

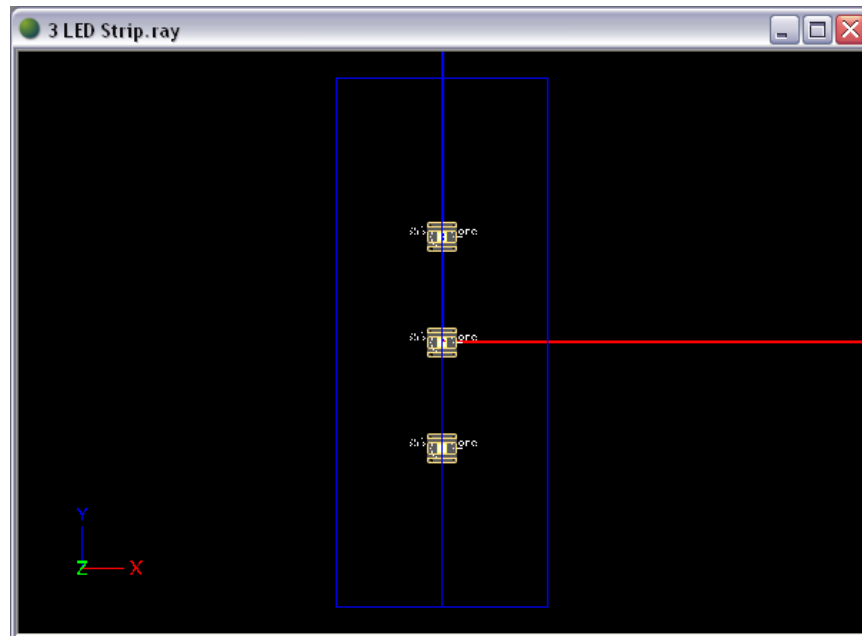
## Advanced Tutorial – Imaging an Optic

This tutorial demonstrates imaging a strip of LED's to “look” back into the optic and see how the optic would appear, rather than analyzing output. In many situations, the aesthetics of a light fixture is important in addition to its output. Using an imaging lens onto an illuminance plane, we can see what the light fixture looks like from that particular angle. In this tutorial, we will image a strip of LED's and see if a diffuser lens can mix the image so that the resulting lens appears more uniform. It is a good idea to complete the beginner tutorials before attempting this advanced tutorial, since many of the more basic functions and concepts are not explained in this tutorial.

### Open the Base Project

A simple project with three LED's, housing and lens has already been created and setup for use in this tutorial. However, any optic in Photopia can be imaged using the following process.

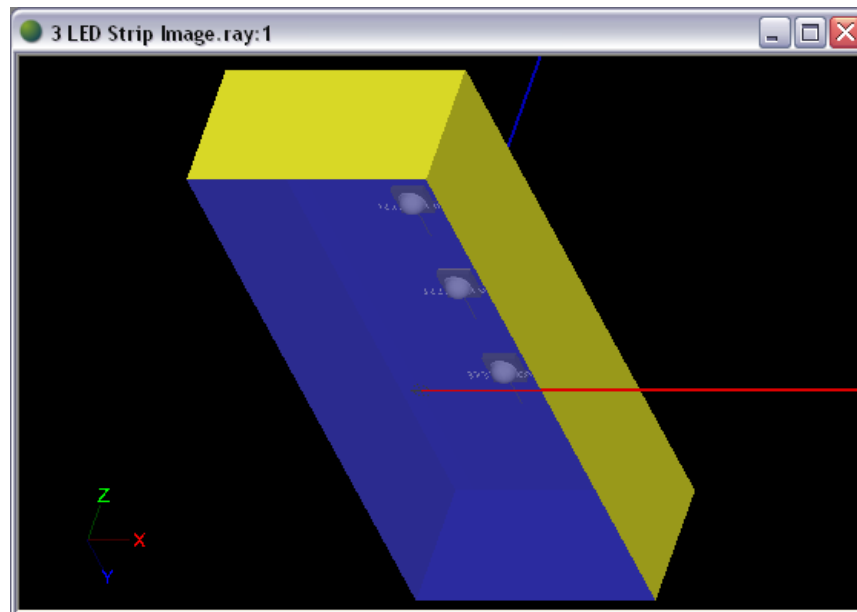
1. Choose **Help > Open Sample Project**, and select the *3 LED Strip.ray* file.



After we import the imaging lens, the output data for this project will be invalid since the imaging lens and diaphragm will block the light that creates the full output distribution. So, it is a good idea to save your image file as a separate file from your project.

