



Breault
Research

Taking Light
Further

APEX[®]

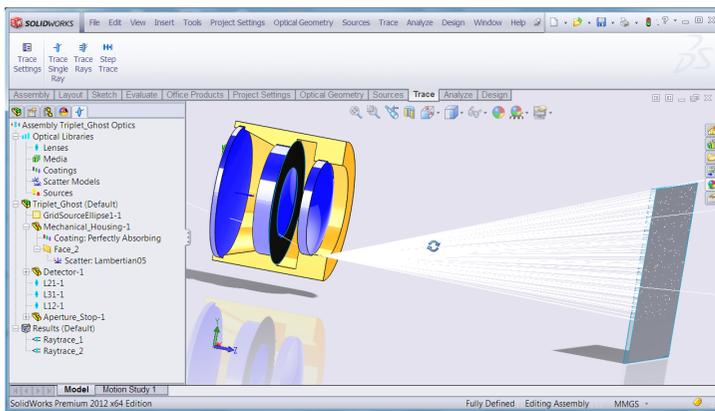
Optical Engineering Power Without the Learning Curve

Available as an add-in to the industry-standard SolidWorks[®] 3D-modeling environment, and based on BRO's ASAP[®] kernel technology, APEX has been developed for the design and analysis of optical and illumination systems using a simple, easy-to-follow workflow.

APEX facilitates and optimizes engineers' interactions with optical software tools through a true CAD interface. With the full power and sophistication of SolidWorks in APEX, there is no need to translate, bridge or link between two separate programs.

In APEX, you learn, create, design, and analyze in the same program environment, and that environment is all about ease of use. APEX seamlessly melds the worlds of computer-aided design and optical engineering, resulting in an "optics aware" design application that allows optical and mechanical engineers to work side-by-side on the same files.

In APEX, no CAD restrictions are placed on your optical components. Rather, APEX combines the power of SolidWorks geometry modeling with the rigor and precision needed for virtual prototyping of optical systems. Optical components created in APEX have optical tolerances and blend seamlessly into larger system models, including electrical, mechanical, and other components.



Perform Ray Traces and Analyze Light Paths in Complex Systems

Key APEX Features

Ease of Use - Work with optical and CAD software designed to be highly capable and visual, yet intuitive and easy to use.

SolidWorks Integration - Complete optical design and analysis tasks in a 3D-based SolidWorks environment.

CAD/Optical Environment - Operate in one environment; no more unnecessary translation or bridging to other software.

Simple Workflow - Create virtual prototypes of optical and illumination systems with a simple, easy-to-follow workflow.

Instant Feedback - Receive immediate feedback when a system characterization or analysis step requires input.

Online Help System - Utilize detailed help records organized by the workflow for designing and analyzing optical systems.

Library Assets - Use and customize comprehensive libraries of sources, lenses, media types, coatings, and scatter models.

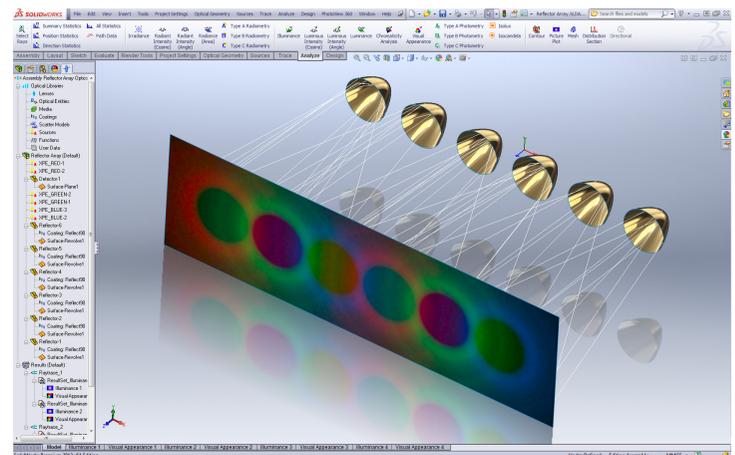
Fast Ray Tracing - Perform fast, accurate ray traces with the ASAP non-sequential ray tracing engine at the core of APEX.

Analysis Flexibility - Perform photometric, visual appearance, and other analyses to assess optical system performance.

