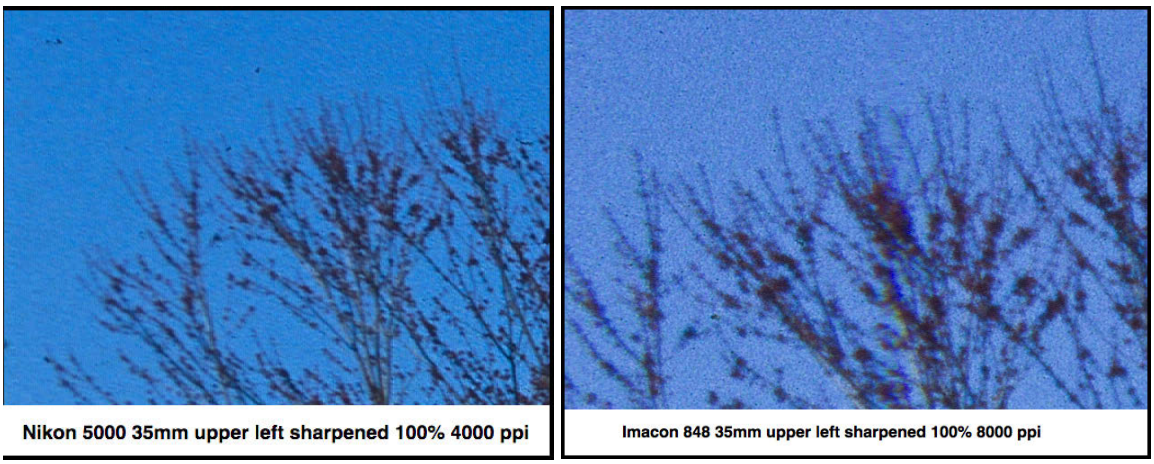
V850 35mm upper left sharpened 100% mag 6400 PPI



V850 35mm upper left sharp 100% 4800 PPI

Plustek OF120 35mm upper left sharpened 100% 5300 ppi

Nikon 9000 35mm upper left sharpened 100% 4000 ppi



Figures 80~85. (Left to right each row); upper left section of Figure 73 photo

The story for the upper left is a bit more complex than it was for the center. The differences of twig definition between the scanners seen in print (11x17 inch) are less than one may infer from these screen grabs. Recall the grabs are at 100% magnification, albeit converted to JPEGs and reduced for presentation. Looking at the screen grabs above, the Plustek 120 result is the sharpest, followed closely by the Imacon 848 and the Nikon 5000. The V850 results come quite close, followed by the Nikon 9000, which is not good (and indicative of an image flatness problem I have raised above and discuss more below). This may be an indication of what to expect if making prints considerably larger than 11x17 inches. For the 11x17 inch prints I made, the only one that looks a bit softer than the other five is the Nikon 9000 result. The others hardly distinguish themselves at an 11x17 inch print size.

Turning to the medium format results, I start with a 6x6 cm transparency, followed by a 6x9 cm transparency. The presentation for each is in two parts: the first for option (A): Scanner output with no resampling, followed by Option (B): scans resampled to 11x17 for printing. The scanners of interest for medium format are the Epson V850, the Plustek OF120, the Nikon 9000 and the Imacon 848.

The full frame 6x6 cm photo (Figure 86) is from the V850. For the center section examination, I selected an area immediately above the central arch, and for the edge examination I selected a small area to the left including the window, some shaded brick and the lantern.

Looking first at Option (A), a 6x6 cm transparency scanned in the V850 at 4800 PPI for printing at 360 PPI, would produce approximately a 30x30 inch print or 900 sq.in. The sharpened center snippet (Figures xx) is about 5 sq.in, or 0.6% of the whole frame. The side snippet is about 16 sq.in, or 1.8% of the whole frame.

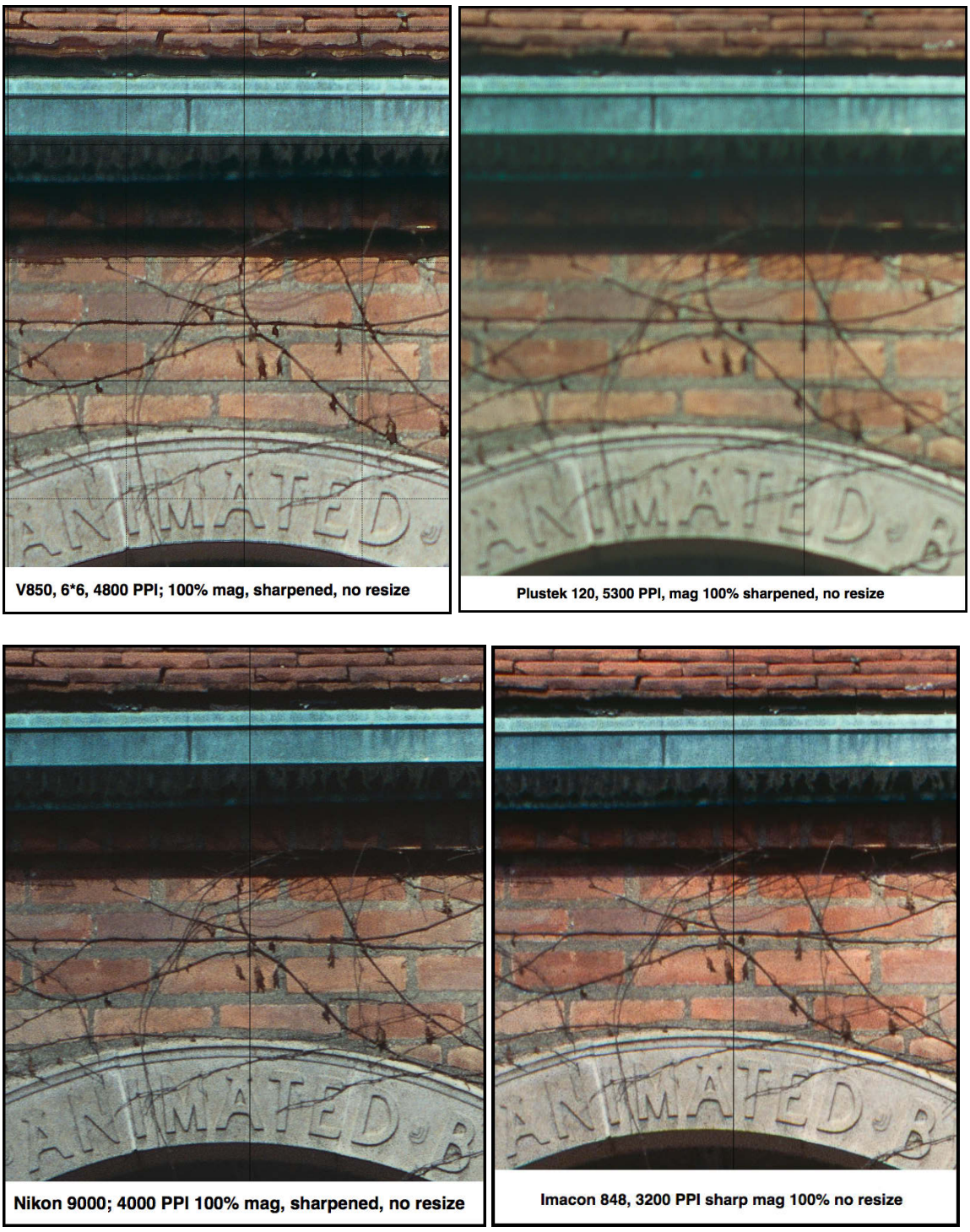
For the center of the photo (Figures 87 to 90), the Imacon 848 and Nikon 9000 results are close in respect of edge and texture rendition. The V850 result is quite

close to those two, being slightly softer in rendition of texture detail. The Plustek 120 result in respect of texture detail is obviously less satisfying.

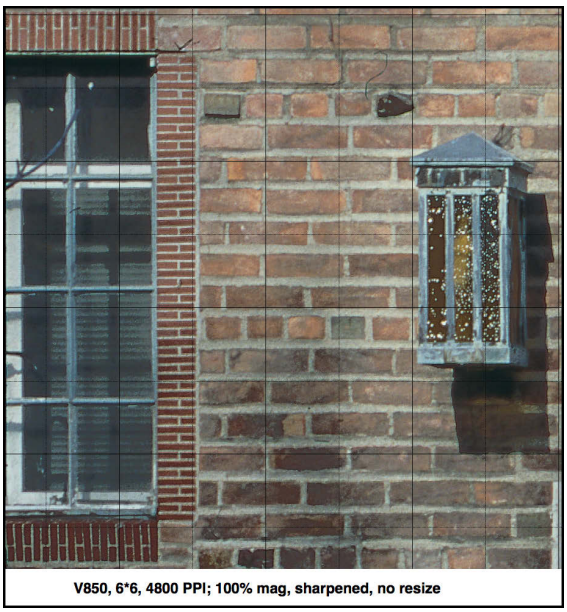
Figure 86. 6x6 transparency: Cranbrook School, “Gateway of Friendship”

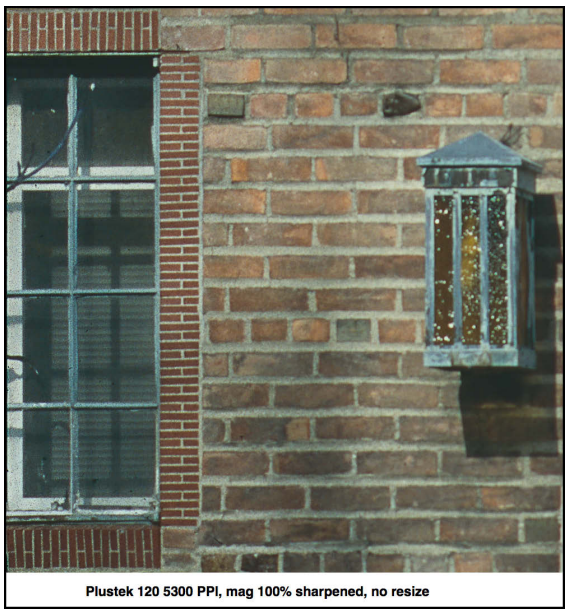
For the left side area (Figures 91~94 two pages over), The Epson V850, Plustek and Imacon results are all very close; however, the Nikon 9000 result indicates a slight softening starting left of the lantern.

