Auto Importance Sampling

Requirements

Models: Lens_DoubleGauss.oml

Properties: None

Editions: TracePro Standard or Expert

Introduction

You can use Importance Sampling for surfaces to improve the performance of the raytrace in situations where very little light reaches a surface that is important to you, such as in stray light analysis. Each surface may have one or more importance sampling targets applied, causing one or more rays to be traced toward each importance sampling target. For stray light analyses of complex optical imaging systems, defining importance sampling targets manually is a chore. TracePro provides a feature for you to do this automatically, using the **Define|Auto Importance Sampling** selection. When you use this feature, TracePro will define an annular or rectangular importance sampling target for each surface in the prescription. Before you automatically set up targets, you must first define the model's Prescription, i.e. its sequence of opticl surfaces. Use the **Prescription** tab of the **Define|Apply Properties** dialog box to do this.

TracePro needs three or four rays to determine the location and size of importance sampling targets. A gut ray, marginal ray, and one or two chief rays are needed. Within TracePro, they are defined as follows:

- Gut Ray – a ray passing through the center of the aperture stop and the center of the field of view.
- Marginal Ray – a ray passing through the edge of the aperture stop and the center of the field of view.
- Chief Ray – a ray passing through the center of the aperture stop and the edge of the field of view.

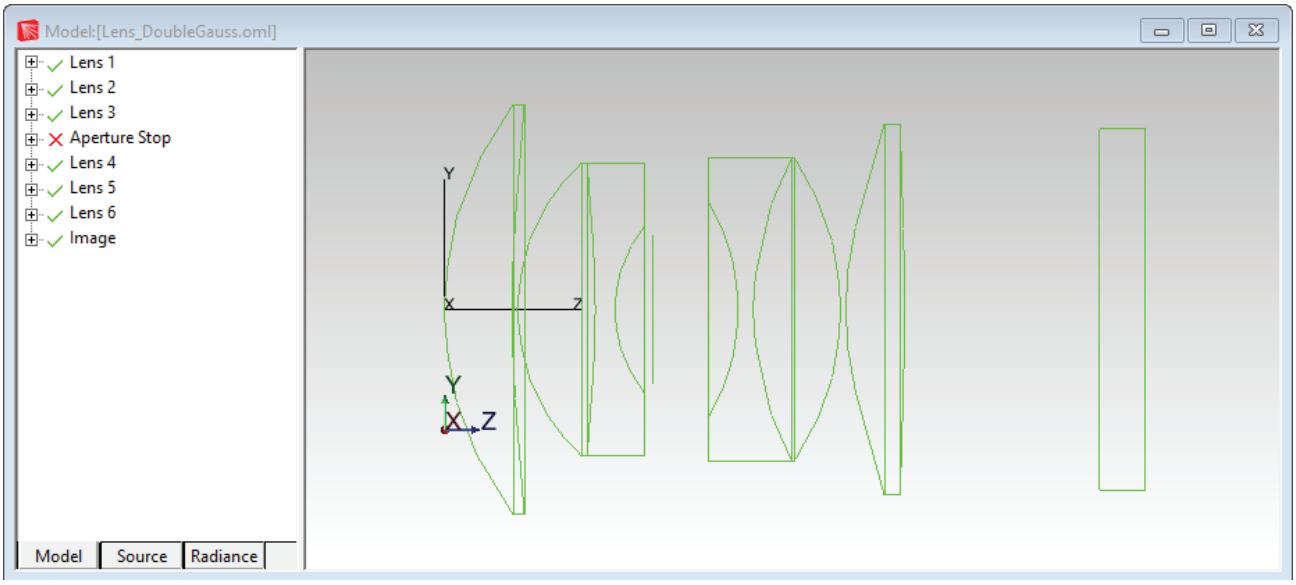
You may find it helpful to use a lens design program to determine the starting positions and directions of these rays. One chief ray is needed to define circular targets, and two chief rays are needed to define rectangular or annular targets.

