Digital camera profile example

## Nikon D70, scene adopted white D50, headroom factor 2

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Profile construction

- **Nikon D70 camera spectral sensitivities**
  - Used to determine color matrices from white balanced camera RGB to D50 XYZ and linear RIMM RGB
- **D50 scene adopted white**
  - Adopted white luminance equals one-half of white-balanced camera saturation (fixed)
- **Fixed flare subtraction**
  - 3% of 0.18 reflectance factor (relative to adopted white)
- **In perceptual intent:**
  - Non-proprietary fixed RIMM-ROMM color rendering tone curve applied to RGB components in perceptual intent
  - Matrix to XYZ
  - Offset to PRM black
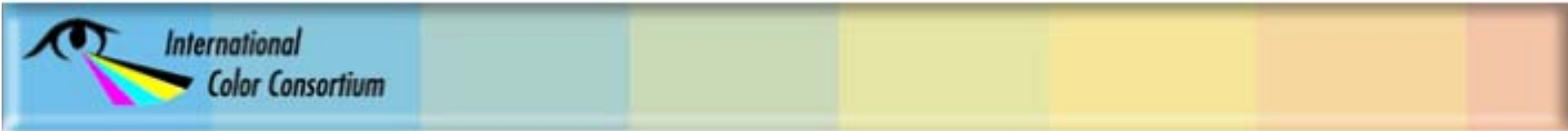
Media relative colorimetric intent

- **lutAtoB type**
  - Mcurves - 3x3matrix - Bcurves
  - XYZ PCS
- **Acurves perform white balancing and remove flare**

```
red curve 0    0     green curve 0     0    blue curve 0     0
        0.0013 0              0.0027 0              0.0019 0
        0.4754 1         1    1              0.6970 1
        1    1                              1    1
```

- **Matrix converts from white balanced and flare subtracted camera RGB values to D50 XYZ PCS values**
  - Determined using measured spectral sensitivities and ISO 17321-1 in-situ natural object spectral radiances (Table D.1), minimizing CIECAM'02 JMh error

```
0.6219, 0.3873, -0.045
0.2179, 0.9814, -0.1993
0.0152, -0.1553, 0.965
(actual matrix and offsets scaled by 32768/65535 for XYZ PCS)
```

- **Bcurves identity**

ICC-absolute colorimetric intent

- **mediaWhitePointTag**

  X = 1.92760586, Y = 1.99917637, Z = 1.64912059

- **viewingConditionsTag**

  illuminant XYZ = 4821, 5000, 4124.5

  surround XYZ = 964.2, 1000, 824.9

  illuminant type - 00000001h (D50)

Perceptual rendering intent

- **lutAtoB type**
  - — Acurves - 2x2x2LUT - Mcurves - 3x4matrix - Bcurves
- **Acurves perform white balancing and remove flare (same as MRC)**
- **2x2x2LUT converts from camera RGB to linear RIMM RGB**
- **Mcurves clip output of 2x2x2LUT to 0 to 1 (remove offset and overrange), and apply color rendering tone curve**
- **Matrix converts to XYZ and offsets scale black point to PRM**

  ```
  Matrix:
  0.797636, 0.135178, 0.031336
  0.288021, 0.711854, 0.000103
  0,        0,        0.824878
  Offsets:
  0.003349, 0.003473, 0.002865
  (actual matrix and offsets scaled by 32768/65535 for XYZ PCS)
  ```
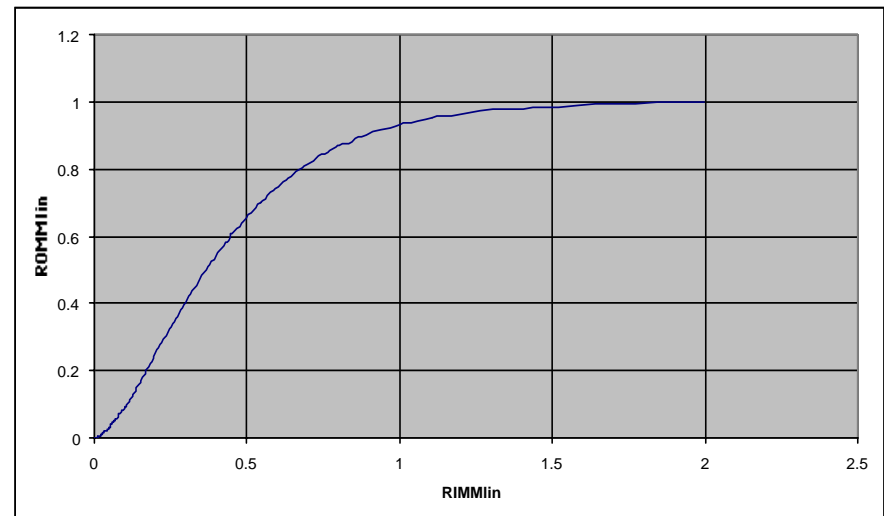- **Bcurves identity**

Preparation of files

- **Camera raw (.NEF) files saved on capture**
- **Converted to linear demosaiced (but not white balanced) camera RGB using Adobe DNG converter**
  - —No color loss
- **Camera RGB image moved to TIFF/EP IFD0 using custom software**
  - —so Photoshop will read
- **Camera RGB image opened in Photoshop and profile is assigned**
  - —Typically see camera saturation (media) relative scene colorimetry in working space
- **Use "convert to profile" or "proof setup" to see what results from different rendering intents**

Use of rendering intents

- **Media relative colorimetric intent puts estimated scene colorimetry relative to camera saturation (after white balancing, if any) in PCS**
  - Useful when photographer wants to bring full captured range into working space for manual color rendering
- **ICC-absolute colorimetric intent puts estimated scene colorimetry relative to scene adopted white in PCS**
  - Maps chromatically adapted scene colorimetry to output medium
  - Useful for "copy work"
- **Perceptual intent puts output-referred colorimetry color rendered to PRM in PCS**
  - Useful for general output-referred ICC profiles
- **Demo**

Profile association and identification

- **Profiles will be image specific**
  - At a minimum, scene illumination specific
  - Most likely with varying headroom (media white point tag Y value), depending on camera exposure
  - Possibly with scene-specific color rendering (typically proprietary)
  - Need to be sure the correct profile is embedded, and remains embedded

- **It would be helpful to have some way to identify the profile as producing scene-referred colorimetry in the PCS (using the colorimetric intents).**
  - A new tag could indicate image state, for example:
    - Un-rendered film scan, digital camera, or computer generated
    - Unaltered scene colorimetry estimates, processed to scene appearance estimates (e.g. RIMM RGB), or edited scene colorimetry