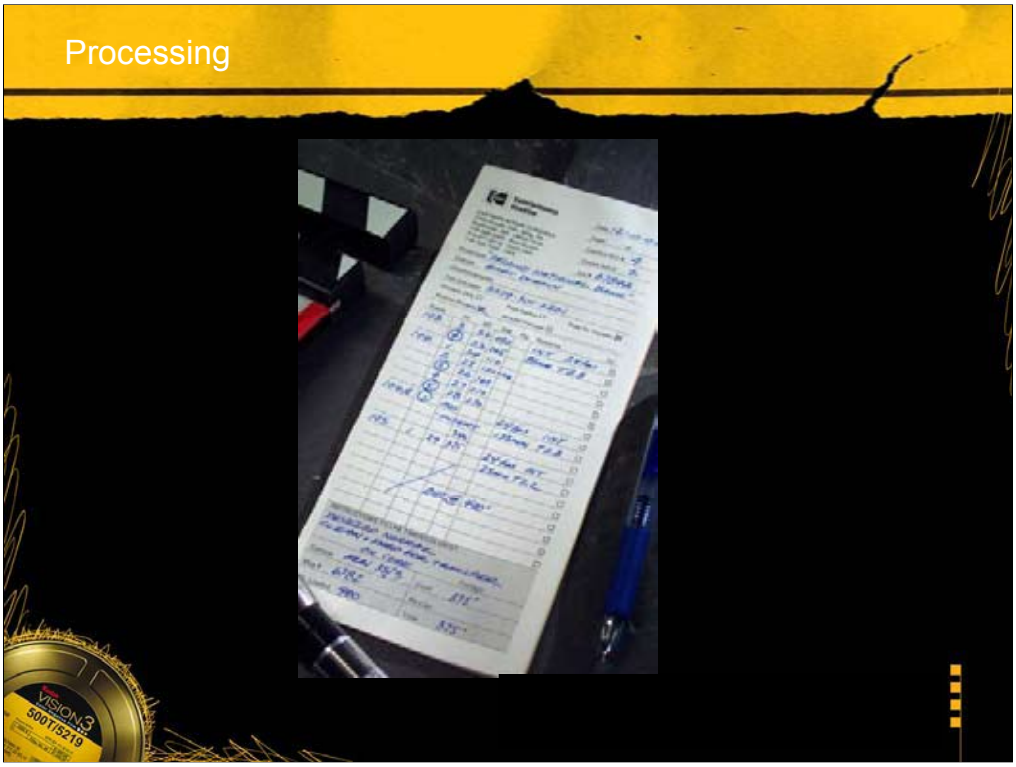
Welcome to the Processing chapter. Quality processing is essential, regardless of the production budget. We'll explore the stps in various film processes, and how they can be adjusted to achieve special looks.



The film arrives at the laboratory by a variety of means—hand, courier, air freight—and is generally accompanied with instructions for processing and printing.

The usual form for these instructions is the camera sheet, but company orders or letters are also acceptable. In addition to paperwork, the film cans should be labeled and special instructions to the lab should be clearly marked on both the camera sheet and each film can. It is essential to tell the laboratory in writing:

•What you are sending (film type and quantity).

•What processing is required, clearly identifying special instruction.

•What dailes/rush printing is required, if any, and what electronic transfer is needed.

•The name and address of the production company, the contact name, and the telephone number.

