

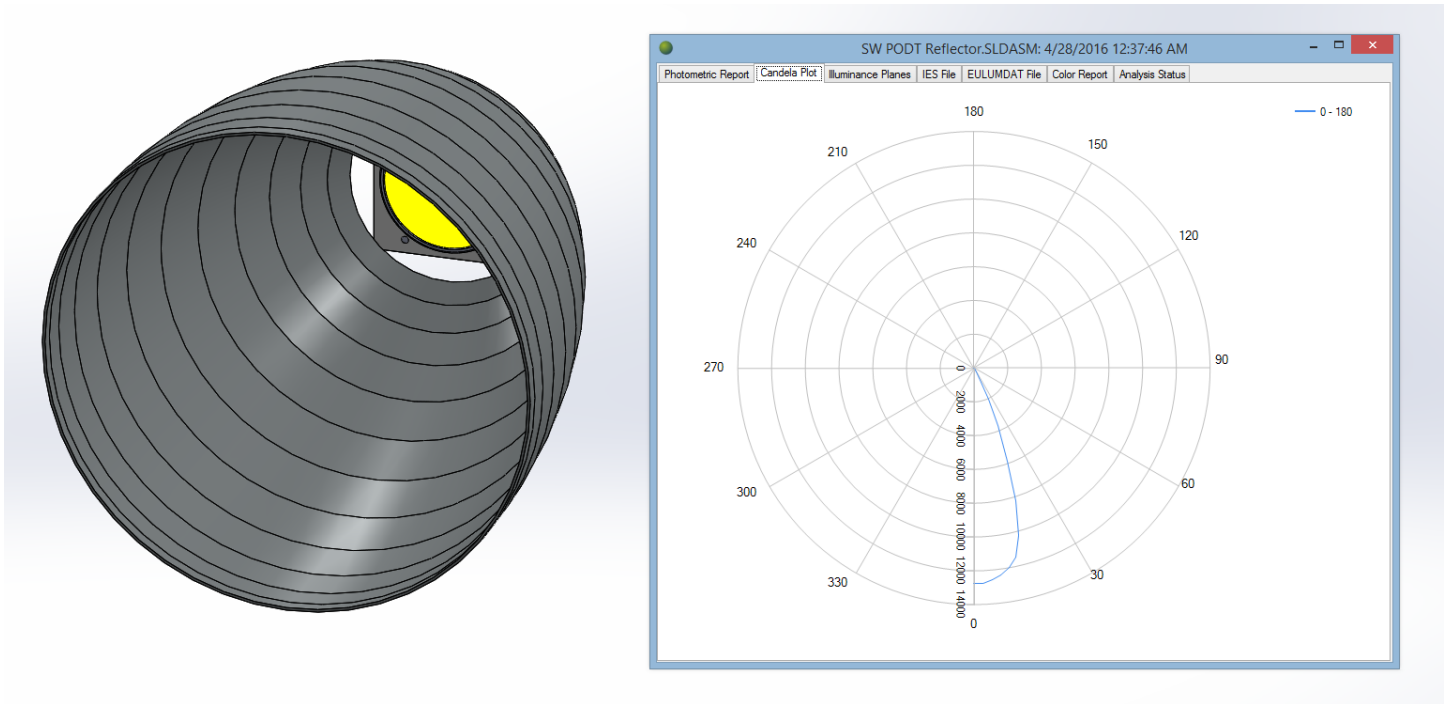
OVERVIEW

In this tutorial you will design a 40° beam medium flood reflector using the Parametric Optical Design Tools (PODT) and the CREE CXA 3050 COB LED. This tutorial assumes you know how to setup and run a Photopia analysis inside of SOLIDWORKS. If you need to review the basics of Photopia for SOLIDWORKS, then start with the Beginner 1: LED TIR Collimator tutorial. <http://www.ltioptics.com/en/support-swaddin-v2015.0.html#pswaitutorials>

Skills Covered:

- Design a reflector
- Analyze the reflector
- Modify the reflector to obtain the desired beam shape

Skill Level: Intermediate



1. Start a New Part

Start SOLIDWORKS and click **File > New** and choose a Part. Set the units for the part to be MMGS.