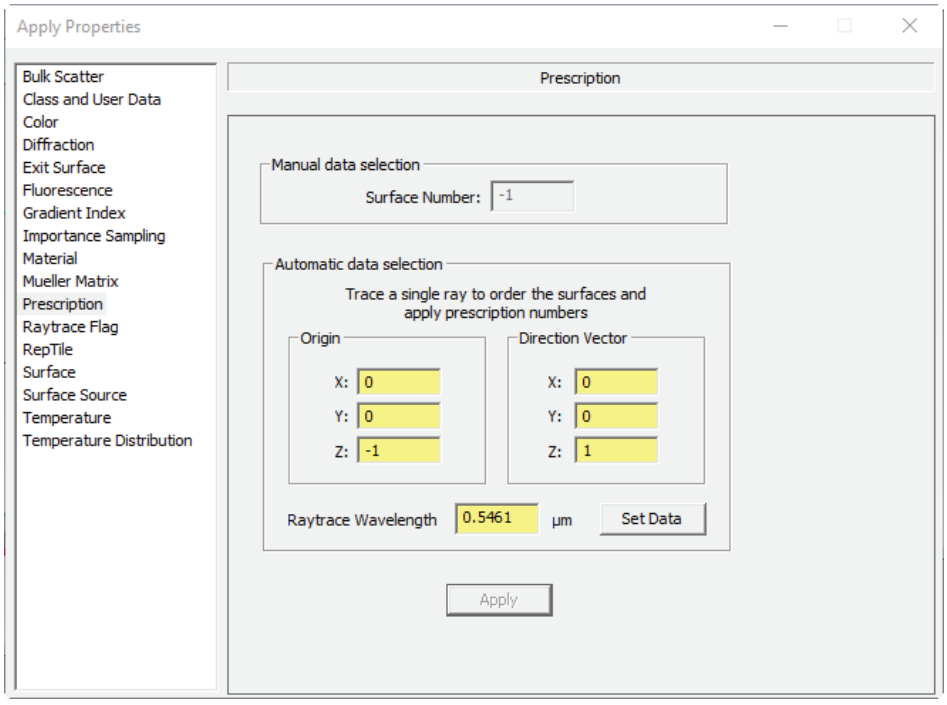
This tutorial illustrates the steps required to use Auto Importance Sampling.

For a detailed explanation of importance sampling, please see the technical reference section of the TracePro User's Manual.