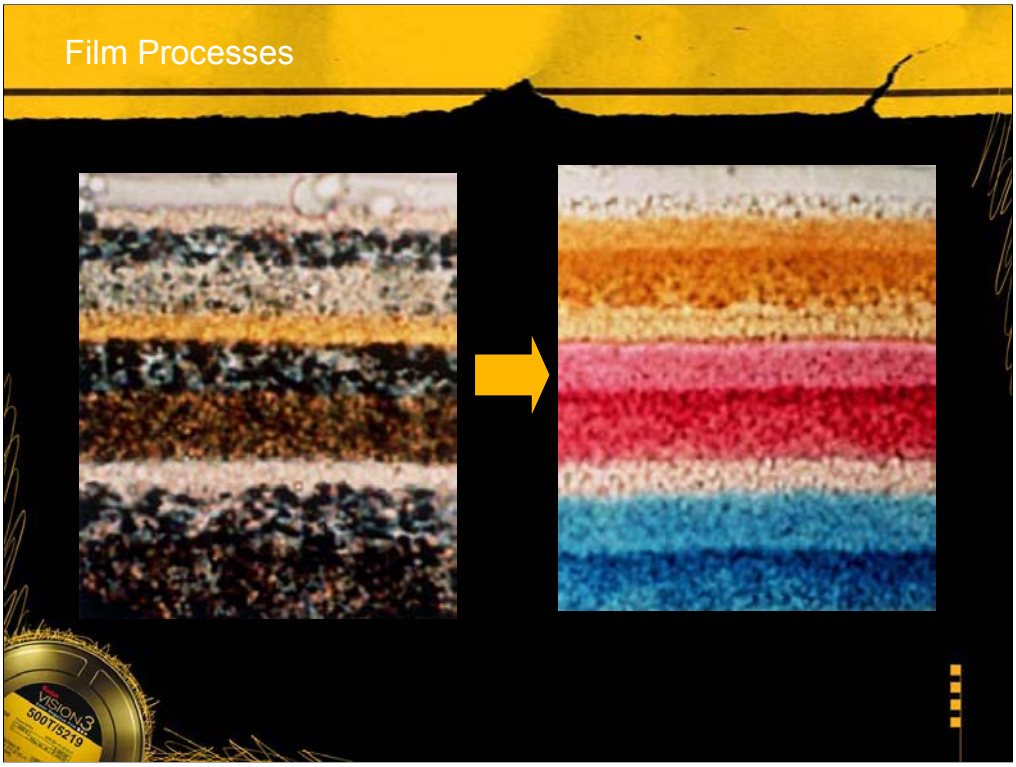
•Where to deliver the dailies/rush prints with the contact and phone number at the delivery address.

These are some of the principal services offered by commercial motion picture laboratories. Few laboratories offer all the services listed but most of them provide a major portion:

•Processing camera film. (Special overnight pickup and delivery, or weekend service is available in some places by pre-arrangement.) Find out what processes are available, including special techniques (for example, flashing, or push/force processing).

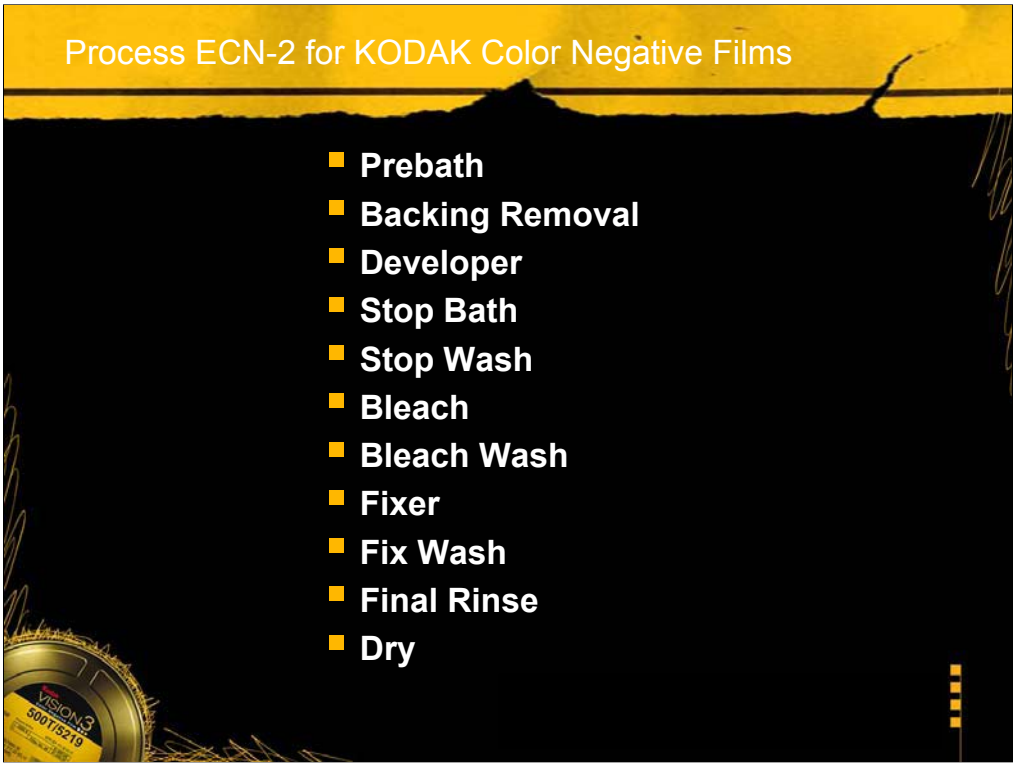
•Furnishing advice to help with technical or even aesthetic problems.

•Printing and duplicating from camera films for workprints or release prints. Most laboratories print or duplicate the camera film after it is processed. They may also hold the original in their vault and forward the print for use as a workprint. Thus, the original is protected from damage in handling until it is needed for final conforming.



