Color Purity of LEDs

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The term "**Color Purity**" often invites inquiries from customers viewing the spectral graphs generated by our integrating sphere. Color Purity was specifically created for LEDs with the 1997 CIE 127 Document. It should not be used for any other type of light source, such as HID, HMI, CFL, or incandescent - but often is.

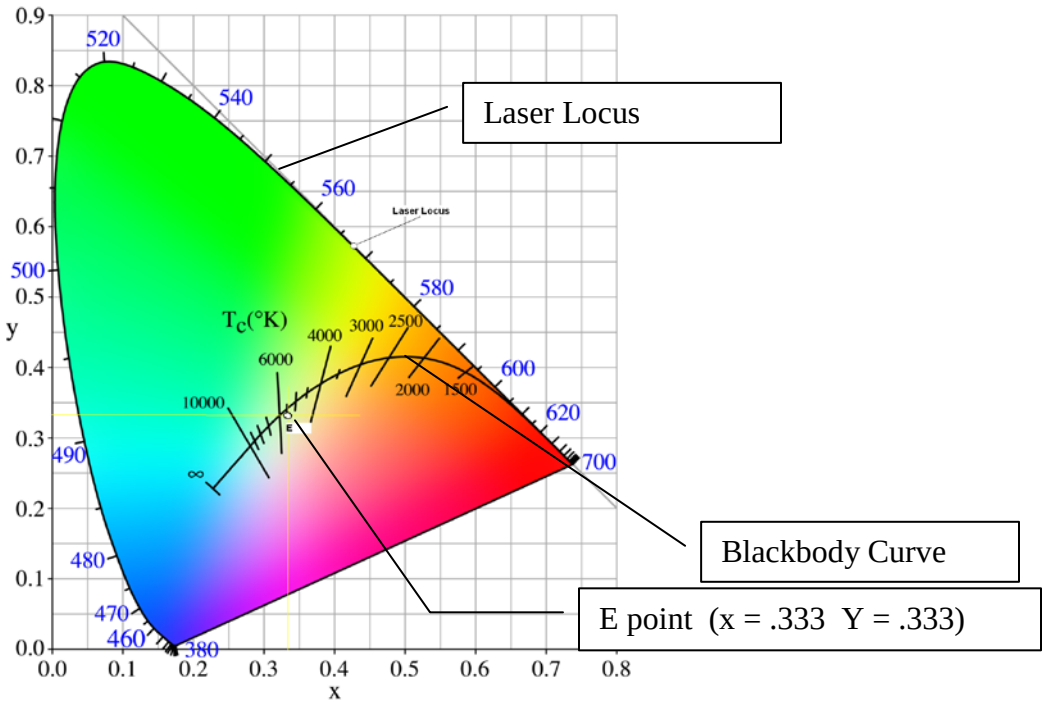
There are a few basic terms needed to understand "color purity."

The descriptions below are drawn on top of the CIE 1932 **chromaticity diagram**, also known as the "color space diagram." It is limited to the portion of the electromagnetic spectrum visible to the human eye, so there is no reference to UV or IR. "**CIE**" stands for the "Commission International de l'Eclairage" or International Commission on Illumination.

The "**E**" point is the point at X = .333 and Y = .333. This is a non-saturated region (all white) where the spectral curve is a flat line (equal energy in all wavelengths)

