# ColorNeg

Adobe Photoshop* Plug-In
User's Manual for Release 1.01
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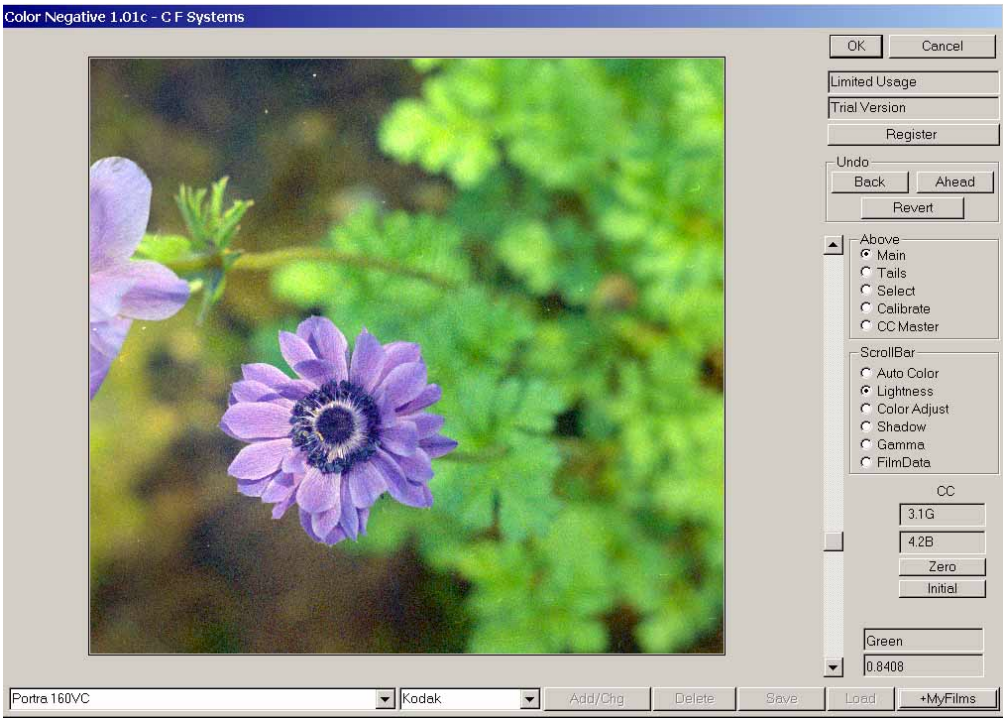
**ColorNeg** 1.01 is an Adobe Photoshop plug-in that correctly converts scanned color negative film images to digital positive images. **ColorNeg** is distributed as a fully functional demo version on our web site (http://www.c-f-systems.com/Plug-ins.html). **ColorNeg** has built-in data for about 115 types of film from Kodak, Fuji, Agfa, Ferrania, and Konica as well as simple devices that can be used with legacy and problem films. For more critical work there is a comprehensive color balance system with CC (color compensation) filter readouts, familiar to many photographers. **ColorNeg** is now available for both PC and Macintosh.

**ColorNeg** also handles B&W negatives so well that some photographers use it primarily for that purpose. We have tweaked the user interface so that it becomes more directed toward the purpose when a monochrome (grayscale) image is treated.

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# **Contents** (Clickable)

# Getting Started

After you have installed **ColorNeg** (described just below), there are four requirements for getting a good start:

1. A good, well-exposed and properly processed negative. You can often get acceptable results from problem negatives, but wait until you have a little experience.

2. A good 16-bit/channel *linear* scan. Easy to do with some scanners, very tricky to do with others. If you can't get **ColorNeg** to work satisfactorily with good negatives, this is almost certainly the reason. Proper scans are the key to success and **Scanning the Negative,** below, tells how to find that key.

3. A good "gray" area in the image as a color reference. Although **ColorNeg** often makes a good first estimate of the color balance, an area of anything from a dark gray road through a middle gray side walk to the (known) white of clothing is more certain. Later on **ColorNeg** has several methods to aid in color balance of problem images.

4. Even if your results are satisfactory please look at the section **Color Management and Setting Gamma C** in the manual. This will get you on the right road to color management of your converted negatives.

## Installation

We have not provided an installation program, but have taken the same approach as Adobe has in distributing "RAW" conversion plug-in revisions. You have downloaded a zip file which contains this PDF manual, addendum manual (if any), a ReadMe.txt file, the two data files sample.negpos and negpos.grayscale, and the plug-in file itself, ColorNeg.8bf. All that has to happen is the ColorNeg.8bf file needs to be put in the Photoshop filters folder. For an all-default installation, that folder will be
C:\Program Files\Adobe\Photoshop x\Plug-Ins\Filters
where "Photoshop x" specifies the version of Photoshop. If your installation is not the default, you probably already know how to find the corresponding filters folder on your system. If you are unable to find the folder we suggest using the Windows "find files or folders" to locate it. Find files or Search is on the Start menu, and a search for file names of "*.8bf" should locate the folder. The Filters folder should have a number of other files with 8bf extension already in it. Once the ColorNeg.8bf file has been placed in the folder, Photoshop will automatically configure for **ColorNeg** the next time it is started.

## Scanning the Negative

To gain familiarity with the system, start by scanning a properly exposed, well-processed negative. This first step in using **ColorNeg** depends entirely upon which scanner software you are using and unfortunately can range from very simple to very confusing. Please understand that this step is *the* key to getting **ColorNeg** to work properly. The working file *must* be 16-Bits/Channel RGB and *must* be in *Linear* mode. It simply is not

mathematically possible to accurately invert an 8-Bits/Channel negative image, so **ColorNeg** will not allow this and in fact is grayed out in the menu for 8-Bits/Channel images. Of course it is possible to fool the system by converting an 8-Bits/Channel image - linear or not - to 16-Bits/Channel and then running **ColorNeg**, but do not expect satisfactory results if you do this. (Read CFS-244 *Negative to Positive* on our web site if you want a full mathematical explanation.) Scanners which scan at 12-Bits/Channel or more and produce a 16-Bits/Channel file should be adequate. In some scanner software there is no mention of *Linear* scans, but it still can be achieved by changing *gamma* from 2.2 to 1.0 somewhere in the scanner software.

The negative can be scanned as a negative, but usually more satisfactory results are gained by treating it as though it were a positive slide. A 16-bit *linear* scan is required in either case and it is always a good idea to *turn off* anything which claims to "manage" or "improve" the color. What may be good for a positive is usually disastrous when applied to a negative. Scratch correction and overall exposure control are normally OK. What you want to end up with in Photoshop is a *negative* image which may have the same color cast as the negative (usually orange) and may be quite dark. Though primarily intended for color, **ColorNeg** also works with 16-Bit grayscale negatives. With some scanners (Minolta, for example) getting a 16-bit/channel linear scan is simply a matter of checking obvious preference boxes. If you have difficulty or are not sure you are getting a proper scan, please look at the scanner page on our web site:
http://www.c-f-systems.com/Scanners.html
which has detailed instructions for obtaining linear 16-Bits/Channel scans from several different scanners and scanner software systems. These instructions were contributed by **ColorNeg** users. Even if your scanner software is not listed, comparing these case studies with what you are experiencing may give a clue that bridges the gap. We welcome contributions to the scanner page, which we will add with or without attribution, as requested.

## Starting ColorNeg

Once you have a properly scanned negative in an active Photoshop window, the rest is simple. From the Photoshop Filter menu: Filter→C F Systems→ColorNeg. The C F Systems entry should be near the bottom of the Filter menu. (If **ColorNeg** is missing or appears in the menu but is grayed out, please read **Scanning the Negative** just above.) There will be a short delay as **ColorNeg** builds tables describing the color negative, then a dialog will appear that looks like the one pictured on the first page of this manual.

Select the maker of your film from the narrower pull-up list at the bottom of the dialog and then select the type of film from the pull-up at bottom left. At this point the image should be nearly correct - sometimes it is satisfactory as is. To explore the next, simple level of **ColorNeg** capability, you will see to the right of the scrollbar control a checklist of ScrollBar options. "Lightness" should already be checked. Use the scrollbar to set the approximate lightness you desire for the image. If the color balance needs to be adjusted, the easiest and often most effective method is to find a patch in the preview image that should be gray (colorless) and click on it. "Gray" can be anywhere from quite dark to

white. If possible, click several gray patches and see what happens to the image, choosing the best result.

With a good, correctly exposed, properly processed negative of identified film type, that is all that is required for satisfactory results with most images. For best results please check **Color Management and Gamma C** to ensure you are correctly set up for your preferred color management. **ColorNeg** also has many features designed to give you a high degree of control over the appearance and quality of your color negative images while retaining the color integrity of the image. For instance, there are images which do not have well-defined gray patches in them, so the **Auto Color** and **Color Adjust** ScrollBar options, described below, take care of them and provide for more critical color balance in general. The remainder of this manual explains **ColorNeg** features and how to use them. We recommend using the **Descriptive Table of Contents** as an easy way to understand what **ColorNeg** does and to locate what you need.

## Descriptive Table of Contents - ColorNeg's Capabilities (Clickable)

Besides inverting normal color negatives quickly, easily, and correctly, **ColorNeg** provides tools to deal with color negatives of unknown type, color negatives with problems which result from poor processing or other sources, tools for perfectionists who want the best possible results, and tools to help speed the processing and matching the results from negatives that are similar.

To correctly invert a color negative, four considerations are necessary. First, a good and proper scan of the negative is absolutely necessary for good results. This is the most likely source of trouble if **ColorNeg** consistently does not work well on good test negatives. While **ColorNeg** cannot help directly with scanning, see **Scanning the Negative** and the scanner page on our web site: http://www.c-f-systems.com/Scanners.html to learn how or if you are having problems.

Second, the film must be properly characterized. **ColorNeg** provides several way of doing that. This often is as easy as selecting the type of film from a list (see **Film Selection System**), which works well for well-processed negatives of a known film type. Negatives of unknown type often can be quickly and satisfactorily characterized by trying the several built-in generic film types as explained in **Legacy Films** or by using the **Film Type** ScrollBar control, as explained in **Film Type Scrolling**. Negatives of a known type that have not been processed properly can sometimes be brought to proper characterization as explained under the **Gamma** ScrollBar control. For the ultimate in characterization, see the **Calibration Feature**. Using calibration the film may be directly characterized with the aid of a grayscale with known gray values (see **Known Calibration**), a grayscale for which the gray values are not known (see **Approximate Calibration**) or even with a grayscale composed of gray elements within a normal scene (see **Natural Grayscale Calibration**).

Third, the image lightness must be properly set. As described in **Lightness**, this is done automatically by **ColorNeg** but because the density range of a color negative is so much greater than of the target digital image, the automatic setting can usually be improved. The setting for automatic lightness can be adjusted - see **Tails Control Panel**.

