Photoshop tips

Calibrating digital camera capture with Adobe Camera RAW

— By Lee Varis

Serious photographers have always tested their equipment to determine the specific characteristics of their image creation capabilities. With film, this was an arduous process requiring multiple exposures and different chemical recipes. Test images were shot through different colored filters to figure out the color bias of a particular emulsion. Once tested, the photographer would purchase large quantities of film from a batch and refrigerate it until use. Nowadays, with digital capture, the testing process has become easier; but imaging system calibration is still very important.

  The first step in designing any digital capture workflow is testing the photographic hardware/software system. The professional photographer must test every component of his system before an assignment to avoid any surprises on the shoot. It is important to realize any capture system relies on several components: lighting, camera, lens, and software processing. If any of these individual components changes significantly, then you have to retest to calibrate the system. You can only calibrate a system, not an individual component – the camera is not separate from the system in which it is used. Calibration becomes especially important in a RAW file workflow.

  Calibration of a digital camera for a RAW file workflow involves the following steps:
- Create a standard target that contains a gray reference, white and black points, as well as standard color patches.
- Establish lighting that mimics your most common shooting conditions.
- Shoot a range of exposures to determine your camera exposure index (E.I., ISO, or ASA rating).
- Identify the best exposure using the most neutral setting in the RAW file software.
- Determine the software settings that result in the best match to your target once the file is processed into the desired RGB workspace.

  The procedures outlined here utilize Adobe software, but the principles would apply to many different software products. I prefer Adobe applications because they are the most straightforward and detailed in their controls.

Standard Test Target
The most widely used target for color calibration is the **GretagMacbeth** 24 patch ColorChecker. **[Fig.1]**. Originally known as a Munsell chart, this target has been in widespread use for at least 50 years in the motion picture and TV industries. An ideal test should include this target, a human subject (for real skin tone reference), a black trap, a diffused white highlight reference, and some written reference for the exposure. My test target **[Fig. 2]** uses a small cardboard box with a hole cut into it, revealing a black velvet-lined interior. The white reference is Styrofoam lens packing material – the curved form creates a soft ramp from near white to a "clipped to white" tone and allows me to see just how much detail is preserved in extreme highlights.
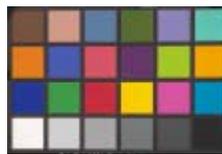
[Fig. 1]

[Fig. 2]

Lighting
Use the same lighting you would for your most common picture making situation: outdoors/daylight, indoors/tungsten or studio/flash. At minimum, you should test for the two major light color temperatures: daylight or 5,000 degrees Kelvin and tungsten or 3,400 degrees Kelvin. It is almost impossible to fully test for fluorescent lighting because of the uneven spectral characteristics; but if you frequently shoot under a specific fluorescent lighting condition, you can test for that. In any case, make sure you illuminate the test target evenly and avoid placing the subject near a colored reflective surface.

Exposure

The idea is to shoot a bracket around the *expected* best exposure to determine the *actual* best exposure. Set the camera on manual and change only the f-stops to shoot the bracket. Use the lowest default ISO setting for the camera. It is best to use a handheld light meter; a spot meter would be ideal. I use a Sekonic multimeter capable of incident and spot reading in continuous and flash light. **[Fig. 3]** Start shooting at two stops over the measured normal exposure for medium gray. If you use a spot meter, you can measure the fourth patch from the left along the bottom row of the ColorChecker for medium gray. Shoot exposures at 1/3 stop intervals and place a written note in the subject indicating the E.I. for that exposure. In other words, if your expected E.I. is 100 and you expose

[Fig. 3]

1-stop over, put E.I. 50 on a piece of paper in the shot to indicate if this shot looks properly exposed, then the E.I. would be 50 (1 stop less than 100); 1-1/3 stops over would be E.I. 40; 2/3 stop over would be 64. Shoot enough exposures to get to at least one stop over the expected E.I. More often than not, the typical DSLR is over rated by one-stop; so if the manufacturer says the E.I. is 100, the actual E.I. for the chip is 50.

