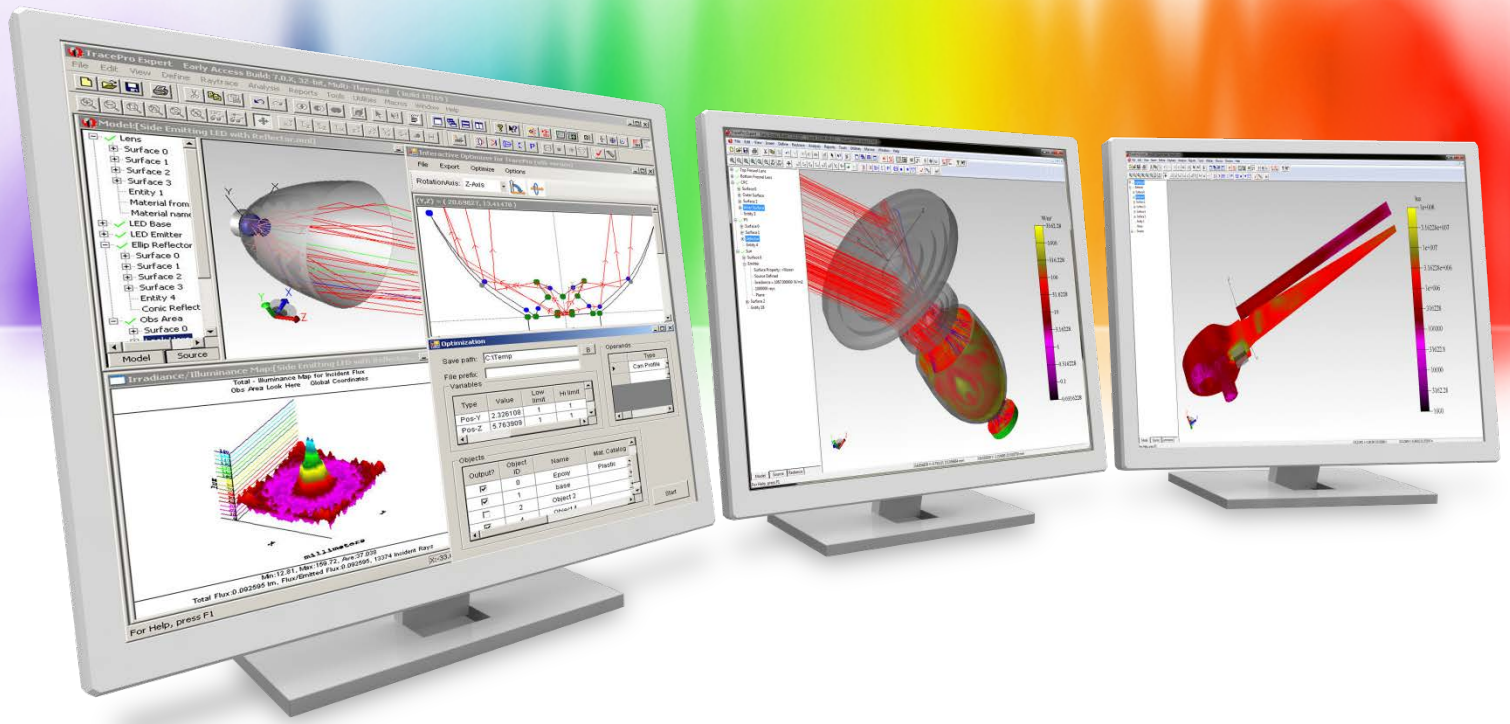
TracePro



The TracePro RepTile Property and the Texture Optimizer II

A Lambda Research Corporation Webinar

September 22, 2016

LAMBDA RESEARCH CORPORATION

Presenter

- **Presenter**

  Dave Jacobsen
  Sr. Application Engineer
  Lambda Research Corporation

- **Moderator**

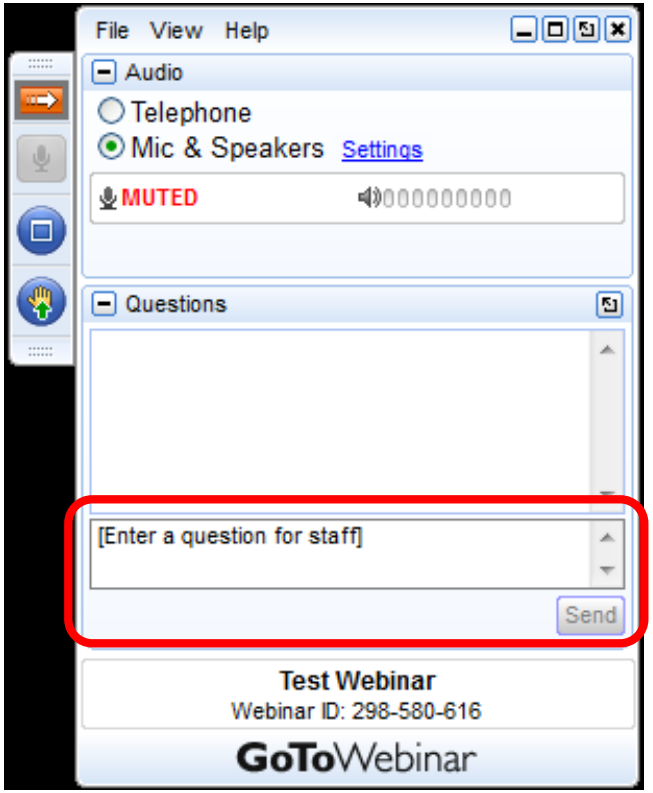
  Mike Gauvin
  Vice President of Sales and Marketing
  Lambda Research Corporation

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
  - http://www.lambdares.com/webinars
- TracePro Tutorial Videos
  - http://www.lambdares.com/videos
- TracePro Tutorials
  - http://www.lambdares.com/features/tracepro-tutorials
- Information on upcoming TracePro Training Classes
  - http://www.lambdares.com/training/software-training

TracePro

Upcoming TracePro Training

- **Jena, Germany**
  - Introduction to TracePro – October. 18-19, 2016
  - Optimization with TracePro – October. 20-21, 2016

- **Littleton, MA USA**
  - Introduction to TracePro – October. 25 -26, 2016
  - Optimization with TracePro– October. 27-28, 2016

TracePro

Latest TracePro Release

TracePro 7.7.2

Released April 1, 2016

TracePro 7.8 EA

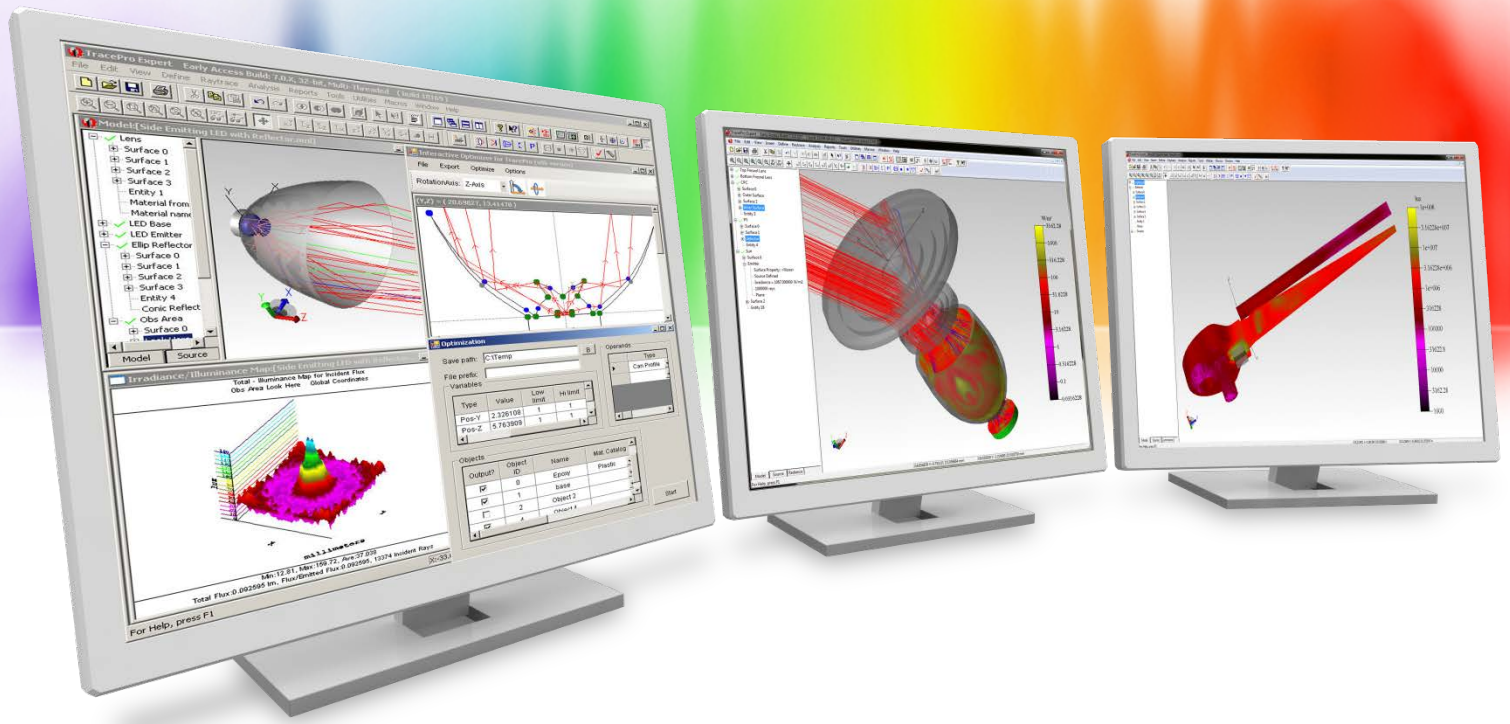
Currently available for download

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 TracePro RepTile Property and the Texture Optimizer II

A Lambda Research Corporation Webinar

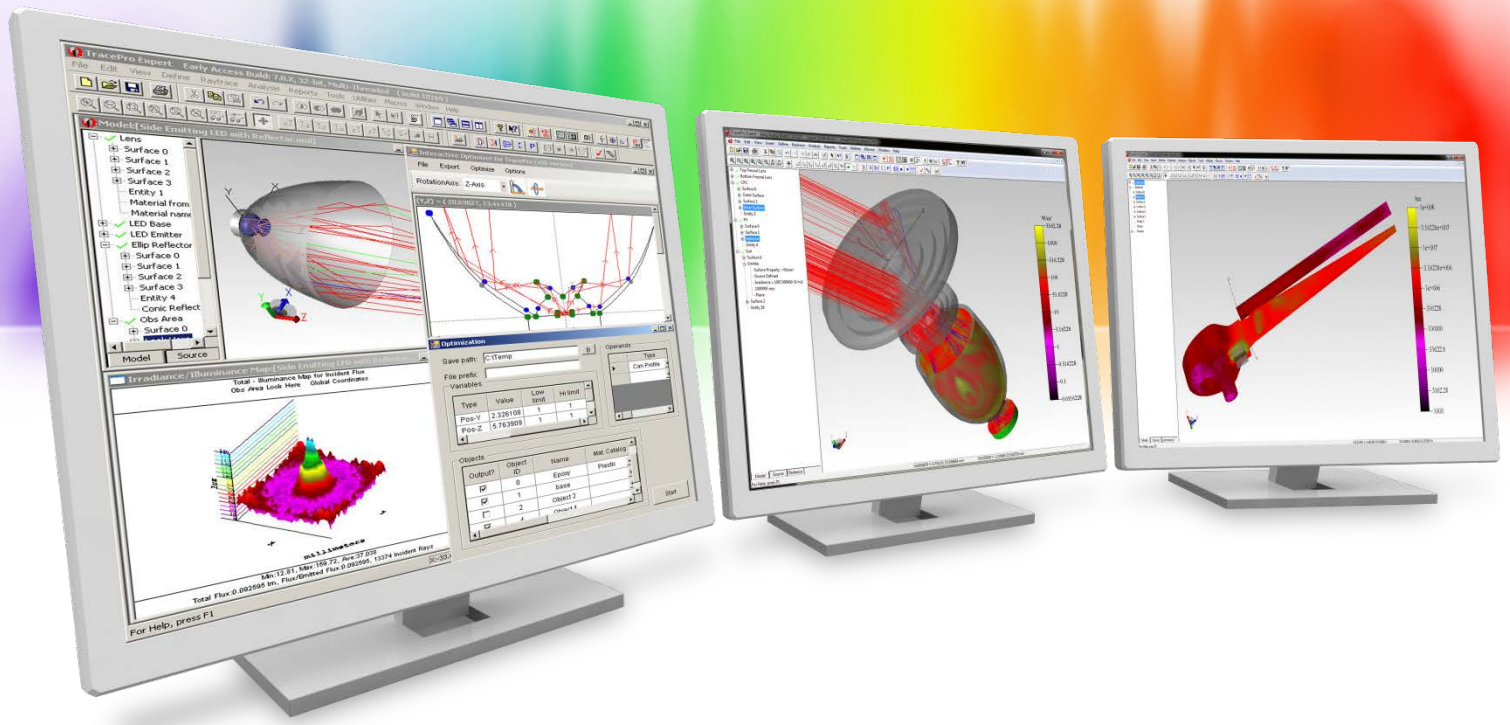
September 22, 2016

LAMBDA RESEARCH CORPORATION

Agenda

- What is the TracePro RepTile property?
- Overview of the Texture Optimizer II
- Texture Types in the Texture Optimizer II
- Setting up the Texture Optimizer II
- The texture optimization process
- Using the Texture Optimizer II to apply texture features to curved surfaces
- Questions and Answers

TracePro



TracePro RepTile Property

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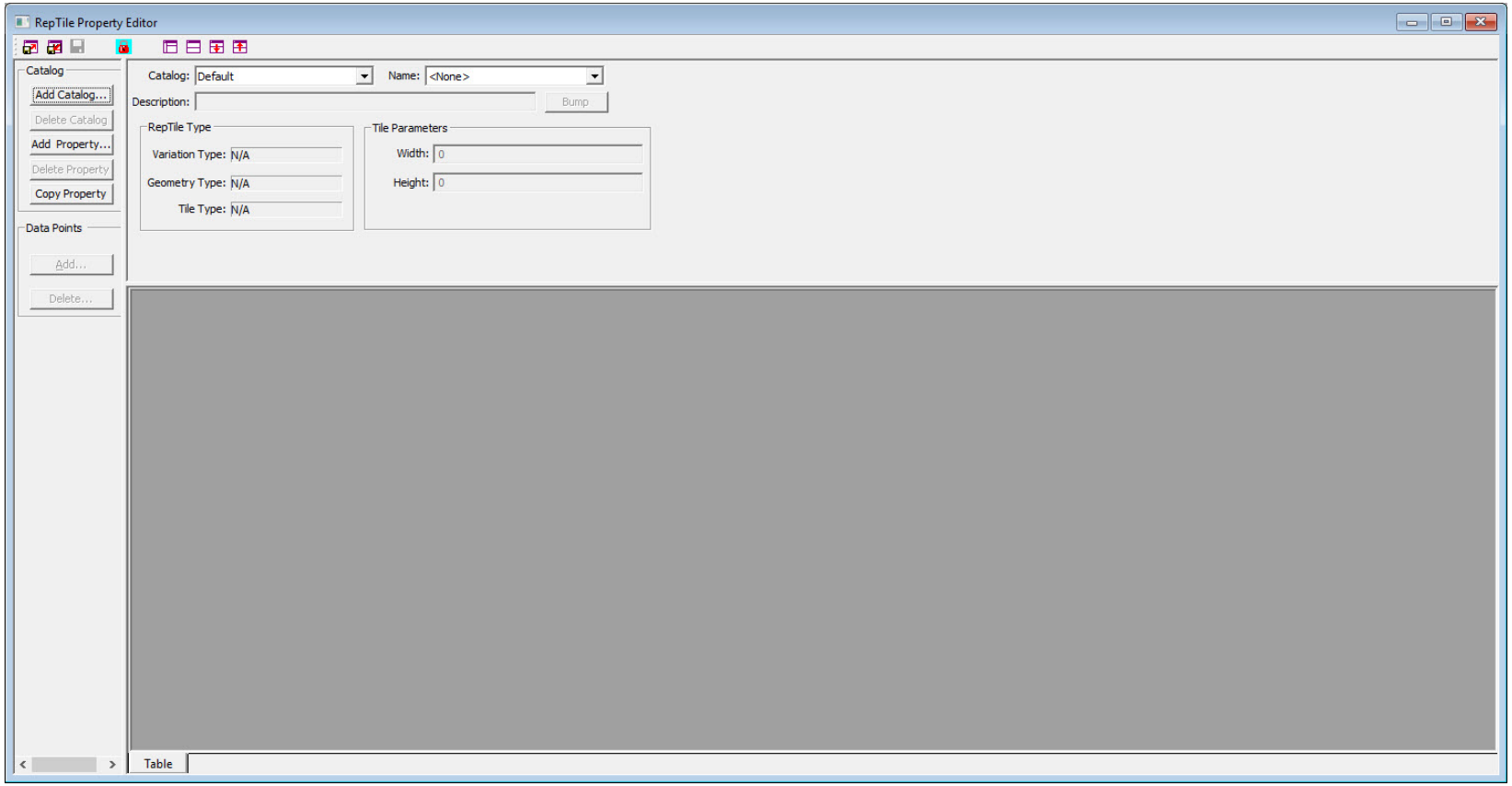
TracePro RepTile Property

What is RepTile?

- RepTile = Repetitive Tile
- Used to define repetitive microstructures in a convenient way
- Mathematical representations of the repetitive structure
- Allows for smaller file sizes as well as faster and easier modification of the structure
- RepTile properties may be applied to planar surfaces
- RepTile region is bounded by a rectangular, circular, or surface boundary
- Many geometry types may be made as either a Bump or Hole
- Requires TracePro Expert edition

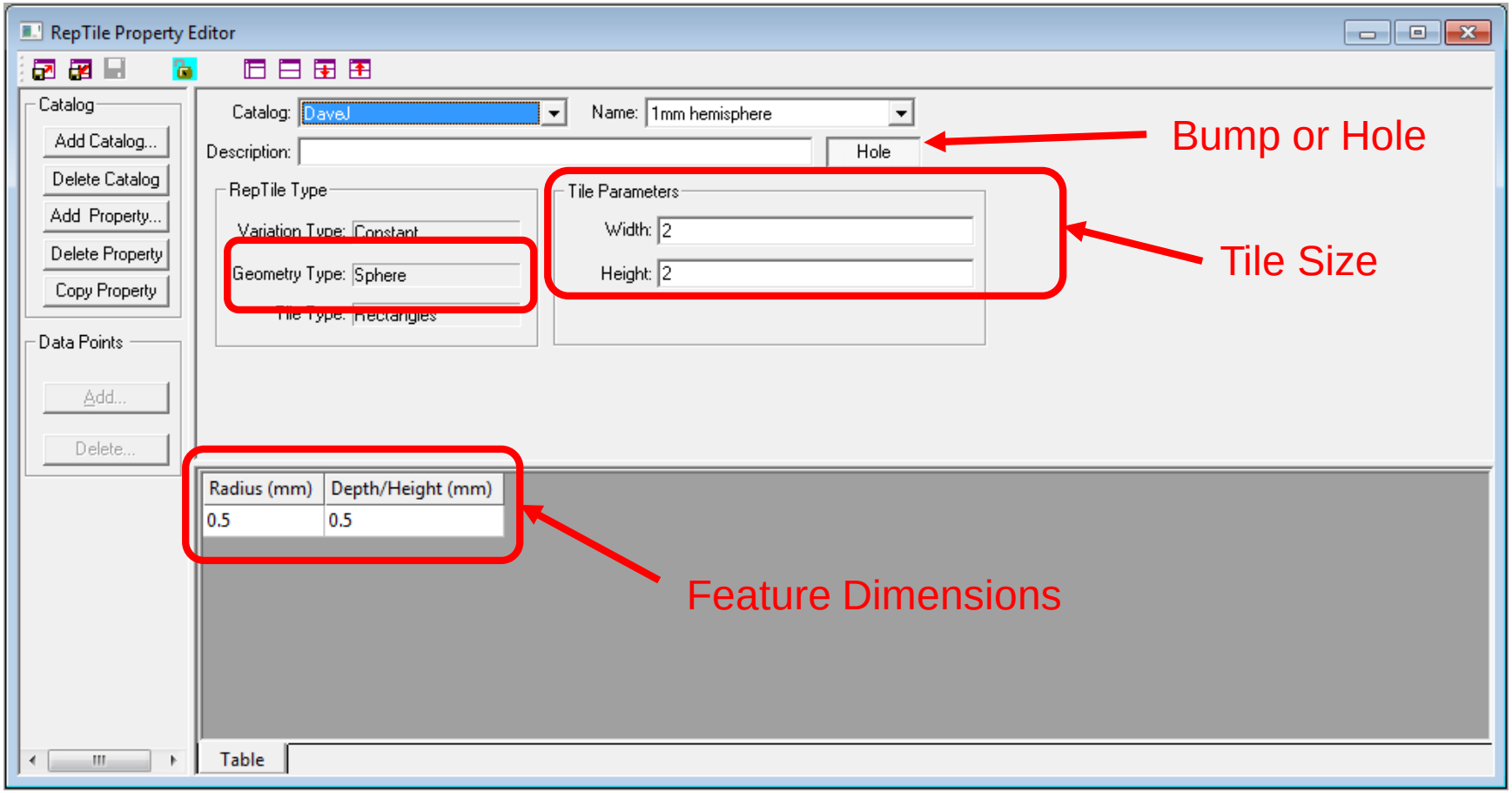
TracePro RepTile Property

RepTile Property Editor : Define->Edit Property Data->RepTile Properties



TracePro RepTile Property

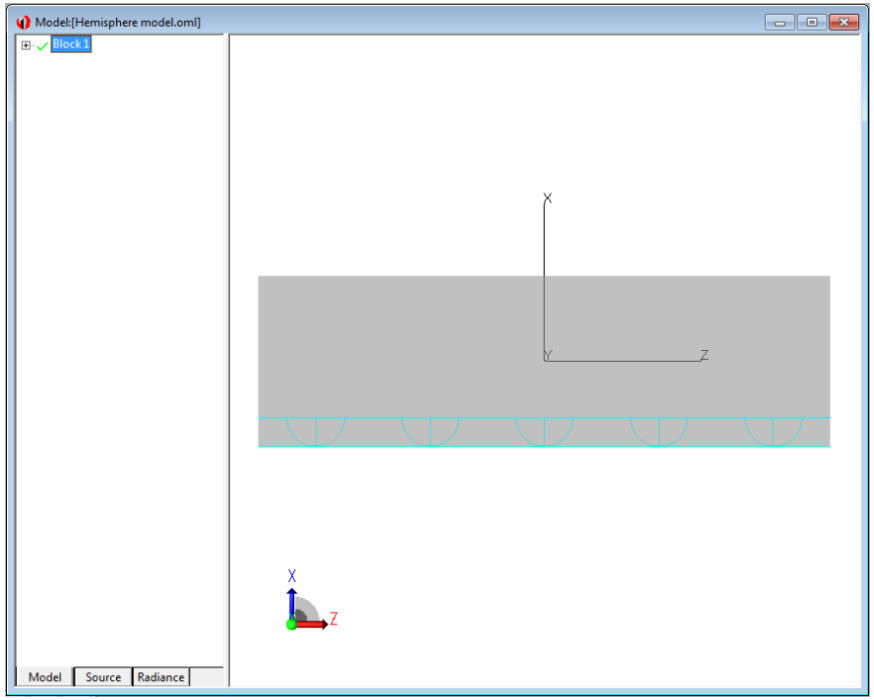
RepTile Example – 1mm diameter hemisphere



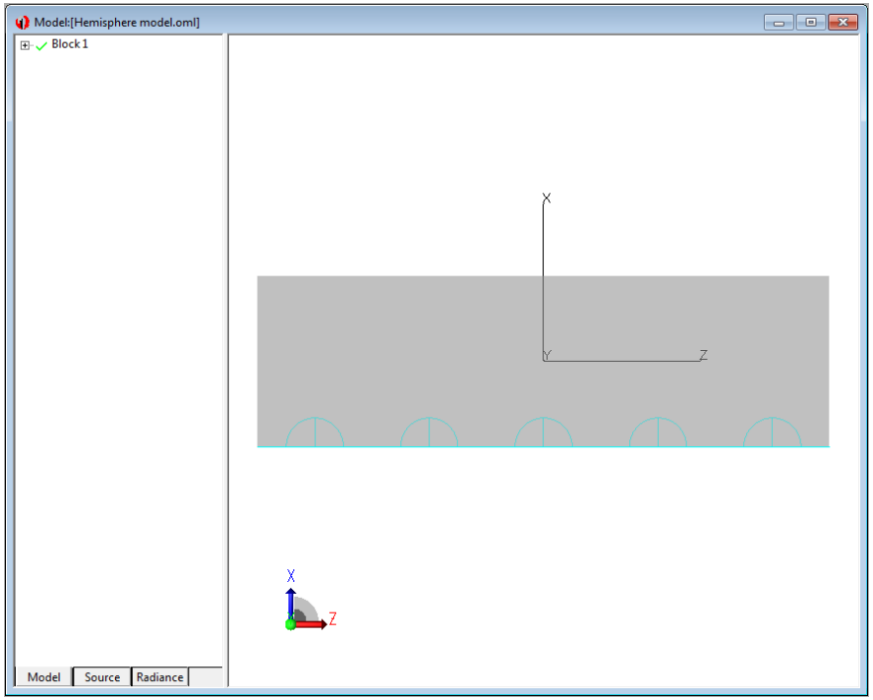
TracePro

TracePro RepTile Property

Bump vs. Hole



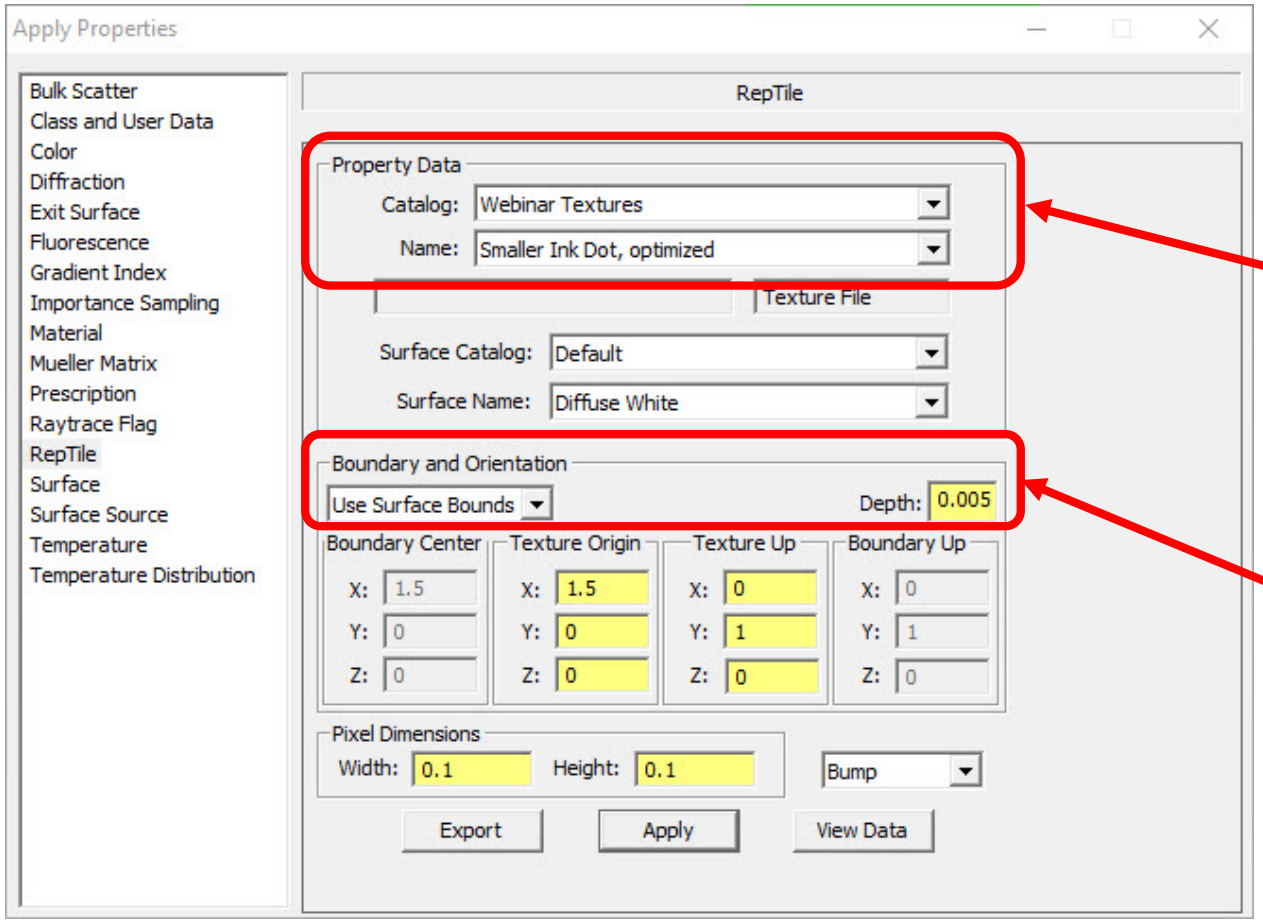
Bump



Hole

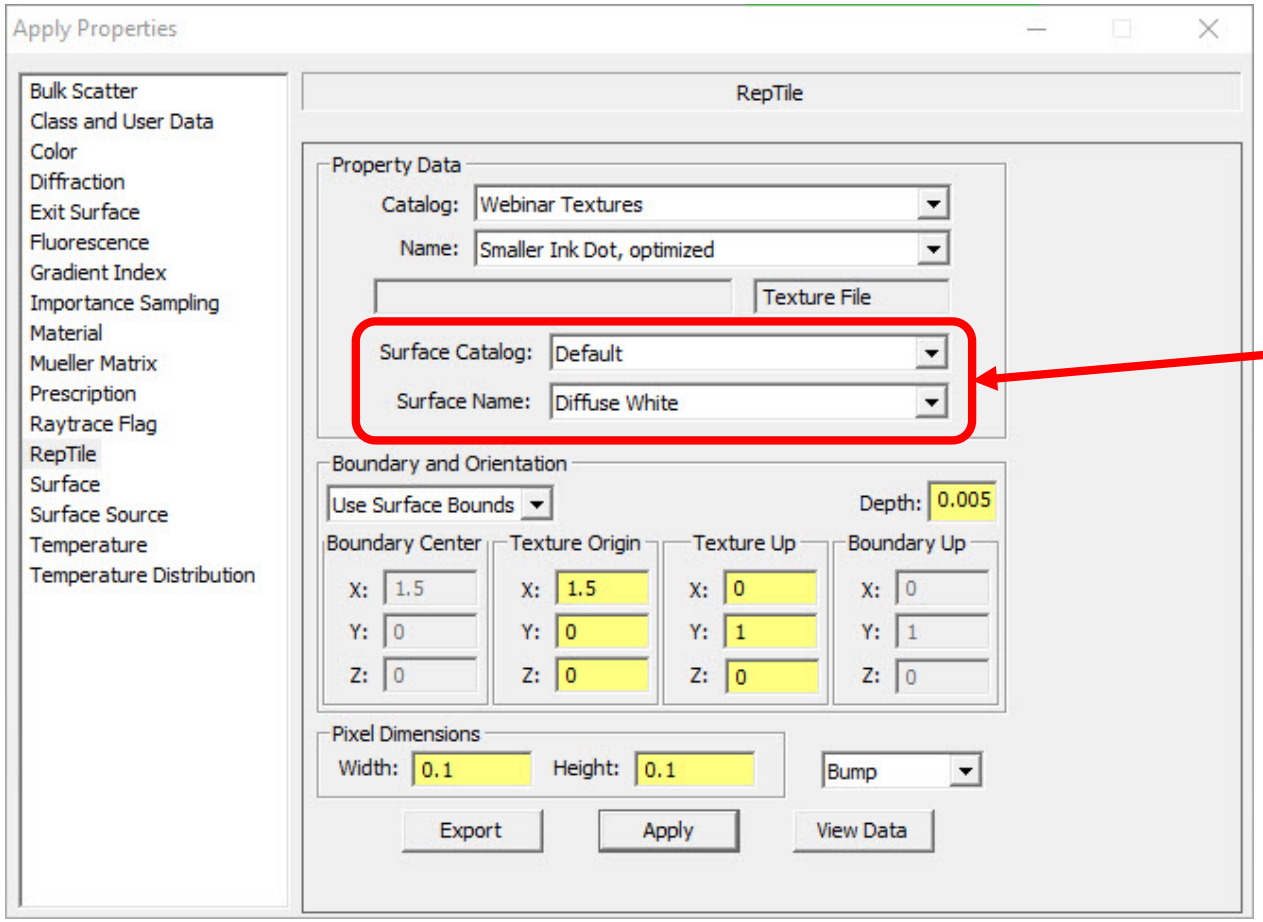
TracePro RepTile Property

Apply Properties - RepTile



TracePro RepTile Property

Apply Properties - RepTile

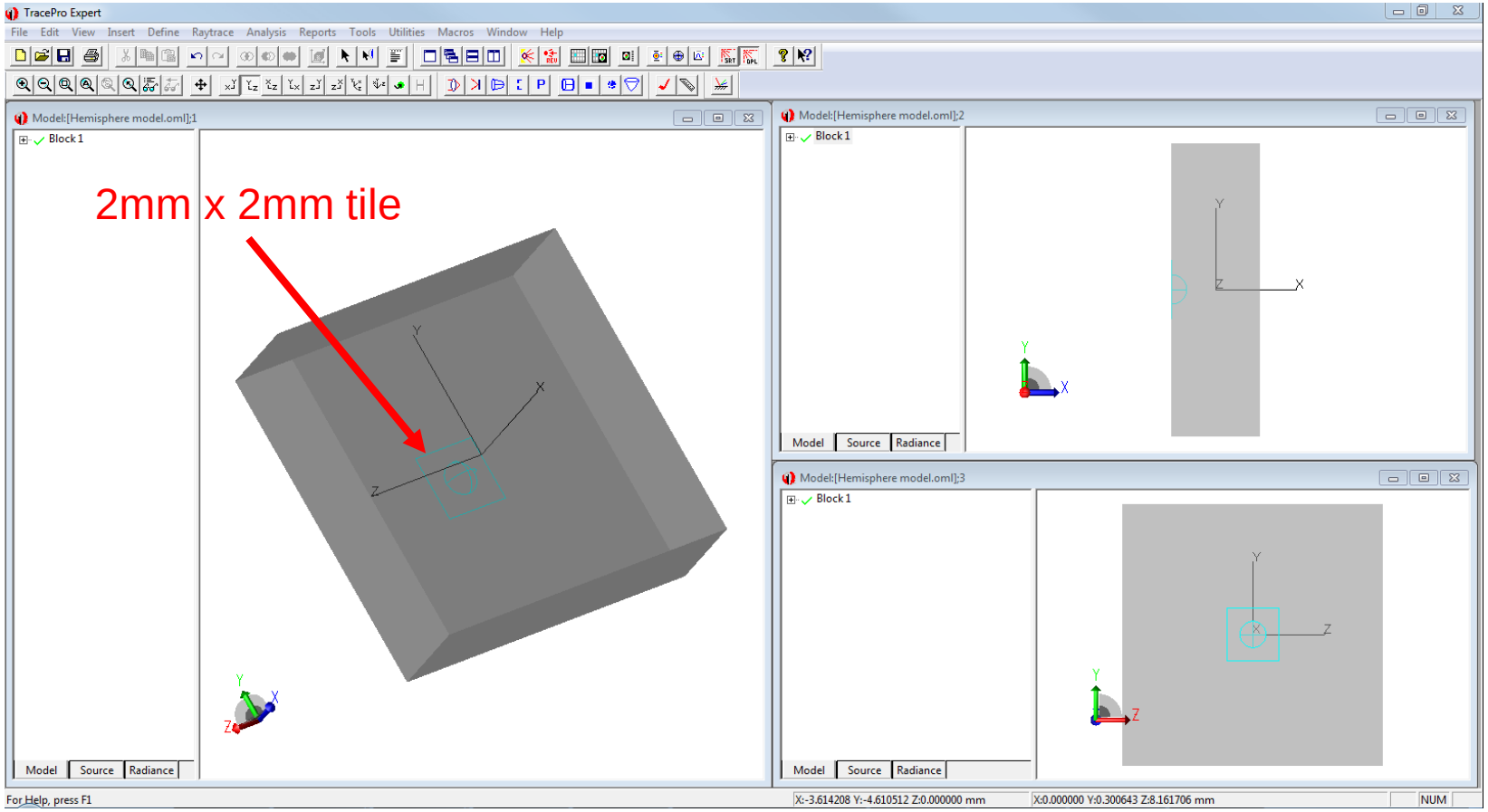


The RepTile can have any Surface Property in the TracePro Surface Property Database

TracePro

TracePro RepTile Property

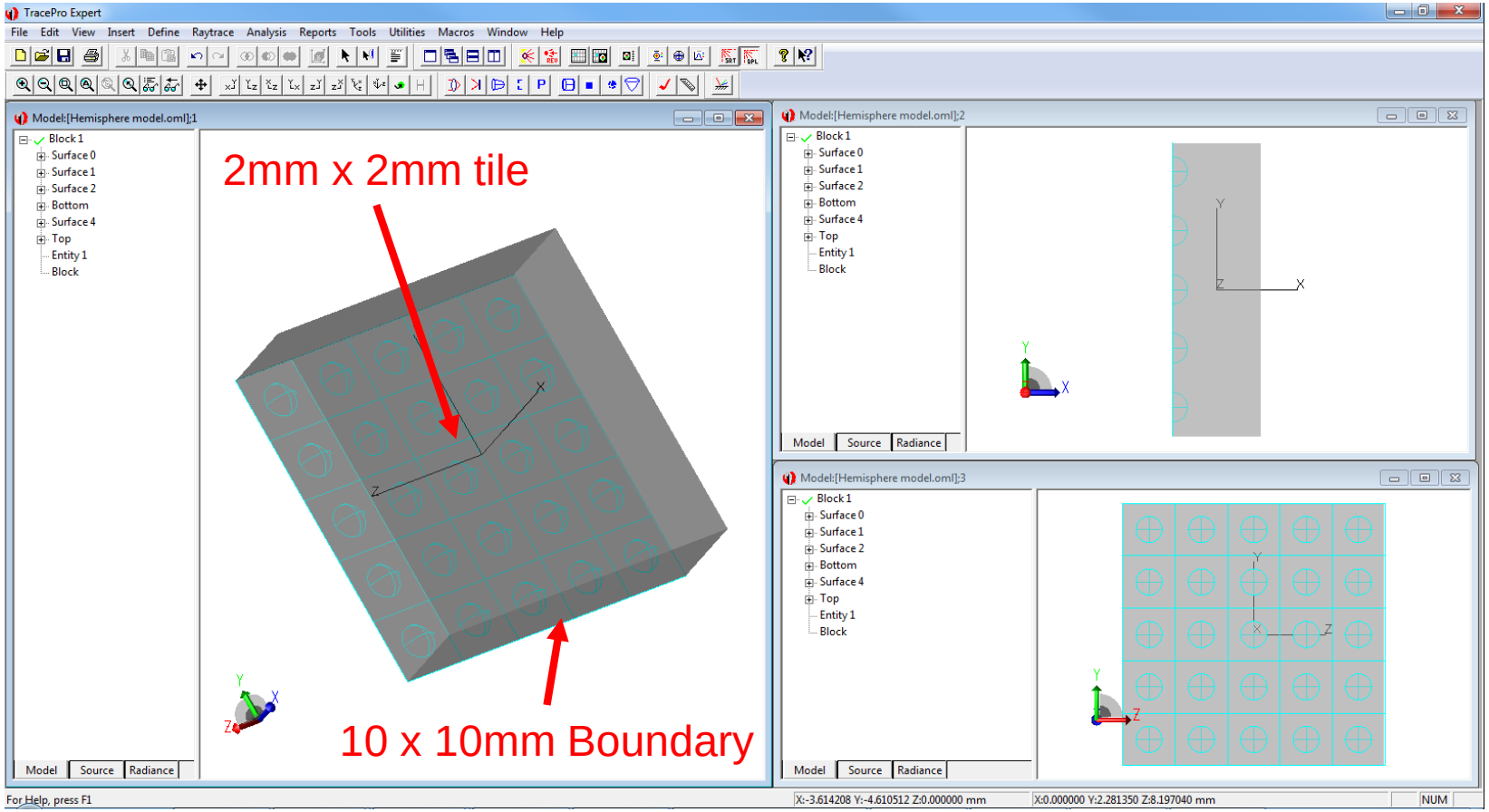
To Display a RepTile: View ->Display RepTiles -> RepTiles & Boundary



TracePro

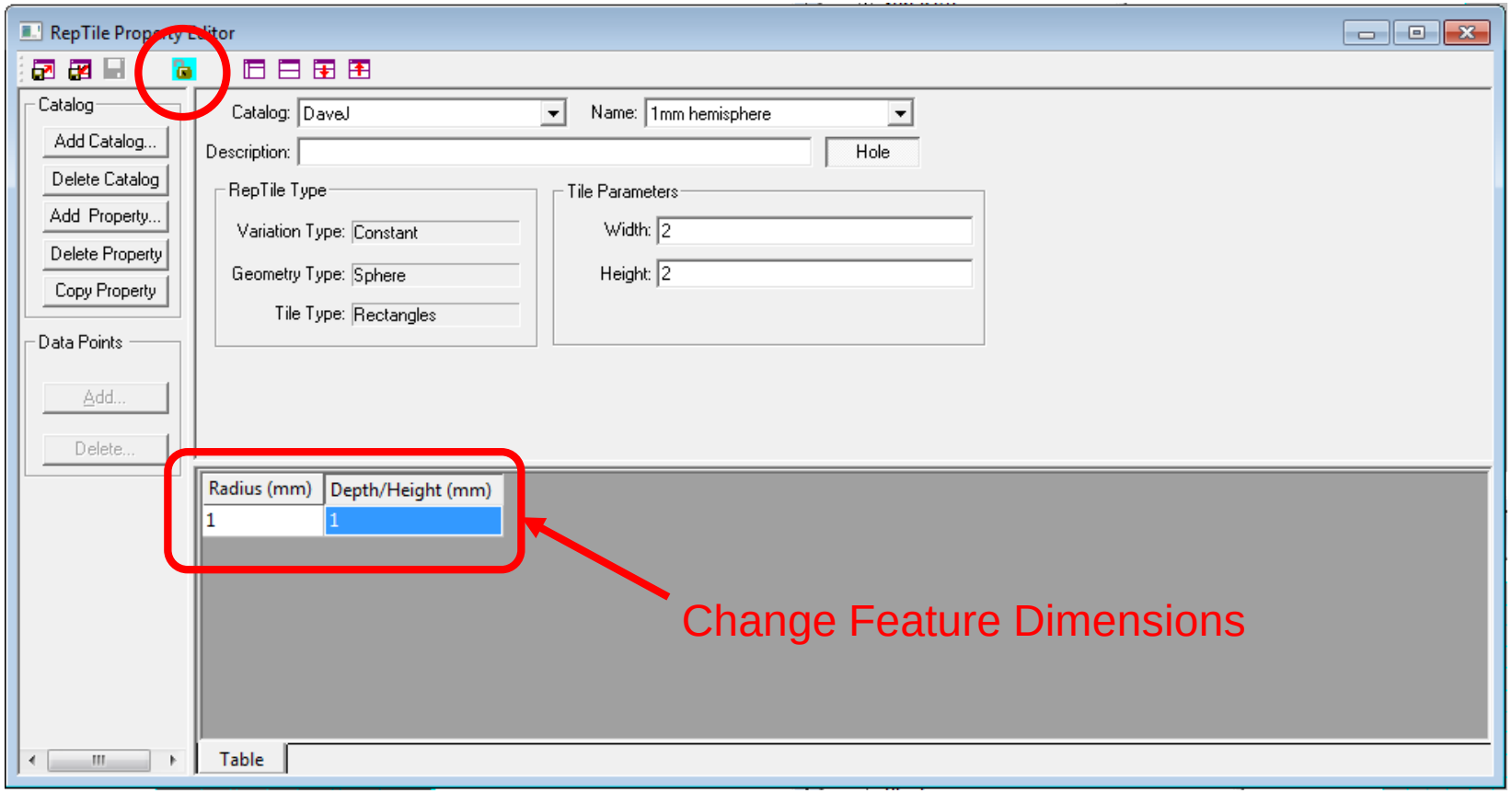
TracePro RepTile Property

To Display a RepTile: View ->Display RepTiles -> RepTiles & Boundary



TracePro RepTile Property

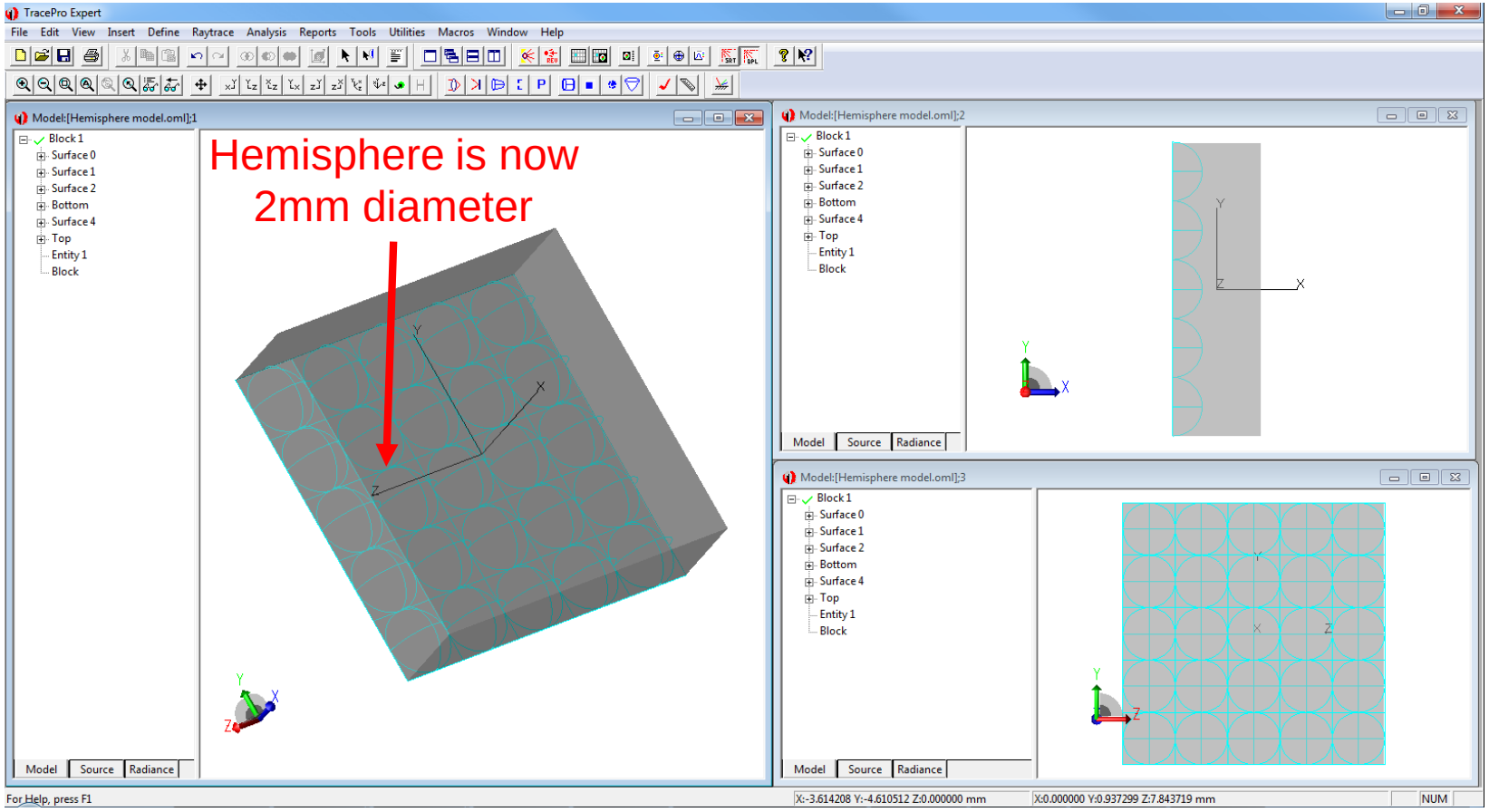
Changing RepTile feature parameters



TracePro

TracePro RepTile Property

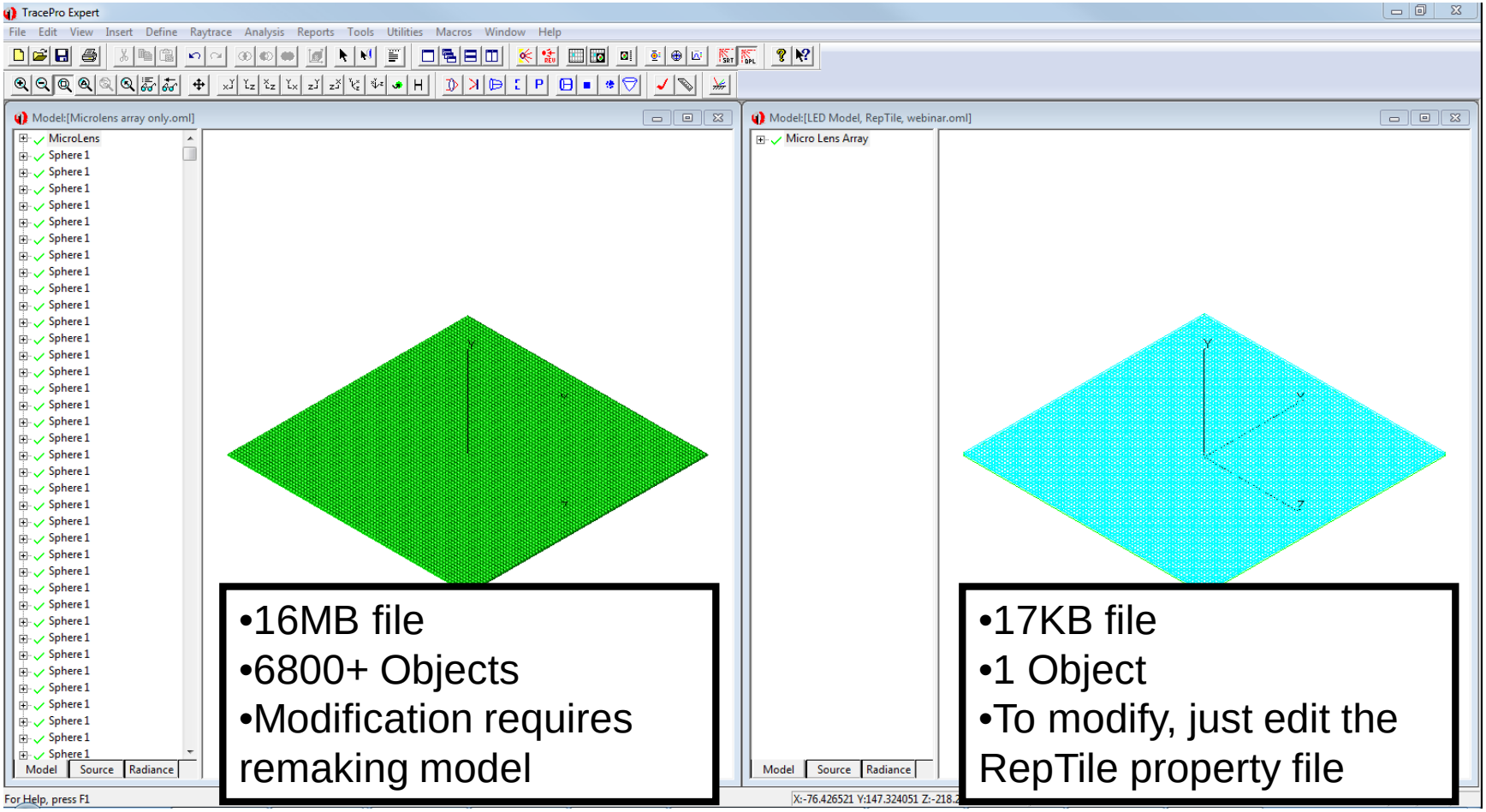
Changing RepTile feature parameters



TracePro

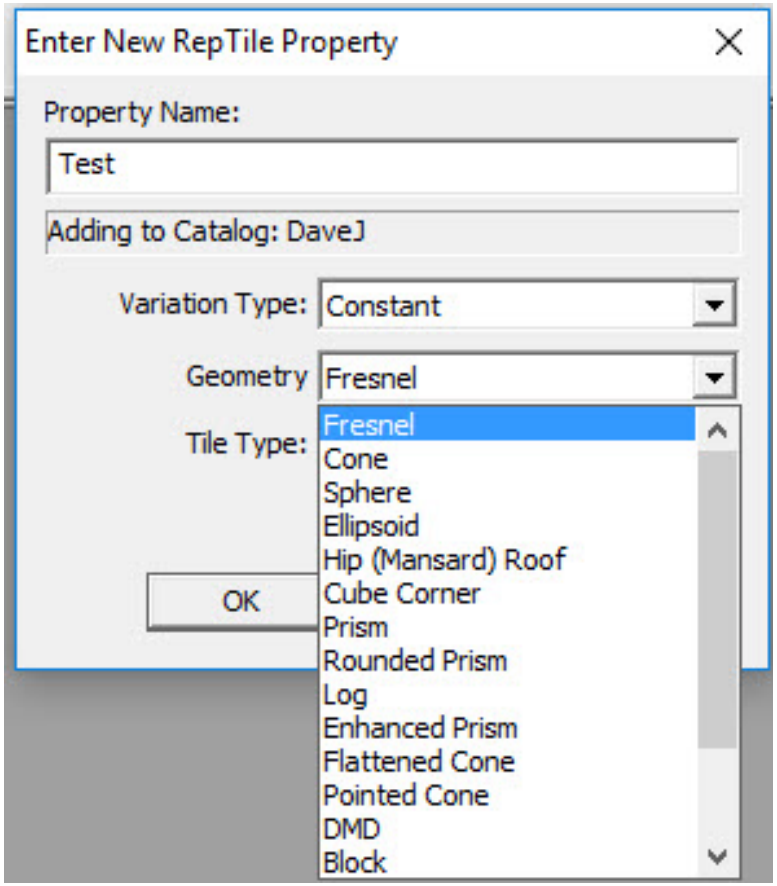
TracePro RepTile Property

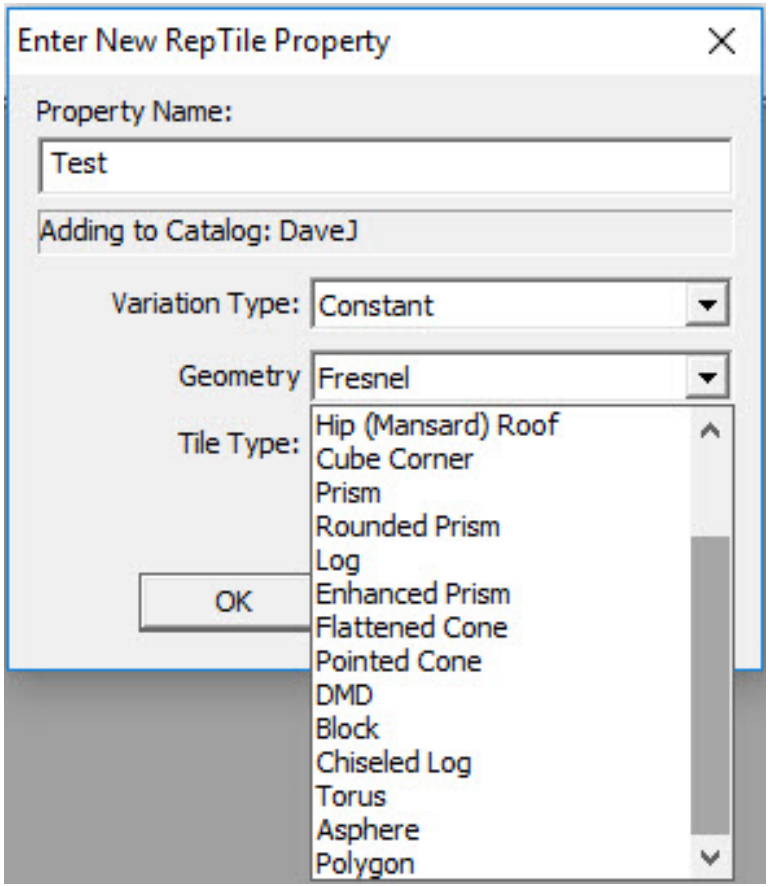
Microlens array – Solid model vs RepTile



