

## Making Custom Optical Properties in TracePro

A Lambda Research Corporation Webinar

July 27, 2017

# Presenter

- **Presenter**

Dave Jacobsen

Sr. Application Engineer

Lambda Research Corporation

- **Moderator**

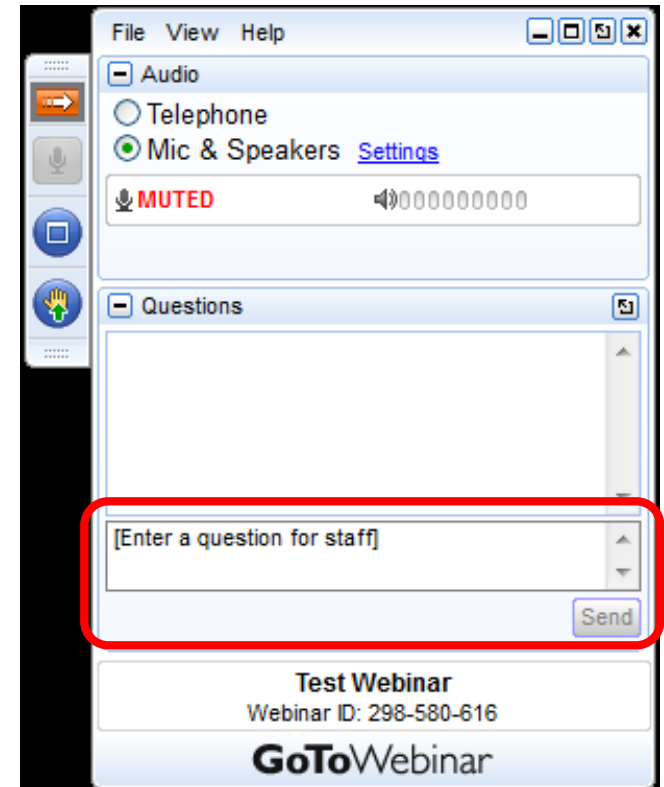
Mike Gauvin

Vice President of Sales and Marketing

Lambda Research Corporation

# Format

- A 25-30 minute presentation followed by a question and answer session
- Please submit your questions anytime using Question box in the GoToWebinar control panel



# Additional Resources

- Past TracePro Webinars
  - <https://www.lambdares.com/su/tracepro-webinars/>
- TracePro Tutorial Videos
  - <https://www.lambdares.com/su/tracepro-videos/>
- TracePro Tutorials
  - <https://www.lambdares.com/su/tracepro-tutorials/>
- Information on upcoming TracePro Training Classes
  - <https://www.lambdares.com/training/>

# Upcoming TracePro Training

- **Tel Aviv, Israel**
  - 1-day TracePro seminar – October 16, 2017
- **Littleton, MA**
  - Introduction to TracePro – October 24-25, 2017
  - Optimization with TracePro – October 26-27, 2017
- **Barcelona, Spain**
  - Introduction to TracePro – November 7-8, 2017
  - Optimization with TracePro– November 9-10, 2017
- **Please ask us about custom onsite training**

# Latest TracePro and RayViz Release

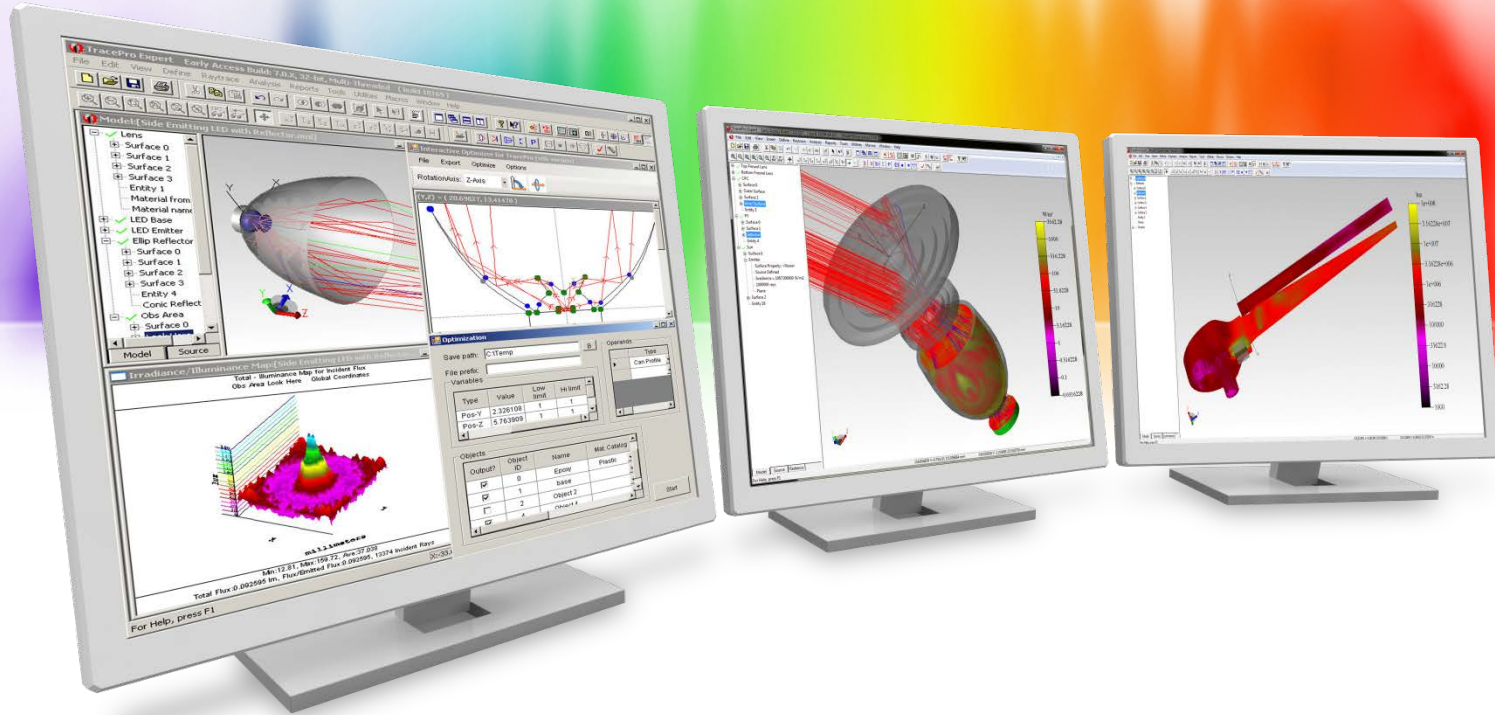
**TracePro 7.8.1** - Released May 3, 2017

**TracePro 7.8.2 Early Access** - Now available

**RayViz 7.8.1** - Released May 3, 2017

Customers with current maintenance and support agreements can download this new release at:

<http://www.lambdares.com/CustomerSupportCenter/index.php/trace-pro/current-release>



## Making Custom Optical Properties in TracePro

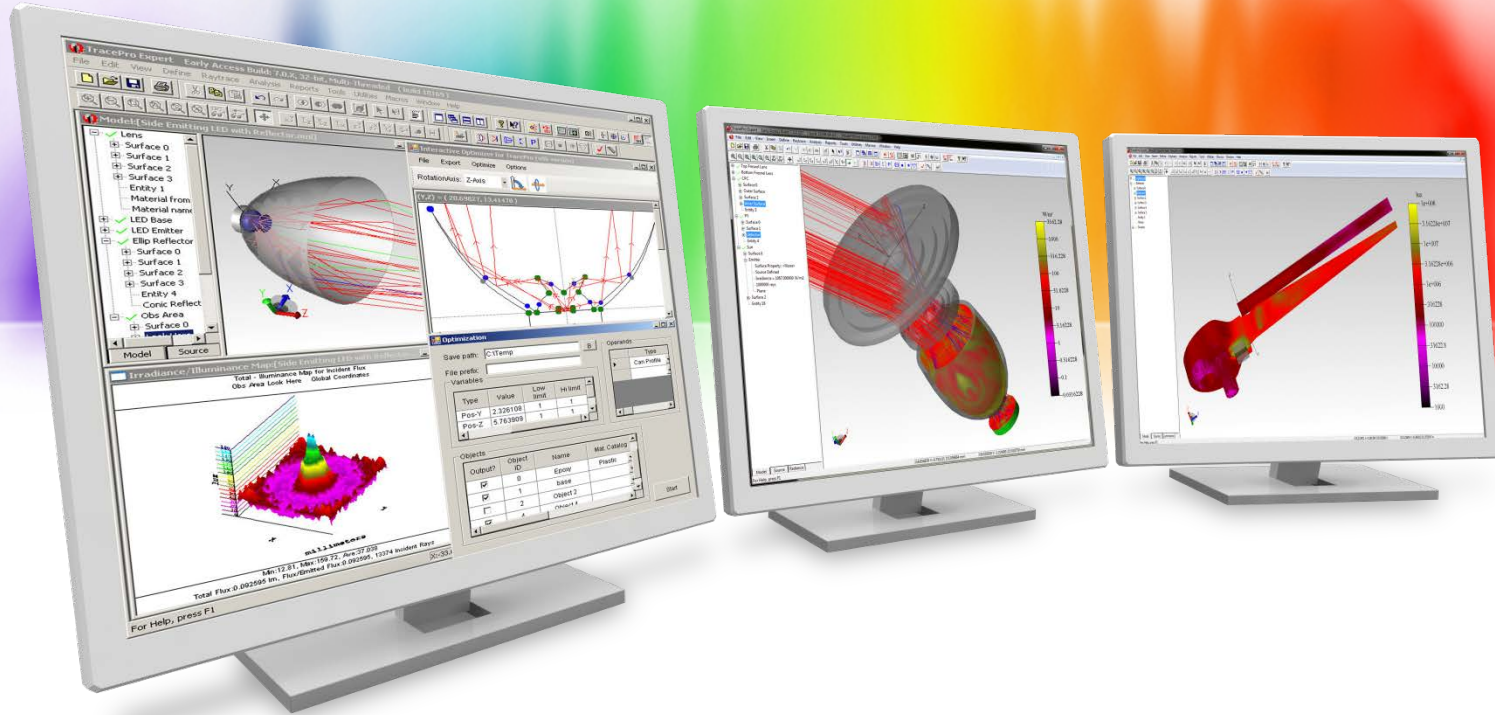
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# Agenda

- What property types are available in TracePro
- Which properties are available in each edition of TracePro
- The parameters that define different property types
- The property editors and how to make new properties
- Utilities in TracePro for making new properties
- Questions and Answers





## Property Types in TracePro

# Property Types in TracePro

Properties applied to objects

- **Material**
- **Bulk Scattering**
- **Fluorescence**
- **Gradient Index**
- Mueller Matrix
- Raytrace Flag
- Importance Sampling (for Bulk Scattering)
- Temperature
- Color

Properties shown in **Red** have a dedicated property editor

# Property Types in TracePro

Properties applied to surfaces

- **Surface**
- **RepTile™**
- Color
- Importance Sampling (surface scattering, surface source, and diffraction)
- Exit Surface
- Diffraction
- **Surface Source**
- Temperature
- Temperature Distribution

Properties shown in **Red** have a dedicated property editor

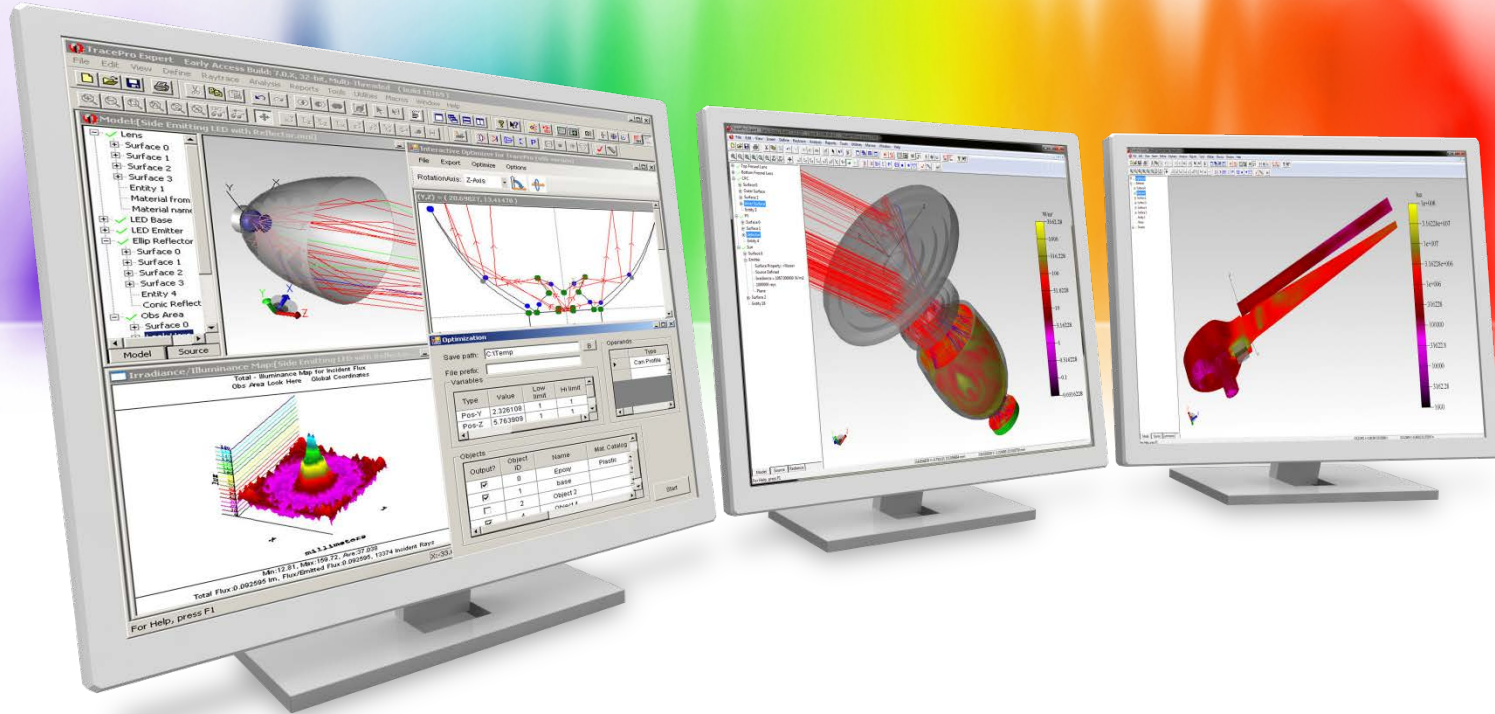
# Property Types in TracePro

Properties are stored in the TracePro property database

- Typical location of TracePro property database:

C:\Users\username\AppData\Roaming\Lambda Research Corporation\  
TracePro\TracePro.db

- Database location can be found at View->Options->General
- Tools->Database->Export – Saves current model properties as a text file
- Tools->Database->Import – Import new properties



# Property Types Available in Each Edition of TracePro

# Property Types in TracePro LC

- Surface
- Material
- Surface Source
- Color
- Exit Surface
- Raytrace Flag

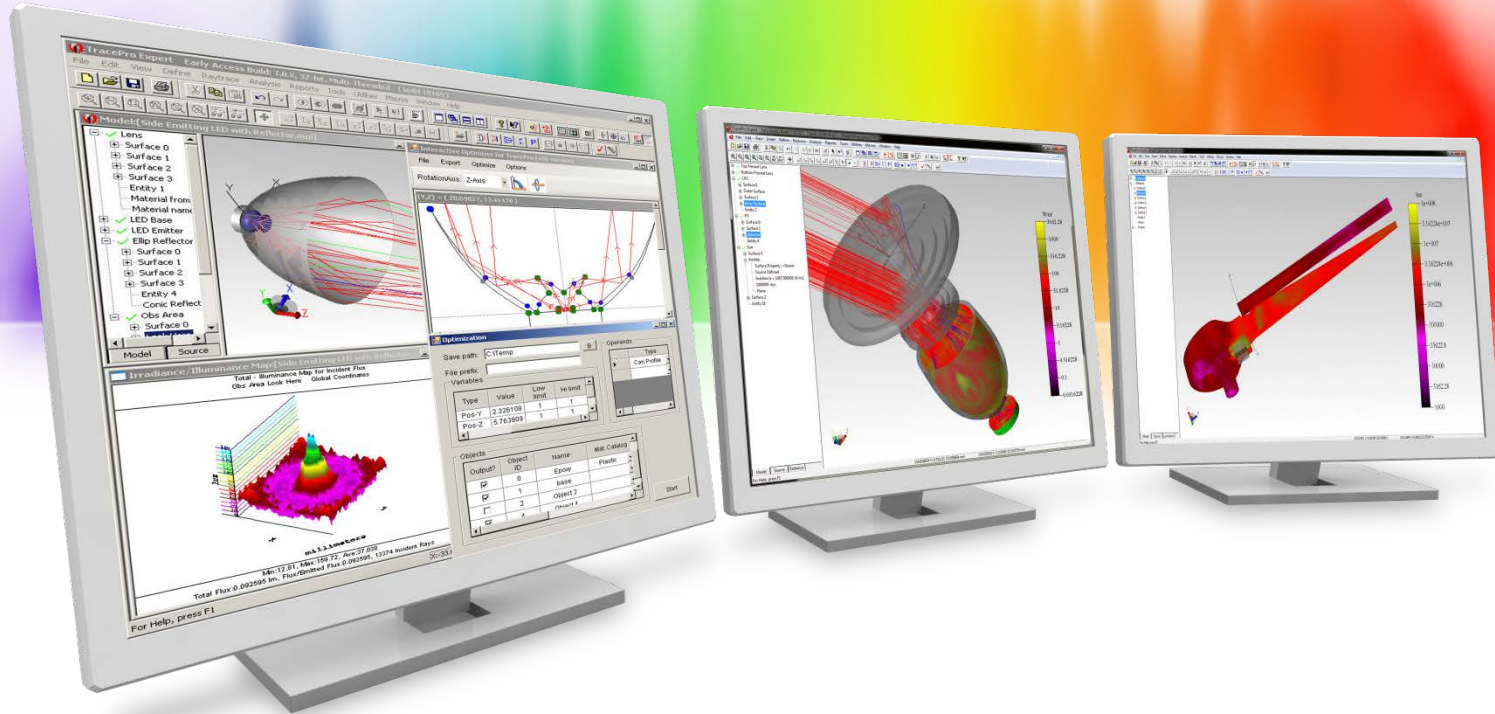
# Property Types in TracePro Standard

- Surface
- Material
- Surface Source
- Color
- Exit Surface
- Raytrace Flag
- Bulk Scatter
- Diffraction
- Gradient Index
- Importance Sampling
- Mueller Matrix
- Temperature
- Class and User Data
- Prescription
- Thin Film Stack

# Property Types in TracePro Expert

- Surface
- Material
- Surface Source
- Color
- Exit Surface
- Raytrace Flag
- Bulk Scatter
- Diffraction
- Gradient Index
- Importance Sampling
- Mueller Matrix
- Temperature
- Class and User Data
- Prescription
- Thin Film Stack
- Fluorescence
- RepTile
- Temperature Distribution





## TracePro Property Parameters

# TracePro Property Parameters

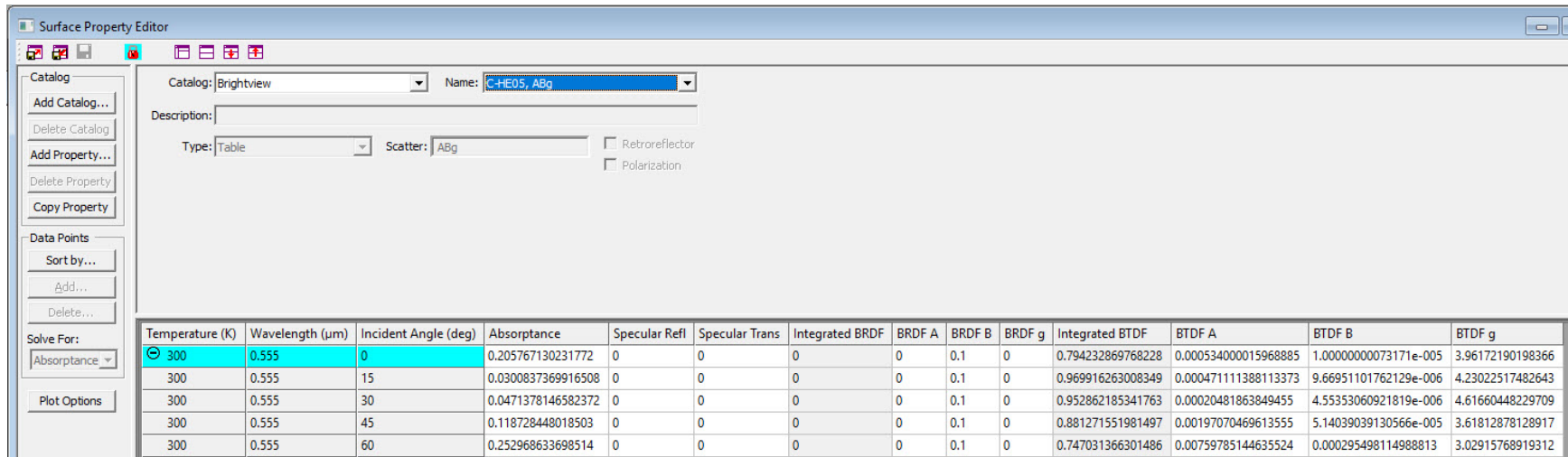
For complete information on all of the TracePro property parameters, please see Chapter 3 of the TracePro User Manual.

The TracePro User Manual is available in TracePro at:

Help->TracePro User Manual

# TracePro Property Parameters

Each property type will have its own set of unique parameters that are used to define the property. In many cases these parameters can vary as a function of other values such as temperature, wavelength, incident angle, or azimuth angle.



The screenshot shows the 'Surface Property Editor' window. The 'Catalog' is set to 'Brightview' and the 'Name' is 'C-HE05, ABg'. The 'Type' is 'Table' and the 'Scatter' is 'ABg'. There are checkboxes for 'Retroreflector' and 'Polarization'. The 'Solve For' dropdown is set to 'Absorbance'. The table below shows the following data:

Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorbance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.555	0	0.205767130231772	0	0	0	0	0.1	0	0.794232869768228	0.000534000015968885	1.00000000073171e-005	3.96172190198366
300	0.555	15	0.0300837369916508	0	0	0	0	0.1	0	0.969916263008349	0.000471111388113373	9.66951101762129e-006	4.23022517482643
300	0.555	30	0.0471378146582372	0	0	0	0	0.1	0	0.952862185341763	0.00020481863849455	4.55353060921819e-006	4.61660448229709
300	0.555	45	0.118728448018503	0	0	0	0	0.1	0	0.881271551981497	0.00197070469613555	5.14039039130566e-005	3.61812878128917
300	0.555	60	0.252968633698514	0	0	0	0	0.1	0	0.747031366301486	0.00759785144635524	0.000295498114988813	3.02915768919312

# TracePro Property Parameters

## Material Property

- Index of Refraction
  - Table
  - Interpolation Formula
    - Schott, Sellmeier, Extended Schott, Herzberger, Conrady, Sellmeier 2, Sellmeier 3, Sellmeier 4, Handbook 1, Handbook 2, Hikari
- Bulk Absorption
  - Absorption Coefficient - defined by Beer-Lambert Law
  - Extinction Coefficient
- Minimum and Maximum Wavelength
- Isotropic or Uniaxial
- Temperature

# TracePro Property Parameters

## Surface Property

- Absorption
- Specular Reflection
- Specular Transmission
- BRDF (bidirectional reflectance distribution function) – reflected scatter
- BTDF (bidirectional transmittance distribution function) – transmitted scatter
- BRDF and BTDF can be either Isotropic or Asymmetric Scatter
- Temperature

Scattering BRDF and BTDF can be: ABg, Elliptical ABg, Elliptical Gaussian, Table BSDF, Asymmetric Table BSDF, 1D ABg, 1D Table, or Use BSDF Properties. TracePro LC is limited to ABg. All of the scatter models are available in both TracePro Standard and Expert.

# TracePro Property Parameters

## Surface Source Property

- Spectral Type
  - Rectangular, Gaussian, Solar, Table
- Angular Type
  - Lambertian, Gaussian, Uniform, Solar, and Table
- Emission
  - Watt/m<sup>2</sup>, Watt, Lux, Lumen
- Temperature

Selecting the Table option for Spectral and Angular type gives you complete control of the emission as a function of wavelength, polar angle, azimuth angle, and temperature.

# TracePro Property Parameters

## Bulk Scatter Property

- Scatter Model
  - Henyey-Greenstein, Gegenbauer, User Defined
- Anisotropy ( $g$ )
  - Likely direction of scatter:  $g=0$  - isotropic scatter,  $g<0$  - backwards scatter,  $g>0$  - forward scatter
- Scatter Coefficient ( $\mu_s$ )
  - Inverse of the mean free path
- Alpha
  - Used in the Gegenbauer scatter model

# TracePro Property Parameters

## Fluorescence Property

- Relative Absorption vs. Excitation Wavelength
- Relative Extinction vs. Excitation Wavelength
- Relative Emission vs. Emission Wavelength
- Temperature



# TracePro Property Parameters

## Gradient Index Property

- Gradient Index model type
  - Axial-Radial, Axial Elliptical, Axial-Sinusoidal-Radial, Axial-Tapered-Radial, SELFOC, Wood Lens, Spherical, Fisheye, Luneburg, GRADIUM (Buchdahl), GRADIUM (Sellmeier)
- Relevant Coefficients for selected Gradient Index model

# TracePro Property Parameters

## RepTile Property

- Variation Type
- Geometry
- Tile Type
- Bump or Hole
- Tile Parameters
- Geometry Type parameters

Please see our webinar on “RepTile and the Texture Optimizer II”

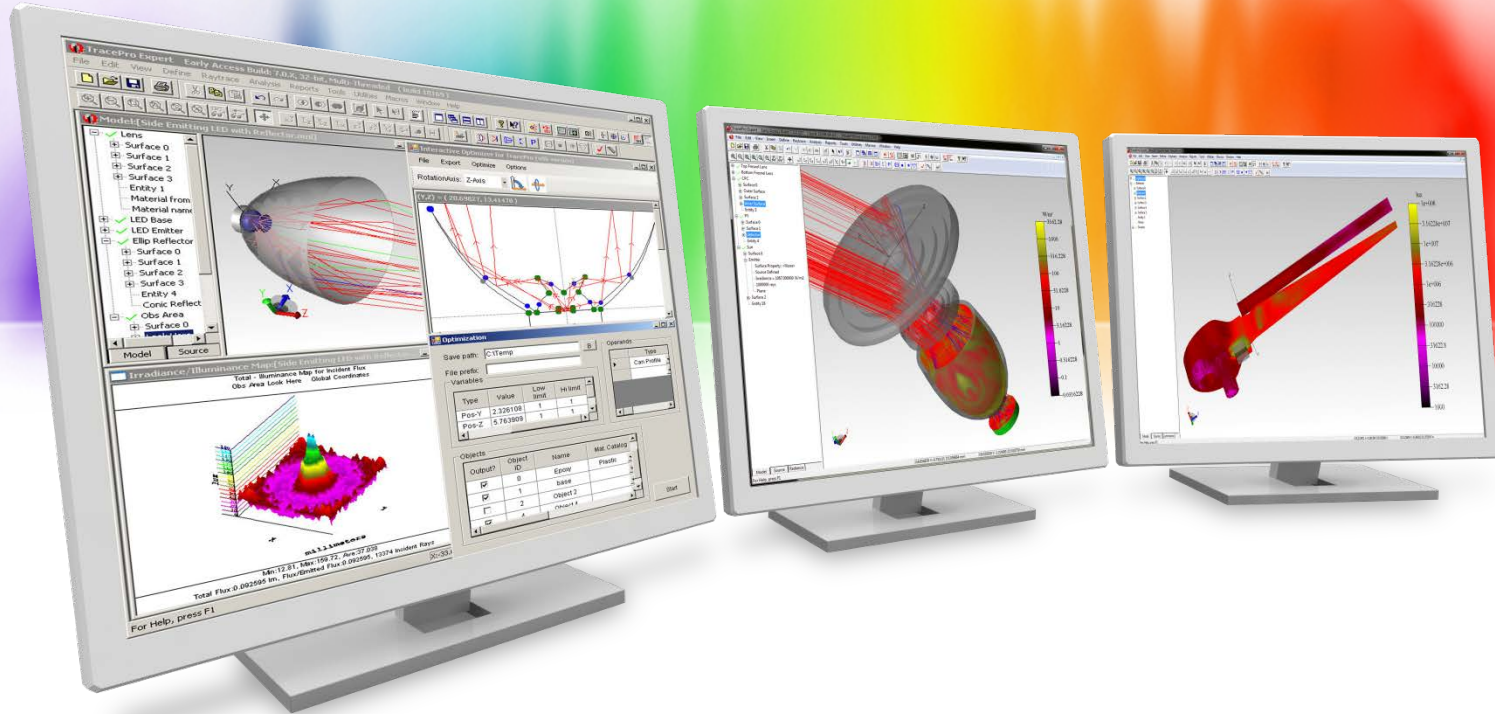
<https://www.lambdares.com/support/reptile-property-texture-optimizer-ii/>

# TracePro Property Parameters

## Thin Film Stack Property

- Material
- Thickness

The Thin Film Stack is referenced by a Surface Property to model a thin film coating applied to a surface.



