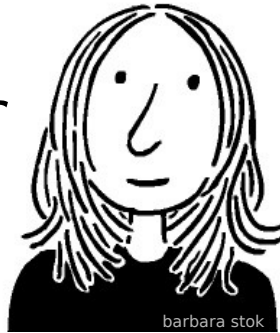


# How Imaging Systems Work

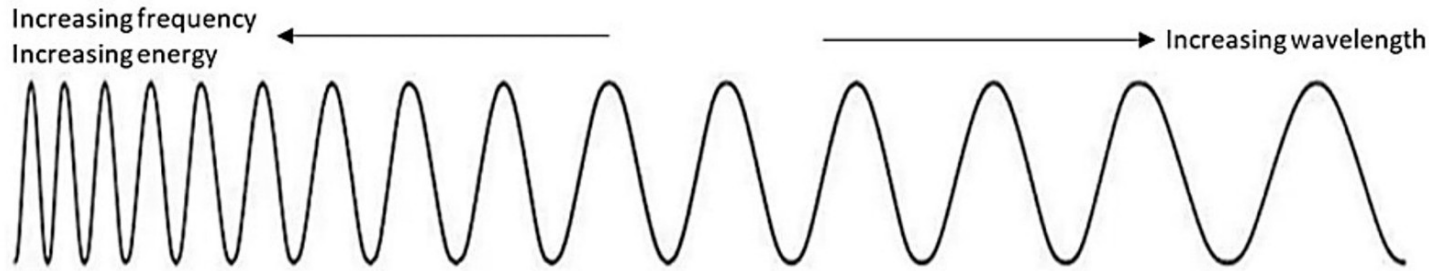
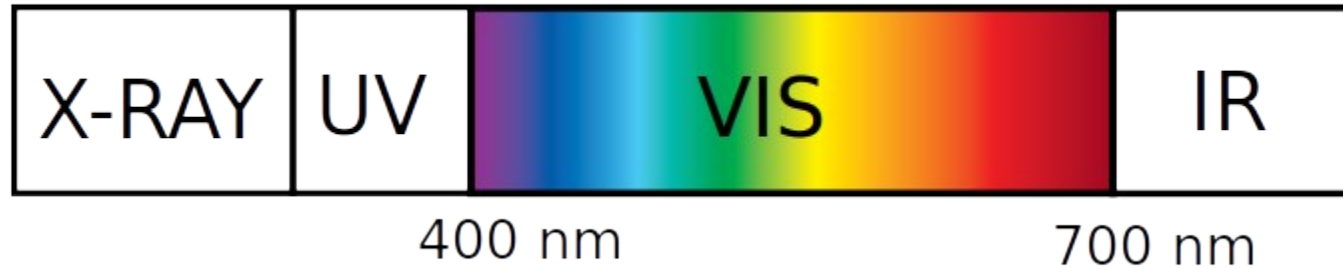
Birgit Reissland and Frank Ligterink



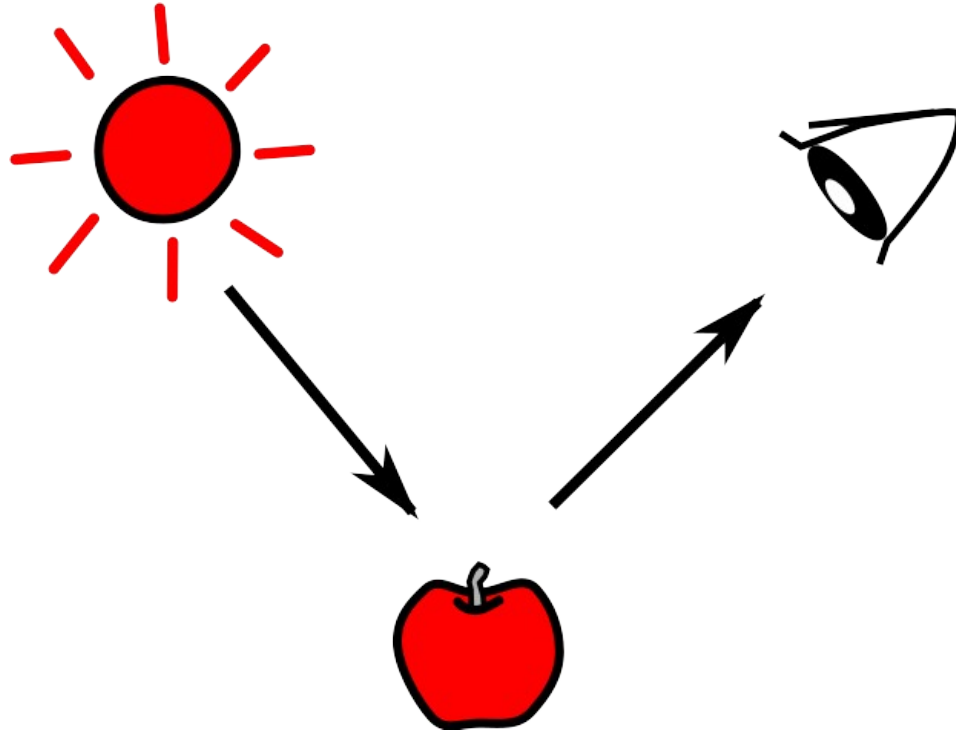
Band pass filter  
X-ray  
CrimeLite Auto  
Hyper Spectral Imaging  
Video Spectral Comparator 8000HS  
FCIR reflectography  
CCD  
Spectral resolution  
NIR  
VIS  
MSI  
UV  
nanometer  
Osiris  
Phase One