TracePro RepTile Property

RepTile Geometry Types





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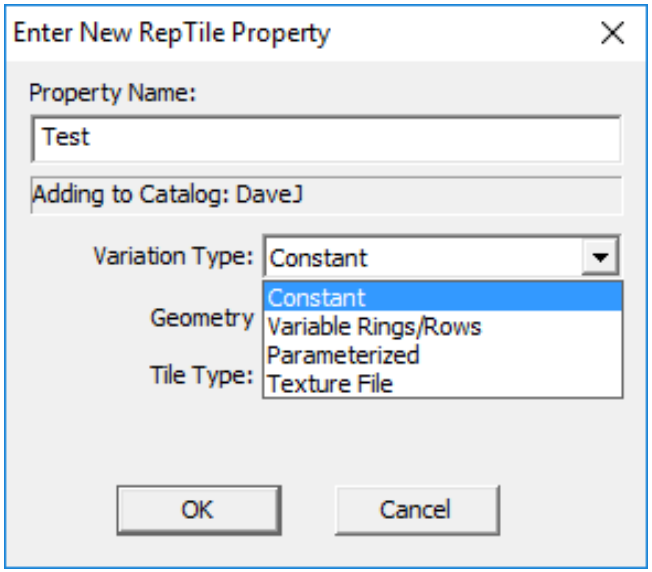
TracePro RepTile Property

RepTile Variation Types

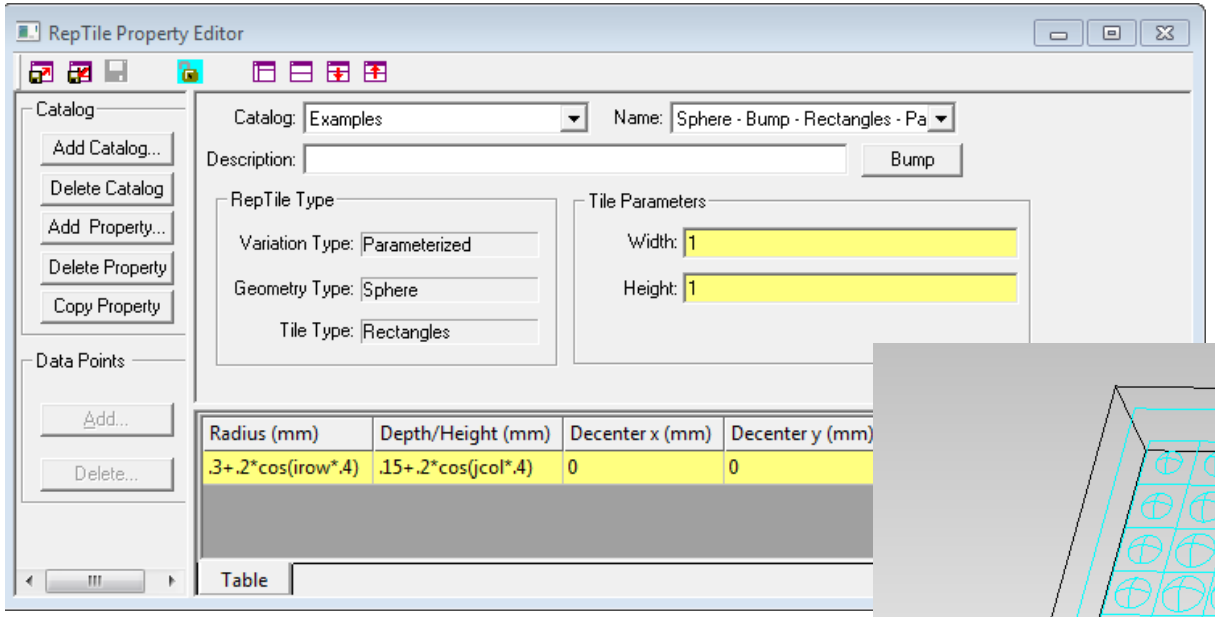


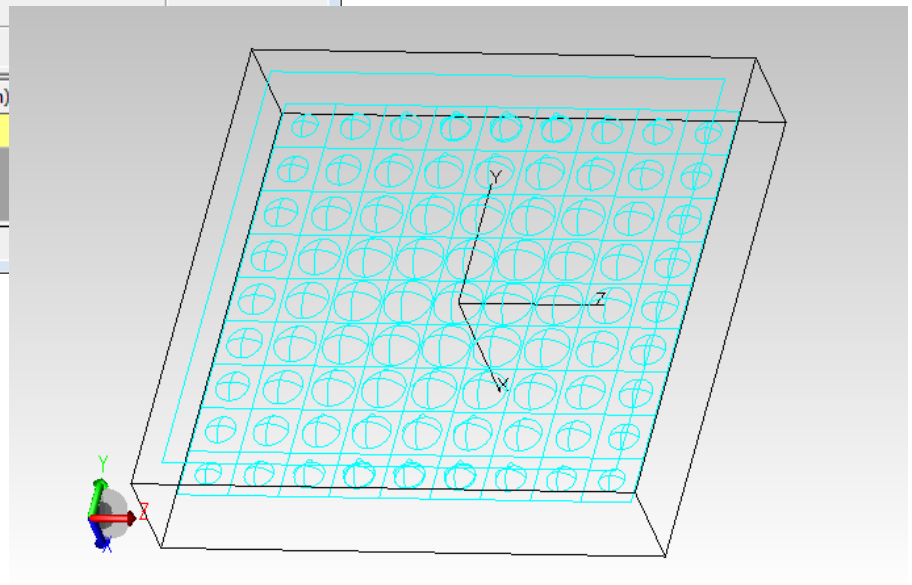
- Constant - Enter data for one tile and it is repeated
- Variable ring/row - Enter data for all tiles for each row. Each row has all the same tiles
- Parameterized - Enter a formula for each geometry dimension and tile dimension
- Texture - Each geometry feature is placed free-form, by entering the coordinates and dimensions in a txt file

TracePro

TracePro RepTile Property

Parameterized RepTile Variation Type Example



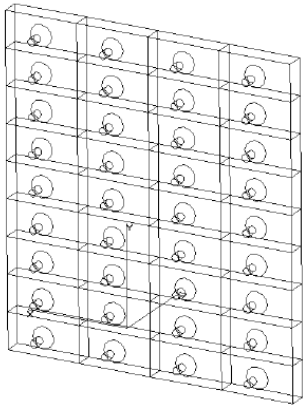


Height varying vs. column # and radius varying vs. row #

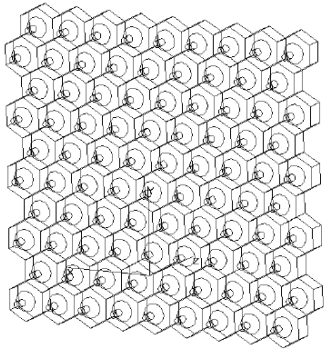
TracePro

TracePro RepTile Property

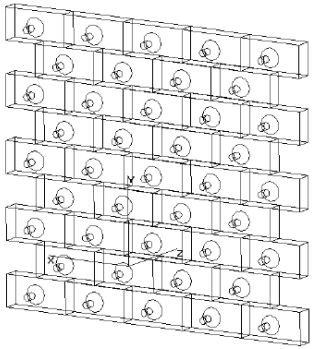
RepTile Tile Types



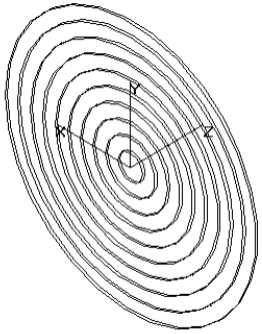
Rectangular Tile



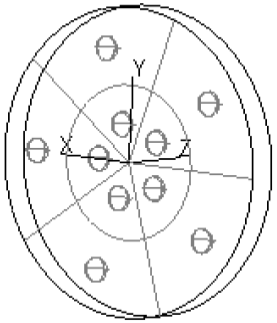
Hexagonal Tile



Staggered Rectangular Tile



Ring Tile

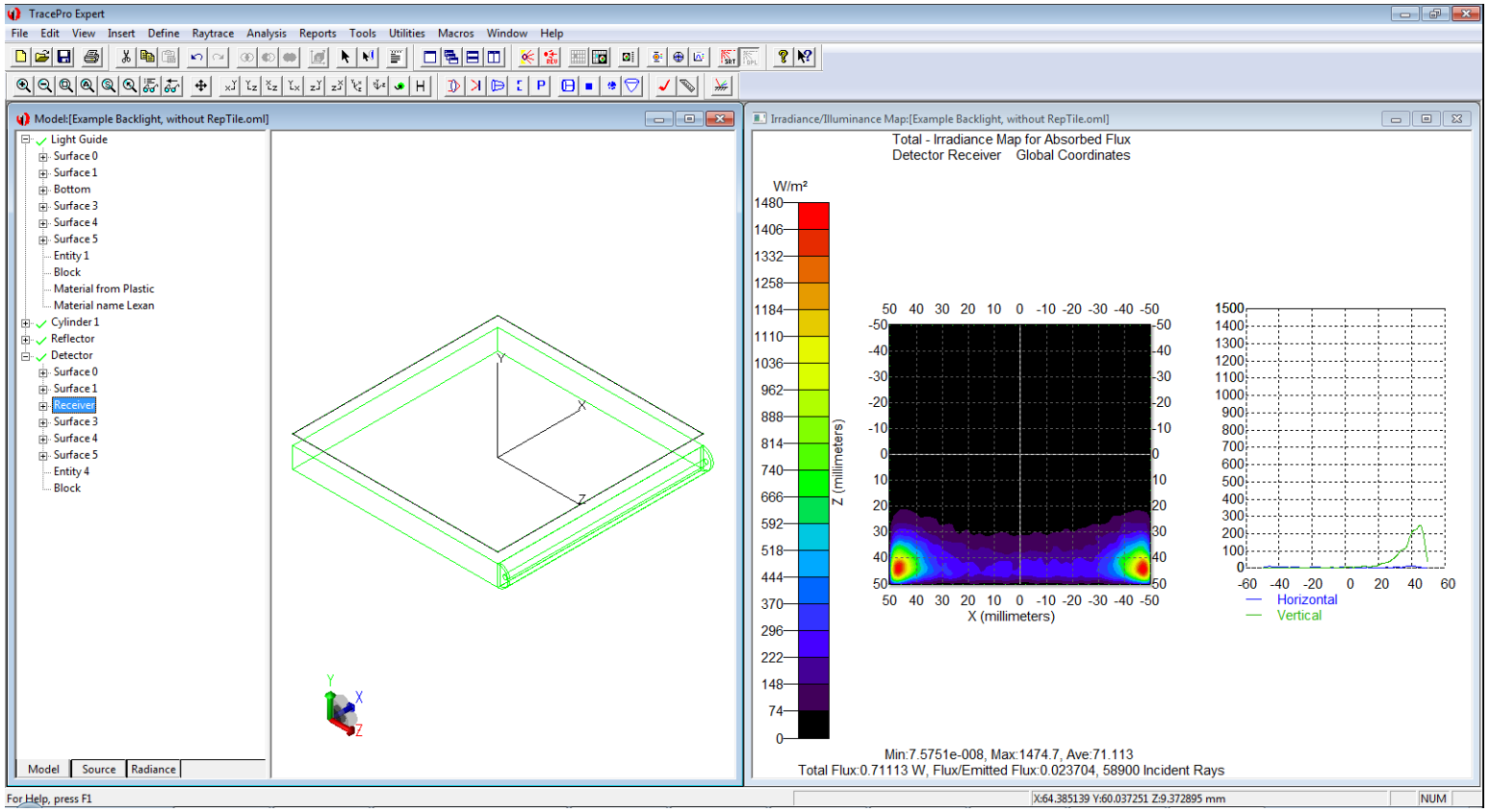


Staggered Ring Tile

TracePro

TracePro RepTile Property

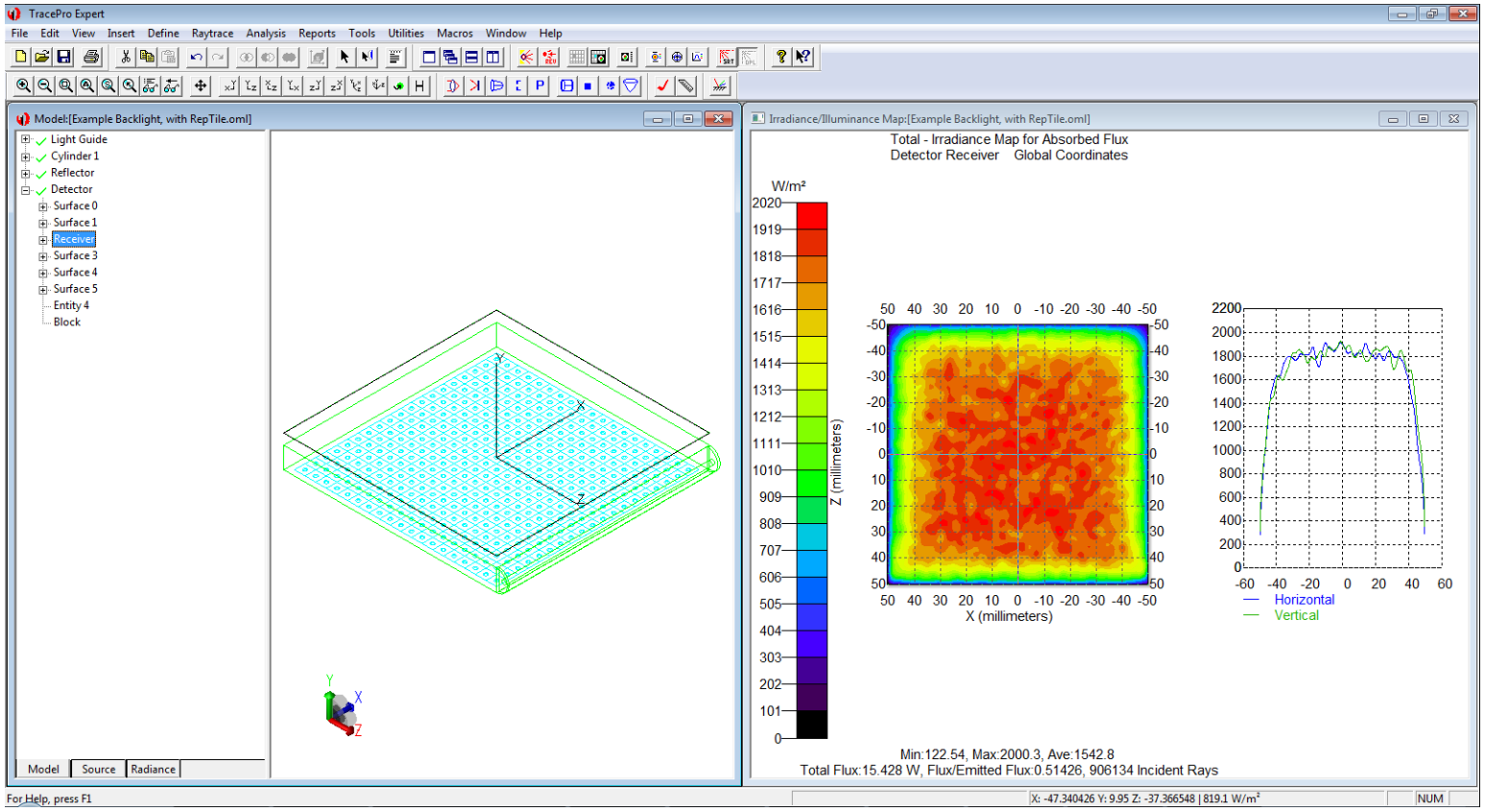
RepTile Examples – Backlight with no texture applied to bottom surface for light extraction



TracePro

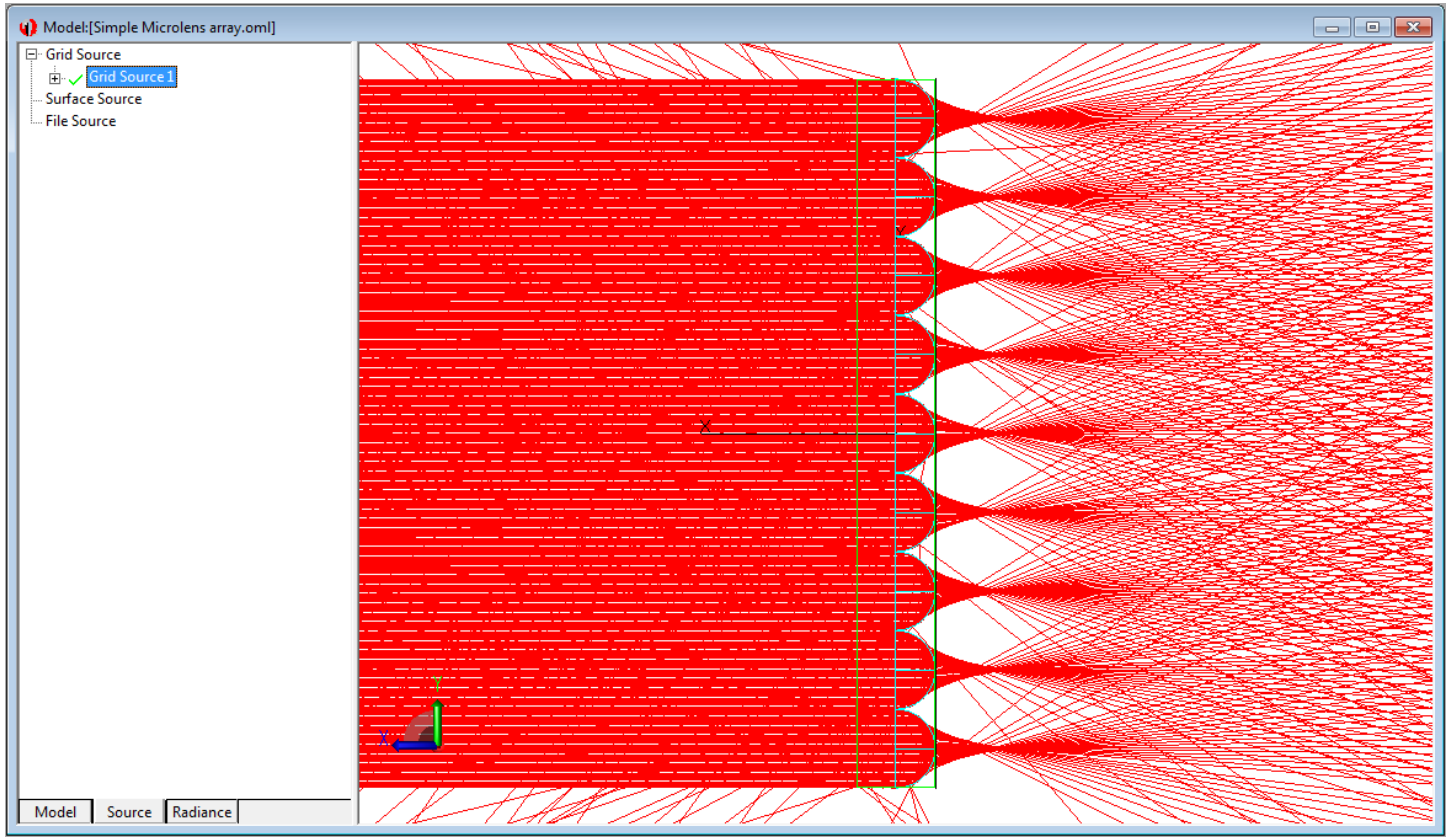
TracePro RepTile Property

RepTile Examples – Backlight with RepTile texture applied to bottom surface for light extraction



TracePro RepTile Property

RepTile Examples – PMMA Plastic Microlens Array made using RepTile Property



TracePro RepTile Property

RepTile Texture File

- Allows the User to define the location and feature type explicitly for each feature of the RepTile surface
- Allows mixing and matching of feature types. For example, a combination of spheres and cones could be defined
- Allowable geometry types: Sphere, Cone, Hip Roof, Ellipsoids, Enhanced Prism, Log, Flattened Cone, Pointed Cone, DMD Mirror, Block, Chiseled Log, Torus, Polygon
- Can be Bump or Hole
- Full description starting on page 7.108 of the TracePro User Manual

TracePro RepTile Property

RepTile Texture File

RepTile Texture File

Filename: C:\Users\djacobsen\Documents\Webinars\September 2011 Webinar, RepTile\Models

Date: 3/31/2010 12:00:00 AM

Version: 1.0

Texture Type: 0

Texture Features

3	-1	0	0	0.75	0.75			
3	-1	4	4	0.5	0.5			
3	-1	-4	-4	0.5	0.5			
3	-1	-4	4	0.5	0.5			
3	-1	4	-4	0.5	0.5			
2	-1	2	2	1	0.1	45	0	0
2	-1	-2	-2	1	0.1	45	0	0
2	-1	-2	2	1	0.1	45	0	0
2	-1	2	-2	1	0.1	45	0	0

X-center

Y-center

Feature parameters. Options will vary with feature selected.

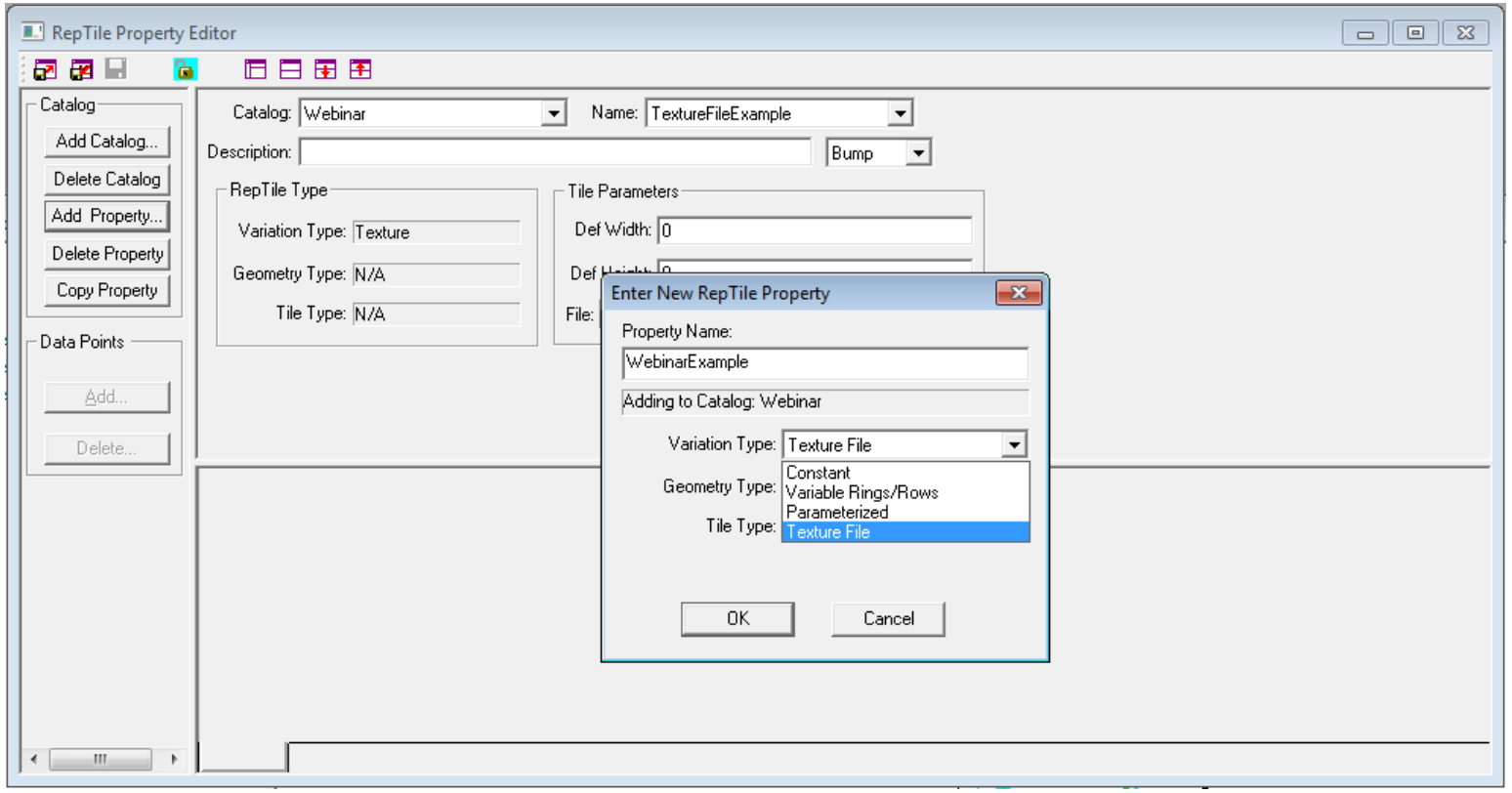
Bump or Hole: 1 = Bump, -1 = Hole

Feature type: 3 = Sphere, 2 = Cone

TracePro

TracePro RepTile Property

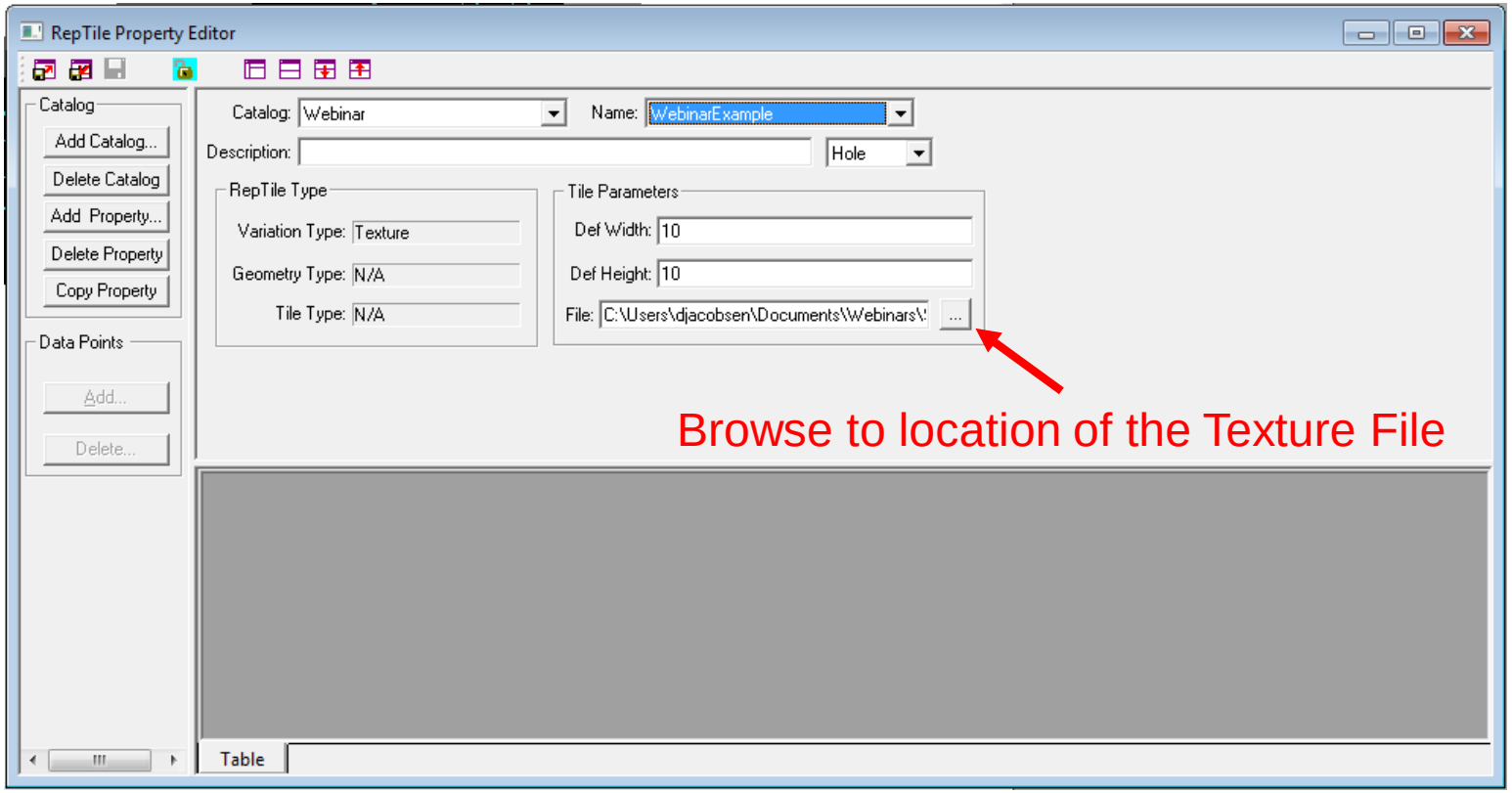
New RepTile property using the Texture File



TracePro

TracePro RepTile Property

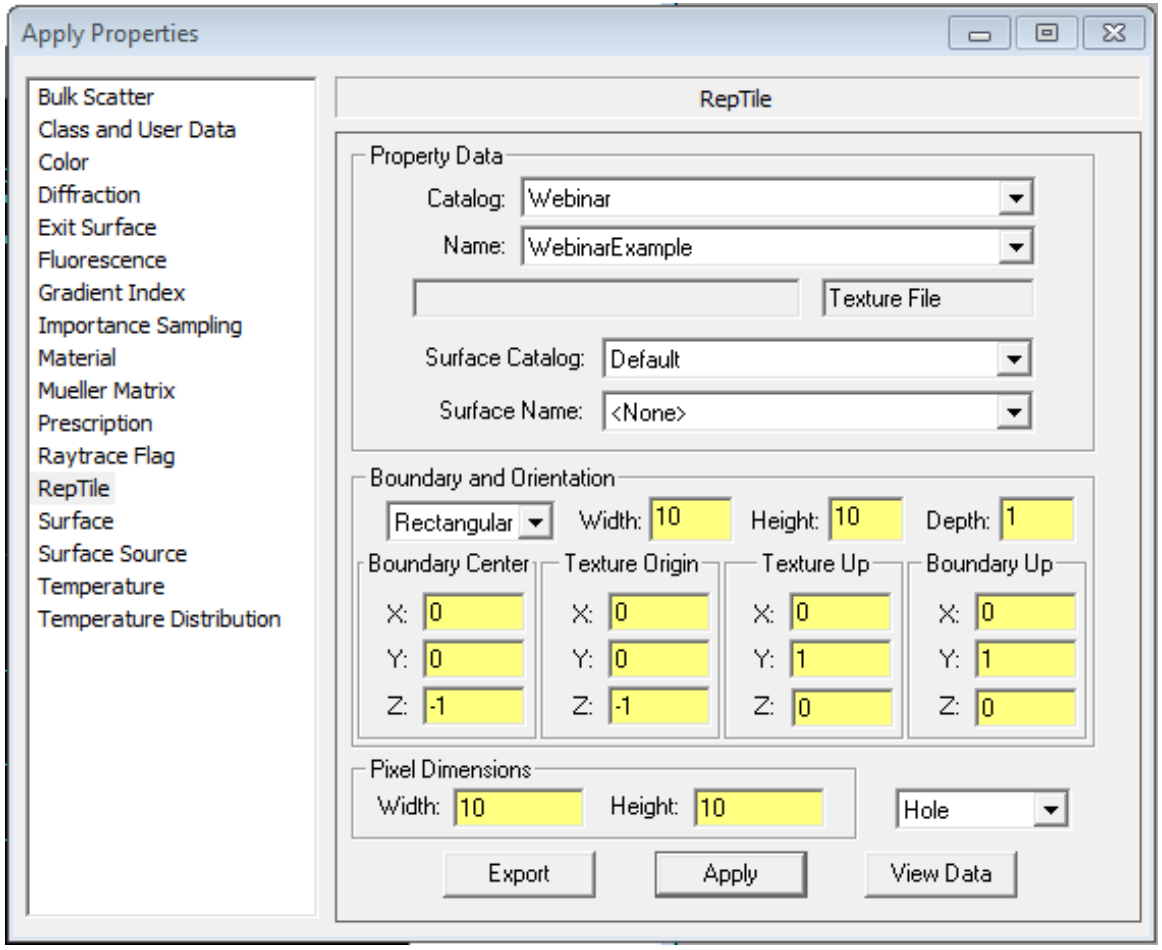
New RepTile property using the Texture File



TracePro

TracePro RepTile Property

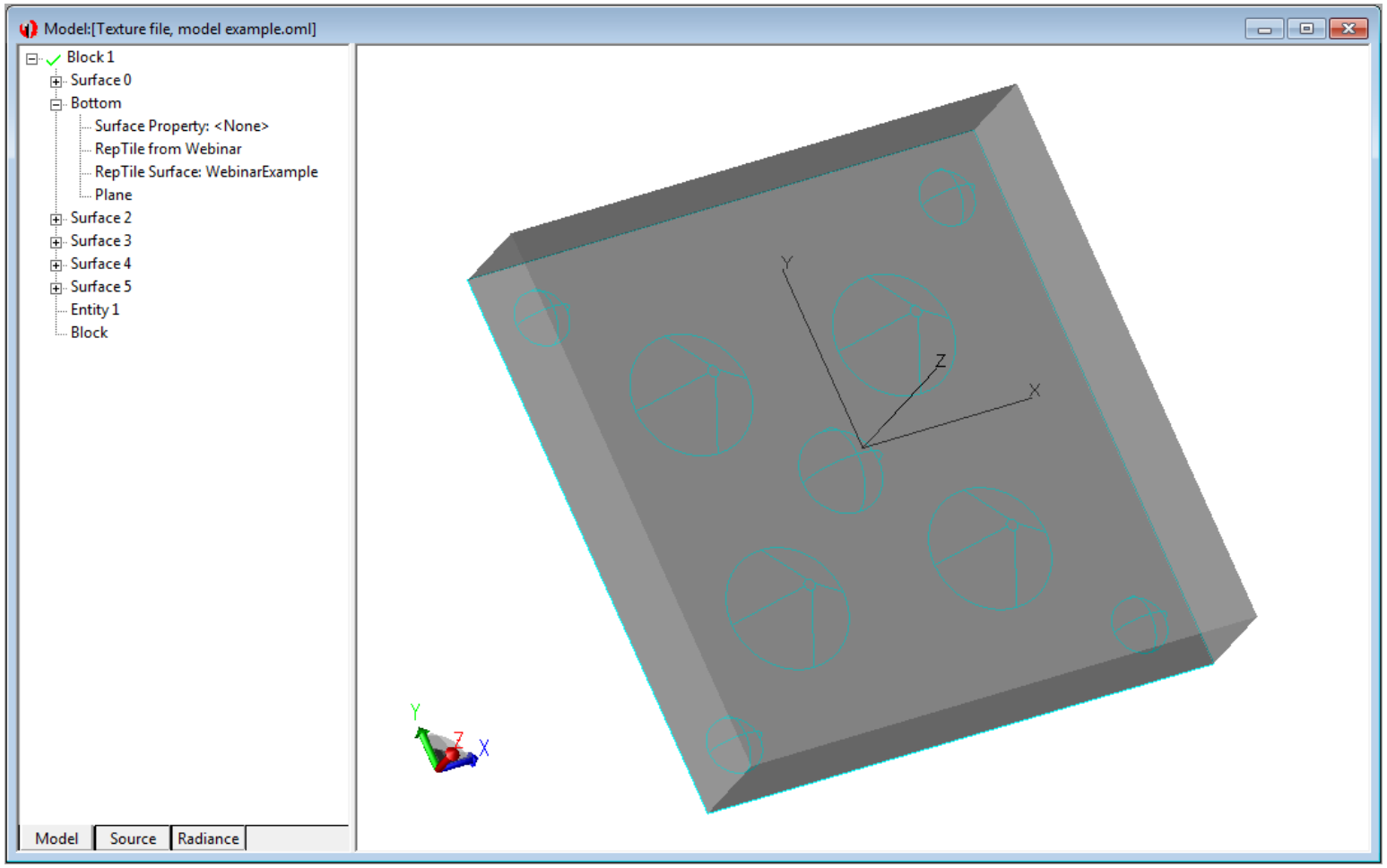
Applying the RepTile property



TracePro

TracePro RepTile Property

RepTile property applied to surface in TracePro



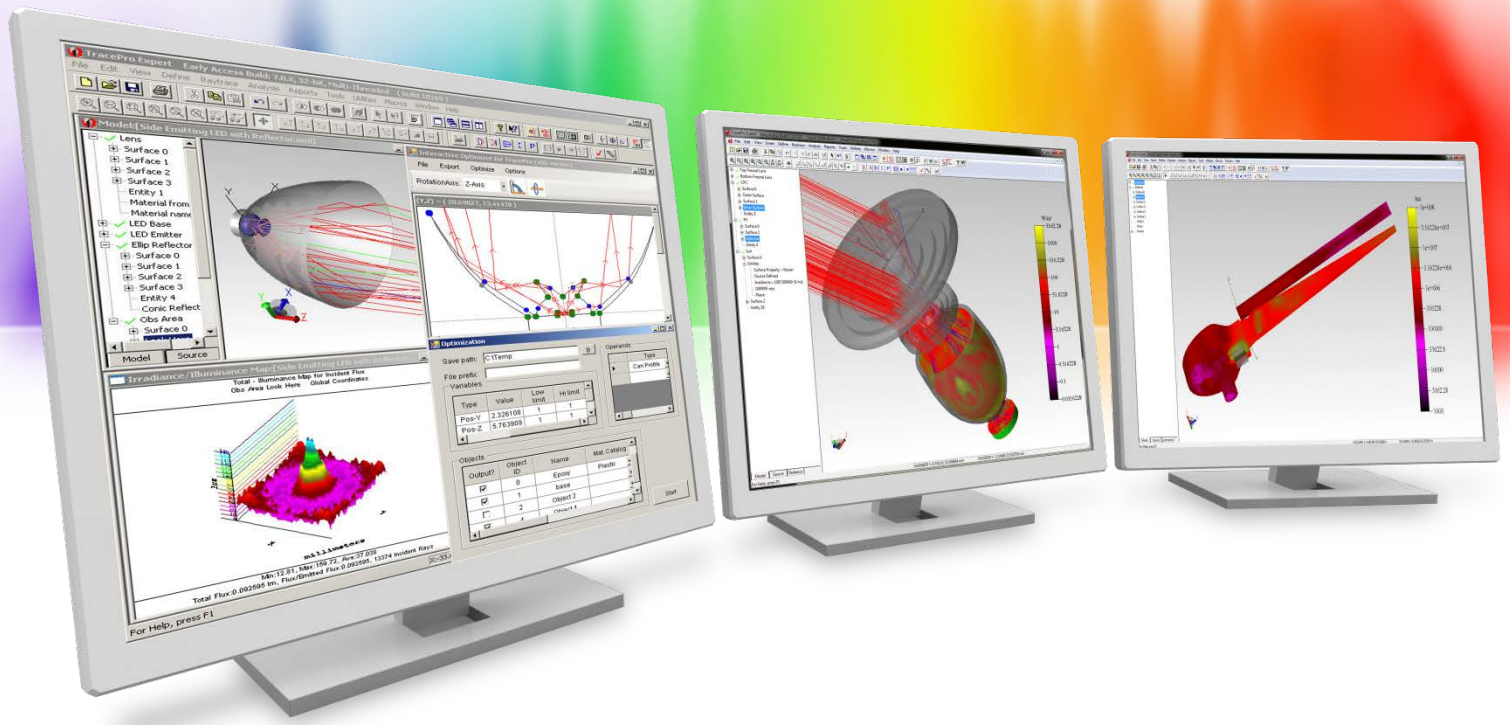
TracePro

TracePro RepTile Property

RepTile Summary

- RepTile allows you to create repetitive structures quickly and easily
- Numerous geometry types are available
- Several variations are available for tile positioning
- Model sizes are greatly reduced and raytrace times can be faster
- Geometry is easily changed by editing the RepTile property file
- Texture File allows you to explicitly define feature types and location and allows mixing and matching of feature types

TracePro



TracePro Texture Optimizer II

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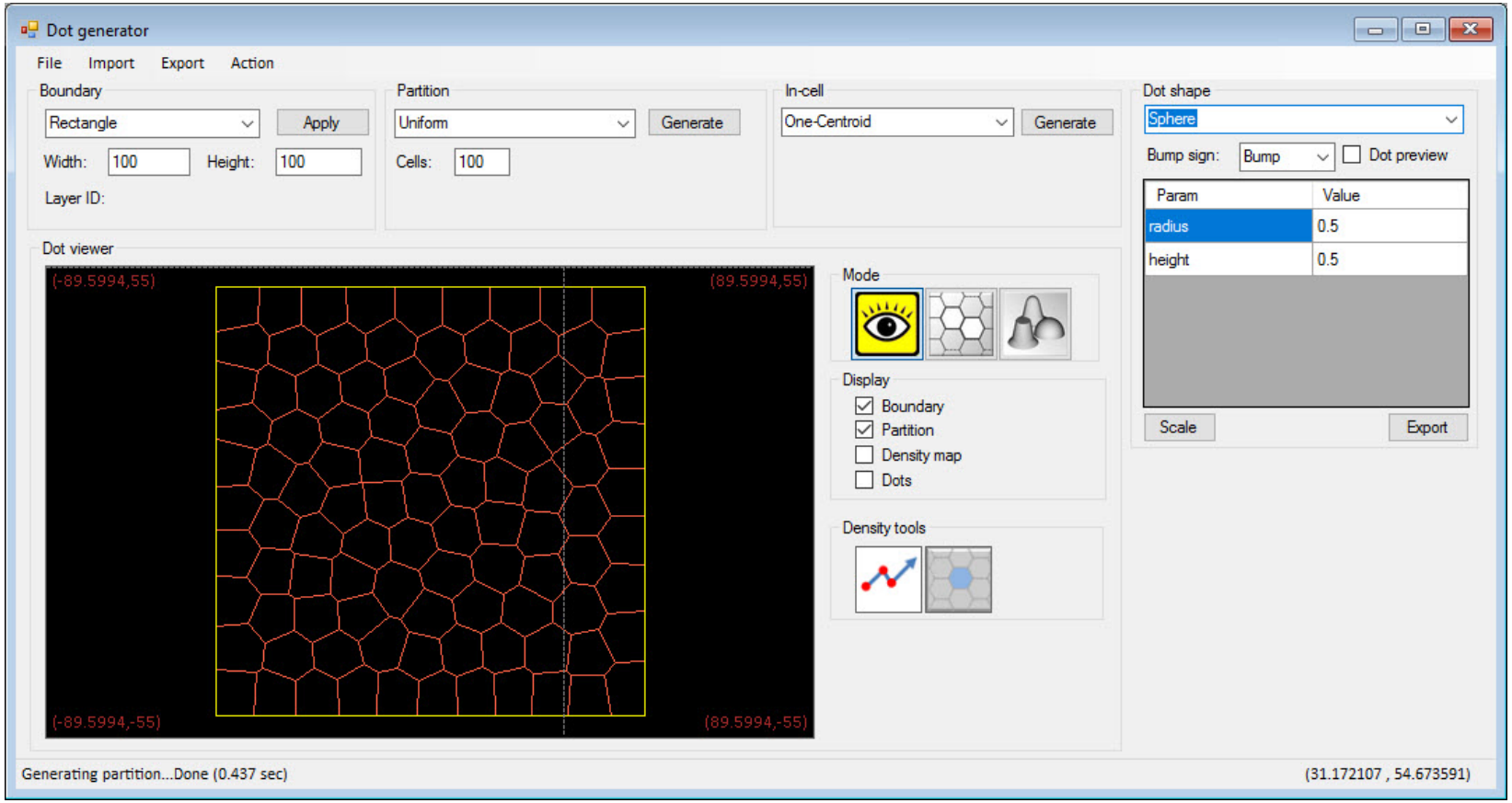
TracePro Texture Optimizer II

What is the Texture Optimizer II

- Included with TracePro Expert in the Optimize menu
- Used with the RepTile property in TracePro
- Allows the user to define the surface boundary for the RepTile, the surface partitioning, the method for filling the cells, and the RepTile feature type
- The surface boundary can be defined using the name of the surface in TracePro, this allows for complex surface boundaries
- Surface partitioning options include uniform, grid, and ring options
- Numerous options are available for filling the cells
- 12 RepTile feature types available for use
- 2 main parts, the Dot Generator and the Optimization windows

TracePro Texture Optimizer II

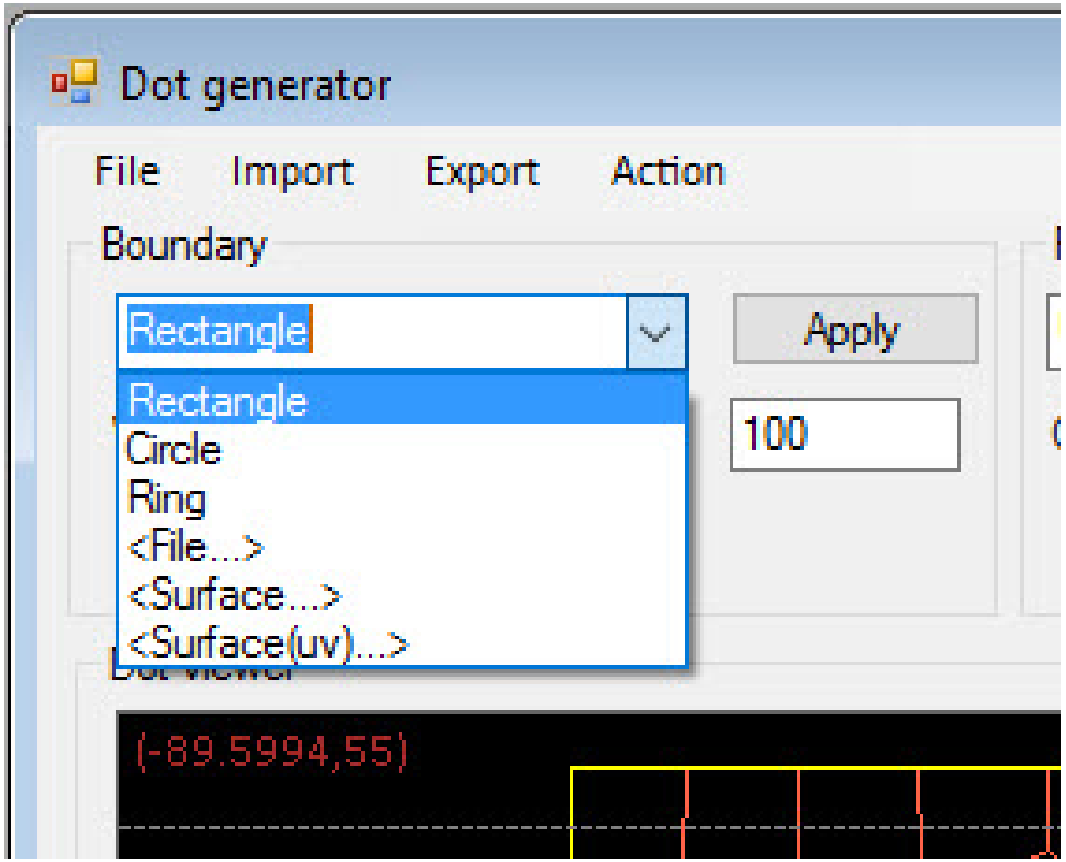
Dot Generator window



TracePro

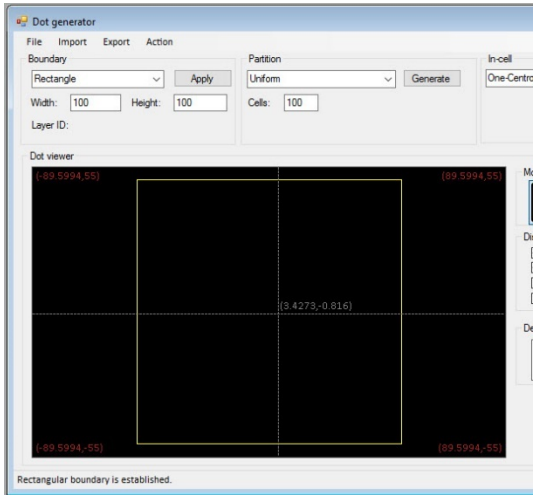
TracePro Texture Optimizer II

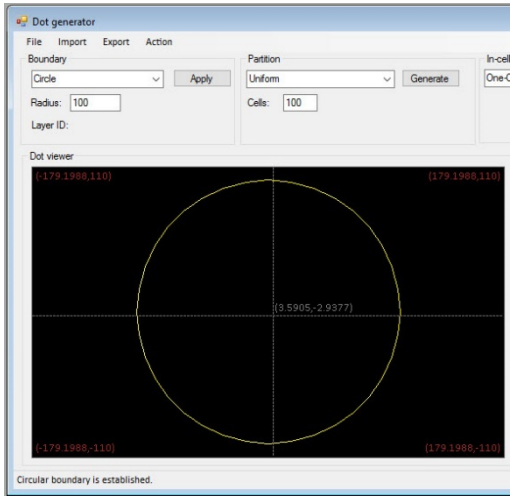
Boundary Options

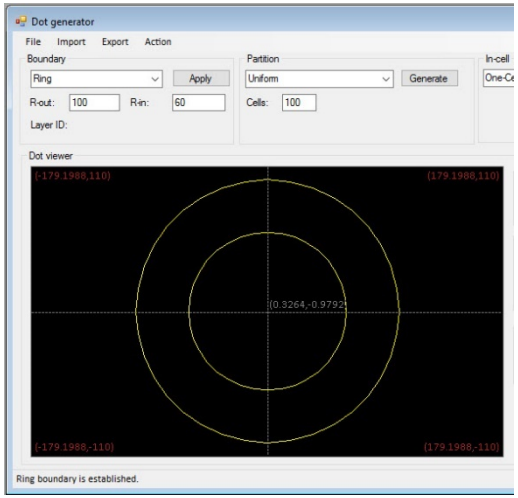


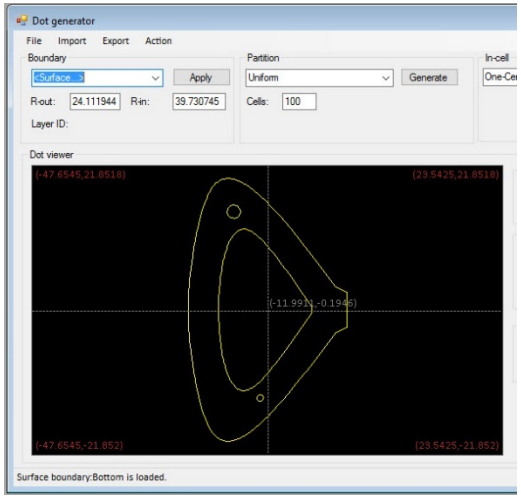
TracePro Texture Optimizer II

Boundary Options









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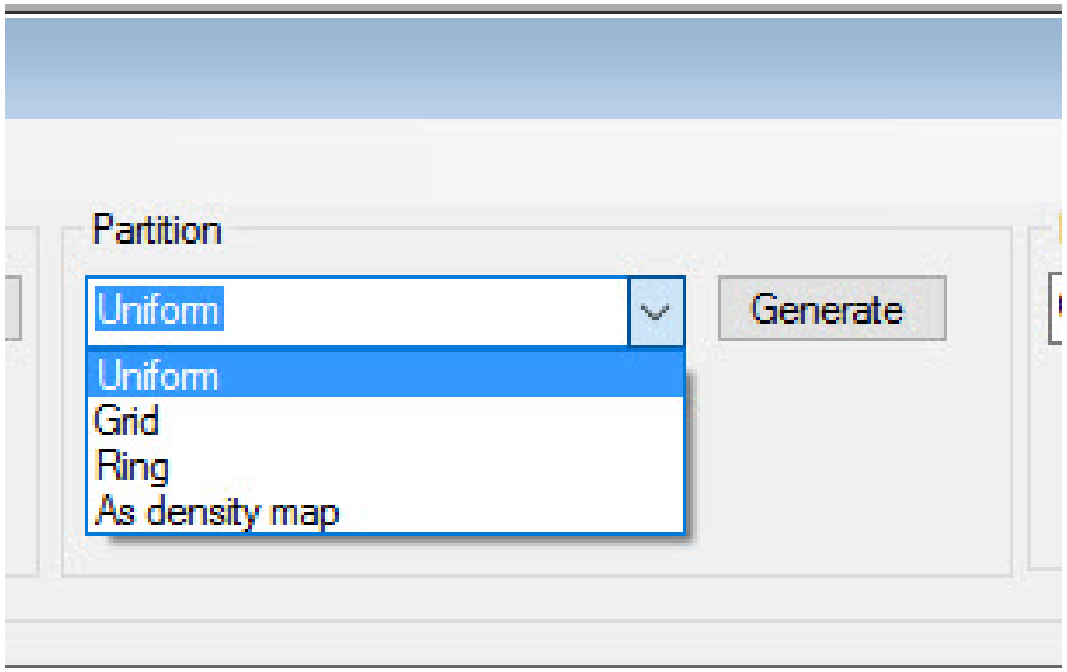
TracePro Texture Optimizer II

