# Using TracePro for LED Lighting Design Applications

Presented by :
Lambda Research Corporation
25 Porter Rd.
Littleton, MA 01460
www.lambdares.com

Moderator:
Andy Knight
Technical Sales Manager
Lambda Research Corporation

Presenter:

Dave Jacobsen
Senior Application Engineer
Lambda Research Corporation

Lambda Research Corporation

# Format

- A 25-30 minute presentation followed by a 10-15 minute question and answer session

- Please submit your questions anytime using Question box in the GoToWebinar control panel

# Using TracePro for LED Lighting Design Applications

Presented by :
Lambda Research Corporation
25 Porter Rd.
Littleton, MA 01460
www.lambdares.com

# In this webinar we will:

•Start with a basic specification and use that as a starting point for our LED lighting design

•Discuss how the specification will influence the choice of LEDs. Can we use a single LED, or will we need an array?

•Use the LED datasheet to create a custom Surface Source Property in TracePro

•Discuss setting up the initial model in TracePro and preparing the system for optimization

•Show how the Interactive Optimizer in TracePro can be used to optimize the system

# In this webinar we will:

- Explain how the Interactive Optimizer can be used with the Scheme macro language in TracePro to optimize the placement of LEDs and/or luminaires

- Validate the design using the analysis tools in TracePro

- Answer your questions in the Question and Answer session

# Current TracePro Release

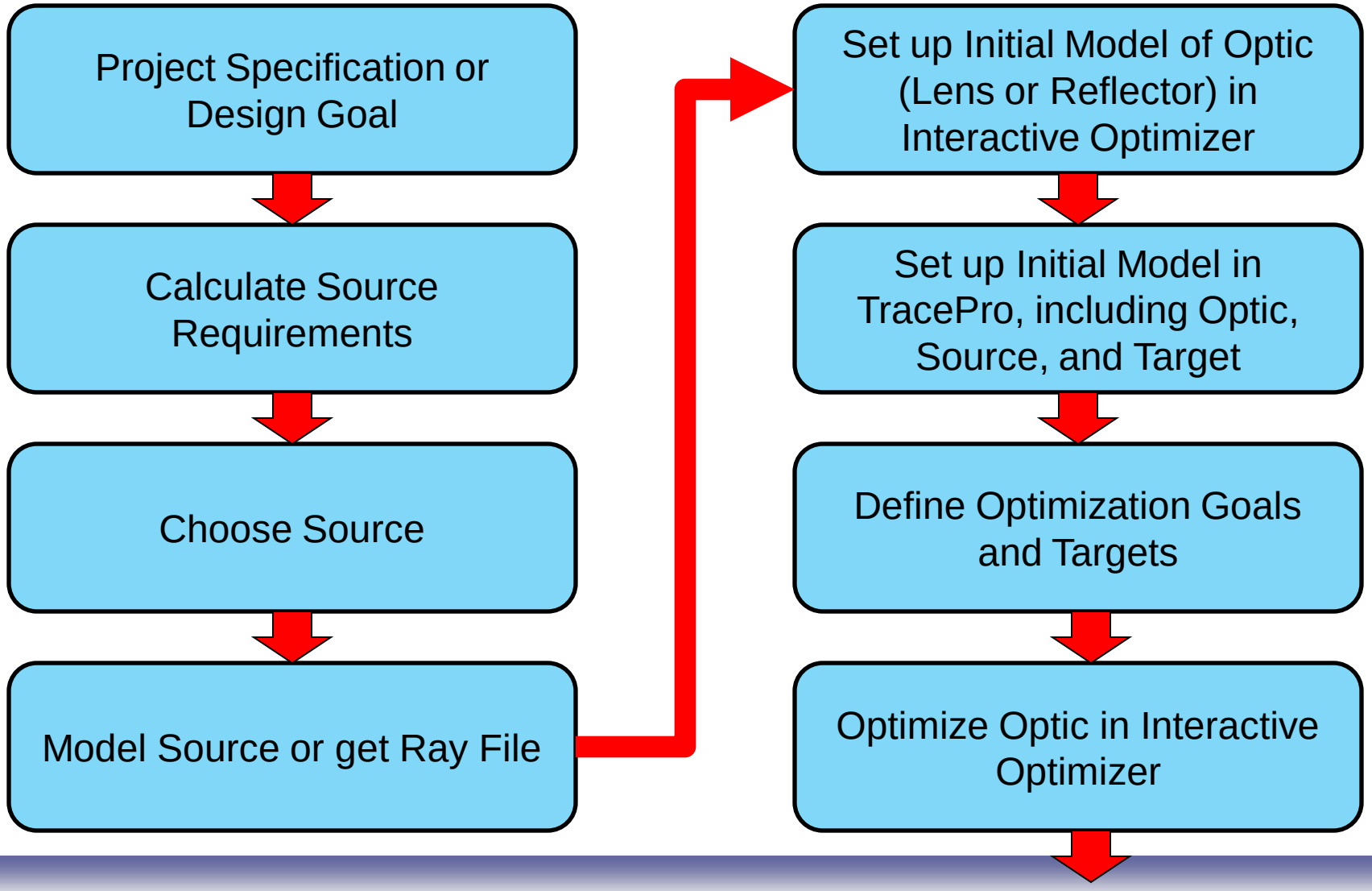
- TracePro 7.0.5

- Can be downloaded by anyone with a current Maintenance and Support Agreement

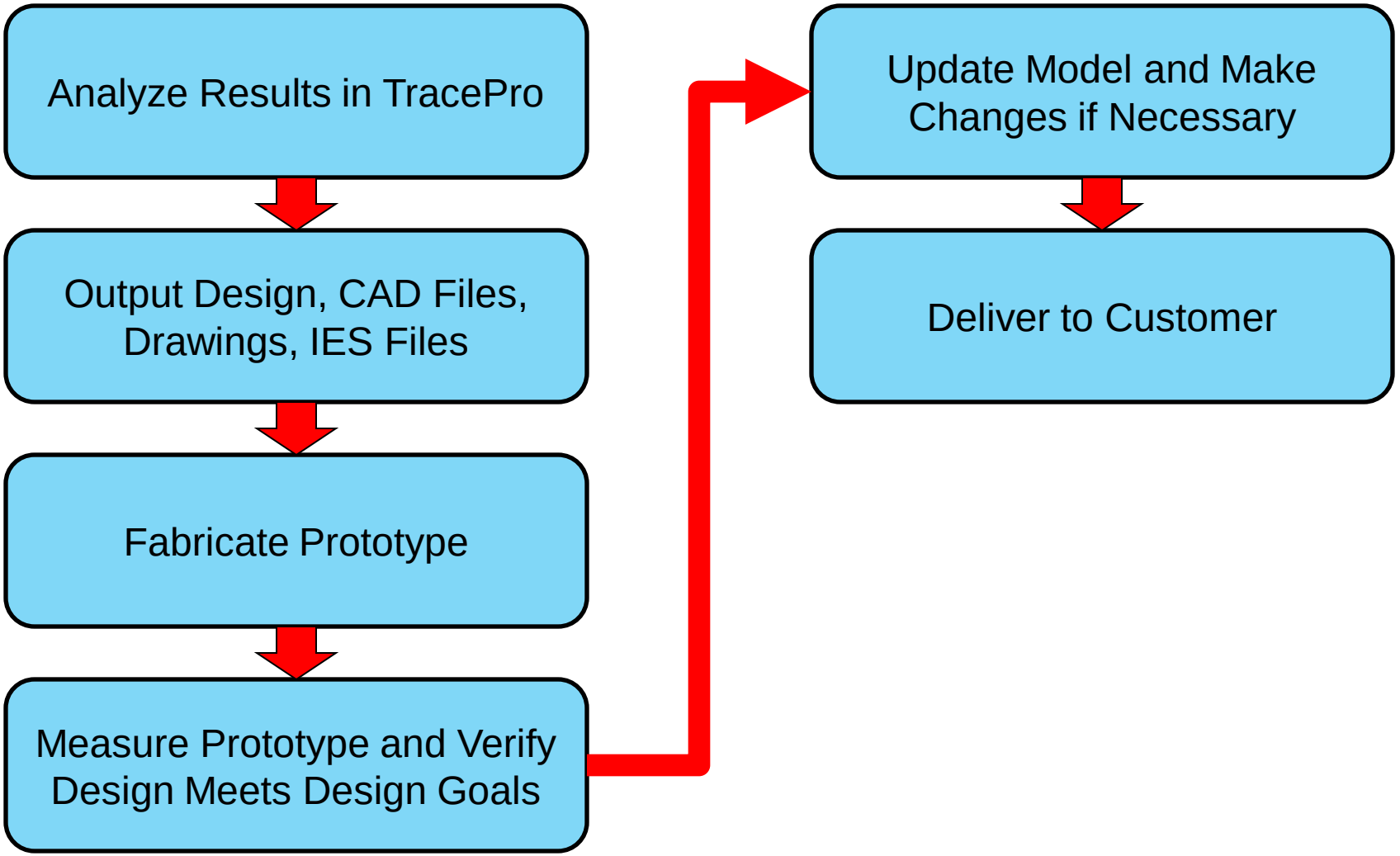
- www.lambdares.com

# Using TracePro for LED Lighting Design

# LED Lighting Design, Typical Workflow



# LED Lighting Design, Typical Workflow



# LED Lighting Design Using TracePro

# LED Luminaire Example

# Specification

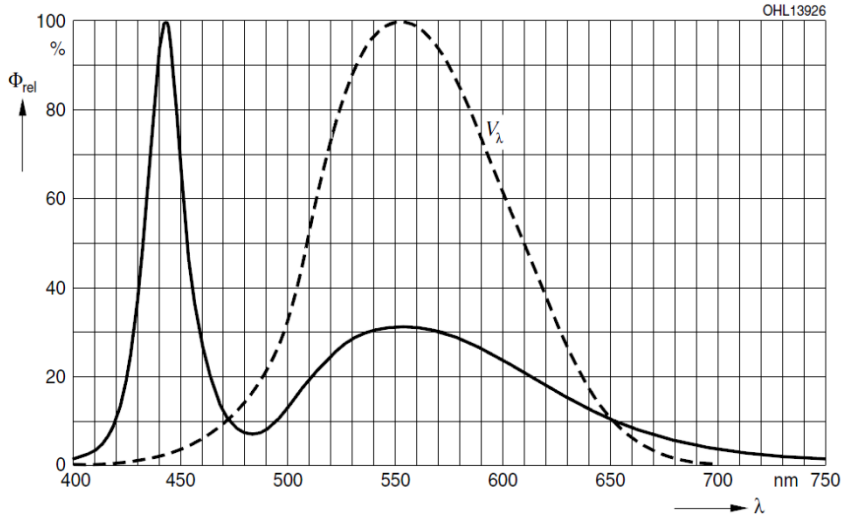
- Target Size = 9 x 10 meters
- Mounting height = 8 meters
- 14 Lux (lumens/square meter) at the target
- Color = White

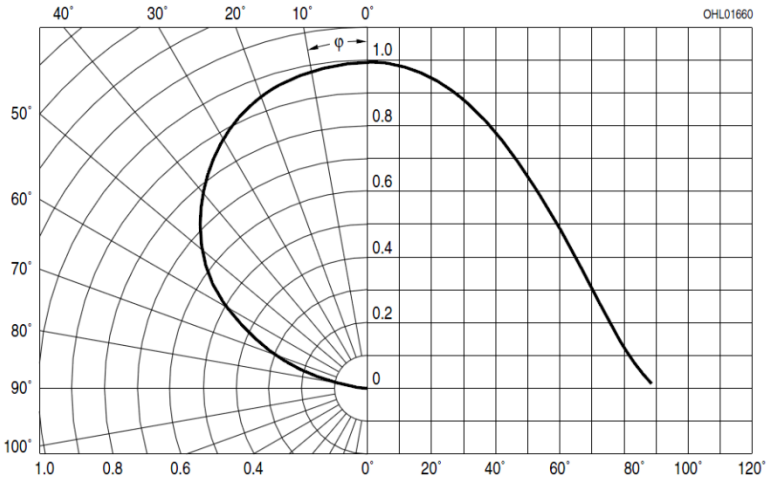
# Calculate Source Requirements

- Target Area = 90 square meters
- Calculated Angular Beam = 30-degrees, half angle
- Calculated Total Lumens = 1260 lumens (used 2000 lumens as design goal)
- Individual LED Lumens = 60 lumens
- Minimum Number of LEDs Required = 34
- Number of LEDs Used = 60

