

Creating Today's Innovative Solutions



TracePro optical and illumination design software has enabled almost twenty years of product innovation and research discovery across a breadth of applications:

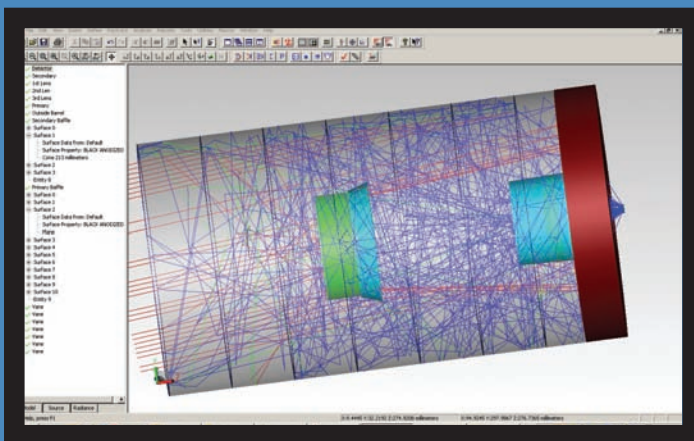
- Lighting
- Display
- Life Sciences
- Industrial Manufacturing
- Aerospace and Defense
- Information Technology
- Energy
- Automotive
- Consumer Electronics
- Security

TracePro is an outstanding optical and illumination design software solution with its accuracy, ease of use, and short learning curve.

Benefits: Faster Development with Greater Capabilities

TracePro decreases prototyping time by combining a 3D CAD interface, multiple utilities, and interoperability with other programs to streamline the design process:

- Import and export from/to almost any CAD program and allow modification of this geometry
- RepTile algorithm for on-the-fly surface creation to quickly define and ray trace millions of surface entities for lighting and display backlight analysis
- Scheme macro language to create complex solid geometry with simple one-line commands. Scheme is taught and used by hundreds of universities worldwide. TracePro and Scheme work together using dynamic data exchange to share data, accelerate geometry creation, and automate design and analysis
- Features to model many optical phenomena including birefringence, diffraction, volume scattering, thin film stacks, and fluorescence



Visualization

Integrating Optical & Solid Modeling for Fast, Accurate Analysis

Model & Analyze

The development of optical and lighting systems, sources, and components requires meeting system performance criteria and constraints, including spatial and angular light output distribution, and spectral characteristics. Achieving these criteria quickly with a manufacturable and cost-effective design requires modeling software that is powerful, easy to use, and accurate. TracePro, renowned in the scientific community for the accuracy of its simulations, offers engineers and scientists the confidence that the simulated design will predict the performance of their finished products without costly prototype iterations.

TracePro is a comprehensive, versatile software tool for modeling the propagation of light in imaging and non-imaging opto-mechanical systems. Models are created by importing existing designs from compatible lens design and CAD programs or directly in TracePro. You can use Boolean operations to unite, subtract, and intersect objects to create more complex parts. The program uses a re-arrangeable system tree to group or layer parts in any order for manageability, and to quickly apply optical materials and surface properties. Sources are modeled using a variety of methods including emission from source geometry, ray or bitmap files, lamp and LED catalogs, grid sources or a combination of the above methods. Rays from these sources are propagated through the model with portions of the flux of each ray allocated for absorption, specular reflection, transmission, fluorescence, birefringence, polarization, and scattering. Output information is designed to be intuitive and easy to export. Complete graphical, ray and textual information makes analysis easy to understand.

Visualization: Seeing is Understanding

After ray-tracing a system, it is essential to understand how energy reaches every surface. In most optical and illumination systems the goal is to either maximize throughput, create the smallest spot, achieve uniformity on a target, or shed unwanted light. TracePro's analysis mode uses visual ray sorting algorithms and ray direction arrows to show how rays reach every surface. These options are extremely useful in understanding a design by seeing a percentage of the starting rays, or as a function of how they interact with each surface. You can even select an area on a target surface and the program will update the ray selection to show you how rays propagated to that area.