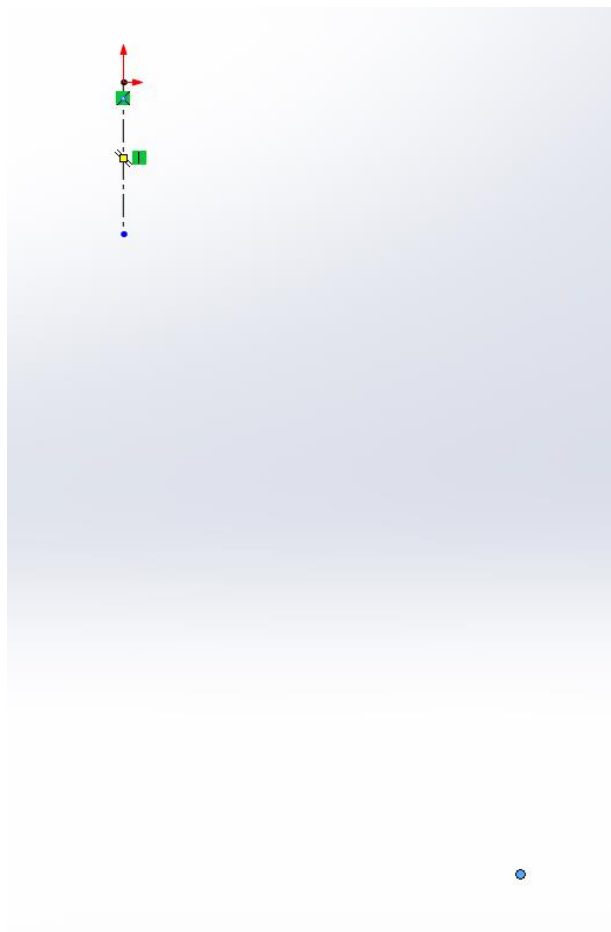
Photopia's PODT module creates reflector and lens profiles in a sketch in a part file. The profiles are based on several geometric constraints and aiming parameters that you will define beforehand. 3D features based on these profiles are then created using the Feature tools within SOLIDWORKS. When you change the underlying PODT profile, the Features will be updated as well.

2. Start a Sketch and Define Constraints

Select the **Top Plane** in the Feature Manager Tree, and then choose the **Sketch** tab from the Command Manager and click the **Sketch** button to create a new Sketch.

Next you will create a line which defines the lamp center and the beam direction. From the **Sketch** tab in the Command Manager, click on the **Line** button and check "For construction". Click to start the line at the origin and drag it down vertically to be about 10mm long. The exact length isn't critical as this line defines the center of the beam and reflector revolve axis.

Finally, from the **Sketch** tab in the Command Manager, click on the **Point** button, click anywhere in the view to create the point, and then change its position to 45,-90 in the Property Manager.



3. Create the Reflector

Ensure the sketch still open and click **Design reflector** (Photopia CommandManager Tab) or **Tools > Photopia > Design reflector**.

For the **Lamp center** property, select the sketch origin.

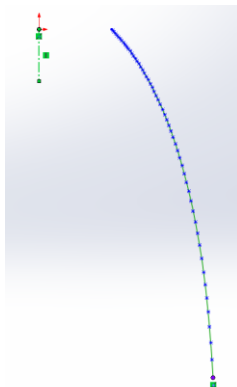
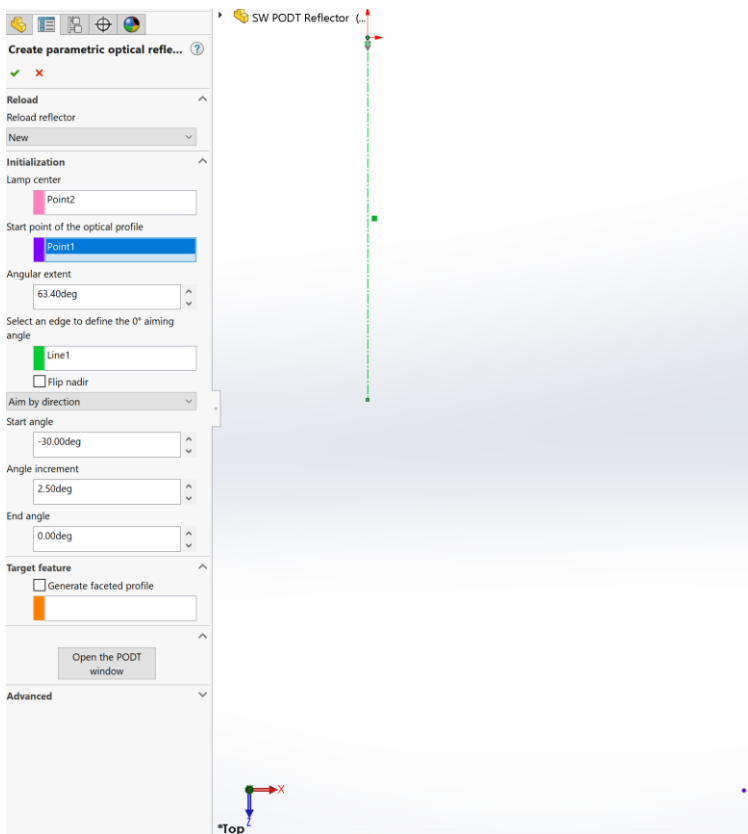
For the **Start point** select the point you added to the sketch.