Evaluating in Adobe Camera RAW

Now you should view the RAW files in the processing software. If you haven't changed the defaults in ACR, you will notice all the images will appear more or less the same in Bridge. **[Fig. 4]** This is because ACR is using auto adjustments to equalize the exposures. We have to turn off auto adjustments and zero out all the sliders before we can get a good idea about the best exposure. Select all the thumbnails and, from the File menu, open in Camera RAW and uncheck "Use Auto Adjustments" from the Settings Flyaway menu.
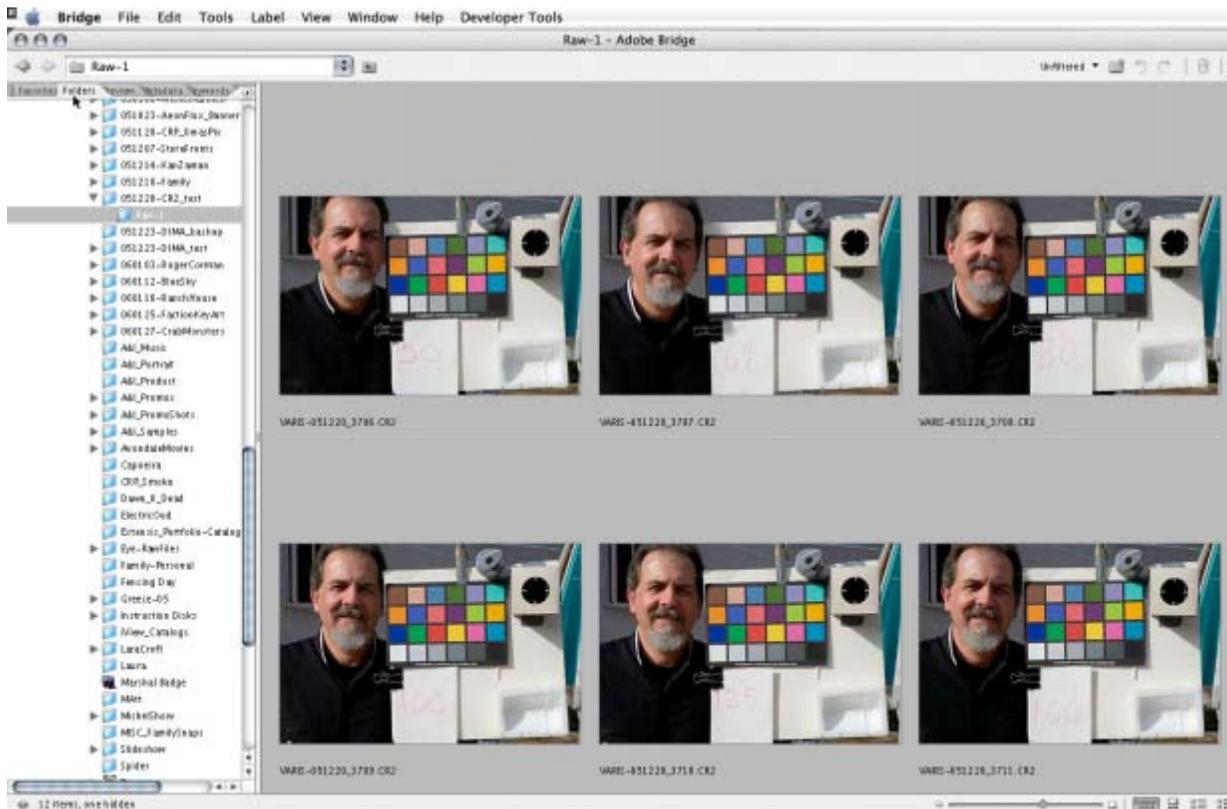
[Fig. 4]