# The electromagnetic spectrum

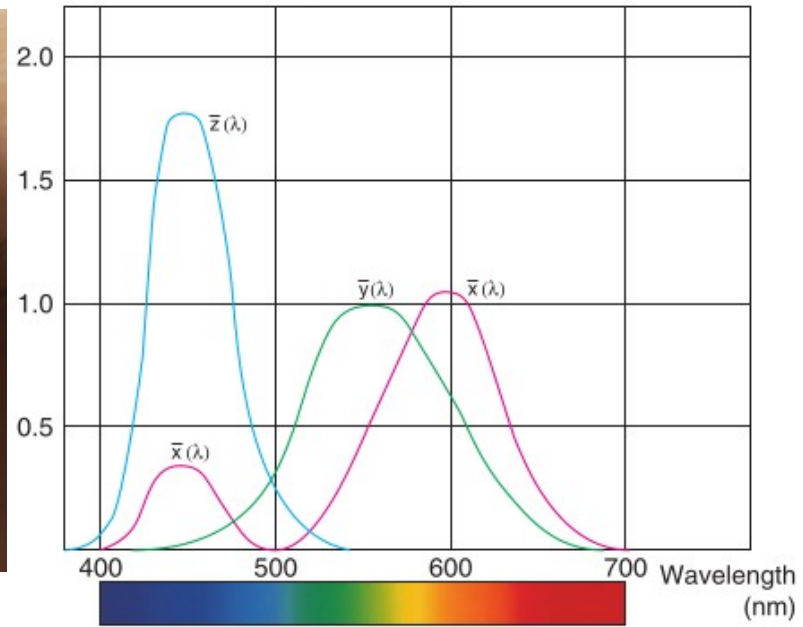


# The observer triangle



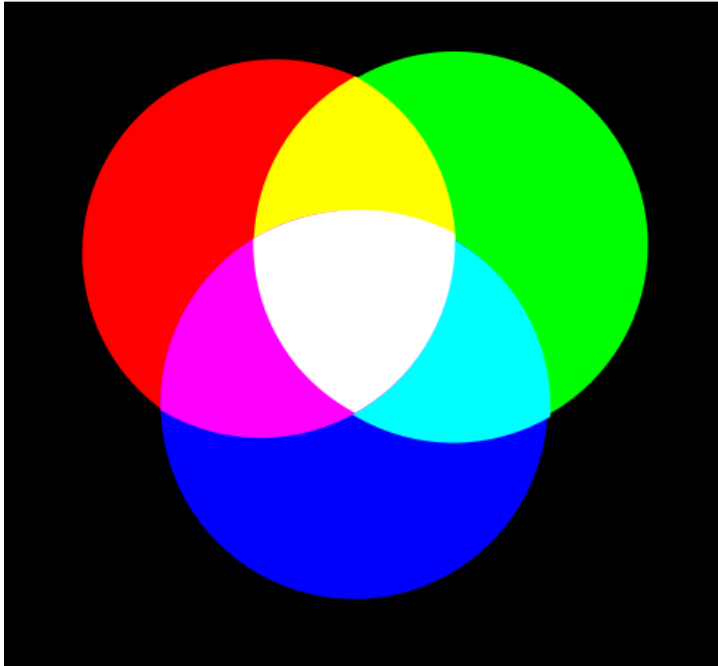
# About color

# The human eye is an RGB device

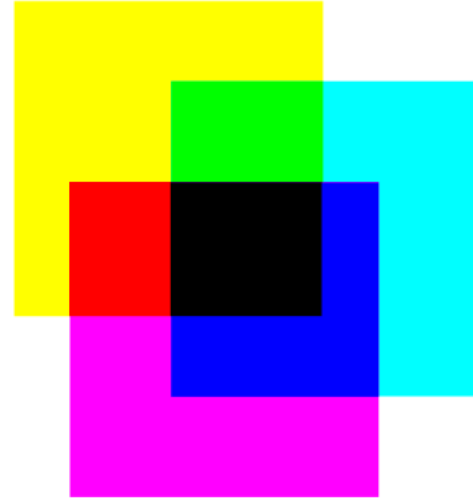


Spectral sensitivity functions for our three types of cone cells.

# Color mixing

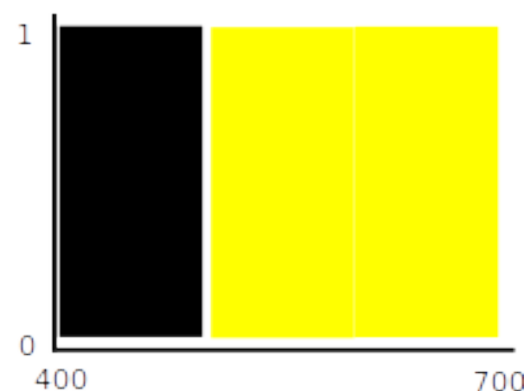
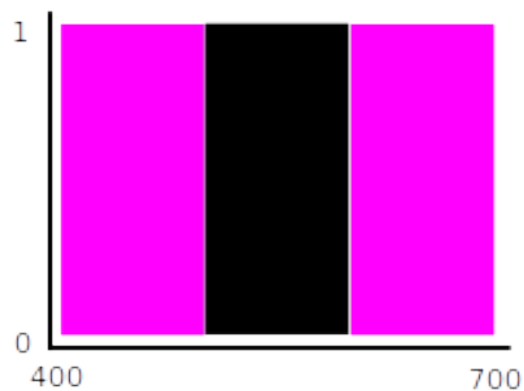
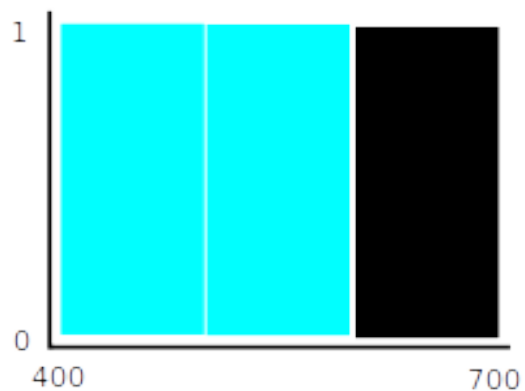
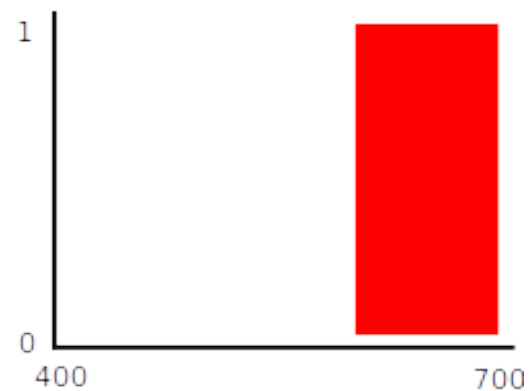
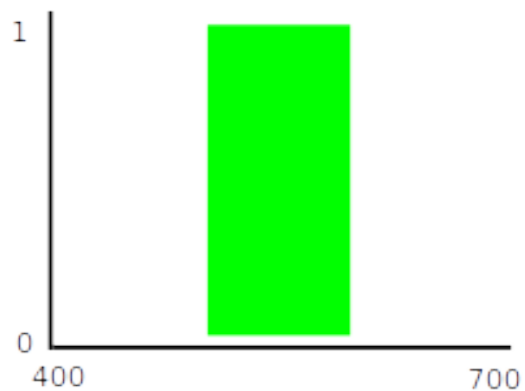
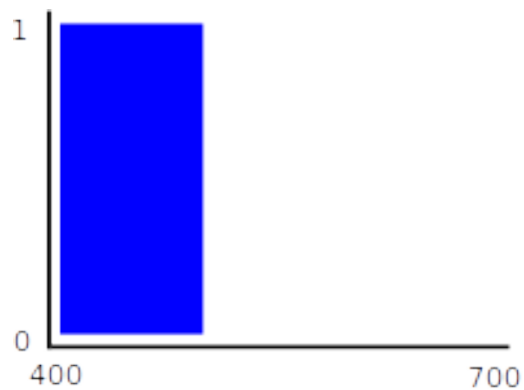