Fourth, although **ColorNeg** makes an initial guess at proper color balance, if a color cast remains in the image, the color balance must be adjusted. Frequently this is as simple as clicking a gray patch within the preview image - see **Color Balance by Preview Image Click**. For images in which there is no convenient gray patch, the **Auto Color** ScrollBar control systematically takes you through a range of settings that should produce good color balance for your negative. Finally, **Color Adjustment** explains how to use the ScrollBar control to directly adjust the color balance, monitoring the result with the CC filter pack readout.

**ColorNeg** also has a comprehensive CC (color conversion) filter system including both readouts in terms of CC filter packs and the ability to save color correction and shadow settings for use on series of similar negatives. See **CC Master Control Panel** for

complete details including **A Brief CC (Color Correction) Filter Tutorial** for those who are unfamiliar with this, an extremely useful concept that has largely gone missing from digital imaging.

The **Problems and Comments** section deals with what to do with negatives that do not respond to normal treatment with sections on **Color Balance Extreme Problems**, **Different Lighting**, **Color Balance Differs in the Shadows and Highlights**, **Setting the Color Balance** (in Photoshop proper), **Color Management and Color Negatives**,**Color Management and Setting Gamma C**, **Getting the Gamma C Value for a Different Profile**, and calculating **Gamma from Manufacturer's Data**.

By default **ColorNeg** applies an S-curve to highlights and shadows. Normally this does an excellent job of preventing blocked shadows and blown highlights. Like all tricks, however, it can sometimes cause problems. If you are having a problem with highlight or shadow blocking or other problems in those areas, the section on the **Tails Control Panel** explains how the highlights and shadow curves are controlled.

**ColorNeg** allows different treatment of the inversion inside and outside a feathered selection. See **Selection Control Panel** for details and **Feathered Selections** and **How to Make Selections on a Negative** for hints on how to effectively use this feature. Also placed in the otherwise empty **Selection Control Panel** are the option for including the image edges in the histograms that control **ColorNeg** and a place where the effective system gamma can be changed if necessary, see **Color Management and Setting Gamma C.**

## Introduction

This manual is not necessary to start using **ColorNeg**, although you will need to read the ReadMe.txt file or the **Getting Started** section to learn how to get the linear 16-bit/channel scan that is so necessary for correctly inverting color negatives. But **ColorNeg** is a very powerful system and this manual explains how to use its many features when you become more familiar with it. We especially recommend reviewing the **Descriptive Table of Contents**, which both explains **ColorNeg** and helps locate the information you want.

The demo version of **ColorNeg** embeds a gridwork in the images it produces. In general, this gridwork is not obtrusive enough to prevent evaluating the results and in fact we expect that some less critical users may find the results usable as is. To unlock the demo version and eliminate the gridwork, a key code may be purchased via a secure link from our web site:
http://www.c-f-systems.com/Plug-ins.html
The same key code will unlock the **ColorNeg, ColorPos** and **GamSat** plug-ins for the PC.

**ColorNeg** is now available for the Macintosh. See our website for further details. http://www.c-f-systems.com/Plug-ins.html.

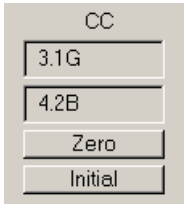
## Legal Notice

## Preview Image Clicking for Color Balance

When you click a point in the preview image in **ColorNeg**, the image is adjusted to make the clicked point gray (colorless) while keeping the image lightness approximately the same. This is the preferred tool for setting a color balance of an image; that is, for removing any color casts. If there is a good gray area, mid-tone, light, dark, or even white *and* if the image has color integrity this is sufficient to remove any color cast from the image.

Three things must be recognized in using this tool. First, color negatives can be quite grainy and images of real gray objects may be uneven, so take several clicks to be certain that the gray patch reading is stable. Second, while **ColorNeg** has a primary goal of producing images with color integrity, there is no way to absolutely guarantee this. If your image has different color casts in the shadows, mid-tones, and highlights it does not have color integrity, which usually means that film is incorrectly characterized. See the "Second" condition in the **Descriptive Table of Contents** to learn how to deal with this problem. Third, with natural objects, what you think is gray may not quite be gray. It is always better to try several different "gray" objects to see how the image changes.

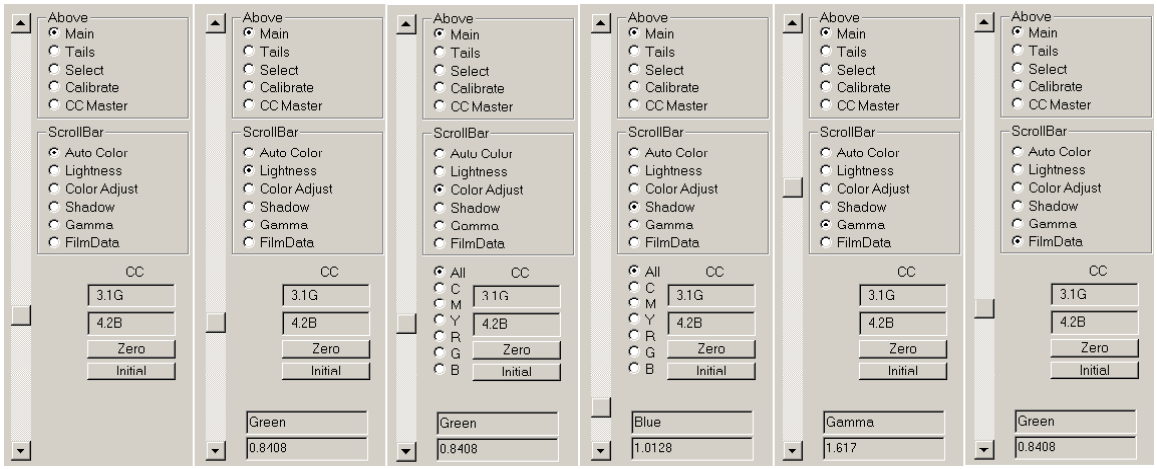
## CC (Color Compensation) Filter Readout




**ColorNeg** introduces the concept of CC (color correction) filter controls. During ScrollBar operations or clicking gray patches the CC filter equivalent of the current settings is shown to the right of the scrollbar. The CC filter pack is an important concept in color photography that has been largely lost in the digital imaging world. For those unfamiliar with CC filters, their use in **ColorNeg** is explained in detail in the section on the **CC Master Control Panel**.

## ScrollBar Controls

In **Getting Started** we briefly used ScrollBar controls. The complete set of six is as follows:




Note that some dialog elements change for the different scrollbar controls.

## Auto Color

Auto Color is used when there are no suitable gray patches in the preview image or clicking does not seem to give a satisfactory result. Check the "Auto Color" option and use the scrollbar. Over the range of the scroll the image will go through the settings most likely to produce a good color balance. Finer control of the scrollbar can be had by using the PageUp/PageDown or Up/Down Arrow keys. Once the color is set, select the "Lightness" option again for fine tuning. Two different methods based upon gray balances internal to the image are used, one in the lower half of the scrollbar and another in the upper half. Scrolling through these settings is often very uneven, with long scrolls through very similar settings followed by a fairly rapid change of settings. Occasionally there even will be a range where the color balance is extremely far off. This is normal and the behavior will typically be somewhat different for each negative. The actual amount of color change is tracked in the CC boxes in terms of a CC filter pack (see the section **CC (Color Correction) Filters** for a full explanation). In our experience if the film is properly identified or calibrated Auto Color will locate a near-ideal color balance in the vast majority of cases, but be aware that like any short-cut there will be rare instances where it does not work. For such cases you will need to use **Color Adjustment**, which is also useful for critical fine tuning of Auto Color results. See **Problems and Comments** at the end of this manual for dealing with particularly difficult cases.

## Lightness

Lightness is the most fundamental control in **ColorNeg** controlling the overall lightness or darkness of the image. **ColorNeg** makes an initial guess at image lightness. This guess can be controlled somewhat (see **Tails Control Panel**) or set precisely for a series of similar negatives (see **CC Master Control Panel**) but it is a mistake to think that it can ever be set-it-and-forget-it except for photographers who exert a very precise control over their shooting. This is because color negatives are capable of recording a much wider dynamic-density range than can be expressed with either print or computer display, and it is always a matter of selecting a smaller range of tones for the final result from within the wide range recorded on the film. Lightness, which is equivalent to "exposure" in traditional printing, makes that selection. Being equivalent to "exposure" this control preserves the color integrity of the image. When using Lightness you will see two boxes at the lower right of the scrollbar; in the illustration above, these contain "Green" and "0.8408." Lightness, the exposure adjustment, effectively drives some portion of the image to saturation. In the example, more Red pixels have been driven to saturation than either Green or Blue, and 0.8408% of the Red pixels been driven to saturation. However, recognize that **ColorNeg** curves the saturated regions just as color printing paper does, so that actual saturated ("blown") highlights will represent considerably less than 0.8408% of pixels and highlight detail will be retained (See **Tails Control Panel**).

## Color Adjustment

Color Adjustment is the **Lightness** control applied individually to the primary colors, which can be selected using the checkboxes for the subtractive primaries Cyan, Magenta, Yellow, or the additive primaries Red, Green, Blue. The subtractive primaries each gang together two additive primaries, so that Cyan simultaneously adjusts Blue and Green, Magenta simultaneously adjusts Red and Blue, and Yellow simultaneously adjusts Red and Green. The All checkbox simultaneously adjusts Red, Green, and Blue so that when All is checked, Color Adjustment is exactly the same as Lightness.

The use of Color Adjustment is exactly equivalent to applying CC filters to the image. This effect can be seen in the two CC boxes to the right of the color selection checkboxes (see the section **CC (Color Compensation) Filter Readout** for a full explanation). Being equivalent to CC filter adjustment, this control preserves the color integrity of the image. Use this control to fine tune a color balance made by clicking the preview or using **Auto Color**, or to find a correct color balance for the rare cases that the automatic methods cannot handle. The two boxes at the lower right of the scrollbar behave as described above for **Lightness**.

The **Problems and Comments** section at the end of this manual describes an easy method for color balancing or checking the color balance of images that have color integrity.

## Shadow

The **Shadow** adjustment allows setting the blackness of the shadow areas while preserving the color integrity of the image as well as possible. Adjusting the shadows also has an apparent effect on image contrast. The shadows adjustment in the Photoshop Levels tool behaves very poorly with regard to color integrity, so it is important to make any necessary shadow adjustments in **ColorNeg**. **ColorNeg** makes an initial guess at shadow darkness and this guess can be controlled somewhat (see **Tails Control Panel**). Further Shadow adjustments are not routinely required. When they are needed, use the **Shadow** control, typically with the All checkbox checked, which simultaneously adjusts Red, Green, and Blue. In cases where the deep shadows have an undesirable color cast after the overall image color has been set, a shadow adjustment of one of the primary colors may be required. These colors can be selected using the checkboxes for the subtractive primaries Cyan, Magenta, Yellow, or the additive primaries Red, Green, Blue. The subtractive primaries each gang together two additive primaries, so that Cyan simultaneously adjusts Blue and Green, Magenta simultaneously adjusts Red and Blue, and Yellow simultaneously adjusts Red and Green.