For the **0° aiming direction** select the construction line.

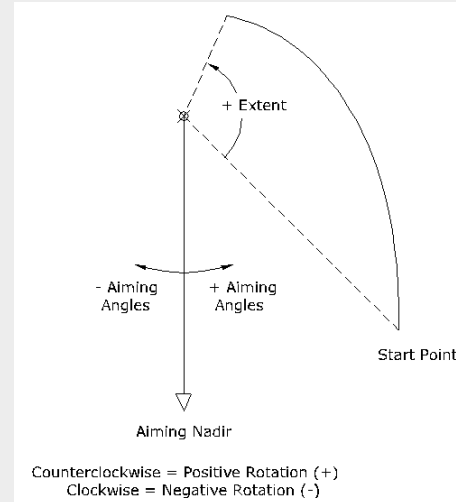
Set the **Angular extent** to 63.4°.

For the **Aiming Start, Increment and End** enter -30, 2.5 & 0

Click **✓** to create the reflector profile and you should see the profile displayed in your Sketch.



The image below shows references for the Aiming Nadir, Angular Extent, and Aiming Angle Directions.



The **Angular extent** sweeps from the start point to a radial line that defined the end of the reflector. In this tutorial, we have computed that it should be 63.4°.

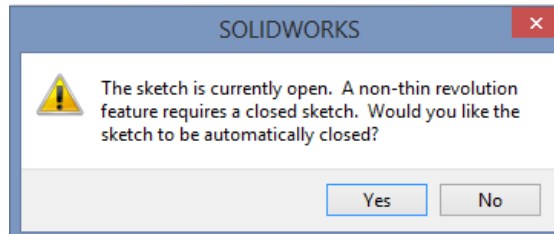
The aiming angles define how you want to aim the light from the reflector. The goal of this design is to create a 40° beam angle, which means the 50% intensity values will be 20° to either side of the beam center. The peak intensity for this design should also be in the beam center. In order to achieve 50% of the peak intensity at 20°, you'll need to aim light beyond that angle since the beam will continue to taper past the 20°. We will start with aiming the light 30° from the beam center and the aiming can be adjusted once we see how the reflector performs. The aiming angles are entered in 3 cells defining the start and end angles of the beam spread, as well as the angular increment between the parabolic reflector aiming sections.

Assuming the bottom of the reflector aims light toward the widest angle, the top toward the center, and increments between those two extremes of 2.5°, the values we enter for start, increment and end are -30, 2.5 & 0.

4. Create a Revolved Boss/Base Feature

Ensure the sketch still open and click **Revolved Boss/Base** button (Features CommandManager Tab).

If you see the following message from SOLIDWORKS, click **No** since we want to create a thin revolution and don't want to modify the PODT generated profile.

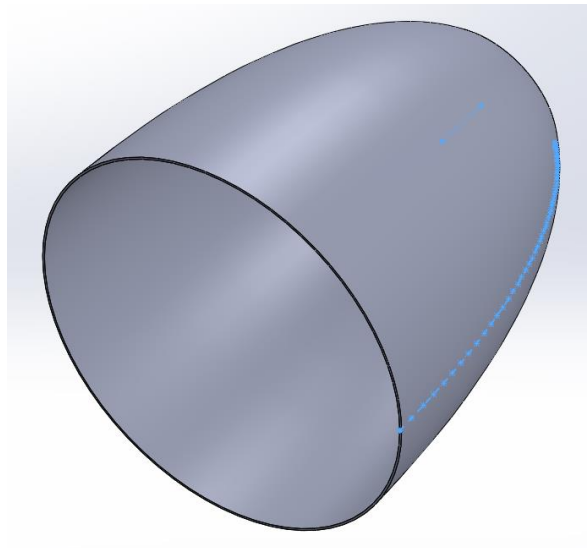


The **Axis of Revolution** should automatically have selected the construction line.

