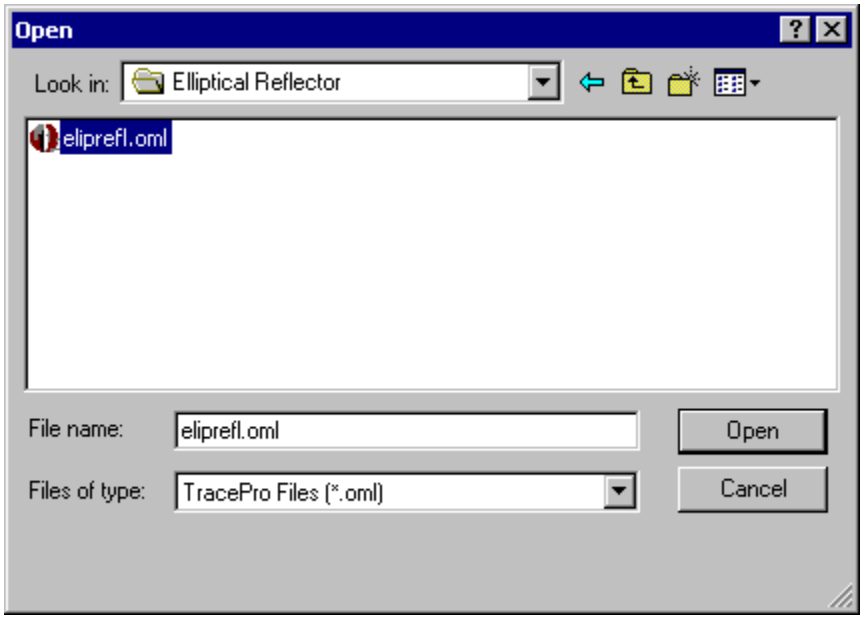
Raytrace and Analysis Tutorial

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

Raytrace and Analysis

This tutorial uses an example TracePro model to illustrate opening and viewing model data, raytracing and displaying analysis output. The steps described are common to most TracePro analysis.

1. Select the **`File|Open`** menu to display the Open file dialog box will appear.
2. After the Open file Dialog box appears, locate the TracePro\Examples\Demos\Elliptical Reflector folder using the “Look in:” dialog control.
3. Click on the **eliprefl** file with the left mouse button to open the file. The file will highlight in blue when clicked on as shown in the figure to the right.
4. The extension of all TracePro files is OML. The OML file is based on the SAT format which is the ACIS standard file format. This gives the user import and export capability with several hundred different programs.