When using the **Shadow** control you will see two boxes at the lower right of the scrollbar; in the above example they contain "Blue" and "1.0128." The Shadows adjustment effectively drives some portion of the image to pure black. In the example, more Blue pixels have been driven to black than Green or Red pixels, and 1.0128% of the Blue pixels been driven to black. When you use the Shadows control, this is a measure of what is happening to the shadow areas of your image. However, recognize that **ColorNeg** curves the deep shadow regions just as color printing paper does, so that actual pure black shadows will be considerably less than indicated (1.0128% of pixels in the above example) and shadow detail is retained. See **Tails Control Panel** and **CC Master Control Panel** for details on this and the several methods of shadow control.

## Gamma

Gamma adjustments are equivalent to the "middle gray" slider in the Photoshop Levels tool. In that form gamma adjustment is the single control most responsible for the loss of color integrity in digital images. Thus it is with some reluctance that we include a gamma control here, however, the **Gamma** adjustment done by **ColorNeg** is more accurate than the one in Photoshop Levels. Short of calibration, a ganged gamma adjustment is the best correction for negatives known to be over- or under-developed, resulting from time, temperature, or developer strength errors; the most common processing problem. If you believe that your negative may have been poorly processed, use the **Gamma** control to adjust the image to have a more natural look, but do not go beyond this. If your intent is to enhance the image to be either more flat or more bold than it would naturally be, we suggest that you use our **GamSat** plug-in instead, as this will preserve color integrity as much as possible while doing this.

**Gamma** gang-adjusts Red, Green, and Blue simultaneously and as shown in the illustration above, will display a single mean value of gamma as this takes place. You

may also see the CC values change as you adjust **Gamma**. Please understand that such changes do not represent true CC filter pack changes as is the case with **Lightness** adjustments. With the **Gamma** adjustment you are effectively changing the assumed characteristics of the film, not its color balance.

**Gamma** adjustments made to built-in film types, as might be required for underdeveloped or overdeveloped films, can be saved to a user film type, but there are specific conditions which govern when this can be done. In particular, there must be an actual significant scrollbar adjustment of **Gamma** and the User film "maker" must be selected immediately afterward. In this case the adjusted gammas are carried over to the User mode and can be Added to the User Film List either under the current film name or a new name can be entered and the results can be permanently saved to a file as described under **Film Selection System**, **User Films**. The results of this characterization can then be used for other color negatives which are believed to be similarly underdeveloped or overdeveloped. When switching to the User maker in all other cases, gamma values are changed to first User film characteristics.

The Gamma adjustment is also used to assist in making "Apprx" calibrations.

## Film Type

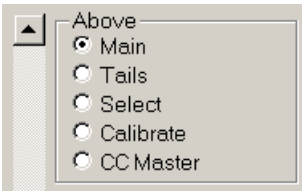
The **Film Type** ScrollBar control is a tool which can be used to characterize the film type of a color negative. Our tests show that if used with care **Film Type** scrolling can estimate the characteristics (gammas) of a color negative with quite reasonable accuracy. This control works by scrolling continuously through characteristics which represent the range of known film types. The preview image must be carefully observed during this scrolling and gray patches in the preview image frequently clicked to keep the image in the best color balance possible. Look for the point in scrolling where the whole image seems to be most natural in color. In particular, any color cast should be similar in the shadows, mid-tones, and highlights. Preferably there should be no color cast at all in any of these.

After a suitable **Film Type** has been scrolled, if the image seems too flat or too contrasty, that can be tweaked using the **Gamma** ScrollBar control. In general it is not wise to have the average gamma go above 2.0 or below 1.0 when doing this.

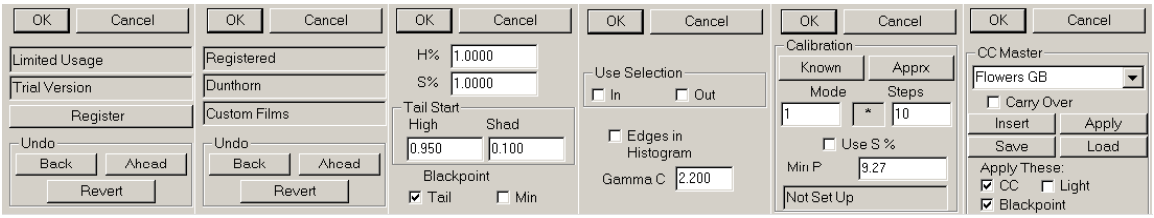
Selecting the **Film Type** control automatically changes the maker to User. The results of the **Film Type** scrolling can be Added to the User Film List either under the current film name or a new name can be entered. The results can be permanently saved to a file as described under **Film Selection System**, **User Films**. The results of this characterization can then be used for other color negatives which are believed to be of the same type.

## Panel Controls

**ColorNeg** has some very powerful features that are initially hidden from view. The panel just under the OK and Cancel button at the upper right of the dialog has several different faces that are selected using the checkboxes marked **Above,** to the right of the upper scrollbar:




Each of these checkboxes causes one of the following controls to appear:



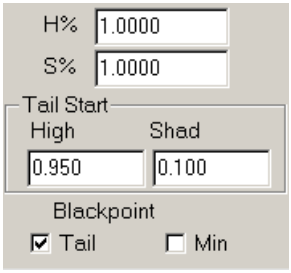

## Main Control Panel - Registration

**ColorNeg** first comes up showing the Main Control Panel, which will look like the Panel on the far left. The "Register" button will appear until a purchased key code has been entered. Pressing the Register button brings up a dialog box:


Enter the key code (we strongly suggest using copy and paste) and press OK, then ***you must*** OK or Cancel out of **ColorNeg** to complete the registration. The next time you call up **ColorNeg**, the Main Control Panel will change to the second version shown above. The two upper text boxes will contain the registration name and replacing the "Register" button will be a box that contains the name of the current user *.negpos file if one has been selected (see **Film Lists** below).

**Undo** in the main panel will allow you to cycle back and ahead through the previous twenty steps. Understanding exactly what "step" means requires some experience using Undo.

## Tails Control Panel



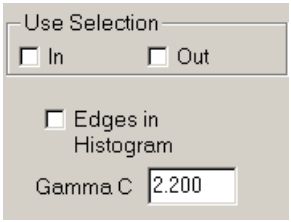

When **ColorNeg** starts it ordinarily makes its first guess at Lightness and Shadow settings according the percentage of pixels at the allowed to saturate in the highlights (H%) and the percentage of pixels allowed to go completely black in the shadows (S%). The default for these percentages is 1% but may be adjusted to any reasonable percentage. If your images are routinely too dark, try a higher value for H%. Too light, a lower value.

**ColorNeg** does not actually allow the H% of pixels to go into saturation or S% to go into complete blackness, but applies an S-Curve so that the image gracefully goes into saturation just as would be the case with a negative printed on photographic print paper. The "Tail Start" figures show the point in image lightness at which the S-curves begin to be applied. Typically values of 0.90 or 0.95 and 0.05 or 0.10 are used for this, the fractional start points being based on the image as adjusted for system gamma. That is, at the default values shown above the shadow curve will start at 0.1 x 255 = 25 and the highlights curve will start at 0.95 x 255 = 242 in the final, positive image.

The tail curves work with no problems for most images, but can sometimes misbehave. If you experience poor behavior in the highlights or deep shadows, adjusting the tail start values can help. Setting "High" to 1.0 or "Shad" to 0.0 will completely turn off the tail and allow you to tell for sure if it is causing a problem.

The need for blackpoint adjustment arises from imperfections and non-ideal behavior of photographic materials and equipment. As such, a blackpoint setting is normally *required*, but the "correct" setting for blackpoint is not easily defined. The choice of blackpoint will affect both overall saturation and color integrity. **ColorNeg** is designed to minimize the effect of blackpoint selection on color integrity, limiting its effects to the darkest shadows insofar as possible. There are three choices for blackpoint, Tail, Min, and no blackpoint. Tail bases the blackpoint on the shadows cutoff point, initially S%, and Min adjusts the blackpoint to the shadows to that resulting from the highlight cutoff point, initially H%. We believe the best setting is Tail.

## Selection Control Panel




First, the **Selection Control Panel** also has two orphaned, rarely used items in addition to selections. Scans of negatives can have light leaks around the edges, and such light leaks can seriously distort the **ColorNeg's** analysis of the image. For this reason a 10% border around the edges of the negative is routinely ignored in the analysis. In cases where this is undesirable, check **Edges in Histogram** and the edges will be included.

The Gamma C value is the normal system gamma in which gamma-adjusted images are stored using Photoshop. It is normally the default value of 2.2. See **Color Management and Setting Gamma C** to see if you need to change this. It is *not* intended for individual image adjustment purposes.

## Feathered Selections

**ColorNeg** allows the use of feathered selections. Color negative film has a very wide exposure latitude and usually contains more highlight detail and more shadow detail than can be accurately produced in a normal digitial positive image. Feathered selections can often be used to bring out this detail in a way that the eye still sees as normal. To use this feature, select an area or areas that are brightly lighted, as when sunlight falls directly on part of a scene while the remainder is in shadow. Feather the selection suitably for a smooth transition - choosing the right amount of feathering varies with every image and comes with experience. Then in **ColorNeg**, work on the entire image adjusting lightness, adjusting the color balance, etc. until the most prominent part of the image looks good. Then click either In or Out under **Use Selection** to work on the area in the selection or outside the selection. Start with whichever part you paid least attention to as you worked on the entire image. When you have that part adjusted to your liking, change from In to Out (or vice versa) and adjust the other part so that the balance between In and Out is smooth. It may take going back and forth a few times. When viewing a real scene, the eye naturally accommodates as you gaze at bright and dark areas and the brain blends it, so the result of working on selections like this can appear quite natural. Feathered selections are also very useful in dealing with an image where two parts of the image are under different lighting conditions. You will find that **Auto Color** is less useful in working with selections, but clicking a gray patch in the work area will still work. Still, it is best to get a good color balance before starting on the selections. After you start using selections, the CC filter pack will reflect the color balance inside or outside the selection, whichever is the active mode. In addition, if you save or insert CC filter packs while using selections, only the filter packs for the active mode will be saved. Note that it is

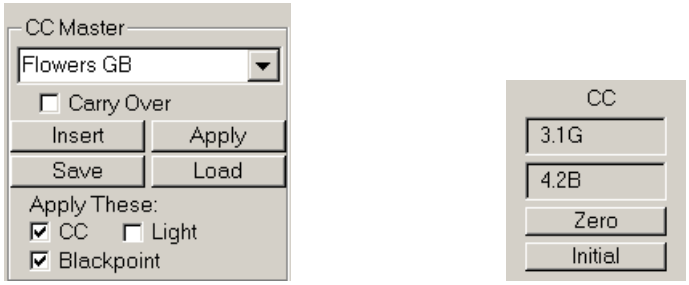
possible to save filter packs for both inside and outside the selection by switching from In to Out and using different names when saving the two filter packs.