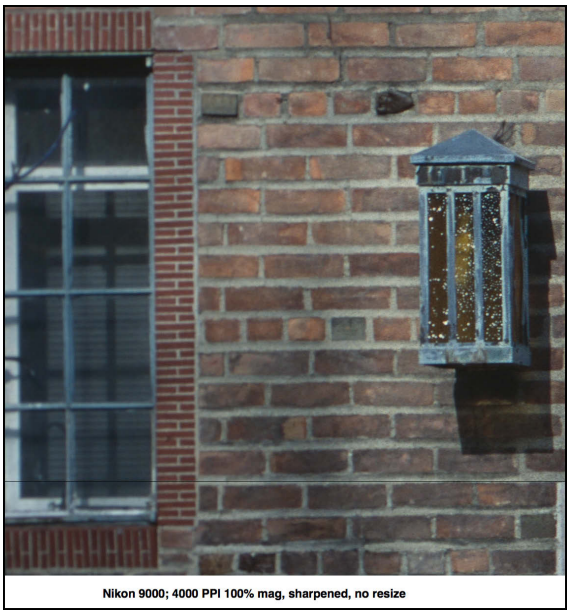
This outcome is an early indication of a problem with flatness of field in the Nikon 9000 scanner using the glassless film holders that Nikon supplied with this scanner. It is accentuated in the 6x9 scans discussed in a following section.

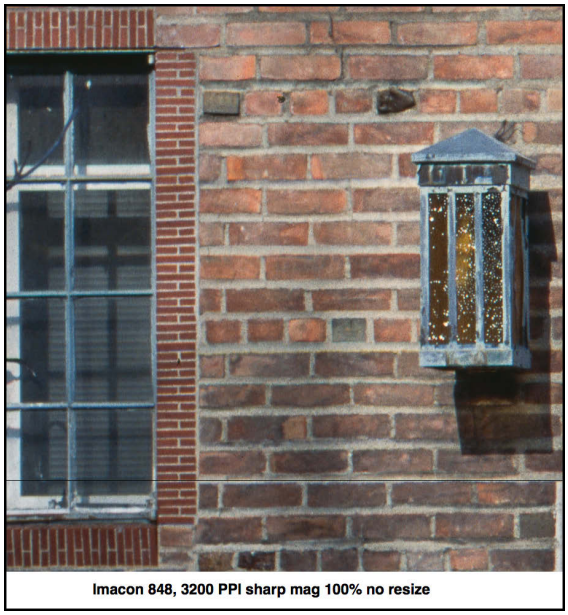


Figures 87~90. 6x6 transparency center, 100% magnification, not resized



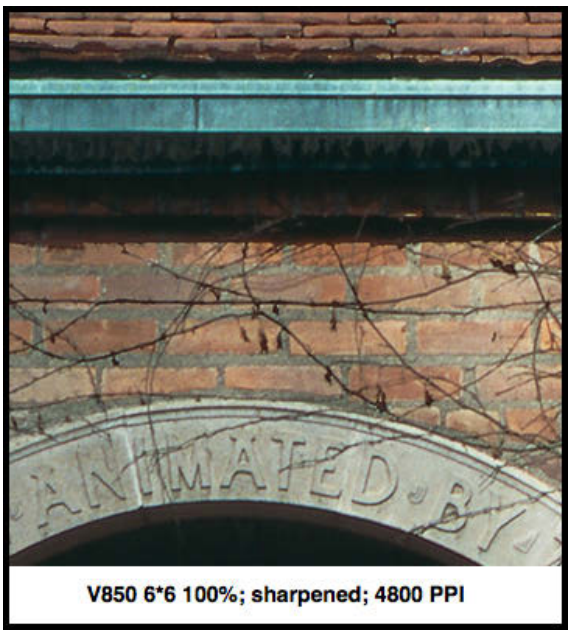


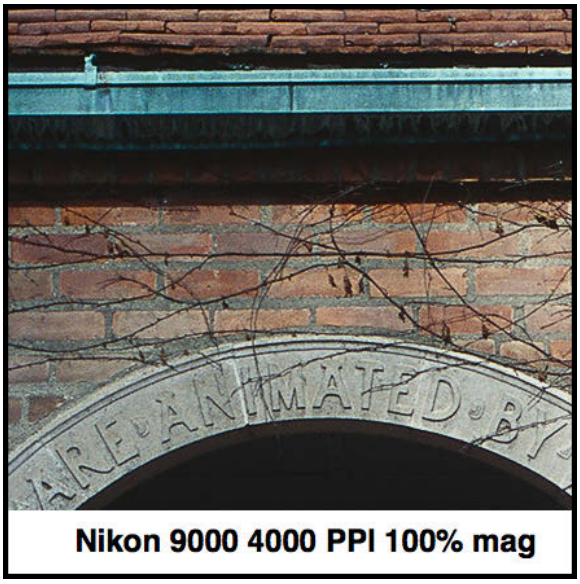


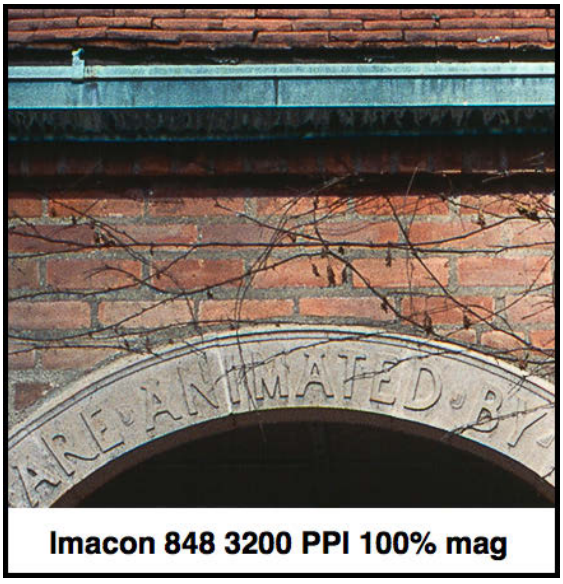


Figures 91 to 94. 6x6 positive transparency, left side, 100% magnification, originals not resized, but illustrations matched for ease of comparison

Turning to Option (B) – print-ready scans, the results are in Figures 95 to 98 and 99 to 102 on the following two pages.







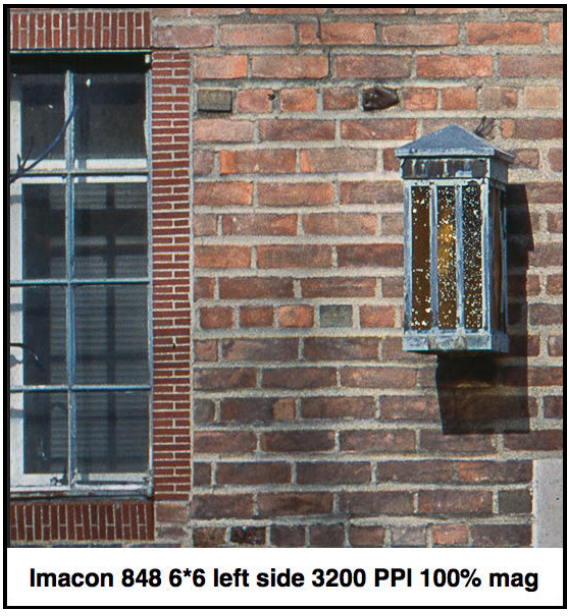
Figures 95~98. 6x6 transparency, center, print ready, 100% magnification

Examining the 11x11 inch prints, setting aside variances of mid-tones and hue, the differences of fine texture rendition are broadly similar to those observed above, but a bit less evidently so. The V850 appears in places to show slightly less acuity for very fine texture detail relative to the Nikon and Imacon scanners, but even with the prints themselves examined under a 2.5X loupe, the differences of detail rendition between these prints are slight. In sum, for the "print-ready" versions in the center section I would rate the V850 slightly better than the Plustek and somewhat below the Nikon and the Imacon.


