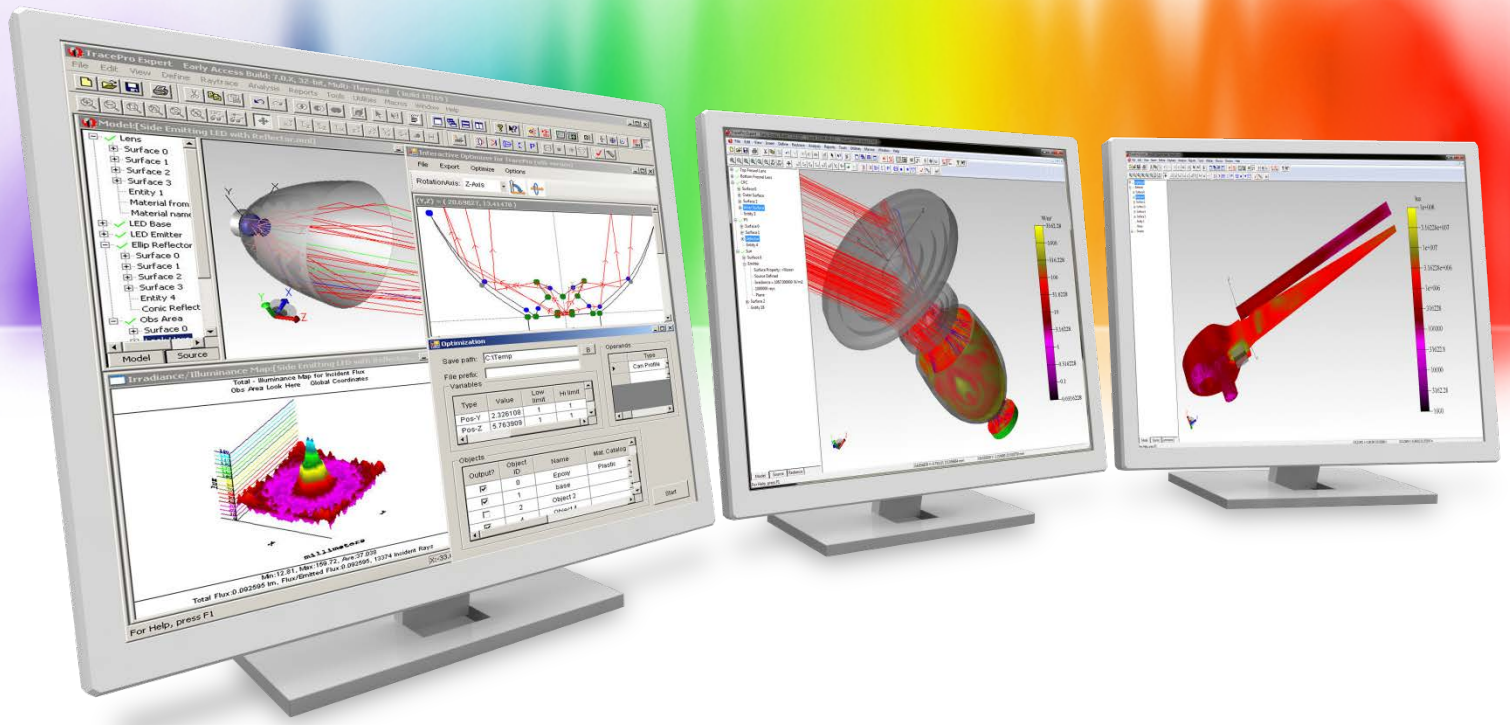
TracePro



The New Surface Property Generator in TracePro

A Lambda Research Corporation Webinar

March 22, 2018

LAMBDA RESEARCH CORPORATION

Presenter

- **Presenter**

  Dave Jacobsen

  Sr. Application Engineer

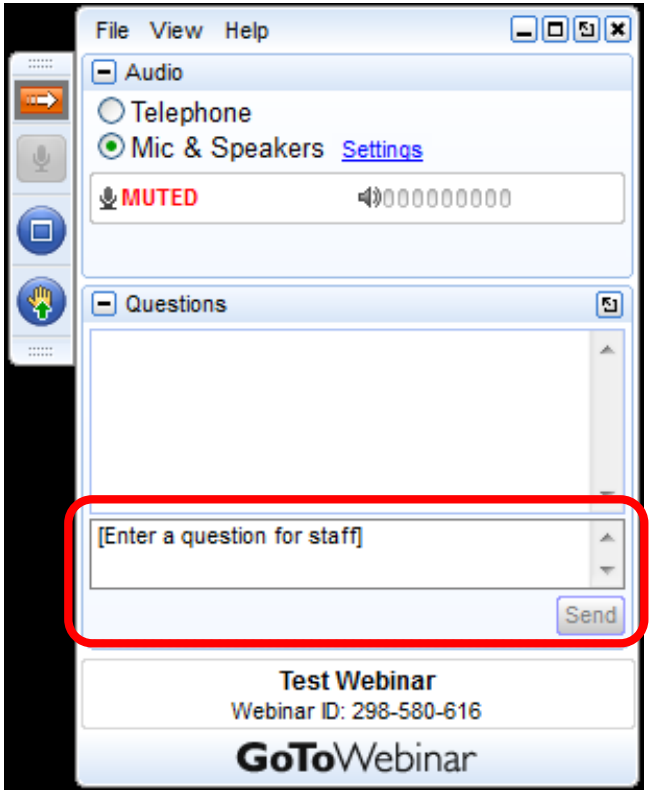
  Lambda Research Corporation

TracePro

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



TracePro

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/

TracePro

Upcoming TracePro Training

- **Littleton, MA**
  - Introduction to TracePro – April 10-11, 2018
  - Optimization with TracePro – April 12-13, 2018

- **Please ask us about custom onsite training**

TracePro

Latest TracePro and RayViz Release

TracePro 2018 18.1 - Released February 12, 2018

TracePro 2018 18.1.3 Early Visibility - Now available

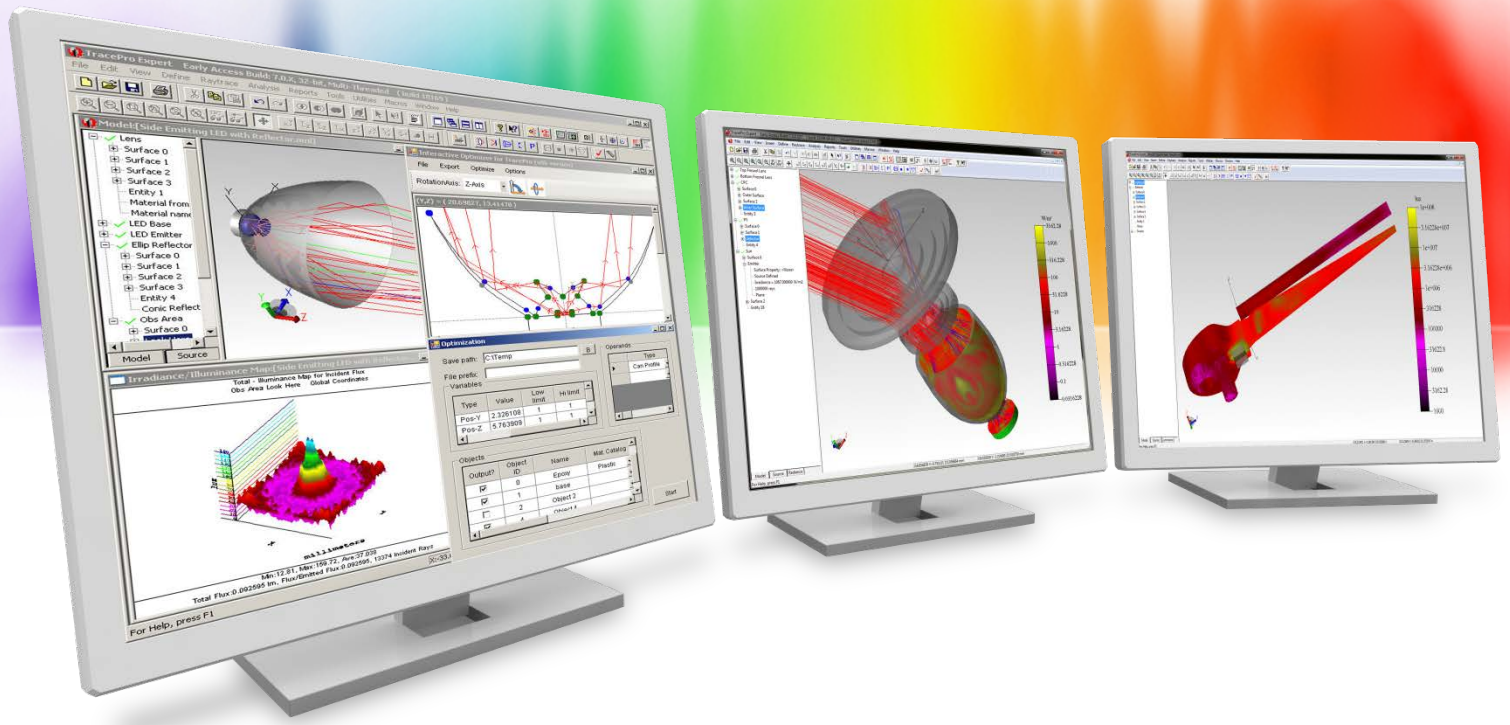
RayViz 2018 18.1 - Released February 12, 2018

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

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

TracePro

TracePro



The New Surface Property Generator in TracePro

A Lambda Research Corporation Webinar

March 22, 2018

LAMBDA RESEARCH CORPORATION

Agenda

- Features of the new Surface Property Generator in TracePro
- Using the new Surface Property Generator to make Surface Properties in TracePro
- How the Surface Property Generator can be used to read measured BSDF data and make new Surface Properties for TracePro based on the scattering measurements
- An example of making a new Surface Property for TracePro

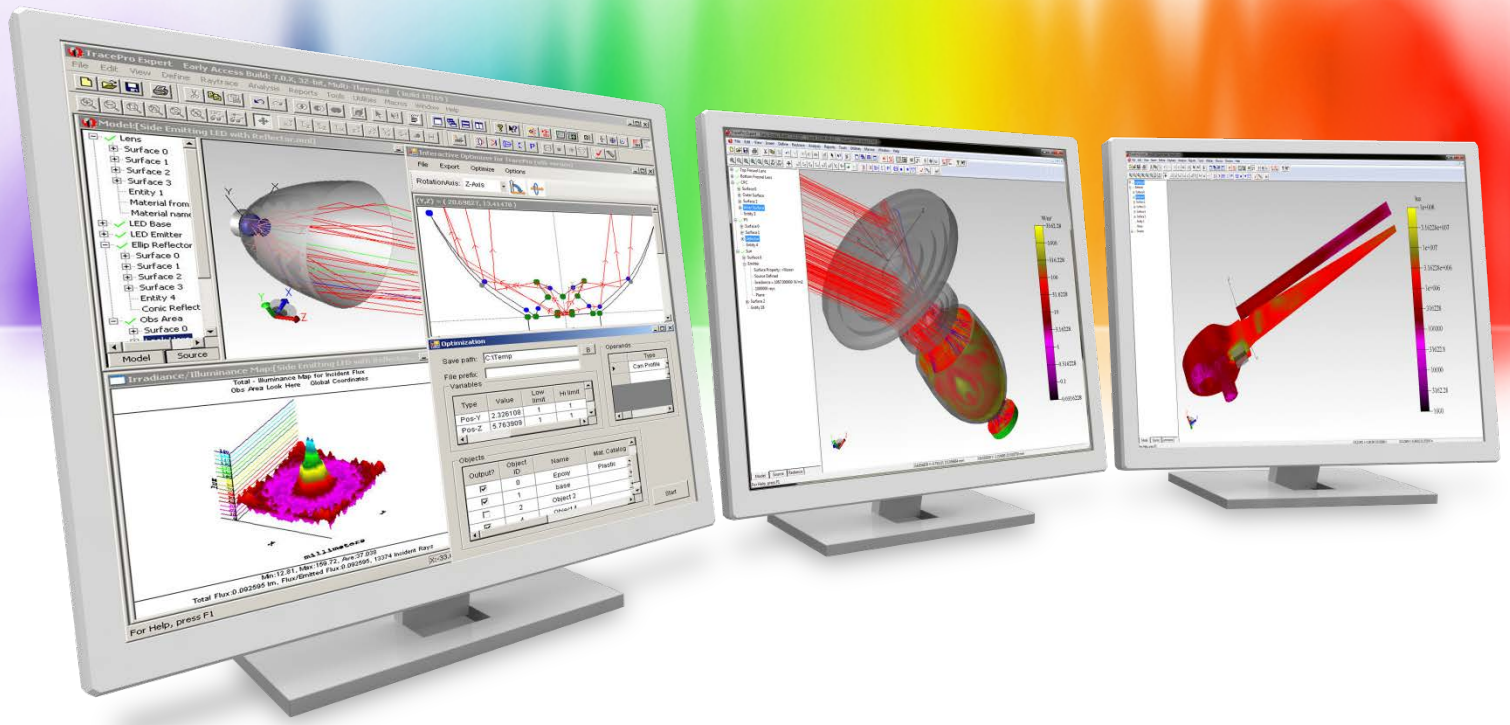
Agenda

- Demonstrate a method for using the new Surface Property Generator to make a Surface Property for materials with large scattering features, such as Alanod Miro 9

- Questions and Answers

TracePro

TracePro



Surface Property Generator Features

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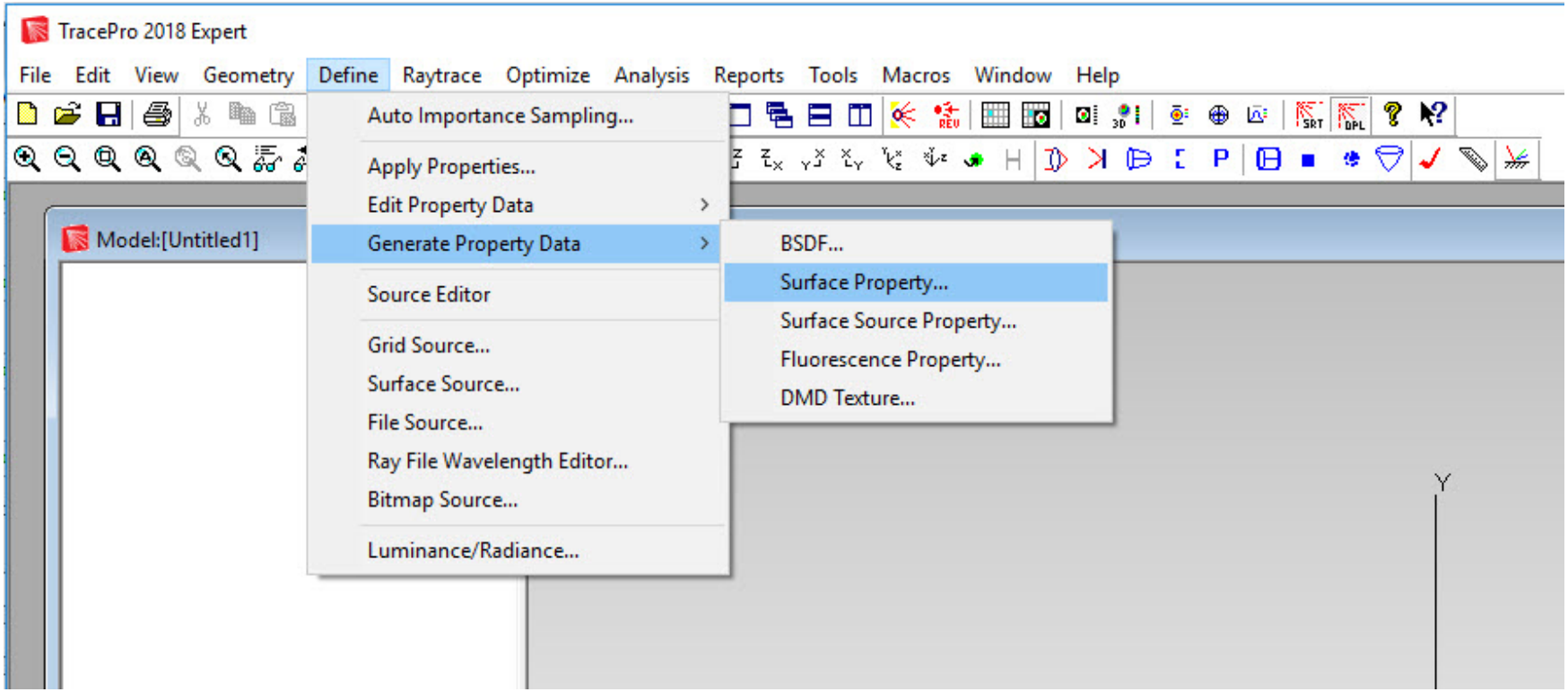
Surface Property Generator Features

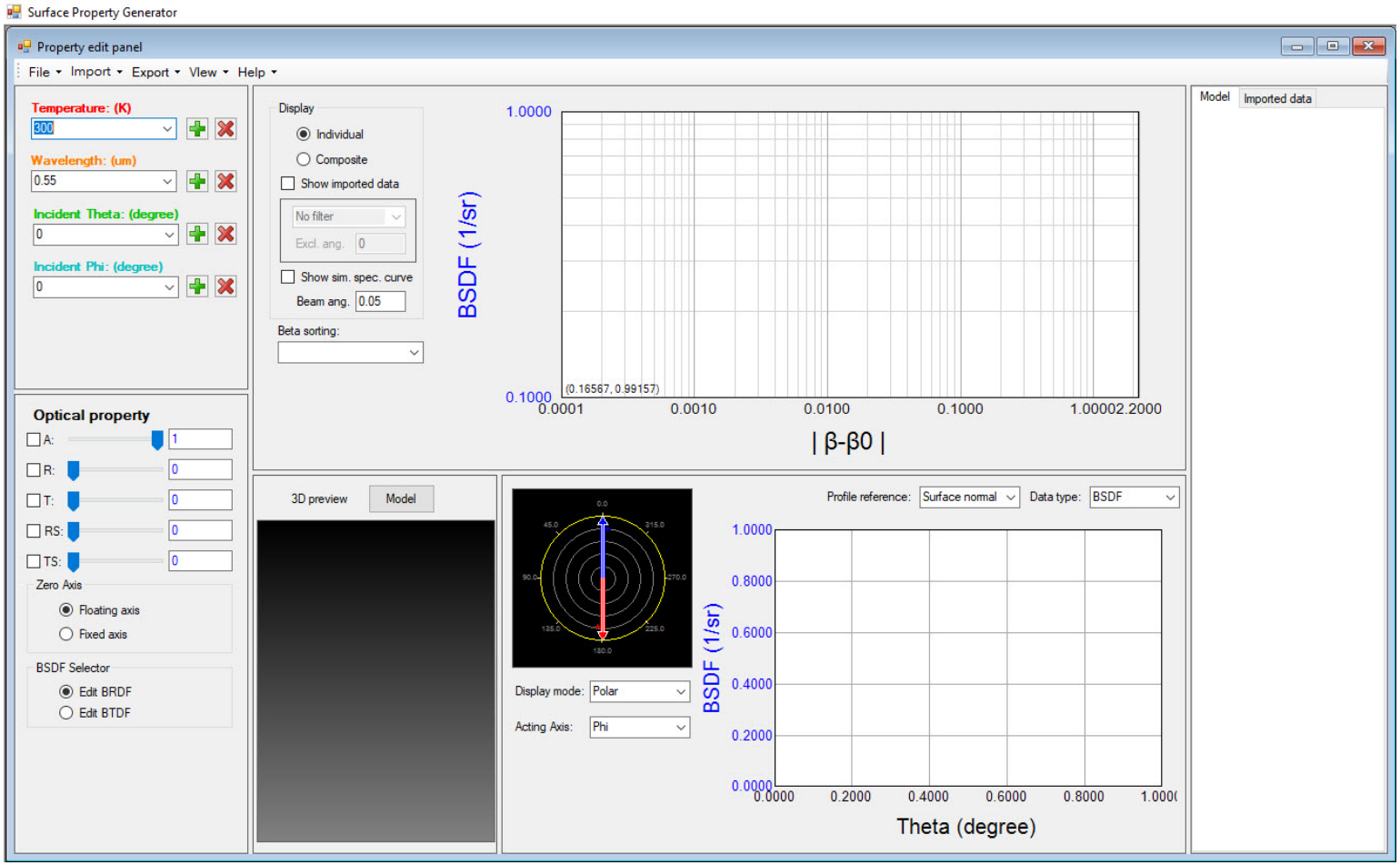
Available in all versions of TracePro



TracePro

Surface Property Generator Features

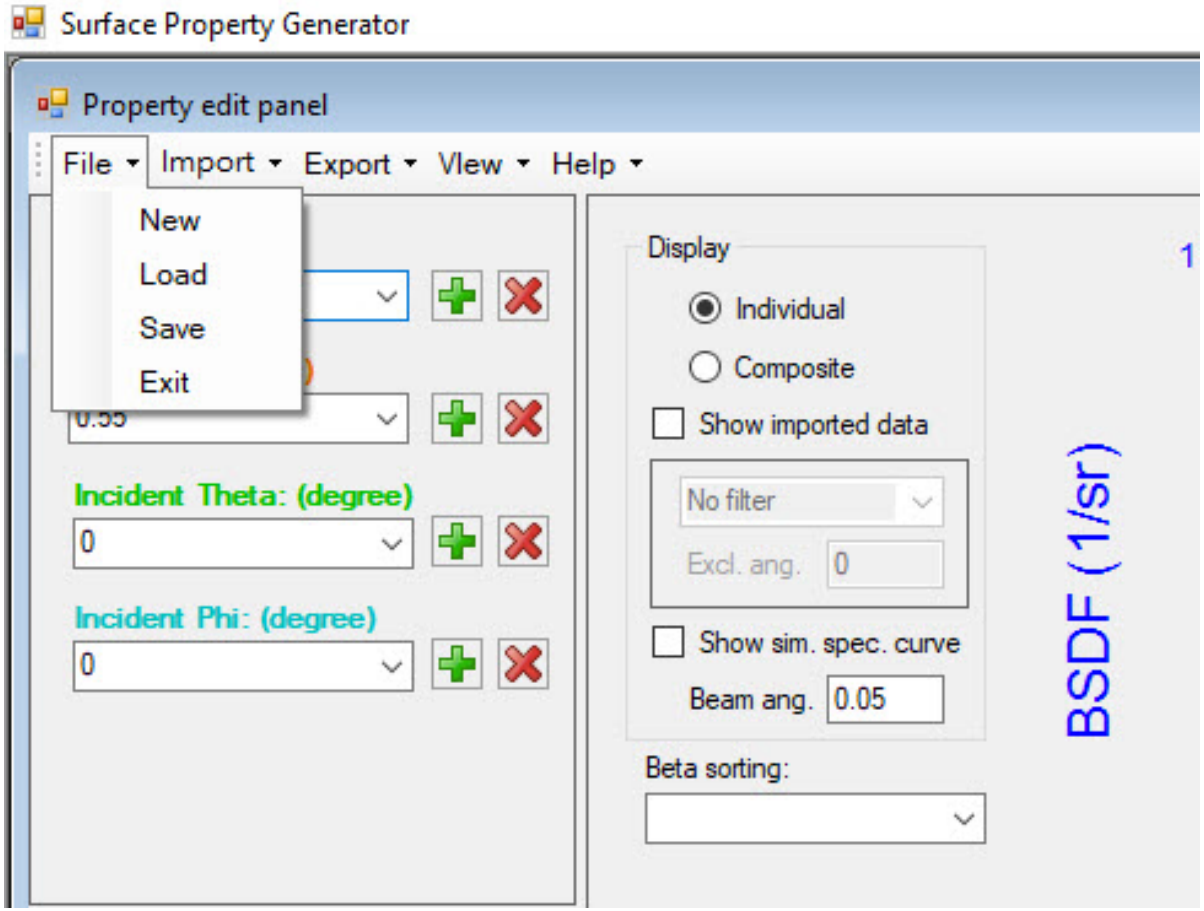
Surface Property Generator



TracePro

Surface Property Generator Features

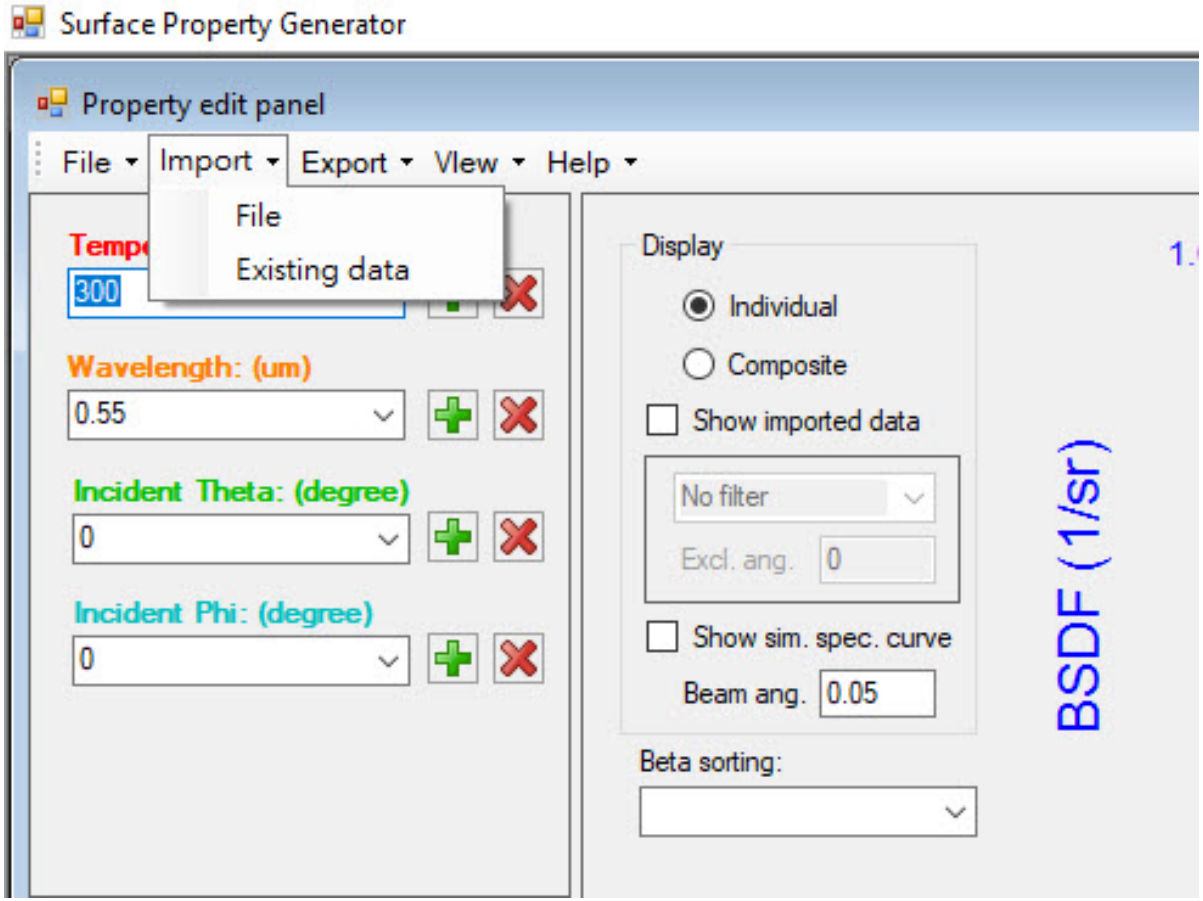
Surface Property Generator – File menu



TracePro

Surface Property Generator Features

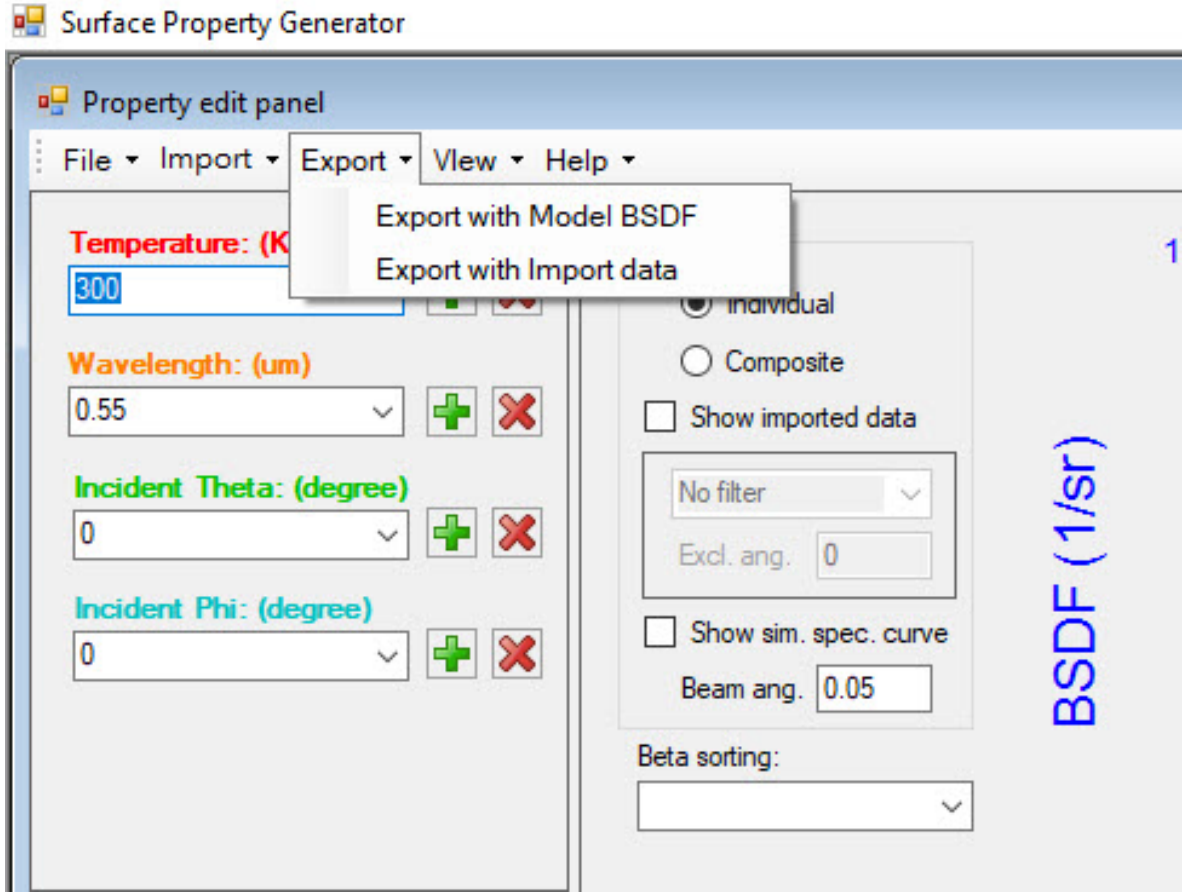
Surface Property Generator – Import menu



