

**Fédération Internationale
des Archives du Film**
International Federation
of Film Archives
**Federación Internacional
de Archivos Fílmicos**



Digitisation for Film Archives – Assorted Complications

Scanning

Standard tests for scanners

There are no standard universal tests and set-ups for film scanners, so it is very difficult to determine exactly what a film scanner is doing when capturing film images. This is in contrast to analogue film technology where printers, processing and film stocks are all routinely subjected to testing and control, and where the response curves of film stocks are published by the manufacturers. This also differs from professional still image digitisation where the whole chain from scanner to printer is subject to colour management ('colour management' also applies to black and white images).

For film scanners, it is usually difficult to obtain any real data from the manufacturers about the response to light levels, about resolution, about the precise effect of settings etc. Given that the general approach to digital film is based on what looks right to the operator rather than compliance with any standard, this may not matter, but it can easily lead to a lack of consistency.

Film scanners do not capture everything

Never think that it is possible to put a film on a scanner, push the button, and capture a perfect digital representation of the film. 2K scanning at 10 bit depth can produce an adequate digital version of a 35mm film for presentation, but not a preservation or restoration copy. 4K scanning at 12 bit (or 16 bit) is much better, and may capture most of the effective image information, but only if it is done properly. A bad scan is still a bad scan even at 4K (or 16K), because scanning a film requires skill (see next point).

Scanning film is a skilled craft

Scanning a perfectly graded print in good condition should require the minimum effort to set up and scan, but any one of the following introduces complications: a range of exposure levels, splices, damage, grading notches, non-standard framing, soundtracks. Common problems are unsteadiness at splices, poor response to very dense negatives, insufficient exposure latitude from scene to scene with ungraded material. Scanning film is a process which requires dedication, experience and a good understanding of both film technology and digital technology.

Scanning facility companies are TV facility companies

Don't be surprised if the company you use for scanning film doesn't understand when you tell them that the frame is expected to move around and the image is supposed to have grain. They are trying to make it look steady and smooth like an HDTV image, because that's where most of their work comes from. They will say, 'Don't worry about us taking all the grain out, we can re-grain it afterwards.' Don't let them take it out in the first place.

Metadata

Did you want metadata with your scan? Some scanners now capture the technical metadata related to the scanner and its settings as part of the scan, although there is no standard format for this. Many scanners don't, so don't expect to be able to re-scan a film on Tuesday that you did on Monday, and get the same result.

Post-scanning

Applications struggle to play in real time

Whatever application you use to play back your HD/2K/4K scans, systems still struggle (in 2012) to play these enormous quantities of data at 24 fps. To do so requires very specialist hardware setups which are not within your IT department's normal realm. Expect to find playback slowing down whenever something in the system is updated, or when the disc drive storage becomes slightly fragmented.

Mac users have the advantage

If your institution doesn't support Macs, prepare to be disappointed from time to time when you find out that the application you want is only Mac compatible. Macs are used by the photography industry almost exclusively, and a great deal by film/TV facilities, so some applications run only on Macs.

Film digitisation carried out by suppliers will probably be delivered on Mac formatted drives unless you specify otherwise.

Grading is a job for trained staff

As with scanning, it requires skill and training to take a raw scan and produce even a 'technical' grade (ie. where the levels are set within a margin of error ready for final grading). Don't expect you (or our staff) to be able to sit down and produce a graded cinema version just because you have a good eye. It's difficult.

Colour management

As with scanning, when grading the result, there are no standard curves, and no easily reproduceable settings. Professional colourists just fiddle about with the image settings until it looks right.

DPX Files

DPX headers are frequently wrong

DPX is a 'standard' but not one which is properly adhered to. The file header is able to record a large amount of information about each DPX file, but much of this is either not used properly by the application writing the DPX file, or not used at all. Most commonly the file header field which records the colour space of the DPX (log, linear, CCIR 709 etc)

is frequently incorrect, which can mean that systems which rely on this information for display or transcoding may have problems (see next point).