## The Property Editors in TracePro

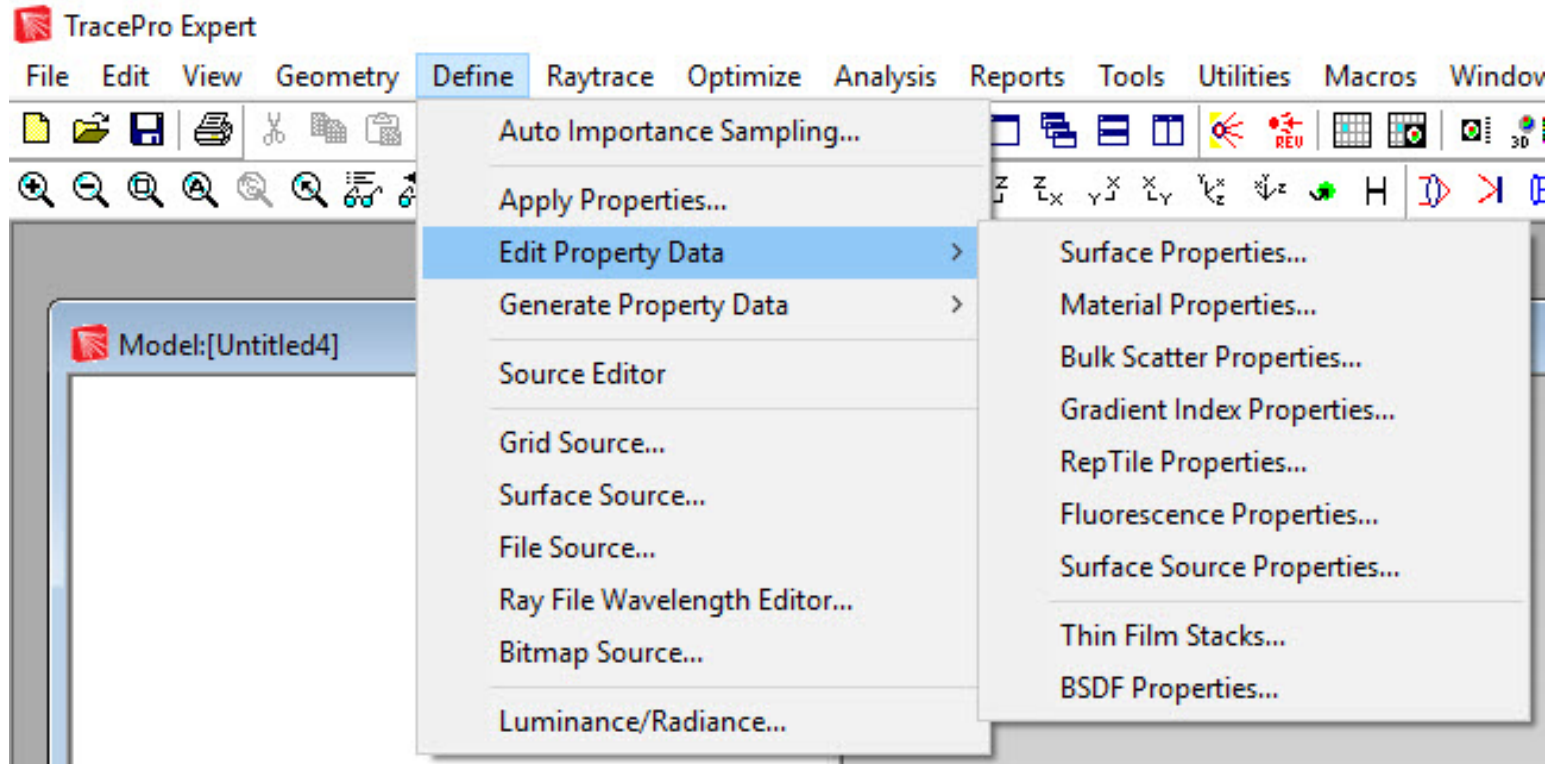
# TracePro Property Editors

- Material
- Surface
- Surface Source
- Bulk Scattering
- Fluorescence
- Gradient Index
- RepTile
- Thin Film Stack

These properties have dedicated property editors to define their parameters. Other properties such as Temperature, Mueller Matrix, and Importance Sampling have their parameters defined in the relevant Apply Properties dialog box.

# TracePro Property Editors

Properties Editors can be found at Define->Edit Property Data



The property editors available will depend on the edition of TracePro being used. TracePro Expert shown above.

# TracePro Property Editors

## Surface Property Editor

The Surface Property Editor window displays the following settings:

- Catalog: Default
- Name: Black Paint
- Description: Standard Paint
- Type: Table
- Scatter: ABg
- Retroreflector
- Polarization

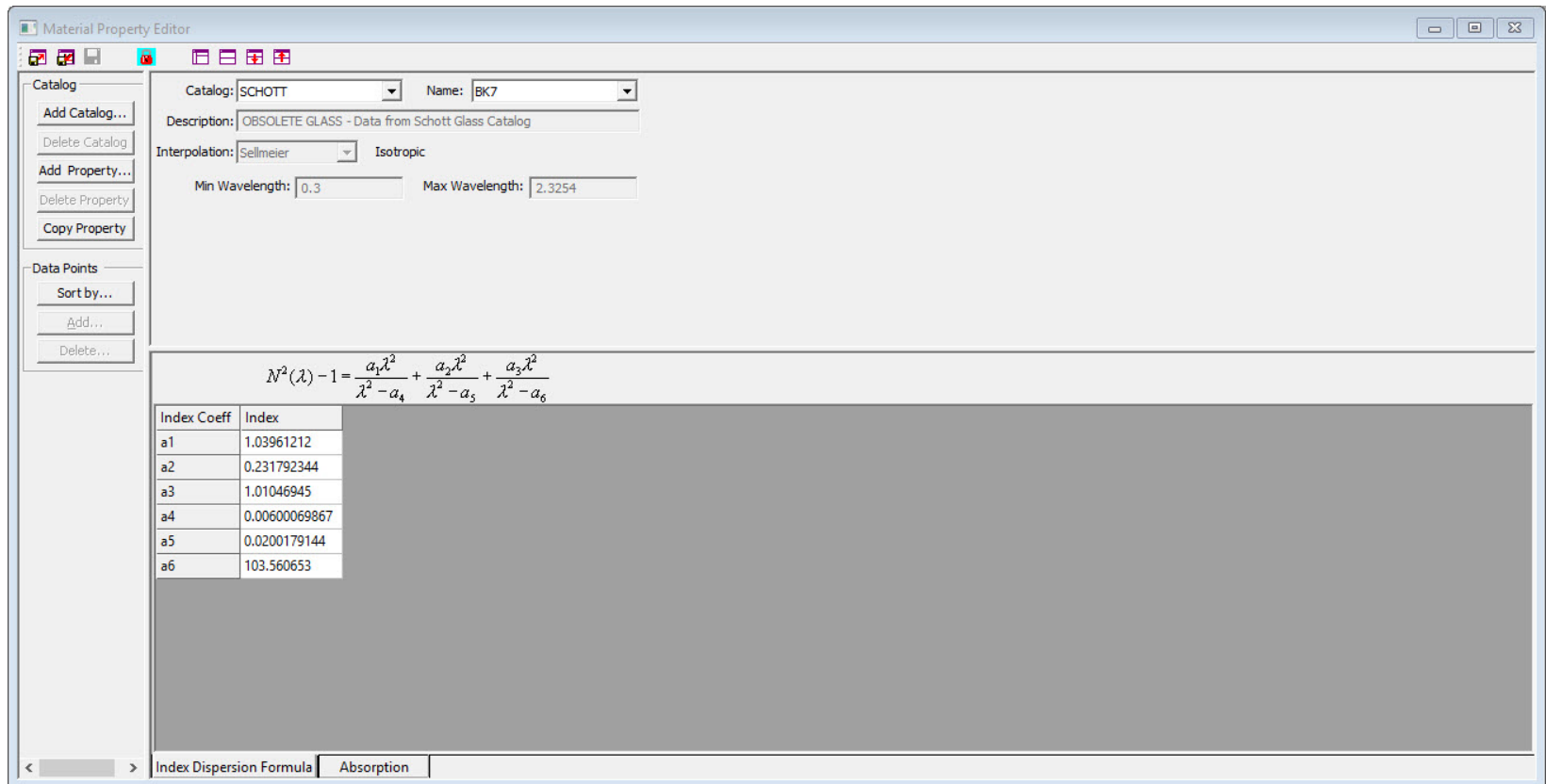
The 'Solve For' dropdown is set to BRDF. The 'Data Points' section includes 'Sort by...', 'Add...', and 'Delete...' buttons. The 'Plot Options' button is also visible.

Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
0	0	0	0.9	1e-005	0	0.09999000000000001	0.0636556110390345	1	0	0	0	0.1	0

At the bottom, there are 'Grid' and 'Plot' buttons.

# TracePro Property Editors

## Material Property Editor



Material Property Editor

Catalog: SCHOTT Name: BK7

Description: OBSOLETE GLASS - Data from Schott Glass Catalog

Interpolation: Sellmeier Isotropic

Min Wavelength: 0.3 Max Wavelength: 2.3254

Data Points

Sort by...

Add...

Delete...

$$N^2(\lambda) - 1 = \frac{a_1 \lambda^2}{\lambda^2 - a_4} + \frac{a_2 \lambda^2}{\lambda^2 - a_5} + \frac{a_3 \lambda^2}{\lambda^2 - a_6}$$

Index Coeff	Index
a1	1.03961212
a2	0.231792344
a3	1.01046945
a4	0.00600069867
a5	0.0200179144
a6	103.560653

< Index Dispersion Formula Absorption >



# TracePro Property Editors

## Surface Source Property Editor

Surface Source Property Editor

Catalog: Cree Xlamp Name: XP-E White 3700-5000K

Description: Data from manufacturer's datasheet

Spectral Type: Table

Angular Type: Table

Emission: 1 Radiometric Flux [Watt]

Temperature (K)	Wavelength ( $\mu\text{m}$ )	Polar angle (deg)	Azimuth Angle (deg)	Emissivity
300	0.4	0	0	0.006772244
300	0.4	5	0	0.006744928
300	0.4	10	0	0.006650263
300	0.4	15	0	0.006524802
300	0.4	20	0	0.006335879
300	0.4	25	0	0.006126812
300	0.4	30	0	0.005908853
300	0.4	35	0	0.005589687
300	0.4	40	0	0.005193924
300	0.4	45	0	0.004768537
300	0.4	50	0	0.004273228
300	0.4	55	0	0.003759854
300	0.4	60	0	0.003183478
300	0.4	65	0	0.00262301
300	0.4	70	0	0.002032882

# TracePro Property Editors

## Bulk Scatter Property Editor

**Bulk Scatter Property Editor**

Catalog: Default Name: Human Whole Blood

Description: Info from Valery Tuchin Tissue Optics Pg 18-33 Type: Henyey Greenstein

**Data Points**

Add...  
Delete...

$$SDF = p(\theta) = \frac{1 - g^2}{4\pi(1 + g^2 - 2g\cos\theta)^{3/2}}$$

Wavelength (μm)	Anisotropy (g)	Scatter Coeff (1/mm)
0.665	0.995	124.6
0.96	0.992	50.5

< Formula >

# TracePro Property Editors

## Fluorescence Property Editor

Fluorescence Property Editor

Catalog:  Name:

Description:

Conversion efficiency:  Peak molar extinction:  [liter/(mole\*cm)]

Temperature (K)	Excitation Wavelength (µm)	Relative Absorption	Relative Excitation
300	0.251	0.9407304	0.9407304
300	0.252	0.8822697	0.8822697
300	0.253	0.828492	0.828492
300	0.254	0.7823125	0.7823125
300	0.255	0.7441641	0.7441641
300	0.256	0.7132793	0.7132793
300	0.257	0.6901089	0.6901089
300	0.258	0.6698339	0.6698339
300	0.259	0.6511948	0.6511948
300	0.26	0.6340891	0.6340891
300	0.261	0.6199538	0.6199538
300	0.262	0.6054483	0.6054483
300	0.263	0.5943069	0.5943069
300	0.264	0.5830869	0.5830869
300	0.265	0.572851	0.572851

Excitation Table | Emission Table

# TracePro Property Editors

## Gradient Index Property Editor

Gradient Index Property Editor

Catalog: SELFOC Name: SLC 180

Description: Data from NSG America, Inc. Type: SELFOC

$$n^2(r) = n_0^2 \left[ 1 - (nr1 r)^2 + nr2 (nr1 r)^4 + nr3 (nr1 r)^6 + nr4 (nr1 r)^8 \right], \quad r^2 = x^2 + y^2$$

Wavelength (μm)	nr1	nr2	nr3	nr4
0.55	0.33838007	0.25	0	0
0.56	0.337676466	0.25	0	0
0.57	0.337015559	0.25	0	0
0.58	0.336393931	0.25	0	0
0.59	0.3358085	0.25	0	0
0.6	0.335256481	0.25	0	0
0.61	0.334735355	0.25	0	0
0.62	0.334242834	0.25	0	0
0.63	0.33377684	0.25	0	0
0.64	0.333335482	0.25	0	0
0.65	0.332917034	0.25	0	0
0.66	0.33251992	0.25	0	0
0.67	0.332142698	0.25	0	0
0.68	0.331784047	0.25	0	0

Formula

# TracePro Property Editors

## RepTile Property Editor

RepTile Property Editor

Catalog: Default Name: Backlight Example Spheres

Description:  Hole

RepTile Type

Variation Type: Constant

Geometry Type: Sphere

Tile Type: Rectangles

Tile Parameters

Width: 5

Height: 5

Data Points

Add...

