QTR Curve Creation Process using Leopard and CS3

Introduction

This QTR paper/printer profiling workflow is the result of my effort to develop a process by which I could start with a digital image and process it to a color or black and white printed image without having to use two entirely different workflows. It was also influenced by my desire to continue using PhotoKit Sharpener from PixelGenius. (The automated process requires that the background image is RGB rather than gray scale.)

I am using a MAC running Leopard 10.5.2 and using Photoshop CS3. So, all the window captures are based on these software components.

I started doing photography in college and then as a commercial photographer for 6 years after college. During that period my favorite B&W film was TRI X and my preferred slide films were Kodachrome 25 and Ektachrome 64. (This was during late 60's and early 70's)

I became interested in digital photography about 2000 when DSLRs started to appear at a price point attractive to amateurs. (my current photographic status.) My Photoshop workflow is motivated by a desire to produce prints that are reminiscent of my earlier favorites.

The advent of the "fiber B&W" papers that approach the look of matte dried gloss paper has further motivated me to find a B&W printing method that deliver images that are close to those I used to get off the dryer drum.

Roy Harrington's QuadTone RIP is an easy-to-use B&W printer driver that eliminates the problems associated with B&W printing using the OEM ink set in the Epson 2200. What follows is my workflow to create a curve for printing B&W on a particular paper stock using QTR.

This document, along with the Baseline curve text file and the modified Ink Separation File (two black inks) will be placed in the Docs folder on the Quadtone RIP Yahoo Group site for those interested in adapting this process for their own purposes.

Photoshop settings

This screen capture shows how I have CS3 configured:

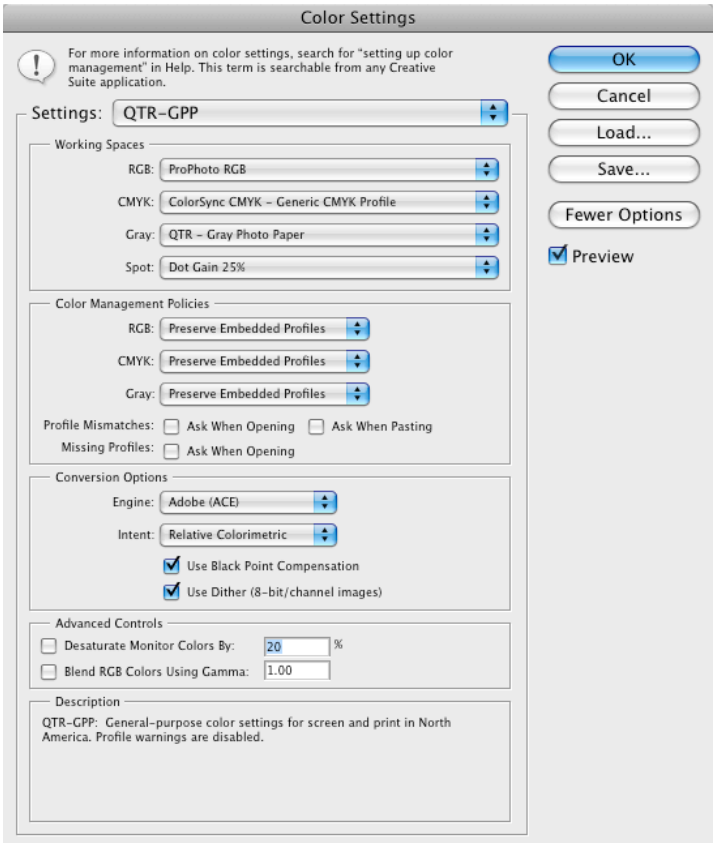

Figure - 1

The important settings are the Gray and RGB selections. ProPhoto RGB is a wide gamut color space that is widely recommended for editing color images from digital capture. The QTR- Gray Photo Paper selection provides a baseline for B&W in the RGB color space that seems to work well with the QTR driver and the profiles I have build using the process being described in this document.

The rest of the settings I use for Photoshop are influenced by reading I have done and seems extraneous to this description.

I have calibrated my LCD display using the ColorVision Spyder 2 profiler software and build paper profiles for color printing using the Spyder3Print companion software and Spectrocolormeter Model 1005.