Advanced Capabilities & Features

When you need advanced ray-tracing capability, TracePro has the features and power to meet your needs. Birefringence, polarization, repetitive structures, bulk scatter, thin film stacks, stratified importance sampling, Scheme macro language, 32- and 64-bit versions, multi-threaded raytrace, analysis and simulation modes, and exact, accelerated and faceted ray-trace options are all available. These features help you understand how light travels through human tissue, and interacts with complex structures such as DMD chips and the millions of repetitive scattering, reflecting, and transmitting structures in backlight displays. Using the Scheme macro language, you can create and modify complex geometry. Together with the built-in macro recorder and Scheme editor, it is simple to create and iterate a design. The healing husk is the ideal tool for analyzing, simplifying and healing faulty imported CAD geometry for accurate raytracing. The faceted and multi-threaded raytrace capabilities combine to give you fast ray-tracing on multi-core computers.

Analyze Every Factor, Avoid Every Pitfall

3D Advanced Rendering Capability

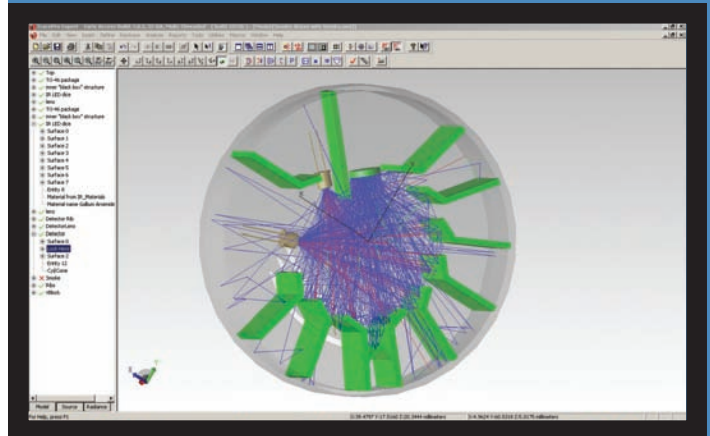
TracePro has several viewing options to let you see inside objects, find problem areas, and visualize energy propagation through any optical or illumination system. Large and readable irradiance/illuminance and candela plots have profiles, enhanced scales, and 3D viewing options. Using the mouse, you can zoom in on problem areas and use incident ray tables or ray histories to understand how unwanted energy propagated from or to specified targets.

Working coordinate systems are available to display local coordinate axes for each object. You can create any custom view of the geometry, name it, and save it with the model file.

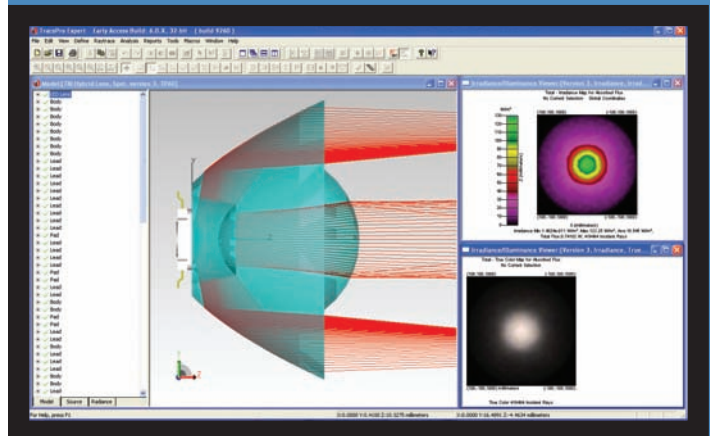
Three-dimensional irradiance maps show flux as it appears directly on selected surfaces. You can quickly determine if illumination is uneven on any object or surface.