V850 4800 PPI mag 100%, sharpened


Plustek 120 left side; 100% mag 5300 PPI


Nikon 9000 6*6 left side 4000 PPI; 100% mag


Imacon 848 6*6 left side 3200 PPI 100% mag

Figures 99~102. 6x6 transparency, left side, print ready, 100% magnification

For the **left side sections**, the Plustek and the Imacon slightly out-performed the V850 and the Nikon 9000, the V850 being sharper at the outer edge of the photo compared with the Nikon 9000, but again, one needs to peep closely in comparison with the other prints to detect it.

For remedial work on scanner focus, it may be useful to recall that the Epson V850 does provide five adjustable positions for the frame, as well as the use of the fluid mount assembly (film on glass) with the ability to flatten the film on the platen, dry,

using a small sheet of museum glass, as I did for these scans. There is no focus control for the Plustek, whereas SilverFast does provide focus control for the Nikon 9000 and the Imacon software has its own autofocus. These considerations could be of some importance, say, to those who would like to scan for several parts of the media, each having its bespoke focus setting, and then do a focus-blend from a stack of the files.

The final positive in this section is the **6x9 cm transparency** (Figure 103).

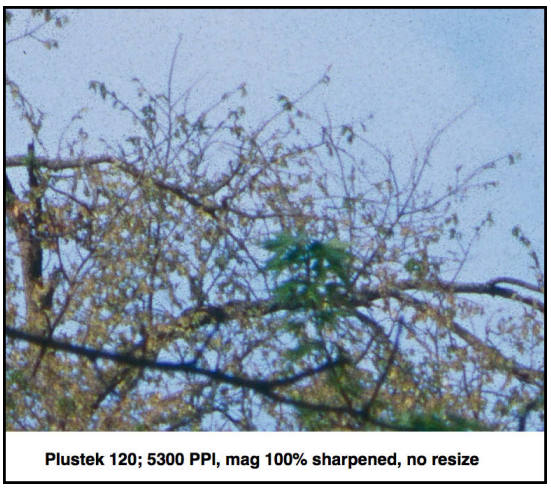
Figure 103. 6x9 cm positive transparency; University of Michigan, Dana Building

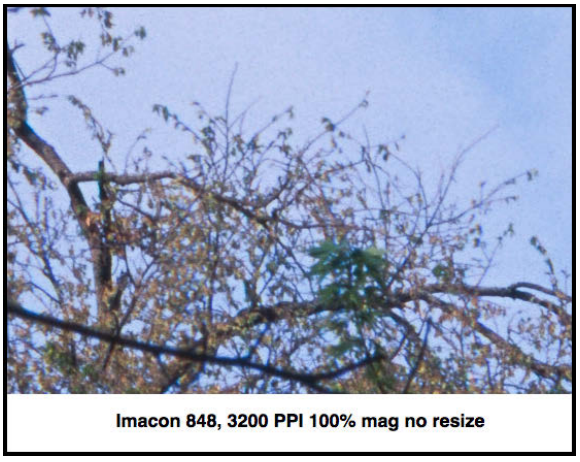
Scanned at 4800 PPI and printed at 360 PPI, the print dimensions would be 30x43 inches. The red rectangles in Figure 103 show the snippets chosen for the center and edge analyses. This photograph is extremely rich in all kinds of detail, however these two snippets tell us what we need to know for present purposes. The discussion follows the same procedures shown for the 6x6 transparency above, starting with Option (A), followed by Option (B).

6x9 Transparency, Option (A), not resized, 100% magnifications:

Figures 104~107 6x9 transparency, center, 100% magnification, no resizing

The telling aspects of detail rendition in this central snippet are the brick, the twigs and window blind. All round, the Imacon rendition comes out best, followed closely by the Epson V850. The Nikon 9000 is less convincing in its rendition of the window blind, even if substantially brightened. The Plustek result is comparatively fuzzy, and this scanner cannot be manually refocused.





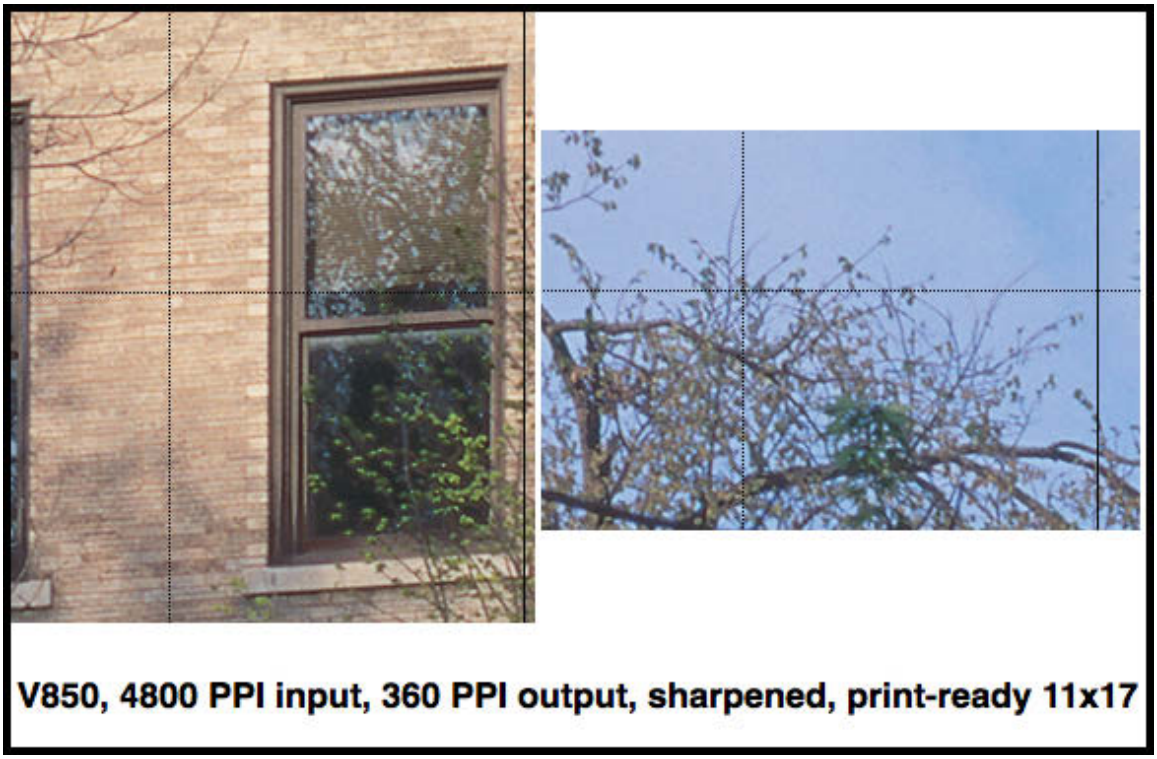
Figures 108~111. 6x9 transparency, upper left, 100% magnification, no resizing

Recall that this snippet is showing a large magnification of very small twigs about 150 feet from the camera in a large surrounding photograph. The performance of the V850, the Plustek 120 and the Imacon 848 in the upper left area are all very good and hardly distinguishable. The Nikon 9000 outcome, however, is unusable. The source of the problem is the glassless film holder – the media simply does not lie flat enough to produce a sharp scan over the entire image area. Nikon made glass film holders, and end users also found ways to incorporate sheets of anti-Newton glass to mitigate this problem. Finally, third-party suppliers produced superior fluid-mount holders for the Nikon 9000. We show below how the Nikon 9000 result would be good with superior holders. For the Epson V850 the museum glass holds the media flat onto the Fluid Mount Accessory without fluid, and the result is good.

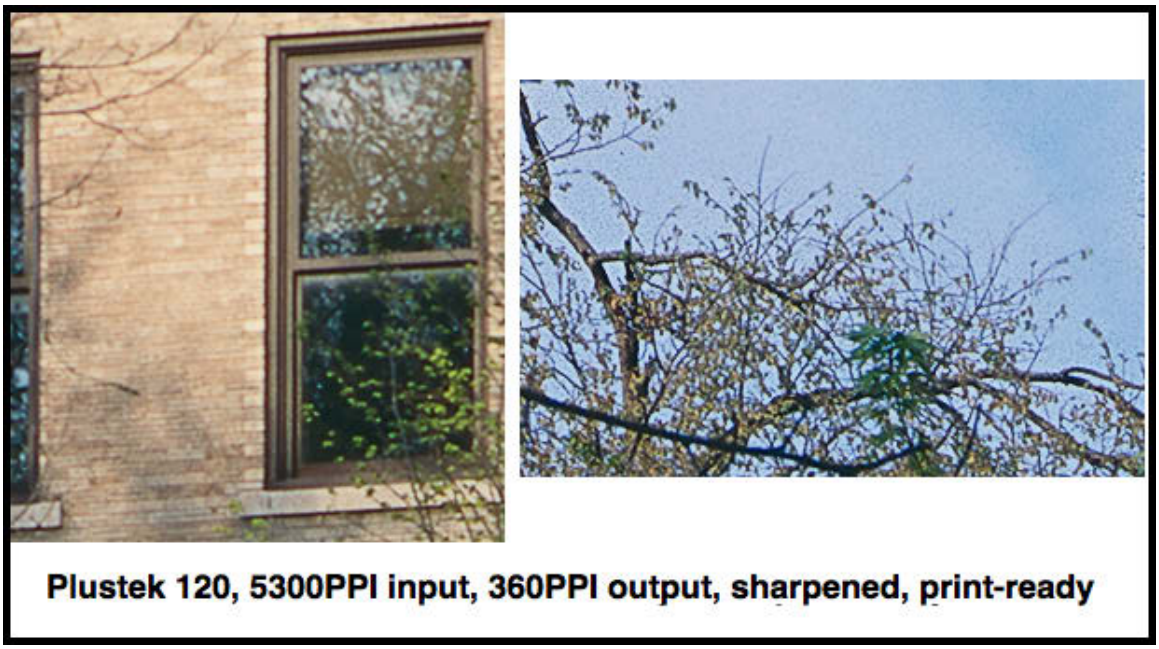
The Plustek film holder is robust, but also perhaps indicating a flatness of field issue, given that the upper left outcome is sharper than that of the center. The Imacon's unique "virtual-drum" imaging system was designed to resolve the flatness of field issue and produces consistent sharpness across the media.