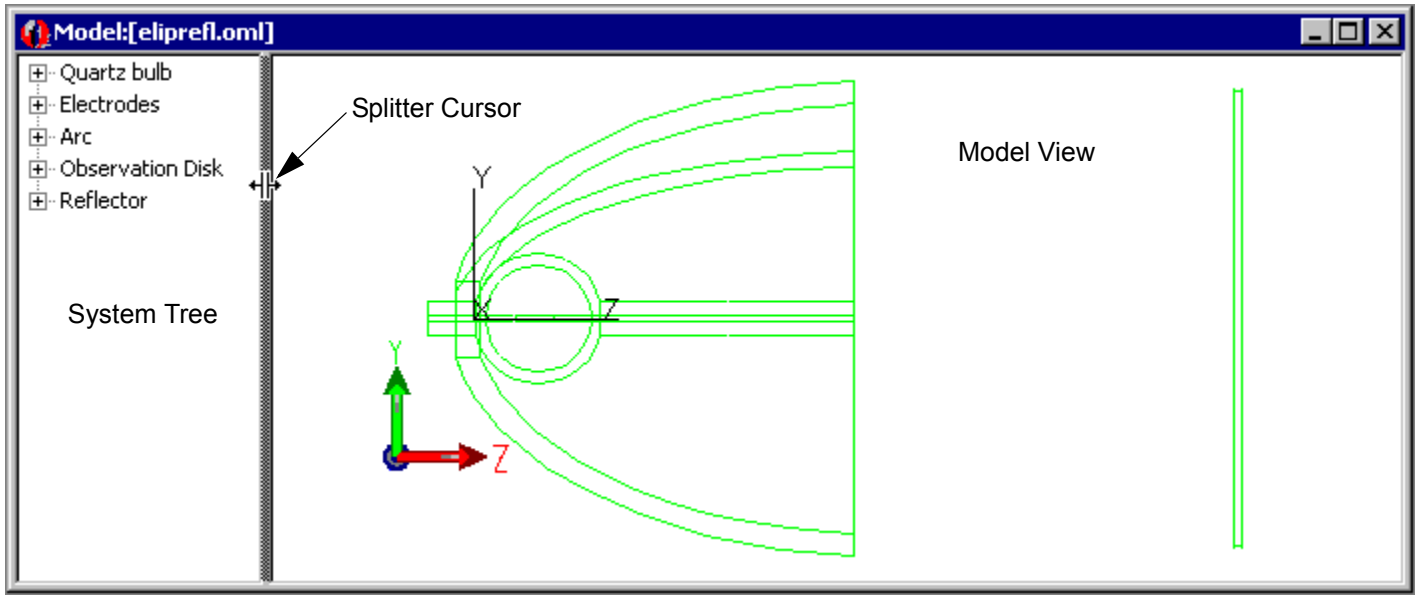
The Model Window

The elliptical reflector and metal halide bulb will appear as shown in the Model Window.

The Global Origin is located by the XYZ Axis. All measurements are relative to this location.

The Model Window may be split into two panes showing the geometry and the System Tree

1. To do this move the cursor to the left double bar and wait until the cursor changes to a double bar cursor, hold the left mouse button down and pull the cursor to the right. The System Tree will be revealed.
2. Alternatively, you can use the **`Window|Split`** menu to position the cursor.



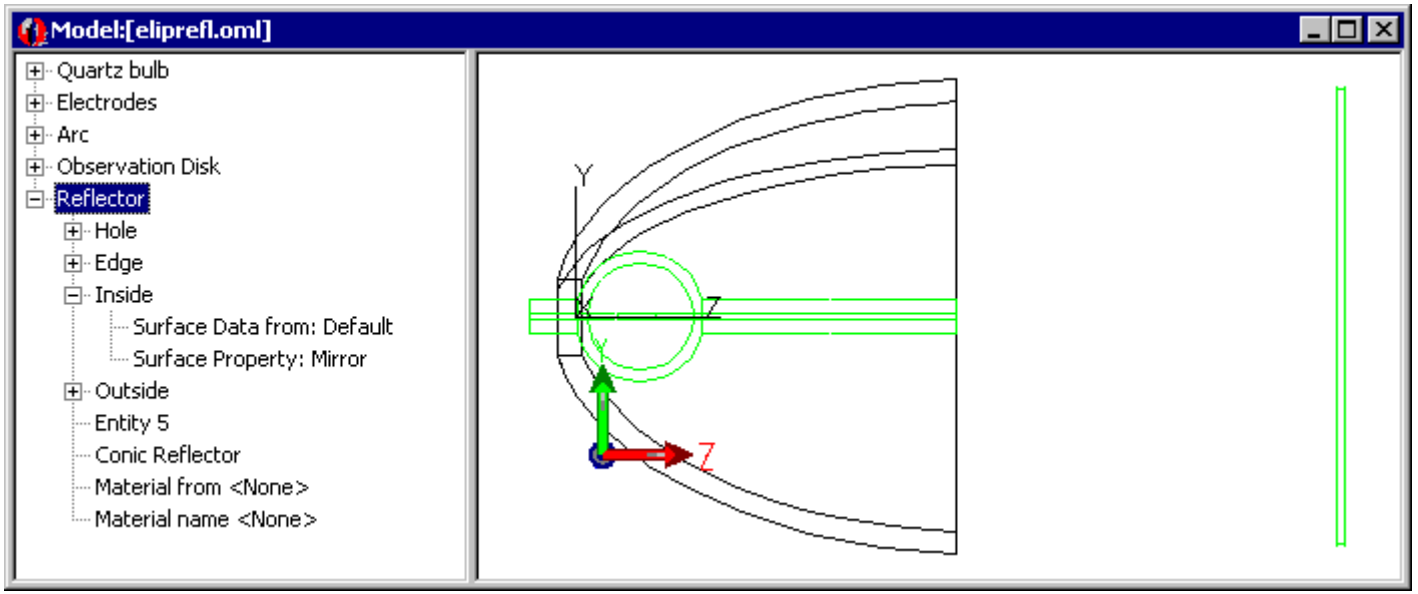
3. When you first open the System Tree the system will not fit the screen, it will overfill it. To zoom it to the size of the screen, click on the zoom all icon 
4. The program will then size the full system to fit the screen. The system will now look as shown above.

Using the System Tree

The System Tree contains all the information about the objects and surfaces contained in the system model.

1. Left Clicking the mouse button on any plus sign before an object or surface opens up information on that object or surface.
2. Clicking on the minus sign closes the information.

This information consists of the surface properties, type of surface and material properties of an object. Further information may show if it is a source, exit surface or any other applied property.



