

# Gernot Hoffmann

## Gamuts and Spectra



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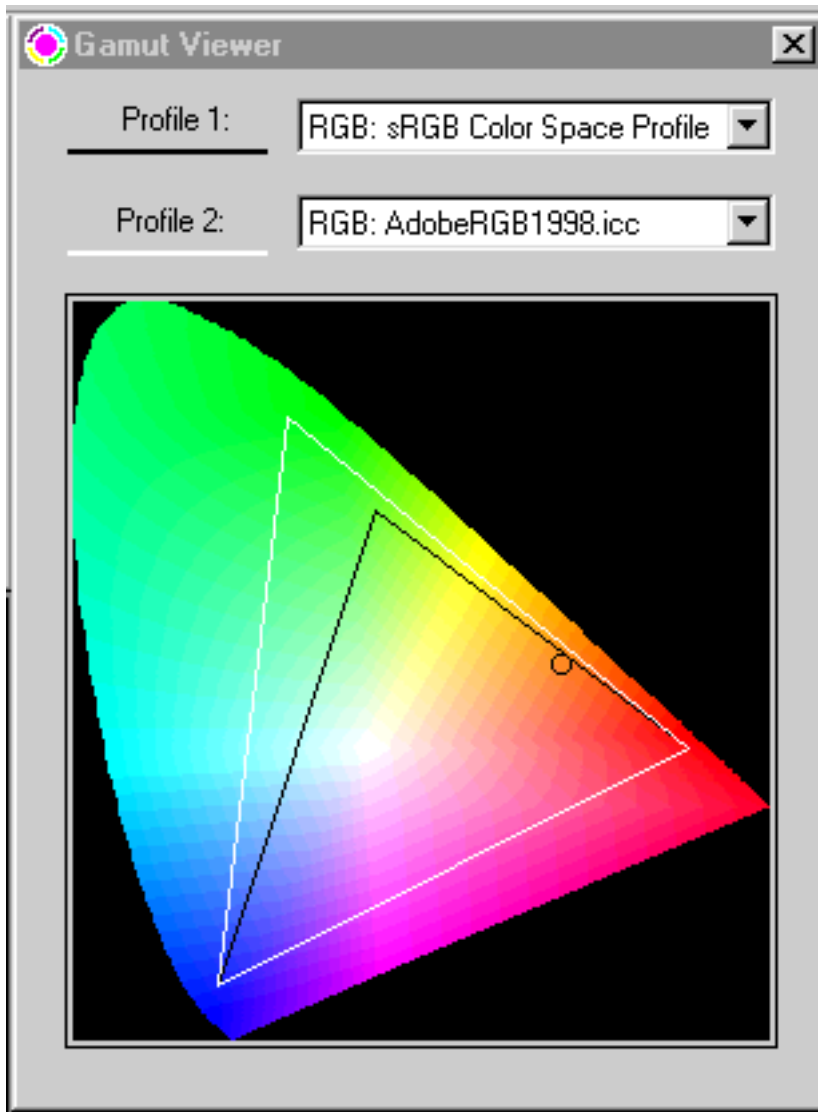
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#### Settings for Acrobat

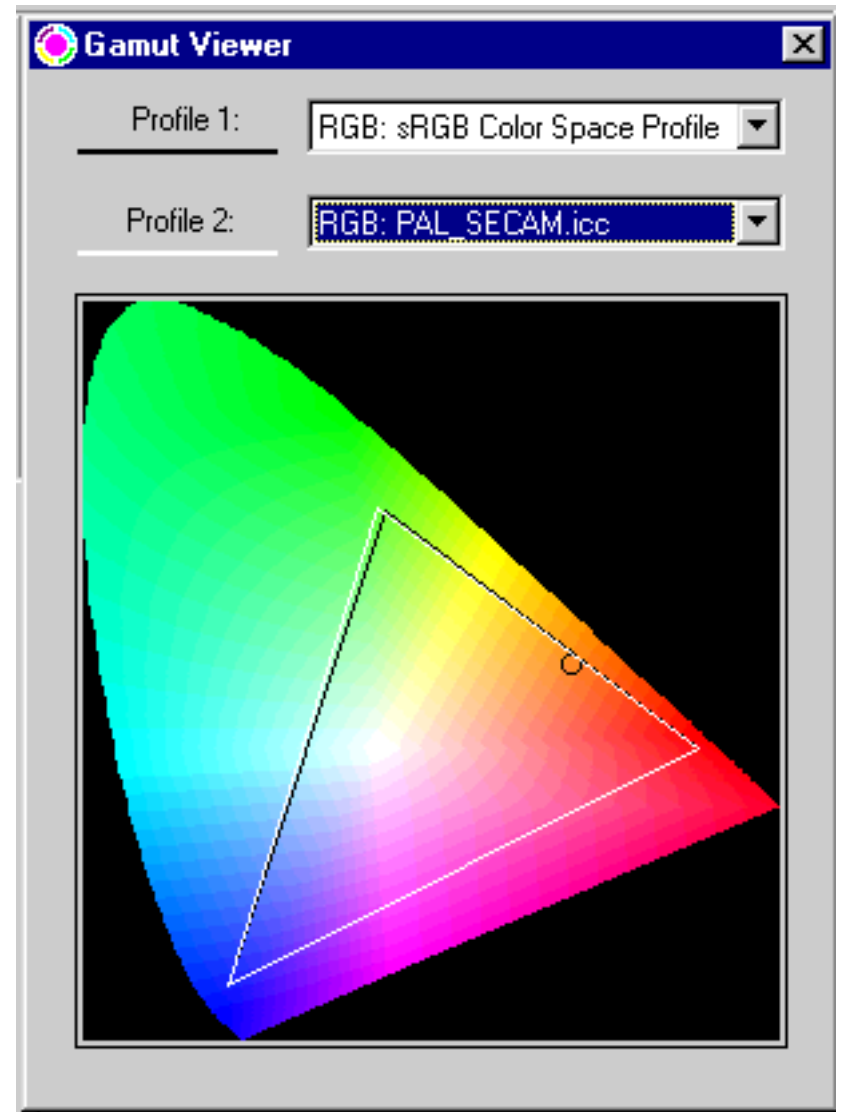
Edit / Preferences / General / Page Display (since version 6)  
Custom Resolution 72 dpi **and use zoom 100% for screenshots**

Edit / Preferences / General / Color Management (full version)  
sRGB  
EuroscaleCoated or ISOCoated or SWOP  
GrayGamma 2.2