The **Contour** should have automatically been populated with the PODT profile.

Set the **Direction 1 Thickness** to 0.5mm.

Click ✓ to create the revolved feature and you should see a reflector that looks like this:



5. Create an Assembly and Import the COB LED

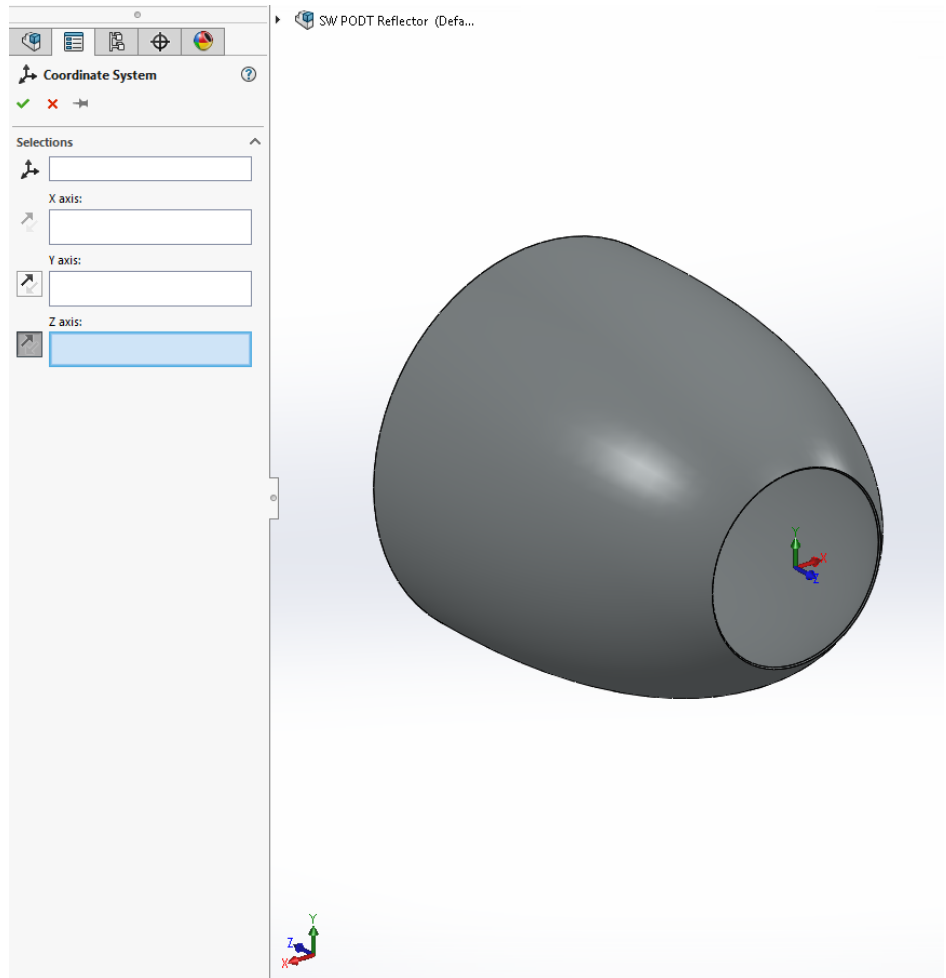
Choose **File > Save** to save the part file. Give it a name of **COB Flood Reflector**.

Choose **File > Make Assembly from Part** to create an assembly file.

Choose **Insert > Reference Geometry > Coordinate System**. Click in the Z Axis reference box and then click the Arrow button to reverse the direction of the z-axis.

Click **✓** to create the coordinate system.

