

# Calibrating and Profiling Hasselblad H System Cameras

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# Hasselblad Custom Camera Profiling:

## Introduction:

The Hasselblad Natural Color Solution (HNCS) produces remarkably consistent colour reproduction across the H4D camera system, from camera to camera and scene to scene. While a difference in white balance between the HNCS reference setting (5000°K) and the scene illuminant can be discounted by using Phocus's neutralising tool on an equally illuminated and spectrally neutral white reference patch in the scene, it can not account for the spectral distribution of the scene's illumination. In such cases productivity gains and accuracy improvements can often be achieved by implementing a custom ICC camera profile. These notes detail the procedure for creating such a profile.

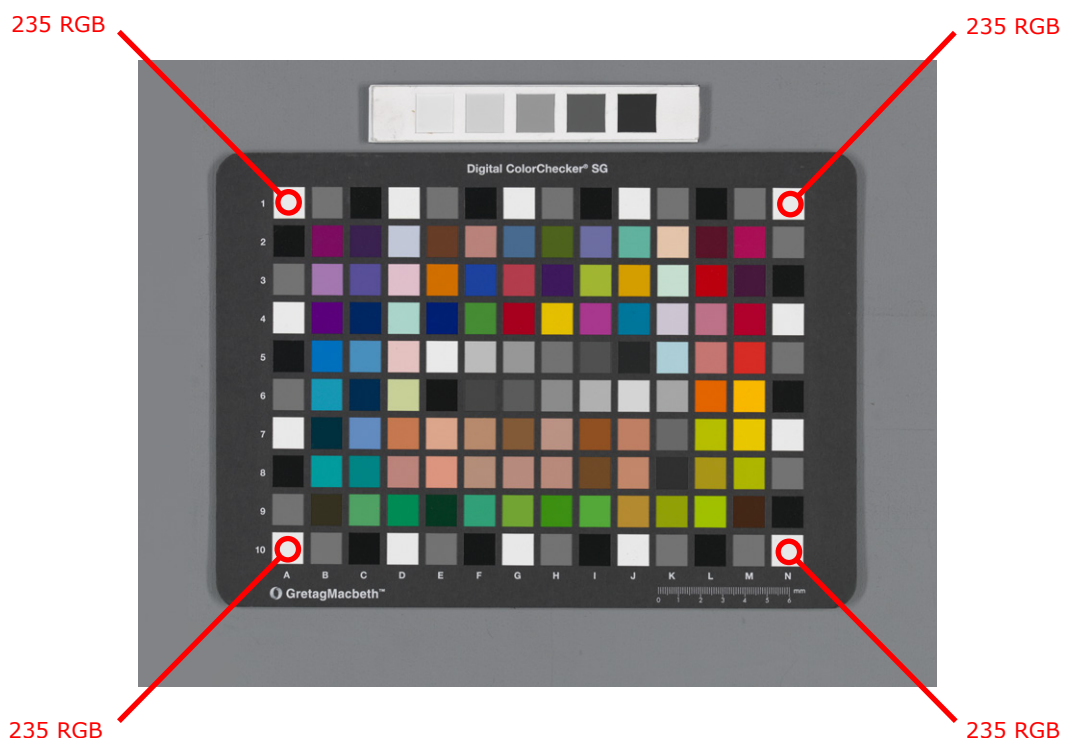
## The following items are required:

- Xrite Profile Maker 5 camera module and license dongle
- Xrite SG Color Checker test target
- Two identical light sources and reflectors
- Hasselblad H system camera and lens
- Hasselblad Phocus processing software

Though this procedure utilises Xrite's Profile Maker software to create the ICC camera profile, the instructions can be adapted to suit other profiling applications.

## Lighting the Test Chart:

Place the test chart on a dark background to minimise unwanted camera and lens flare, and light it evenly from opposite sides. Adjust the distance, focus and output of the lights until the test chart is evenly illuminated within a 1/10th of an f-stop. If applicable include your control target(s) to ensure exposure and processing consistent with normal practice.