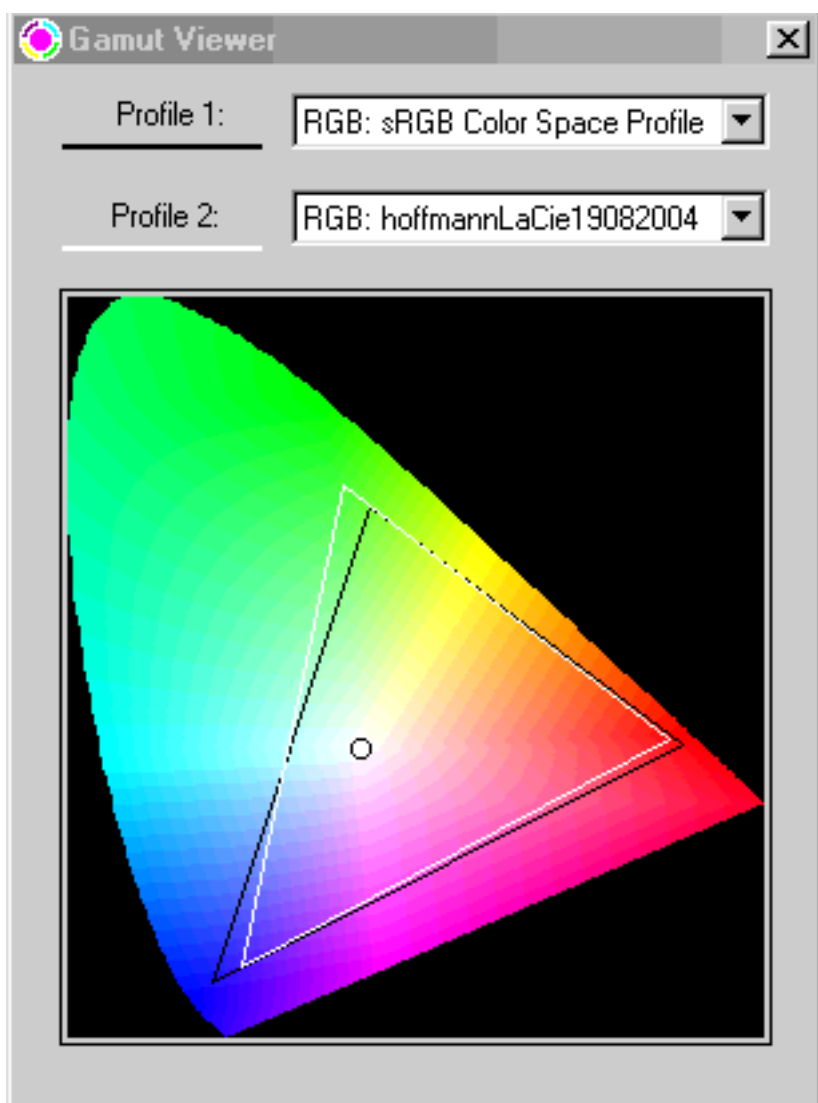
# 1. Monitor and Working Space Gamuts



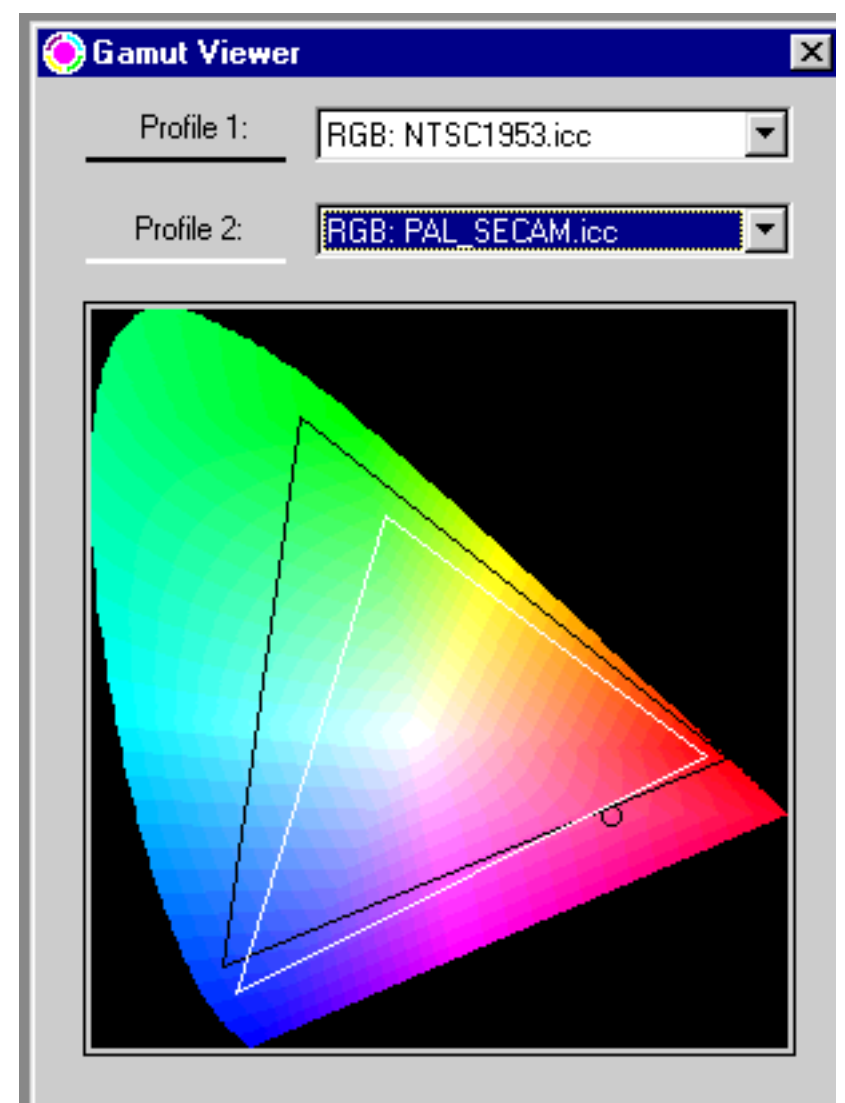
sRGB and Adobe RGB (98)



