

Designing a TIR High Beam

Using LucidShape and CAD Software

Introduction

In this application example, you will set up a high beam unit for a headlight in which the light distribution is controlled by a Total Internal Reflection (TIR) optic. You will create the TIR device from various design features that LucidShape provides as a tool. Using external CAD software, you will trim the individual components into a TIR unit. For this example, you do not necessarily need a CAD software, as files with already trimmed surfaces are available.

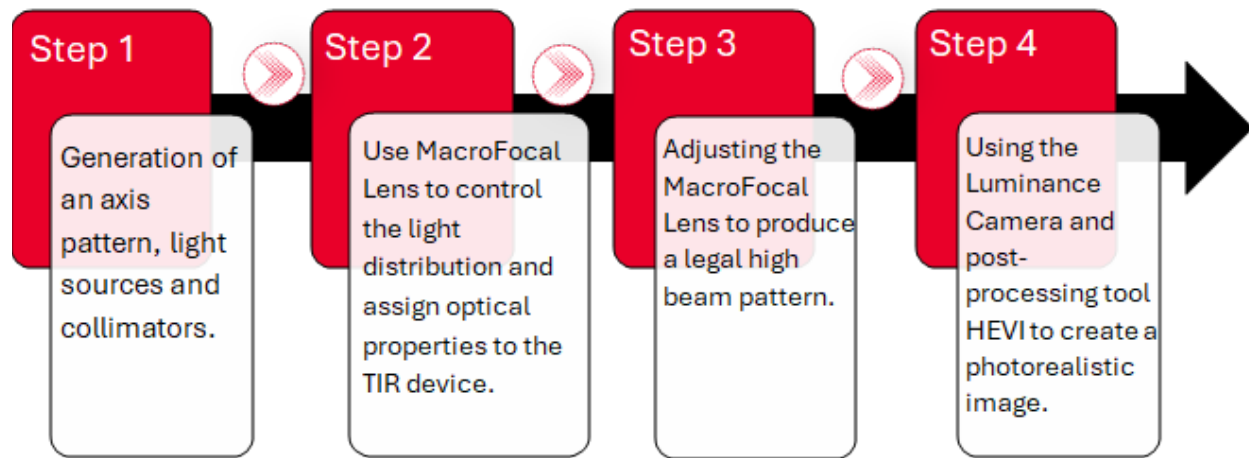
You will then integrate the high beam unit into an existing headlight housing and create a photorealistic image by rendering.

The focus of this example is:

- Arranging light sources and TIR optics on an axis pattern.
- Using FunGeo design features Collimator and MacroFocal Lens for the TIR optics.
- Setting up Luminance Camera in Backward mode to create a photorealistic image.
- Human Eye Vision Image (HEVI) for post-processing the image.



Flow Description

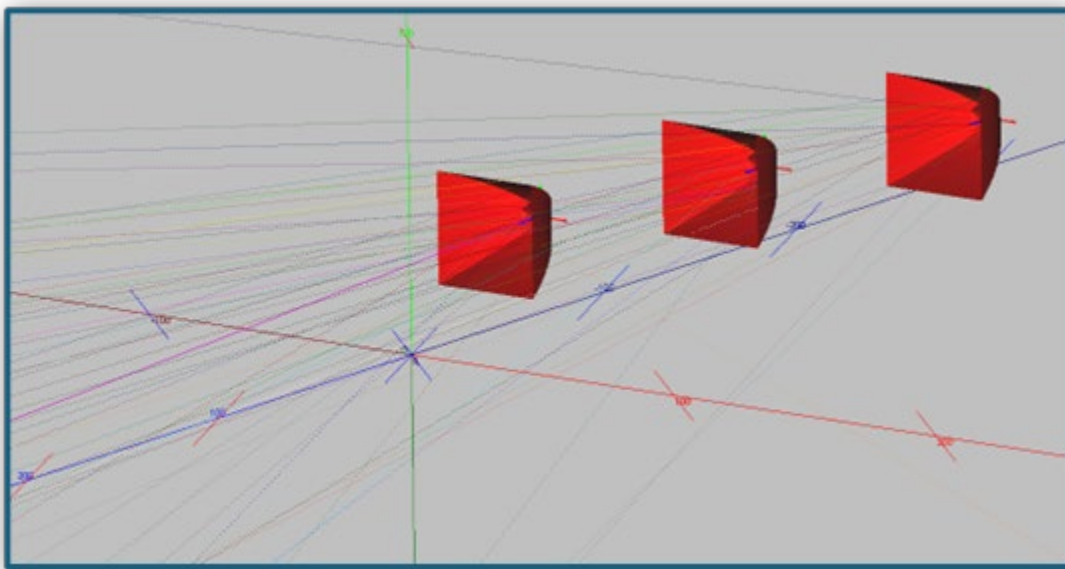


Generating an Axis Pattern, Light Sources and Collimators

In the first step, you create an axis pattern that consists of 3 individual axis systems. The axis pattern is essential for the model, as further optical components are positioned on it.

After the axis pattern has been created, position LEDs and Collimators on the individual axis systems in one step.