Additive color mixing with  
Red, Green and Blue primaries



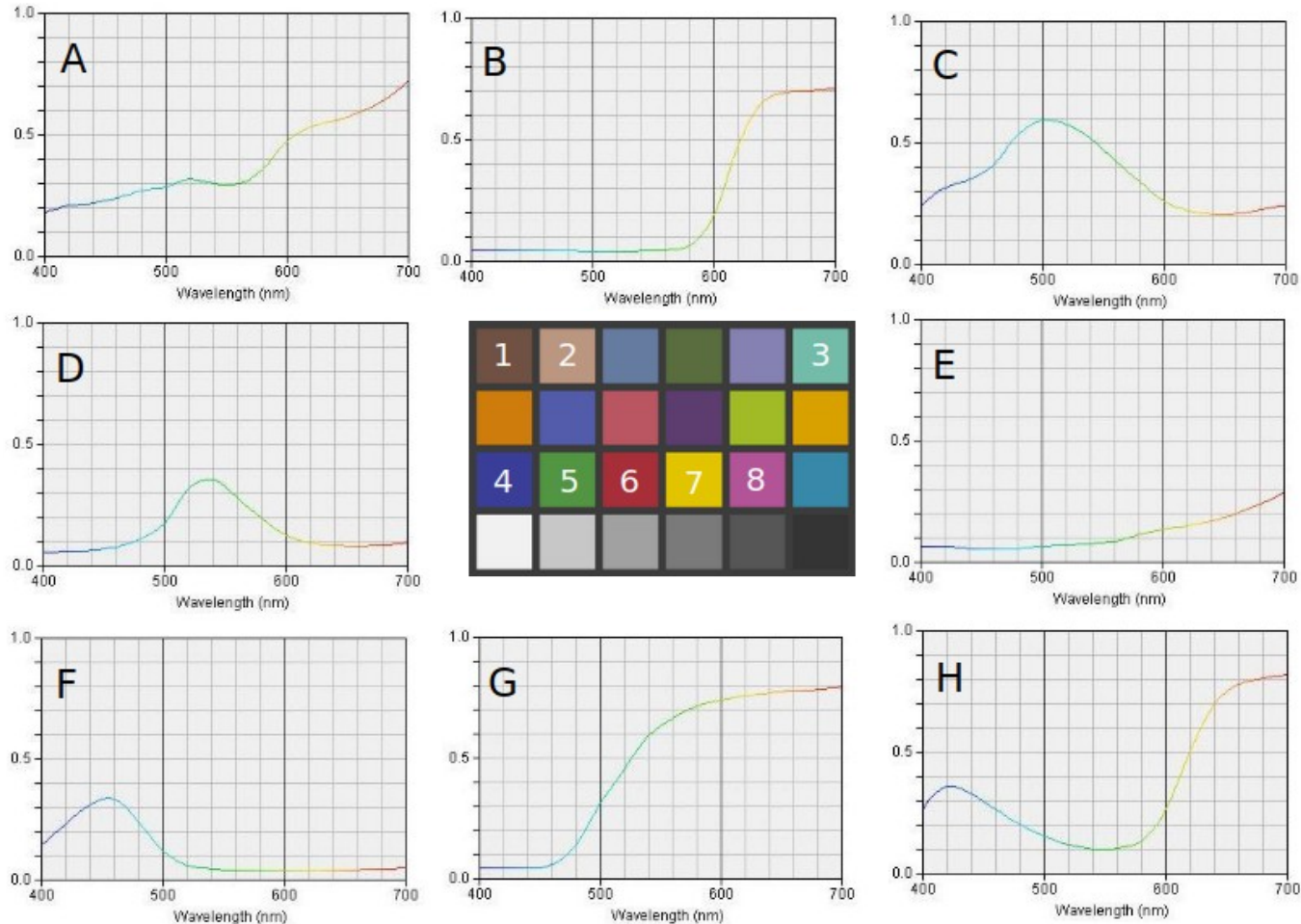
Subtractive color mixing with  
Yellow, Magenta and Cyan  
primaries