Selecting Surfaces and Objects

There are two methods for selecting an object or surface. You can use the main viewing window or the system tree.

1. To use the main viewing window:

   • Perform a left mouse click on the Select Object icon to select objects (or use **`Edit|Select|Object`**).

   • Perform a left click on the Select Surface icon to select surfaces (or use **`Edit|Select|Surface`**).

   • After clicking on the icon it will look pushed in.

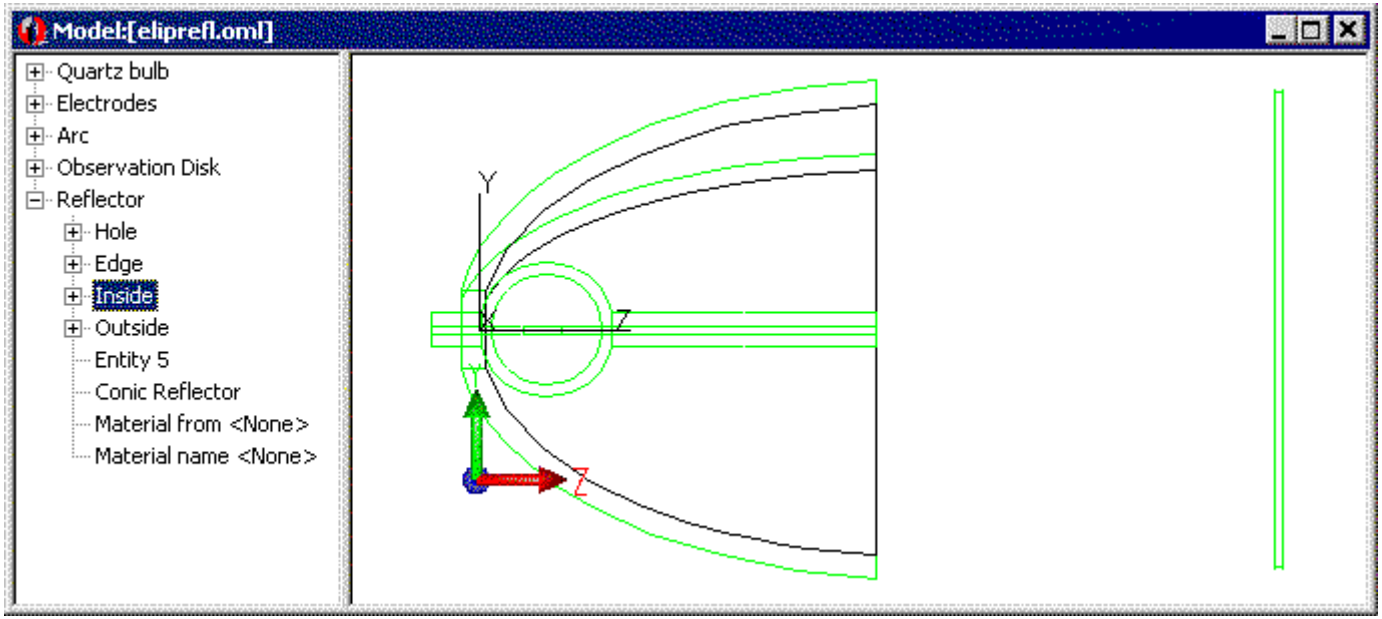
   • If the icons are grayed out first click on the main viewing screen to activate these icons.

   • You can now select objects or surfaces by positioning the cursor on top of the object or surface to be selected and left mouse click.

2. To use the system tree:

   • Select an object or surface by clicking on the Object or Surface label.

