Auto Importance Sampling Tutorial

This is a general tutorial for users of TracePro and TracePro Expert.

Lambda Research
Corporation

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Introduction

Importance sampling is defined for surfaces to improve the performance of the raytrace. Each surface may have zero or more importance sampling targets, causing one or more rays to be traced into the solid angle defined by each importance sampling target. For stray light analyses of complex optical imaging systems, defining importance sampling targets manually can be 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. 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. 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, please see the technical reference section of the TracePro User's Manual.

Double Gauss - Define Prescription

1. Open the DBLGAUSS.OML model file in the Examples\Demos\Lens Demo folder using `File|Open`

2. Define the Prescription using the Set Data feature

   • Select `Define|Apply Properties` dialog box

   • then the `Prescription` tab).

3. Enter the data as shown and click the `Set Data` button.

   • The origin is changed 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.
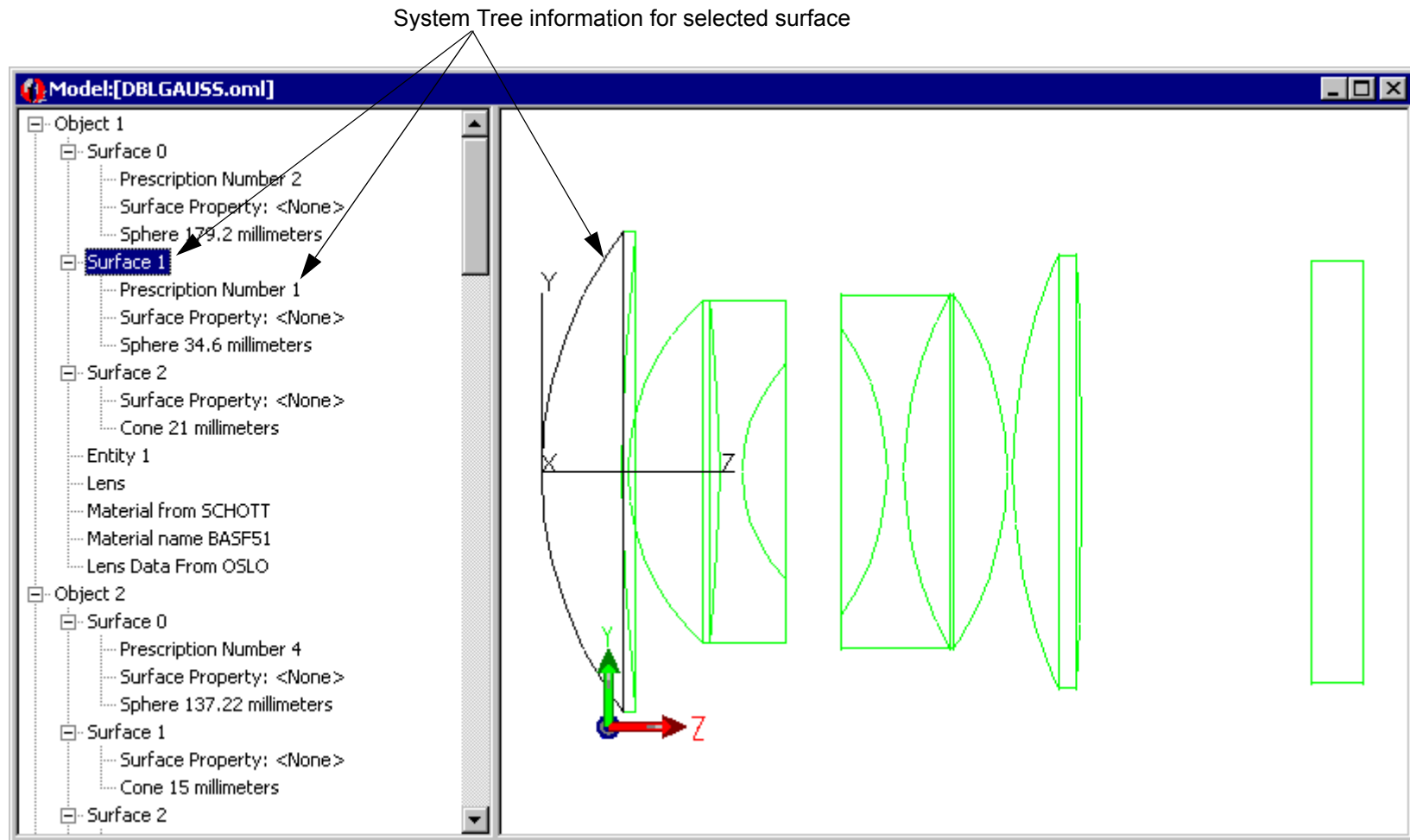
5. The image surface must absorb the ray completely.
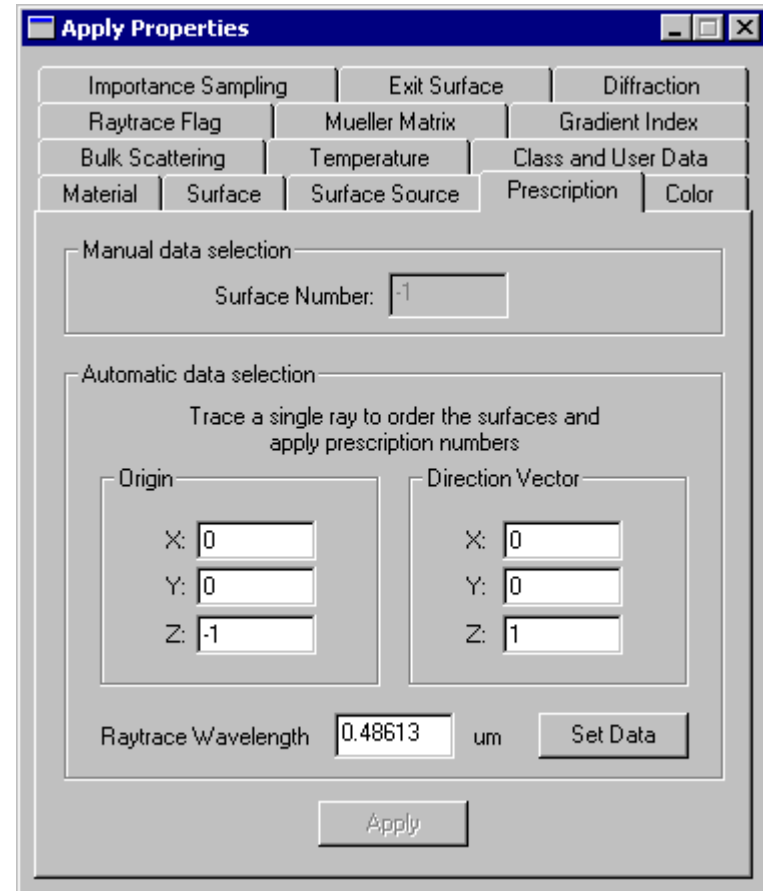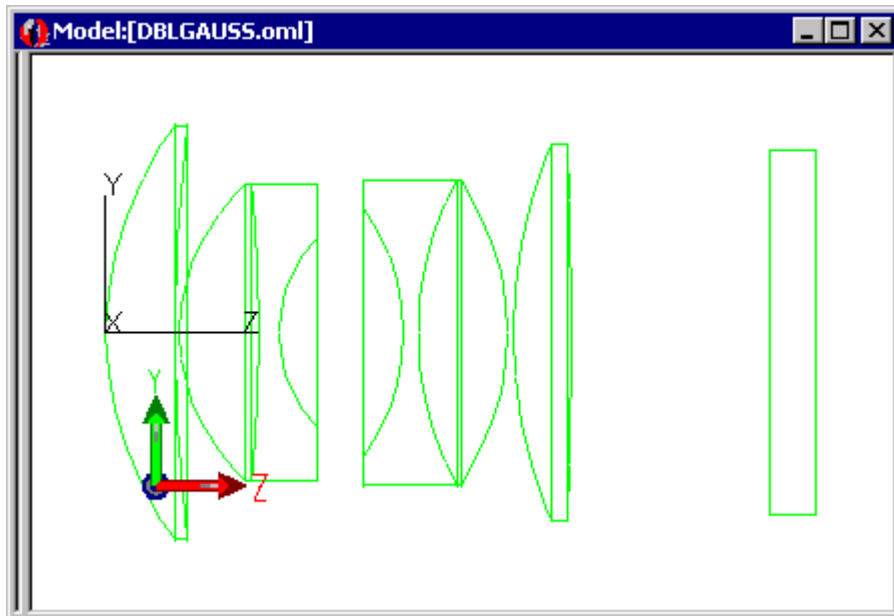
Verify Prescription

Examine the System Tree to verify prescription numbers.

