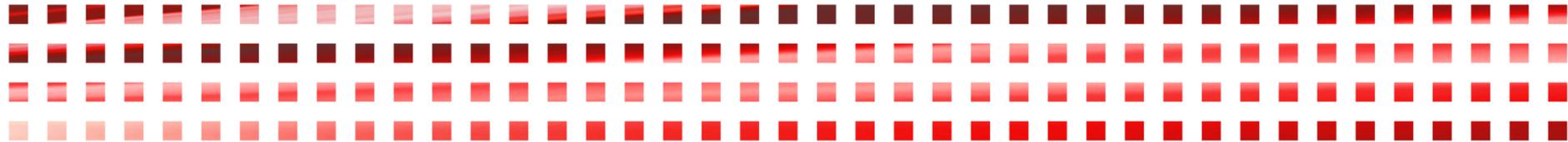




# Color calibration and ICC profiles

4th Workshop AIDPATH project

Gert Van Hoey



## Overview

- Terminology
- Color management with ICC profiles
- Validation

# Terminology

## ■ Calibration

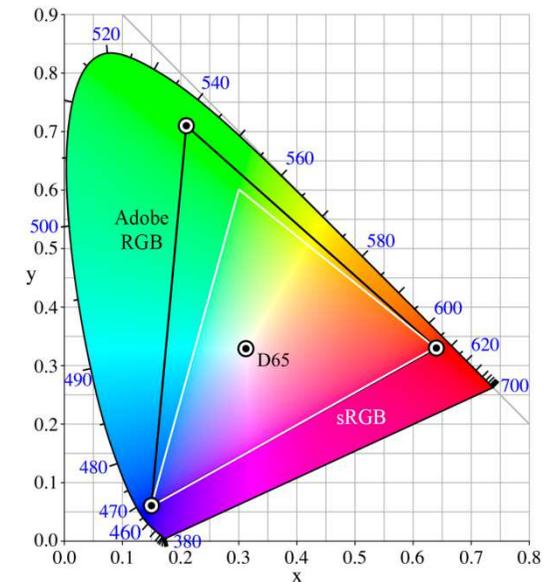
- adjusting a device's behavior to meet a certain "target"
  - e.g. target = white luminance 350 cd/m<sup>2</sup>, white point D65, tonal response curve gamma 2.2
- how ? change internal settings in device → changes behavior of device
- goal: consistency over time, consistency between devices

## ■ Characterization (profiling)

- describe how a device responds to or reproduces color
- does not change behavior of device

# Terminology

- Gamut
  - set of colors recorded or reproduced by a device
- Color management
  - take into account color capabilities of all devices and applications in the chain