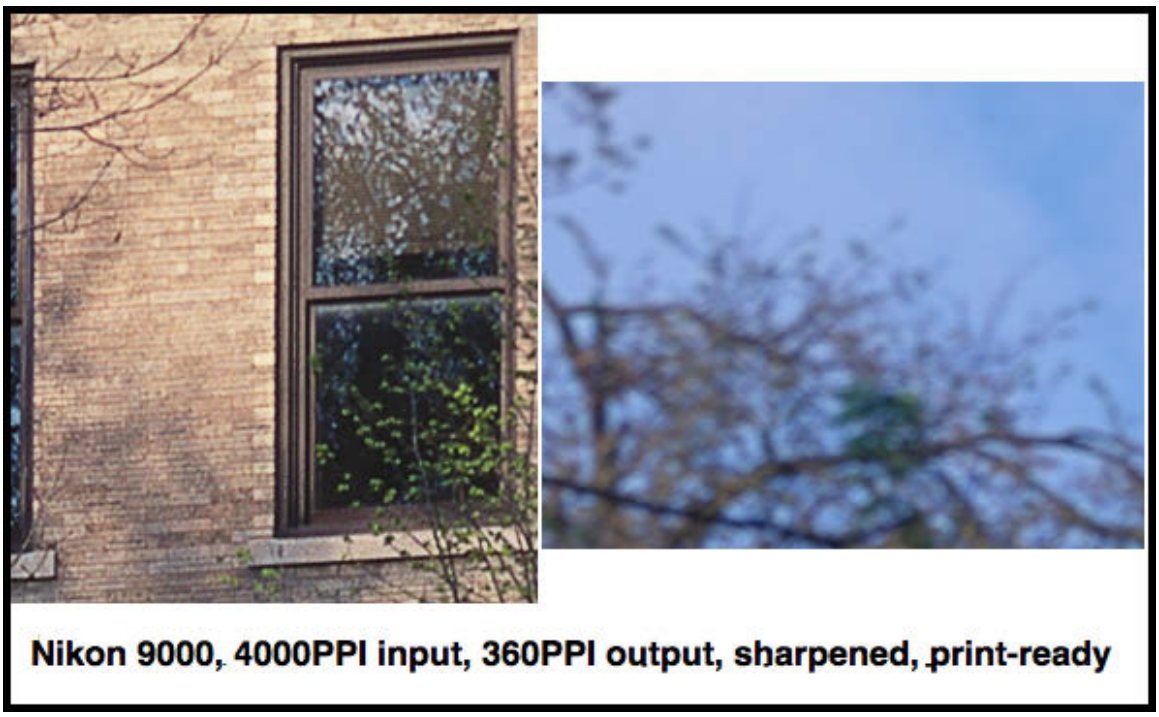
Option (B): 6x9 transparency, print-ready scans of the medium format media

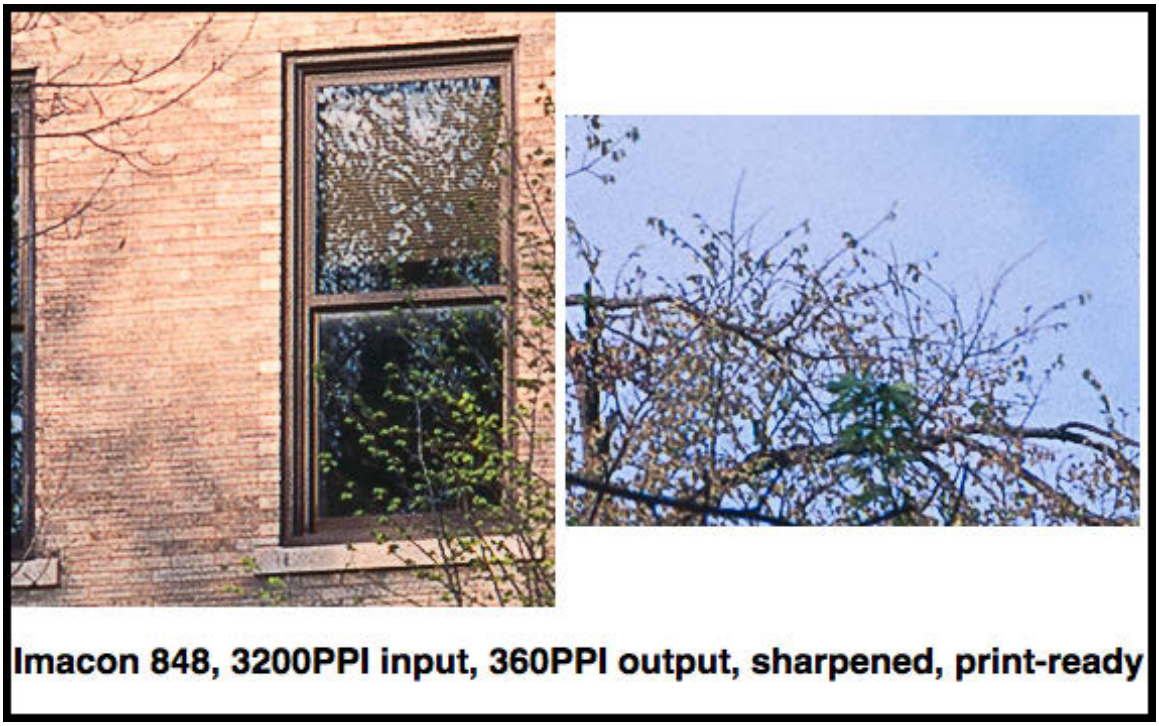
Figures 112~115 show the print-ready versions (11x17 inches) of both sections.



(The Photoshop "grid view" is active in the above grab, set to inches)







Figures 112~115 6x9 transparency both sections, print ready 100% magnification

The "print-ready" results don't tell a different story from the non-resized results, save for the Plustek OF120 center outcome which looks improved as a result of the downsampling. The Epson V850 outcome still ranks ahead of it. The Nikon 9000 problem is preserved, and the Imacon result is fine in all respects.

I made several references above to the flatness of field problem. It showed particularly for the Nikon 9000 results where the center was sharp but the edge area fuzzy, and in the Plustek OF120 medium format results, where the edge was sharp but the center somewhat soft. This is because the film holders, as supplied and unaided, don't hold the film flat enough. There is a third-party solution to this for the Nikon 9000 holders; but Christopher Campbell had put considerable time and money into developing his own fluid-mount medium format holder from a modified Nikon holder for the Nikon 9000. He kindly scanned two versions of the same photo (one similar to the 6x9 positive transparency of Figure 103) for this article, the one using the Nikon FH-8695 film carrier (Figure 116) and the other his custom-made film carrier (Figure 117).