[Fig. 5]The preview will update to reflect the current Camera RAW default settings for this camera. Note the Exposure, Shadows, Brightness, and Contrast sliders all have positive values. We need to zero out all the sliders to see what the native performance of the chip is like without any processing enhancements. Change all the sliders to zero values and click on the "Select All" button at the upper left of the dialog, then click "Synchronize." The thumbnail previews will change, and you will most likely find the expected E.I. now looks too dark. As mentioned before, most of my cameras look best exposed one f-stop higher than normal, meaning I have to rate it at E.I. 50 instead of 100. At this point, all the thumbnails visible in the panel at the left will change to reflect the new zero slider settings, and you can get a good feel for which exposure is closest to the ideal with minimal processing intervention. Select the best exposure to display it in the big preview window.
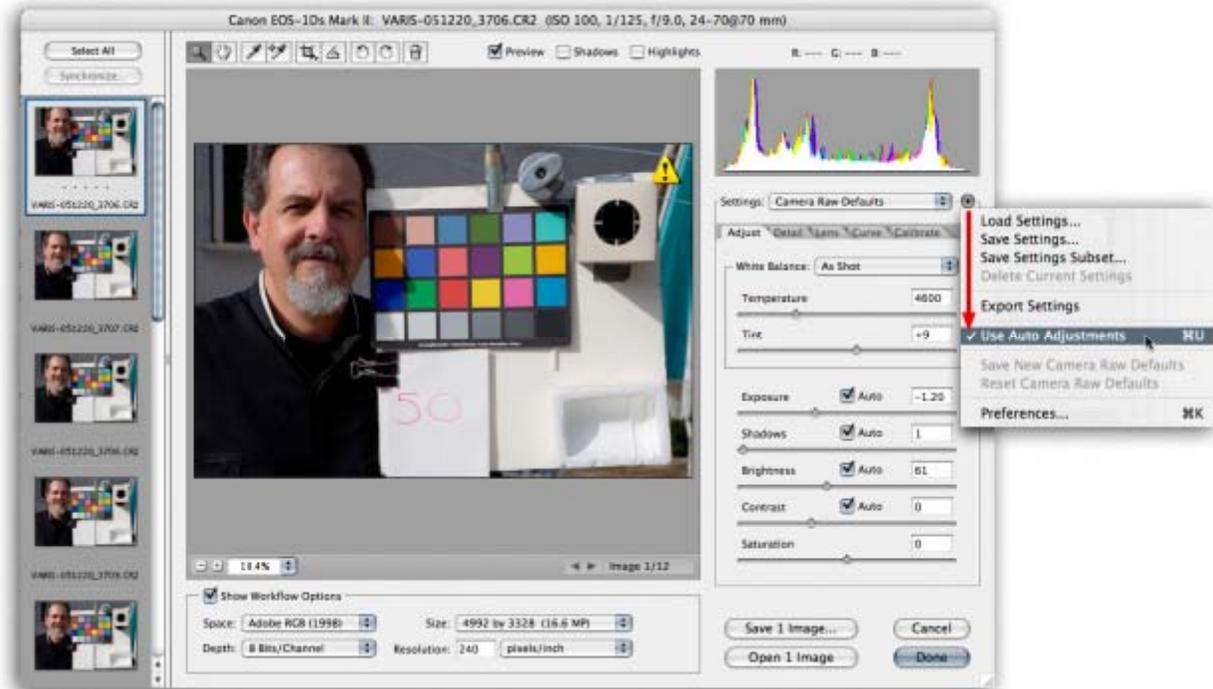

[Fig. 5]

Adjusting for color calibration

The next step is to determine custom adjustment settings for the best color rendition of a gray balanced shot. ACR has a unique method to adjust for subtle color bias in the Calibrate tab under the Settings menu. Before doing anything else, however, you must use the white balance tool (the gray eyedropper in the row of icons at the upper left) to neutralize the color. Select the white balance tool and click on the light gray patch. **[Fig. 6]**