TracePro

Surface Property Generator Features

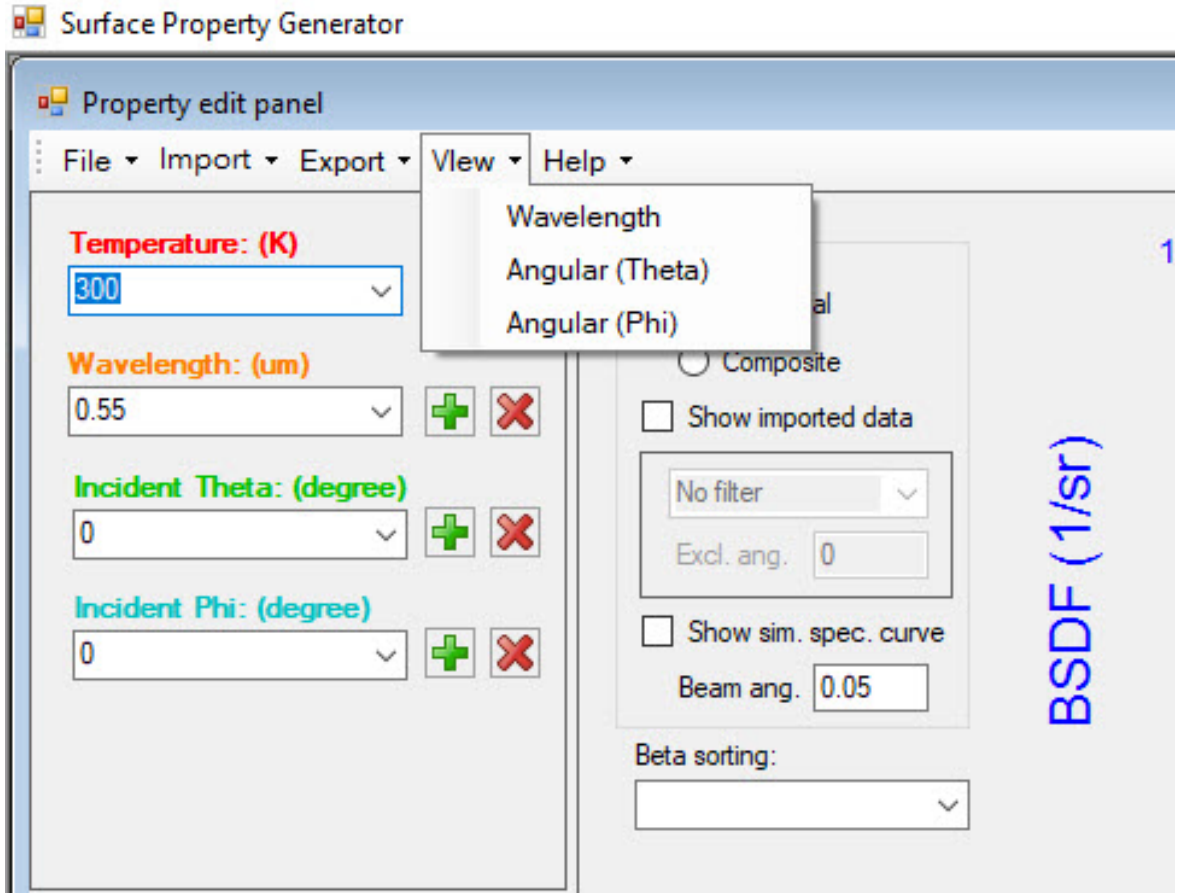
Surface Property Generator – Export menu



TracePro

Surface Property Generator Features

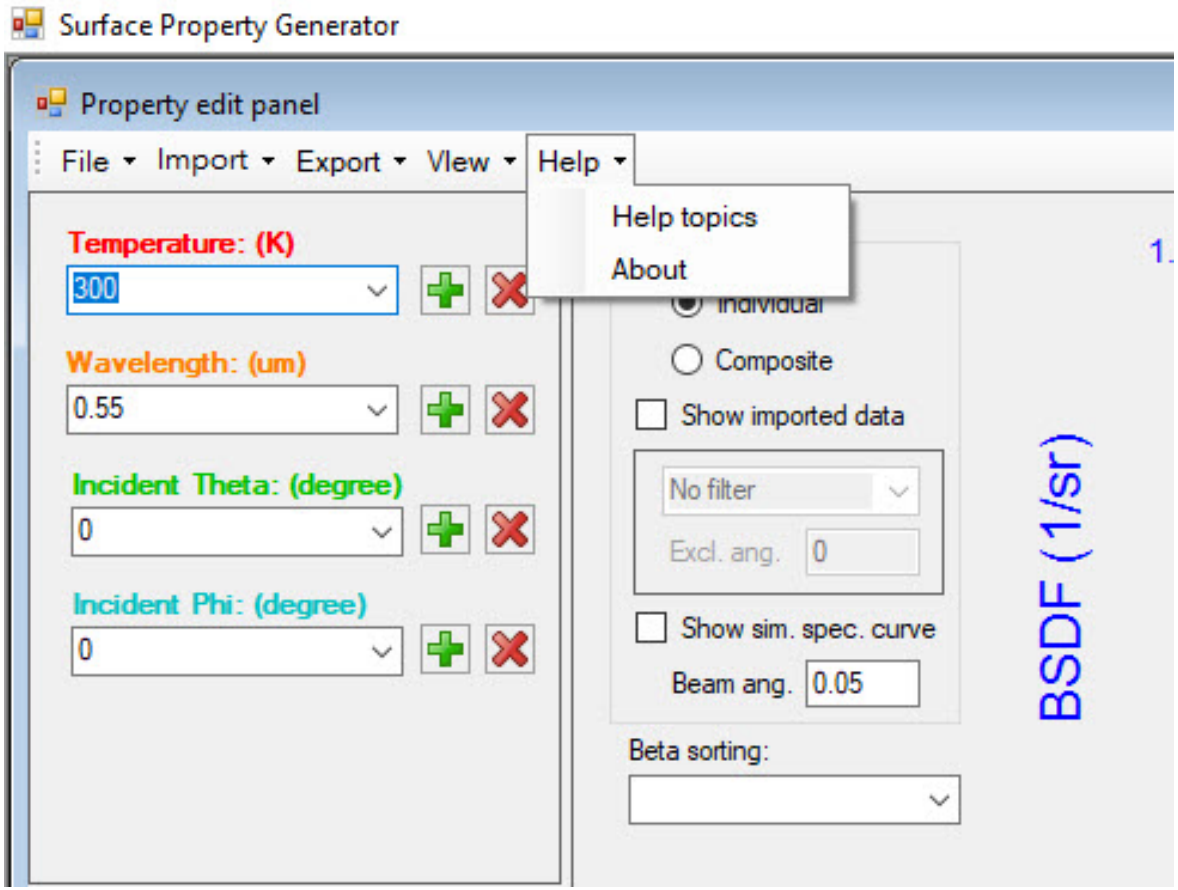
Surface Property Generator – View menu



TracePro

Surface Property Generator Features

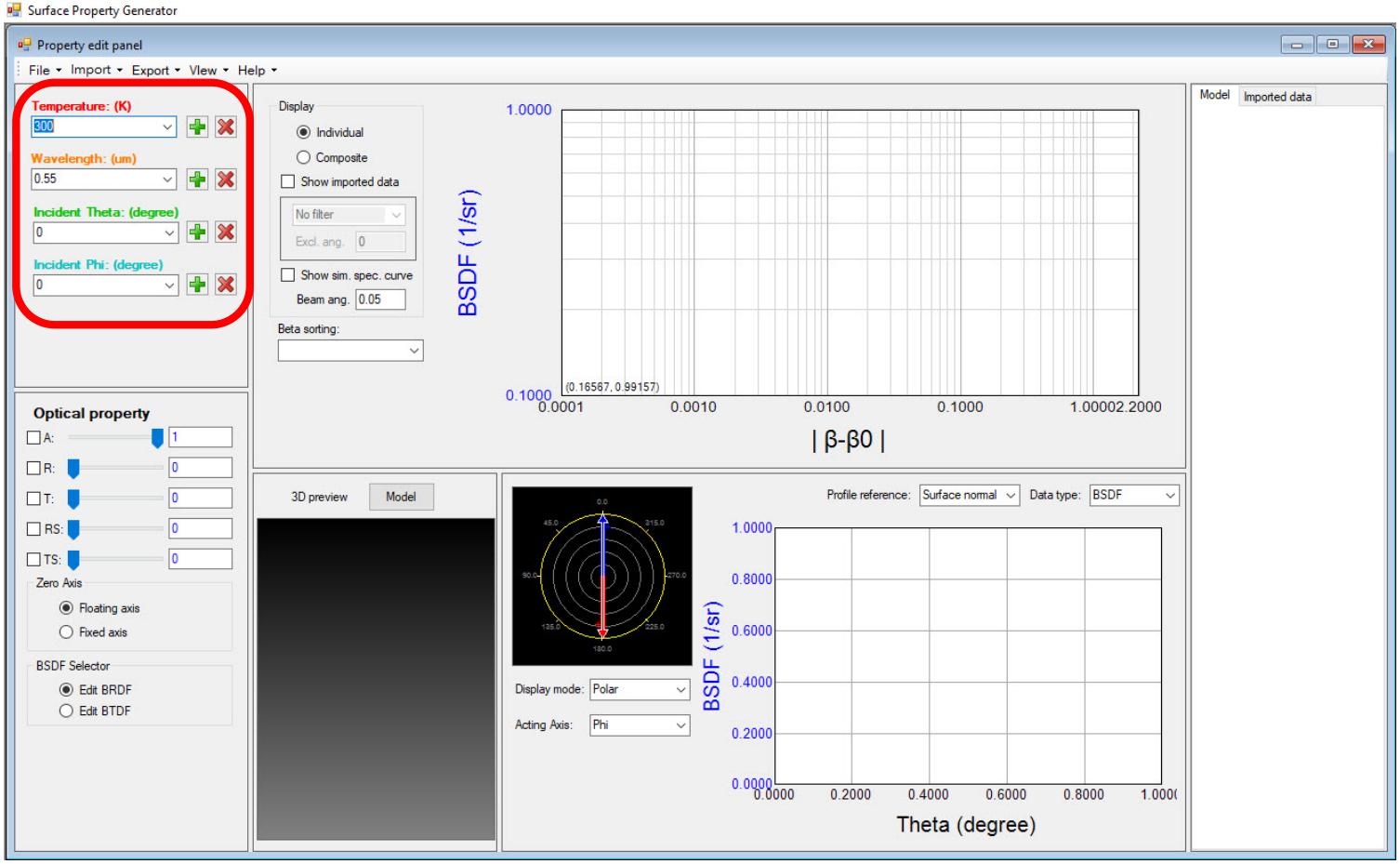
Surface Property Generator – Help menu



TracePro

Surface Property Generator Features

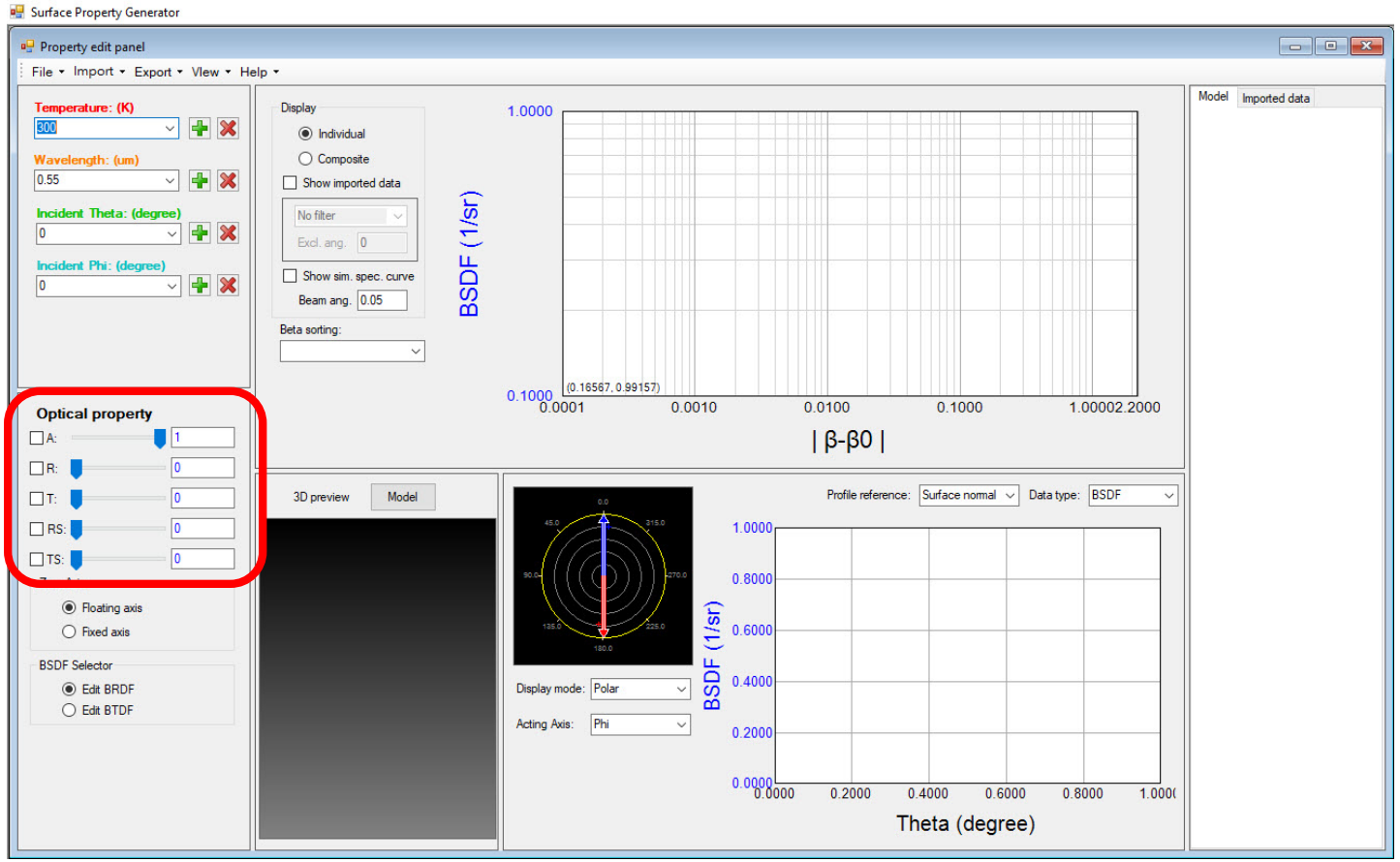
Surface Property Generator – Enter values for Temperature, Wavelength, Incident Theta, and Incident Phi



TracePro

Surface Property Generator Features

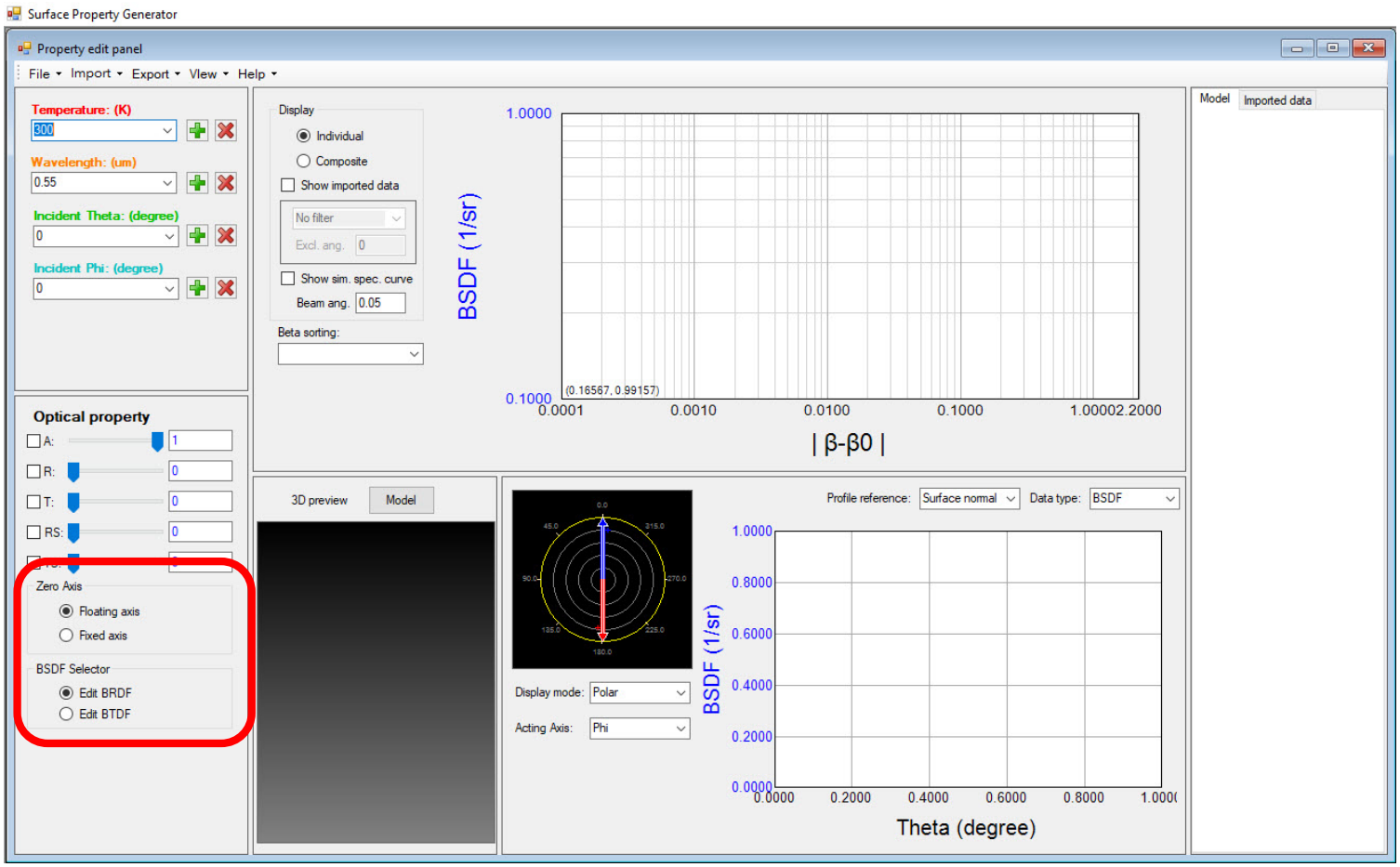
Surface Property Generator – Enter values for Absorption, Specular Reflection, Specular Transmission, Reflected Scatter, and Transmitted Scatter



TracePro

Surface Property Generator Features

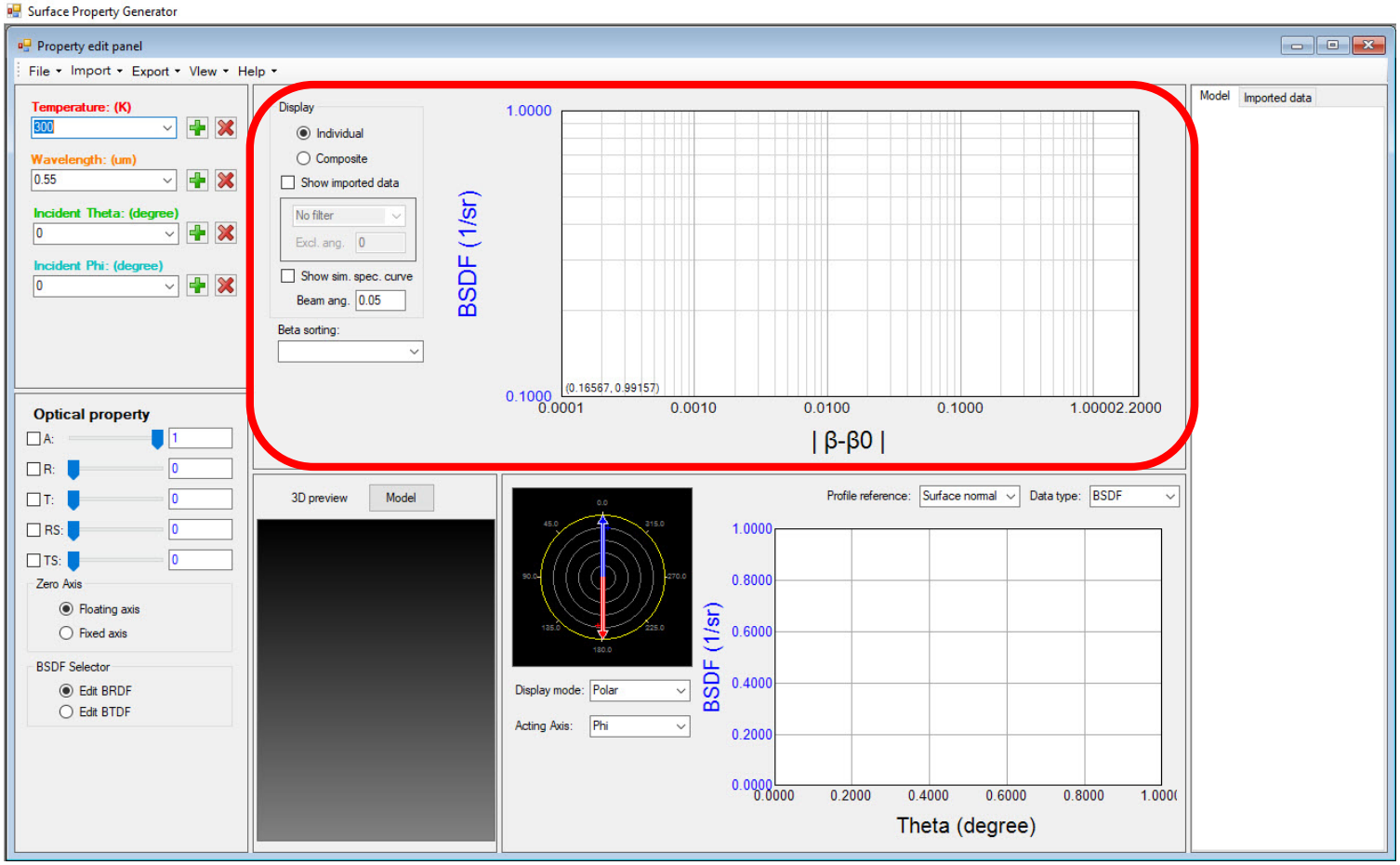
Surface Property Generator – Zero Axis and BRDF or BTDF



TracePro

Surface Property Generator Features

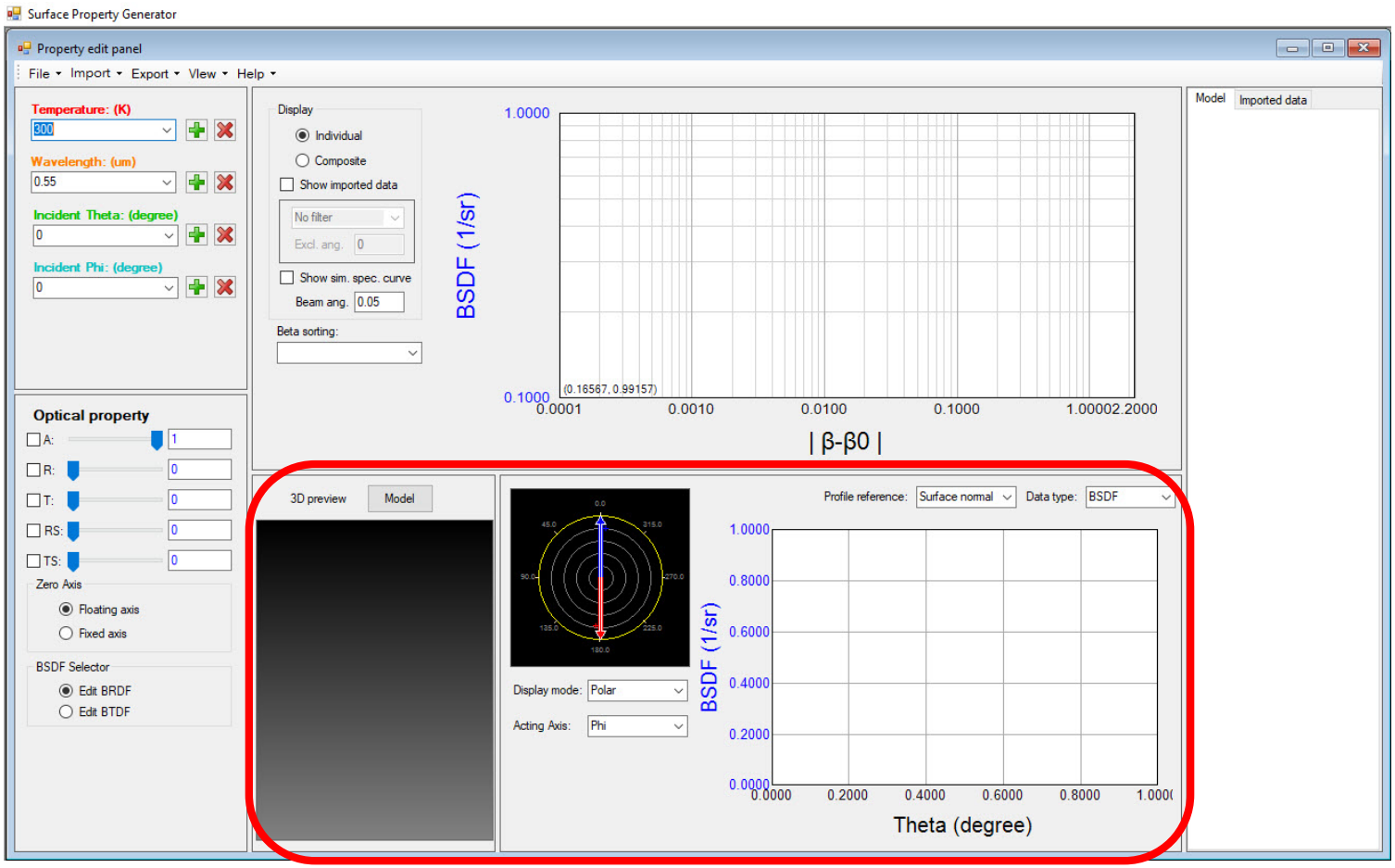
Surface Property Generator – BSDF Plot – Imported Data