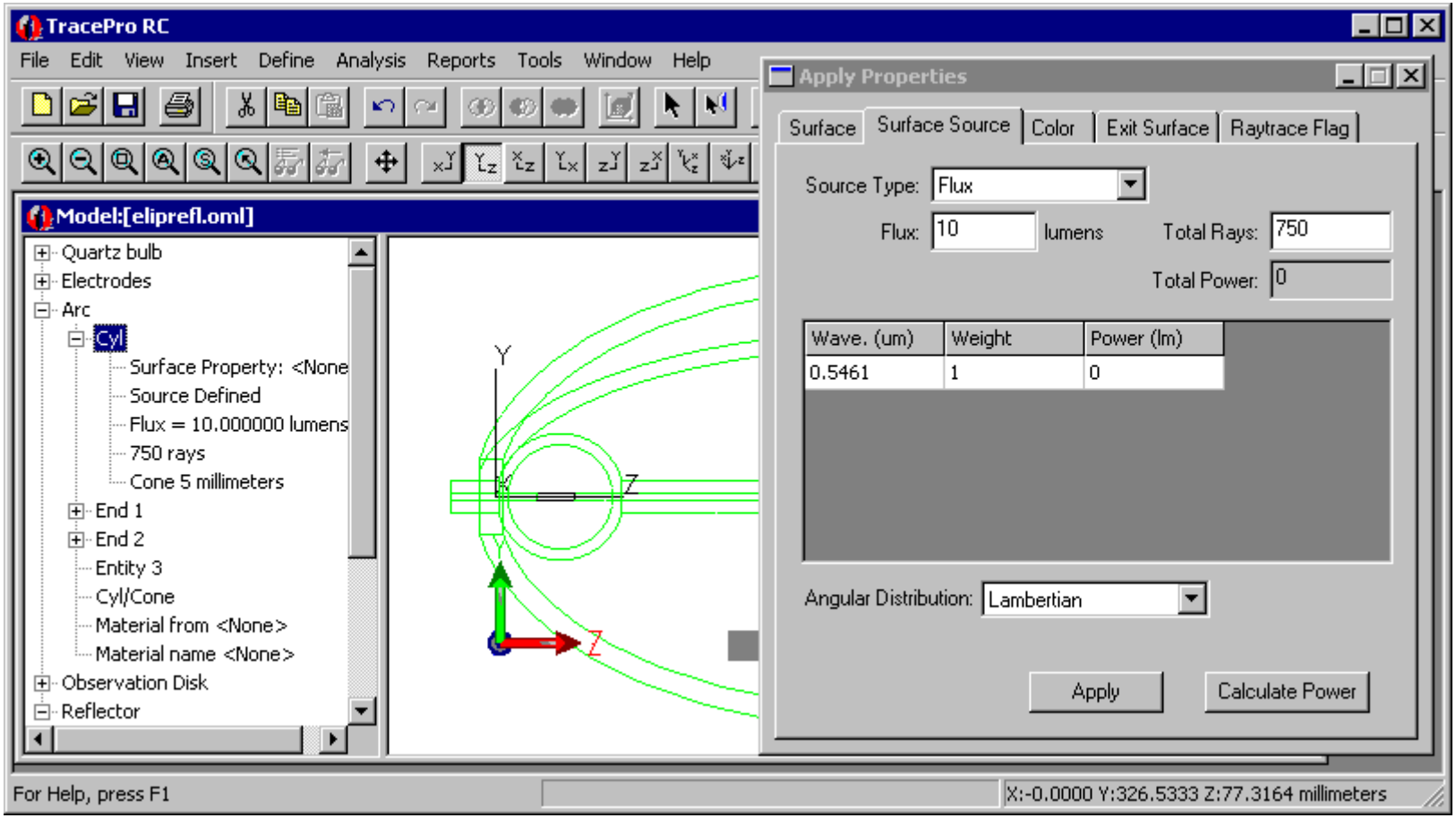
The object will be highlighted in black on the main viewing window and background highlighted in blue in the system tree as shown to the right.



Modifying Surface Sources

This model uses a surface source. This source is defined on one of the surfaces that define the Arc lamp system geometry. Open the Arc object definition by left mouse clicking on the Cyl surface. This will open the Cyl surface definition.

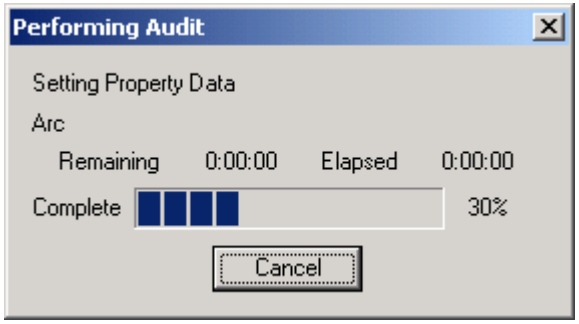
1. You can now change this Cyl surface in the **System Tree** by right mouse clicking inside the main viewing window. A dialog box will appear. Left mouse click on the **Properties** option. An **Apply Properties** Dialog Box will appear as shown to the right.
2. Change the number of rays from 1000 to 750 and left mouse click on the **Apply Button.** The information for the source definition will change in the **System Tree**.



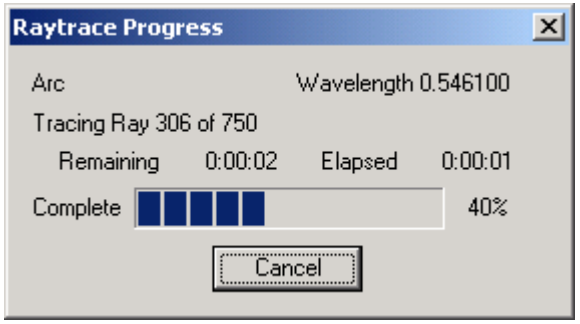
Tracing Rays

To trace rays from the surface source click on the **Source Trace** icon.