The Monte Carlo Method Takes the Gambling Out of Sampling

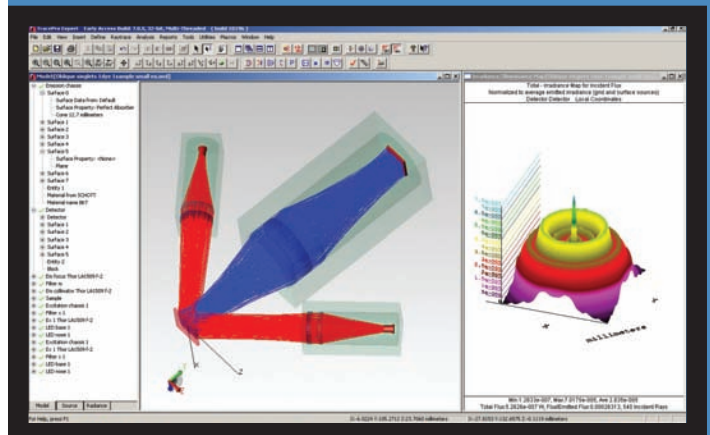
TracePro uses the standard in non-sequential ray tracing, the Monte Carlo Method, to accurately model scattering and diffraction of light. TracePro is a descendent of GUERAP, developed more than 40 years ago as the first Monte Carlo optical raytracing program. Instead of propagating a distribution of light, as in deterministic sampling, the Monte Carlo Method propagates discrete samples or rays.



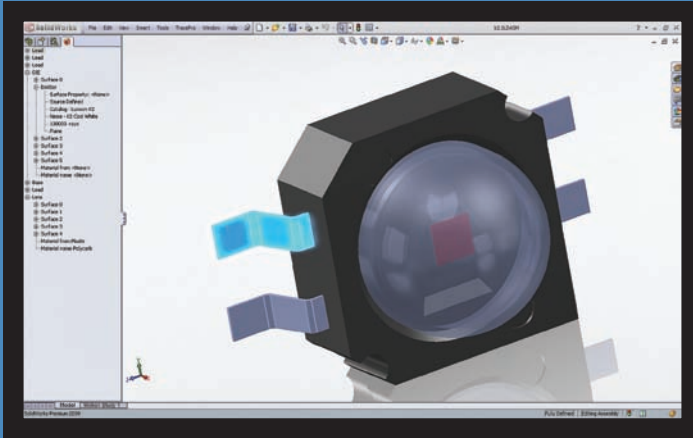
Smoke Alarm System with Volume Scattering



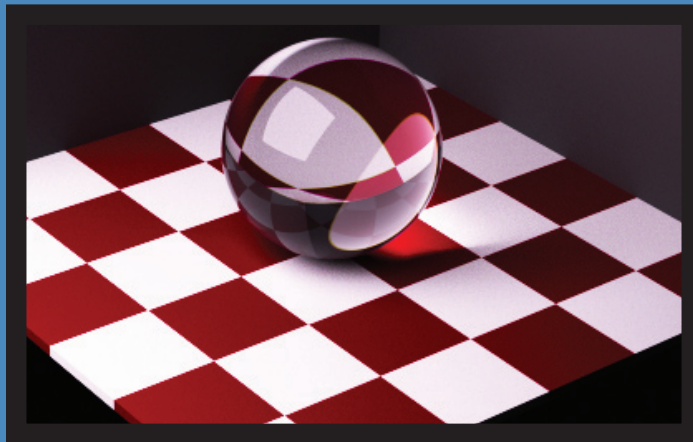
Hybrid TIR Lens with Resulting Irradiance and True Color Output