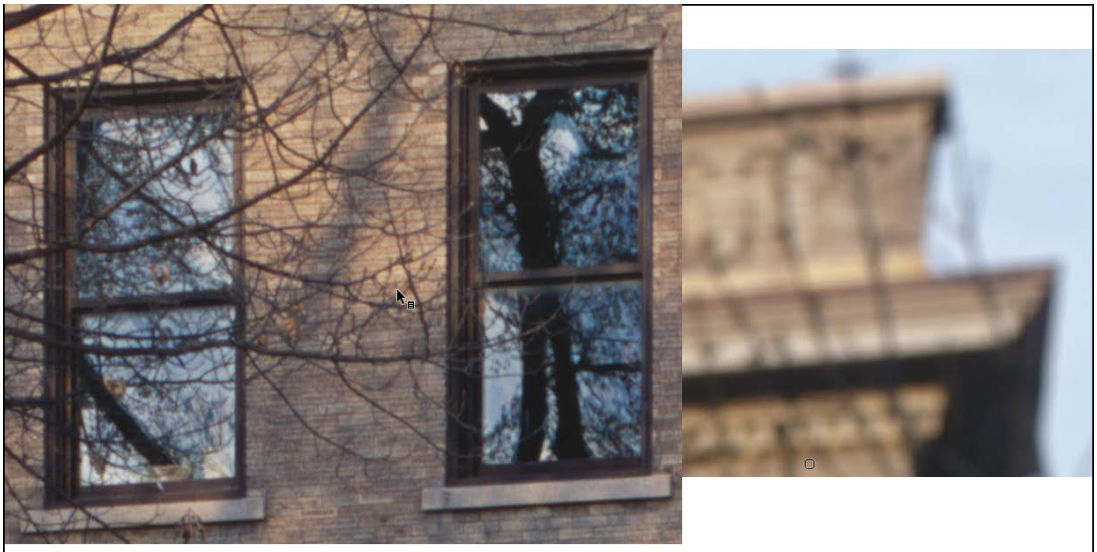


Figure 116. UM Dana building, flatness of field issue, glassless film holder

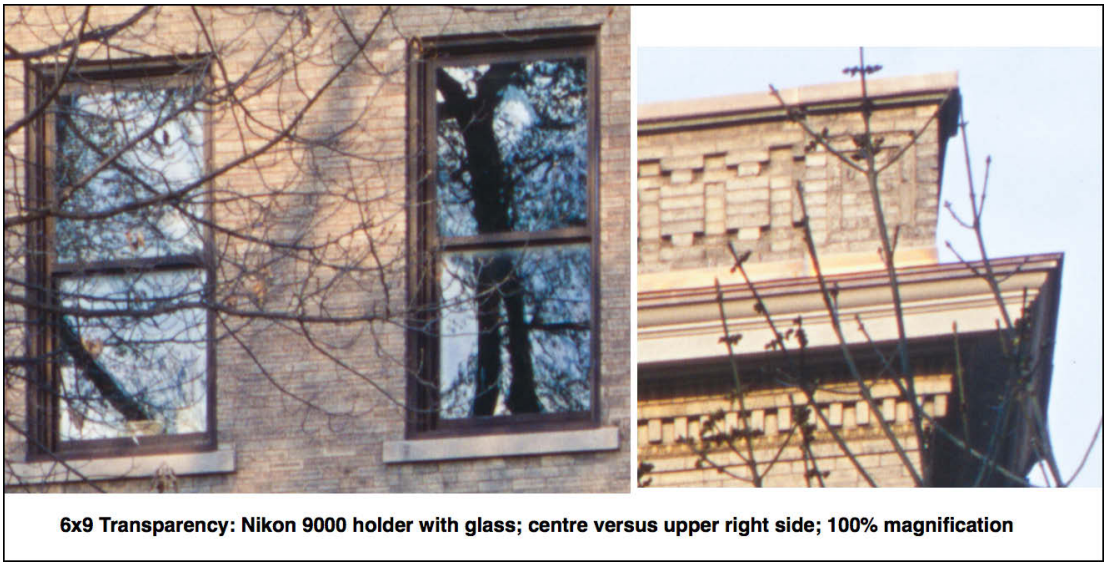


Figure 117. UN Dana Building, flat field in film holder with glass

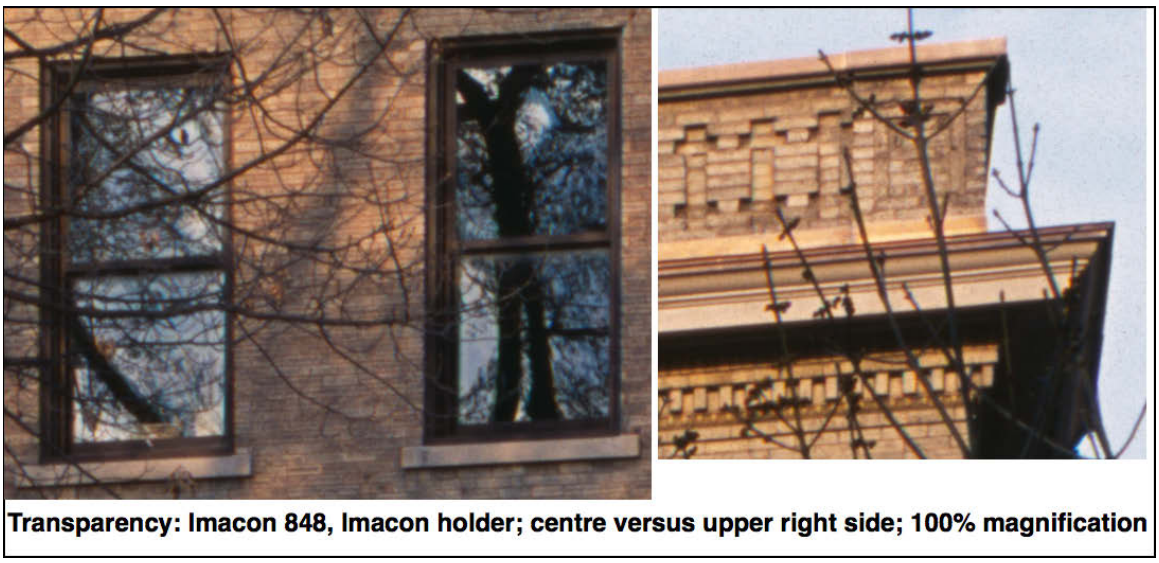


Figure 118. UN Dana Building scanned in Imacon 848, Imacon holder

Christopher scanned this transparency at 4000 PPI in the Nikon 9000 and at 3200 PPI in the Imacon 848 (Figure 118). None of the screen grabs in the three figures above have been sharpened. These three figures demonstrate conclusively the nature of the flatness of field issue. Fortunately, there needn't be such an issue using the Epson V850, because the Fluid Mount Assembly and a piece of Museum Glass are all that's needed to keep the media flat. I was not enamoured with the V850's medium format film carrier. I found it finicky to place the film in the guides and keep it in position while closing the holder, nor did it appear to hold the film completely flat. With the fluid mount assembly, placing the film on the glass is easy – just put it there and cover it with the Museum Glass. Then use SilverFast's easy "Find Frame" tool for framing the photo with a click of the mouse.

Summing-up this whole analysis of the medium format positive transparency scans, the Epson V850 stands up well to the near-comparators, one of which is twice the price and less versatile (the Plustek OF120), and another of which is no longer produced (the Nikon 9000). I would not call the Imacon 848 a near comparator, because it is from 6 to 20 times the cost, but I included it as the ultimate reference point short of high-quality drum scanning. Flatness of field is important for all these scanners, hence I recommend that those scanning medium format media in the Epson V850 buy the Fluid Mount Accessory and a piece of Museum Glass for making these scans, as I did here. I did not rely on the supplied holders for these tests, because my primary purpose is to show how the scanner performs when used at its best. The media must be very flat for film holders to work as well as the approach I used.

Summary Comments on the Epson V850 Pro

Wrapping-up this rather extensive excursion into scanner-land, I think the Epson V850 Pro is a versatile and quality performer. It's overall performance is similar to that of the V750, except that it's faster and the film holders are more robust; people who already use a V750 would see no other advantage up-grading to the V850. It produces very detailed, high quality reflective scans. The high-end dedicated film scanners will outperform it for apparent sharpness when scanning 35mm media, but not by a whole lot. Once these scans are properly sharpened, they produce very acceptable prints at least up to 11x17 inch image dimensions (perhaps more – that's the limit I tested). Its output from medium format B&W negatives and colour positives is of a high standard. The scanner is reliable – I did not experience one freeze or crash using it with SilverFast 8 throughout the testing period. The Epson V850 combined with SilverFast 8 makes a powerful productivity combination for batch scanning. This will be especially attractive to people who have large archives of film media they wish to scan.

I recommend using the bundled EpsonScan software for business document scanning. I used SilverFast Ai Studio for all the reflective photo and transparent film scanning I did for this article, save for the Imacon scans (it uses FlexColor), quartertone luminance adjustments, sharpening and one instance of grain mitigation for which I used other specialized applications. I unequivocally recommend that people who buy this scanner with the intention of scanning film should upgrade the bundled SilverFast SE/SE+ version to SilverFast Ai Studio. The up-grade features are worthwhile and the pricing is reasonable. Having done so, for customizing colour management of the scanner, buy a SilverFast target and save yourselves the time and aggravation of using X-Rite i1 Scanner. More generally, SilverFast 8 is an efficient and user-friendly application bundling a lot of refinement and capability for producing high quality scans, including very efficient batch-scanning, especially in the Ai Studio version. Even considering the very capable software options for a post-scan workflow, starting with a good quality, well balanced scan makes anything else you do afterward with the file easier and in some cases better. SilverFast 8 combined with the Epson V850 Pro scanner makes it possible to produce high quality scans rather easily.

A Perspective from Christopher Campbell

Christopher has been helpful beyond any call of duty in the production of this article. Thanks to Christopher, I was able to access the Imacon 848 and the Nikon 9000 scanners, he graciously made available some superb specimen photographs that we both thought appropriate for examining the issue of center versus edge area sharpness in scans and he put a good chunk of time into making the scans of these images and those in Figures 116 to 118 using his two scanners. More than all that though, he bravely soldiered through several successive reviews of this article, making very helpful editorial suggestions, most of which I adopted. All that said, for avoidance of all doubt, everything you read above is my responsibility. However, Christopher has written his own perspective on our work and some of his own experience, which is reproduced below.