Double Gauss - Define Prescription

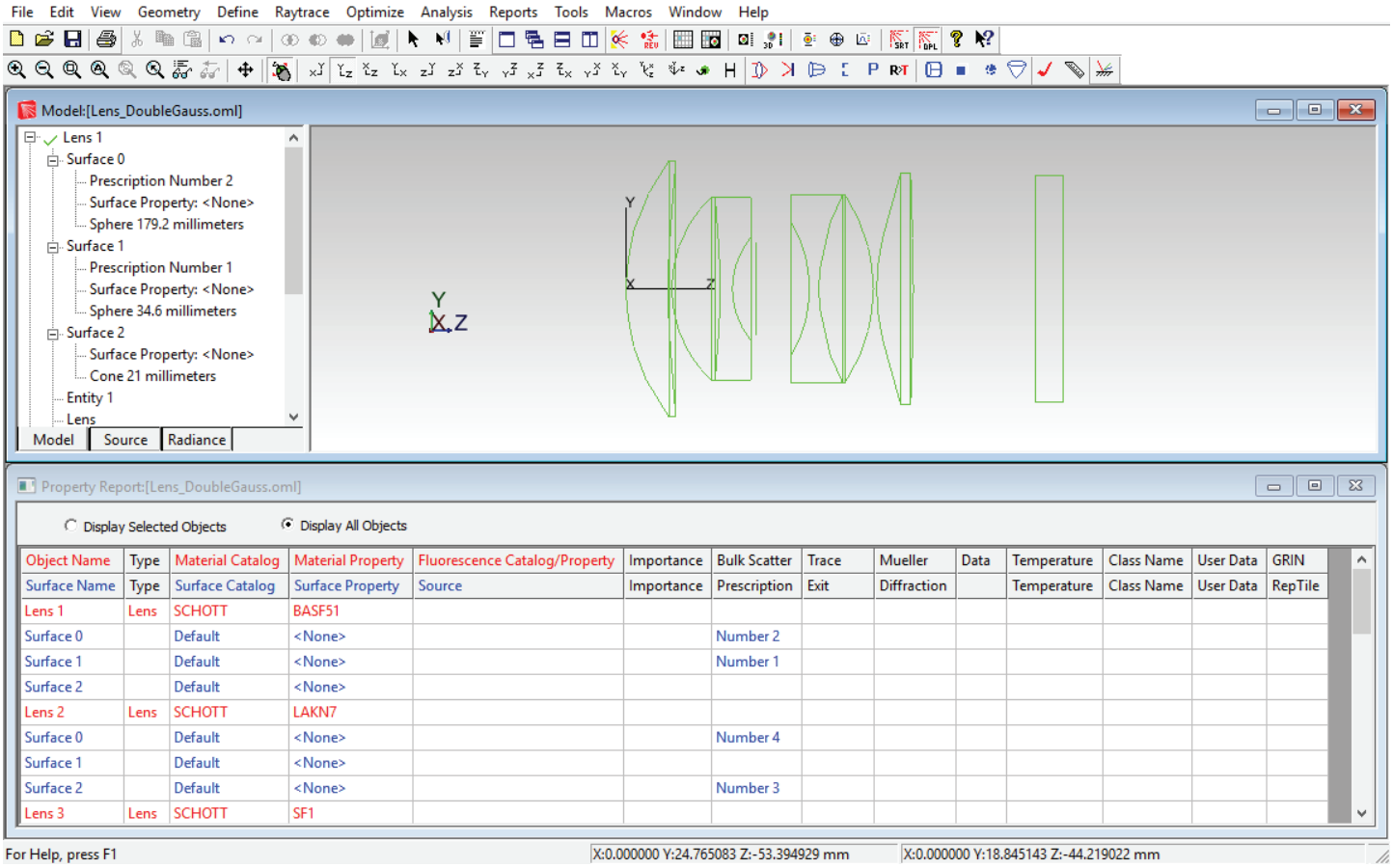
1. Open the Lens_DoubleGauss.OML model file.
2. Define the Prescription using the Set Data feature.
   a. Select **Define|Apply Properties** dialog box.
   b. Select the **Prescription** page.
3. Enter the data as shown below and click the Set Data button.
   a. The origin is set so the ray starts to the left of the first lens.
4. TracePro will trace a ray through the lens and assign a prescription number to each surface it intersects in sequence.
5. The image surface must absorb the ray completely.