Delete...

Radius (mm)	Depth/Height (mm)
1	0.5

Table

# TracePro Property Editors

## Thin Film Stack Editor

Thin Film Stack Editor

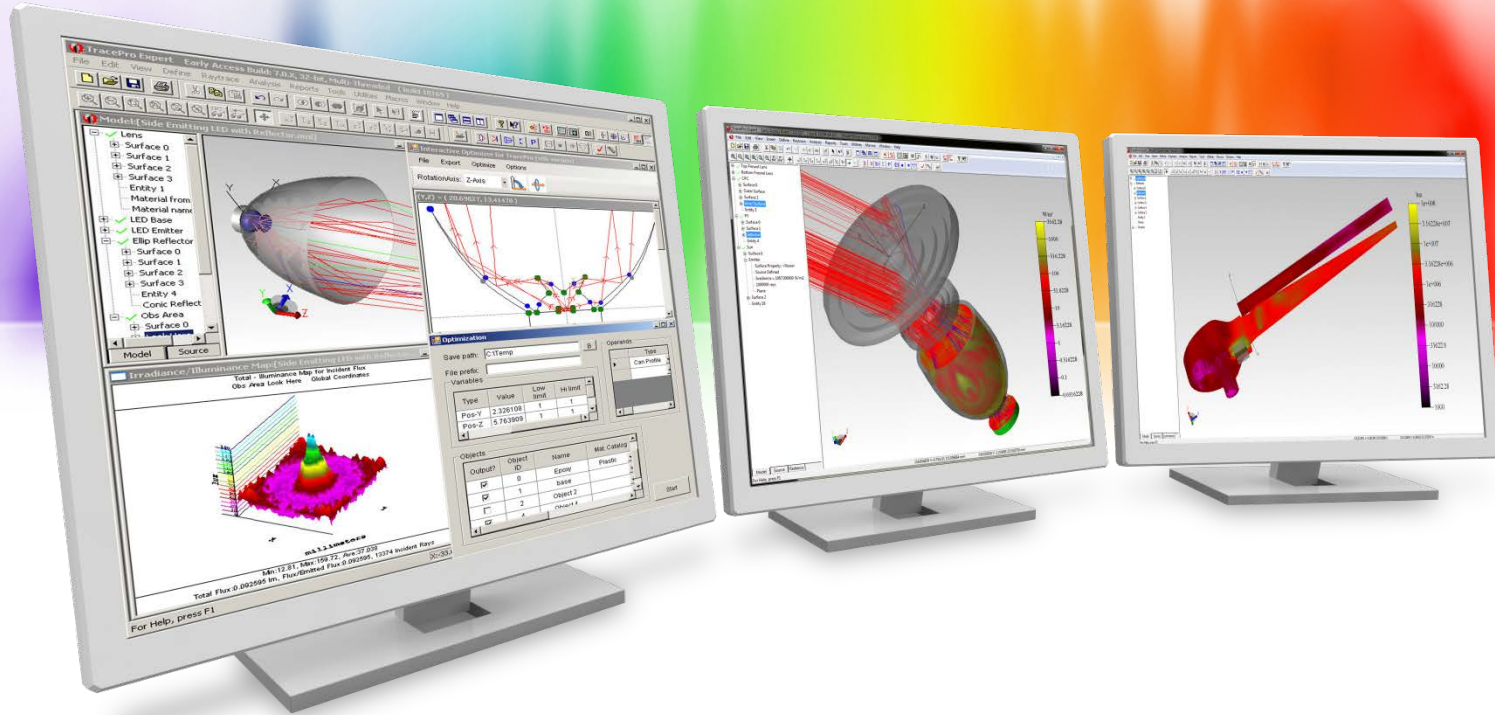
Catalog: Default Name: 3 Layer AR

Description: Three Layer Anti-reflection for 500nm on BK7

Data Points

Thickness (µm)	Material Catalog	Material Name
INCIDENT MEDIA		
0.0912	Coating	MgF2
0.125	Coating	ZrO2
0.0769	Coating	Al2O3
SUBSTRATE		

Table



## Making New Properties in TracePro

# Making New Properties in TracePro

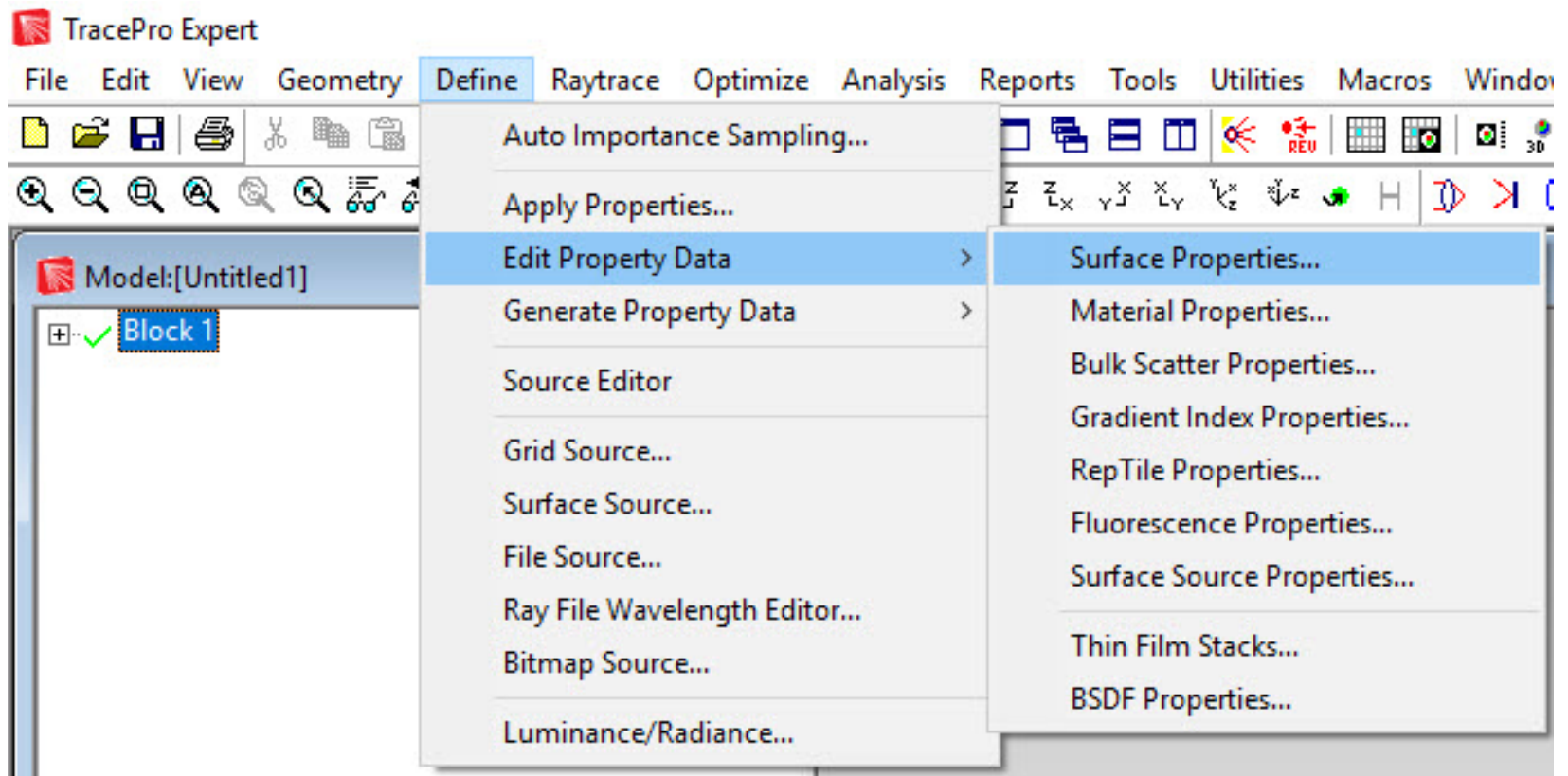
Steps for making a new property in TracePro

1. Open the relevant property editor
2. Click Add Catalog if you want to add a new catalog to the database
3. Click Add Property
4. Enter a name for the property
5. Choose options for the property if necessary
6. Enter the required data for the property
7. Click the disk icon to save the property



