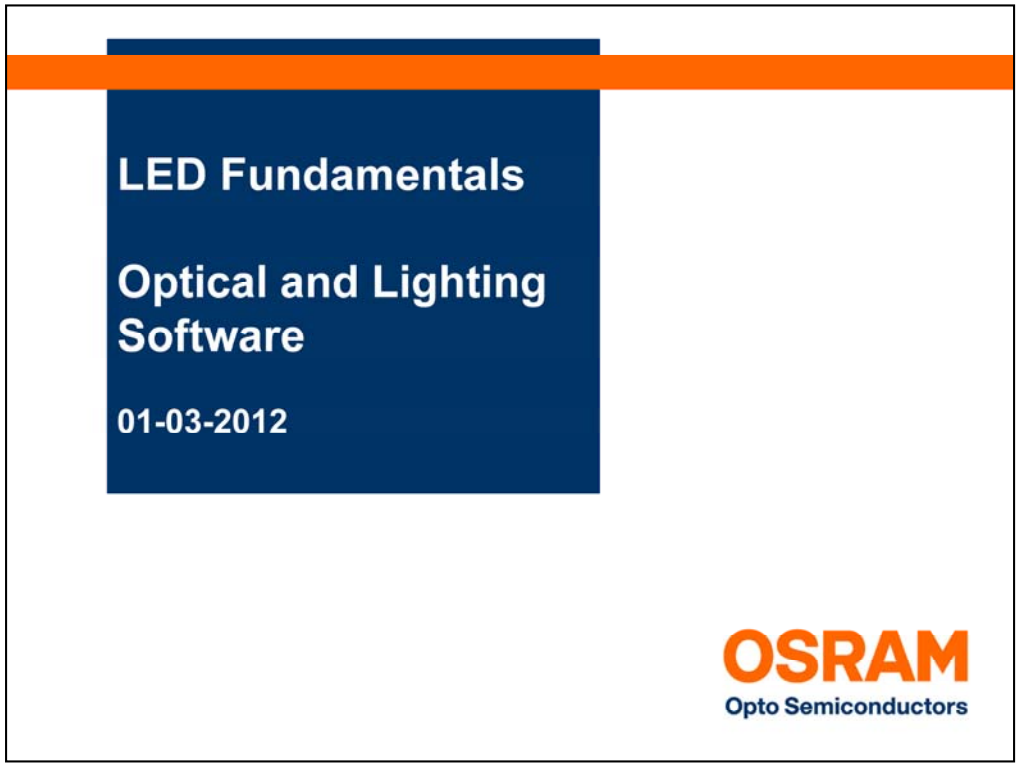


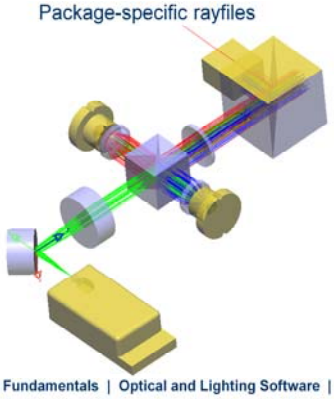
Hello and welcome to this presentation on Optical and Lighting Software, part of OSRAM Opto Semiconductors‘ LED Fundamentals series.

In this presentation we will look at the differences between optical and lighting software, when each type of software should be used, and appropriate light source models for each software type.

What is the Difference Between "Optical Software" and "Lighting Software"?

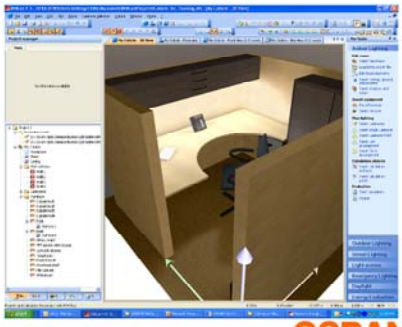
Optical Software

- High-end software packages
- Design & analysis of optical system
- Raytrace
- Precision
- Package-specific rayfiles



Lighting Software

- Lighting design; look & feel of the scene
- Analysis of application
- Speed
- IES or Eulumdat distribution files



LED Fundamentals | Optical and Lighting Software | Page 2

OSRAM
Opto Semiconductors

Optical software is used to design optics and optical systems, model optical effects according to the laws of physics, and use precision source models, such as rayfiles.