Photographic emulsions consist of silver halide crystals suspended in gelatin. When these crystals are exposed to light or other radiation, minute quantities of silver are formed. These quantities of silver record the image. Because they are so small, however, the image can't be seen. This latent (hidden) image requires "amplifying" under controlled conditions to make it visible and "treating" to make it permanent and usable. These steps are known as processing. The following examples of three common processes identify the main stages in each.

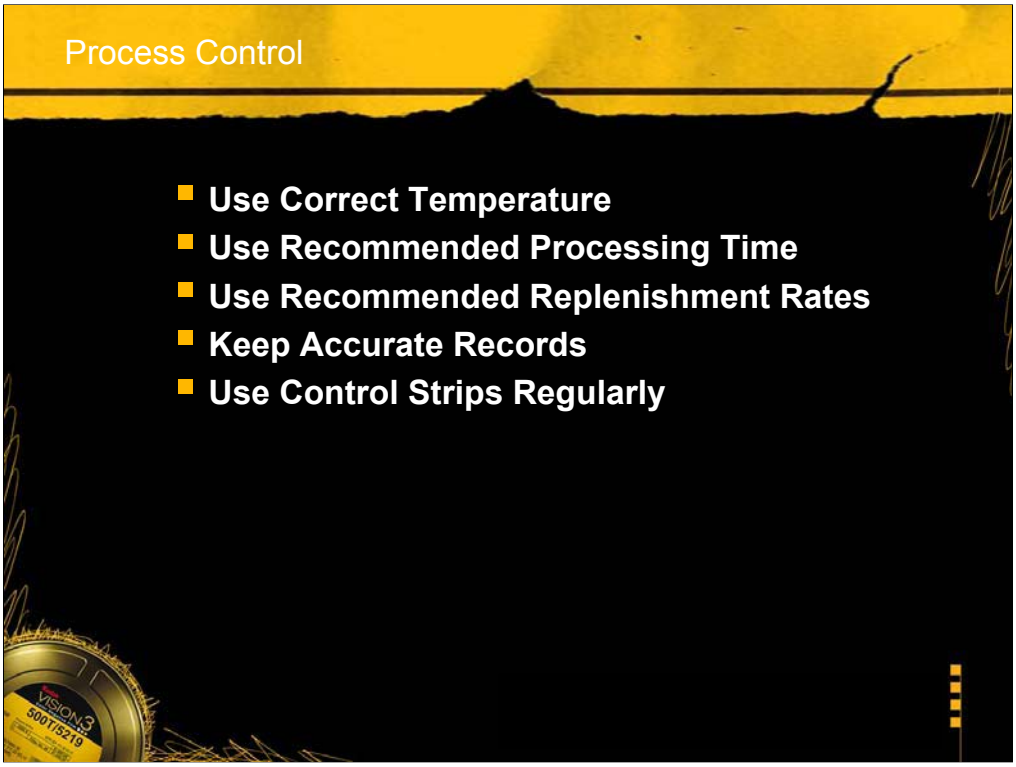
A **developer** converts the invisible latent image formed during exposure into a visible form by accelerating the action of light in converting the exposed silver halides to metallic silver. To stop the development reaction, the emulsion may be immersed in a **stop bath**—normally an acid solution. Then the **fixer** converts the unexposed silver halides to soluble complexes. The soluble complexes and fixer must be removed from the emulsion by efficient **washing**, otherwise staining and fading of the image may occur. The emulsion is then **dried** under ideal conditions. The emulsion is very soft at this stage and should be handled with extreme care.



First, the **prebath** softens the remjet on the back of color negative films. Then, a **backing removal** step washes away the softened remjet. The **developer** step converts latent image silver halide to silver and dye in the various color layers. The **stop bath** is a highly acidic solution that uniformly and quickly stops the development of silver halide after it has reached the correct level of completion. The stop bath also removes the color-developing agent from the film, preventing it from causing problems later. A **stop wash** prevents acid from contaminating the bleach solution. **Bleach** converts the metallic silver from the silver picture image, formed during color development, to silver-halide compounds that can be removed by the fixer. Then a **bleach wash** prevents bleach from contaminating the fix. The **fixer** converts the silver-halide compounds to soluble silver thiosulfate complex salts that are removed from the film in this fixer and subsequent wash. The **fix wash** removes fixer that could destroy the dye image if not completely removed. The final wet step is the **final rinse**, which contains a wetting agent that

Some features of this process appear similar to those of ECN-2, but are usually different in practice. The CD2 developing agent, for example, is some ten times more reactive than the CD3 used in the more gentle working ECN-2 process. This agent is used to achieve the correct level of contrast in the projection print while keeping the development time short.