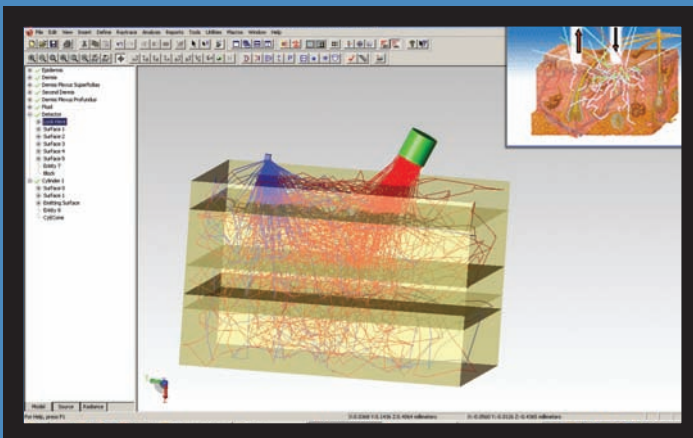
Dual Beam Fluorometer System



TracePro Bridge



Photorealistic Rendering



Biomedical Simulation

Three Editions

TracePro has three editions to fit your needs: LC, Standard, and Expert. Each edition is specifically designed to get you started on your application and then provide an upgrade path as your needs increase. The LC edition is targeted at standard lighting and lightpipe applications. The Standard edition is perfect for most optical and illumination design, analysis, and stray light tasks. When advanced capability is needed for textured back-light design or life science applications, the Expert edition has the superior capability to model millions of scattering dots and bulk scatter functionality for simulating biological tissue.

Powerful Interactive Design & Analysis Capabilities

Design

TracePro's CAD interface, smart tools and utilities are advantageous for creating excellent starting points to start the optimization process. TracePro's utilities and features walk you through the process of designing reflectors, lenses, textures for back-lights, lightpipes, and entire systems.

Work Quickly

TracePro is built from the ground up as a native Windows application. The result: a multi-threaded program with tremendous capacity. You will learn fast, work fast, and stay current with the easy-to-learn TracePro graphical user interface.

Learning TracePro is as Easy as Pointing and Clicking

In fact, if you have used any Windows application, you know how to use TracePro. There's little need to memorize commands. Functions are easily performed via toolbar buttons and pop-up menus with built-in context-sensitive help. Using the mouse you can control the view, move and rotate objects on screen, and zoom in and out. For quick reference, the coordinates of the mouse cursor are always displayed on the status bar at the bottom of the application window.

Move Between Tasks Seamlessly

You can open multiple models and multiple views of each model at the same time. Since many operations are based on modeless dialog boxes, you can also move back and forth between tasks while keeping the dialog boxes open. Windows can be cascaded, tiled and minimized using standard Windows controls. You can copy and paste sources and objects from one model to another.

Translators, Utilities, Surface, Lamp & LED Catalogs

Lens and Mechanical Designers Can Now Share Data

Sharing data is a two way street in TracePro. Complex models of mechanical structure from one or many CAD files can be melded with an optical design from another program for complete analysis. Translators exchange information about solid models, not just lines or wires. All mechanical data is preserved when information is exchanged. You import these industry-standard files into TracePro simply by opening them.

Incorporating Light Sources

Any surface or object can be turned into a source and your model can include any number of sources (Standard and Expert only). TracePro includes a library of over 500 lamps and over 100 LEDs along with the capability of reading IES files. Quick sources can be defined using TracePro's native grid source dialogs, specifying type of grid, size, angular information, polarization, and spectral data.

Managing Design Workflow

The design, tolerancing and documentation of optical systems require a high level of collaboration between optical and mechanical engineers. Design teams face increasingly shorter product development cycles and lower R&D budgets. To effectively manage collaborative work flow, Lambda Research Corporation offers tools that not only facilitate optical design, but also facilitate the overall system level development process by integrating the optical model into both the CAD model and the design team's work flow.

TracePro Bridge™ for Solidworks®

TracePro Bridge is an add-in to SolidWorks that allows you to apply and save optical properties directly to the SolidWorks model via the TracePro System Tree. To insure data integrity, a single model is used by both TracePro for ray tracing and optical analysis and by SolidWorks for mechanical design. With the Bridge, users significantly accelerate the iterative design process - all without sacrificing performance or functionality.