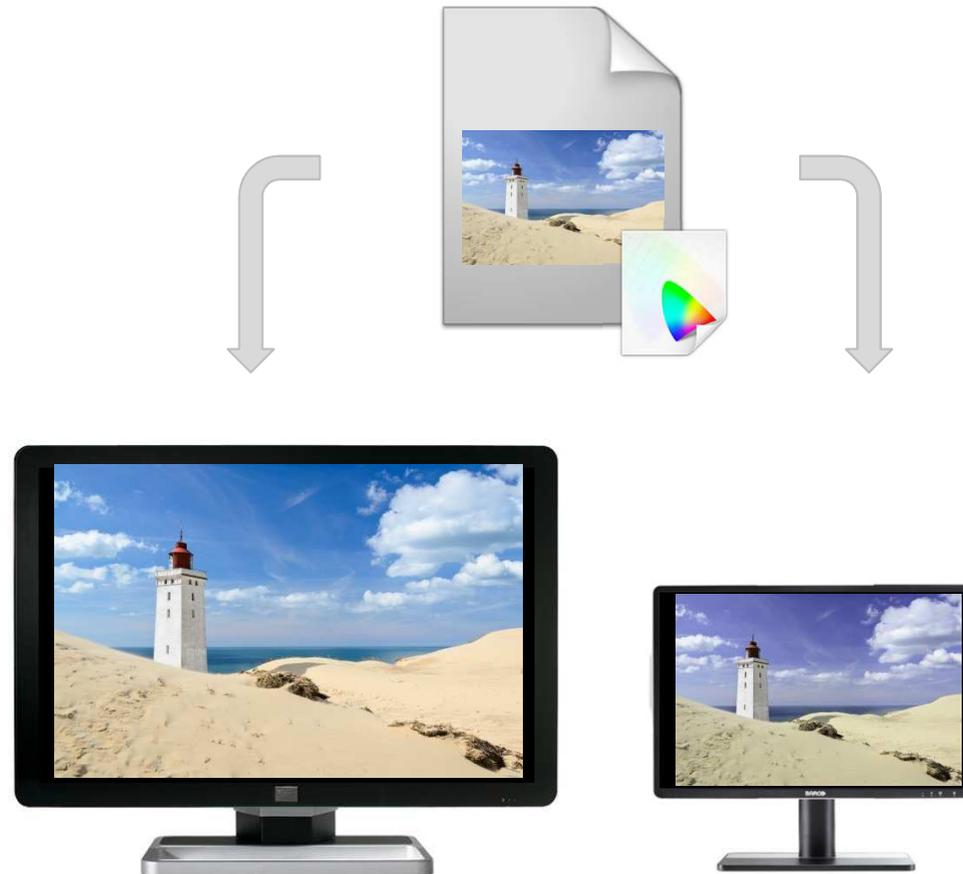
## Different input devices



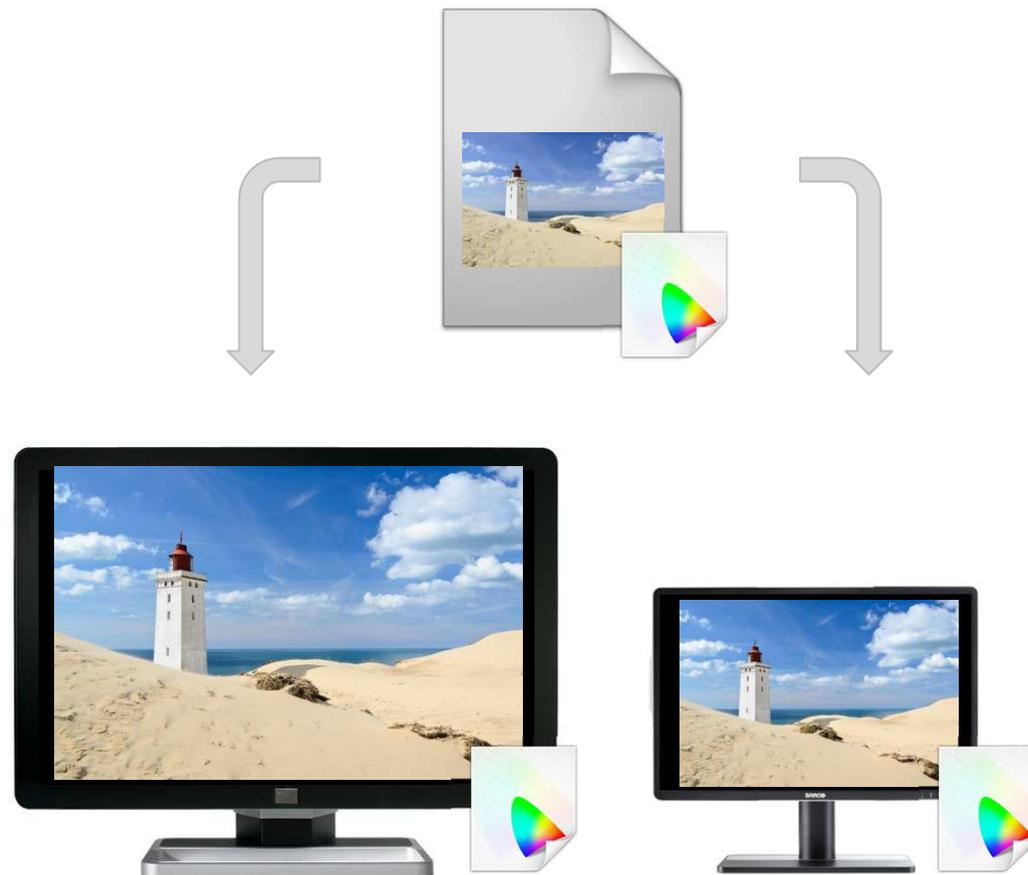
## Different input devices



## Different output devices

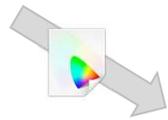


## Different output devices

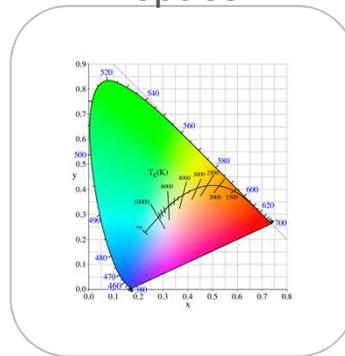


# Color management

Input devices



Profile connection space

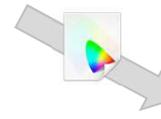


Device-independent

XYZ or L\*a\*b\*

Unambiguous definition of colors

Output devices



## Color management systems (CMS)

- Color management system/module (CMS/CMM)
  - uses source profile and destination profile
  - Calculates transformation from source space to destination space
- Commonly used CMS'es
  - ICM and WCS in Windows
  - ColorSync on Mac OS X
  - Adobe Color Engine
  - Little CMS

# ICC profile

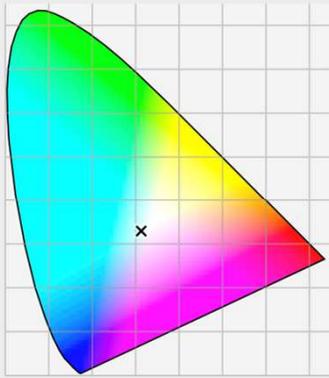
Barco Coronis Color Fusion 6MP DL MDCC-6230 D65 G2.2.icc