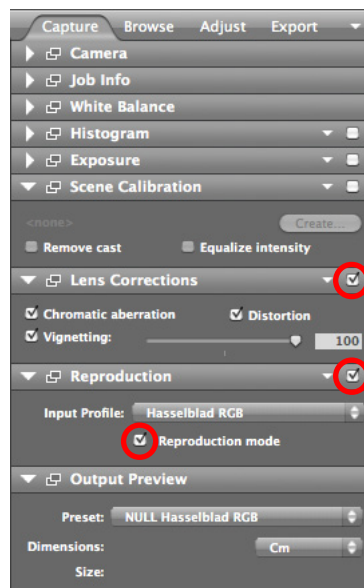


## Setting up the Camera:

Place the camera on a secure stand and arrange it perfectly parallel with the test chart and at a distance that fills approximately 50% of the frame with the test chart. If the test chart does not appear perfectly rectangular in the viewfinder, adjust the camera's position until it is. When working tethered the grid view in Phocus is helpful in making sure the test chart is perfectly planar to the sensor and lens. If using the HTS 1.5 Adapter ensure that its tilt and shift settings are also zeroed. Focus on the test chart.

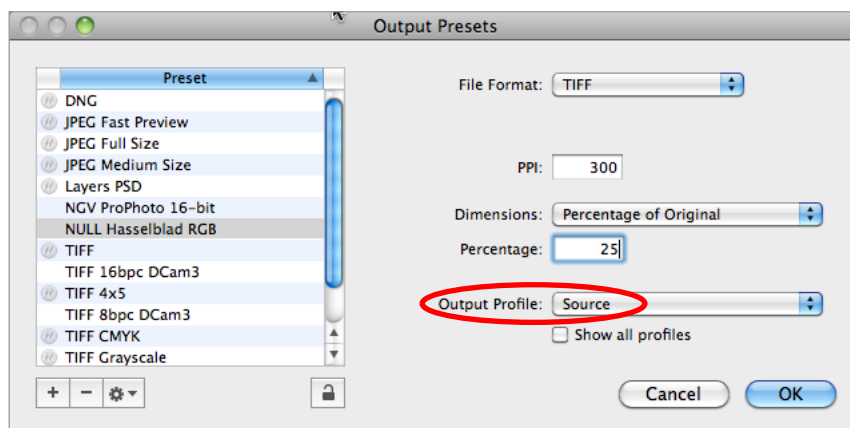
## Setting up Phocus:

Activate the Reproduction, Output Preview and Lens Corrections tools as follows:



Also select (tick) the Reproduction Mode to ensure a linear transformation, and check that all other tools are not active (no ticks in the top right hand corner boxes) so that no additional processing is applied to the image.

## Create a Null Transformation Output Preview Preset:



In the above example the Preset has been named **NULL Hasselblad RGB**. Any name can be used as long as it is readily identifiable that it is using the Source as its output profile.

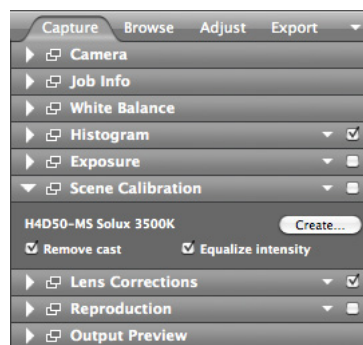
## Exposing the Test Chart:

Sufficient exposure is required so as to render the SG Color Checker's surrounding white patches between 230 and 240 (Hasselblad RGB) levels in the output image. Also check to ensure all the white patches are within +/- 1 level of each other. This is most easily facilitated when working tethered with Phocus's output levels readout.

