

LensMechanix™



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Tutorial:

**Package, analyze, and validate
a sample lens system**

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In this tutorial, you will learn how to package, analyze and validate an OpticStudio sequential file in LensMechanix. LensMechanix works in nonsequential mode; it converts sequential files to nonsequential upon loading a .zmx file. The file used in this tutorial is an OpticStudio sequential file.

Learning objectives

At the end of this tutorial, you will be able to:

- Load an OpticStudio sequential file in SOLIDWORKS using LensMechanix
- Build mechanical components around the optical components
- Add scatter profiles to the mechanical components
- Run an analysis on the complete optomechanical system
- Make necessary changes to the mechanical system to meet specified requirements
- Create a .zar file with optical and mechanical components

Load an OpticStudio file into LensMechanix

1. In SOLIDWORKS 2015 or later, on the Menu Bar > **File** > **New** > **Assembly**.
2. Verify that LensMechanix is enabled in the Command Manager. If it is not, go to **Tools** > **Add-Ins** and select the **LensMechanix** check box.
3. On the **LensMechanix** tab, select **Load OpticStudio File**.

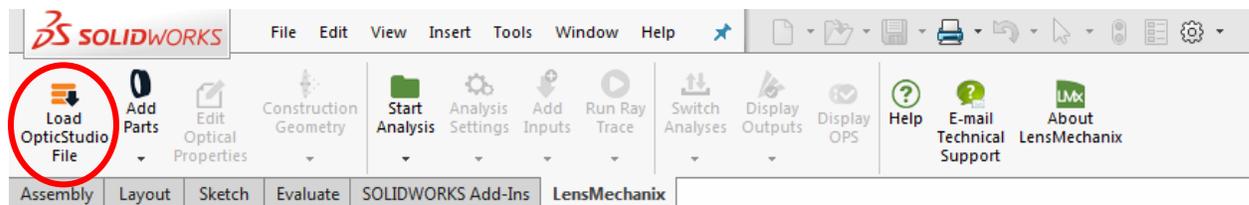


Figure 1. The Load OpticStudio File button in the Command Manager.

4. Click **Browse**, and click **Documents** > **Zemax** > **Samples** > **LensMechanix** > **Single Gauss 25mm Sample** > **25mm Single Gauss SEQ**.

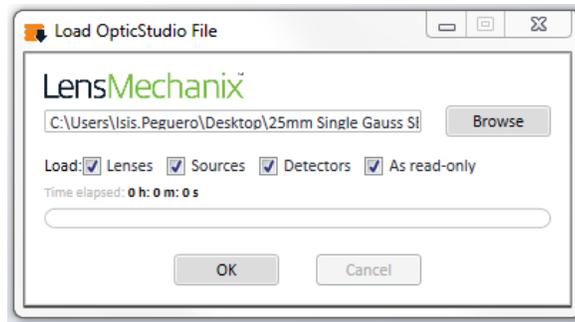


Figure 2. The **Load OpticStudio File** dialog box.

5. Ensure that all check boxes in the dialog box are selected, and then click **OK**. Close the dialog box after the files are loaded.

Note: If you clear the **As read-only** check box, you can modify the optical design in SOLIDWORKS. However, it is recommended that you modify the optical design in OpticStudio only. LensMechanix does not have optimization features for optical design.

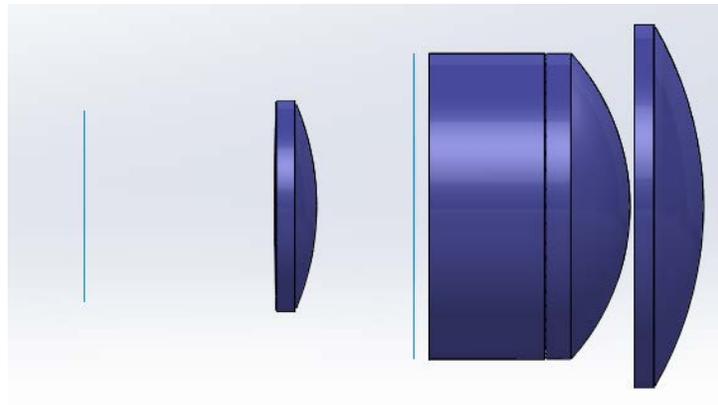


Figure 3. Loaded lens geometries in SOLIDWORKS.

You are now ready to design the mechanical components for the optical system.

Package an optical system in LensMechanix

1. On the **LensMechanix** tab > **Construction Geometry** > **Show All**.
2. On the **Assembly** tab > **Insert Components** > **New Part**.