sRGB and PAL/Secam



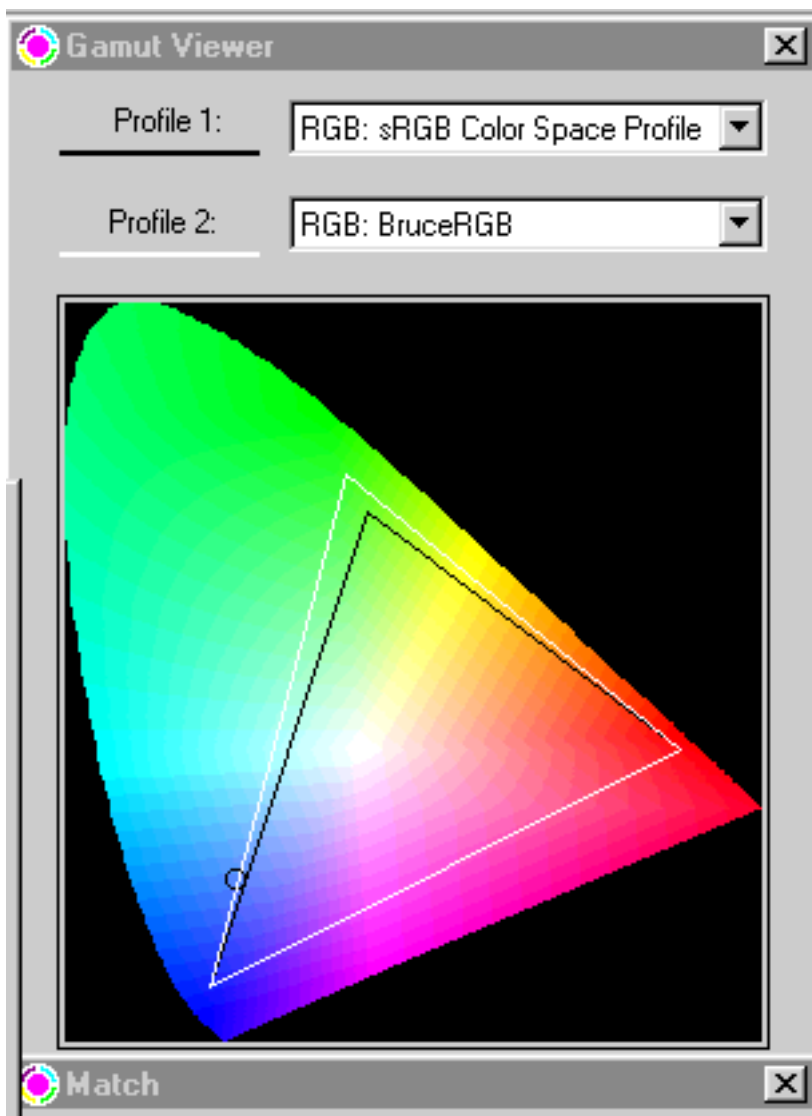
sRGB and monitor LaCie



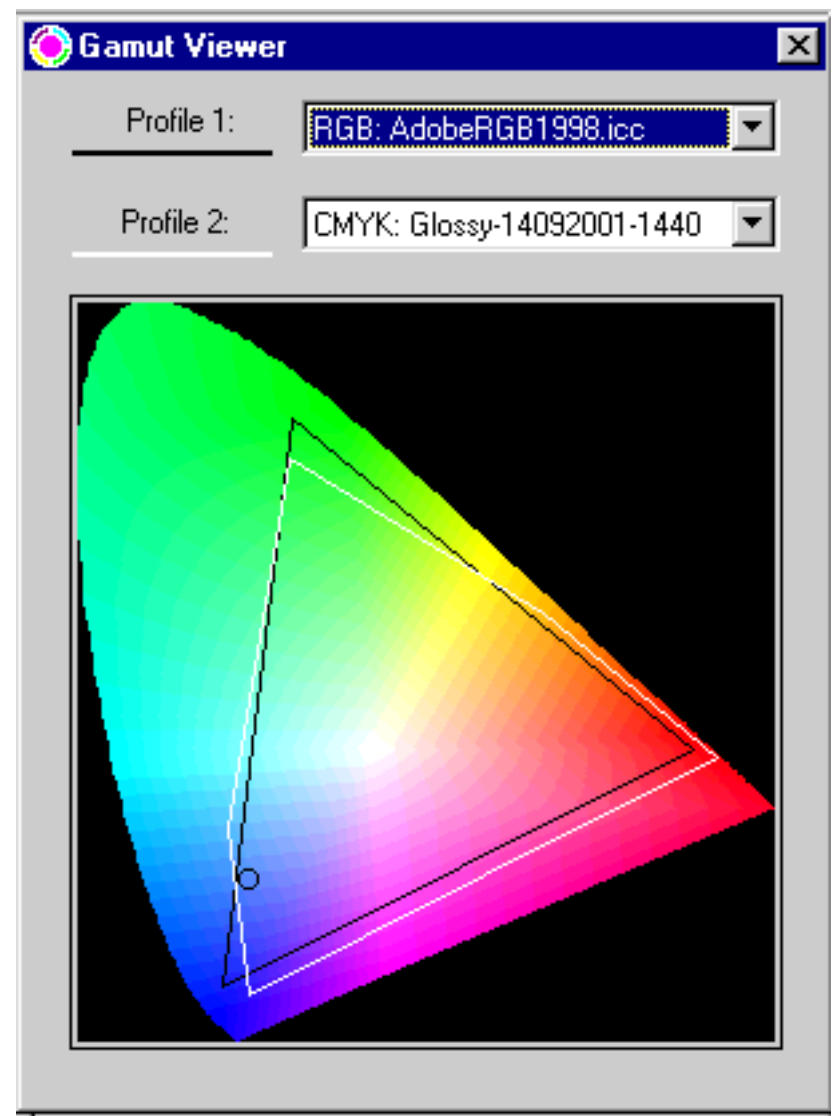
NTSC and PAL/Secam

Banded because of ZIP(4) compression for small file size

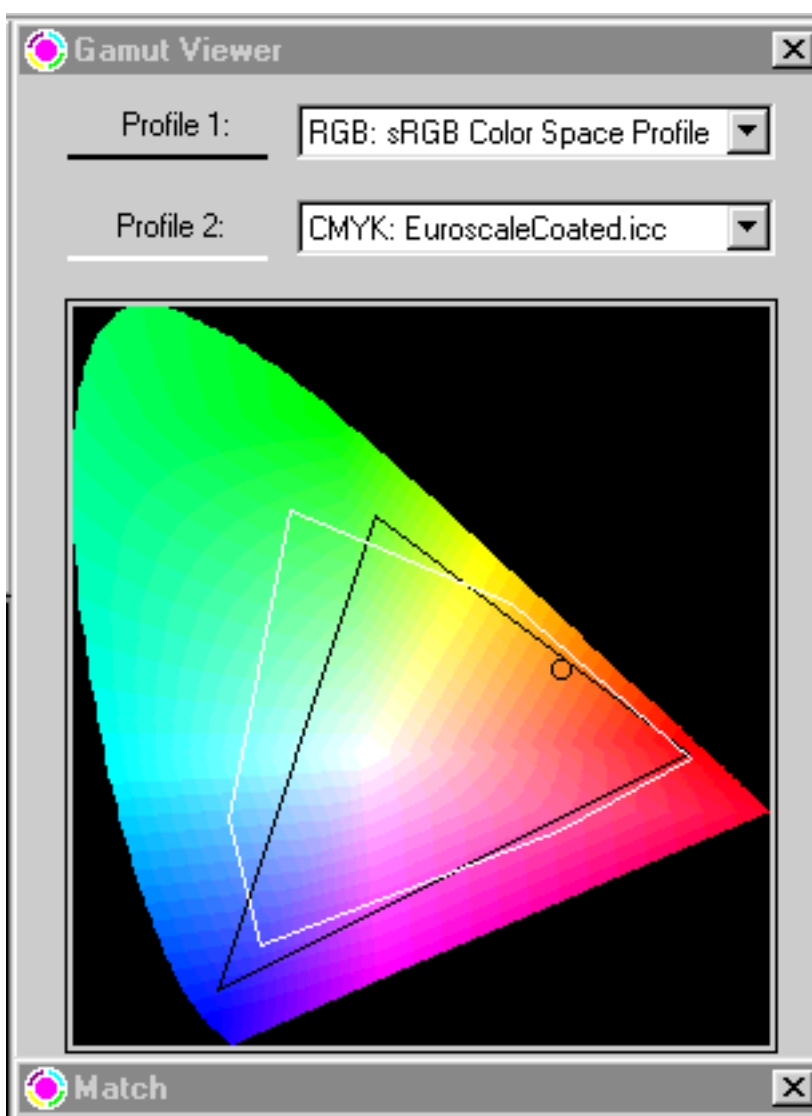
## 2. Printer Gamuts



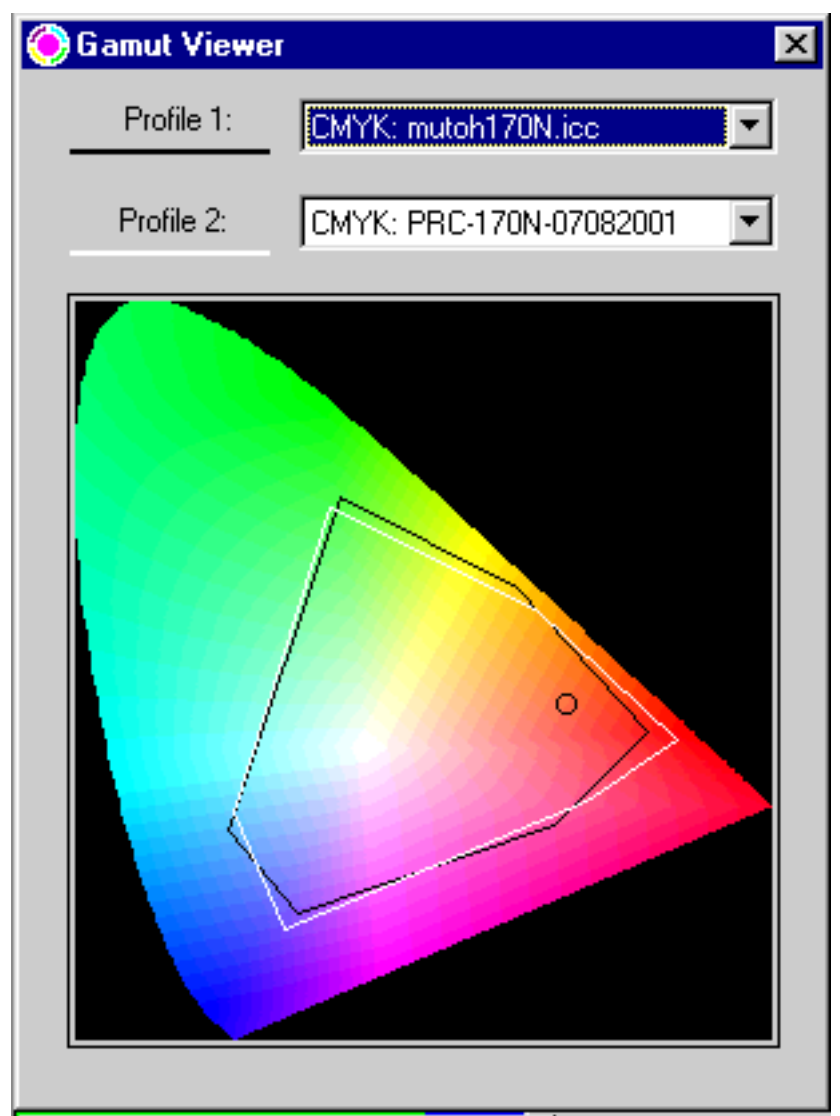
sRGB and Bruce RGB  
(working spaces)