Output: Information that Helps Solve Problems

More Reporting Tools Than You Thought Possible

Flux Reports, incident ray tables and ray histories are essential to understanding where light is being absorbed, lost, scattered, reflected, or refracted. TracePro's reports enable you to do detailed stray light analysis, as well as optical and illumination analysis. TracePro excels at reporting how the light reached each surface. The Flux Report details where energy is lost or



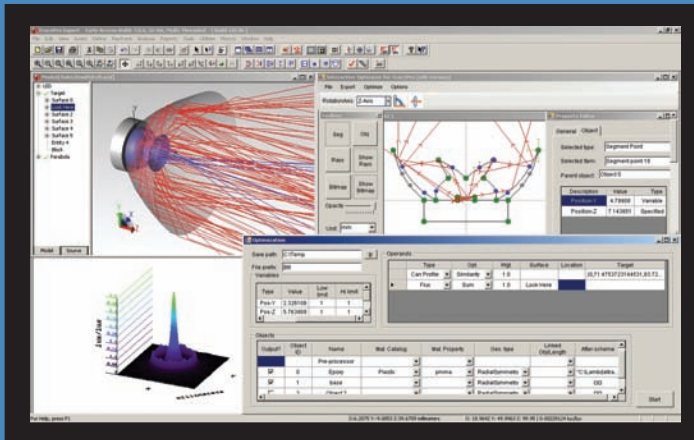
MEGAMAN® LED Par 16 Reflector as Modeled in TracePro

"MEGAMAN® has been employing TracePro (an optical analysis software) to assist in the development of its eco-lighting products since 2008. The software plays an important role in the design of reflectors of the LED lamp, which is critical to the light quality and used widely in MEGAMAN® lamp and fixture products.

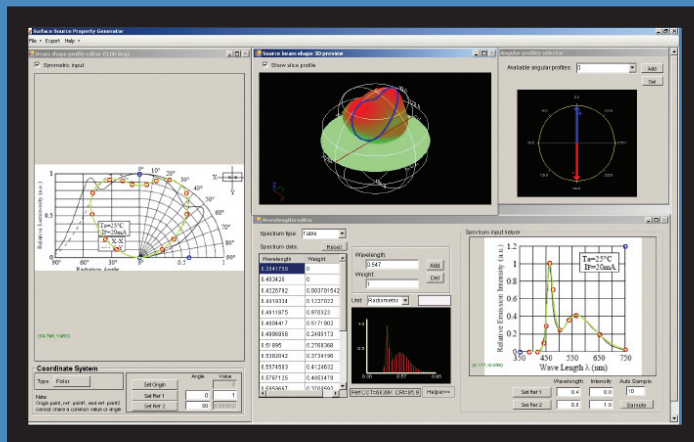
As a pioneer in the eco-lighting industry, MEGAMAN® continuously introduces ideas and cutting-edge technology in eco-lighting solutions to consumers from all over the world. MEGAMAN® has been immensely impressed by the sophistication of the TracePro software, and the MEGAMAN® LED technology combined with the software has allowed MEGAMAN® to successfully launch a groundbreaking series of high quality, energy-saving and eco-friendly LED reflector lamp that is already gaining a reputation in the industry.

Using TracePro as an idea design tool, MEGAMAN® can use the data generated by the software to find easily a design direction. While it may take a long time to analyse and compare data using normal lighting software, TracePro enables a prompt and satisfactory design to be achieved, significantly accelerating the iterative design process. Time and cost are saved in making test samples and in analysing the cycle. What is more, the software can provide a credible indication of any fine adjustment in design that is required, which lessens the potential for deviation occurring in the prototype sample and measurement."