#	Tag	Data	Size	Description
Header			128	
1	'desc'	'desc'	143	Localized description strings
2	'cprt'	'text'	41	Copyright ASCII Text String
3	'wtpt'	'XYZ '	20	Media white-point tristimulus
4	'rXYZ'	'XYZ '	20	Red colorant tristimulus
5	'gXYZ'	'XYZ '	20	Green colorant tristimulus
6	'bXYZ'	'XYZ '	20	Blue colorant tristimulus
7	'rTRC'	'curv'	14	Red tone response curve
8	'bTRC'	'curv'	14	Blue tone response curve
9	'gTRC'	'curv'	14	Green tone response curve
10	'chad'	'sf32'	44	Chromatic adaptation matrix

Size: 580 bytes  
 Preferred CMM: Apple  
 Specification Version: 2.0.0  
 Class: Display  
 Space: RGB  
 PCS: XYZ  
 Created: 17/08/12 15:53  
 Platform: Apple  
 Flags: Normal Quality  
 Device Manufacturer: 'BRCO'  
 Device Model: ' '  
 Device Attributes: 00000000 00000000  
 Rendering Intent: Perceptual  
 PCS Illuminant: 0,96420, 1,00000, 0,82491  
 Creator: 'BRCO'  
 MD5 Signature:

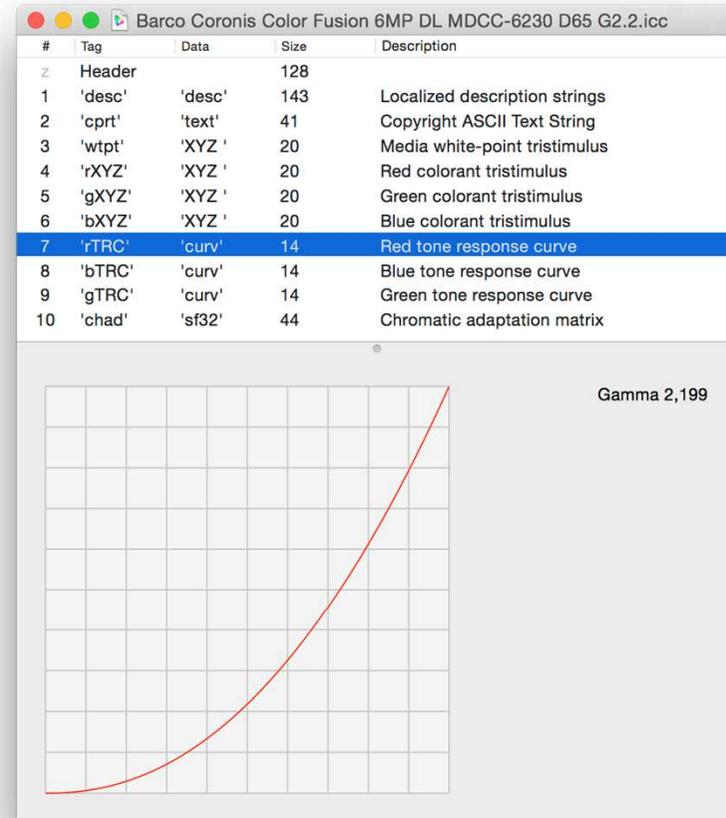
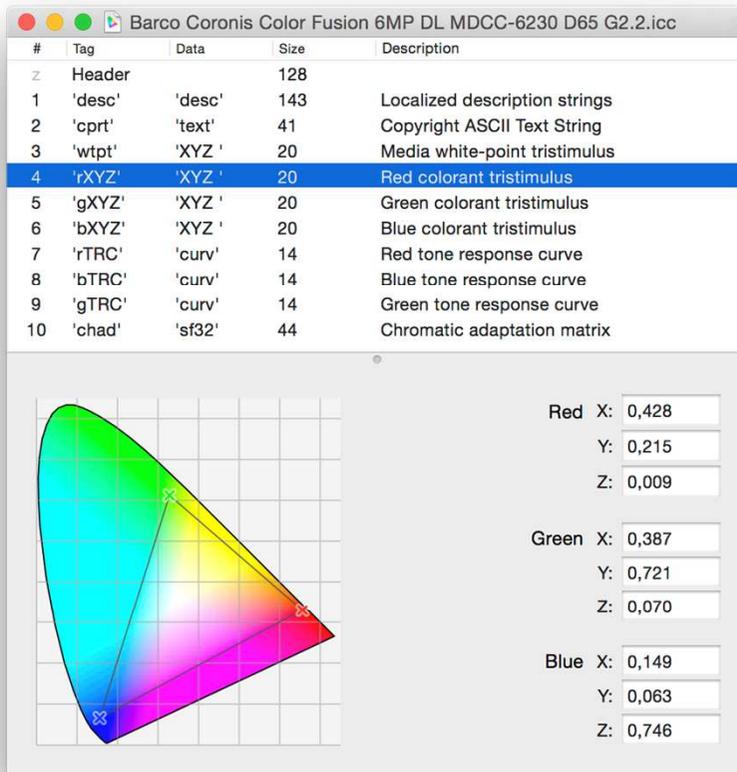