R: 235 G: 235 B: 235

## Creating a Scene Calibration:

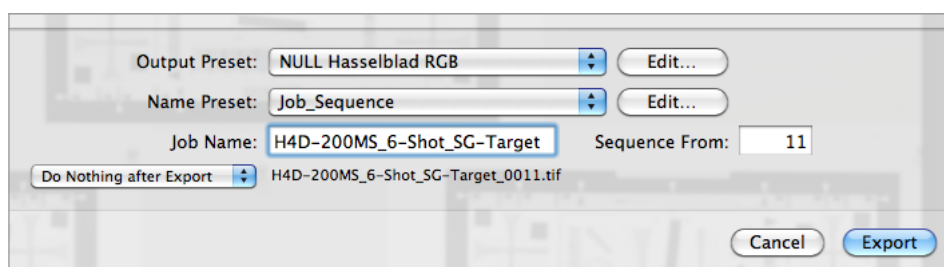
Once the correct exposure has been achieved, temporarily cover the SG Color Checker with a clean white target, such as a sheet of mat or Gator Board and without changing the lighting in any way, capture the white target. Check that the white target is clean and free of any surface scratches or blemishes. Use the same exposure as for the SG Color Checker test chart and verify that the exposure has been sufficient to render the white target between 230 to 240 RGB levels in the Hasselblad RGB colour space. Do not neutralise or apply any other Phocus adjustments to this file.



In the Scene Calibration tool and with the white target image highlighted in the Phocus Thumb Nail Browser and/or visible in the Viewer window, select the Create button and include at a minimum the camera model and illumination source in the custom Scene Calibration name. It may also be necessary to include the date and job details as well. This is important to ensure that this calibration is not confused with any other lighting setup.

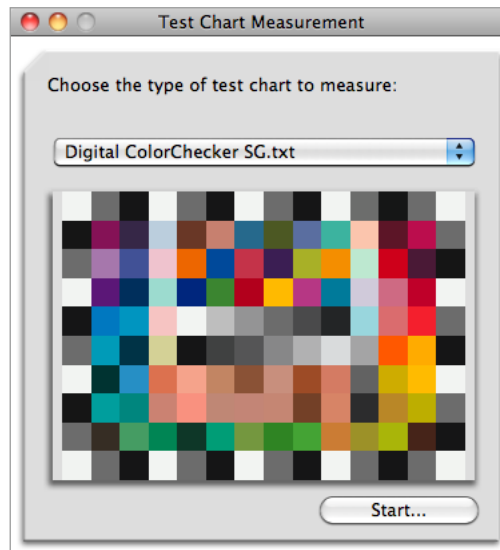
## Processing the Test Chart Image:

With the custom Scene Calibration active and the default Hasselblad RGB profile listed as the Reproduction (input) profile, Export the image using the Null Transformation Output Preset previously created with the Source output profile (i.e. Hasselblad RGB).



## Creating a Custom Reference File for the Test Chart:

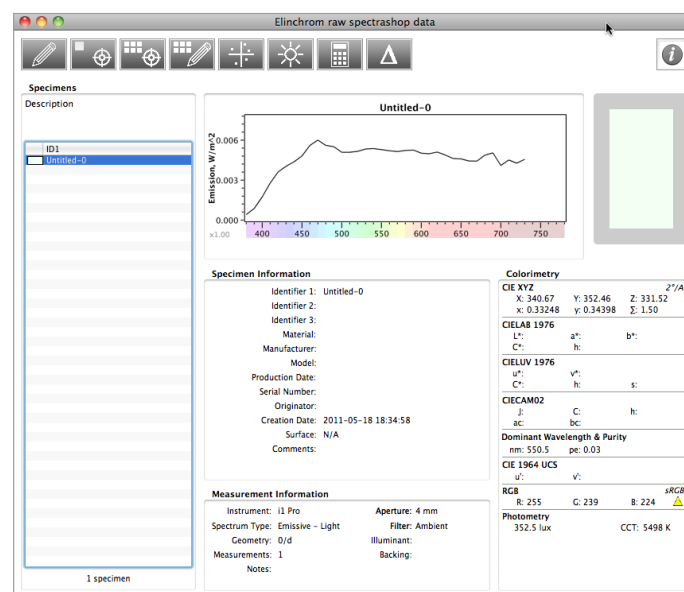
Connect a non-uv cut (no uv filter) EyeOne Pro spectrophotometer to the computer and open up the Profile Maker 5 Measure Tool. Select the Measuring tab, and select the default **Digital ColorChecker SG.txt** reference file that can be found in the Profile Maker 'Reference Files/Scanner' folder.



