This is a tutorial for users of TracePro Expert.



### LCD Back Lighting Tutorial

This tutorial illustrates how to use TracePro for the analysis of LCD Back Lights. The steps include

- generating a solid model
- applying material properties
- applying surface properties
- creating and applying RepTile properties
- creating surface sources
- tracing rays
- viewing irradiance

The tutorial also provides an expanded description of the irradiance options included in TracePro.

#### **Create an LCD Panel**

The first step will be to create the LCD Panel

- 1. Start TracePro.
- 2. From the **Insert** Menu, select **Primitive Solid**.
- 3. Select the **Block** Tab and enter the Width values 100 for X, 10 for Y and 100 for Z.
- 4. Click the **Insert** button to create the block.
- 5. Press the Zoom All button or select the **view**|**zoom**|All menu to see the new object

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File Edit View Insert Define Analysis Reports Tools Macros Window Help	
	<u>&gt; ⊨ : P ⊡ = # ♥ √ ℕ ?№</u>
<pre>Model:[Untitled1]</pre>	Insert Primitive Solids
	Block       Cylinder/Cone       Torus       Sphere       Thin Sheet         Width       X:       10       Z:       100         Center Position       X:       0       X:       0         Y:       0       Y:       0       Y:       0         Z:       0       Z:       0       in Degrees
For Help, press F1	X:0.0000 Y:20.6366 Z:6.8651 millimeters

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#### **Opening the System Tree**

The TracePro System Tree provides an expandible list of data showing model object and surfaces along with their properties.

- 1. To open the System Tree go to the **window** Menu and select the **split** option. This option moves the mouse cursor over the splitter bar at the left of the window. You can do the same by moving the mouse there yourself.
- 2. Drag the splitter bar to separate the window into two separate and distinct areas, one showing the System Tree and the second the 3D viewing area.
- 3. Left mouse clicking on any + sign in the System Tree opens the object or surface to display more information.



#### Adding Material Properties to the LCD Panel

TracePro attaches properties to the model objects and surfaces in order to create an "optical model". The LCD Panel needs to be made optical by the application of a Material Proeprty.

- 1. Click on the block in the System Tree to highlight it in the tree and the viewing area.
- Right-click either on the viewing side or the tree side of the screen to open a pop-up menu. Select Properties to open the Apply Properties dialog box. (You can also do this by selecting Define | Apply Properties from the TracePro menu.)
- 3. On the Apply Properties dialog box, select the Material Tab.
- 4. Select the Plastic Catalog and the Polycarb name using the dropdown lists.
- 5. Click the **Apply** button to apply the property.

Popup in Model View

6. The System Tree should show the Plastic Polycarb as the material applied to the block.



	Intersect Subtract Unite
_	Properties Save As
v	<ul> <li>Display Object</li> <li>Display Object WCS</li> </ul>
	Move Rotate Scale Orientation
	Cut Copy Paste Delete



#### Adding Surface Properties to the LCD Panel

Add a mirrored surface to the bottom and three sides of the panel you need to select surfaces 1, 2, 3 and 5.

- 1. First expand the block object by clicking on the + sign next to the object.
- 2. Click on Surface 1 to highlight the surface in the System Tree and the viewing area.
- 3. Hold the Ctrl key down and click on surfaces 2, 3, and 5 to add them to the selection.
- 4. In the Apply Properties dialog box, select the Surface tab.
- 5. Using the drop-down list, select the Perfect Mirror property.
- 6. Click the Apply button to apply this property to all the selected surfaces.
- 7. Look in the System Tree to verify that the surface property has been applied to the correct surfaces



Apply Properties			
Importance Sampling Exit Surface Diffraction Raytrace Flag			
Mueller Matrix Gradient Index Bulk Scattering Temperature			
Class and User Data RepTile Temperature Distribution			
Material Surface Surface Source Prescription Color			
Property Catalog: Default			
Property Name: Perfect Mirror			
Mirror with 100% reflectance, no scatter			
No Scotter			
Reference Data			
Type: Data Table , no polarization, no retroreflector			
Beference Material			
Angles measured in Air - Refractive Index = 1.0			
Angles are corrected by Snell's law and the refractive index on either side of the Surface Property. Select measured index reference of Surface Property data:			
Apply View Data			

#### **Creating the Fluorescent Tube**

The panel will be illuminated from the side by a fluorescent tube. The next several steps will create the tube.