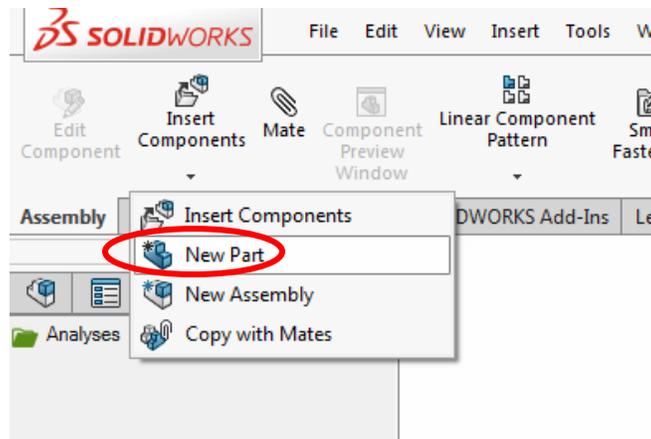


Figure 4. New Part in SOLIDWORKS.

3. In the Feature Manager, click **Right Plane**.

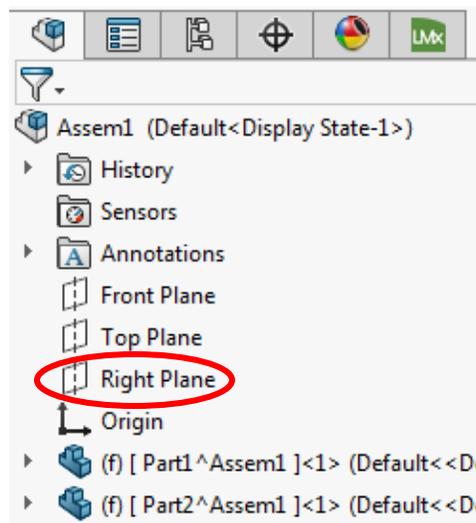


Figure 5. Reference the sketch to the Right Plane.

4. On the **Sketch** tab, create the sketch for the mechanical housing. To completely define your sketch, use the lens geometry and either a centerline, clear aperture, apex, or origin.
5. On the **Features** tab, click **Revolved Boss/Base**.

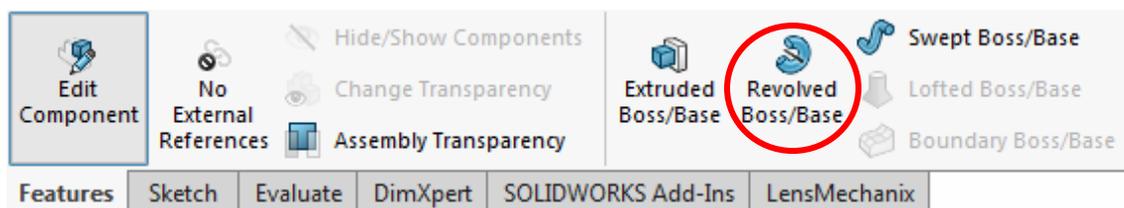


Figure 6. The Revolved Boss/Base feature.

6. Select the centerline as the axis of revolution, and then click the green check mark.

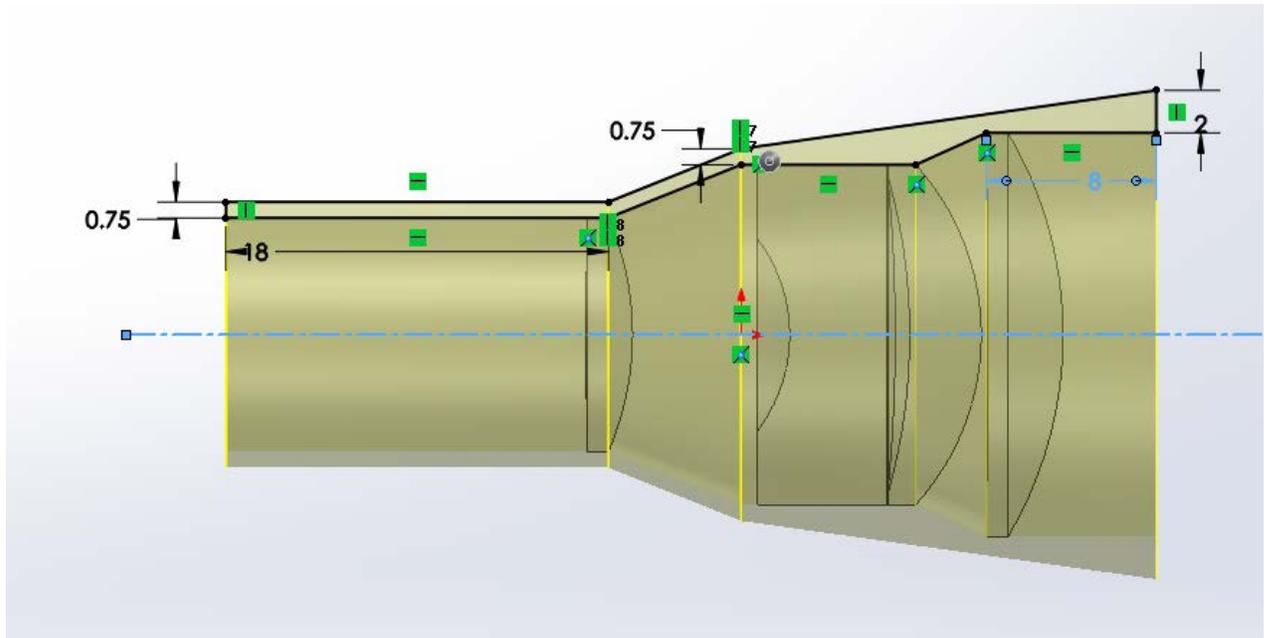


Figure 7. The result of the revolved base with the optical axis as the center of revolution.

