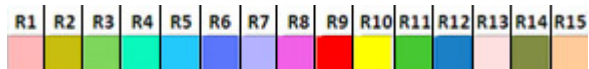


Color Rendering Index (CRI)

Definition:

Effect of an illuminant on the color appearance of objects by conscious or subconscious comparison with their color appearance under a reference illuminant.

Explain:



Average color rendering index (Ra):

This is the average of the color rendering index of 8 colors (R1 ~ R8).

Special color rendering index:

Strong red (R9), Strong yellow (R10), Strong green (R11), Strong blue (R12), Caucasian skin color (R13), Moderate olive green (leaf) (R14), Asian skin color (R15)

Light source	CRI	CCT (K)
Incandescent/halogen bulb	100	3200K
Ceramic metal halide	96	5400K
Tri-phosphor cool-white fluorescent	89	4080K
Quartz metal halide	85	4200K
"White" SON	82	2700K
Halophosphate cool-daylight fluorescent	76	6430K
Tri-phosphor warm-white fluorescent	73	2940K
Halophosphate cool-white fluorescent	64	4230K
Halophosphate warm-white fluorescent	51	2940K
Coated mercury-vapor	49	3600K
High-pressure sodium (HPS/SON)	24	2100K
Clear mercury-vapor	17	6400K

Actuality Application:



High CRI - Color Saturation and Vivid



Low CRI - Color Unsaturation and Dull

Color Quality Scale (CQS)

Definition:

In order to meet the new needs in the Solid State lighting industry and consumers for communicating color quality of all lighting products, Color Quality Scale (CQS) is being developed at NIST, which evaluates several aspects of the color quality of objects illuminated by the light source.

Explain:

Average color quality scale (CQS):

The method for calculating the CQS is derived from modifications to the method used in the CIE's Color Rendering Index(CRI). The method evaluates 15 colors to more accurately span the range of normal object colors.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Q9	Q10	Q11	Q12	Q13	Q14	Q15	

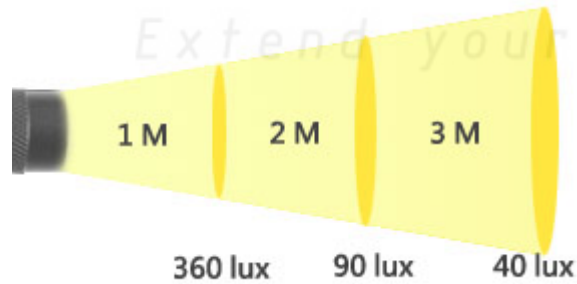
Illuminance

Definition:

Illuminance is the total luminous flux incident on a surface, per unit area. It is a measure of how much the incident light illuminates the surface, wavelength-weighted by the luminosity function to correlate with human brightness perception.

Explain:

$$\text{Illuminance} = \text{Lumen} / \text{Square Meter}$$



Place	Illuminance (lux)
Under the blazing sun	100,000
Cloudy day	80,000
Drawing	600
Reading	500
Night baseball field	400
Office / Classroom	300

Application:



High Illuminance



Low Illuminance

Chromaticity Coordination

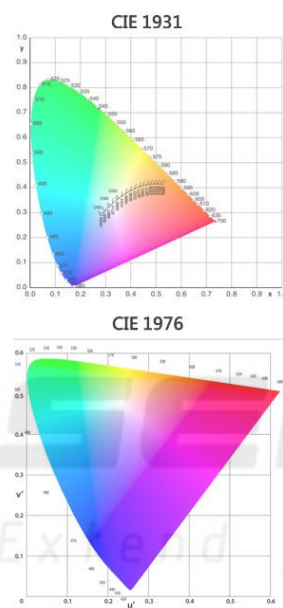
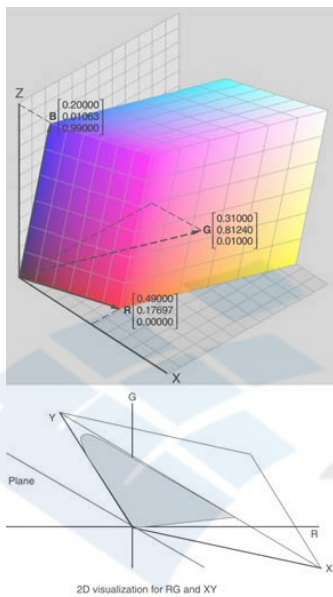
Definition:

CIE1931 (x, y)

CIE1976 (u', v')

Color as described in the CIE1931 system can be plotted on a chromaticity diagram, usually a plot of the chromaticity coordinates x and y . Another popular color system is the CIE1976 uniform-chromaticity scale which advantage is that the distance between points is approximately proportional to the perceived color difference, something definitely not true in the CIE1931 diagram.

Explain:

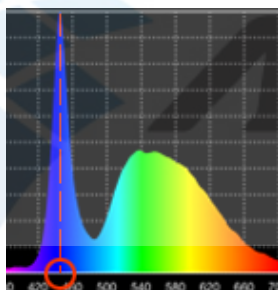


Wavelength of Peak and Peak counts

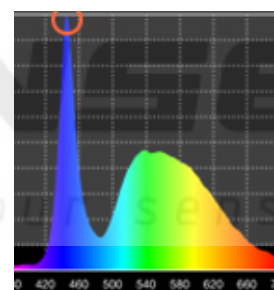
Definition:

Wavelength of peak, the wavelength at which the intensity of a light source is maximum. Peak count, the maximum counts in the spectral diagram.