- 1. To create the fluorescent tube, from the **Insert** Menu select **Primitive solid**, then select the **Cylinder/Cone** tab.
- 2. Enter the radius, length, base position, and rotation as shown in the dialog box at right.
- 3. Click the Insert button to create the cylinder.



Insert Primitive Solids	
Block Cylinder/Cone Tor	us Sphere Thin Sheet
💿 Cylinder 🔘 Cone	Elliptical Base
Base	Тор
Major R: 1	Major R: 1
Minor R: 1	Length: 90
Base Position	Base Rotation
×: -49	X: 0
Y: 0	Y: 90
Z: 52.5	Z: 0
	in Degrees
[nsert]	Modify

#### Adding a Surface Property to the Bulb

- 1. Click on the + sign of the object that was just created to expand the tree and display the three surfaces that make the cylinder: the two plane ends and the cone between the ends.
- 2. Click on Surface 0 to highlight the surface in the System Tree and the viewing screen.
- 3. Click on the + sign of Surface 0.Right-click on the viewing area to open the pop-up menu.
- 4. Select Properties.
- 5. Select the Surface tab.
- 6. Using the drop-down list, select the Fluor White property.
- 7. Click the **Apply** button at the bottom of the Apply Properties dialog box to apply the property.
- 8. Surface 0 should now display the Surface Property Fluor White as shown in the figure.



Importance	Sampling	Exi	it Surface	e   Dif	fraction	Raytr	race Flag
Mueller Mat	rix Grad	dient l	ndex	Bulk S	cattering	Ten	nperature
Class and	User Data		RepTile		Temperat	ure Dist	tribution
Material	Surface	S	urface So	ource	Prescrip	otion	Color
Pro	perty Catalo	og:	Default				•
Pi	roperty Nam	ne:	Fluor Wh	ite			•
ABg Scatte	er						
Referenc	e Data						
Type: Da	ata Lable , r	no pol	larization,	, no retro	preflector		
Referen	ce Material						
Angles	measured ir	n Air -	Refractiv	ve Index	= 1.0		┓║
Ang	les are corre	ected	by Snell'	s law an	d the refra	active	- 11
inde	x on either : sured index	side o vefer	if the Sur	face Pro Surface I	perty. Se Property d	lect	
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		Γ	Appl	v	Viev	w Data	

#### Adding a Surface Source Property to the Bulb

The next step with the tube is to add a Source Property to the tube's cylindrical surface. Surface Sources define emitting surfaces in Tracepro.

- 1. On the **Apply Properties** dialog box, select the **Surface Source** tab.
- 2. For the **Source Type** select **Flux**, enter **Flux** of **30** Watts, set the **Number of Rays** to **1000**, and set the **Angular Distribution** to **Lambertian**.
- 3. Click **Apply** to apply this source property to surface 0.

<pre>   Model:[Untitled1] </pre>	<u>- 🗆 ×</u>
Entity 1 Block Material from PLASTIC Material name Polycarb Object 2 Surface Data from: Default Surface Property: Fluor White Surface Property: Fluor White Flux = 30.000000 Watts Tool rays Cone 1 millimeters Surface 1 Surface 2 Entity 2	Y ↓ ↓ ↓ Z

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mportance Samp	ling 📔 Exit S	urface	Diffraction	Raytrace Flag
Mueller Matrix	Gradient Ind	lex B	ulk Scattering	Temperature
Class and User I	Data 📔 R	}epTile	Tempera	ture Distribution
Material Surf	ace Surfa	ace Sour	ce Prescri	ption Color
	lino.		7	
		_	-	
Flux: 3	νo w	/atts	Total Rays:	1000
			Total Power:	0
Waya (um)	Waiabb	Deure		
wave. (um)		Powe	er (w)	
0.5461	1	U	_	
Angular Distributi	ion: Lamberti	lan	<b>_</b>	
Angular Distributi	ion:   Lamberti ndom rays (Re	ian equires Si	ource Importar	ice Sampling)
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Angular Distributi	ion:  Lamberti ndom rays (Re	ian equires Si Apply	Durce Importan	ice Sampling) ulate Power

#### Creating the Reflector around the Source

A reflecting surface will be added to collect the light from the source which is emitted away from the panel and redirect the light into the panel.