The difference between log and linear

Scanners commonly output log DPX files, which is designed to mimic the response of a film negative. Systems sometimes have look-up tables (LUTs) to convert the log response curve into a linear one for display on computer systems or for conversion to other formats. These LUTs typically produce terrible results, and TV and film colourists generally don't use them, preferring to apply an ad-hoc correction curve to produce a result which looks right to them. This is another case of the motion picture industry preferring an empirical approach rather than a standardised structure.

For a film archive, where the response curves of the original film are probably unknown, and where the settings of the scanner are at the whim of the operator, it doesn't really matter whether the DPX output is believed to be log or linear provided that the end result (eg. a DCP, which has a different colour space altogether) looks right.

Single channel DPX is not always supported

It would make sense to use single channel monochrome DPX rather than RGB DPX for capturing a black and white film, since this results in a third of the amount of data, a very significant saving, especially if scanning at 4K. However, many systems do not support single channel DPX because it is not much used in film production. Unless you are sure that every stage in your workflow will happily deal with single channel DPX, it may be safer to stick with RGB and suffer the consequences of dealing with three times as much data.

Temporary storage requirement is easily (always) underestimated

When dealing with film scans, storage space fills up rapidly, and if there is a temporary hold up further down the workflow (see next point), even very generous amounts of temporary storage space will not be sufficient. A system designed for film digitisation will need far more digital storage space than you ever imagined.

Doing anything with DPX files takes a long time

IT systems are not well designed for dealing with tens of thousands of DPX files. Even copying a scanned film in DPX from one drive to another may take the whole day. Standard computer file management is designed to maximise storage efficiency by fragmenting files and storing them in available blocks on a hard disc, and continuous writing and rewriting of DPX files to a storage area without defragmentation will lead to performance problems. Workflows should aim to minimise file copying and movements, and very high speed networking is needed wherever this is unavoidable. Expect your IT infrastructure to break down frequently under the strain.

Audio

Separate workflow for sound

Unlike telecine machines, not many scanners are able to capture soundtracks at the same time as the picture, and in any case the sound is captured as an audio file, separate from the DPX files, so it is likely that a synchronisation stage will be required in the workflow, for which an application which will play DPX files in real time is needed. It is easy to underestimate the additional work involved in dealing with sound film.

Negative soundtracks

Scanning the original picture negative can result in superb quality, but the same is not true of sound. There are sound capture systems which are able to emulate the image spread effect of printing an optical positive soundtrack, but these are not widely used at present (in 2012). External suppliers may tell you that they can capture acceptable sound from negative tracks by applying some noise reduction. This is not true.

Speed

If the sound is captured separately from the picture using a telecine machine (a common method), this will probably be done at 25 fps. The resulting audio files will then need resampling to 24 fps. The DPX scans are speed-independent, so when using an application to check synchronisation, the application playback speed must of course be set to 24 fps, not 25 fps.

Output

DCP

DCPs are the wrong aspect ratio (1.89:1) for many archive films, so most scanned films will need to be scaled down to fit into the DCP container. If making your own DCPs in-house using one of the available DCP creator applications, you may need to scale the DPX files using a separate application before creating the DCP.

Until (and unless) archive frame rates for DCPs are implemented, it is difficult to create a DCP for silent films. One method is to create a 48 fps DCP with each frame shown three times, resulting in a 16 fps presentation. However, some D-cinema systems assume that a 48 fps DCP is a 3D film, and automatically apply the wrong colour settings. Digital projectionists may not know how to set the colour settings manually.

Formats for other requirements

It is assumed that once your film is digitised, it can easily be made available for every purpose: BluRay, DVD, TV, download, streaming. This may be true, but each output needs to be set up carefully, especially regarding aspect ratios and frame rates.

The TV industry has no standard file format for programme-making, and producers usually request the format that their editor happens to be familiar with. Archives may find it simpler to make only one or two broadcast-quality formats available and not give the producer any other choice.

Speed

The good news is that with the phasing out of videotape, there is now little need to worry about converting films to 25 or 30 fps. The frame rate of files for download or streaming (MPEG, Flash, etc.) is easily set to 24 fps, or 16, or 18 or anything (although that doesn't necessarily mean that all players will play the film back at the correct speed). Similarly, TV may be currently tied to either 25 fps or 30 fps for actual broadcast, but lower frame rates are easily handled in the TV production process. For DVDs, though, a 25 or 30 fps version is still needed.