Developer reduces exposed silver halide grains in all three light-sensitive layers. The developing agent is oxidized by the exposed silver halide, and the oxidation product couples with the particular dye coupler incorporated within each layer to produce dye images. A silver image is formed simultaneously at the exposed silver-halide sites. Next, the **stop bath** halts development. The **stop wash** removes excess acid stop to avoid contamination of the next solution. An **accelerator** prepares the metallic silver present for the action of the **persulfate bleach**, which converts the metallic silver from both the sound track image and picture image that was formed during color development, to silver-halide compounds that can be removed by the fixer. In the sound track, the silver image formed during color development is converted to silver halide by the **bleach**. It is then redeveloped to a silver image by a black-and-white **developer** solution. Next, a **wash** removes residual bleach from the film, preventing contamination of the fixer. The **fixer** converts the silver-halide compounds formed in the picture area during bleaching to soluble silver thiosulfate complex salts that are removed from the film in this fixer and subsequent **wash**, which removes unused fixer and the residual soluble silver thiosulfate complex salts formed during fixing. A **final rinse** prepares the film for drying. Finally, the film is **dried**. A **lubrication** step (to promote longer projection life) may be an in- or off-line operation.



To ensure the best possible results from a process, the operator checks the physical operation of the machine periodically. A good lab observes the following practices in the physical control of a process:

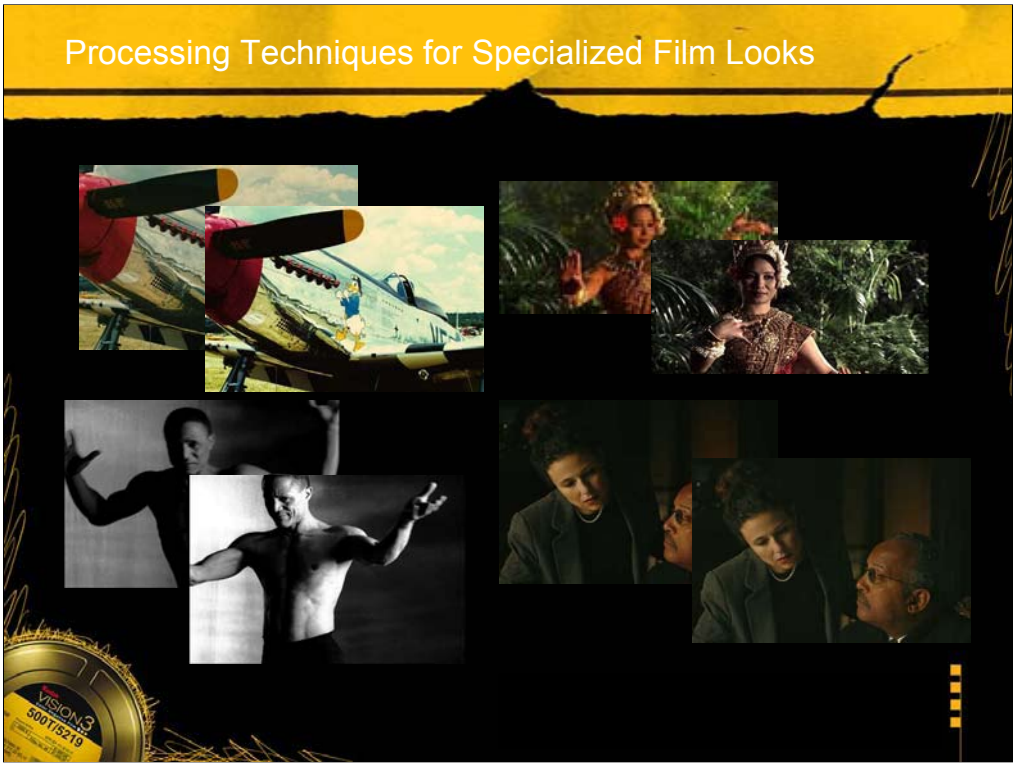
Use of correct processing temperatures, which are checked often. Thermometers and temperature-controlling devices are calibrated periodically to insure that the instruments are operating properly. The temperatures of all solutions are kept within specification to ensure tight photographic quality control.

Use of recommended processing times. Machine speed is checked by carefully measuring the time it takes for a given length of film to pass a specific point. Knowing it is possible to use an incorrect processing time when a machine uses different thread-ups for different film stocks, the careful laboratory checks the solution times every time there is a threading change.