2. Choose **File > Save As** to save the file as *3 LED Strip Image.ray*.

Orbit in CAD view to examine the optic. Three LED's are aligned in a simple rectangular housing, with a flat lens as the optic's exit surface. This is the surface we are interested in imaging so that we can see what the flat lens looks like when you look directly at it.

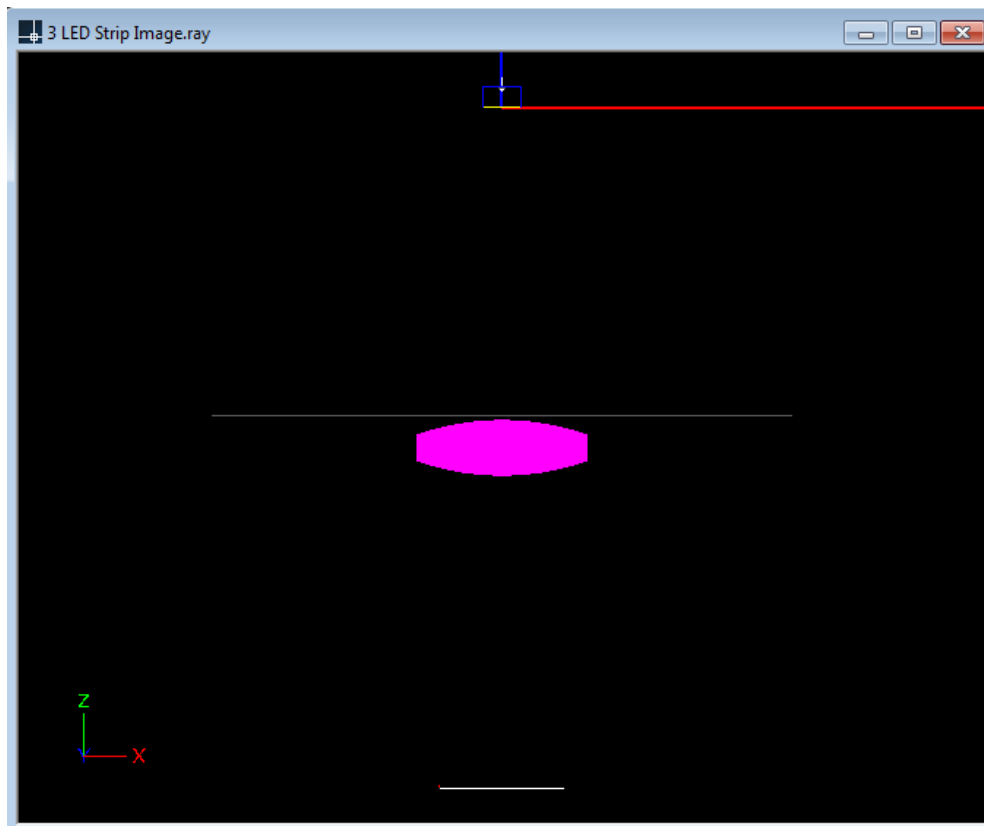


### Import the Imaging Lens

3. Choose **File > Import Component** and browse to *IMAGING LENS 2.cmp*.

The component is setup so that the object to be imaged would be at 0,0. Since the flat diffusing lens of the optic, the surface we want to image, is already centered at 0,0, we can import the imaging lens file with its default origin.

4. Press Enter to accept the default origin of 0,0.



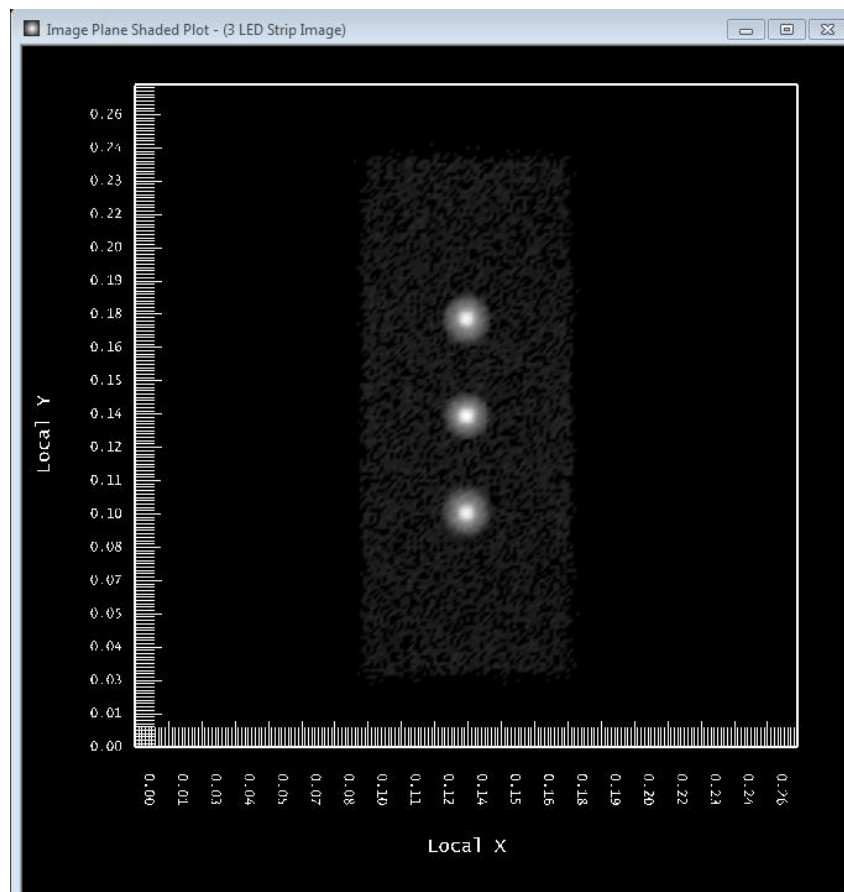
Included in the component file are an imaging lens (magenta), diaphragm (gray), and illuminance plane. If you want to image something that is sized much differently than the opening in the diaphragm, you can simply scale all of the imaging lens system parts (lens, diaphragm, and illuminance plane) around 0,0.