Partition Options



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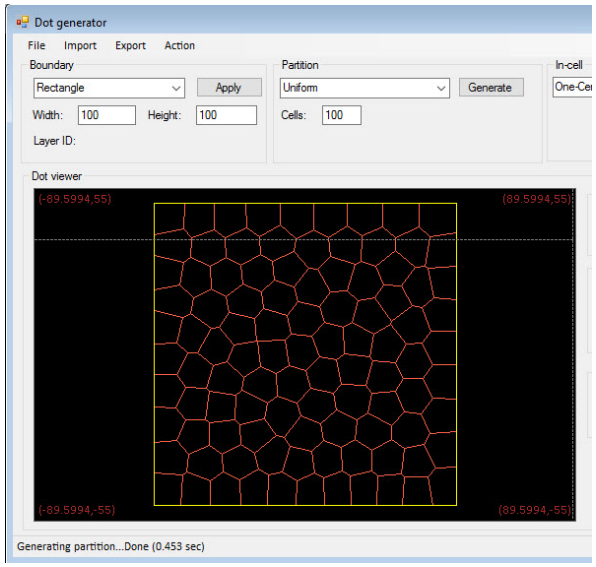
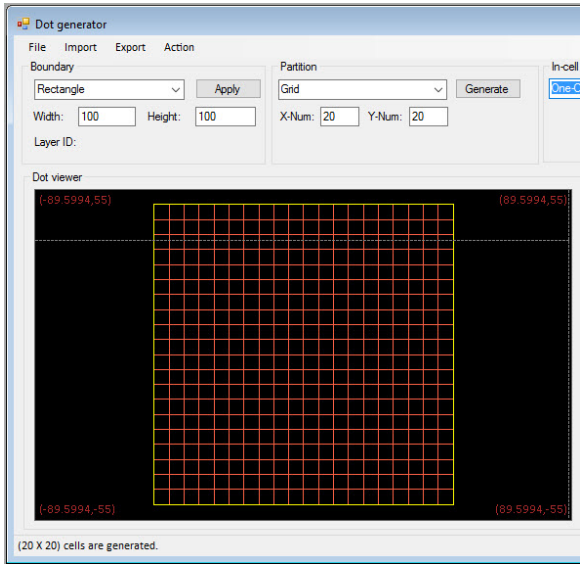
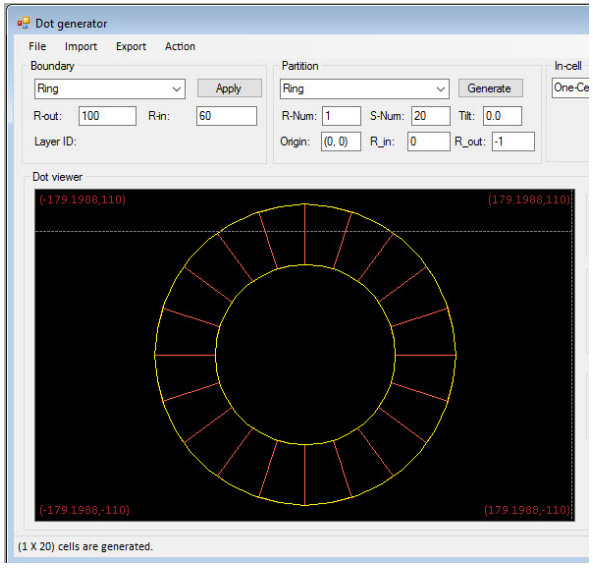
TracePro Texture Optimizer II