Measure the SG Color Checker beginning in the top left corner and measuring horizontally row by row until you end up in the lower right corner; 140 patches in all. Save this file with an appropriate name that identifies it as a custom reference file for that test chart.

## Create a Custom Light Source Reference File:

Use Robin Myers' Spectrashop or similar software with an EyeOne Pro spectrophotometer without a uv-cut filter to measure the light source under which the test chart was photographed, which should be the same lighting as the job will be photographed under.



Export the light source file as spectral data in the Spectrashop format for use in Profile Maker.

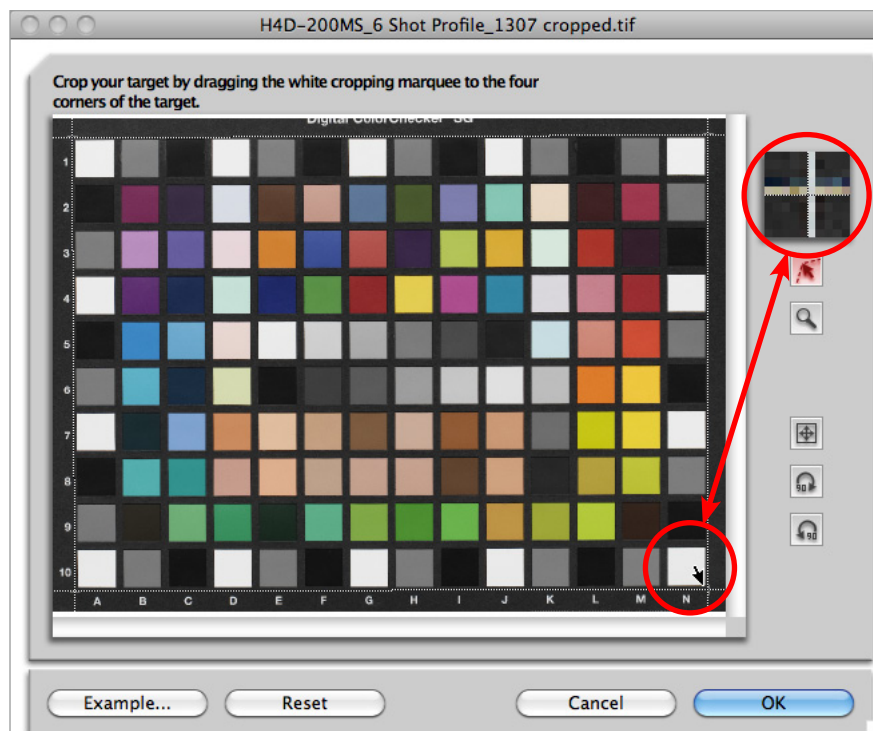
## Load the Custom Reference File:

Open Profile Maker 5 and select the custom SG Color Checker reference file in the Reference Data tab. Also open the photographed SG Color Checker test chart in the Photographed Test Chart tab.



