

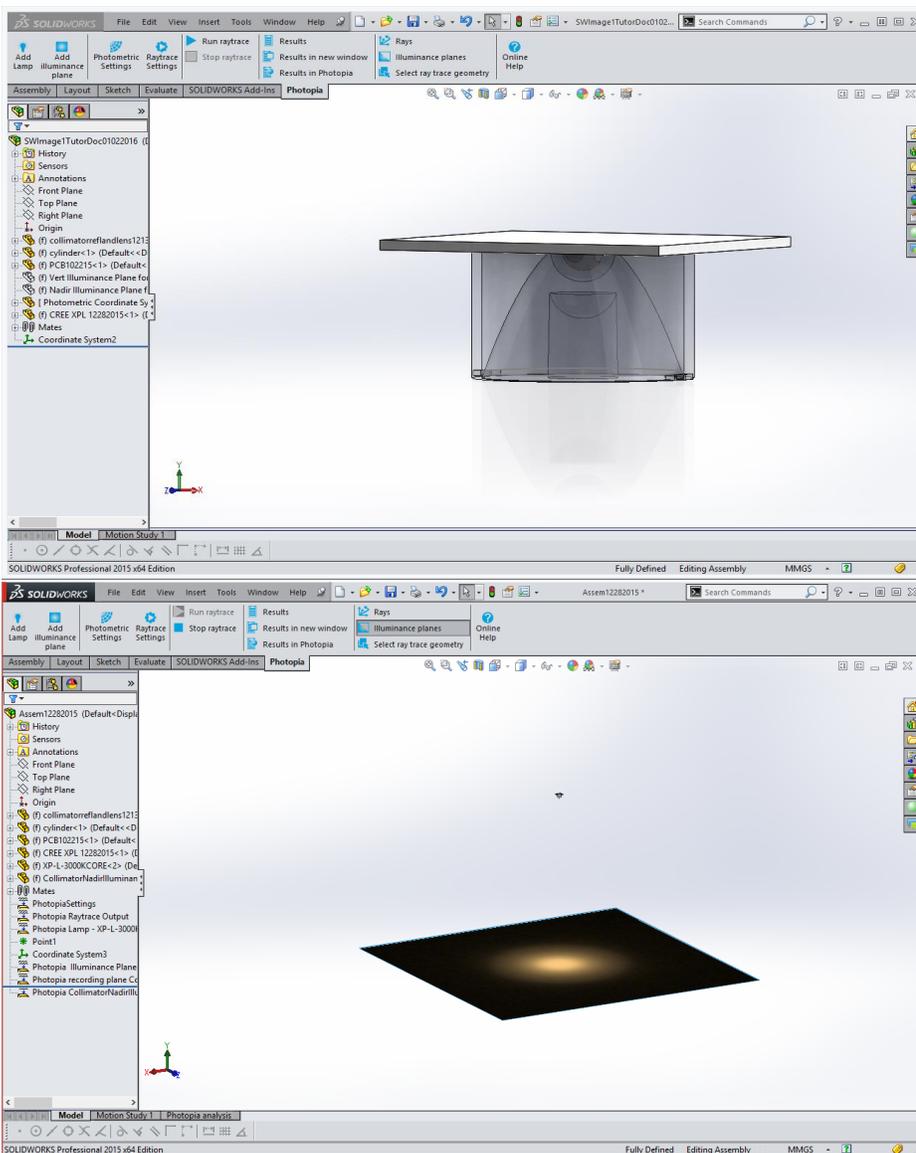
## OVERVIEW

In this tutorial you will setup a Photopia analysis for an assembly that already exists. This is based on an LED TIR Collimator lens using a CREE XP-L LED that creates a narrow beam.

### Skills Covered:

- Adding a lamp
- Assigning material properties
- Setting up Photometric and Raytrace Settings
- Adding an Illuminance Plane
- Running a Raytrace
- Viewing Results