7. To exit editing the part, click the icon in the top-right corner of the graphics area.



Figure 8. The icon in the top-right corner of the graphics area for returning to assembly.

Analyze your optomechanical system

1. On the **LensMechanix** tab > **Start Analysis** > **Start Analysis Wizard**.

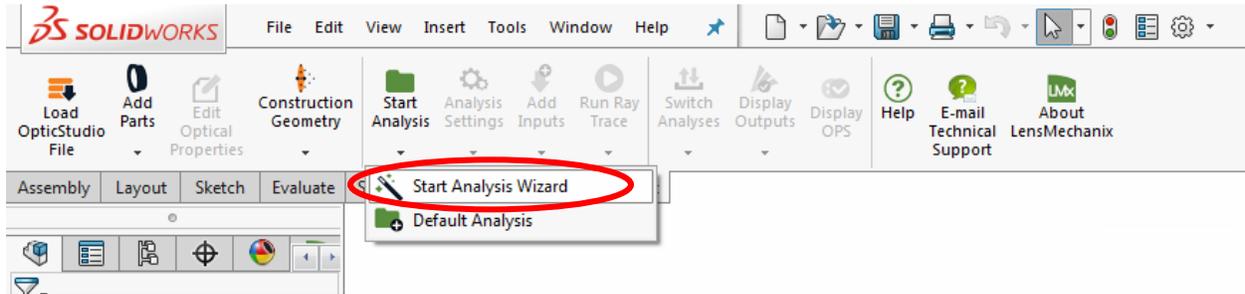


Figure 9. The **Start Analysis Wizard** in the Command Manager.

2. Name your analysis Ray Trace and click **Next**.
3. On the **Analysis Settings** page, set the overfill clear aperture to 10%, select **Image quality + scattering** and click **Next**.
4. On the **Ambient Conditions**, set the ambient conditions to 25° C and 1 ATM and click **Next**.
5. On the **Wavelength**, click **Next**.
6. On the **Surface Properties**, click **Next**.
7. On the **Precision Settings**, set the slide bar to position 2, and click **Next**.
Note: A Medium mesh setting corresponds to 100,000 rays and a scatter profile sample R of 5 degrees.
8. Ensure that all components are in the **Included Components** section in the **Computational Domain**. If any components are in the **Ignored Components** section, right-click the mechanical component, click **Add to Computational Domain**, and then click the green check mark.

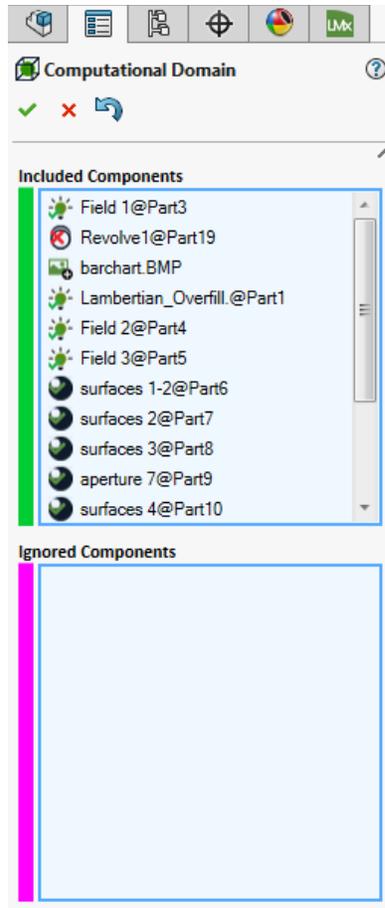


Figure 10. Components are in the **Computational Domain**.

9. To define a scatter profile for the component, in the Input Tree, under Mechanical Components, right-click the part that you created, and click **Edit Surface Properties**.

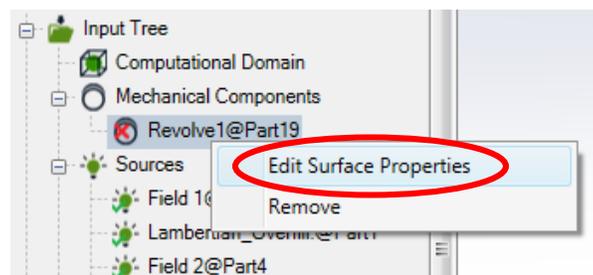


Figure 11. The **Edit Surface Properties** command for defining a scatter profile.