All the readings for the QTR curve profiles were read using the Sypder3Print software and hardware. The option Tools\Measure opens this window;

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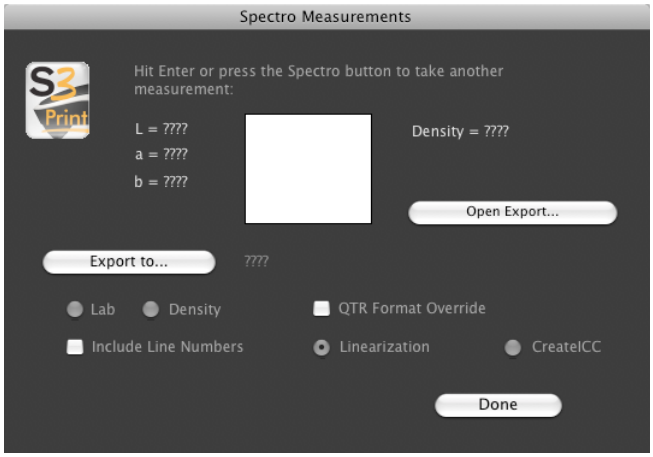

Click on Export to… and input a file name, click the include Line Numbers and the Lab radio button gets the software ready for measuring the step wedges. After the measurements are completed, clicking on done saves the measurement file in the Applications \Datacolor \Spyder3Print 3.0 \Data \Export folder. (I found it easier to create an alias and put it on my desktop.) These are the text files that are dropped onto the QTR-Linearize-Data script in step 2.

QTR Profiling Process

The process I have arrived at is based on the material provided with the QTR package from Roy, as well as material on the QTR Yahoo Group site in the documentation folder.

The specific documents are:

- QTR Mini Tutorial on Curves (Group Docs)
- Calibration (in QTR/CurveDesign folder)
- Getting Started (in QTR/CurveDesign folder)
- Gray-ReadMe (in QTR/CurveDesign folder)

What follows provides a step-by-step flow rather than explain the logic that drives each step. The more detailed information is included in the other documentation.

The process includes the following steps:

1. Determine optimum ink flow and printing resolution to obtain best dMAX.
2. Print test charts for spectrometer measurement to determine linearization curve for profile.
3. Assemble profile file and install for printing.

Step 1:

The first requirement is to determine what ink flow and print resolution delivers the deepest black on the selected paper. This is accomplished with a modified Ink Separation PSD file. I created the file by eliminating the color ink step wedges so only the black and light black are printed for calibration purposes. (There is also a version for printers with three black inks.)

The calibration prints are made using the following Photoshop and QTR print dialogs:

- Photoshop – No Color Management
- QTR - Calibration

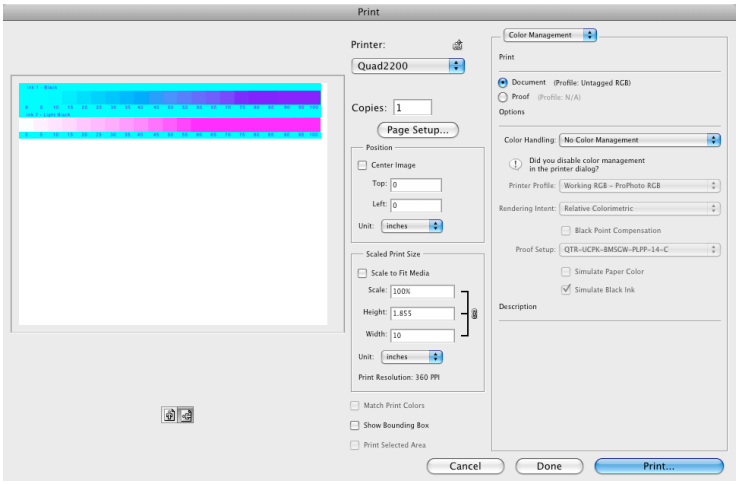

Figure - 2

This Photoshop dialog shows the modified Ink Separation file that I created for just the black inks (Epson 2200 with PK and LK). The important item is the No Color Management setting.

This version permits me to try a variety of resolution and paper settings on a single sheet of paper.

The objective is to determine the best resolution and ink flow for the selected paper.