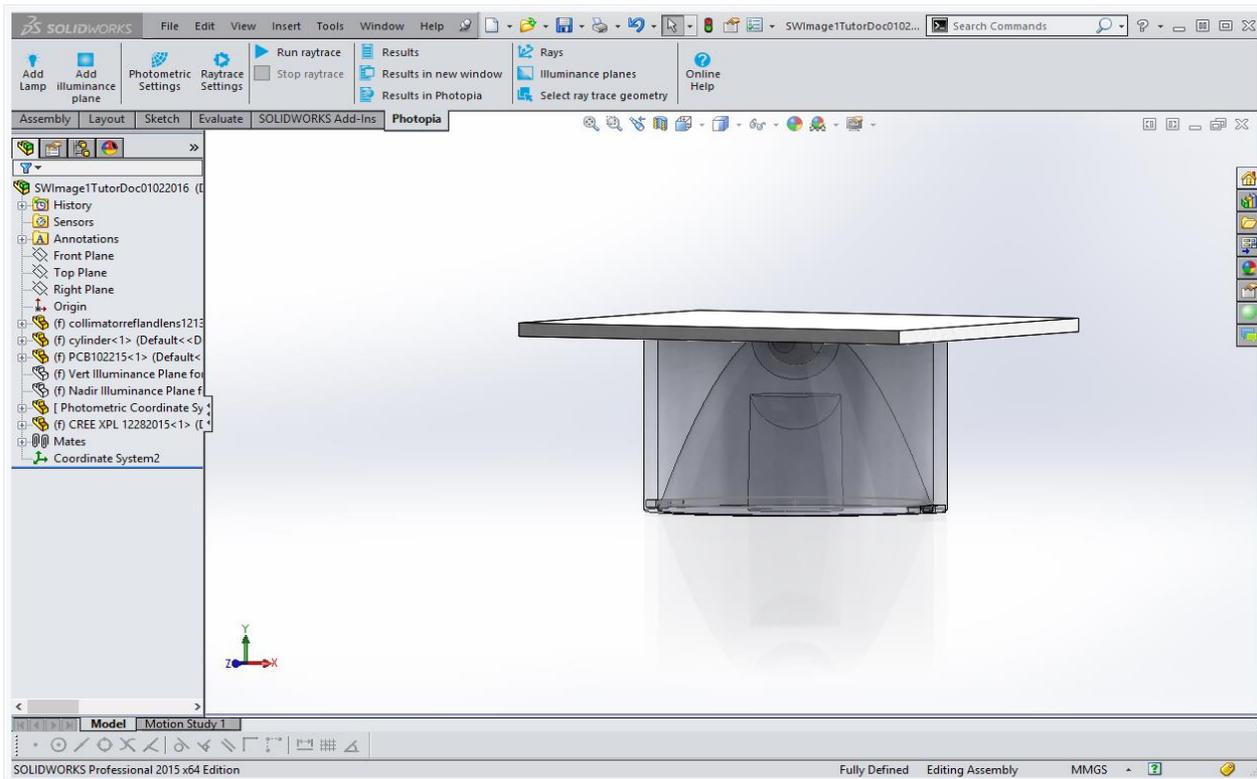
**Skill Level:** Beginner



## 1. Open The Assembly

Start SOLIDWORKS and click **File > Open** and browse to C:\Users\Public\Documents\LTI Optics\Photopia\SampleProjects\LED Collimator\ and open the “LED Collimator.SLDASM” assembly.

This assembly model includes a collimator lens, lens holder, PCB, LED, and a rectangular face which will be used for an illuminance plane.



## 2. Import A Lamp Model

Typically, you will already have some mechanical geometry for you lamp, which is also the case in this assembly. There is a part that was created from the CREE XPL 3D.STP file on CREE’s website.

You’ll need to import the Photopia lamp model from our library in order to run an analysis.

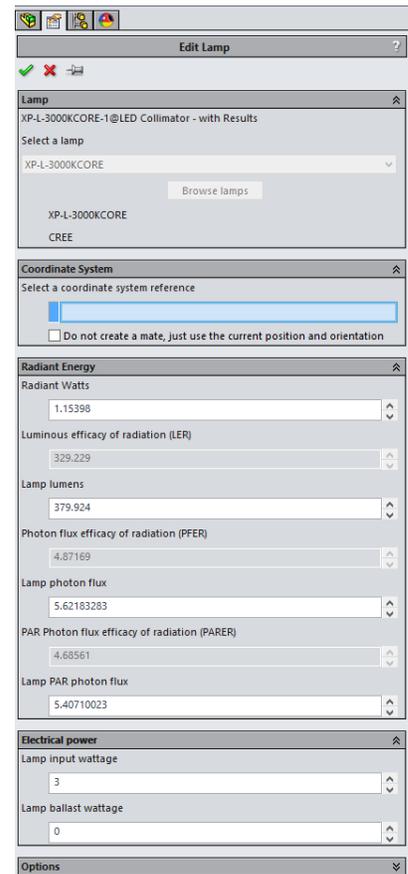
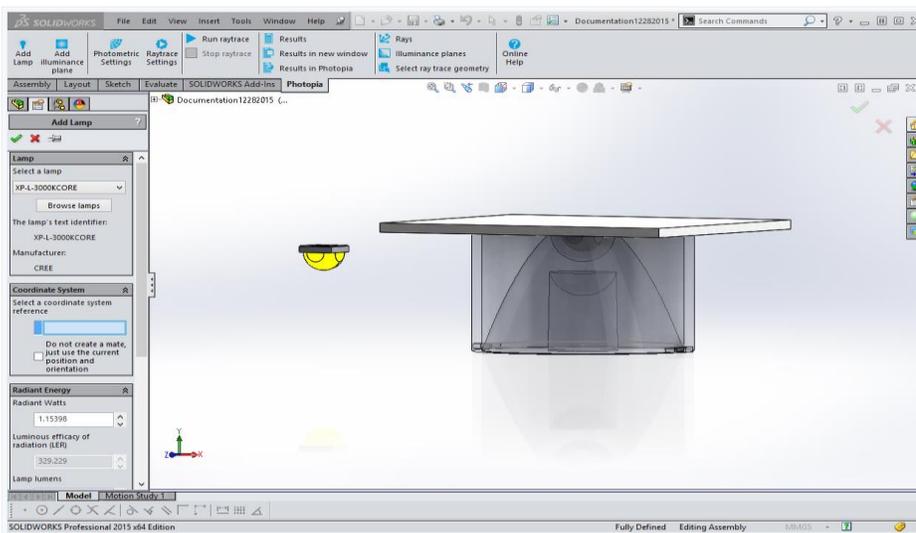
Click **Add Lamp** (Photopia CommandManager (CM) Tab) or **Tools > Photopia > Add Lamp**.

Under **Lamp: Select a lamp**, use the drop down to find the XP-L-3000KCORE lamp. You can also click **Browse lamps** to see more information or search by keywords.

You can adjust many of the lamps properties, including lamp lumens and electrical power. For this example, you will just accept the default lamp properties.

You can also mate the lamp to a coordinate system if you had already set one up. In this example we haven’t, so you won’t specify a coordinate system. The Photopia lamp model’s origin point will be placed at 0,0,0 in your assembly file in the default orientation.

Click **✓** to place the lamp in the project.