10. In the **Mechanical Component Editor**, in the **Scatter Profile** dropdown, select **Grey Anodized**, click **Apply to Component**, and then click the green check mark.

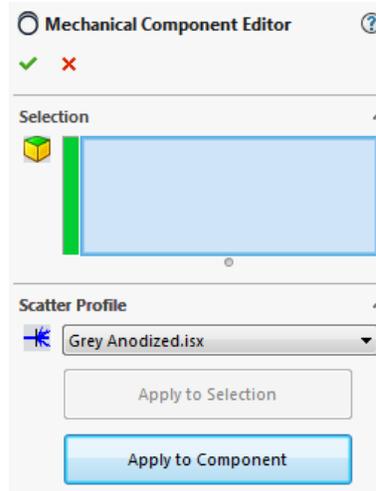


Figure 12. The Scatter Profile dropdown in the Mechanical Component Editor.

11. In Command Manager > Add Inputs > Surface Power Input.

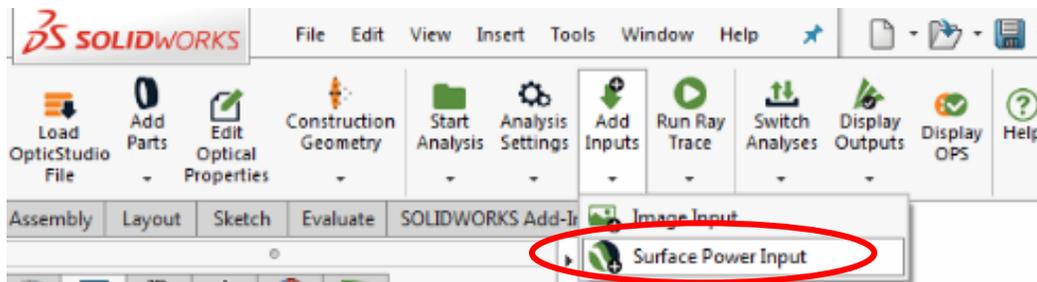


Figure 13. The Surface Power Input in the Command Manager.

12. Select the lens surface of the larger outermost lens that is closest to the color detector.
13. Under **Display**, click **Irradiance**, select the blue to red color scale, and then click the green check mark.

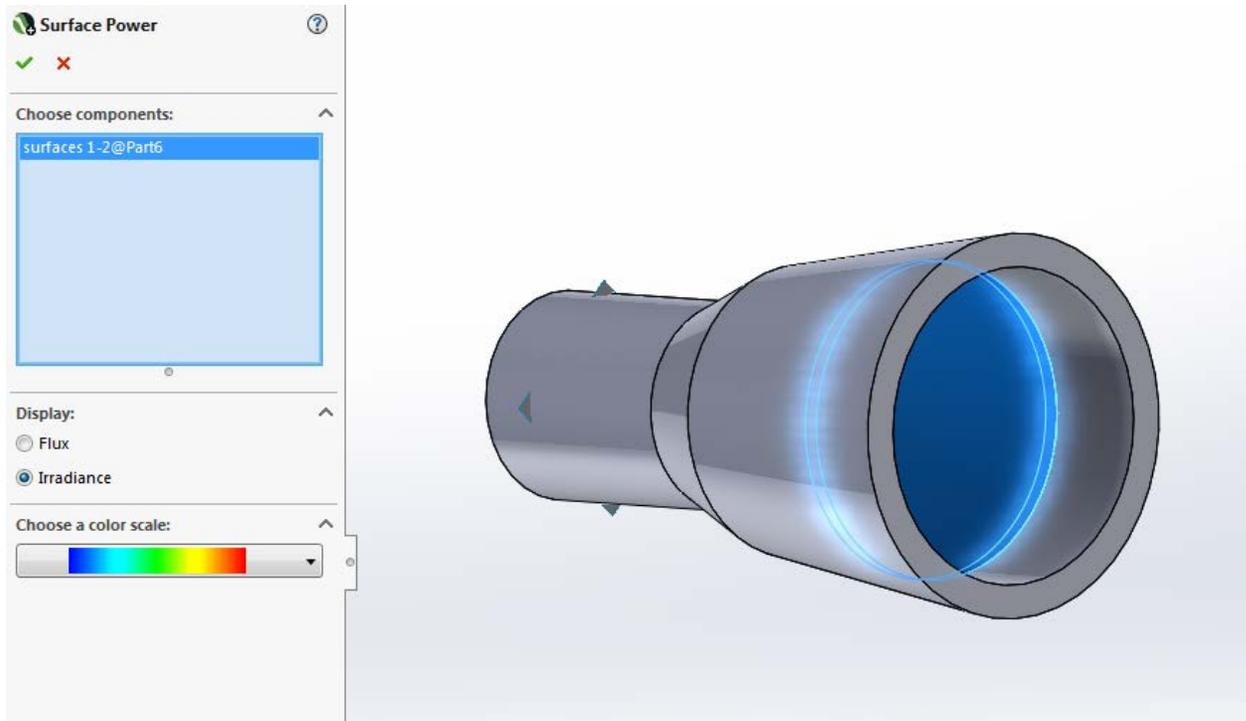


Figure 14. The Surface Power pane with the display irradiance option enabled.