NOTE: Once you start to use selections, there is no going back. You will no longer be able to work on the entire image without restarting **ColorNeg**. Undo will not go back past the start of using selections, either. Additionally, calibration uses selections in an entirely different way. Any time you call up **ColorNeg** with an image that has selections you can try to run a calibration *or* work with selections as explained above, but you will not be able to do both.

## How to Make Selections on a Negative

The above selection feature sounds all well and good, but how do you make meaningful selections working with a dark negative that is hard to read in the first place? It is a lot easier and more accurate to first use **ColorNeg** to create a preliminary positive and then make the selections using the positive image. If you are working with Photoshop 7 or earlier, you may even want to convert the positive to 8-Bit/Channel first so that the magic wand and other aids are available in making the selection. Once you have accurately made the selection, save the selection *in a new file*: Select→Save Selection. Make sure the Document: pull-down says New and give the selection a Name: - anything convenient. When you OK this will save the selection in a separate image, typically Untitled-1. Now you can revert if you haven't overrun the History list, or reload the original negative image and Select→Load Selection to put the selection over the negative. In doing this remember to save the negative image first if there is any chance you might overrun the History list in making your selection.

## CC Master Control Panel




**ColorNeg** features the concept of CC (color correction) filter controls. During ScrollBar operations or clicking gray patches the current CC filter equivalent of the chosen settings is shown to the right of the scrollbar. Color correction filters or color density filters have been a part of color photography since the beginning, and with very good reason. They are equivalent to changes in the color of the lighting of a scene and thus represent the most physically natural adjustments of color. In addition to monitoring the application of color corrections to a single image, the concept of CC filters can be used to match the color correction treatment of similar negatives. As many photographers already know, images from the same roll or emulsion of film that are taken under similar lighting conditions will normally require the same color corrections.

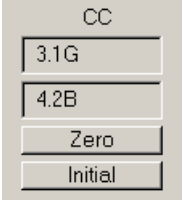
## A Brief CC (Color Correction) Filter Tutorial

The concept of CC filters has been missing from digital photography not because they were no longer believed necessary or useful but apparently because there was a lack of understanding of how to program the equivalent of CC filters. Thus CC filters may be an unfamiliar concept to some but we strongly believe that digital photographers will benefit greatly from understanding and using CC filter equivalents in assessing their images.

A 10R CC filter is of a light red color and passes all red light while having a density of 0.1 to both blue light and green light. Physically this means the 10R adjusts the lighting by passing 100% of red light while passing only about 80% of green light and 80% of blue light. The filter has a red color and by convention the 0.1 density is multiplied by 100 in naming the filter "10R." CC filters densities of the same color are additive, so that two sandwiched 10R filters are equivalent to 20R. In traditional color photography color adjustments are made using combinations of CC filters, for example 10R 5B, called a "filter pack." CC filters of different primary (RGB) colors are not additive, so a filter pack may be 10R 5G. A filter pack of equal density in all three primary colors appears gray. For example 10R 10G 10B, appears gray has a "neutral density" of 0.1. Since neutral density is equivalent to a simple exposure change, by convention such combinations are subtracted out before reporting CC filter packs. Thus a filter pack 10R 15G 5B would have 5R 5G 5B subtracted from it and be reported simply as 5R 10G. In this way, filter packs never contain CC filters of more than two of the three primary (RGB) colors. The filter pack is thus a good measure of what is happening to the color balance of an image independent of overall lightness.

Those of you familiar with using CC filters or dialed-in equivalents for printing color with an enlarger and print paper will find that the CC filter pack reported by **ColorNeg** is *not* a printing filter pack for the negative. When a 5R CC filter is listed, the image will appear more red, not more cyan. Those of you familiar with the "factor of 2" difference between viewing filters and printing filters will find that has gone missing, also. Originally we did plan to report CC filters as the filter pack applied to the negative for printing, but the result was very confusing at best, even to a person quite familiar with that usage. For digital imaging it really is better to report the CC filter pack in terms of changes to the resulting positive image, as we are doing it.

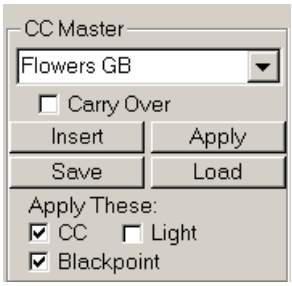
## The CC Reference Problem and the Zero and Initial Buttons




Our plug-ins for positive images were first to have a display of the CC filter pack. This is because the CC filter pack is by nature a *comparison*, rather than an *absolute* measure.

With positive images it is obvious that the comparison should be with the starting image as reference. With color negatives it is not at all obvious what should be used as the comparison reference and in fact different references may be appropriate under different circumstances. When **ColorNeg** first comes up, the CC reference is set to the initial guess at color balance so that the filter pack normally starts at zero. In some cases this will be sufficient. However, it is often helpful to change the reference point for easier CC comparisons. At any time the reference may be set to the current image colors by pressing the **Zero** button. This will cause the CC readout to become zero and further CC comparisons will refer to the current state of the image. To get an overall view of color changes it is also possible at any time to go back to using the initial state of the image as reference by pressing the **Initial** button.

## Matching a Series of Similar Images




Often a series of color negatives has been taken under very similar lighting conditions using the same film and processing. In such cases the CC filter pack can be identical for all negatives in the series. **ColorNeg** makes it easy to match such a series. Start with a typical negative and make any adjustments necessary to have it come out as you want it. Then, press the **Zero** button to make the current filter pack the current CC reference as described above. Click the "CC Master" button in the **Above** checklist to show the CC Master control. The pull-down (showing "Flowers GB" above) is a list of ten names. Select one of the existing names to hold your CC data. You can leave the selected name or enter a new one. There is a twelve character limit on the length of the name. (Initially all the names start with "Z" so new names you add will be at the top of the list. Press the **Insert** button and the current CC reference will be saved under that name. Note again that prior to pressing **Insert**, you need to press the **Zero** button to make the current CC reference the same as the current preview image. The **Insert** action also records your current **Shadow** settings as part of the CC record stored under the chosen name.

Once a CC Master has been saved it can be applied to other negatives by selecting the name in the CC Master pull-down and pressing the **Apply** button. This will apply the color correction to the current negative so that it will match the positive version of the reference negative and the CC readout will report how much the negative has been changed from its initial setting.

The "Apply These" checkboxes govern exactly which correction will be applied when the **Apply** button is pressed. The "CC" option will apply the color correction settings without altering the lightness of the image. The "Light" option will apply just the Lightness

setting of the reference negative without altering the color correction. The "Blackpoint" option will apply just the Shadow settings of the reference negative. These three options can be used in any combination. If you did not do a special **Shadow** adjustment to the reference negative, don't apply blackpoint. Whether to use the Light option along with the CC option will depend largely on how the pictures were taken. It is a simple matter to change which options are checked and press **Apply** again to see how the image changes.

The changes you make to the CC Master, changing names and CC data for any of the ten names, will automatically be recorded for use on the next negative when you press the OK button to exit **ColorNeg**. Note that the changes are *not* saved if you Cancel out of **ColorNeg**.

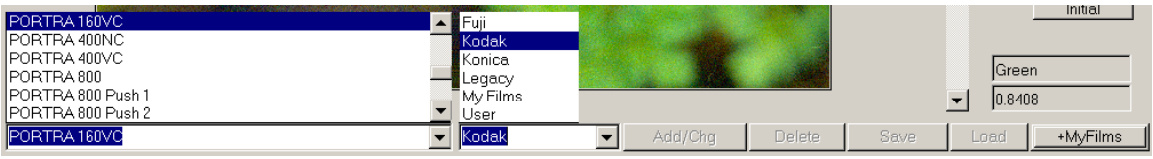
You can arrange to have adjustments automatically made to the next negative by checking the "Carry Over" box. Whichever CC name is selected when you exit **ColorNeg** using OK will be automatically applied to the next negative, using whichever options were last checked.

For systematic photographers, the CC Master settings from one batch of films may also be a good starting point for another batch. Remember, however, that applying a CC Master does *not* affect the film type setting. Make sure that the proper film type has been selected *before* applying a CC Master.

CC Master settings naturally become obsolete as one batch of film is finished and we move on to another. Thus the ten CC Master name slots provided should be enough for most operations. Nonetheless the **Save** and **Load** buttons provide the means for saving and reloading CC Master settings.

The **CC Master** settings are saved as tab-delimited text files with the extension *.negcc. Except for the chosen names, the data in these files will not in general be comprehensible to the user. CC Master names are always written as the entire group of ten and **Load** expects to find ten records. This somewhat complicates the reuse of saved CC Master names but of course the user is free to use a text editor to cobble together a *.negcc file with a group of ten records selected from different saved files. We suggest that any such put-together file be read into and written back out of **ColorNeg** to be compared with the original and be sure it is being interpreted correctly.

## Film Selection System




**ColorNeg** has a built-in selection for around 115 types of color negative film from Agfa, Fuji, Kodak, Ferrania, and Konica-Minolta, derived from the manufacturer's published film data. First choose the maker from the Maker list pull-up on the right and then choose the specific film type from the list on the left. If you later exit **ColorNeg** using OK (not Cancel), the film selection will still be effective the next time you use **ColorNeg**.

## Legacy Films

There is a **Legacy** maker listed in addition to the five actual manufacturers. Legacy is simply a list of eleven generalized film types typical of color negative films, Vintage 1 through Vintage B. These selections can be used to try and find a suitable match for any color negative film that is not included on the list. In doing this, try each of the selections and then click a gray patch or use **AutoColor** to get the best color balance. Pick the Vintage that gives the best overall color - shadow, mid-tone and highlight - after doing this. If the same film selection also performs well on several other negatives of the same type you have a useful match. Searching the **Legacy** list can also be very useful in trying to find a reasonable solution for films that have been poorly stored or processed and are not a good match with the film manufacturer's data. The **Film Type** ScrollBar operation is an alternate way of doing this.

## My Films

The sheer number of choices makes selecting a film more annoying than it should be. To aid against this we have added an item to the **Maker** list called "**MyFilms**" and a control button at the bottom right of the dialog called "**+MyFilms**" or "**-MyFilms**." When you have selected a Maker, for instance Kodak, and a Film, for instance GA200, you can press the +MyFilms button and the GA200 will be added to your MyFilms list, for up to 20 film types. These selected films types will appear in the pull-up Film list when the Maker is set to MyFilms. While you are in MyFilms you can press the -MyFilms button to remove a film from the MyFilms list. Films will remain in the master built-in list whether or not they are in the MyFilms list. Removing a film from the MyFilms list will not remove it from the master list. Films from the User list below cannot be added to MyFilms. Manage User films by editing and saving the *.negpos file.