Autosave Results - Perform multiple system simulations in a single project with autosaving of simulation and analysis results.

Project Sharing - Share complete system characterization, simulation, and analysis results with one "pack-and-go" step.

Optimization Studies - Define targets, goals, constraints, merit functions, and exit criteria to optimize systems.



Perform Photometric Calculations and Visual Appearance Studies in APEX

(See the Complete APEX Feature List on the reverse-side.)

APEX Features

System Setup Features	
User-Friendly SolidWorks Add-In	Use APEX as an optical engineering add-in to the industry-standard SolidWorks 3D-modeling software.
SolidWorks Modeling	Model system geometry using the full suite of SolidWorks CAD features, along with other third-party add-ins.
Workspace Customization	Create your own custom workspace with flexible, drag-and-drop graphical user interface (GUI) elements.
ENHANCED Design Tree and Optics Menus	Utilize the familiar SolidWorks "Design Tree" and Menus to work with Feature, Property, Configuration, and Optics Managers.
Geometry Importation	Access geometry in native SolidWorks files and interoperate with other CAD programs and file formats.
Smart Dimensions	Set key fixed dimensions in system geometry using the SolidWorks "Smart Dimensions" feature.
Geometrical Relationships	Set geometrical relationships in system geometry using the SolidWorks "Relations" feature.
Equation-Based Geometry	Create parameterized, equation-based geometry using the SolidWorks "Equations" feature.
ENHANCED System Configurations	Create, organize, and toggle between system variations using the SolidWorks "Configurations" interface.
BRO Digitizer™	Import data for system setup from images in .bmp, .gif, .jpg, .png, and .wmf format using the BRO Digitizer.
Optical Geometry	Manage lenses, media, coatings, scatter models, functions & user data with the APEX "Optical Geometry" tab.
Lens Library	Insert lens models from popular lens catalogs, including CVI, Edmund Optics, and Thor Labs, using the "Lens Manager".
Custom Lens Models	Create and save custom lens models with user-defined dimensions and media in the "Lens Manager".
Adjacent Media	Use the "Adjacent Media" feature to conveniently set the index differences between two objects sharing an interface.
Media Library	Insert optical media definitions from more than 15 popular catalogs and categories using the "Media Manager".
Custom Media Models	Create and save custom media definitions using formula-defined and tabulated-media wizards in the "Media Manager".
Optical Parameters	Define media with parameters including Conrady, Herzberger, Schott, and Sellmeier formulas in the "Media Manager".
Coating Library	Insert absorbing, anti-reflection, color filtering, reflecting, transmitting, and other coatings using the "Coatings Manager".
Custom Coating Models	Create and save custom coating models using simple-coating and prescriptive-coating wizards in the "Coatings Manager".
Scatter Model Library	Insert Alanod, Mold-Tech, Tenibac, Toray, and other scatter models using the "Scatter Manager".
Custom Scatter Models	Create and save custom ABg, Harvey, K-Correlation, Lambertian, and Polynomial and User-defined scatter models.
Bill of Materials	View and export a "Bill of Materials" itemizing parts, lenses, and media found in your system model.
Online Help System	Utilize detailed help records organized by the workflow for designing and analyzing optical systems.
NEW Foreign Language Support	Set foreign languages to appear in the APEX user interface, including Korean, Simplified Chinese, and Traditional Chinese.
Source Definition Features	
Source Libraries	Use popular arc, CCFL, filament, and LED source models ready to combine with your system model.
Light Source Manager	Browse and insert arc, CCFL, filament, and LED sources from source libraries using the "Light Source Manager".
Multiple Sources and Raysets	Insert multiple copies of one or more sources simultaneously, and create new raysets from sources placed in your system.
Apodize Sources	Apodize emitting objects, grid sources, and emitting data using angular and positional flux information.
NEW Polychromatic Sources	Create sources at one wavelength or create polychromatic sources with user-defined wavelength intervals.
Rayset Options	Insert source models with pre-defined or user-defined color temperature, flux, and ray count properties.
NEW Edit Emitting Sources Simultaneously	Simultaneously edit Emitting Disc and Rectangle sources with user-defined ray distribution, direction, and emission properties.
Import/Export Source Data	Import and export measured/computed source data in a variety of formats, including EULUMDAT, IES LM-63-02, and BRO .dis.
Source Statistics	View and export ray, power/flux, position, direction, and/or summary statistics for rays associated with your sources.
Select Rays	Select and utilize subsets of rays from system sources using combinations of Boolean ("AND", "OR") operators.
Source Radiant or Luminous Exitance	Perform Radiant or Luminous Exitance calculations and create plots to visualize source power per unit area.