Christopher's Perspective:

Mark has done an enormous amount of careful work for this review, and I think he's correct in finding the Epson V850 an impressive scanner. When he arrived at my studio and laid out a range of 13 x 19" prints for me to compare — labeled only on the back — I was surprised at how hard it was to try to match them to the scanners that had produced the source files. He is certainly right that if one only anticipates prints of a certain size, the Epson does very well. In the course of doing some of the comparison scans for this review, however, I found myself thinking about what's involved if one wants to make larger prints from even higher-resolution scans.

Back in 2006, I first began looking hard at film scanners, and tested a Nikon 5000ED. I found it quite excellent over most of the frame, but slightly disappointingly soft in the extreme corners when scanning a mounted 35mm slide. That fact, combined with the fact that I also needed an efficient way to scan 6x9 transparencies that I was shooting for architectural clients, pushed me towards the medium-format Nikon 9000ED. Michael Reichmann wrote an excellent early review of that scanner's immediate predecessor, the 8000ED, in 2001, and having just re-read it, I find that his conclusions still stand:

http://www.luminous-landscape.com/reviews/nikon-8000.shtml

He compared it to an Imacon Flextight Photo, and if he rated the Imacon scan a 10.0, then he awarded the 8000ED a 9.7. Fast forward a few years, and the immediate successors to this pair are the Nikon 9000ED, and the Imacon Flextight 848, both of which I now happen to have in house. Mark and I scanned his negatives, and my transparencies, on all our scanners, and I thought it might be interesting to draw a few larger conclusions. The first and most obvious one for me is how nearly effortless digital photography has become in comparison to the difficulties of preserving, handling and digitizing physical pieces of film. Armed with a good camera (I'm now using a Sony A7R with Zeiss and Canon glass), Lightroom and some of Eric Chan's superb contributions (Adobe DNG Profile Editor, Adobe DNG Flat Field plug-in), I routinely get results I could only have dreamed of in the past.

If one needs to scan legacy film, however, there is still nothing that can touch a scan from a highly skilled drum scanner operator. When the Gagosian Gallery recently requested a scan for a catalog, I knew exactly what to do: send the transparency out to Lenny Eiger at Eiger Studios in Petaluma, the best scanner operator I know. For something like $125, one gets absolutely everything there is to be had out of a piece of film: every grain and dye clamp, every bit of the deepest shadow detail. But if you have a lot of scanning to do, and don't wish to take on the difficulties and complexities of owning and maintaining a drum scanner or a high-end flatbed like a Creo, what to do in 2015? This question will be answered differently by every photographer, but the Nikon 9000ED and Imacon 848 are two obvious answers.

Epson, Minolta, Nikon and Imacon have all done very sophisticated engineering in the optical systems of their scanners, and you can see this in the numbers that Mark recorded when scanning the USAF target. However, the total performance of a film scanner is considerably more than just its resolution, and film flatness is a huge problem. If you look at corner performance, the Nikon 5000ED seems to do slightly better than the 9000ED, probably because the focal length of the lens is shorter, and depth of focus effectively greater. Here, not having to cover a larger format is an advantage. Optically, the 9000ED is an excellent scanner, but is let down somewhat by the supplied film holders.

Back when the 9000ED was current, Photo.net was full of posts from users unhappy with the Nikon glassless holders. Some found that the various Nikon glass holders were good enough (and didn't create too much trouble with Newton rings). Some found that a thin glass insert, such as the ones from Focal Point, could be dropped into glassless holders to improve film flatness. The best solution for edge-to-edge sharpness was probably a design published by Ernst Dinkla for a fluid- mount holder back in 2002. I proceeded to make one for myself, starting with a Nikon FH-869M and working with a local machine shop. Essentially it's a 120 holder that contains a removable sheet of glass; commercial versions with fixed glass were available from Aztek and Image Mechanics. I take the sheet of glass to a mounting station, spray on a fluid such as Kami SMF 2001 or Lumina, spray and lay down the film, and then squeegee a 4-mil acetate overlay over the whole. I drop the glass panel into the Nikon holder, focus and scan, and get a perfectly sharp scan of a (temporarily) absolutely flat and constrained piece of film. The Nikon 9000ED is of course no longer in production, but easy to find on the used market, and fully supported by Silverfast 8.

Do you get a better scan, meaning that it contains more information, with greater micro-contrast and higher resolution, for all this expense and trouble? Yes, you do. But as Mark has shown, you have to have end uses of a certain size and character for it to matter. Viewed on screen at 100%, the difference between an Epson flatbed scan (I have the V700), and a fluid-mount scan on the 9000ED looks quite substantial. Properly sharpened and printed at 13 x 19", the difference is clearly lessened.

If you want the quality of the 9000ED, but without the trouble of fluid-mounting, there are the Imacons. Now part of Hasselblad, Imacon scanners are still made, but sadly extremely expensive. Happily, they were designed for heavy-duty, professional, day- in/day-out use, and so older models may still be working perfectly, and all the more recent models are still serviced by Hasselblad in New Jersey. The Imacon design solves the film flatness problem of every scanner that doesn't use fluid-mounting by using flexible holders (hence the name "Flextight"), and advancing the film across the apex of a slowly rotating drum so that a flat film plane is being scanned as it passes the line of sight of the truly excellent optics (a superb Rodenstock Grandagon lens). This also makes the Imacon an example of

"direct-to-lens" imaging, without the degradation of bouncing the light from a mirror, as in most other scanners.

In our testing the Imacon consistently delivered the best scans, as well it should: the Imacon Flextight 848 cost some $18,000 when new, whereas a good price for a used example in excellent condition is now about $6000. Yes, that's a big number, but price doesn't tell the whole story.

I am primarily a painter, and I have a book project to produce about my time studying with the painter Joan Mitchell in Vétheuil, France, in the early 1990s, and hundreds of additional scans to do for the Joan Mitchell Foundation. With the Nikon, for exhibition/publication/archive quality, I would be fluid-mounting all the film, and would need to manually focus each frame in Silverfast. With the Imacon, I load up the film, let FlexColor and the Imacon auto-focus (it works so well that there is no manual focus feature!), and four minutes later I have an 8000 spi scan with gorgeous color, and absolutely sharp grain from corner to corner. That is an exceedingly high level of productivity, and a very fine scan, so that has to become part of the economics of choosing a scanner.

Finally, I will note a few things that I find extremely useful to producing the highest quality scans with a minimum of trouble:

- Compressed air. I use compressed air for cleaning equipment such as film holders, with Balston coalescing filters to remove water vapor and oil.

- Kodak Static Eliminator unit. This was originally manufactured by Chapman for Kodak, and later rebranded by Fred Picker at Zone VI. It works very well to reduce film static, and hence the dust in dry scans. Kinetronics and Simco-Ion currently produce a variety of static elimination tools.

- HutchColor HCT. Profiling targets from Don Hutcheson, with double the number of patches of an IT8, 3x the grayscale steps and many more dark colors, the HCT targets make superb profiles for color transparency scanning. On the advice of Pat Herold at Chromix, I use them in conjunction with basiCColor Input to build scanner profiles.

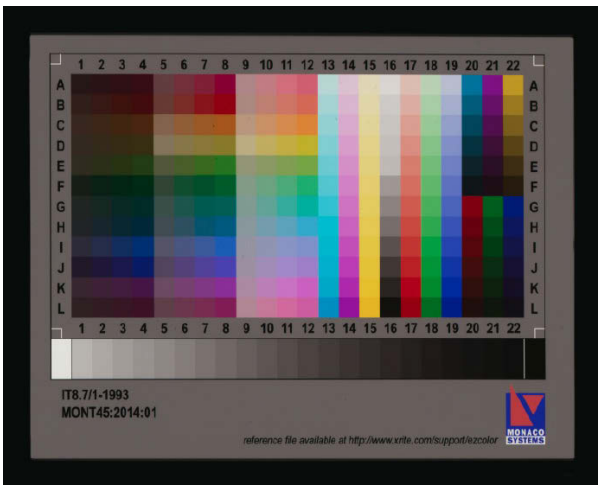
- Silverfast Ai Studio 8, and Silverfast Archive Suite 8. Silverfast is complex, but it provides complete functionality — and a consistent interface — on both the Epson and Nikon scanners. Most recently, Mark has shown in his article on film scanning how to use the Archive Suite's HDR application to invert and color-correct the scans of color negatives, and this works exceedingly well; much better, in my experience, than either Photoshop or Lightroom.

- Capture sharpening. Sharpening is an essential part of digital capture, and Bruce Fraser's concept of dividing it into Capture, Creative and Output stages is brilliant. The best exposition I know is the Fraser/Schewe 2nd edition of *Image Sharpening*

with Adobe Photoshop, Camera Raw and Lightroom. The easiest way to implement this mode of sharpening is to use the PixelGenius plug-in for Photoshop, PhotoKit Sharpener 2, where there are specific algorithms for each film size, type and edge frequency.