As an aside here, we really hated to call this "MyFilms" because the "MyWhatever" concept has been so abused and so inappropriately set up on PCs in general, starting with Microsoft. After reviewing the possible alternatives, however, we came to believe that this really is one of the few appropriate uses of the "MyWhatever" concept.

## User Films


Dedicated users of **ColorNeg** who want to get the best possible results eventually will want to calibrate according to their actual film usage or will want to track down manufacturer's data for old films which are not on the built-in list. In either case, such data can be added to **ColorNeg** under the **User** "maker." When the **User** maker is chosen, four buttons at the lower right of the dialog become available to allow you to control this special film list. Note that it is not possible to alter the settings for the built-in films; only the list of films under the **User** maker can be changed or added to.

User film data is kept in a text file with a *.negpos extension. This file may be located anywhere the user wishes, and there may be more than one such file. A file Sample.negpos is supplied that contains a few films calibrated for C F Systems home processing, to serve as examples. These samples may or may not work well for similar films depending upon whether the processing was also similar home processing. The file is a standard tab-delimited text file and may be altered and edited using any text editor capable of saving the file in pure text format. For example, two lines in Sample.negpos are:

1.719 1.129 1.202 Ektacolor 35mm
1.600 1.090 0.978 Ektacolor S

Which are the red, green, and blue gammas followed by the name that is to appear in the Film List pull-up. The items are separated by tabs. The method of calculating gamma values for other films using manufacturer's data is described in **Gamma from Manufacturer's Data** at the end of this manual, and the **Calibration Feature** section explains how to calculate gamma values from grayscale images, to more exactly characterize the film that you use.

The **Add/Chg** button is used to add or change values in the film list. When this button is pressed, the current, active **ColorNeg** gamma values will be entered into the film list, replacing the current values if the film name is already on the list or making a new entry if the name is a new one. Normally this is only done immediately after a calibration has been completed. To create a new entry for the **User** maker, simply edit the film name in the pull-up edit box, perform the calibration to generate the gamma values in place and then press **Add/Chg**. With **ColorNeg** it is not possible to type in gammas that you have calculated other than with calibration. The easiest way is to use a text editor to operate directly on the *.negpos file. ***Please note:*** Both Add/Chg and Delete affect *only* the list currently in use ***internally*** by **ColorNeg**. This list will be *lost* when **ColorNeg** is exited. ***Changes do not become permanent until the Save button is pressed.***

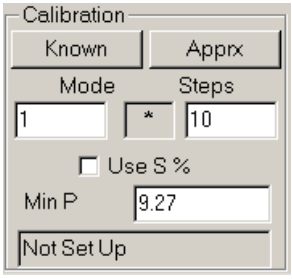
The **Delete** button will delete the named entry from the film list (if the name exists on the list).

The **Save** button brings up a standard file save dialog allowing the user to pick the name and location of the *.negpos file to be saved and will save the entire **User** film data under a specific file name with an extension of *.negpos. Similarly, the **Load** button will load and replace **User** film data from a specific *.negpos file. After **ColorNeg** has been registered, the name of the currently active **User** *.negpos file (or as much of the name as will fit) will be shown in the Main Control Panel area at the upper right of the **ColorNeg** dialog, under the registration data.

The built-in values are derived from manufacturer's data for each film and as such they will apply well to film that has been stored properly and processed properly according to manufacturer's specifications and properly scanned. For color negative film in particular, this is not always a safe assumption. Variations due to processing time, developer strength, or temperature can sometimes be compensated as explained above under **Gamma**. The **Legacy** settings and **Film Type** scrolling may help deal with more significant variations, but **Calibration** is often the best idea when time and circumstances permit.

## Calibration Feature

As you can guess from the length of this section dealing with it, calibration requires dedication and attention to detail to do correctly. Calibration is not necessary to the successful use of **ColorNeg**, but when properly mastered it can make a significant difference in the quality of your work. Calibration is operated mainly through a single box that appears in the Control Panel area at the upper right corner of the dialog when Calibration is checked in the **Above** box:

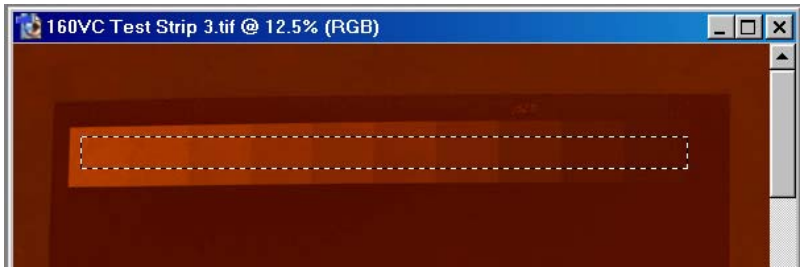



The calibrations performed follow and automate the methods described in Dunthorn Calibration as explained on our web page http://www.c-f-systems.com/DunthornCalibration.html. This web page explains why grayscale calibration is both *necessary and sufficient* for three color RGB or CMY systems like color negatives. Calibration is possible using negatives of a *known* grayscale (where the target values of each grayscale step are known) or negatives of an *unknown* grayscale or even from a *natural* grayscale in regular negatives, where various elements of the image have been selected to function as a grayscale. Although it certainly is not required, we recommend making a Dunthorn grayscale for this purpose, using the method described in
http://www.c-f-systems.com/DunthornCalibration.html
or in

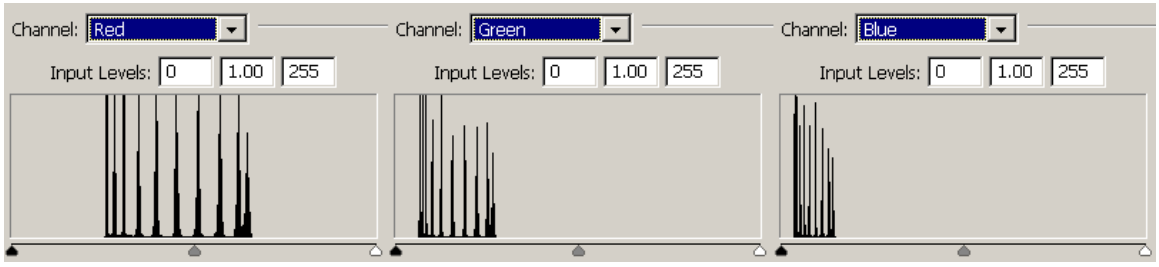
http://www.c-f-systems.com/AlternateGrayscale.html.

We do not suggest that calibration is easy even with the tools provided here. It will require using the tools enough to become familiar with them and it will require attention to detail to determine whether the results of a calibration are valid or not. We *do* suggest that these skills can be readily learned and are well worth the effort.

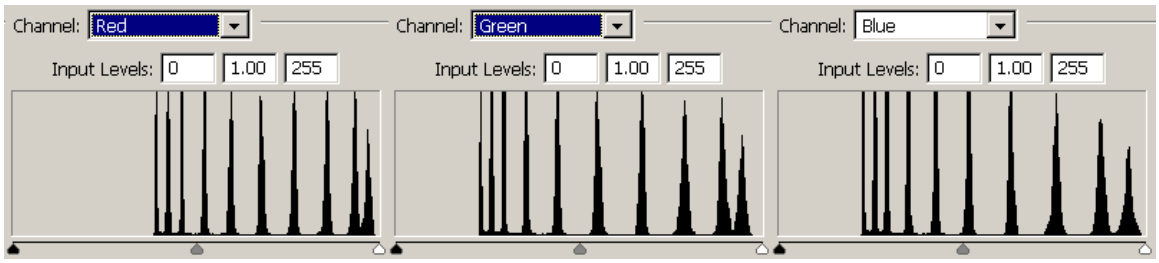
To calibrate, there must *always* be a selection. If there is no selection (or if the image is monochrome) the calibration box will indicate "Not Set Up" (as shown above) and will not function. (Selections may be used either for doing calibrations as described here *or* for making different adjustments inside and outside the selected area as described in the **Selection Control Panel** section above, but not for both purposes at the same time.) The selection should be the portions of the image to be used as a grayscale. In many cases the selected portion will actually be an image of a grayscale. For best results - or at least less confusing results - the negative image should not be closely cropped. The complete image surrounding the grayscale should be used, but with a selection made that includes only the grayscale:




This image should be a linear 16-bit scan, as required for **ColorNeg** in general. Normally, the histogram from such a selection will not show sharp peaks, especially in a high resolution image. For proper calibration it normally is necessary to sharpen the peaks using Filter→Blur→Gaussian Blur. (Yes, that's right. Use blur to *increase* the sharpness of histogram peaks.) We have found that a radius of 7-10 pixels normally will produce nicely sharpened peaks, but that will vary with the scanner resolution being used. The resulting histograms in the Image→Adjustments→Levels tool may look like this:



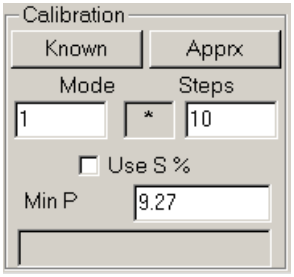

If the histograms are hard to evaluate, as is the case here, the peaks may be expanded for examination. Using the levels tool, slide the highlights slider (white, at right in the above histograms) until it almost hits the area with histogram data. OK out of the Levels tool and then call up the Levels tool again, with a result similar to:




Here we can see that each of the three colors has ten quite distinct peaks corresponding to the ten steps of the grayscale in the negative. For calibration to work best, the peaks must be reasonably distinct and separate, as in the above. Even though calibration often will work with peaks that are partly merged into one another and that are more uneven spires than the above, for good, consistent results, target producing histograms as distinct as the above. Do not expect good results from a poor gray scale pattern. Poor patterns may result from incorrect exposure, uneven lighting with shadows or reflections on the grayscale, poor processing, etc. The radius chosen for Gaussian Blur will have an effect on this, but it is not a cure-all. If too large a radius is chosen, adjacent steps will start to blend in with one another; also, blur-blending itself becomes a questionable process when more than a small amount of blending is required.

*Once you have examined the peaks, be sure you **undo** the Levels adjustment* (that allowed you to see the peaks better, yourself) before using the **ColorNeg** plug-in.

When you start **ColorNeg** to do a calibration, the image initially displayed may (or may not) be poorly expressed because the selected areas are initially analyzed by the same method normally used for complete scenes. Look again at the calibration box:




When **ColorNeg** is entered with a color image having a selection, it is properly set up to attempt a calibration and the message box at the bottom will be blank. The calibration can be either against a grayscale with **Known** exact target values or it can be an **Apprx** calibration in which the target values are not known.

## Known Calibration

For a known grayscale, the target values must be in a file named negpos.grayscale and that file must be in the same folder as the *.negpos file currently in use. Each time a *.negpos is opened or Loaded an attempt is made to load negpos.grayscale from the same folder. Thus it is possible to use several different negpos.grayscale files in different folders. If no negpos.grayscale file is found, **ColorNeg** reverts to built-in values for the Dunthorn grayscale.