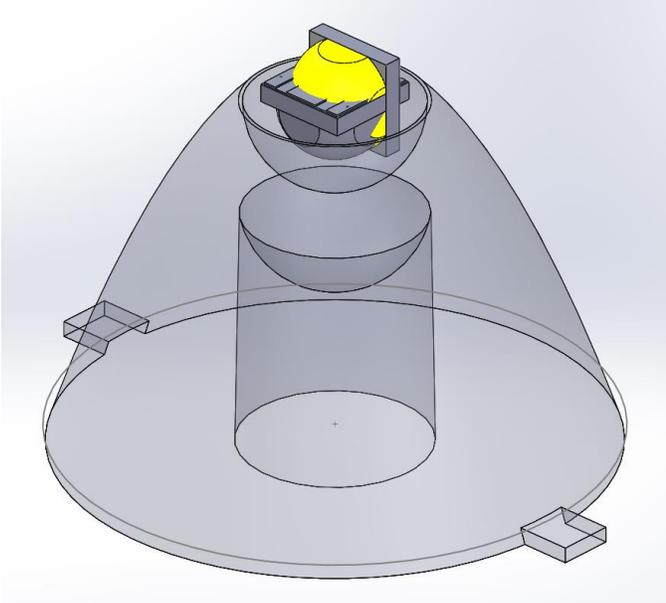
### 3. Align The Lamp Model

Hide the PCB and cylinder parts so it is easier to see the LEDs.

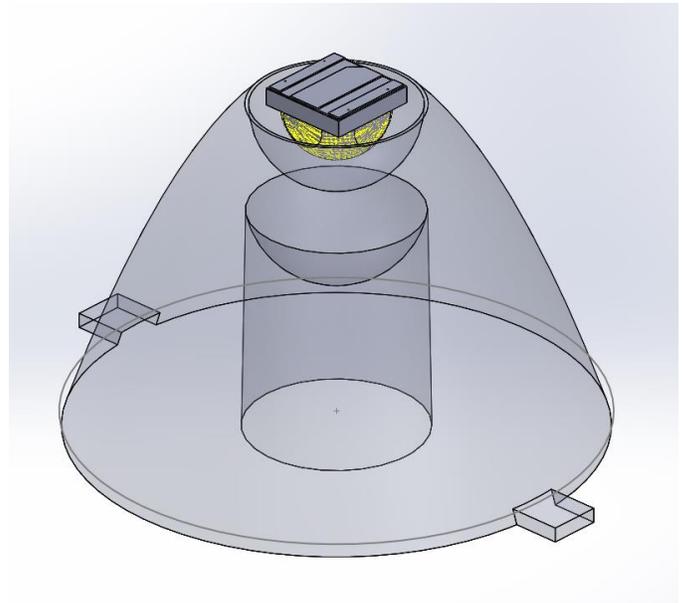
You will see that the Photopia lamp model (the one with the yellow dome) isn't oriented correctly with respect to the lens.

One way to get it oriented and located properly is to mate it with the reference LED geometry that was already in the assembly. Perform this mate so that the Photopia Lamp Model (with the yellow dome) will re-orient to match the proper orientation.

*Before Mating*



*After Mating*



## 4. Assign Photopia Materials

Optical material properties are assigned using special Photopia appearances that are installed with the add-in.

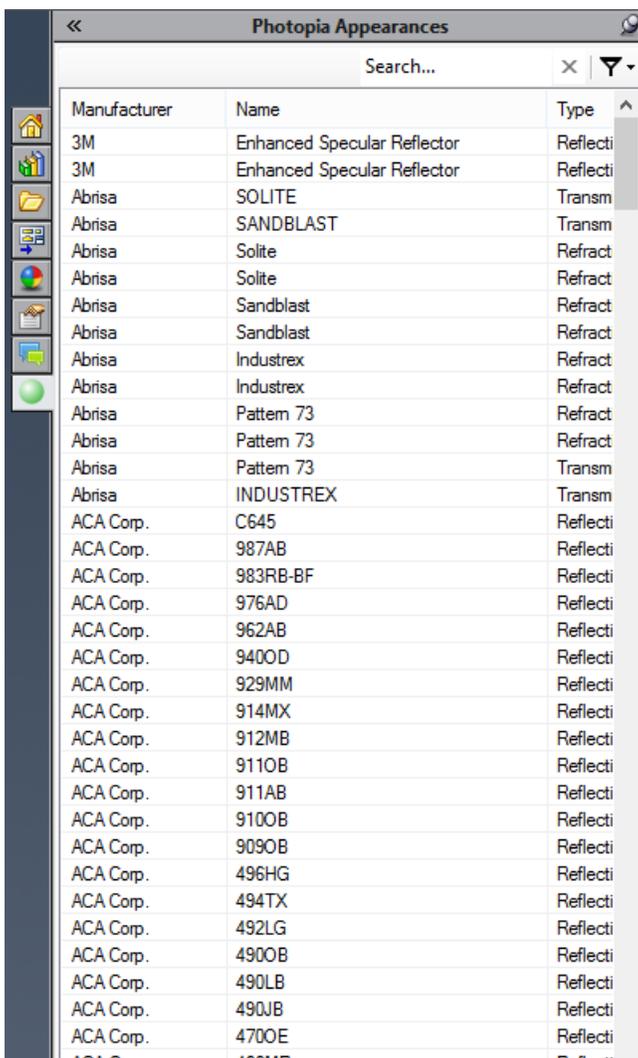
In the **Task Pane**, click the **Photopia Appearances** tab (green sphere icon).

You will assign a material to each part, and this will be assigned at the assembly level, not changing the part document.

Find the **IDI 44-10 White TR-2** white reflective material (typing into the search box is the easiest way to find materials). Click on the material and then drag it over into the **FeatureManager (FM)** tree and drop it onto the cylinder part.

Find the **Generic White PCB** white reflective material. Click on the material and then drag it over into the FM tree and drop it onto the PCB Part.

Find the **Generic ACRYLIC1** refractive material. Click on the material and then drag it over into the FM tree and drop it onto the Collimator part.