- 1. Select **Insert|Primitive Solid** to open the Insert Primitive Solids dialog box.
- 2. Select the **cylinder/Cone** tab and insert a cylinder with the dimensions as shown in the dialog box at right.
- 3. Make a second cylinder slightly shorter and smaller in radius than the first. This will define the inside of a cylindrical shell.
- 4. After inserting a cylinder with the dimensions as in the dialog box below, you will have two cylinders that are positioned around the bulb.

Insert Primitive Solids	_ 🗆 🗙
Block Cylinder/Cone To	rus Sphere Thin Sheet
💿 Cylinder 🔿 Cone	🔲 Elliptical Base
Base	_ Top
Major R: 4.9	Major R: 4.9
Minor R: 4.9	Length: 98
Base Position	Base Rotation
X: -49	X: 0
Y: 0	Y: 90
Z: 50	Z: 0
	in Degrees
[nsert	Modify

Inside Reflector Dimensions

🔲 Insert Primitive Solids	
Block Cylinder/Cone Tor	us Sphere Thin Sheet
💿 Cylinder 🔿 Cone	Elliptical Base
Base	Top-
Major R: 5	Major R: 5
Minor R: 5	Length: 100
- Base Position	-Base Rotation
X: -50	X: 0
Y: 0	Y: 90
Z: 50	Z: 0
	in Degrees
Insert	Modify

#### **Outside Reflector Dimensions**

#### **Creating the Reflector**

The reflector shell will be made by subtracting the inner cylinder from the outer cylinder using a Boolean Subtraction operation.

- 1. Select the outer (larger) cylinder in the System Tree.
- 2. Select the inner (smaller) cylinder in the System tree while pressing the Ctrl key. This is call a Ctrl+Click and extends the selection tow include both objects.
- 3. Select the Boolean Subtract icon, or use the Edit | Boolean | Subtract menu to perform the Boolean operation.
- 4. then click on the Object number that is the larger cylinder in the System Tree, then click on the smaller cylinder in the tree. The result will be one object with 6 surfaces.
- 5. If you make a mistake, click on the Undo Icon or select **Edit | Undo** to reverse the subtraction operation and try again.



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#### **Creating the Reflector**

Surface 2

E - Surface 2

 Surface 3 . ⊕ Surface 4 . ⊕ Surface 5 Surface 6 Entity 4

🖻 Object 4 Surface 0 Gurface 1

Entity 2 ·Cyl/Cone

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You only need the right half of the reflector shell. Another Boolean Subtract is used to complete the creation of the reflector geometry. Start by inserting a second block and use it to cut off half the reflector.

- 1. Open the Insert Primitive Solids dialog box and make a block with the dimensions shown at right.
- 2. Select the reflector shell
- 3. Ctrl+Click select the block.
- 4. Click the Boolean Subtract icon.
- 5. This should create the half-cylinder reflector that you need.



#### Applying a Surface Property to the Reflector

- 1. Using the System Tree, click on the reflector object, expand it and click on the surface tagged "Cone 4.9 millimeters" This is the inside cylindrical surface of the reflector.
- 2. In the Apply Properties dialog box, Surface tab, select the Diffuse White surface property.
- 3. Click **Apply** to apply it to the reflector surface.
- 4. An expanded view of the object is shown in the System Tree.



#### Creating a dot pattern using RepTile™

Now you will create a dot pattern using the RepTile<sup>™</sup> feature in TracePro Expert Edition.

1. Select **Define|Edit Property Data|RepTile Properties** to open the RepTile Property Editor

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File Edit View Insert Define Analysis Reports	Tools Macros Window Help	
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Image: Constraint of the second se	Surface Properties	₽ 🕒 ■ ♥ 💙 🖌 📎 🤶 😢
Source Editor	Material Properties Bulk Scatter Properties	
Entity 2 Cyl/Cone	Thin film stacks	
Material from <none> Material name <none></none></none>	RepTile Properties	
E Surface 0 ⊕ Surface 1		
Surface 2 Surface Data from: Default	×Z	)
Cone 4.9 millimeters	<b>†</b>	
Surface 4     Surface 5	<b>d</b> →>Z	
Surface 6		
View and modify RepTile Surfaces	X:0.0000 Y:3.2884 Z:53.5684 millimeters	X:0.0000 Y:32.3611 Z:-40.4150 millimeters

#### Creating a dot pattern using RepTile

You can add and edit property data with the Tracepro Property editors. The next step is to add a RepTile property for the LCD panel.