Partition Options



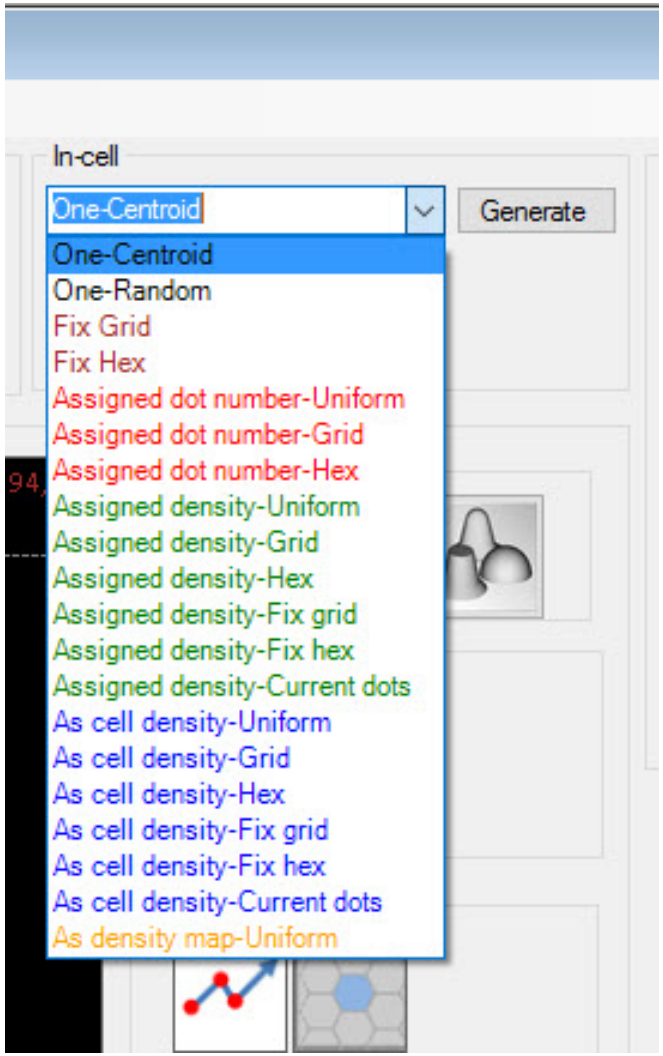




TracePro

TracePro Texture Optimizer II

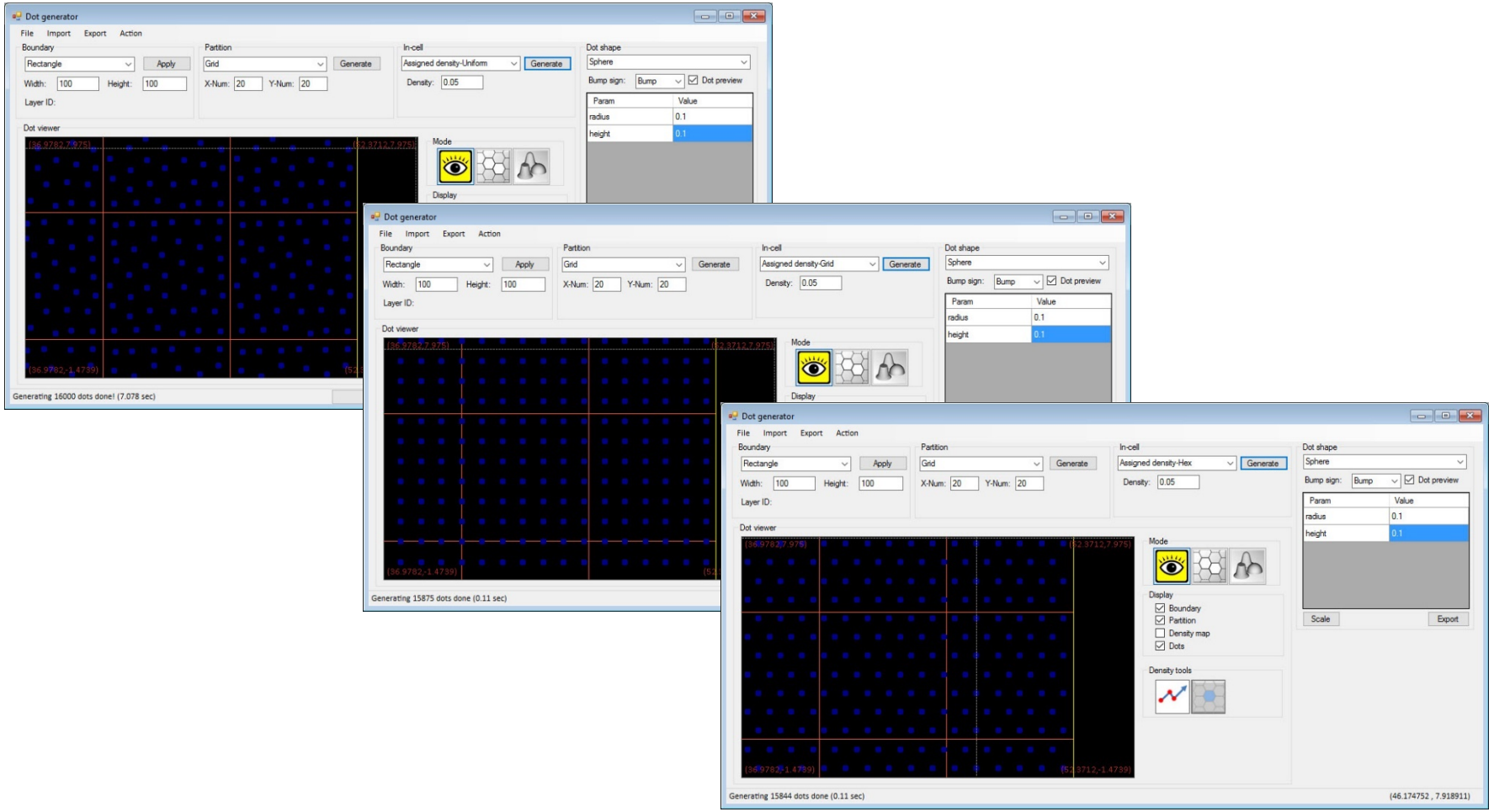
In-cell fill options



TracePro

TracePro Texture Optimizer II

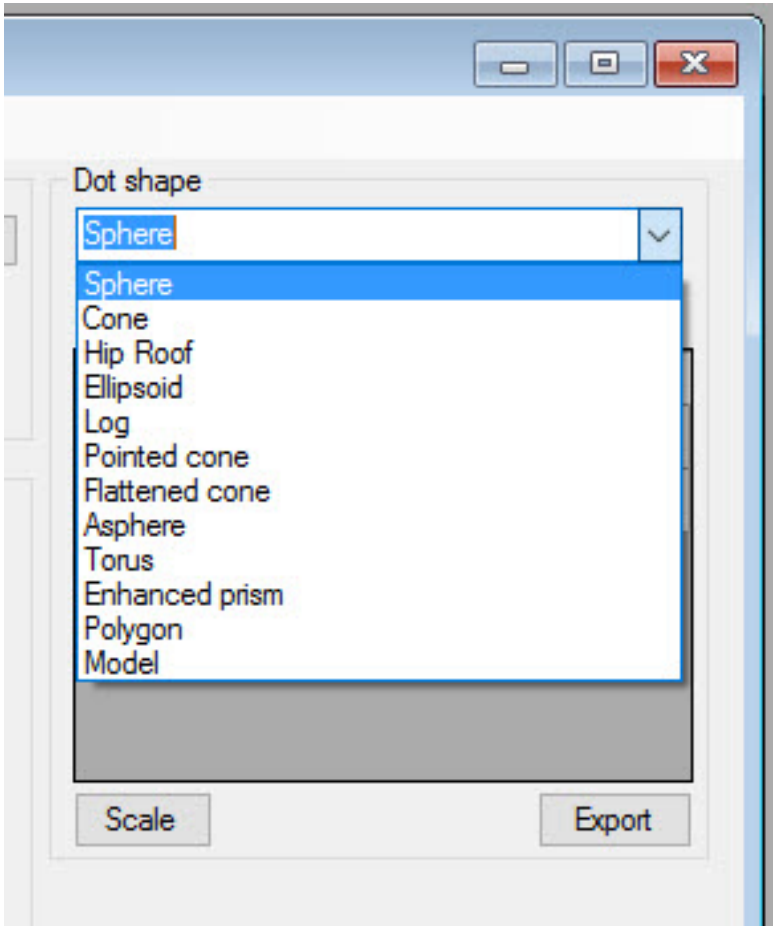
In-cell fill options



TracePro

TracePro Texture Optimizer II

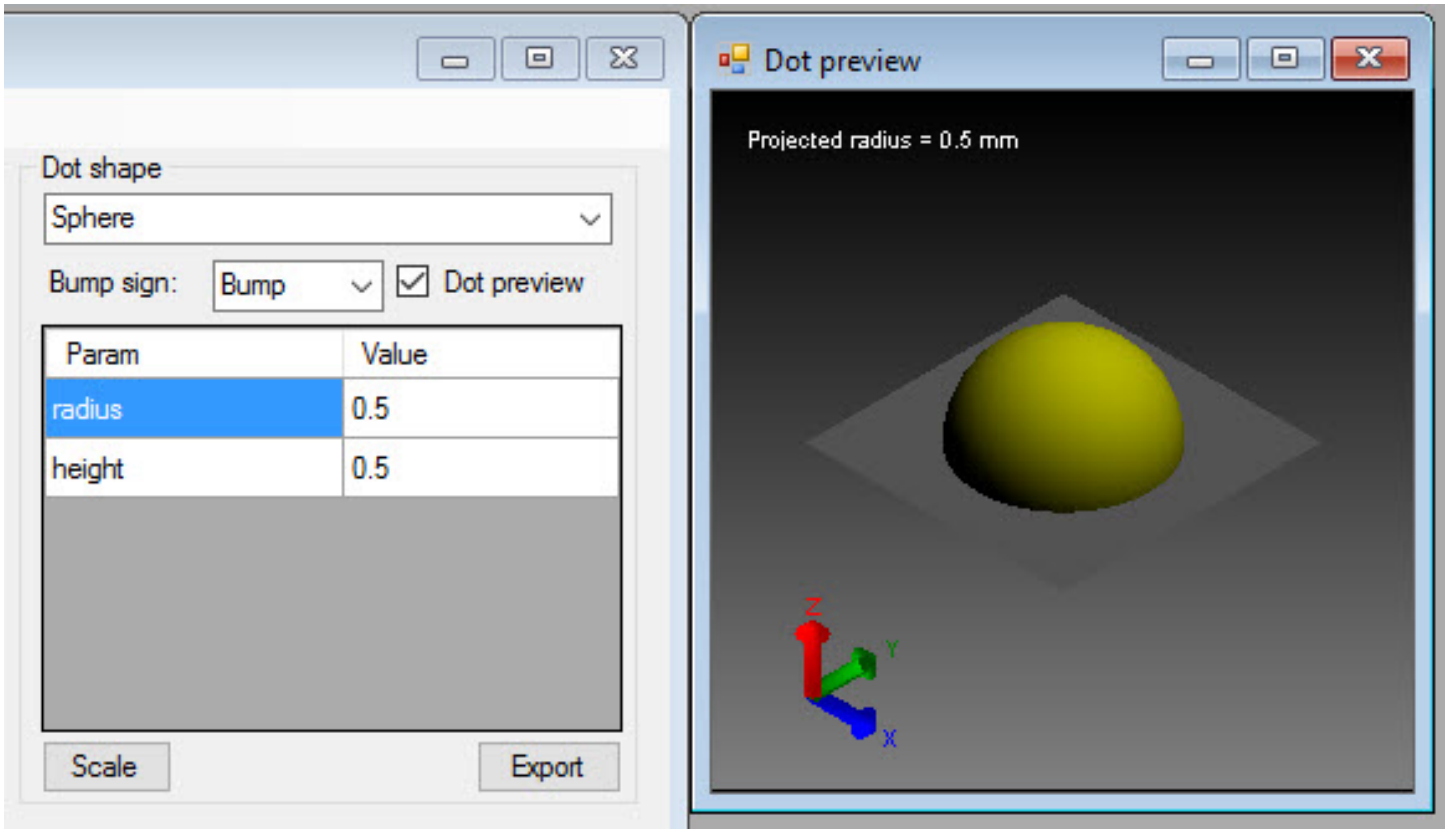
Dot shape options



TracePro

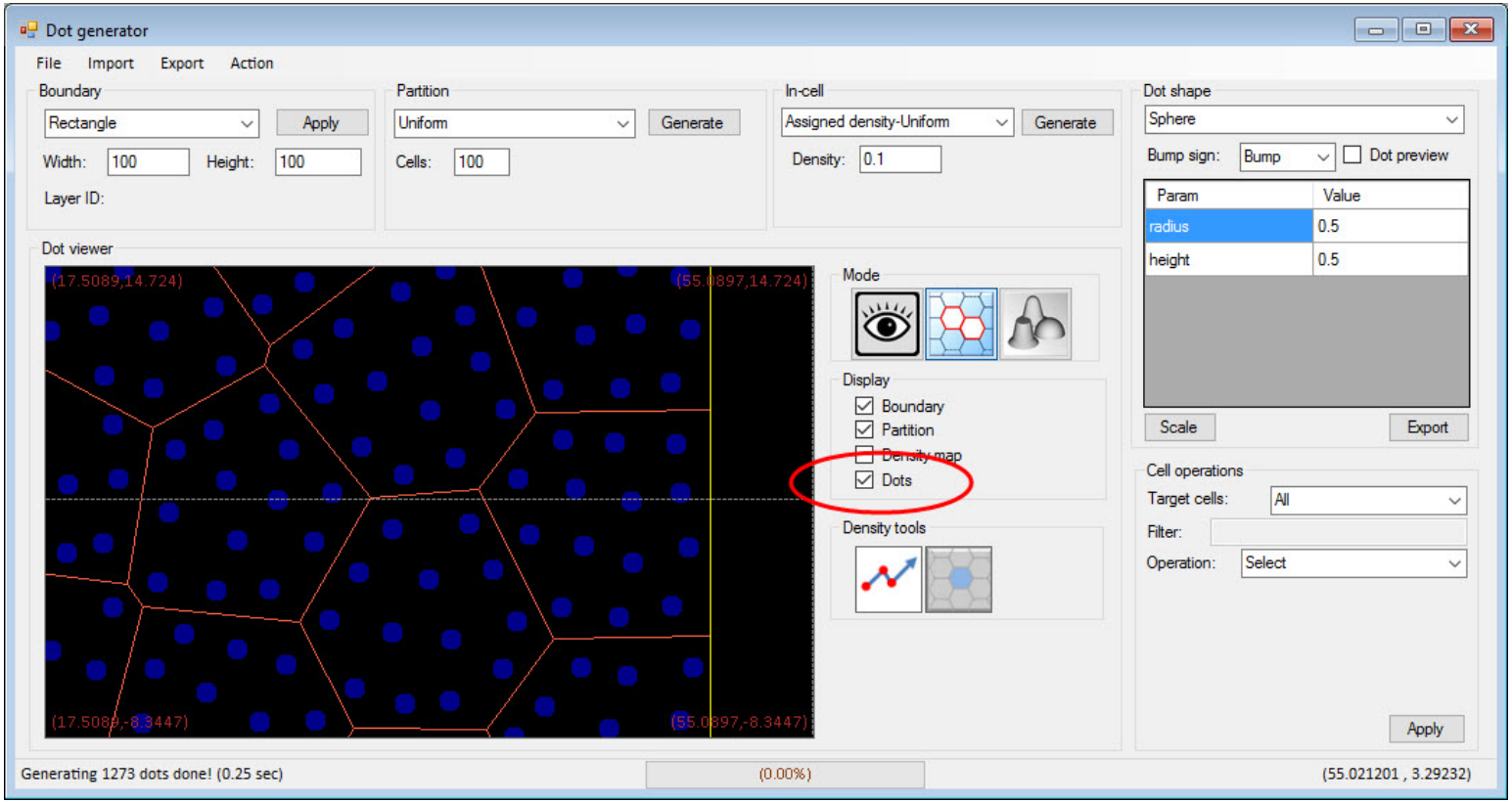
TracePro Texture Optimizer II

Dot shape options – Dot preview on



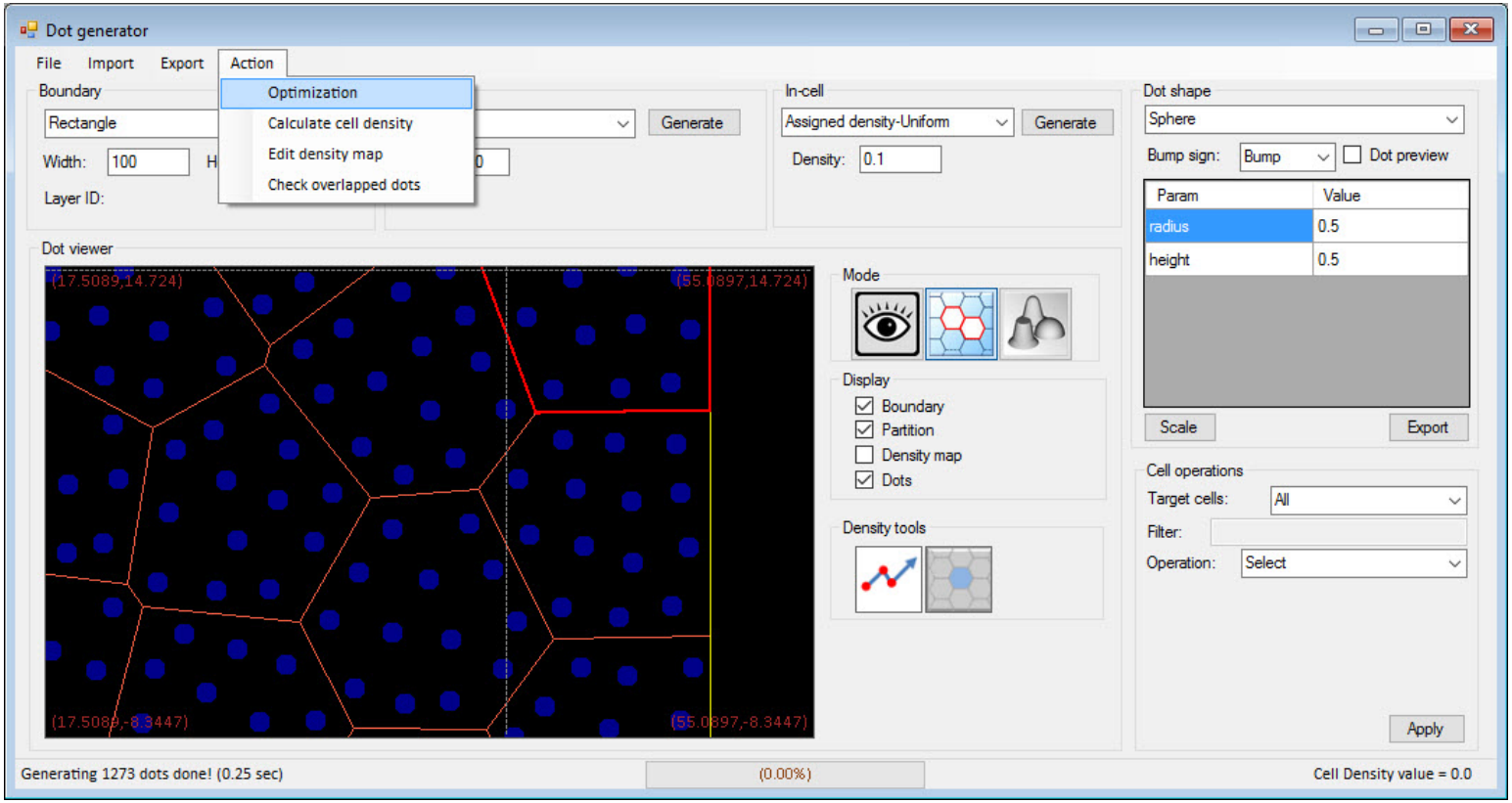
TracePro Texture Optimizer II

Dots display – on/off



TracePro Texture Optimizer II

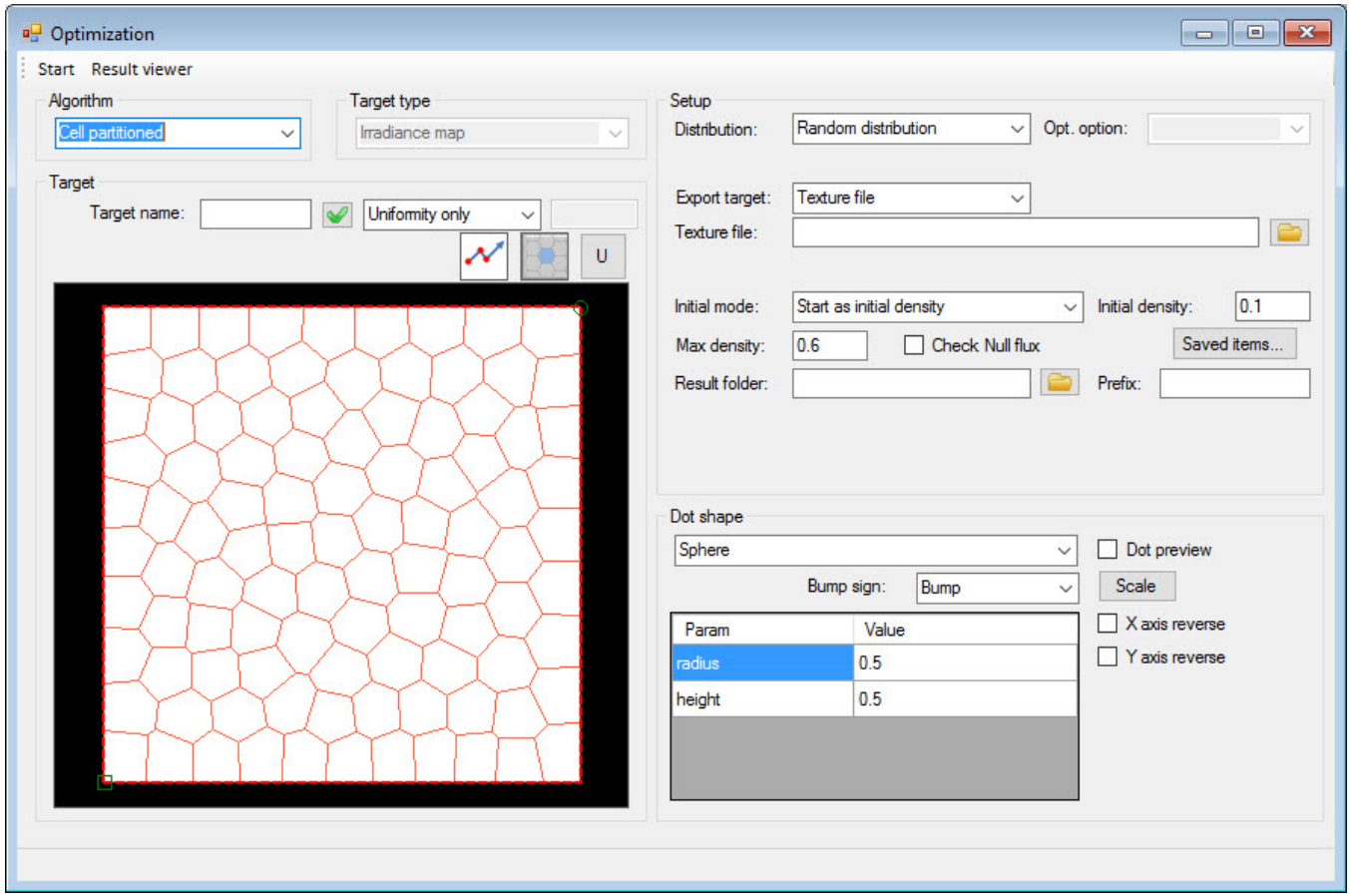
Optimization window



TracePro

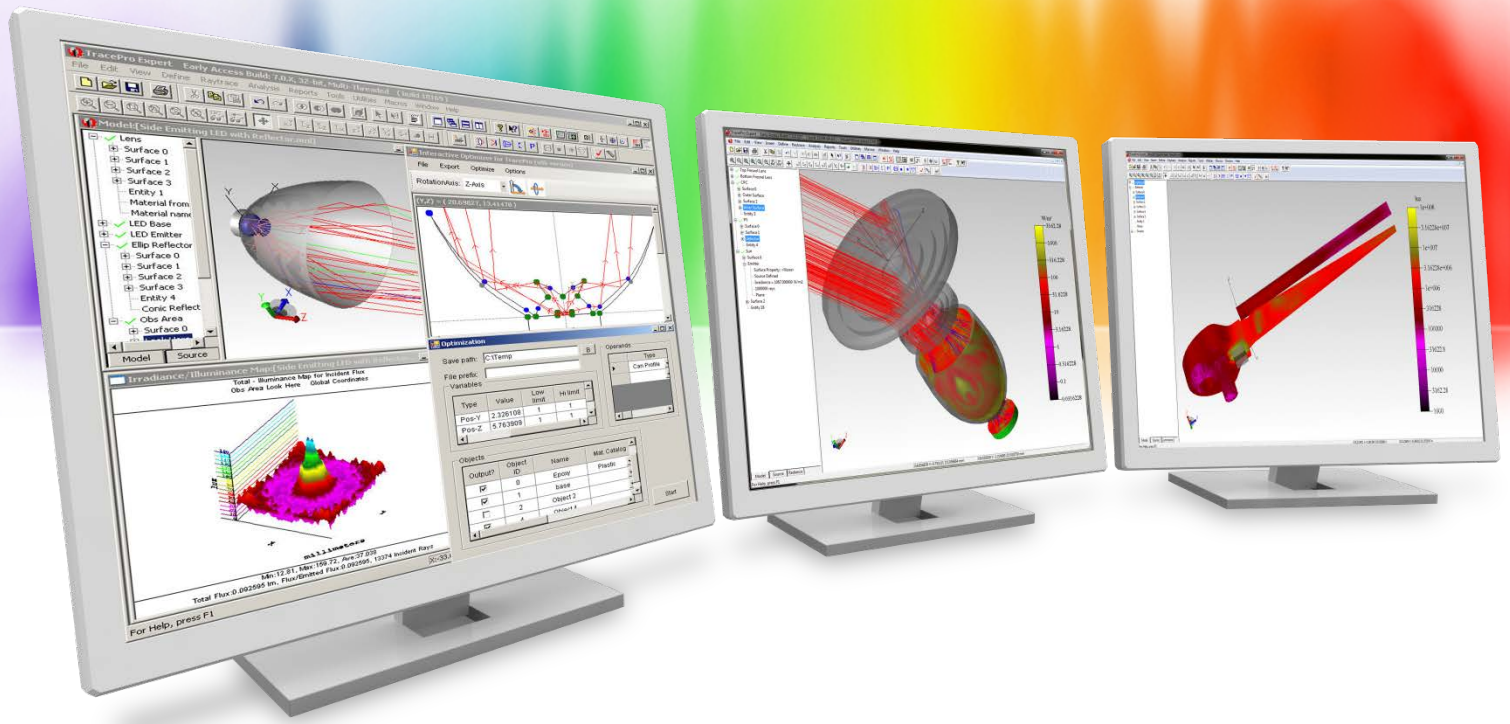
TracePro Texture Optimizer II

Optimization window



TracePro

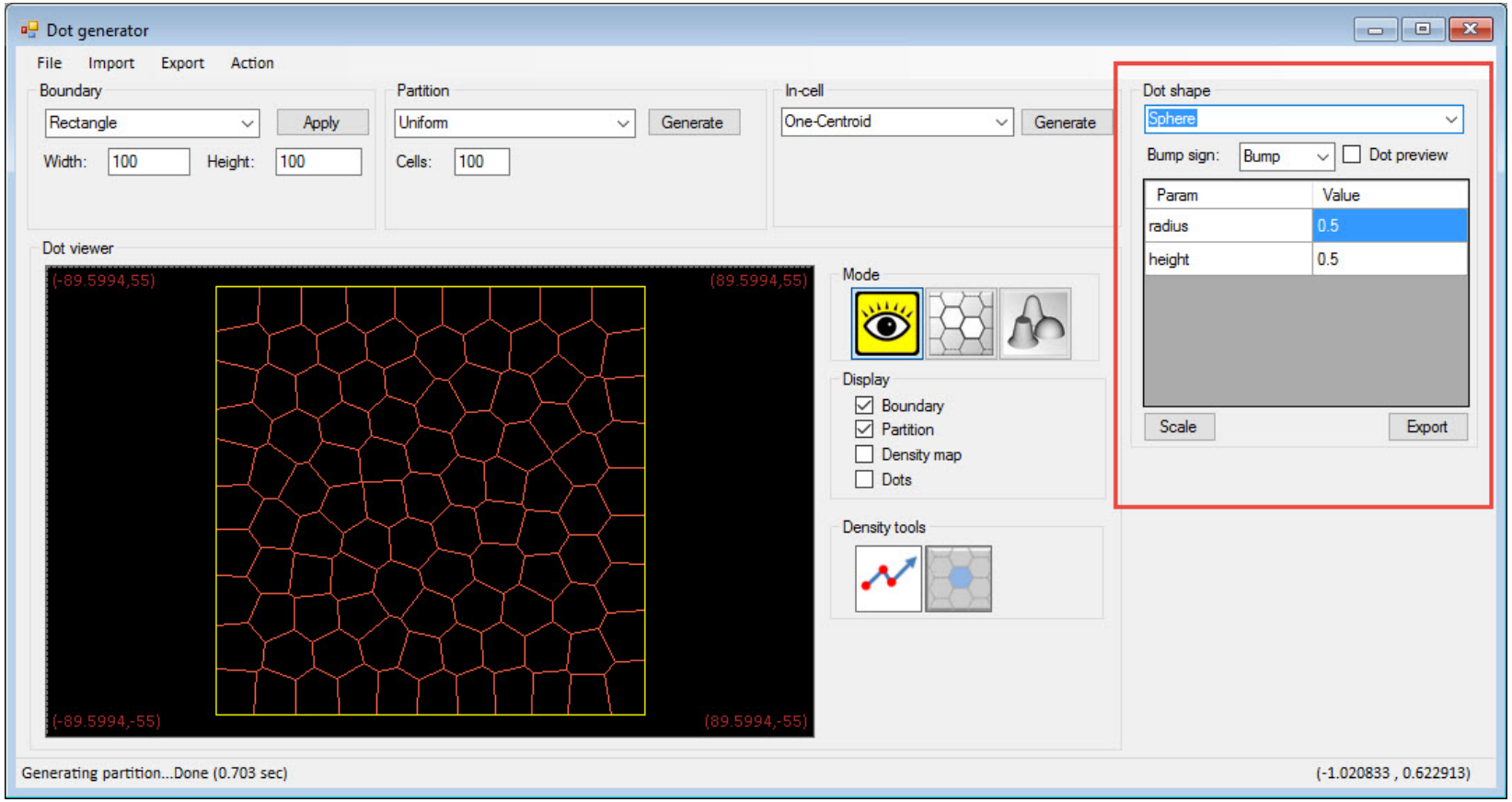
TracePro



Texture Optimizer II
- Texture Types

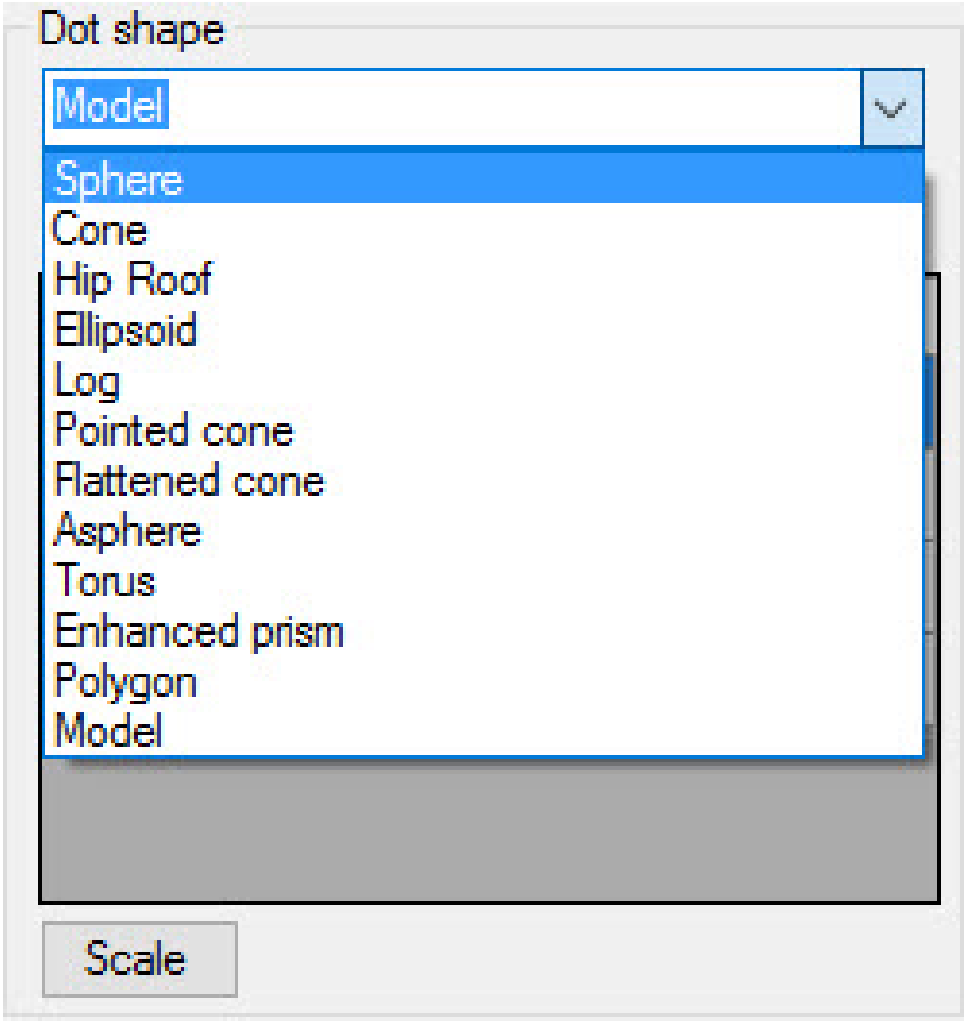
LAMBDA RESEARCH CORPORATION

Texture Optimizer II – Texture Types



TracePro

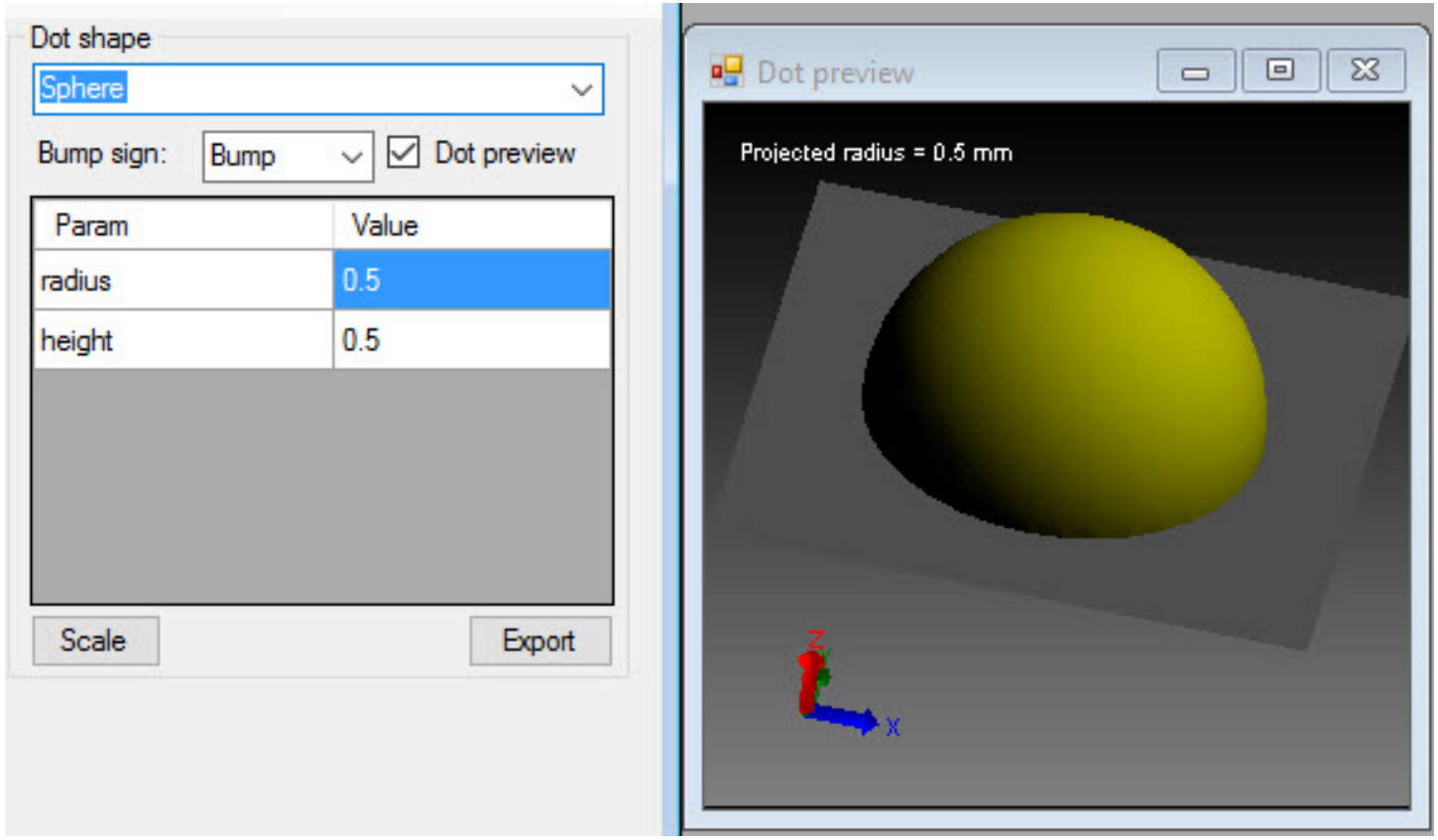
Texture Optimizer II – Texture Types



TracePro

Texture Optimizer II – Texture Types

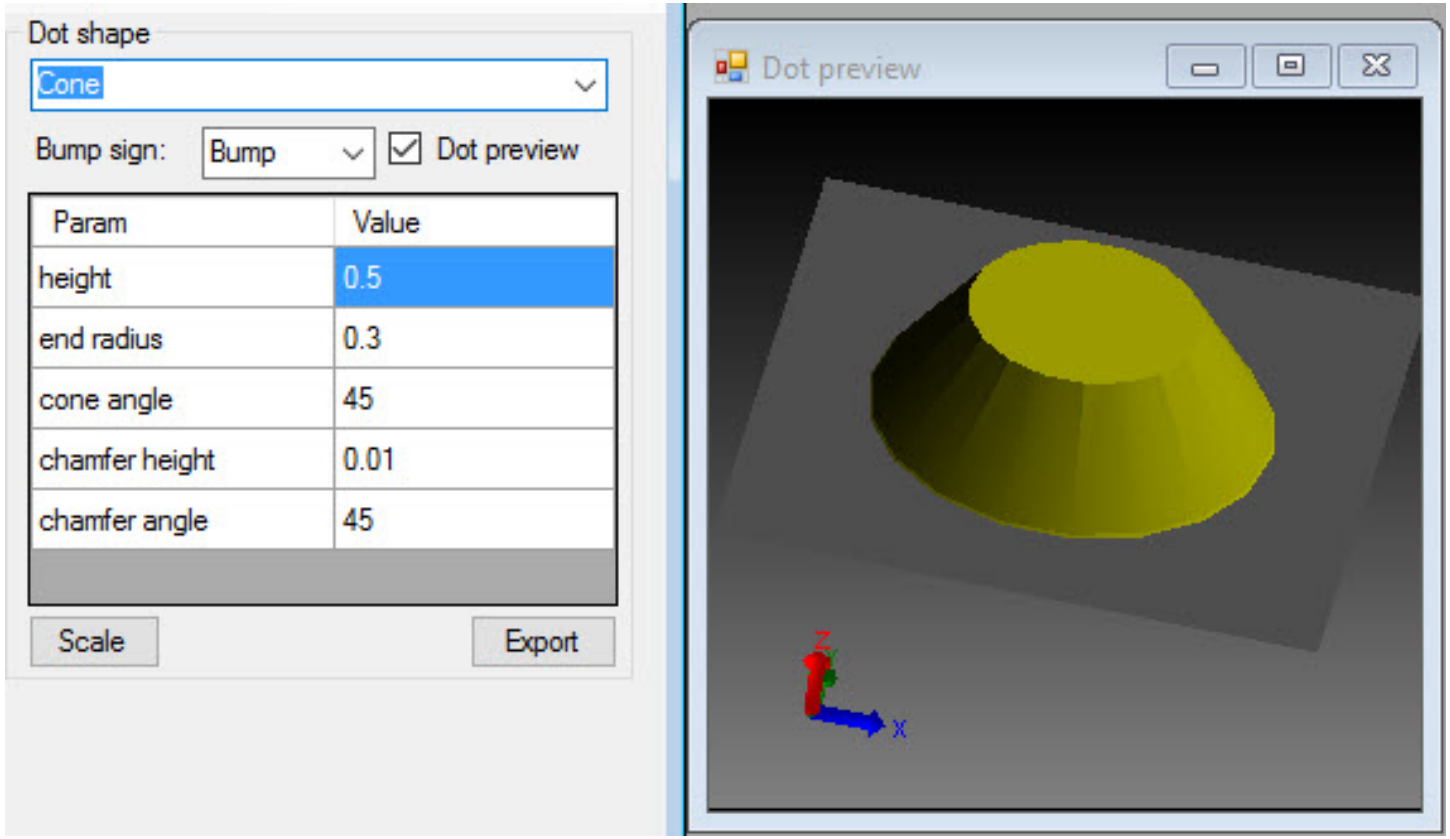
Sphere



TracePro

Texture Optimizer II – Texture Types

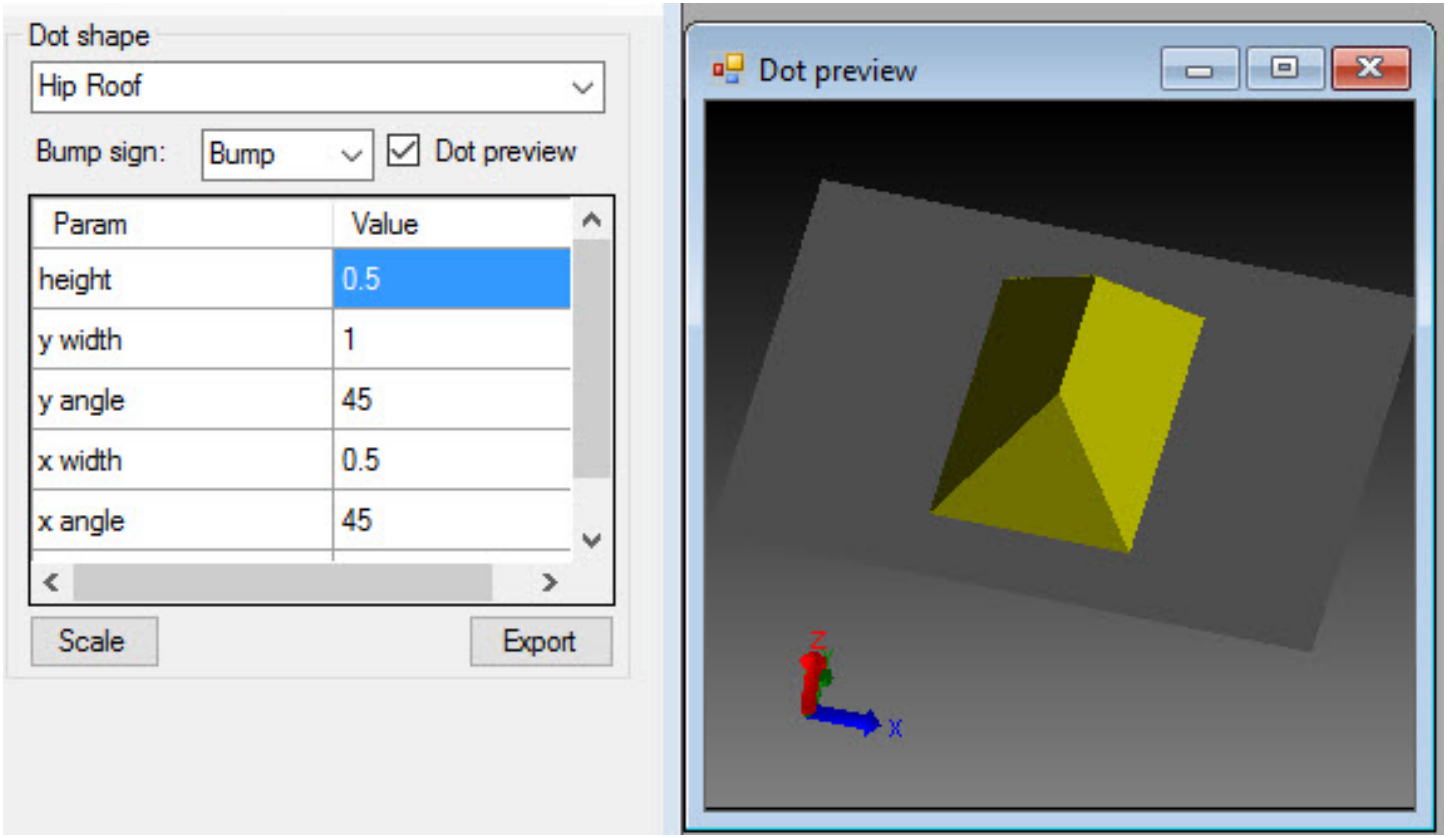
Cone



TracePro

Texture Optimizer II – Texture Types

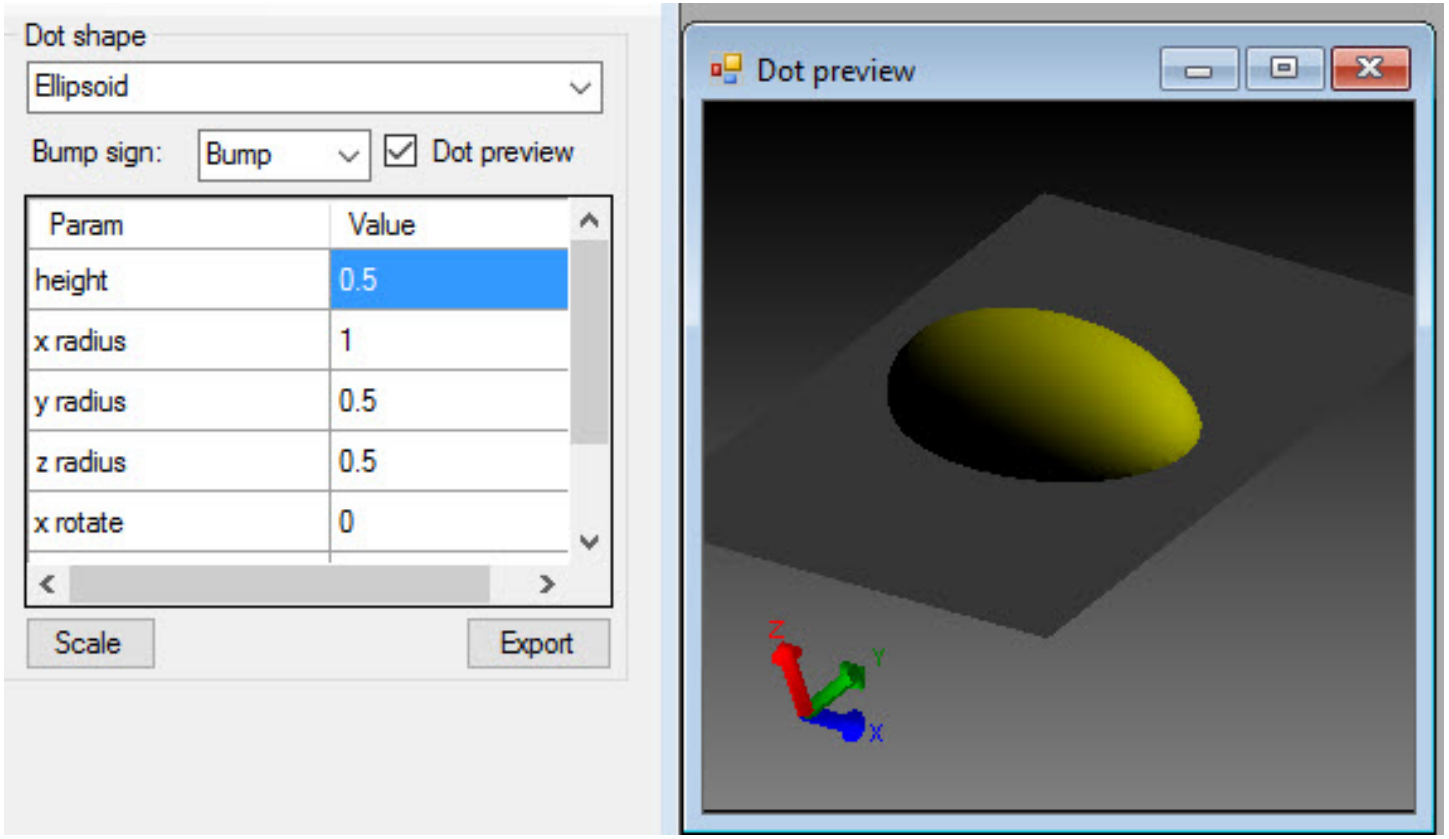
Hip Roof



TracePro

Texture Optimizer II – Texture Types

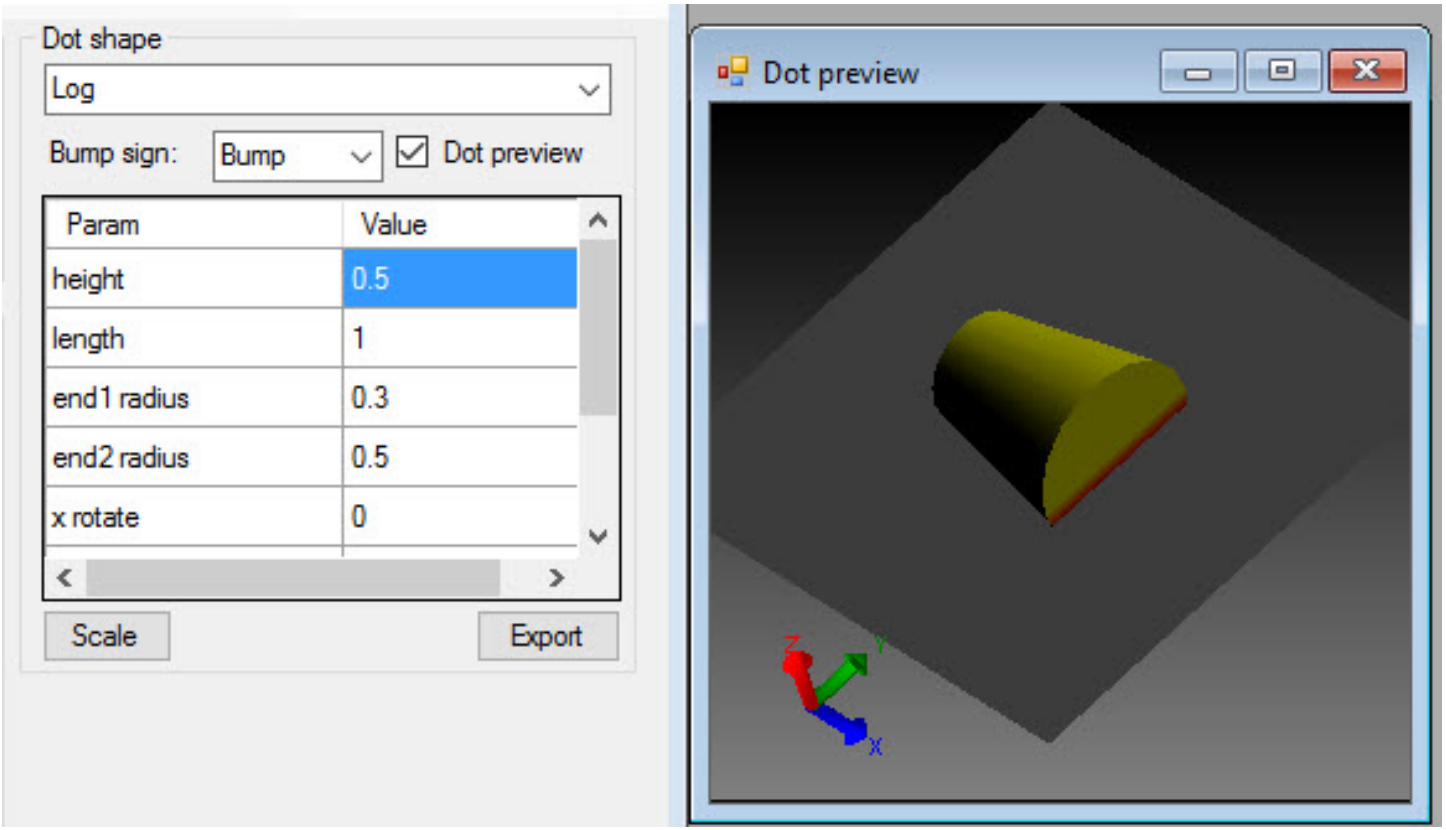
Ellipsoid



TracePro

Texture Optimizer II – Texture Types

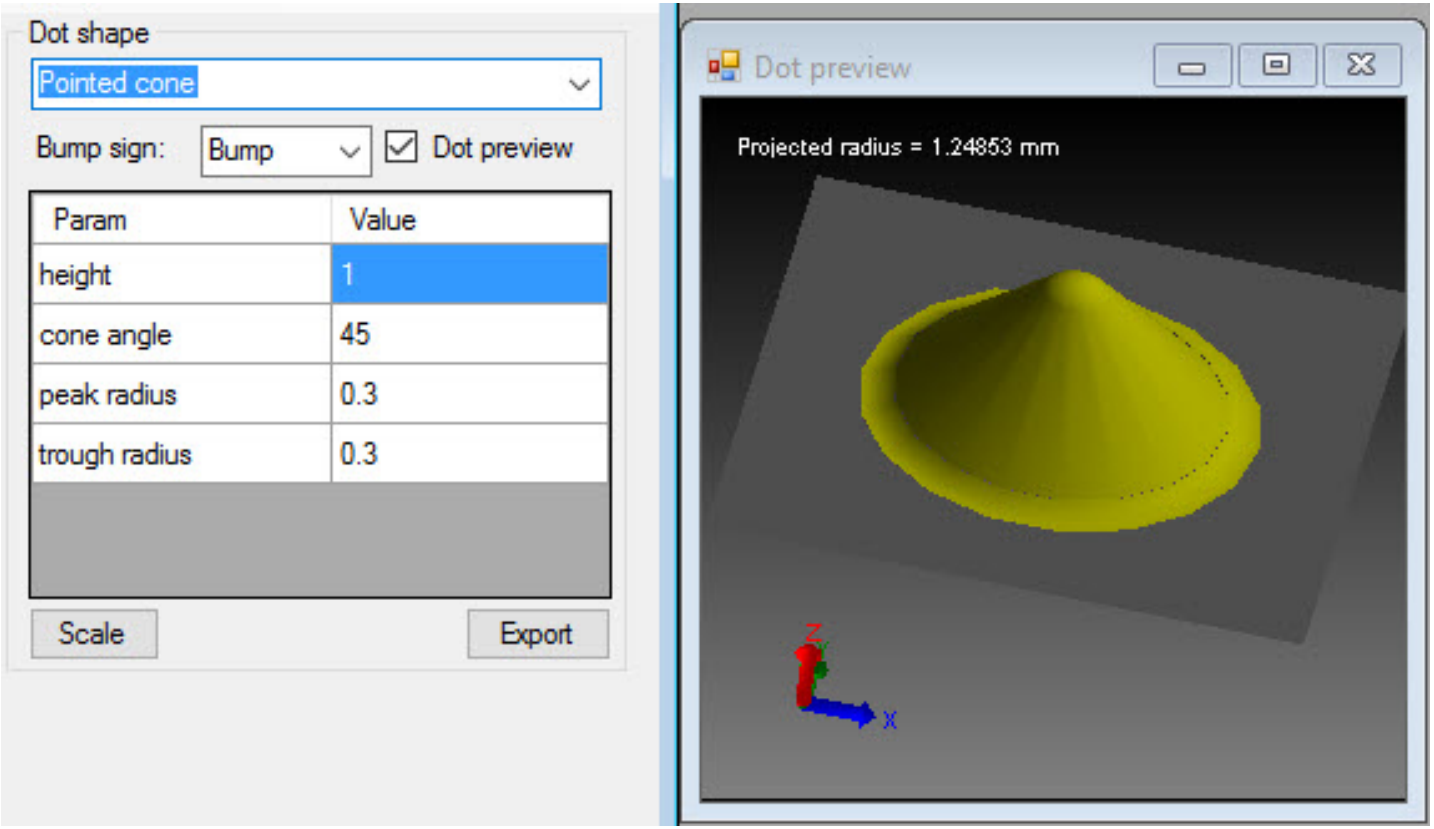
Log



TracePro

Texture Optimizer II – Texture Types

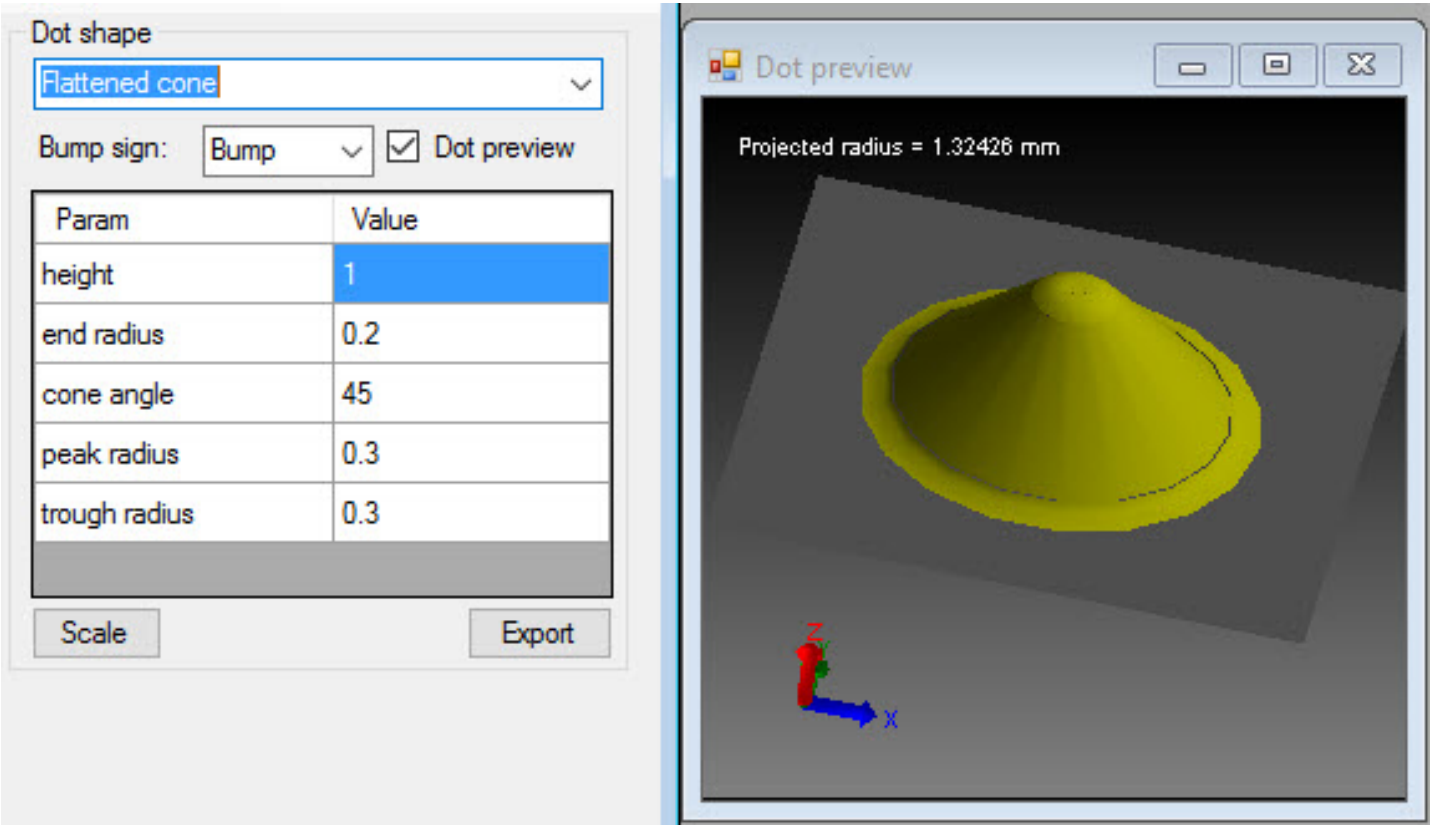
Pointed Cone



TracePro

Texture Optimizer II – Texture Types

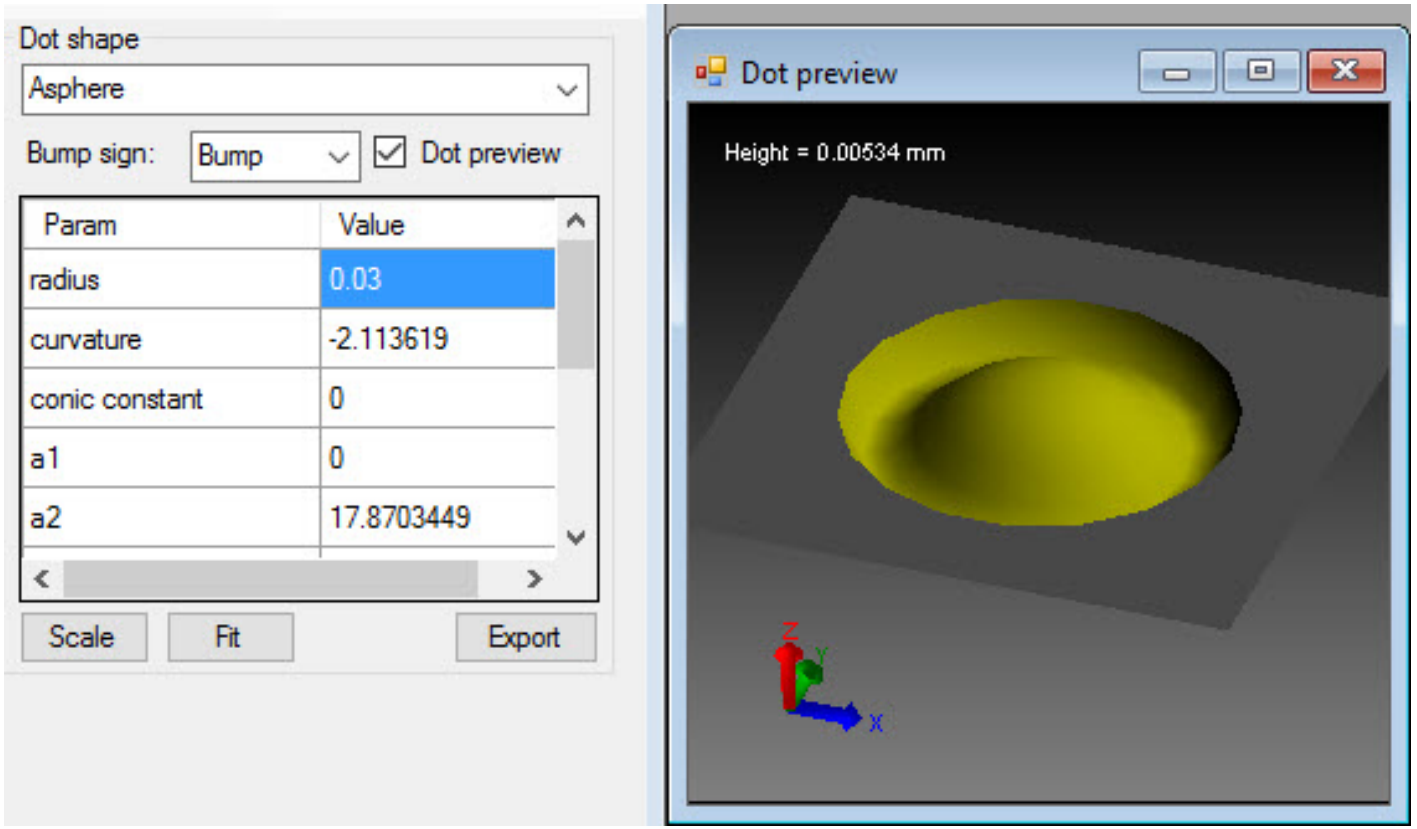
Flattened Cone



TracePro

Texture Optimizer II – Texture Types

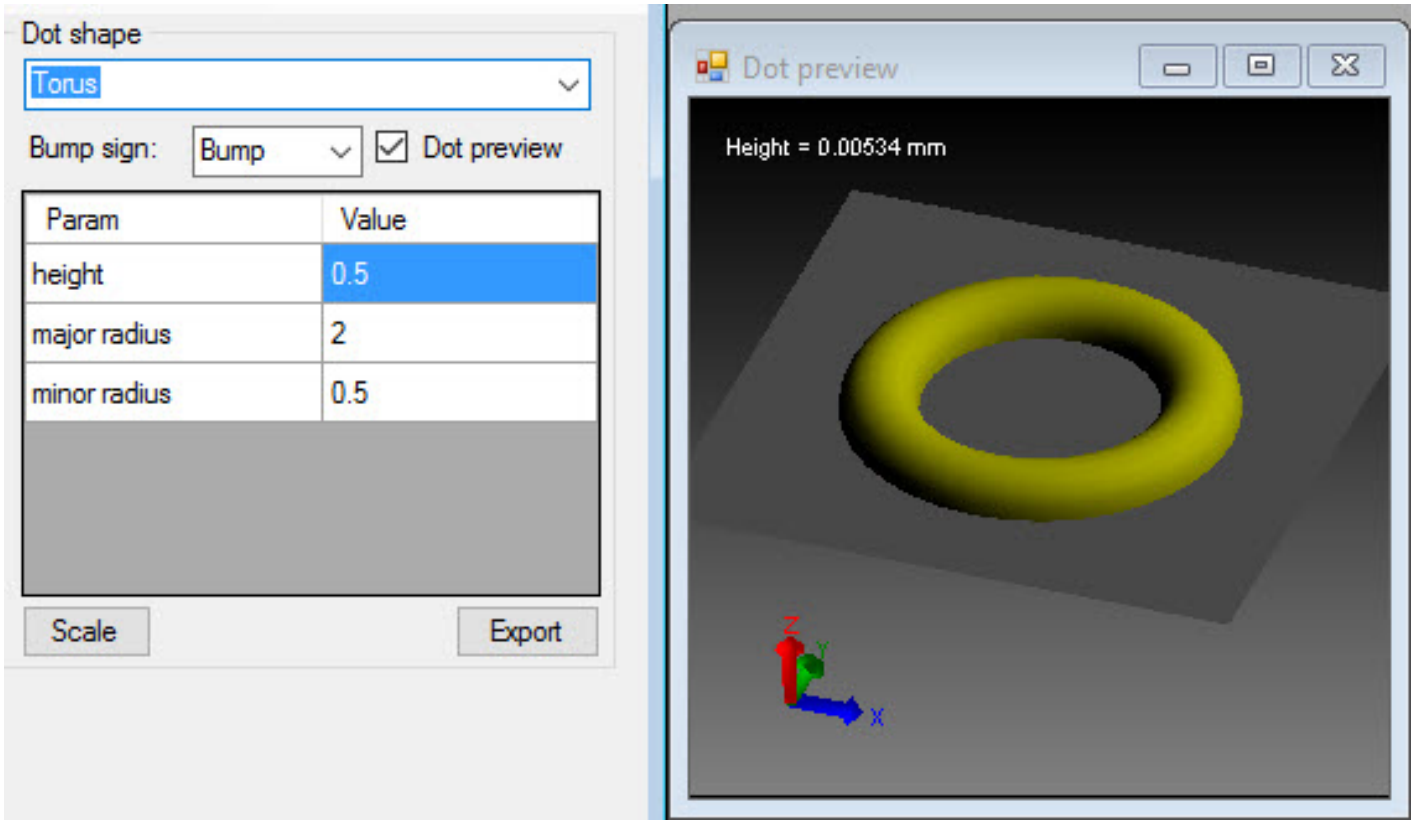
Asphere



TracePro

Texture Optimizer II – Texture Types

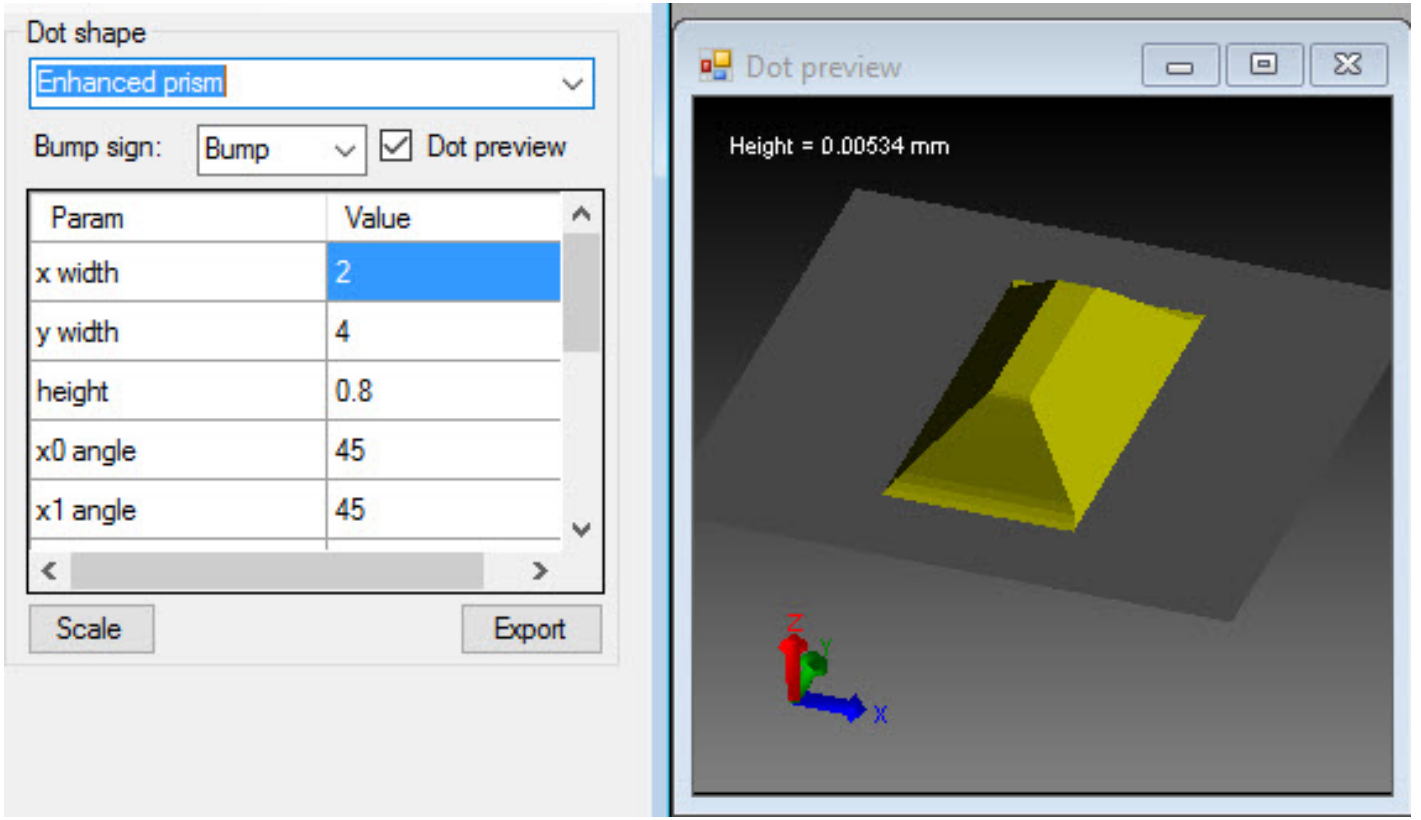
Torus



TracePro

Texture Optimizer II – Texture Types

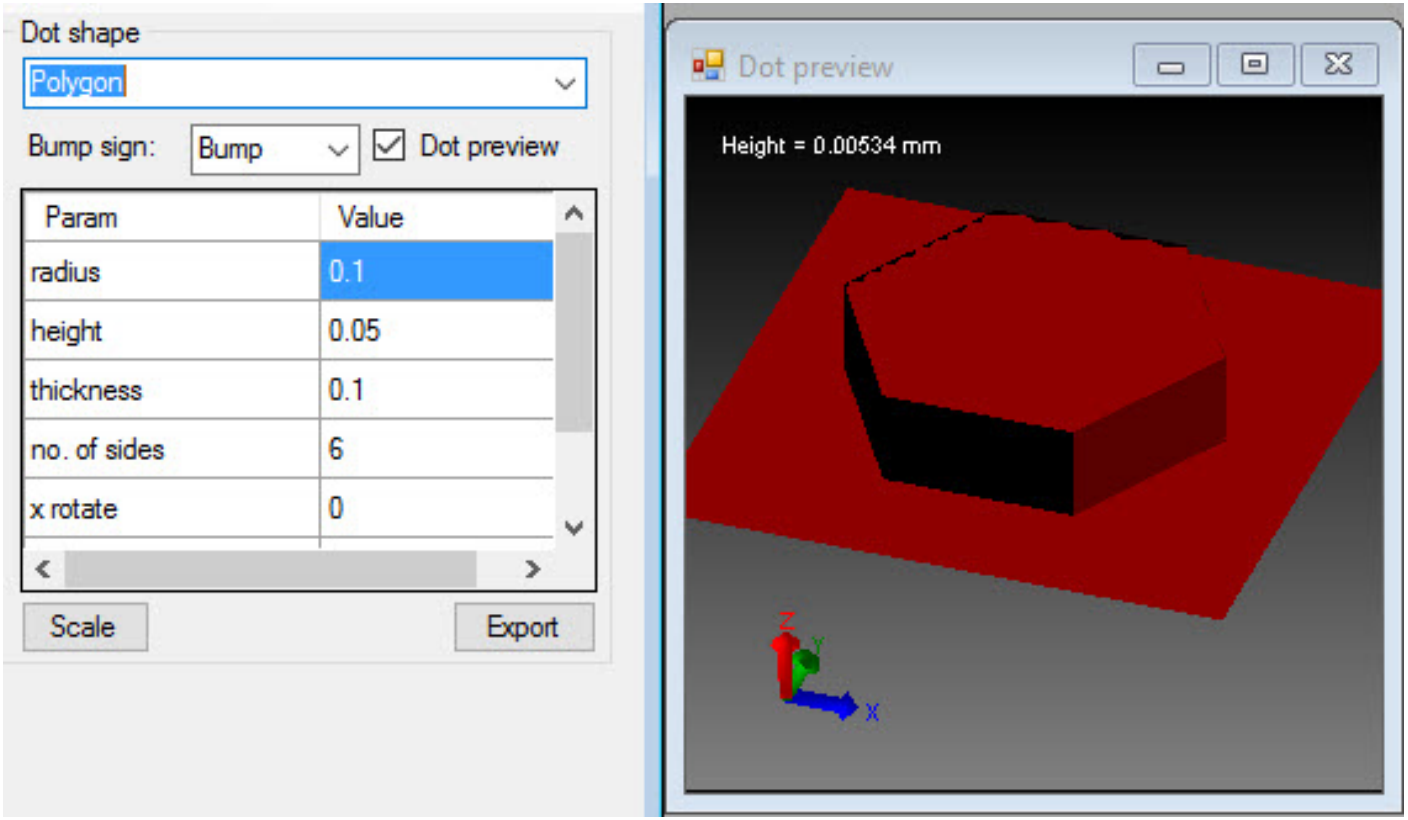
Enhanced Prism



TracePro

Texture Optimizer II – Texture Types

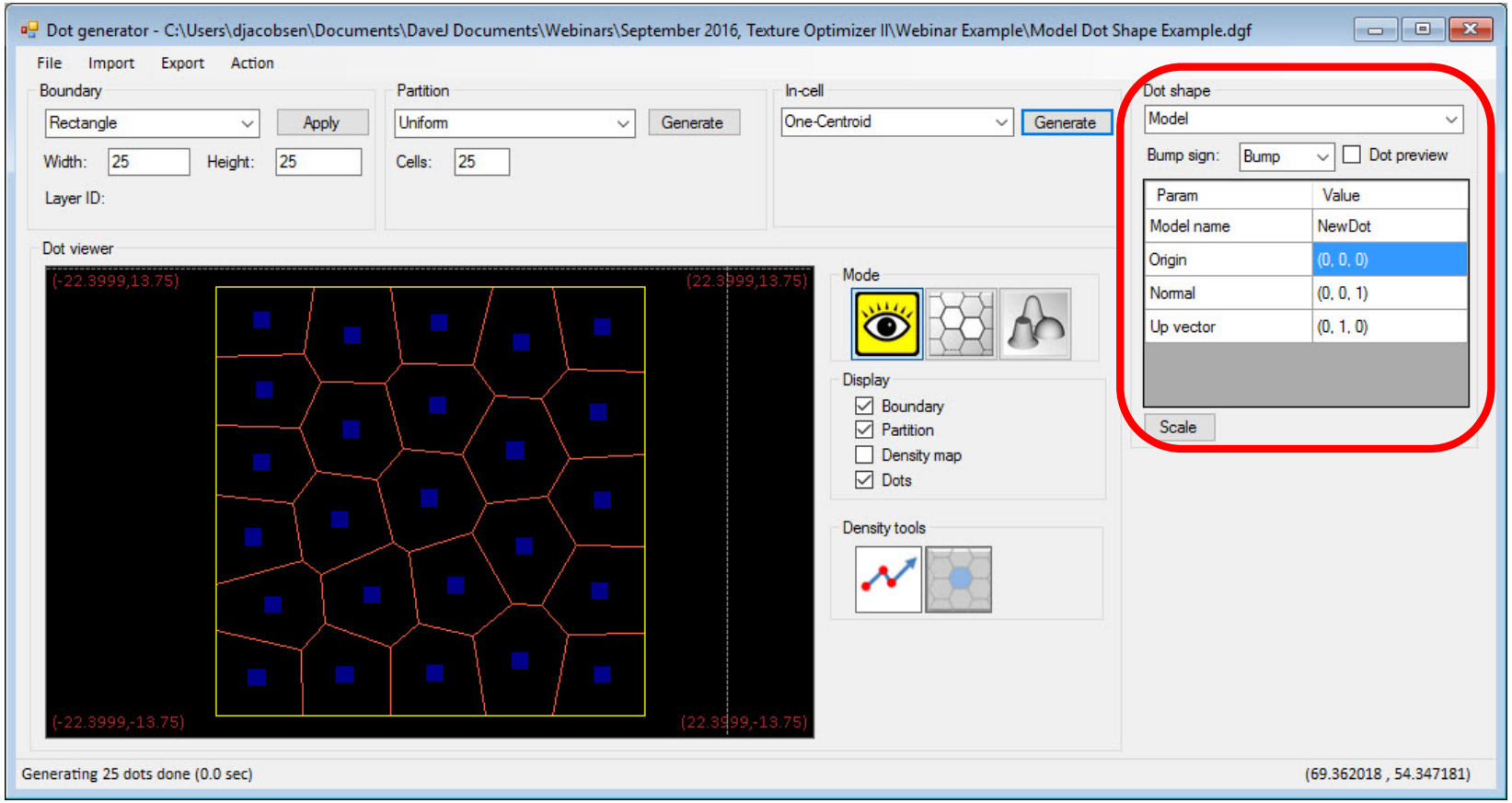
Polygon



TracePro

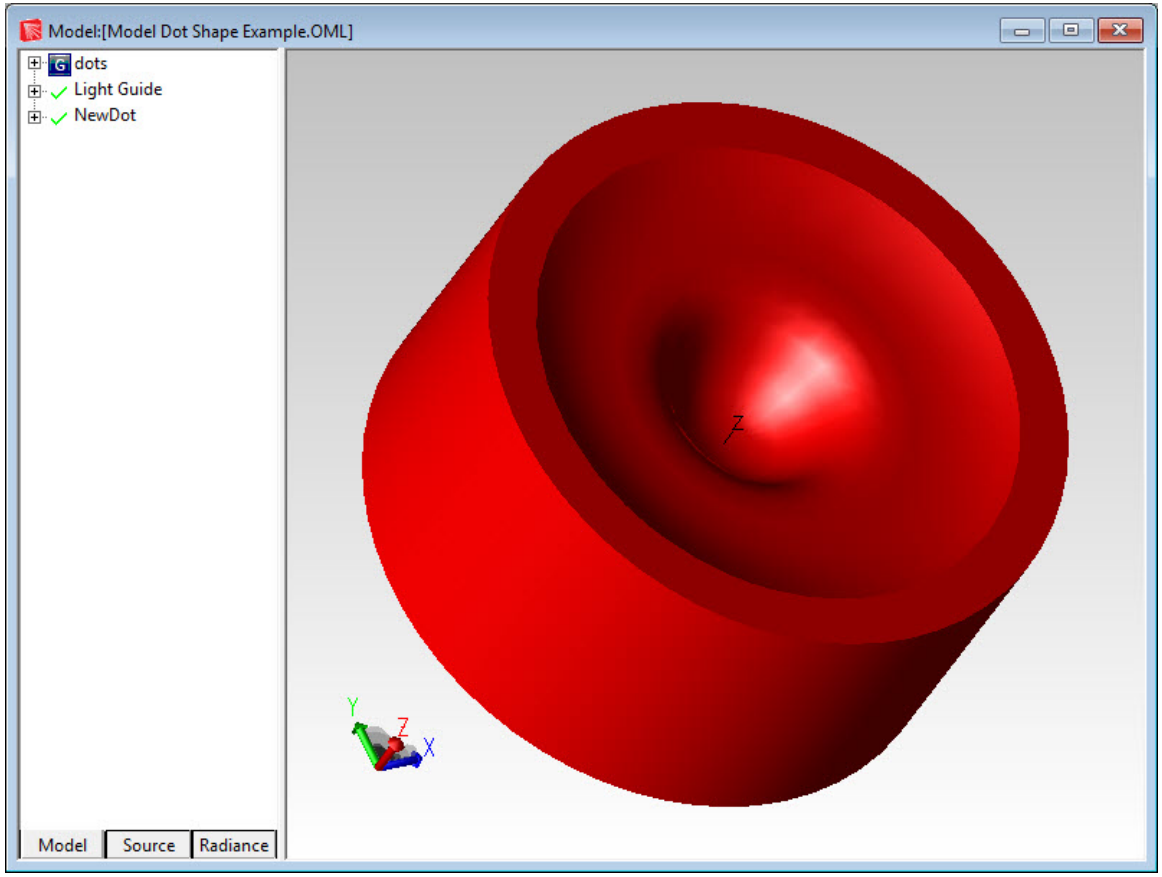
Texture Optimizer II – Texture Types

Model



Texture Optimizer II – Texture Types

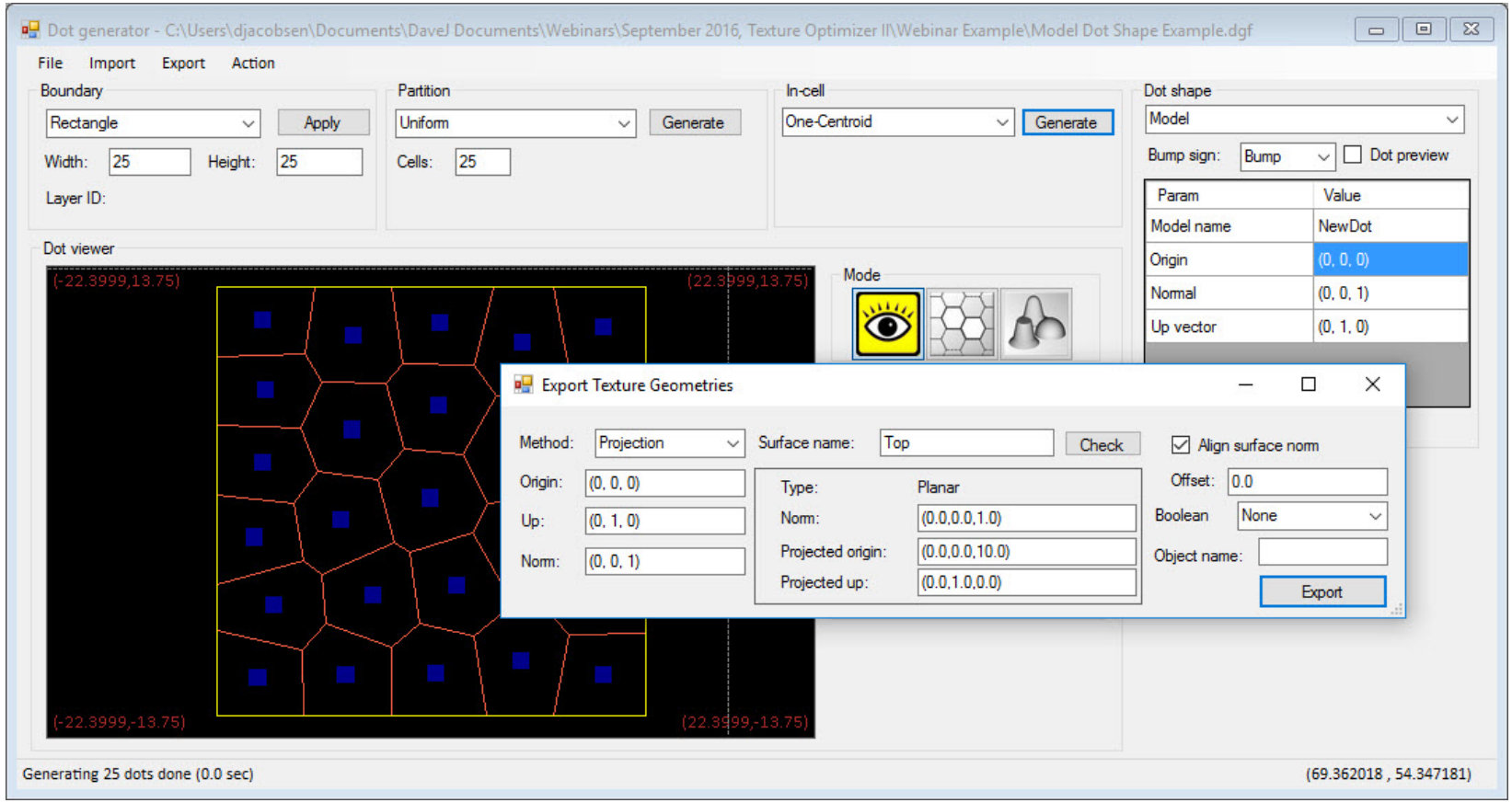
Model



TracePro

Texture Optimizer II – Texture Types

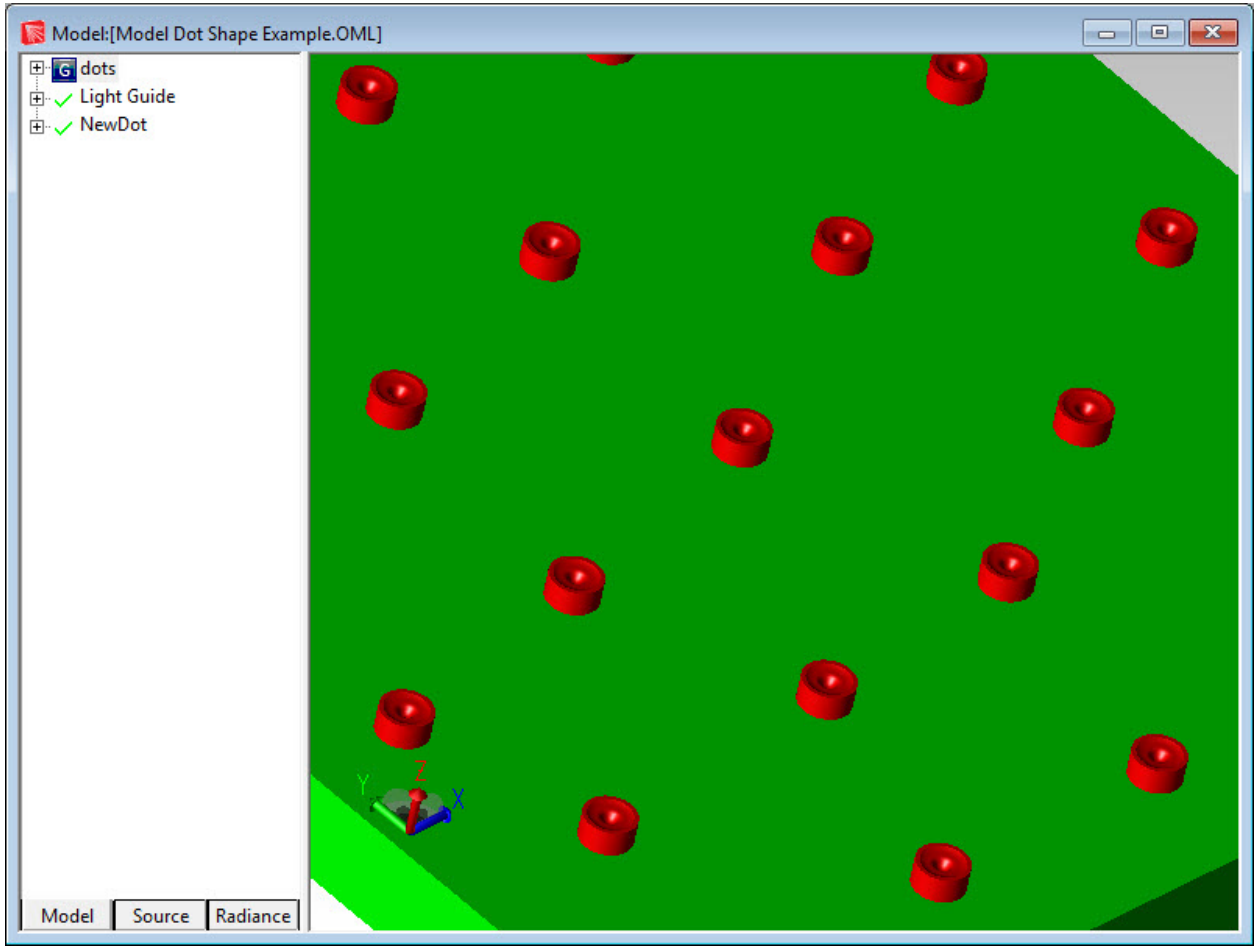
Model



TracePro

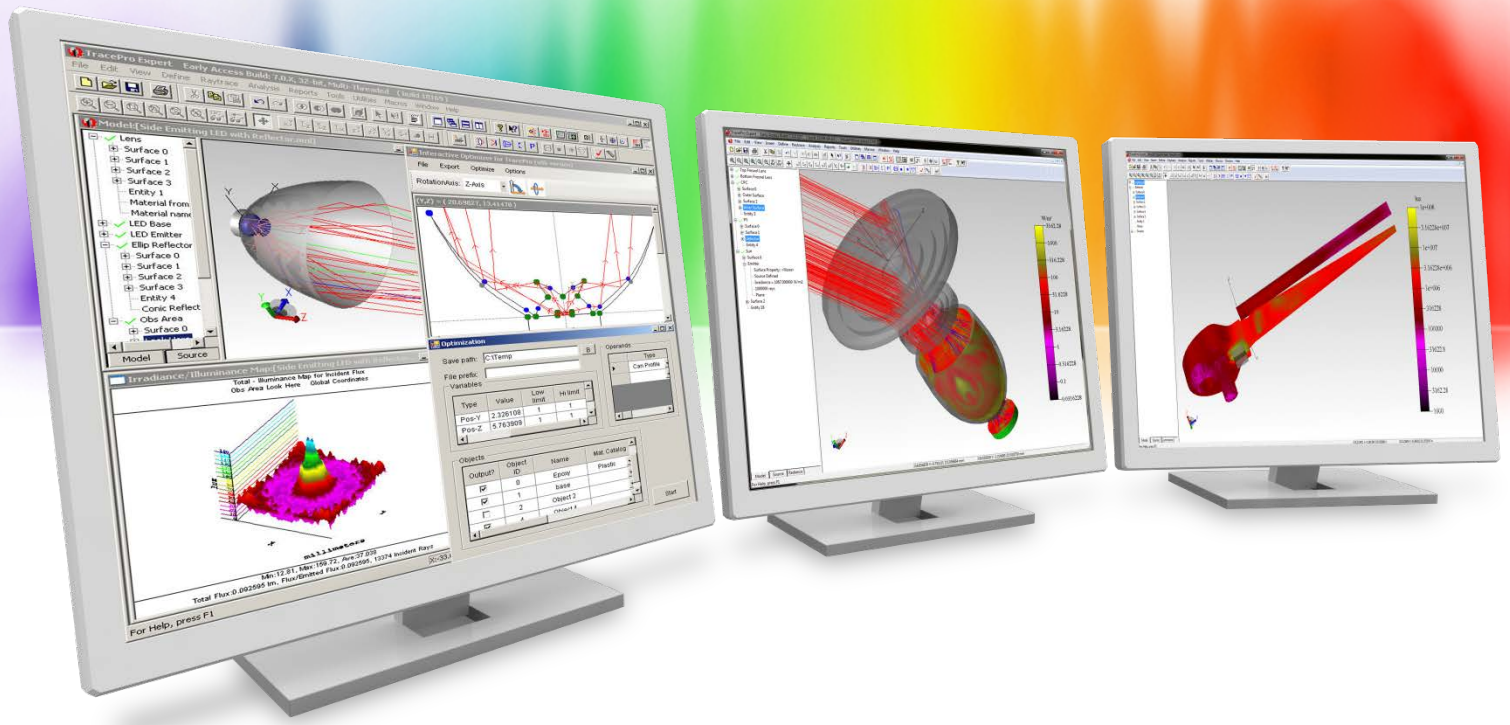
Texture Optimizer II – Texture Types

Model



TracePro

TracePro

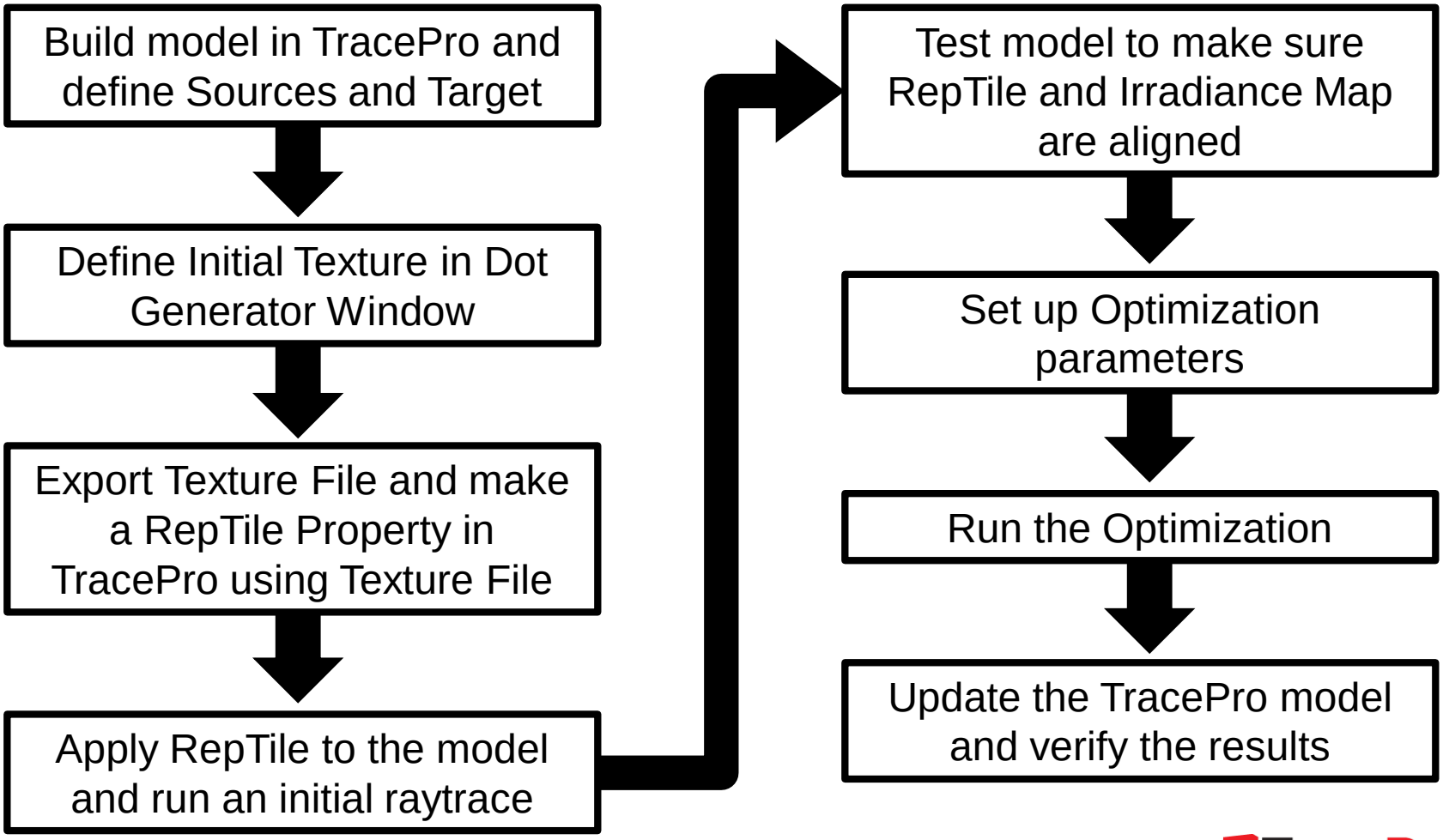


Setting up the Texture Optimizer II

LAMBDA RESEARCH CORPORATION

Setting up the Texture Optimizer II

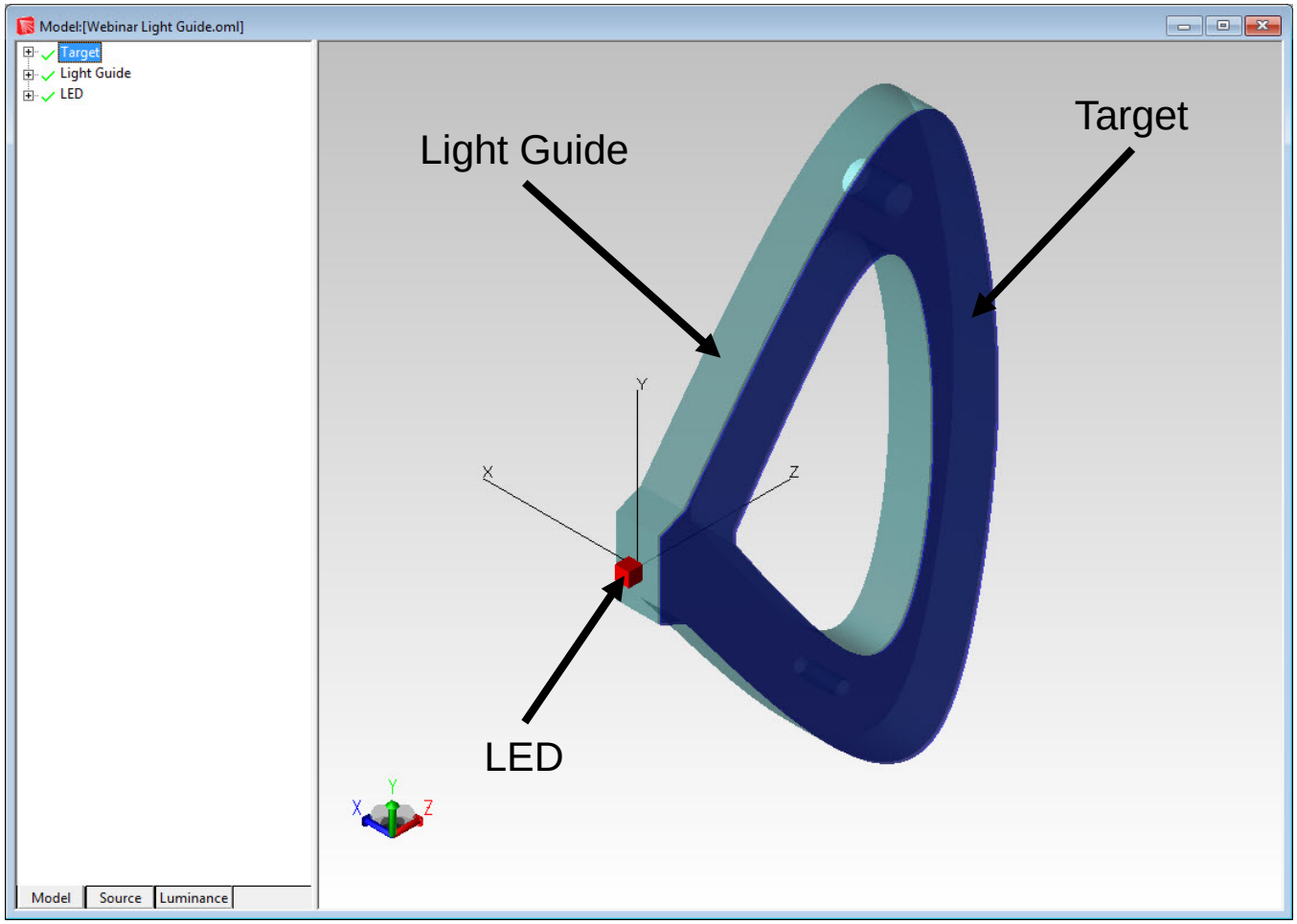
Typical Workflow



TracePro

Setting up the Texture Optimizer II

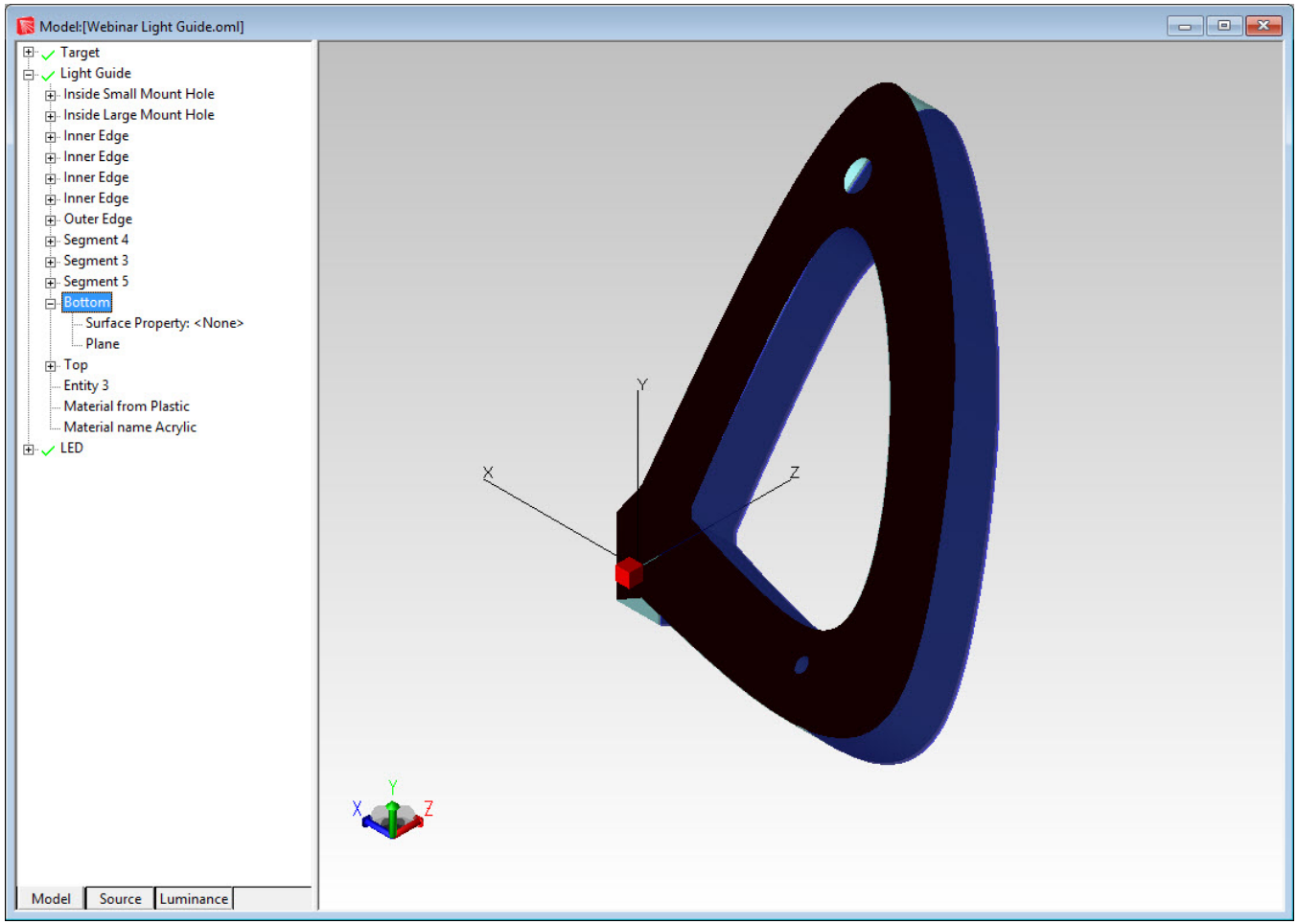
TracePro model



TracePro

Setting up the Texture Optimizer II

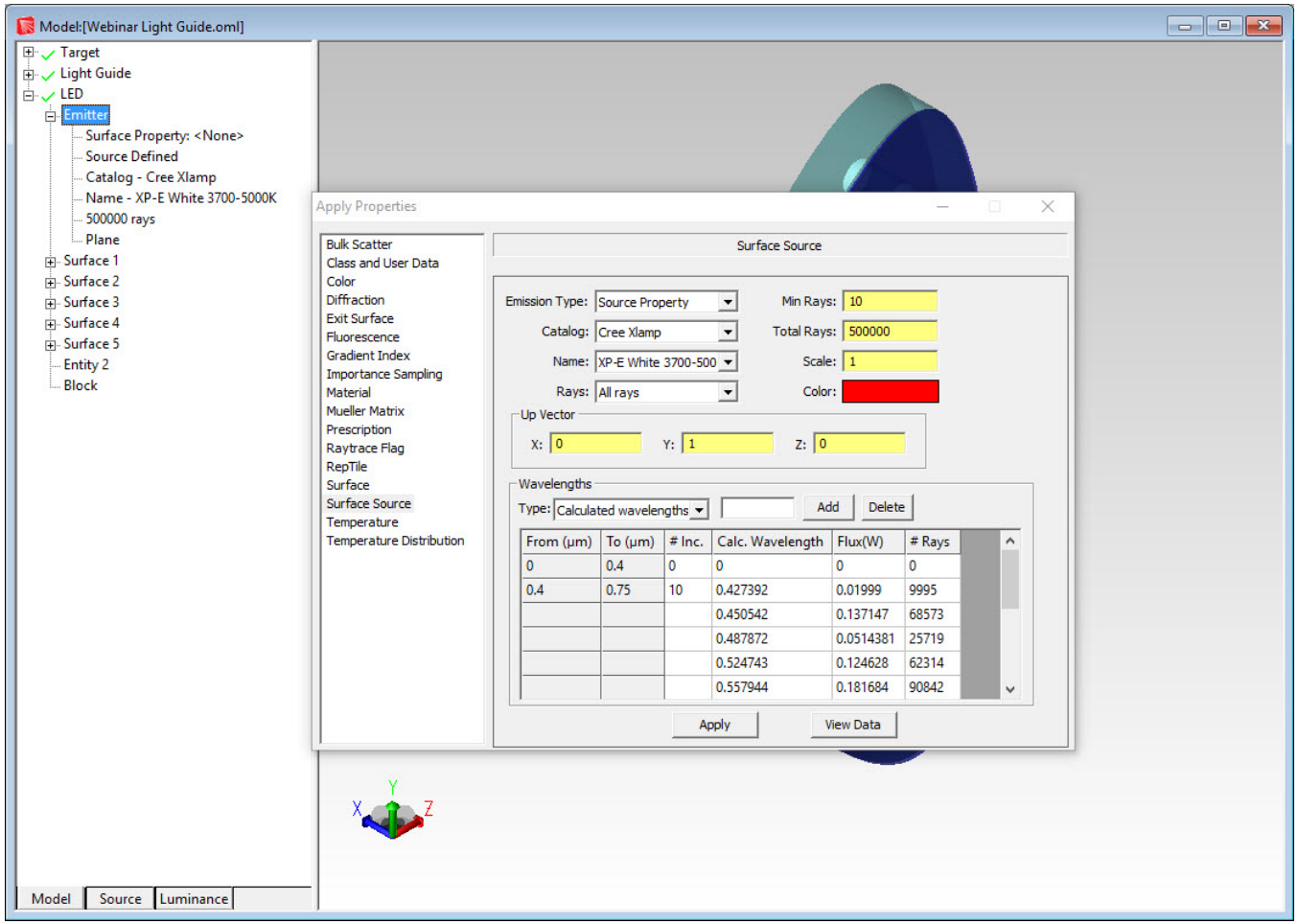
TracePro model – Acrylic Light Guide with “Bottom” surface named