Verify Prescription

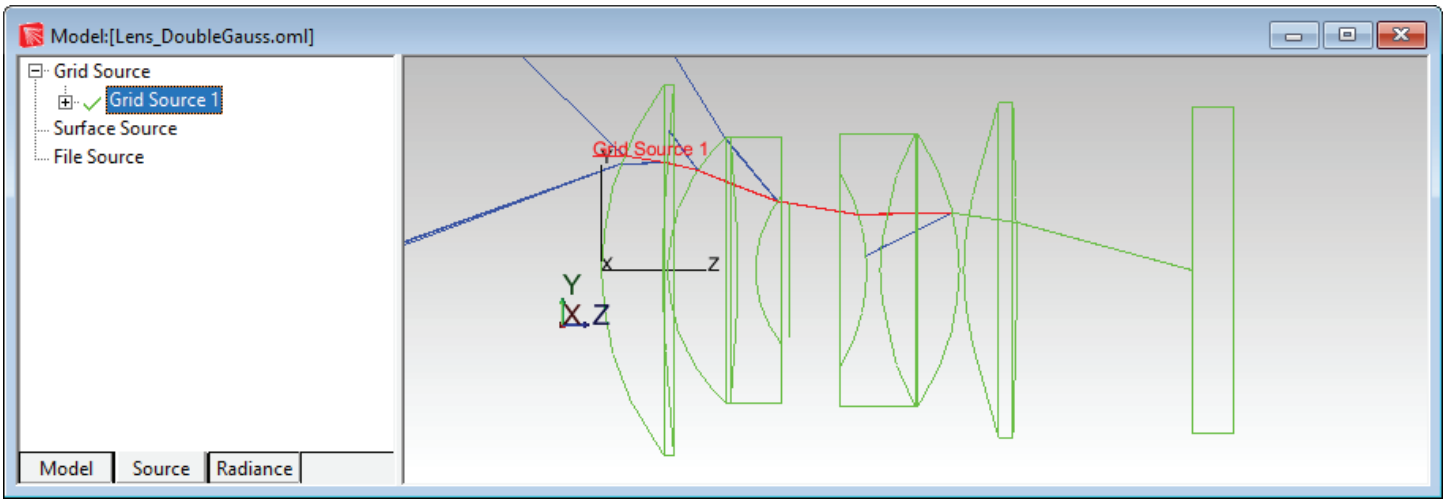
1. Examine the system tree to verify prescription numbers.
2. Cemented groups have two coincident surfaces at each cemented interface.
3. You can also use the Property Report (**Reports|Property Data)** to view the Prescription numbers.

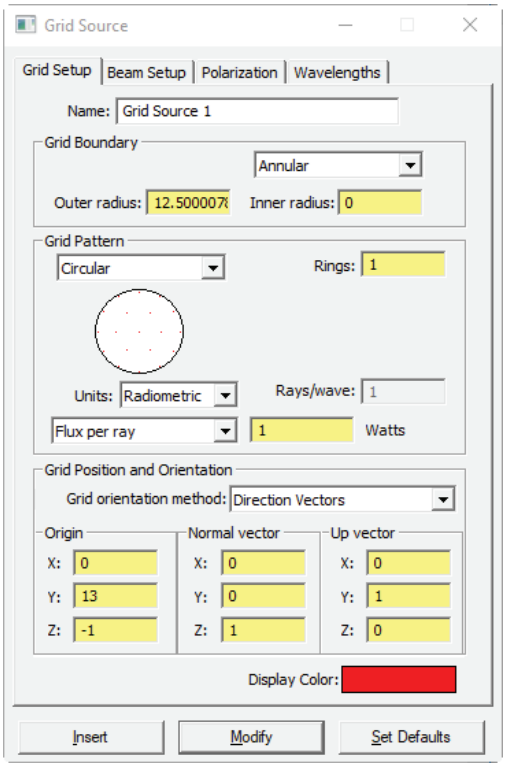


Object Name	Type	Material Catalog	Material Property	Fluorescence Catalog/Property	Importance	Bulk Scatter	Trace	Mueller	Data	Temperature	Class Name	User Data	GRIN
Surface Name	Type	Surface Catalog	Surface Property	Source	Importance	Prescription	Exit	Diffraction		Temperature	Class Name	User Data	RepTile
Lens 1	Lens	SCHOTT	BASF51										
Surface 0		Default	<None>			Number 2							
Surface 1		Default	<None>			Number 1							
Surface 2		Default	<None>										
Lens 2	Lens	SCHOTT	LAKN7										
Surface 0		Default	<None>			Number 4							
Surface 1		Default	<None>										
Surface 2		Default	<None>			Number 3							
Lens 3	Lens	SCHOTT	SF1										