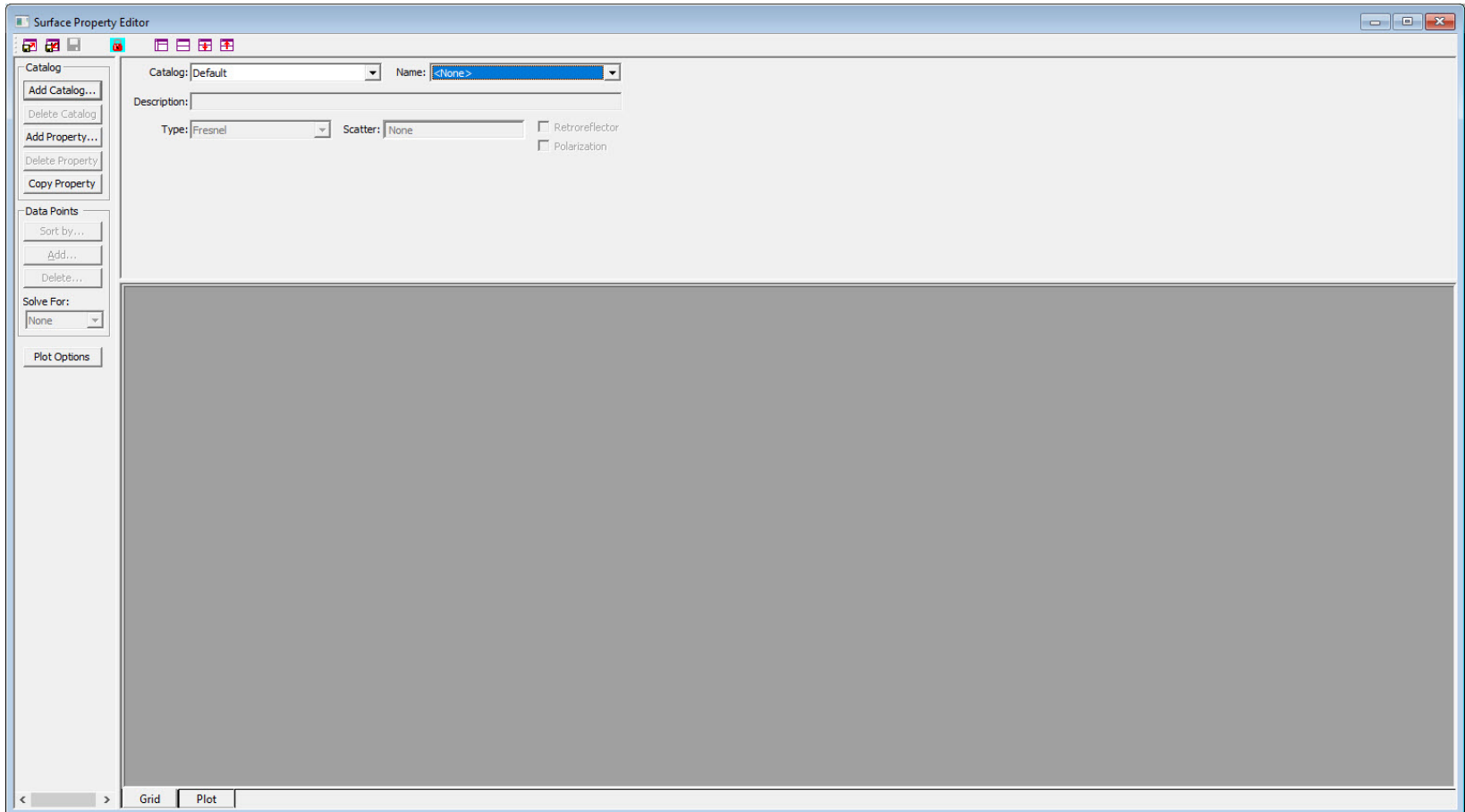
# Making New Properties in TracePro

Surface Property Example – Open Surface Property Editor



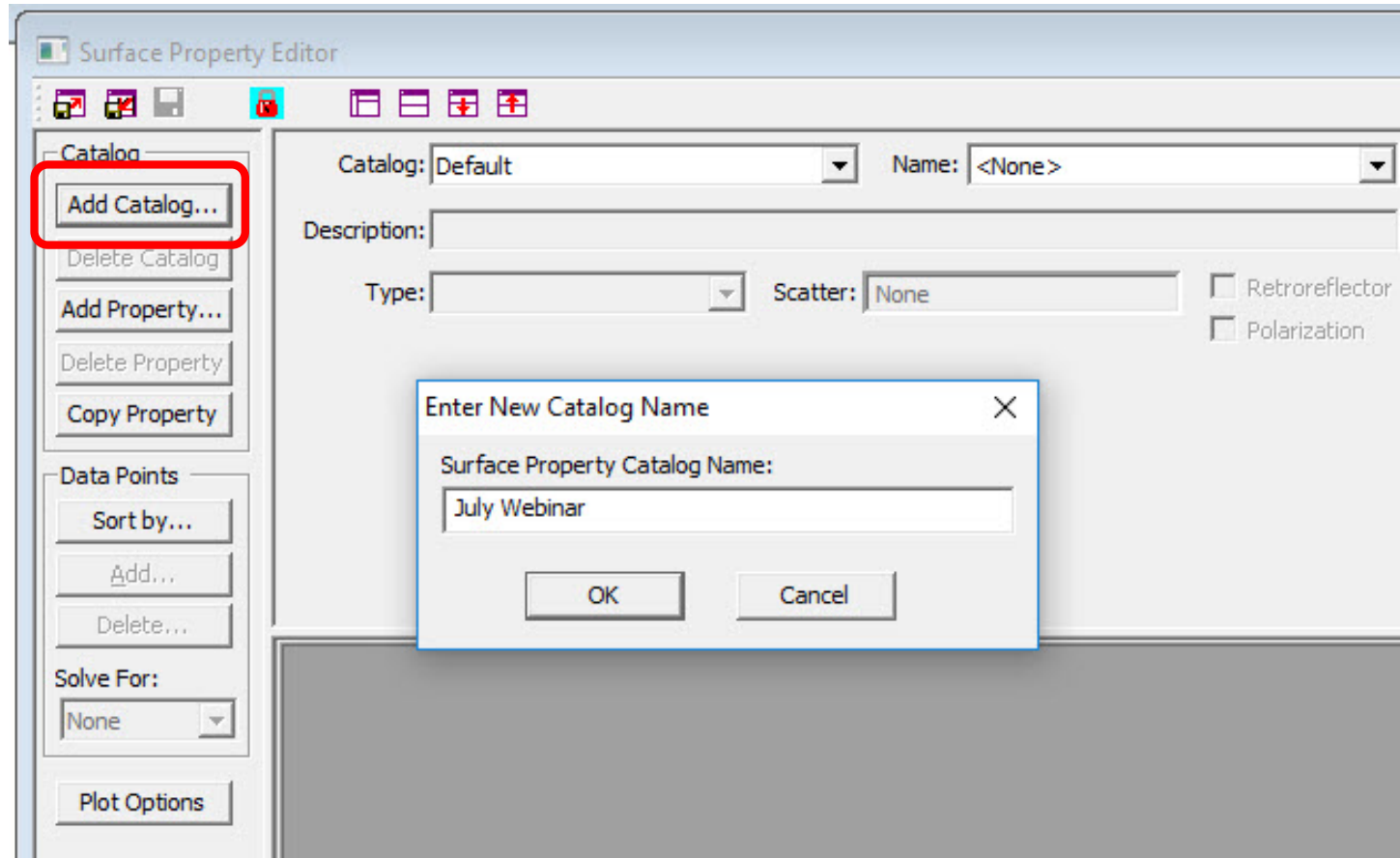
# Making New Properties in TracePro

## Surface Property Example – Open Surface Property Editor



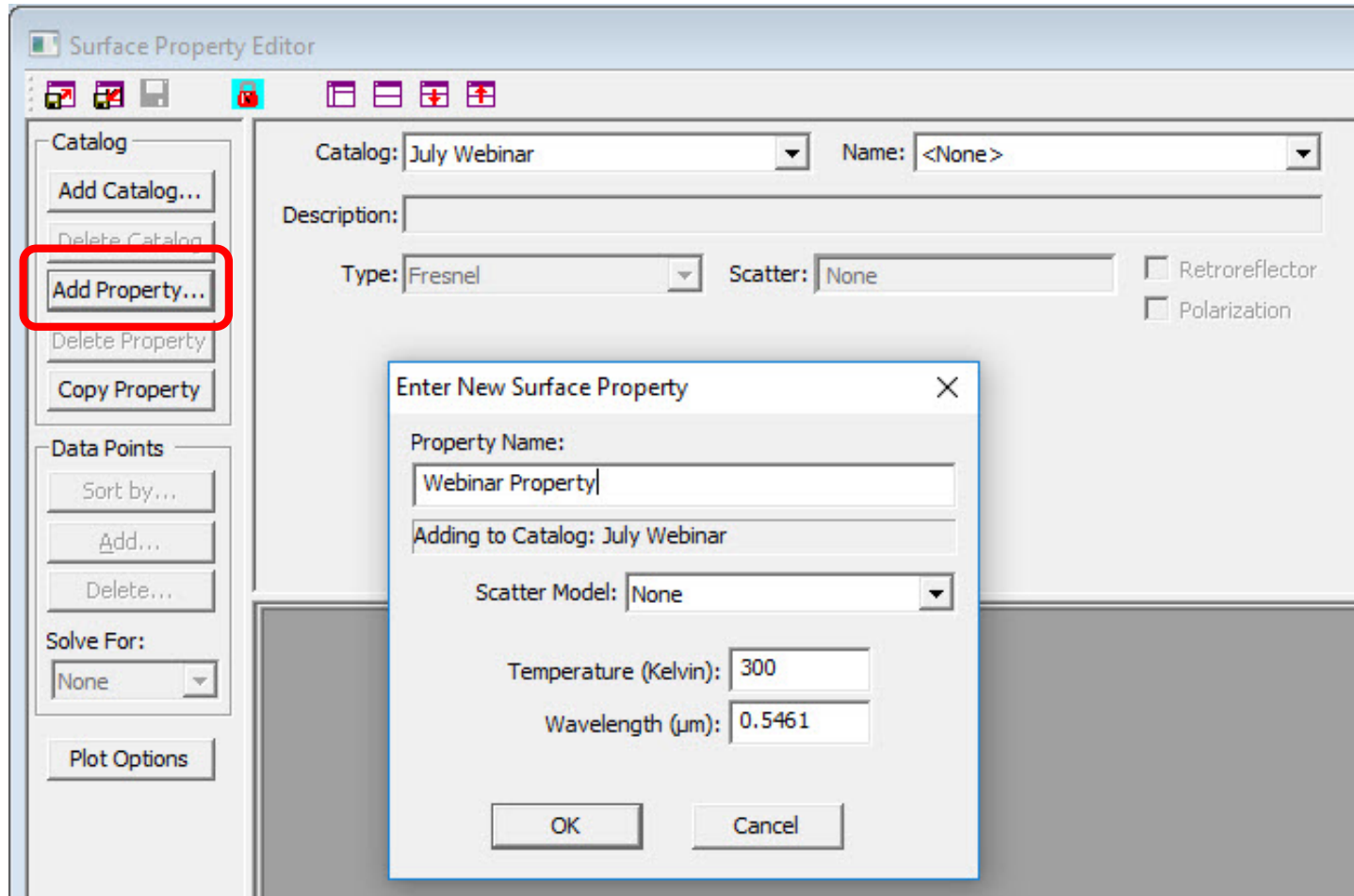
# Making New Properties in TracePro

Surface Property Example – Add a new Catalog if needed



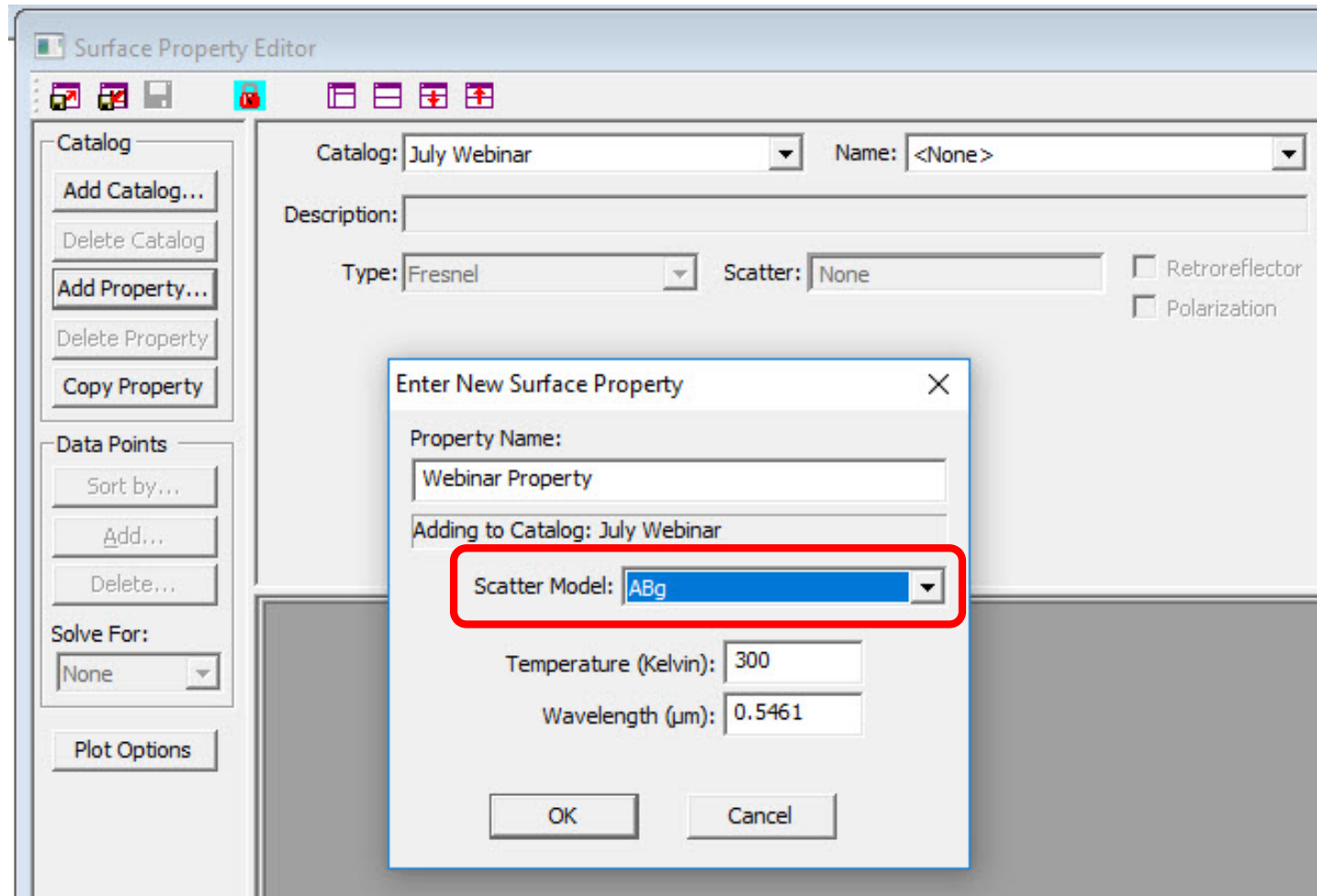
# Making New Properties in TracePro

## Surface Property Example – Add a new Property



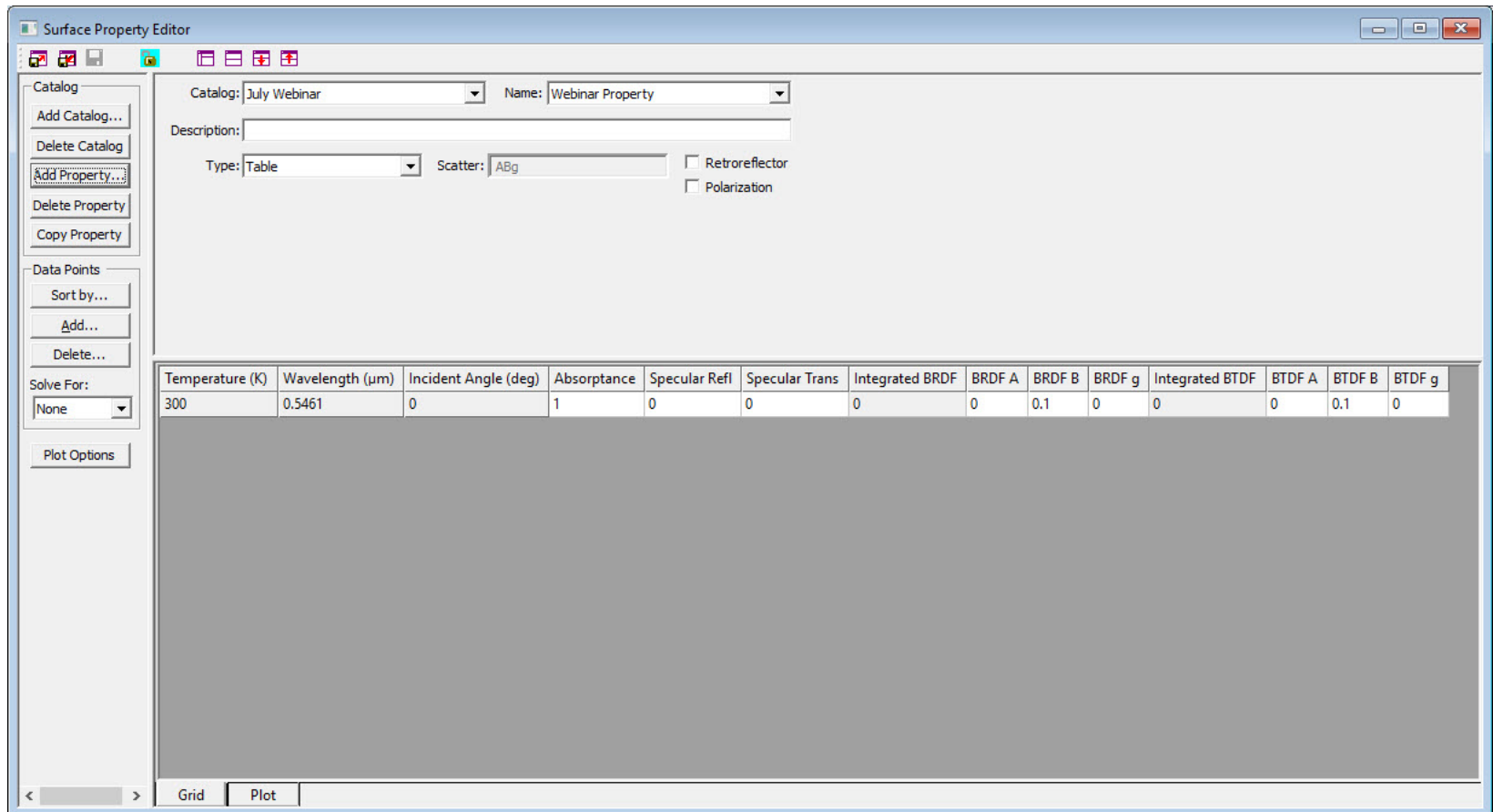
# Making New Properties in TracePro

## Surface Property Example – Select the Scatter Model



# Making New Properties in TracePro

## Surface Property Example – Surface Property Editor



The Surface Property Editor window displays the following settings:

- Catalog: July Webinar
- Name: Webinar Property
- Description: (empty)
- Type: Table
- Scatter: ABg
- Retroreflector:
- Polarization:

The Data Points section includes buttons for Sort by..., Add..., and Delete... The Solve For dropdown is set to None. The Plot Options button is also visible.

Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5461	0	1	0	0	0	0	0.1	0	0	0	0.1	0

# Making New Properties in TracePro

## Surface Property Example – Enter initial parameters

Surface Property Editor

Catalog: July Webinar Name: Webinar Property

Description:

Type: Table Scatter: ABg  Retroreflector  Polarization

Data Points

Sort by...

Add...

Delete...

Solve For: None

Plot Options

Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5461	0	0.1	0.15	0.05	0	0	0.1	0	0	0	0.1	0

Grid Plot

# Making New Properties in TracePro

Surface Property Example – Use Solve For to solve for additional parameters such as BRDF

The screenshot shows the 'Surface Property Editor' window. The 'Catalog' is set to 'July Webinar' and the 'Name' is 'Webinar Property'. The 'Type' is 'Table' and the 'Scatter' is 'ABg'. There are checkboxes for 'Retroreflector' and 'Polarization'. The 'Solve For' dropdown menu is open, with 'BRDF' selected. Below the settings is a table with the following data:

Temperature (K)	Wavelength (um)	Incident Angle (deg)	Absorbance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5461	0	0.1	0.15	0.05	0	0	0.1	0	0	0	0.1	0



# Making New Properties in TracePro

Surface Property Example – Surface Property with initial data entered

Surface Property Editor

Catalog: July Webinar Name: Webinar Property

Description:

Type: Table Scatter: ABg  Retroreflector  Polarization

Data Points

Sort by...  
Add...  
Delete...

Solve For: BRDF

Plot Options

Temperature (K)	Wavelength (um)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BT
300	0.5461	0	0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0

Grid Plot

# Making New Properties in TracePro

Surface Property Example – Use Data Points->Add to add additional lines to the spreadsheet

The screenshot shows the 'Surface Property Editor' window. The 'Data Points' section is highlighted with a red box, and the 'Add...' button is selected. A 'Surface Property - Add Data Dialog' is open, showing a list of variables to add. The 'Wavelength (µm)' variable is selected, and the 'Value' field is set to 0.6.

Temperature (K)	Wavelength (µm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BT
300	0.5	0	0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0
300	0.5461	0	0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0
300	0.6	0	0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0

# Making New Properties in TracePro

Surface Property Example – Use Data Points->Delete to add remove lines from the spreadsheet

The screenshot shows the 'Surface Property Editor' window. On the left, the 'Data Points' section is highlighted with a red box, containing 'Sort by...', 'Add...', and 'Delete...' buttons. A 'Surface Property - Delete Data Dialog' is open, showing input fields for Temperature (300), Wavelength (0.5, 0.5461, 0.6), and Incident Angle (0). The main window displays a spreadsheet with columns for Angle (deg), Absorptance, Specular Refl, Specular Trans, Integrated BRDF, BRDF A, BRDF B, BRDF g, Integrated BTDF, BTDF A, BTDF B, and BTDF. The spreadsheet contains three rows of data.

Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF
0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0	
0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0	
0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0	

# Making New Properties in TracePro

Surface Property Example – Click the disk icon to save the property

The screenshot shows the 'Surface Property Editor' window. The 'Catalog' is set to 'July Webinar' and the 'Name' is 'Webinar Property'. The 'Type' is 'Table' and the 'Scatter' is 'ABg'. There are checkboxes for 'Retroreflector' and 'Polarization'. A table of data points is shown below. The first row is highlighted in cyan. A red box highlights the disk icon in the top-left toolbar.

Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5	0	0.05	0.2	0.01	0.74	0.259104247353606	0.1	0	0	0	0.1	0
300	0.5461	0	0.1	0.15	0.05	0.7	0.245098612361519	0.1	0	0	0	0.1	0
300	0.6	0	0.15	0.1	0.1	0.65	0.22759156862141	0.1	0	0	0	0.1	0

# Making New Properties in TracePro

Surface Property Example – Click the lock icon to unlock the property for editing

The screenshot shows the 'Surface Property' dialog box in TracePro. The 'Catalog' is set to 'July Webinar' and the 'Name' is 'Webinar Property'. The 'Type' is 'Table' and the 'Scatter' is 'ABg'. The 'Description' field is empty. There are checkboxes for 'Retroreflector' and 'Polarization', both of which are unchecked. A table of data points is displayed below the form. The first row of the table is highlighted in cyan. The table has the following columns: Temperature (K), Wavelength (um), Incident Angle (deg), Absorptance, Specular Refl, Specular Trans, Integrated BRDF, BRDF A, BRDF B, BRDF g, Integrated BTDF, BTDF A, BTDF B, and BTDF g.

Temperature (K)	Wavelength (um)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5	0	0.05	0.2	0.01	0.7400000000000001	0.259104247353606	0.1	0	0	0	0.1	0
300	0.5461	0	0.1	0.15	0.05	0.7000000000000001	0.245098612361519	0.1	0	0	0	0.1	0
300	0.6	0	0.15	0.1	0.1	0.6499999999999999	0.22759156862141	0.1	0	0	0	0.1	0

# Making New Properties in TracePro

## Surface Property Example – Import and Export property icons

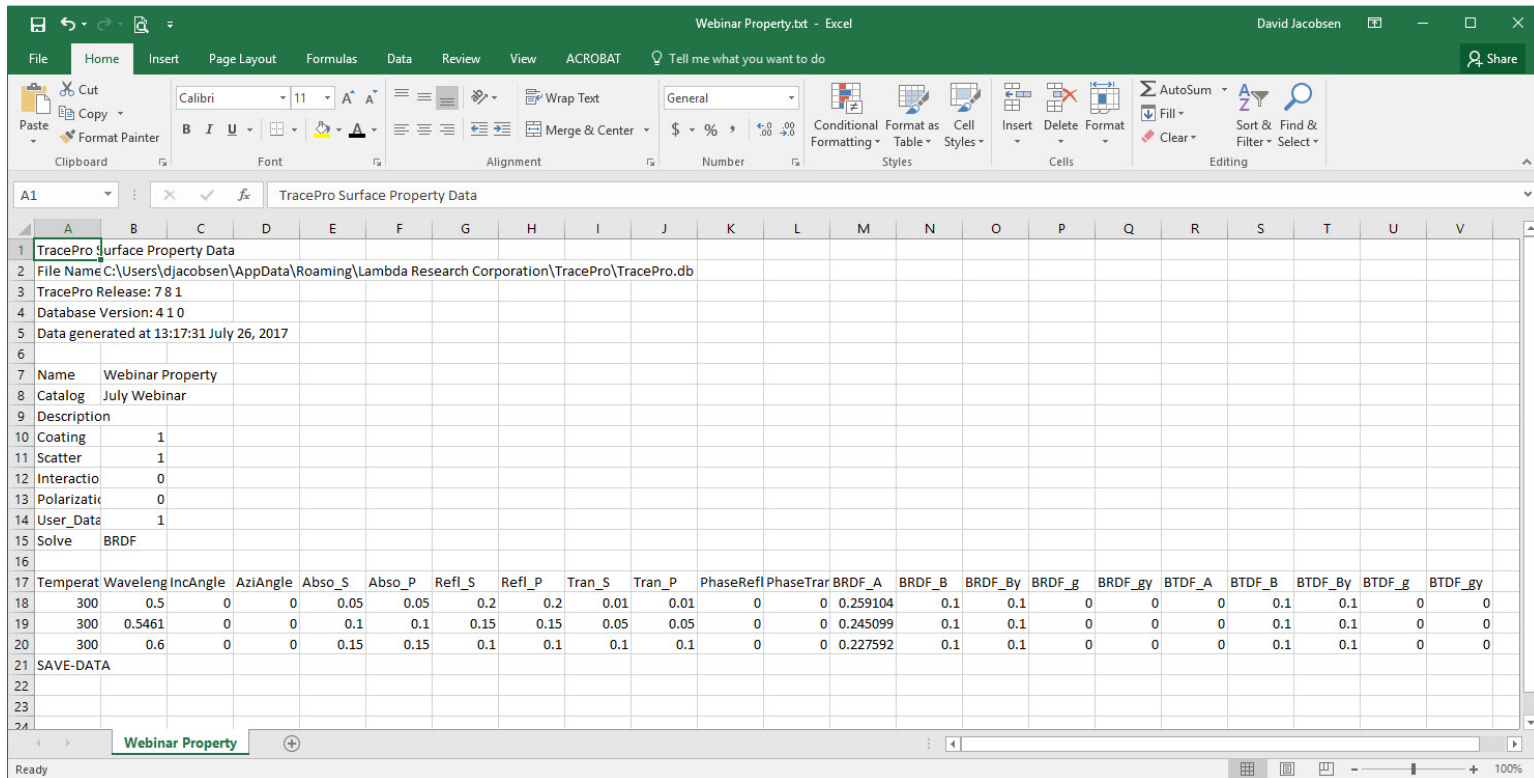
The screenshot shows the TracePro Property Editor window. The title bar reads "Property Editor". The window contains a sidebar on the left with buttons for "Add Catalog...", "Delete Catalog", "Add Property...", "Delete Property", and "Copy Property". Below these are "Data Points" buttons: "Sort by...", "Add...", and "Delete...". The "Solve For:" dropdown is set to "BRDF", and there is a "Plot Options" button at the bottom of the sidebar. The main area has a "Catalog:" dropdown set to "July Webinar" and a "Name:" dropdown set to "Webinar Property". Below this is a "Description:" field. The "Type:" dropdown is set to "Table" and the "Scatter:" dropdown is set to "ABg". There are checkboxes for "Retroreflector" and "Polarization", both of which are unchecked. At the bottom of the main area is a table with the following data:

Temperature (K)	Wavelength (µm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.5	0	0.05	0.2	0.01	0.7400000000000001	0.259104247353606	0.1	0	0	0	0.1	0
300	0.5461	0	0.1	0.15	0.05	0.7000000000000001	0.245098612361519	0.1	0	0	0	0.1	0
300	0.6	0	0.15	0.1	0.1	0.6499999999999999	0.22759156862141	0.1	0	0	0	0.1	0

At the bottom of the window, there are "Grid" and "Plot" buttons.

# Making New Properties in TracePro

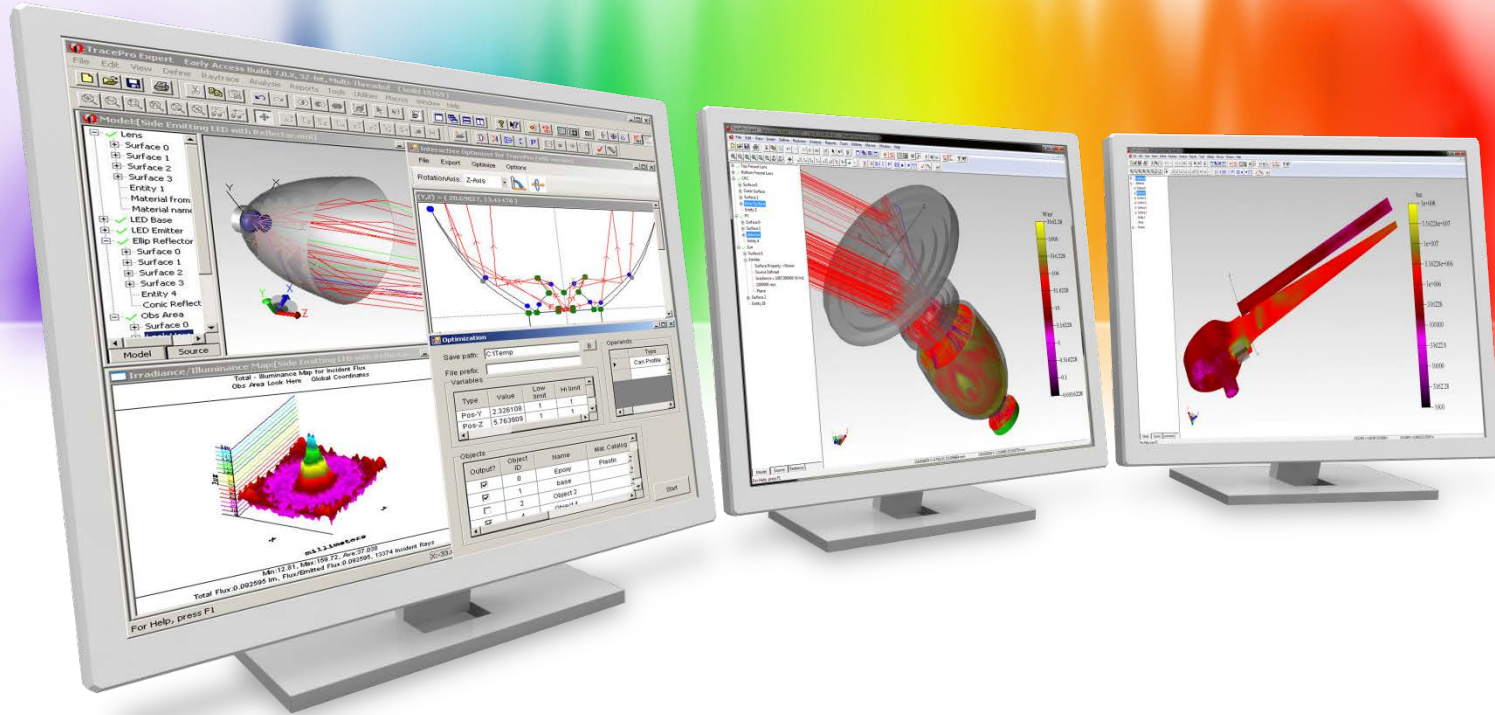
Surface Property Example – Properties in TracePro are text files. They can be created and modified in a text editor, Excel, or similar program.