Adobe RGB (98) and  
Mutoh 6100 Glossy, Dye



sRGB and EuroScaleCoated



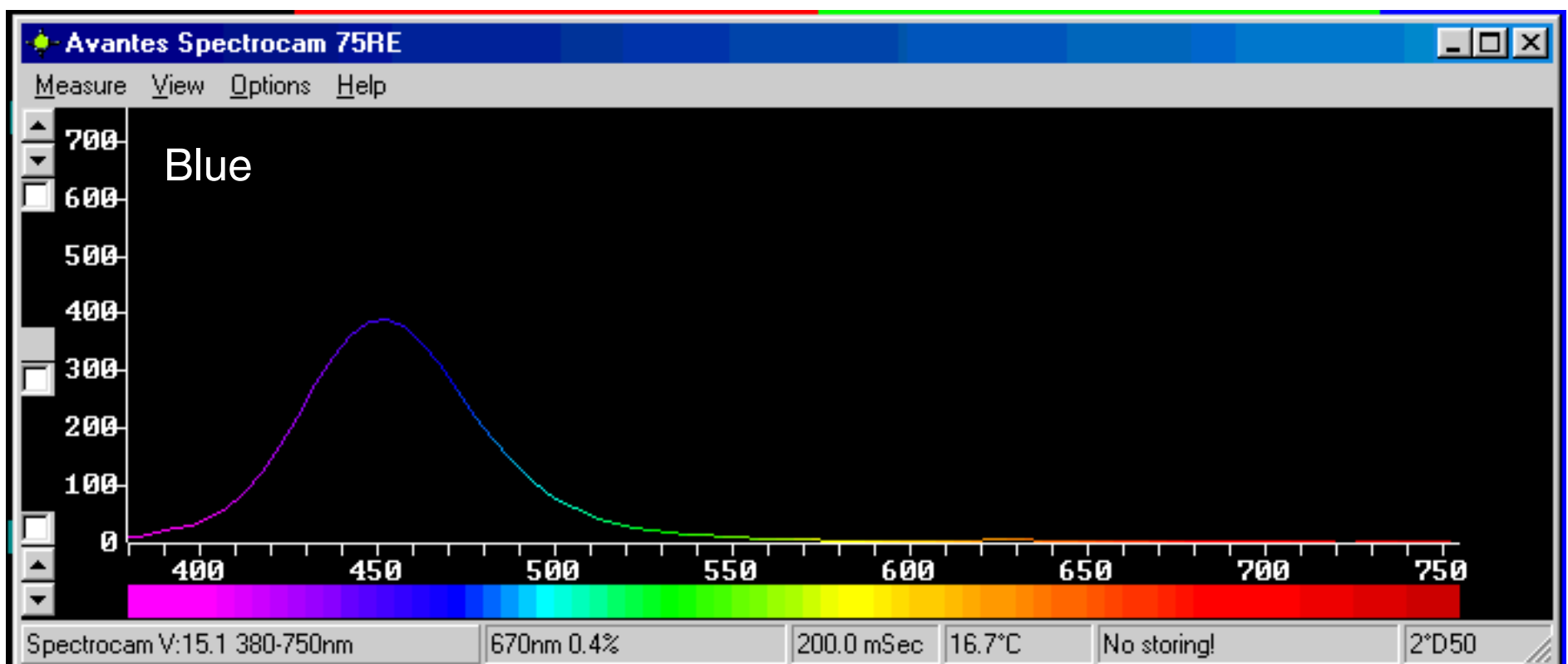
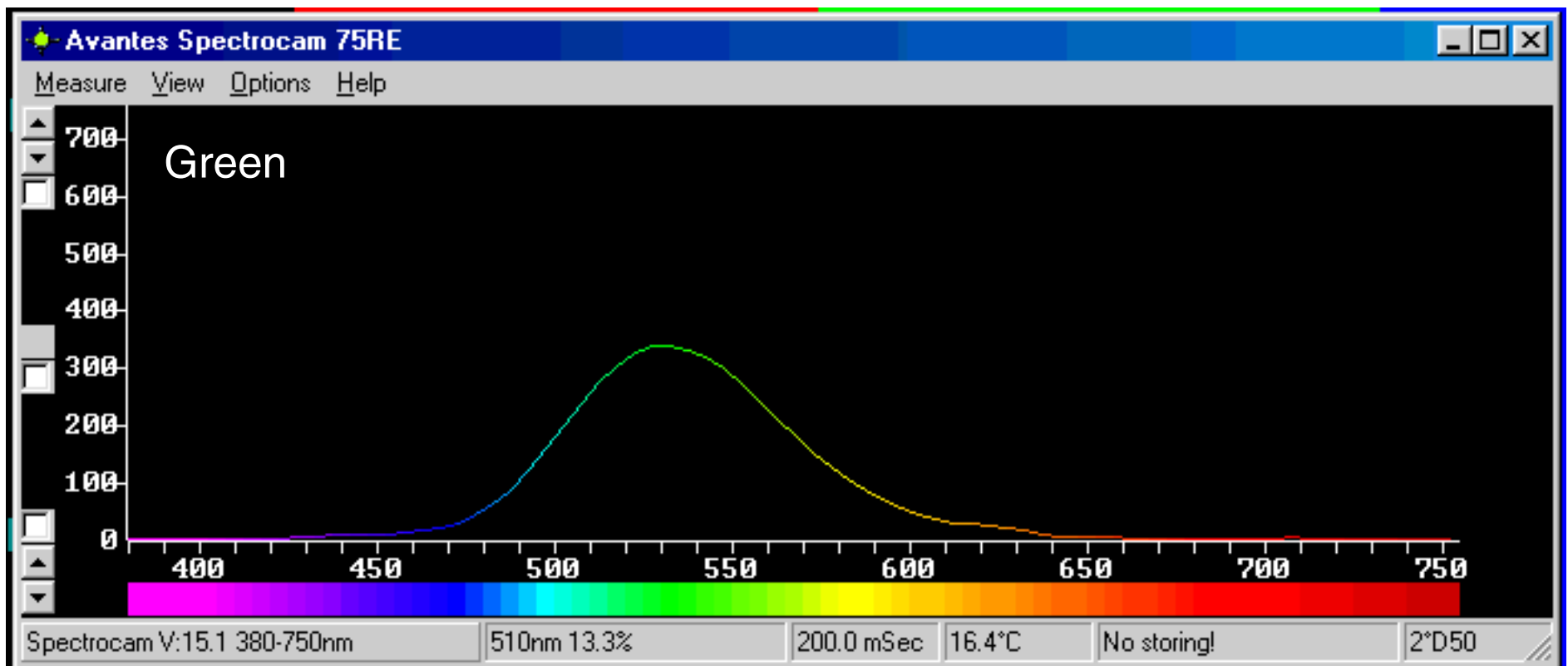
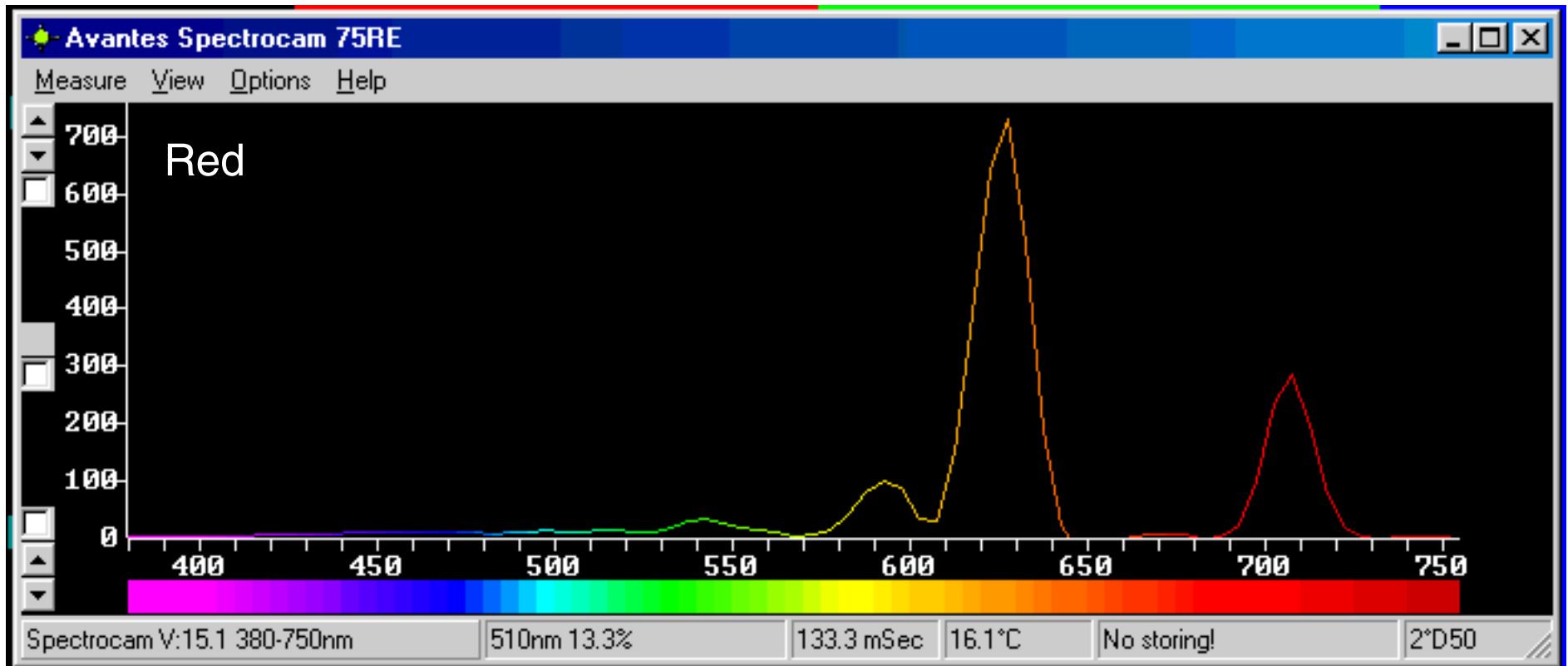
Mutoh 6100 Matt Paper  
Pigment (1), Dye (2)