The imaging lens is positioned so that the object to be imaged is at 0,0, and the image (without magnification) is at the location of the illuminance plane.

## Image Results

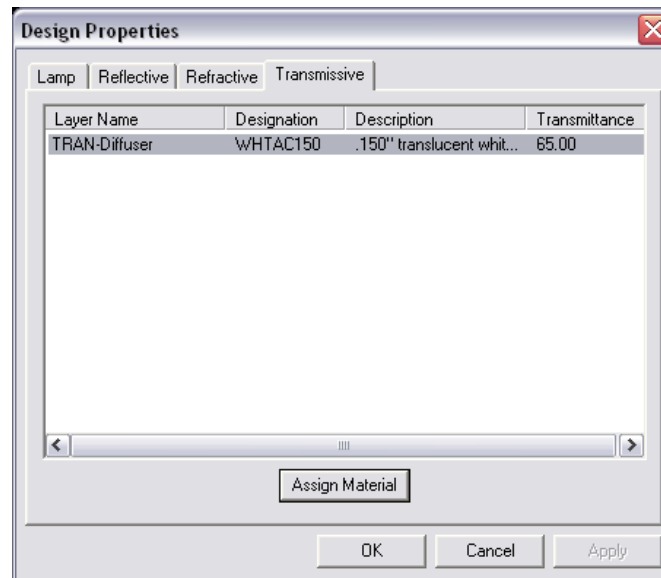
The materials have already been pre-assigned and the default raytrace settings are appropriate, so we are already set to run the analysis. The flat lens is currently set to clear acrylic. After viewing these results, we will try assigning white acrylic to the flat lens and compare the results.

5. Run the analysis by choosing **Analysis > Begin Analysis**.
6. View the image plane by choosing **View > Illuminance > Shaded Plot**.

