Photo Scanning for Video with ScanGuide™ Pro

Demystifying the world of pictures, pixels and postproduction.

Loren S. Miller

The hardware

Photos and photo-motion are an essential part of films, especially documentary productions, and the lowly flatbed scanner has taken on a new life as a major tool in digitizing stills for use in digital video. Today's inexpensive scanners offer incredible resolution. Scanners sporting 1200 dots per inch (DPI) *optical* resolution— that is, not invented or "enhanced" in software but actual tiny "pixel-picker-uppers" mounted in the scanning tube— are now easy to find among Canon, Microtek, Hewlett-Packard and other manufacturers. One of my favorites as of this writing is the Canon LiDE 30. Retailing for US$100.00, it's slim, storable, and among the first without a power brick— totally USB-powered. I'm sure others will follow.

All scanners listed above supply a plug-in for direct Photoshop acquisition/import. Most all inexpensive scanners offer an 8 1/2" X 11" scanning bed. Scan oversized images in tiled sections, and join them in Photoshop, and— very important— scan each tile at the recommended *dots-per-inch* (DPI) rate determined for the total width. Proper dpi rates are discussed below.

Hardware includes megapixel digital cameras from Nikon, Olympus, Canon, et al. Many have USB connections; you can take a high-pixel picture, download it through iPhoto/Image Capture, and process it further for import to Final Cut Pro, and still be able to zoom into the image.

The mission: *stamp out fuzzy photos*

I don't care if you're posting for a syndicated reality TV show, an A&E documentary, or even a cloying AMC "Back Story" leveraging yet another shelf of the immense 20th Century Fox archives of dead star stills into formulaic all-new programming— there is *no* excuse for fuzzy photos. Soft, pixellating digital photo animation is everywhere these days. It telegraphs cheapness and disregard for craft. The goal here is to scan your photos to keep pixels out of the picture, and leave you with the resolution limits of the photo grain itself— unless of course that's the effect you really want, along with lower Neilsons.

Does this mean you should immediately scan all your photos at 1200 dpi? Heavens, no, not unless the photo is 2" wide and you want to zoom into it 5 times normal for NTSC D1/DV. (You'll see shortly why I was able to rattle that off so quickly.) Over-rich scan rates are way overkill and for larger images put real strain on your processing power, which invites odd display behavior, file corruption and outright freezes, lockups and crashes due to import limits. There are *always* limits, you see. The trick is how to leverage them for your creative needs.

In August 2001 LAFCPUG's Ken Stone, also a professional photographer, provided a nice tutorial on scanning photos for video, showing how to factor a zoom using two very cool freeware tools. Don't lose those! Tom Wolsky, another LAFCPUG headliner, also provides a cogent treatment of scanning in the newest version of his awesome Final Cut Pro 3 Editing Workshop, from CMP Books, (and yes, my FCP KeyGuide™ is proudly included).

This tutorial takes all that wisdom a step further and simplifies the process of getting exactly what you need in pixels into Final Cut Pro and ***only*** what you need— to work creatively within import limits, to fill the frame, to zoom in, to reduce render times and strain on the CPU which comes from tugging around a huge imported graphic while trying to animate it… and above all, to keep the image as crystal clear as possible.

To make this exciting and dynamic, prepare a scanner, photos, Photoshop and FCP to play with.

To assist me I'm using the new ScanGuide™ Pro, a two-sided laminated reference I developed for just this need. I'm frankly excited about its utility and I hope it's contagious, because a fair amount of research and design went into it. It's a vastly expanded and redesigned version of the free "junior" ScanGuide™, available right through the LAFCPUG store or my website.

ScanGuide™ Pro helps you plan photo zooms that stay sharp, no matter what format.

Observe Posted Limits

ScanGuide™ Pro sports built-in safety ranges which observe graphic import limits. In a typical ScanGuide™ Pro column header you'll note ***zoom multiples*** listed in white, and then yellow. The white listings keep your scans under 4000 pixels— Final Cut Pro's current import limit. The yellow listings keep you within 16,000 pixels, easily accommodated by After Effects®. Listed below each multiple is the scanrate needed to achieve it, for image widths from 1" to 14" wide.