   The "Settings" drop down will change from "As Shot" to "Custom," and the "Temperature" and "Tint" sliders will change to reflect the new white balance. Click on the "Calibrate" tab, select the color sampler tool (eyedropper with target) and place a sampler in the light trap black hole.
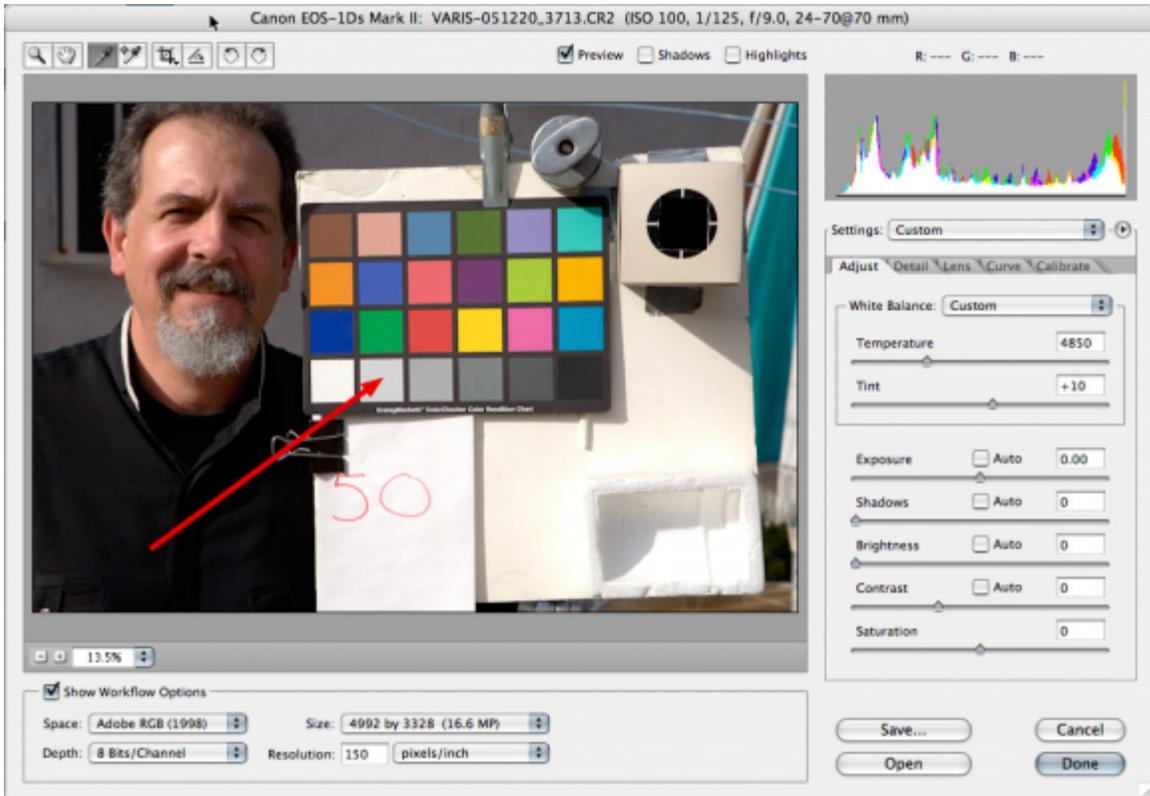
[Fig. 6]

[Fig. 7] If you are lucky, the black point will be fairly balanced (R=G=B); but if not, you can use the shadow tint slider to balance the numbers. Moving to the right will shift towards magenta, to the left towards green. Don't beat yourself up if the numbers are within two points of each other – look out if one channel ends up five to 10 units higher!