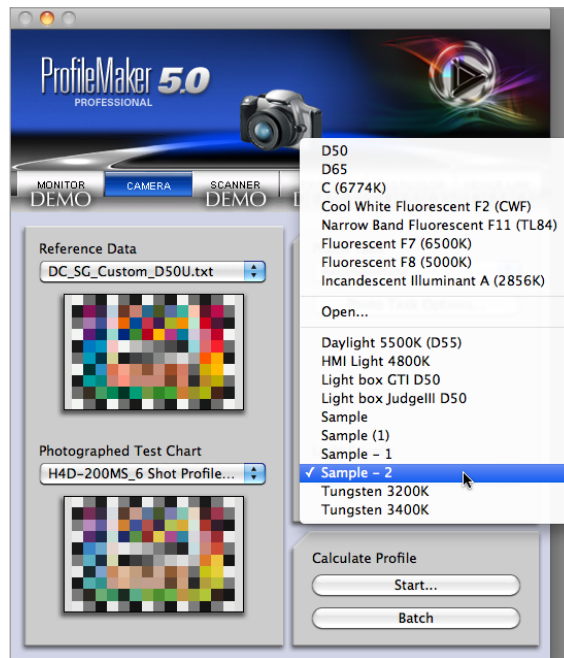
## Setup the Photographed Test Chart:

Click and drag the corners of the 'thin white dotted guide line' to the small '+' in each corner of the test chart image. Use the magnified view in the upper right corner to precisely align the guides. Click OK to load the correctly aligned test chart in Profile Maker.



## Select the Custom Light Source:

Under the Light Source tab select the previously created custom light source spectral data file.



## Create the Custom ICC Camera Profile:

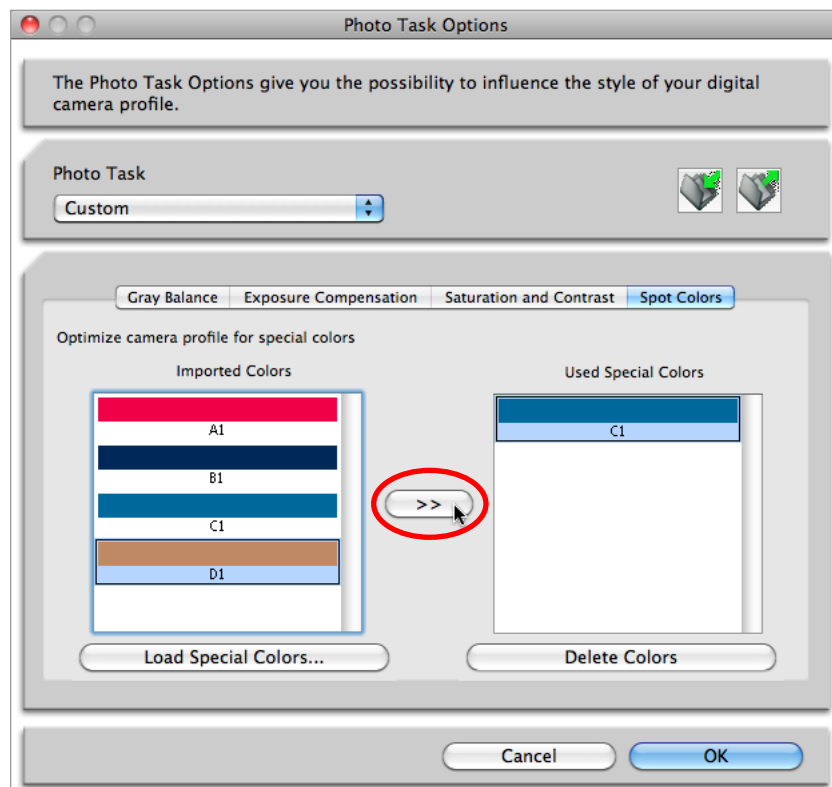
Select the default Reproduction setting under the Photo Task tab and click Start to render the profile. Save it with an appropriate name that identifies what it is being used for, including the camera, light source and its reproduction mode.



Restart Phocus so the new camera profile will be available, then select it as the Input Profile in the Reproduction tool, and set your normal output profile in the Output Preview.