TracePro

Surface Property Generator Features

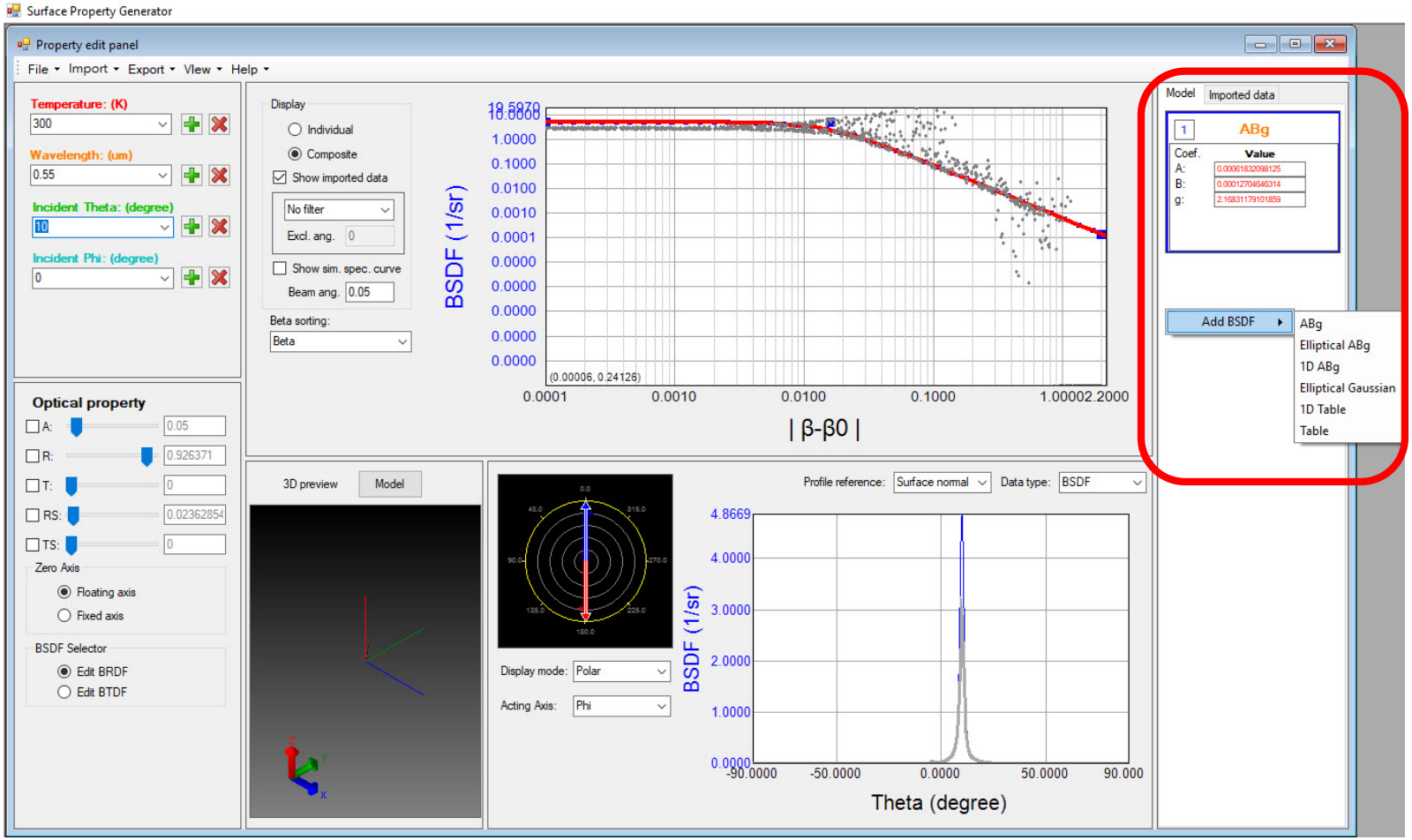
Surface Property Generator – BSDF Plot – Fitted BSDF Data



TracePro

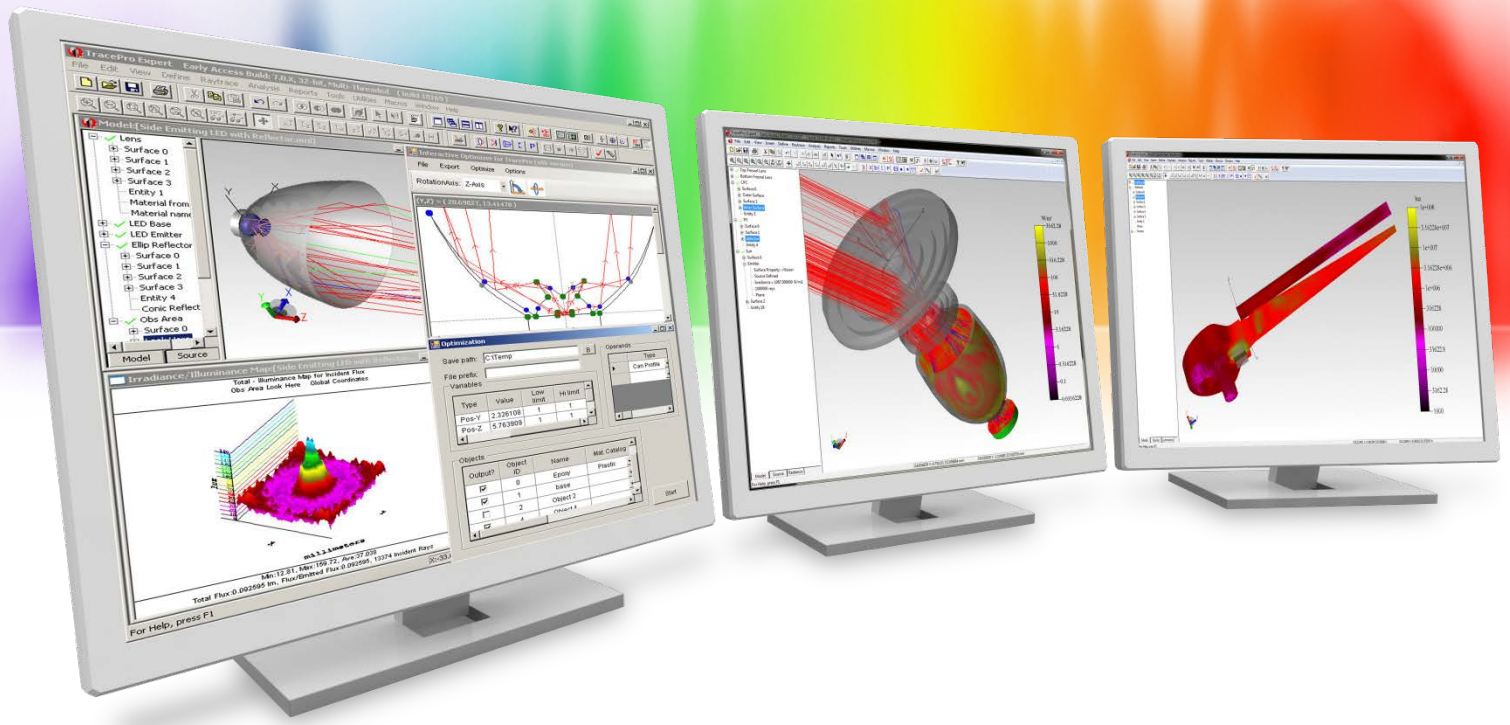
Surface Property Generator Features

Surface Property Generator – BSDF Plot – Available Scatter Models



TracePro

TracePro

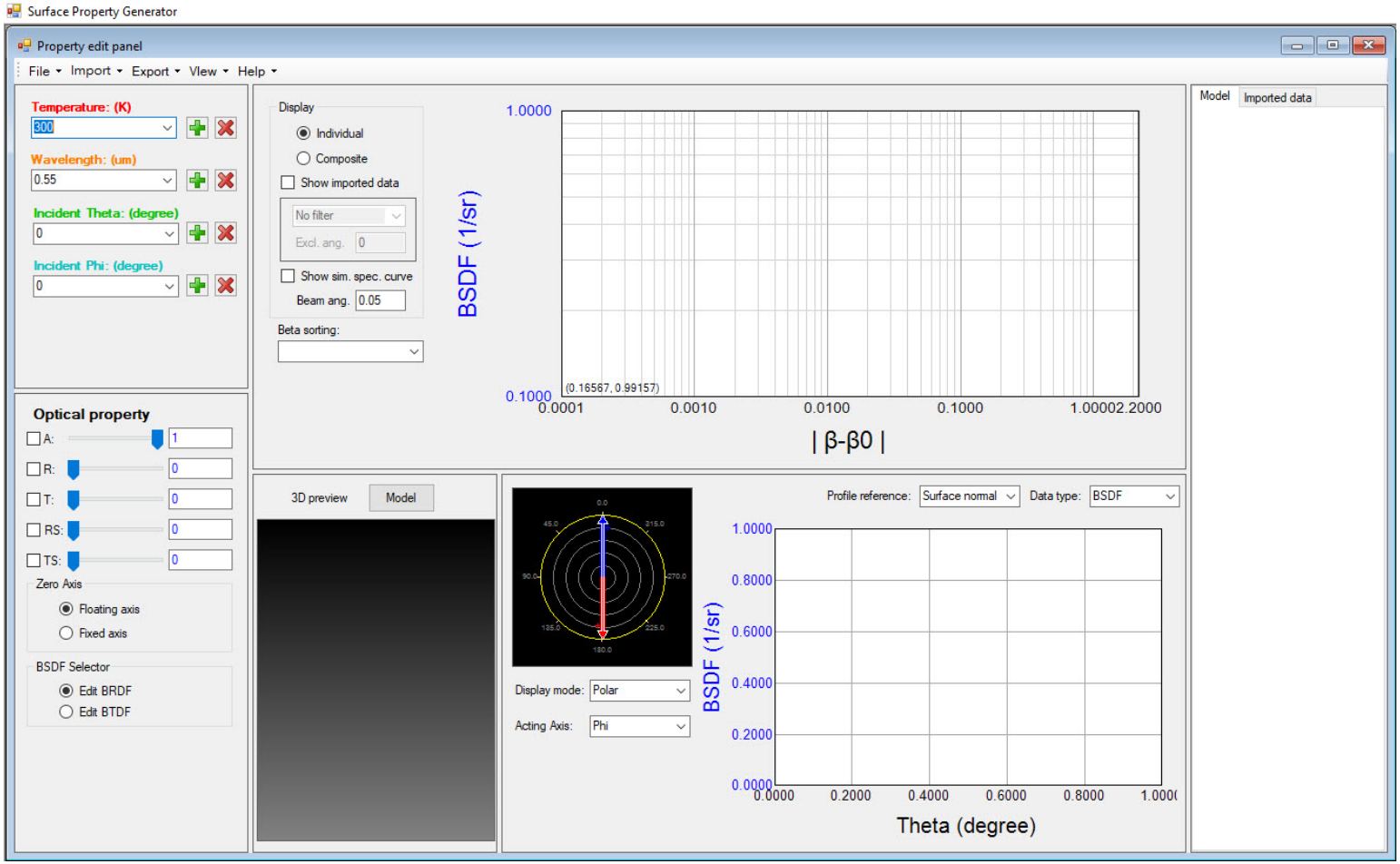


Making a Surface Property – No Scattering

LAMBDA RESEARCH CORPORATION

Making a new Surface Property – No Scattering

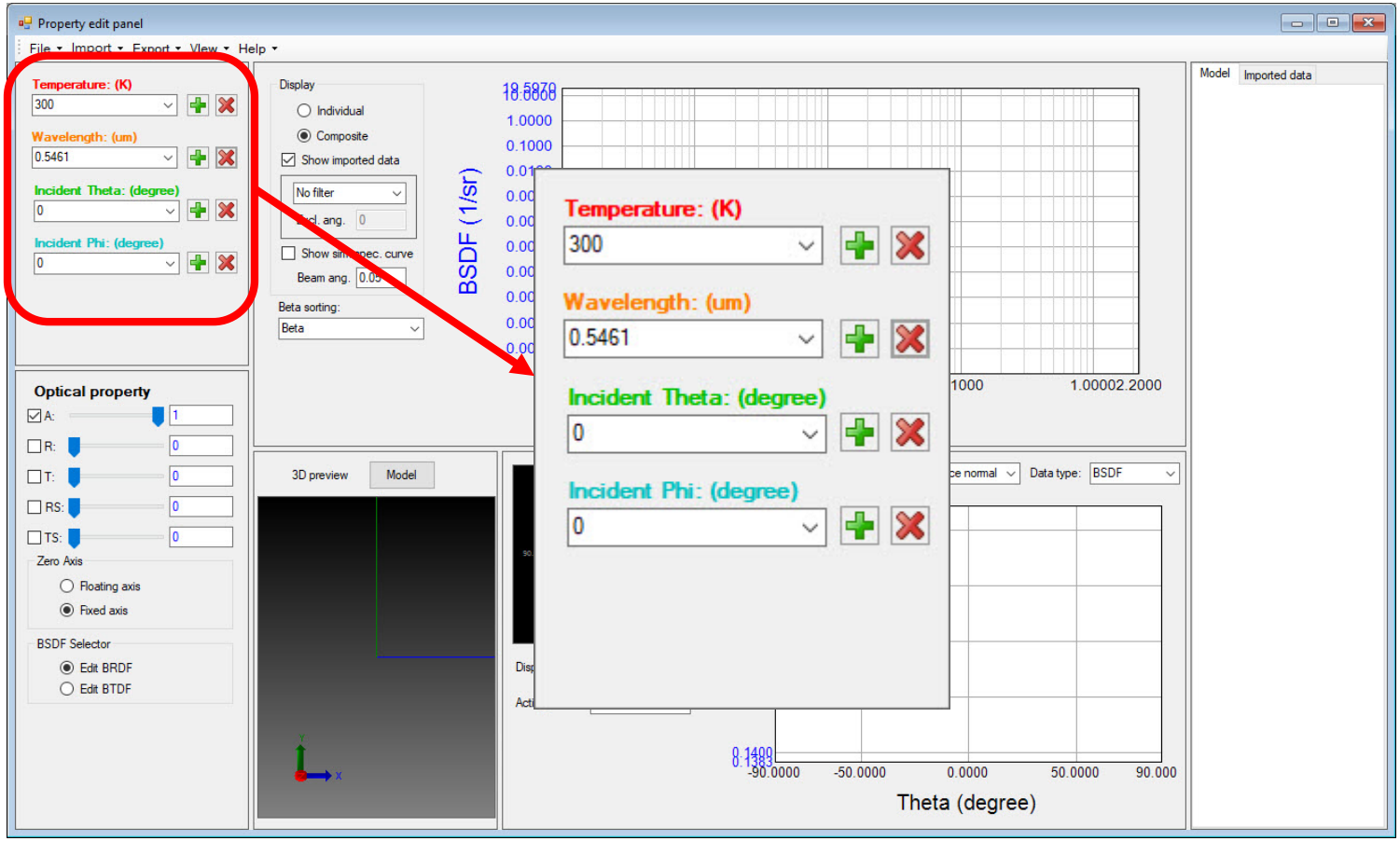
Open the Surface Property Generator



TracePro

Making a new Surface Property – No Scattering

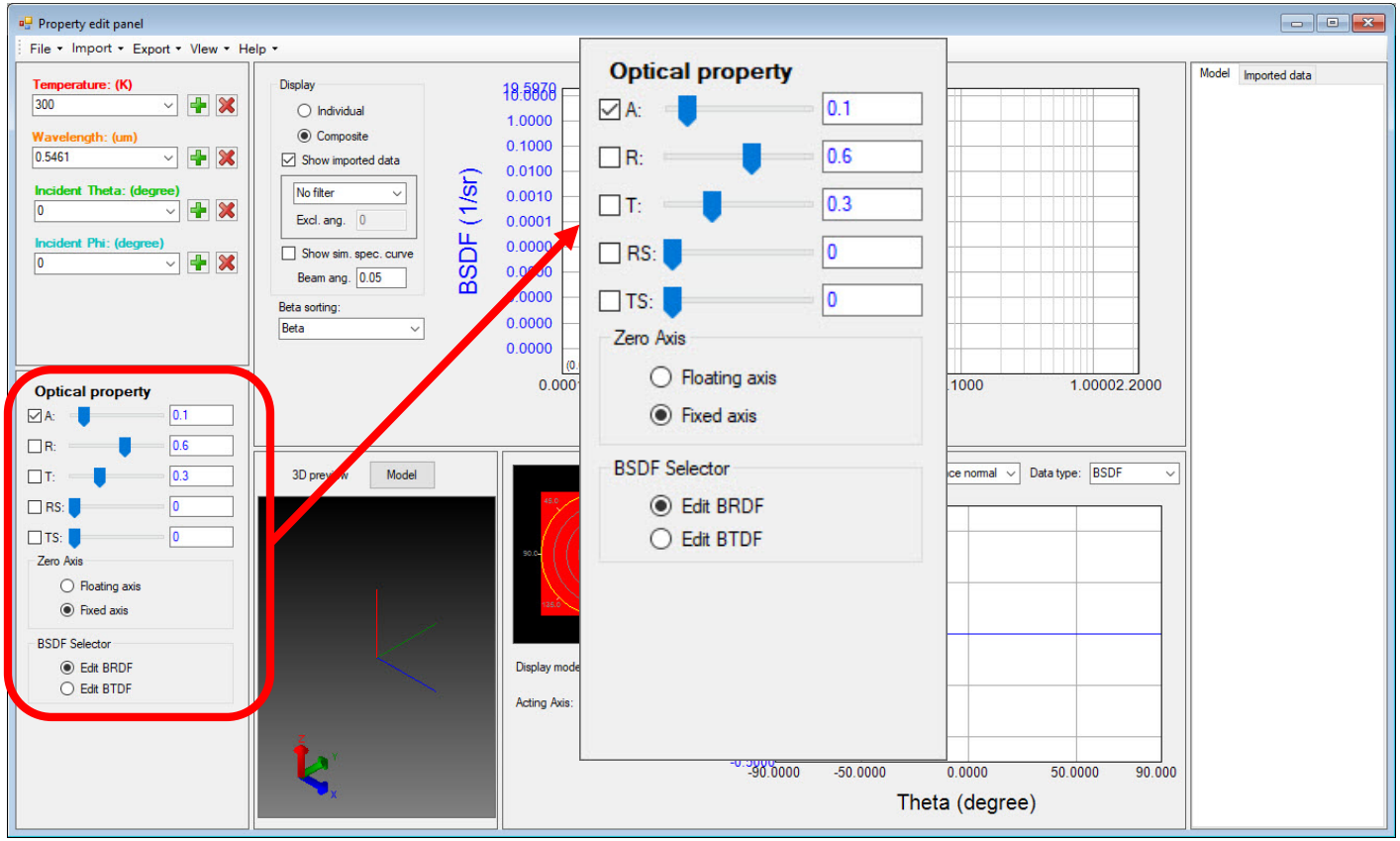
Enter values for Temperature, Wavelength, Incident Theta, and Incident Phi



TracePro

Making a new Surface Property – No Scattering

Enter values for Absorption, Reflection, and Transmission

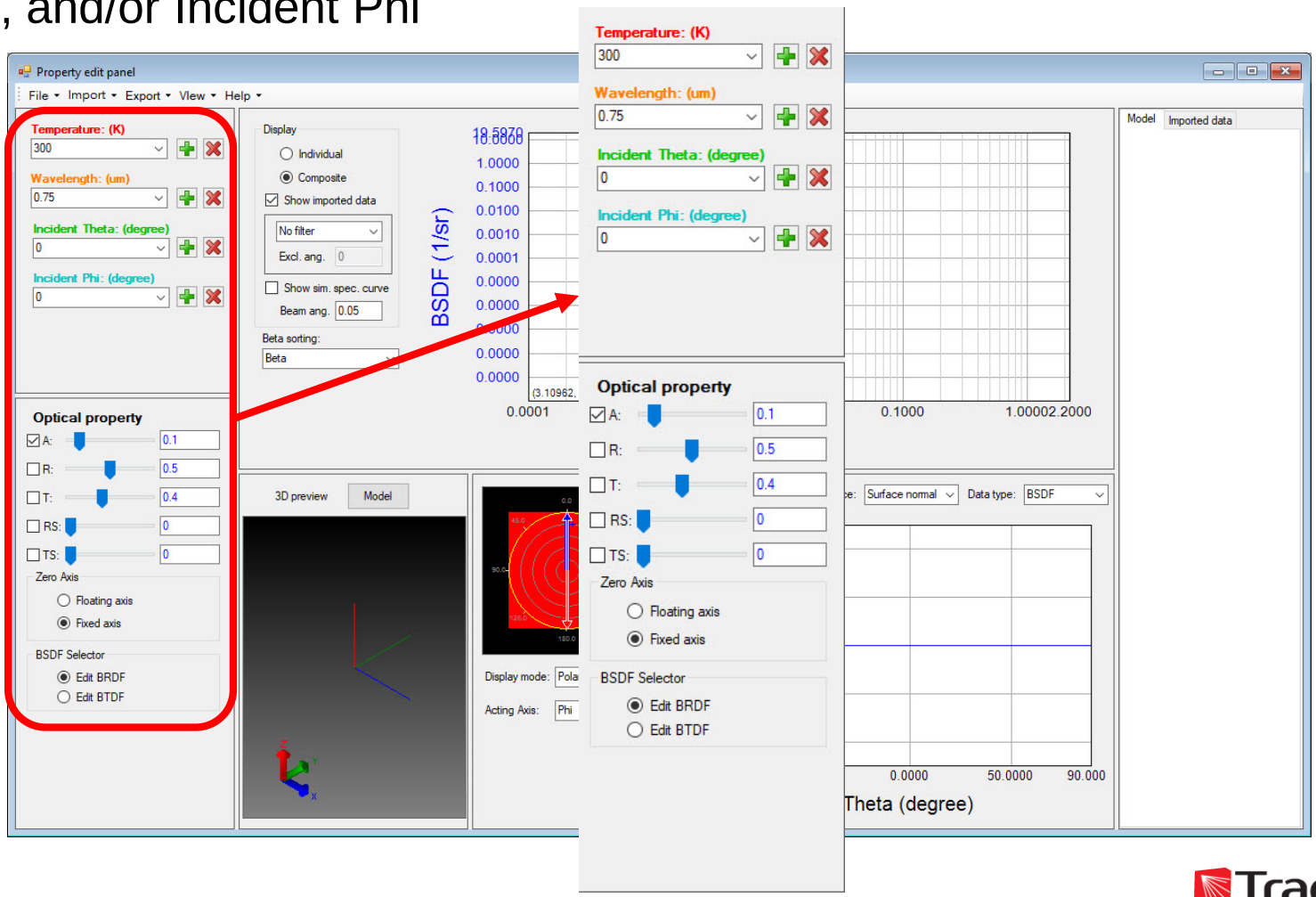


Values can be set using the sliders or by entering the values directly.
Check the box next to the parameter you want to Solve For.

TracePro

Making a new Surface Property – No Scattering

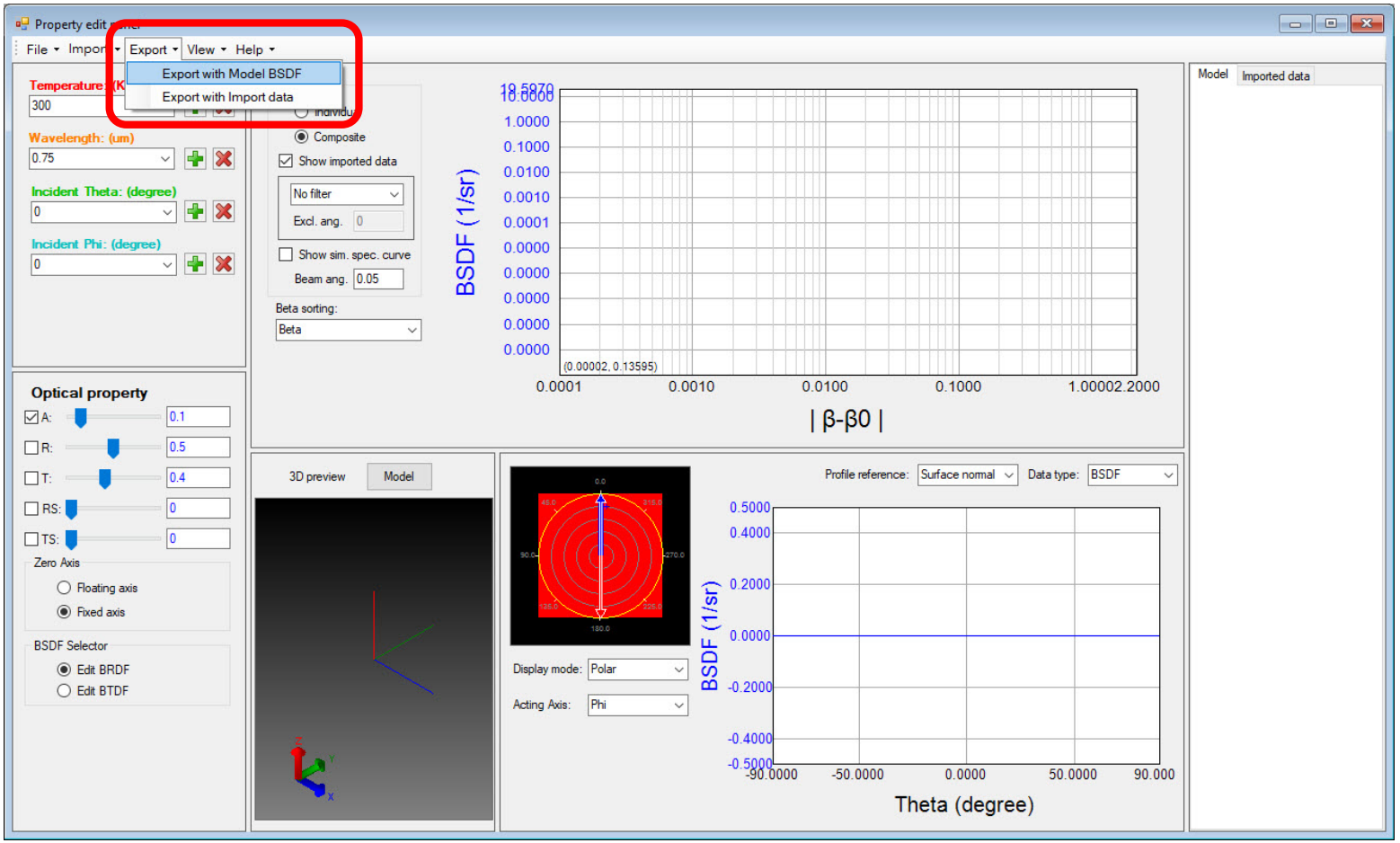
Repeat the process for additional Temperature, Wavelength, Incident Theta, and/or Incident Phi



TracePro

Making a new Surface Property – No Scattering

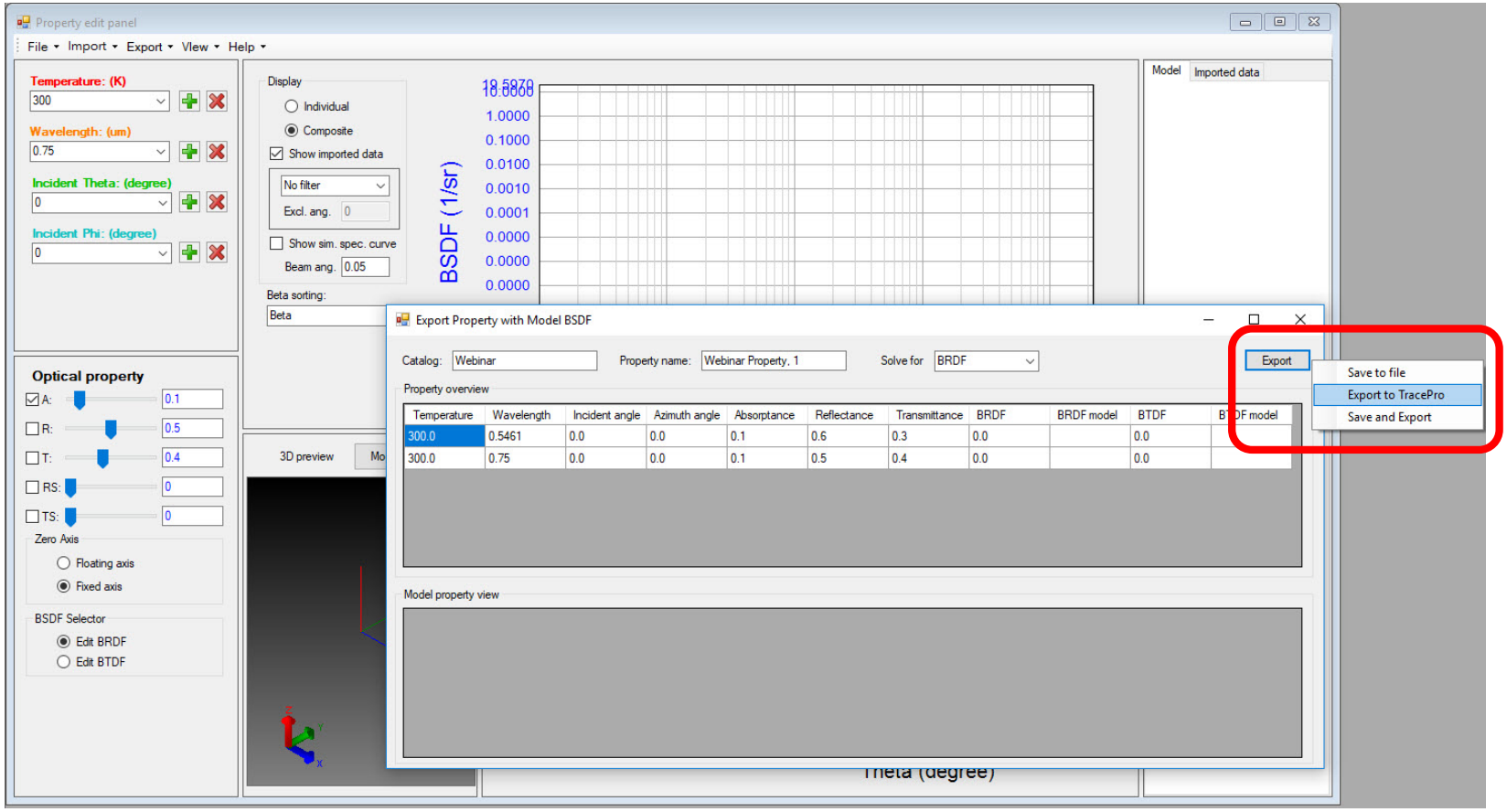
Export the property to TracePro – Export->Export with Model BSDF