# LED Selection

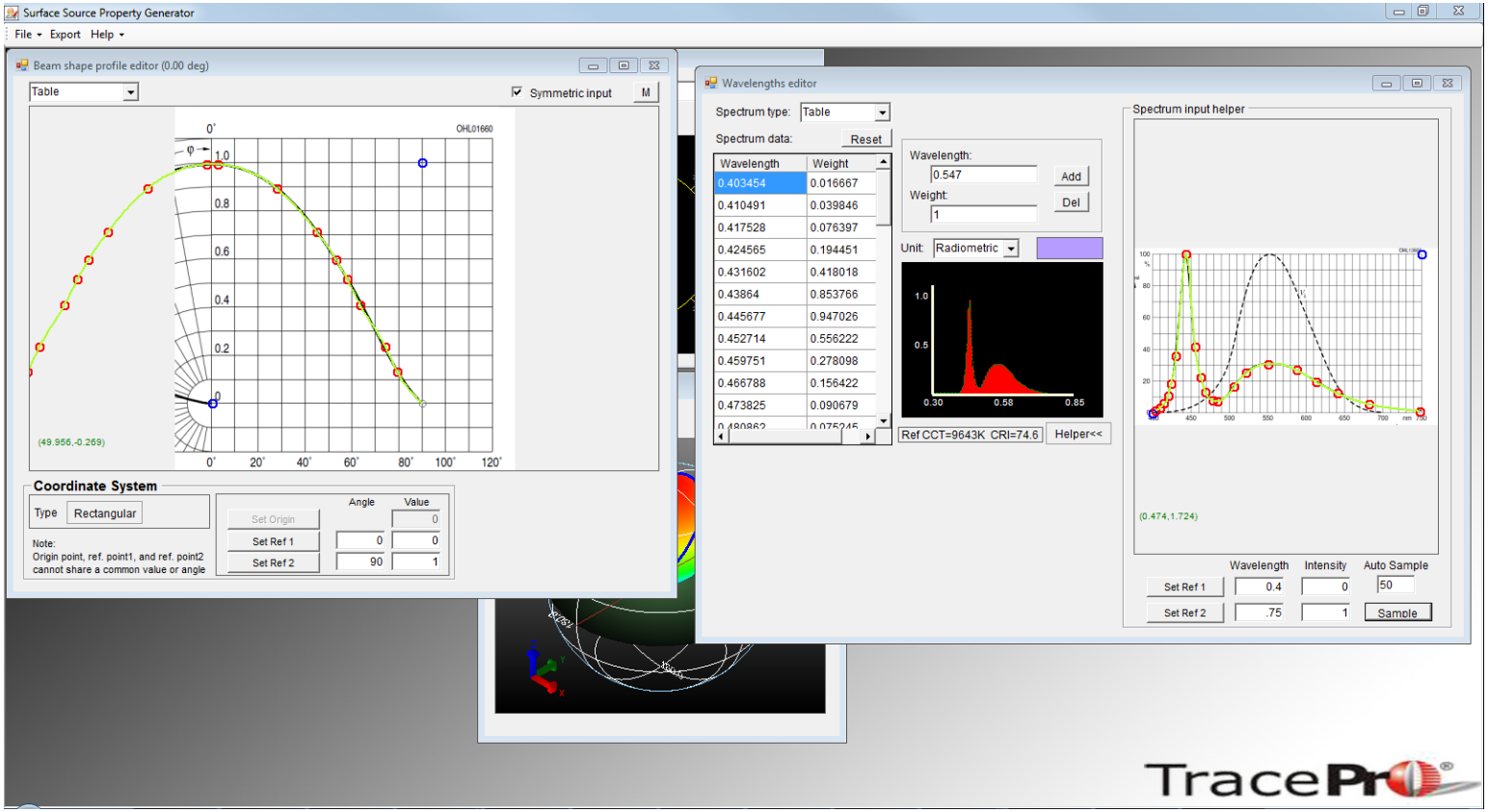
- White LED
- Datasheet for LED lists 60-130 lumens
- Using 60 lumen value and 60 LEDs yields 3600 lumens total




Osram Golden Dragon LUW-W5SM

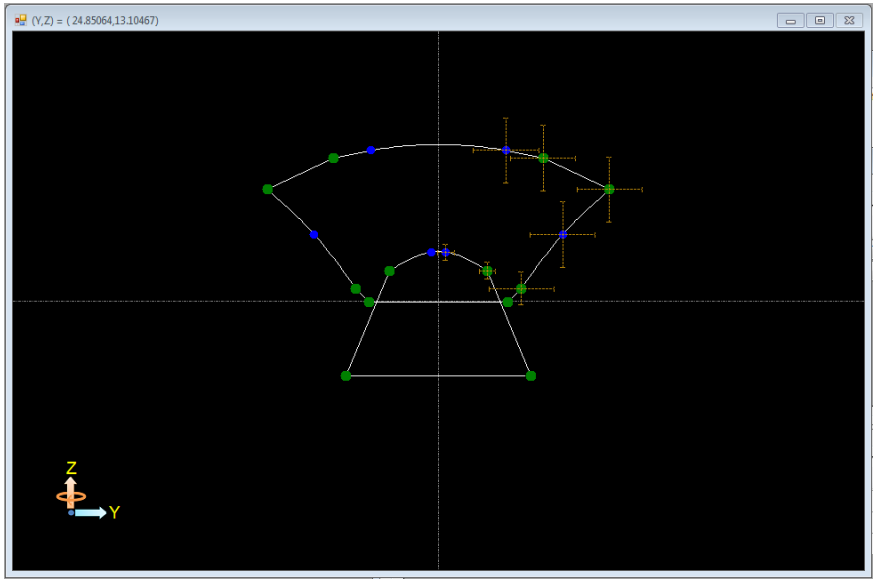
# LED Source Model

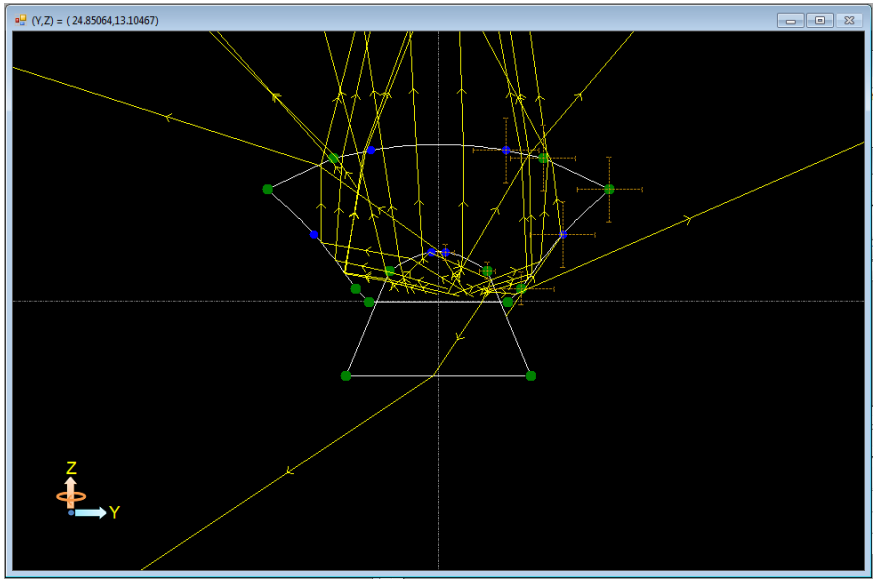



Model LED in Surface Source Property Generator Utility in TracePro

Tutorial Video at: http://www.lambdares.com/videos/

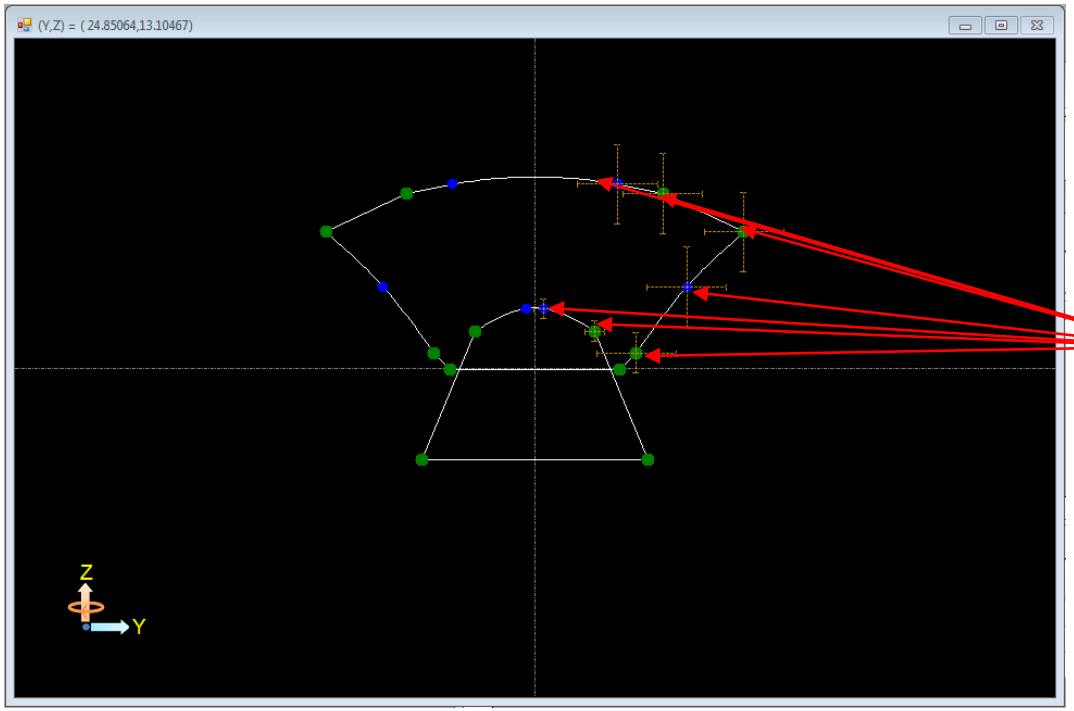
# Initial Lens Model in Interactive Optimizer




Sketch initial lens model in Interactive Optimizer. Use Ray Display to see where the light is going to achieve a good starting condition for optimization

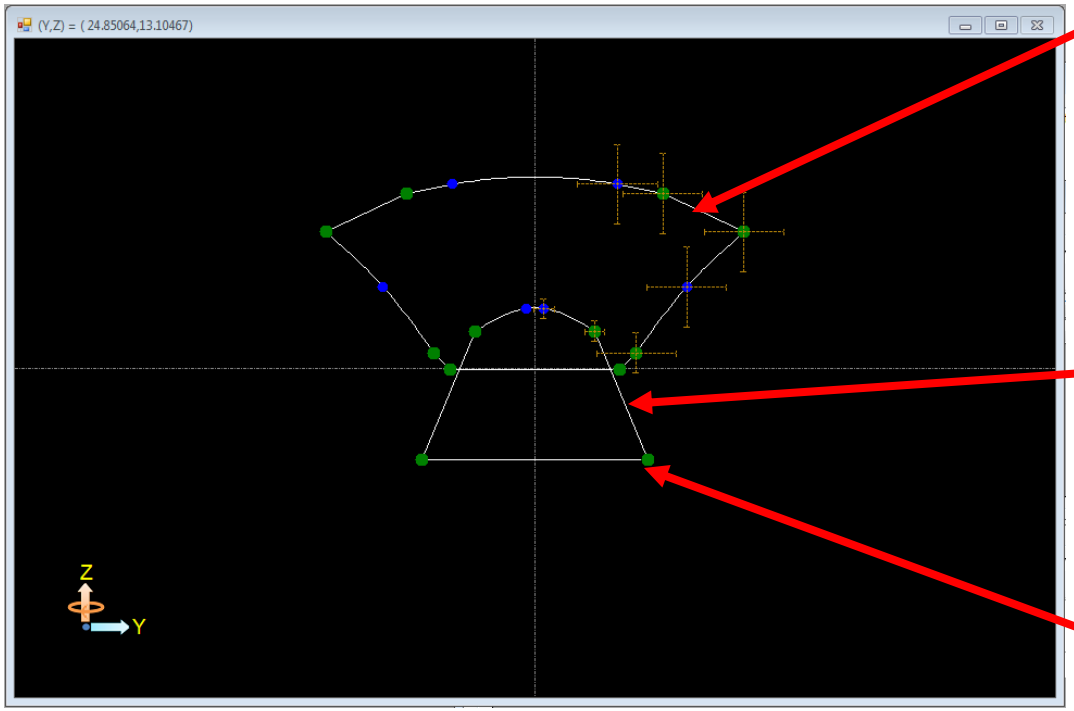
# Initial Lens Model in Interactive Optimizer




Variables for optimization

Define points to be used as variables for optimization. Variables can also be set to limit the maximum or minimum size of the lens.