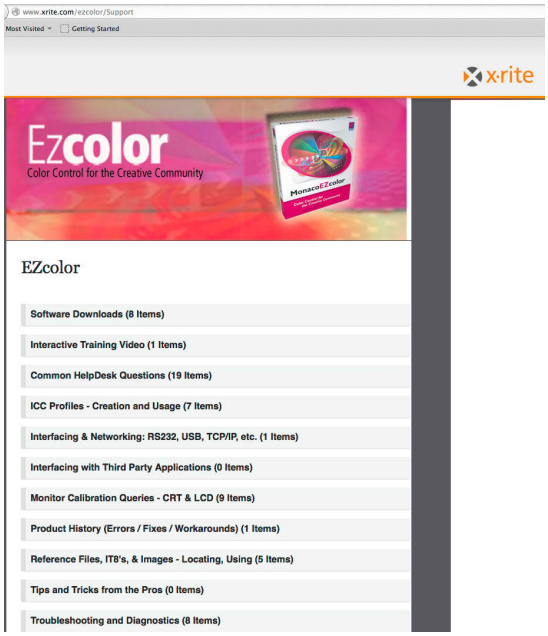
Annex 1
The X-Rite i1Scanner Profile Creation Process

A. Reference File Detection

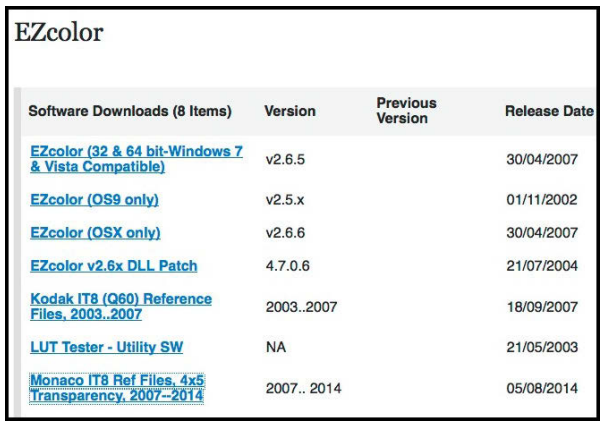


1. Open Monaco target in Epson Scan

2. Where is the <MONT45.2014:01> Reference File the target wants?



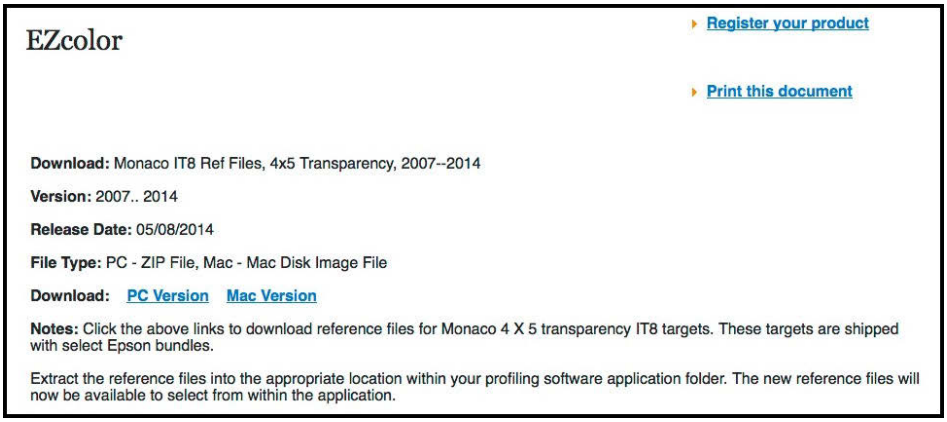
3. Find X-Rite resources for locating the reference file



EZcolor

Software Downloads (8 Items)	Version	Previous Version	Release Date
EZcolor (32 & 64 bit-Windows 7 & Vista Compatible)	v2.6.5		30/04/2007
EZcolor (OS9 only)	v2.5.x		01/11/2002
EZcolor (OSX only)	v2.6.6		30/04/2007
EZcolor v2.6x DLL Patch	4.7.0.6		21/07/2004
Kodak IT8 (Q60) Reference Files, 2003..2007	2003..2007		18/09/2007
LUT Tester - Utility SW	NA		21/05/2003
Monaco IT8 Ref Files, 4x5 Transparency, 2007--2014	2007.. 2014		05/08/2014

4. Navigate to the page for finding the download site



EZcolor

Register your product

Print this document

Download: Monaco IT8 Ref Files, 4x5 Transparency, 2007--2014

Version: 2007.. 2014

Release Date: 05/08/2014

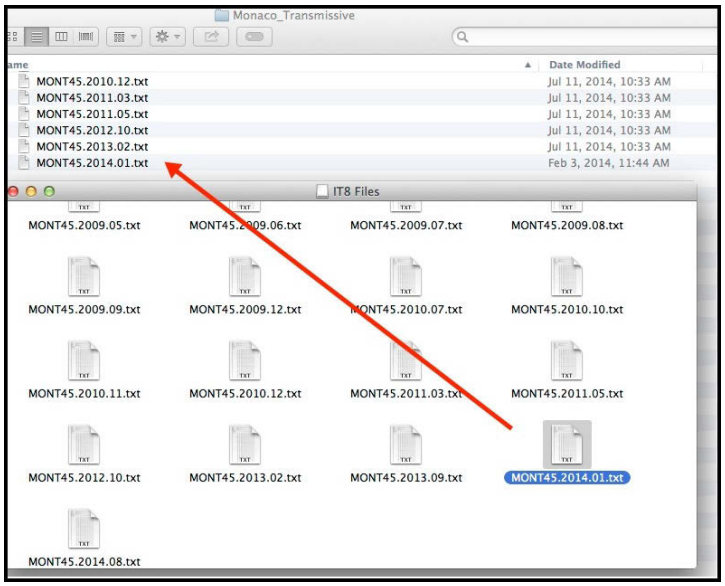
File Type: PC - ZIP File, Mac - Mac Disk Image File

Download: PC Version Mac Version

Notes: Click the above links to download reference files for Monaco 4 X 5 transparency IT8 targets. These targets are shipped with select Epson bundles.

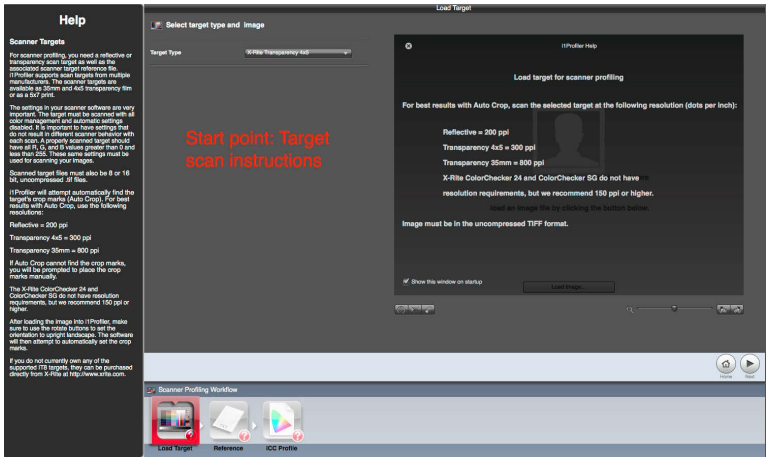
Extract the reference files into the appropriate location within your profiling software application folder. The new reference files will now be available to select from within the application.