Manufacturer	Name	Type
3M	Enhanced Specular Reflector	Reflecti
3M	Enhanced Specular Reflector	Reflecti
Abrisa	SOLITE	Transm
Abrisa	SANDBLAST	Transm
Abrisa	Solite	Refract
Abrisa	Solite	Refract
Abrisa	Sandblast	Refract
Abrisa	Sandblast	Refract
Abrisa	Industrex	Refract
Abrisa	Industrex	Refract
Abrisa	Pattem 73	Refract
Abrisa	Pattem 73	Refract
Abrisa	Pattem 73	Transm
Abrisa	INDUSTREX	Transm
ACA Corp.	C645	Reflecti
ACA Corp.	987AB	Reflecti
ACA Corp.	983RB-BF	Reflecti
ACA Corp.	976AD	Reflecti
ACA Corp.	962AB	Reflecti
ACA Corp.	940OD	Reflecti
ACA Corp.	929MM	Reflecti
ACA Corp.	914MX	Reflecti
ACA Corp.	912MB	Reflecti
ACA Corp.	911OB	Reflecti
ACA Corp.	911AB	Reflecti
ACA Corp.	910OB	Reflecti
ACA Corp.	909OB	Reflecti
ACA Corp.	496HG	Reflecti
ACA Corp.	494TX	Reflecti
ACA Corp.	492LG	Reflecti
ACA Corp.	490OB	Reflecti
ACA Corp.	490LB	Reflecti
ACA Corp.	490JB	Reflecti
ACA Corp.	470OE	Reflecti
ACA Corp.	466MB	Reflecti

### Assigning Appearances

Appearances inside of SOLIDWORKS can be assigned in several ways. We've described one in this tutorial, which is dragging the appearance onto the entire Part in the FM. This assigns the appearance to the entire part, but only for the part in the assembly, which doesn't modify the part file.

You can also drag appearances onto items in the Model View, and you'll have the option to assign that appearance to the face, body, part, or part @ assembly.

You can also select a part, body or face and then double click the appearance to assign it.

Ultimately you can use whichever method you prefer.

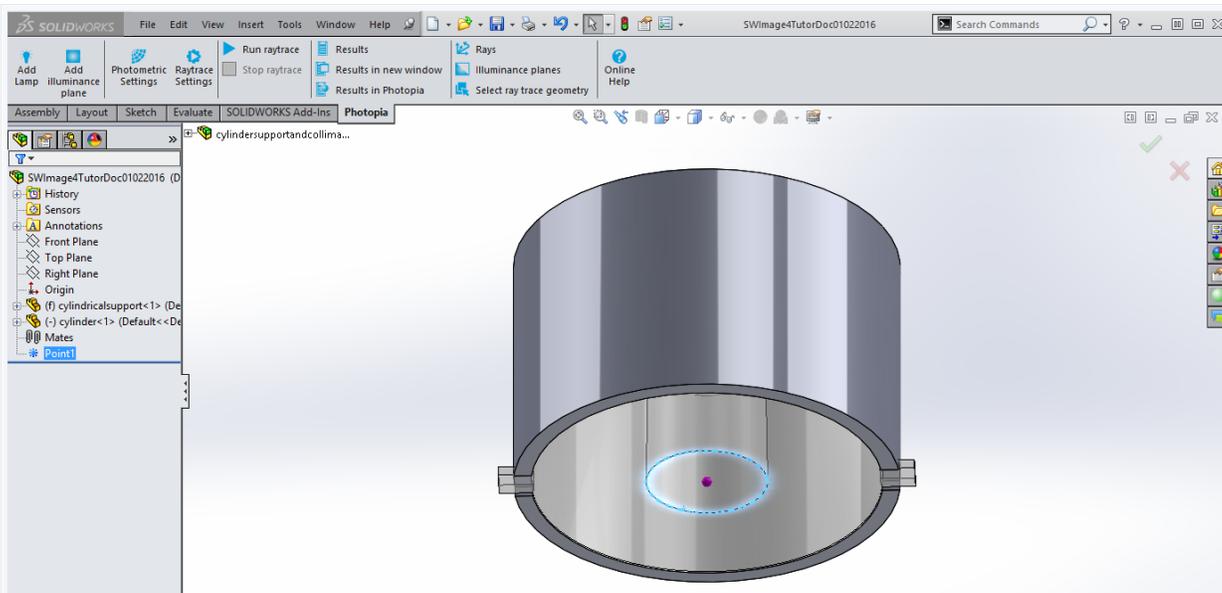
### Verifying Assigned Appearances

Only surfaces with an assigned Photopia Appearance will participate in the raytracing. Click the "Select ray trace geometry" button in the Photopia CM to display the surfaces that will participate. You can also see which Photopia appearances have been used by clicking the DisplayManager (DM) Tab (right side above the FM) to display the current appearance assignments

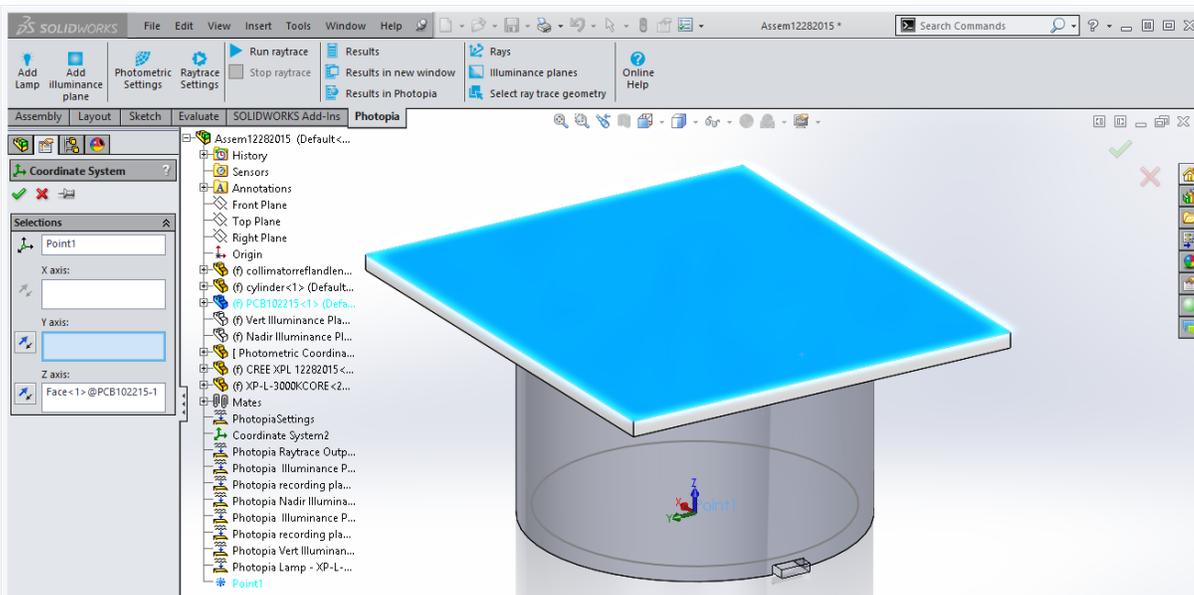
### 5. Define the Photometric Coordinates