Use of the recommended replenishment rates. Accurate replenishment replaces ingredients that are depleted and maintains the process at a constant, efficient level. To prevent serious out-of-control situations and chemical waste, laboratories routinely check the accuracy of their replenisher delivery systems.

An accurate daily record is kept of conditions affecting the process, including developer temperature, amount of film processed, volume of replenisher added, and identification numbers of control strips processed at particular times.

Regular processing of pre-exposed photographic control strips. The strips are then measured with a densitometer and the results compared with a standard and plotted on a graph. This gives a clear display of the consistency of the process and warnings when it starts to stray, allowing corrective action to be taken.



Some cinematographers use these alternative techniques to obtain different looks. Popular techniques used to achieve specialized looks are:

•Silver retention techniques

•Push and pull processing

•Cross-processing

•Flashing

Although the impact of using alternate processes varies, in most cases it affects changes occurring in color emulsions, which may not occur equally in all layers. Those changes could result in:

•Improper color reproduction

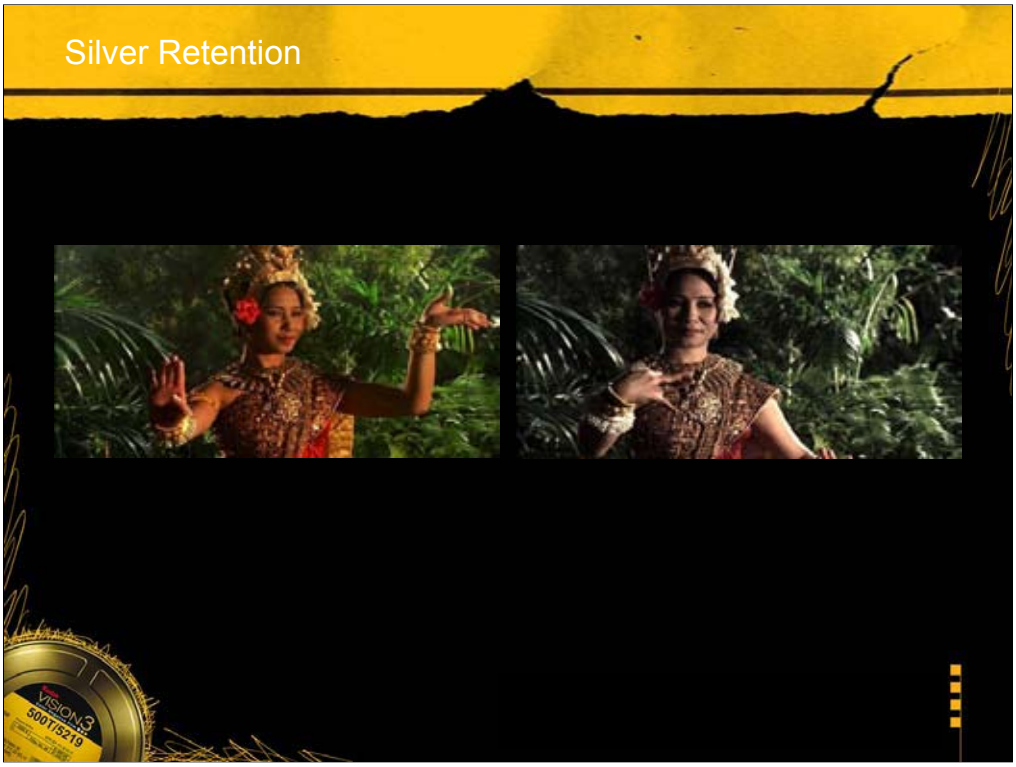
•Speed shifts

•Contrast changes

•Increased fog

•Increased grain

If you decide to try one of these alternative processes, discuss it with your lab, test the technique in advance, and understand that the results are not reversible.



Silver Retention

Silver retention techniques create a distinguishing visual style. Labs call the technique different names:

•Silver retention
•Bleach bypass
•Skip bleach

In all of these processes, varying amounts of silver are left in the print or negative film stock. And, no matter what it is called, the end results are very similar.

Silver retention may mean:

•Selected bleaching of the silver image
•The film is not bleached at all
•The film is left with varying amounts of silver

SIDEBAR

Silver retention can happen when developing the negative, intermediate, or print. Each has slightly different looks. To preserve the original camera negative, many filmmakers choose silver retention at the duplicate negative stage. More currently, they achieve the same look in a digital intermediate process.

During the development process, the exposed silver halide is developed and the oxidized developer forms dyes. Those areas contain a silver plus dye image. In the skip bleach process, some of the non-converted silver remains in the film where there is dye formation. This technique produces a certain look, which in some circumstances is very desirable.