5. Finally, the reference file download page

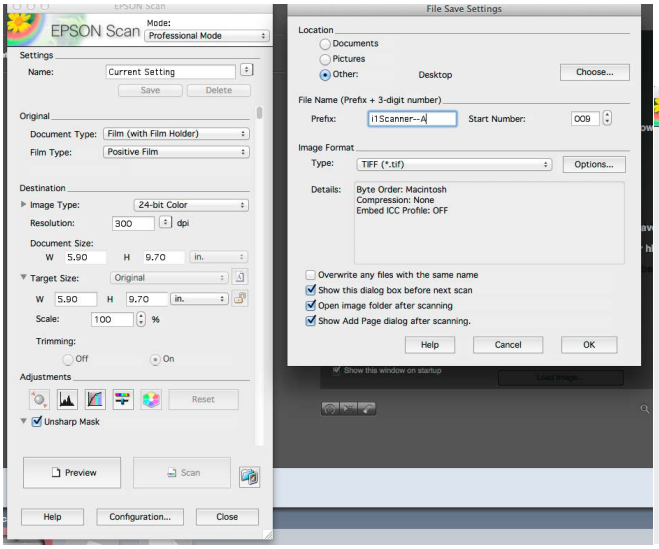


6. Drag the correct reference file into the correct folder

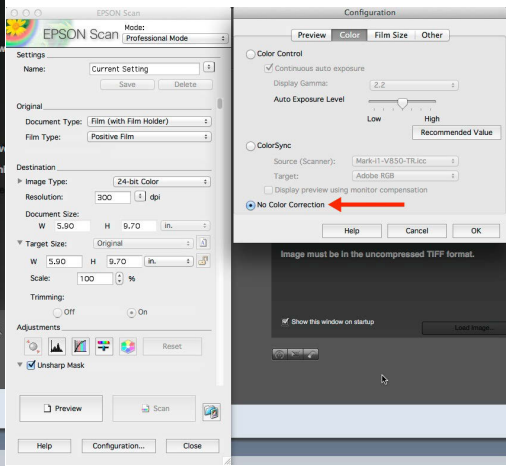
B. Profile Creation Process



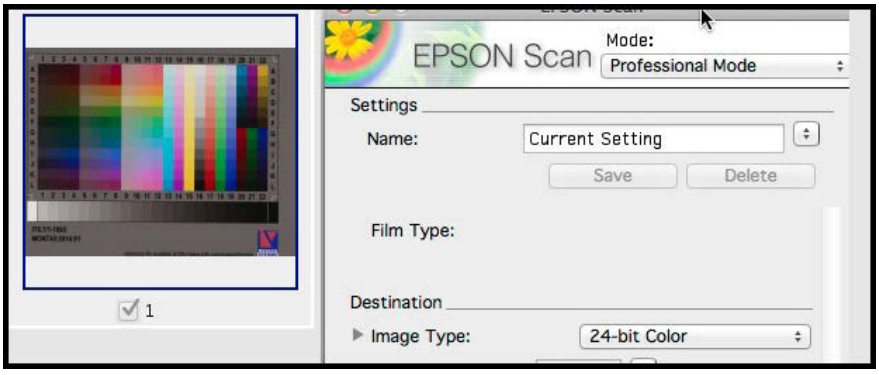
1. Start target scan process



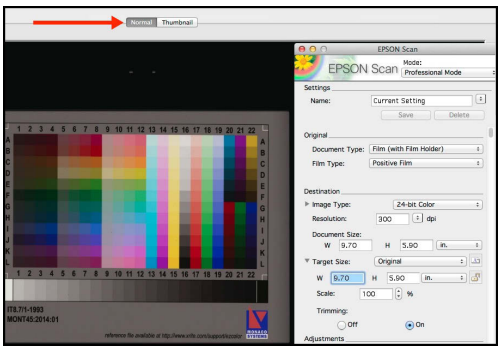
2. Open Epson scan to set-up the target scan



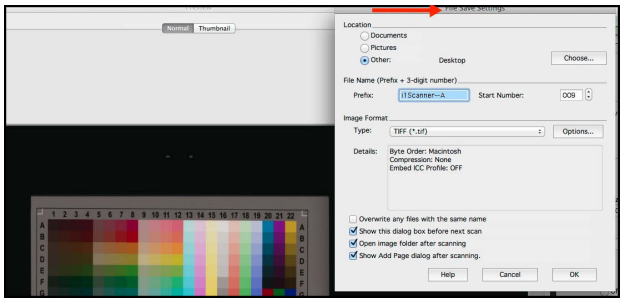
3. Check No Color Management



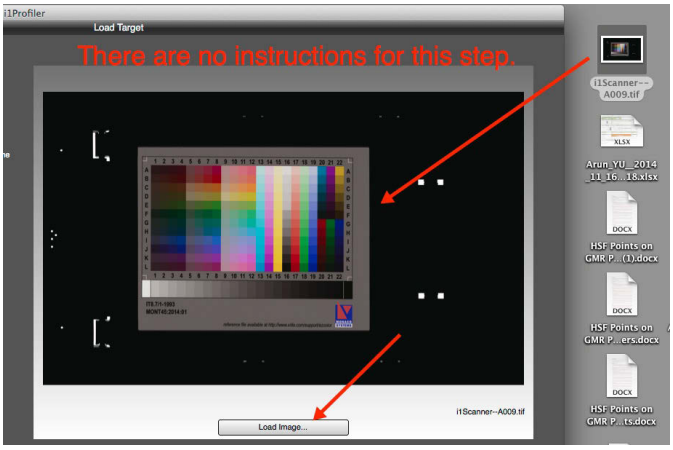
4. Generate a preview thumbnail of the target scan



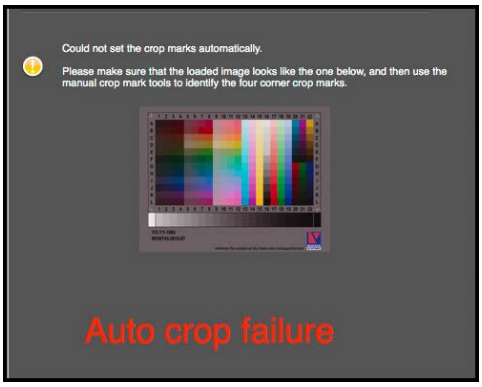
5. Switch Preview to Normal



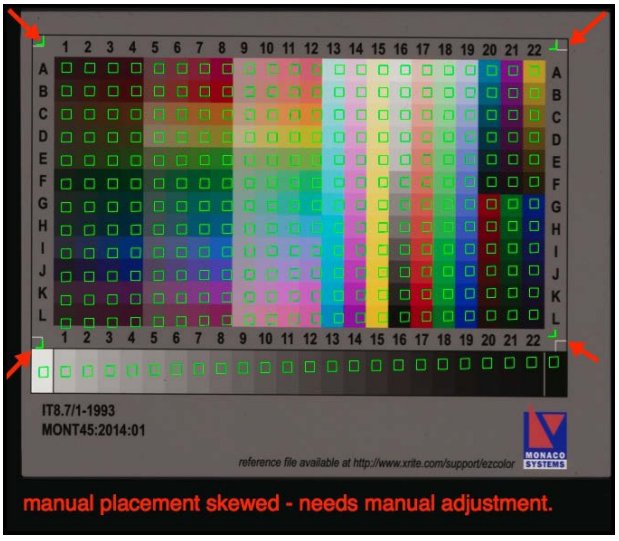
6. Click scan to trigger Save settings



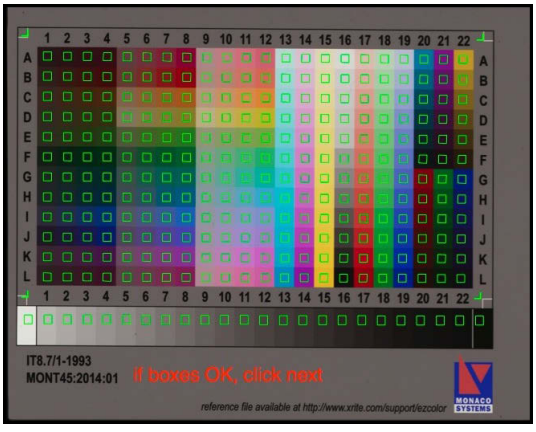
7. Drag target to window, click “Load Image”



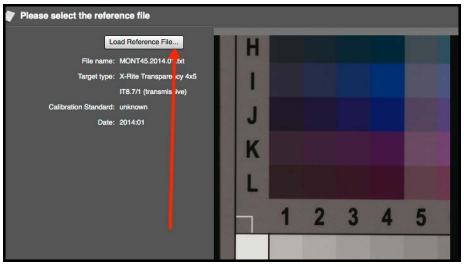
8. Click “Auto Crop” – but it fails.



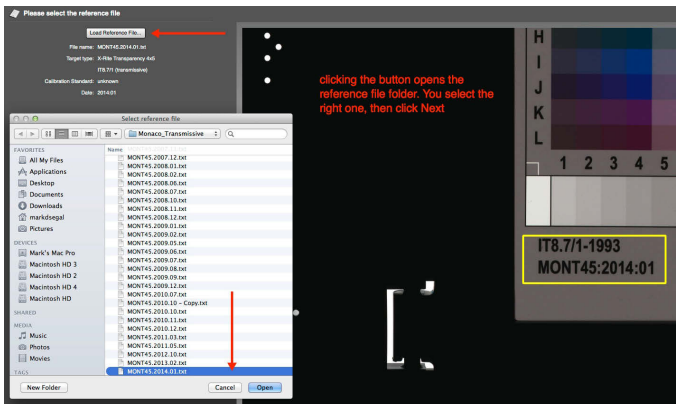
9. Place the crop marks manually



10. Verify that it worked, click next

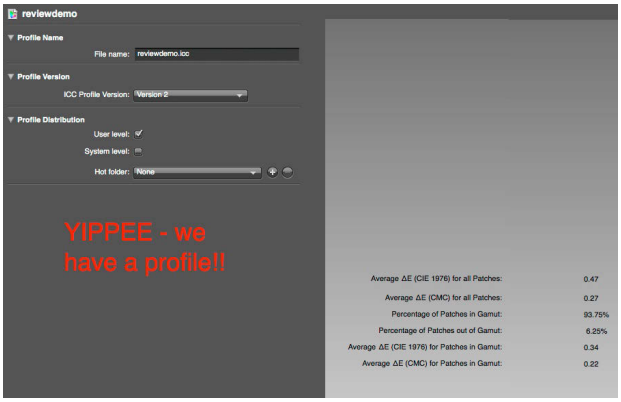


11. Instruction to load ref. file



12. Loading the reference file manually

13. Name the profile and Create it



14. Profile is made