The screenshot shows an Excel spreadsheet titled 'Webinar Property.txt - Excel'. The spreadsheet contains the following data:

TracePro Surface Property Data																						
1	TracePro Surface Property Data																					
2	File Name C:\Users\djacobsen\AppData\Roaming\Lambda Research Corporation\TracePro\TracePro.db																					
3	TracePro Release: 7 8 1																					
4	Database Version: 4 1 0																					
5	Data generated at 13:17:31 July 26, 2017																					
6																						
7	Name	Webinar Property																				
8	Catalog	July Webinar																				
9	Description																					
10	Coating	1																				
11	Scatter	1																				
12	Interactio	0																				
13	Polarizati	0																				
14	User_Data	1																				
15	Solve	BRDF																				
16																						
17	Temperat	Waveleng	IncAngle	AziAngle	Abso_S	Abso_P	Refl_S	Refl_P	Tran_S	Tran_P	PhaseRefl	PhaseTrar	BRDF_A	BRDF_B	BRDF_By	BRDF_g	BRDF_gy	BTDF_A	BTDF_B	BTDF_By	BTDF_g	BTDF_gy
18	300	0.5	0	0	0.05	0.05	0.2	0.2	0.01	0.01	0	0	0.259104	0.1	0.1	0	0	0	0.1	0.1	0	0
19	300	0.5461	0	0	0.1	0.1	0.15	0.15	0.05	0.05	0	0	0.245099	0.1	0.1	0	0	0	0.1	0.1	0	0
20	300	0.6	0	0	0.15	0.15	0.1	0.1	0.1	0.1	0	0	0.227592	0.1	0.1	0	0	0	0.1	0.1	0	0
21	SAVE-DATA																					
22																						
23																						
24																						

Stock properties cannot be edited or modified. To modify a stock property, make a copy of it and then edit the copy.

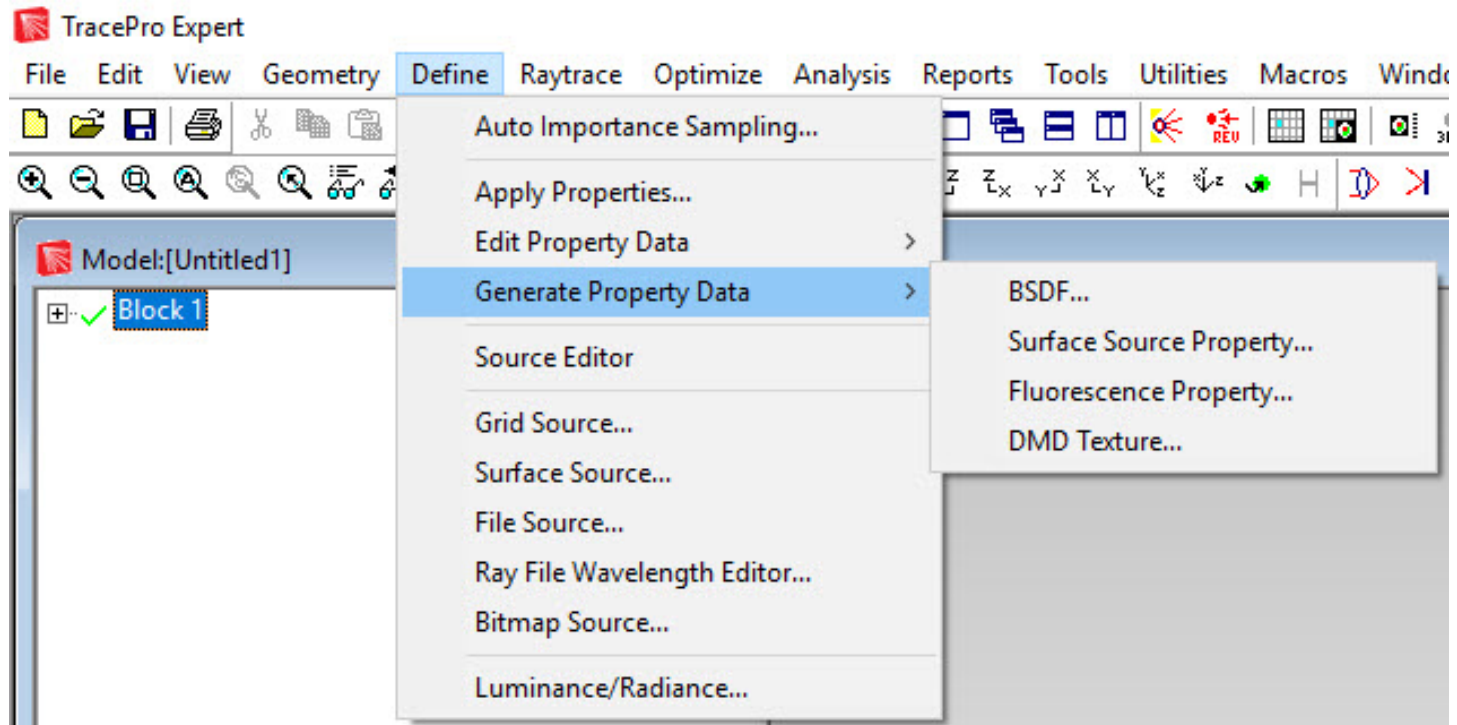


## TracePro Utilities for Making New Properties



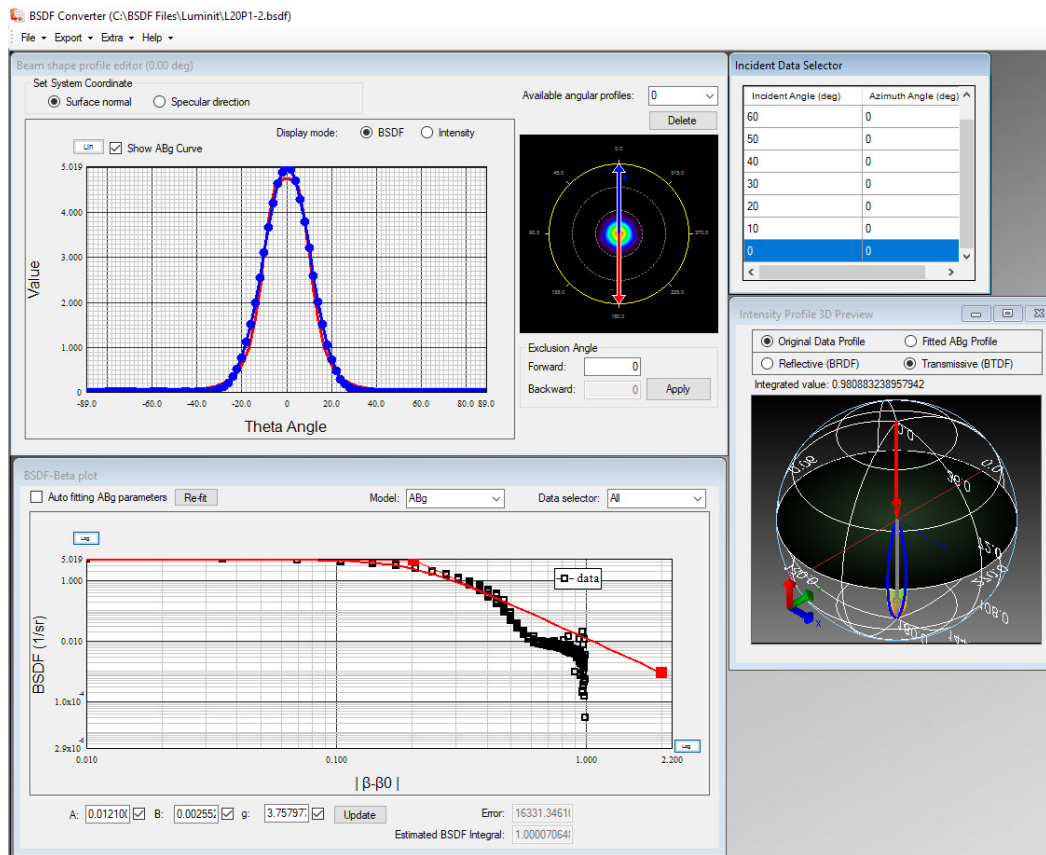
# TracePro Utilities for Making Properties

TracePro utilities for making new properties can be found at:  
Define->Generate Property Data