SD NTSC D1/DV	IDEAL SCAN RATES/TARGET RESOLUTIONS	Standard Definition DV/D1 format: 720 X 480/486 pixels												
IMAGE AREA h X w	100% WIDTH	2X	3X	4X	5X	6X	7X	8X	9X	10X	12X	14X	16X	18X	20X
10 1/2"h x 14"w	52 dpi*	104	156	208	260	312	364	416	468	520	624	728	832	936	1040

White multiples safe for FCP; yellow for After Effects.

So what's all this fuss about pixel limits anyway? The 4000-pixel limit is built into current QuickTime architecture. This will definitely change; it becomes an issue as more of us get into High Definition post and need deeper scans to cover bigger image areas. Thus far two major HD formats have concretized: the Sony 1080i/p standard, with a 16 X 9 window measuring 1920 X 1080 pixels, and the Panasonic 720p format, with a 16 X 9 window measuring 1280 X 720 pixels. ScanGuide™ Pro provides scanning tables for both. (For those of you designing for direct film recording, there's a 16 X 9 Cineon table too.) A glance at these tells you immediately you're in "yellow alert": HD photomotion is currently an After Effects game.

After Effects® sidesteps the QuickTime import limit by implementing its own rendering engine, hosting up to 30,000 pixels square. At 16,000 pixels maximum the Pro guide keeps you well within current limits anywhere on the sheet.

Best Scanning Content Candidates

- Continuous-tone black and white or color photo prints. Photos from magazines or newspapers are usually printed using the halftone dot screen system, and your scanner will collect them exactly that way. Unless you apply a descreening filter at the source or treat it in Photoshop, the result can be a distressingly bizarre vibrating display called a moiré pattern.

- Digital camera stills of 2.5 megapixels or higher, which give you more than the data you need to zoom in. Suddenly iPhoto becomes relevant to your workflow because photo image capture is effortless. Rehearse zooms, see if you have enough pixels for magnification.

Cop it, Crop it

Let's start with your raw flat art: photos! Knowing that storytellers must proceed based upon what they can get for scanning— be it an aging treasure map, a ripe 3" square Polaroid snap from a family scrapbook, or an 8" X 10" glossy of his legendary brother Phil at the Michael Ochs Archive (http://www.michaelochs.com)— ScanGuide™ Pro lists them as a range of image areas from 1" to 14" wide, with accurate ratio heights depending upon the selected video format.

As Ken indicates in his tutorial, you often want to crop the original and scan only a portion of it. Most scanner software allows you to do just that *in situ*. Just because your photo is 8" X 10" doesn't mean you need to scan the whole photo. Pre-edit and keep that pixel count down!

Plan, Then Scan

Once you've determined the actual desired width, you can determine the height needed from the Pro guide. Not everything you encounter will be conveniently 4:3 or 16:9— that's life, but it's still annoying. For instance, suppose we're dealing with an odd-sized wallet photo. Here's my cute niece Alexa, original size, 2 1/2" X 3 1/2". (She's since grown considerably.) I refer to the Pro guide to quickly derive the required frame height for 4:3 and for 16:9 aspect ratio at a 3" width.

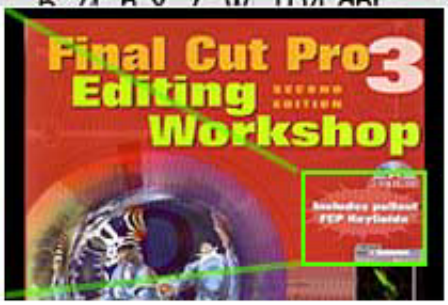
Now this may interest you: I choose the 3" width line because I know from experience there's conservatively 15% "wiggle room" for zooming. That is, up to a point you can let FCP's QuickTime (or After Effect's) display engine do some inventive, barely detectable pixel pushing for you— it helps keep the file size down, too. Small photos generally need very rich scans.

First I'm concerned about composition. Pro guide tells me I'll be cropping the SD 4:3 vertical to 2 1/4". That's fine, I can always animate a tilt-up to her face. I also know cropping becomes more severe for SD 16:9— 1 11/16" height!— and it puts her into a choker, but I want that too because widescreen is so cool! I can intelligently plan "baseline" scanrates to fill either video frame and start worrying about magnification.