Marginal Ray

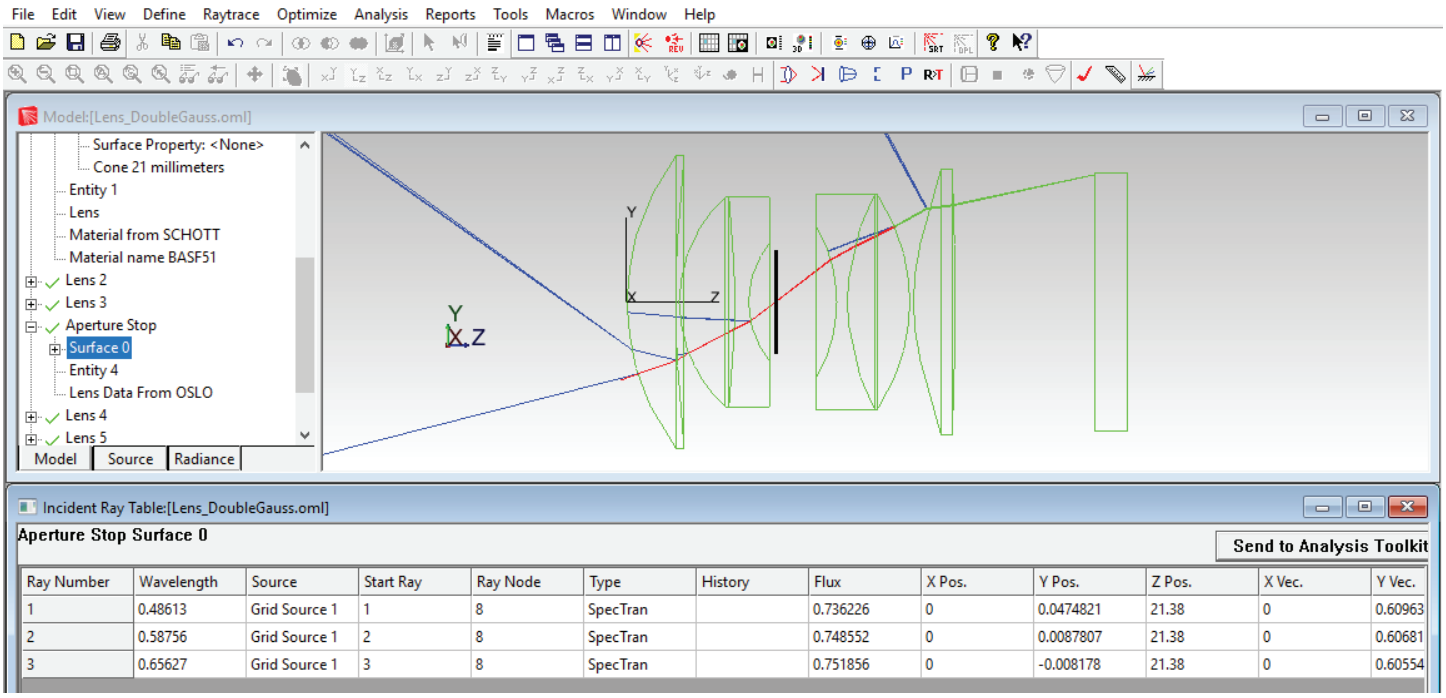
1. Empirically locate the origin of a marginal ray by tracing rays using **Define|Grid Source**.
2. Start with the Y position of the origin set to the entrance beam radius of the lens. Adjust the Y origin of the ray until it passes through the edge of the aperture stop.