TracePro

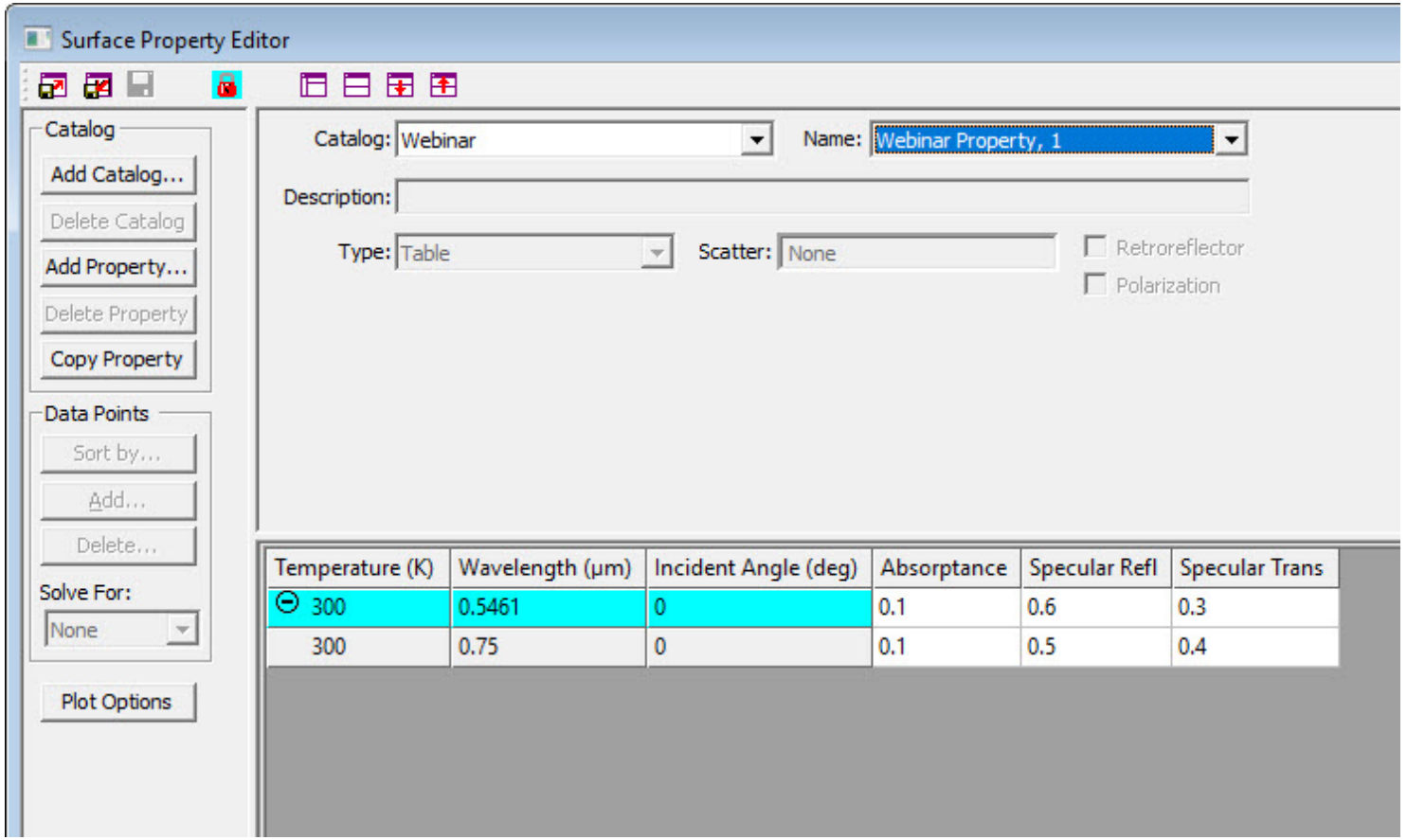
Making a new Surface Property – No Scattering

Enter a Catalog and Property Name. Click Export->Export to TracePro in the Export Property with Model BSDF window



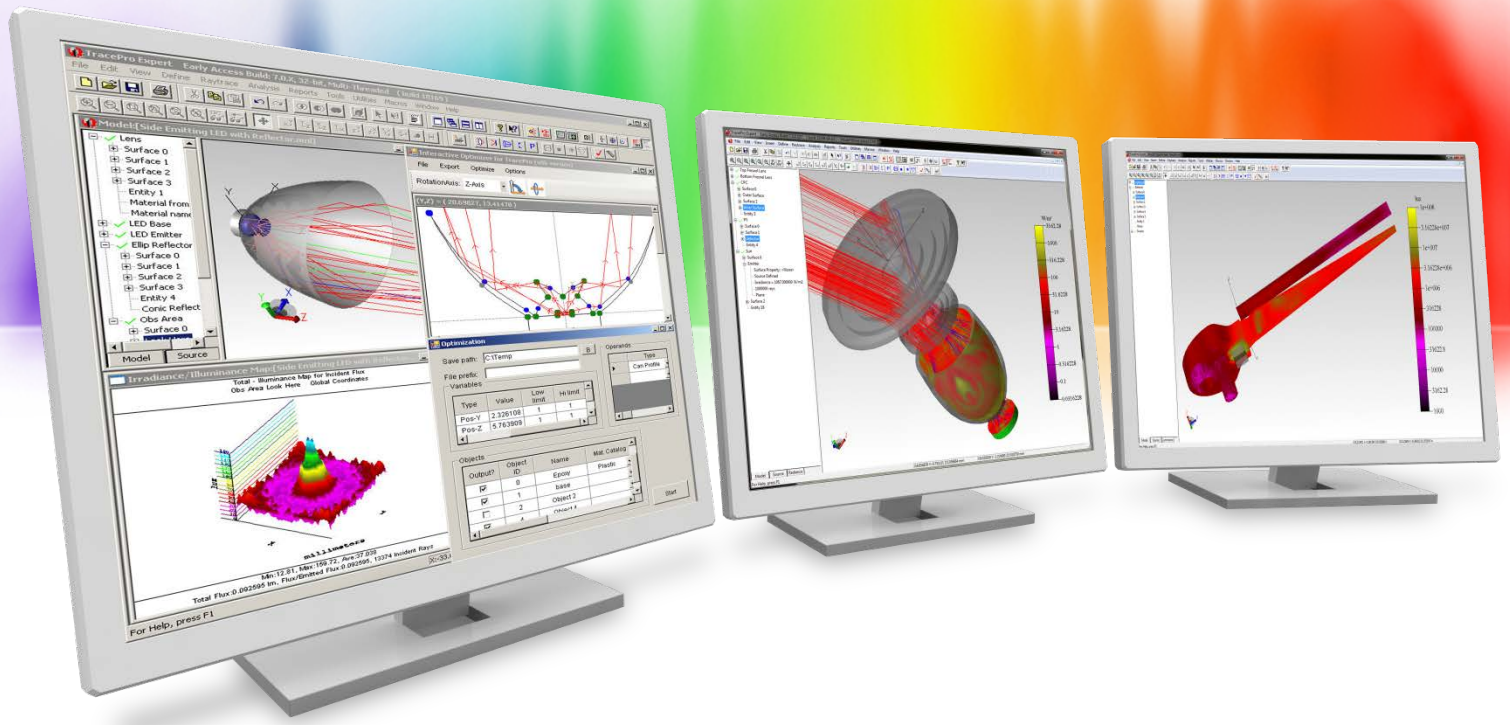
Making a new Surface Property – No Scattering

Resulting Surface Property in TracePro



TracePro

TracePro



Making a Surface Property – With Scattering

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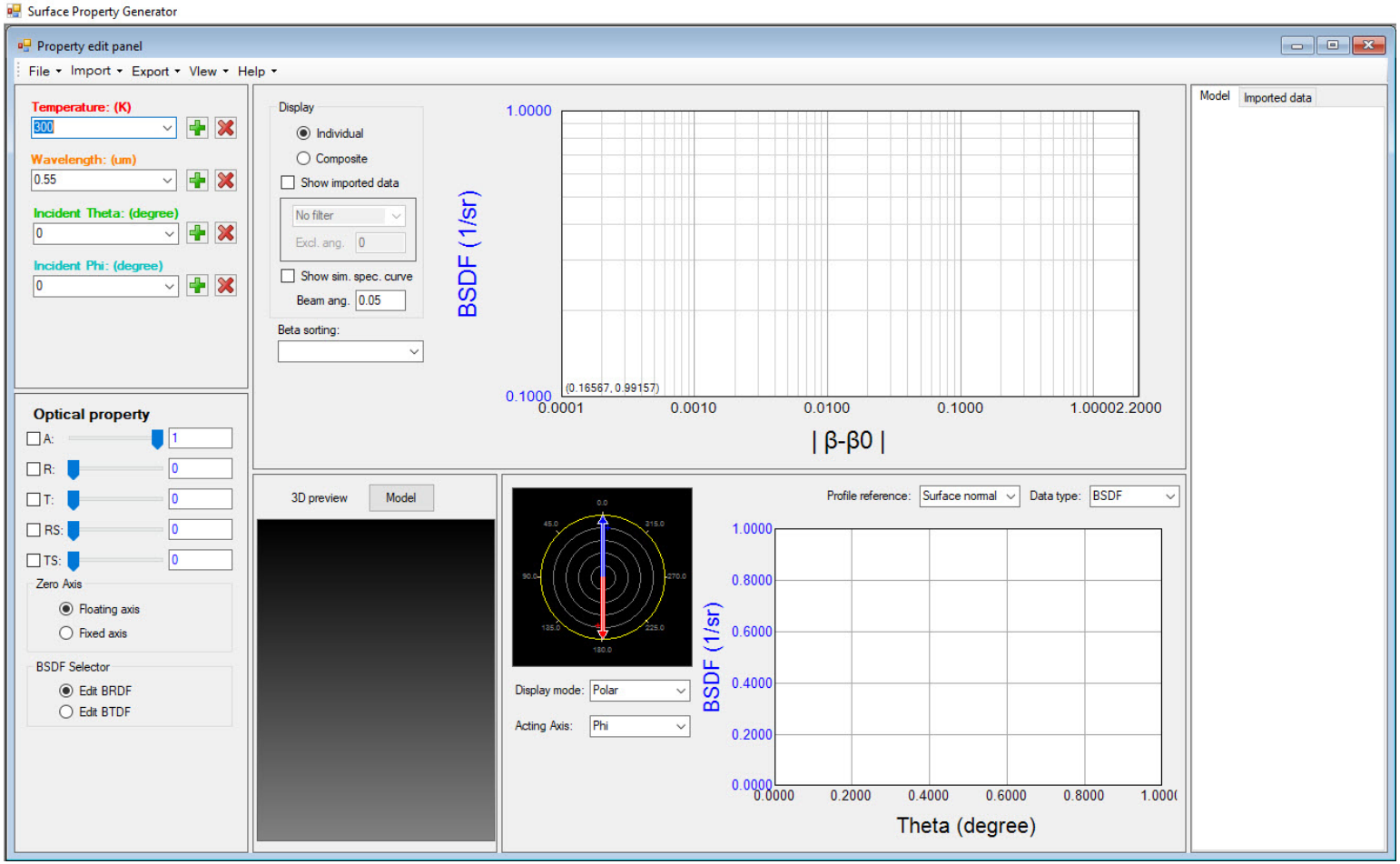
Making a new Surface Property – With Scattering

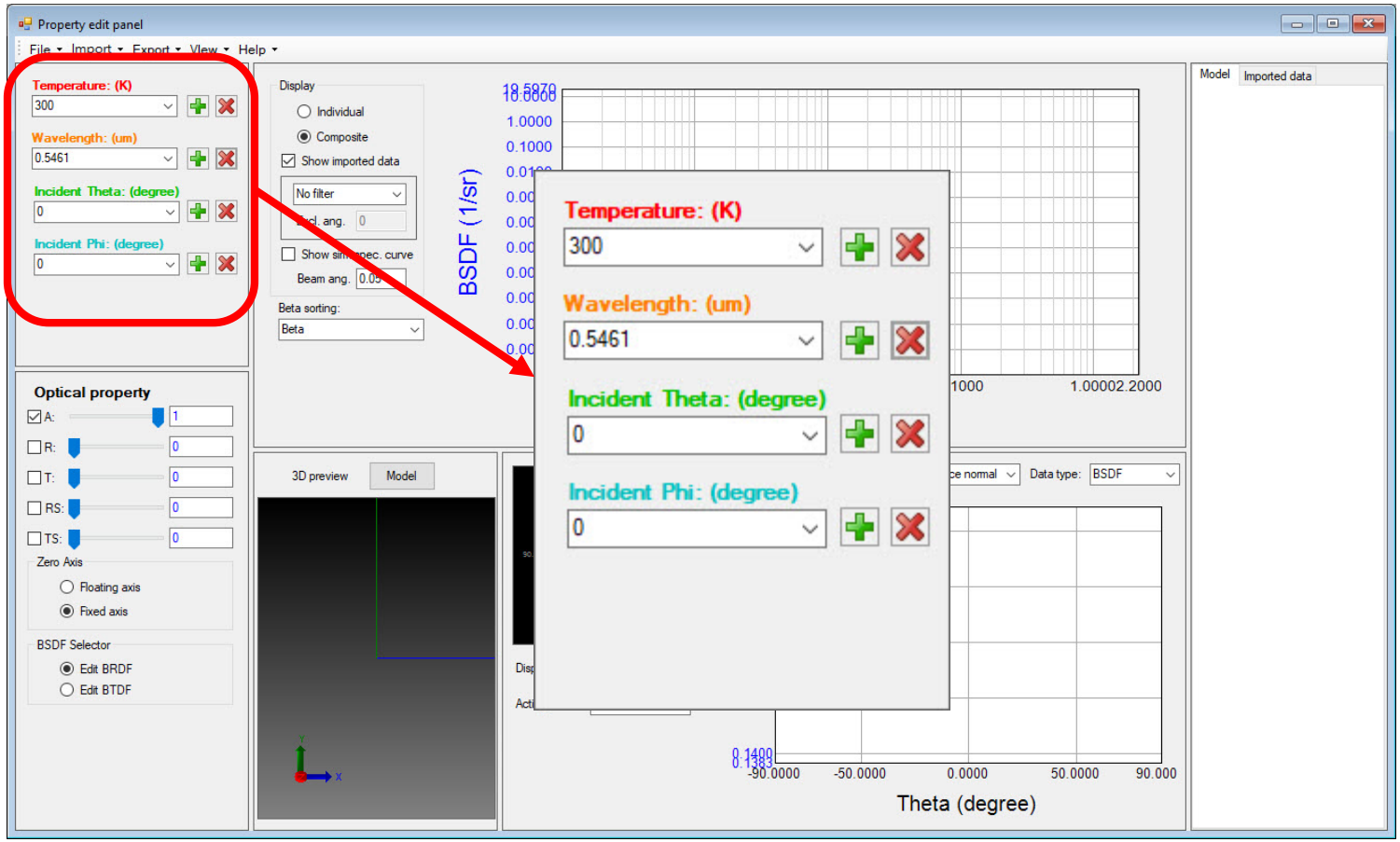
Open the Surface Property Generator



TracePro

Making a new Surface Property – No Scattering

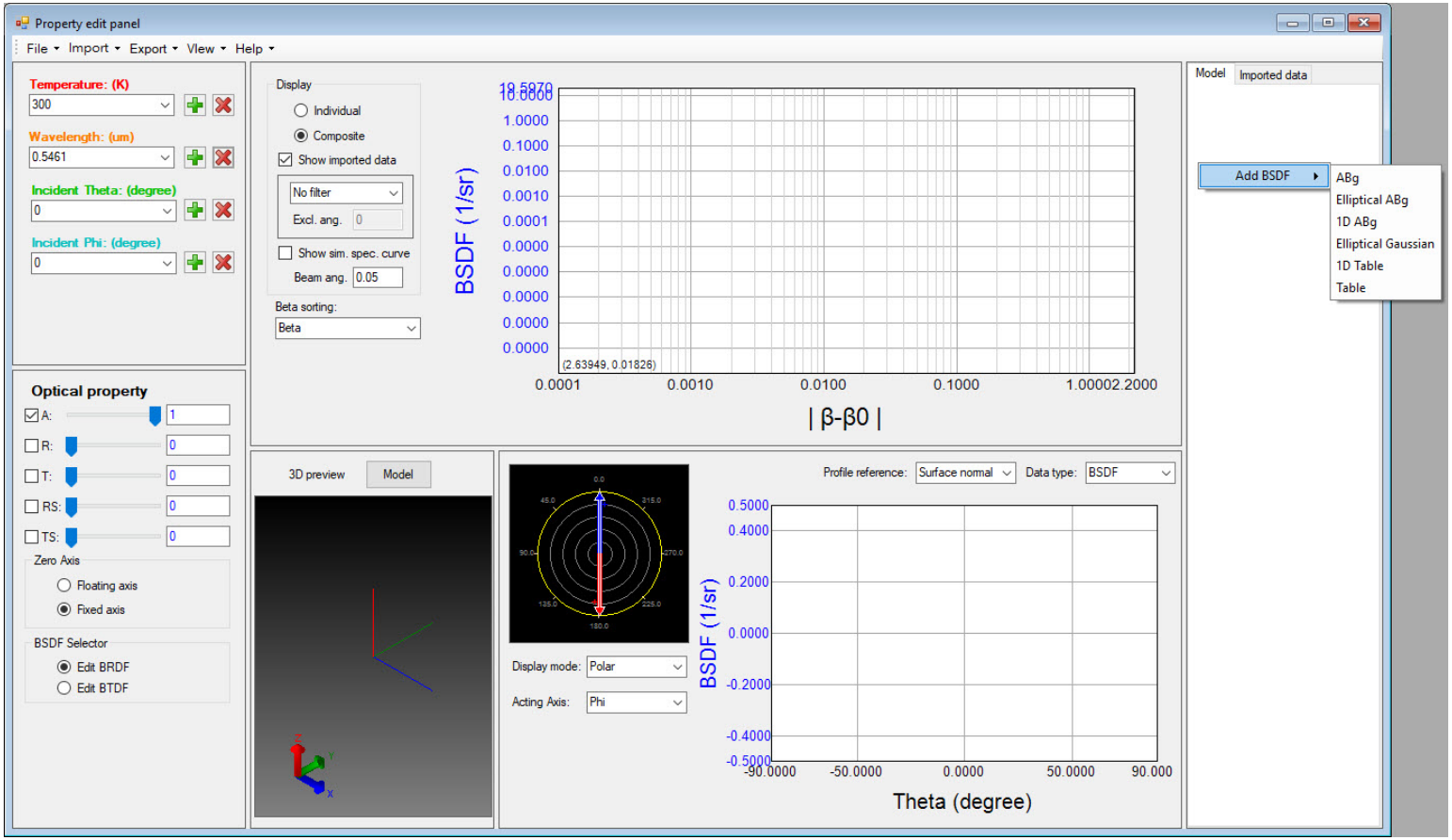
Enter values for Temperature, Wavelength, Incident Theta, and Incident Phi as before. Multiple values can be used for each parameter.



TracePro

Making a new Surface Property – With Scattering

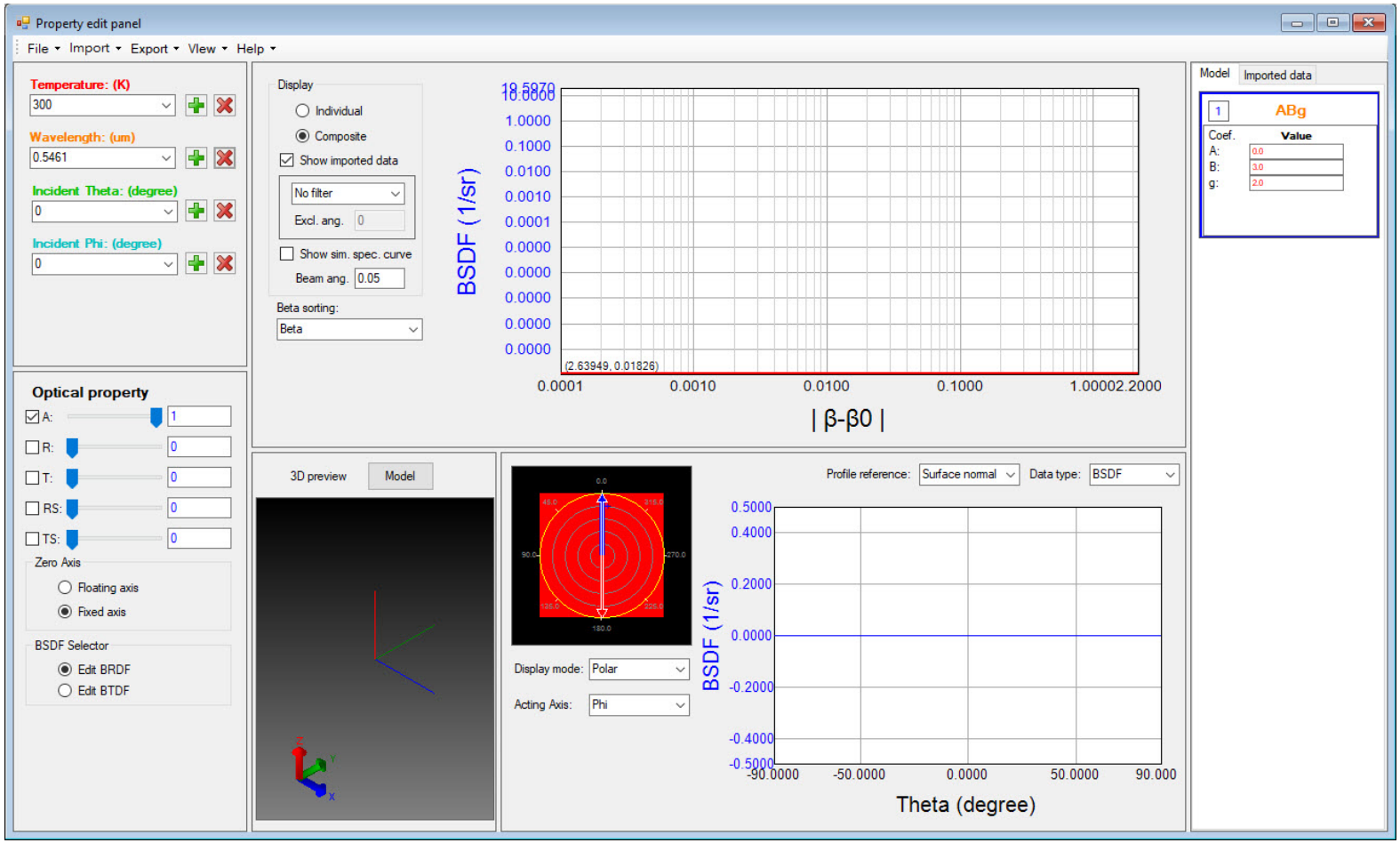
Right click on the right side of the window, select Add BSDF, and then select the BSDF model to use



TracePro

Making a new Surface Property – With Scattering

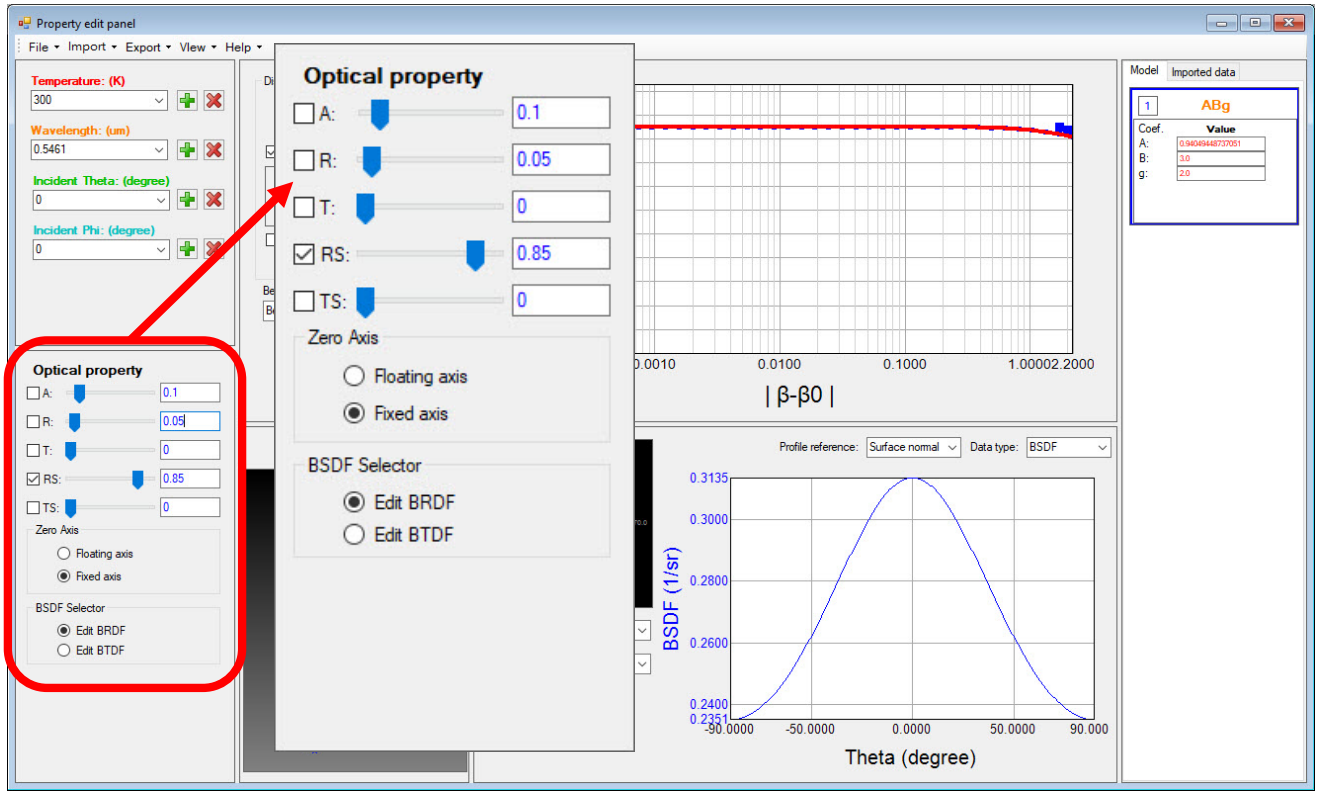
ABg scatter model used in this example



TracePro

Making a new Surface Property – With Scattering

Enter values for Absorption, Reflection, and Transmission, Reflected Scatter, and Transmitted Scatter

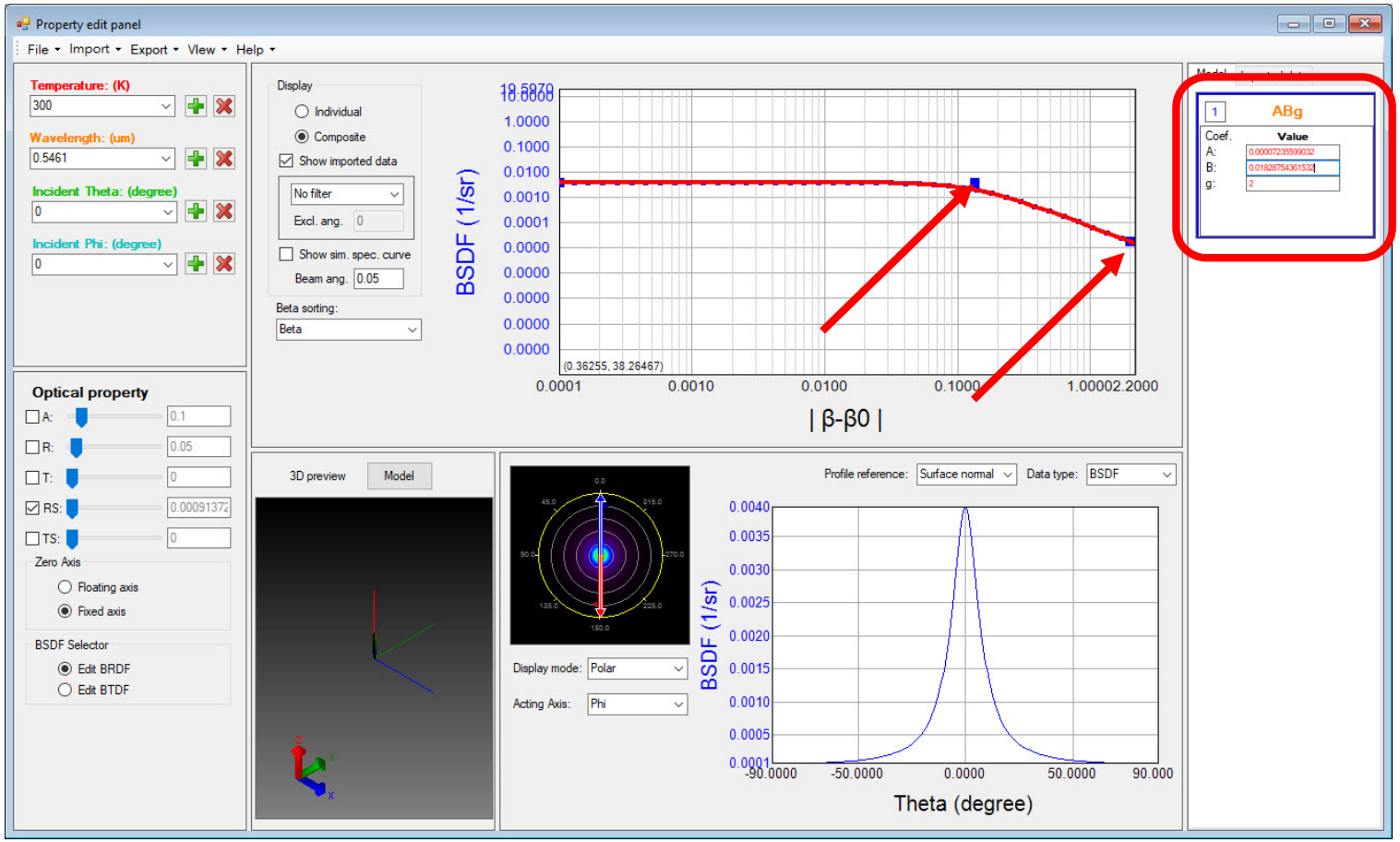


Values can be set using the sliders or by entering the values directly.
Check the box next to the parameter you want to Solve For.