# Block spectra

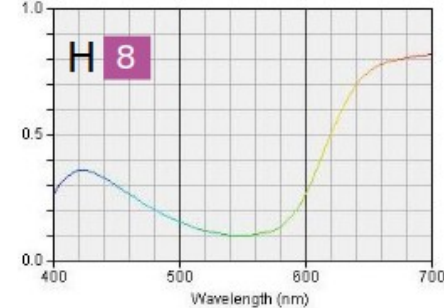
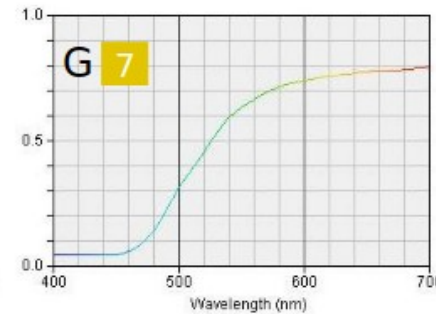
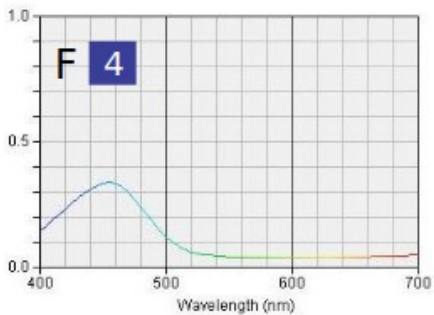
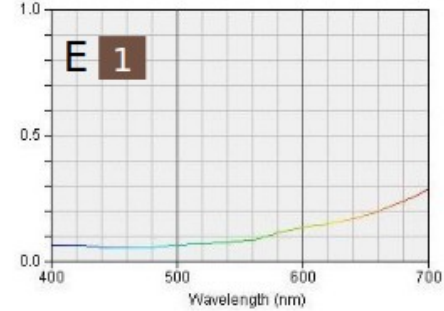
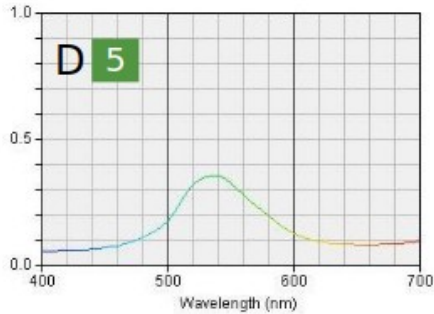
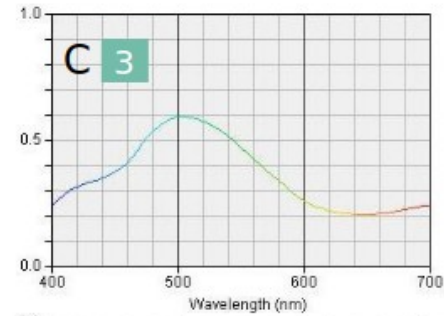
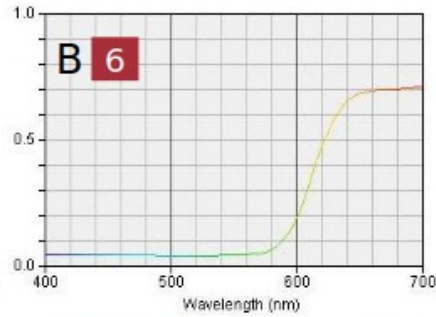
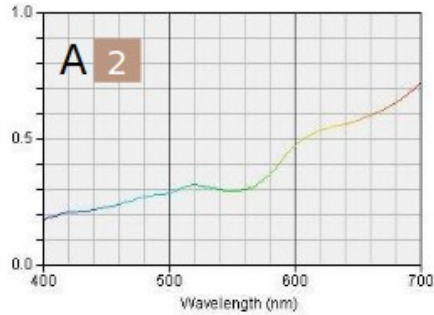




