# Spectral Effects of LED Forward Lighting Systems (Headlamps)

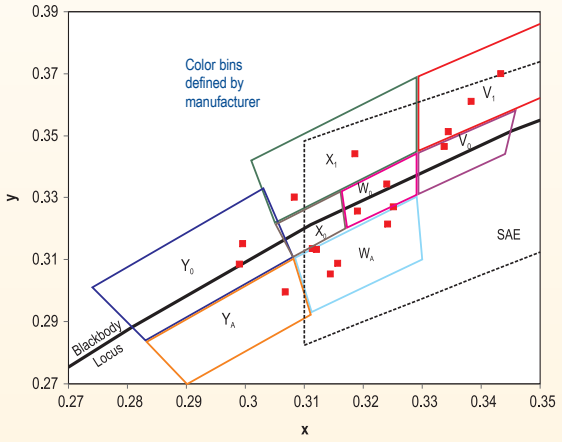
LED vehicle forward lighting systems will soon become a reality on today's roadways, thanks to advances in white light LED technology.

The LRC conducted a study to determine whether LED systems, due to their spectral properties, offer a benefit to off-axis visual performance, and if so, how this benefit varies among different LEDs.

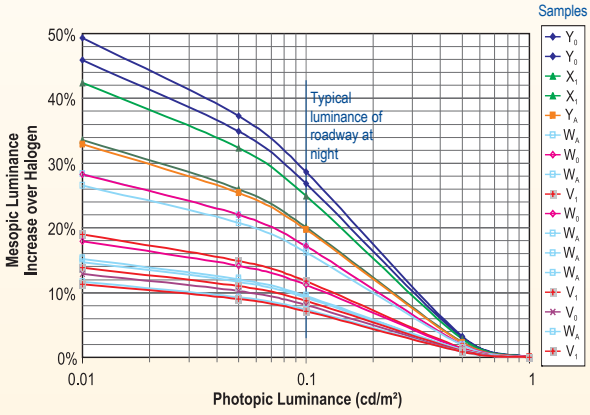
## Experiment

Researchers measured the spectral power densities (SPD) of a representative sample of phosphor-based, high brightness LEDs suitable for use in vehicle headlamps. The chromaticity of these fall within or near the Society of Automotive Engineers' (SAE) definition of "white." Similar calculations were performed on tungsten halogen (TH) and high intensity discharge (HID) sources for comparison.

LED headlamp prototypes (photo courtesy of Visteon)




**Chromaticity (CIE 1931) of LED test samples (■), shown with a single manufacturer's binning structure (bins $V_0$ through $Y_A$), the SAE white box, and the black body locus**




**Increase in mesopic luminance of white LED test samples over a halogen headlamp source**

## Results

Some LED sources contain more relative energy in the short wavelength region of the visible spectrum. They may provide a benefit to off-axis visual performance over standard TH lamps (up to 30% at common luminances). This can result in at least a 150ms decrease in reaction time over TH systems for high angle targets.

Note that the amount of off-axis visual benefit achievable depends on the SPD of the LED, which can vary among samples.

## Sponsors


Transportation Lighting Alliance (TLA):

DaimlerChrysler, General Electric, Hella, Lighting Research Center, OSRAM SYLVANIA, Philips, Visteon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