Lighting software is used to model the application environment, such as a roadway or room. Assumptions are made about optical properties in order to speed calculations. The light source models only contain intensity vs angle information and can be anything from a lighting fixture to an individual LED. While optical software can perform the same functions as lighting software, lighting software can produce results much faster.

When do I Need Optical Software?

Optical Software

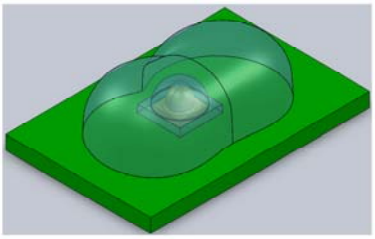
Design optical elements (lenses, reflectors)

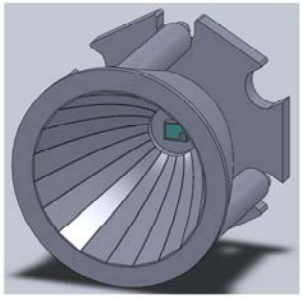
Design & analysis of complete optical system

- Surface treatments
- Materials
- Lit appearance (glare)

Raytrace

Package-specific rayfiles





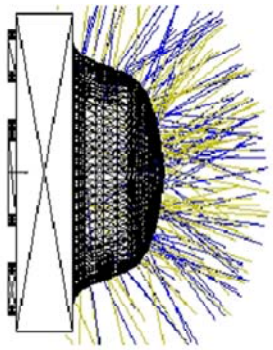
OSRAM
Opto Semiconductors

Optical software is needed to design the individual optical elements in your system. It is also needed to model the effects of different optical surfaces and materials, and to make realistic predictions about lit appearance. Optical software requires detailed source models, such as rayfiles, for accurate results.

What are Rayfiles?

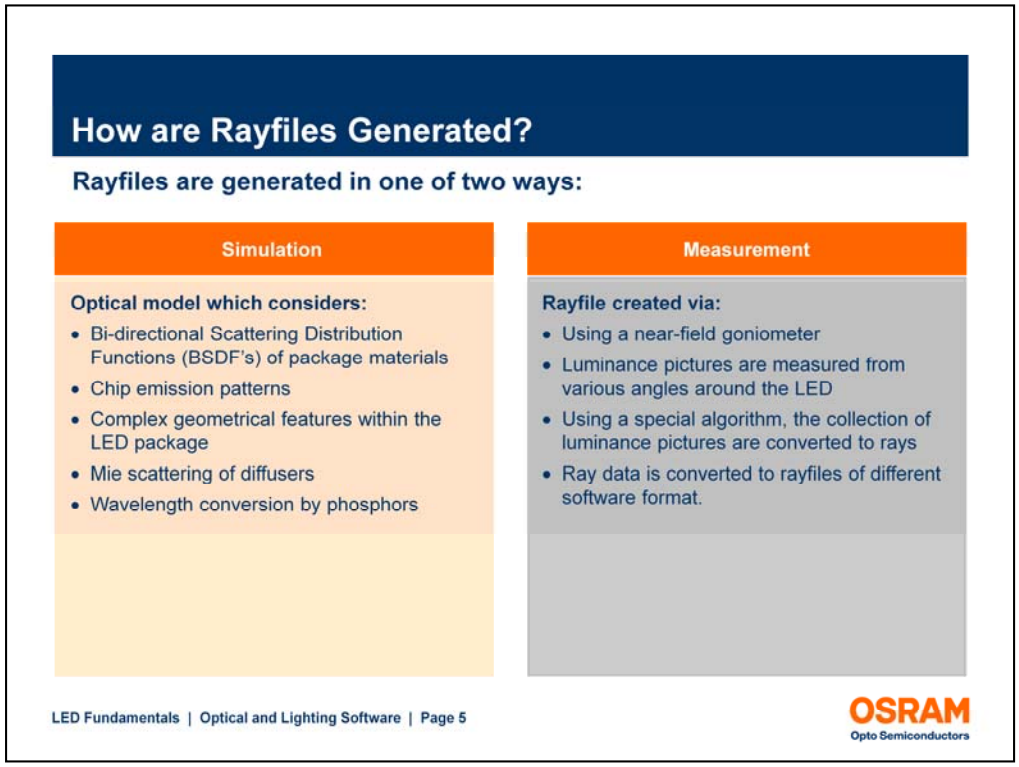
Tabulated data with the properties of each ray exiting the LED:

- Coordinates of the ray starting point (x, y, z)
- Direction of the ray (kx, ky, kz)
- Power/flux of the ray
- For some optical software, the wavelength of the ray



OSRAM
Opto Semiconductors

An LED rayfile contains detailed information about the source. Each ray in the file contains its starting coordinate, ray vector, optical power, and in some cases, the wavelength.



Rayfiles are generated through either computer simulation or measurement.

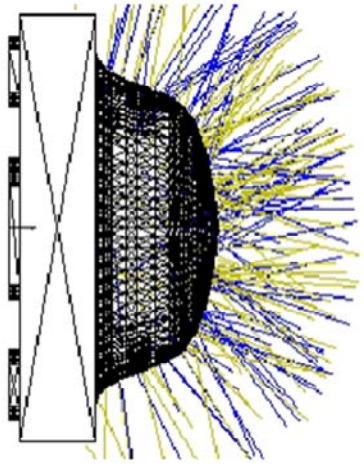
How are Rayfiles Generated?

Rayfiles are generated in one of two ways:

Simulation

Optical model which considers:

- Bi-directional Scattering Distribution Functions (BSDF's) of package materials
- Chip emission patterns
- Complex geometrical features within the LED package
- Mie scattering of diffusors
- Wavelength conversion by phosphors



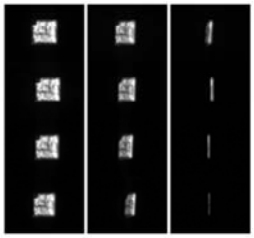
OSRAM
Opto Semiconductors

For simulation, a complicated model is built and raytraced in optical software. Detailed optical properties and physical phenomena must be considered.

How are Rayfiles Generated?

Rayfiles are generated in one of two ways:

Near field goniometer set-up



Luminance pictures taken at different viewing angles θ, φ

Measurement

Rayfile created via:

- Using a near-field goniometer
- Luminance pictures are measured from various angles around the LED
- Using a special algorithm, the collection of luminance pictures are converted to rays
- Ray data is converted to rayfiles of different software format.

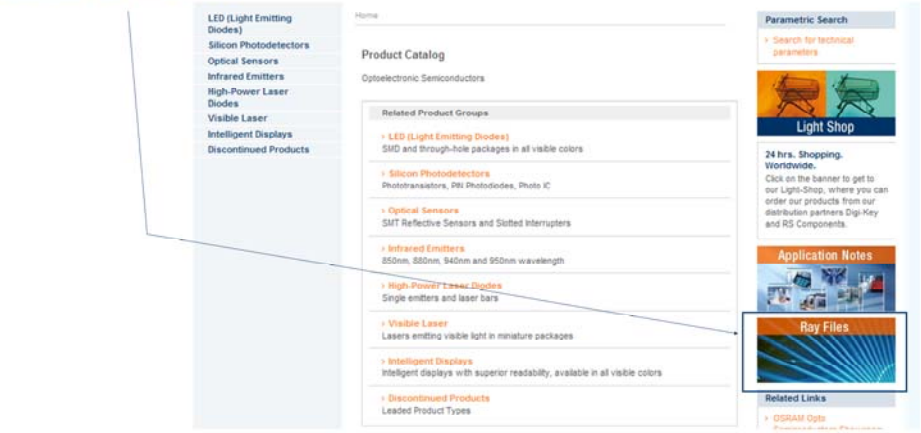
OSRAM Opto Semiconductors

For measured data, a near field goniometer is used to measure the light distribution of the LED. A collection of luminance images is recorded and converted into ray data suitable for use with a number of different software brands.