You will need to place a reference coordinate system in order to define the photometric coordinate system. This is necessary because you can orient your assembly model however you prefer, but the photometric coordinate system must be defined to ensure proper horizontal and vertical angle values in your output. The photometric coordinate system should be placed in the center of the luminous opening of the optic, and it will have the  $-Z$  axis defining the  $0^\circ$  vertical angle and the  $+Y$  axis defining the  $0^\circ$  horizontal angle.

Click **Insert > Reference Geometry > Point** and choose **Center of Arc** and click the arc (circle) in the center of the collimator shaft shown below.



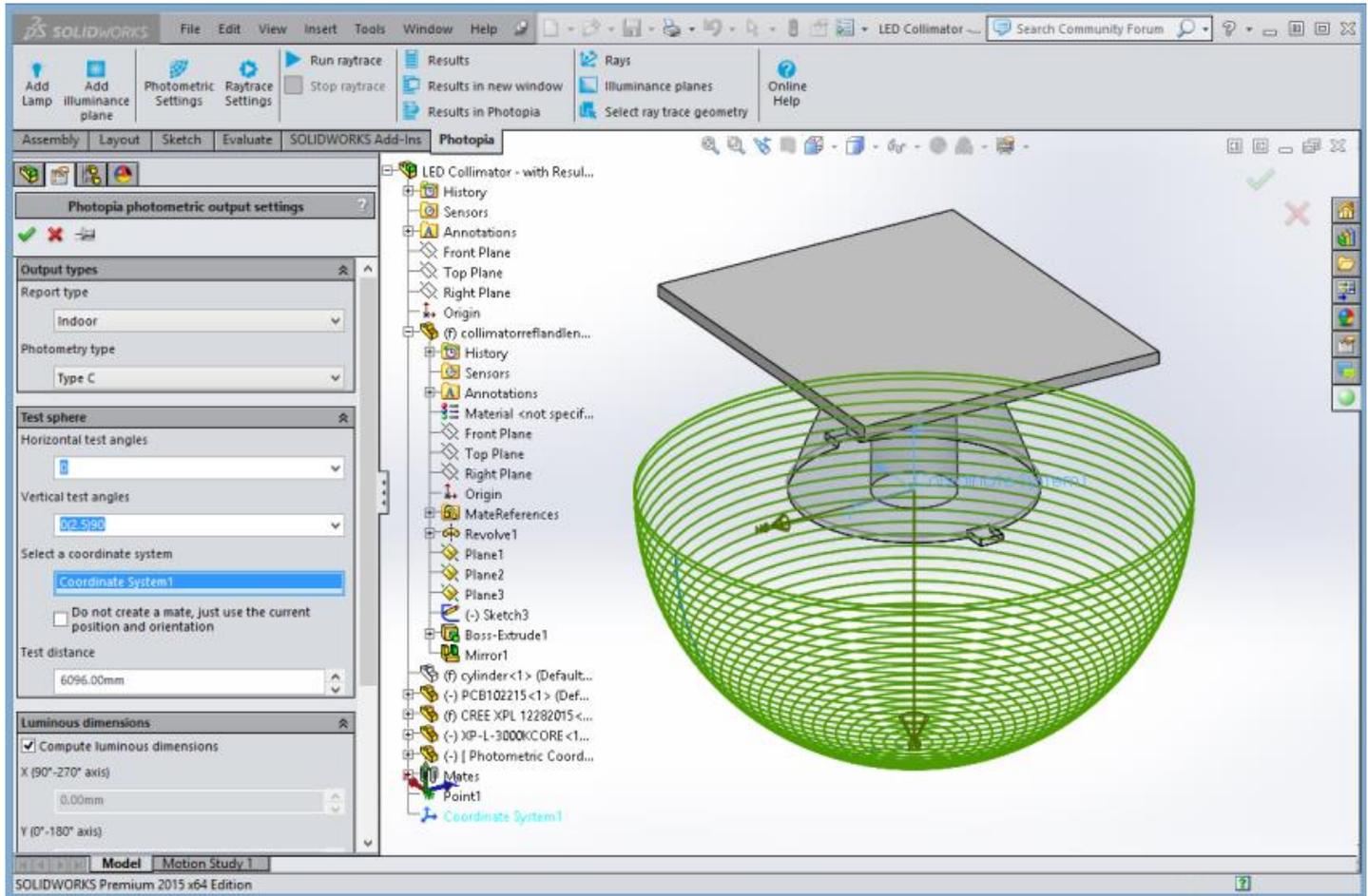
Click **Insert > Reference Geometry > Coordinate System**. Choose the point that was just inserted as the **Origin** for the coordinate system. Then click in the **Z axis** selection box and select the top face of the Collimator PCB to orient the Z axis upwards.