- To view the Optical Performance Summary (OPS) table, which shows in the Command Manager, click **Display OPS**.

Note: The OPS table compares the performance of your complete system to the performance of the original OpticStudio design, after LensMechanix converts the design to nonsequential.

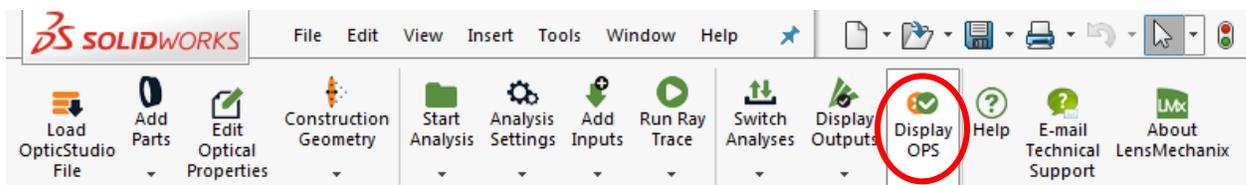


Figure 15. Display OPS opens the Optical Performance Summary table in the Command Manager.

Validate the performance of the complete optomechanical system

- In the **Allowable Δ** column, set the tolerance requirements: spot size = 1.5 μ , beam clipping = 1%, and image contamination = 0.8%

Note: Tolerance requirements are usually provided by the optical engineer.

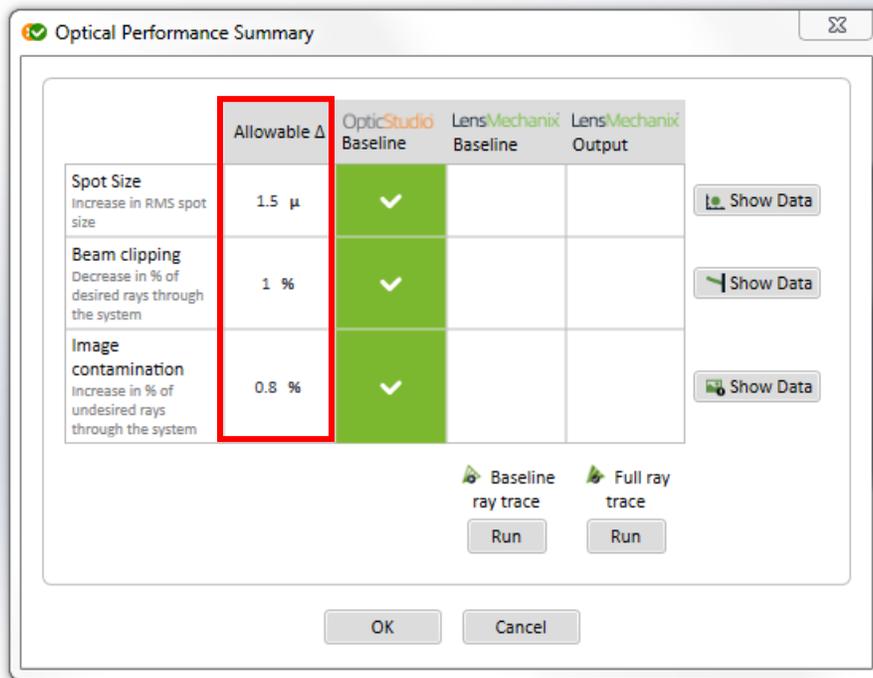


Figure 16. The modified parameter values in the **Allowable Δ** column. Notice that the **OpticStudio Baseline** column is green, indicating that the conversion from sequential to nonsequential was successful.

- In the **LensMechanix Baseline** column, click **Run** to run a baseline ray trace.
Note: LensMechanix calculates the ray trace using only the optical components in the model.