Since you will lose color saturation in a silver retention process, it is important to discuss your plan with all necessary departments (props, make-up, costumes, etc.) since dark tones will record as black.

Color negative films that go through a silver retention exhibit:

•Higher contrast
•Less saturation
•Blown-out whites and highlights
•Loss of shadow detail

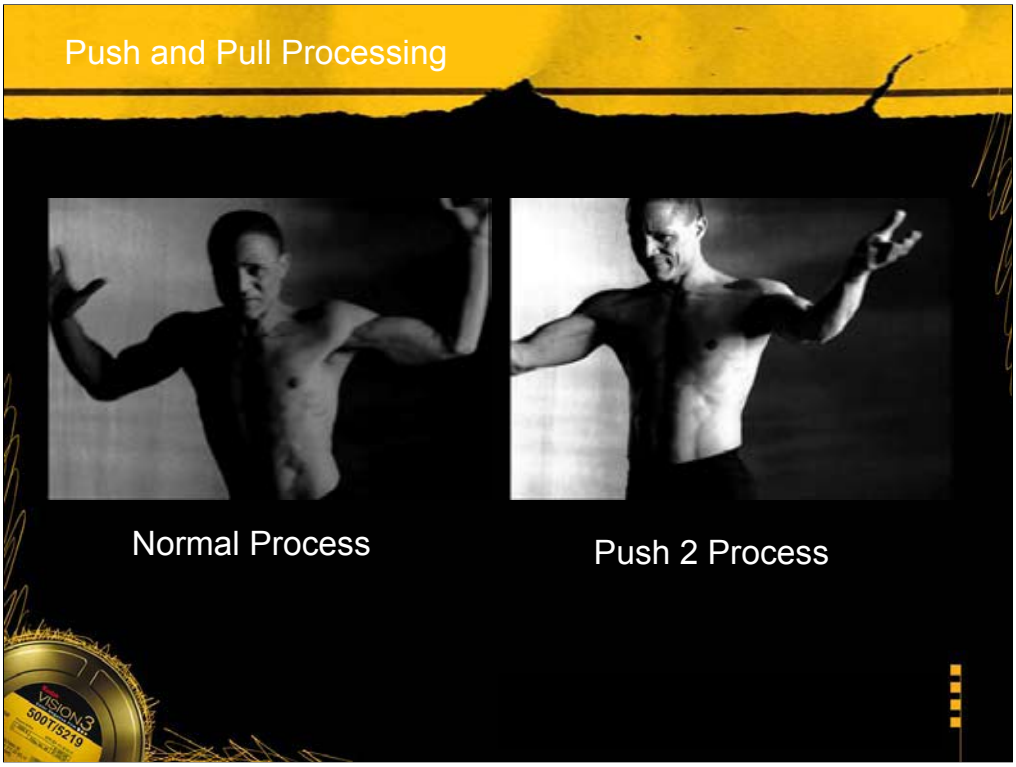
On the left is KODAK VISION 200T Color Negative Film 5274 that has been processed through the normal ECN-2 process. The colors are vibrant. Green and red are realistically reproduced.

On the right, an example of the ECN-2 bleach bypass process, with higher contrast in the woman's face and a lack of detail in the foliage. Also, the colors are very desaturated.

Another example of silver retention:

On the left, a tungsten-balanced color negative film (exposed with an 85 filter) through a normal ECN-2 process.

On the right, the bleach bypass image is higher in contrast and the colors are very desaturated.



Push processing compensates for under-exposure (either conscious or accidental), while pull processing compensates for over-exposure (either conscious or accidental).

In push processing, a camera operator shoots film at a higher exposure index (EI) than the film's rating to obtain usable footage under low-light conditions. The lab then compensates for this in the first developer in a reversal process or the developer in a negative process. Pictorially, push processing results in:

•Higher contrast

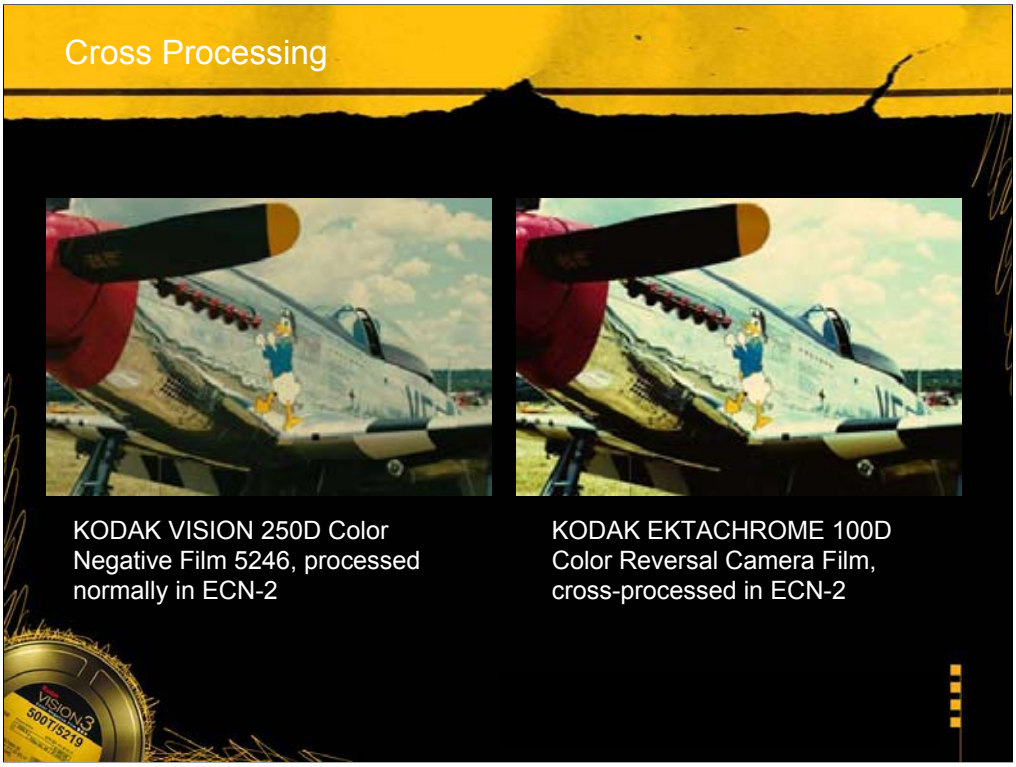
•Color imbalance (curves are no longer parallel), most notably in the shadows or highlights.

•More grain

•Smoky blue shadows. Because of changes to the yellow record, shadows go smoky in appearance and sometimes actually appear blue.

In pull processing, the negative is under-developed. Overexposure and pull processing are sometimes used to reduce grain and create a special look. Pictorially, the lower contrast makes for a flat-looking image, but with the benefit of less grain. Because there is less saturation, you need to weigh the benefits against the disadvantages.

It is important to consult the lab before under- or over-exposing your film to make sure they offer push and pull processing, and in what increments. Also, they may have advice about how current films react to their adjusted process. In theory, two stops underexposure needs a two-stop push. But in practice, your lab may advise a two-stop push for film underexposed by a stop and a half.



Cross-processing

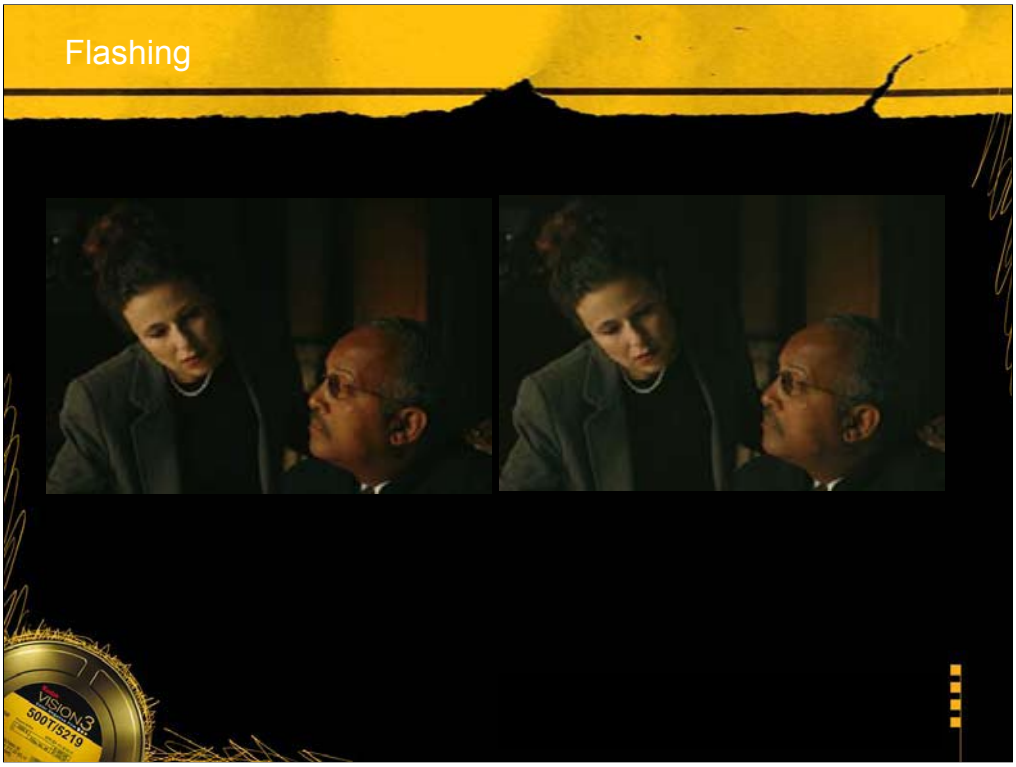
In cross-processing, a film is processed through a process for which it was not intended—for example, running a color reversal film through a camera negative process (ECN-2) instead of through the color reversal process (E-6) for which it was designed.