The negpos.grayscale file provided with **ColorNeg** contains the values for the Dunthorn grayscale in comma-delimited text format:

13, 38, 64, 89, 115, 140, 166, 191, 217, 242

There is a technical detail about the Dunthorn grayscale that becomes more important when using an unusual working profile. The Dunthorn grayscale should be produced using a profile with a Gamma that matches the **Gamma C** used by **ColorNeg** in its analysis. On a PC and on most Macs operating in Photoshop, the working profile Gamma is 2.2, but some native Mac working profiles have a Gamma of 1.8. Please see **Color Management and Setting Gamma C** to be sure you know your working profile's Gamma and that **Gamma C** is set to that value.

If the Dunthorn grayscale was printed using a different working profile (for instance if it was printed on another machine in the past) it is still possible to use it. If the working profile Gamma used to produce the Dunthorn grayscale is 2.2 and your working profile gamma is 1.8, use grayscale values of:

7, 25, 47, 70, 96, 123, 151, 179, 209, 239

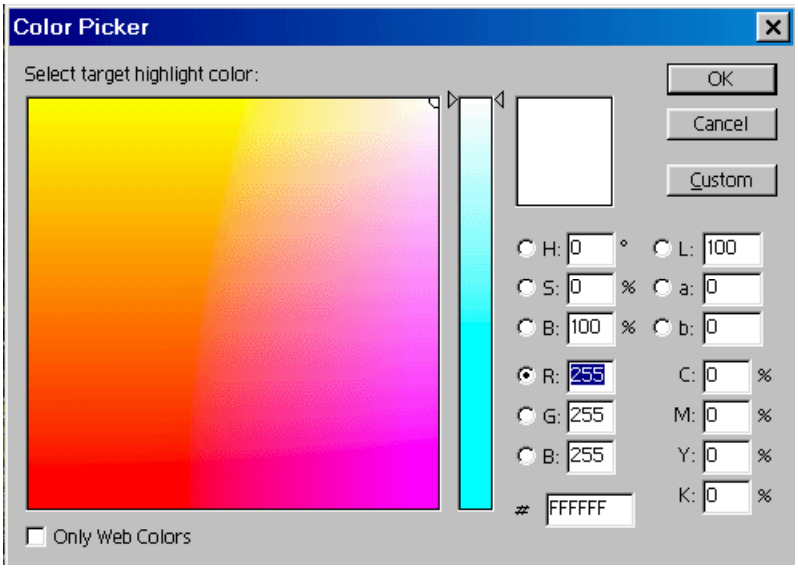
If the working profile Gamma used to produce the Dunthorn grayscale is 1.8 and your working profile gamma is 2.2, use grayscale values of:

22, 54, 82, 108, 133, 156, 179, 201, 223, 244

If some other known grayscale is being used, its values may be entered into a negpos.grayscale file and used. The values should be on the 0 to 255 pixel value scale and values near 0 or near 255 should be avoided. If the end steps of the target grayscale are considered to be black = 0 or white = 255, omit those steps from the list in the file and also *do not* include them in the selection area when preparing the negative for calibration. The number of grayscale steps is arbitrary, but needs to be at least four. The number of steps found in the file negpos.grayscale will appear under "Steps" in the Calibration box on entry to **ColorNeg**.

Pressing the Known button will match the grayscale negative against the known grayscale values and will produce a set of gammas for R, G, and B that best fit the grayscale. It will also adjust the shadow and highlight percentages to approximately

match the blackpoint and color balance determined as part of the matching. These gammas can then be saved according to a selected film type name, as described above. If you then OK out of **ColorNeg**, the resulting positive image grayscale should be fairly close to the known grayscale. It may be necessary to scale the image according to the brightest cell for best agreement. To do this, activate the Levels tool Image→Adjust→Levels. There are three eye-dropper buttons at the lower right. Double-click the rightmost (highlight) dropper button and the Color Picker dialog box will appear:

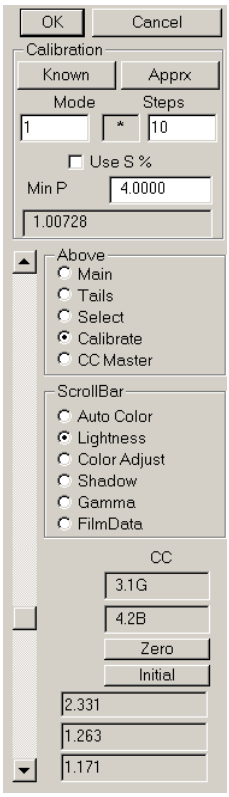



R, G, and B, show the value of 255 above. Enter the value of the pixel corresponding to the lightest step of the grayscale (242 for the Dunthorn grayscale) for each of these and click OK. The mouse cursor appears as a dropper. Use it to select areas in the lightest square of the grayscale image. Pick several points and stop when the Levels histogram seems to bounce about the least.

Now OK the Levels dialog. Probably a message box will inquire whether you wish to save the new target colors as defaults. Answer **No.** This adjustment is effectively an overall lightness adjustment and the pixel values in the steps of the grayscale will now match the target values fairly closely if the calibration is a good one.

The most frequent difficulty with grayscale negatives is in the light end of the grayscale (which becomes the black end of the positive grayscale). If this happens, exclude the darkest cell or cells in the selection for calibration and in **ColorNeg** change the number of steps to the number of steps remaining after the exclusion. This will automatically ignore the correct darkest cells in doing a **Known** calibration.

After each successful calibration trial a number will appear in the box at the bottom of the calibration area and a value will appear in the "Min P" box:




This number is a surrogate for the standard deviation of the grayscale match and we will call it "sigma". In general, you should target smaller numbers here, preferably less than one. We really do not have enough data on this to generalize but as a very rough guideline, you should start to be more suspicious as this number gets much larger than one. The three color gamma values will be listed to the lower right of the scrollbar, Red, Green, and Blue from top to bottom as in the above illustration (i. e. the Red gamma is 2.331). You should also be suspicious if any gamma is much less than one or is approaching three or more. See below for more comments related to this number. If a message appears in the box rather than a number it means that the calibration attempt has been rejected by the system and it will be necessary to re-examine what you have done and try again. The "Min P" number is the minimum spacing allowed between peaks. Normally the program determines this, but if you enter a value in the "Min P" box, it will be used as the minimum permitted spacing between peaks for the next calibration calculation. The spacing is based on a 0-255 scale and is applied to "gamma-corrected" values even though the negative image is entered in linear form. That is, if you look at the histogram of the selected portion of the *positive* image of the grayscale produced by **ColorNeg**, Min P refers to the minimum spacing of grayscale peaks you see on that histogram. Note: A Min P value of 3.0 means that no two peaks are closer than 3 (of 255) apart. However, it does *not* mean that any two peaks are anywhere near that close together - they usually are spaced much further apart. Min P is primarily intended to keep a jagged histogram peak from being counted as two peaks.

## Which Grayscale Is Actually in Use?

Above it states that any time a user film type file (*.negpos) is loaded into **ColorNeg**, the folder that holds the *.negpos file is searched for a user grayscale file (negpos.grayscale) to define the **Known** grayscale. If found, that grayscale is loaded and used for any subsequent **Known** calibrations.

While this method works reasonably well it requires feedback to assure that the proper grayscale loading has actually taken place, so any time a new negpos.grayscale file is read into **ColorNeg**, the **Steps** parameter in the calibration dialog will be adjusted to match the full number of steps in the negpos.grayscale file. Note that normally the **Steps** parameter is also allows the user to specify how many steps are actually to be used in the calibration, which may or may not match the number in the **Known** grayscale. Second, there is a grayed read-only box placed between **Mode** and **Steps** in the **Calibration** dialog. This box displays the status of the user grayscale and will take on one of three values:

"D" - no user grayscale has been found since **ColorNeg** was called up, so the Default Dunthorn grayscale is in place.

"*" - a user grayscale file was found in the last folder from which a *.negpos film type file was loaded, and that user grayscale is in place.

"P" - no user grayscale was been found in the last folder from which a *.negpos film type file was loaded, but a previously found user grayscale is still active.

This status flag combined with showing the number of steps found in the user grayscale file provides assurance of which grayscale file is actually in use.

## Approximate Calibration

It is usually possible to do a good calibration even when the target values for the grayscale steps are unknown, first tying down the calibration by fixing one of the color gammas. For **Apprx** calibration, first use the **Gamma** ScrollBar Control to set the mean gamma and then press the Apprx button. The three color gammas, as well as the blackpoints and color balance, are then calculated. The three color gamma values will be listed to the lower right of the scrollbar, Red, Green, and Blue from top to bottom as in the above illustration (i. e. the Red gamma is 2.331). The number of steps in the grayscale (Steps) can be more freely set in doing an Apprx calibration than was the case for Known. If Steps is set at 5, then for Apprx, the five tallest peaks will be selected for each color. Since we are working with *gray* steps, the five (or whatever number) tallest peaks will generally correspond to one another across R, G, and B. In fact, it can be useful to see what happens to the gammas when different numbers of steps are taken into account and thus see how stable the calibration is.

In doing an Apprx calibration, a key question is exactly what to use for the mean gamma (set using the **Gamma** ScrollBar) that controls the calculation. There is no "correct" value to use. We have noted that the data from Kodak characteristic curves seems have red gamma the highest and to favor a red gamma of about 1.75. Accordingly, we normally try to end up with a maximum color gamma of 1.75. If the result seems too contrasty we lower the target from 1.75 and if too flat, we raise the target from 1.75. In any event, gammas much below one or approaching three or more should be suspect. If you have trouble getting an Apprx calibration to work, and are getting FAILURE messages in the "sigma" box, it is worth trying a few different values for the mean gamma. If you started with 1.75 or 2.0, try 1.0 or even lower. If the message persists it very likely indicates an unsatisfactory histogram.

The number in the "sigma" box will normally be less for an Apprx calibration versus a Known calibration of the same grayscale and does *not* mean that the Apprx calibration is better. The reason for this will be obvious to anyone who understands the concept of "degrees of freedom" but too involved to explain here otherwise. Again the calibration becomes more suspect as this number gets much larger than one. See **Sigma and the "Best" Calibration** below for more general comments on sigma. If a message appears in the box rather than a number it means that the calibration attempt has been rejected by the system and it will be necessary to re-examine what you have done and try again.