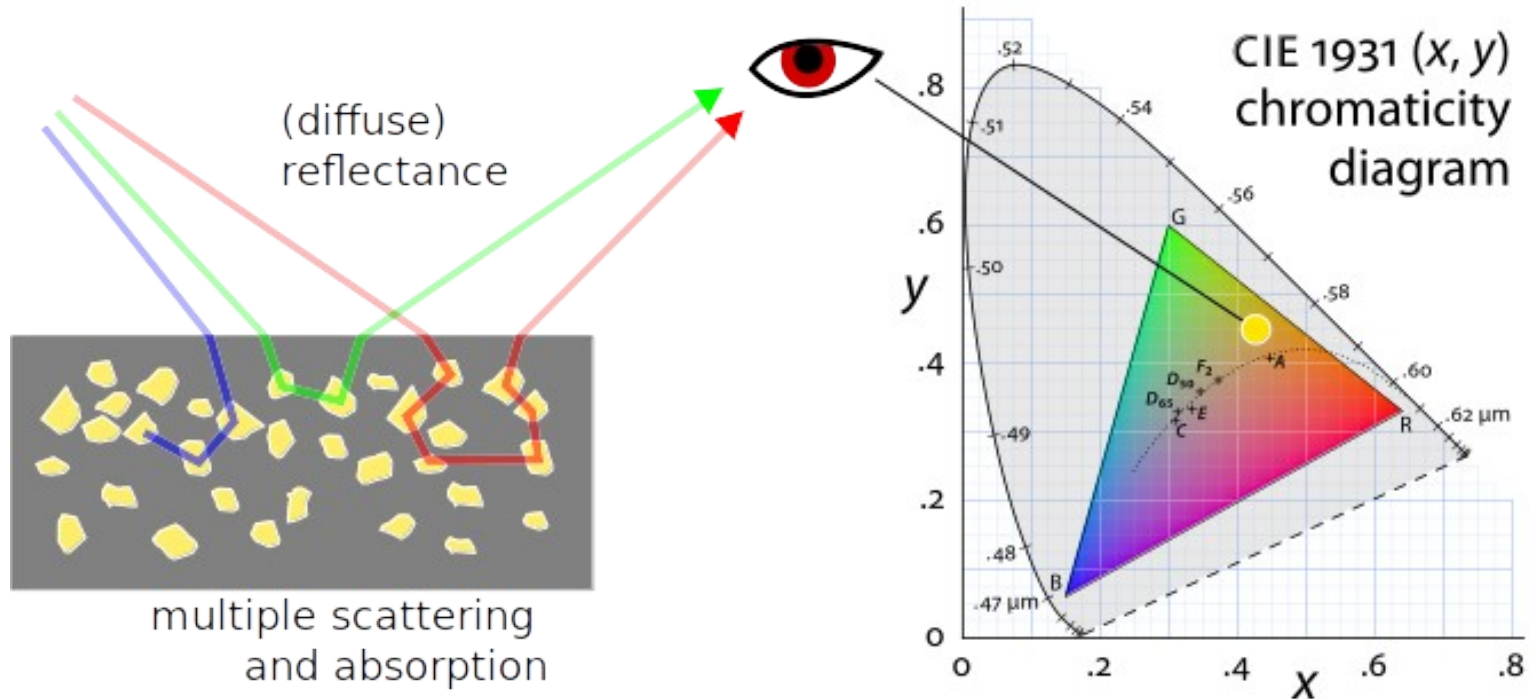
# Color checker exercise



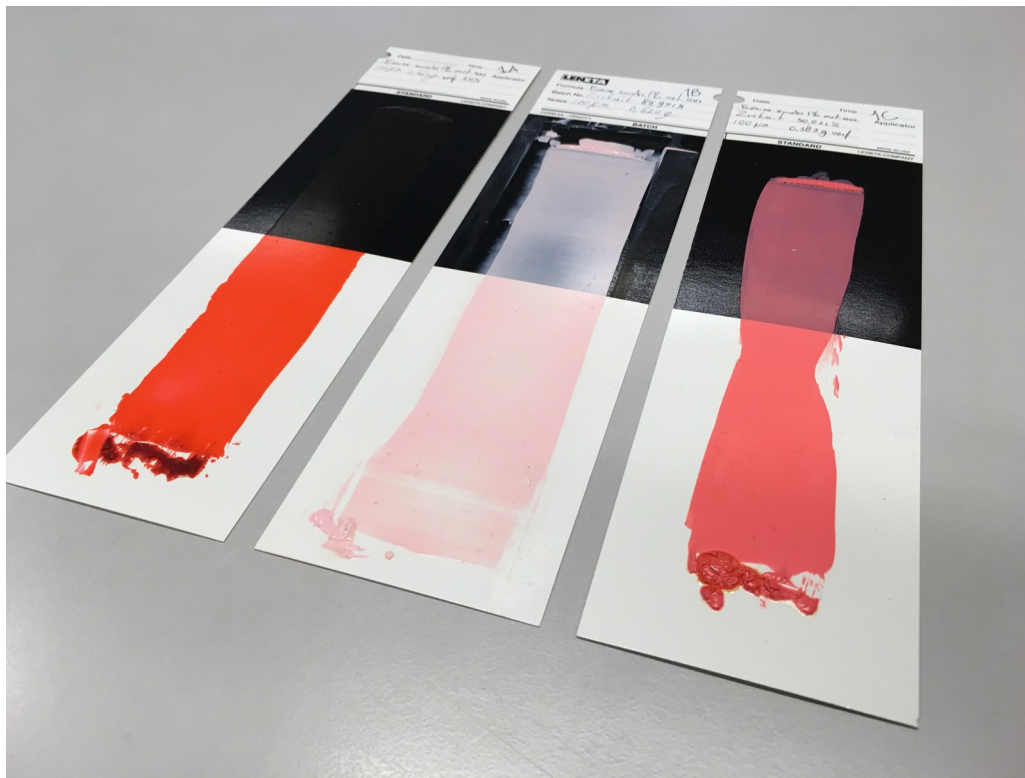
# Color checker answers



# Traveling the photon path



# Pigments versus dyes



Transparent, translucent and opaque

# Imaging systems

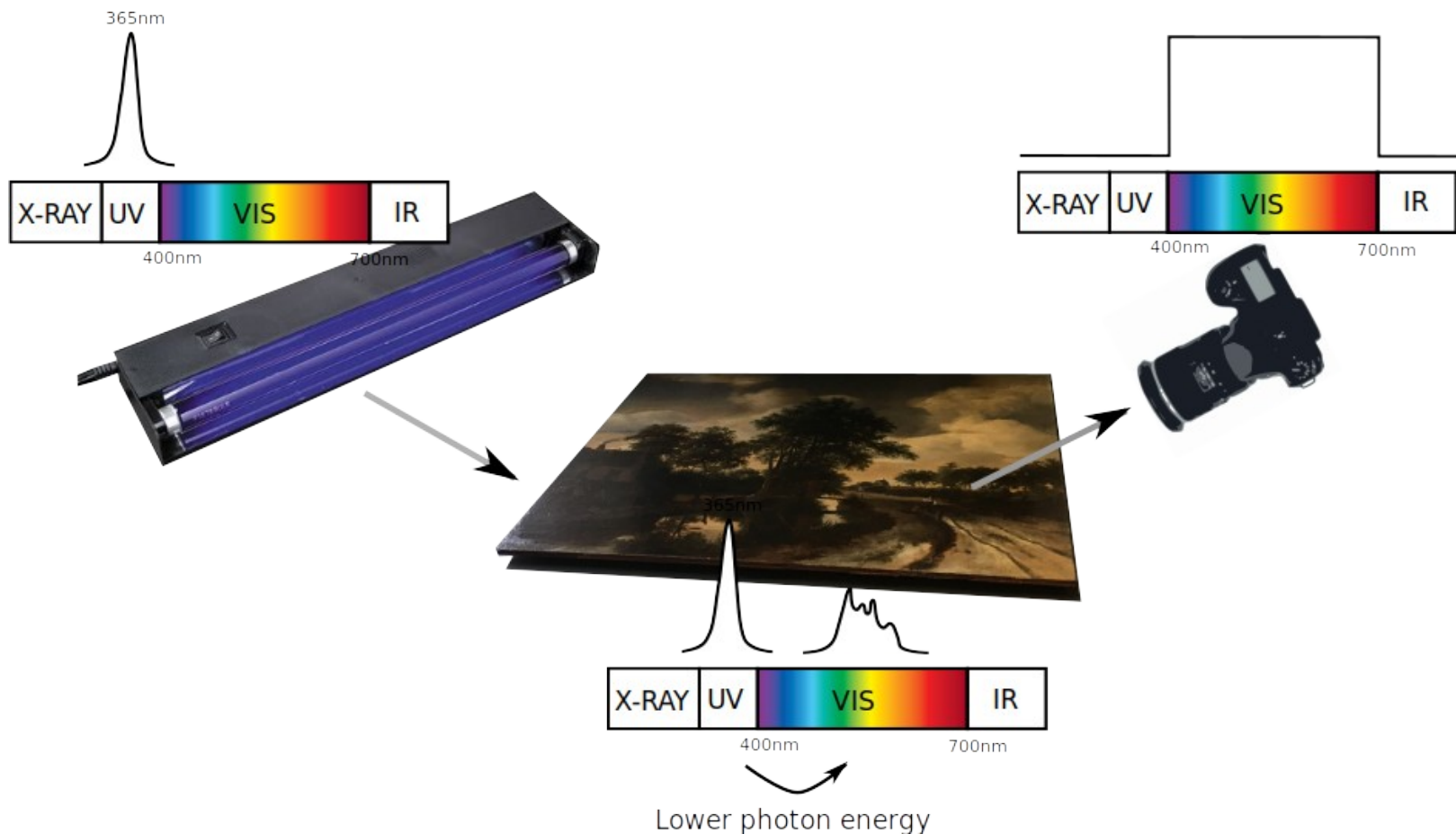


# UV Fluorescence Imaging



UV fluorescence (right) reveals retouching areas in a potential Ruisdael painting