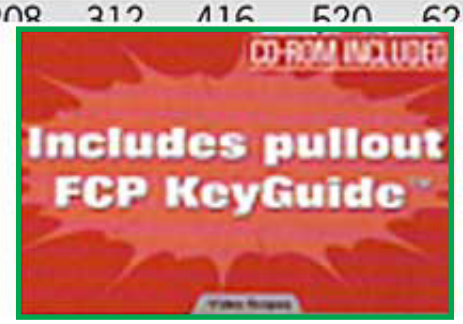
Zooms Loom, Avoid Doom

The results of scanning only for 100% width and risking a 4X zoom-in, rather than judiciously scanning for it, are illustrated below. Want to get out of cable access TV and into PBS or not?

SD NTSC D1/DV	IDEAL SCAN RATES/TARGET RESOL					
IMAGE AREA h X w	100% WIDTH	2X	3X	4X	5X	6X
6" h x 8" w	90 dpi	180	270	360	450	54



90 dpi "Baseline" scan of this 7 1/2" wide cover looks great at 100%...



...but falls apart when zoomed in 4X !

SD NTSC D1/DV	IDEAL SCAN RATES/TARGET RESOL					
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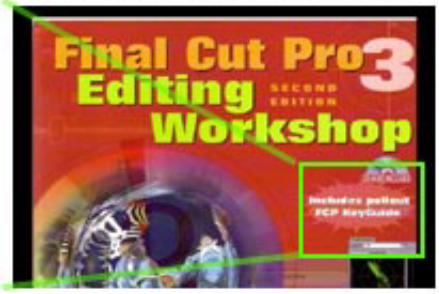
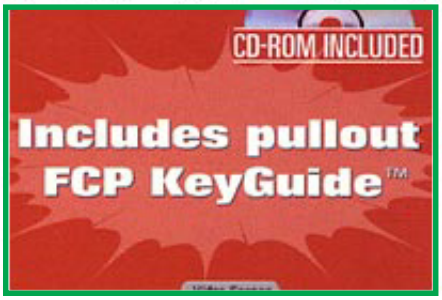


360 dpi "4X" scan looks good at 100%...



...and just as clean at 4X zoom, after treatment for moire.

You can determine zoom factor as a rough calculation. For instance, assume you have an 8" H X 10" W, you intend to start wide, and zoom into an area of interest measuring about 2 inches across. What's the zoom factor, class? 5X! Now look it up on the 10" width line, under "5X" to get the ideal scanrate to support the zoom-in. For this width, zooming in five times, NTSC DV 4:3, it's 360 dpi. Make it so!

Which reminds me of another Ken Stone wisdom— it's fine to overscan slightly for flexibility. When you come up with a fractional factor, it doesn't hurt to go for the next higher zoom multiple. Many scanrates supplied in the Pro guide are in fact slight overscan rates which hit even numbered dimensions to avoid video weirdness.

So what do we know or infer thus far?

> That physical photos need to be scanned to be imported into FCP.
> That a high-resolution scanner is a good idea, and they're now cheap.
> That there are zillions of fine photos in the 20th Century Fox archives.
> That to scan small photos to render properly at 100% width, scan rich.
> That to maintain sharpness at the close end of a zoom, scan richer.
> That a scan for SD won't work well for HD; scan even richer.
> That you can scan direct, or overscan for touchup, and then downsample.
> That there are absolute dimensional limits to graphic import sizes— depending.
> That ScanGuide™ Pro will guide you through scanning based upon your photo image area, your zoom requirements, your video format and your import limits, for $19.95.

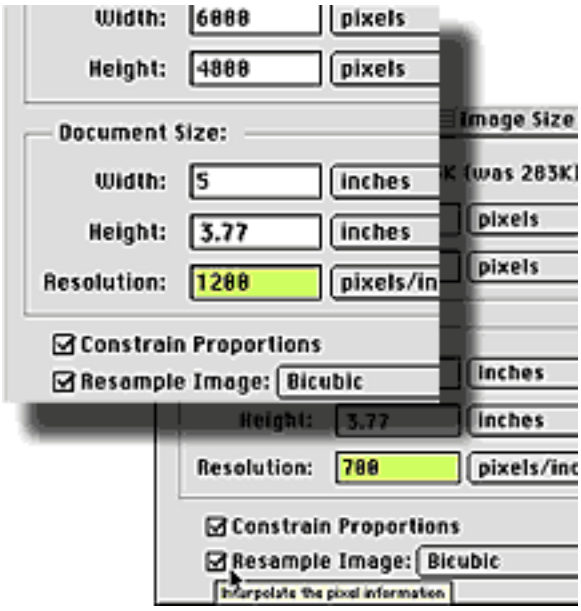
Workflow Tips and Techniques

I don't care how miserly you are with your pixels: ***never*** scan in Line art mode— that's way too little data. You want at least 24-bit grays or colors to work with, in RGB format. That mode assigns each pixel one of 16.7 million available colors.