# Initial Lens Model in Interactive Optimizer



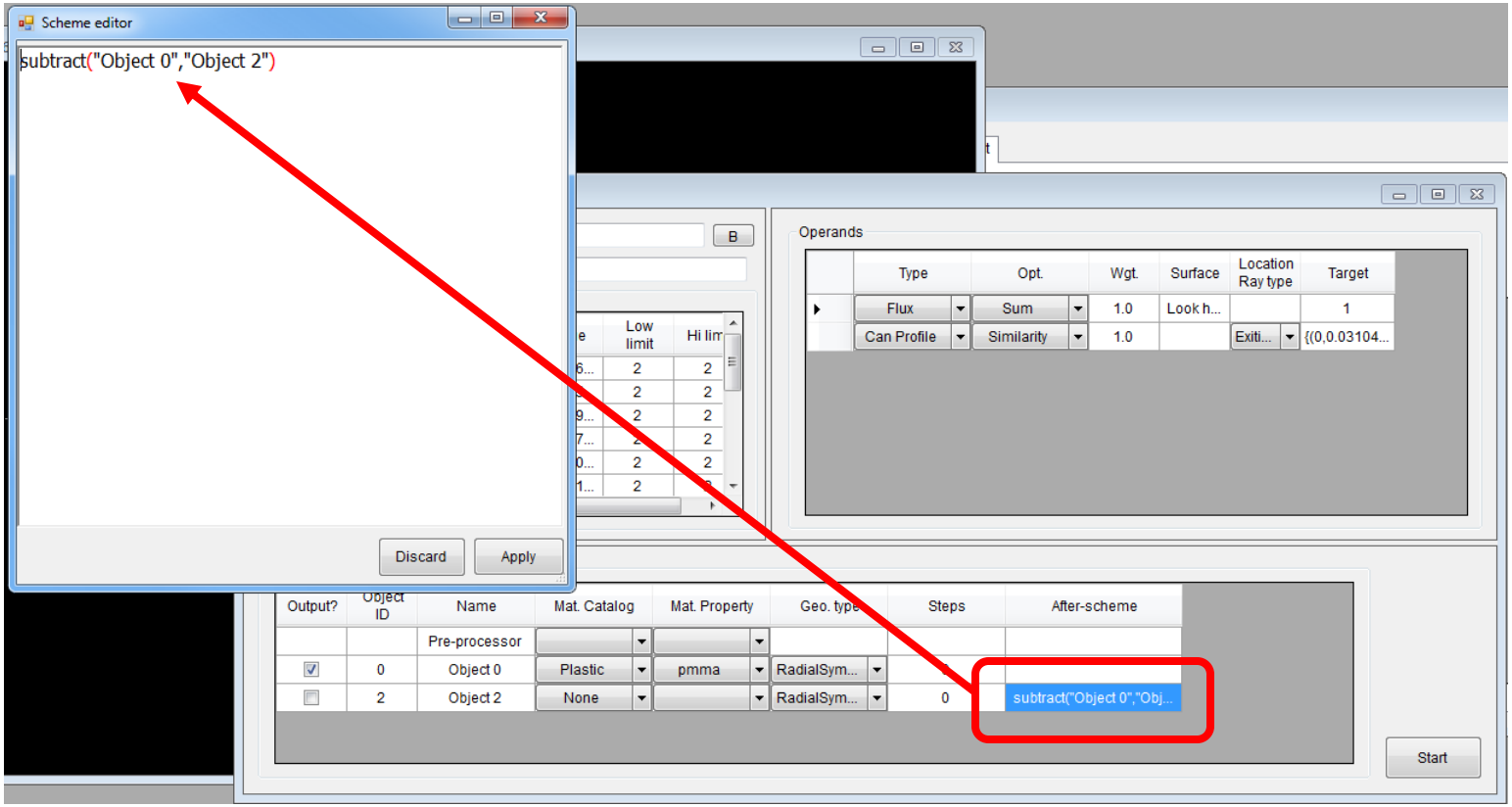

Object 0

This object is subtracted from the lens using the After-Scheme option to create space for the LED in the lens

Object 2

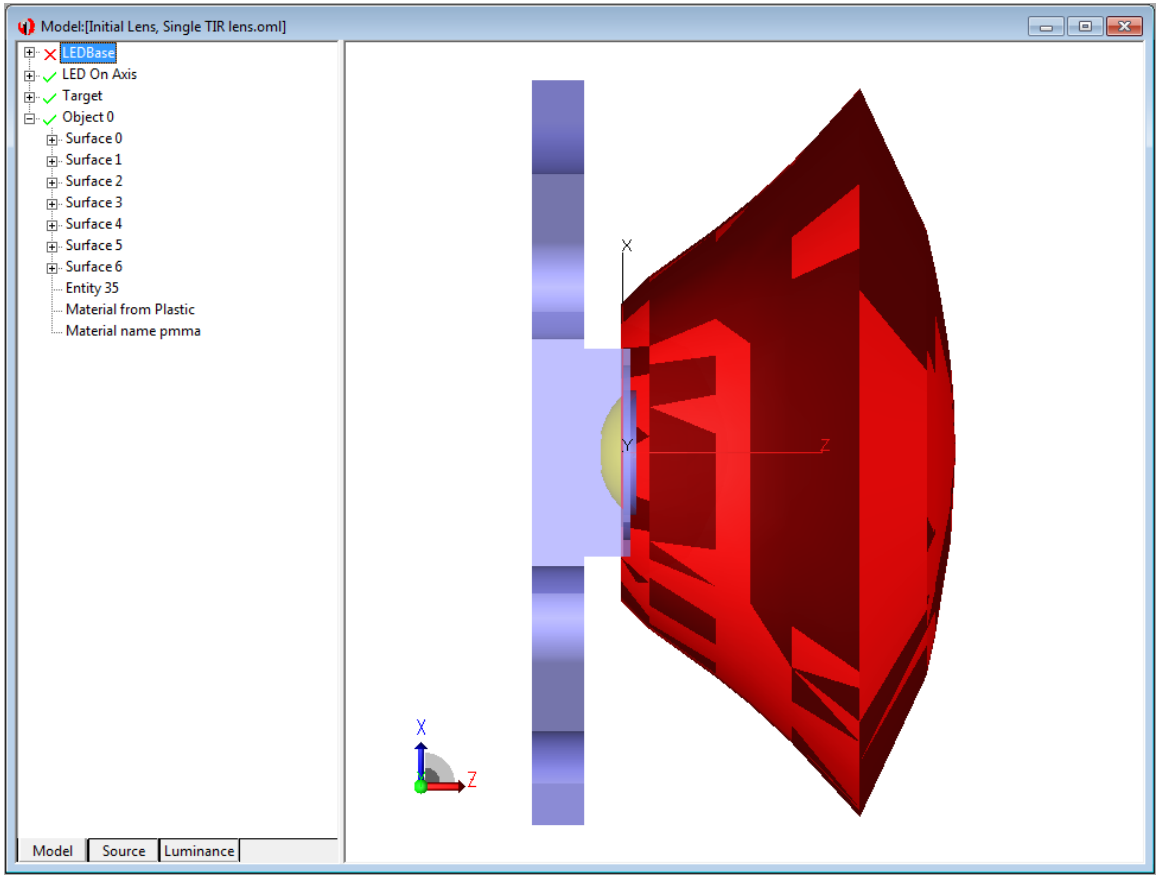
The After-Scheme option in the Interactive Optimizer allows you to run Scheme macros as part of the optimization process. In this case the Scheme macro creates the space for the LED in the lens.

# Initial Lens Model in Interactive Optimizer



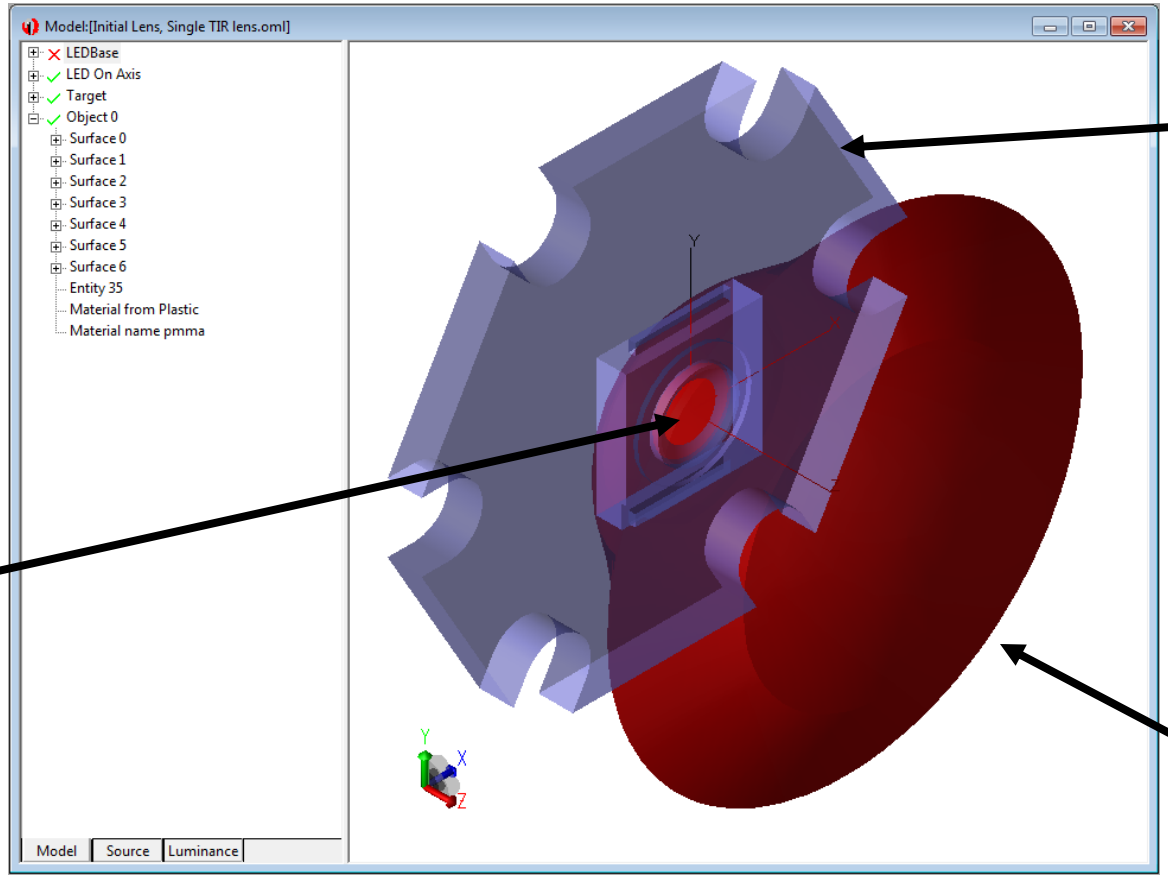

The After-Scheme option in the Interactive Optimizer allows you to run Scheme macros as part of the optimization process. In this case the Scheme macro creates the space for the LED in the lens.