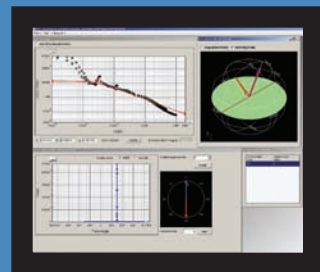
Mr. O.F. Foo
Chairman, Megaman



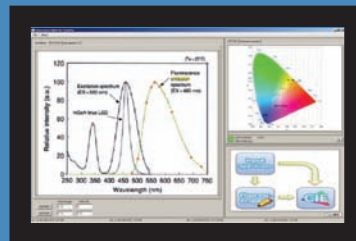
Interactive Optimizer



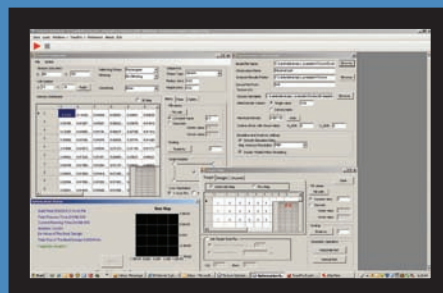
Source Property Generator



BSDF Converter



Fluorescence Utility



Texture Optimizer

absorbed. The Incident Ray Table shows individual ray information including optical path length, position, direction, and polarization state for every ray incident on the surface. All of this information is available for post-processing by saving in a text file or copying and pasting into your favorite Microsoft-compliant package, like Excel, for further investigation.

No matter what information you need for a complex analysis, TracePro has the visualization capability you need to understand what is happening in your system. Outputs include 3D irradiance maps, irradiance/illuminance maps, intensity or candela maps, luminance/lit appearance, optical path length/time of flight plots, and polarization maps.

Utilities

TracePro Has Two Powerful Optimization Utilities

The Interactive optimizer uses a powerful digitizer to create a reflector or lens. You can either sketch in a new design using 2D profiles, or trace an existing design by pasting an image into the digitizer and sketching splines or lines on top of the design. An interactive ray tracer validates the design by tracing individual rays in real time. Systems are easily modified by pulling on any spline or line segments while updating previously sketched rays. Menus define system variables, set geometry limits, create single or multiple merit functions, and finally optimize the design. Using this optimization utility significantly accelerates the iterative design process by starting with better initial designs and using multiple target functions through minimization and maximization of flux, intensity and irradiance profile targets and spectrum requirements. Optical design progress is monitored through the use of an optimization log and the iterative error function graph.

The texture optimizer utility optimizes backlight displays using the RepTile (Repetitive Tile function). Start with a textured backlight design in TracePro, create a target output, either uniform, balanced, or a particular pattern, and this utility will iterate the RepTile scattering pattern and optimize it to achieve the target output.

Other Utilities

TracePro has several utilities to help you model surfaces, sources and materials quickly. The Source Property Generator is extremely convenient for digitizing large amounts of data to correctly model lamp and LED emission versus wavelength and angle. The BSDF converter imports measured data from several hardware manufacturers and outputs TracePro surface properties. The IES importer reads IES files and exports TracePro surface and file source properties. The Fluorescence Utility is perfect for digitizing excitation and emission spectra and exporting TracePro fluorescence property data. We are constantly updating our utilities, and more are on the way.

TracePro EDITIONS COMPARISON

Three Editions of TracePro are available to cost effectively accommodate your design and analysis needs