### 6. Setup the Photometric Settings

Select the reference coordinate system you just created and click **Photometric Settings** from the **Photopia** tab in the CM. Since the output of this lens is essentially axially symmetric downlight, set the Horizontal Test Angles to 0 and the Vertical Test Angles to 0(2.5)90. You can also set the Test distance and Luminous dimensions here as well, but can accept the defaults for this example. You will also see the photometric sphere as a wireframe in the correct orientation and centered at the lens opening.

Click ✓ to accept the Photometric Settings.

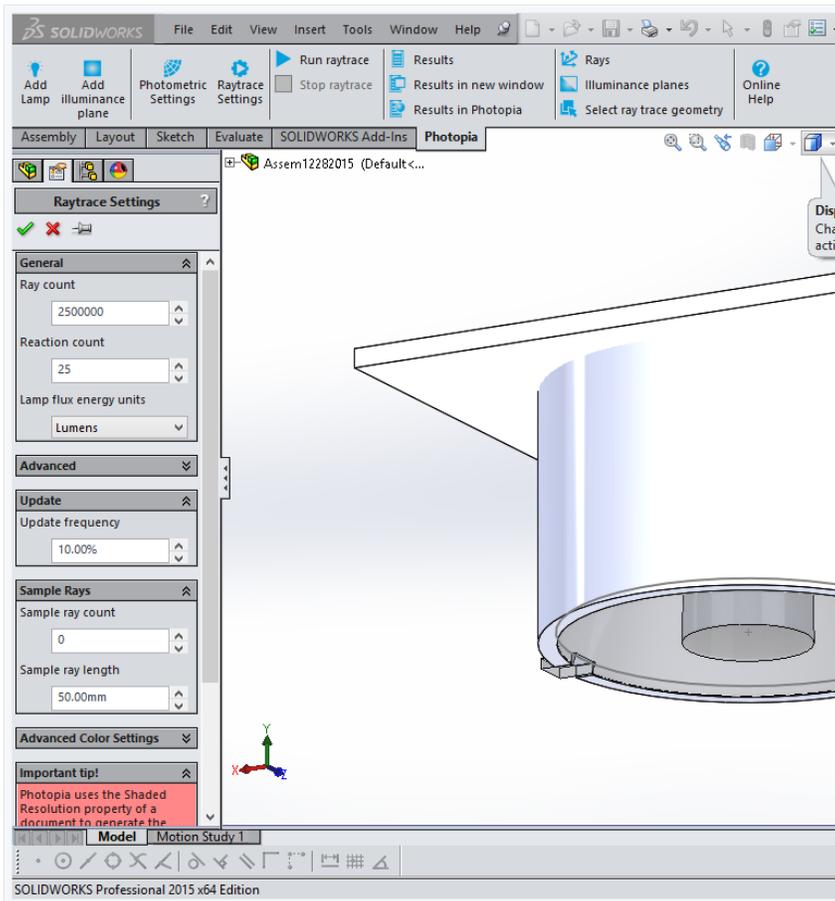


## 7. Setup the Raytrace Settings & Run A Raytrace

Select **Raytrace Settings**, from Photopia on the CM. This is where you can enter the # of rays & reactions. The defaults will be good for this project. For a more detailed description of all of these parameters, visit <http://www.ltioptics.com/SWSupport> and see the box to the right on this page.

Click ✓ to accept the Raytrace Settings.

Click **Run Raytrace** to begin the raytrace.



**Number of Rays:** The default of 2.5 million is good for design iterations. Increasing to 10 to 25 million will produce very smooth illuminance planes and candela plots.

**Reaction Count:** The default of 25 works for most designs, but if you have a white reflector in an enclosure with a diffusing cover lens, then you might require more reactions to get most of the light out. The photometric report will tell you how much light reached this limit in the raytrace so you'll know if the value was high enough.

**Update Frequency:** This defines how often you'll see results as the raytrace progresses. This is helpful in longer raytraces so you can stop the process if you've already seen enough information about the performance.

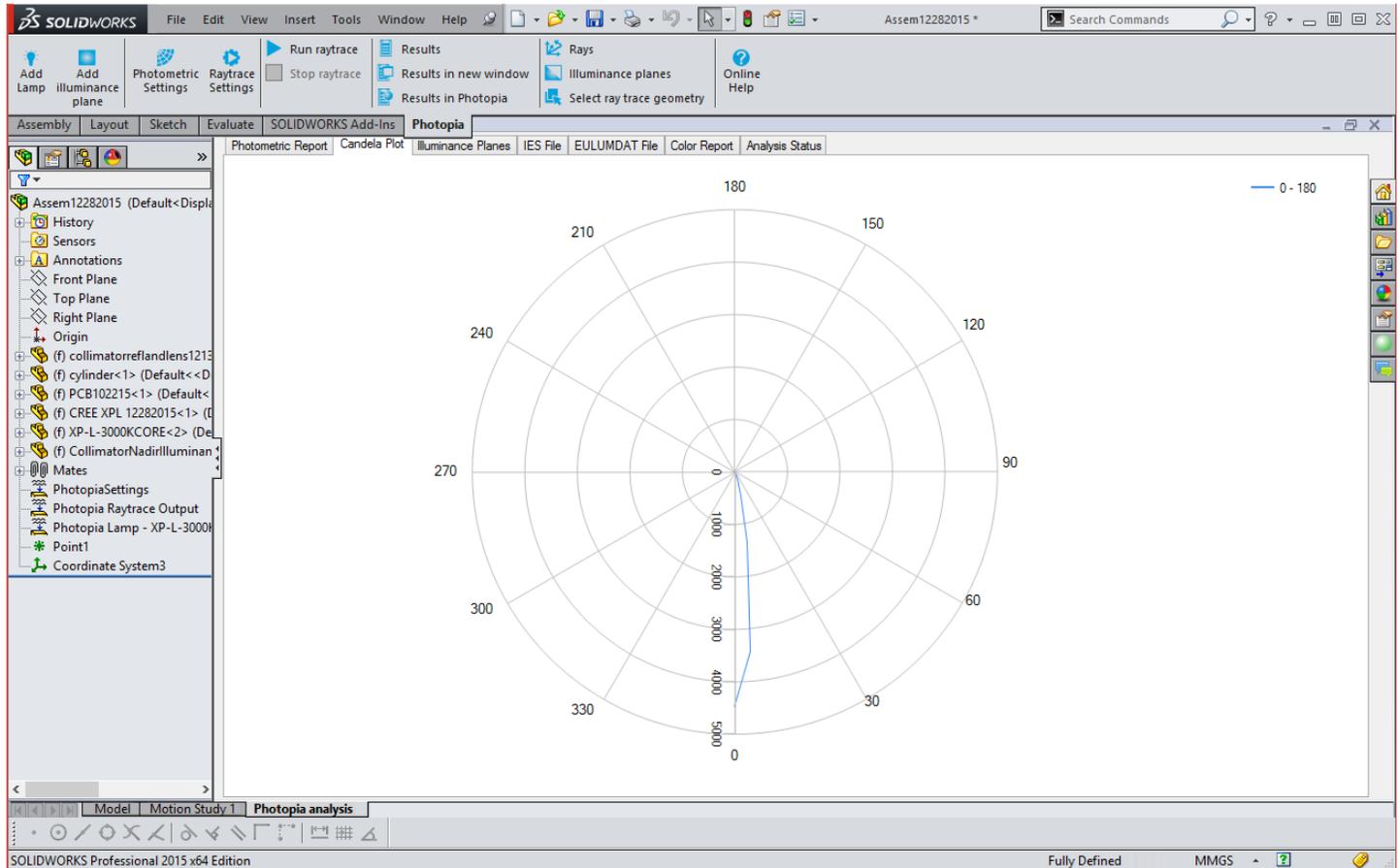
**3D Rays:** You can also enter a number of rays to be displayed in the CAD view as well as their length once they exit the optic. We suggest just a few hundred rays so the screen is not too cluttered to see their trends.