Cemented groups have two coincident surfaces at each cemented interface.

You can also use the `Reports|Property Data` to view the Prescription information

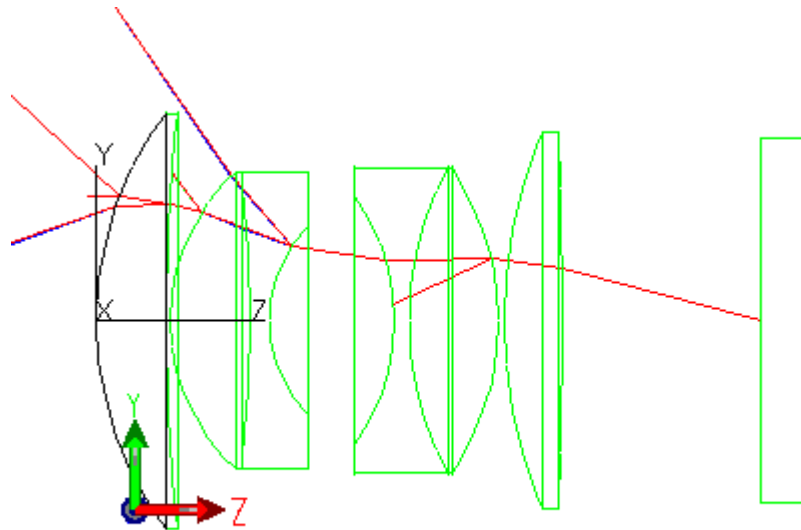System Tree information for selected surface

Marginal Ray

Empirically locate the origin of a marginal ray by tracing rays using `Analysis|Grid Raytrace`.

The Y position of the origin may be set to the Entrance Beam Size of the lens.

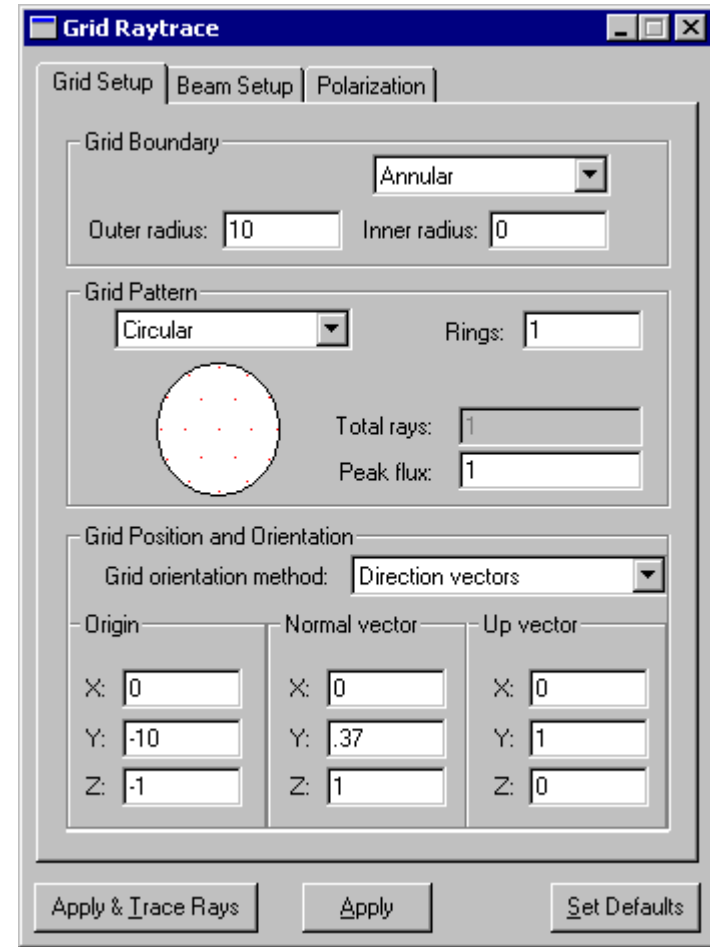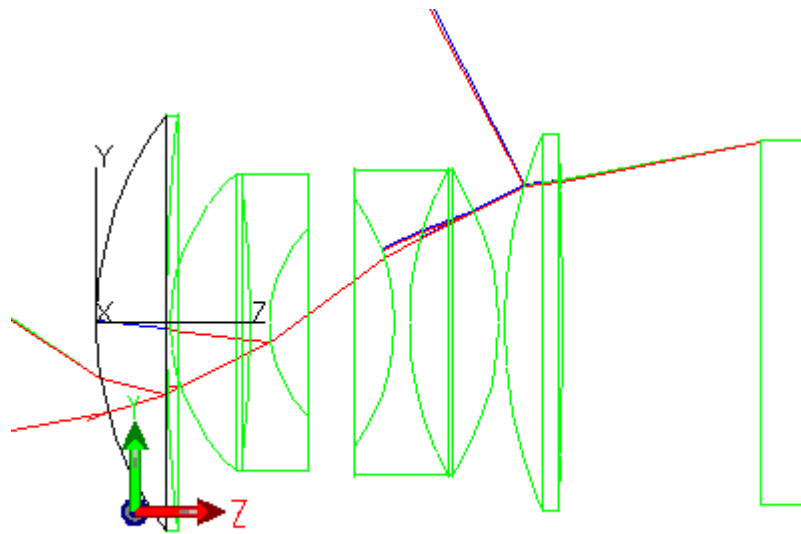**Note** ray parameters - you must later enter them in the Auto Importance Sampling dialog box.