# TracePro Utilities for Making Properties

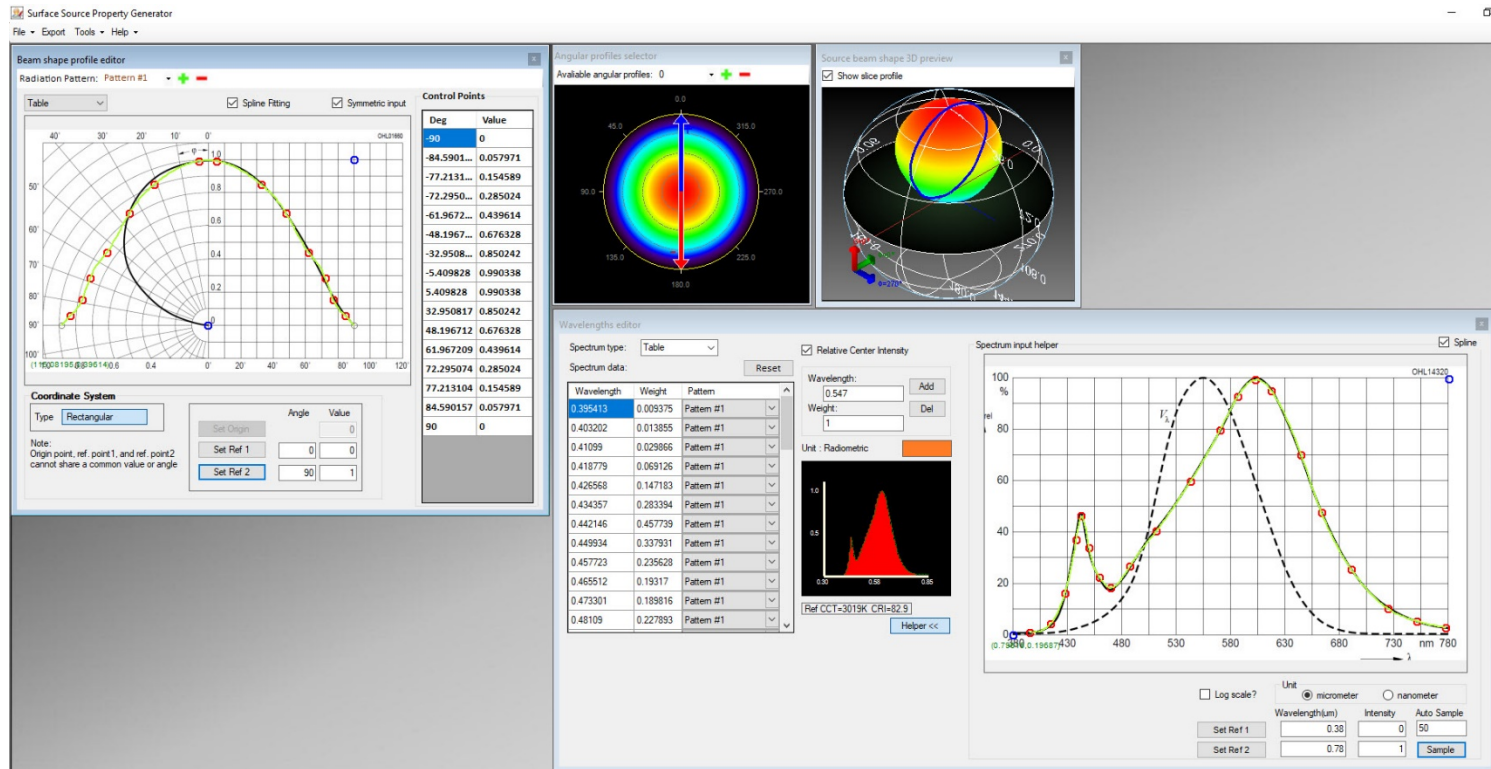
## BSDF Converter Utility



Convert measured BSDF data to Surface Properties for use in TracePro

# TracePro Utilities for Making Properties

## Surface Source Property Utility

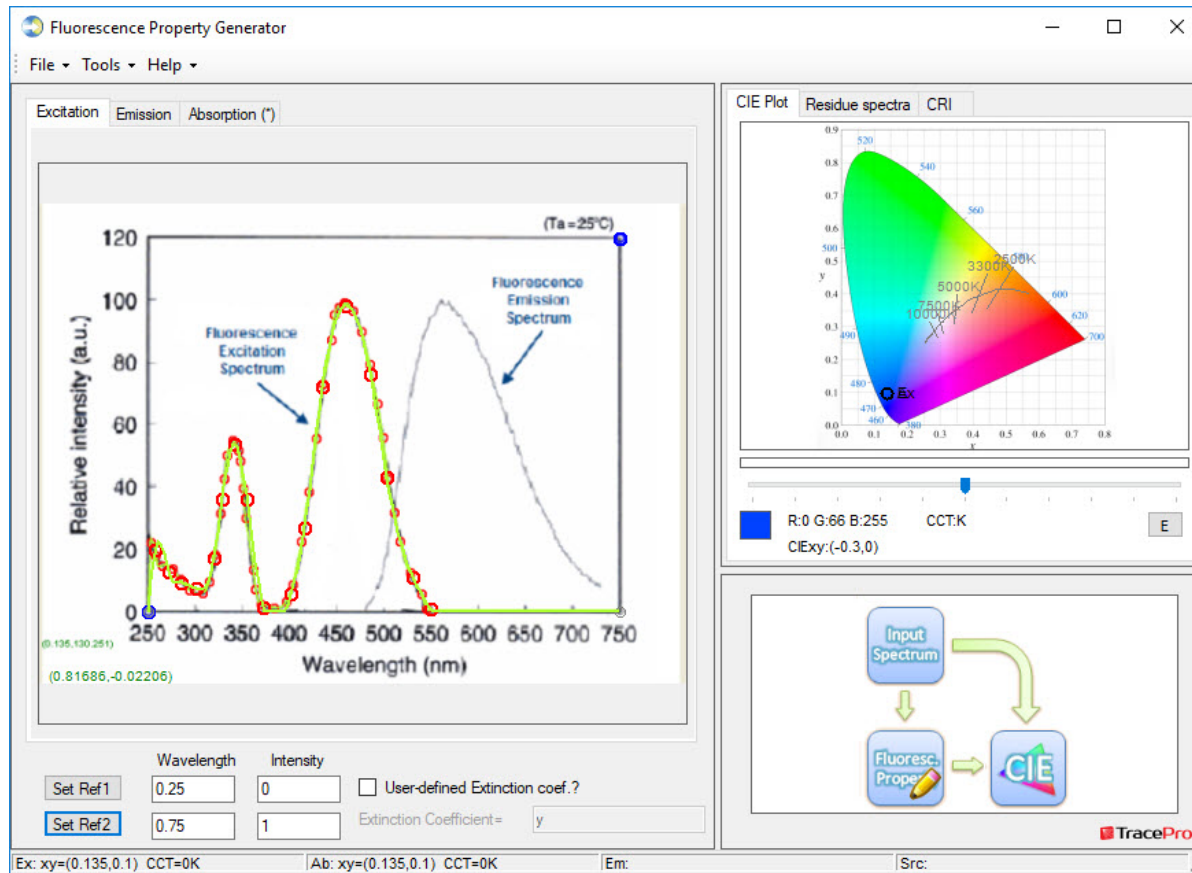


Use graphs from LED datasheets to make new Surface Source Properties for use in TracePro. Please see out tutorial video:

<https://www.lambdares.com/support/making-led-surface-source-property-1280x720-resolution/>

# TracePro Utilities for Making Properties

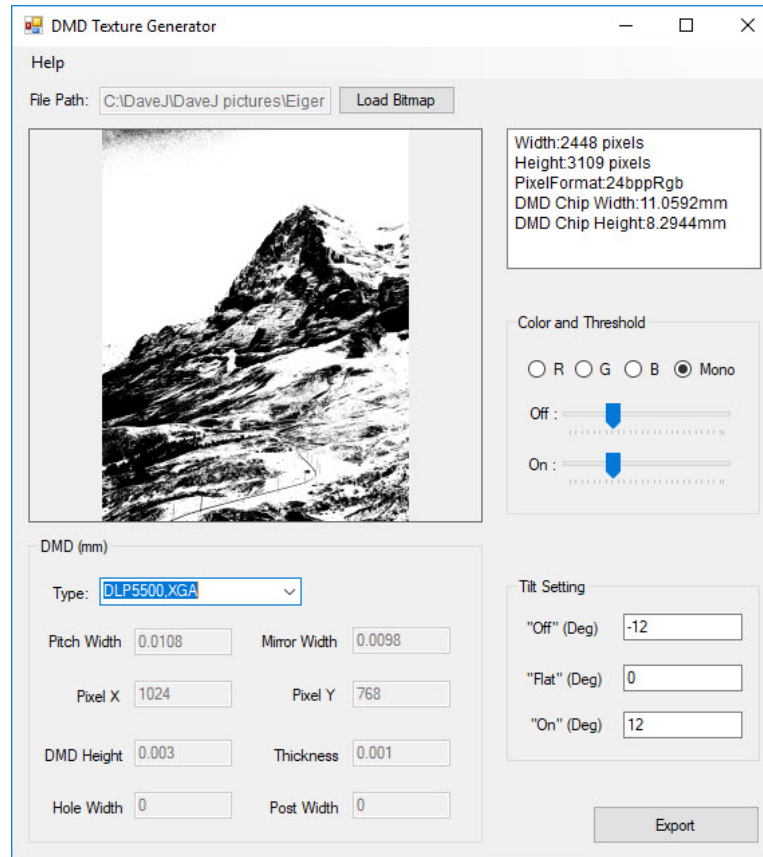
## Fluorescence Property Utility



Use graphs for Excitation, Emission, Absorption, and Source Spectrum to make Fluorescence properties for use in TracePro

# TracePro Utilities for Making Properties

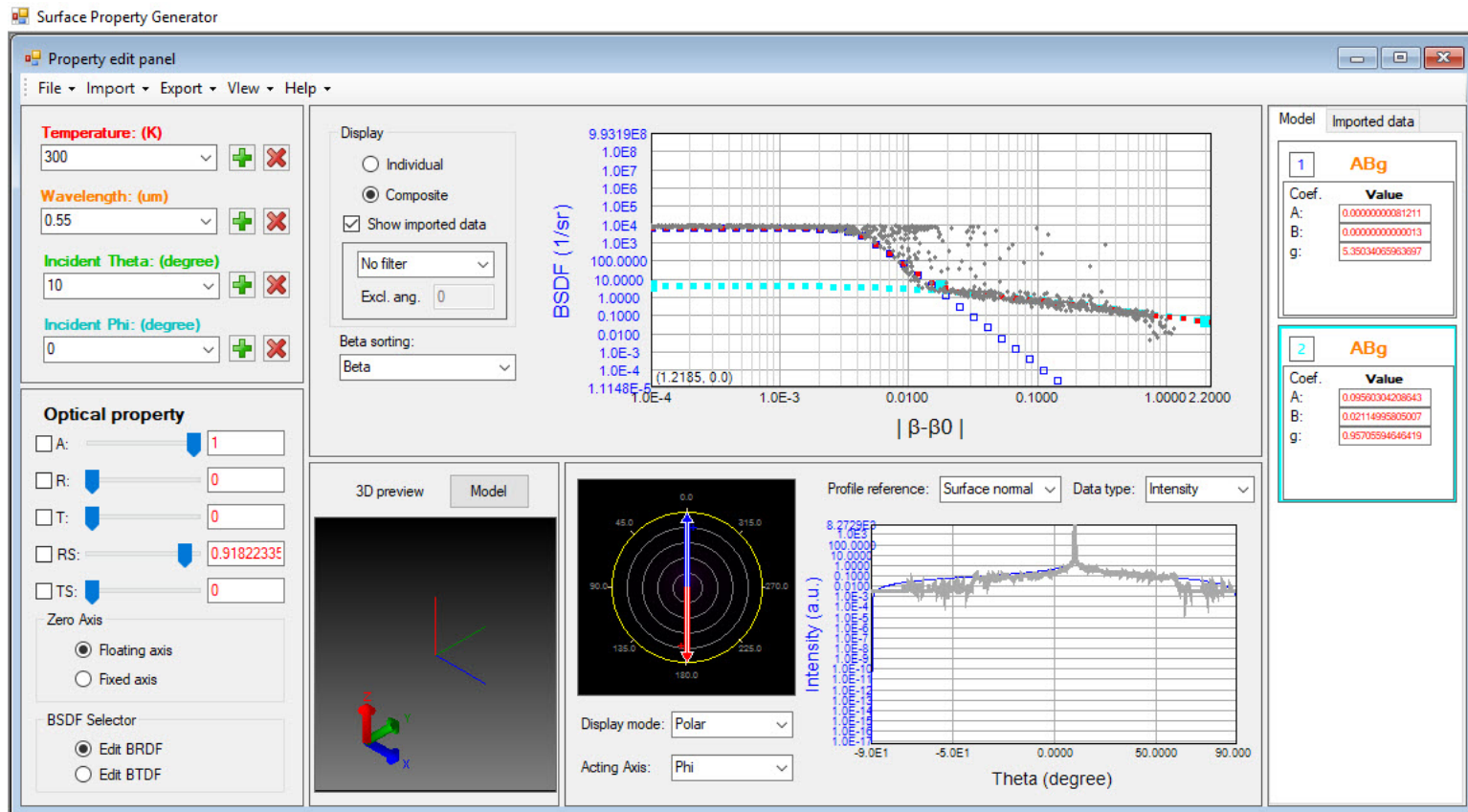
## DMD Texture Utility



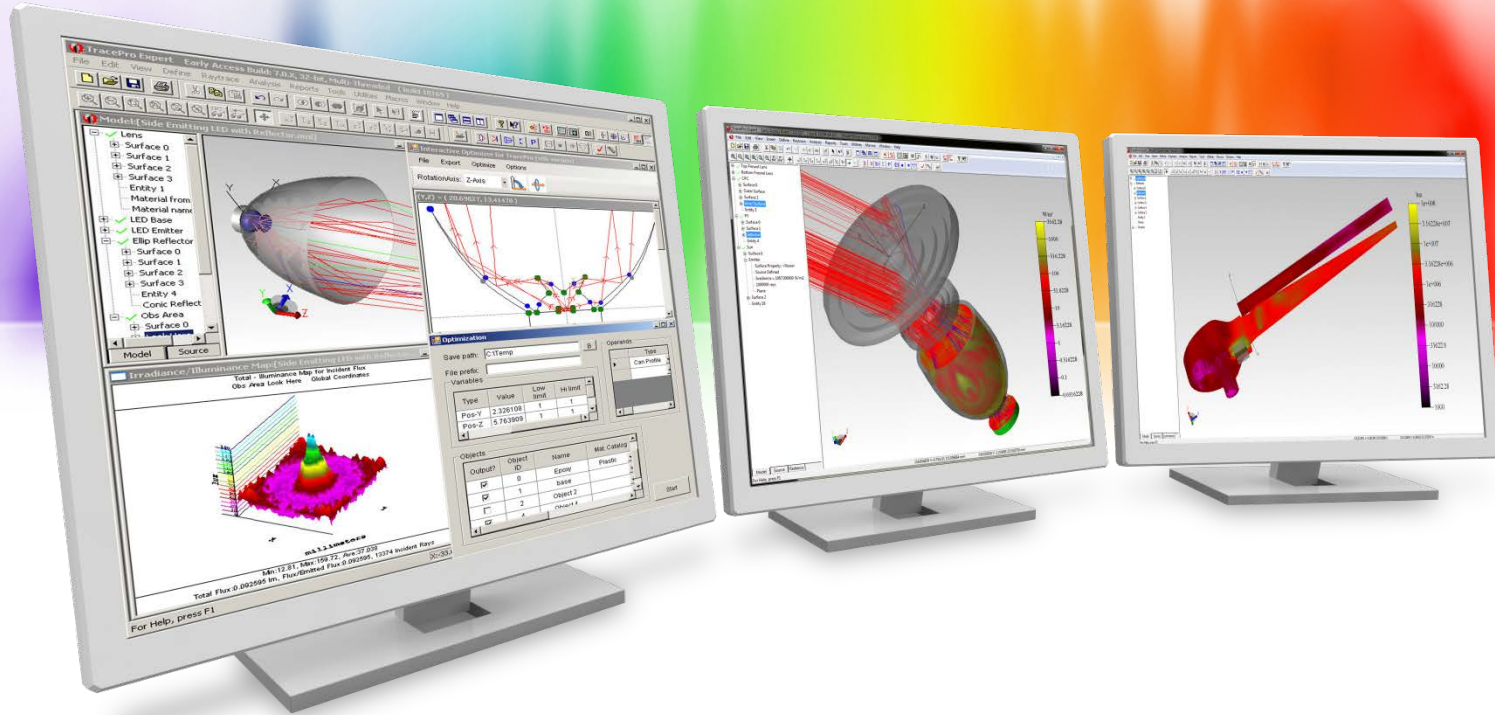
Make custom DMD RepTile properties using a Bitmap or JPEG image

# TracePro Utilities for Making Properties

## Surface Property Utility – new in TracePro 7.8.2



Convert measured BSDF data to Surface Properties for use in TracePro including composite BSDF properties



## Summary and Questions

# Summary and Questions

The TracePro allows you to define new, custom optical properties at any time:

- ✓ Open property database allows users to add new properties to the database
- ✓ Adding new properties is easy and straightforward
- ✓ A wide variety of property parameters to accurately model different property types
- ✓ Properties can be easily shared between users
- ✓ TracePro utilities are available to help with defining some property types

For more information or to sign up for our free 30-day trial please visit us at:

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