- 1. In the RepTile Property Editor, click Add Reptile Property.
- 2. Type in **LCD** panel dot pattern for the name, and select **Geometry Type = Sphere**.
- 3. Click OK to create the property.

TracePro Expert - [RepTile Property Editor]		_ 🗆 🗵
📄 File Edit View Define Tools Window Help		_ 8 ×
	I ⊕ K (I ♦ ¥ ¥ I z I z Z Z	P 🕒 = # 🖓 🗸 📎 🤶 🥂
Name: None>	Enter New RepTile Property	
Description:	RepTile Name:	
	LCD	
Tile Parameters       Select Tile Type	Geometry Type: Sphere	
	OK Cancel	
For Help, press E1	X:0.0000 V:3.2884 7:53.5684 millimeters	X:0.0000 Y:-7.1615 7:-53.9255 millimeters

#### Creating a dot pattern using RepTile

- 1. Select Tile Parameters Rectangles from the drop-down list.
- 2. Enter 5 for both the Width and Height.

- 3. In the spreadsheet part of the editor, enter 1 for the radius and 1 for the height.
- 4. Finally, click the Bump button to change it from Bump to Hole.
- 5. The completed property should appear as shown.
- 6. Click the Save icon to save the property in the database (or select File|Save) and close the Editor.

🚯 TracePro Expert - [RepTile Property Editor]			_ 🗆 🗙
📰 File Edit View Define Tools Window Help			_ 8 ×
			<b>१ №</b>
		* 🗸 🗸	
Name: CD	Edit Enable Add RepTile Property		
Description:	🔽 🗖 Variable rows —————	1	
	Insert Row Delete Row		
Tile Parameters	Geometry Parameters	1	
Rectangles	Type: Sphere Hole		
Width 5 Height 5			
Radius (mm)     Depth/Height (mm)       1     1			
For Help, press F1	X:0.0000 Y:8.4752 Z:19.5039 millimeters	X:0.0000 Y:-37.0946 Z:-53.9005 millimeters	

#### Creating a dot pattern using RepTile

The RepTile property will be used on the bottom of the LCD panel to improve the uniformity of the reflected light.

- Select the bottom surface of the LCD in preparation for applying the RepTile property. It's also a good idea to label the objects and surfaces for easy reference. Surface and object names are modified by clicking in the Stem Tree label and typing the new name.
- 2. Open the **Define**|**Apply Properties** dialog box and select the **RepTile** tab.
- 3. Select the LCD panel dot pattern property and Diffuse White surface property
- 4. Enter the values shown for boundary dimensions, center, (0,0) tile, and Up Vector.
- 5. Press Apply to update the surface.

The patterned surface is now complete.

- You have created a 98x98 mm rectangular region on the bottom surface filled with spherical holes (as seen from the outside of the solid).
- The surface property on the substrate is Perfect Mirror, and the property on the holes is Diffuse White.
- The holes are spaced 5 mm apart and are 1 mm in radius.

Apply Properties			
Importance Sampling         Exit Surface         Diffraction         Raytrace Flag           Mueller Matrix         Gradient Index         Bulk Scattering         Temperature           Material         Surface         Surface Source         Prescription         Color           Class and User Data         RepTile         Temperature Distribution			
Property Data Name: LCD			
Sphere			
Surface Catalog: Default			
Surface Property: Diffuse White			
Boundary and Orientation Rectangular Vidth: 98 Height: 98			
Boundary Center Origin for tile (0,0) Up Direction			
X:     0     X:     1			
Y: -5 Y: -5 Y: 0			
Z: 0 Z: 0 Z: 0			
[Apply] View Data			

#### **Display the RepTile Surface**

RepTile surfaces do not have geometry like other objects and surfaces in TracePro but can be displayed.

- 1. Select the view|Display RepTile menu.
- 2. Select the **view**|**Profile**|**Iso 1** menu.



#### Adding an observation screen

An observation screen defines the output of the LCD panel and can be located anywhere in space. The object will allow you to examine the irradiance distribution from your light guide.