Rayfiles Online

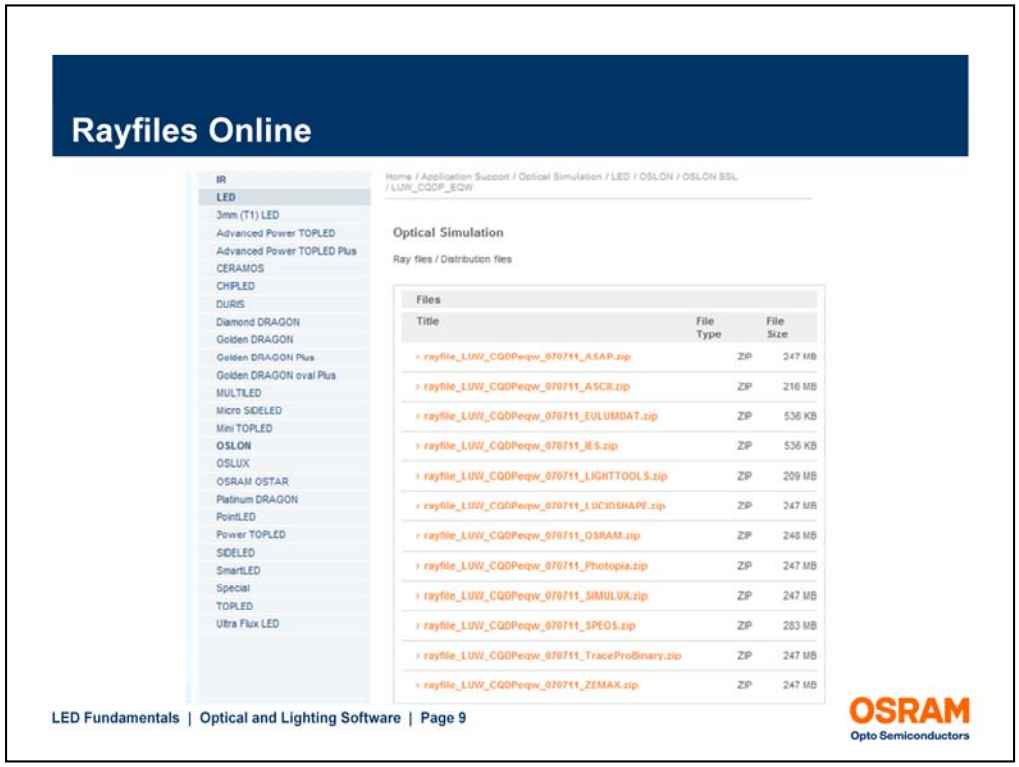
http://catalog.osram-os.com

Click on “Ray Files” icon



OSRAM Opto Semiconductors

Rayfiles for OSRAM Opto Semiconductors’ LEDs can be found on our website by following the links shown here.

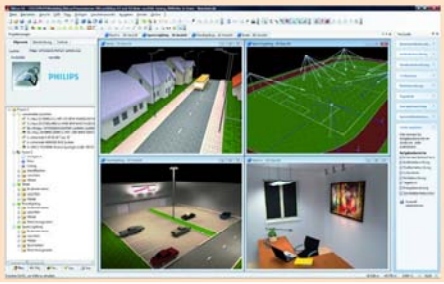


Once you have navigated to the rayfiles of your LED of interest, you will see links to a number of ZIP files. Each ZIP file contains ray data in a different software format. In addition, each ZIP file contains an informational document, 3-D CAD data, and in some cases, spectral information and library files.

What can Lighting Software do for me?

Create any lighting scenario using OSRAM Opto Semiconductors LEDs as the light sources or in a fixture.