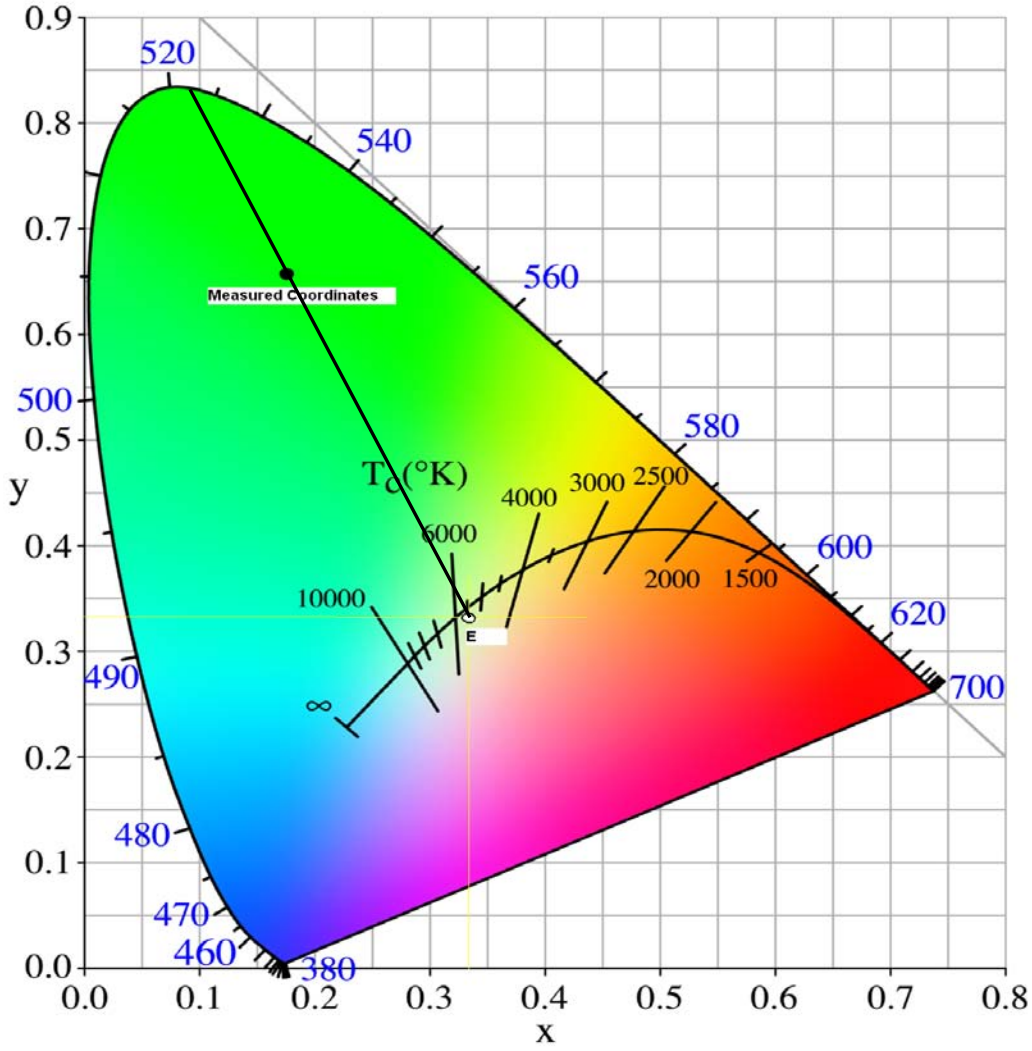
The "**Laser Locus**" is the outside perimeter of the CIE diagram. By definition, all measurements of a totally monochromatic light source, such as a laser, will fall on this line. The blue numbers outside the curve correspond to the wavelength of the light in nanometers.

An ideal **blackbody** is a body that absorbs all energy and does not reflect it or re-transmit that energy. A blackbody will only radiate energy if it is heated. This property of a blackbody is independent of material. The "**blackbody curve**" (sometimes referred to as the 'Planckian Locus') is the path that the color of an "ideal blackbody" would take in the color space as the **blackbody temperature** changes. It is recorded in degrees Kelvin, hence the expression, "**color temperature**." It starts at deep red for low temperatures, moves towards a yellowish white and ends up in the bluish white at very high temperatures. Viewed without atmospheric influence, our sun is about 6500 °K, a bluish-white light.