# Initial Model in TracePro



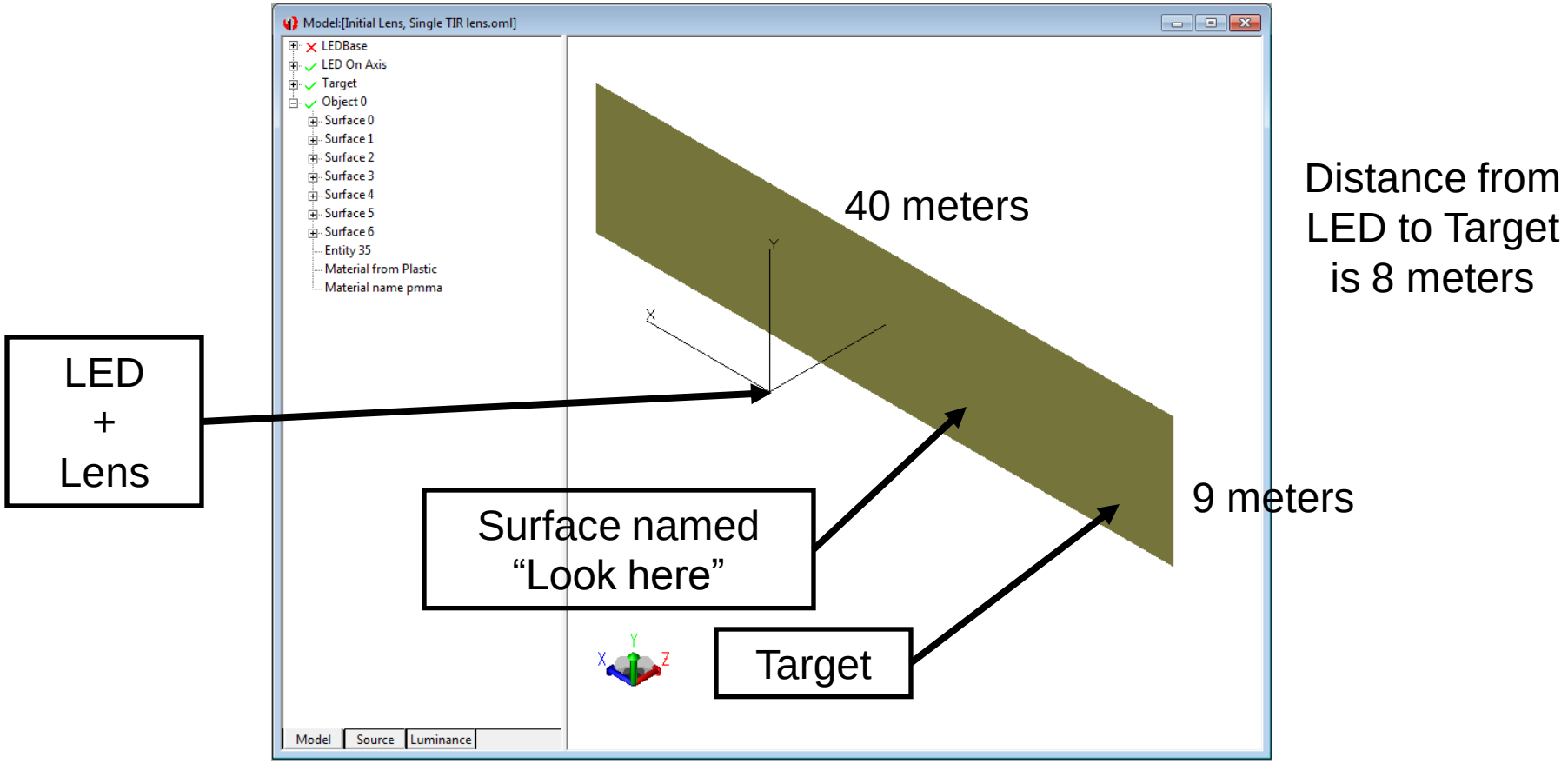

Export the initial lens design from the Interactive Optimizer and use that to set-up the model in TracePro

# Initial Model in TracePro



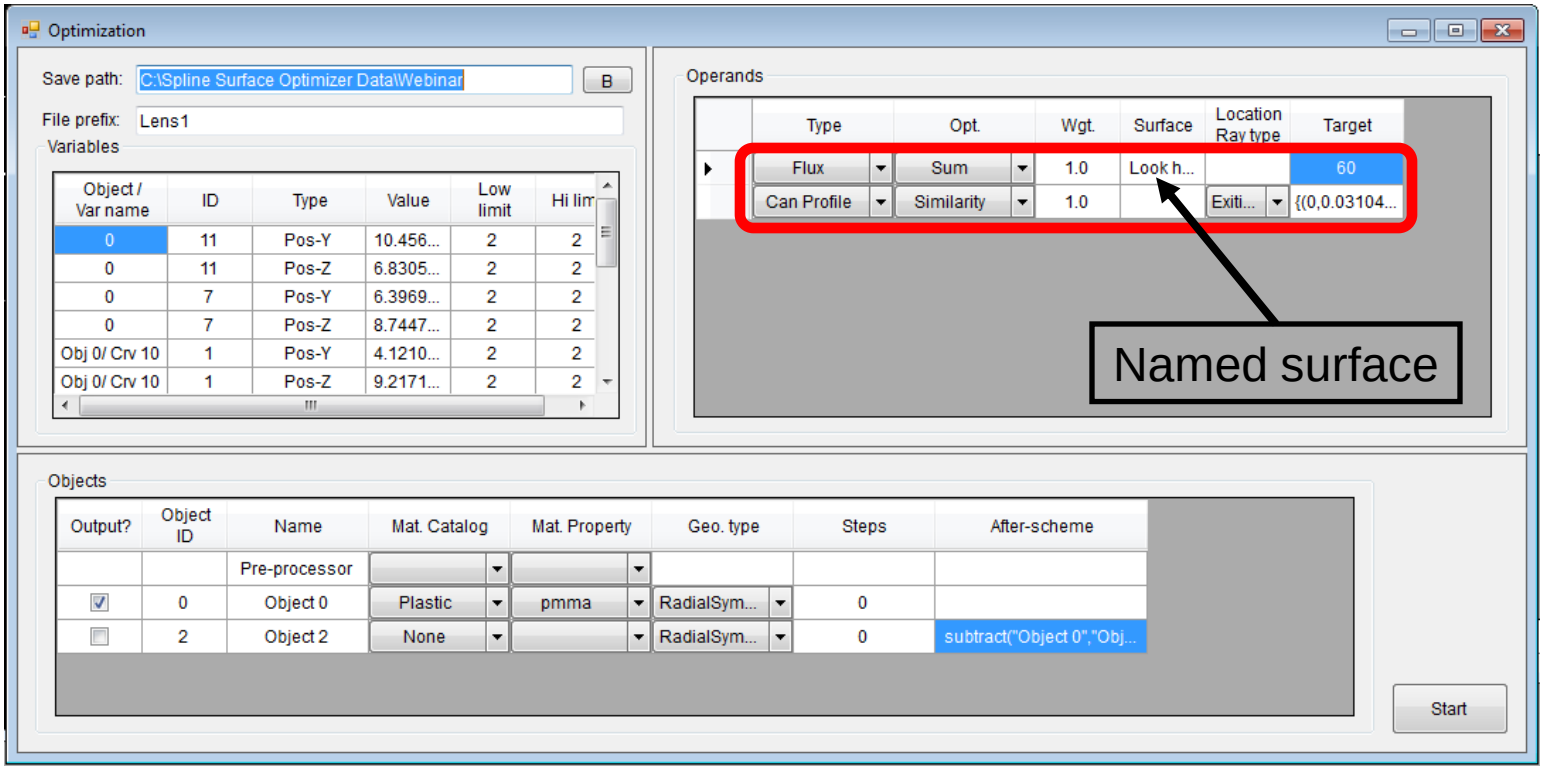

Insert model for LED and place Surface Source Property with LED properties on the appropriate surface to create the light source.

# Initial Model in TracePro



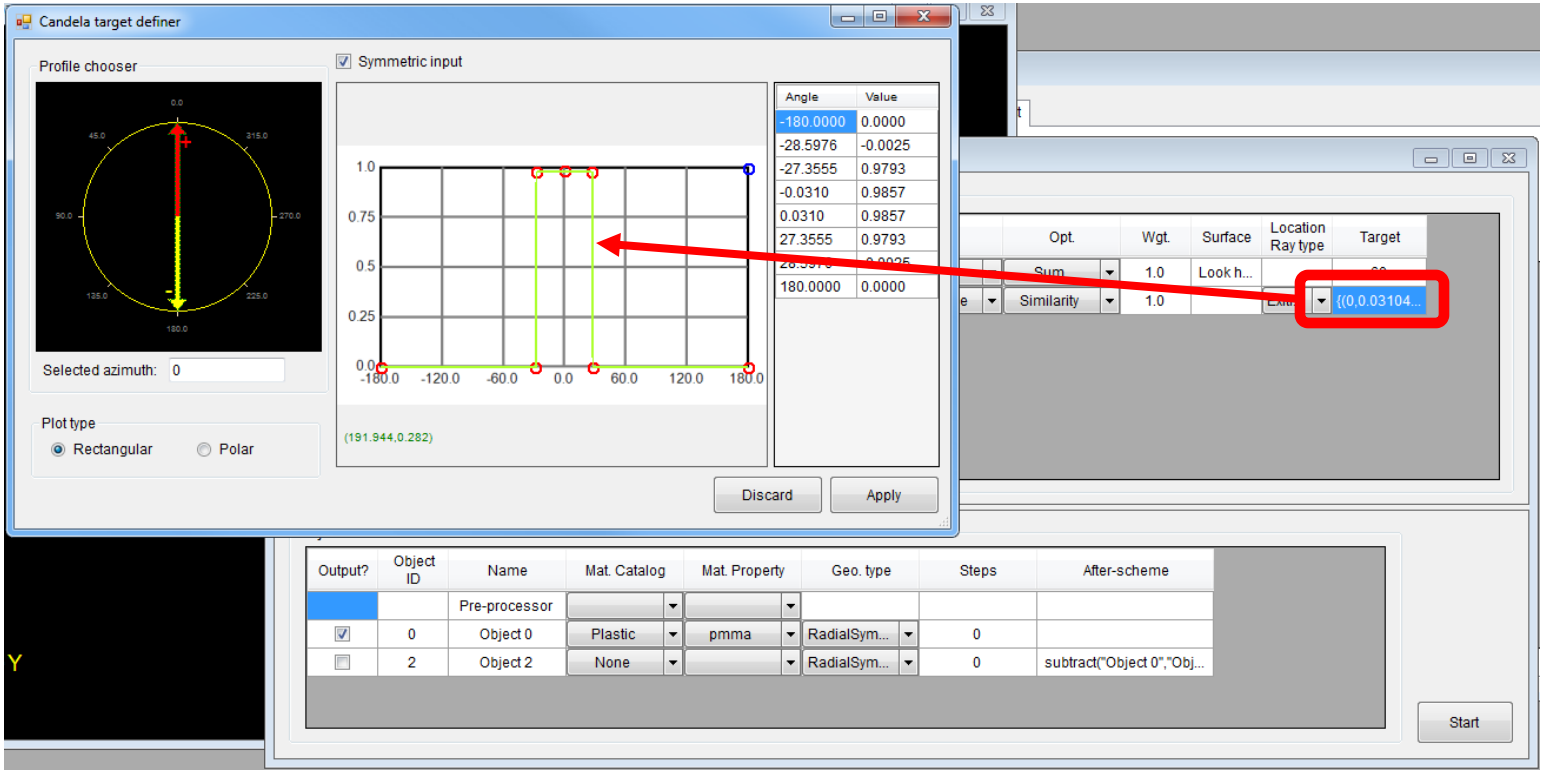

Insert Target surface. Name the surface facing the LED/Lens. This surface will be the one used by the optimizer to calculate results.

# Define Optimization Goals and Targets



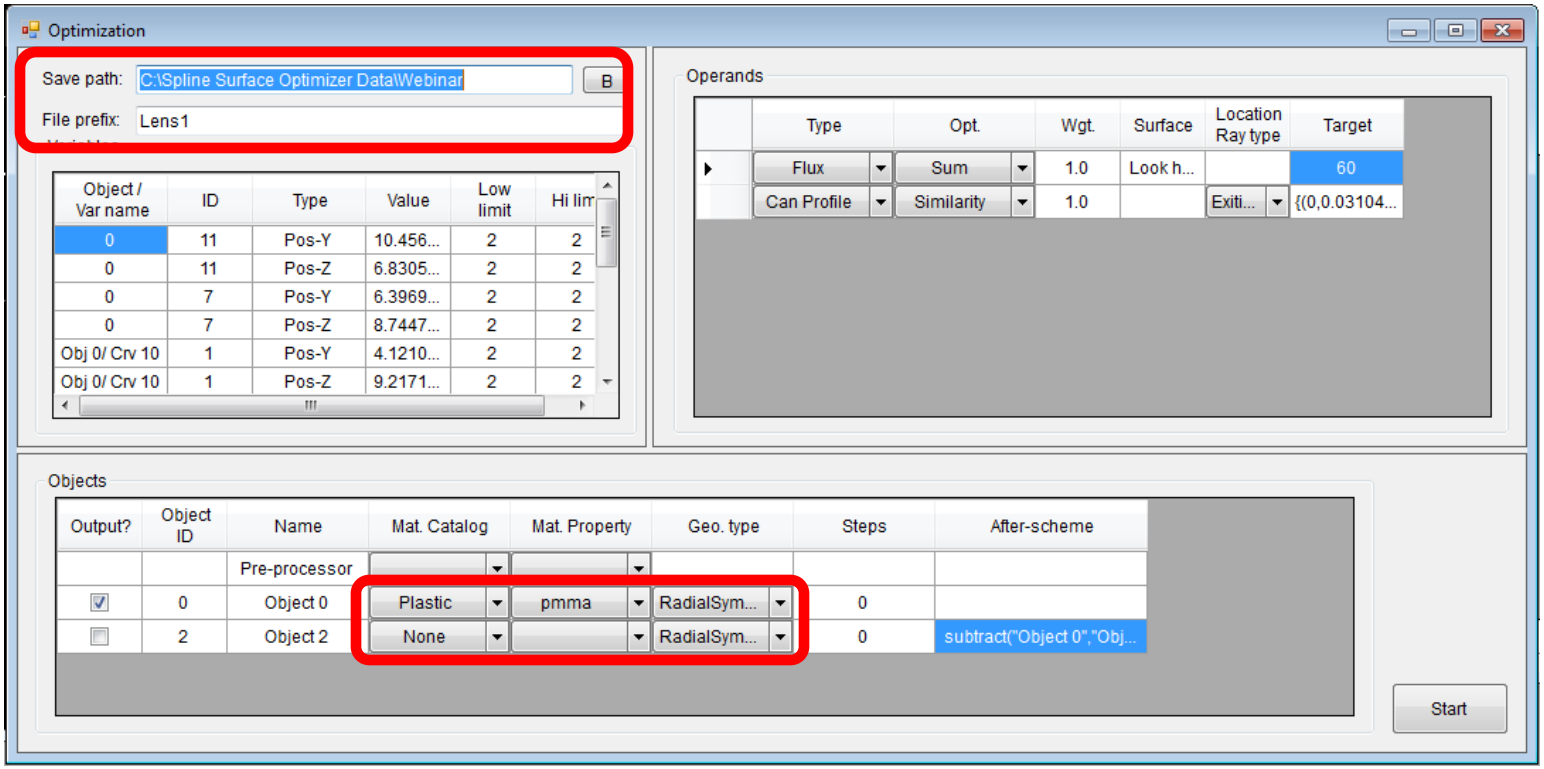

Define 2 optimization targets, equally weighted. The first is for Flux on the “Look here” surface. This is set to 60 lumens, the maximum output of the LED.