## Natural Grayscale Calibration

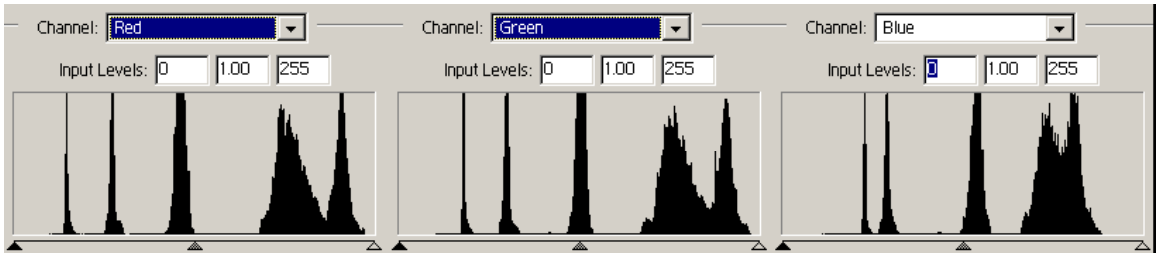
As more fully explained on the Dunthorn Calibration web page, it is often possible to calibrate an image of a natural scene which does not contain a grayscale image as such. This is particularly useful for old negatives where it is impossible to make new grayscale calibration images. The idea is to select a number of areas in a negative which are fairly even in tone and which are known or believed to be nearly neutral in color. Objects such as white shirts, blacktop roads, white houses, sand, tree bark, branches, etc. can be used to form a natural grayscale. Consider the following image:

Working in this mode it is usually best to first use **ColorNeg** to create a preliminary positive and make the selections using the positive image as a guide. Try to select areas which are evenly toned and have tones which range up the tonal scale. The Info window helps in showing the pixel values of areas to be selected. Make sure the different areas selected have distinctly different values for all three colors - if one color shows nearly the same pixel values in two different selected areas it will have one less peak in its histogram than the other colors. Note that the "magic wand" selection tool is specifically intended to select patches of an even tone and thus can be very helpful in selecting suitable areas. If you look carefully at the above picture you will find that five areas have been selected.

The selections have to be applied to the negative, of course. To do this, save the selection: Select→Save Selection. Make sure the Document: pull-down says New and give the selection a Name: - anything convenient. When you OK this will save the

selection in a separate image, typically Untitled-1. Now you can revert or reload the original negative image and Select→Load Selection to put the selection over the negative.

After making gaussian blur and highlight slider adjustments as explained above, the Levels histograms for these selections is as follows:




This set of peaks is adequate - but only barely adequate - to use for an Apprx calibration with 5 Steps. Selecting a good natural grayscale is not particularly easy and it can be quite difficult to get even the minimum four or five representative areas. Experimentation with different gaussian blur pixel radii may be required. Fortunately, when calibrating to a natural grayscale it usually is evident from the result when it is not working well. Gammas much below one or approaching three or more should be suspect. In any case several images from the same film type should be tried and compared.

A natural grayscale will normally be inferior to a specially produced grayscale - the steps will vary more from a true neutral. It very likely will require some practice before you will be able to select acceptable surrogate grayscales from natural images, but if you work at all with old negatives, it is worth the effort. Be sure to select fairly small uniformly colored areas. The sigma number can be of considerable help in doing this. Because there is more uncertainty in the grays, sigma will normally be a little higher than for true grayscales and may range up toward ten or more even in some successful cases although sigmas that high typically signal a bad choice for at least one grayscale step. Look at the Levels histograms for all three colors. If there is a step that seems out of place with the rest, identify it, remove it from the selection, and try again.

As we stated in our calibration web page, it is not strictly necessary that the grayscale be "gray," only that it be even-toned and not very deficient in any of the three colors. Gray is best, but alternatives may be useful in trying to produce natural gray scales. For instance, if there are flesh tones from a single individual that show sufficient differences in shading and are even toned, it can be possible to form a "Gray" scale and calibrate on those. In doing this, however, remember that **ColorNeg** will be trying to make the tonal scale gray and it will be necessary to color balance back to flesh tones (using the highlights color sliders) afterwards.

## Sigma and the "Best" Calibration

In technical terms (which you need not understand) these calibrations involve non-linear least squares fitting of function combinations that are ill-behaved due to cross-talk. As explained in our calibration web page the behavior of blackpoint and gamma is confounded. Due to this, it can be difficult to know whether a gamma of 2.25 is significantly better than a gamma of 1.75 in setting a calibration. However, the three color gammas will *track* one another; that is, a calibration producing a red gamma of 2.25 will also require higher green and blue gammas than the calibration giving a red gamma of 1.75. In fact, the three gammas will normally track closely with the method used by **ColorNeg** for the gamma scroll.

If an **Apprx** calibration is done using two different gammas, say 1.75 and 2.25 again, it normally is *not* correct to assume that if the sigma reported for 2.25 is less than the sigma for 1.75 then the 2.25 calibration is better. The design of **Apprx** is such that it cannot validly compare the two.

You will also find slight variation between two calibrations that ought to be identical. For example, if you do a Known calibration to a grayscale and then do an Apprx calibration without changing the gamma, the results should be identical. Similarly, if you do a calibration of either type and then repeat the calibration with "Use S%" checked, leaving the Shadow %s as the calibration set them, the results should be identical. In either of these cases, there will actually be small changes in the values so that they are not exactly identical. This has to do with such factors as the granularity of the histograms, is normal, and is not of consequence.

## Calibration Modes

The calibration area has a Mode box. This selects exactly how differences are weighed in matching the calibration. Mode 1 is the normal mode in which the "gamma-corrected" pixel values are used. In Mode 3, the linear pixel intensities are used, and Mode 2 is halfway in between. Here "gamma-corrected" refers to the system gamma, called "Gamma C" in **ColorNeg**. Normally the difference in the results of the three weighting systems will be small and it is usually an indication of a marginal grayscale if the differences are large. This control is largely intended for our own testing.

# Problems and Comments

## General Problems Getting a Good Inversion

We must repeat that a good and proper scan of the negative is absolutely necessary for good results. This is the most likely source of trouble if **ColorNeg** consistently does not work well on good test negatives of identified film type. See the section on **Scanning the Negative** and the scanner page on our web site:
http://www.c-f-systems.com/Scanners.html.

## Color Balance Extreme Problems

There will be will be a small number of images do not have gray patches suitable for preview click color balance and which also do not respond well to the **Auto** procedure. In our experience this is nearly always because one color (Red, Green, or Blue) is missing from the highest highlights. In those rare cases when color balance is way off, use **Color Adjust** to scroll the color that seems to be missing. That is, if the image has a strong cyan (blue-green) cast, adjust Red, for a strong magenta (red-blue) cast, adjust green and for a yellow cast, adjust Blue. Very likely you will be able to scroll to a reasonable color balance, and normally a major adjustment of only one color will be required (followed by a **Lightness** adjustment). If the color balance seems to be still off a bit, try the suggestion for **Setting the Color Balance** below, in Photoshop.

## Different Lighting in Different Parts of an Image

Normal color balance depends directly on lighting, so if the primary source of light is different in parts of an image, the parts may require different color balance. **ColorNeg** can deal directly with this when there are only two parts with different lighting - see **Selection Control Panel** including **Feathered Selections** and **How to Make Selections on a Negative**. In the rare cases where there are more than two principal light sources, these same sections can be of help, but see **Setting the Color Balance** below for an explanation of how to do the color balance within Photoshop itself, where multiple selections can be handled. It is important to realize that in images with more than one principal light source it may be undesirable to completely color balance all the parts of the image as this may not be what the eye would see. For instance an image that is partly in sunlight and partly in shade (with a large influence of blue sky) might actually look worse if the two parts of the image were each fully color balanced. **ColorNeg** makes it easy to move partway to a full color balance using the CC filter pack readout, but working with multiple parts of the image in Photoshop will not have this capability.

## Color Balance Differs in the Shadows and Highlights

For a negative that has been properly characterized color balance is normally an easy task. The principal symptom of a poorly characterized negative is that the color balance will be different in the shadows, mid-tones, and highlights and none of the color balance

methods will fix this. For example, when the bright tones of an image look OK the dark areas are magenta. Particularly if you are having serious problems color balancing several negatives from the same film there is a good chance that the film is not properly characterized. This can be because the selected type of film is not correct, but it can happen even if the type of film is definitely known and the processing differed from the manufacturer's spec, the film was stored poorly, or any of the numerous other problems that can occur in film handling. In such cases - especially if there are several similar negatives - it is worth trying to characterize the film using the method described for the **Film Type** ScrollBar. If the best results from that are still unsatisfactory, take those best results and with the and set the color balance for the lighter areas of the image as best they can be. Then use the methods described for the **Shadow** ScrollBar to bring the shadow areas into color balance.

Finally, remember that you can't make a silk purse from a sow's ear. There are negatives with problems serious enough that they never will produce a good image.

## Setting the Color Balance

For images with color integrity - such as a negative properly inverted using **ColorNeg** - it is normally very easy to do a precise color balance within Photoshop in those cases where the balance produced in **ColorNeg** itself seems off or where it is necessary to separately color balance several different areas in an image. The technique is based on the same principles as the method used when clicking on the preview image in **ColorNeg.** In most cases there will be a gray patch somewhere in the image that will be satisfactory and it can be easier to find such patches in Photoshop than in the **ColorNeg** preview. Our page http://www.c-f-systems.com/RoutineBalance.html includes a target with shades of flesh tones and sky colors to use in color balancing in place of the gray, but it is trickier to use than grays from the image itself.

When gray patches can be found, with the image loaded into Photoshop, use the Image→Adjust→Levels command and double-click the highlights dropper to bring up the Color Picker window. Look for an area in the image that should be gray, anything from almost white (but with no pixel above about 245-250) to quite dark gray. (Yes, for an image with color integrity the "highlights" adjustment is appropriate for dark gray as well as true highlights.) White or gray clothing, asphalt, concrete, tree bark are often good targets if really gray. Put the cursor over that area or click on it. Watch the pixel numbers that appear in the color picker and be sure they are fairly consistent. Now pick the middle value of R, G, or B in the color picker window and type that same number in for the other two colors so they are all the same. OK out of the Color Picker and click the highlight dropper cursor on the same area you picked for the gray previously, again. The calibrated image has been color balanced. If you are not satisfied with the result, pick another apparently gray area and try again. In doing this you may wish to add a little to the Color Picker numbers to lighten an image or subtract a little to darken an image, but we do not recommend doing any major changes in tone depth. When you exit out of Levels, it may ask if you want to save the settings you have selected with the Color Picker. You do not, as they will only lead to confusion later.

Perhaps you have noticed that here we exclude white from the "grays" that can be picked while inside **ColorNeg** we allow white. This is because in the positive image the white areas will tend either to have gone into saturation or to be S-curved as **ColorNeg** does. In **ColorNeg** we work directly on the color negative and because it has a greater dynamic range the image data normally continues to be valid well above where the positive image has gone into saturation.

Once the image has reached this stage – and not before – we recommend using our **GamSat** plug-in for any major color or contrast enhancing that is to be done. Such enhancements move the image away from color integrity, but **GamSat** will preserve color integrity insofar as is possible. If **GamSat** is not able to make the desired changes, we suggest that any major adjustments of contrast enhancement, lightening, darkening, etc. be done by first converting the image to Lab mode and using the Curves tool to make the adjustments. Lab mode also preserves color integrity insofar as possible, but of course can do so only after color integrity has been established, as we have here. The curves tool can be used to minimize the loss of highlight and shadow detail.