1. The program will first perform an audit function. The Audit function tests the system geometry for defective objects, and then applies the properties and materials to each object and surface.



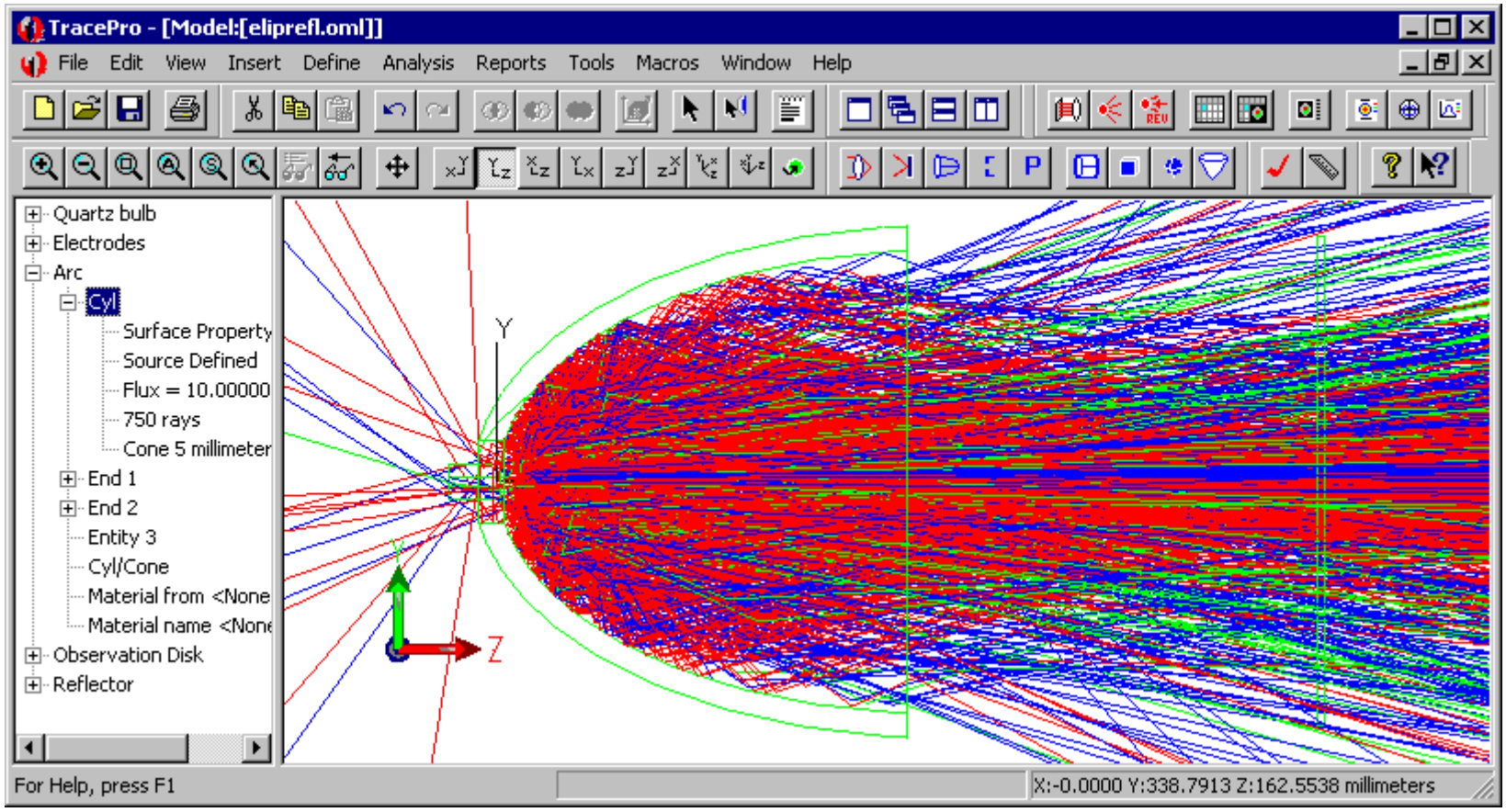
2. After the Audit function is complete the program will trace all 750 rays. A Raytrace Progress report is displayed. The Progress report displays the number of rays traced so far and an estimate of how long the ray trace will take. It will also show you the wavelength for each source.



Viewing the Raytrace

On completion of the ray trace all rays are displayed on the main viewing window. If this does not occur check to make sure the **Display Rays** option in the **Analysis Menu** is checked.