- Full software for calculating lighting layouts
  - Create detailed interior and exterior illuminated scene models
  - Create detailed lit renderings
  - Calculate lighting levels on all surfaces



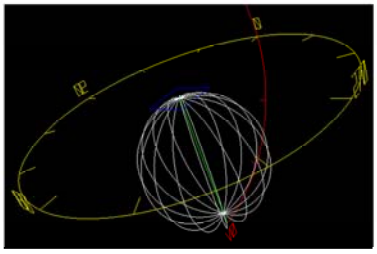
OSRAM Opto Semiconductors

"Lighting software" is used to demonstrate the performance of your fixture or prototype within the application environment. It calculates illuminance and luminance values throughout the scene, and can produce high-quality lit renderings. Both interior and exterior scenes can be created.

What are IES Files?

IES file

- *I*llumination *E*ngineering *S*ociety
- Photometric data (intensity in candela vs. angle)
- ASCII text file, file extension *.ies
- Commonly used in North America



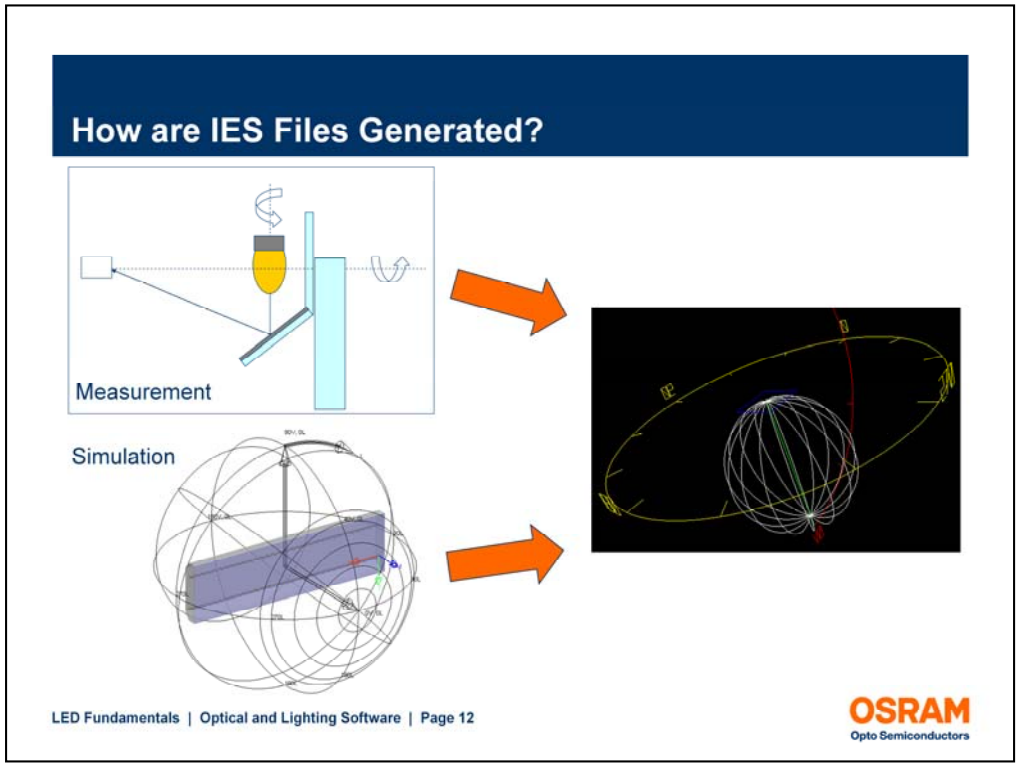
Eulumdat file

- European version of the IES file
- File extension *.ldt

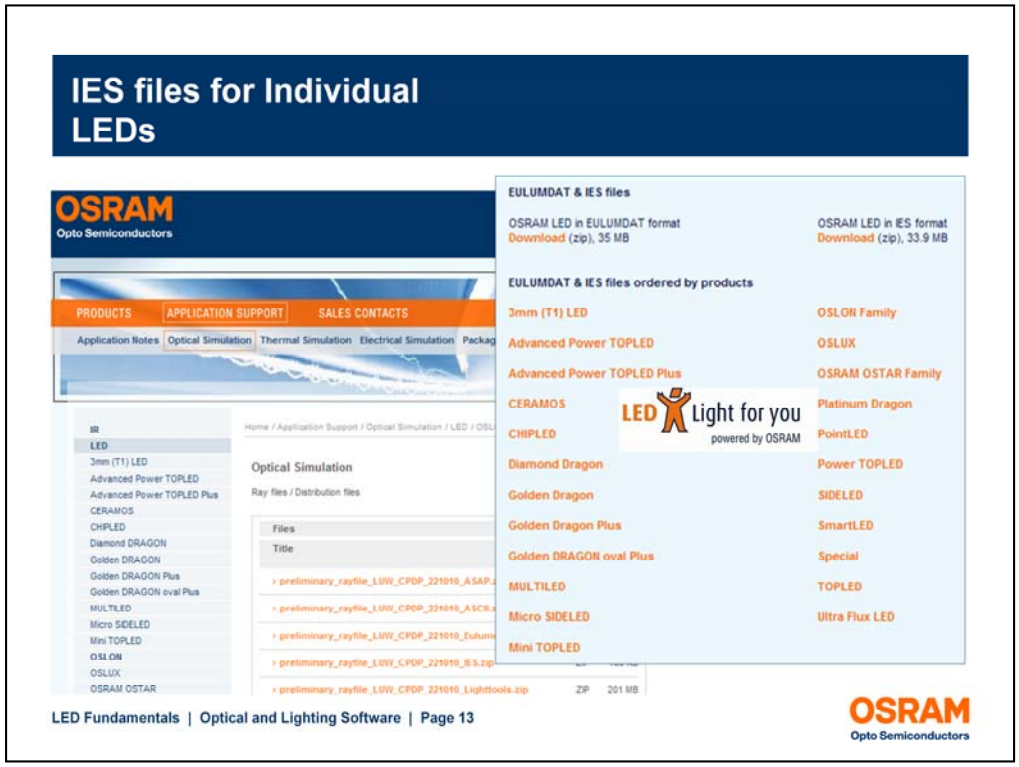
OSRAM
Opto Semiconductors

For lighting software, the light source files are either IES or Eulumdat files. An IES file contains intensity vs angle data for the light source, which can be anything from a single LED to an entire fixture. This ASCII text file is in a standard format developed by the IESNA, and is commonly used by North American fixture manufacturers to distribute photometric information.

An Eulumdat is similar to an IES file in that it is also a text file with intensity vs angle information, but the formatting is different. The Eulumdat format is typically used in Europe.