Source Definition Features (continued)	
Source Radiant or Luminous Intensity	Perform Radiant/Luminous Intensity calculations and create plots to visualize source power vs unit solid angle.
Source Radiance or Luminance	Perform Radiance/Luminance calculations and create plots to visualize source power per unit area per unit solid angle.
Isocandela Visualization	Perform Isocandela-type calculations and create Isocandela plots to visualize sources.
Type A, B, and C Radiometry /Photometry	Perform type A, B, and C intensity calculations and create related plots to visualize sources.
Ray Tracing Features	
NEW Auto-Recognize Media in Contact	Correctly trace parts or surfaces in contact, even with coatings or other interface properties.
Trace Single Ray	Trace a single ray to get a quick idea of how light will propagate through your system model.
Trace in Steps	Trace rays one or multiple steps at a time with the Step Trace feature found on the "Trace" tab.
Ambient Medium	Specify the ambient media for your system using custom or pre-defined catalogs in the "Media Manager".
Fresnel Settings	Specify system- or object-level Fresnel settings to handle S and P polarization states, normal incidence, and TIR cases.
Ray Termination	Specify ray termination characteristics with settings for directions, intersections, flux thresholds, and flux ratios.
Ray Splitting	Specify ray splitting characteristics with settings for specular splitting and Monte Carlo splitting.
Scattering and Importance Edges	Specify ray scattering characteristics based on ray path and flux information, and scatter rays toward importance edges.
ENHANCED Ray Display, Move, Focus, and Export	Visualize rays with settings for nth rays, ray color, and previous traces; Move and Focus rays after a trace; and export plotted rays.
ENHANCED Ray Trace Accuracy and Speed	Trace rays with improved speed via complex feature recognition, now always on during APEX ray traces.
Analysis Features	
NEW Analysis Templates	Create, save and re-use prior raytrace analysis suite as automated template for future traces.
NEW Data Tables	Save and re-use data tables of angular or positional values in future analysis.
NEW Non-Orthogonal Detector Analysis	Automatically calculate irradiance on surfaces in any orientation in the 3D CAD environment.
NEW Photometric Analysis Optimization Goals	Use luminance, illuminance and luminous intensity as optimization goals.
Comprehensive Analysis Capabilities	Use comprehensive analysis features to perform photometric, visual appearance, and other system analyses.
Optimization Studies	Define targets, goals, constraints, merit functions, and exit criteria to optimize system performance.
Parametric Studies	Define parameters, increments, constraints, and goals to check system performance as a function of one or more parameters.
Ray Path and Critical Surface Analyses	Perform ray path, ray fluence, and critical surface analyses using new analysis options defined on the "Project Settings" tab.
Split-View Interface Mode	Visualize and confirm numerical outputs such as ray statistics and specific ray paths in the new split-view graphical pane.
Radiometric & Photometric Analyses	Perform radiometric & photometric analyses on complete systems, individual surfaces, or at interim locations.
Irradiance Calculations	Calculate Irradiance (power per unit area) and create plots to visualize system performance.
Intensity Calculations	Calculate Radiant Intensity (power per unit solid angle) and create plots to visualize system performance.
Radiance Calculations	Calculate Radiance (power per unit area per unit solid angle) and create plots to visualize system performance.
Multiple Plot Types	Create a variety of 2D and 3D plots to visualize light distributions and assess system performance.
Type A, B, and C Radiometry /Photometry	Perform type A, B, and C Intensity calculations and create related plots to assess system performance.
Mathematical Processing	Post-process simulation results using mathematical operations such as averaging, logarithms, squaring, and others.
Customize Plots and Plot Defaults	Customize your plot windows, axes, backgrounds, and styles; create plot defaults; and view multiple plots in a single window.
Autosave and Revisit Results	Perform and revisit multiple system simulations in a single project with autosaving of simulation and analysis results.
Project Sharing	Share complete system characterization, simulation, and analysis results with the "Optical Pack-and-Go" feature.