The colors of each ray indicate the flux of each ray traced. Red rays have flux from 100 to 66 percent of their beginning ray flux. Green rays are between 66 and 33 percent and Blue rays are between 33 and 0 percent.

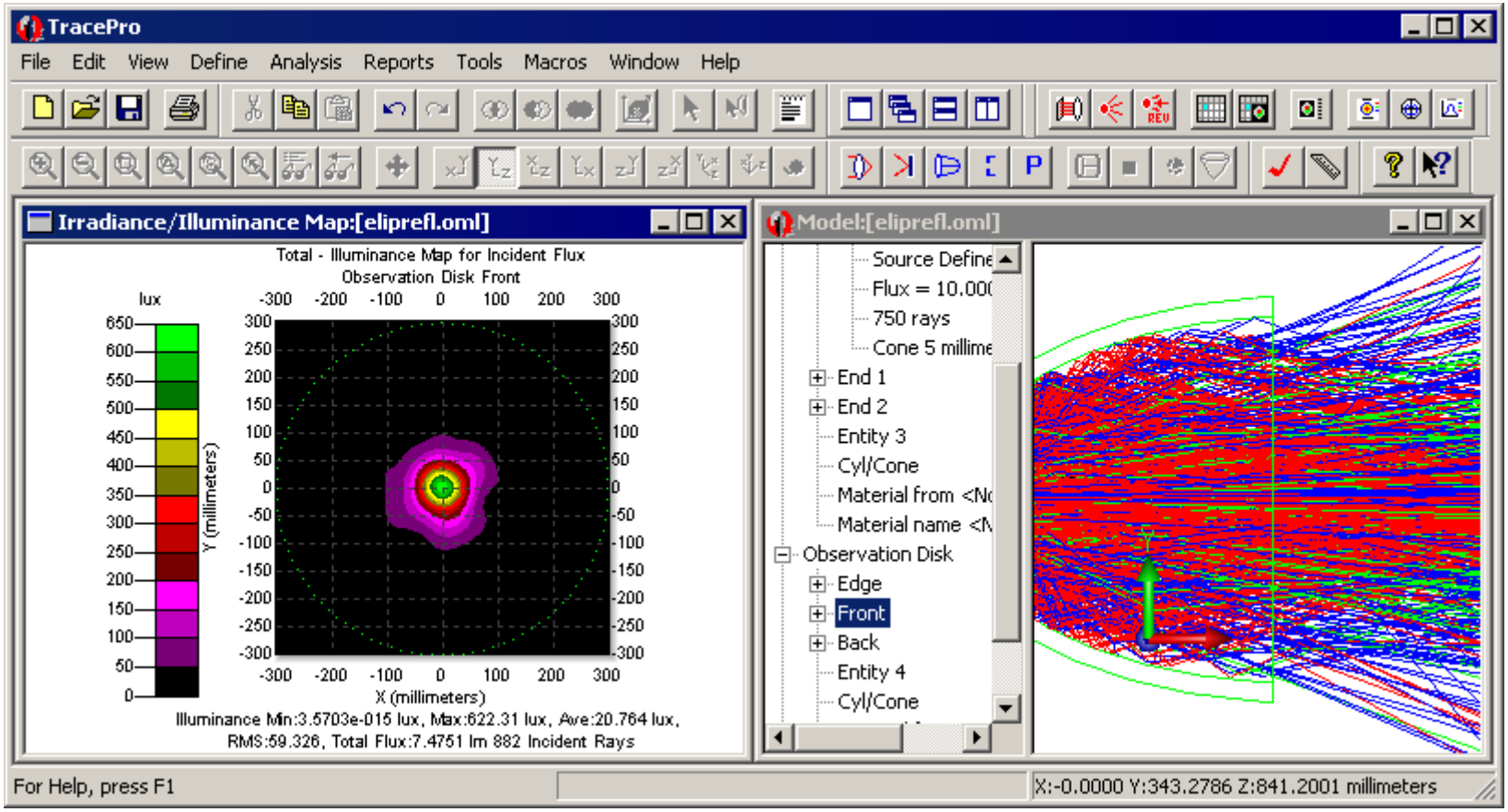


Raytrace Mode and Irradiance Plots

There are two modes to analyze systems in TracePro. **Analysis** and **Simulation** mode. Analysis mode lets the user look at Position and Angular result plots on any surface. Simulation mode lets the user look at only one surface that must be defined before a ray trace takes place. Simulation mode uses much less virtual memory due to the smaller amount of information saved and usually traces faster.