# UV Fluorescence Imaging



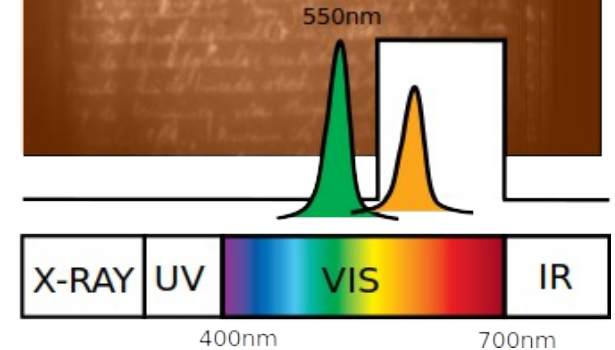
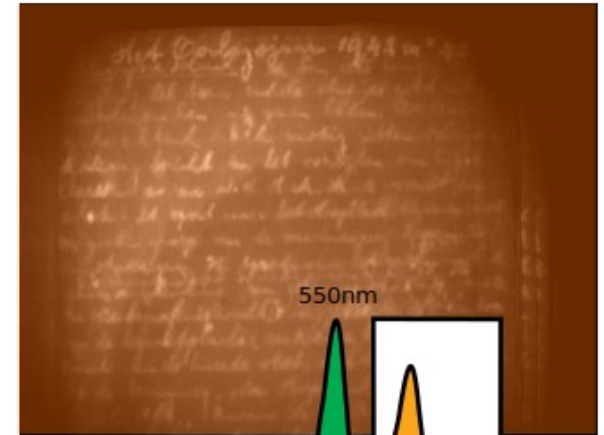
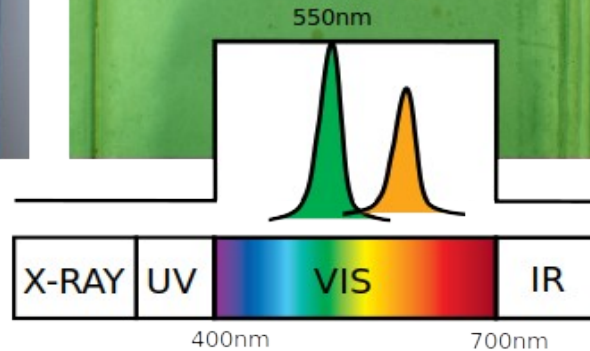
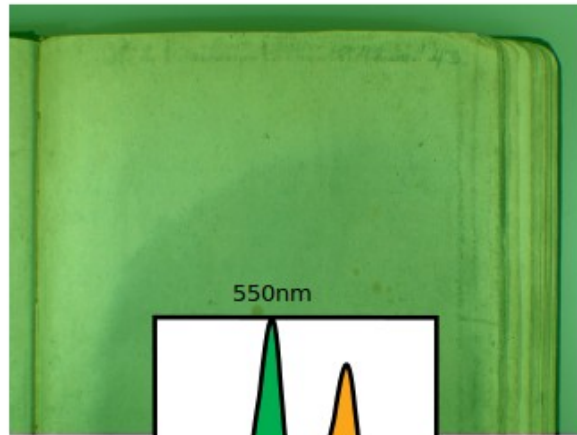
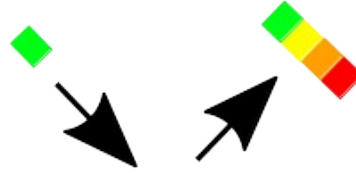
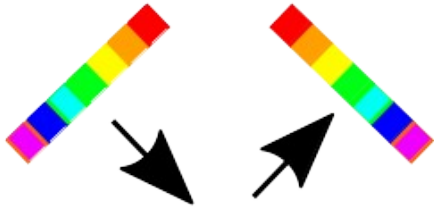
# UV Fluorescence