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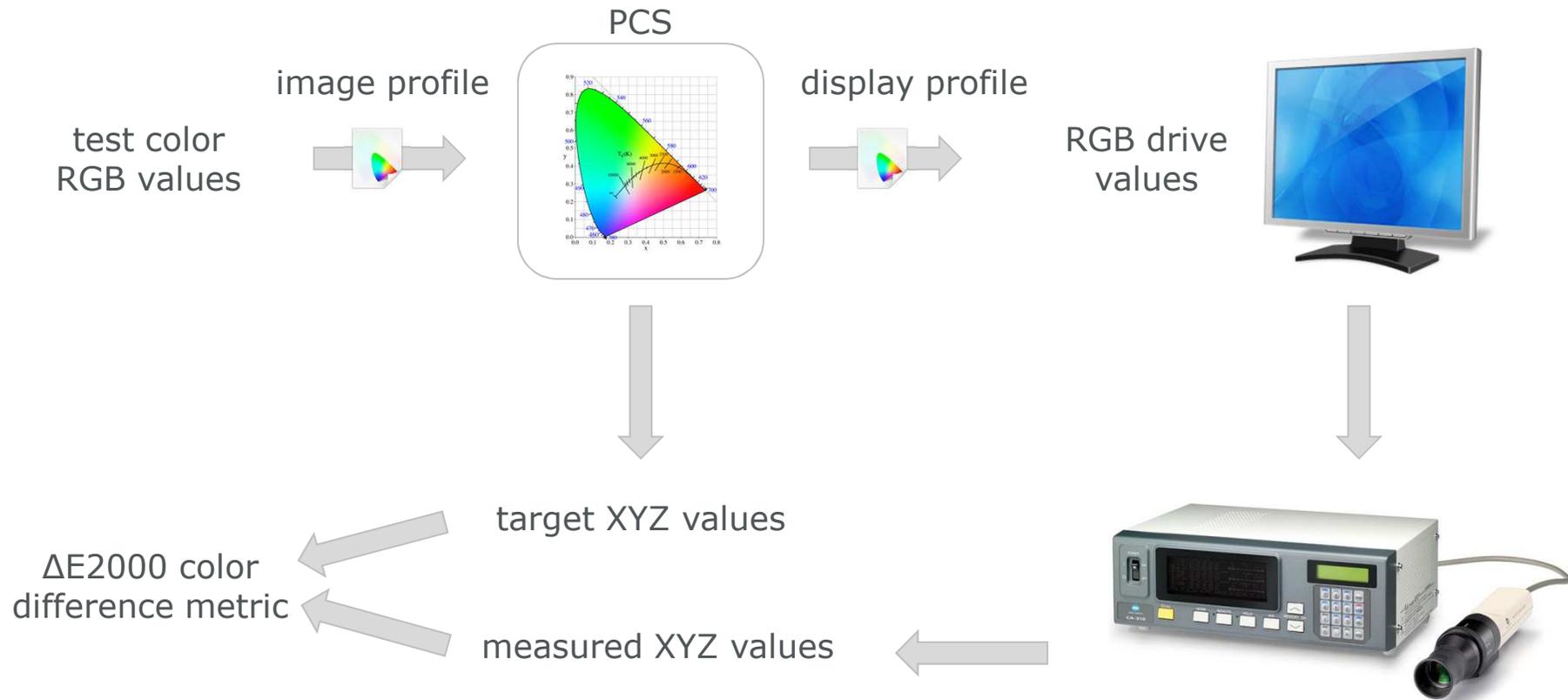