Chief Ray

Empirically determine the origin and direction of the chief ray.

In this example, we have assumed that the stop is in the center of the lens, z = 20.4.

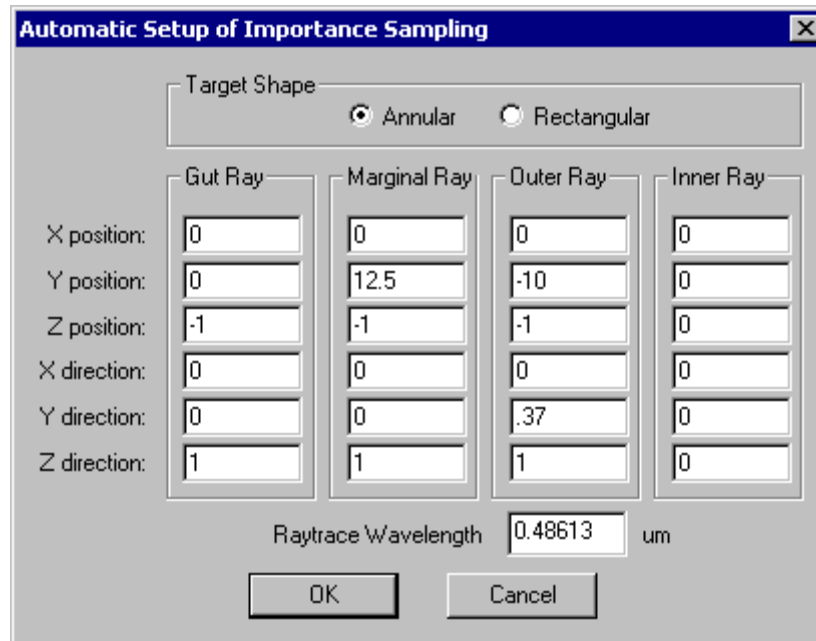The chief ray will intersect the center of the stop at the optical axis and intersect the edge of the image.

Auto Importance Sampling dialog

Enter the marginal, chief and gut ray data into `the Define|Auto Importance Sampling` dialog.

The Gut Ray defines the optical axis. The Inner and Outer rays are chief rays to define the inside and outside of the annual target. Setting the Inner ray to zeros defines a circular region.

Enter the values as shown and press OK. TracePro traces rays and calculates locations, sizes, and senses of targets.

Automatic Setup of Importance Sampling

Target Shape
- ⊙ Annular   ○ Rectangular

	Gut Ray	Marginal Ray	Outer Ray	Inner Ray
X position:	0	0	0	0
Y position:	0	12.5	-10	0
Z position:	-1	-1	-1	0
X direction:	0	0	0	0
Y direction:	0	0	.37	0
Z direction:	1	1	1	0

Raytrace Wavelength   0.48613   um

[OK]   [Cancel]

Verify Target Definitions

The new importance targets will be visible in the System Tree and the Property Report.

Select `Define|Apply Properties`, and then the `Importance Sampling` tab for details of each target.