Overscanning is a very common strategy, but this can result in huge file sizes— a 6" X 8" image scanned at 1260 dpi for DV can support a 14-to-1 zoom-in— anything but film grain down there? But as a 24-bit file it can weigh in around 220 megabytes! Do you really need all that data? Storage isn't the problem these days; it's the processing, applying filters and ultimately the time rendering your animation of that image that gets expensive. Especially if you're doing one of those fabulous Ken Burns-type photo documentaries about another cool dead white guy and you've got 30 dozen of these photos to process. (Which is why Ken's producers only scan low rez for rehearsal animation in the NLE, and use Frame Shop (http://members.aol.com/frameshop1) to shoot final versions with motion control on *film*, to be repurposed anyway they like— an efficient and sensible workflow.) Of course most of us working in DV/DVCAM/Beta with fewer pieces to animate can scan for output resolution from the start.

But why would you overscan rather than scan direct at an ideal scan rate? Well, as Ken Stone points out, the downsampling algorithms in Photoshop are sophisticated and help preserve the highest tonal quality and detail. It's especially useful to overscan if your scanner is not calibrated via Colorsync profile to your monitor, or the photo is of secondary quality, or major touchup is required. We like to deal with such issues at a deep scanrate in Photoshop. For this scenario, downsampling to an ideal target resolution which still allows you to zoom in and stay sharp— is a good thing. It's good bit budgeting. You decide.

To downsample — always the final operation (before pixel resizing and saving) — you merely open Photoshop's Image Size window, keep the image dimensions just as they are but change the Resolution value to the recommended DPI listed in ScanGuide™ Pro for the X factor you desire, and make certain the Resample checkbox is checked. That's it.



At 6000 pixels wide this photo cannot be safely imported into FCP or even Avid systems! Downsampling— a form of resampling— reduces file size and cleverly removes excess pixels.

While downsampling, keep an eye on the Pro guide's Zoom Multiple heading. If you discover you must downsample to a value "in the yellow" for desired zooming, you'll be importing the scan into After Effects® and animating there, so prepare to wrestle keyframes to the ground. For instance: you scan a 5" snapshot for DV 16:9 widescreen dimensions. You've also decided you'll need to zoom in 4X for dramatic punch. On the Pro guide, the 5" width line reveals the 4X zoom multiple to be listed in white- hey, cancel Yellow Alert! You're still okay for FCP.

Image Adjustment Before Final Import

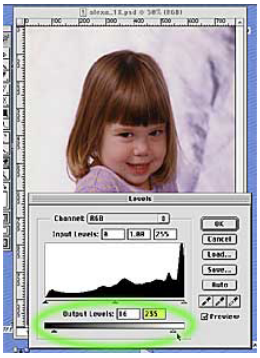
If you're stuck scanning halftone sources, try to find the highest quality available and be prepared to introduce 1 pixel of Gaussian Blur in Photoshop, to fuzz the edges of halftone dots to help avoid the bizarre collision of dots and video scanlines— major moire. Believe it or not, small blur — 1 pixel or less— can actually enhance some details on video.

The most common scanning hazard deals with very fine lines of detail measuring 1 pixel thickness or less. Rich scans carry a lot of fine detail! These invite *scanline twitter* especially along horizontals, because the import just doesn't know where to place the detail —on one scanline or the one below. During a zooms, this can be a horrible thing. Sometimes performing a subpixel reposition of the clip itself solves this, but the best strategy is to apply a 1-pixel Gaussian Blur to the scene.

A phenomenon you might notice after a rich scan is…*what're all these twinkly white dust spots?* Even after assiduous cleaning of the glass bed and the artwork, twinkly white dust spots pop up. Eliminate these through image editor touch-up tools before importing to FCP. Otherwise during zooms they'll twinkle like stars on a cheap B-movie backdrop— a "mini-moire" effect.

Almost every uncalibrated scanner requires some compensation for introducing too much green,. red or blue from the scanning lamp itself. Best done in Photoshop with Color Balance tools.