Explain:



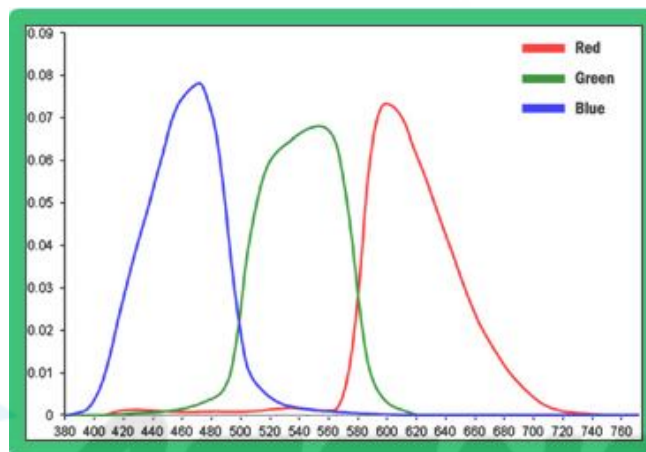
Wavelength of peak



Peak count

What is "TLCI"?

European Broadcasting Union (EBU) presented new evaluation standard for studio lights and luminaires, Television Lighting Consistency Index (TLCI). TLCI mimics a complete television camera and display, using only those specific features of cameras and displays which affect color performance, and there are more and more TV Studio (such as: BBC, CNN, NBC, iTV, Disney CHANNEL ...) adopt TLCI as their purchasing standard. TLCI uses a Color Checker [split Macbeth] chart to compare the color rendering qualities of a measured luminaire to a "benchmark" and then assigns a single value between 0 and 100 to the luminaire, the higher the number, the better the color quality. (For more information about TLCI, please download SGS-iPad APP)



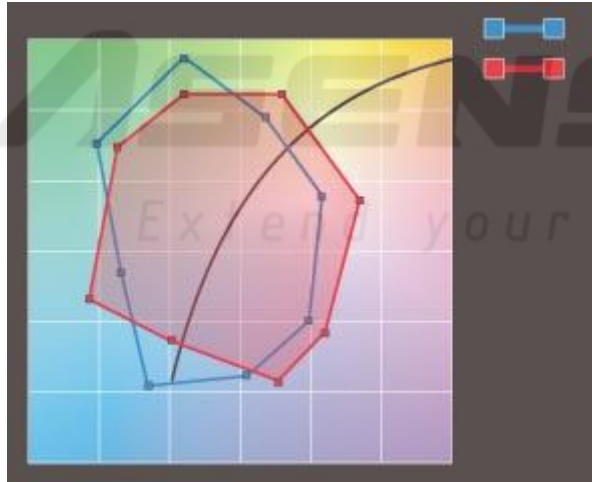
Spectral response of modern camera used in TLCI-2012

THE FIVE LEVELS OF TLCI:

	100	85 to 100	Excellent quality with errors so small that a colorist/lighting engineer/DP may not consider making a correction or making very small adjustments.
	85	75 to 85	A Colorist/Lighting engineer/DP could easily reach the acceptable result by making some adjustments for color performance.
	75	50 to 75	Depending on professional experience, colorist/lighting engineer/DP would adjust the camera equipment or use filter to correct the deficiencies of luminaire. It takes a lot of time to reach the acceptable result.
	50	25 to 50	A Colorist/Lighting engineer/DP will need to make significant adjustments due to poor color rendering of the luminaire. The result might not suit for broadcast standard.
	25	0 to 25	The quality of luminaire is very poor. Although colorist/lighting engineer/DP spends a long time to adjust the camera equipment or improve the performance, the result still not qualify the standard of broadcast.
5	0		

What is "GAI"?

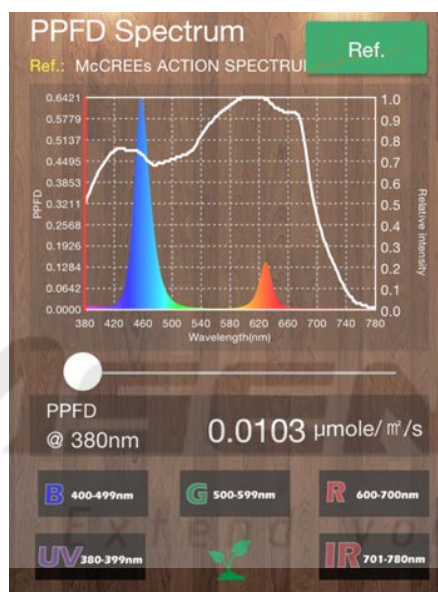
Gamut area index (GAI) is a good indicator of color saturation. A light source with high GAI shows good color discrimination, saturation, and vividness. Choosing a source with high CRI (85 or greater) and a high GAI (80-100) is better. However, GAI higher than 100 might be saturated.



The calculations of Gamut Area, the blue area means standard reference, and the red area means the measured value.

What is "PPFD"?

PPFD is a value that explains how many photons in specific range(it's from 400-700nm for plant growth) of the visible light spectrum (photosynthetic active radiation or PAR) that fall on a square meter of target area per second. The unit is $\mu\text{mol}/\text{m}^2\text{s}$.



PPFD Spectrum : Vertical axis is PPFD