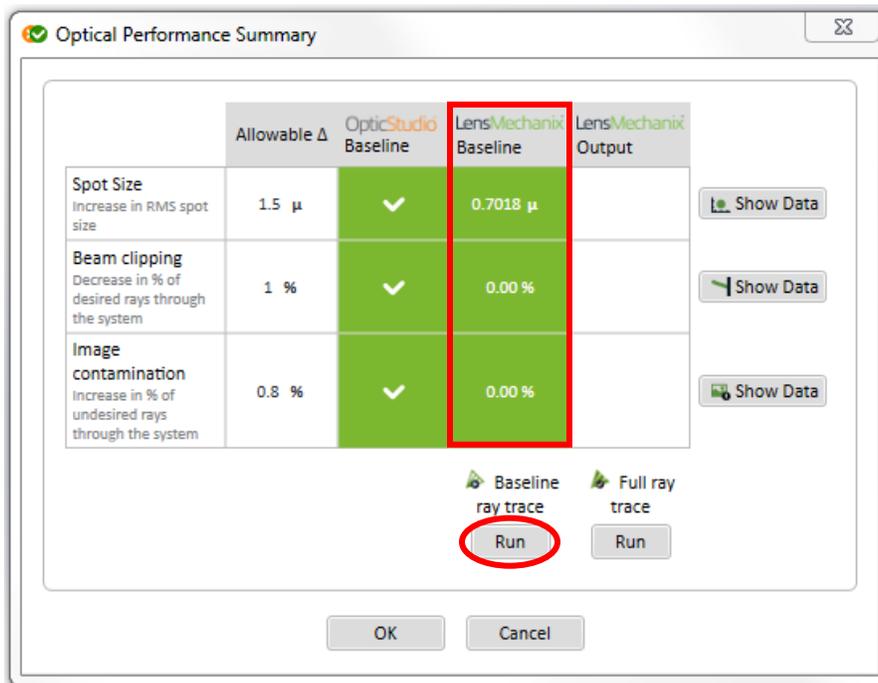


Figure 17. The baseline ray trace results appear in the **LensMechanix Baseline** column.

- In the **LensMechanix Output** column, click **Run** to run a full ray trace.
Note: LensMechanix calculates the ray trace using both the optical and mechanical components in the Computational Domain.

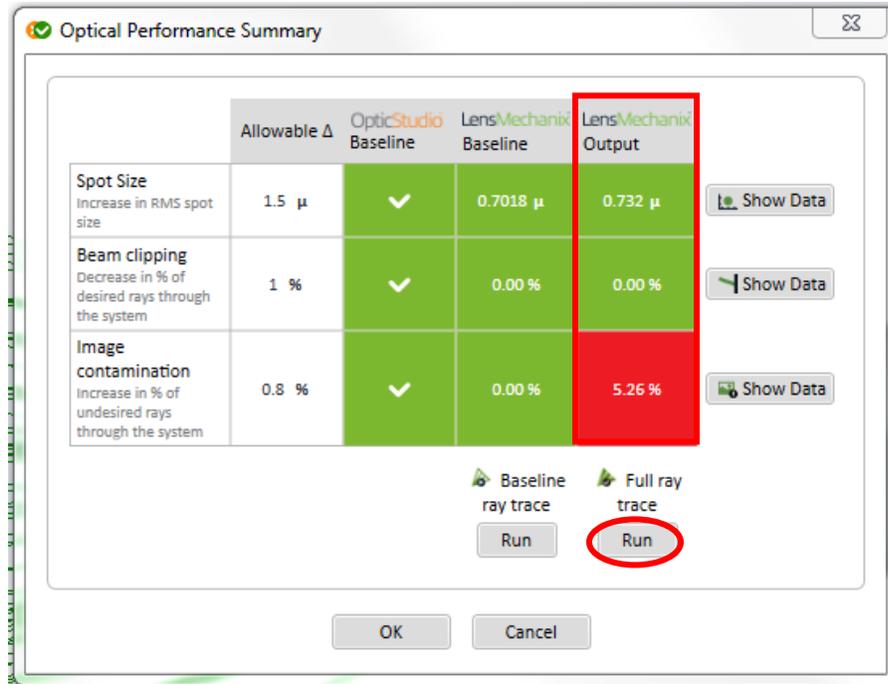


Figure 18. The full ray trace results appear in the **LensMechanix Output** column. Note that the full ray trace revealed an image contamination problem.

- Next to the **Spot Size** row, click **Show Data** and confirm that there is no change in the size of the spot size.
- Next to the **Image contamination** row, click **Show Data** to investigate the image contamination. Note: LensMechanix traces critical rays to perform calculations. You can determine if any critical rays are travelling in undesired paths.
- To see the rays traveling through the system more clearly, click **Section View** near the top of the screen in the graphics area.
- In the **Plane 1** section, select **Right Plane** and click the green check mark.

Figures 19 and 20 show the results of the surface power analysis. Notice that some rays are bouncing off the barrel. For this reason, the barrel will be made shorter.