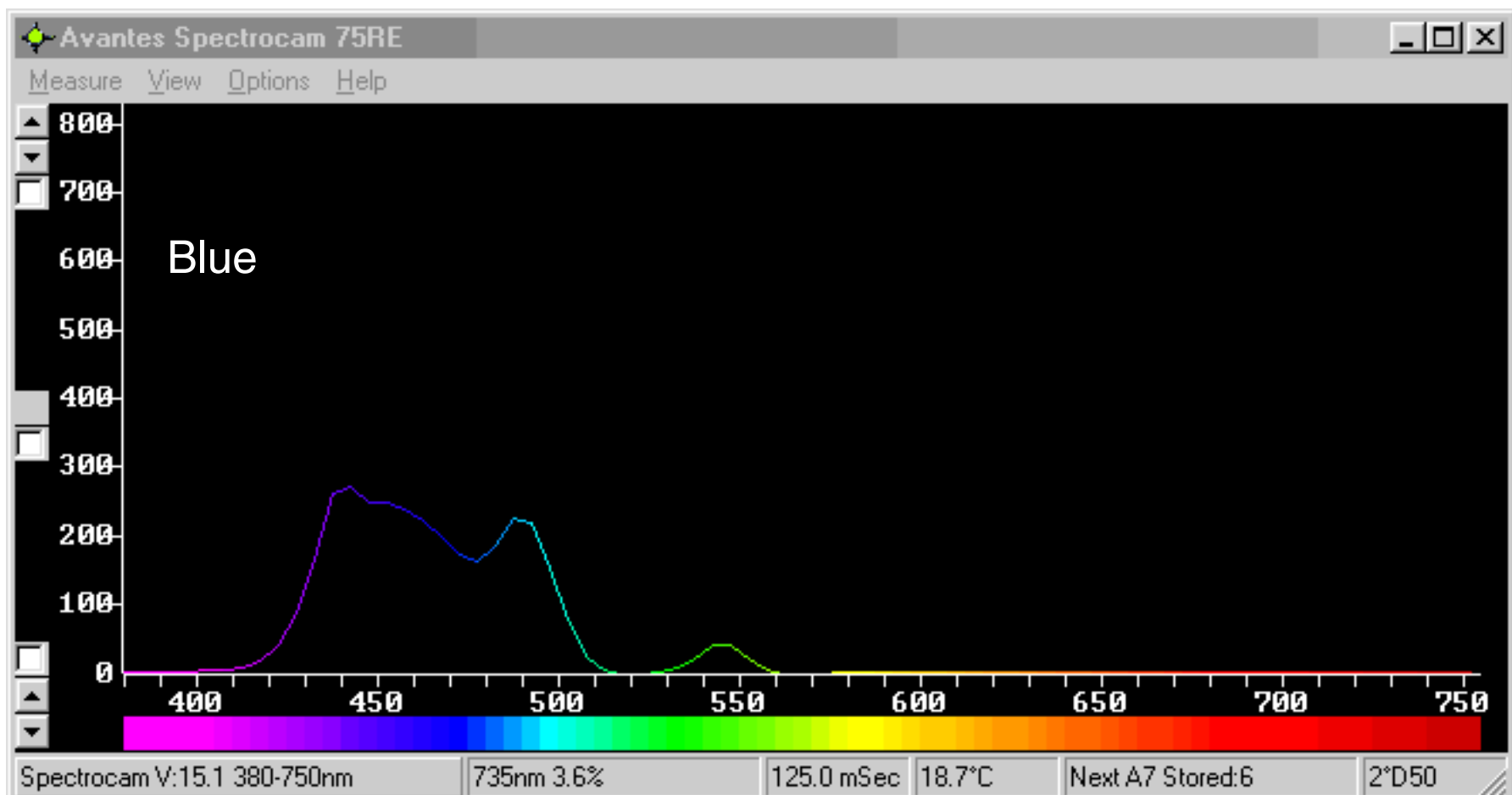
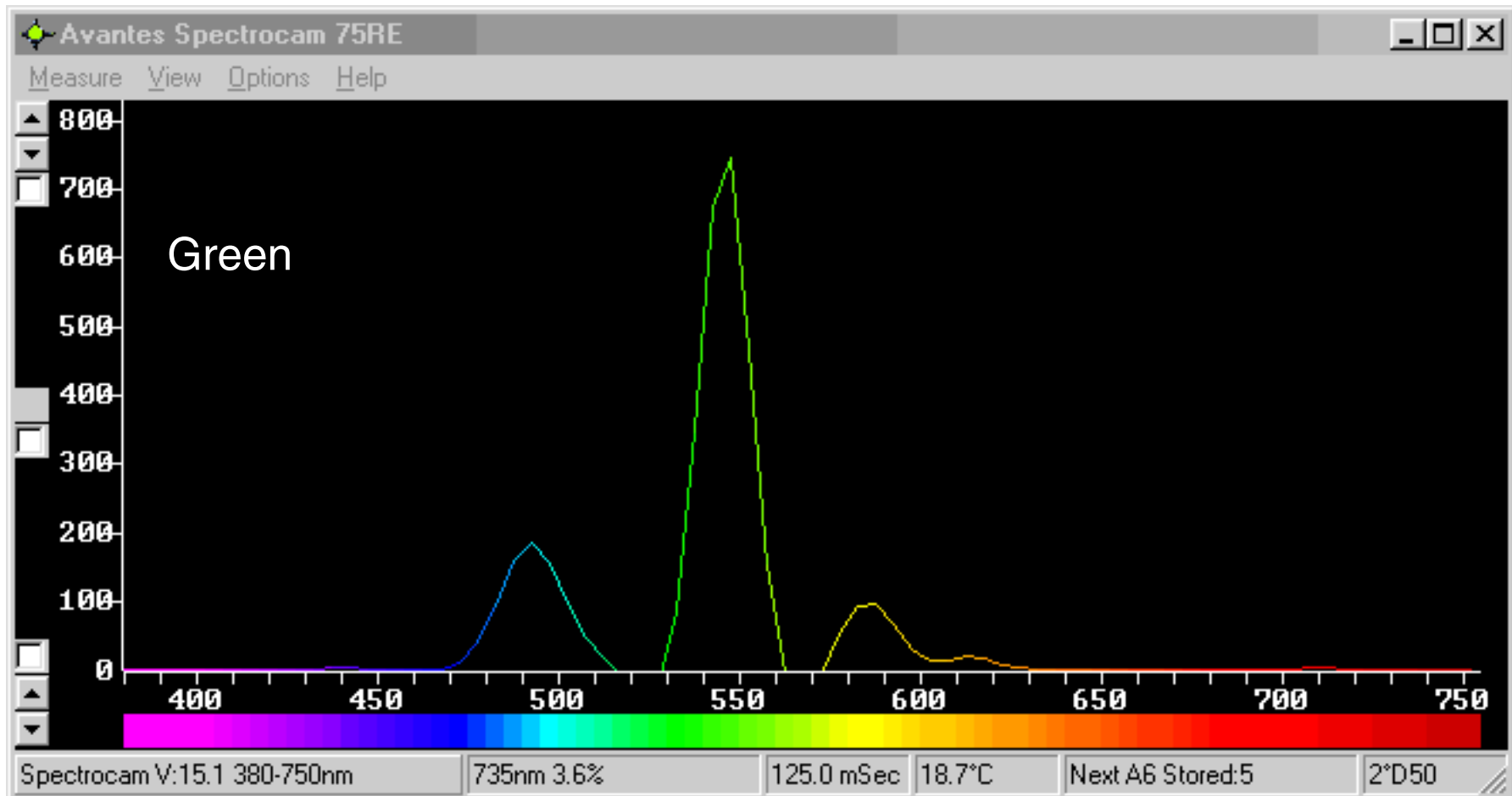
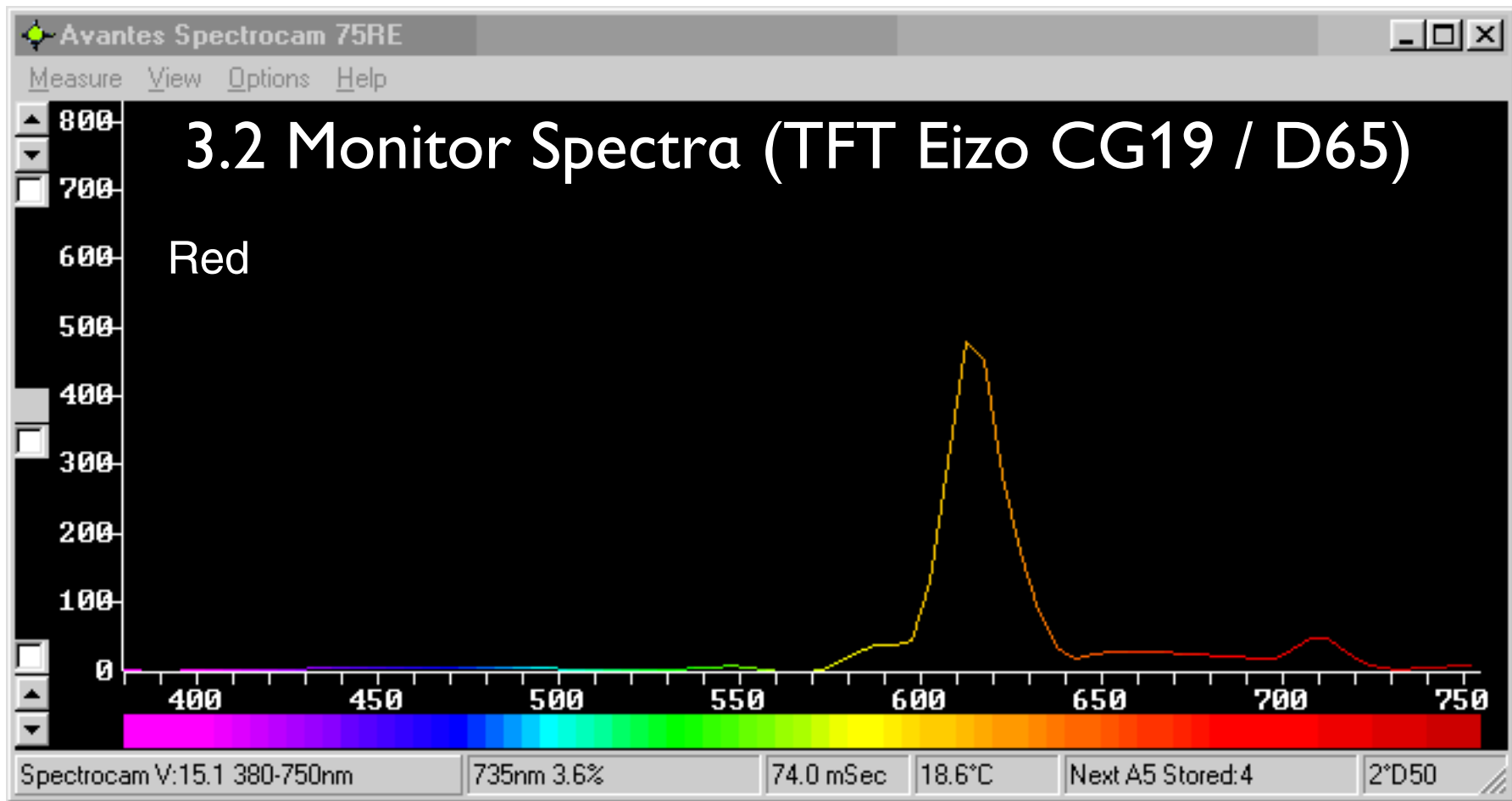
Banded because of ZIP(4) compression for small file size