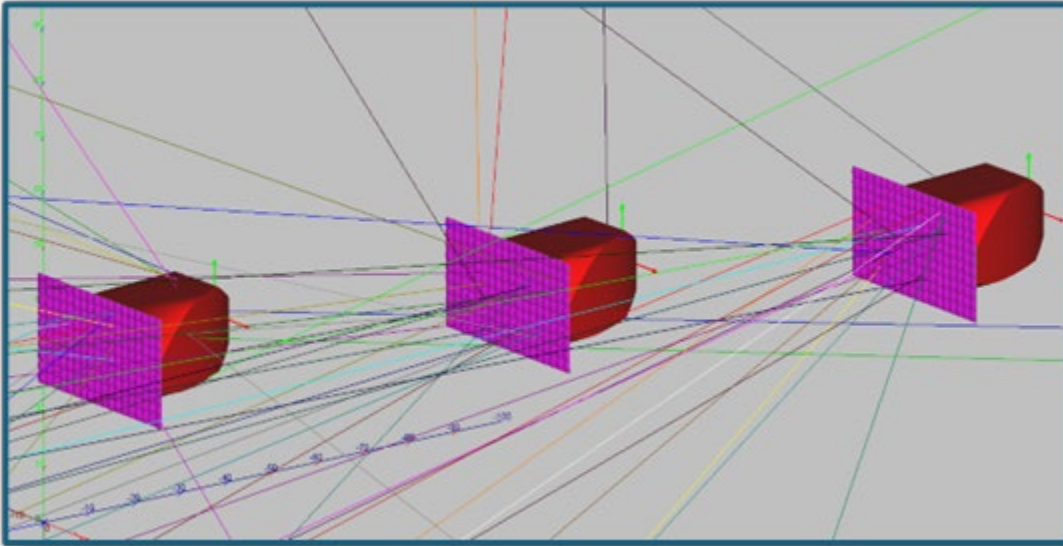
The collimators are necessary to parallelize the divergently emitted light from the light sources. For the collimators to fit into the given housing, they must be cut accordingly. To do this, the geometries are transferred to a CAD software, edited there and transferred back to LucidShape.



Creating MacroFocal Lenses and Assigning Optical Properties

In the second step, you create MacroFocal Lenses that you also position on the axis pattern. Then you trim the previously created collimators with the lenses again in CAD to create a TIR body.

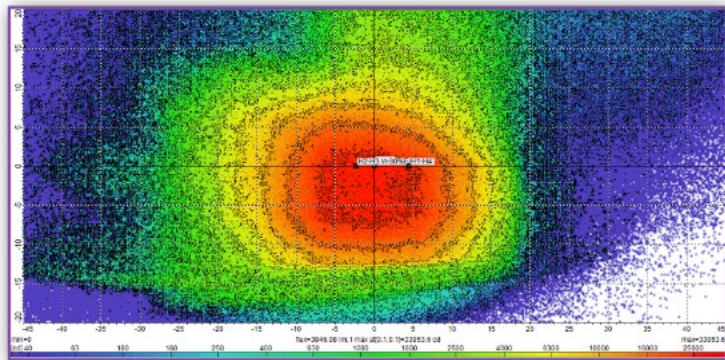
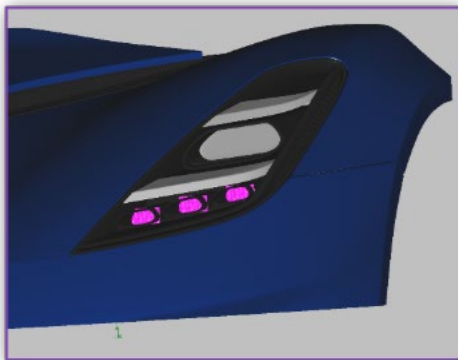
Back in LucidShape, assign optical properties to the trimmed surfaces so that they will participate in ray tracing.



Adjusting the Lens and Checking the Light Pattern With a Test Table

After the geometry transfer is complete, you can trace the model.

Adjust the lens' spread angles step by step to create a suitable light pattern. Use test tables to check the results and determine if the light pattern meets legal requirements.



Creating a Photorealistic Image

Use the Luminance Camera in backward ray trace mode to generate a photorealistic image. In addition to the camera, you need an environment light source to represent your model's surroundings.

Since the environment source provides high luminance values, the Human Eye Vision Image (HEVI) post-processing tool must be applied. Additionally, a Vos glare model will emphasize the glow around the high-beam light sources which improves the realistic impression of the image as well.



Conclusion

In this example, you learned how to create a TIR device for a high beam application.

By integrating it into an existing housing, you understood how to transfer geometries between LucidShape and a CAD program and reassign optical materials.

You are now also familiar with the MacroFocal Lens design feature to control the light distribution to create a high beam pattern that complies with legal requirements.

You also learned how to use a luminance camera and HEVI for post-processing to create photorealistic images of your model.

Example files:

Designing TIR High Beam.pdf: A step-by-step guide that takes you through the entire setup from start to finish.

Designing TIR High Beam - Step 1.lug: This is the starting model for this example and includes the specified housing and single axis systems.

Designing TIR High Beam - Step 2.lug: In this file the collimators with the housing surfaces are already trimmed.

Designing TIR High Beam - Step 3: In this model, the collimators are already trimmed with the lenses, and the previously created MacroFocal Lens is also present.

Final Model.lug: In this model, the MacroFocal lenses were trimmed with the collimator surfaces. The lens parameters can no longer be changed.

Final Model with editable Lenses.lug: This is the finished model where the lens parameters can still be changed. The lenses have not been trimmed and overlap the body.

Final Model with Luminance Camera.lug: This model contains the preset Luminance Camera. The TIR object can no longer be changed.

White Spectrum.txt: This file is the spectral power distribution for the light sources.

Final Model Result.lid: The simulation result is traced with a large number of rays and can be used for post-processing of the tone mapping.