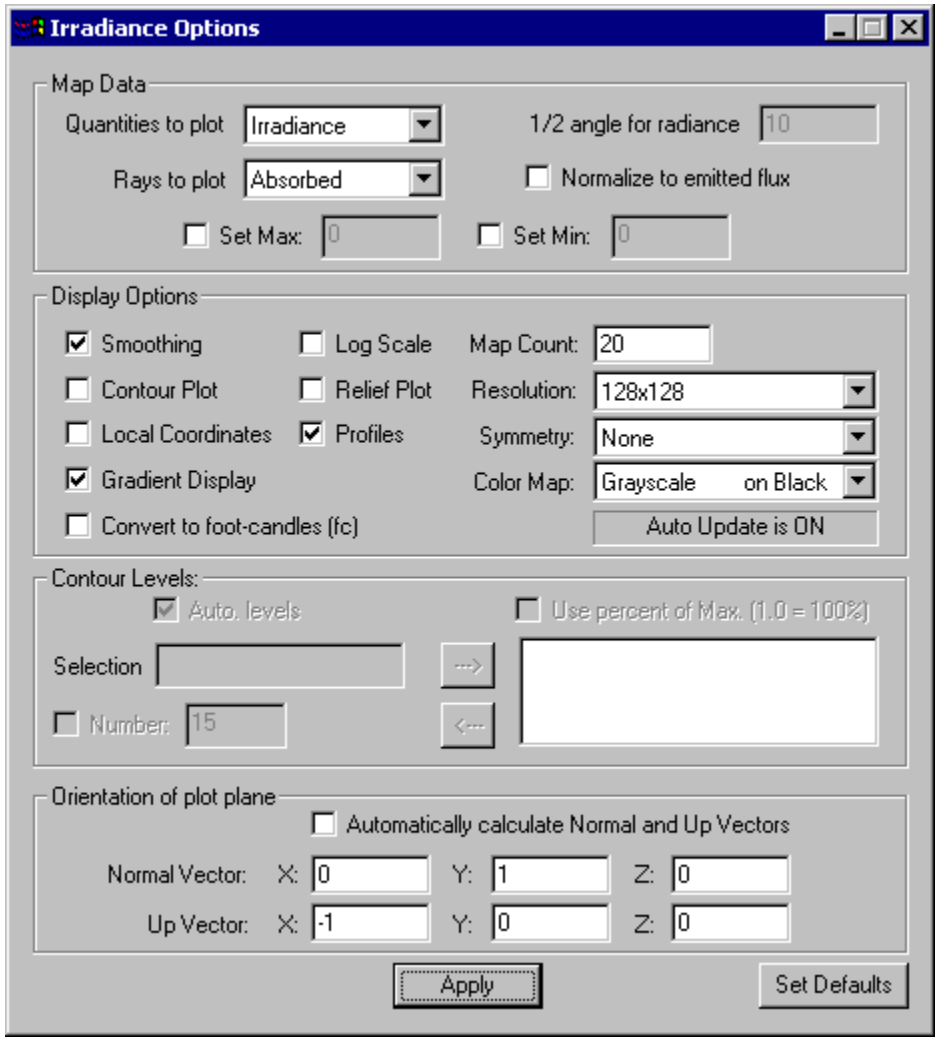
By default **Analysis** mode is on. Start by looking at an **Irradiance Map** for this system.

1. First, select the Observation Plane object and the Front surface.
2. Next click on the irradiance map icon to see the plot shown.
3. Next click on the Tile Vertical icon or select **`Window|Tile Vertical`** to rearrange the windows.



Understanding the Irradiance Options

The Irradiance/Illuminance Options dialog box is shown at right. This dialog box is available from the Analysis Menu and is used to set all the parameters for the Irradiance/Illuminance Map.



The default Rays to Plot setting is Absorbed rays. If you do not see any irradiance/illuminance on a surface, change this option to incident and an Irradiance/ Illuminance Map should appear. This system is set to Radiometric units so that all output units are shown in Watts and Watts per meter squared.

To change radiometric units to Photometric, select **`Analysis|Raytrace Options`** and change the Radiometric Units setting.

If the Normalize to emitted flux box is checked the flux of each ray is divided by the total emitted flux from the source(s) before being added to the irradiance map. Us this to calculate the efficiency of a light pipe when you have many sources.

The foreground and background colors of the map are set using the Color Map option. Black&White and grayscale maps are good for sending maps over faxes or Black and White printers. Color is best for pseudo-color display.

The Count option determines the number of pixels used by the map to collect rays. A count set to 20 divides the detector into a 20x20 grid of pixels and counts the rays striking each section of the grid and then totals the energy of these rays together. Larger counts show more rays and provide a more accurate view of what is happening on the map if small detail is needed. Smaller counts let you trace fewer rays and get a quick, approximate idea of what the system looks like.