# Define Optimization Goals and Targets



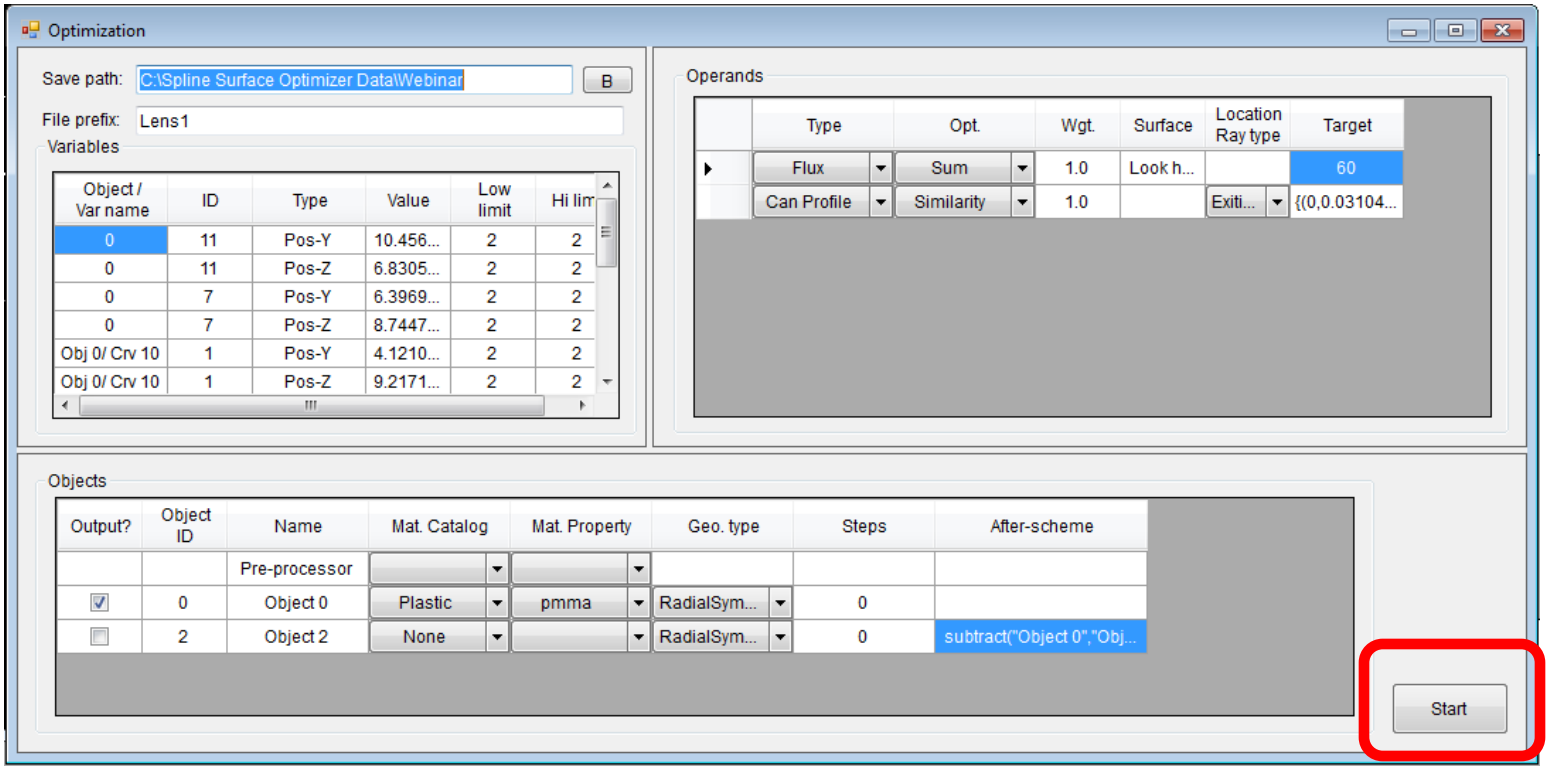

The second optimization target is a Candela Profile. The Candela Profile target is set to a 30-degree beam in this case.

# Define Optimization Goals and Targets



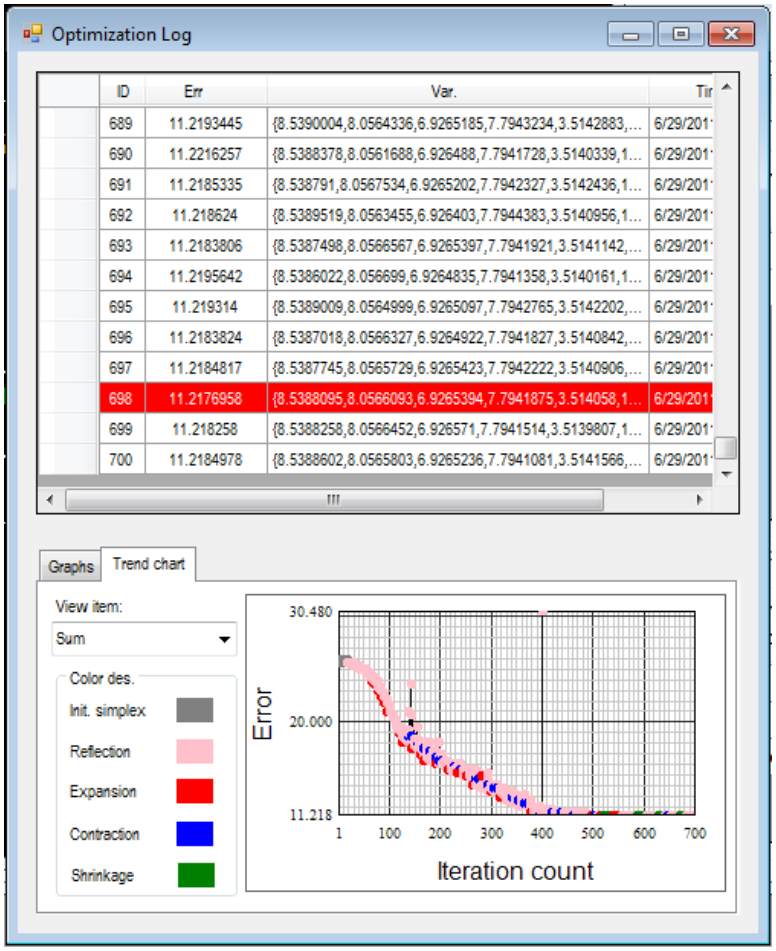

Define the file paths for saving the results as well as the Material Property for the lens and the Geometry type.

# Optimize the Lens in the Interactive Optimizer



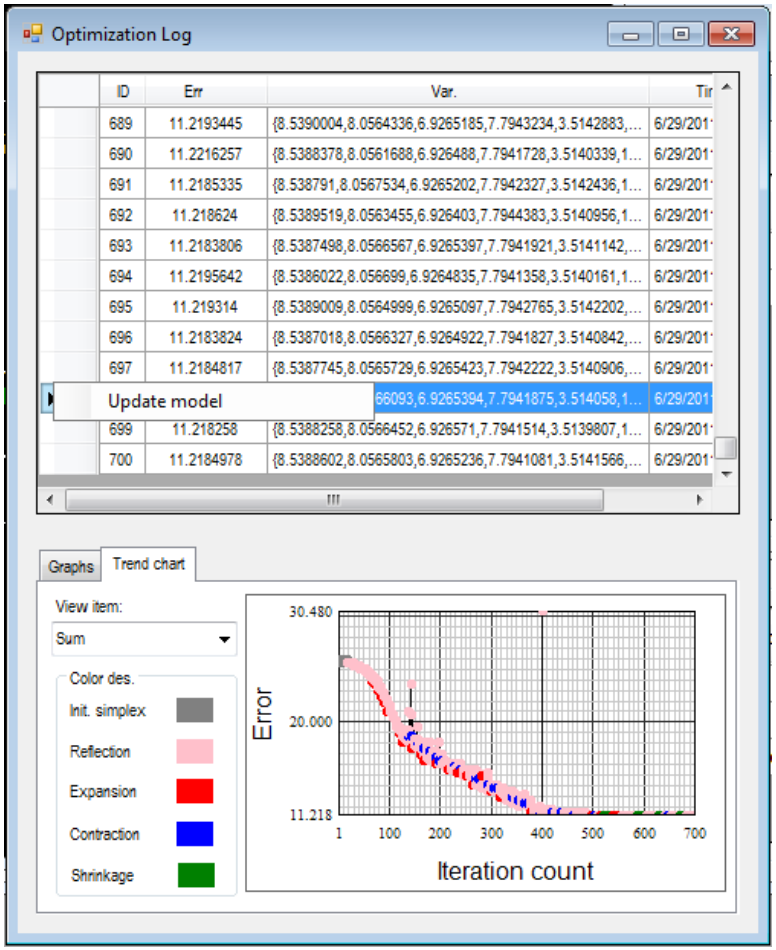

Start the optimization.

# Optimize the Lens in the Interactive Optimizer



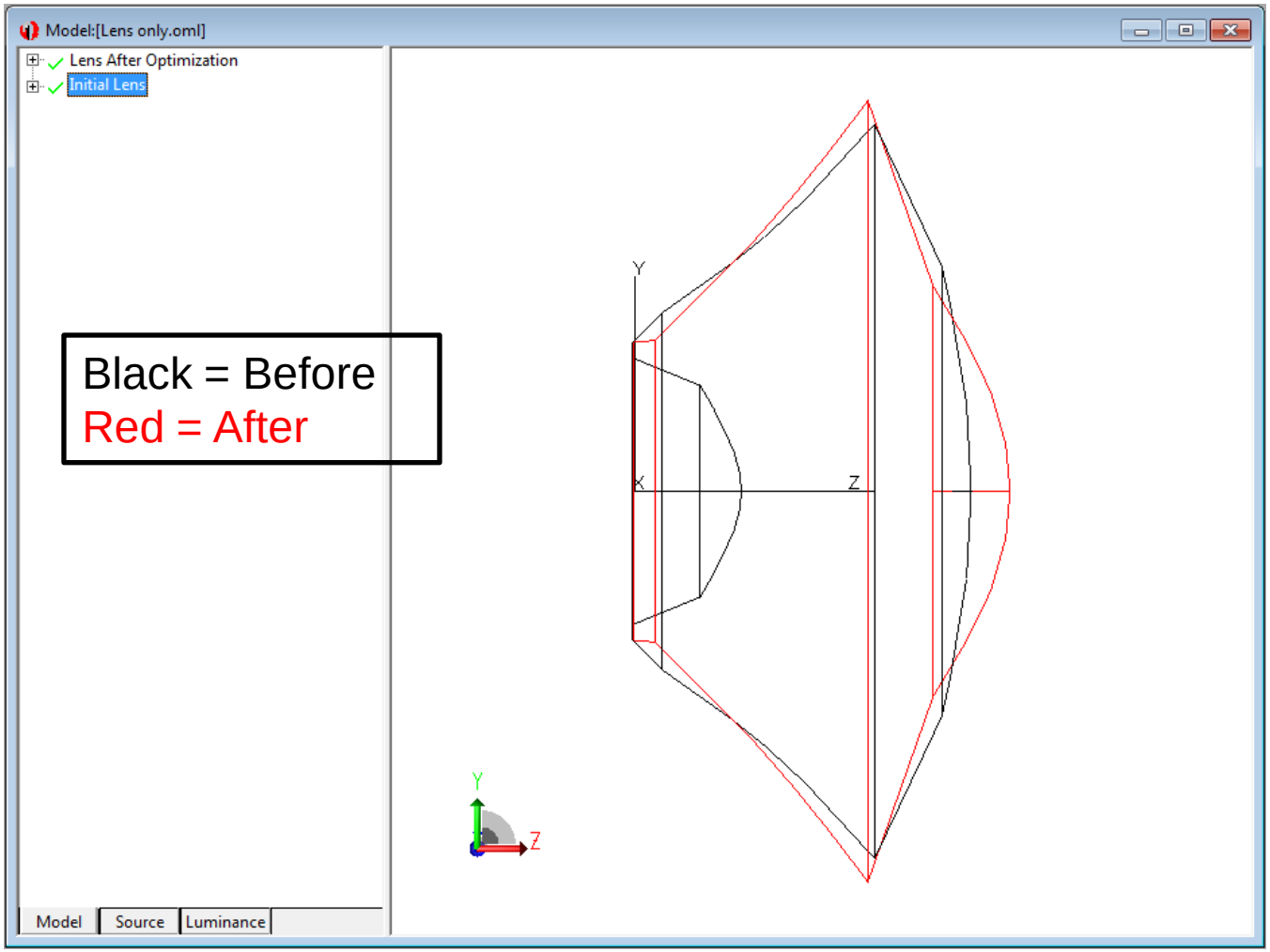

Optimization Log for lens optimization. 700 iterations run, about 30-seconds per iteration. Total time approximately 6 hours.