TracePro

Making a new Surface Property – With Scattering

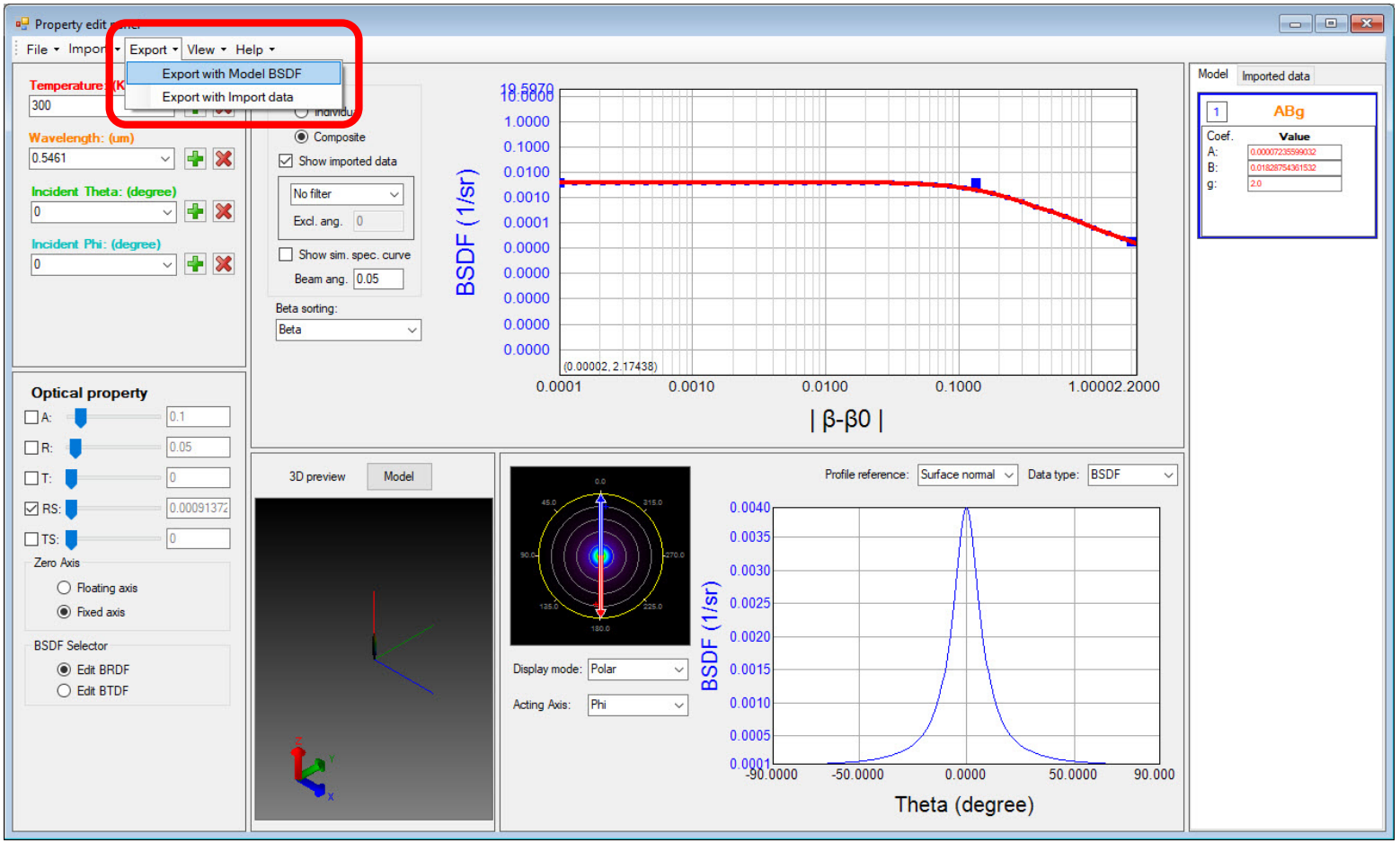
BSDF curve can be changed by entering A, B, and g values in the ABg dialog box, or by moving the blue control points on the ABg BSDF curve.



TracePro

Making a new Surface Property – With Scattering

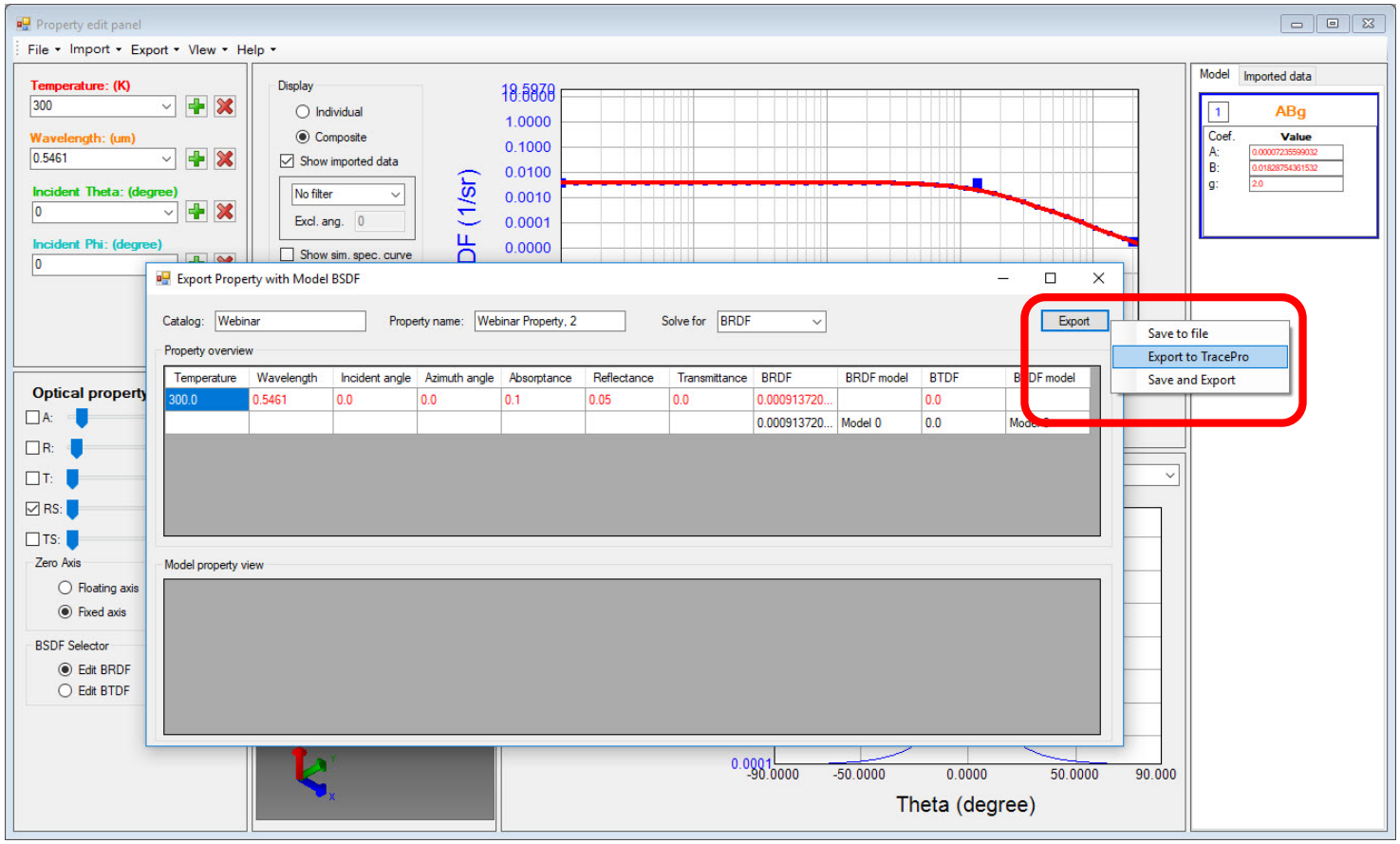
Export the property to TracePro – Export->Export with Model BSDF



TracePro

Making a new Surface Property – No Scattering

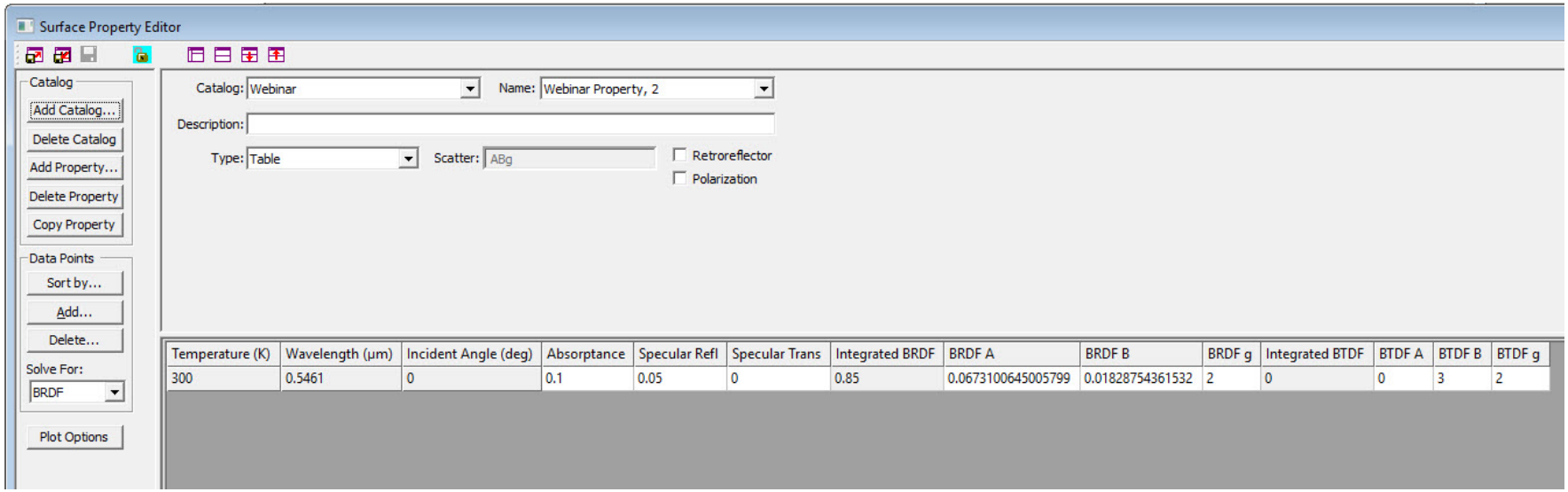
Enter a Catalog and Property Name. Click Export->Export to TracePro in the Export Property with Model BSDF window



TracePro

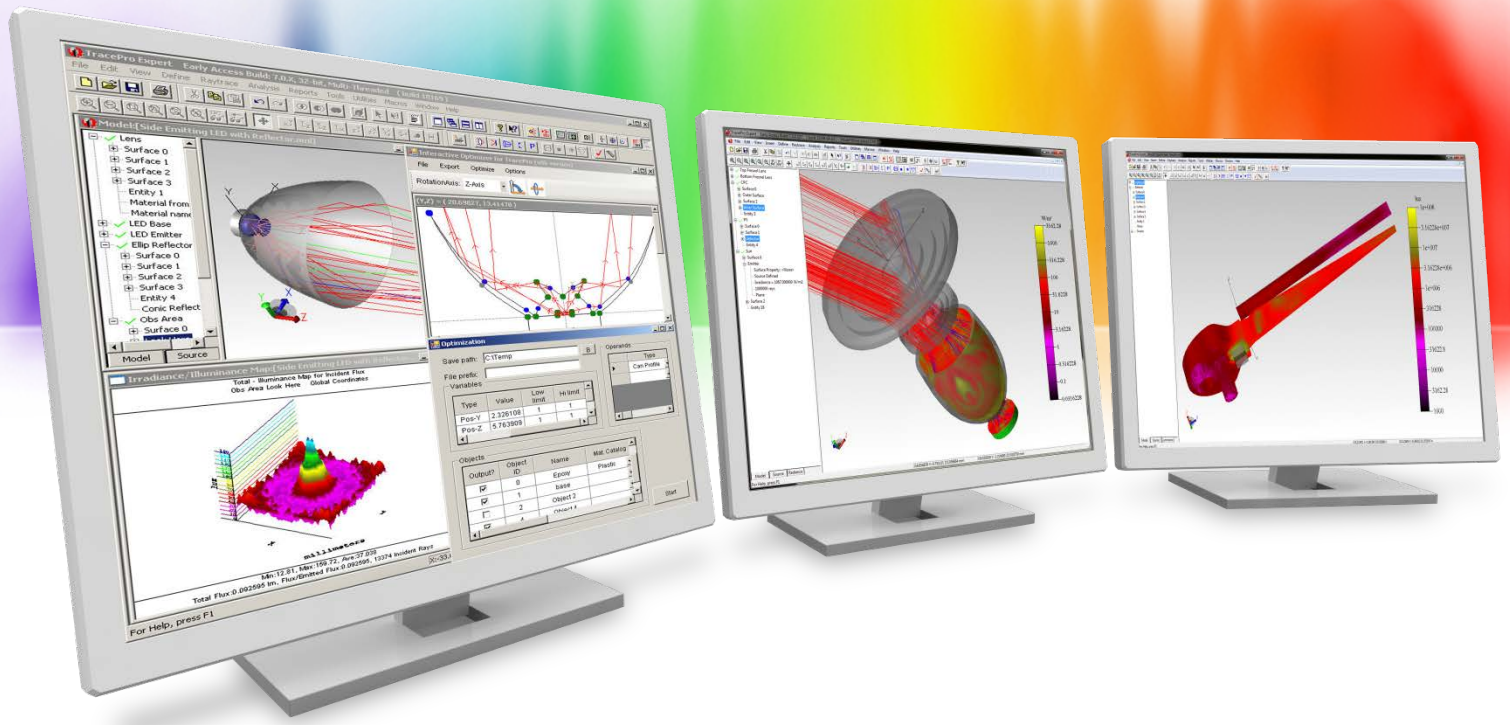
Making a new Surface Property – No Scattering

Resulting Surface Property in TracePro



TracePro

TracePro



Making a Surface Property – Using Measured Scatter Data

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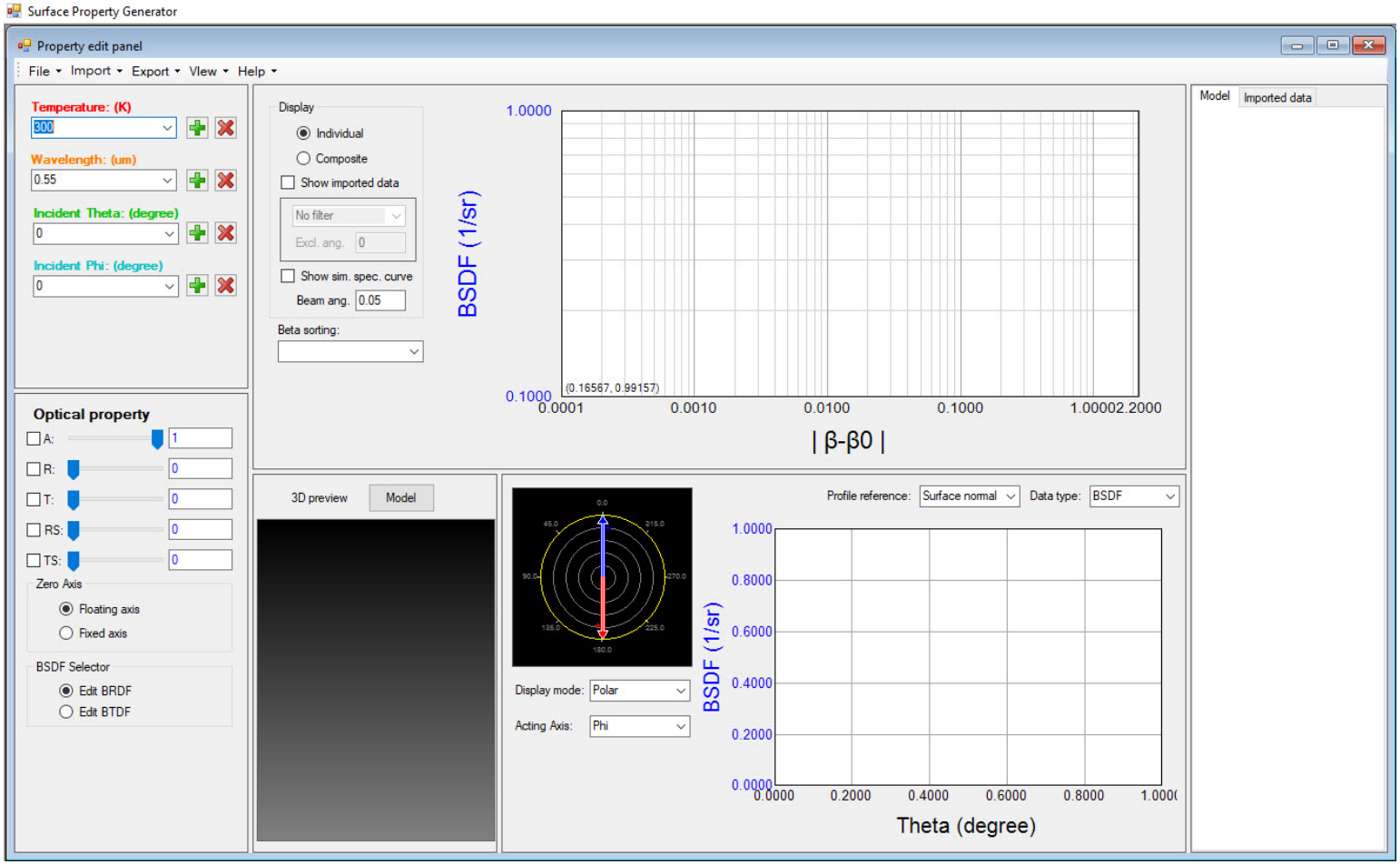
Making a new Surface Property – Measured Scatter Data

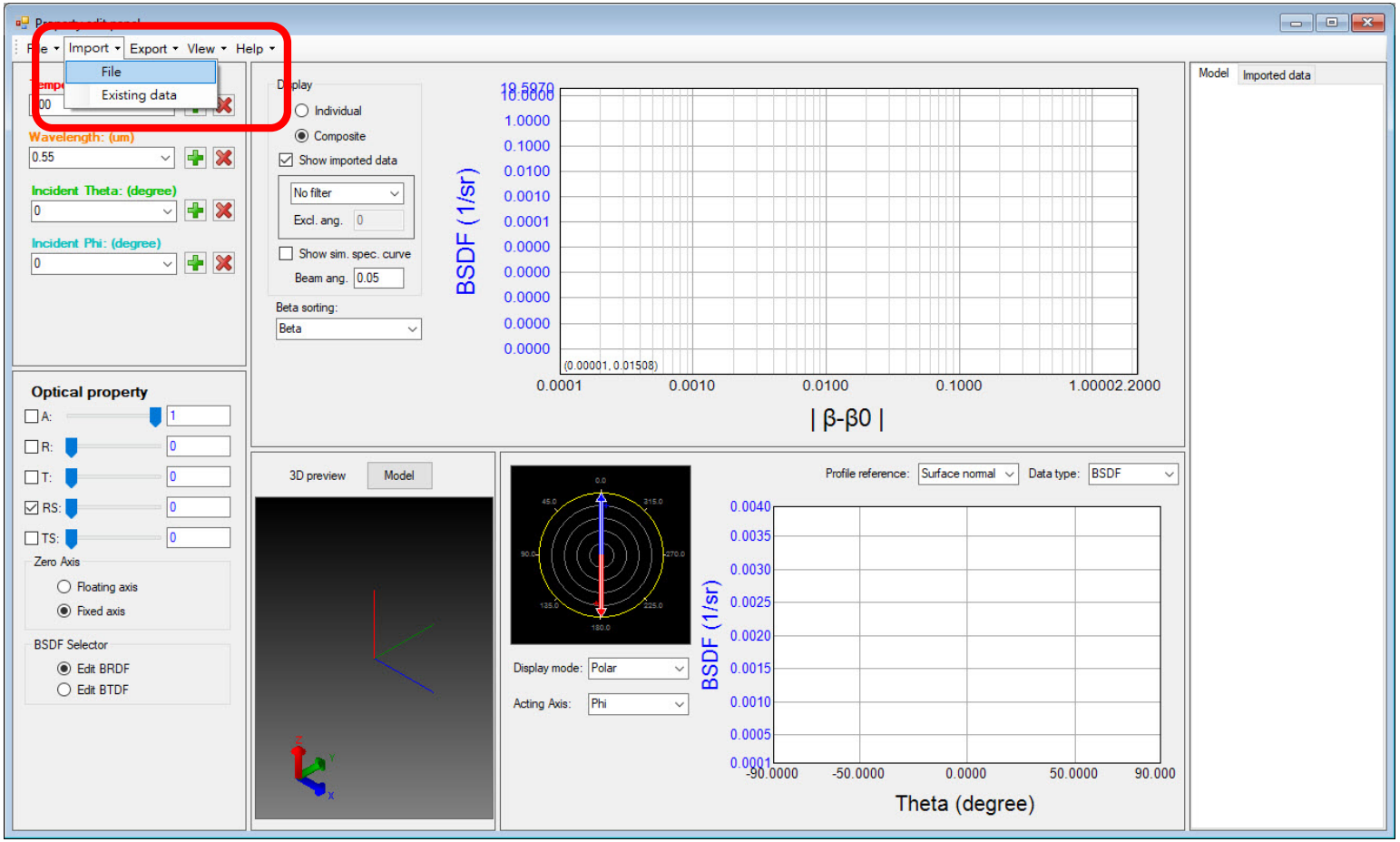
Open the Surface Property Generator



TracePro

Making a new Surface Property – Measured Scatter Data

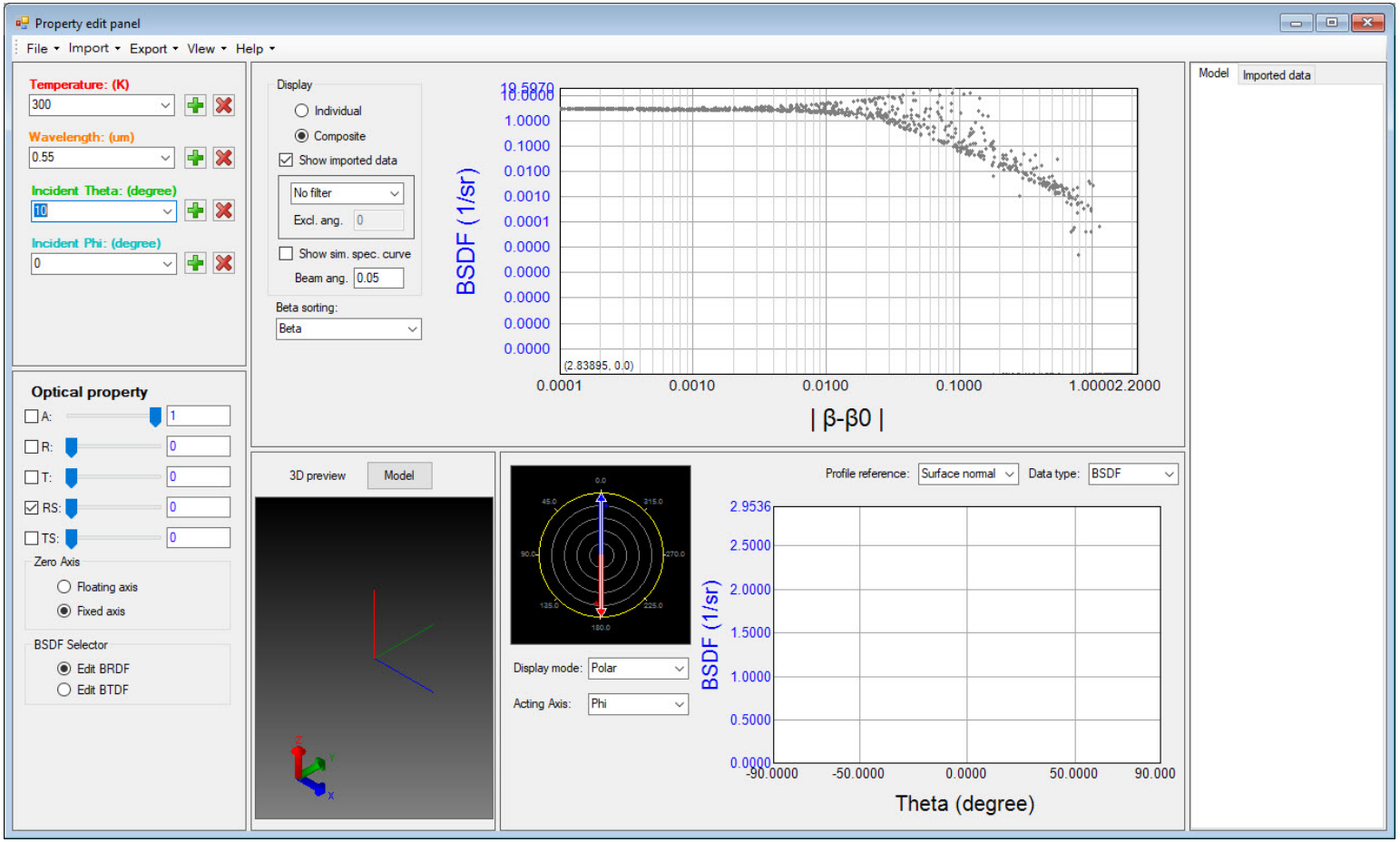
Load the measured scatter data file – Import->File