Now you can begin to adjust the Red, Green, and Blue sliders to get the patches on the ColorChecker to match the hue and saturation of the ideal values. Unfortunately, ACR doesn't give us HSB numbers, only RGB; so the easiest way to figure out how to set the sliders is to process out the file and read HSB (Hue, Saturation, and Brightness) numbers in Photoshop.
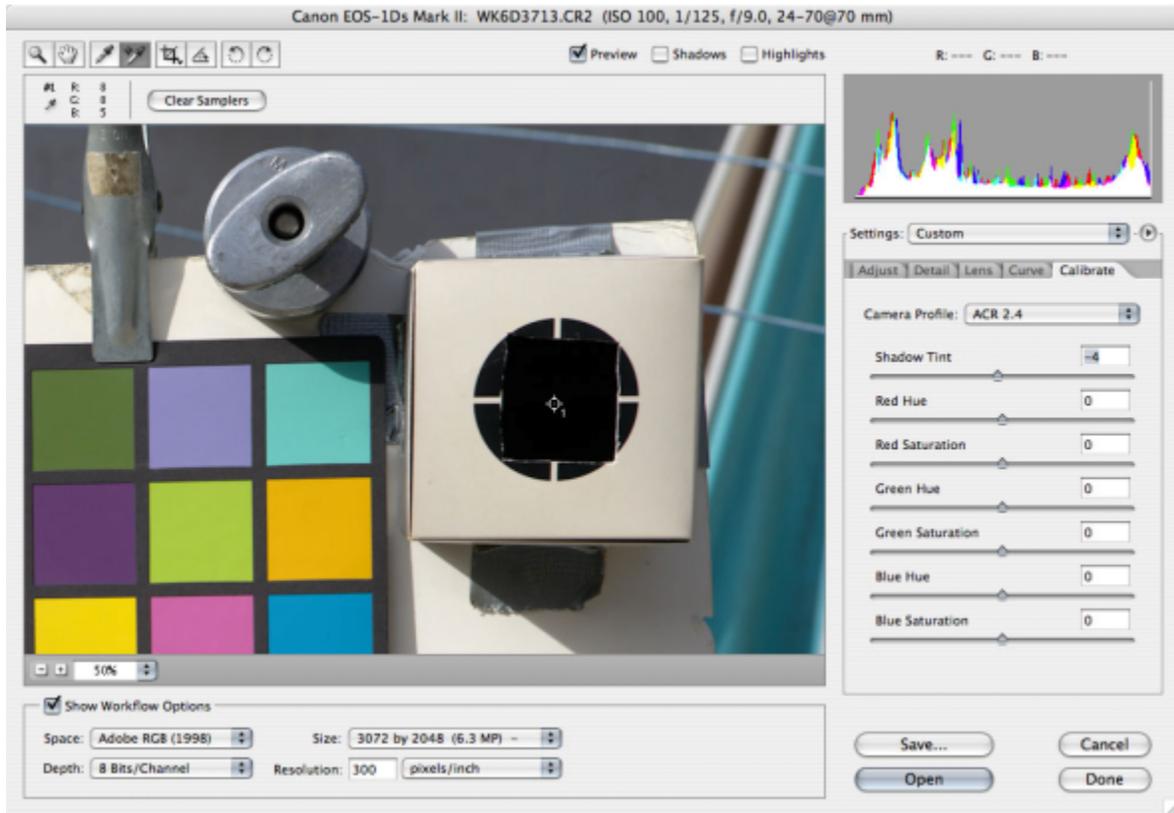

[Fig. 7]

First, set up a crop with the Crop tool. Try to aim for a Crop Size close to 800-by-600, then click on Open to bring the image into Photoshop. **[Fig. 8]** The idea here is to compare the real world ColorChecker against an artificially generated "ideal" chart. **Bruce Lindbloom** has developed a LAB file for the color values of the GretagMacbeth ColorChecker by measuring a large number of real ColorCheckers with a spectrophotometer and averaging the values. You can download this file from his website, **http://brucelindbloom.com.** (There is a wealth of information on this website that is well worth your time to explore.)