By processing reversal films through a non-standard process, the actual speed of the film is not known. Therefore, it is strongly recommended that you perform exposure tests to ascertain what the exposure level of the film should be through the lab's process.

Another consequence of using a non-standard process is the impact on color rendition. Therefore, discuss with the laboratory and run tests to make sure that the desired look of the final image is achieved. Use the same lab for all your cross processing—don't switch to someone else and expect to see the same results.

On the left you see KODAK VISION 250D Color Negative Film 5246, processed normally in ECN-2. Note the uniform contrast and realistic color reproduction.

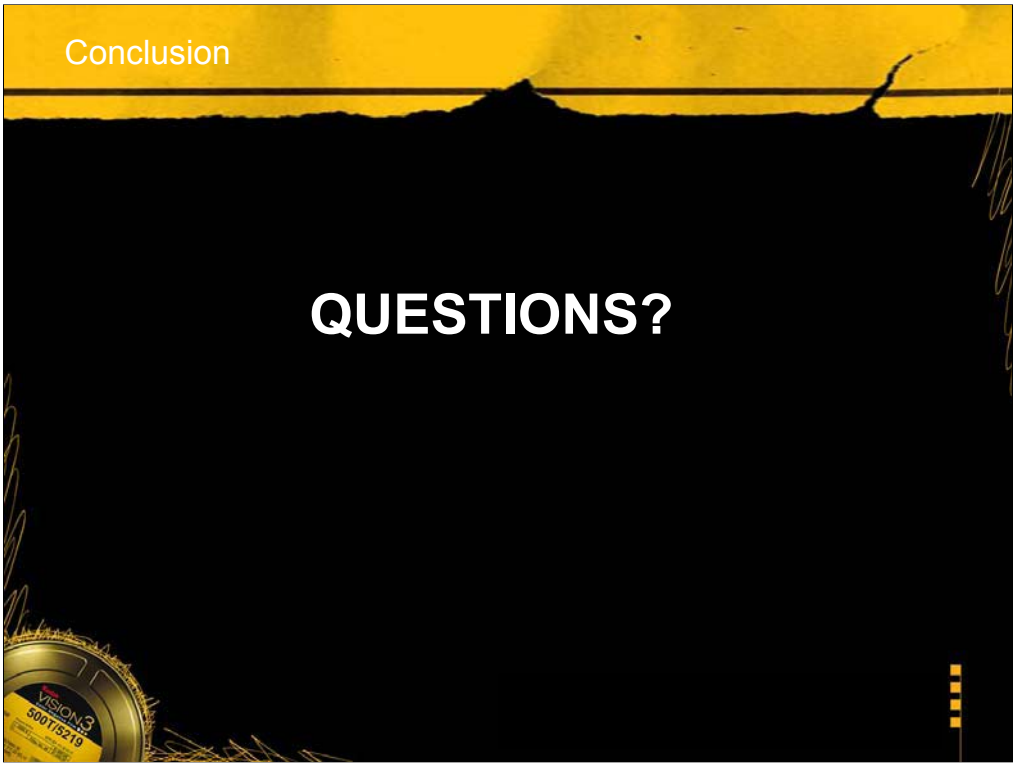
And on the right, KODAK EKTACHROME 100D Color Reversal Camera Film, cross-processed in ECN-2. The contrast is higher, and the colors are saturated and distorted.



Flashing is a method used to open up shadows. This is accomplished with in-camera methods or in the laboratory. Flashing the negative:

•Lowers contrast and simulates increased toe speed

•Opens filled-in shadow areas that result from silver retention. The toe area of a color negative film is where shadow information is captured.



This concludes the chapter on Processing.