Printing one image at 2880 and a second at 1440 helps to find the ink flow that results in the best dMAX for the paper being profiled. I have found that fiber based papers such as Epson Exhibition Fiber and Harman GLOSS FB AI offer the best dMAX at 2880. On the other hand, Calumet Photo's Brilliant Museum Silver Gloss White gets the best dMAX when printed at 1440.

Here is the QTR printer dialog for printing the ink separation image.

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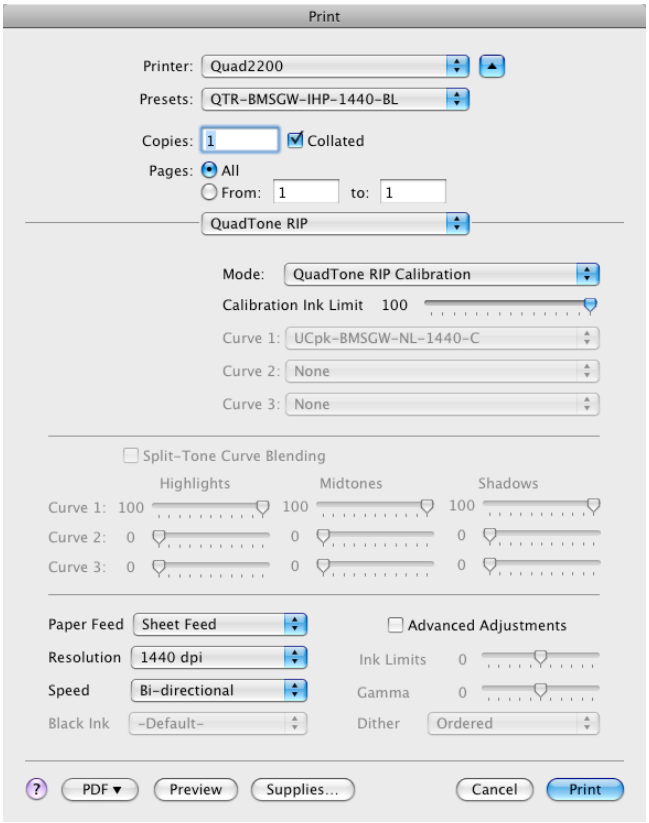

Figure - 3

The important item is the Mode selection.

The Printer Features option provides access to the various paper choices available with QTR. Changing the paper appears to have some influence on ink flow and also printer head relationship to the paper. For example, I found that Ilford Heavy Paper worked best with Brilliant Museum since it too is a thicker media.

The following dialog box illustrates this setting.

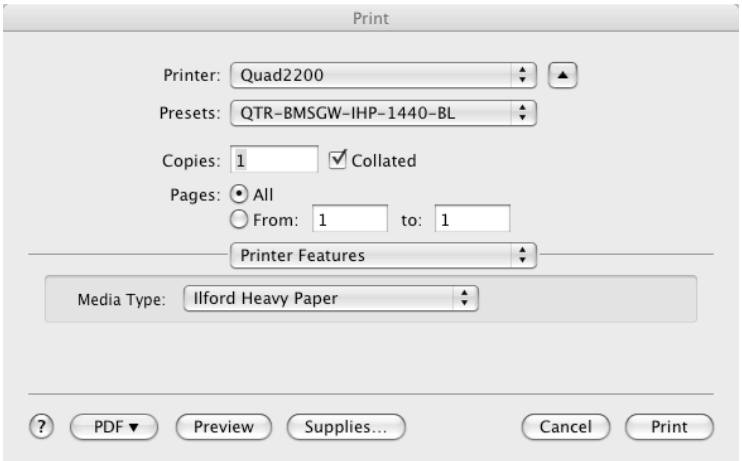

Figure - 4

- Print an image for each of the paper stock options
- All prints are made with the Calibration selection in the QTR printer dialog box, just as when printing the full Ink Separation Image.
- Each print is made per the ink separation instructions in the calibration document included in the CurveDesign folder.
- Read the various 100 percent wedges to see which indicated the best density.
- Also read the 95 and 90 percent steps to ensure that too much ink does not deteriorate the density. (I read the wedges after 2 hours drying time and again after 24 hours, the readings were consistent within a few hundredths. i.e. one time the reading for the 100% wedge was 1.92 the next time 1.94)
- Also read the LK 100% wedge and then read the Black wedges starting at 30% to see where the LK and K cross over. Determine the crossover; for example it was between the 35 and 40 percent wedges for the Brilliant Museum SGW paper I was testing. (Turned out to be about 38 % when interpolated.)