Once you have Bruce's LAB file, you can set up Photoshop to compare the HSB numbers for the patches on both the real target and the "ideal" LAB target. Set up Color Samplers for the Red, Green and Blue patches; then change the readouts to HSB numbers. You can do this by clicking on the little eyedropper icon next to the numbered sampler readouts in the Info palette and selecting from the flyaway menu. **[Fig. 9]** Place samplers in both the real world file and the LAB reference file, and compare the numbers.
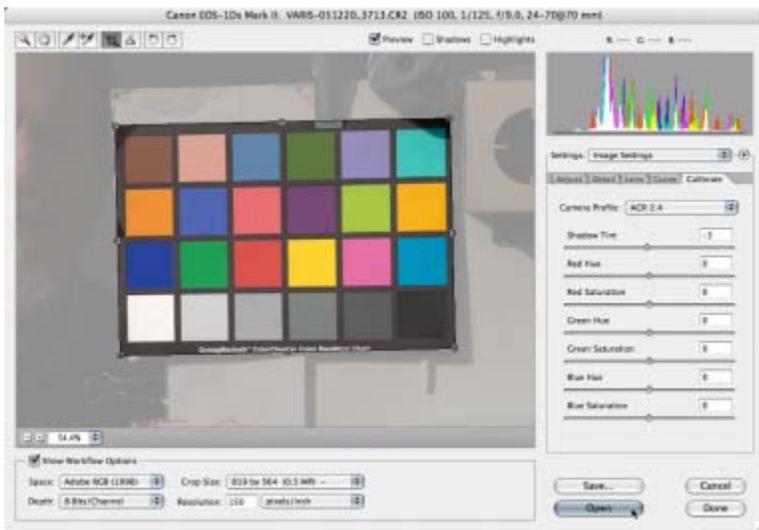

[Fig. 8]
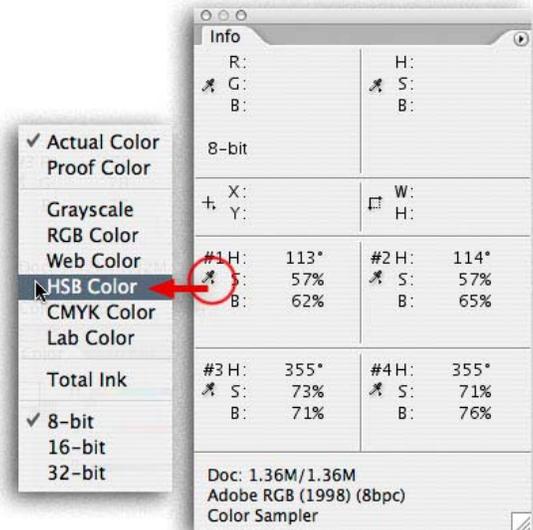
[Fig. 9]

[Fig. 10] The difference between the values will give you a clue for how to adjust the sliders in ACR to bring the values in the processed file closer to the ideal values of the ideal. Start by entering the differences in "H" and "S" as slider values in the ACR Calibrate tab for Hue and Saturation in Red, Green, and Blue. You will have to process the file out and remeasure to find out if you hit the values. You will probably have to do this a couple times before you actually arrive at the best slider settings, because the ACR sliders don't quite behave in a linear fashion. Ideally, calibrating the Red, Green, and Blue patches should cause all the other colors to fall into place; but usually certain color patches will look slightly off. It is useful to calibrate for the skin color patch as skin tone is often the most important color and usually the most difficult to get right in digital capture. Compare samplers for the light skin patch (second from the upper left) and readjust if necessary. You usually have to settle for a more orange looking red patch to get the skin tone to match up properly.

Once you have a calibration you're happy with, you can return to the adjust tab and set the other sliders to get the look you're after for a good default. Think about how you prefer your color. More contrast? More saturation? Put these into your calibration, so you don't have to tweak every file every time. Don't go overboard with creative adjustment, because you can always tweak images on a case-by-case basis. You're just looking for a good starting place for the bulk of your photography. After you're happy with the overall settings, change the white balance setting back to "As Shot" using the drop down menu!