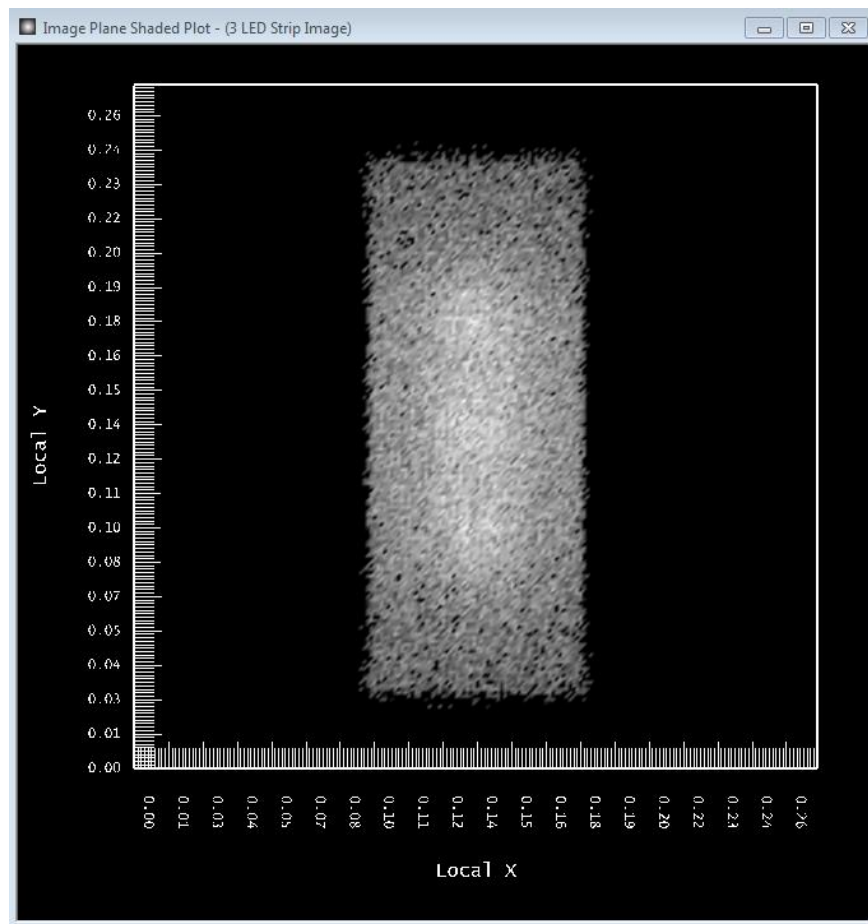


As expected with our flat lens being clear acrylic, the image shows us that if we were to look straight into this optic, we would see three bright spots where the LED's are located. You can also see a slightly luminous area around the LED's due to reflection off of the inside of the clear lens and back into the white box. We can now try assigning white acrylic to the flat lens.

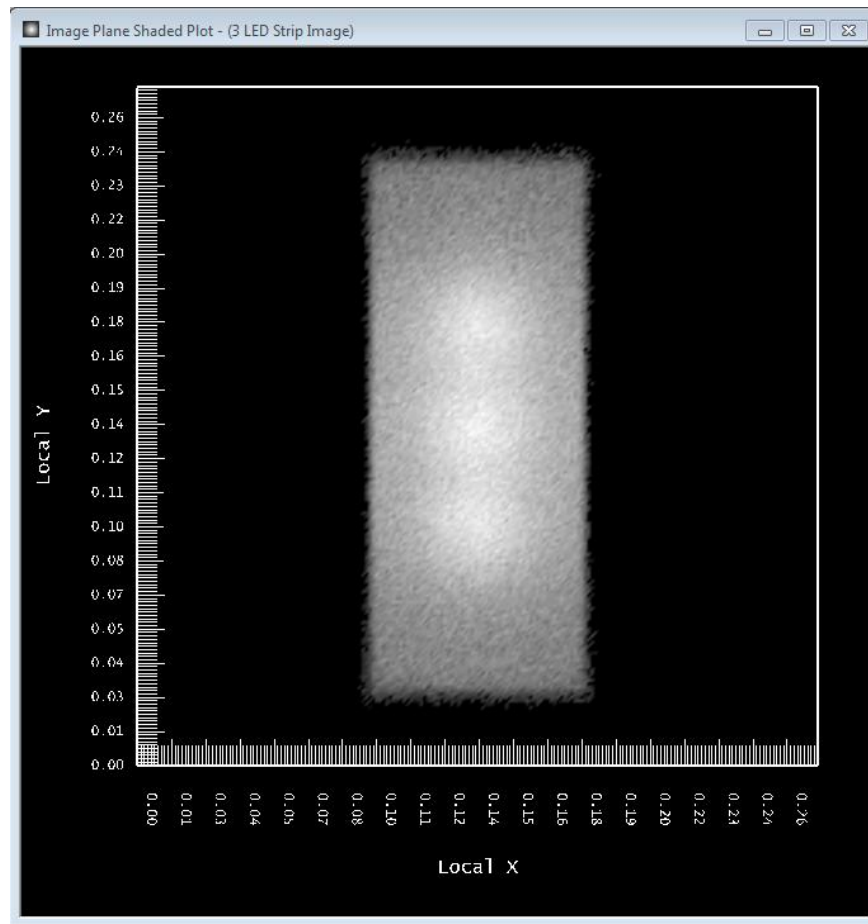
7. Under **Edit > Design Properties**, go to the Transmissive tab to find the TRAN-Diffuser layer. Change its material from clear acrylic to *Generic WHTAC150*, 0.150" translucent white acrylic.



8. Run the analysis and view the image plane.



The image now shows that when looking into the optic, we would see a more diffuse lens. This may be more aesthetically pleasing. However, you can see that the image is somewhat rough because of the low number of rays used. It is important to run a higher number of rays to see if any bright spots might become apparent. The image below was run with 25,000,000 rays.



This imaging lens process can be used to “look” into any optic. Note that you should disregard any output other than the Image Plane illuminance plane, since the imaging lens was included. Polar candela plots and IES files, for example, are invalid.