Step 2:

With the ink crossover for LK determined along with the paper and ink settings that deliver the best dMAX the next step is preparing the BaseLine profile for building the QTR curve file. The document “Mini Tutorial on Curves” has a good description for creating the “base-line” curve profile that is used as the starting point for this process.

I modified and saved a base-line profile as described in that document. This file has no linearization curve. The section on Gray partitioning provides a good description of how to use the information determined in step 1.

Once the baseline file has been completed with the ink information it should be saved in the printer profile folder and the install script should be run to install the baseline profile so that the linearization test images can be printed.

To simplify the printing process it is useful to prepare a Printer Preset. Figure 4 shows an example. This was accomplished by selecting the Media Type that delivered the best dMAX and ensured no printer head conflict when printing the ink calibration tests. Then selecting the baseline curve and resolution as shown in Figure 5 and saving it as a preset.

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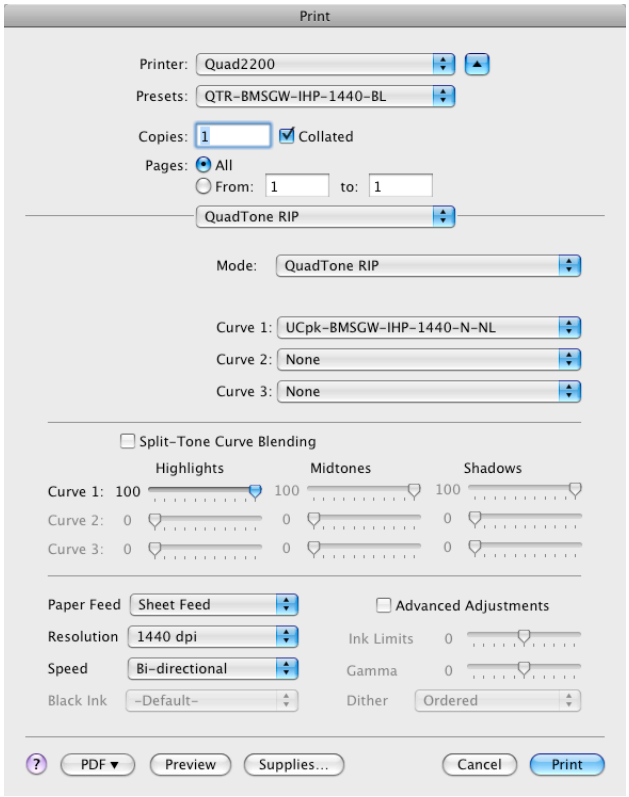


Figure – 5

Now the preset can be used to ensure QTR has the proper setting for printing the linearization test images.

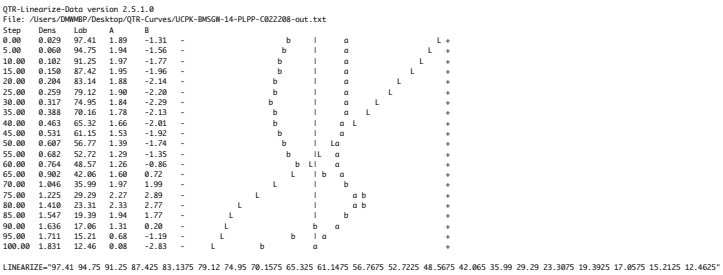
Roy recommends using the 21 x 4 random step wedge image for profiling. Print this image using the baseline curve.

Permit the print to dry for at least a couple of hours. (My experience is that 2 to 3 hours drying time results in essentially the same reading as an overnight drying.)

Read the test print using a spectrometer and then drop the measurement file onto the QTR-Linearize-Data script in the CurveDesign\Eye-One folder.

I found it easier to put a folder on my desktop named QTR-Curves and to copy the droplets into the folder.