TracePro

Making a new Surface Property – Measured Scatter Data

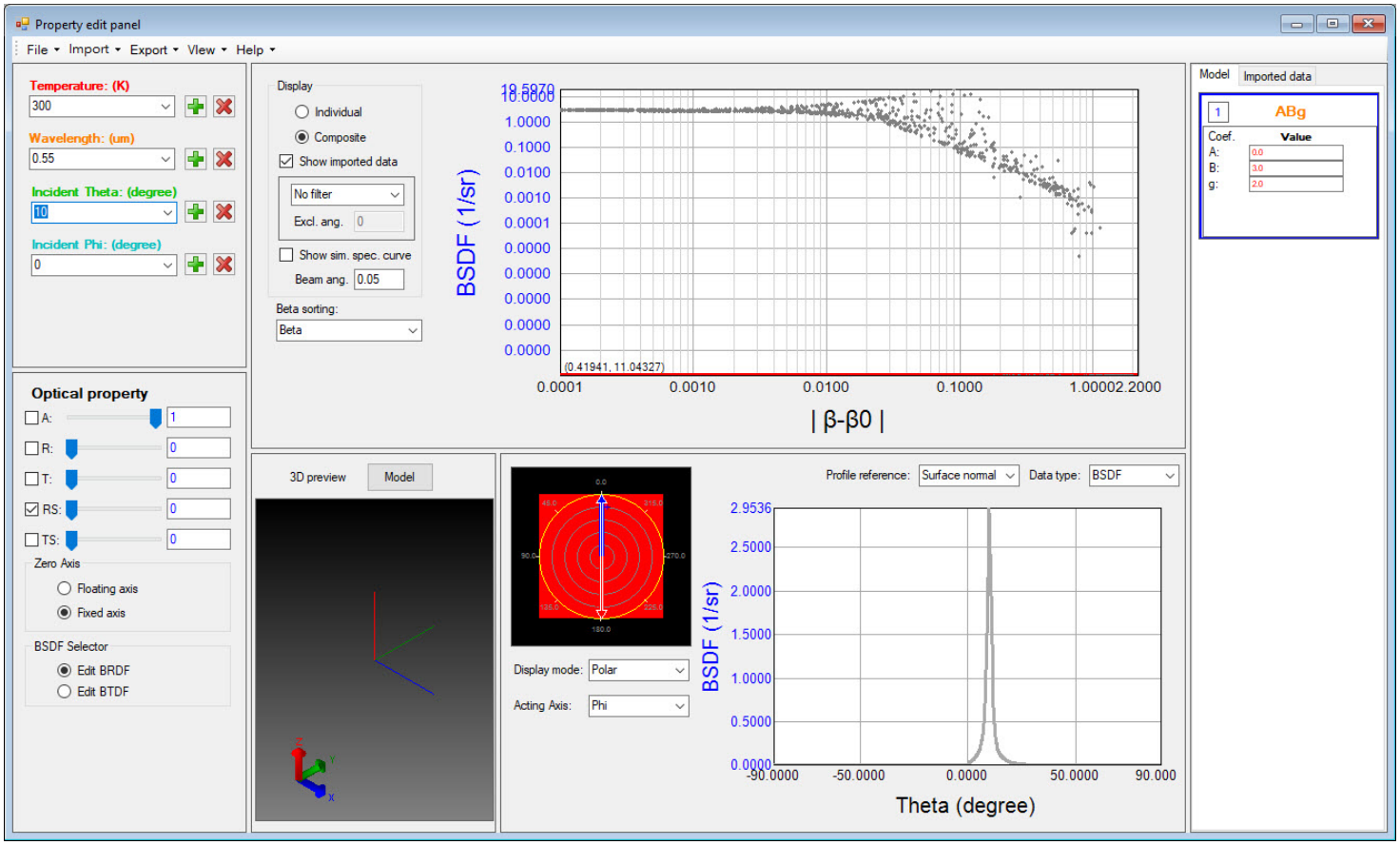
Load the measured scatter data file – Import->File



TracePro

Making a new Surface Property – Measured Scatter Data

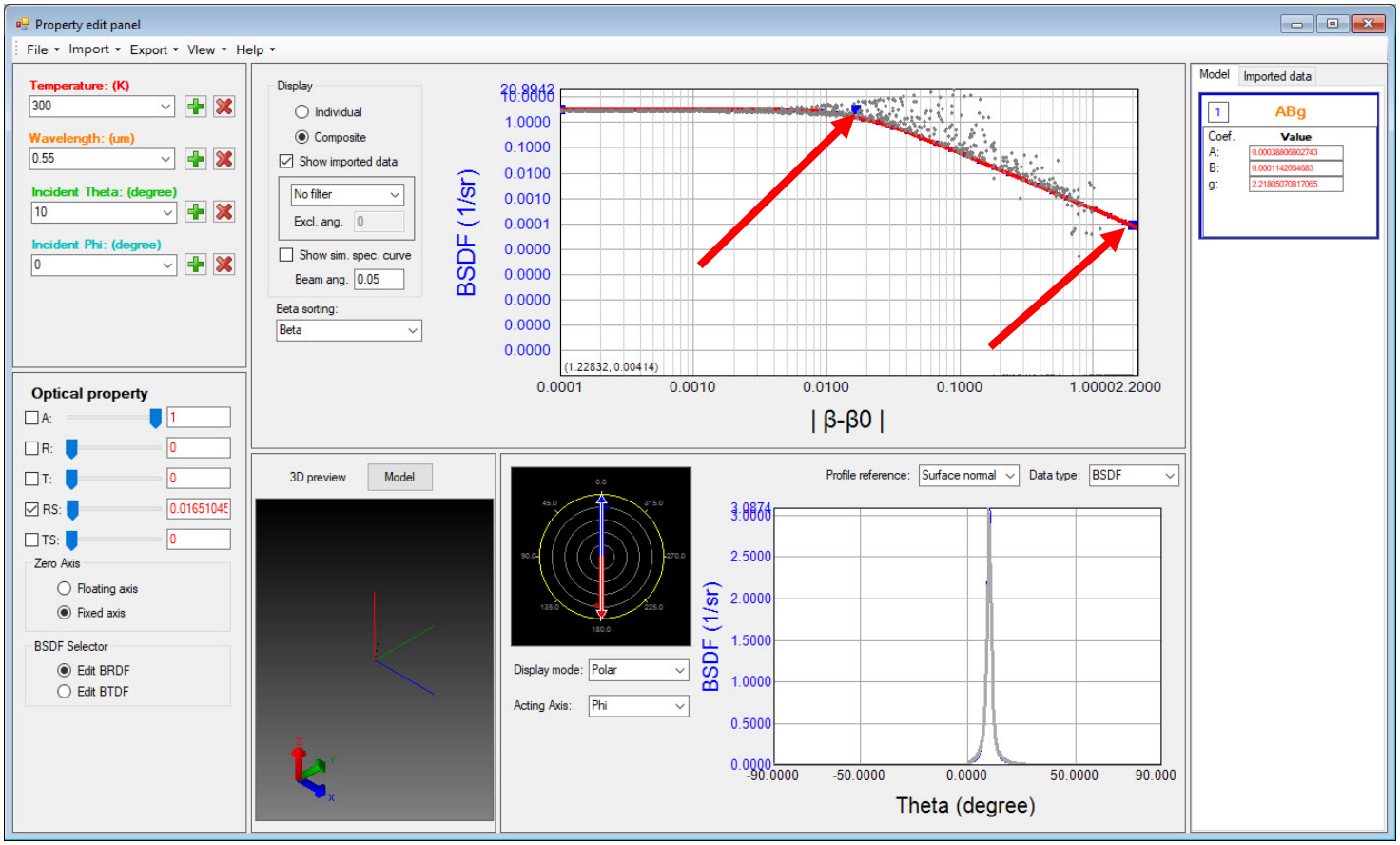
Right click on the right side of the window, select Add BSDF, and then select the BSDF model to use. ABg selected for this example.



TracePro

Making a new Surface Property – Measured Scatter Data

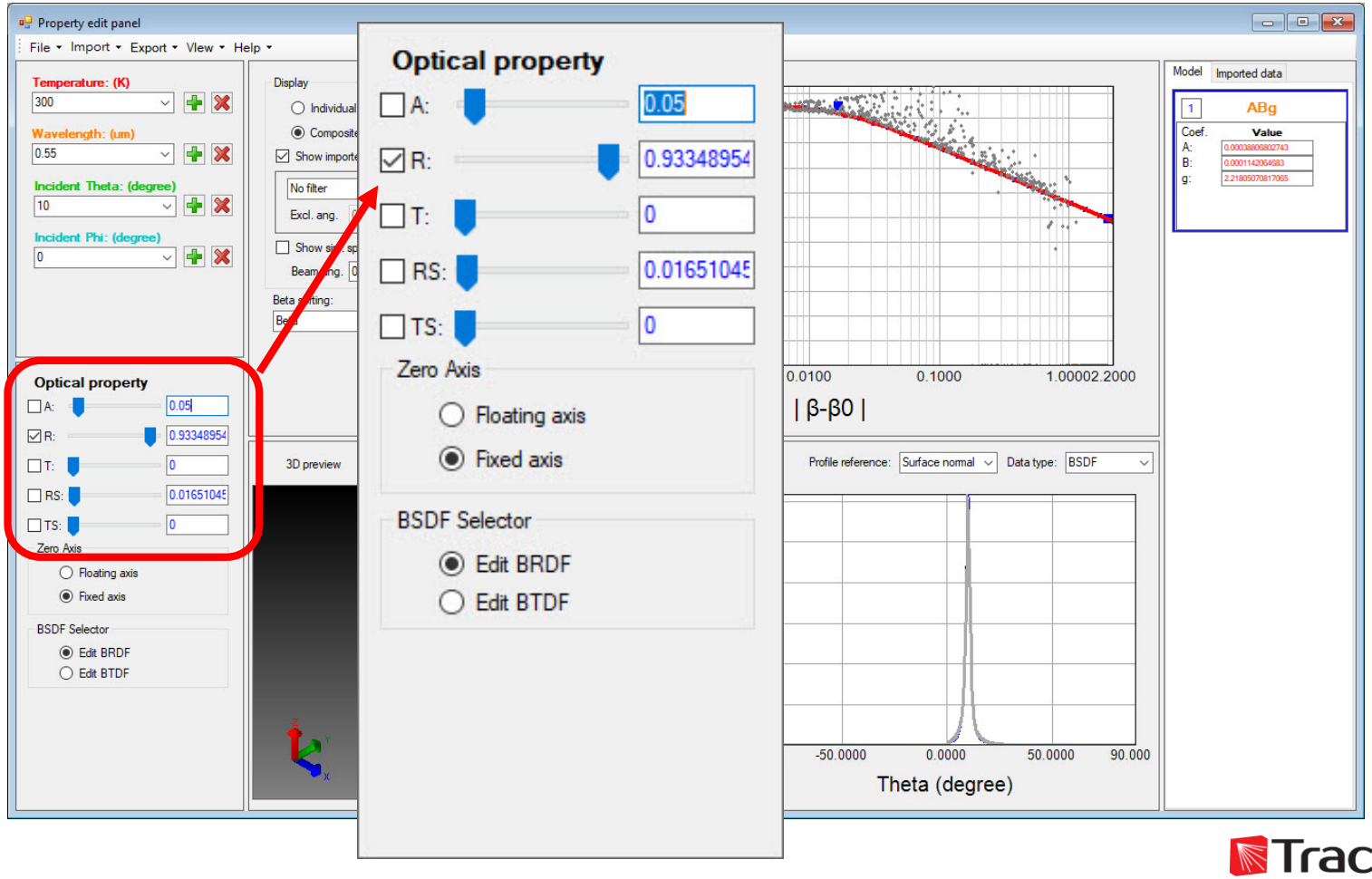
Use the blue control points to adjust the fitted ABg curve to match the imported data. Results can be checked in the lower plot.



TracePro

Making a new Surface Property – Measured Scatter Data

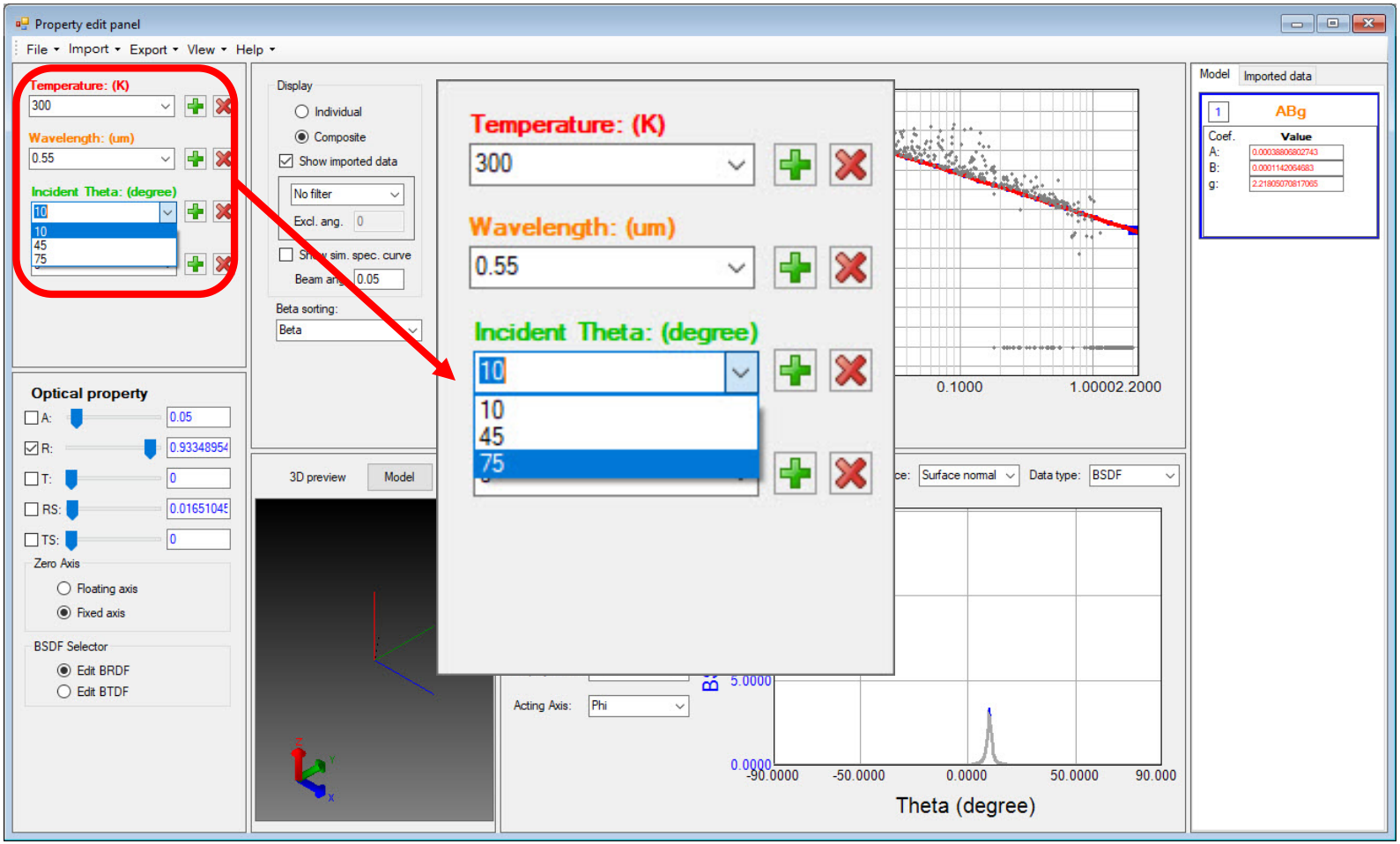
Enter a value for Absorption. RS (reflected scatter) comes from the BSDF curve. Solve for R (reflection).



TracePro

Making a new Surface Property – Measured Scatter Data

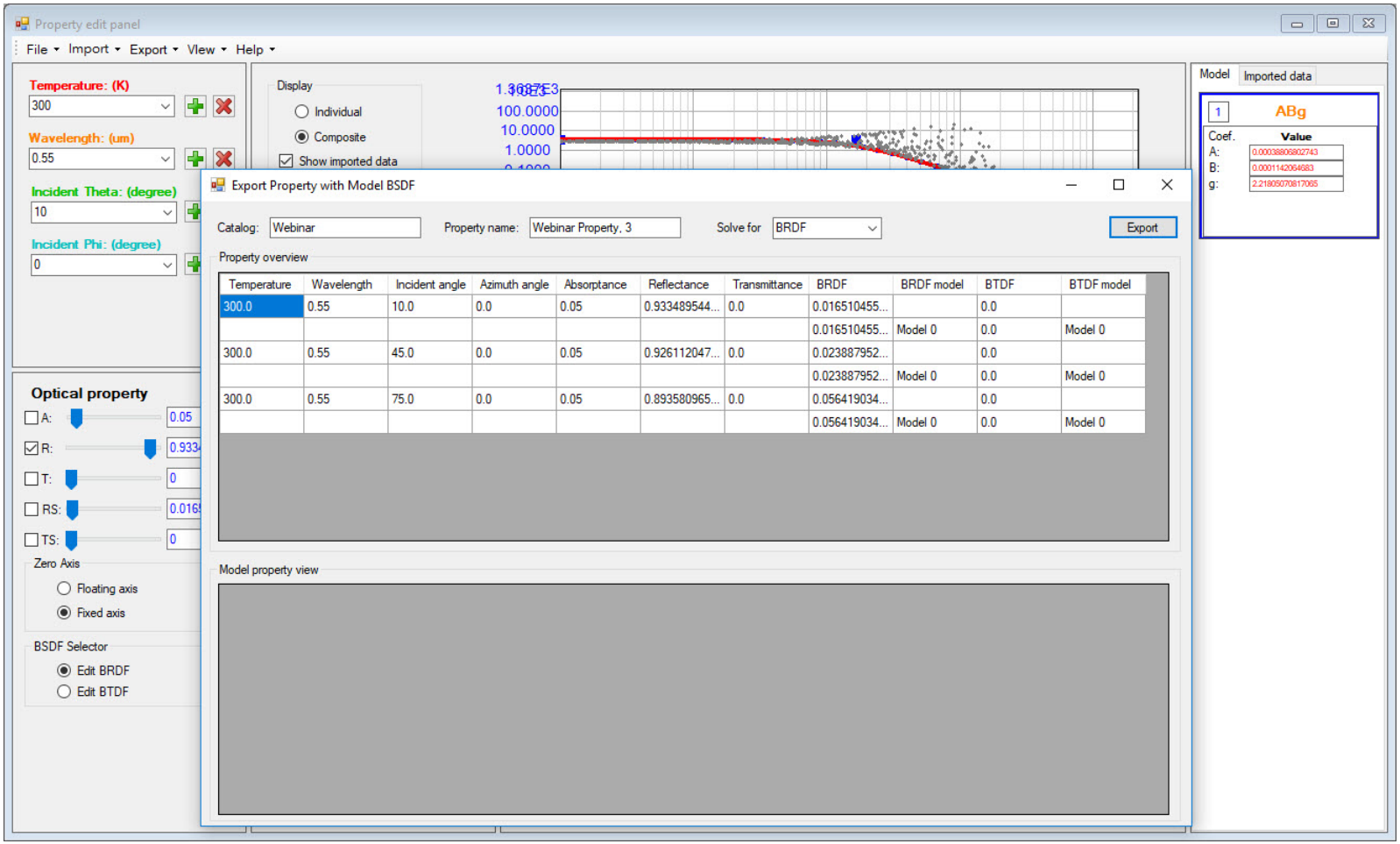
Repeat the process for other incident angles.



TracePro

Making a new Surface Property – Measured Scatter Data

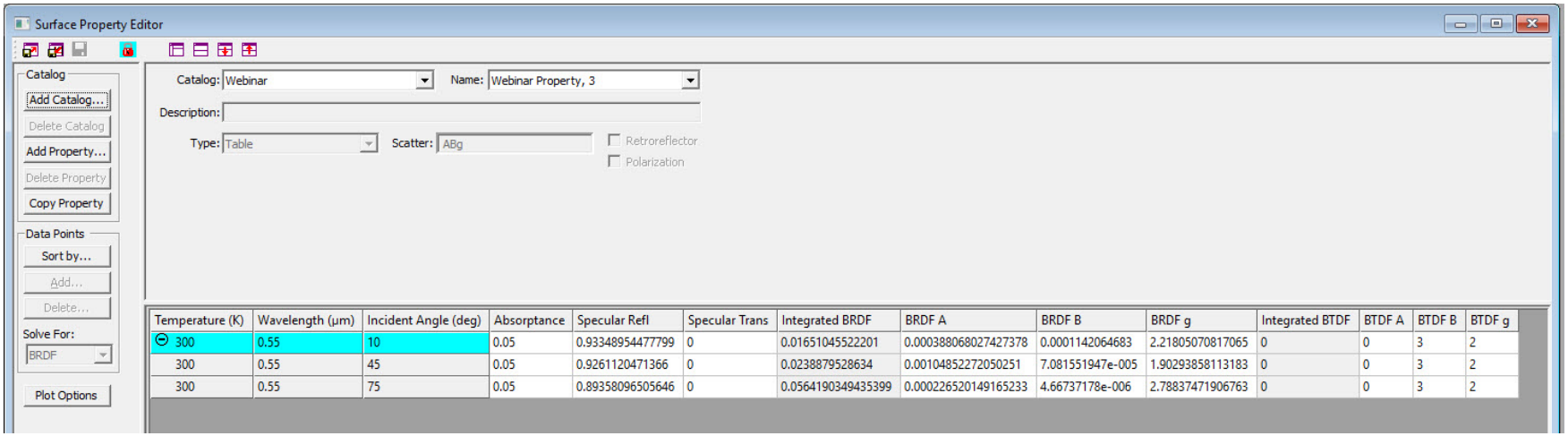
Export the property to TracePro – Export->Export with Model BSDF



TracePro

Making a new Surface Property – Measured Scatter Data

Resulting Surface Property in TracePro

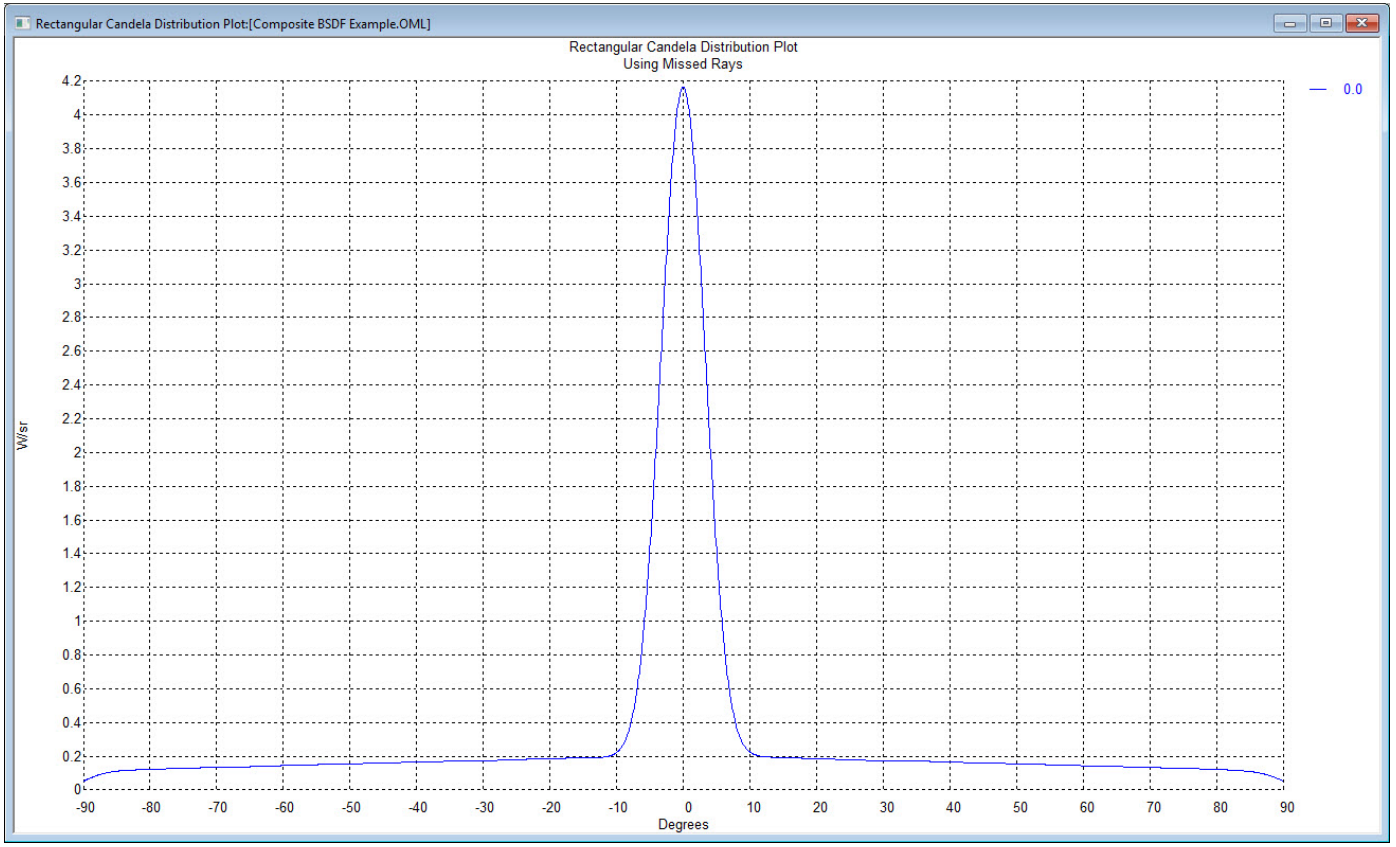


Temperature (K)	Wavelength (µm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A	BTDF B	BTDF g
300	0.55	10	0.05	0.93348954477799	0	0.01651045522201	0.000388068027427378	0.0001142064683	2.21805070817065	0	0	3	2
300	0.55	45	0.05	0.9261120471366	0	0.0238879528634	0.00104852272050251	7.081551947e-005	1.90293858113183	0	0	3	2
300	0.55	75	0.05	0.89358096505646	0	0.0564190349435399	0.000226520149165233	4.66737178e-006	2.78837471906763	0	0	3	2

TracePro

Making a new Surface Property – Measured Scatter Data

Some scatter profiles are not well modeled with a standard ABg model. The new Surface Property Generator allows for composite BSDF profiles using multiple ABg models.