- 1. To add an observation screen to the system, select **Insert|Primitive Solid** and select the **Block** tab.
- 2. Enter the width and position for the block as shown.
- 3. Label the object Observation Screen.
- 4. Apply the Perfect Absorber surface property to the object. This operation will apply the surface property to all member surfaces of the object.
- 5. Label the bottom surface Screen.

Insert Primitive Solids	Apply Properties
Block Cylinder/Cone Torus Sphere Thin Sheet Width X: 100 Y: 5 Z: 100	Importance Sampling         Exit Surface         Diffraction         Raytrace Flag           Mueller Matrix         Gradient Index         Bulk Scattering         Temperature           Class and User Data         RepTile         Temperature Distribution           Material         Surface         Surface Source         Prescription
Center Position         Rotation           X:         0           Y:         12.5           Z:         0           Image: Center Position         Y:           Image: Center <td< th=""><th>Property Catalog: Default Property Name: Perfect Absorber  100% absorbing, no reflectance or transmittance No Scatter Reference Data Type: Data Table , no polarization, no retroreflector Reference Material</th></td<>	Property Catalog: Default Property Name: Perfect Absorber  100% absorbing, no reflectance or transmittance No Scatter Reference Data Type: Data Table , no polarization, no retroreflector Reference Material
<u>Insert</u> <u>M</u> odify	Angles measured in Air - Refractive Index = 1.0  Angles are corrected by Snell's law and the refractive index on either side of the Surface Property. Select measured index reference of Surface Property data:           Apply         View Data

#### Turning the Display of Rays off

Since you are tracing 1,000 rays and having them scatter into 1000s of more rays it is a good idea to turn off the display of rays off before the ray-trace, so the screen doesn't become too cluttered with rays.

- 1. To do this go to the Analysis menu and left mouse click on the Display Rays option.
- 2. The check mark in front of the Display Rays option should disappear.



#### Running a source trace simulation

- 1. Now click on the Source Trace icon to begin the Surface Source ray-trace.
- 2. Before the ray-trace begins, TracePro will Audit the system. All properties will be preprocessed, and the object space will be partitioned for faster ray-tracing.
- 3. When the ray-trace begins, a dialog box will appear showing how long the ray trace will take and what ray is currently being traced. The time it takes will depend on your computer, but expect it to take a few minutes.
- 4. After the audit is finished, TracePro will start ray tracing 1,000 rays.

TracePro Expert - [Model:[Untitled1]]		
🜒 File Edit View Insert Define Analy	sis Reports Tools Macros Window Help	_8×
	⊻ ∞∞⇔ ⊠ ⊾Ҹ ≣ ⊐⊑⊟⊐	
<u>QQQQQ</u>	xJ Ľz Ľz Ľx zJ zJ Ľ Vz I	P ⊡ ■ ♥♡ ✓ ℕ ፻№
<ul> <li>Object 1</li> <li>Object 2</li> <li>Object 4</li> <li>Observation Screen</li> </ul>	Raytrace Progress	Z
For Help, press F1	X:0.0000 Y:3.2884 Z:53.5684 millimeters	X:-75.5211 Y:-41.2500 Z:-31.7711 millimeters

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### **Display Ray Trace**

With large numbers of rays the ray display sheds little light on what is happening in the model. The Ray Sorting options in Tracepro provide a way to reduce number and select the type of rays to display.

- 1. Select Analysis | Ray Sorting.
- 2. Change 100 to 5 in the % Starting Rays to Display and click Update. This will reduce the number of rays shown to 5 out of every 100.
- 3. Turn the Display Rays option back on by selecting Analysis | Display Rays. Rays will be displayed.



The observation screen was set to be completely absorbing and most rays reach, and stop at, its bottom surface. Rays missing this object are shown bypassing it. The color of each ray indicates its flux. 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.

#### **Displaying an Irradiance Map**

There are two modes to trace rays in TracePro, Analysis and Simulation mode. Analysis mode lets the user look at Irradiance/Illuminance maps and Candela/ Intensity 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 has less flexibility, but uses much less memory.

By default Analysis mode is on.

- 1. Select Analysis | Irradiance Options.
- 2. Update the Irradiance Options as shown to correctly display an Irradiance Map.
- 3. Click **Apply** to make the new settings take effect.