# Optimize the Lens in the Interactive Optimizer



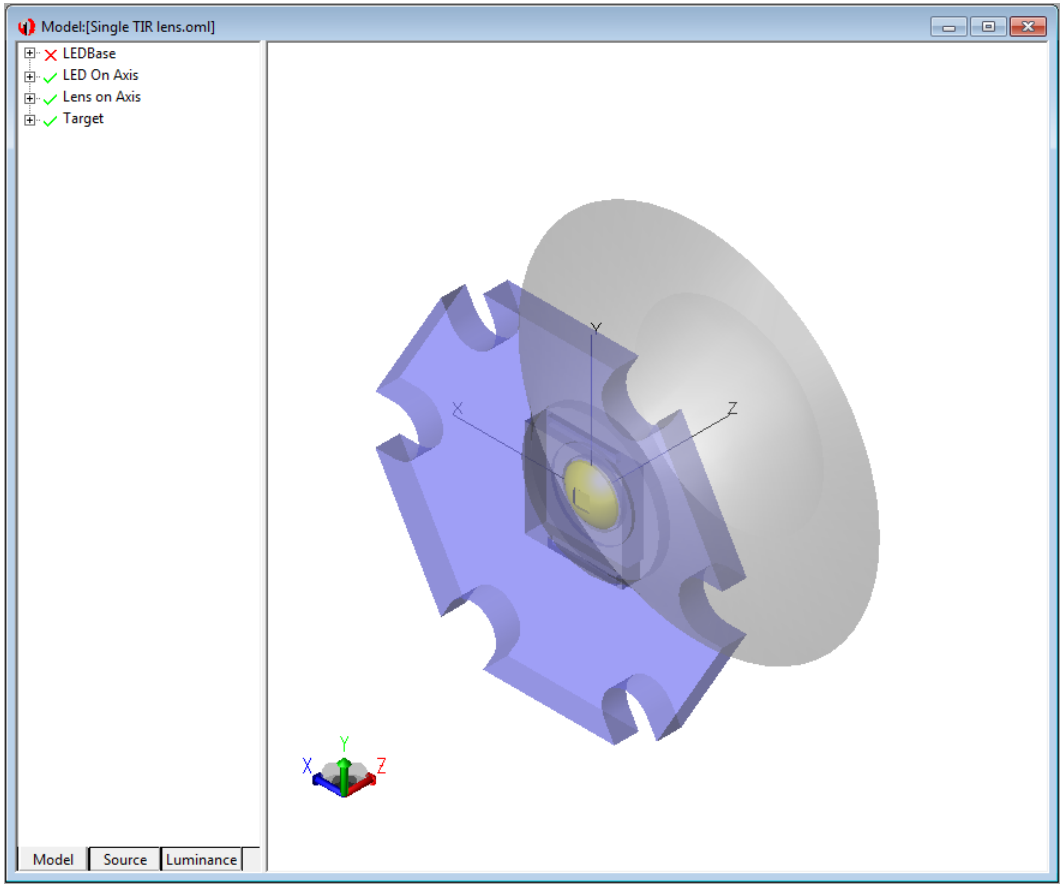

Export the optimized lens design to TracePro

# Optimize the Lens in the Interactive Optimizer



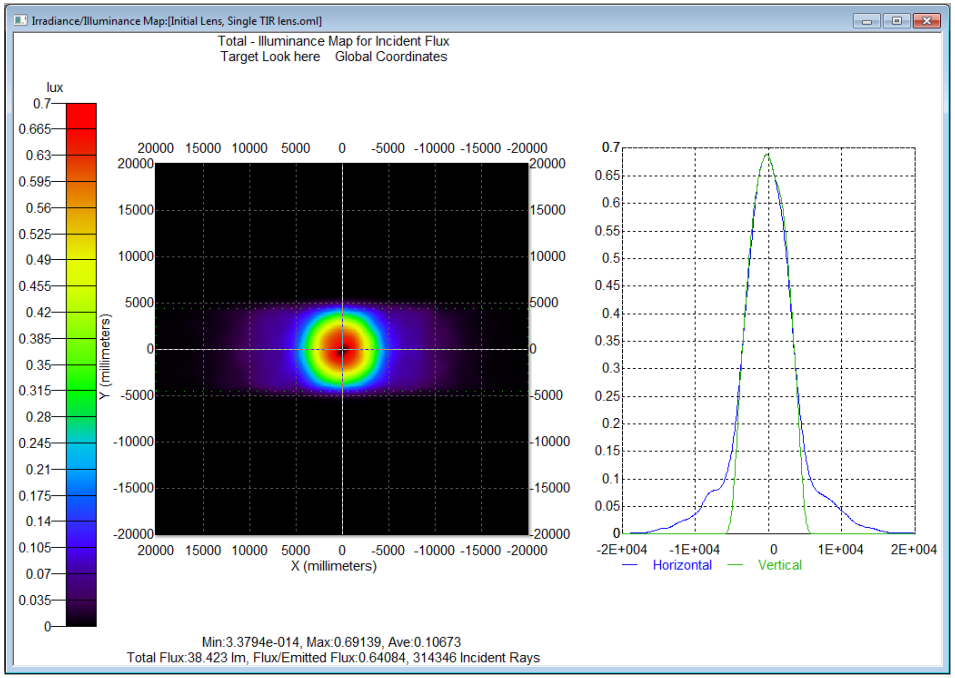

Lens Design Before and After Optimization

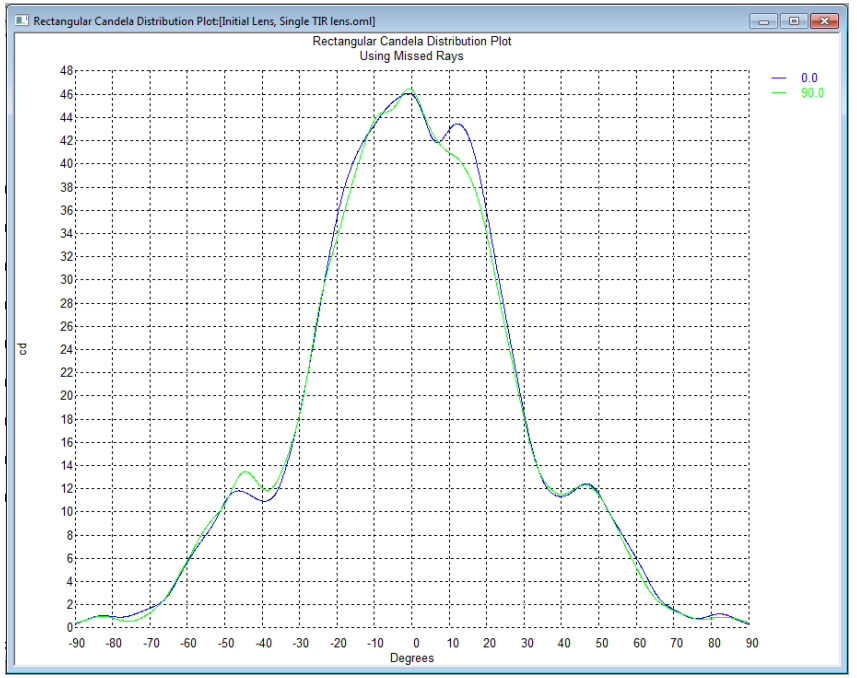
# Analyze the Results in TracePro




Single LED centered on target.

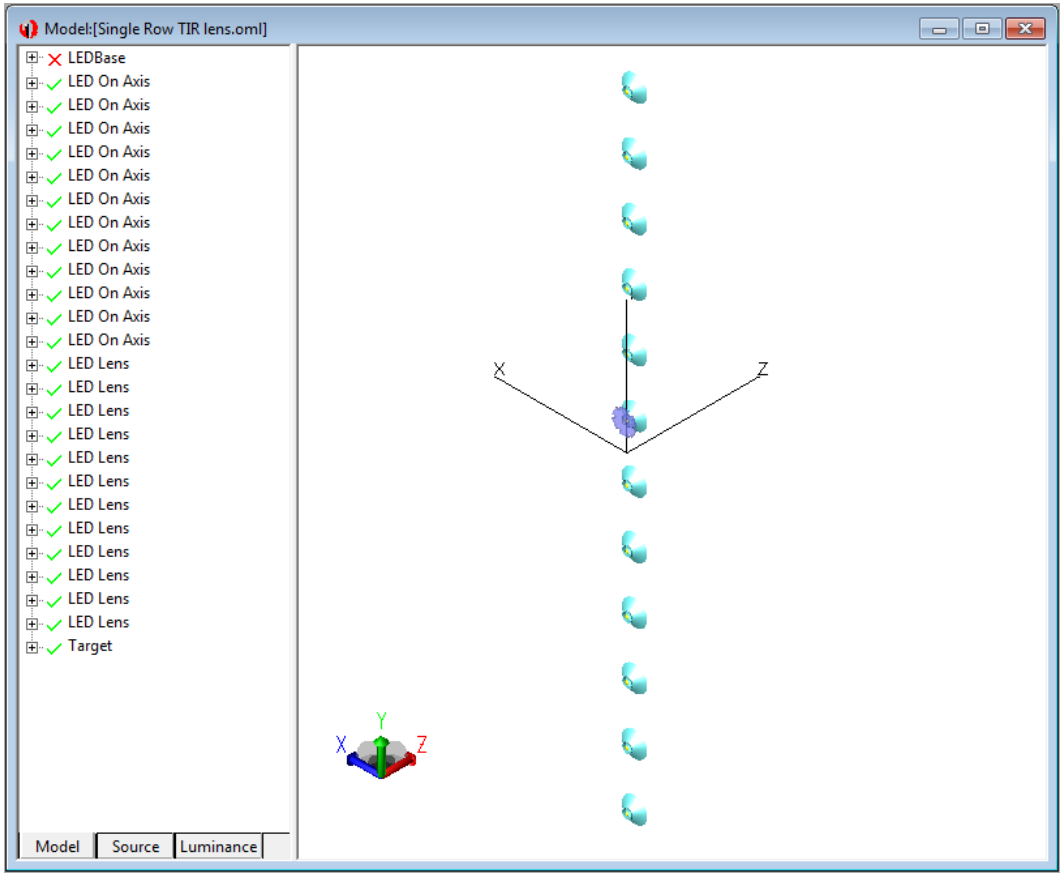
# Analyze the Results in TracePro



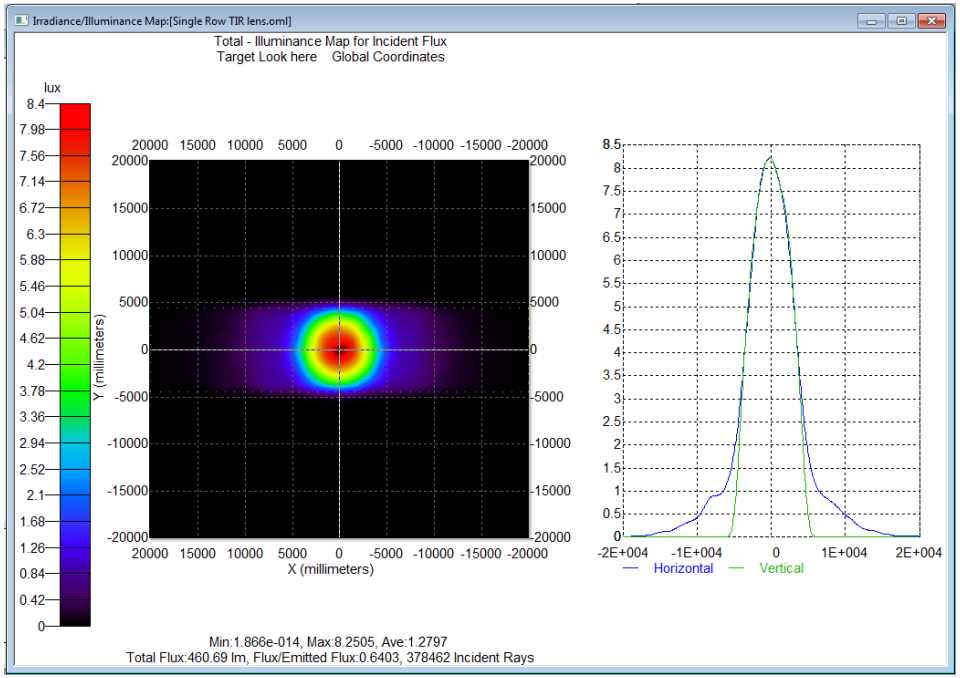

Irradiance Map and Candela Plot of Single LED and Lens.