- Powerful way to see retouches!
- Low tech
- Need darkness
- Protect your eyes



# VIS Fluorescence

Long-pass  
camera filter  
blocks green  
to improve  
readability

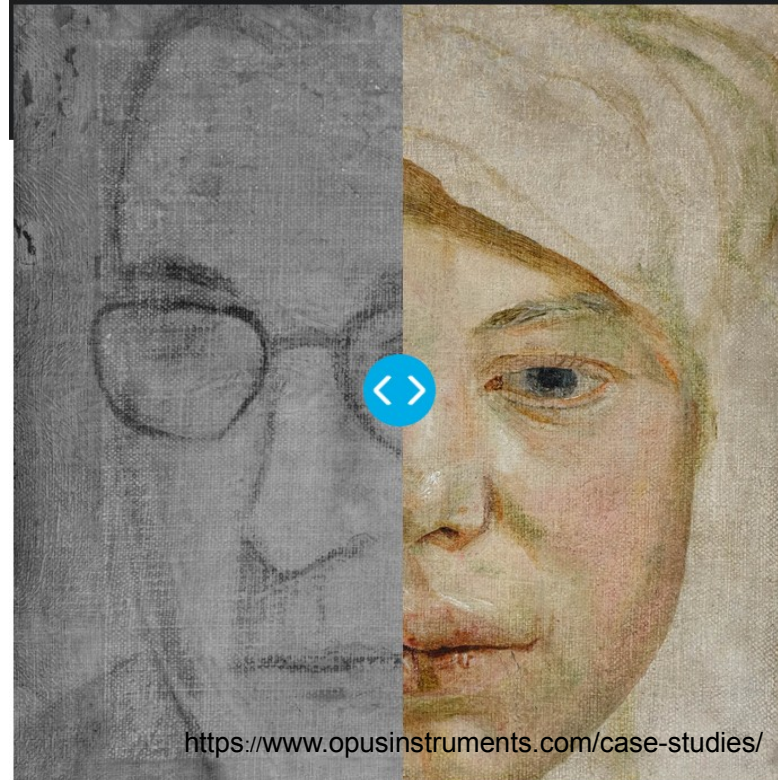


# IR Reflectography



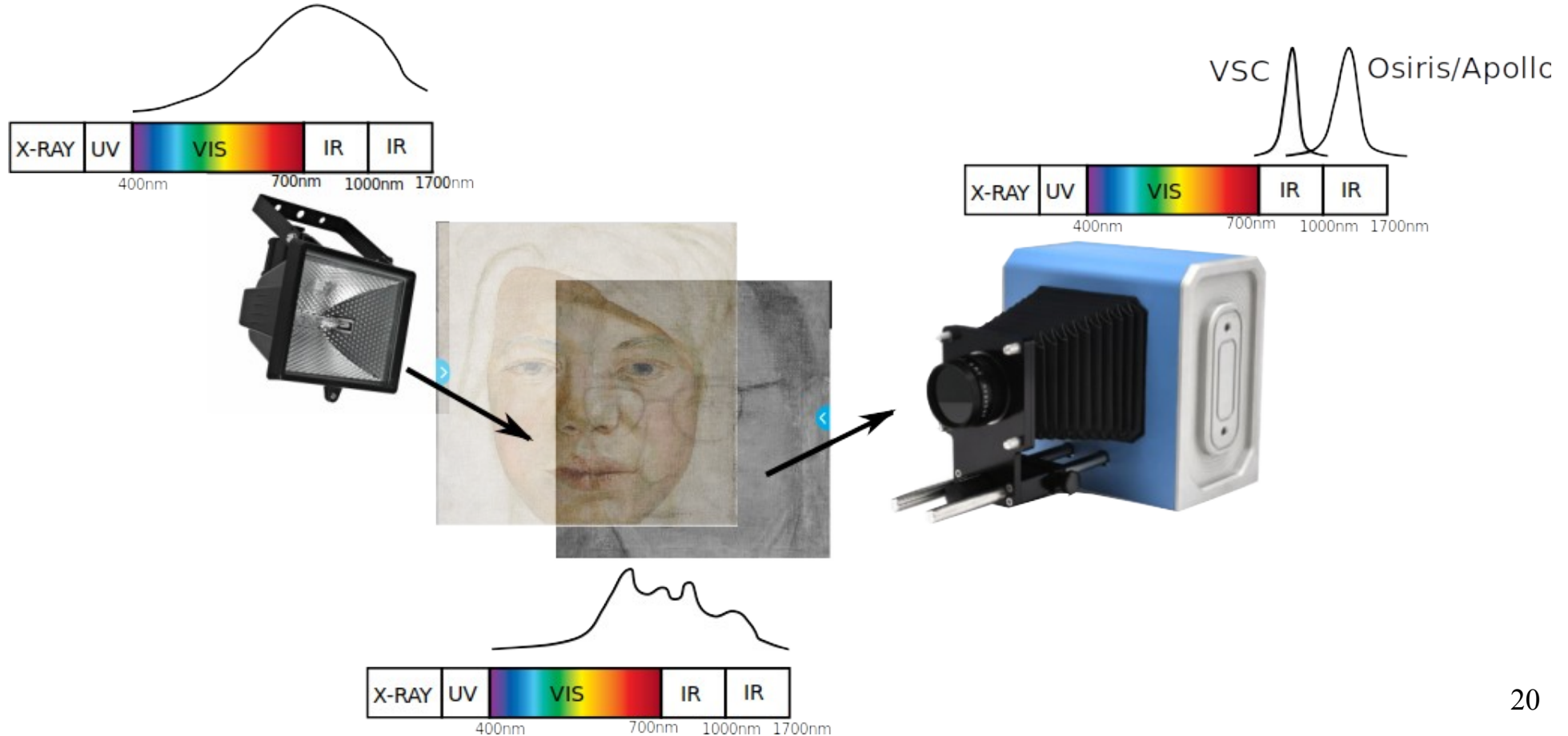
Black lace made visible with VSC long pass filter  $>850\text{nm}$

# IR Reflectography



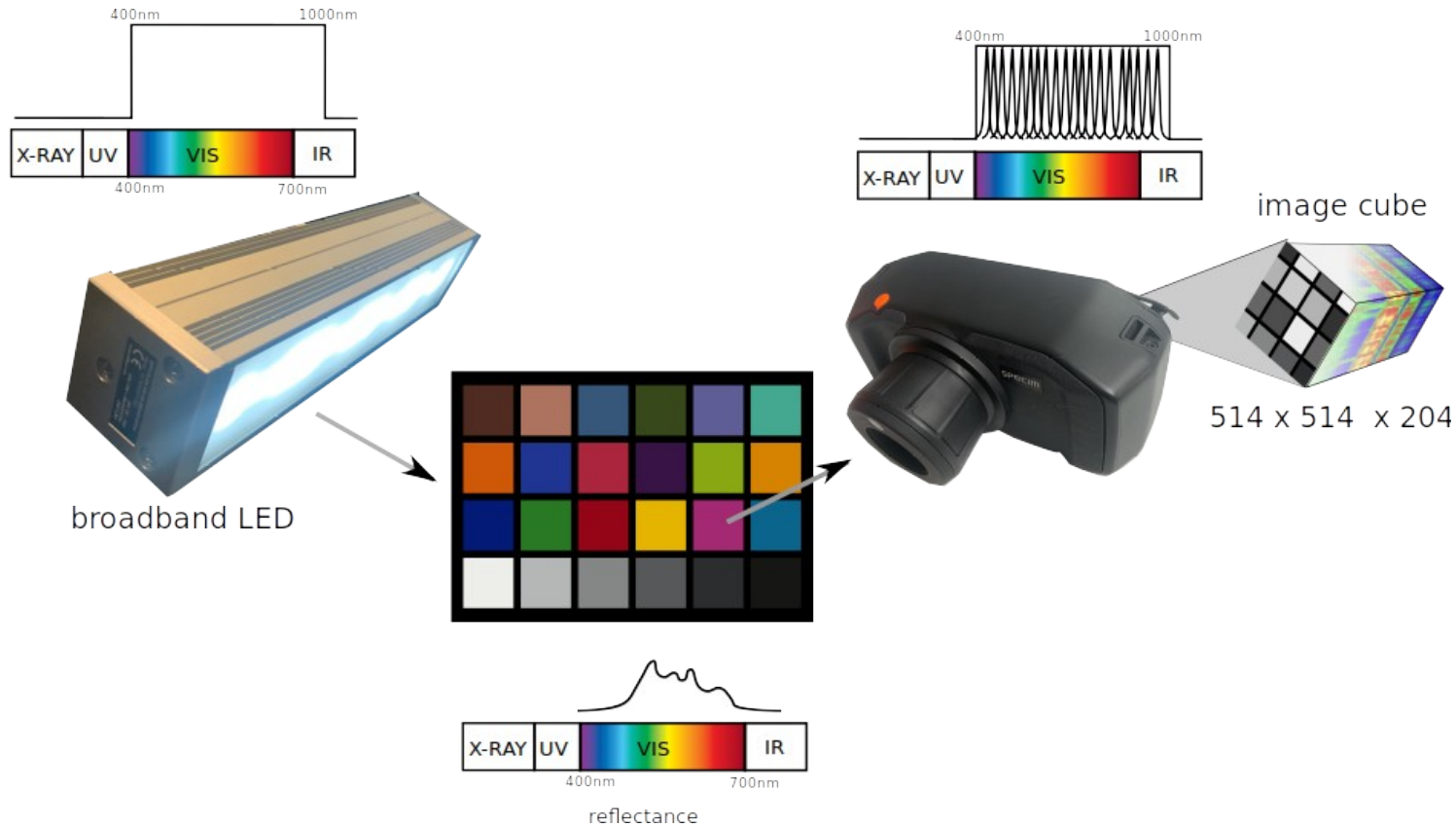
Underdrawings can often be made visible with infrared reflectography