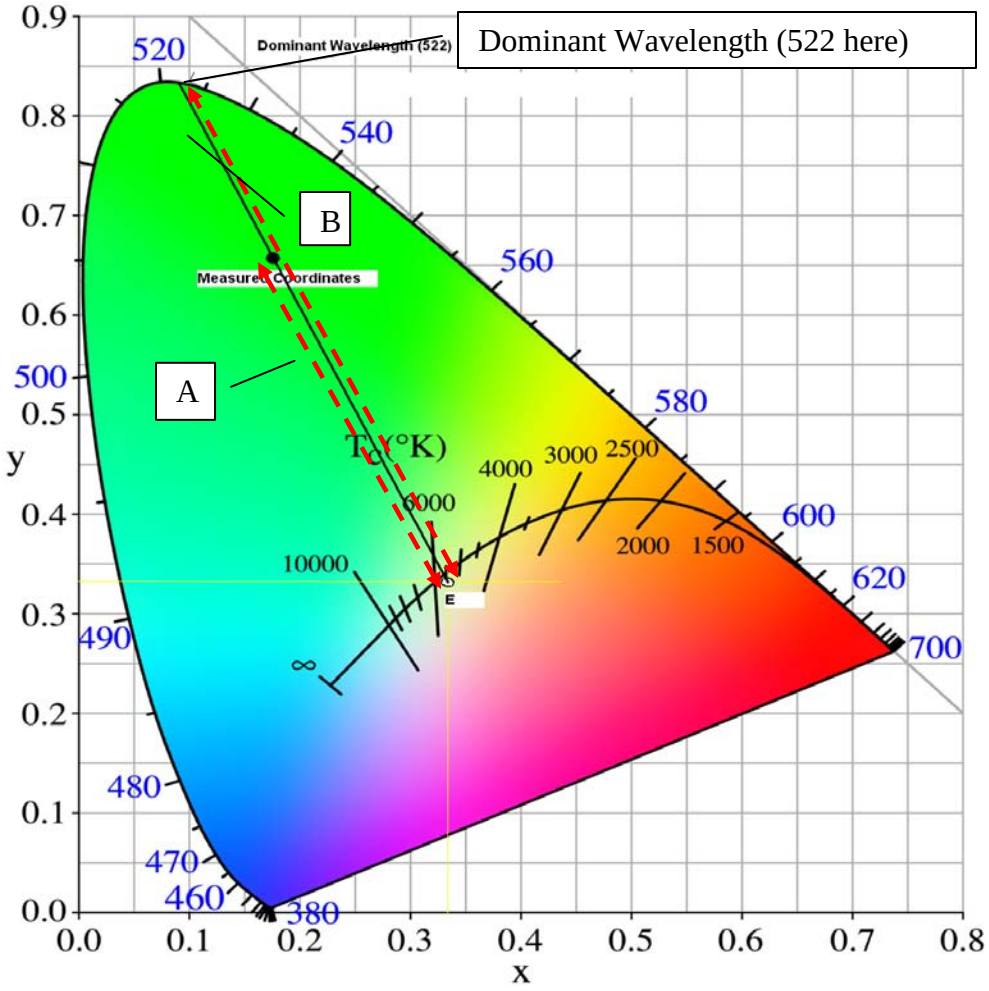
Here a point is plotted for a fictitious measurement.

Color purity is derived by plotting a line from the ‘E’ point out to the “laser locus” through the plotted data point:



The point where the line meets the “laser locus” is called the **dominant wavelength** for that measurement.

“Color Purity” is basically a ratio of the distance from the “E point” to the plotted point vs the distance from the “E point” to the laser locus for that plot. (A / B)



Purity is unit-less and will fall between 0 and 100%

For a white light, a low color purity is usually desired.

For a monochromatic source, a high color purity is usually desired.

Designers select the desired color purity based upon what application the light is being used for.

References:
1. Chris Durel, VP Sales, Sphereoptics
Wikipedia.org