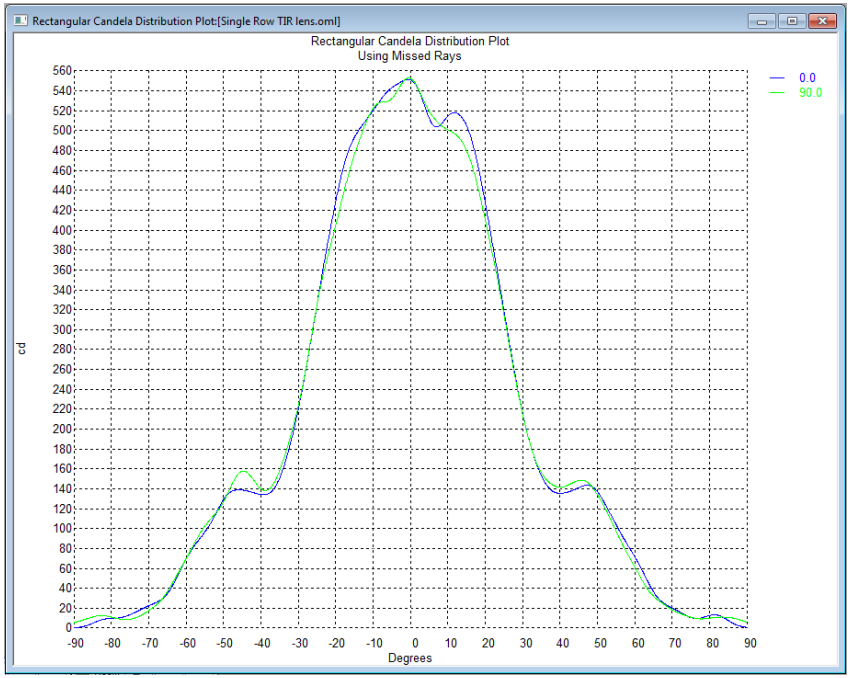
# Analyze the Results in TracePro




Single column of 12-LEDs and Lenses.
Axis of the column is along the narrow 9 meter side of the target, centered on the 40 meter side.

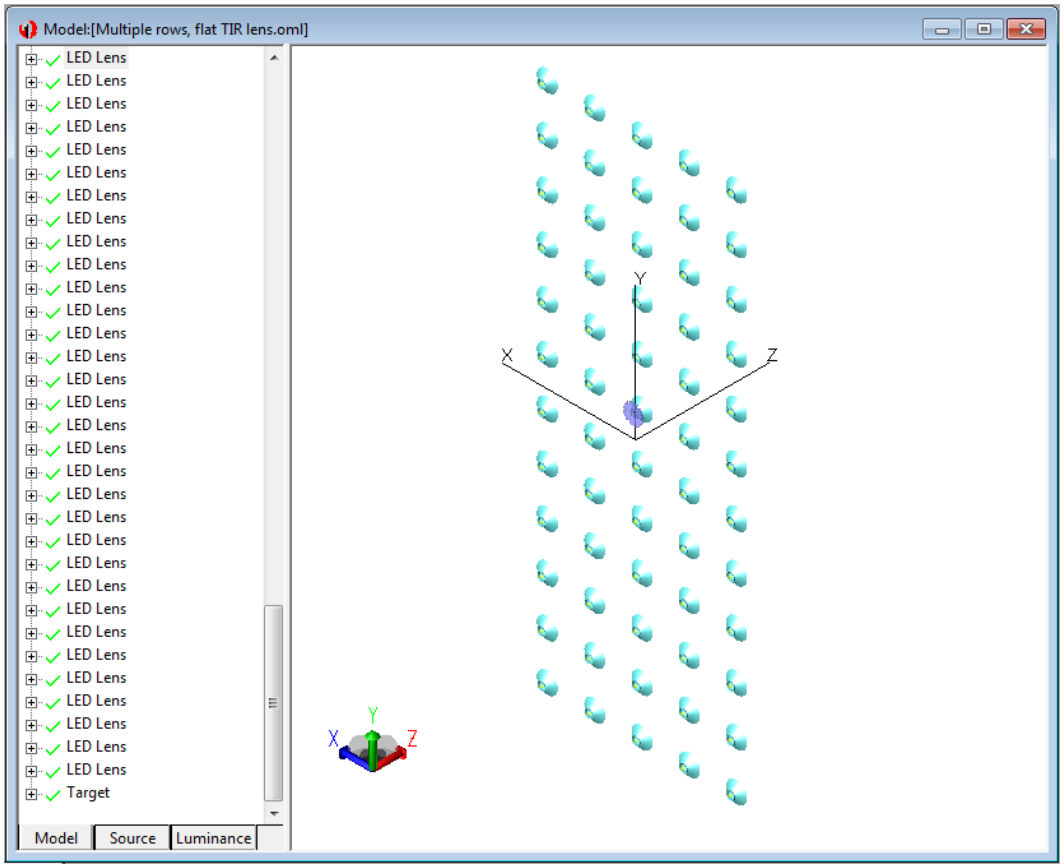
# Analyze the Results in TracePro



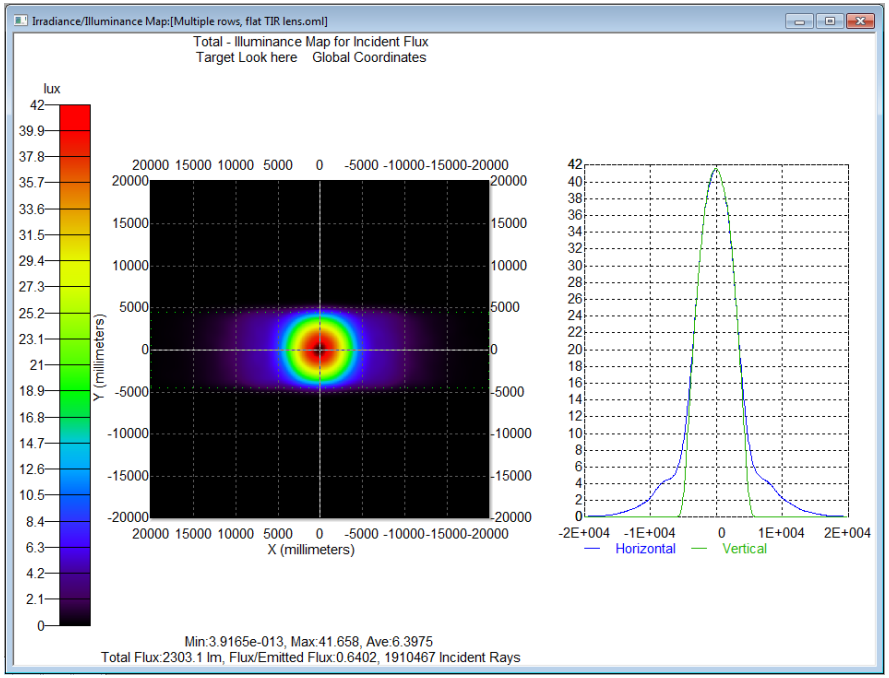

Irradiance Map and Candela Plot of single column of 12 LEDs and Lenses.

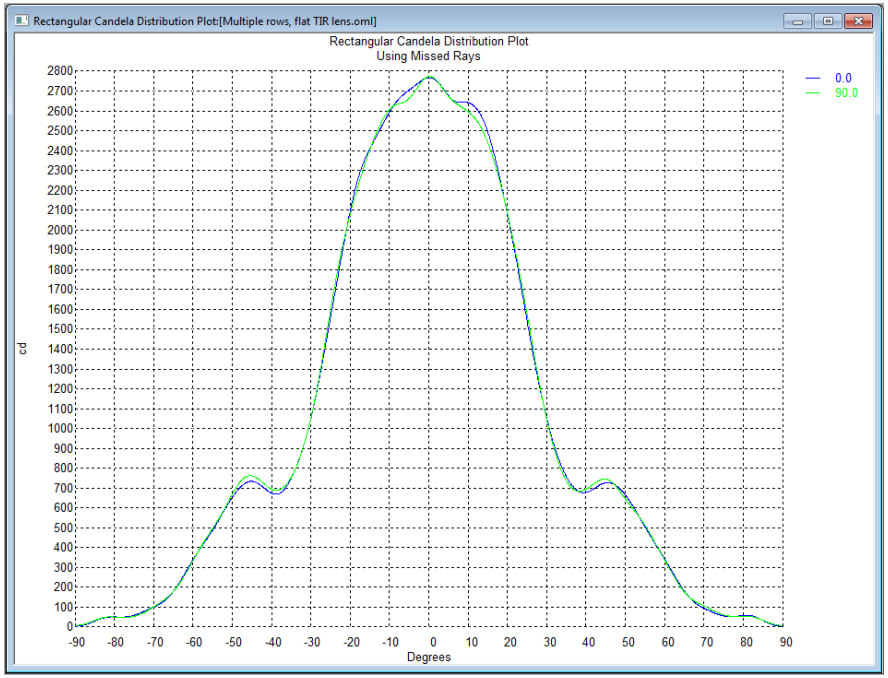
# Analyze the Results in TracePro




5 rows of 12 LEDs and Lenses in a column. Linear spacing on the rays.