White X: 0,950  
 Y: 1,000  
 Z: 1,087

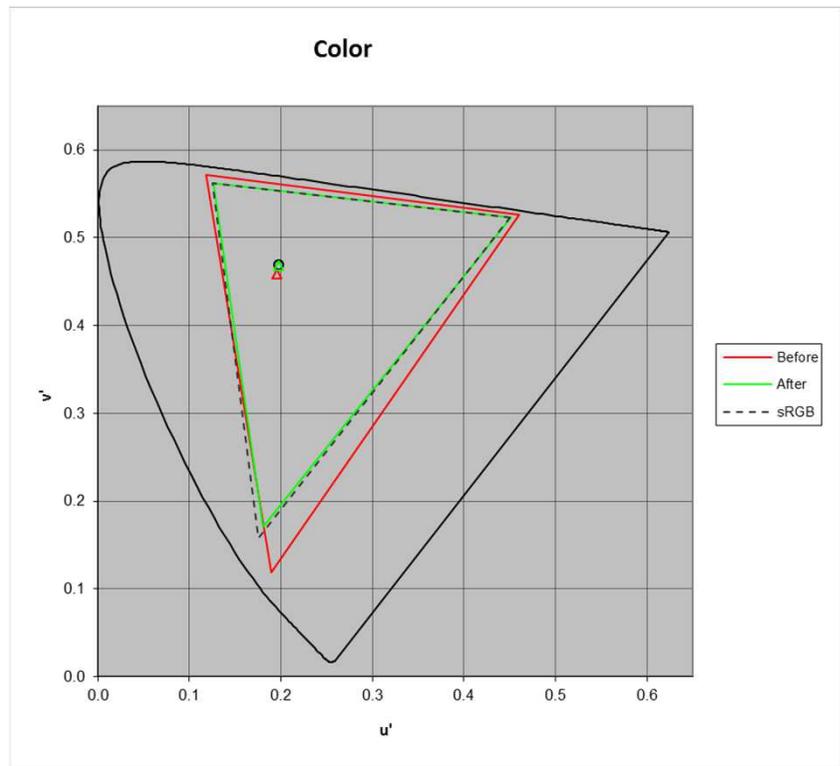
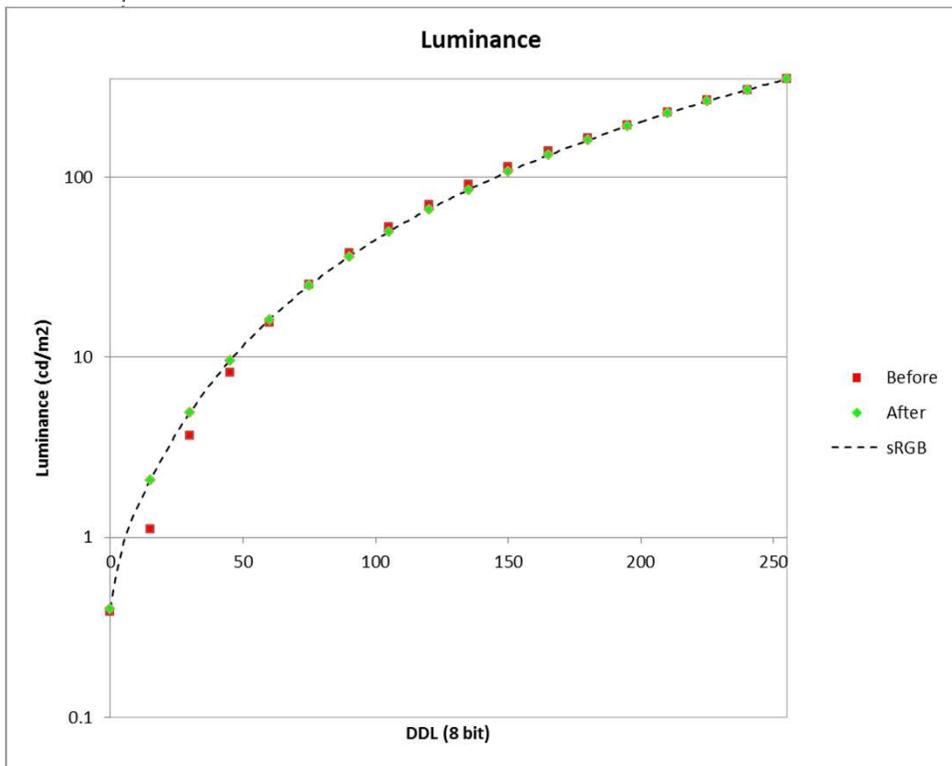
# ICC profile



# Validation



# Validation

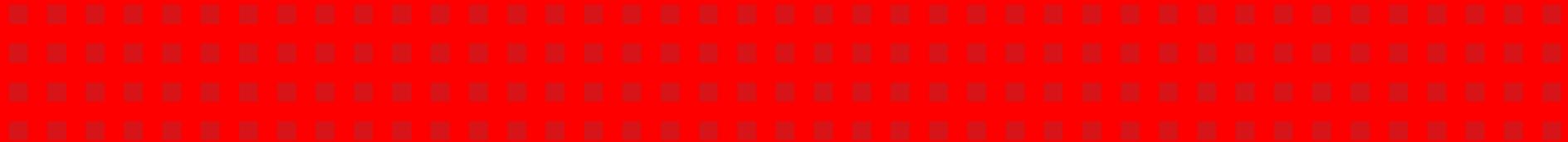


	Average $\Delta E_{2000}$	Maximum $\Delta E_{2000}$
Uncalibrated, not color-managed	2.75	6.88
Calibrated, color-managed	0.38	1.55



## Summary

- Consistent color requires color management in the entire chain
  - calibration and profiling at acquisition side
  - calibration and profiling at reproduction side
  - appropriate color handling in applications (CMS)
- Display calibration and profiling can reduce color differences below the visibility threshold



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