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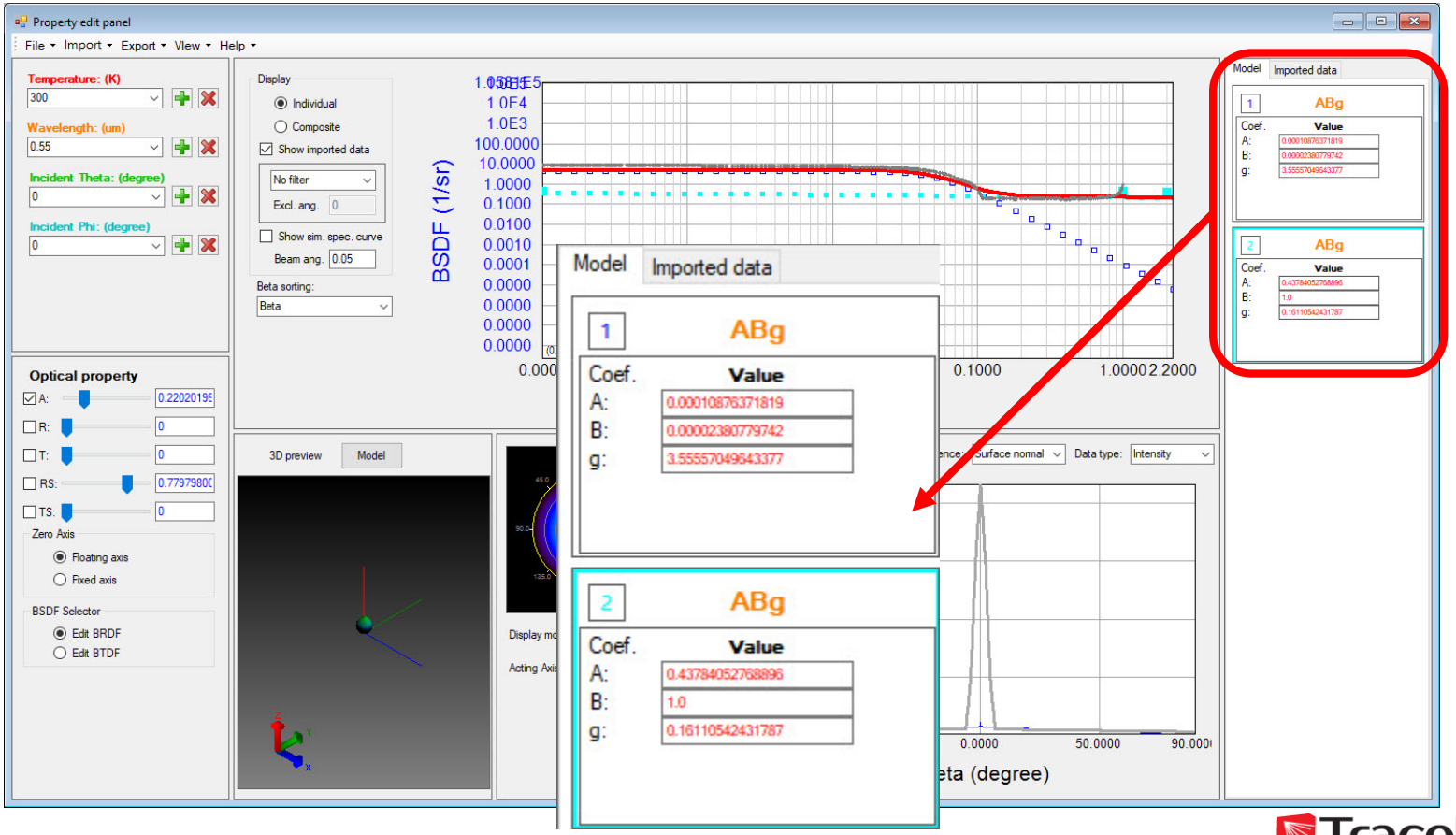

TracePro

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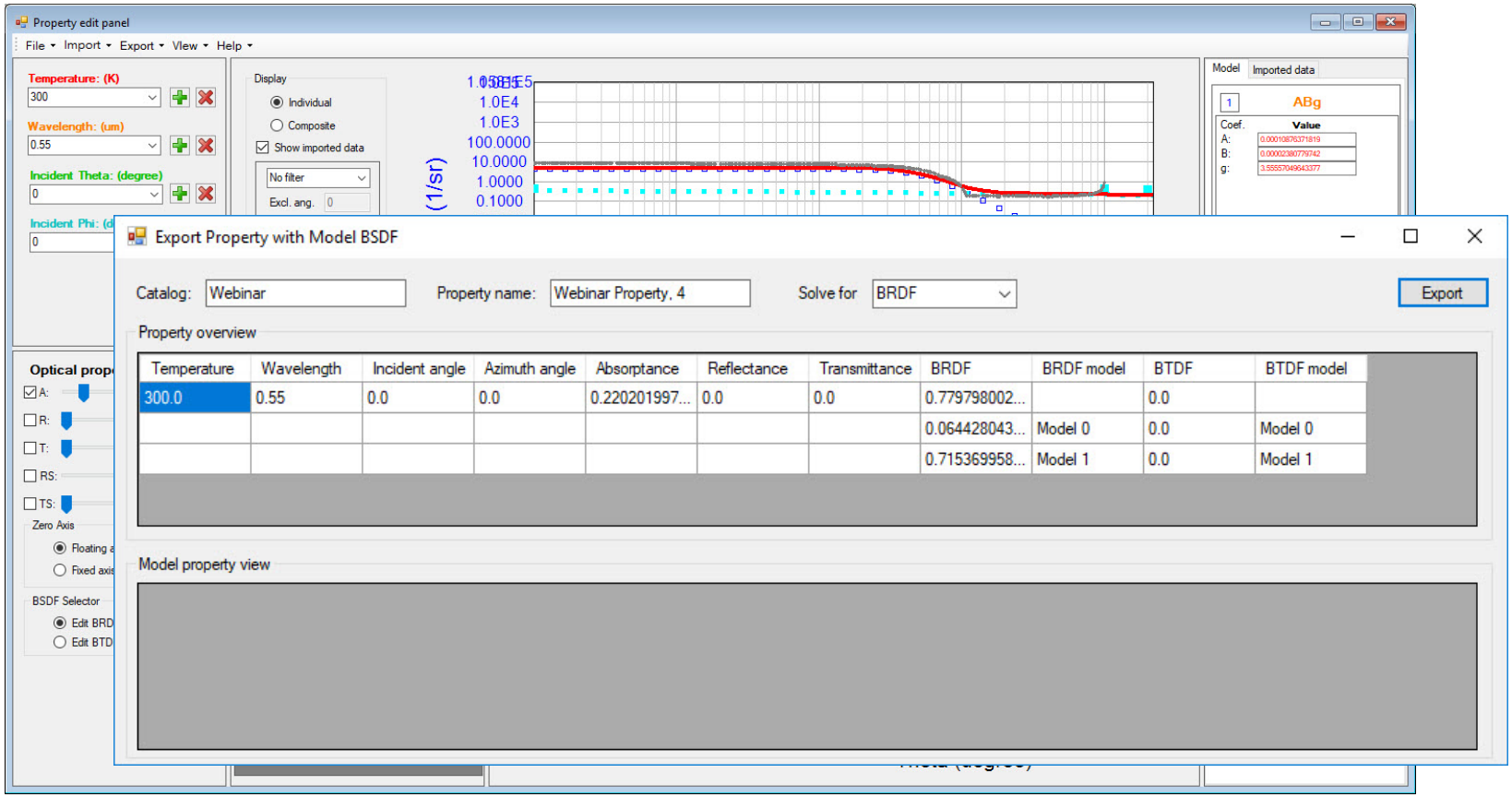
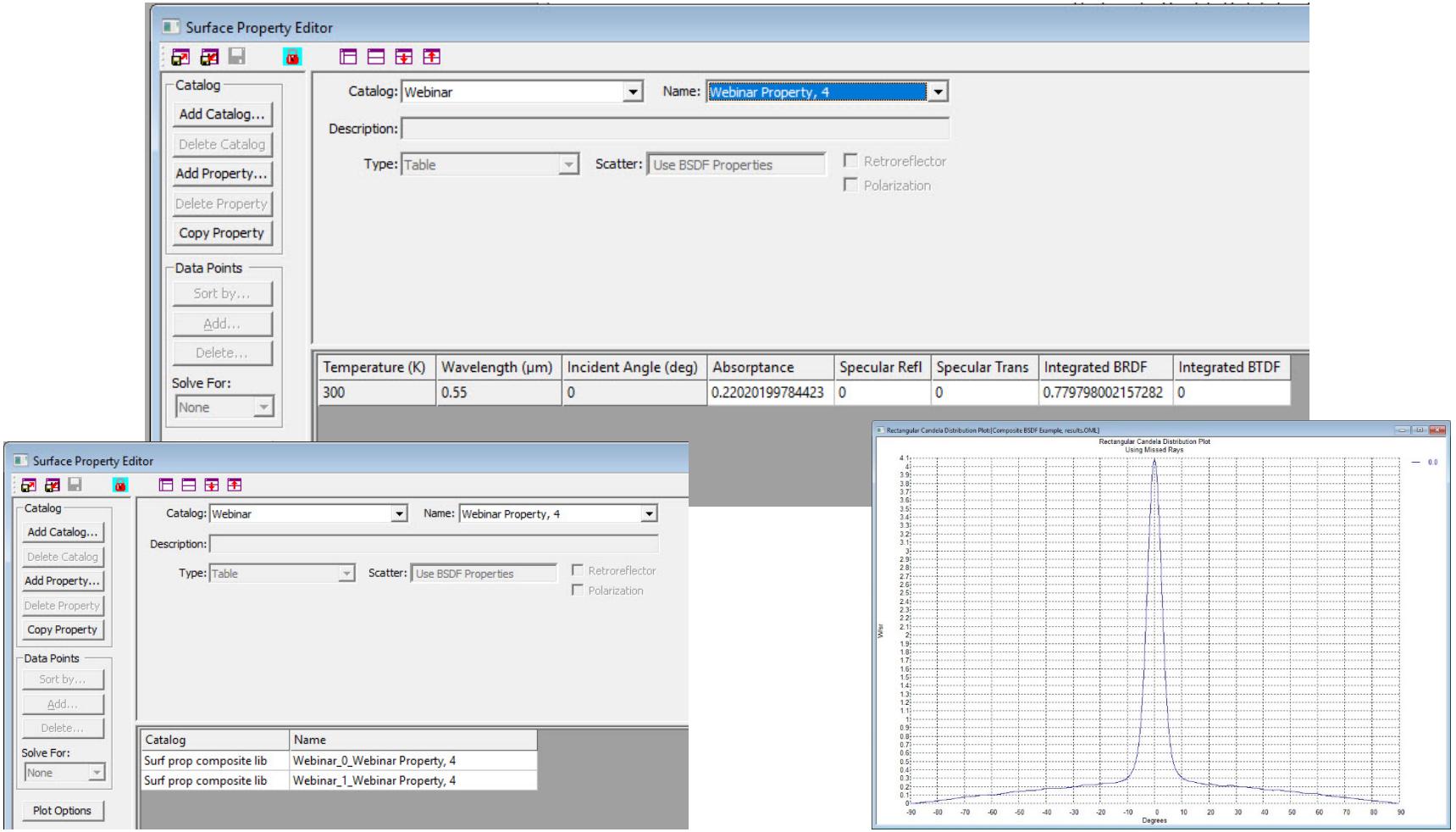


TracePro

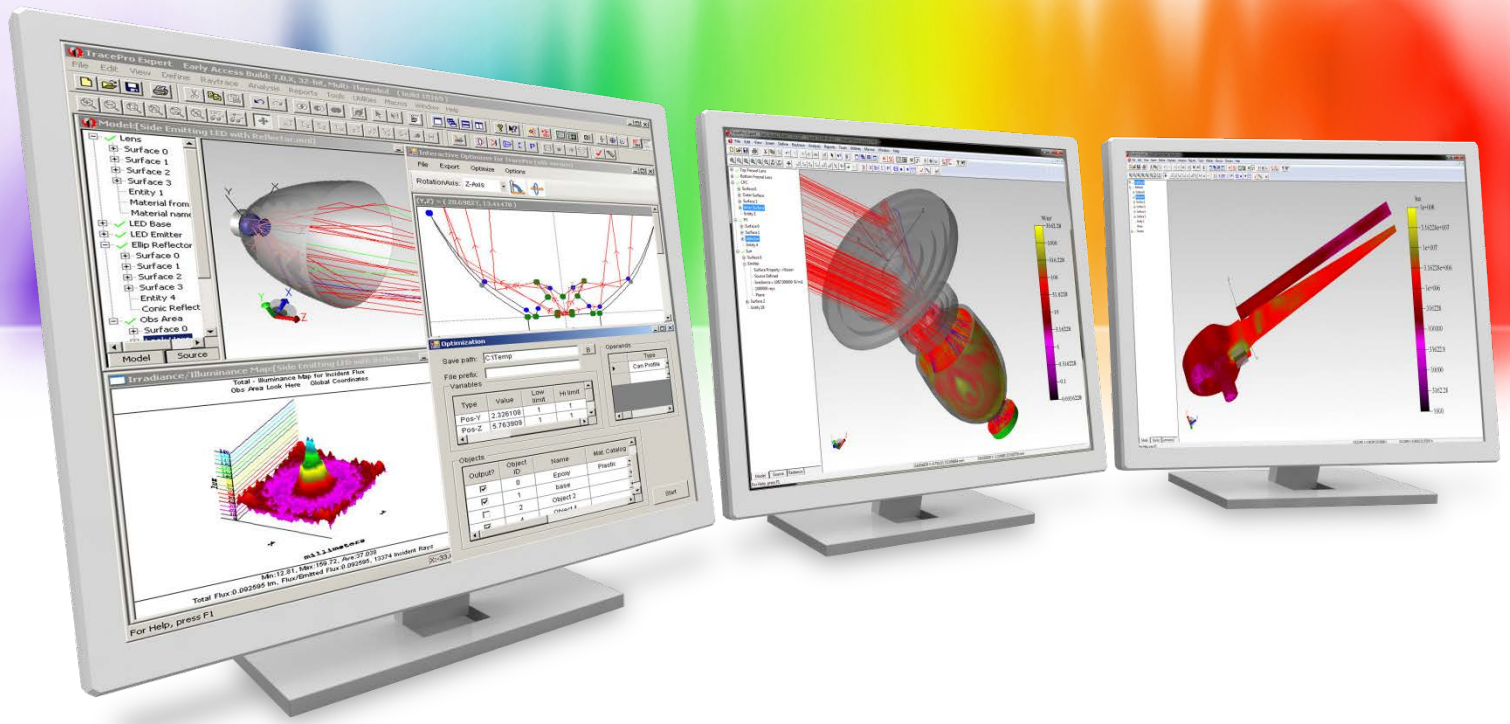
Making a new Surface Property – Measured Scatter Data

Resulting Surface Property in TracePro and raytrace results



TracePro

TracePro



Making a Surface Property – Surface with large scattering features

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Making a new Surface Property – Large Scattering Features

- When using materials and surfaces with large scattering features such as Alanod Miro 9, ACA 475/900OC, or ANOFOL Medium Hammertone 1216, the traditional method of measuring BSDF and then using the data to make a scatter property may not work properly.

- One potential problem is that the laser or other light source used to illuminate the sample may be smaller than the texture features on the surface. The surface finish on the material may actually be highly specular, but the texture features work to scatter and diffuse the light. If the illumination source in the scatterometer does not adequately sample a large enough area, the resulting BSDF model may be more specular overall than the actual surface is.

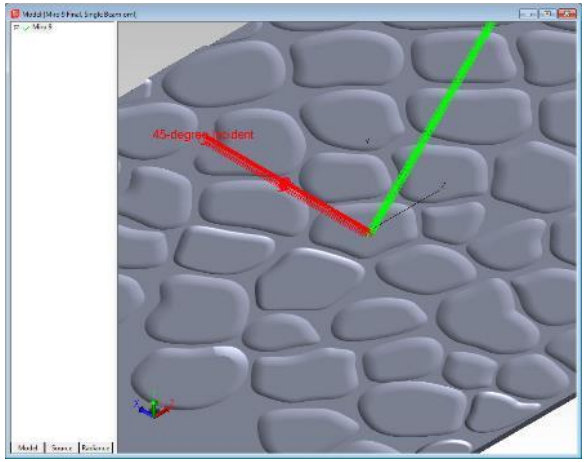
Making a new Surface Property – Large Scattering Features

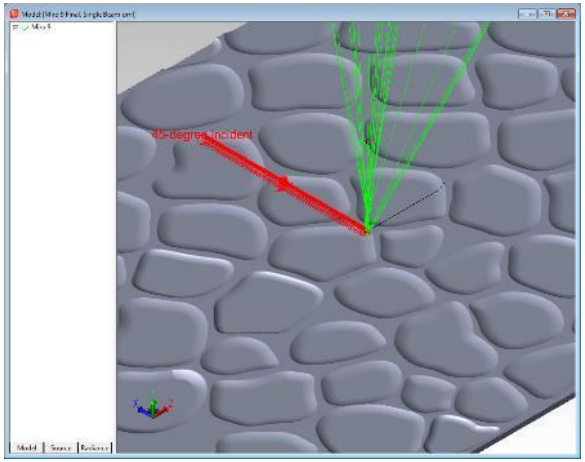
Alanod Miro 9 Example

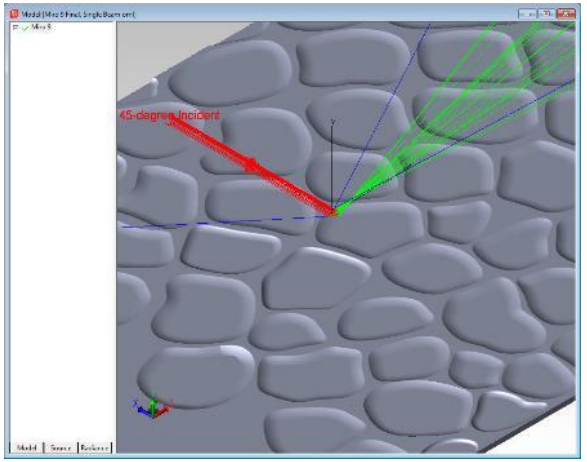
TracePro

Making a new Surface Property – Large Scattering Features

If the illuminating beam is small, scattering is dependent on the location of the beam







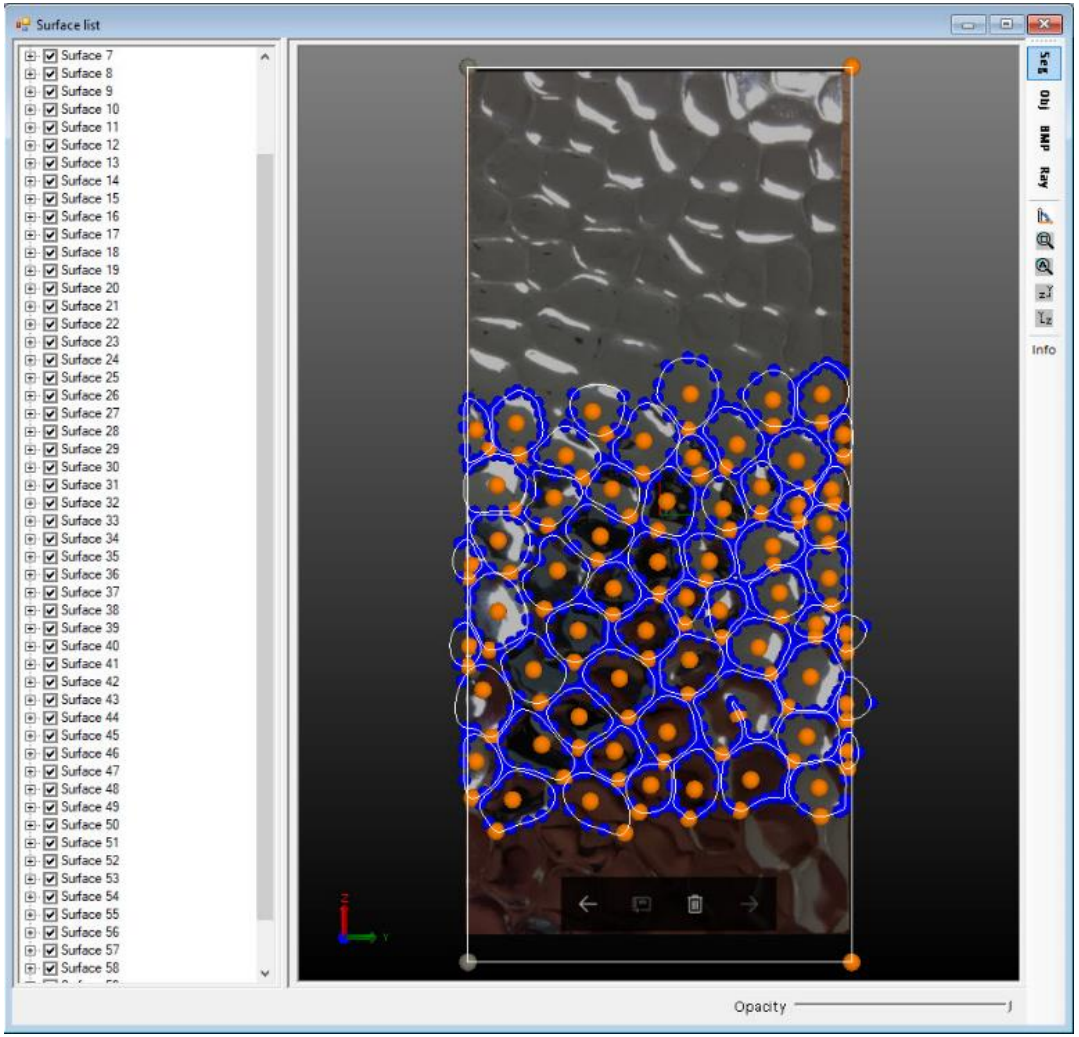
TracePro

Making a new Surface Property – Large Scattering Features

- A possible solution to this problem is to make a CAD model of a representative area of the surface, apply a surface property to model the scattering of an equivalent flat surface, and then run a raytrace of the model in an optical design and analysis program. The results of this raytrace can then be used to make an equivalent scatter property of the surface. This scatter property can then be applied like any other surface property to surfaces in the optical model and used to model the effects of the large textured surfaces.

Making a new Surface Property – Large Scattering Features

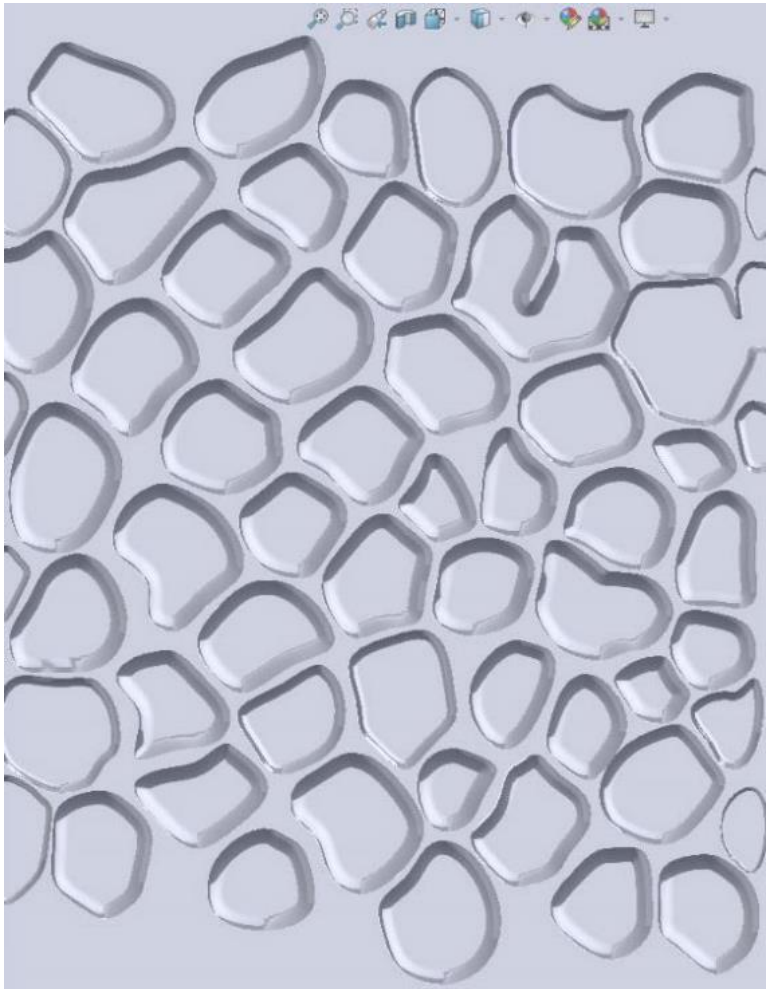
Bitmap of Miro 9 in the TracePro 3D Optimizer