**Model Resolution:** Photopia for SOLIDWORKS raytraces with the same mesh that SOLIDWORKS uses for display. This may be a fairly coarse mesh display to improve the responsiveness of the graphics. If your performance is very sensitive to absolute geometry, then you will need to increase the display resolution so that Photopia gets truer surface geometry. Click **Tools > Options > Document Properties > Image Quality > Shaded and Draft Quality HLR/HLV Resolution** and set it in the red zone for sensitive optics such as this collimator design.

### 8. View Raytrace Results

Click the **Results** button to view the status and results. You can also open the results in a separate window so that you can still interact with the model.

You select from the tabs to view the different results that are available: Photometric Report, Candela Plot, Illuminance Plane, IES File, EULUMDAT File, Color Report and Analysis Status.

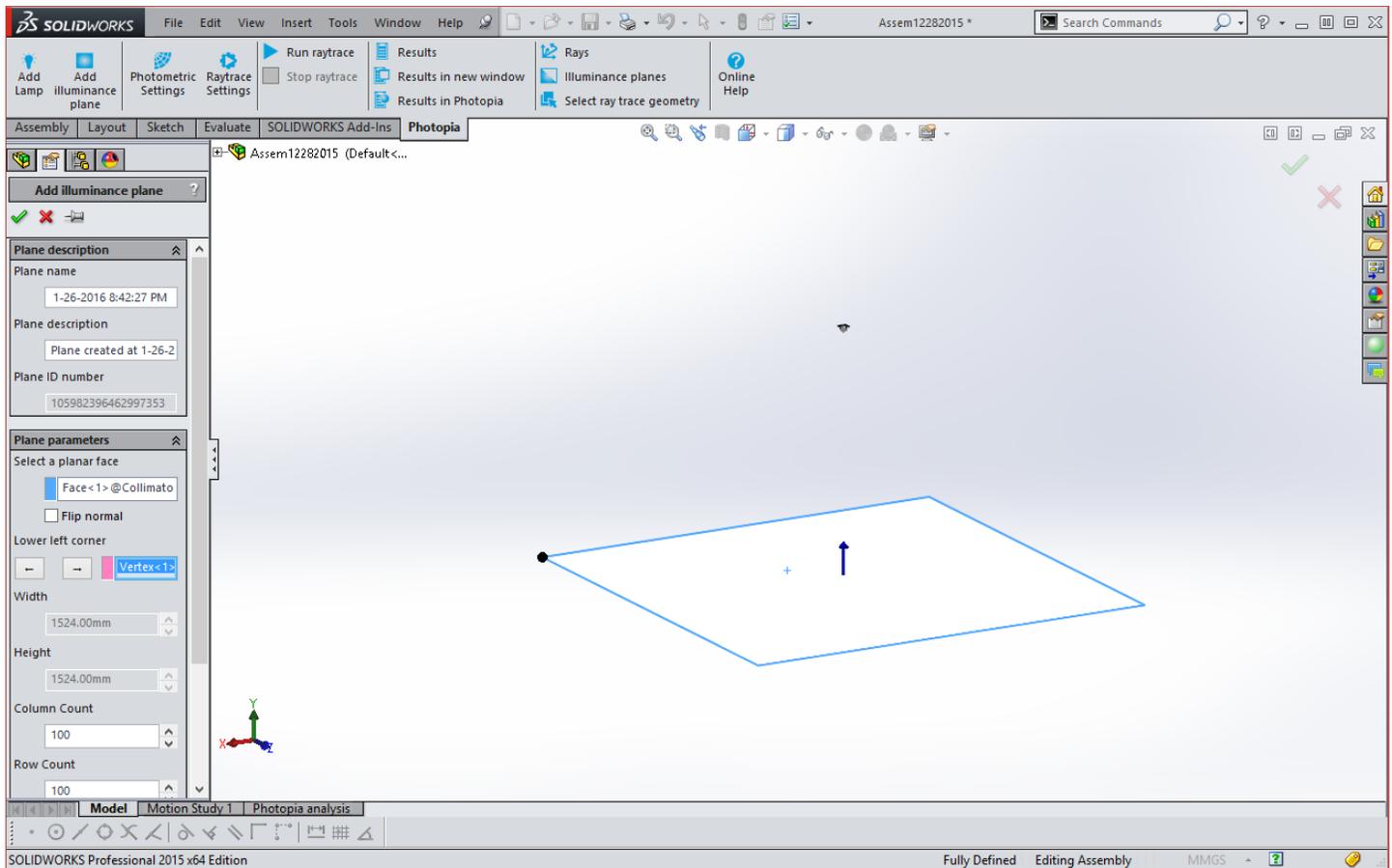


### 9. Add an Illuminance Plane

Being able to see the light onto a surface is helpful for evaluating the performance of many optics. Illuminance planes can be assigned to any rectangular planar face and are added to the SOLIDWORKS assembly file as components (part files). This Assembly already has a rectangular face that you use to create an illuminance plane.