[Fig. 10]
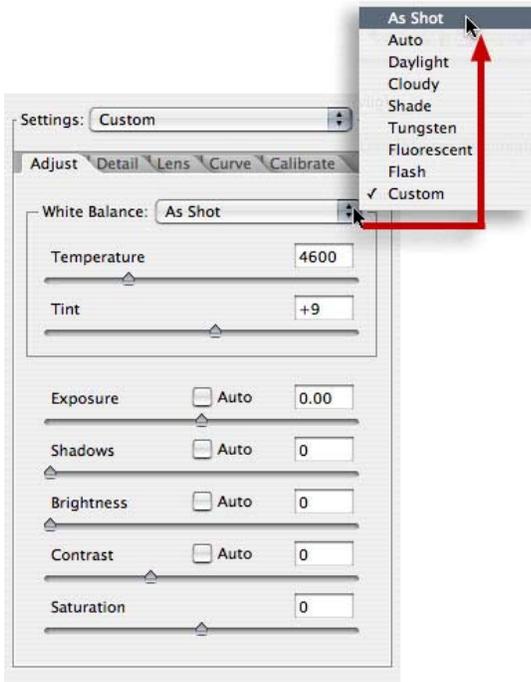
[Fig. 11]
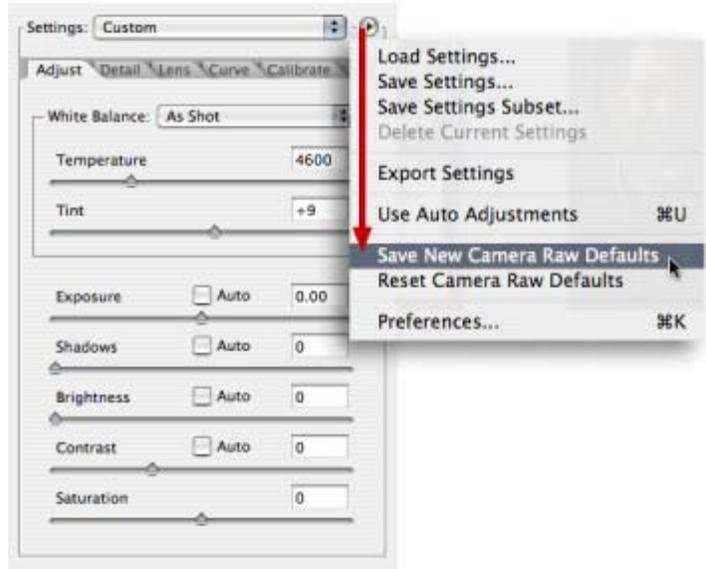
[Fig. 12]

[Fig. 11] ACR is now set up the way you want to see your default capture. "As Shot" allows for different white balance depending on the shooting environment, and in-camera white balance or auto white balance for a particular scene.

   Now you want to save your new camera default setting for all future captures from this camera. Select "Save New Camera RAW Defaults" from the Settings flyaway. **[Fig.12]** All the current slider settings are now saved as the new default.

For a more detailed examination of this camera calibration procedure, check out Varis' book: "Skin: The Complete Guide to Digitally Lighting, Photographing, and Retouching Faces and Bodies."

Lee Varis has been a commercial photographer in Hollywood, Calif., for more than 30 years. He has been involved with digital imaging for almost two decades, working with the earliest digital capture systems and providing digital image compositing, retouching and special effects, as well as straight photography for his clients. Varis is president of the **Los Angeles Digital Imaging Group** *(LADIG), a new professional organization dedicated to advancing the art of digital imaging. He is also on the* **DIMA** *Board of Directors, maintains a busy consulting schedule, and teaches private classes in digital photography.*