📲 Irradiance Options				
Map Data				
Quantities to plot Irradiance	e 💌 1/2 ar	ngle for radiance 10		
Rays to plot Absorbed	d 🔽 🗆 No	ormalize to emitted flux		
🗖 Set Max: 📔	🗍 🗖 Set Min	: 0		
Display Options				
Smoothing	Log Scale Map Count:	10		
Contour Plot	Relief Plot Resolution:	128x128		
🗖 Local Coordinates 🔽	Profiles Symmetry:	None		
🔽 Gradient Display	Color Map:	Color(rainbow) on Black 💌		
Convert to foot-candles (	fc)	Auto Update is ON		
Contour Levels:	Contour Levels:			
M Auto, levels		e percent or Max. [1.0 = 100%]		
Selection	>			
Number: 15	<			
Orientation of plot plane				
	Automatically calculate N	ormal and Up Vectors		
Normal Vector: X: [0	Y: [1			
Up Vector: X: 1	Y: 0	Z: 0		
	Apply	Set Defaults		

#### Irradiance map

When showing an Irradiance map, a surface needs to be selected to define the map's data set.

- 1. Select the Screen surface of Observation Screen object.
- 2. Click on the Irradiance Map icon (or select Analysis | Irradiance/ Illuminance Map) to see the plot shown at right.
- 3. Click in the center of the irradiance map to get the profiles to appear. The two profiles will pass through whatever point you click.
- 4. The irradiance map shown should pop-up on the screen.
- 5. To see the windows side by side as shown, select window|Tile Vertical or click the Tile Vertical toolbar button.



#### Improve Irradiance Sampling

The Irradiance plot displayed with 1000 rays is greatly under sampled. This can be improved by increasing the rays traced and displaying the plot.

- 1. Start by turning off the ray display from the **Analysis** menu and left mouse click on the **Display Rays** option.
- 2. Select the source surface and update the number of rays from 1,000 to 10,000. See "Adding a Surface Source Property to the Bulb".
- 3. Perform a source raytrace and view the Irradiance Map.



#### **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 pseudocolor 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.

Map Data Quantities to plot	diance 💌	1/2 ar	ngle for radiance
Baus to plot			rmalize to emitted flux
Set Ma	аж: О	🗖 Set Min	
- Display Options			
☑ Smoothing	🗖 Log Scale	Map Count:	10
Contour Plot	🗖 Relief Plot	Resolution:	128x128
🗖 Local Coordinates	Profiles	Symmetry:	None
🔽 Gradient Display		Color Map:	Color(rainbow) on Black 💌
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- Contour Levels:  - Contour Levels:  - Contour Levels:  - Contour Levels:  - Orientation of plot plane  - Normal Vector:	idies (rc)	> < ally calculate N Y: 1	Auto Update is UN percent of Max. (1.0 = 100%) ormal and Up Vectors Z: 0
- Contour Levels:  - Contour Levels:  - Contour Levels:  - Contour Levels:  - Orientation of plot plane  - Normal Vector:  Up Vector:	Automatica X: 0 X: -1	> Use > < ally calculate N Y: Y: Y:	Auto Update is UN percent of Max. (1.0 = 100%) ormal and Up Vectors Z: 0 Z: 0

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.

<b>201</b>	Irradiance Options			_ 🗆 X
Г	Map Data			
	Quantities to plot	diance 💌	1/2 ar	ngle for radiance 10
	Rays to plot Abs	orbed 💌	🗖 No	rmalize to emitted flux
	🗖 Set Ma	вж: 0	🗖 Set Min	0
	Display Options			
	🔽 Smoothing	🔲 Log Scale	Map Count:	10
	Contour Plot	🔲 Relief Plot	Resolution:	128x128
	🔲 Local Coordinates	Profiles	Symmetry:	None
	🔽 Gradient Display		Color Map:	Color(rainbow) on Black 💌
	Convert to foot-can	dles (fc)		Auto Update is ON
	Contour Levels:	le.		ecroent of blog (1.0 – 100%)
	Auto, leve			percent or max. (1.0 = 100%)
	Selection		>	
	Number: 15		<	
	Orientation of plot plane			
		Automatica	ally calculate N	ormal and Up Vectors
	Normal Vector:	<: 0	Y: 1	Z: 0
	Up Vector: >	<: [-1	Y: 0	Z: 0
		/	Apply	Set Defaults