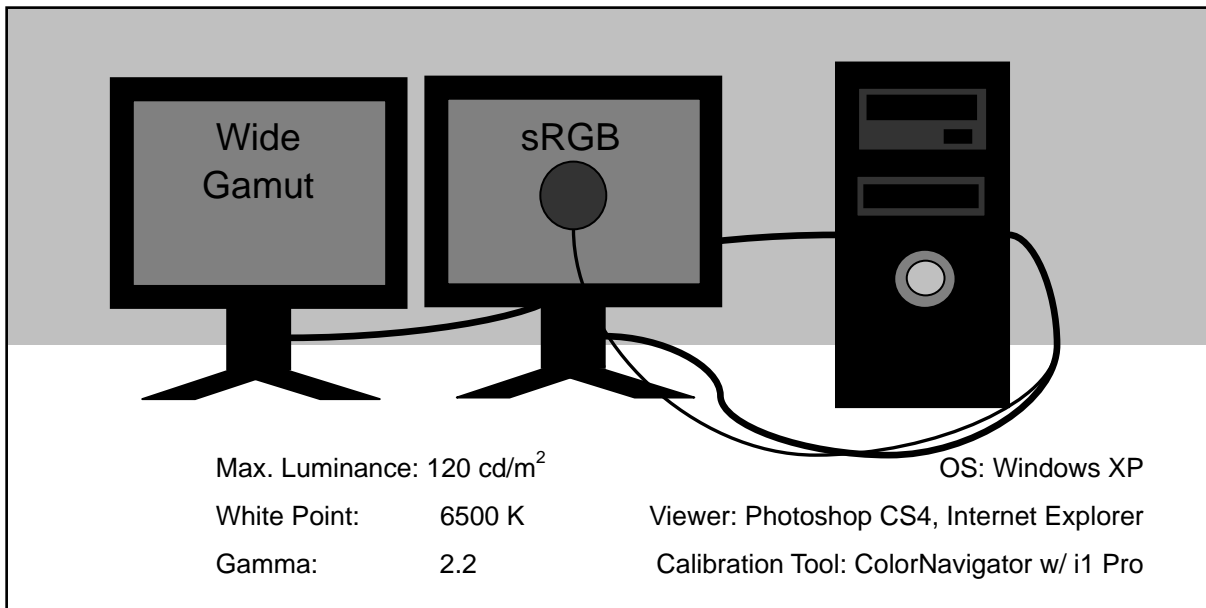


Color Matching Demo

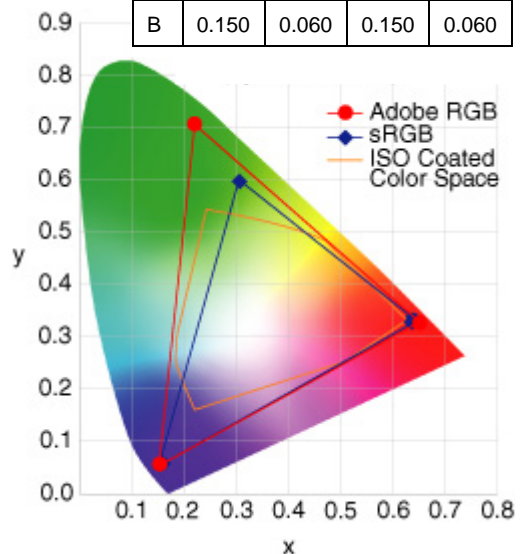
- Check the color appearance of the same images on the screens! -



What YOU CAN See

- Two same images, the one viewed with Adobe Photoshop (= color-managed) and the other viewed with Internet Explorer (= not color-managed) look different especially on the wide color gamut display
- Wide color gamut images (e.g. w/ AdobeRGB profile embedded) look different on the sRGB display and the wide color gamut display even if they are color-managed: the colors of the wide color gamut images look paler on the sRGB display than on the wide color gamut display
- Color-managed narrow color gamut images (e.g. w/ sRGB profile embedded) look almost the same on the both displays
- Calibration or adjustment of displays and the generation of ICC color profiles

	Adobe RGB		sRGB	
	x	y	x	y
R	0.640	0.330	0.640	0.330
G	0.210	0.710	0.330	0.600
B	0.150	0.060	0.150	0.060



Color Gamuts of Adobe RGB and sRGB in CIE 1931 xy Chromaticity Diagram

Any influences of different color appearance on diagnosis?

- **Do you need color management system?** Check whether color management is already implemented on your system e.g. viewer software
 - If color management is not implemented (highly probable), compare the color appearance of the same clinical images on the various displays in the hospitals and check whether the appearance differences recognized influence the diagnosis or not
- **Do you need wide color gamut displays?** Check the color gamut of image acquisition device (e.g. high-end CCD camera) especially if you treat real color images of pathology or dermatology

(vs. artificial or pseudo color images for multi-modality fusion)

- If the gamut of the image acquisition device is wide like AdobeRGB, compare the color appearance difference of the same clinical images on the displays already installed in your hospitals (e.g. sRGB) and on wider gamut displays as demonstrated here and check whether the appearance differences recognized influence the diagnosis or not

FAQ

Q1. Why does the color appearance of the same images usually differ with displays?

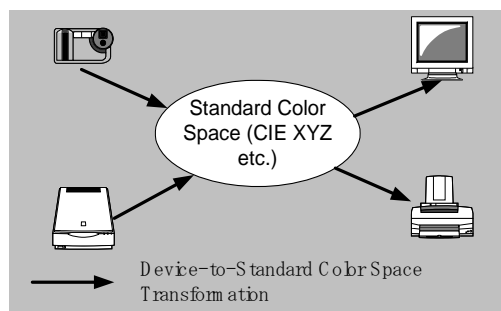
A1. Because the color data of each image or pixel is encoded in RGB format (e.g. R: 255 G: 255 B: 0 for yellow) and the final output on the screen fully depends on the display's primaries, R, G and B whose color coordinates differ with displays and also shift over time due to the deterioration of color filters and backlights. Though most displays support sRGB mode, the criteria available today is loose.

Q2. How does the calibration of displays for color-critical use demonstrated here differ from GSDF calibration well-known in the medical field?

A2. After the adjustments of luminance, tone curve (e.g. gamma: 2.2) and white point (or color temperature), the process also known in the medical field, an ICC profile describing tone curve, white point and color coordinates of primaries is created based on the measurements with a colorimeter.

Q3. What are ICC profiles?

A3. Device-specific information used by color management systems (Photoshop in this demo) to convert color data between native device color spaces and device independent standard color spaces. For example, raw color data captured by a digital camera is converted to the corresponding color data in the standard color space using the camera's profile. When output on the screens, they are converted to native color data of displays using the profile of each and thus the consistent color appearance can be realized.



Q4. Are there any methods or criteria for quality control of color displays?

A4. In the printing industry where displays are used to simulate/check color reproducibility on paper, methods to evaluate the color quality of displays are included in the certification program developed by International Digital Enterprise Alliance (IDEAlliance). For consumer displays, "Windows Color Quality Test Kits for Device OEMs" created by Microsoft and Hewlett-Packard etc. provides reference tools and instructions to quantitatively measure the ability of color-capable devices including color displays to render sRGB color within certain color difference tolerances.

References and Further Information

- International Color Consortium <http://www.color.org>
- IDEAlliance <http://www.idealliance.org>
- Windows Color Quality Test Kits <http://www.microsoft.com/whdc/archive/colortest.msp#EW>