TracePro

Setting up the Texture Optimizer II

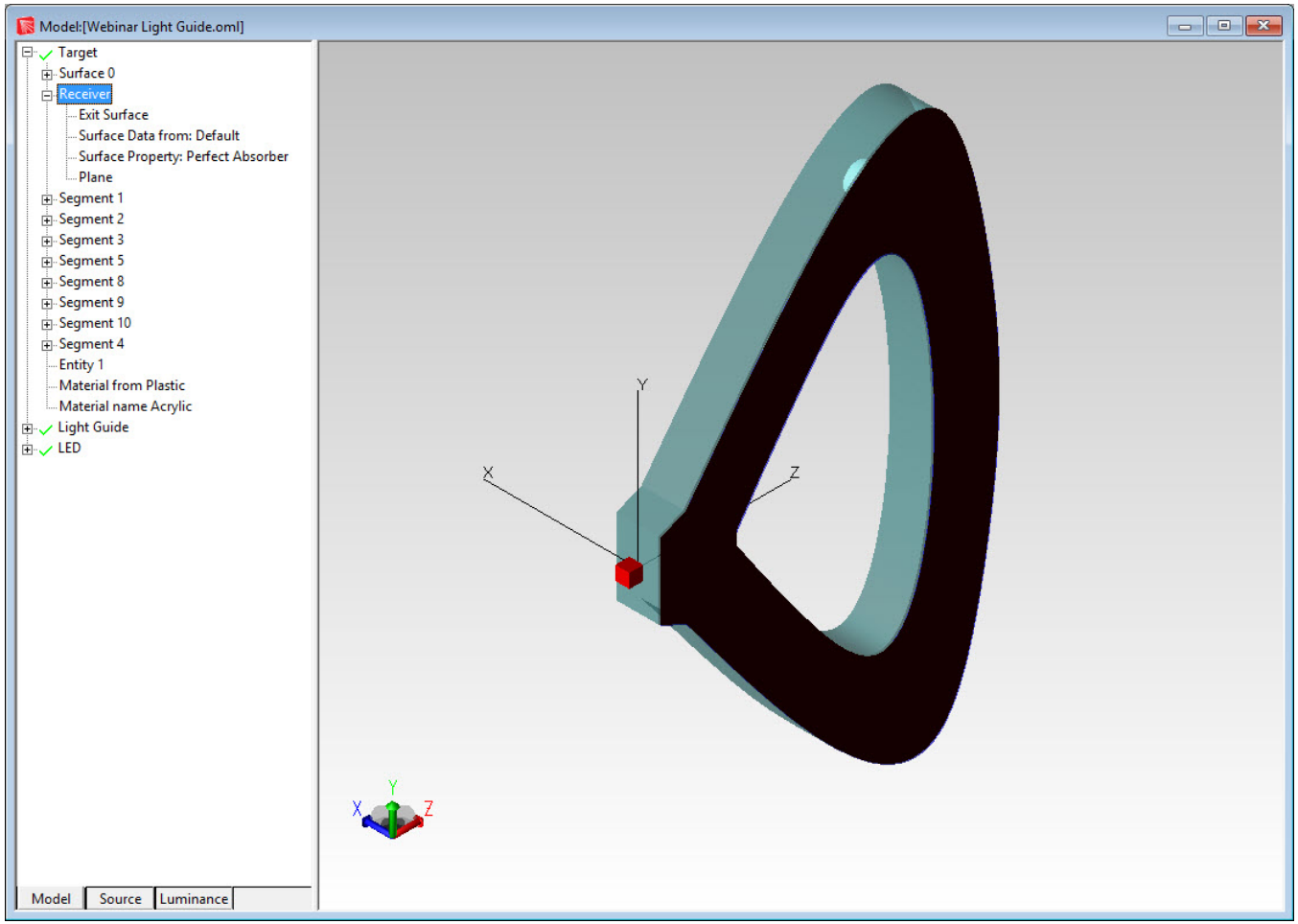
TracePro model – LED model with Surface Source Property



TracePro

Setting up the Texture Optimizer II

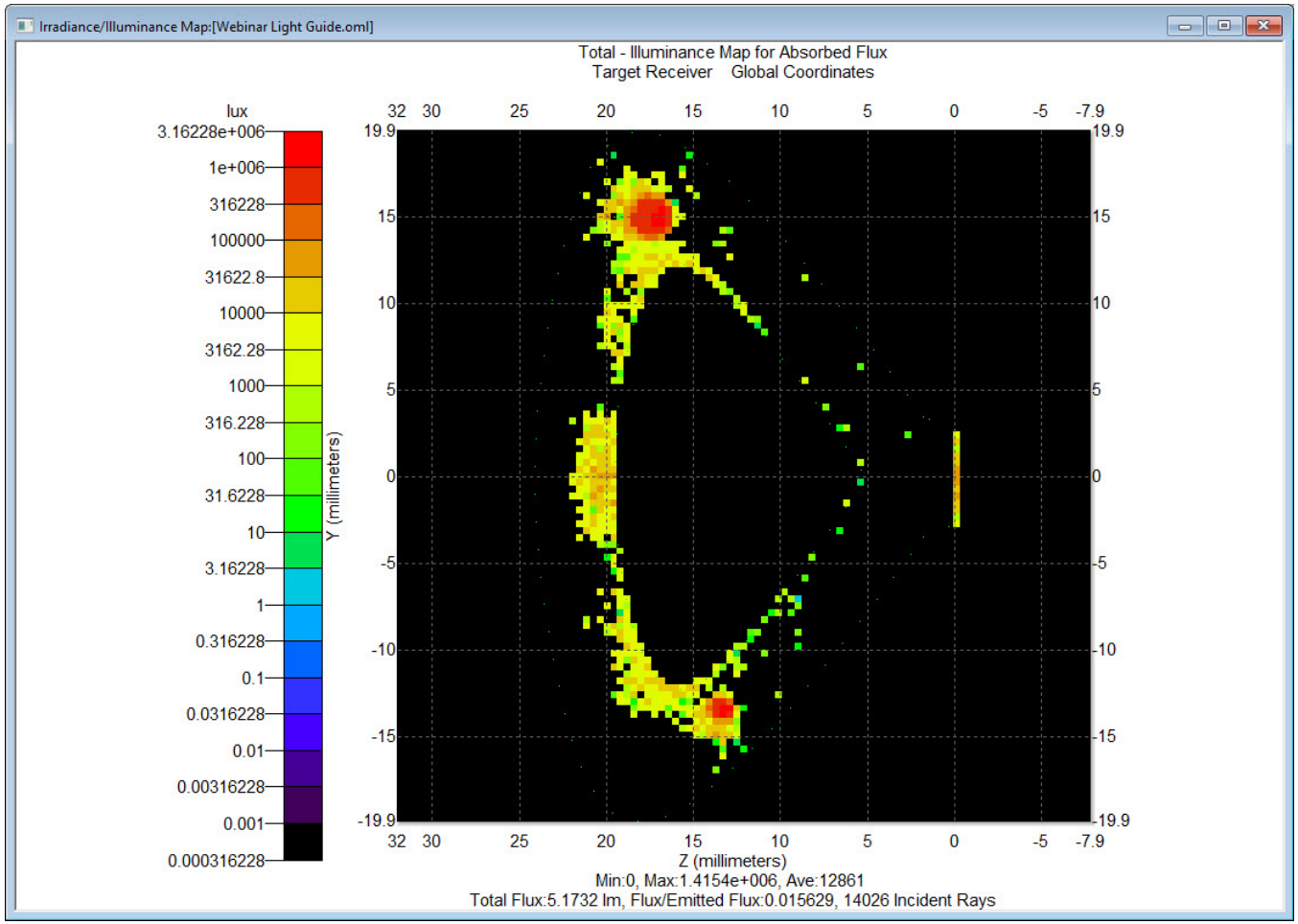
TracePro model – “Target” with “Receiver” surface named



TracePro

Setting up the Texture Optimizer II

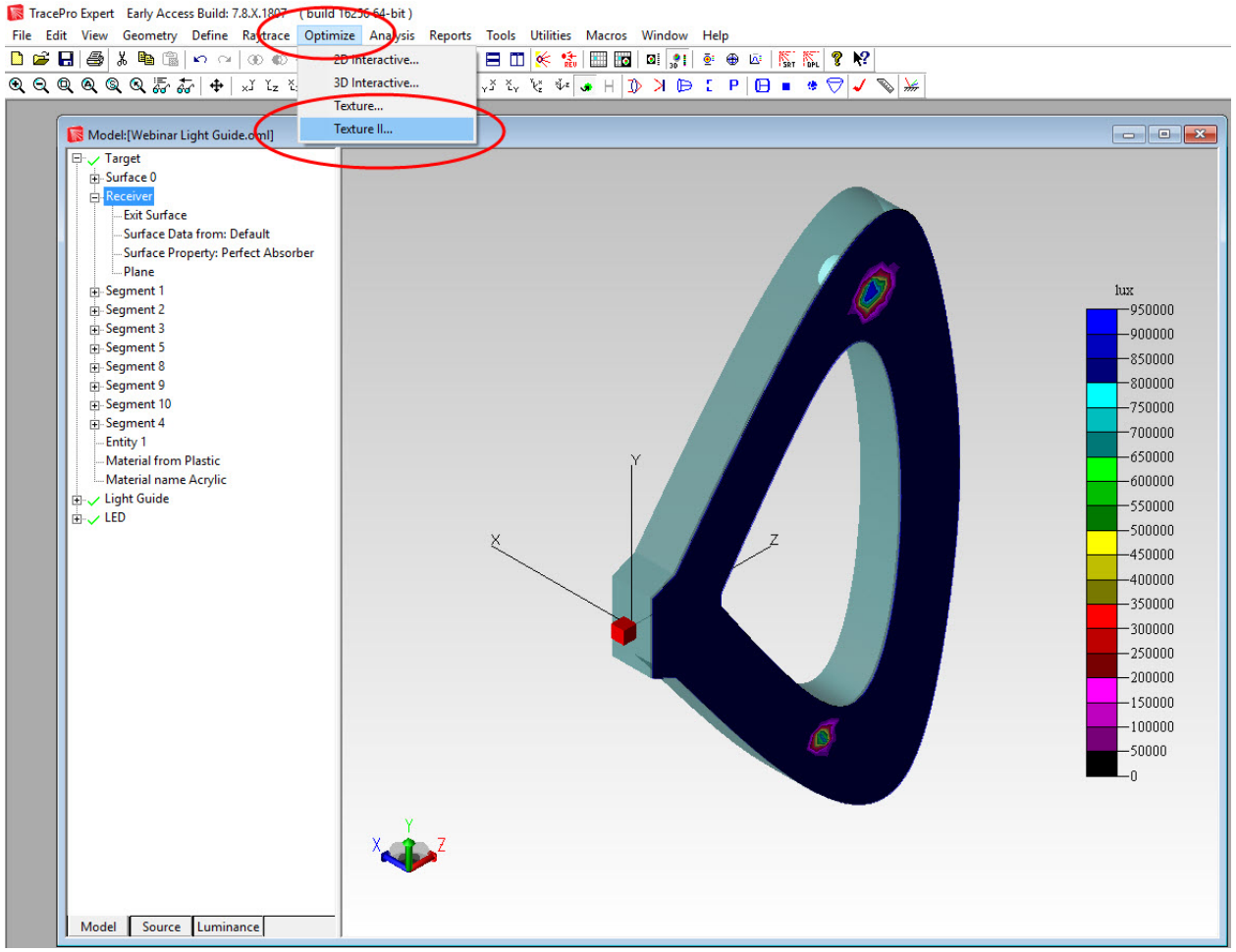
TracePro model – Initial Illuminance Map – Log Scale



TracePro

Setting up the Texture Optimizer II

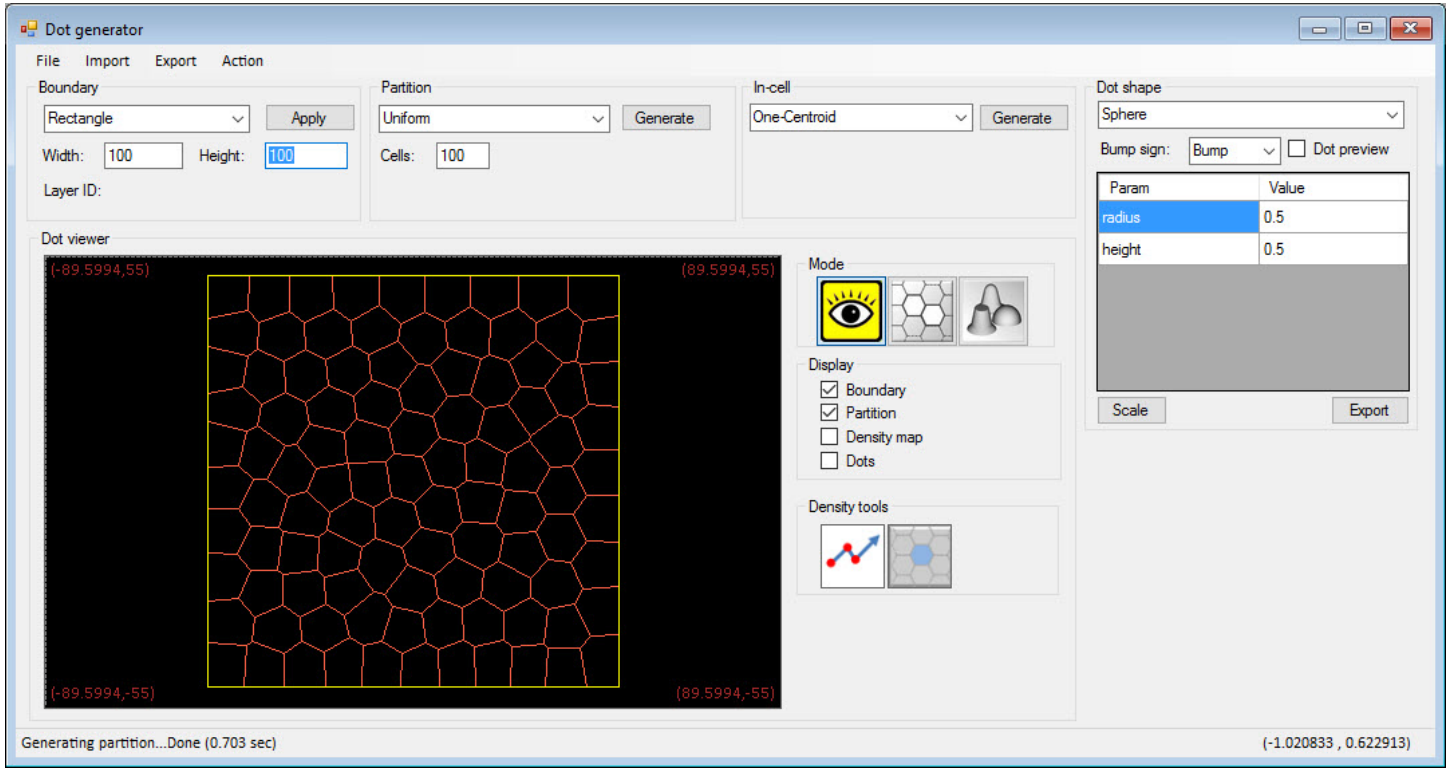
Open the Texture Optimizer II



TracePro

Setting up the Texture Optimizer II

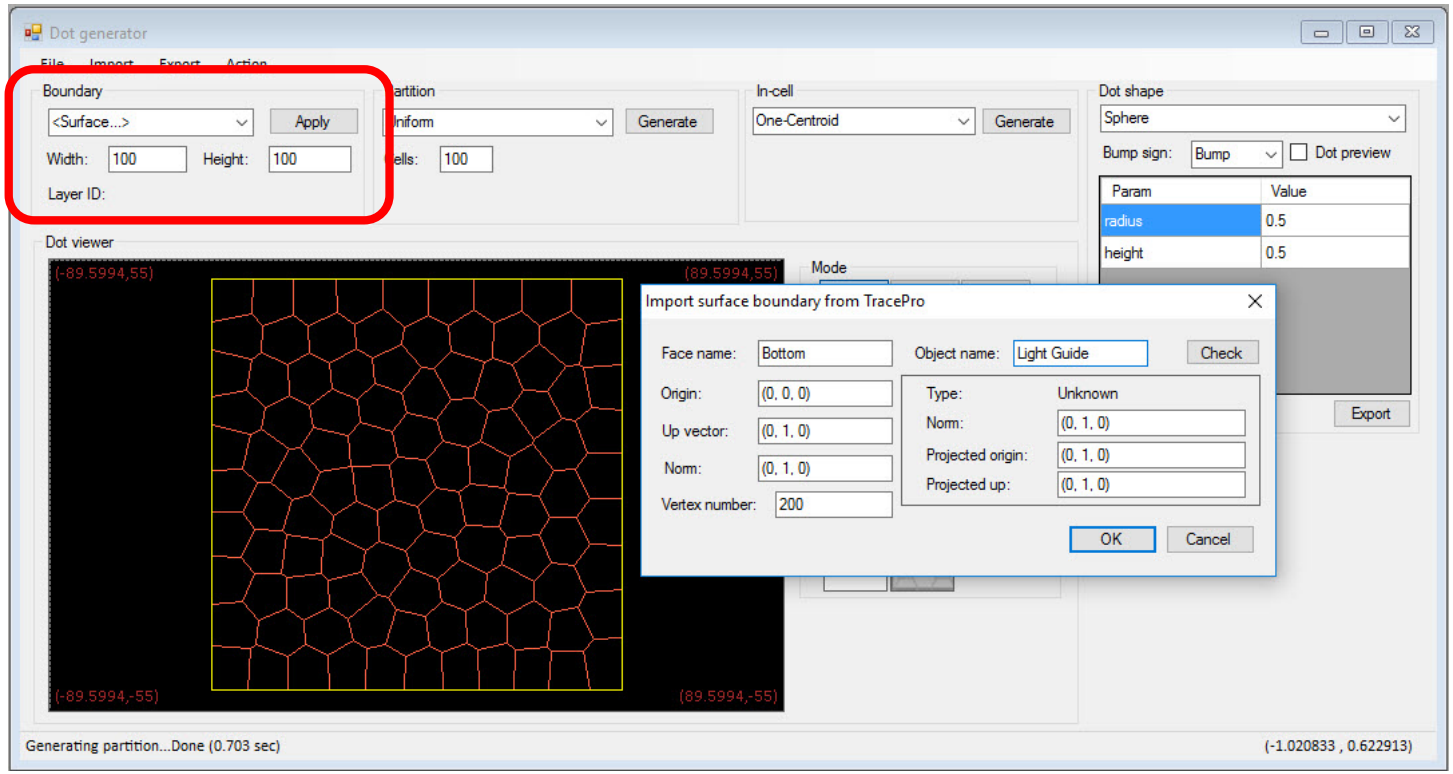
Texture Optimizer II



TracePro

Setting up the Texture Optimizer II

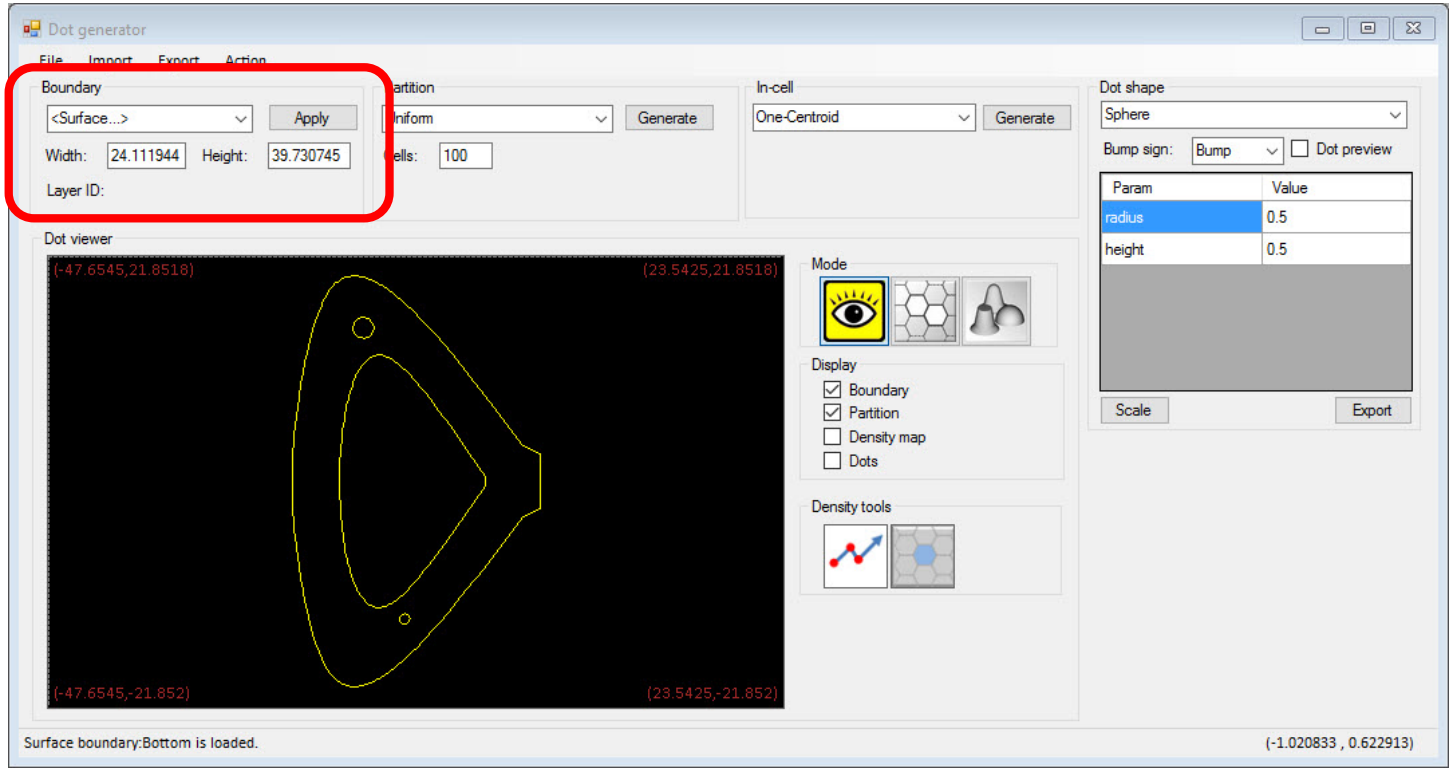
Select Surface for Boundary type and then enter “Bottom” for Face Name and “Light Guide” for Object Name. Click OK.



TracePro

Setting up the Texture Optimizer II

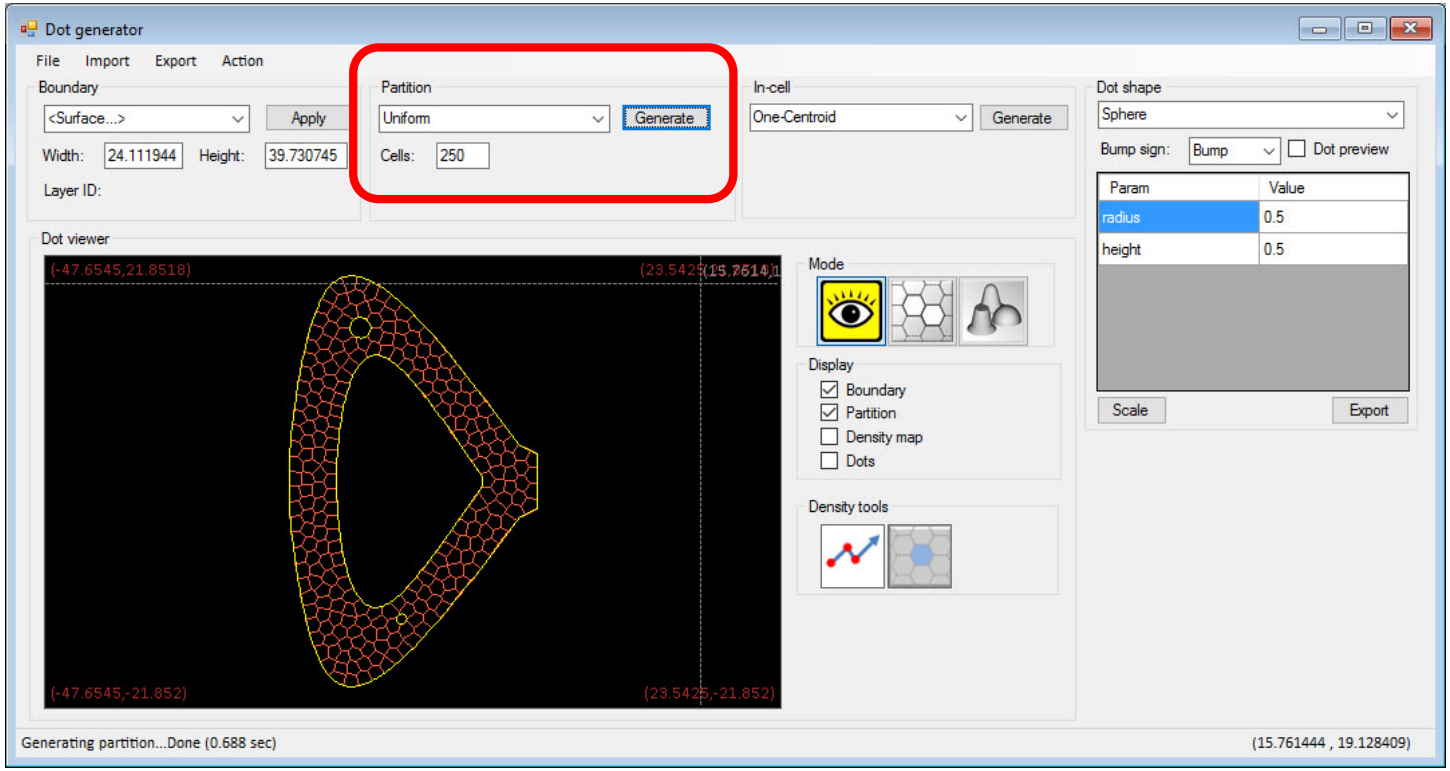
Bottom surface of the light guide is now used as the boundary



TracePro

Setting up the Texture Optimizer II

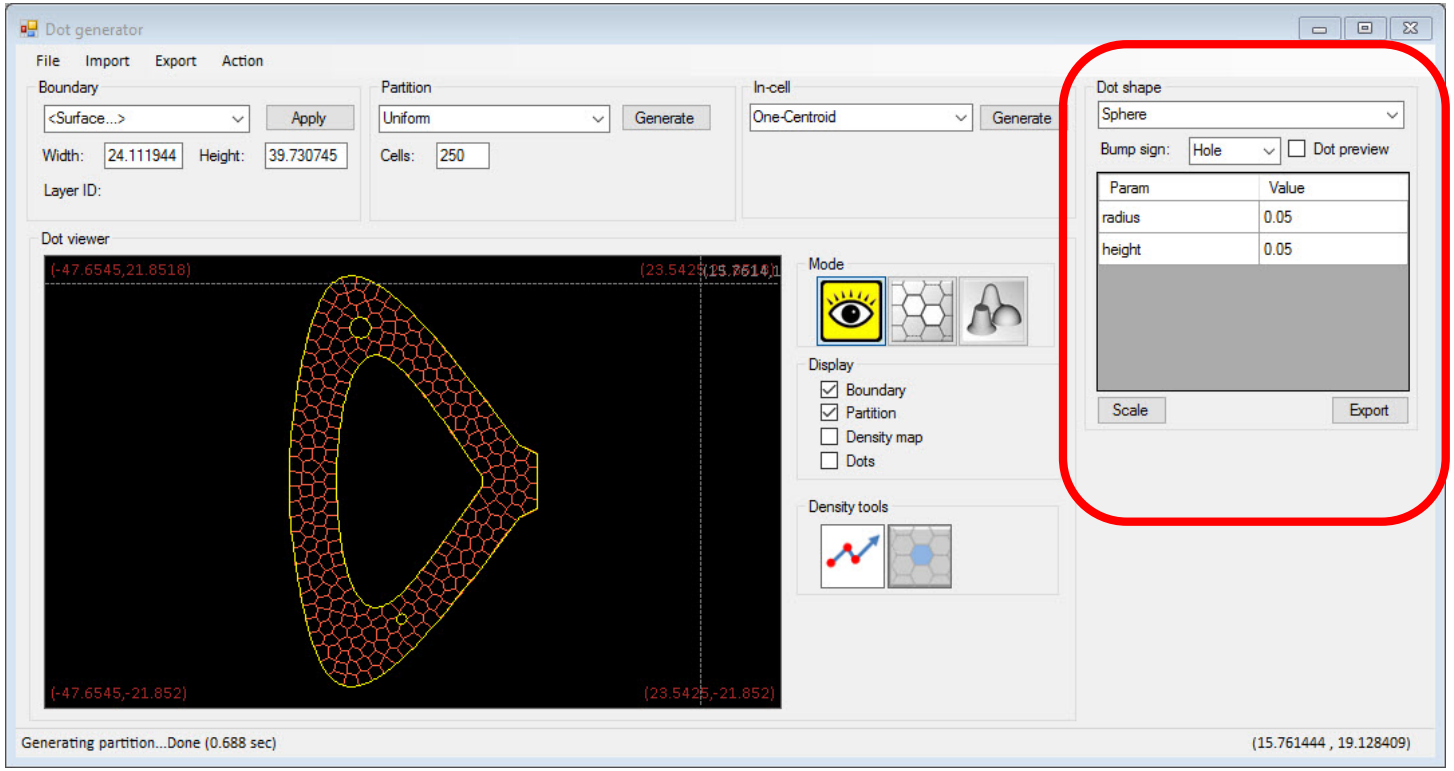
Select Uniform for Partition, enter 250 for Cells, and then click Generate



TracePro

Setting up the Texture Optimizer II

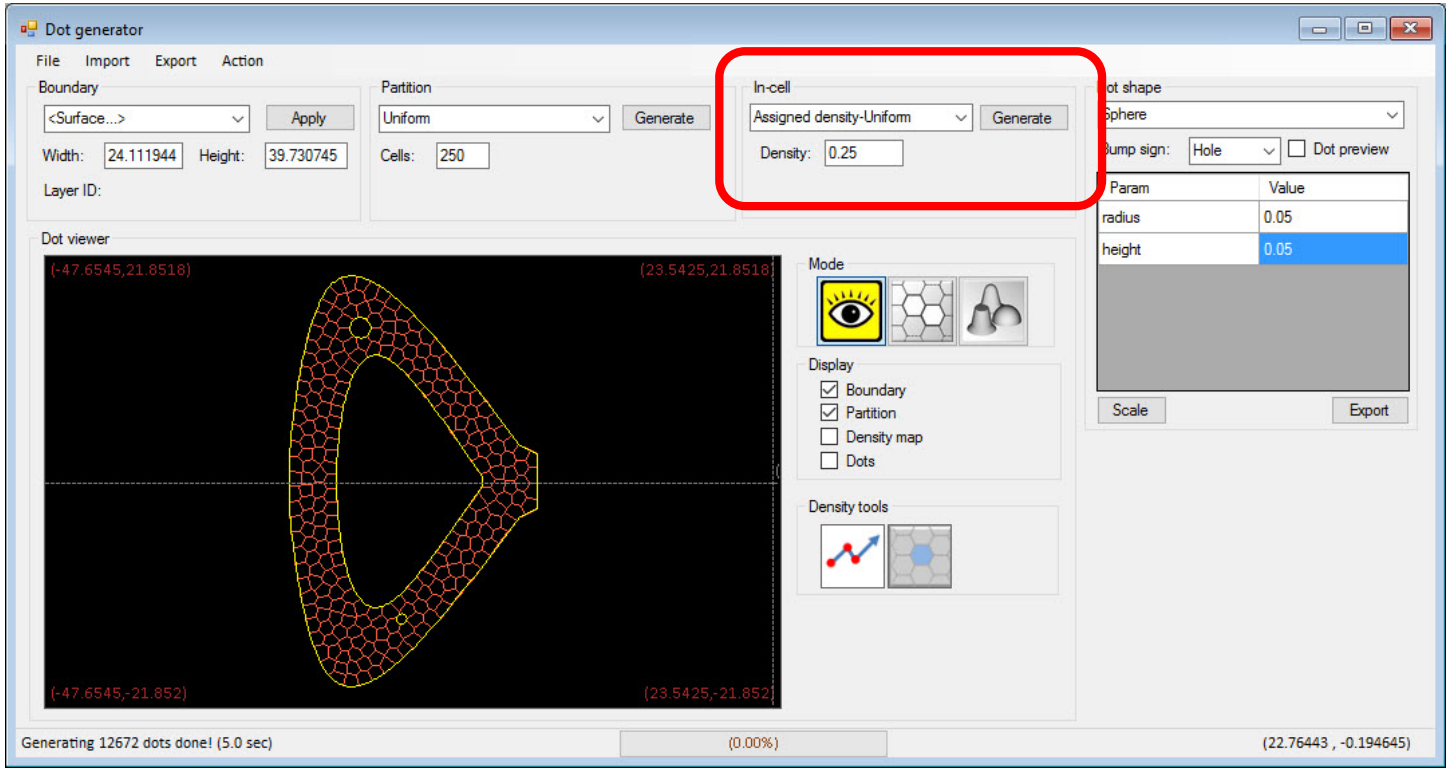
Select Sphere for Dot Shape, Hole for Bump Sign, and enter 0.05 for the Radius and Height. Units are mm.



TracePro

Setting up the Texture Optimizer II

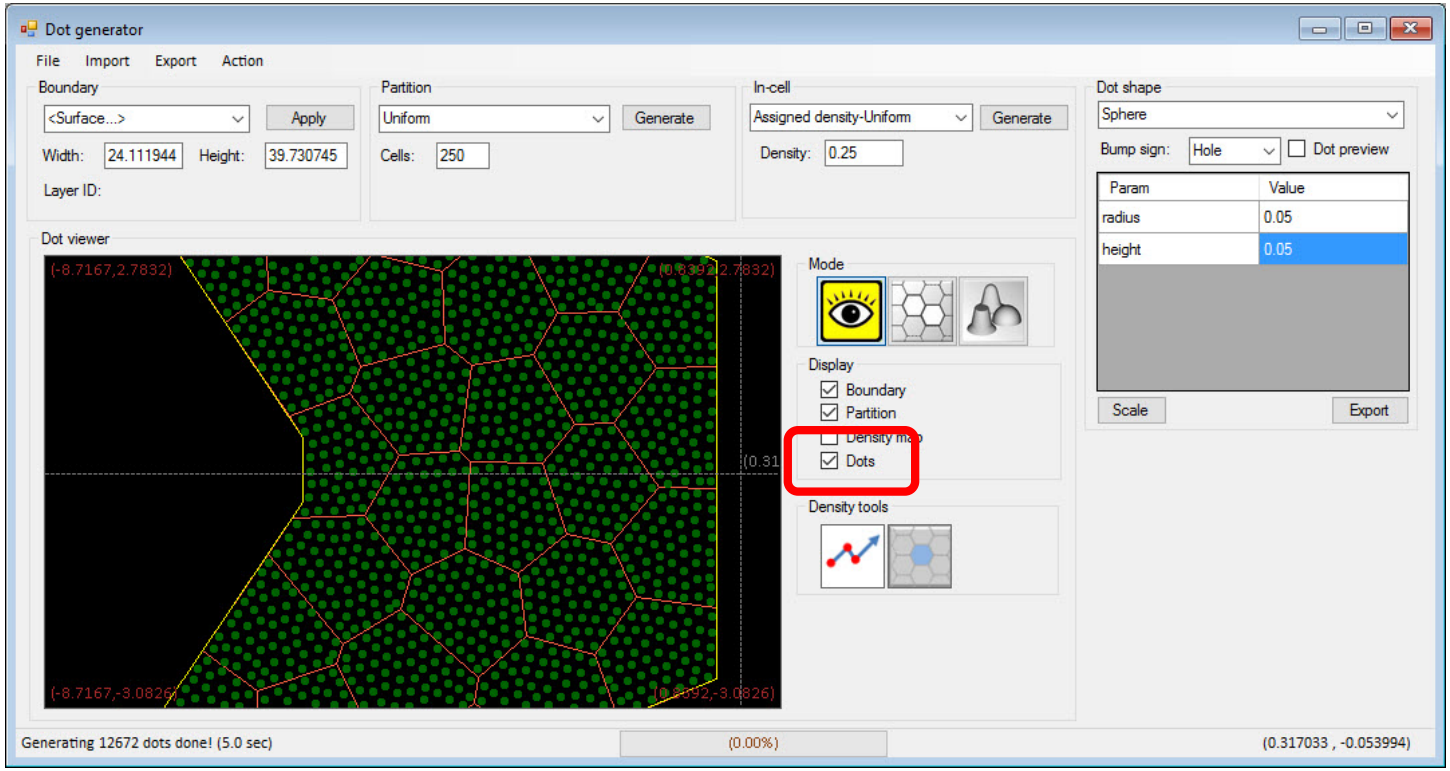
Select Assigned density-Uniform for the In-cell setting, enter 0.25 for the Density, and then click Generate



TracePro

Setting up the Texture Optimizer II

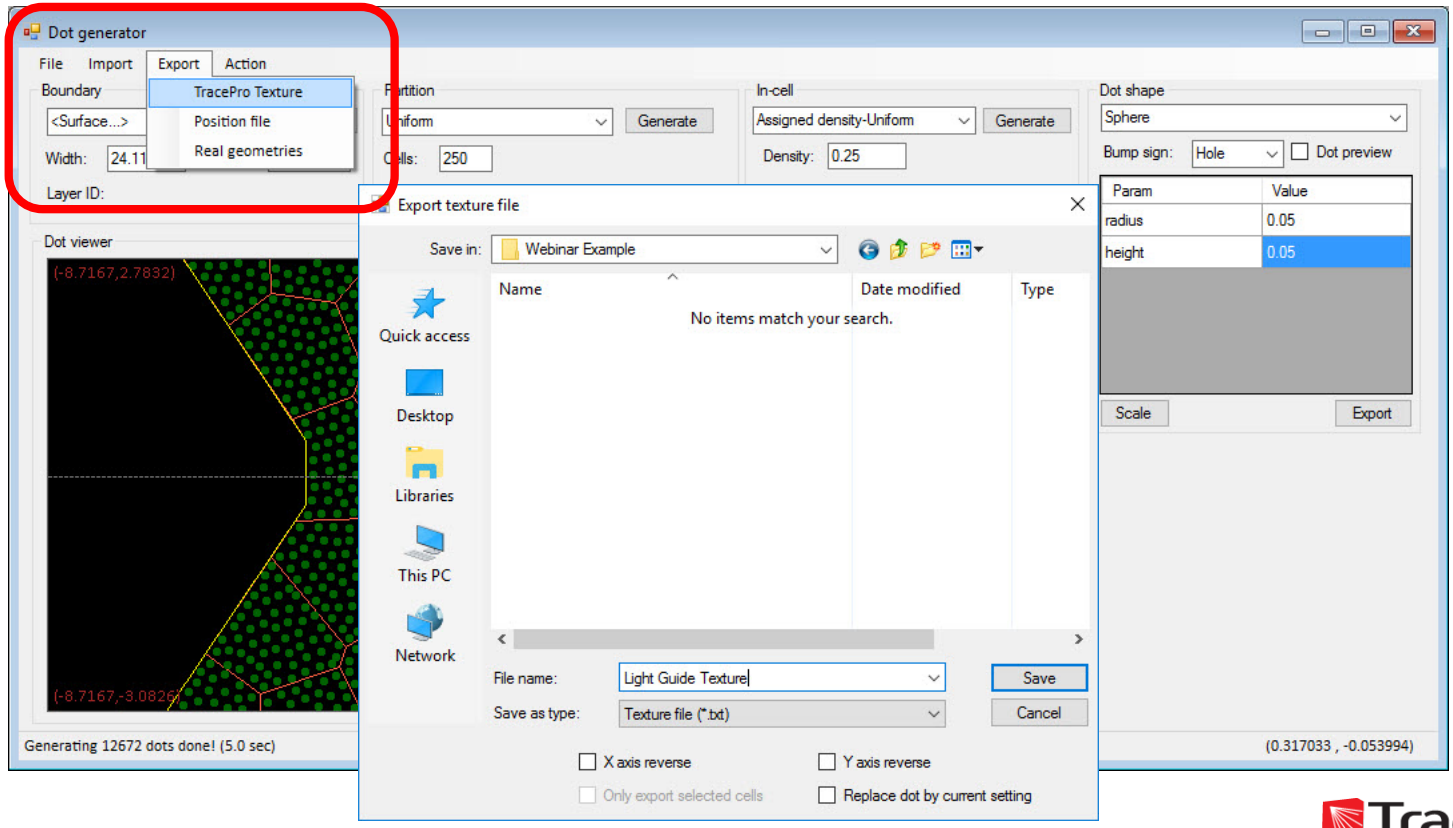
Click Dots to display the dots. The scroll wheel can be used to zoom in and out.



TracePro

Setting up the Texture Optimizer II

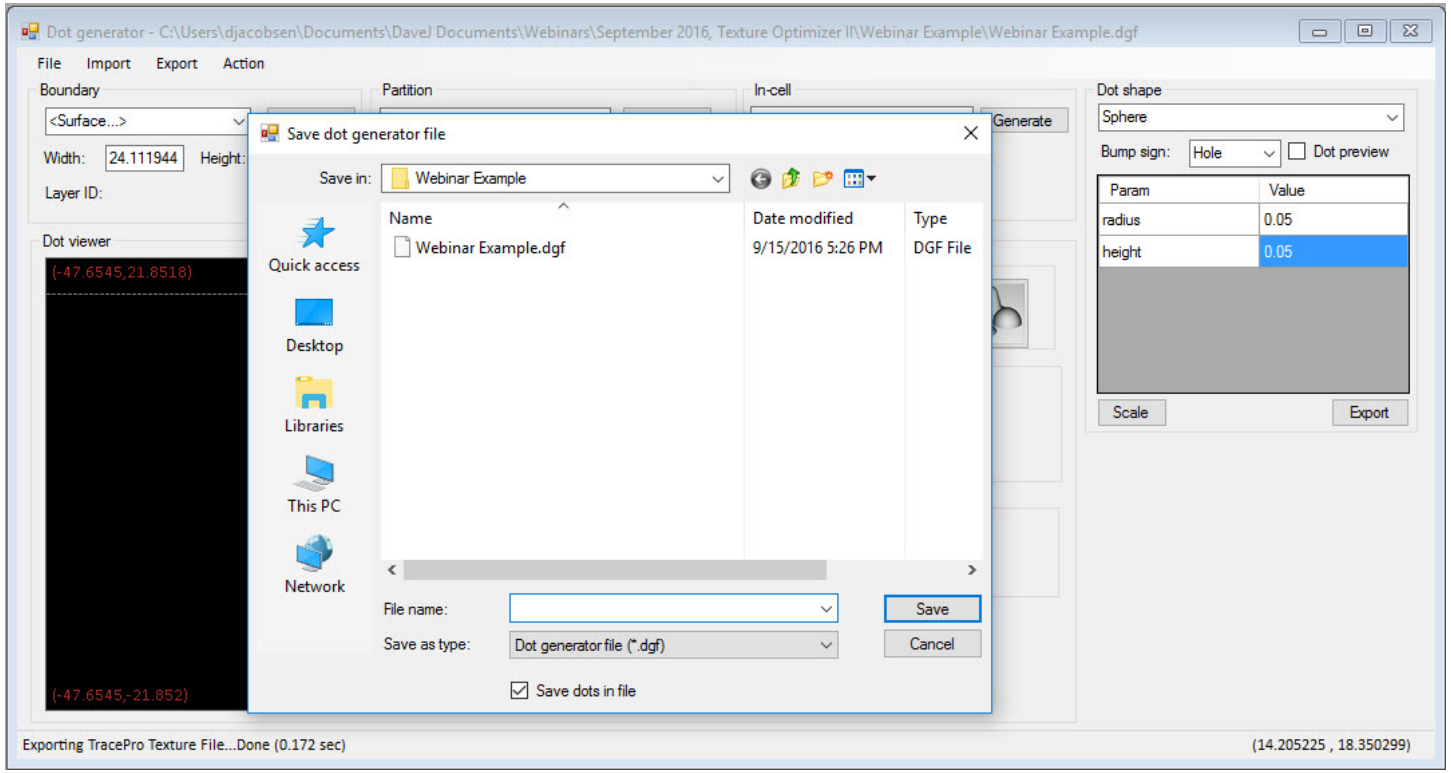
Export the Texture File by going to Export->TracePro Texture and then saving the resulting .txt file



TracePro

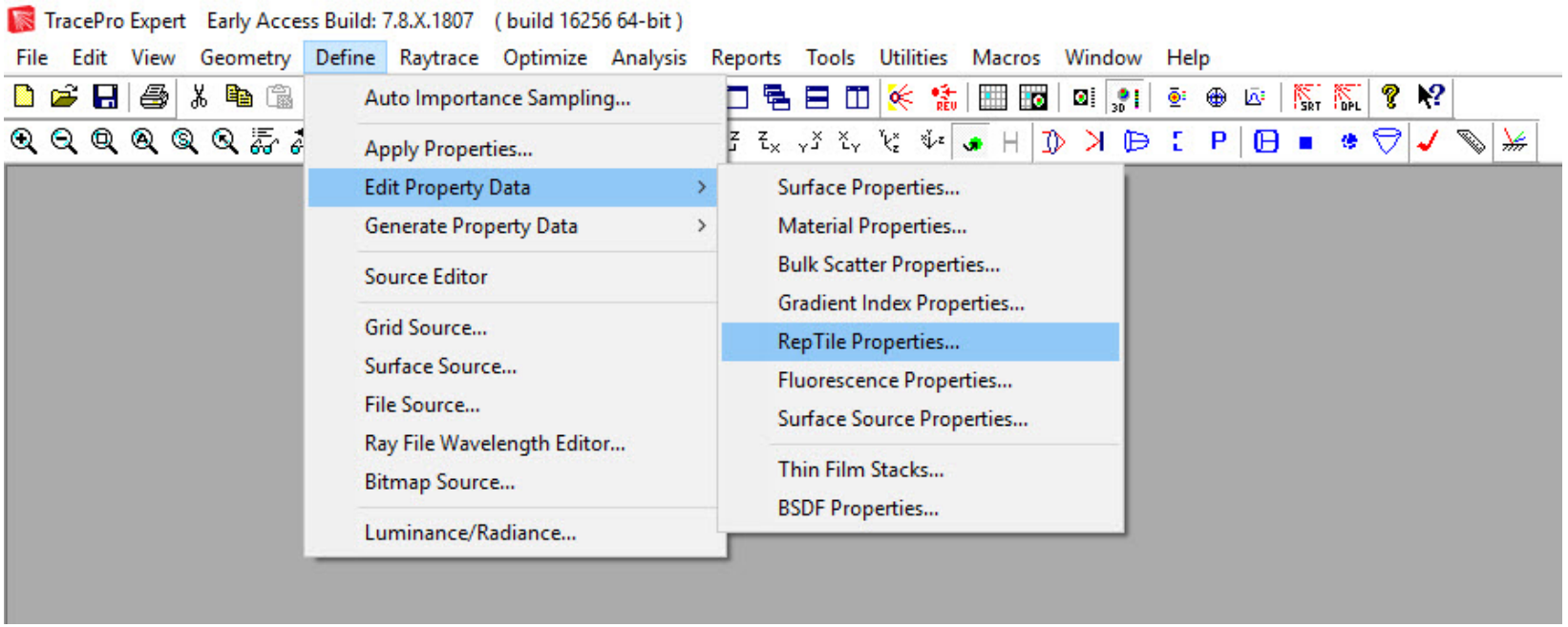
Setting up the Texture Optimizer II

Save the Texture Optimizer II file by going to File->Save as.. The file extension is .dgf. This will save all of the settings defined in the texture optimizer for future use.