### 3.1 Monitor Spectra (CRT LaCie / D65)

Spectra measured by Avantes Spectrocam

Optical resolution 5nm (75 bands) / Bandwidth 20nm / Spectral reporting 5nm interval

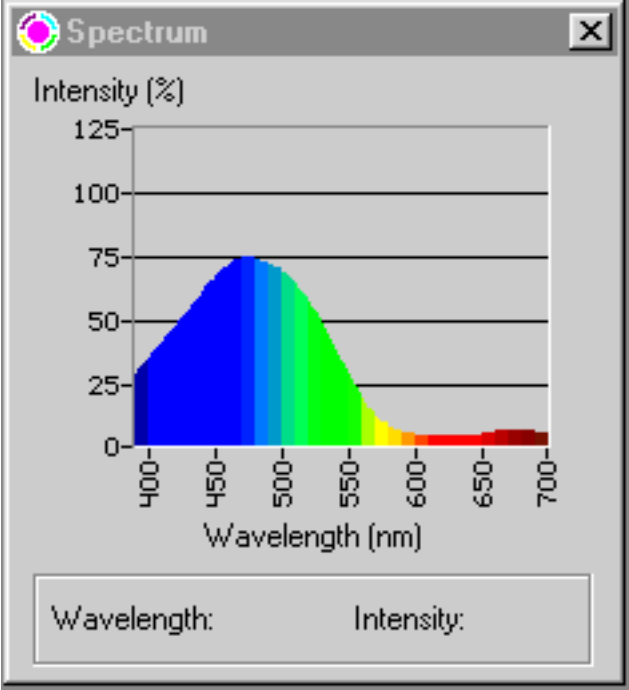




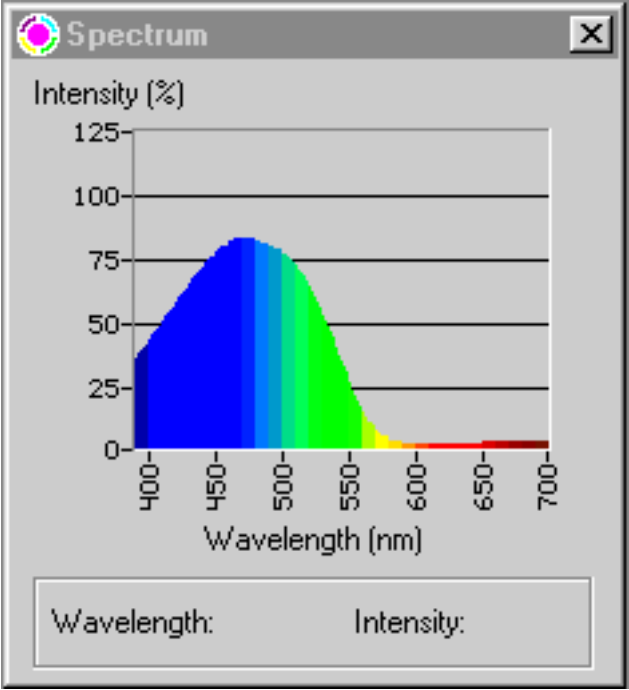
# 4. Spectra of Offset Inks and Pigment Inks