Edition	LC	Standard	Expert
FEATURES			
User-Friendly CAD Interface, Interoperability with Commercial CAD software through the SAT (ACIS) file format and Lens Design Software	YES	YES	YES
Scheme Macro Language, Recorder and Editor	NO	YES	YES
Material, Surface, Lens, Lamp and LED catalogs of commercially available glass, plastics, metals, anodized surfaces, paints, lamps and LEDs	YES	YES	YES
Optimization	NO	YES	YES
SOLID MODELING			
SAT Import and Export with Healing Utility	35 OBJECTS	UNLIMITED	UNLIMITED
Lens Design Import for all commercial design programs including OSLO	35 OBJECTS	UNLIMITED	UNLIMITED
TracePro Bridge for Solidworks Compatibility	35 OBJECTS	UNLIMITED	UNLIMITED
CAD features including solid modeling, Boolean Operations, 3D interactive view, 3D Rendered, transparent, wireframe, hidden view and measurements	35 OBJECTS	UNLIMITED	UNLIMITED
Multiple CAD translators including, CATIA, Inventor, Pro/E, STEP and IGES	35 OBJECTS	UNLIMITED	UNLIMITED
PROPERTIES			
Surface Property modeling include absorption, reflection, refraction, scatter off any surface and bulk absorption	YES	YES	YES
Diffraction, Bulk Scatter, Grin, Thin Film Stacks, Polarization, Diffraction Gratings, Temperature Dependent and Anisotropic Properties	NO	YES	YES
Tabular Scatter Models, Repetitive Tile (Reptile™) Surface, Temperature Distributions, Birefringence, Wire Grid Polarizers and Fluorescence	NO	NO	YES
Scatter Models	SYMMETRIC	SYMMETRIC AND ASYMMETRIC	SYMMETRIC AND ASYMMETRIC
SOURCES			
Grid and Ray Sources	10 TOTAL SOURCES	UNLIMITED	UNLIMITED
Surface Sources	10 TOTAL SOURCES	UNLIMITED	UNLIMITED
Blackbody/Greybody Sources	10 TOTAL SOURCES	UNLIMITED	UNLIMITED
Bitmap and Source Files (ProSource - Radiant Imaging)	10 TOTAL SOURCES	UNLIMITED	UNLIMITED
RAYTRACE			
Monte Carlo with Ray Splitting	YES	YES	YES
Exact, Accelerated and Facetted Ray-tracing	YES	YES	YES
Simulation Mode (1 or multiple exit surfaces to see results) or Analysis mode (infinite surfaces to see results)	YES	YES	YES
ANALYSIS			
Irradiance/Illuminance and Candela Maps (Intensity) for both Photometric and Radiometric output, CIE(x,y), CIE(u,v) and True Color plots	YES	YES	YES
3D irradiance maps, Polarization and Luminance/Radiance (Lit Appearance)	YES	YES	YES
Flux, Ray History, Enclosed Energy, OPD and Time of Flight Reports	YES	YES	YES
UTILITIES			
Interactive Optimizer	SKETCH & INTERACTIVE RAYTRACE	FULL OPTIMIZATION	FULL OPTIMIZATION
BSDF Converter	SYMMETRIC PROPERTIES	SYMMETRIC & ANISOTROPIC PROPERTIES	SYMMETRIC & ANISOTROPIC PROPERTIES
Source Property Generator	YES	YES	YES
IES Import Utility	YES	YES	YES
Texture Optimization	NO	NO	YES
Fluorescence Property Utility	NO	NO	YES



We are Here to Help!

Since 1992, Lambda Research Corporation has developed innovative optical software programs that reduce design and prototype time in a wide variety of industries. Our products give engineers industry-standard tools and conventions for 3D virtual prototyping that eliminate the need for trial-and-error methods. Our support is outstanding with website access to a knowledge base, webinars, tutorials, and up-to-date examples, as well as email and telephone support through annual contract.

Lambda Research Corporation has comprehensive technical expertise and development resources that go beyond the normal capabilities of other programs. Our programmers and optical experts can work closely with your engineers and designers to customize our TracePro product specifically to meet your needs.

Lambda Research Corporation
25 Porter Road, Littleton MA 01460
978-486-0766

www.lambdares.com
sales@lambdares.com

TracePro APPLICATIONS



"I have used TracePro to design collection optics for LEDs, arc lamps, and halogen lamps. I found that TracePro is very intuitive, has a short learning curve and is easy to retain. I can use TracePro infrequently and not have to 're-train.' I was analyzing and designing within a week! I would recommend TracePro for the optical engineer who needs a powerful yet easy-to-use illumination analysis tool."

Rick Tamburrino, Program Director
Photonics Center of Excellence
Welch Allyn, Inc.