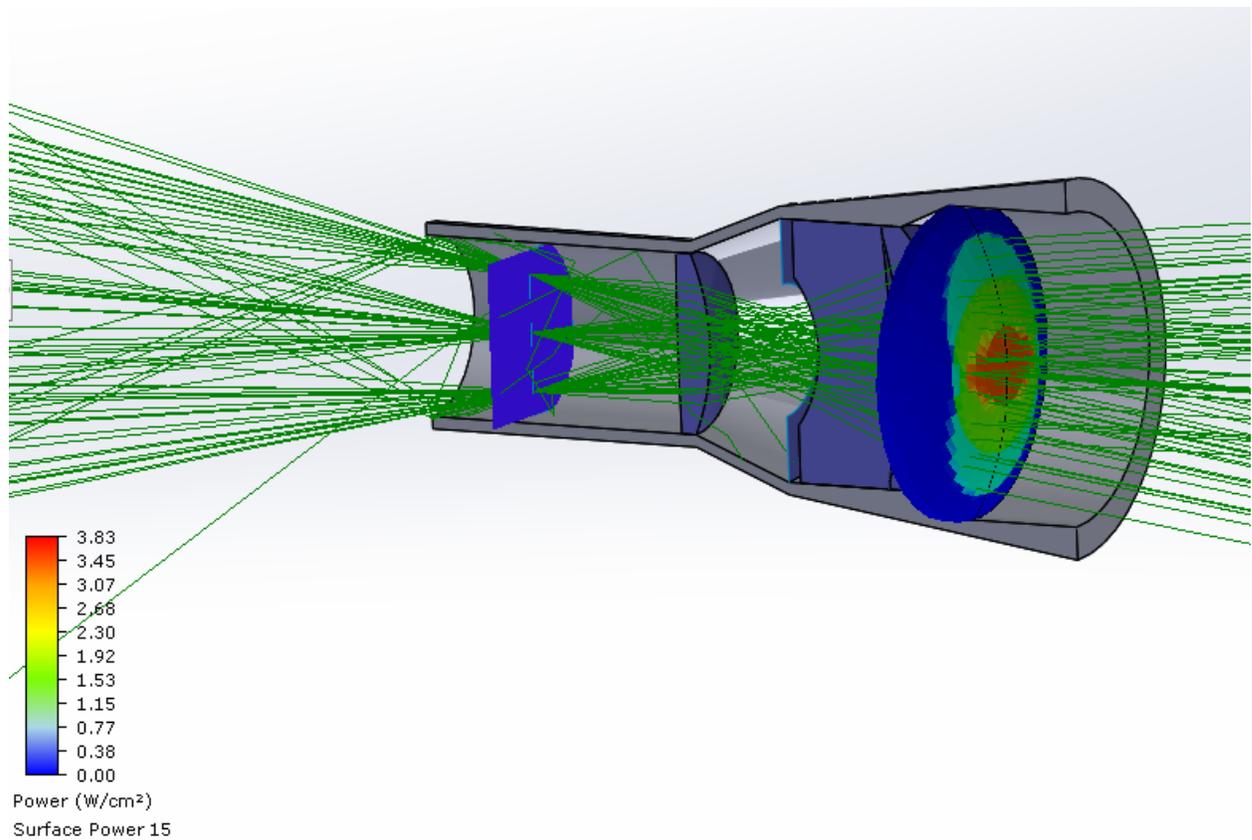


Figure 19. Sectional view of the optomechanical assembly.

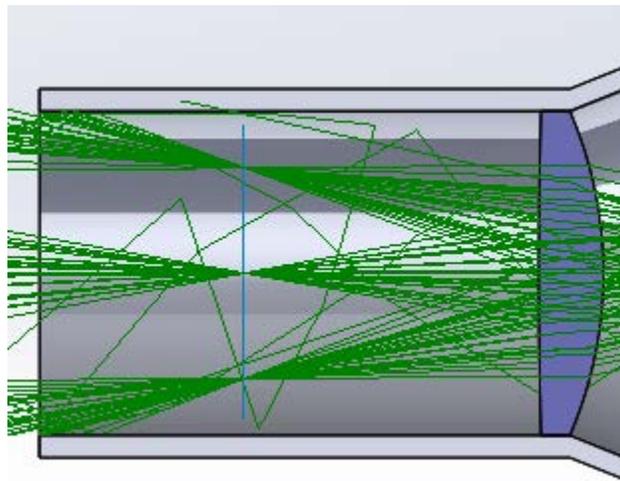


Figure 190. A close-up view of the barrel. Notice that the barrel interferes with the rays.

8. In Feature Manager Design Tree, expand the part that you created, click the sketch, and then click **Edit Sketch**.

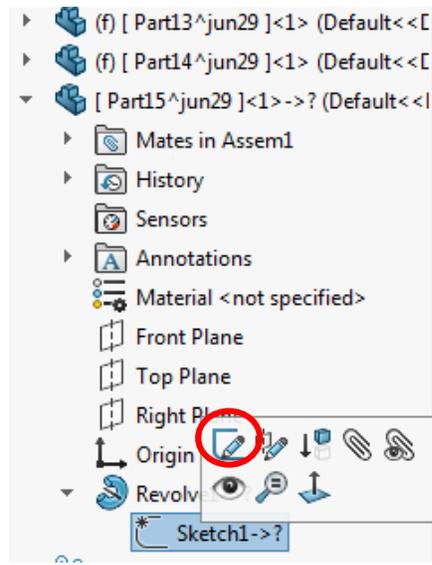


Figure 21. The **Edit Sketch** icon in the Feature Manager.