You should see the Z axis of the reference coordinate system point in the opposite direction of the SOLIDWORKS coordinate system in the lower left corner of the CAD view:

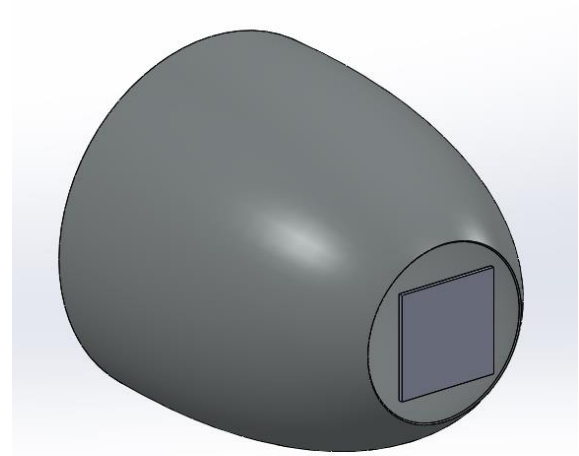


Select the **Coordinate System1** in the FeatureManager and then click the **Add Lamp** button (Photopia CommandManager Tab).

Scroll down to this lamp in the list: CXA3050-5100K

You will see **Coordinate System1** already referenced to this lamp model, which will ensure the lamp imports in the correct orientation.

Click **✓** to import the lamp.



6. Prepare & Run the Photometric Simulation

In the **Photopia Appearances Tab** on the right (green sphere icon), find the “Generic Spec 85” material.

Drag this material onto the Reflector Part in the Feature Manager tree to assign the material at the component level to the entire part.

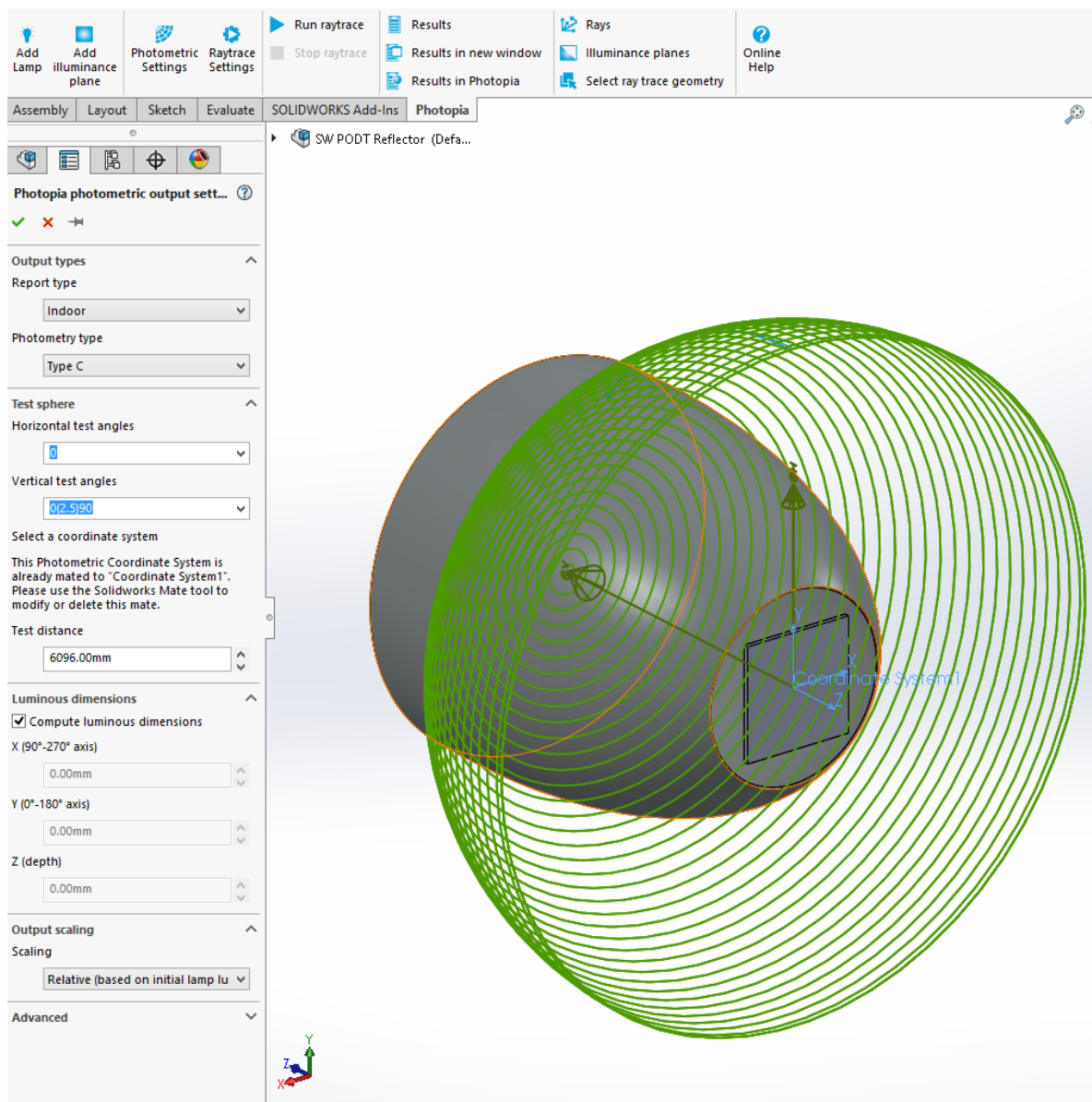
Select **Coordinate System 1** in the Feature Manager and then click the **Photometric Settings** button (Photopia CommandManager Tab).