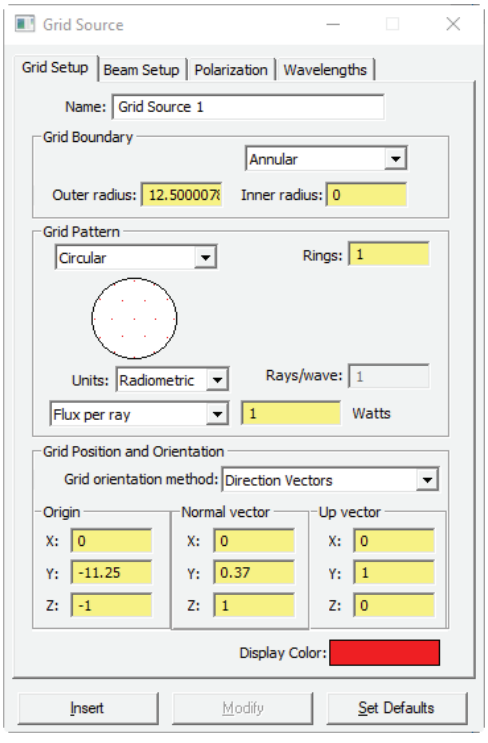


Chief Ray

1. Empirically determine the origin and direction of the chief ray.
2. The chief ray must intersect the center of the aperture stop and intersect the edge of the image.
3. As a starting guess, set the Y origin to -10 and the normal vector to (0, 0.3, 1). Adjust the Y normal until the ray intersects near the edge of the image surface.
4. Adjust the Y origin until the ray intersects the center of the aperture stop surface.
5. Note ray parameters for entry in the Auto Importance Sampling dialog box.

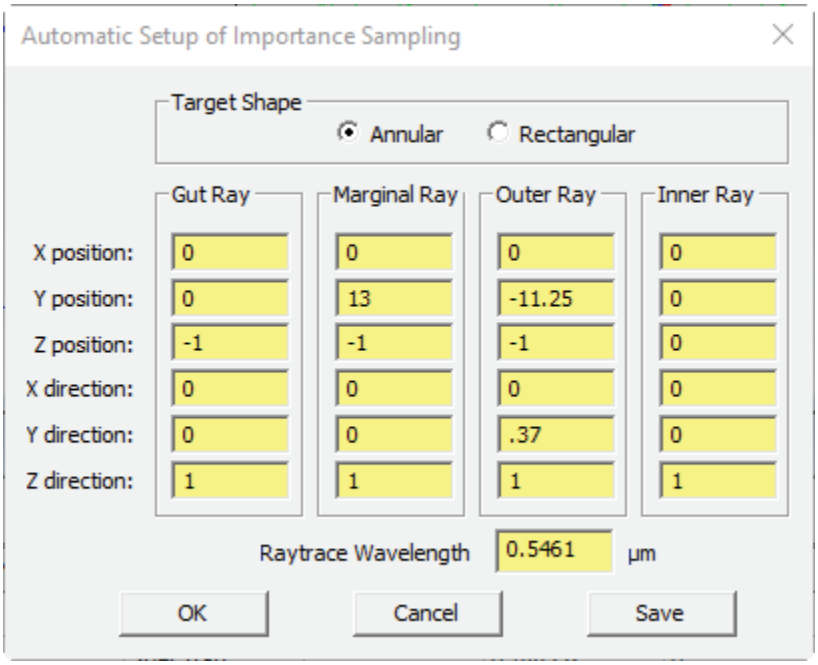


Ray Number	Wavelength	Source	Start Ray	Ray Node	Type	History	Flux	X Pos.	Y Pos.	Z Pos.	X Vec.	Y Vec.
1	0.48613	Grid Source 1	1	8	SpecTran		0.736226	0	0.0474821	21.38	0	0.60963
2	0.58756	Grid Source 1	2	8	SpecTran		0.748552	0	0.0087807	21.38	0	0.60681
3	0.65627	Grid Source 1	3	8	SpecTran		0.751856	0	-0.008178	21.38	0	0.60554



Auto Importance Sampling

1. Select **Define|Auto Importance Sampling,** and enter the marginal, chief and gut ray data into the **Auto Importance Sampling** dialog.
2. The Gut Ray defines the optical axis. The Inner and Outer rays are chief rays to define the inside and outside of the annular target. Setting the Inner ray data to zeros defines a circular region.
3. Enter the values as shown and click OK. TracePro traces rays and calculates locations, sizes, and senses of targets.



Verify Target Definitions

1. The new importance targets will be visible in the system tree and the Property Report.
2. Select **Define|Apply Properties**, and then the Importance Sampling tab for details of each target.
3. The targets may also be viewed in the model window using **View|Display Importance** menu. (The target origin is indicated by the IT label)

You have now defined appropriate importance sampling targets for all optical surfaces, a minimal requirement for analysis of scattered stray light.