9. Shorten the length of the barrel, accept changes, and then exit the part editing mode.
10. On the **LensMechanix** tab, click **Start Analysis > Clone Analysis**, name the analysis Ray Trace 2, and then click **OK**.
11. In Command Manager, click **Display OPS**.
12. In the **Allowable Δ** column, set the tolerance requirements: spot size = 1.5 μ , beam clipping = 1%, and image contamination = 0.8%.
13. In the **LensMechanix Output** column, click **Run** to run a full ray trace.
In the OPS table, the **Image contamination** row is now green, indicating that the geometry change solved the image contamination problem.

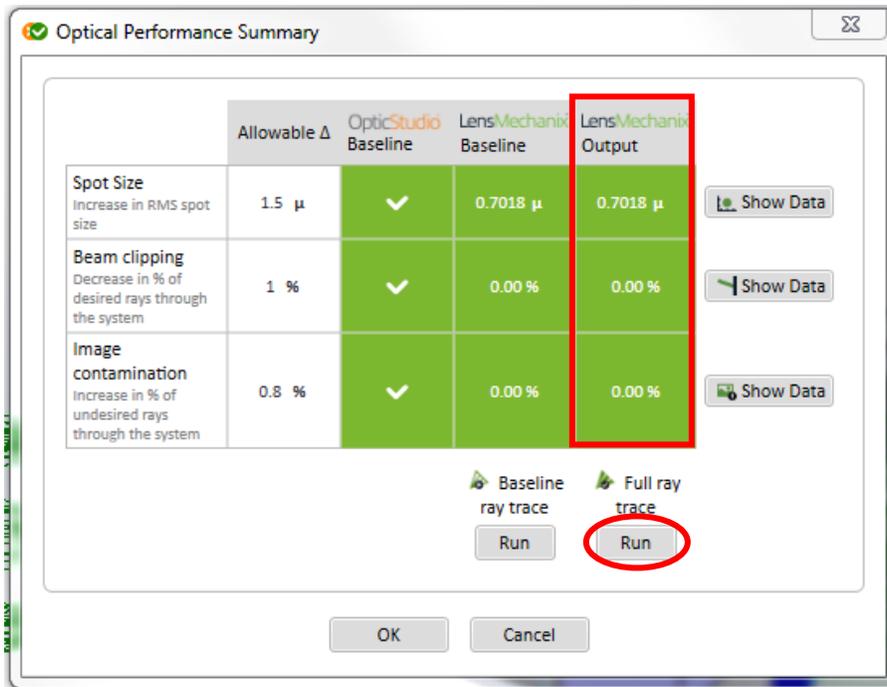


Figure 203. When all boxes are green in the OPS table, this indicates that the optomechanical system has met the design requirements.

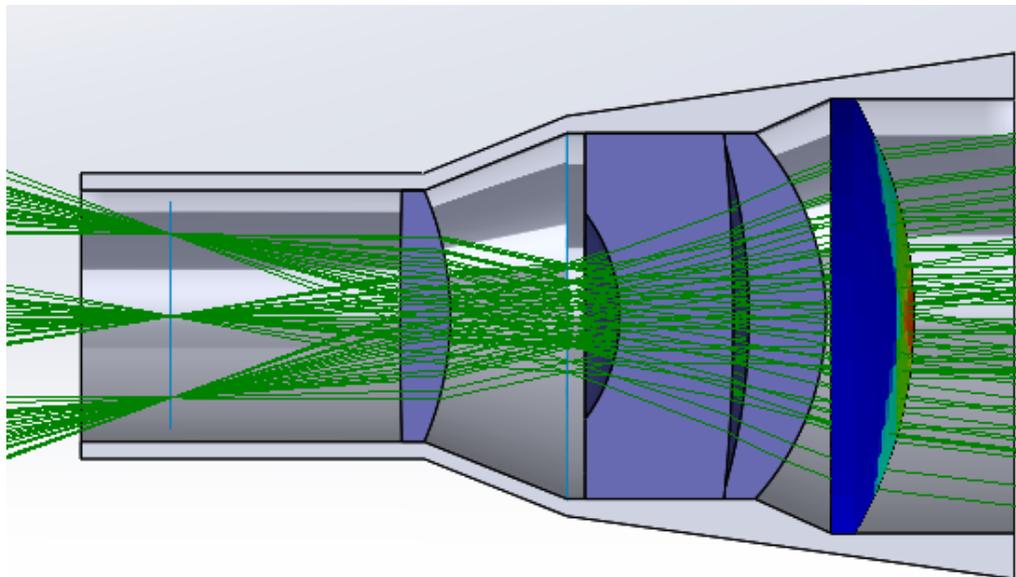


Figure 214. A section view of the optomechanical housing. Notice that the rays are no longer interfering with the mechanical housing.

Congratulations! You successfully packaged, analyzed, and validated an optomechanical system.