If your scanner software allows you to set a white and black point, this is an opportunity to build a proper tonal scale right into the scan, (that's a Ken Stone tutorial too) but again, many would rather do it afterwards in Photoshop, especially since the scanning software is usually a Photoshop plugin which brings the image right into the program. There you can also apply the NTSC Safe Color filter and set your Output Levels.

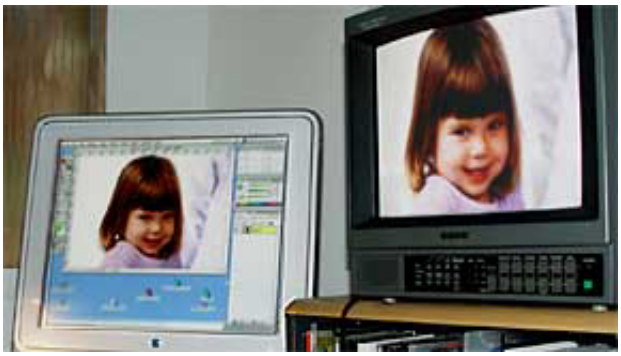


Output levels for legal video: typical image adjustment in Photoshop

It's common to adjust the digital Levels scale in Photoshop to the NTSC setup and white point level standards. To properly render video levels of a computer scan, boost the Levels Histogram black value output from 0 to 16 and the white level down from 255 to 235. Lo and behold, without getting technical, if you import this file and examine its readout in the FCP Toolbench Waveform scope, the setup and white values will be legal. If for some reason they are not, stay right inside FCP and apply the Broadcast Safe filter, it's been blessed by professionals.

Video Monitor Previews

As with all image editing in Photoshop, it's extremely valuable to preview your work on a broadcast monitor, to evaluate color, applied blurs and other enhancements affecting the image on video. If you employ one of the qualified analog capture cards , use its live video preview, or just get the software-based utility **Echo-Fire™**, (www.synthetic-ap.com) a magnificent tool which pumps the Photoshop or After Effects image out the FireWire port, through your camera or deck to your client monitor. It also gives you video scope overlays to check legal video values. Either strategy eliminates many nasty surprises.



EchoFire™ provides a convenient, accurate software-based graphic preview.

The Resizing Rumba

Most video editors working in Standard Definition NTSC or PAL know the resizing dance to correct graphics for square to rectangular TV pixels, to prevent a perfect circle from looking like an egg in video. The nice thing about the HD formats is that we don't need to futz about compensating for differing pixel ratios anymore. In HD, all is square, from your Photoshop scan to final delivery format. All is square throughout the upcoming workflow. I cannot get over it. Meanwhile, ScanGuide™ Pro provides the scaling factors required for both current NTSC/PAL.

Image Adjustment After Final Import
We've waded through all these issues so you can finally import the photo, and start swimming.

Your import, for one reason or another, might not display exactly as you expect right off the bat. A rich scan may overfill the Canvas when you first view it. Don't panic. Double-click the clip in the timeline, select the Motion tab of the Viewer. The culprit is the Scale value, and it's easily reset here. Experiment with values. See what the import looks like at 100%. See if you get your wide shot by scaling back—for instance, if you scanned for 5X, back the Scale off to 20%.