Measured in swatch book

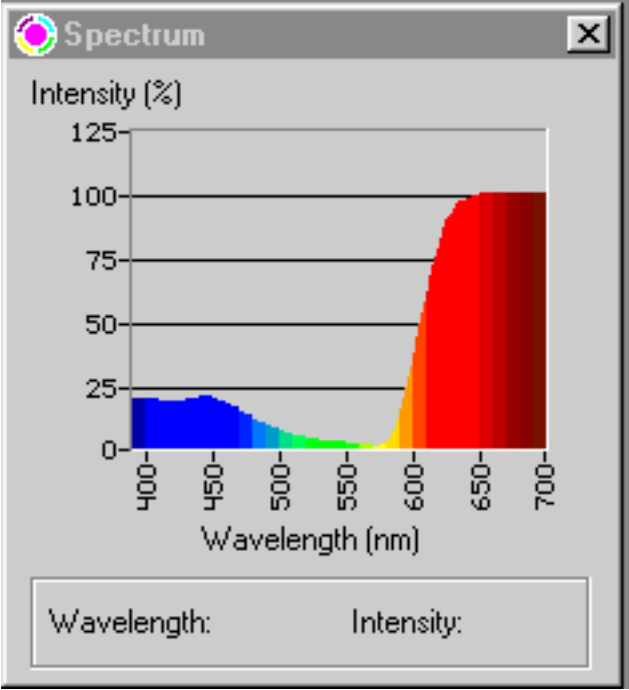
Measured on inkjet print



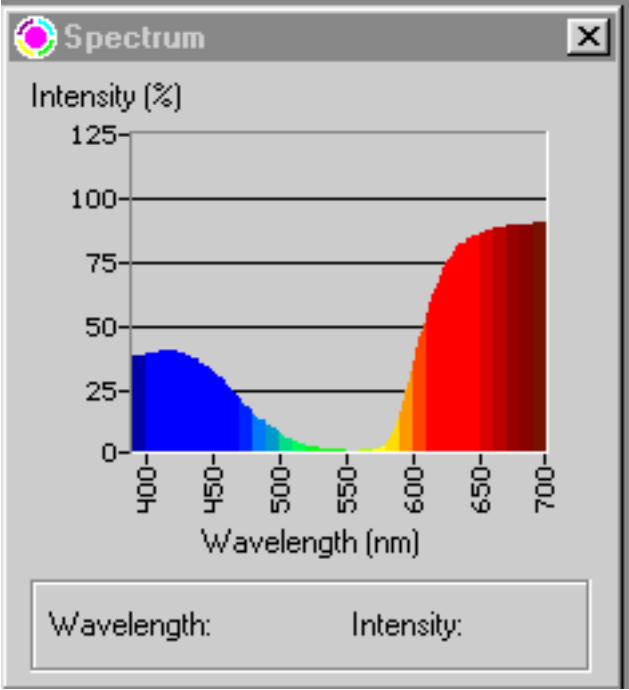
Pantone Process Cyan



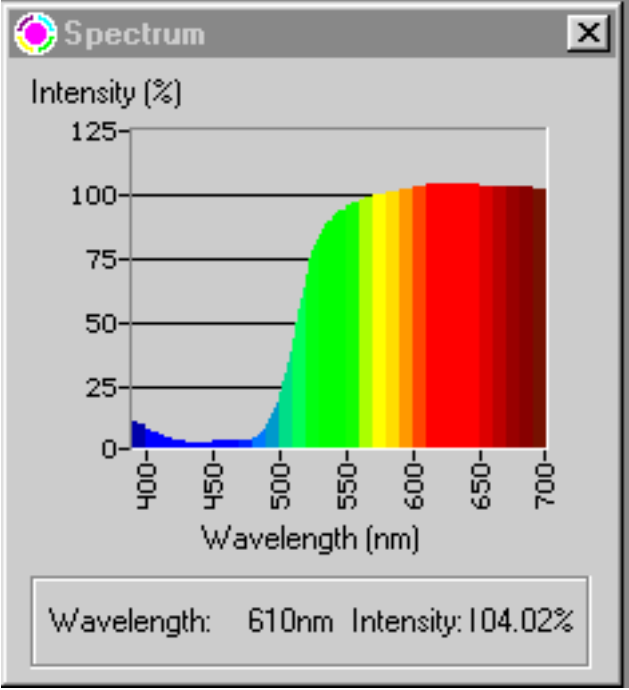
Mutoh Inkjet Cyan



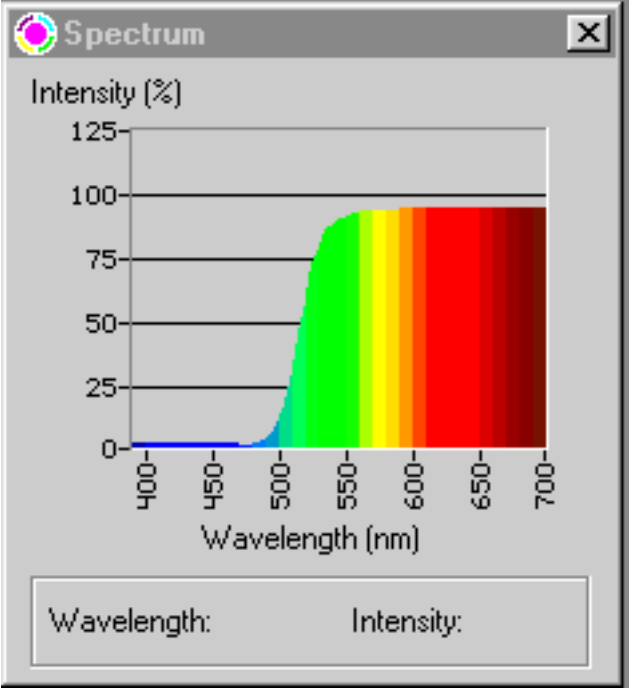
Pantone Process Magenta



Mutoh Inkjet Magenta



Pantone Process Yellow

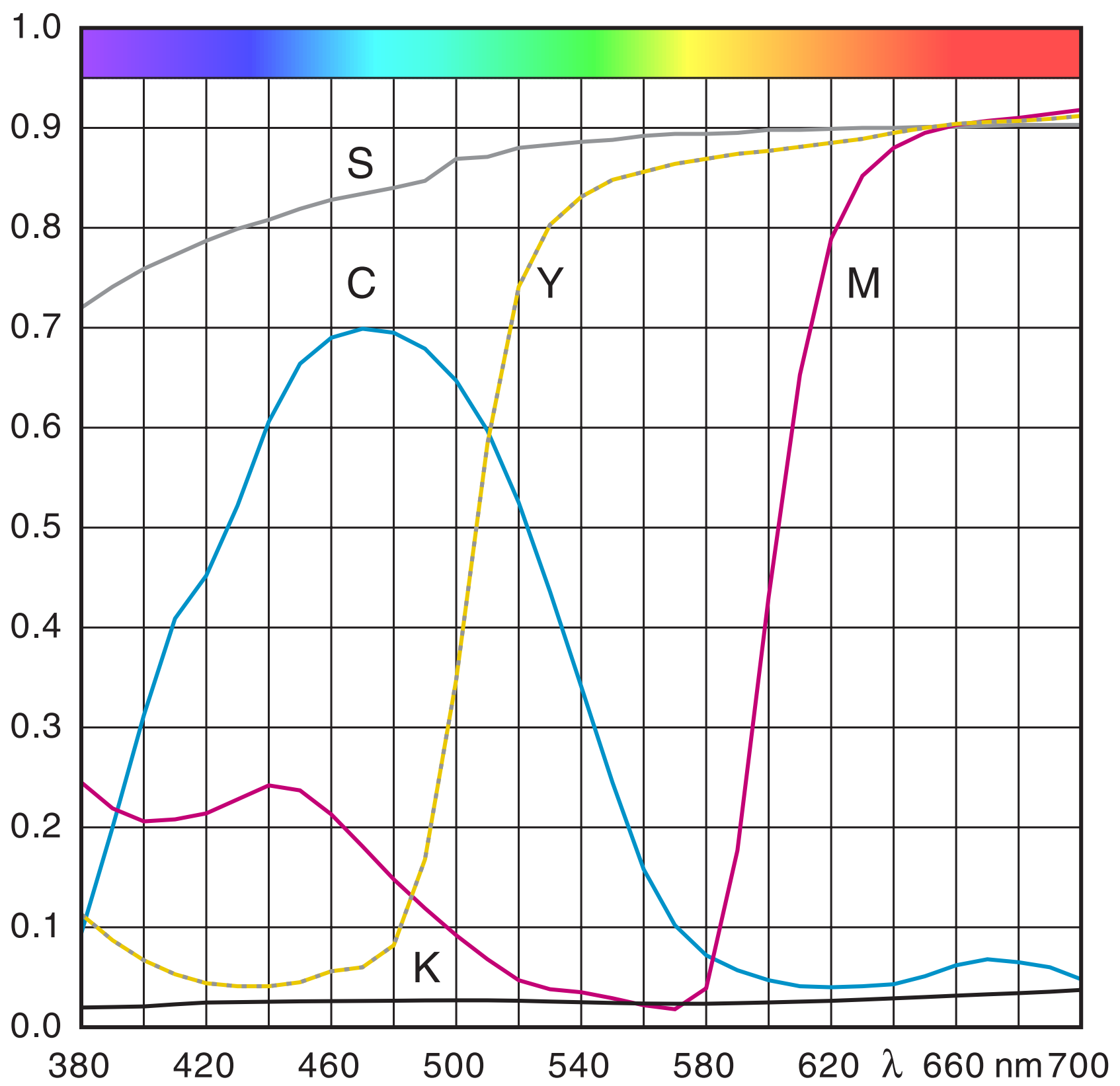


Mutoh Inkjet Yellow

# 5. Spectra of Offset Inks ISO 2846-1:1997(E)

Reflectance

S is the substrate



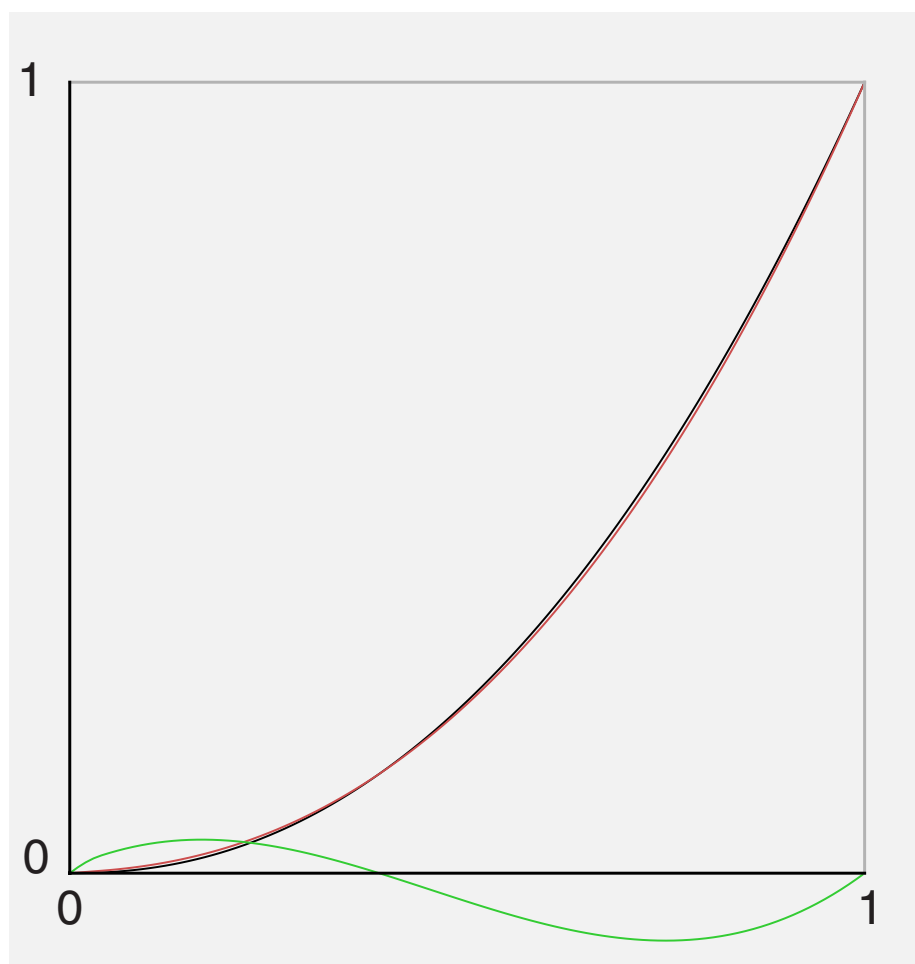
## 6. Tone Reproduction Curve for sRGB

sRGB is a standard color space, defined by companies, mainly Hewlett-Packard and Microsoft.

The transformation of RGB image data to CIE XYZ requires primarily a Gamma correction, which compensates an expected inverse Gamma correction, compared to linear light data.

For normalized values  $C = R, G, B = 0 \dots 1$  as below. The matrix multiplication is here not explained.