Setting up the Texture Optimizer II

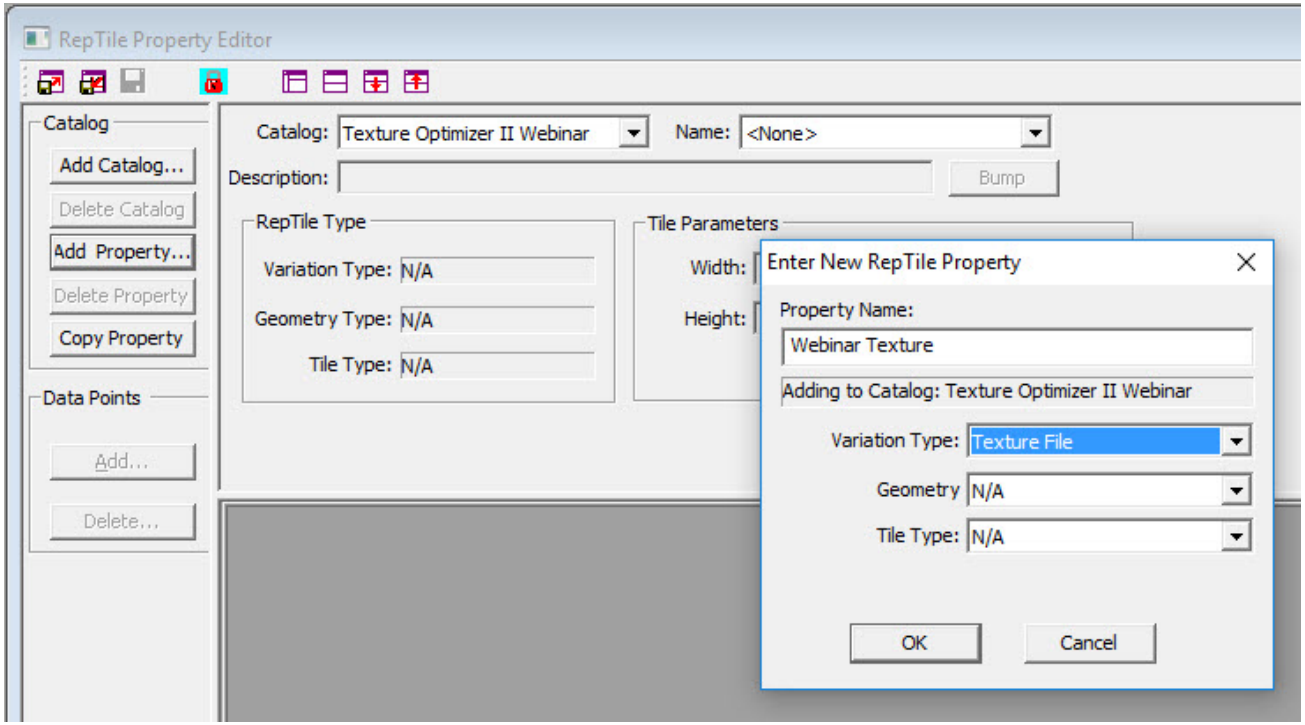
Make a new RepTile Property in TracePro by going to Define->Edit Property Data->RepTile Properties



TracePro

Setting up the Texture Optimizer II

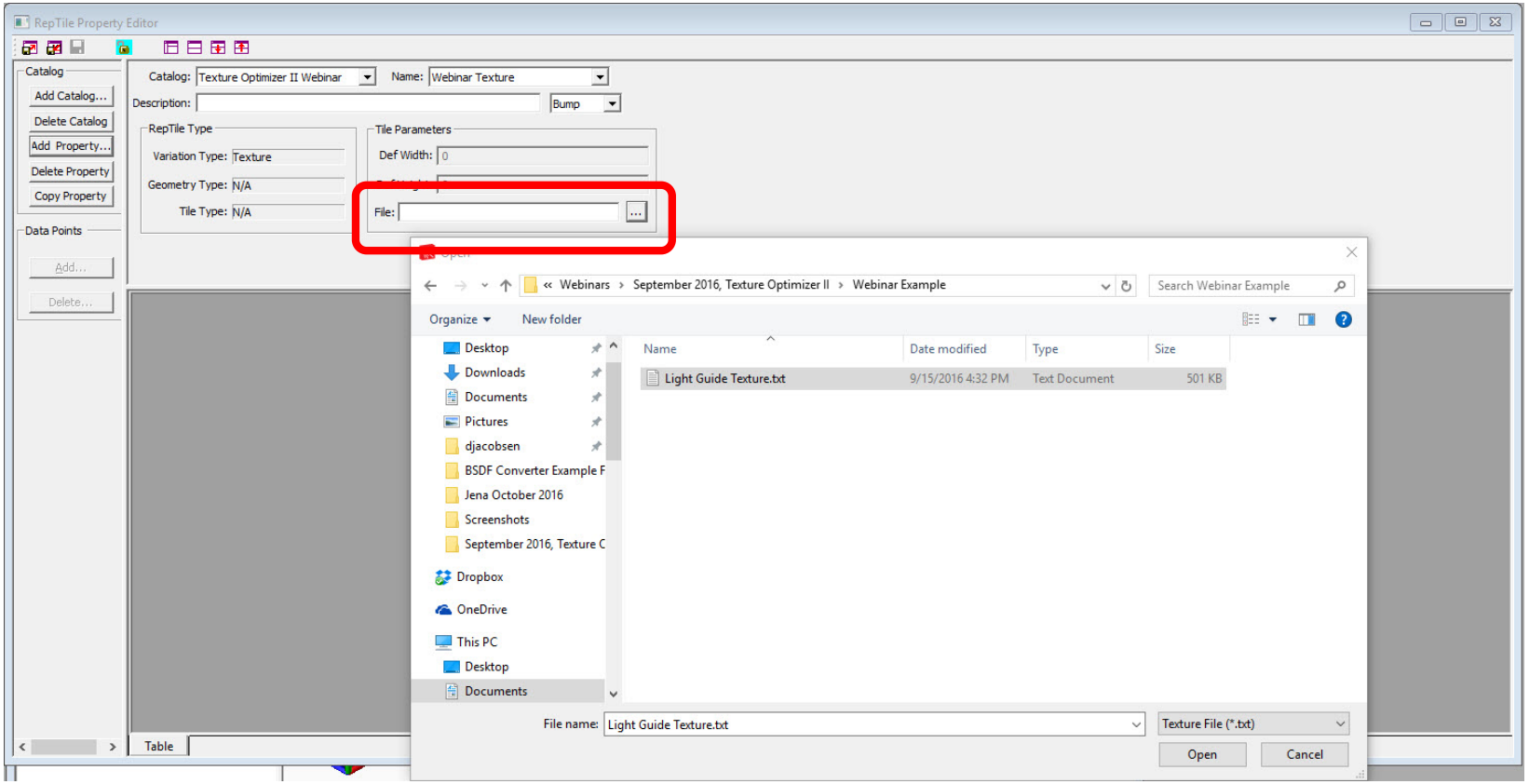
Select a Catalog or make a new one using Add Catalog. Click Add Property. Give the property a Name and select Texture File for the Variation Type. Click OK.



TracePro

Setting up the Texture Optimizer II

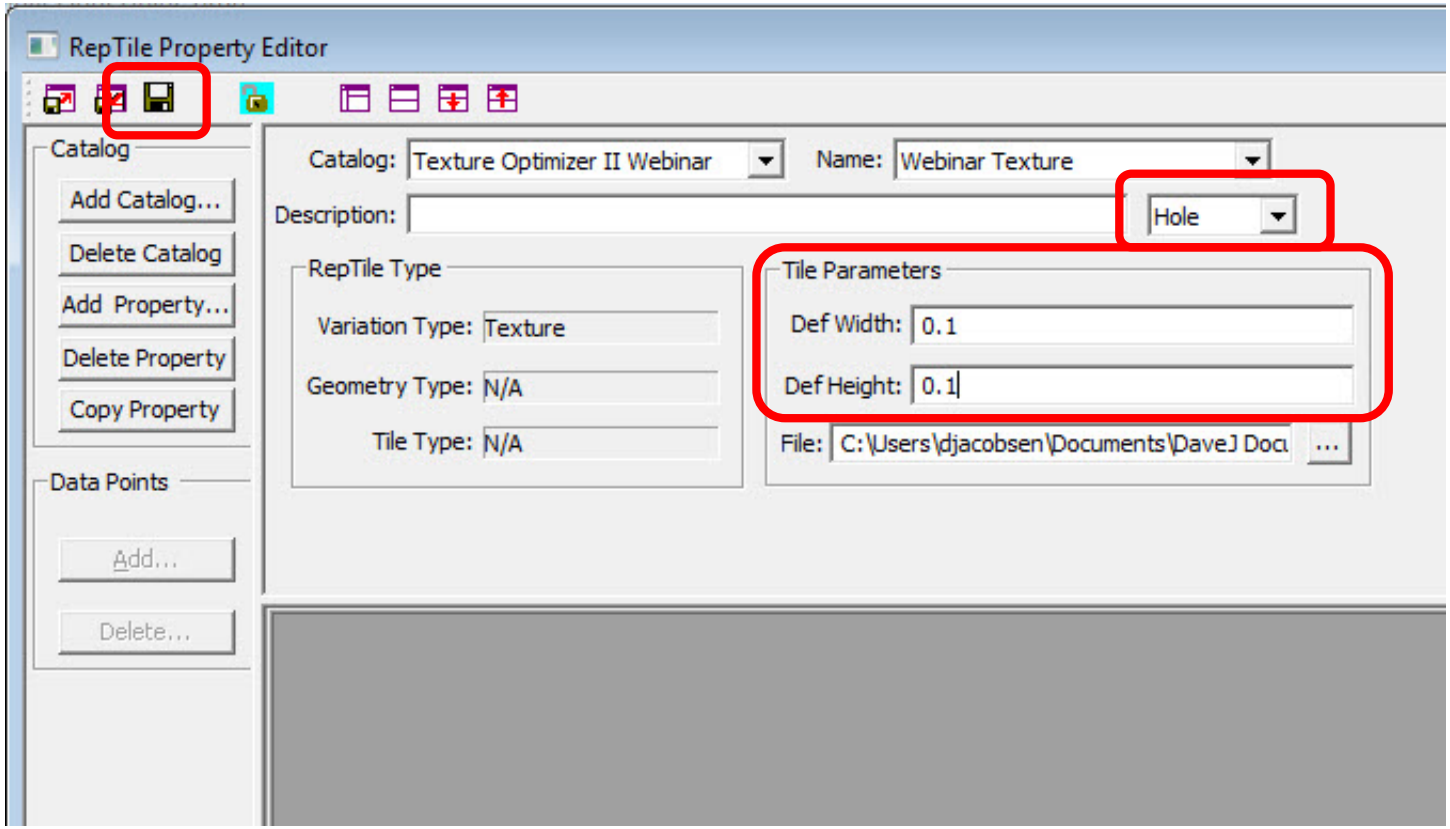
Click the Browse icon next to File: and then browse to the Texture File that was previously saved and then click Open



TracePro

Setting up the Texture Optimizer II

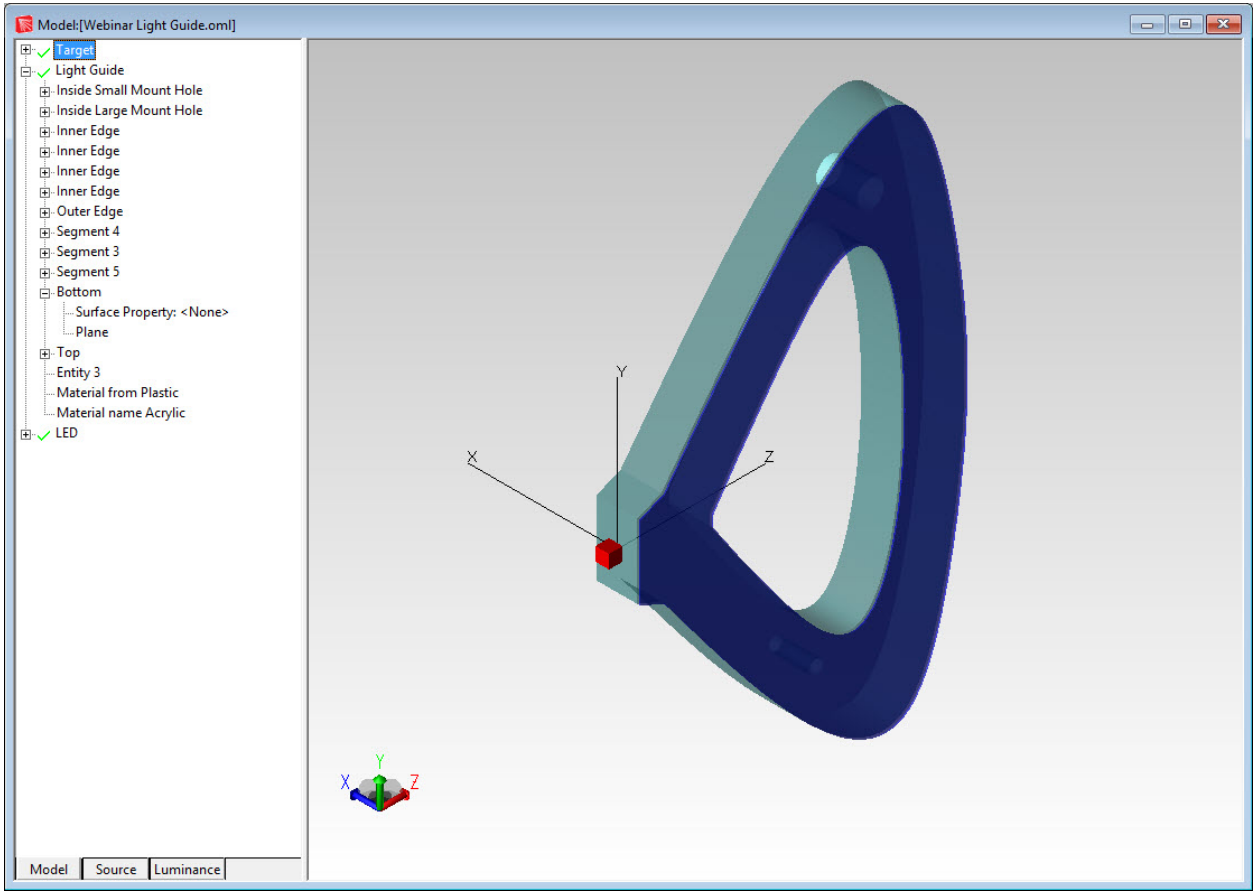
Select Hole and then enter 0.1 for Def Width and Def Height Tile Parameters. Click the disk icon to save the RepTile property.



TracePro

Setting up the Texture Optimizer II

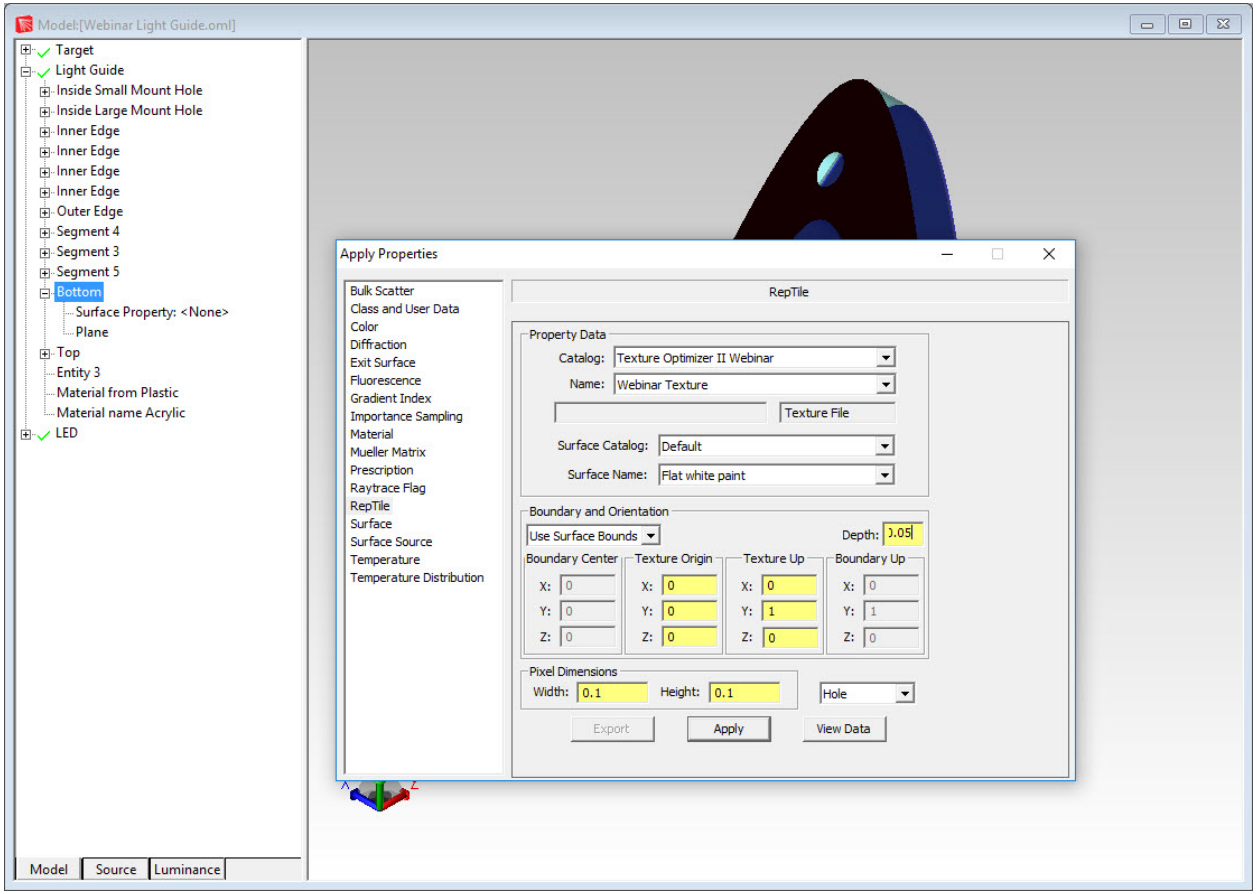
Apply the RepTile to the Light Guide model in TracePro.



TracePro

Setting up the Texture Optimizer II

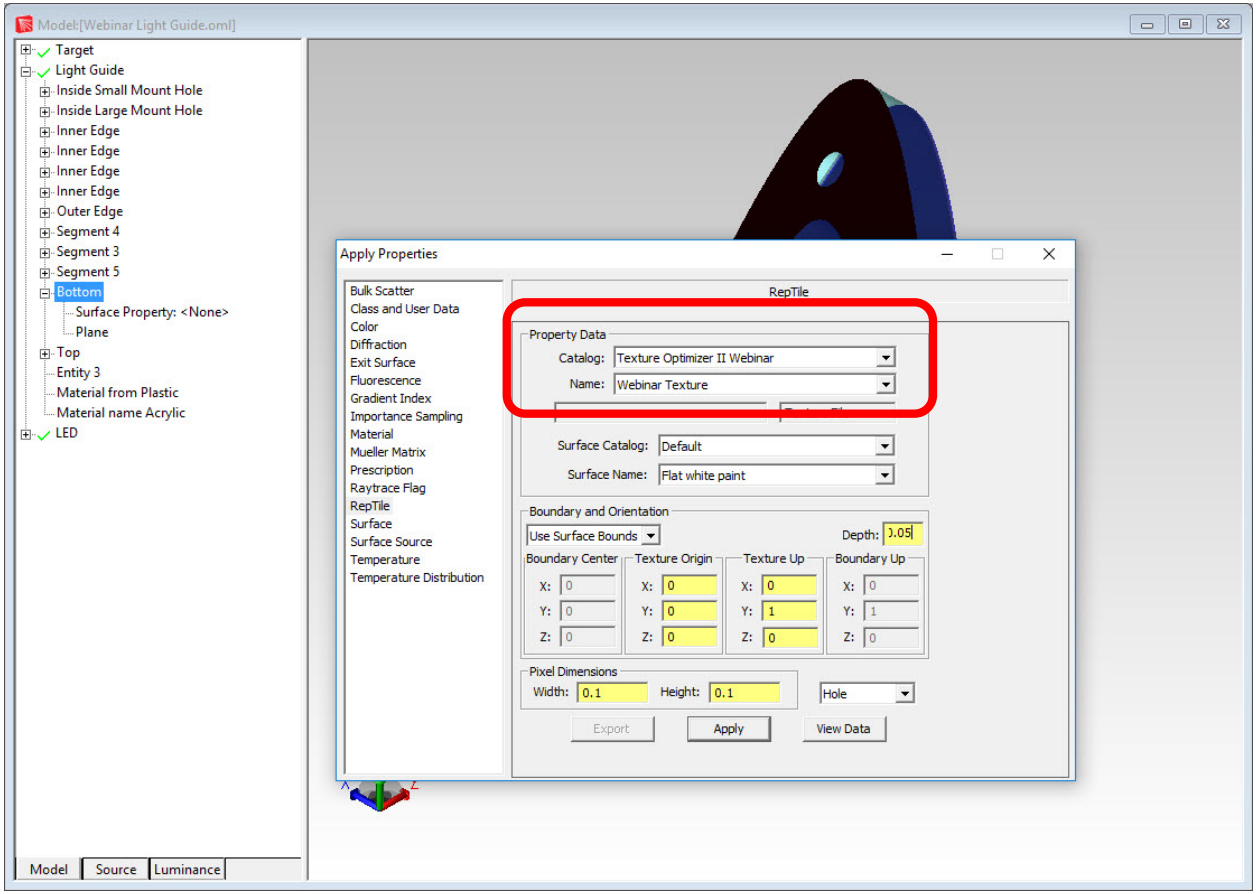
Select the surface named “Bottom” of the “Target” object, right click, choose Properties, and then choose RepTile



TracePro

Setting up the Texture Optimizer II

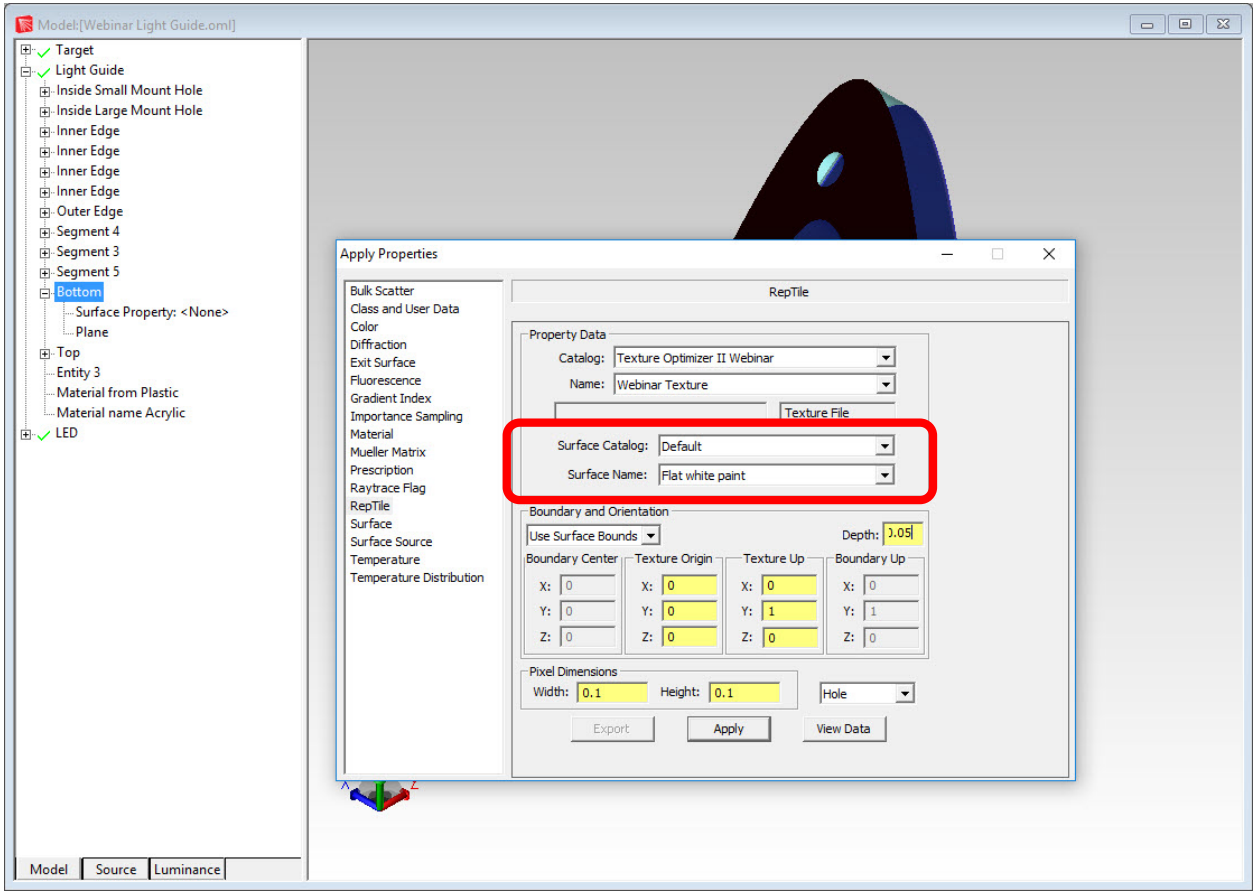
Select the Catalog and Name for the RepTile property that was previously saved



TracePro

Setting up the Texture Optimizer II

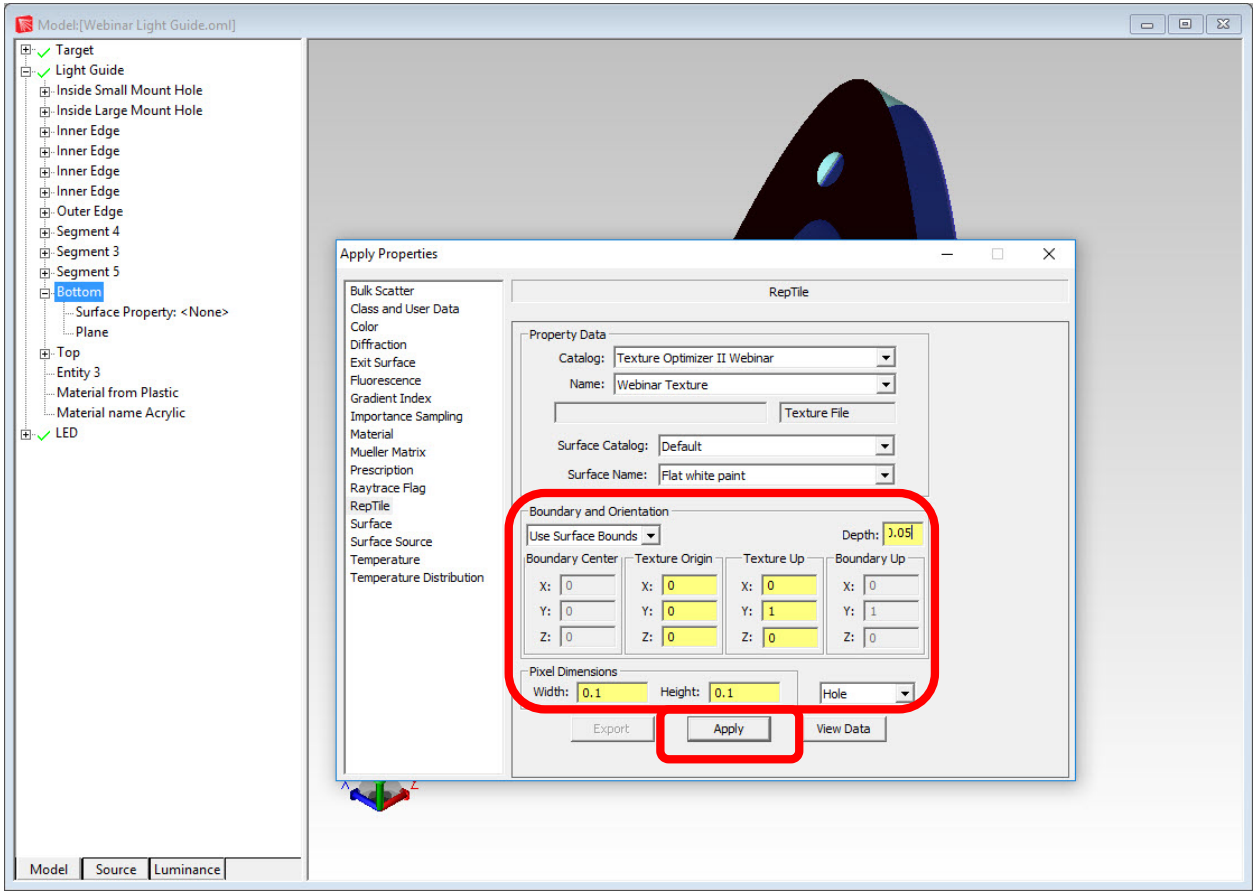
Select Default for the Surface Catalog and Flat white paint for the Surface Name. This will apply the flat white paint property to the RepTile features.



TracePro

Setting up the Texture Optimizer II

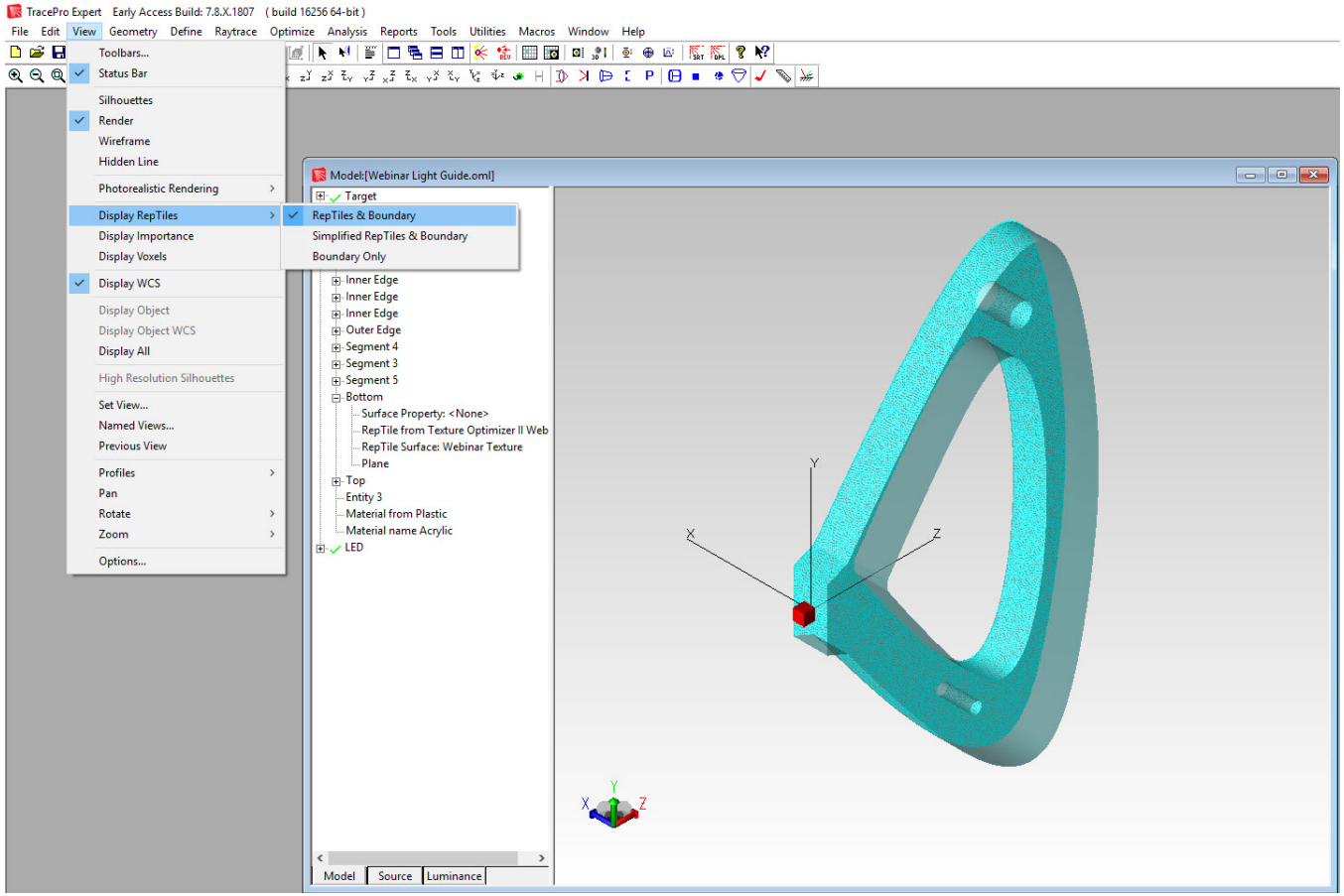
Enter 0.05 for the Depth and choose Use Surface Bounds for the Boundary and Orientation. Click Apply to apply the RepTile property.



TracePro

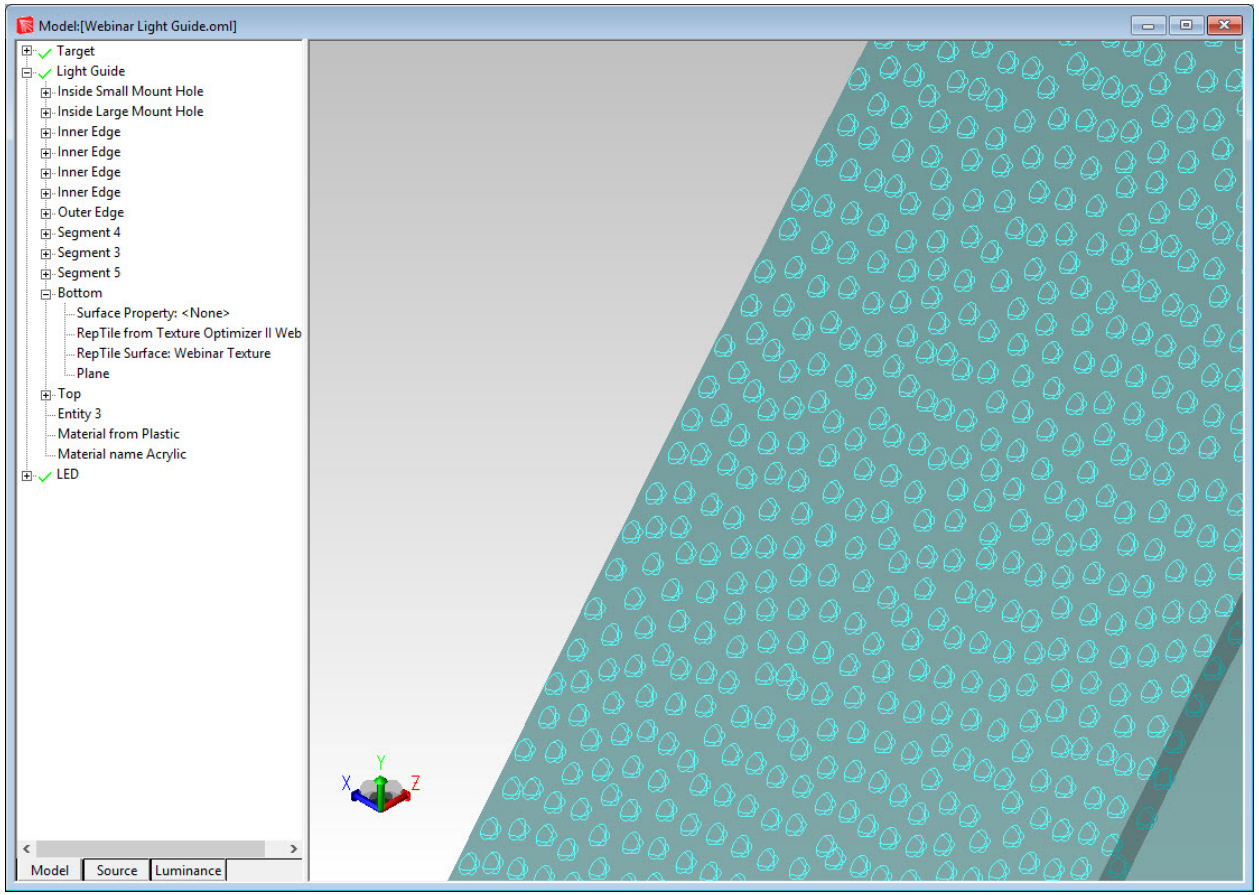
Setting up the Texture Optimizer II

Display the RepTile by going to View->Display RepTiles->RepTiles & Boundary



Setting up the Texture Optimizer II

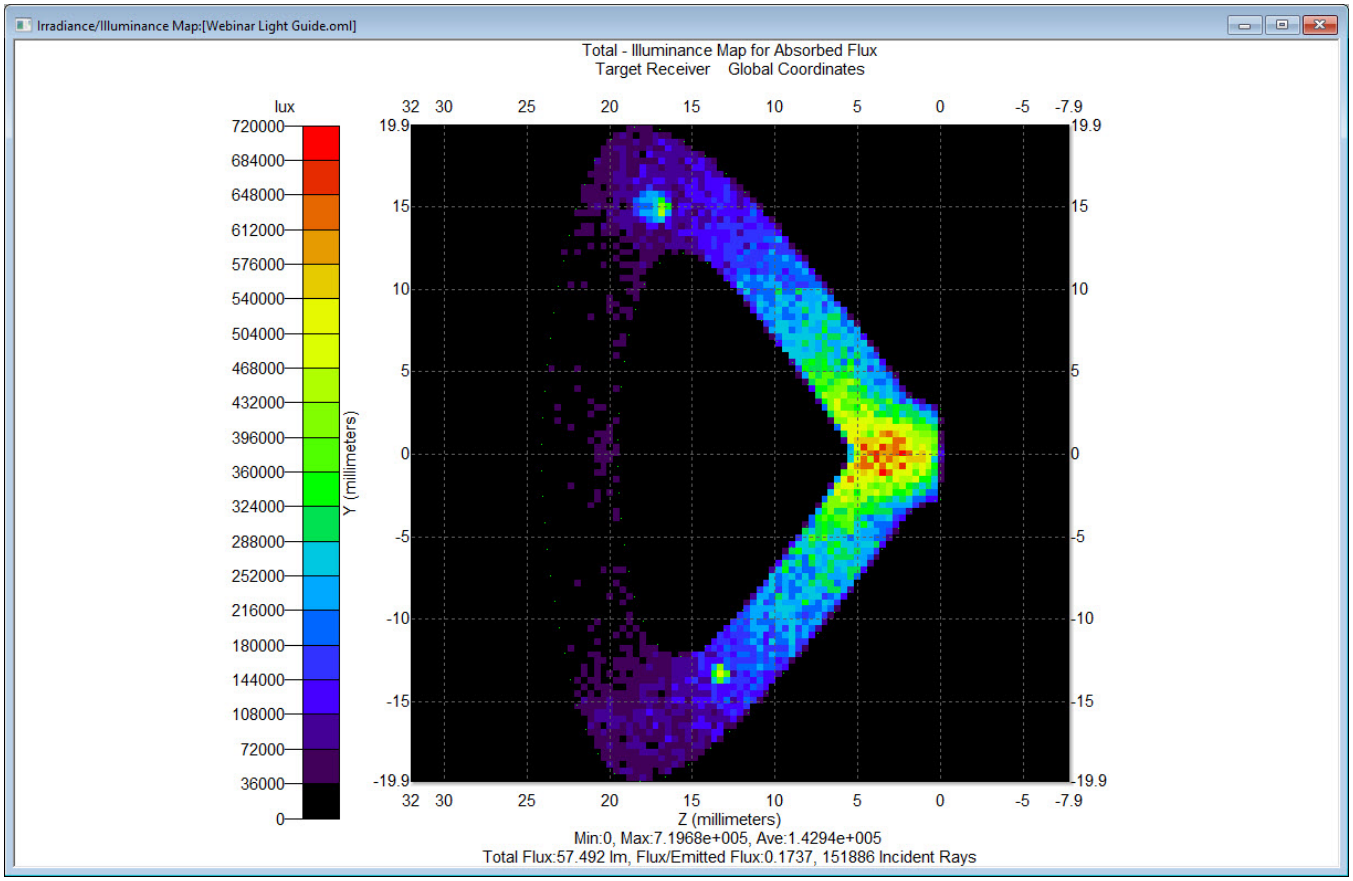
Display the RepTile by going to View->Display RepTiles->RepTiles & Boundary



TracePro

Setting up the Texture Optimizer II

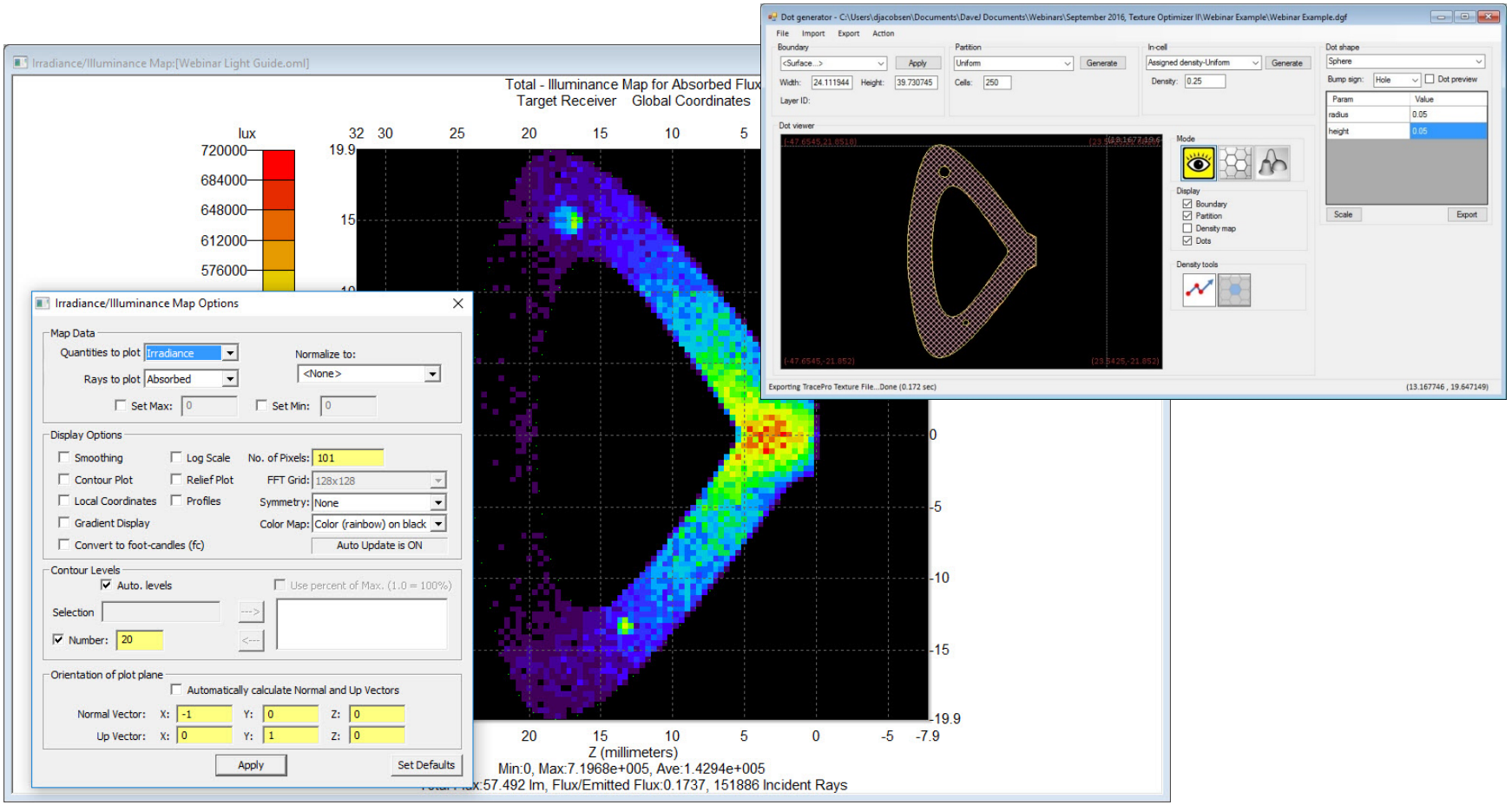
Display the Illuminance Map for the “Receiver” surface of the “Target”



TracePro

Setting up the Texture Optimizer II

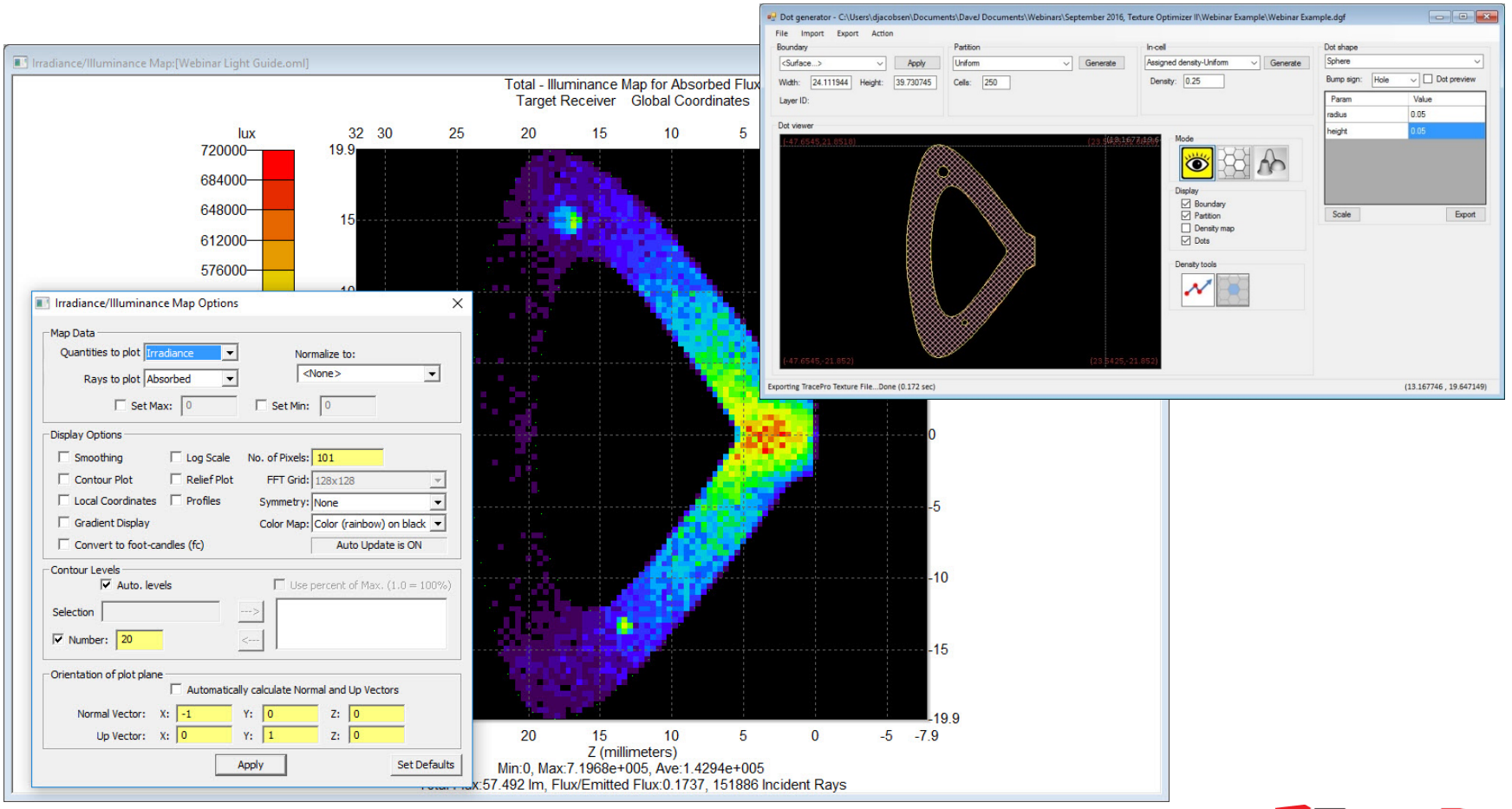
Adjust the Normal and Up Vectors for the Irradiance/Illuminance Map so that the plot matches the orientation in the Texture Optimizer II