## Customising the Camera Profile with Spot Colours:

Any ‘problem colours’ that are not reproducing correctly via the default Reproduction Mode can be individually measured and added to the SG data set via the Spot Colors tab.



Use an EyeOne Pro Spectrophotometer without uv-cut filtration and measure the ‘problem colour(s)’ with Robin Myer’s Spectrashop application. Save the spectral measurements in a CGATS format and import them into Profile Maker via the Load Special Colours button.

A list of colours recorded in Spectrashop will also be loaded in Profile Maker as a series of colour samples, that can then be highlighted and moved via the double arrow button into the ‘Used Special Colors’ column for inclusion in the revised profile.

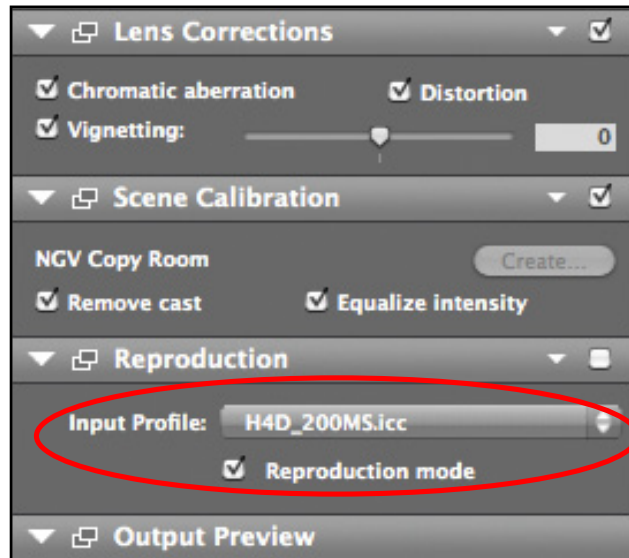
### Summary:

The procedure is based on a null transformation of the camera data into an RGB file to produce an accurate characterisation of the camera, lens and lighting setup. The resulting ICC profile is applied either in situ or retrospectively by Hasselblad’s Phocus software to images captured under the same conditions. Note that the .FFF file format must be used in the calibrated workflow if the advantages of Phocus’s Lens Corrections and Scene Calibration tools are to be included. At this time a DNG workflow does not support these features. This includes exporting and re importing the image into Phocus as a .DNG file.

Refining Hasselblad’s Natural Color Solution (HNCS) with a custom ICC camera profile that accounts for the spectral distribution of the exposing light source along with a custom (lighting) scene calibration, and if required spot colours to extend or refine the calibrating test chart’s gamut, has the potential to provide significant workflow productivity and quality gains.

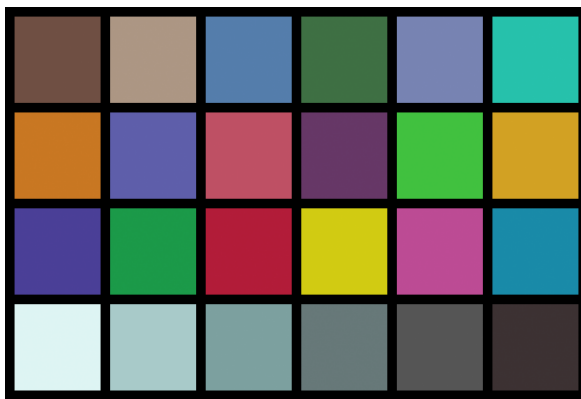
## Applying the Custom Camera Profile:

For use load the custom camera profile as the input profile in the Phocus processing workflow and replicate all other settings used in the creation of the profile, such as the Lens Corrections.



## Evaluating Workflow Gains:

The results of using the two profiles, the generic Hasselblad RGB.icc and custom H4D-200MS.icc profile in the Phocus workflow *before* neutralising the greyscale of the photographed Original ColorChecker Standard (24 patch) test chart produces the following results..