The targets may also be viewed in the Model Window using the `View|Display Importance` menu.
(The target origin is indicated by the IT label)

Data for the single target defined on Surface 1
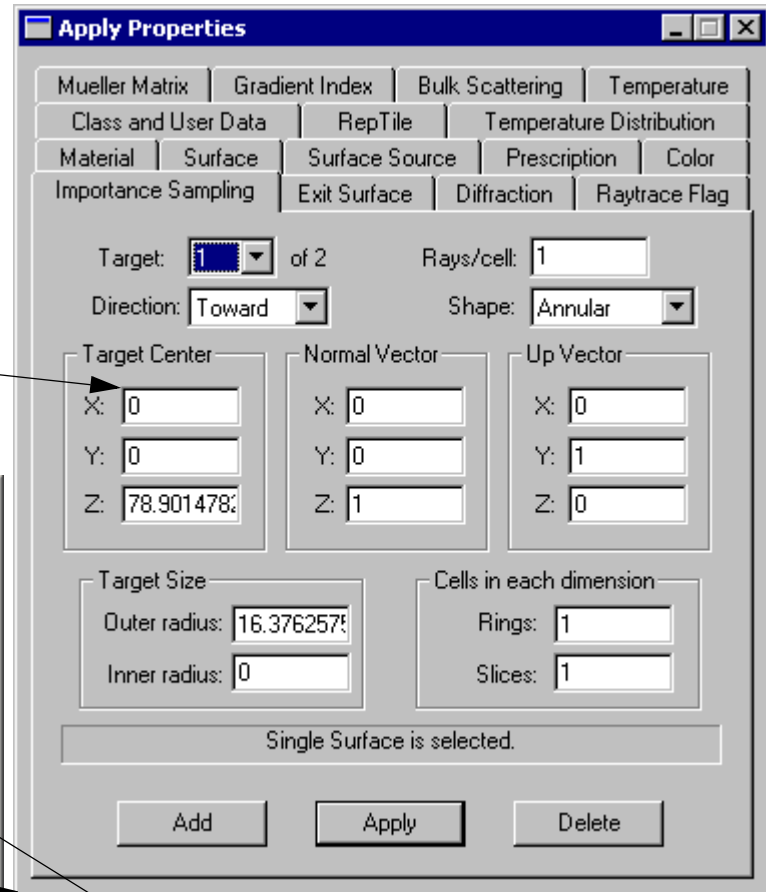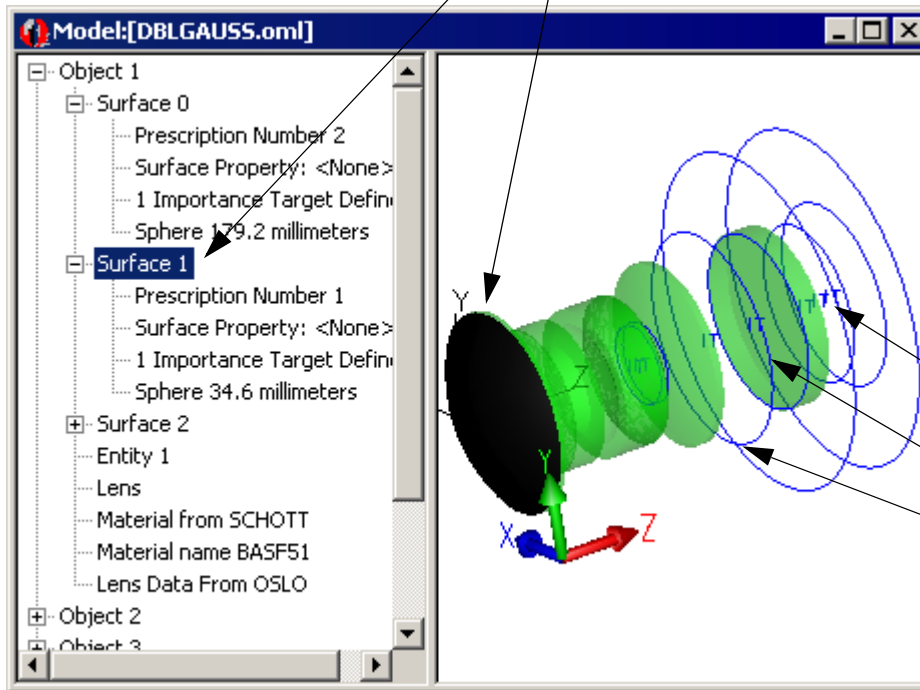
Several targets displayed:

origin
diameter
orientation