TracePro

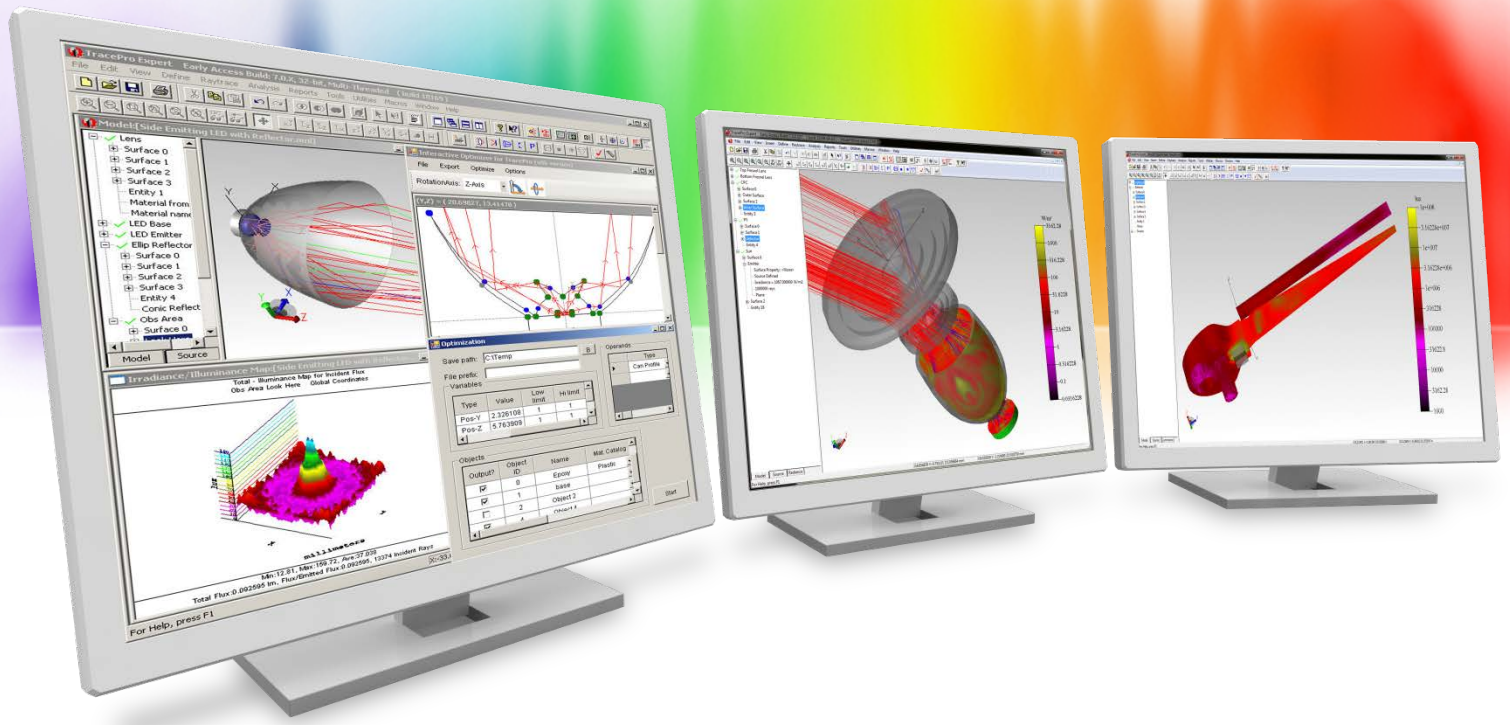
Setting up the Texture Optimizer II

We are now ready to start the optimization process



TracePro

TracePro

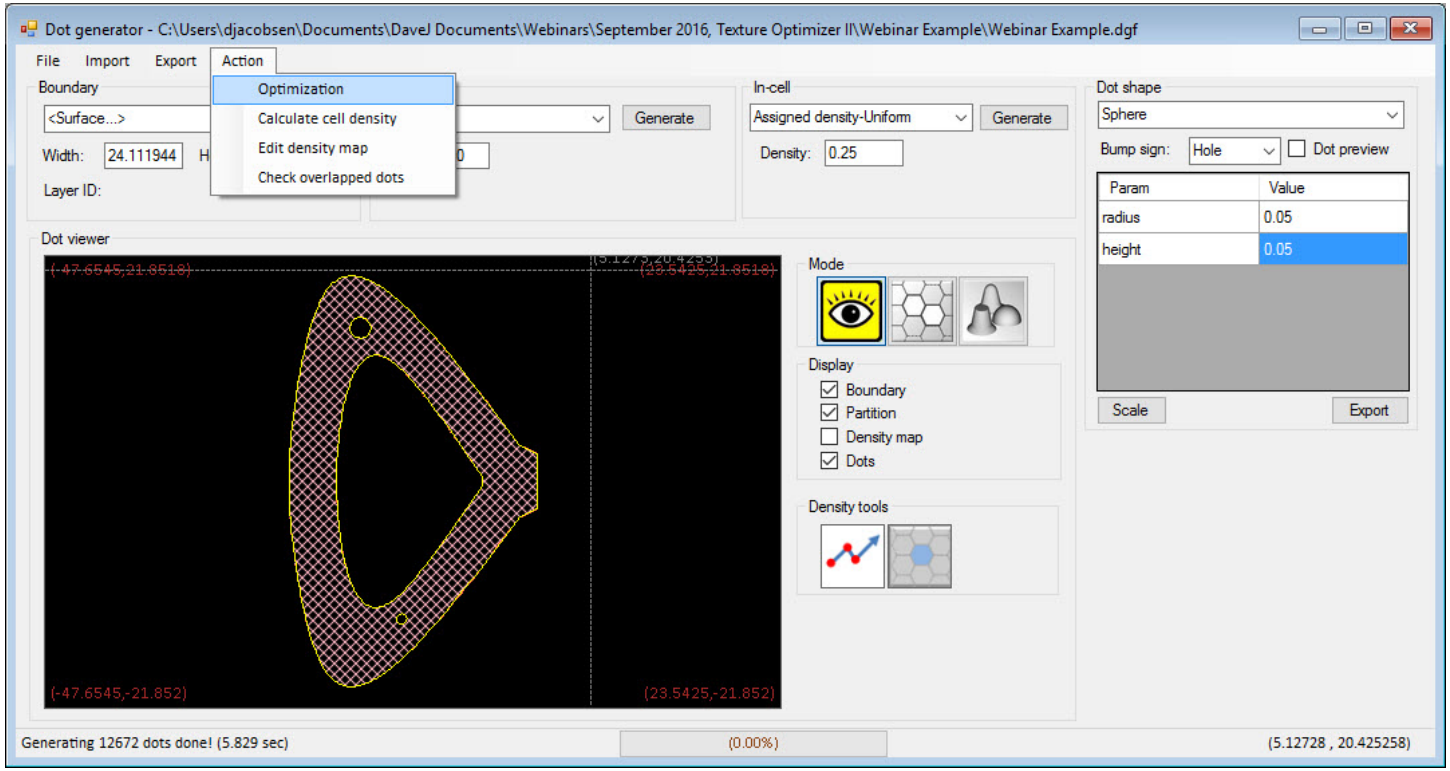


The texture optimization process

LAMBDA RESEARCH CORPORATION

Texture Optimization

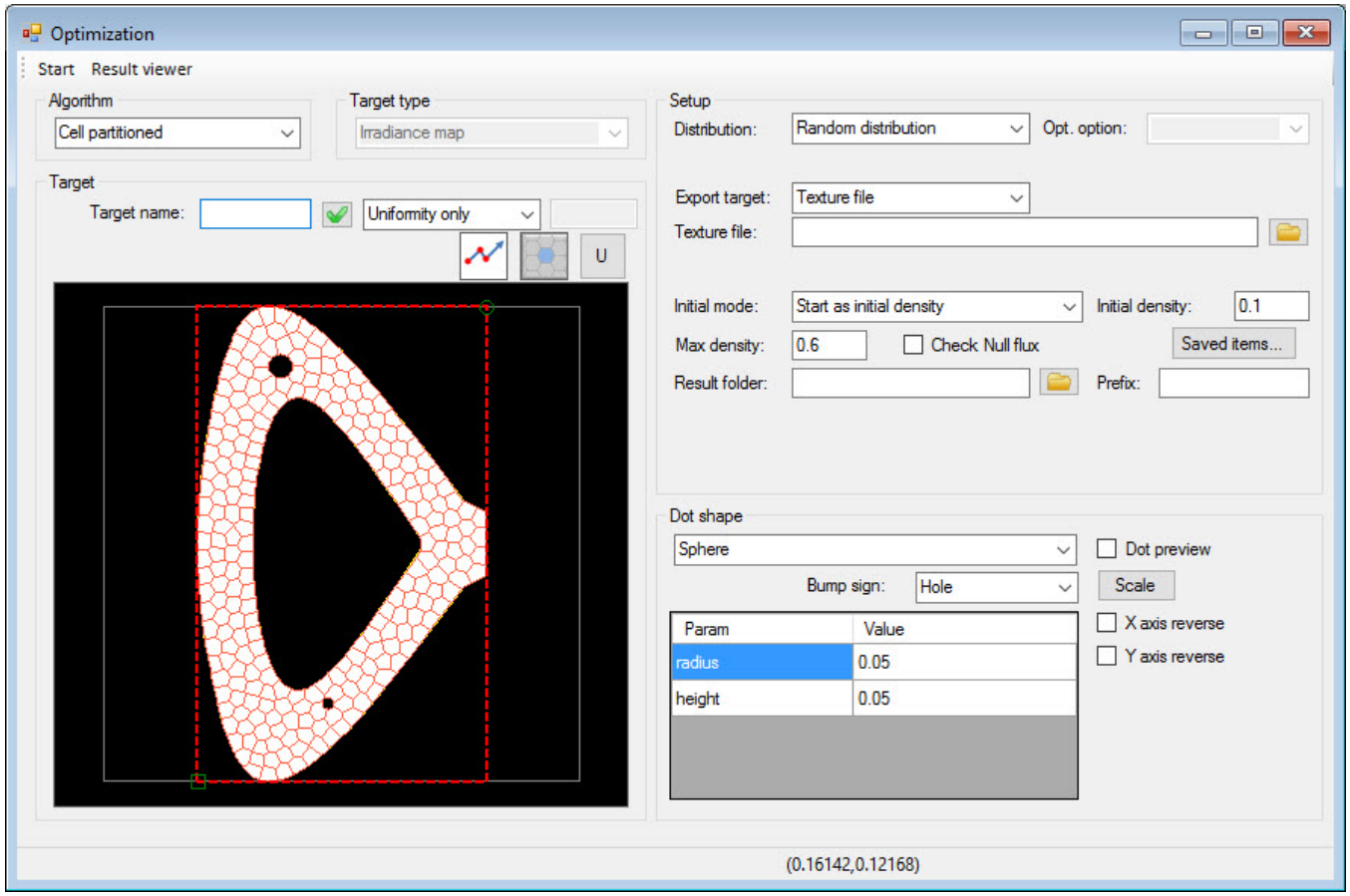
Open the optimization window by going to Action->Optimization



TracePro

Texture Optimization

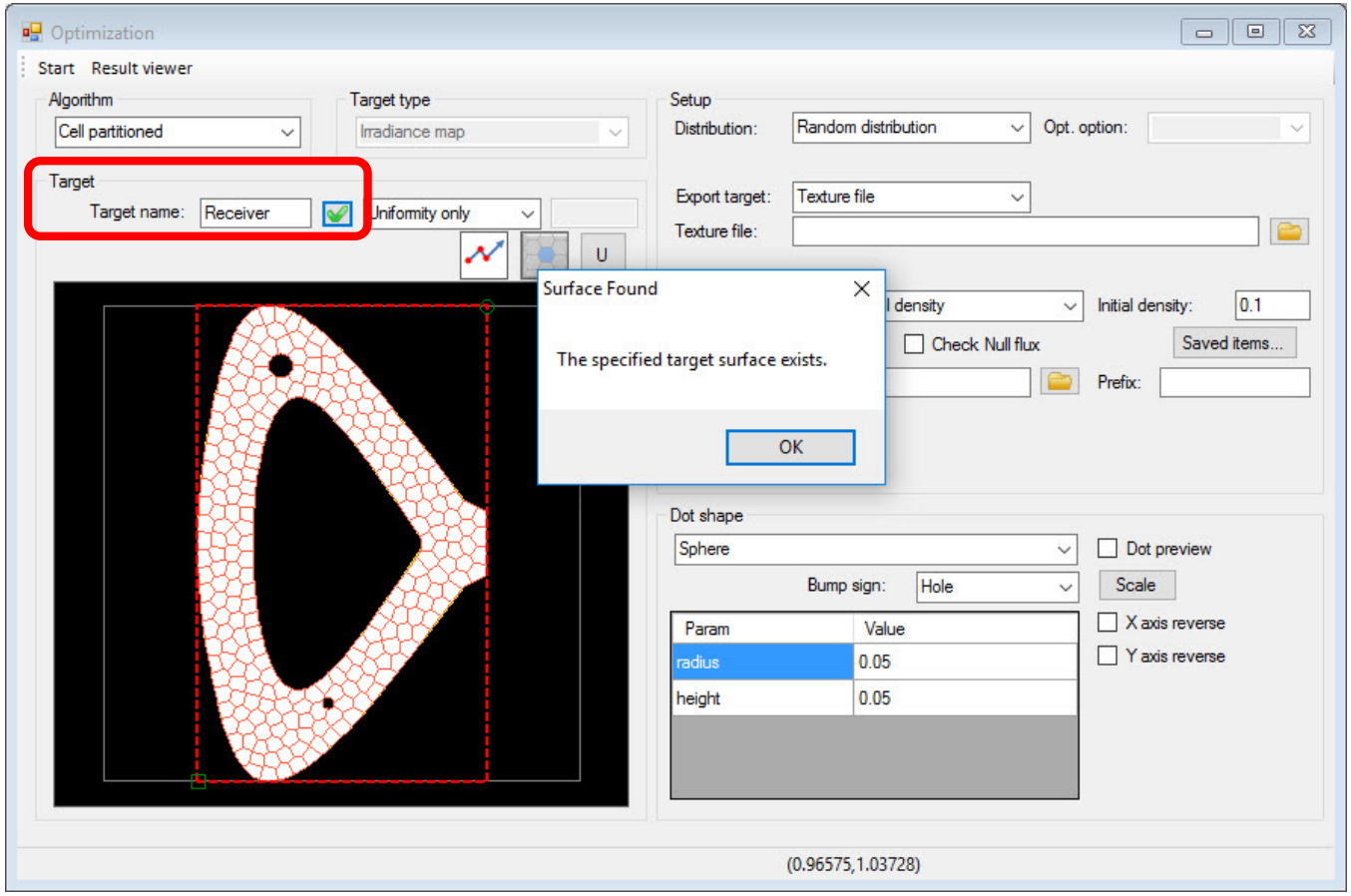
Texture Optimizer II Optimization window



TracePro

Texture Optimization

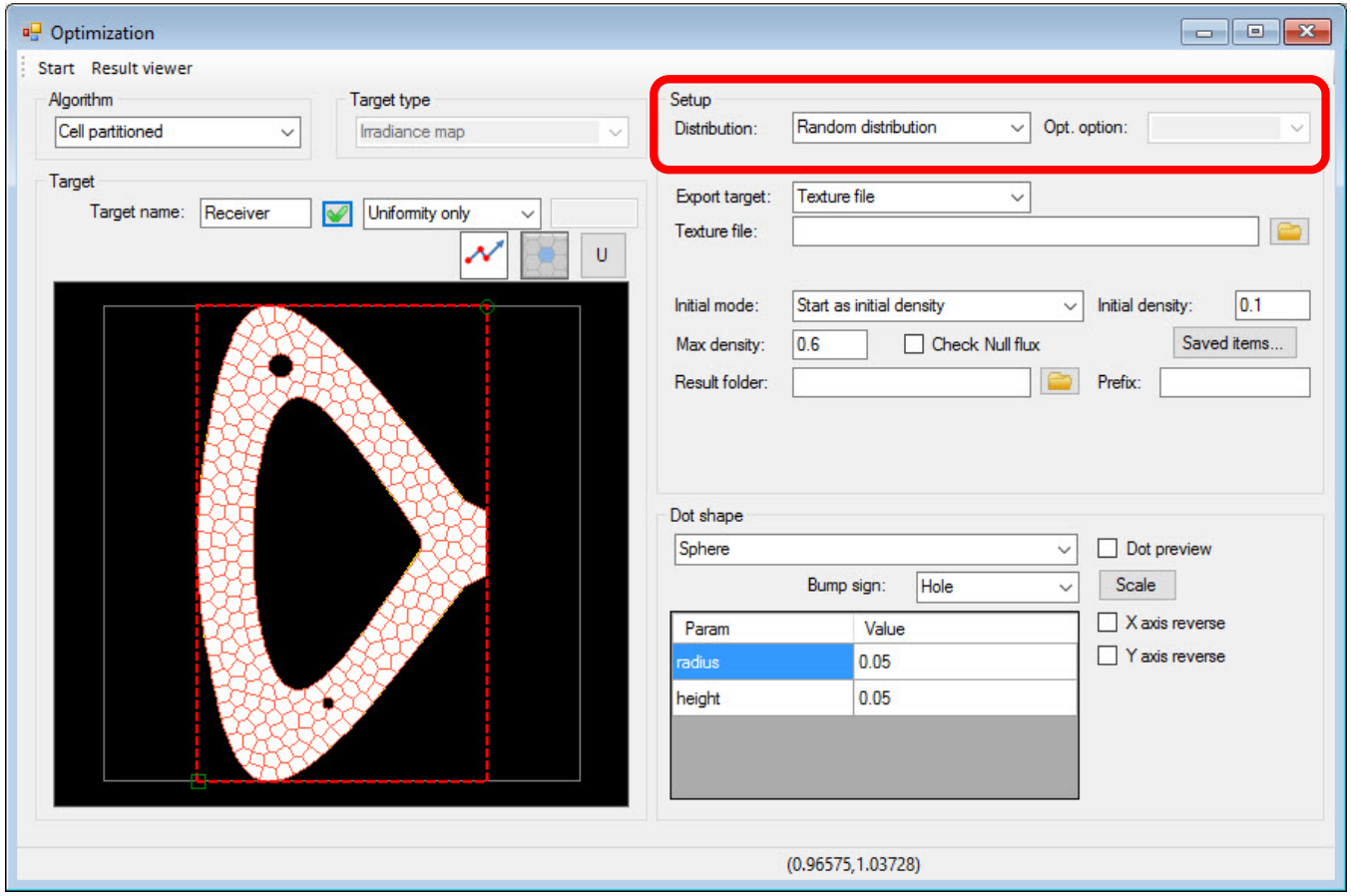
Enter “Receiver” for the Target Name. Clicking the green checkmark will verify that the surface exists



TracePro

Texture Optimization

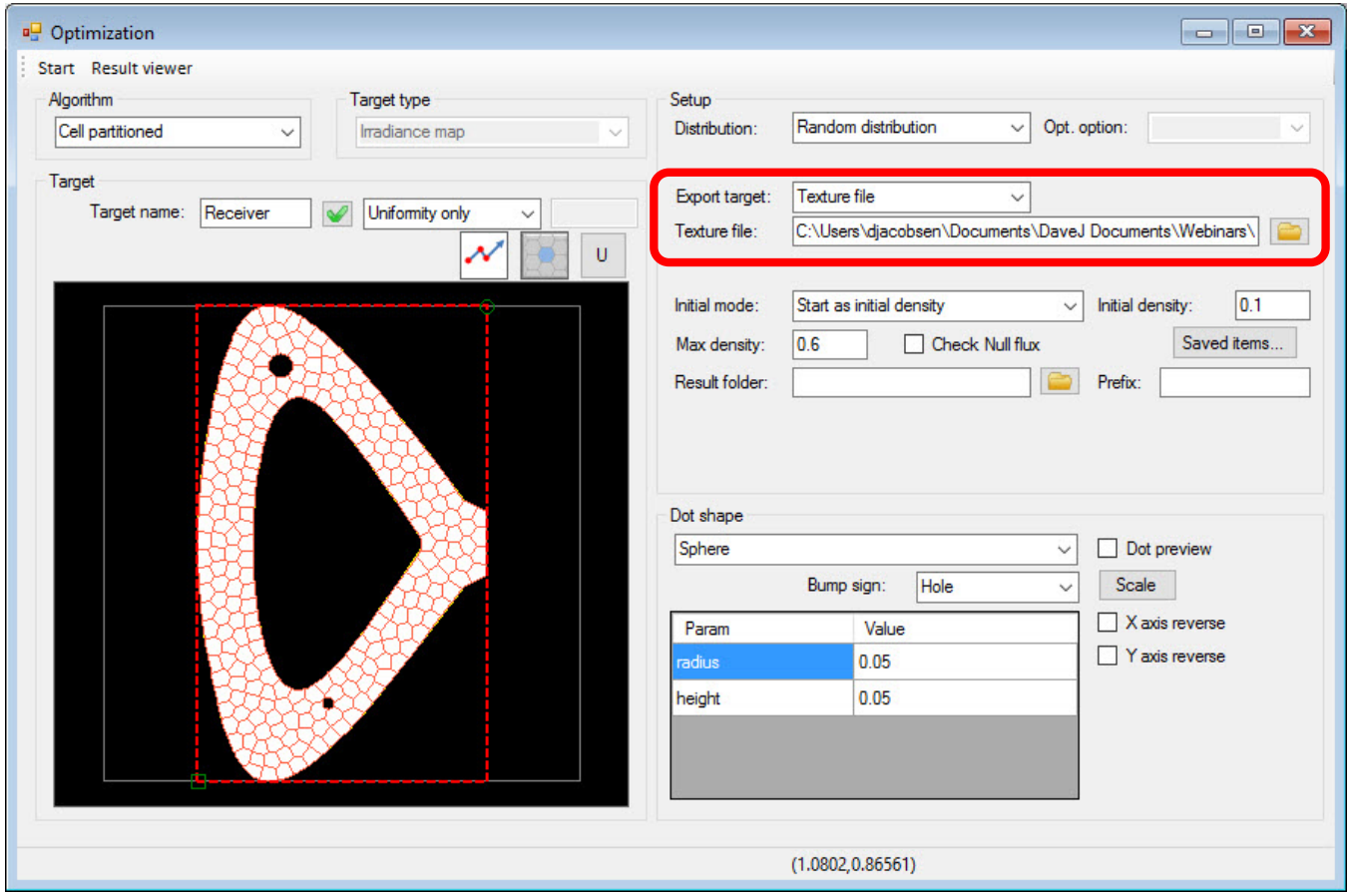
Choose Random distribution for Distribution. This option will optimize the texture pattern by varying the texture density in each cell.



TracePro

Texture Optimization

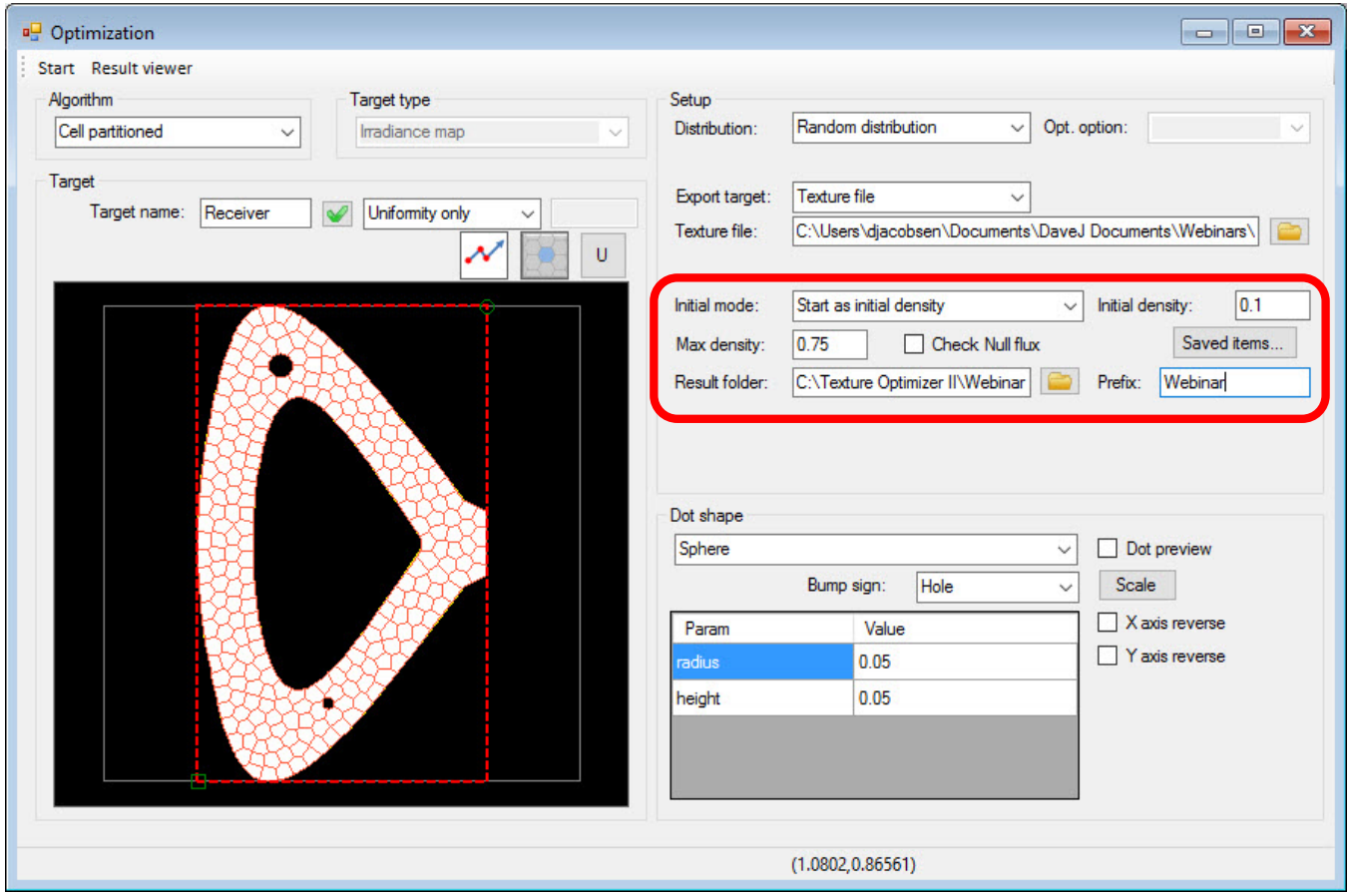
Select Texture file for the Export Target and then browse to the location of the saved Texture File



TracePro

Texture Optimization

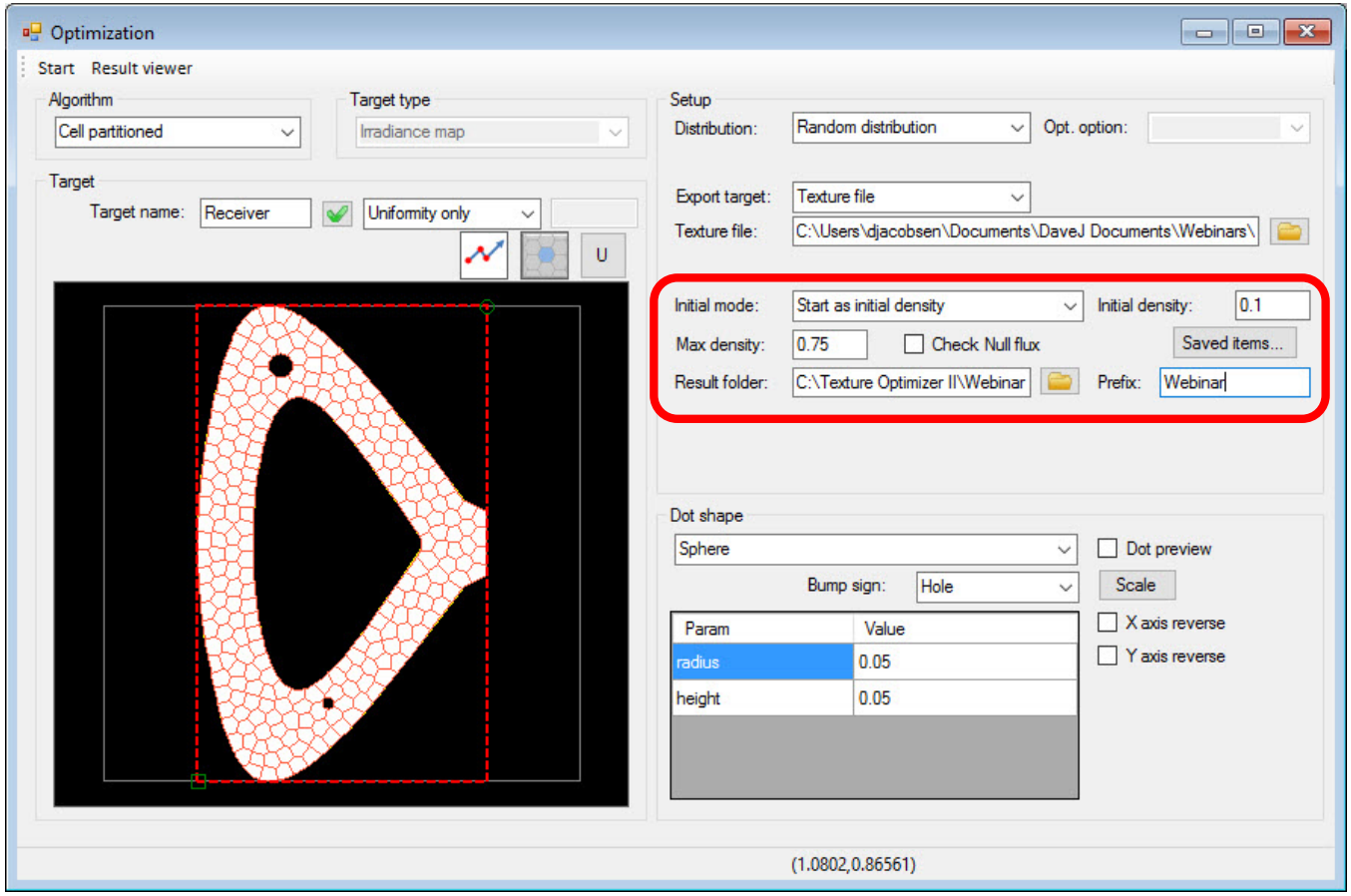
Set the Initial Mode to Start as initial density. Set the Initial Density to 0.1 and the Max. Density to 0.75.



TracePro

Texture Optimization

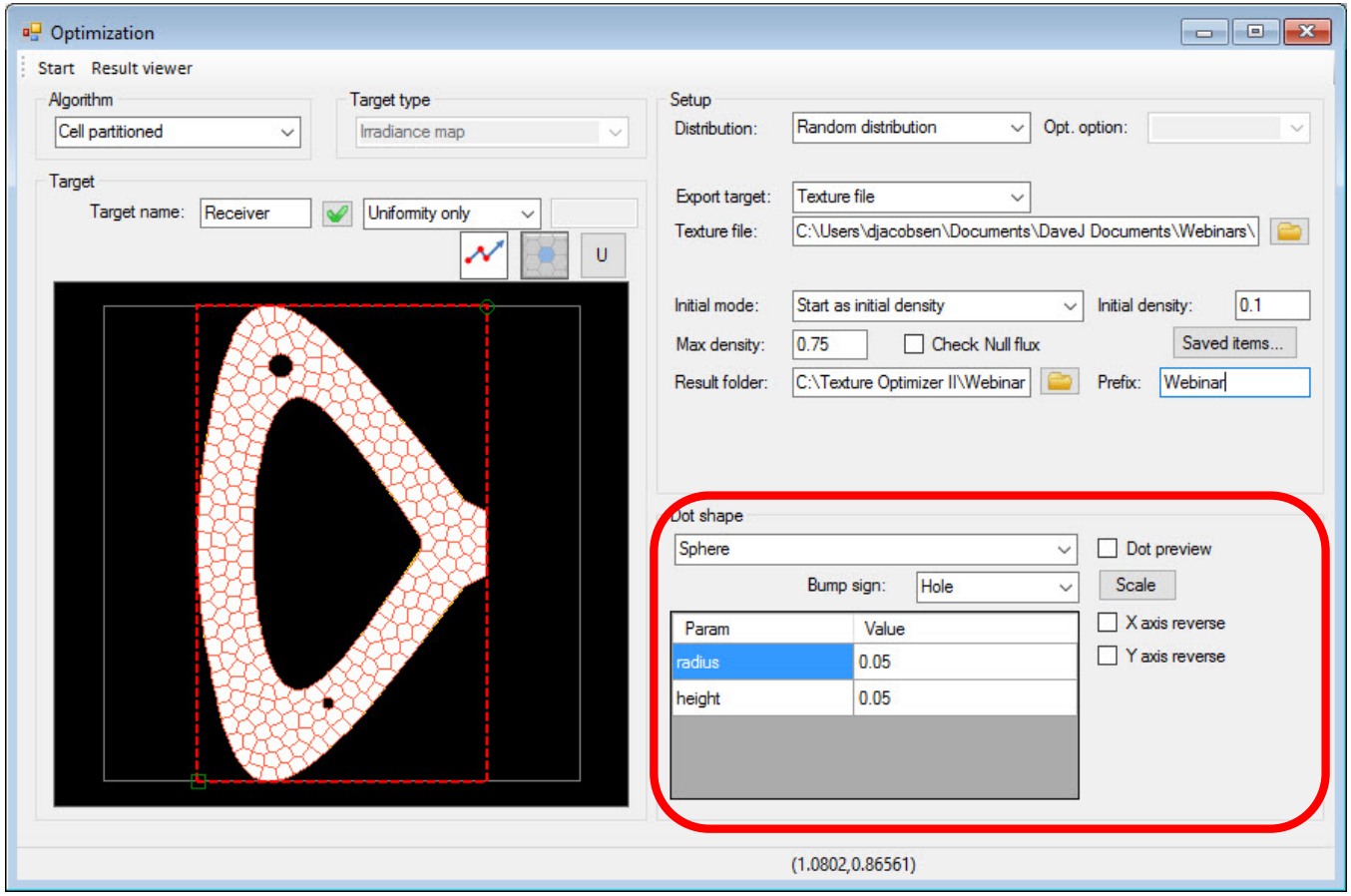
Browse to a location to for the Results Folder. This is where the results will be saved. Define a Prefix that will be used for each file.



TracePro

Texture Optimization

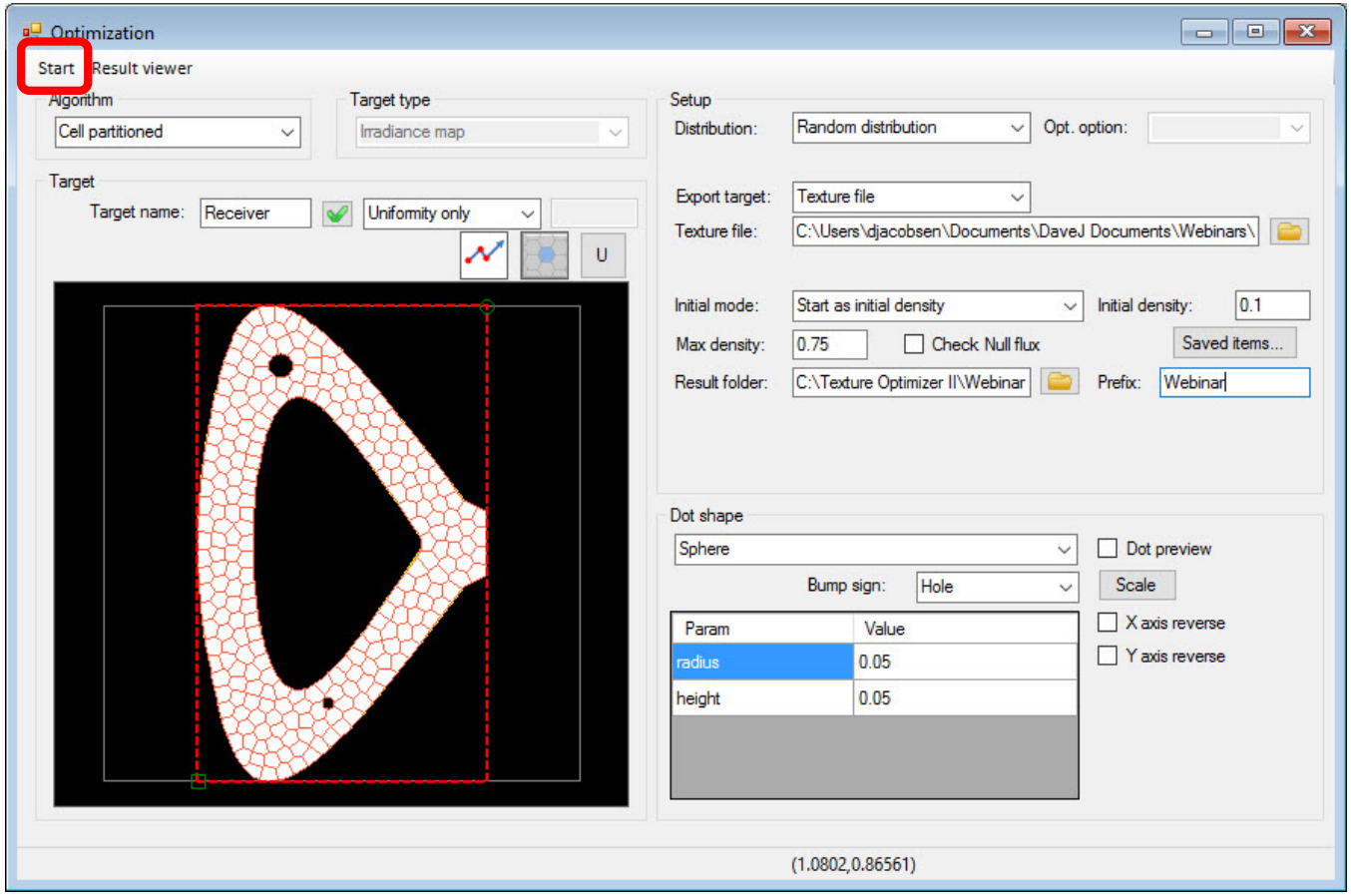
Verify the Dot Shape parameters



TracePro

Texture Optimization

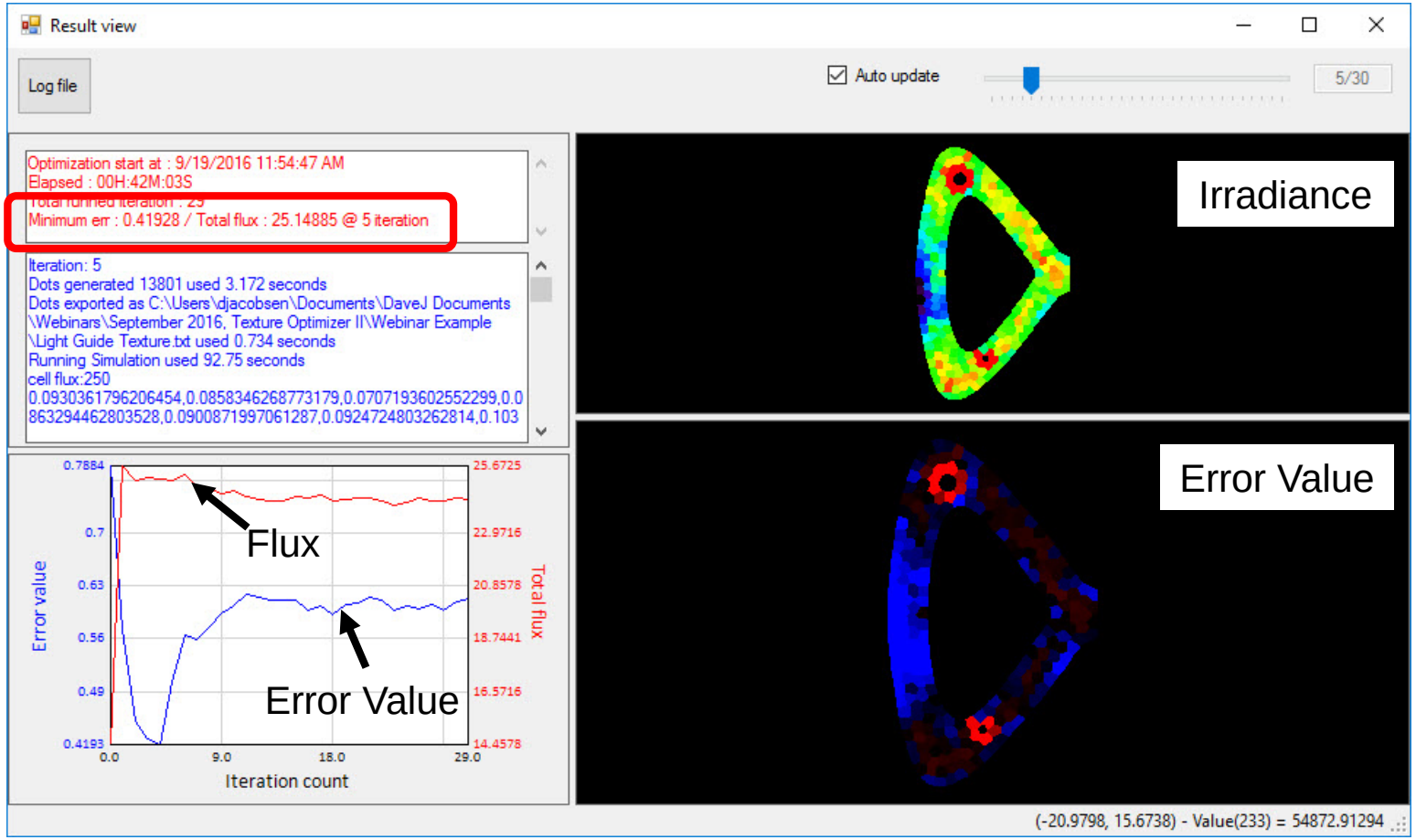
Click Start to start the optimization process



TracePro

Texture Optimization

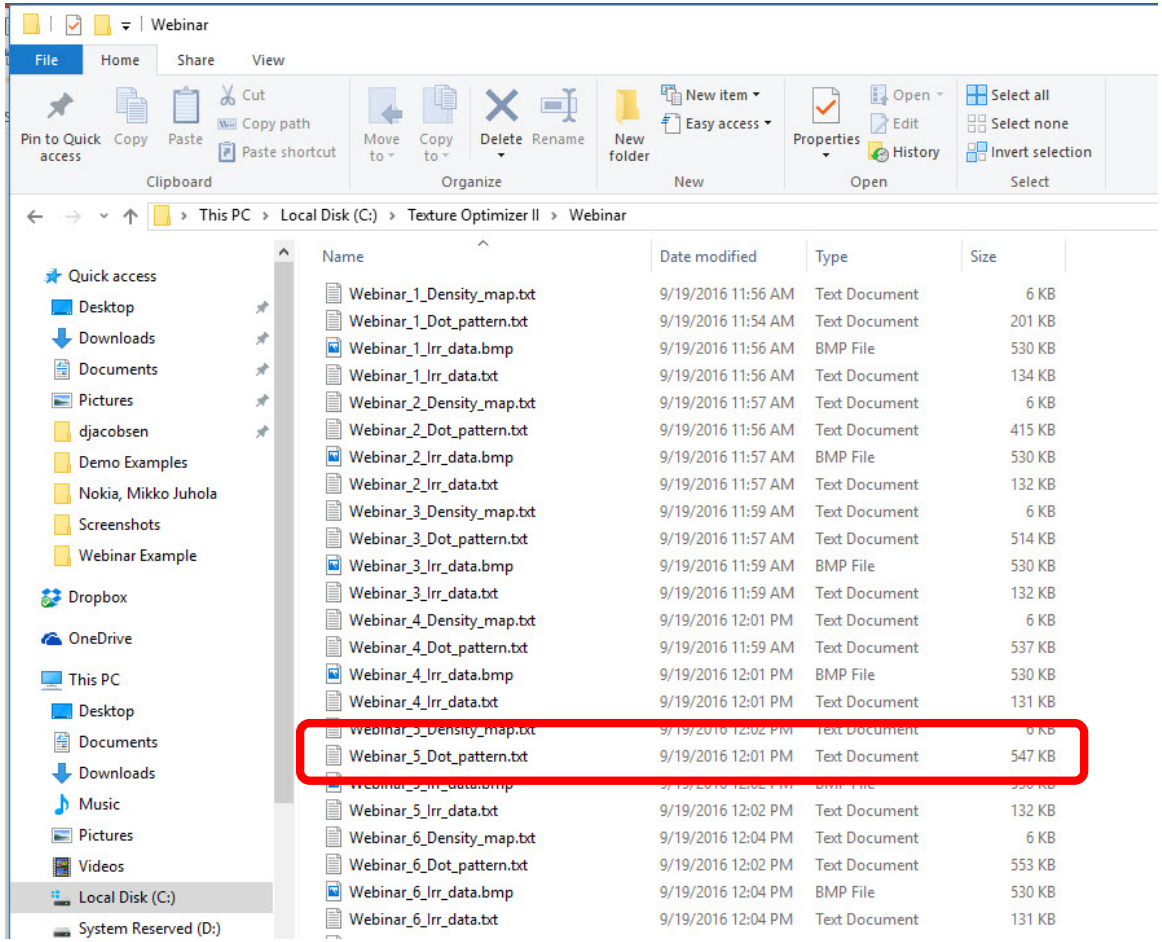
Optimization Log – Best result was the 5th iteration



TracePro

Texture Optimization

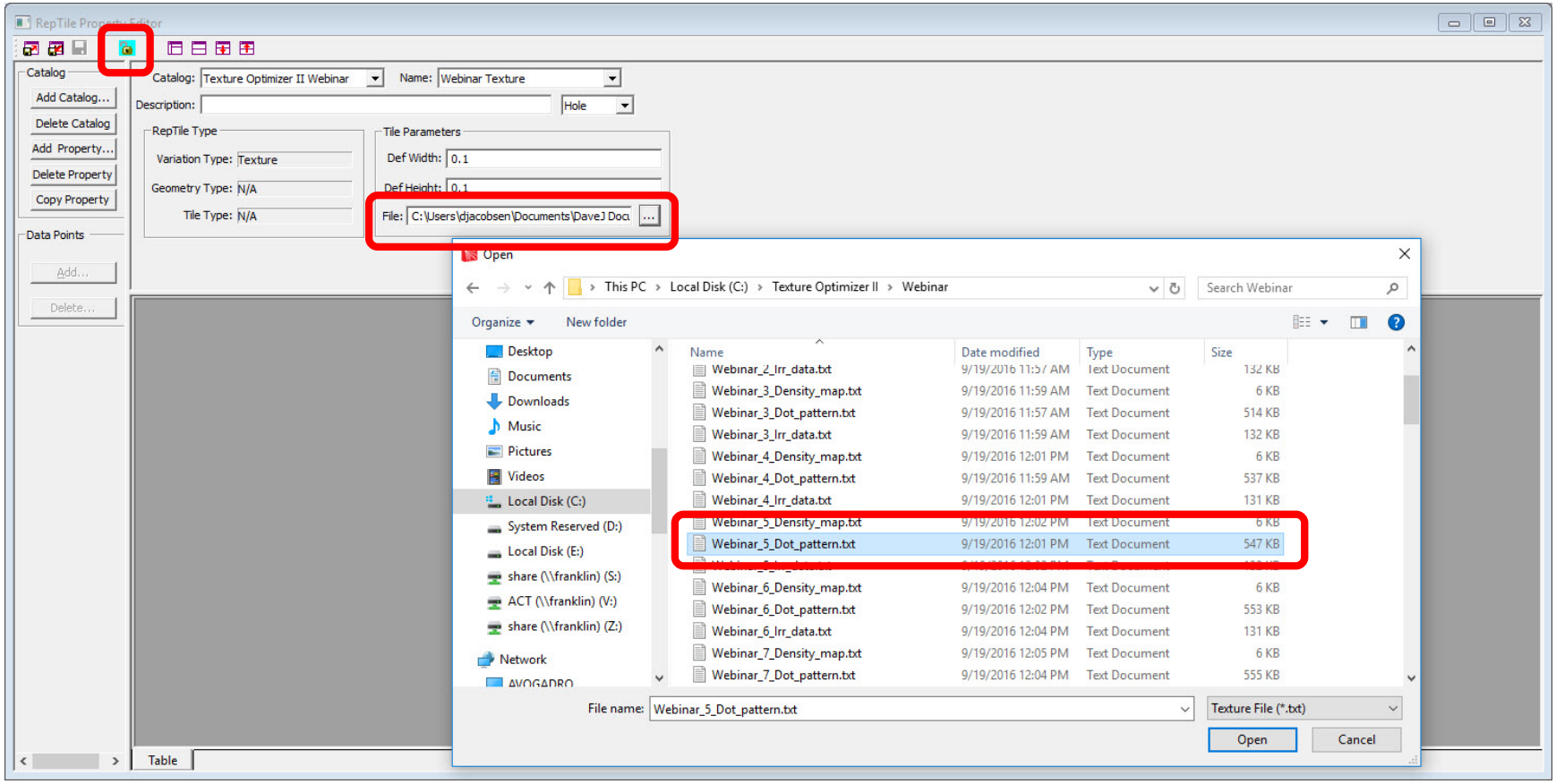
Dot_pattern.txt for best result in Results folder



TracePro

Texture Optimization

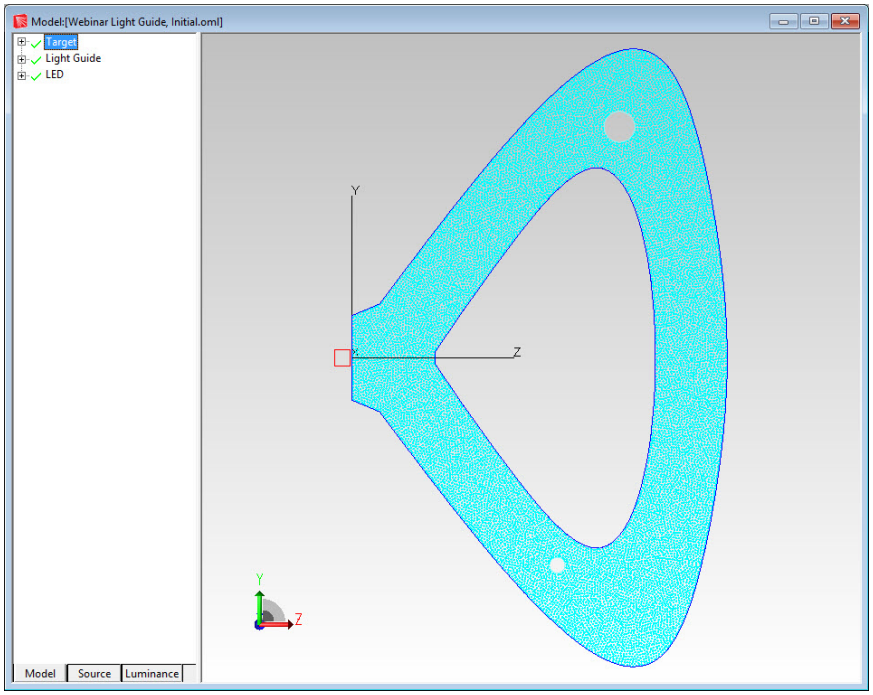
Update TracePro RepTile property using the best result Dot_pattern.txt file