# IR Reflectography





# Hyper Spectral Imaging

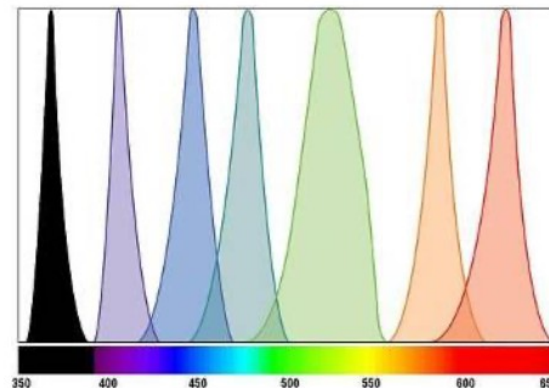


# CrimeLite Auto

*Crime-lite*®AUTO: Optical specification (Light sources)

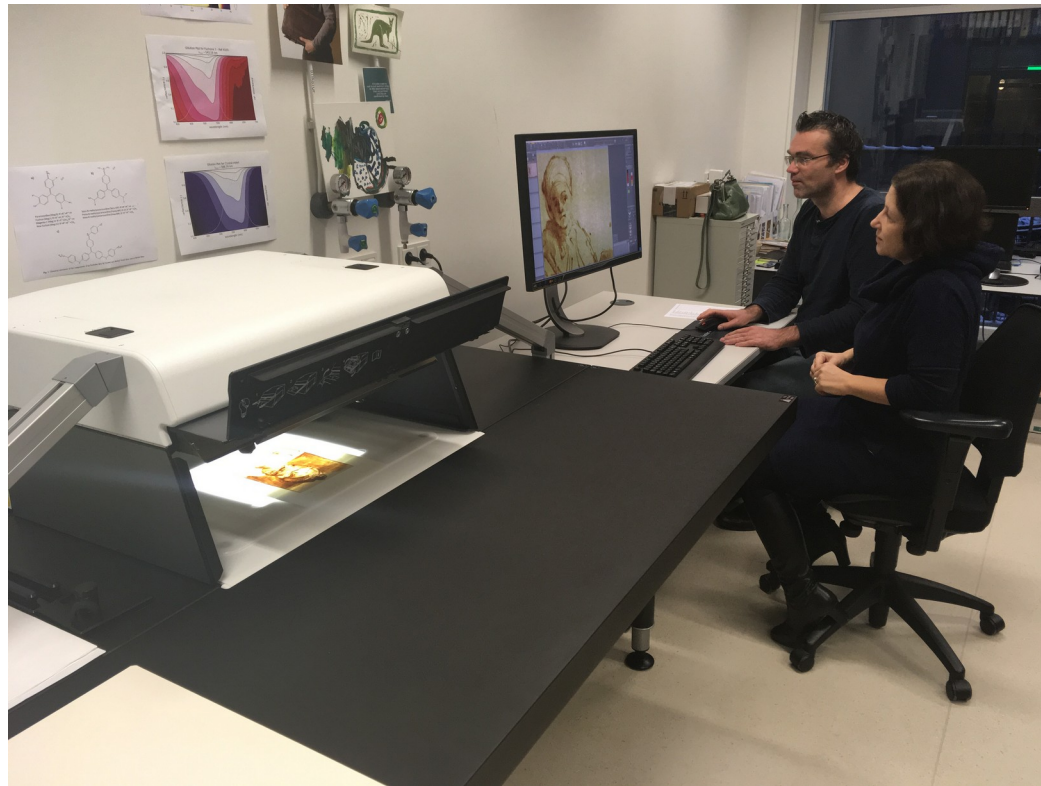


Colour	Nominal wavelength (nm)	
	Bandwidth (10%)	Peak
<b>Ultraviolet</b>	<b>350 – 380</b>	<b>365</b>
<b>Violet</b>	<b>395 – 425</b>	<b>410</b>
<b>Blue</b>	<b>420 – 470</b>	<b>445</b>
<b>Blue-Green</b>	<b>445 – 510</b>	<b>475</b>
<b>Green</b>	<b>480 – 560</b>	<b>520</b>
<b>Orange</b>	<b>570 – 610</b>	<b>590</b>
<b>Red</b>	<b>600 – 660</b>	<b>640</b>
<b>Infrared</b>	<b>800 – 900</b>	<b>860</b>
<b>White</b>	<b>400 – 700</b>	



Not shown: White; Infrared  
Wavelength (nm)

# Video Spectral Comparator



Multi spectral imaging device with many modalities. Great for exploration.