Set the **Horizontal test angles** to: 0.

Set the **Vertical test angles** to: 0(2.5)90.

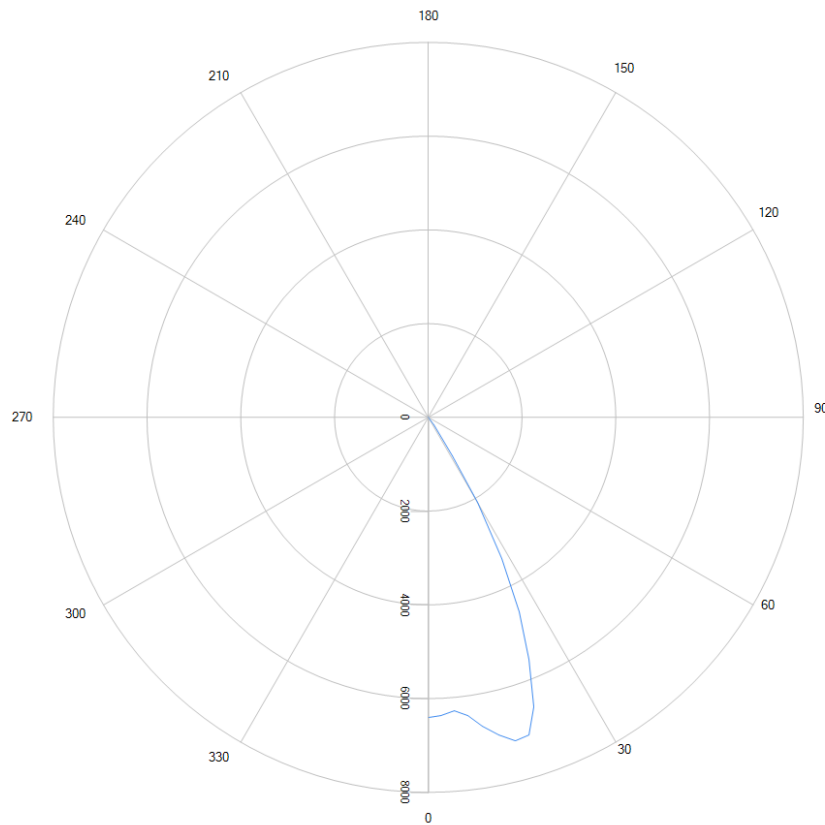
Click ✓ save the Photometric Settings.

Click the **Start Raytrace** button (Photopia CommandManager Tab) to begin the raytrace.



7. Review the Results

After the raytrace is complete, you should get a candela distribution that looks like the following:



The results for this initial reflector produce a 54° beam with the peak off center. Since we were targeting a 40° beam with a centered peak, we will now adjust the reflector profile.

8. Modifying the Reflector

Right click on the **COB Flood Reflector** in the Feature Manager and select **Edit Part** from the flyout menu.

Select the **Revolve-Thin1** feature and then click the **Design reflector** button (Photopia CommandManager Tab).

Under **Reload Reflector**, click the drop down list and choose the last item in the list. This will associate your initial reflector parameters with the revolved boss/base feature.

Click the **Open PODT window** button.

Change the **Start angle** to 27.5 and click **Update Aiming** to narrow the beam a bit.

Change the **Weight minimum** to 0.9.

Change the **Weight exponent** to -15.

You should now see the blue weighting factor plot with higher values in the beam center. The obtained candela plot from the last run is also shown in this view.