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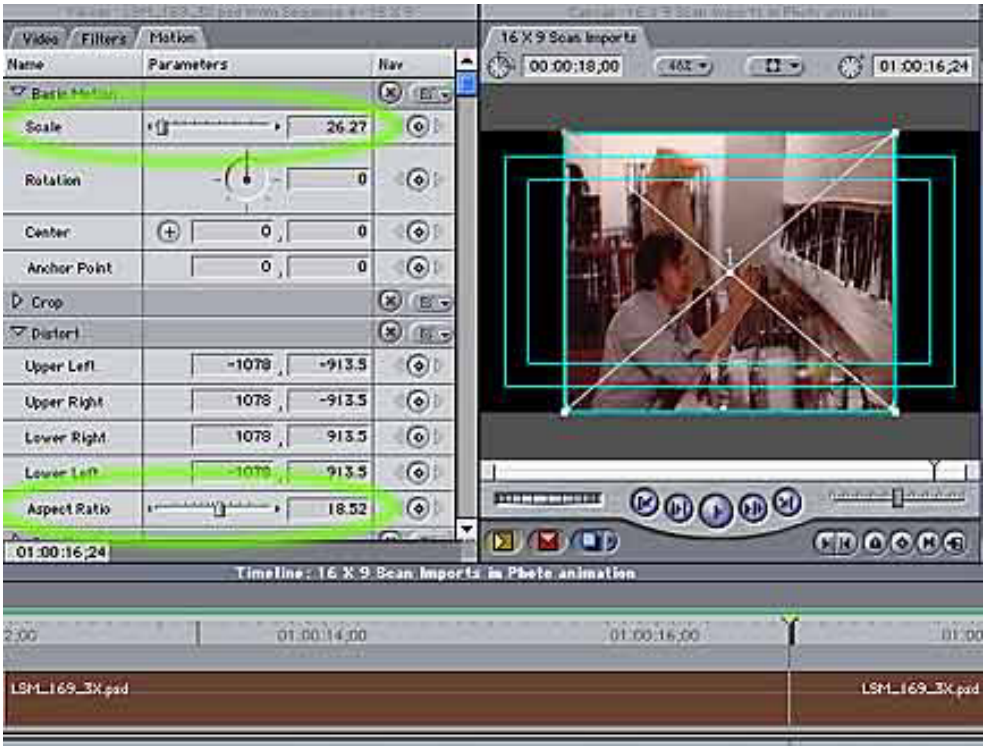
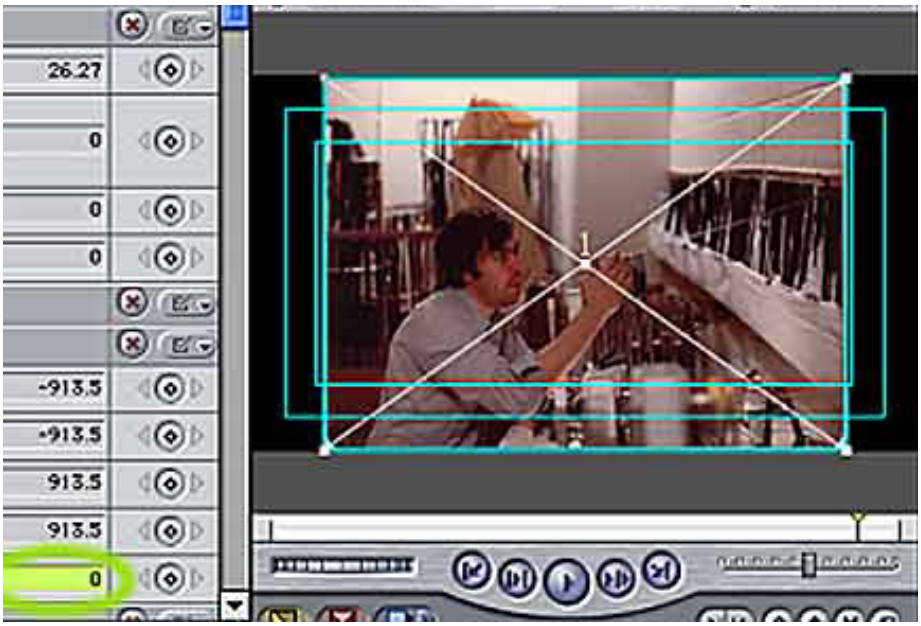
A 3 1/2" X 5" snapshot scanned for SD 16:9 format and 3X zoom factor. The scanrate to achieve this: 525 dots per inch.

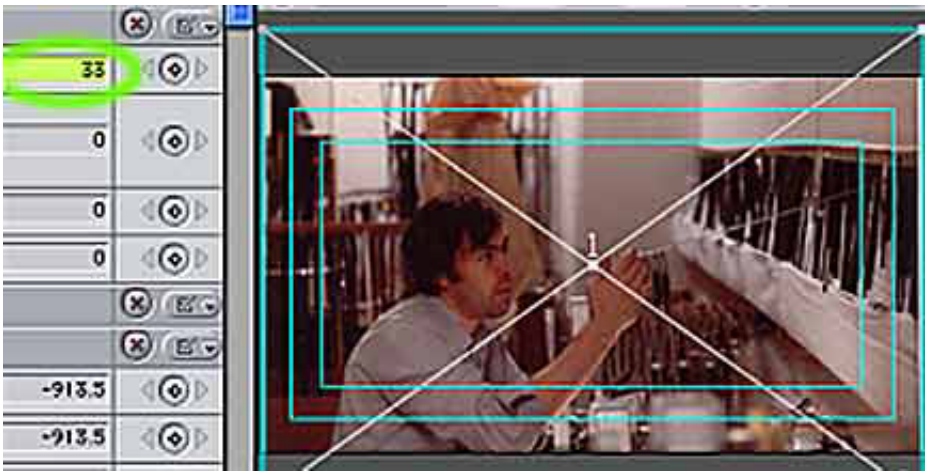
You will likely encounter oddball scaling situations, such as the above scan for a Standard Definition anamorphic widescreen sequence, which is fun to work in. The original snap was a 3 1/2" X 5" snapshot of some poor devil negative cutting A, B, C and D rolls back in the late 70's. (The shot was taken by Michael Korolenko, and his film *Since '45* became a Student Oscar winner.) It was scanned rich for a 3X zoom. Let's see what happens on import.



