



Breault  
Research

Taking Light  
Further

# APEX®

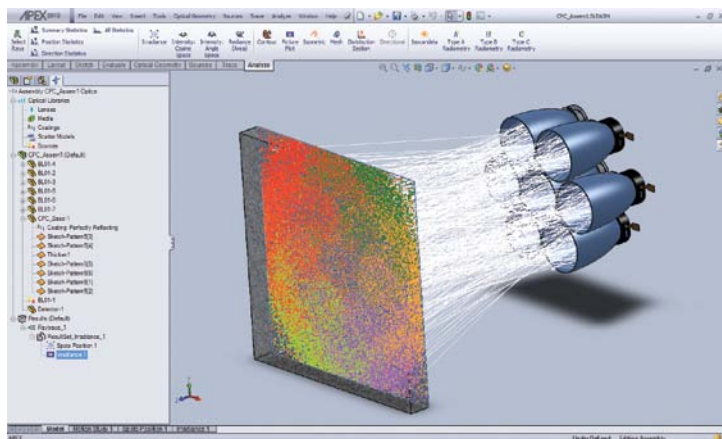
## Optical Engineering Power Without the Learning Curve

Fully integrated into 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 is a standalone application that 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.

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.

APEX allows optical and mechanical engineers to work side-by-side on the same files, opening up new possibilities for the future of optics.



Compound Parabolic Concentrator Array in APEX

## 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 SolidWorks 3D modeling-based environment

**CAD/Optical Environment** - Operate in one environment, eliminating the need for translation, bridging, and file-sharing

**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.

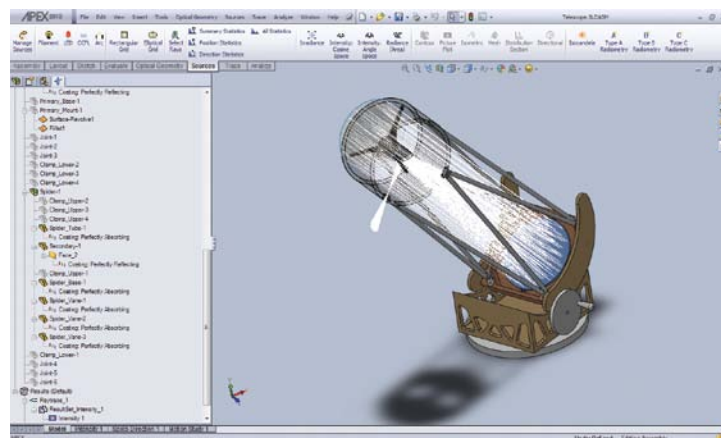
**Analysis Flexibility** - Run simulations and use comprehensive analysis features to understand optical system performance.

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

**Revisit Results** - Toggle between multiple sets of simulation and analysis results that are automatically saved and organized.

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

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



Dobsonian Telescope in APEX

# APEX Features

System Setup Features	
User-Friendly Environment	Work in a user-friendly optical software environment based on SolidWorks 3D-modeling software.
SolidWorks Modeling	Model system geometry using the full suite of SolidWorks Parts, Assemblies, and Drawings features.
Workspace Customization	Create your own custom workspace in APEX with flexible, drag-and-drop graphical user interface (GUI) elements.
Design Tree	Utilize the familiar SolidWorks “Design Tree” view to visualize 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.
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, and scatter models 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”.
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 optical parameters including Conrady, Herzberger, Schott, and Sellmeier formulas in the “Media Manager”.
Coating Library	Insert absorbing, anti-reflection, color filtering, reflecting, transmitting, and other coating types 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 Harvey, Random Slope Error (RSE), and Lambertian scatter models using the “Scatter Manager”.
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.
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	Insert multiple copies of the same source simultaneously or add different sources to your system model.
Wavelength Options	Create source raysets at one wavelength or multiple wavelengths with user-defined wavelength intervals.
Rayset Options	Insert source models with pre-defined or user-defined color temperature, flux, and ray count properties.
Grid Sources	Create rectangular and elliptical grid sources with user-defined ray distribution and direction properties.
Measured Source Data	Create light source models from measured source data that has been imported into APEX using a variety of formats.
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 Irradiance	Perform Irradiance calculations and create plots to visualize source power per unit area.

Source Definition Features (continued)	
Source Intensity	Perform Radiant Intensity calculations and create plots to visualize source power in direction cosine and angle spaces.
Source Radiance	Perform Radiance 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	Perform type A, B, and C radiometry (intensity) calculations and create related plots to visualize sources.
Ray Tracing Features	
Trace Rays	Perform fast, accurate ray traces with the time-proven ASAP non-sequential ray tracing engine at the core of APEX.
Trace Single Ray	Trace a single ray to get a quick idea of how light will propagate through your system model.
Ambient Medium	Specify the ambient media for your system using custom or pre-defined catalogs in the “Media Manager”.
Wavelength and Power Units	Specify default wavelength value and units such as nanometers, and default power units such as Lumens and Watts.
Fresnel Computations	Specify Fresnel computation 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.
Ray Scattering	Specify ray scattering characteristics with settings for scattering generations and relative flux thresholds.
Ray Trace Display	Specify trace display characteristics with settings for displaying nth rays, ray color, and visualization of previous traces.
Ray Trace Accuracy	Specify ray trace accuracy using settings for normal and enhanced ray tracing modes.
Analysis Features	
Analysis Flexibility	Use comprehensive analysis features to visualize and access raw data on optical system performance.
Radiometric Analyses	Perform radiometric analyses on complete systems, individual surfaces, or at interim locations in your system.
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.
Contour Plots	Create 2D and 3D Contour plots to visualize light distributions and assess system performance.
Picture Plots	Create false-color Picture plots to visualize light distributions and assess system performance.
Isometric Plots	Create 3D Isometric plots to visualize light distributions and assess system performance.
Mesh Plots	Create Mesh Surface plots to visualize light distributions and assess system performance.
Distribution Sections	Create Distribution Section plots to visualize cross sections of light distributions and assess system performance.
Isocandela Plots	Perform Isocandela-type calculations and create Isocandela plots to assess system performance.
Type A, B, and C Radiometry	Perform type A, B, and C radiometry (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.
Plot Customization	Customize your plot windows, axes, backgrounds, and styles, and save your plot templates for future use.
Autosave Results	Perform multiple system simulations in a single project with autosaving of simulation and analysis results.
Revisit Results	Toggle between multiple sets of simulation and analysis results that have been automatically saved and organized.
Project Sharing	Share complete system characterization, simulation, and analysis results with the “Optical Pack-and-Go” feature.