The diagram shows that sRGB has an effective Gamma = 2.2 = 1/0.4545.



Black  $C = C^{2.2} = C^{1/0.4545}$

Red sRGB  
If  $C \leq 0.03928$   
Then  
 $C = C/12.92$   
Else  
 $C = ((0.055 + C)/1.055)^g$   
 $g = 2.4 = 1/0.4167$

Green 10 times the difference

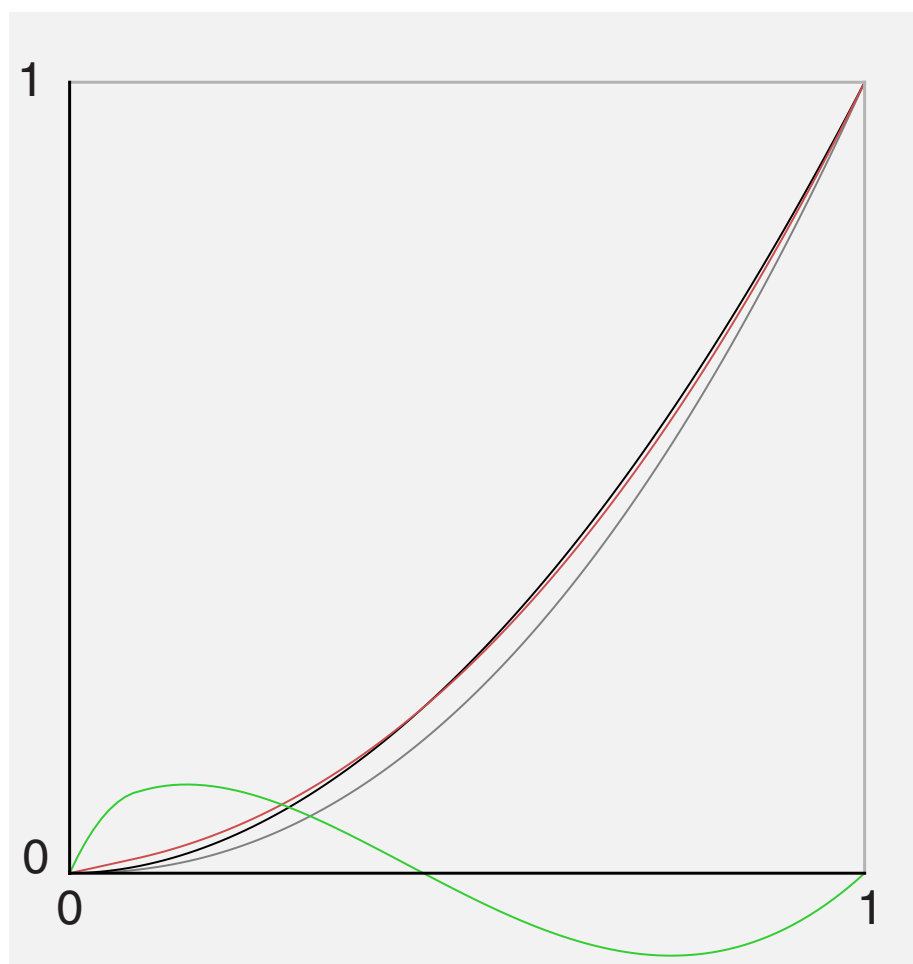
## 7. Tone Reproduction Curve for Rec.709

Rec.709 uses the same primaries as sRGB, but the Tone Reproduction Curve is different. This standard belongs to video systems.

The transformation of RGB image data to CIE XYZ requires primarily a Gamma correction, which compensates an expected inverse Gamma correction, compared to linear light data.

For normalized values  $C = R, G, B = 0 \dots 1$  as below. The matrix multiplication is here not explained.

The diagram shows, that Rec.709 has an effective Gamma = 1.93 .



Gray  $C = C^{2.2}$

Black  $C = C^{1.93} = C^{1/0.518}$

Red Rec.709

If  $C \leq 0.081$

Then

$C = C/4.5$

Else

$C = ((0.099 + C)/1.099)^g$

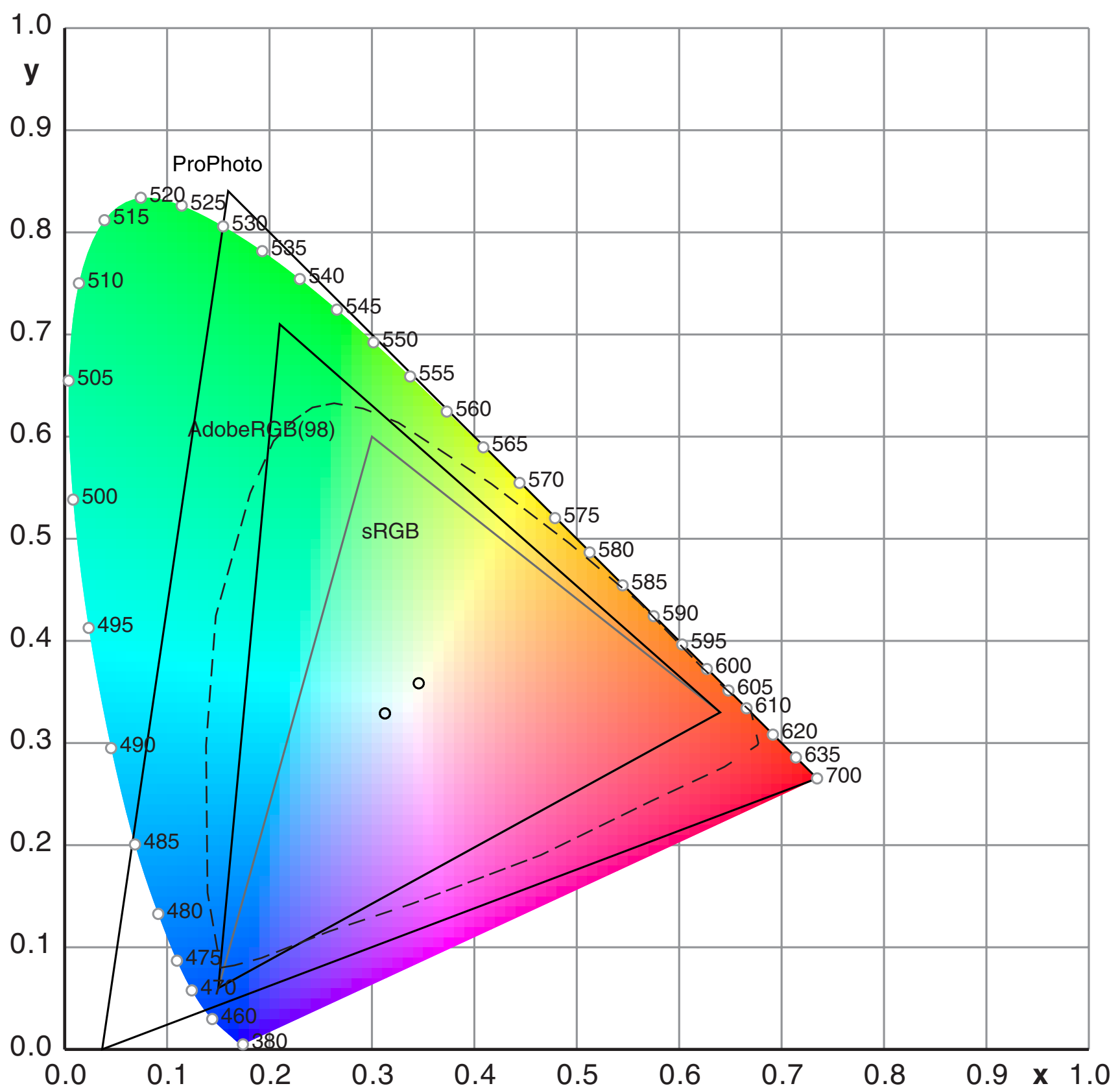
$g = 2.2222 = 1/0.45$

Green 10 times the difference

## 8. Real World Surface Colors

The graphic shows

1. sRGB, as usual
2. AdobeRGB(98)
3. ROMM RGB by Kodak  
This is a wide gamut working space.  
The primaries and the white point are the same as for ProPhoto RGB
4. Surface colors (real world surface colors)  
This is probably the gamut which should be retained in quality photos.  
Without proof: inside the Lab range  $a^*, b^* = -128$  to  $+127$   
The informations were extracted from [20]:  
Kevin Spaulding and Edward Giorgianni  
Implementation of device-independent color at Kodak  
The set of real world surface colors is nicely represented by spot inks on coated stock [22].



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Mutoh 6100  
Large format inkjet, using CMYKcm

Spectrophotometers  
X-Rite DTP 41  
X-Rite Digital Swatchbook  
Spectrocam

Some graphics by GMB ProfileEditor

This doc:  
<http://www.fho-emden.de/~hoffmann/gamuts08072002.pdf>

Gernot Hoffmann  
December 17 / 2006  
Website  
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