Weighting Factors

The Weighting Factors (WF) determine the relative importance of each reflector aiming section. A higher weight means more of the reflector angular extent will be aimed toward that angle. Increasing the WF exponent generally creates higher WF's at wider angles in the beam. A negative WF exponent creates higher weights in the beam center, with a stronger emphasis at 0° the more negative the exponent. See chapter 4 in the Photopia User's Guide for a more complete explanation of the WF equation.

Section #	Weight Adj.	Calc Weight	Total Weight	% Reflector	Aiming Type	Aiming Angle	Aiming Point X	Aiming Point Y
1	1.000000	0.065552	0.065552	1.0%	By direction	-27.5°	-461.748613	-887.010833
2	1.000000	0.128631	0.128631	2.0%	By direction	-25.0°	-422.618262	-906.307787
3	1.000000	0.204951	0.204951	3.3%	By direction	-22.5°	-382.683432	-923.879533
4	1.000000	0.293357	0.293357	4.7%	By direction	-20.0°	-342.020143	-939.692621
5	1.000000	0.391239	0.391239	6.2%	By direction	-17.5°	-300.705800	-953.716951
6	1.000000	0.494507	0.494507	7.9%	By direction	-15.0°	-258.819045	-965.925826
7	1.000000	0.597787	0.597787	9.5%	By direction	-12.5°	-216.439614	-976.296007
8	1.000000	0.694826	0.694826	11.1%	By direction	-10.0°	-173.648178	-984.807753
9	1.000000	0.779080	0.779080	12.4%	By direction	-7.5°	-130.526192	-991.444861
10	1.000000	0.844416	0.844416	13.4%	By direction	-5.0°	-87.155743	-996.194698
11	1.000000	0.885818	0.885818	14.1%	By direction	-2.5°	-43.619387	-999.048222
12	1.000000	0.900000	0.900000	14.3%	By direction	0.0°	0.000000	-1000.000000

Close this screen.

Check the **Generate faceted profile** check box.

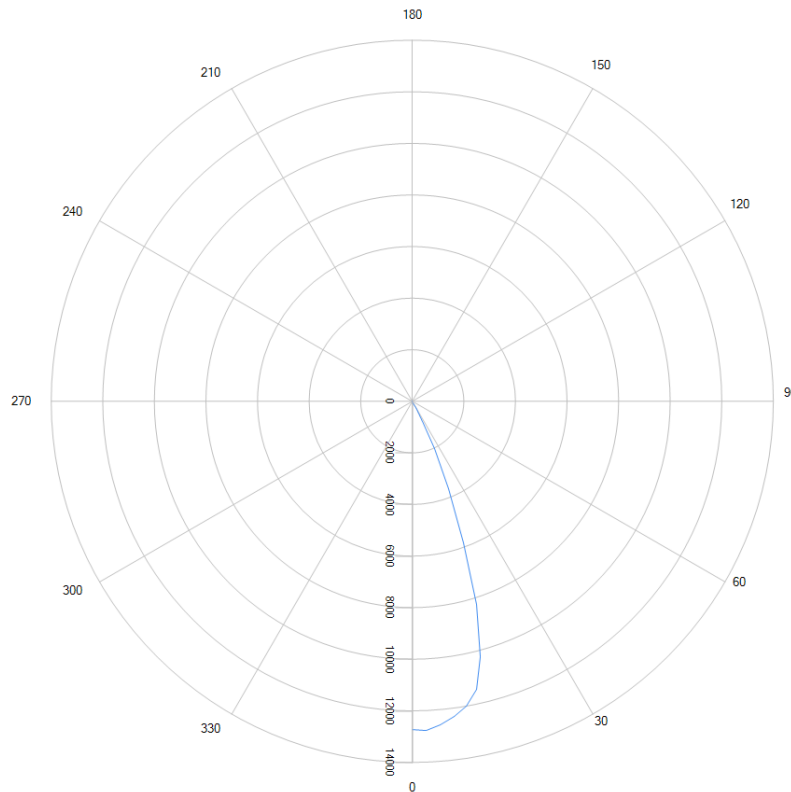
Click the ✓ to update the reflector.

9. Rerun the Raytrace

Exit the part edit mode and return to the assembly.

Run the simulation again.

You should now see a beam with the following distribution and about a 39° beam angle.



10. Complete

CONGRATULATIONS! You have completed the PODT reflector design tutorial.

Suggested Next Steps:

- Design a new reflector with your own beam requirements
- Review the documentation at <http://www.ltioptics.com/SWSupport>
- Complete the tutorial for the parametric lens design