## Color Management and Color Negatives

Any "color management" applied to color negative images prior to their being delivered to **ColorNeg** will certainly not improve results and in fact is very likely to create problems which may not be correctable. The first order of business is to make sure the scanner and Photoshop deliver a clean, unaltered, 16-bit/channel linear image for **ColorNeg** to use.

As to what color management should be done after **ColorNeg**, it is a matter of what appears to work best for you. We normally assign Adobe RGB, by default. This appears to be a casual, unreasoned answer, but that is not the case. By the time the image gets into positive digital form it has gone through primary color separation via the three (or more) sensitized silver halide layers in the film, is then expressed by the primary colors in the cyan, magenta, and yellow dyes of the film, goes again through primary color separation according to the sensitivities of the scanner, and will finally be expressed as a positive image using yet another set of primaries. Added to this are the variations in film gamma caused by processing differences. Even in the best scenario, for different films and different scanners each of these steps will behave a little differently and the detailed characteristics for the steps are not generally available. That the system works at all is due only to the fact that the designers of these system have, over the years, aimed at similar - but not identical - targets. All in all this makes the choice between profiles such as Adobe RGB and sRGB a matter of preference rather than accuracy.

## Color Management and Setting Gamma C

Our recommended procedure is once you have scanned in your linear 16-bit/channel negative image, assign your preferred profile to the negative image (Edit → Assign Profile…). Assigning the profile does not alter the image, but it gives Photoshop the

correct instructions for rendering the preview image which **ColorNeg** produces and for interpreting the final result. **ColorNeg** will correctly interpret the negative as linear 16-bit/channel regardless of the assigned profile.

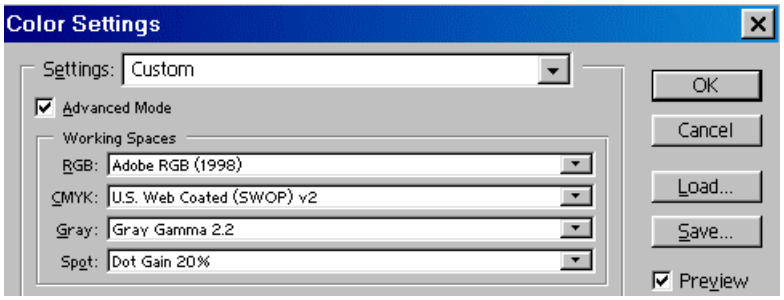
**ColorNeg** delivers a fully corrected image back to Photoshop and the **Gamma C** value is used to make sure it agrees with the working profile in use. Typically the default value of 2.2 is what is wanted, but this is not necessarily the case. The default value is correct for the commonly used Adobe RGB 1998 and sRGB working profiles, but some working profiles such as ColorMatch RGB or Apple RGB will require **Gamma C** to be set as 1.8 in **ColorNeg**.

**Gamma C** appears on the **Select** menu, click **Select** in the **Above** box to see the menu. Enter the correct value of **Gamma C** (if it is not already correct) and OK out of **ColorNeg**. The changed value of **Gamma C** will be retained in future sessions (though it is always wise to check the first new session to be sure).

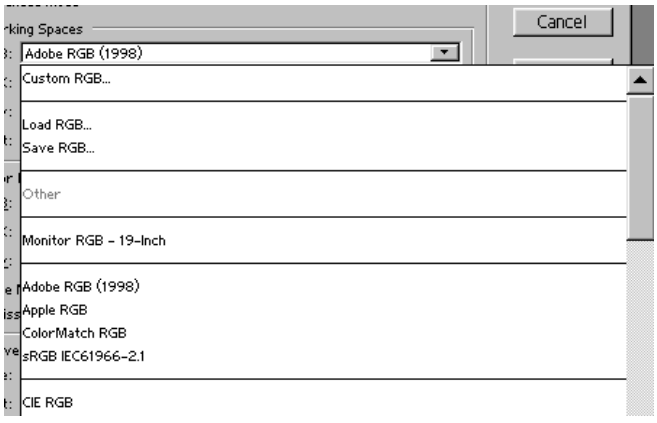
If you use a different profile, here is how to find the correct value for **Gamma C**.

## Getting the Gamma C Value for a Different Profile

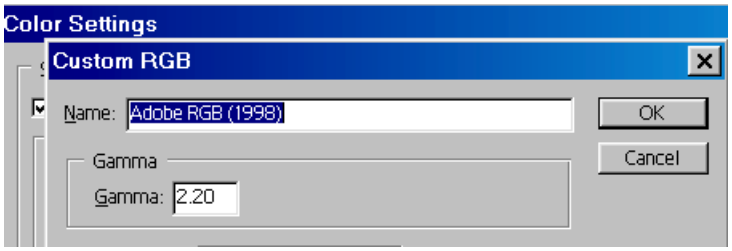
If you are using a working profile other than the few common ones we have listed you can find the correct **Gamma C** value for your profile as follows. In Photoshop, with an image selected click Edit → Color Settings… to get the following:




Do the pull-down for Working Spaces RGB and you will see:



First select your working space from this list (the list will likely will be somewhat different than the one shown here). Your working space profile should appear in the pull-down box (see Adobe RGB (1998) in the box with the pull-down arrow above). Select the pull-down again. Now select Custom RGB… at the top of the pull-down and the following will appear.

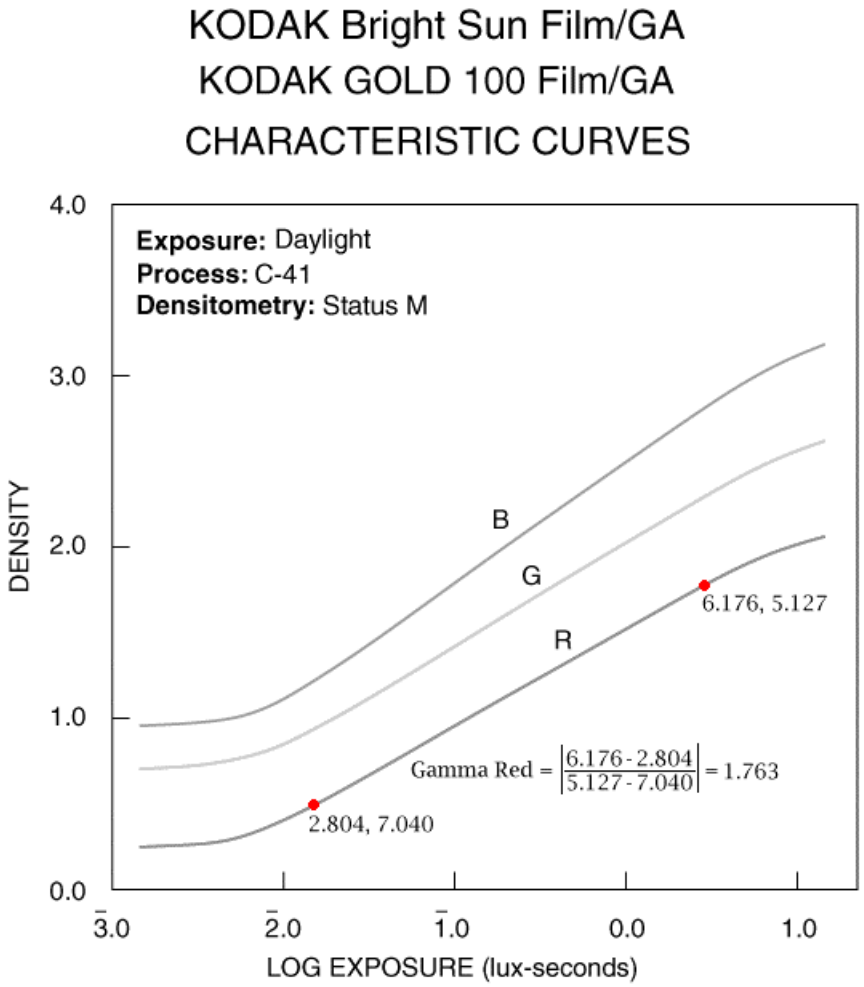



This will show the Gamma for your working space. This Gamma is the **Gamma C** value to be set in side **ColorNeg**. **Gamma C** appears on the **Select** menu, so click **Select** in the **Above** box to see the menu. Enter the correct value of **Gamma C** (if it is not already correct) and OK out of **ColorNeg**. The changed value of **Gamma C** will be retained in future sessions (though it is always wise to check the first new session to be sure).

For working with B&W, explore the gray working space pop-up in a manner similar to the above. Again, for whatever working profile you use, set **Gamma C** to the same (sometimes approximate) gamma. Alternatively you can select a working profile that actually has a gamma for use with **ColorNeg** and the use Edit → Convert to Profile… to put the image into your working non-gamma profile.

## Gamma from Manufacturer's Data

If you have or can obtain manufacturer's data for films beyond those built into **ColorNeg**, you can find the gammas for the films and produce *.negpos files for use with **ColorNeg**. Look for the characteristic curve for the film, which should be a plot of density versus $\log_{10}$ exposure. Be sure that the units spacing is the same on both axes, that is, that the distance between 1.0 and 2.0 is the same for the horizontal and vertical axes. For an image of a graph, this can be done quite neatly by changing the image size in Photoshop using a different amount for width than for height. Then the gamma can be determined from by calculating slope of the straight portion of the characteristic curve and taking its inverse. To see this in detail, examine the following characteristic, taken from the Kodak web site:




This plot was downloaded as an image from the Kodak web site. It was put into Photoshop and scaled so that one unit took the same number of pixels on each axis. This was done by first carefully cropping the image so that precisely 4 units on each axis remained in the image; that is, we cropped at -3.0 and (+)1.0 on the LOG EXPOSURE axis and at 0.0 and 4.0 on the density axis. Let us say that part of the image was 500 wide by 400 high. To get the units to match we need to make that portion 500 x 500, so it is necessary to multiply the height by 500/400 = 1.25 to square the graph. We revert to the entire original image; let's say it is 552 wide by 501 high. We rescale the image (Image→Image Size) so that it is 552 by 501 x 1.25 or 552 by 626. Check Resample Image and select bilinear resampling (which usually works best for graphs). Uncheck constrain proportions. Leave the width as is (552 in the example), change the height from 501 to 626, and OK. At least until familiar with this operation, it is advisable to check the result to be sure 1.0 unit on the log exposure axis now matches the size of 1.0 unit on the density scale.

Two widely separated points on the straight line portion of a characteristic curve are chosen, as illustrated by the red dots. Coordinates for the points can be read by carefully placing the cursor on the line and reading X and Y from the Photoshop Info window. The X and Y readings of the two points have been printed on the graph above and the

gamma calculation made as shown, the difference between the X readings divided by the difference between the Y readings, taken as a positive number. This is done separately for the three colors R, G, and B. Alternatively, the plot can be printed and measured with a ruler. In any case, the slope required is the (positive) measured distance between the two points on the Log Exposure axis divided by the (positive) measured distance between the two points on the density axis.