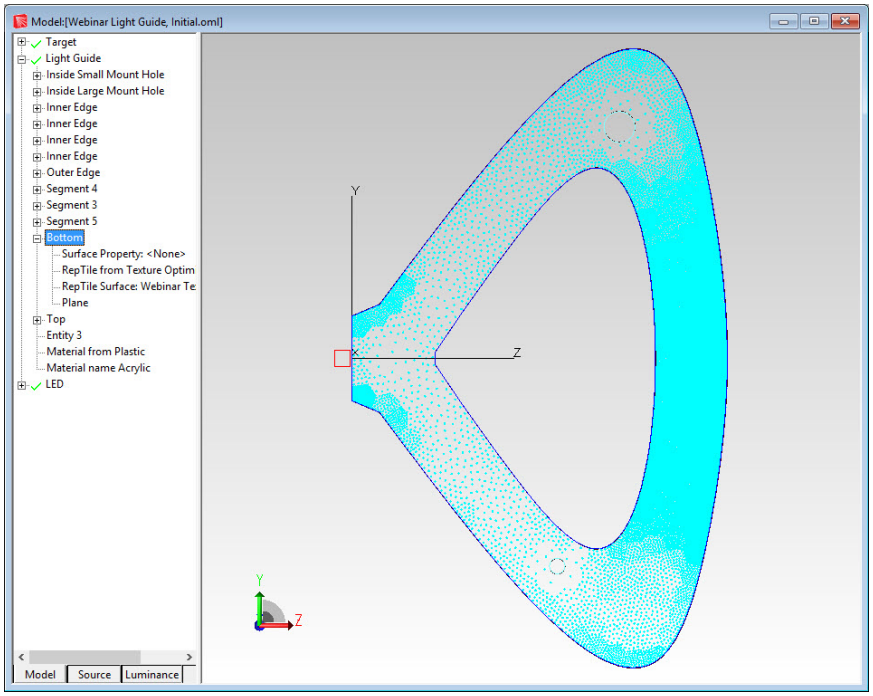
TracePro

Texture Optimization

Initial vs. Optimized RepTile Texture Pattern



Initial RepTile Texture Pattern

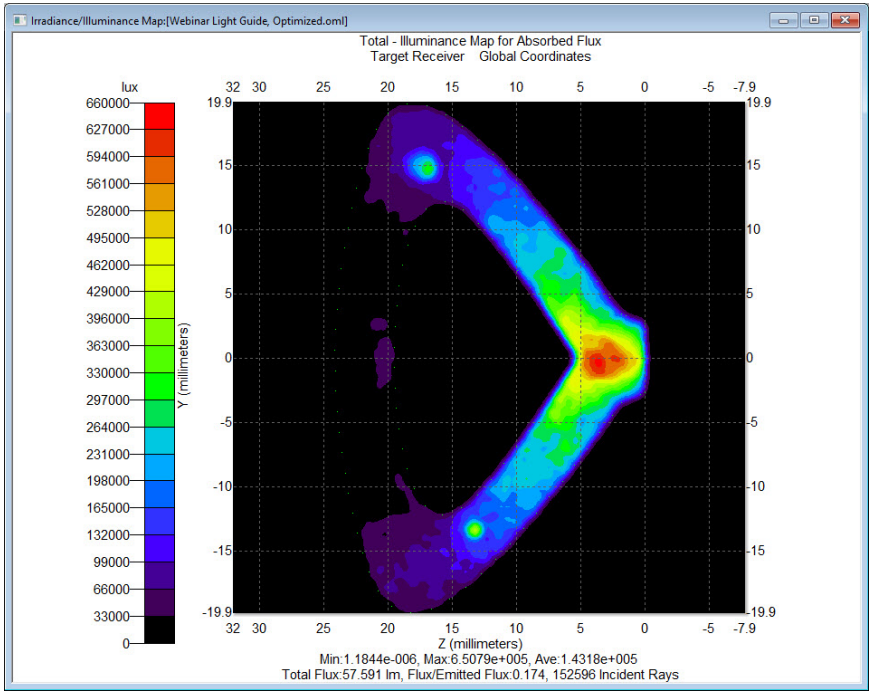


Optimized RepTile Texture Pattern

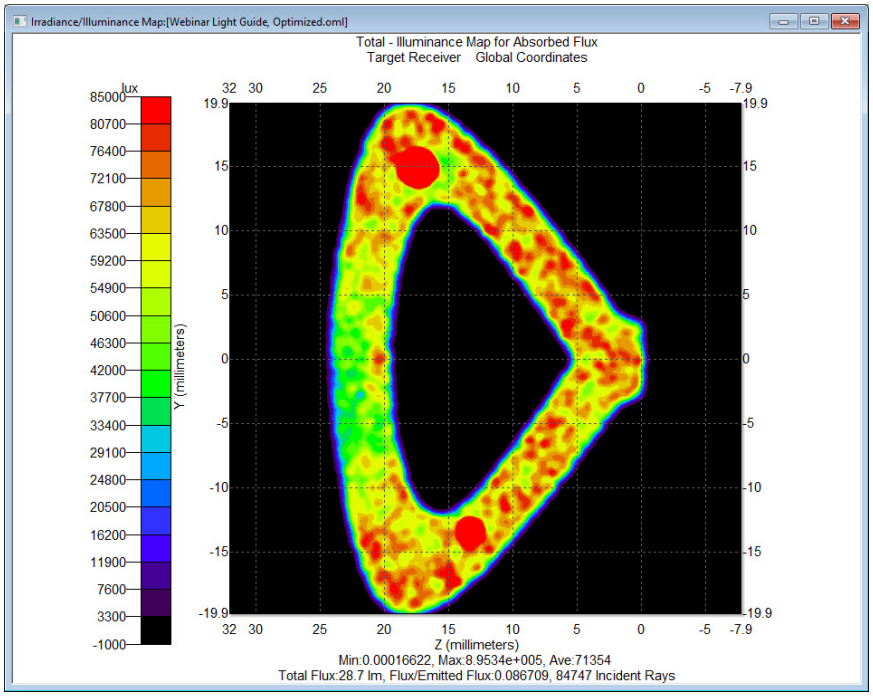
TracePro

Texture Optimization

Re-run the raytrace to check the results – Illuminance Map



Initial Illuminance Map

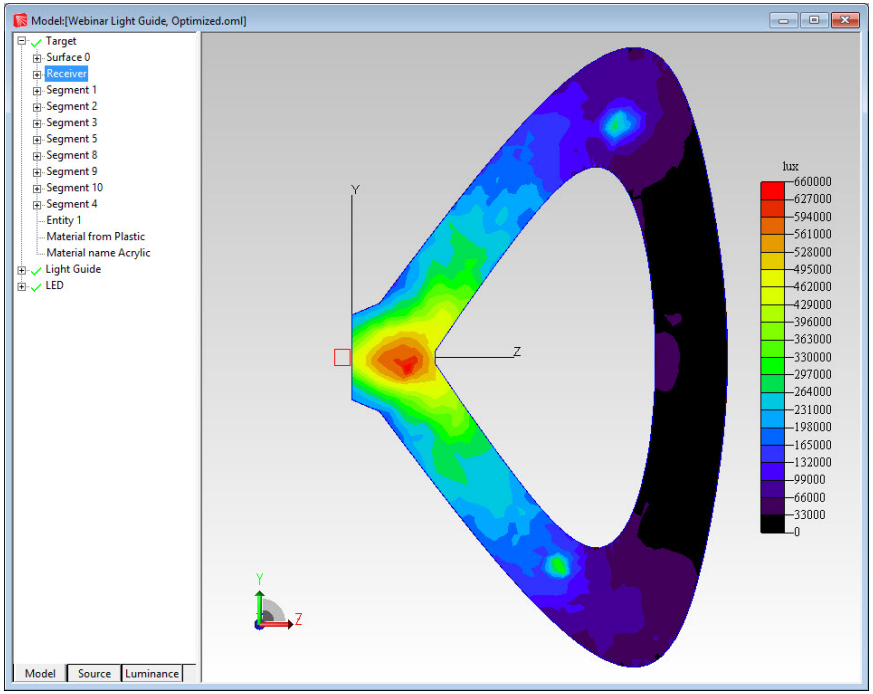


Optimized Illuminance Map

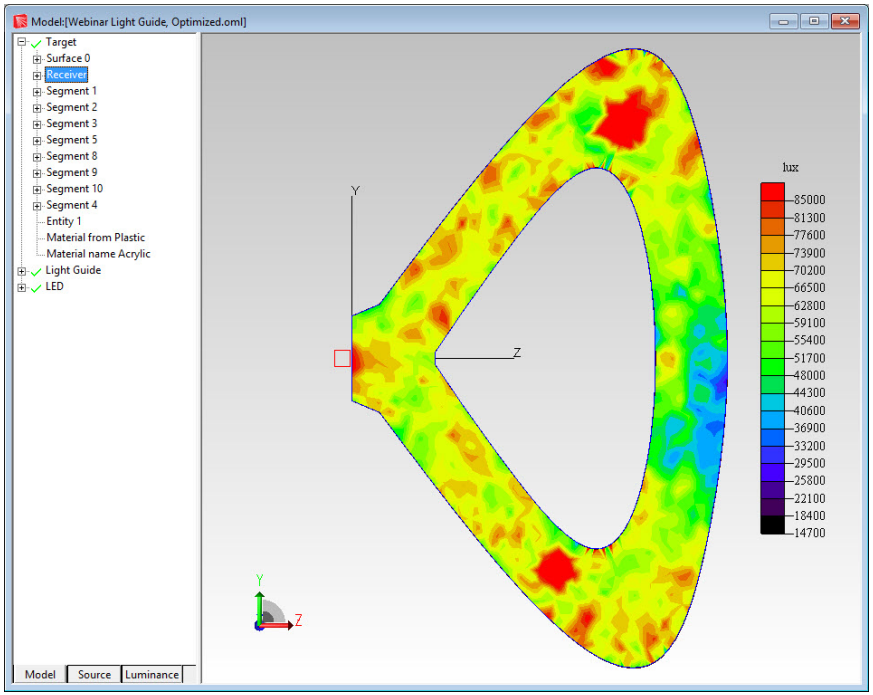
TracePro

Texture Optimization

Re-run the raytrace to check the results – 3D Illuminance Map



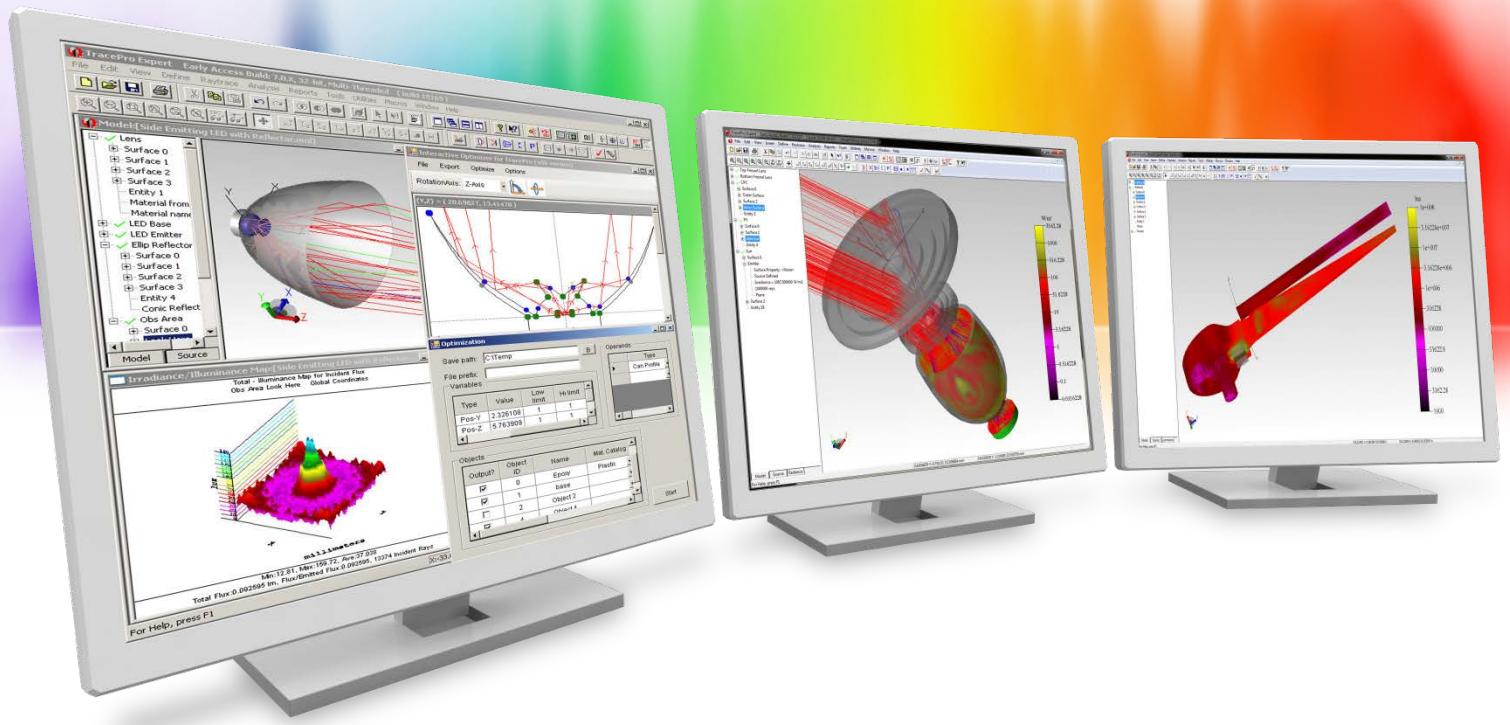
Initial 3D Illuminance Map



Optimized 3D Illuminance Map

TracePro

TracePro



Applying texture to a curved surface

LAMBDA RESEARCH CORPORATION

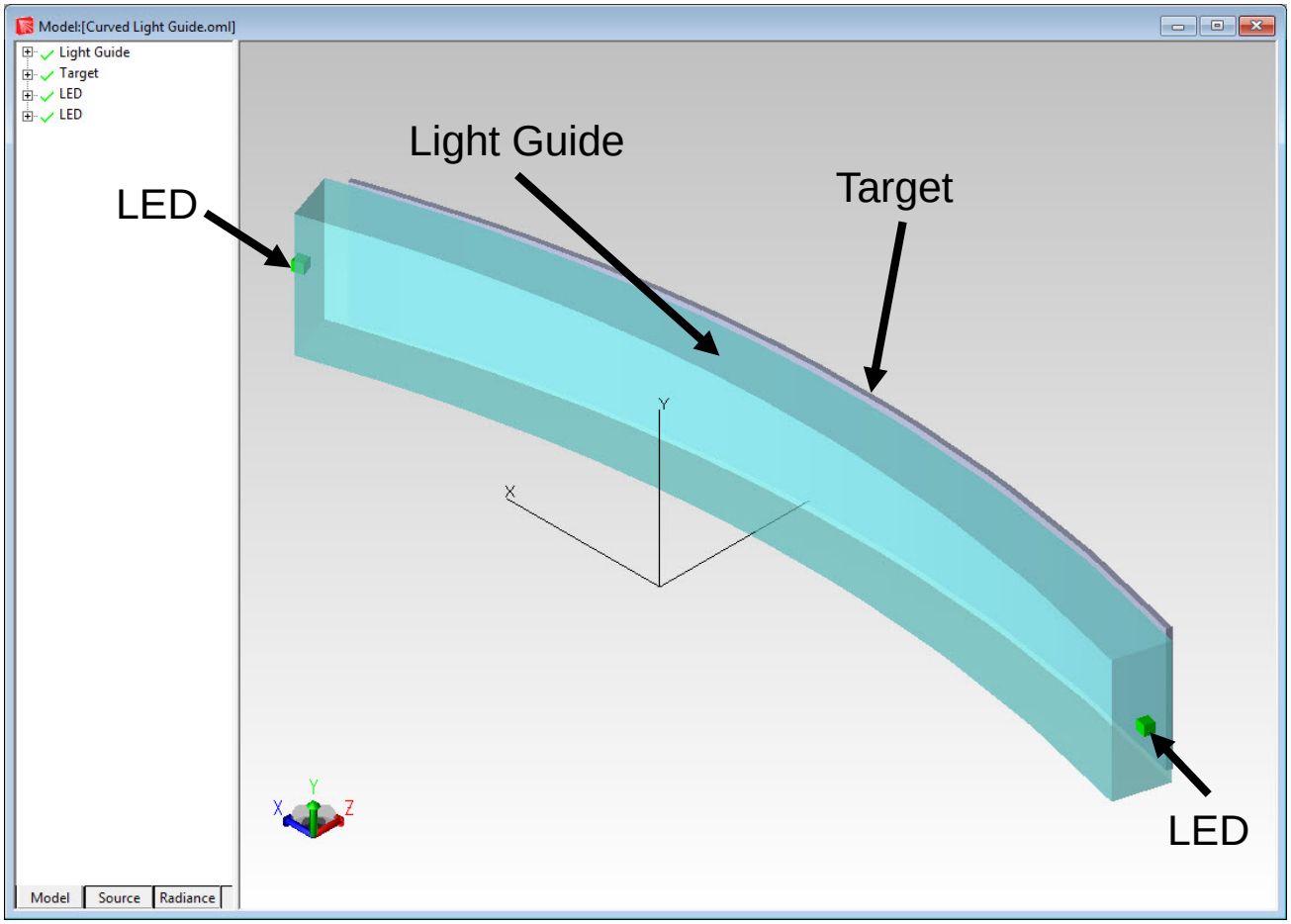
Texture on a curved surface

Applying Texture to a Curved Surface with the Texture Optimizer II

- The Texture Optimizer II allows the user to apply a texture to a curved surface
- The texture is applied as a real geometry and not a RepTile property
- The boundary, partitions, dot shape, and cell densities can be defined in the Texture Optimizer II
- Boolean subtract and unite options are available for making holes or bumps
- Because the texture is modeled as real, 3D geometry, there can be a limit to the number of texture features applied. More texture features will take more time.

Texture on a curved surface

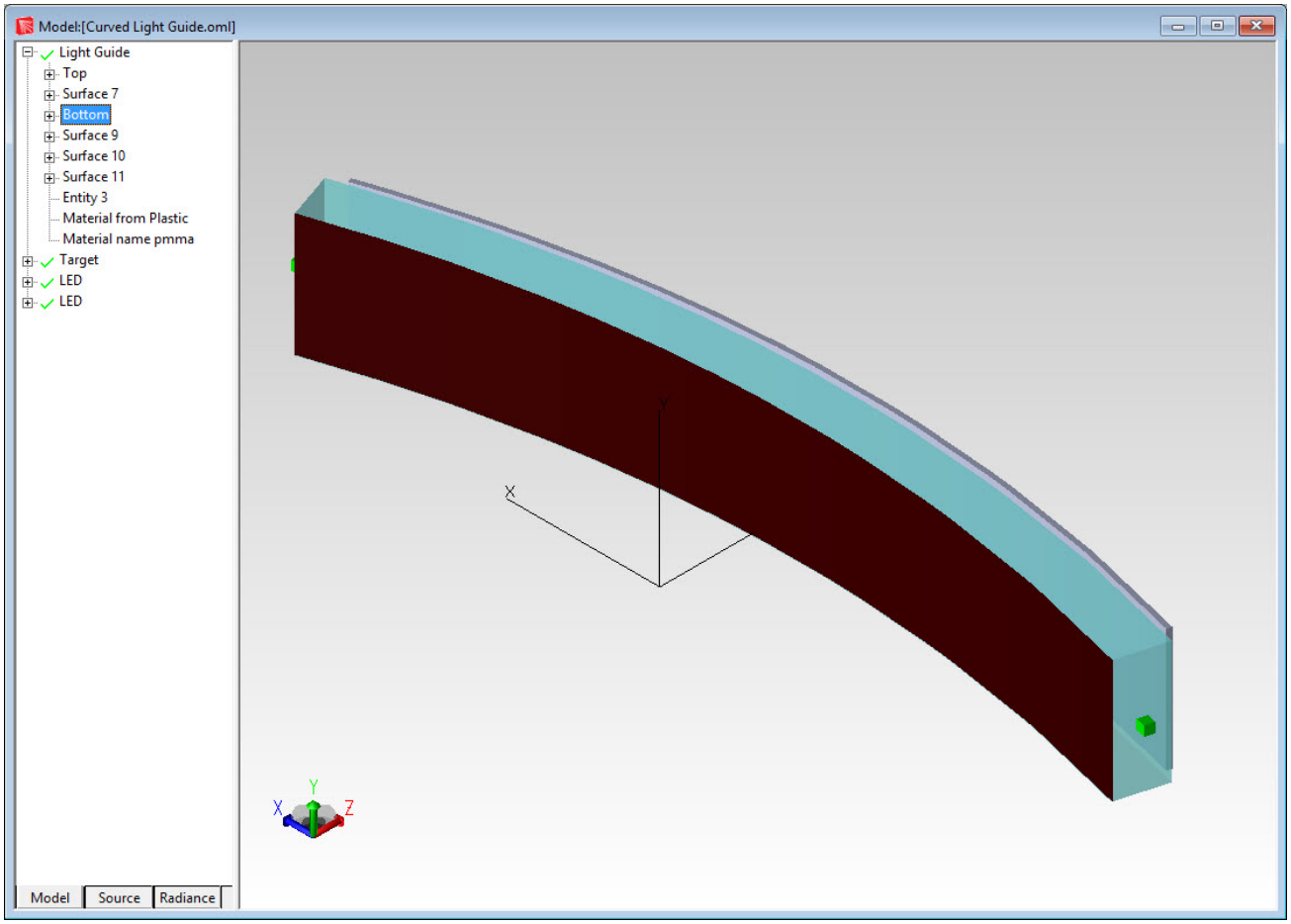
Curved Light Guide model in TracePro



TracePro

Texture on a curved surface

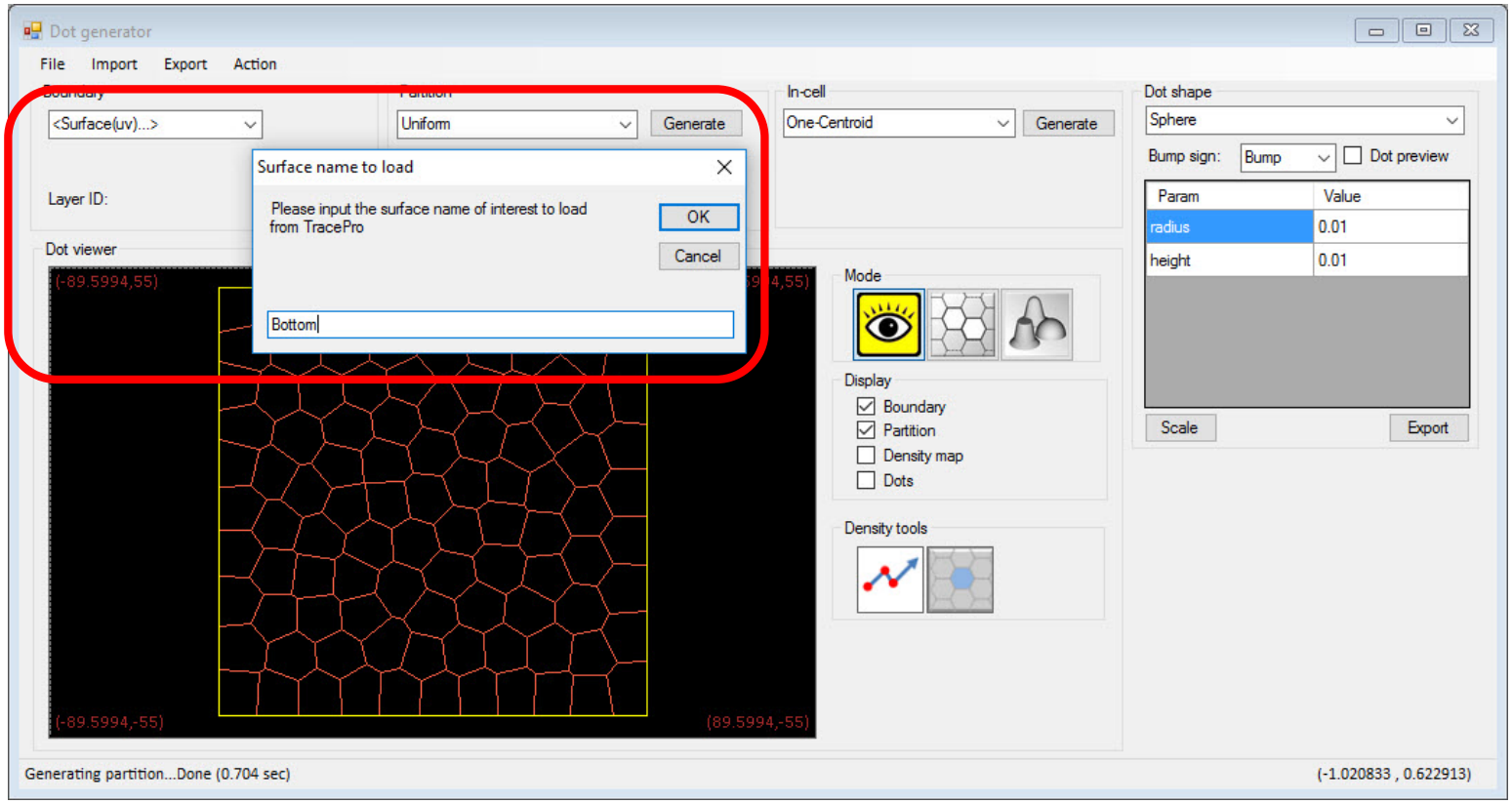
The texture will be applied to the “Bottom” surface of the Light Guide



TracePro

Texture on a curved surface

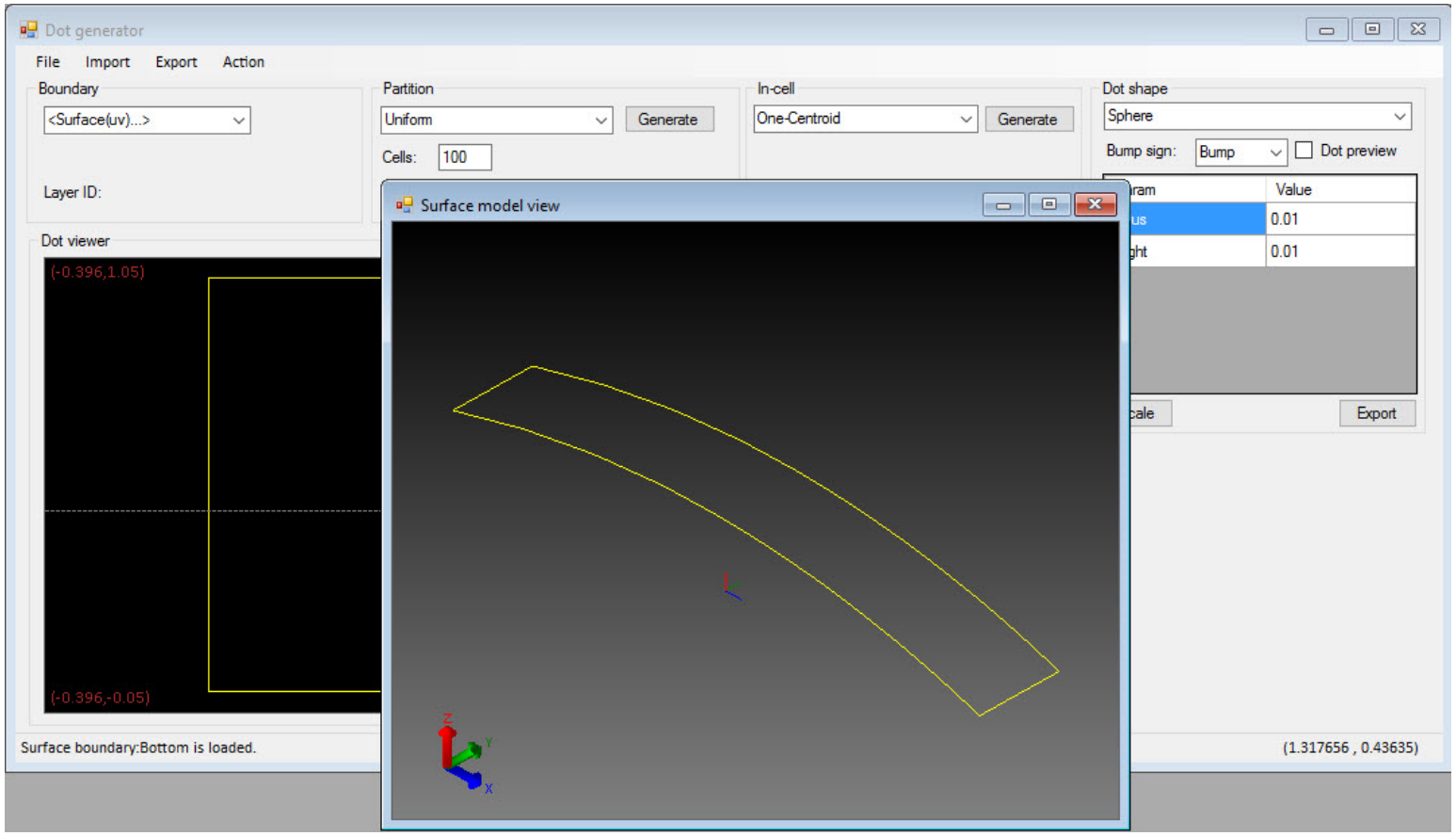
Select Surface(uv) for the Boundary, enter the name of the Surface in the dialog box, and then click OK



TracePro

Texture on a curved surface

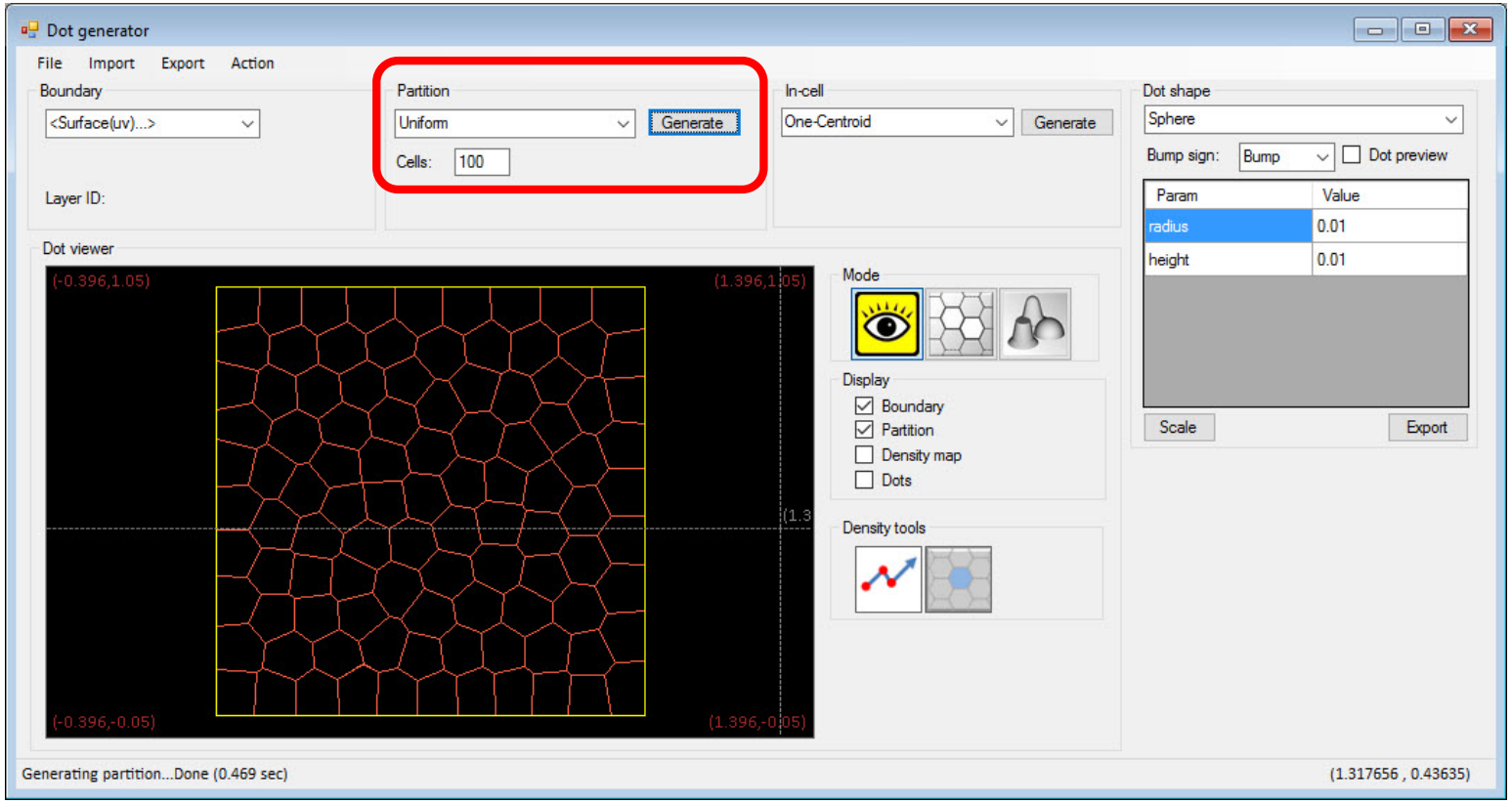
Select Surface(uv) for the Boundary, enter the name of the Surface in the dialog box, and then click OK



TracePro

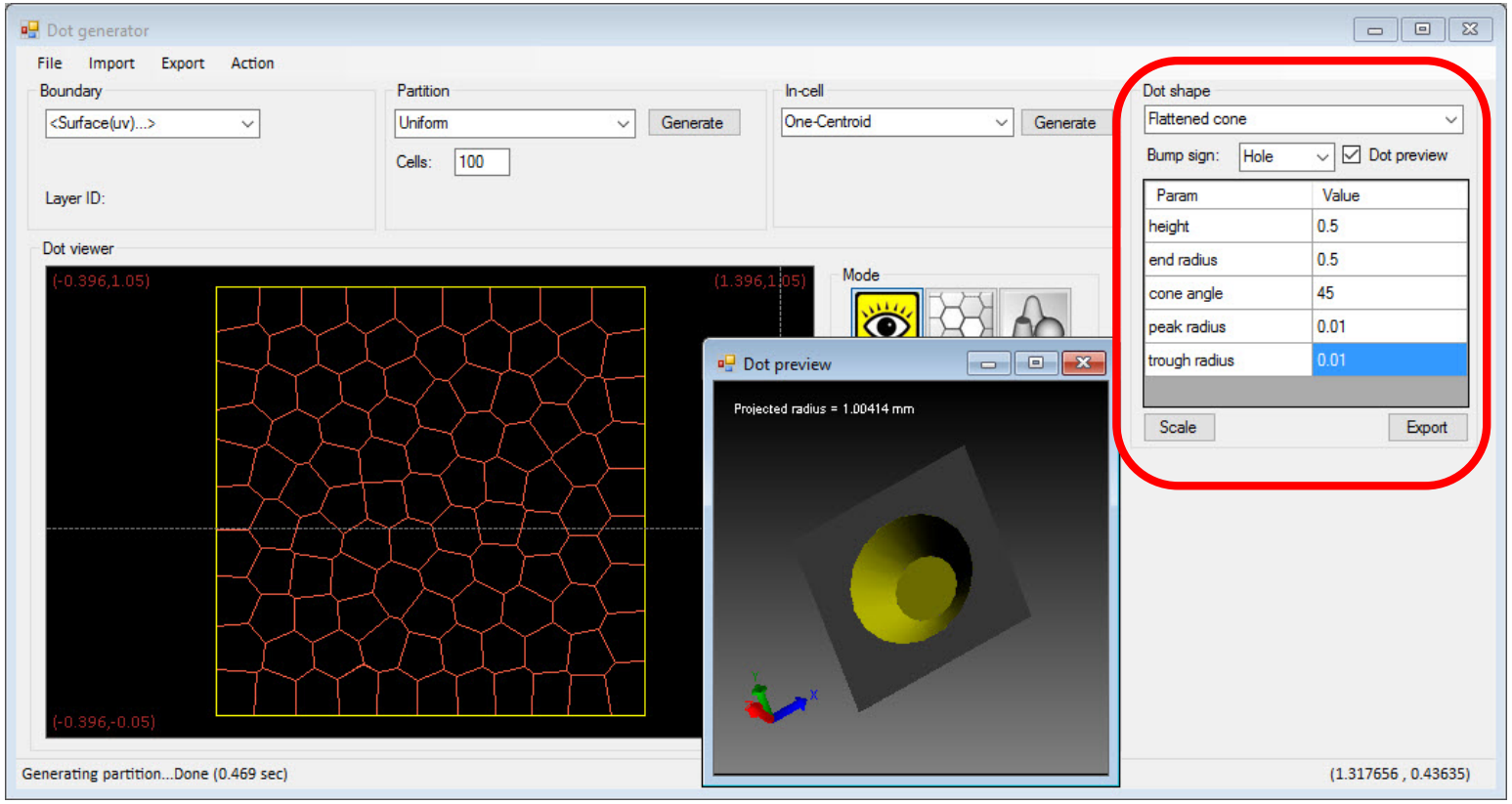
Texture on a curved surface

Select the Partition type and number of Cells. Example below is Uniform partition with 100 cells.



Texture on a curved surface

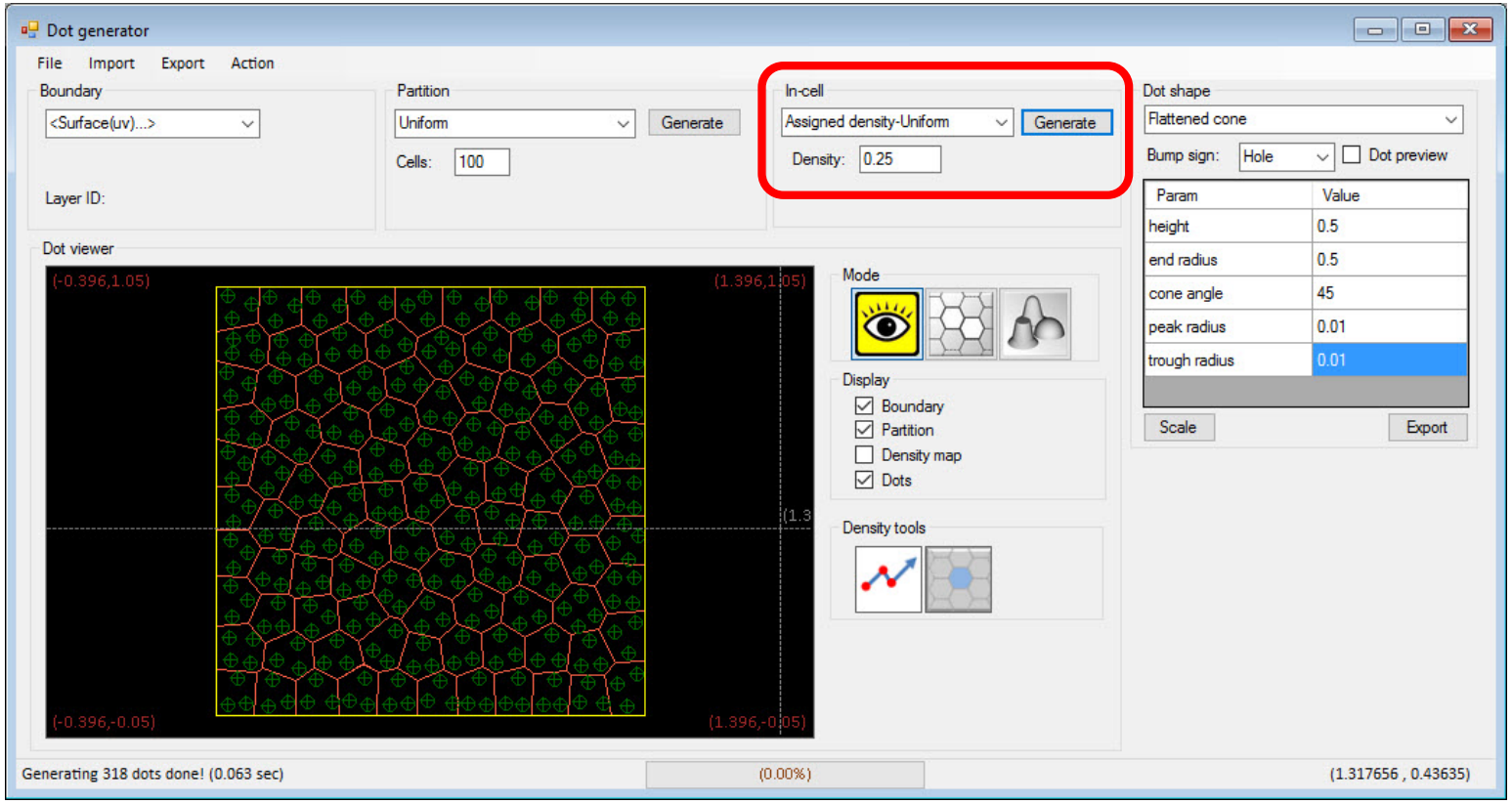
Define the Dot Shape. Example below is a Flatted cone, 0.5mm high with an end radius of 0.5mm and a 45-degree cone angle.



TracePro

Texture on a curved surface

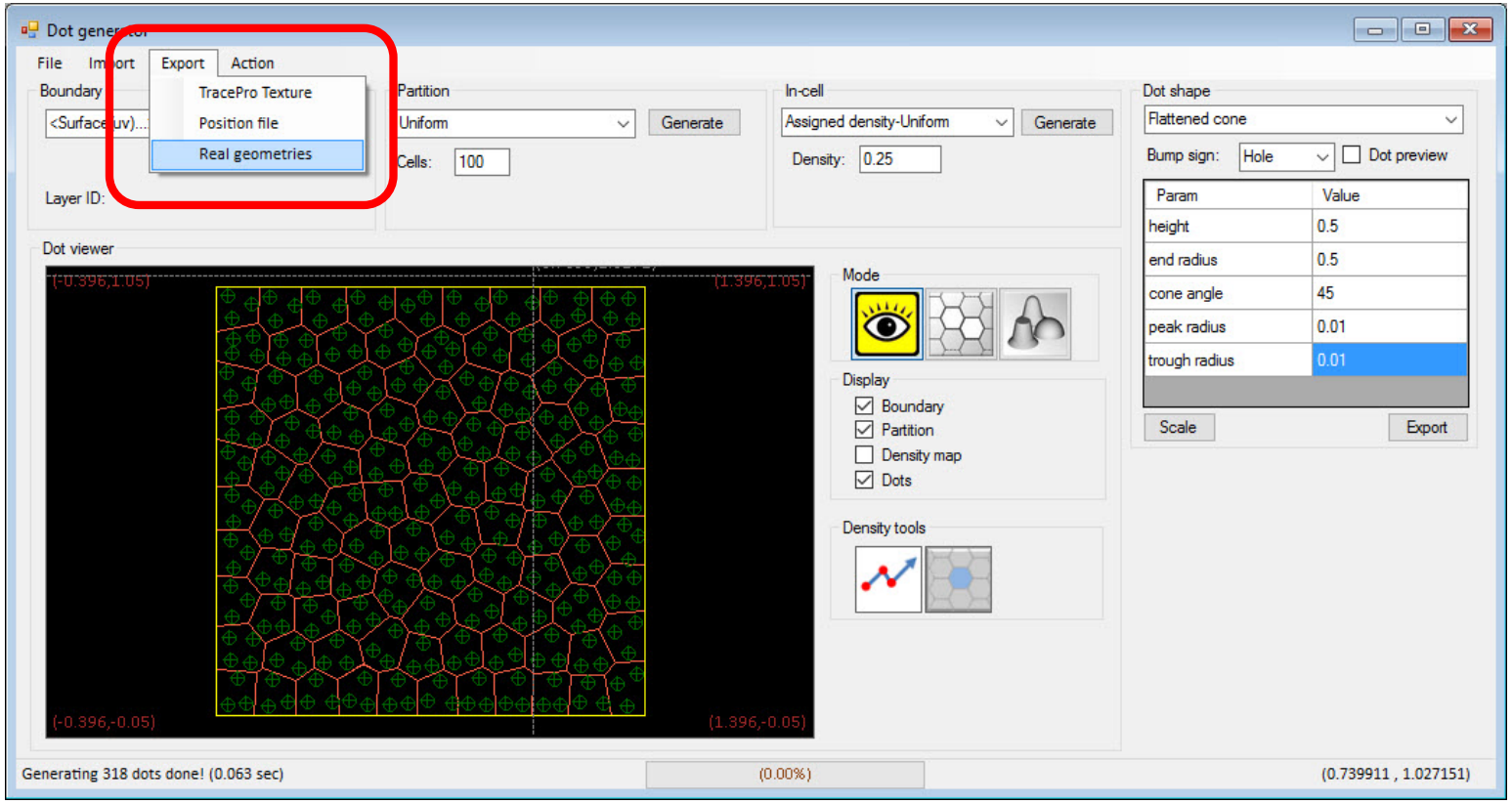
Choose the In-cell method and the density. Click Generate to generate the dots. Turn on Dots to see the dots. The example below uses Assigned density-Uniform for the In-cell method and 0.25 for the Density.



TracePro

Texture on a curved surface

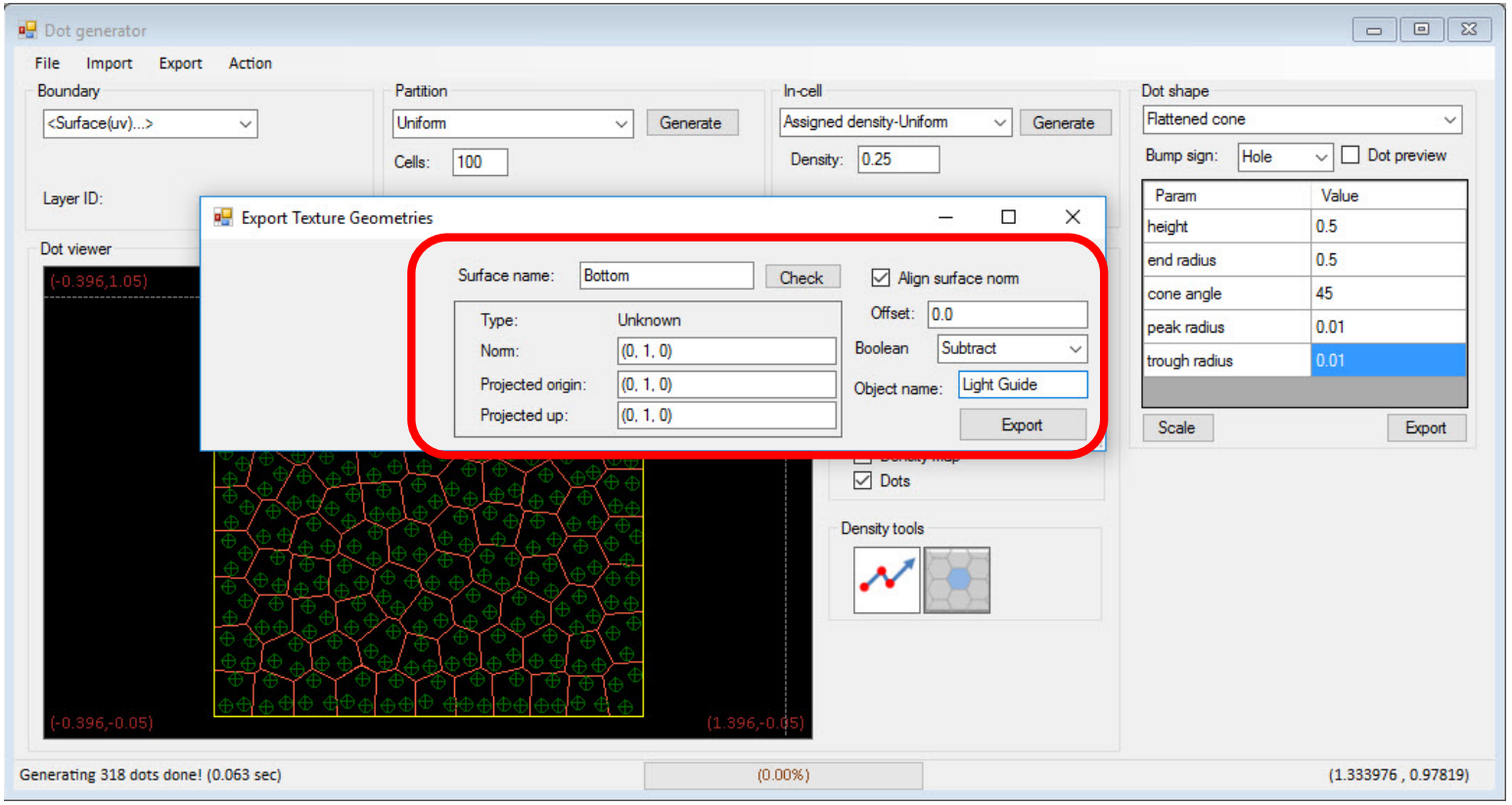
Select Export->Real geometries



TracePro

Texture on a curved surface

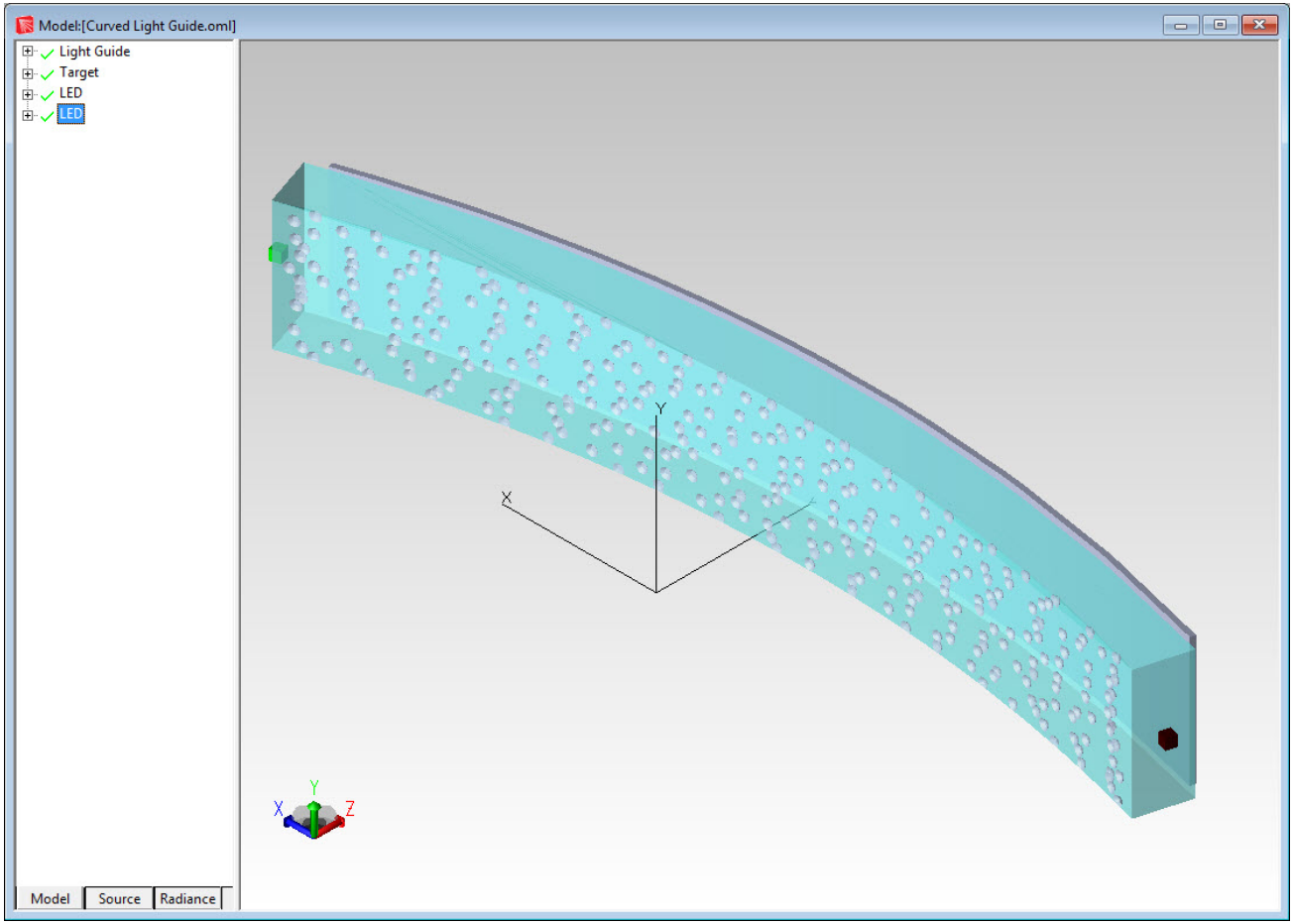
Enter the Surface Name, Object Name, and Boolean type and then click Export.



TracePro

Texture on a curved surface

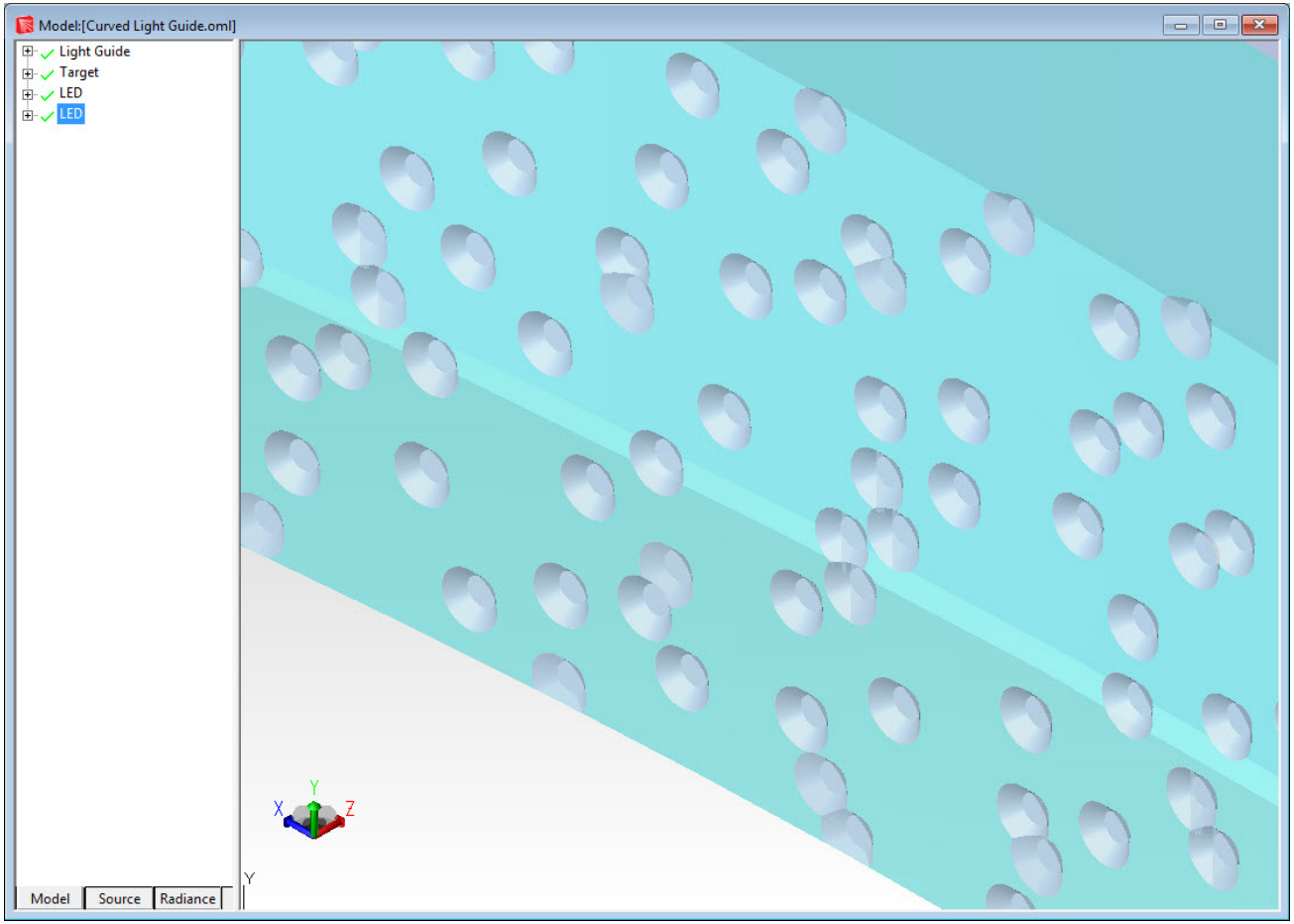
Results in TracePro



TracePro

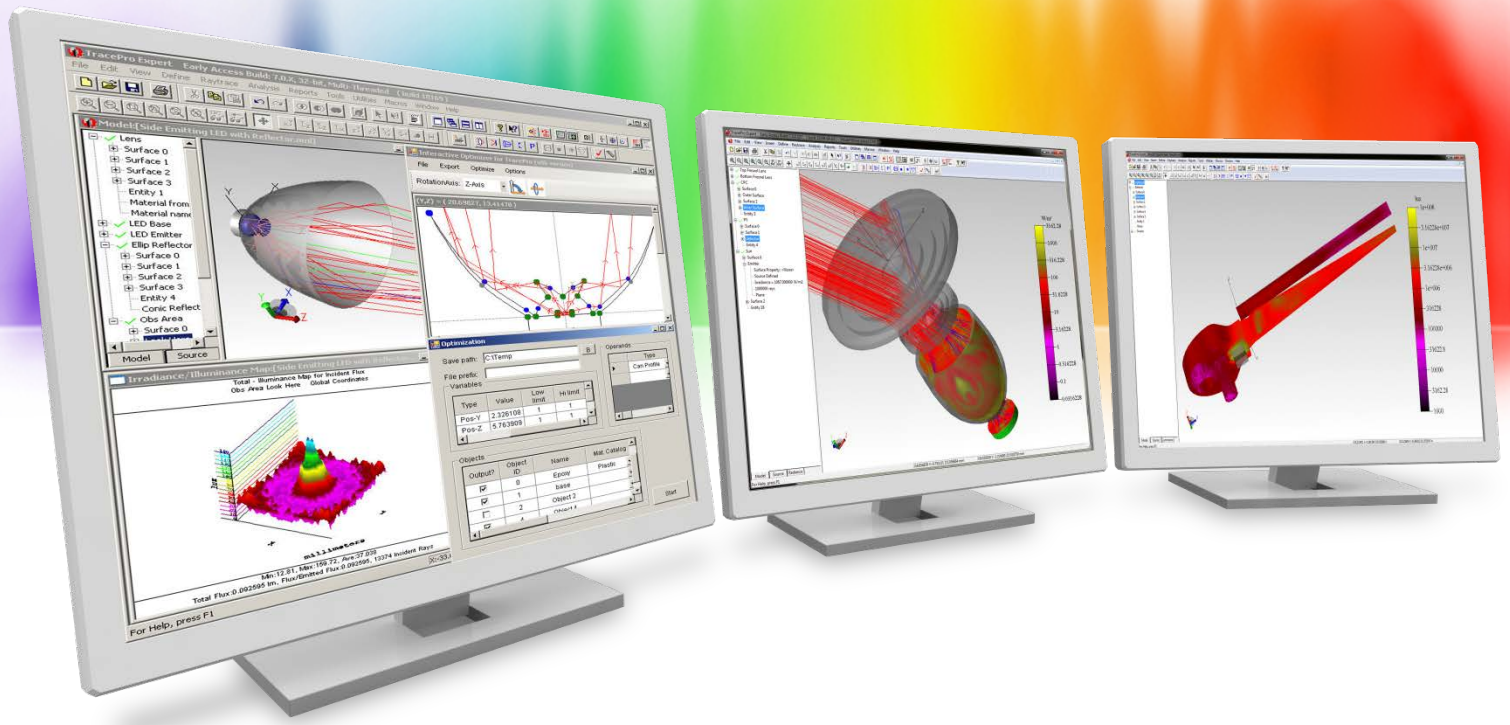
Texture on a curved surface

Results in TracePro



TracePro

TracePro



Summary and Questions

LAMBDA RESEARCH CORPORATION

Summary and Questions

The TracePro RepTile property and Texture Optimizer II allows:

- ✓ A fast, accurate, and efficient way to model repetitive microstructures on light guides and backlights
- ✓ Numerous options for feature types
- ✓ Quick and easy optimization of RepTile texture patterns on light guide and backlights for improved uniformity
- ✓ The ability to add texture features to curved surfaces as real geometry

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