TracePro® Tutorial
LED Example
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• Create an LED package based on manufacturer’s datasheet.
  – Use Siemens LWT676
  – Data include dimensions and photometric curve
Create a Thin Sheet

- First we analyze the package to determine the best method of constructing the geometry in TracePro. The symmetry of the package leads us to start from a Thin Sheet and extrude the top and bottom halves with a small draft angle.

- We will construct and view package in the XY plane. Select View|Profiles>XY or click the corresponding button on the toolbar.

- Select Insert|Primitive Solid and select the Thin Sheet tab of the dialog box. Enter the four corners of the Thin Sheet in mm in the dialog box and click Insert.
Surface Sweep to form a solid

- The package has a small angle of about 4 degrees so we will extrude the sheet using Edit|Surface>Sweep.
- Close the Insert Primitive Solid dialog box and select the surface in the System Tree. The thin sheet object has only one surface.
- Return to the YZ view.
- Select Edit|Surface>Sweep and enter a sweep distance of .9 mm and a draft angle of 4 degrees. Click Apply. The surface will be swept along the plane's surface normal.
Complete the solid

- Sweep by .2 with draft=0 to create the central portion of the package.
- Sweep again by .9 with a –4 degree draft to complete the construction.
Create a conical hole

- To create a conical hole, we will first create a cone, then perform a Boolean Subtract operation.
- Select Insert|Primitive Solid and select the Cylinder/Cone tab. Select the Cone option and enter the values shown, then click Insert to create the cone.
Boolean Subtract conical hole

- To subtract the cone from the other object, you can start by any one of the following:
  - select Edit|Boolean>Subtract
  - click the Subtract button on the toolbar
  - right-click in the model window and select Subtract from the pop-up menu
- Click on the package object, then the cone. As soon as you click on the second object, the subtraction occurs. The package should appear as it does in the figure.
Add diffuser

- We also need to add a diffuser. This will be a thin cylinder joined to the package.
- We will make the inner surface of the diffuser scattering and the inside of the cone a perfect mirror.
- Select Insert|Primitive Solid, Cylinder/Cone tab, and enter the values shown. Click Insert to create the cylinder.
Add LED

- Now we will add the LED chip itself. The dimensions are not given, but we can estimate that it is 0.4 x 0.4 x 0.15 mm.
- From the **Insert|Primitive Solid** dialog box, select the **Block** tab and enter the values shown. The z-value 1.175 for the center positions the block so that it is on the bottom of the conical hole.
- Click **Insert** to create the block.
Diffusing Surface Property

We will make three assumptions about the optical properties of this LED package. First, that the Diffuser is a perfect Lambertian transmitter with no losses. Second, the inside is a perfect reflector with out any losses. Third, the LED is a perfect reflective diffuser. These simplifications could be removed if we had more data from the manufacturer.

TracePro includes a Perfect Mirror Surface Property so we only need to add the diffuser property. After opening the Surface Property Editor (Define|Edit Property Data>Surface Properties), Click the Add Surface Property button and enter the property name Lambertian Diffuser. Set the absorptance value to 0.0 (because we are assuming a lossless surface) and select Solve for BTDF (Bidirectional Transmission Distribution Function) from the drop-down list. The BTDF is the scattering portion of the surface property with three coefficients. (See the manual for information about the ABg scattering model.)
Apply Diffuser surface property

- Open the **Apply Properties** Dialog box (**Define|Apply Properties**) and select the **Surface** tab.
- Select the inner surface of the diffuser, by either:
  - clicking on it in the System Tree
  - Selecting **Edit|Select|Surface** and clicking on the surface in the model window.
- You may want to zoom in on the diffuser to see which surface is which (as shown).
- Select Lambertian Diffuser from the Surface Property Name drop-down list. Click **Apply** to apply the property to the diffuser.
Apply Mirror surface property

• Select the conical surface and the bottom of the conical hole. After selecting one surface, you can add to the selection by holding down the Ctrl key and selecting additional surfaces.

• Select Perfect Mirror from the Surface Property Name dropdown list. Click Apply to apply the property to the selected surfaces.
Apply Lambertian surface property

- Select the LED object.
- Select Lambertian from the Surface Property Name drop-down list. Click **Apply** to apply the property.
- When you apply a surface property to an object (or selection of objects) the property is applied to all member surfaces of the object(s).
Define LED source

- Select **Analysis|Raytrace Options** to open the Raytrace Options dialog box. On the Options tab, select Photometric for the Radiometric Units type. Click **Apply** and close the dialog box.
- Select the top surface of the LED.
- In the **Apply Properties** dialog box, select the **Surface Source** tab.
- Enter the values and selections shown and click **Apply** to create an LED that emits .05 lumens in a Lambertian pattern.
Run a ray-trace

- Now we are ready to do a ray-trace. You can begin a Surface Source Raytrace by either:
  - clicking the Source Trace button
  - selecting Analysis|Source Raytrace and clicking Trace Rays.
- Begin the ray-trace by one of the above options. First TracePro will perform an Audit of the model and report any invalid properties or geometry, then the ray-trace will start.
Display Candela plot

- Select **Analysis|Candela Plots>Polar Distribution**.
- Select **Analysis|Candela Plots>Polar Distribution**. And set the Normal and Up vectors as shown in the top illustration.
- Select the **Candela Distributions** tab and enter the settings shown in the bottom illustration.
- Click **Apply** to see the changes on the plot.
Display Candela plot

- The candela plot should look like the illustration at right.
- Compare to the data.
- To make a better model, you need to refine the surface properties and/or the geometry model.