Like rayfiles, IES files are generated through either computer simulation or measurement. For simulation, a detailed model is built and raytraced in optical software, and the output data is structured into IES format. For measured data, a far field goniometer is used to measure the light distribution.



IES and Eulumdat files for OSRAM Opto Semiconductor LEDs can be found along with our rayfiles. They can also be found on OSRAM's LED Light For You website.

Please refer to the application note **“Importing OSRAM Opto Semiconductors Rayfiles”** on the main OSRAM website for additional information.

Thank you for viewing this presentation by OSRAM Opto Semiconductors.

Disclaimer

All information contained in this document has been checked with the greatest care. OSRAM Opto Semiconductors GmbH can however, not be made liable for any damage that occurs in connection with the use of these contents.

OSRAM Opto Semiconductor GmbH makes no representations and warranties as to a possible interference with third parties' intellectual property rights in view of products originating from one of OSRAM Opto Semiconductor GmbH's partners, or in view of products being a combination of an OSRAM Opto Semiconductor GmbH's product and a product of one of OSRAM Opto Semiconductor GmbH's partners. Furthermore, OSRAM Opto Semiconductors GmbH cannot be made liable for any damage that occurs in connection with the use of a product of one of OSRAM Opto Semiconductor GmbH's partners, or with the use of a combination of an OSRAM Opto Semiconductor GmbH's product and a product of one of OSRAM Opto Semiconductor GmbH's partners.

OSRAM
Opto Semiconductors