TracePro

Making a new Surface Property – Large Scattering Features

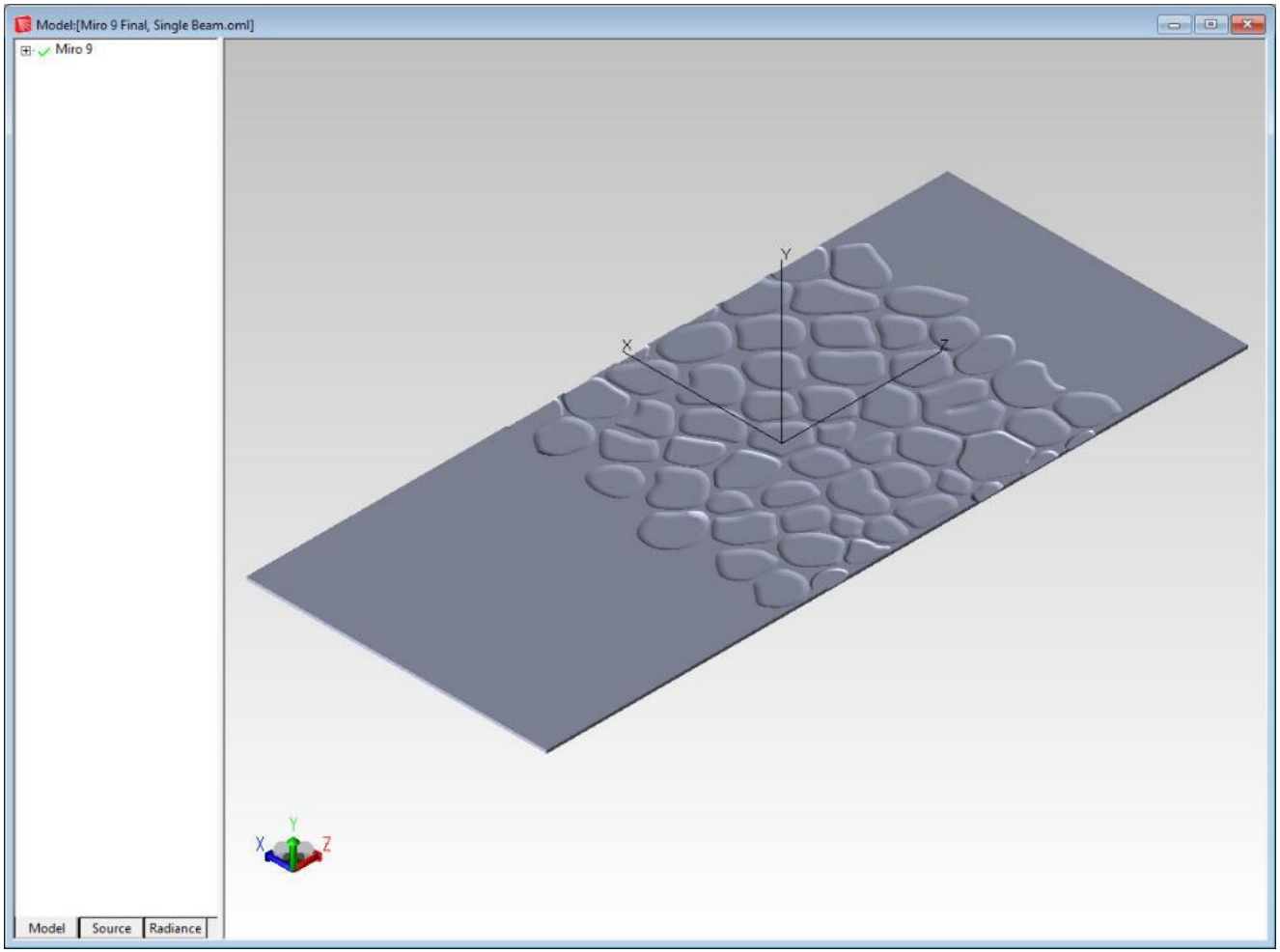
Alanod Miro 9 SolidWorks CAD model



TracePro

Making a new Surface Property – Large Scattering Features

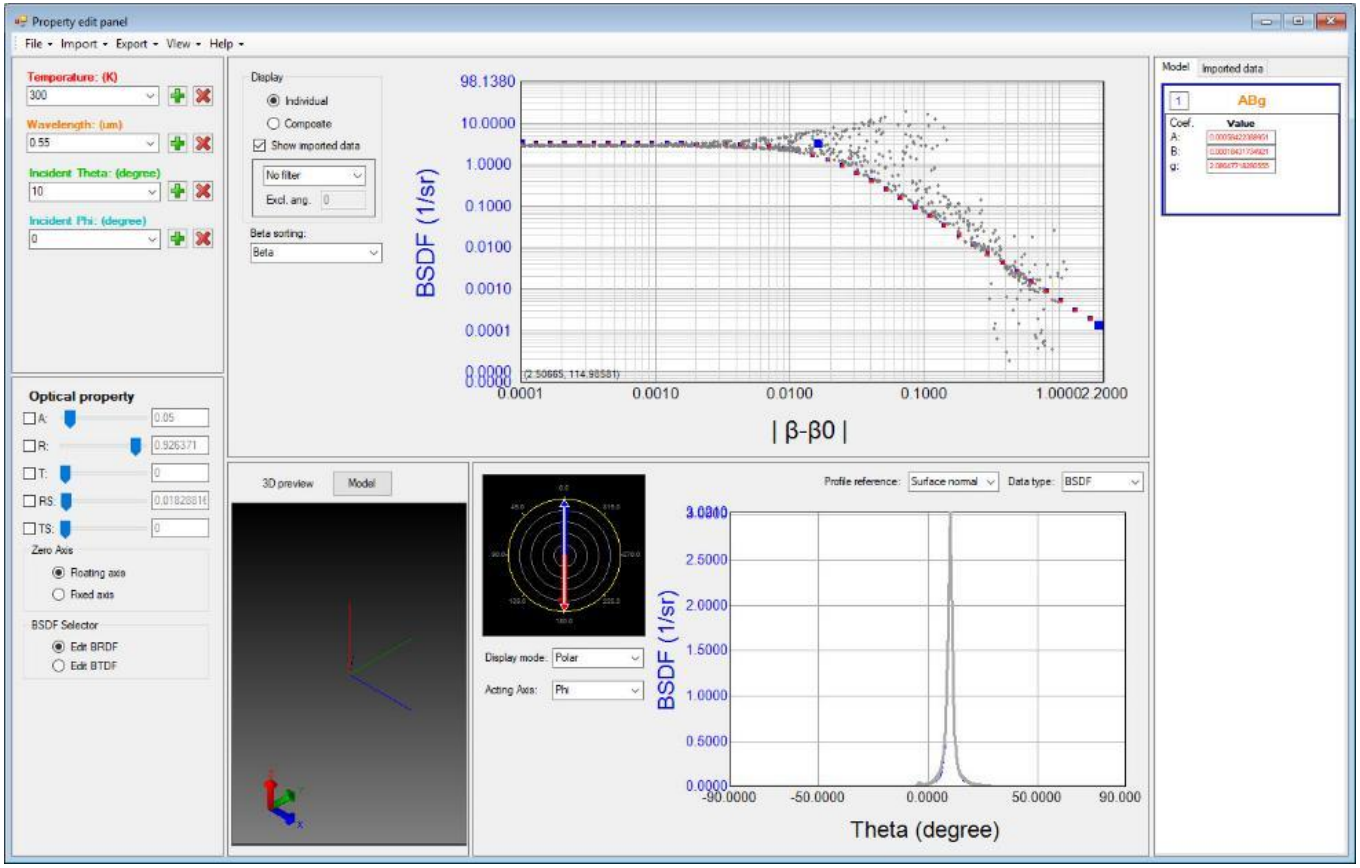
Alanod Miro 9 model in TracePro



TracePro

Making a new Surface Property – Large Scattering Features

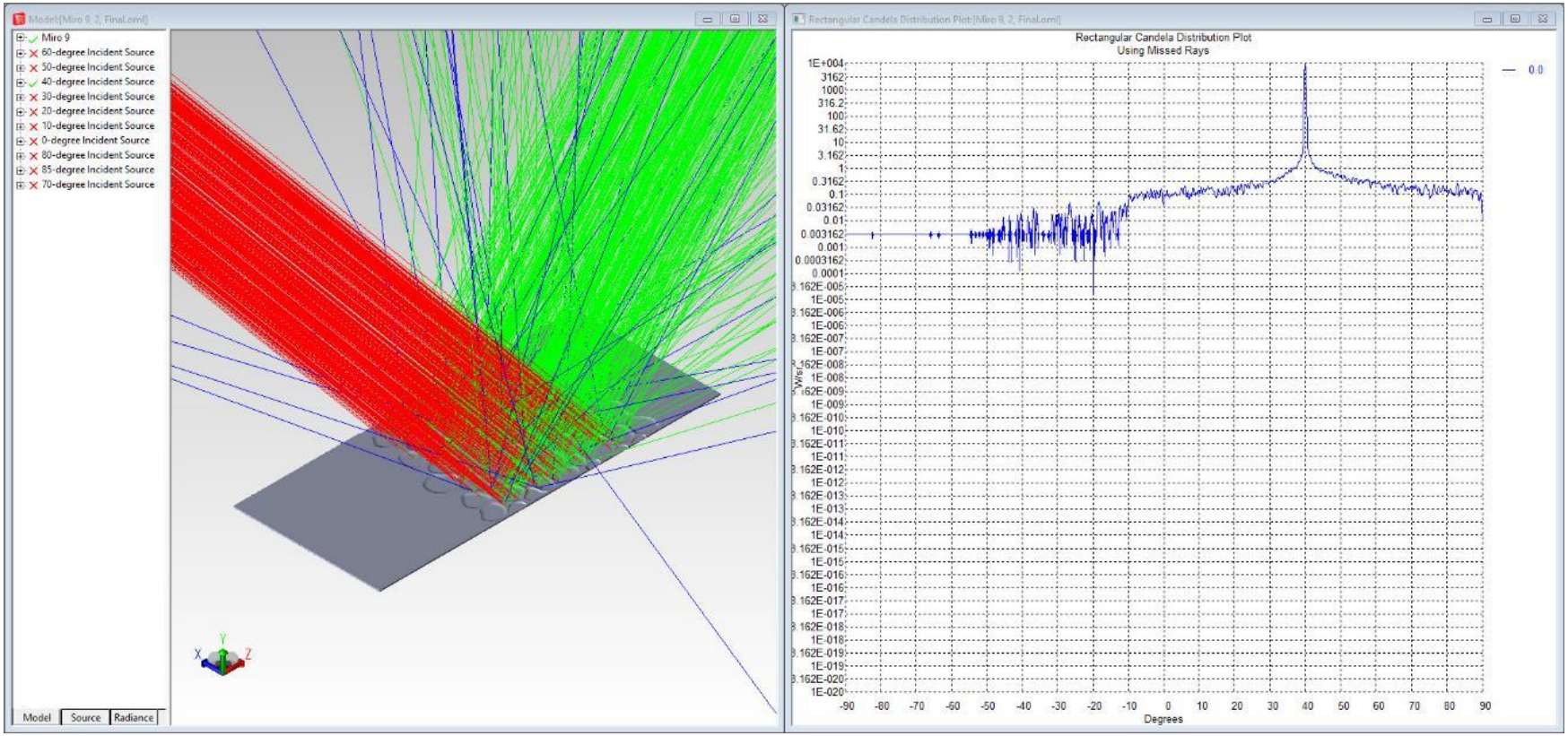
A scatter measurement was made on a flat area of the Miro 9 sample. This data was used to make a Surface Property to apply to the CAD model.



TracePro

Making a new Surface Property – Large Scattering Features

A large area of the model was illuminated and the resulting angular distribution for multiple incident angles was saved as Candela Plots.



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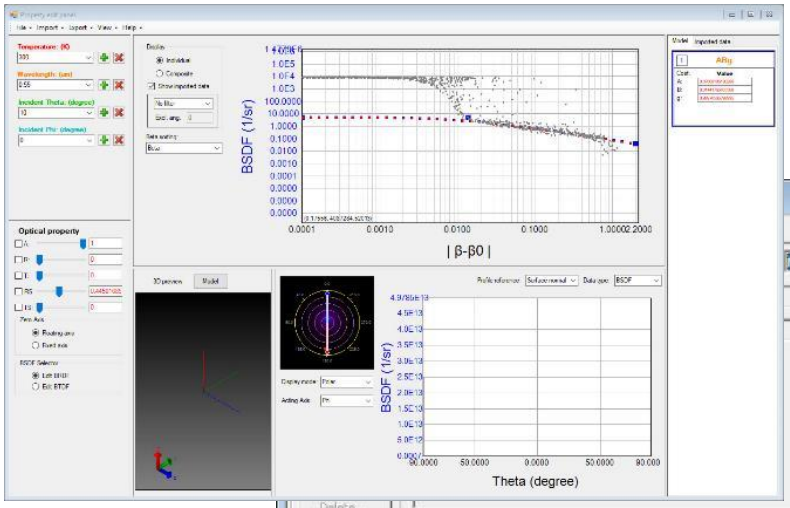
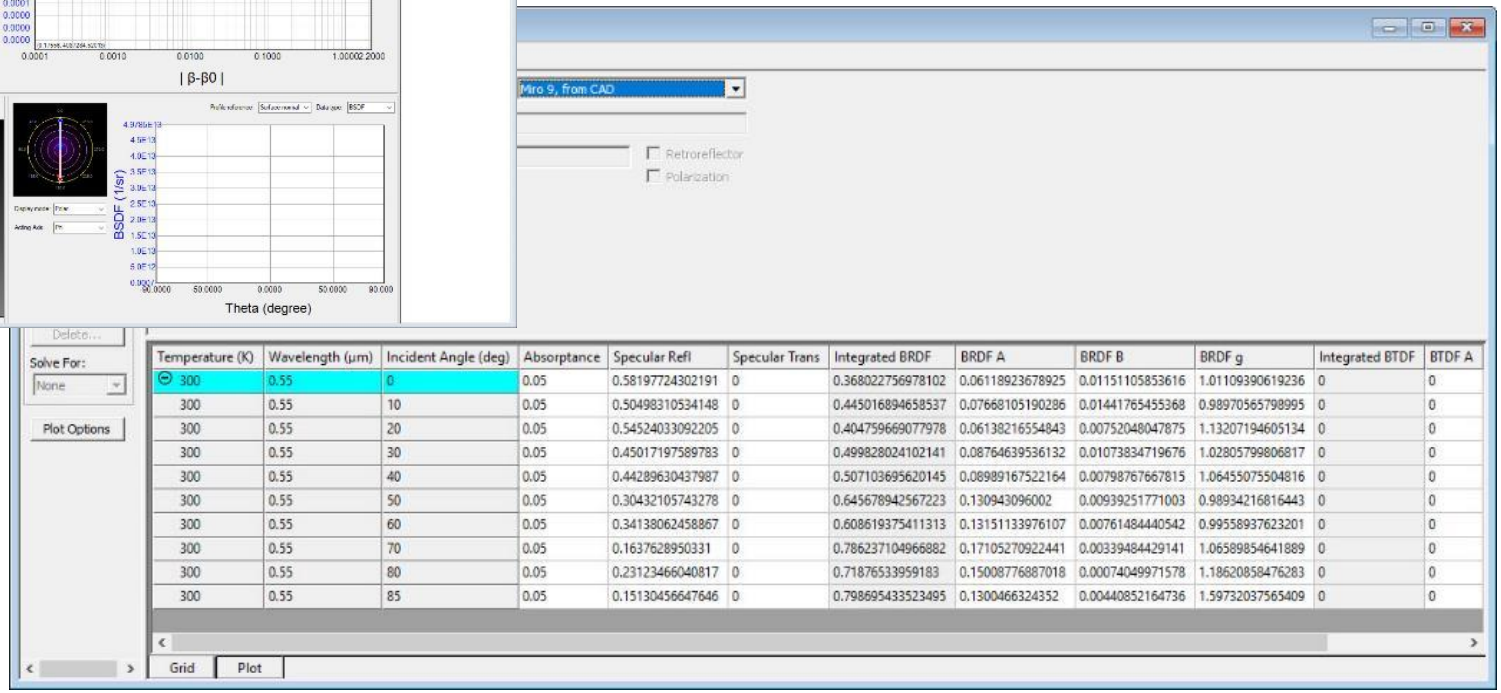
Making a new Surface Property – Large Scattering Features

A new BSDF ABg surface property was made using the raytrace results from the CAD model. The Surface Property Generator can read TracePro Candela files.



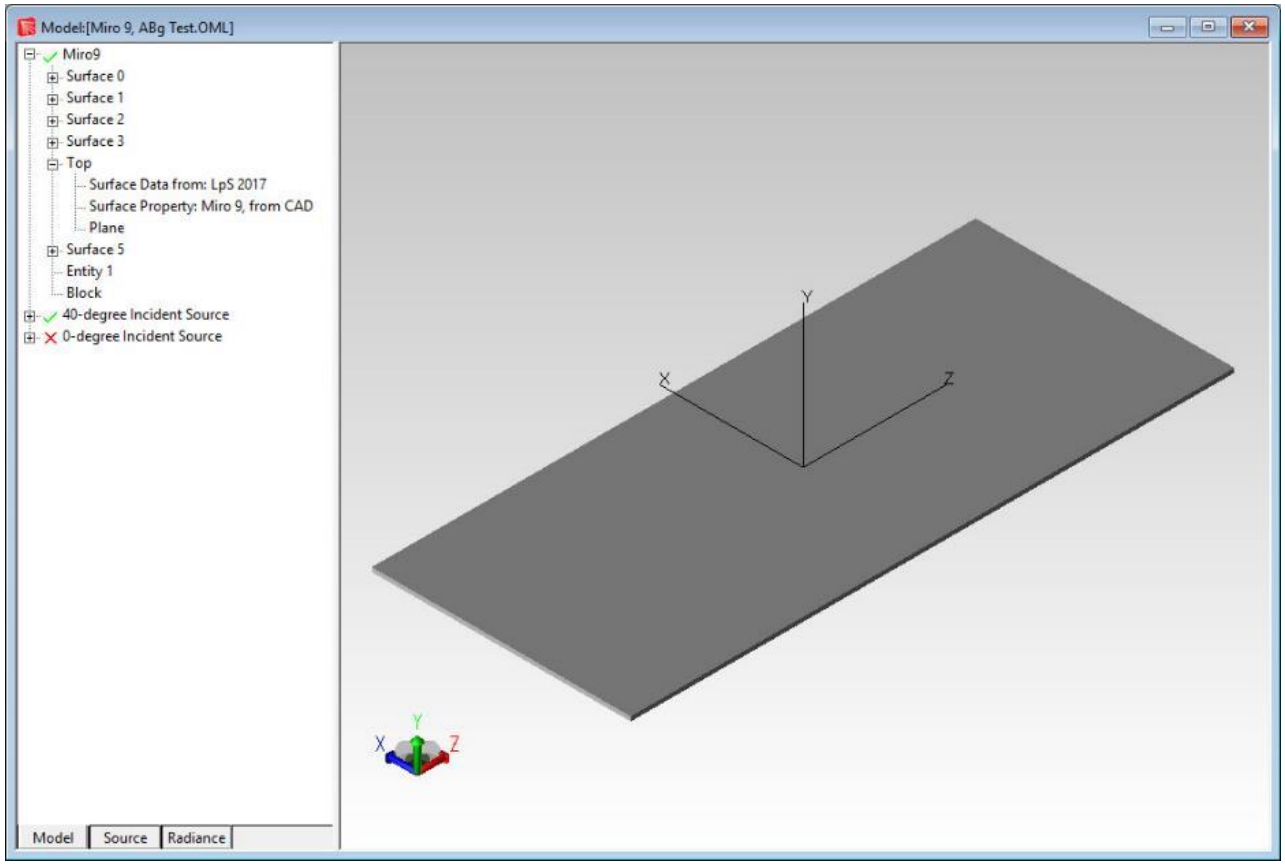


Temperature (K)	Wavelength (μm)	Incident Angle (deg)	Absorptance	Specular Refl	Specular Trans	Integrated BRDF	BRDF A	BRDF B	BRDF g	Integrated BTDF	BTDF A
300	0.55	0	0.05	0.58197724302191	0	0.368022756978102	0.06118923678925	0.01151105853616	1.01109390619236	0	0
300	0.55	10	0.05	0.50498310534148	0	0.445016894658537	0.07668105190286	0.01441765455368	0.98970565798995	0	0
300	0.55	20	0.05	0.54524033092205	0	0.404759669077978	0.06138216554843	0.00752048047875	1.13207194605134	0	0
300	0.55	30	0.05	0.45017197589783	0	0.499828024102141	0.08764639536132	0.01073834719676	1.02805799806817	0	0
300	0.55	40	0.05	0.44289630437987	0	0.507103695620145	0.08989167522164	0.00798767667815	1.06455075504816	0	0
300	0.55	50	0.05	0.30432105743278	0	0.645678942567223	0.130943096002	0.00939251771003	0.98934216816443	0	0
300	0.55	60	0.05	0.34138062458867	0	0.608619375411313	0.13151133976107	0.00761484440542	0.99558937623201	0	0
300	0.55	70	0.05	0.1637628950331	0	0.786237104966882	0.17105270922441	0.00339484429141	1.06589854641889	0	0
300	0.55	80	0.05	0.23123466040817	0	0.71876533959183	0.15008776887018	0.00074049971578	1.18620858476283	0	0
300	0.55	85	0.05	0.15130456647646	0	0.798695433523495	0.1300466324352	0.00440852164736	1.59732037565409	0	0

TracePro

Making a new Surface Property – Large Scattering Features

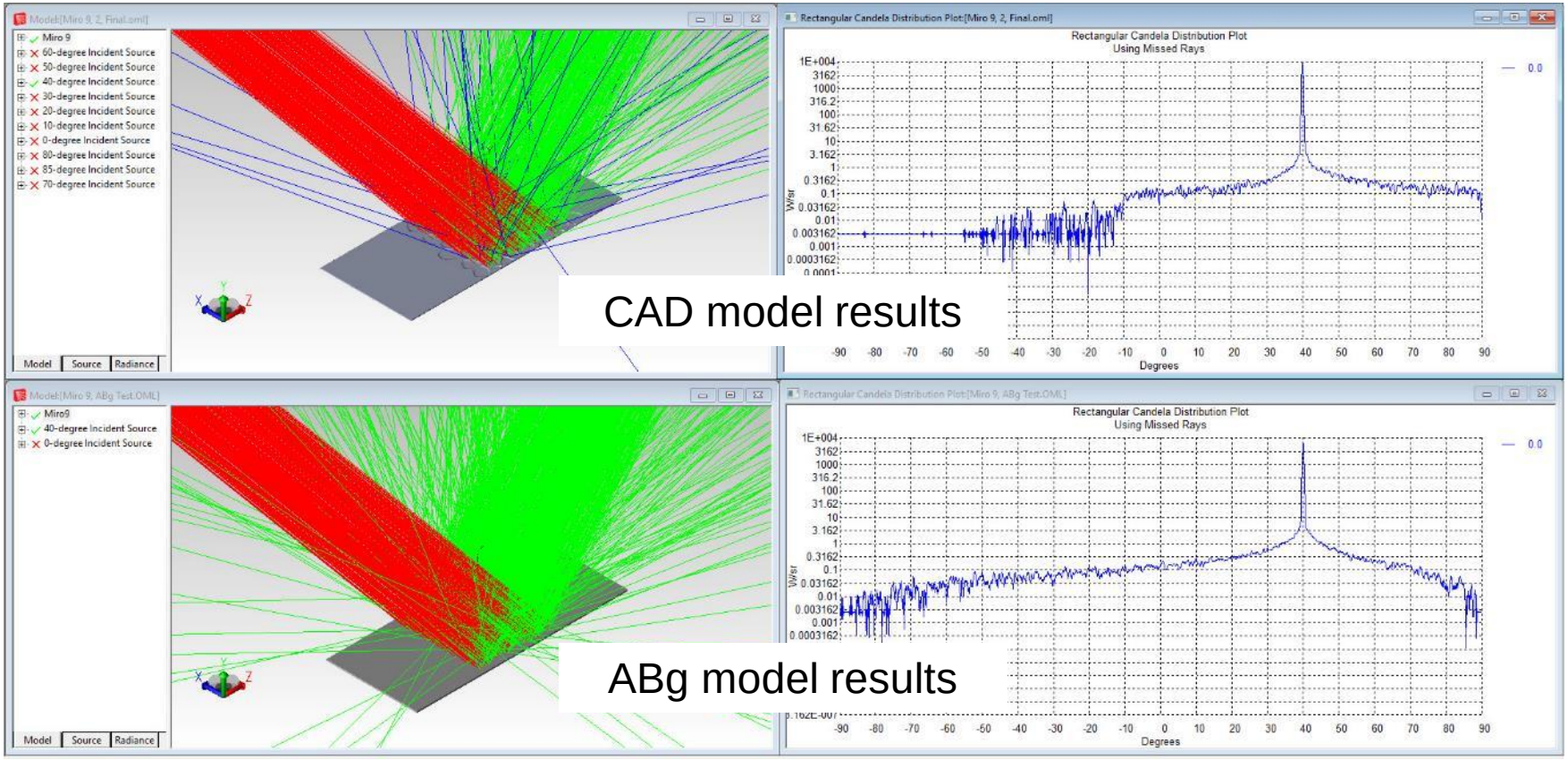
The new surface/scatter property was then applied to a surface in the model. The scatter property will model the effect of the large texture features.



TracePro

Making a new Surface Property – Large Scattering Features

Comparison of CAD model and BSDF ABg model for Alanod Miro 9



TracePro

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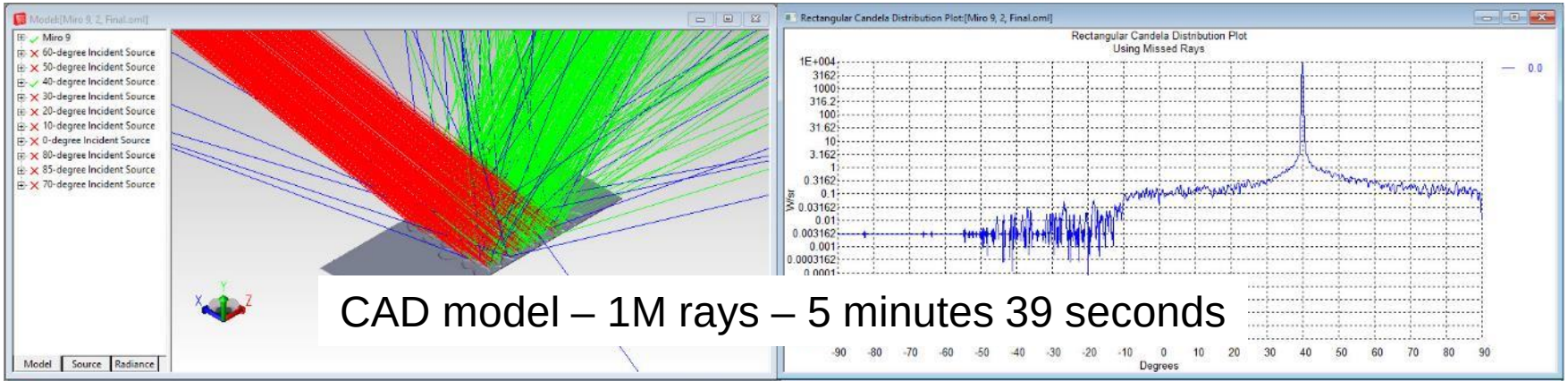
Comparison of CAD model and BSDF ABg model for Alanod Miro 9



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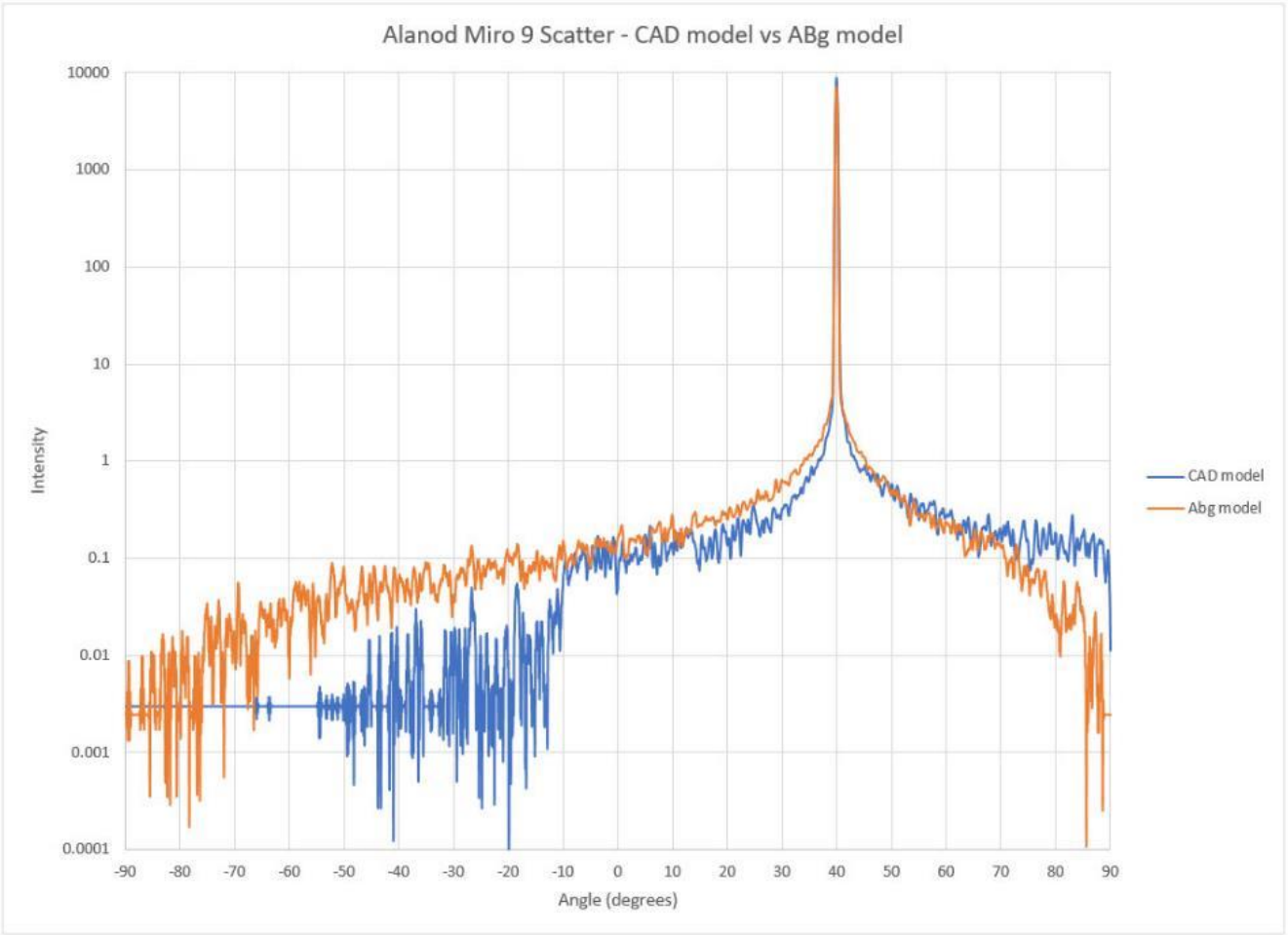
Making a new Surface Property – Large Scattering Features

Intensity Plot - CAD model versus ABg model



TracePro

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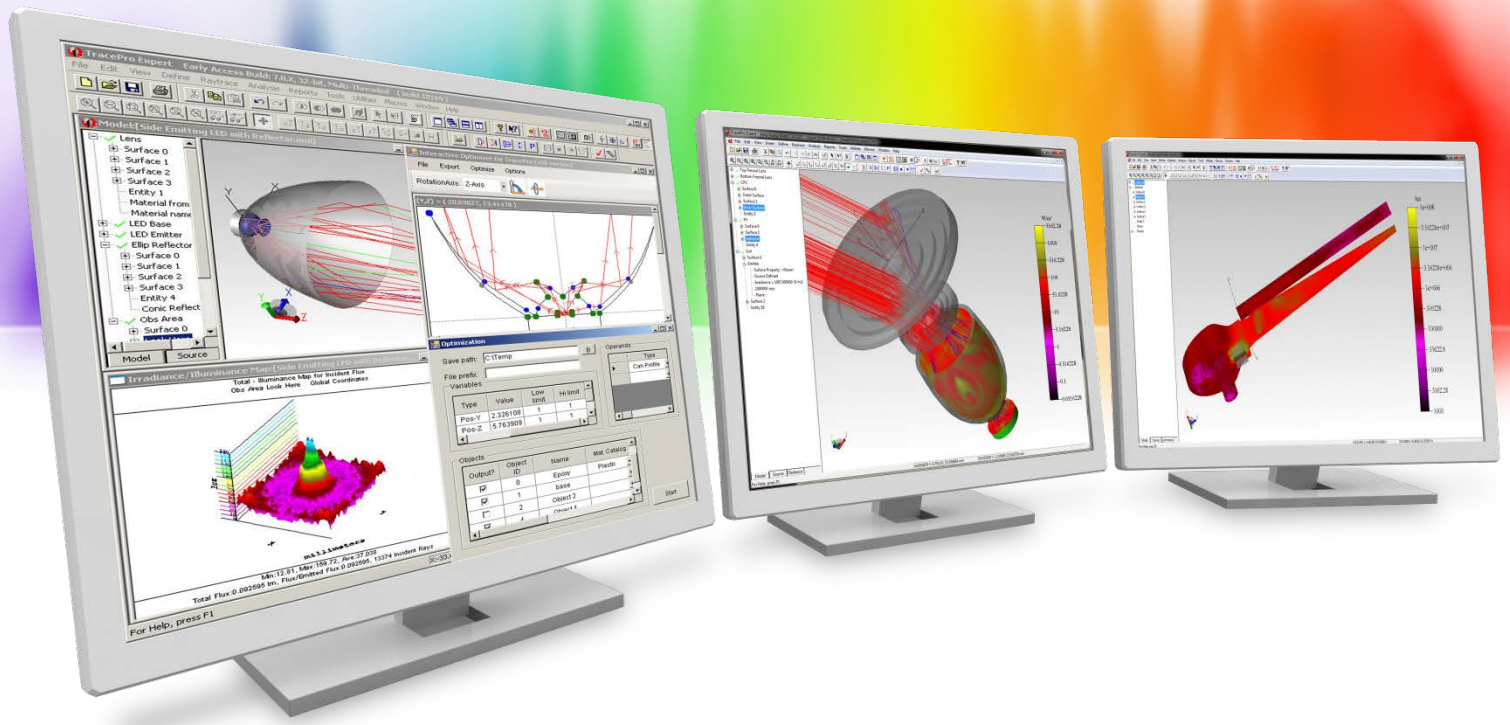

Summary and Questions

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Summary and Questions

TracePro features a new Surface Property Generator:

- ✓ New surface properties, both with and without scattering, can be easily made and exported to TracePro from the Surface Property Generator
- ✓ Measured scatter data can be imported into the Surface Property Generator and new TracePro Surface Properties can be made
- ✓ The new Surface Property Generator can be used along with a CAD model to model the scattering of materials with large scattering features. This can lead to easier modeling with these types of materials and faster raytraces.

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

www.lambdares.com

Phone: +1 978-486-0766 E-mail: sales@lambdares.com

TracePro