Designing LED Optical Components using TracePro

Overcome LED Component Modeling Challenges to Achieve Optimal Result

TracePro offers several methods to accurately model LED light sources and predict output performance. Sources can be modeled as grid sources, surface sources, or extended sources using ray files derived from measurements. Sources can also be modeled by actual source geometry and defined completely using the TracePro sketch facility. Four surface design concepts are supported to address LED-specific design issues – imaging lenses, TIR lenses, hybrid imaging-and-TIR lenses, and reflectors.

Optical component design for LED systems presents unique challenges, each overcome with TracePro's powerful utilities and feature sets. LED designers must address:

Smaller and more powerful light sources

The focusing elements need to follow the same trend and become smaller in size while delivering the required system performance, e.g. a specific light intensity distribution profile.

Etendue requirements

Narrow-angle LED emission is needed in many display applications. Optical components are needed to transform Lambertian emission into a narrow-angle distribution.

Color variation

Needs to be controlled due to LED phosphor shapes and die size limitations.

Hybrid design with non-imaging optic to shape emission

Photo courtesy of: Innovations in Optics, Inc.
www.innovationsinoptics.com

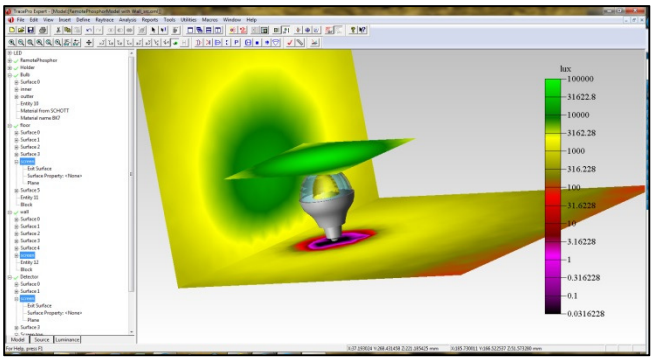

Figure 1: LED Phosphor – 3D Irradiance

25 Porter Road | Littleton, MA 01460 USA
Phone: +1 978-486-0766 Web: www.lambdares.com Email: sales@lambdares.com

TracePro is a highly intuitive tool for simulating the properties and geometries of LED modules in order to determine the output performance.

The utility used for this process is the Surface Source Property Utility, which helps users enter angular and spectral emission data quickly and accurately.

- **Utility**
  The utility allows users to digitize screen-captured spectral and angular radiation distributions from the LED manufacturer's data sheets, including: relative spectral power distribution and either polar or rectangular radiation pattern distributions.
- **Applications**
  For applications in which near-field interaction is important, users can create an opto-mechanical model of the LED module by importing the geometry from mechanical CAD files available from the LED manufacturers or by directly creating the geometry in TracePro based on manufacturers' specifications.
- **Properties**
  The user can model the complete packaged LED – cup, lens, die, etc. – and then apply material, surface, and fluorescence properties using the Material, Surface, and Fluorescence Property dialog boxes.

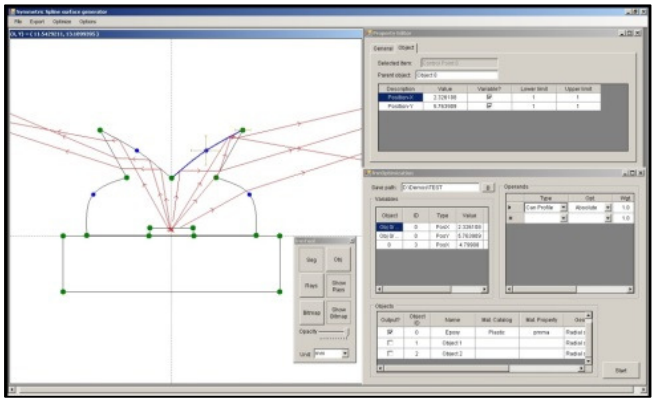

Figure 2: Side Emitting LED lens with interactive raytracing – illustrates light output using 2D optimizer sketch utility

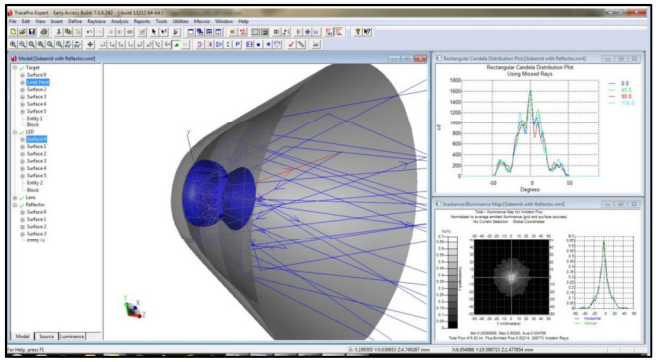

Figure 3: Side Emitting LED with lens and reflector combination. Before optimization – large angular output and 62% efficiency

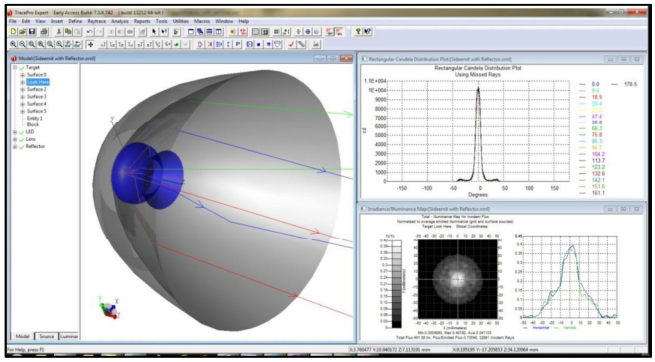

Figure 4: After optimization - angular output narrowed substantially and the combination is now 73.5% efficient

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