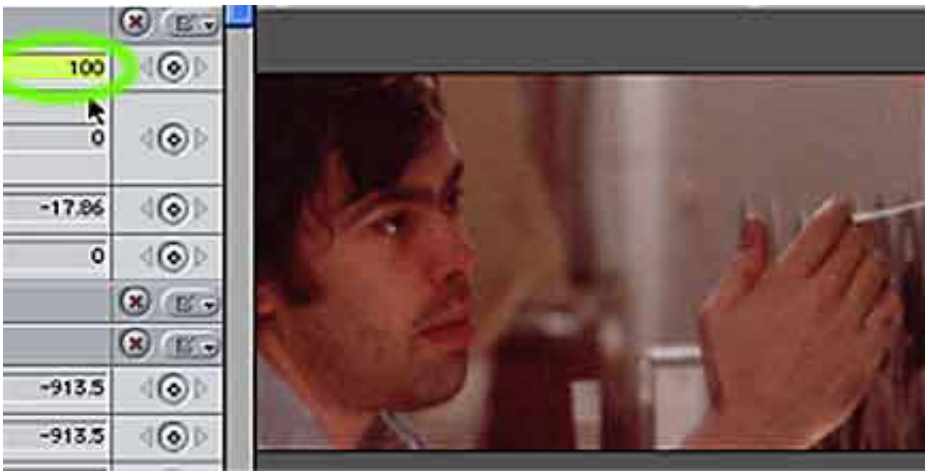
The scan comes in squished horizontally and scaled to the vertical. Notice odd Scale and Aspect Ratios. Ready to give up and return to real estate? Wait!



First we expand the image to the original proportions by zeroing out the Aspect Ratio.



Now we can begin to play with our pre-built scan values. Since the scan was 3X, change the scale from the oddball import value to 33%. This fills the frame with a wide shot. Top and bottom are cropped— you're not surprised by that— and it gives you compositional room.



Finally, check the planned zoom by setting Scale to 100%. Hey, isn't that the young Tim Curry...?

Photomotion itself is another topic altogether and best learned in a good class, from an able practitioner, or competently written procedural text along with your own time noodling the tools. But it all begins with acceptable source materials and your ability to *scan smart* puts you ahead.

Conclusion

Scanrates are really nothing you couldn't figure with a calculator...but there are many variables: photo image area, zoom intent, aspect ratios, resizing, alien workflows, *el niño*, the stock market. To save you time, it's all been integrated for you, all the popular international video systems, for deep zooms, for any practical width from a 1" postage stamp to oversize 11" X 14 " prints, in ScanGuide™ Pro.

Do try the free ScanGuide™ Jr. for popular photo size scanning in NTSC/DV 4:3 to best understand the utility of the Pro Guide.

Scan away, stay sharp, and don't make me come down there with the big shoes: ***stamp out the fuzzies!***

Grateful Thanks to
Ken Stone, Phil Hodgetts, Trish and Chris Meyers, Tom Wolsky, Michael Korolenko, and of course, Alexa.

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When he's not obsessing over fuzzy photos, or differences between Avid and FCP splicing buttons, or annoyances of the OSX interface, Loren S. Miller is an award-winning documentary producer, freelance editor, screenwriter, project consultant, graphic designer, editing teacher, reporter, author, active member of both Los Angeles and Boston Final Cut Pro User Groups, developer of ScanGuide™ Pro, and KeyGuides™ for major Macintosh media authoring software. Reach him anytime at LorMiller@aol.com.