When the measurement file is dropped onto the script it generates a file that includes a Linearization data set. The text file looks like figure 6.



```
QTR-Linearize-Data version 2.5.1.0
File: /Users/DMWMBP/Desktop/QTR-Curves/UCPK-BMSGW-14-PLPP-C022208-out.txt
Step    Dens    Lab     A       B
0.00    0.029   97.41   1.89    -1.31   -                       b     |     a                  L +
5.00    0.060   94.75   1.94    -1.56   -                     b       |     a                L   +
10.00   0.102   91.25   1.97    -1.77   -                   b         |     a              L     +
15.00   0.150   87.42   1.95    -1.96   -                   b         |     a            L       +
20.00   0.204   83.14   1.88    -2.14   -                  b          |     a          L         +
25.00   0.259   79.12   1.90    -2.20   -                  b          |     a        L           +
30.00   0.317   74.95   1.84    -2.29   -                 b           |     a      L             +
35.00   0.388   70.16   1.78    -2.13   -                 b           |     a    L               +
40.00   0.463   65.32   1.66    -2.01   -                 b           |     a L                 +
45.00   0.531   61.15   1.53    -1.92   -                  b          |     a                   +
50.00   0.607   56.77   1.39    -1.74   -                  b          |   La                    +
55.00   0.682   52.72   1.29    -1.35   -                    b        |L  a                     +
60.00   0.764   48.57   1.26    -0.86   -                     b L|    a                       +
65.00   0.902   42.06   1.60    0.72    -                     L  | b  a                       +
70.00   1.046   35.99   1.97    1.99    -                    L   |     b                       +
75.00   1.225   29.29   2.27    2.89    -                 L      |       a b                   +
80.00   1.410   23.31   2.33    2.77    -              L         |       a b                   +
85.00   1.547   19.39   1.94    1.77    -           L            |     b                       +
90.00   1.636   17.06   1.31    0.20    -        L               b     a                       +
95.00   1.711   15.21   0.68    -1.19   -     L                  b   | a                       +
100.00  1.831   12.46   0.08    -2.83   -  L          b           a                             +

LINEARIZE="97.41 94.75 91.25 87.425 83.1375 79.12 74.95 70.1575 65.325 61.1475 56.7675 52.7225 48.5675 42.065 35.99 29.29 23.3075 19.3925 17.0575 15.2125 12.4625"
```

Figure – 6

The linearization data line at the bottom of the file is copied and pasted into the baseline profile as described in the QTR Mini-Tutorial on Curves.

Once the Linearization data is pasted into the file save it with a new name. Place the file in the printer profile folder and run the install script again to install the curve.

Since the 21X4 Random step wedge image is only about 2 inches deep, I print the second image on the same sheet as the first one.

Select the preset created for the base line file and change Curve 1 to the new curve that includes the linearization data and make the test print.

After it dries for a couple of hours read the step wedge and save the measurements.

Drop this measurement file onto the linearization droplet, which will create a text file such as this;

```
QTR-Linearize-Data version 2.5.1.0
File: /Users/DMWMBP/Desktop/QTR-Curves/UCPK-BMSGW-PLPP-14-D-C-2228-out.txt
Step    Dens    Lab     A       B
0.00    0.029   97.42   1.80    -1.49   -                       b     |     a                  L +
5.00    0.081   93.03   1.85    -1.87   -                     b       |     a                L   +
10.00   0.135   88.61   1.88    -2.06   -                   b         |     a              L     +
15.00   0.190   84.26   1.82    -2.26   -                   b         |     a            L       +
20.00   0.252   79.61   1.80    -2.29   -                   b         |     a          L         +
25.00   0.315   75.12   1.77    -2.47   -                   b         |     a        L           +
30.00   0.389   70.06   1.69    -2.57   -                  b          |     a      L             +
35.00   0.450   66.12   1.55    -2.36   -                  b          |     a  L                +
40.00   0.524   61.59   1.52    -2.47   -                  b          |     a                   +
45.00   0.602   57.06   1.46    -2.15   -                   b         |   La                    +
50.00   0.674   53.17   1.40    -1.78   -                   b       |L  a                       +
55.00   0.765   48.50   1.24    -1.19   -                     b  L|   a                       +
60.00   0.857   44.11   1.33    -0.44   -                      L b |   a                       +
65.00   0.941   40.35   1.72    0.20    -                     L   b     a                       +
70.00   1.053   35.69   1.88    0.96    -                   L     |  b  a                       +
75.00   1.166   31.41   2.19    1.88    -                 L       |     ba                      +
80.00   1.275   27.60   2.12    2.38    -               L         |       ab                    +
85.00   1.414   23.18   2.20    2.35    -            L            |       ab                    +
90.00   1.523   20.03   2.04    1.72    -         L               |     b a                     +
95.00   1.649   16.71   1.09    -0.33   -      L                  b |   a                       +
100.00  1.792   13.32   -0.37   -3.32   -   L        b            a |                           +

LINEARIZE="97.42 93.03 88.61 84.26 79.61 75.12 70.06 66.12 61.59 57.06 53.17 48.5 44.11 40.35 35.69 31.41 27.6 23.18 20.03 16.71 13.32"
```