Hasselblad RGB.icc

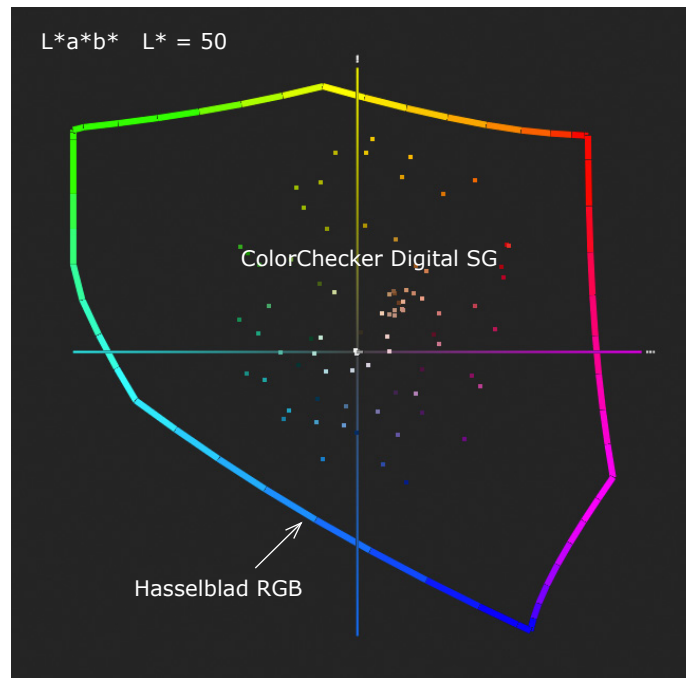


Custom H4D-200MS.icc

The differences are due to the exposing light source not being the same (neither its correlated colour temperature nor spectral distribution) as the generic Hasselblad RGB profile's reference light source. This results in colour casts in both highlights and shadows. These 'errors' can be easily corrected in the Phocus software by adjusting the RGB curves' end points, but this extra work also creates a less productive workflow. The 'errors' are automatically corrected in the custom profile. But even when neutralised, the generic Hasselblad RGB profile's colour rendering is still not quite the same as in the custom H4D-200MS profile.

## Evaluating Colorimetric Gains:

The Xrite ColorChecker Digital SG colour target does not provide an equal distribution of colours that encompass the camera's predicted gamut (Hasselblad RGB). Therefore a degree of extrapolation is involved during the custom profile creation. Evaluating the accuracy of a profile based on the 140 colours of the ColorChecker Digital SG chart indicates its relative performance within that limited gamut, and also correlates well with visual comparisons.



For example, custom uv-cut spectral measurements of the photographed ColorChecker Digital SG chart were used as the reference data in the creation of the custom profile H4D-200MS.icc. Comparing the measurement data in the custom H4D-200MS profile with the custom uv-cut reference data returns a total average Delta E 2000 of 0.68, and a maximum Delta E 2000 of 1.72 (patch L6). The total Standard Deviation is only 0.32.

On the other hand, the results from converting the custom uv-cut reference data of the ColorChecker Digital SG chart into the generic Hasselblad RGB.icc profile and then extracting and comparing the converted data against the ColorChecker Digital SG chart's custom uv-cut reference data, reveals an even better total average Delta E 2000 of 0.53, though this is really a moot point because all the errors are well below the visual threshold. However maximum error for the generic Hasselblad RGB.icc profile (patch E4) is 5.78 and the total Standard Deviation is 0.67 which is significantly greater than the custom profile.

The statistical differences between the generic and custom profiles also concur with their visual comparison on screen and in print when applied to real world imaging tasks. In all test reproductions of paintings, works on paper and biological specimens, the Phocus software with the custom profile increased the 'separation' between adjacent colours resulting in 'cleaner' colours and a more neutral rendering compared with the generic Hasselblad RGB profile. In each case the gamut of the photographed objects were within the gamut covered by the ColorChecker Digital SG chart. No data was obtained for colours outside this gamut.