The Smoothing option applies a Gaussian smoothing across the detector pixels to smooth out choppy or non-contiguous data. Use this to trace fewer rays while debugging your system or while in early design stages and let the Gaussian smoothing function fill in the missing data.

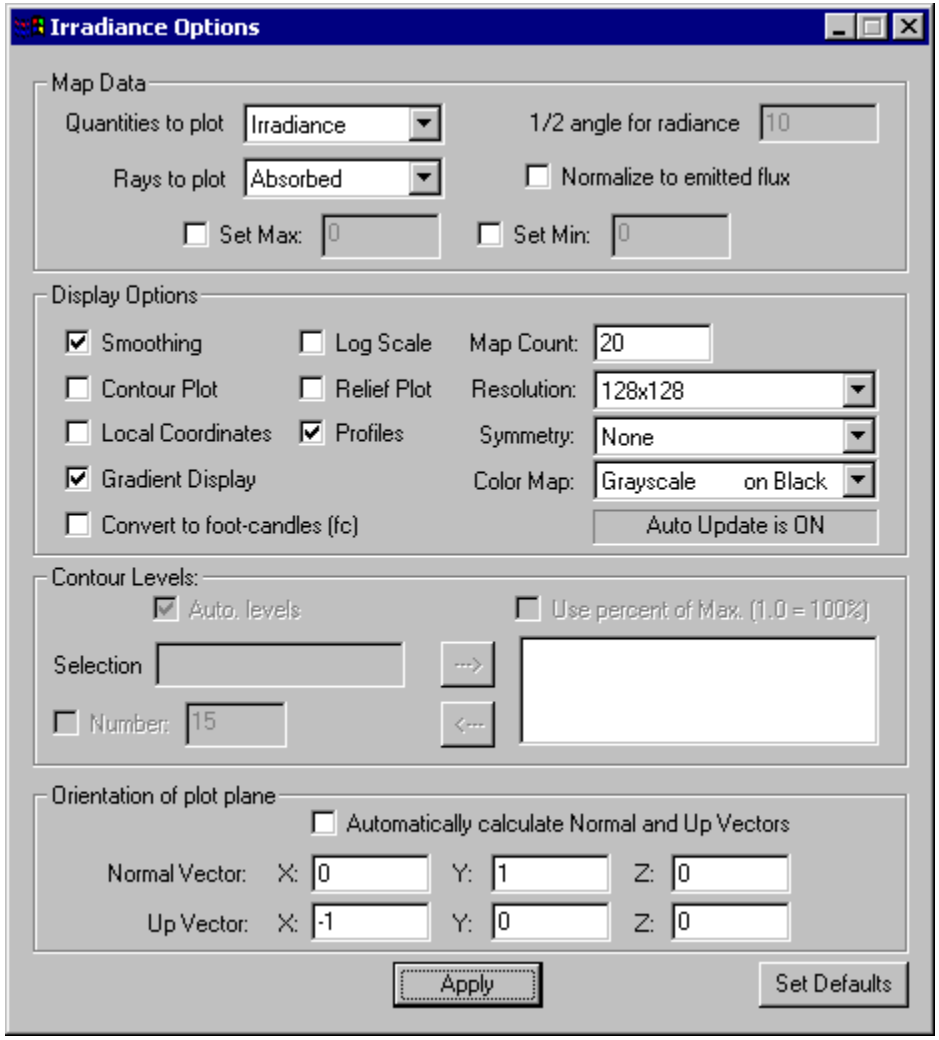
Understanding the Irradiance Options

The **Profiles** option creates the cross sectional plots of the map**.** Clicking anywhere on the map will show a cross section in both profiles of a horizontal and vertical cut through the map. The profiles intersect at the point you click.

The Normal and Up Vector selection sets the projection plane that all rays will be collected on. If you have a doubt what the collection plane is, the program can automatically calculate the Normal and Up vector for you. Just click on the **Automatically calculate Normal and Up Vector** box. Remember you must click **Apply** before any option is applied to the map.

- The normal vector is the vector that is perpendicular to the collection plane.
- The Up vector is parallel to the vertical side of the plane.

If the Normal and Up vector box is entered with the wrong vectors the map may look incorrect. This incorrect map may look like a slice if the selected plane is perpendicular to the correct plane or may show no results at all.



Incorrect Normal and Up Vectors

Irradiance map of the observation plane with the wrong **Normal** and **Up** vector selected. The plot is no longer displayed in the plane of the observation surface.