Click the **Add illuminance plane** button on the Photopia CM tab. Select the surface in the Illuminance Plane part and be sure that the arrow is facing up toward the optic. If not, then check the **Flip Normal** checkbox to reverse it. You can adjust the grid parameters, but leave them at the default for this project.

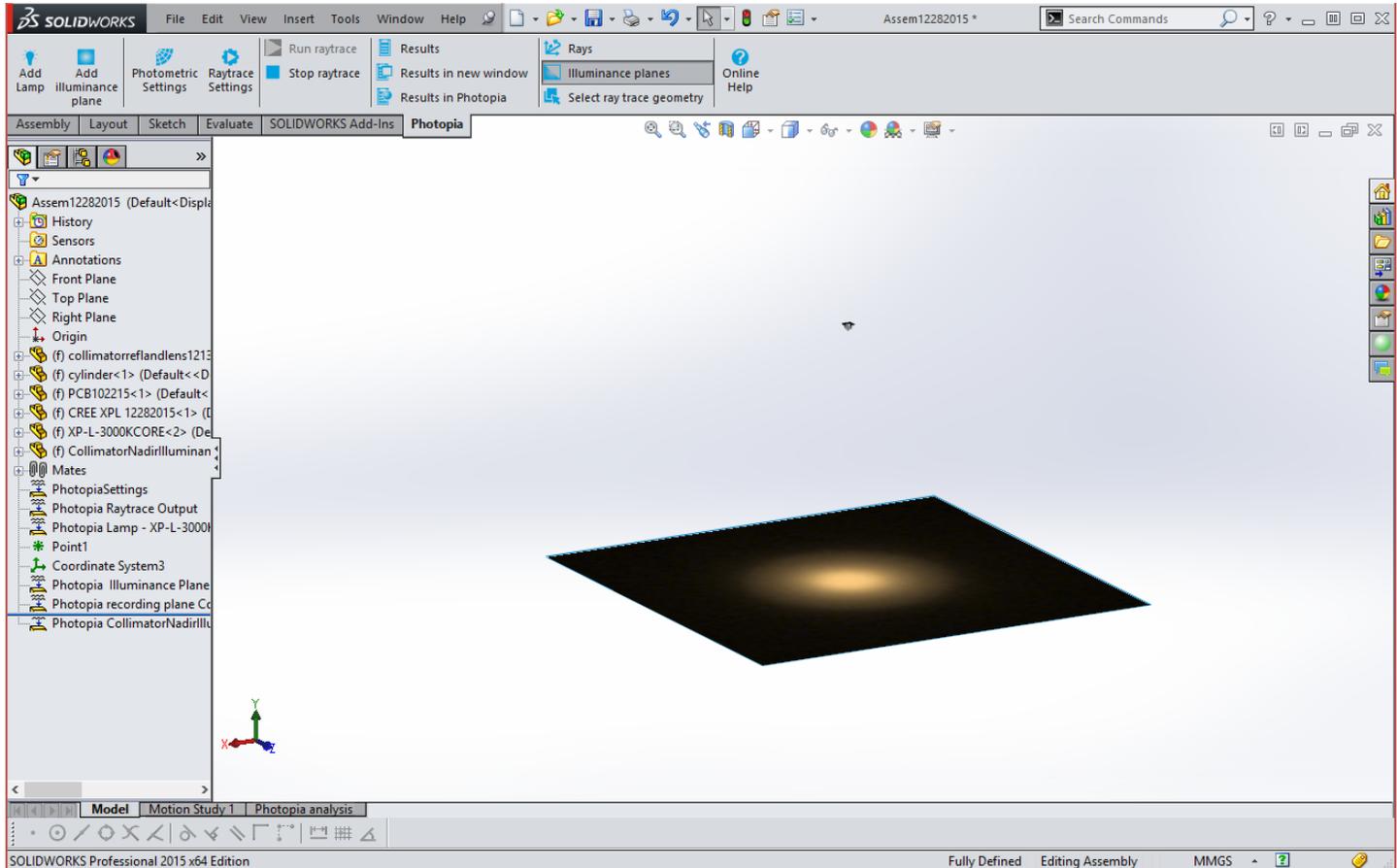
Click  to add the illuminance plane.



## 10. Re-Run Raytrace and View Illuminance Planes

Click **Run Raytrace** to rerun the raytrace with the Illuminance Plane in the model.

Click **Illuminance Planes** to view the illuminance plane in the model view. You can also choose the Illuminance Plane tab in the Results screen to view the numeric and rendered plot information.



## 11. Complete

CONGRATULATIONS! You have completed the LED Collimator tutorial.

### Suggested Next Steps:

- Setup a raytrace for one of your own assembly models
- Review the documentation at <http://www.ltioptics.com/SWSupport>
- Complete the tutorials for the Parametric Optical Design Tools