Figure – 7

Notice that the line depicting the Lab values is now essentially a straight line. That is the objective for this process.

Copy this Linearize data into the curve file to replace the data that you previously copied into the file. It can be saved with a new file name or with the same name. Place the file into the printer profile folder and run the install printer script again to update the profile for the printer.

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Step 3:

I noticed that the step wedge printed with the 2K ink from Epson was warm for my taste.

The Mini-Tutorial includes a section for building additional profiles with a toning component using the light cyan, light magenta and yellow inks.

Since I prefer cooler prints the normal inks delivered what I considered a warm tone. I opened the curve file and added 10 in the light cyan value line as described in the Mini-Tutorial and saved it with 10C at the end of the file name. I also created versions with 15 and 20 in the light cyan value line.

Now there are 4 curves; normal, 10C, 15C, and 20C.

Run the install script to install these additional curves.

I printed 4 21 random step wedges on a single sheet of paper. This required 4 passes through the print dialog sequence changing the curve 1 selection each time. (I moved the image down on the paper using the position option in the Epson Printer Dialog window (Figure – 2)

After letting these step wedges dry for a couple of hours to I decided that the “normal” curve produced what I consider a “warm” print. The 10C curve produced what I consider a “normal” B&W print, while the 15C had a bluish cool cast.

I went to the profile folder and renamed the three curves with W for warm, N for normal and C for cool. I eliminated the 20C curve since it was too blue for my taste.

After running the install printer script again I could go into the QTR printer dialog and create a preset that includes all three curves;

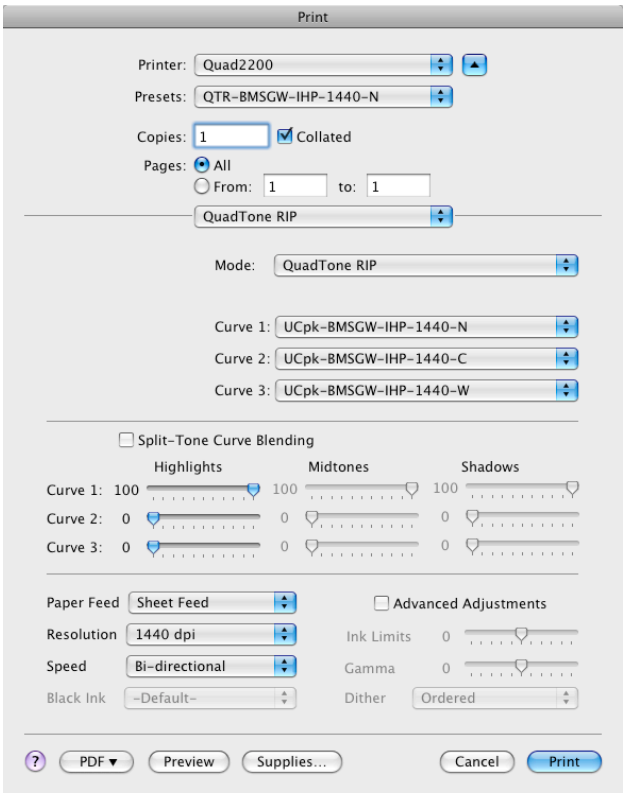

Figure – 8

End Note:

I have found that the resulting prints are quite close to my calibrated monitor image even when leaving the B&W image in the ProPhoto RGB profile. The measurement file made for the final linearization step can be dropped onto the ICC script. This builds an ICC file that can be added to the Colorsync folder so that soft proofing can be done in Photoshop.