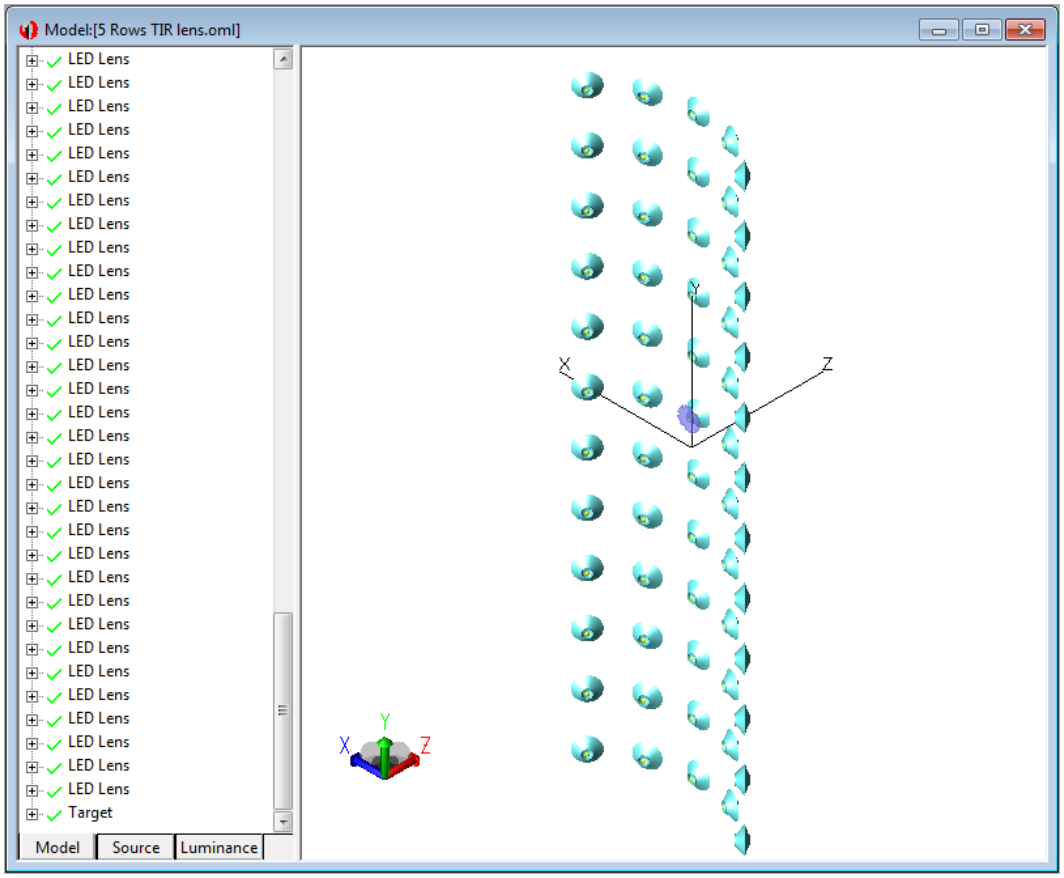
# Analyze the Results in TracePro



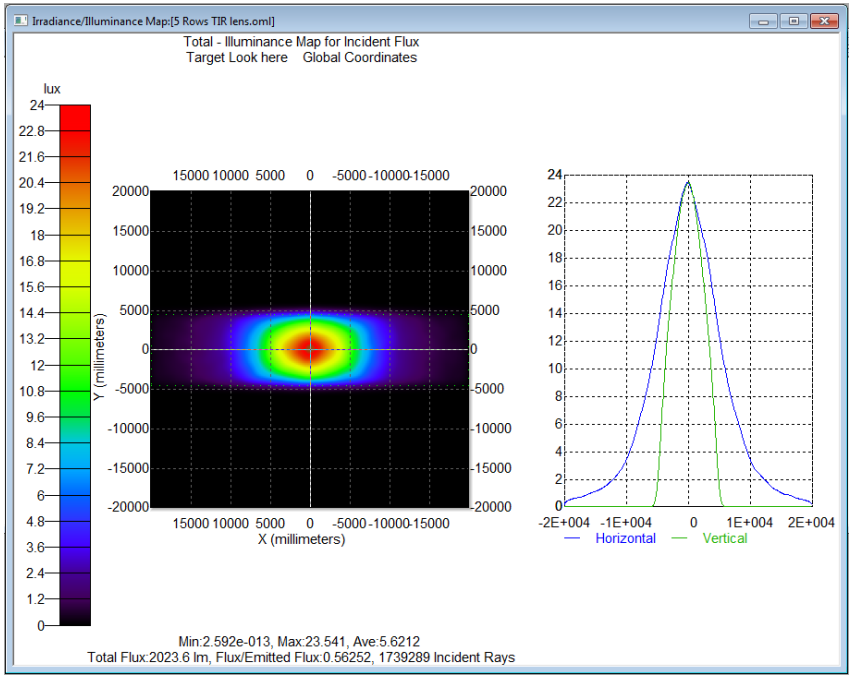

Irradiance Map and Candela Plot of 5 rows of 12 LEDs and Lenses in a column. Each column is spaced linearly.

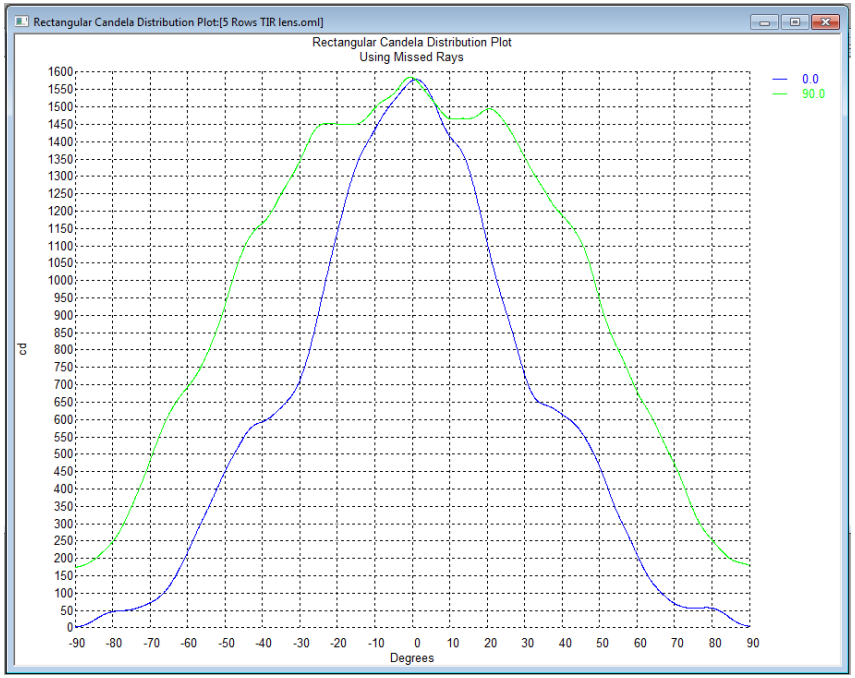
# Analyze the Results in TracePro




5 rows of 12 LEDs and Lenses in a column. Each column is rotated with respect to the center column.

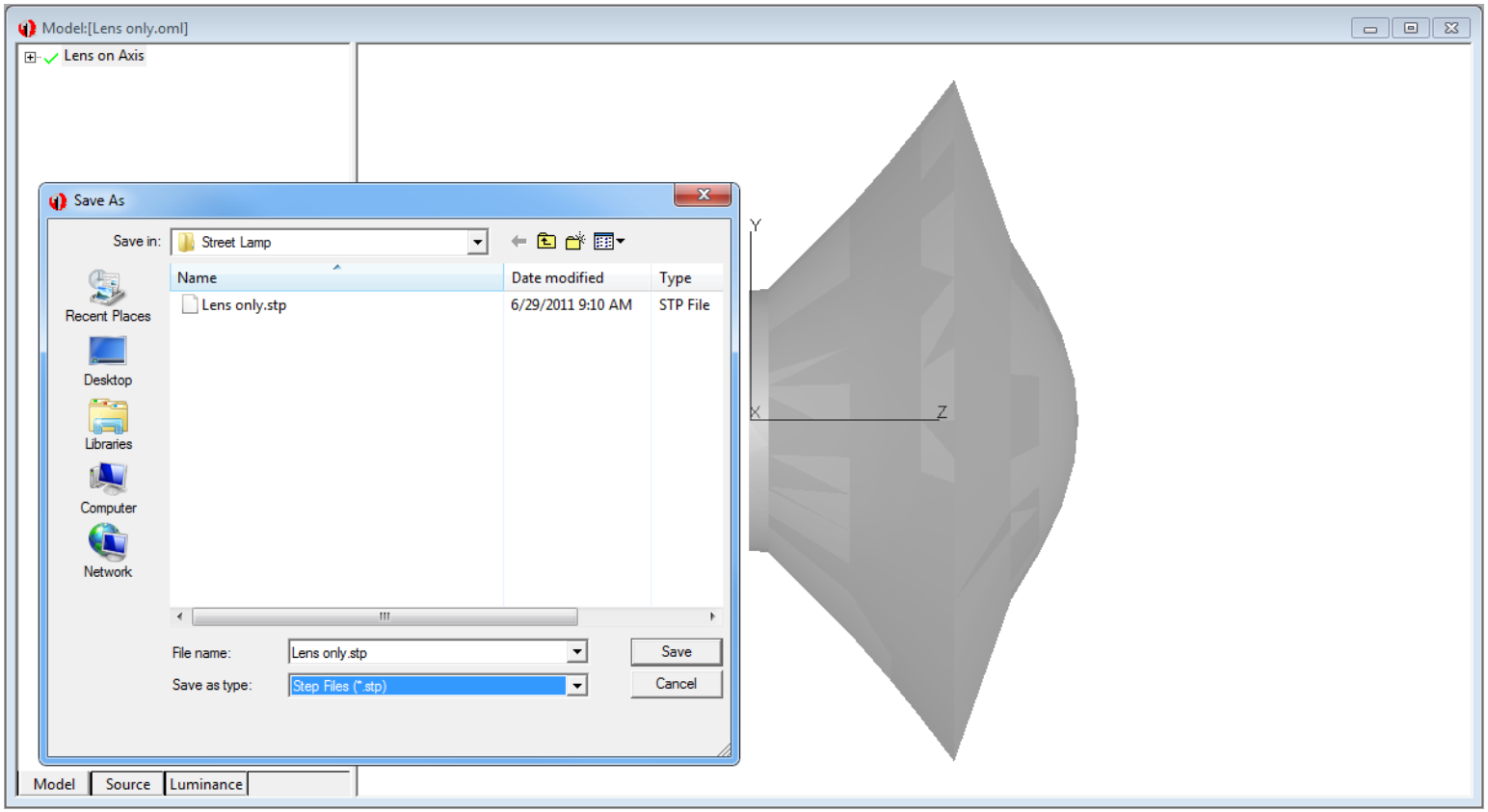
# Analyze the Results in TracePro



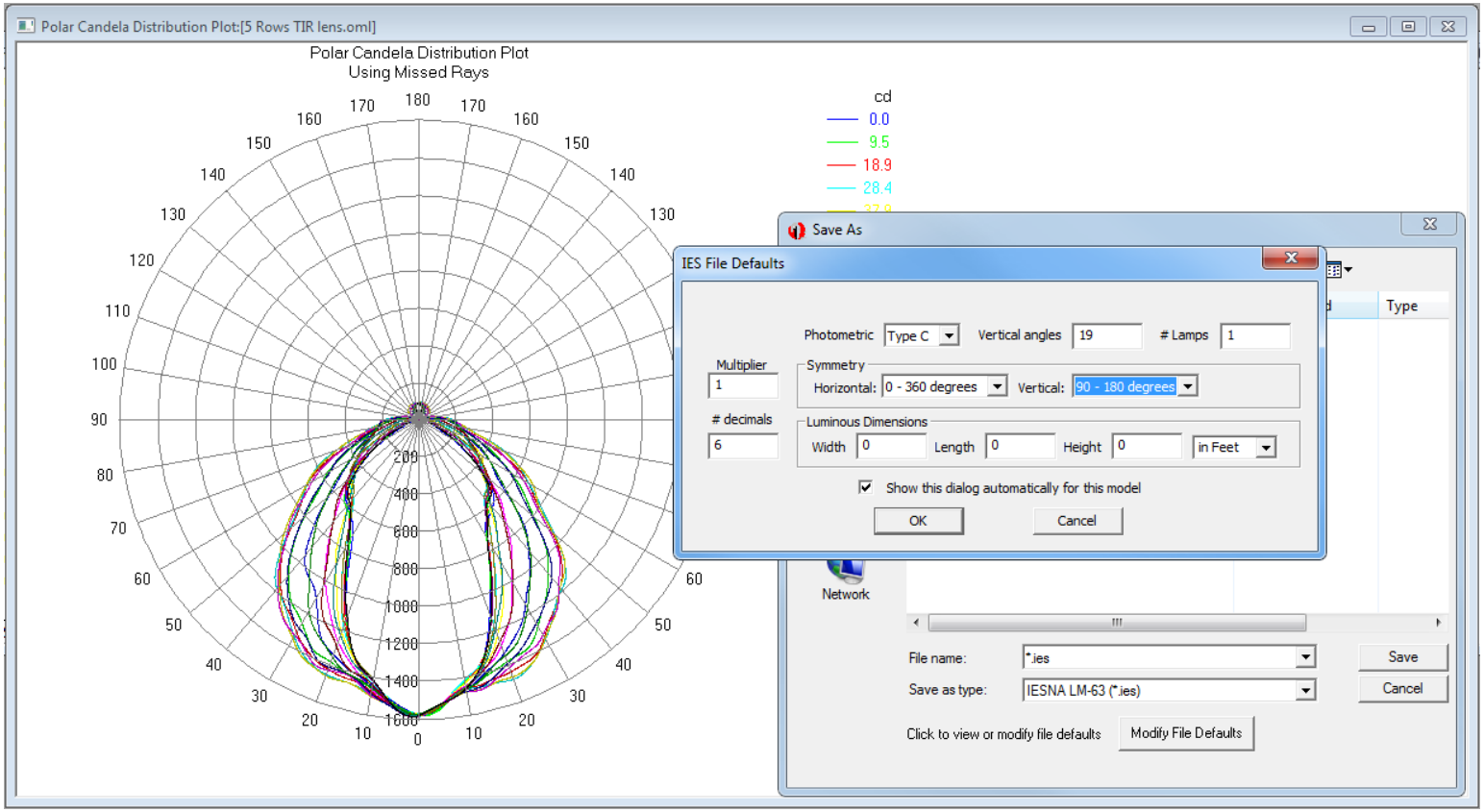

Irradiance Map and Candela Plot of 5 rows of 12 LEDs and Lenses in a column. Each column is rotated with respect to the center column.

# Output the Design



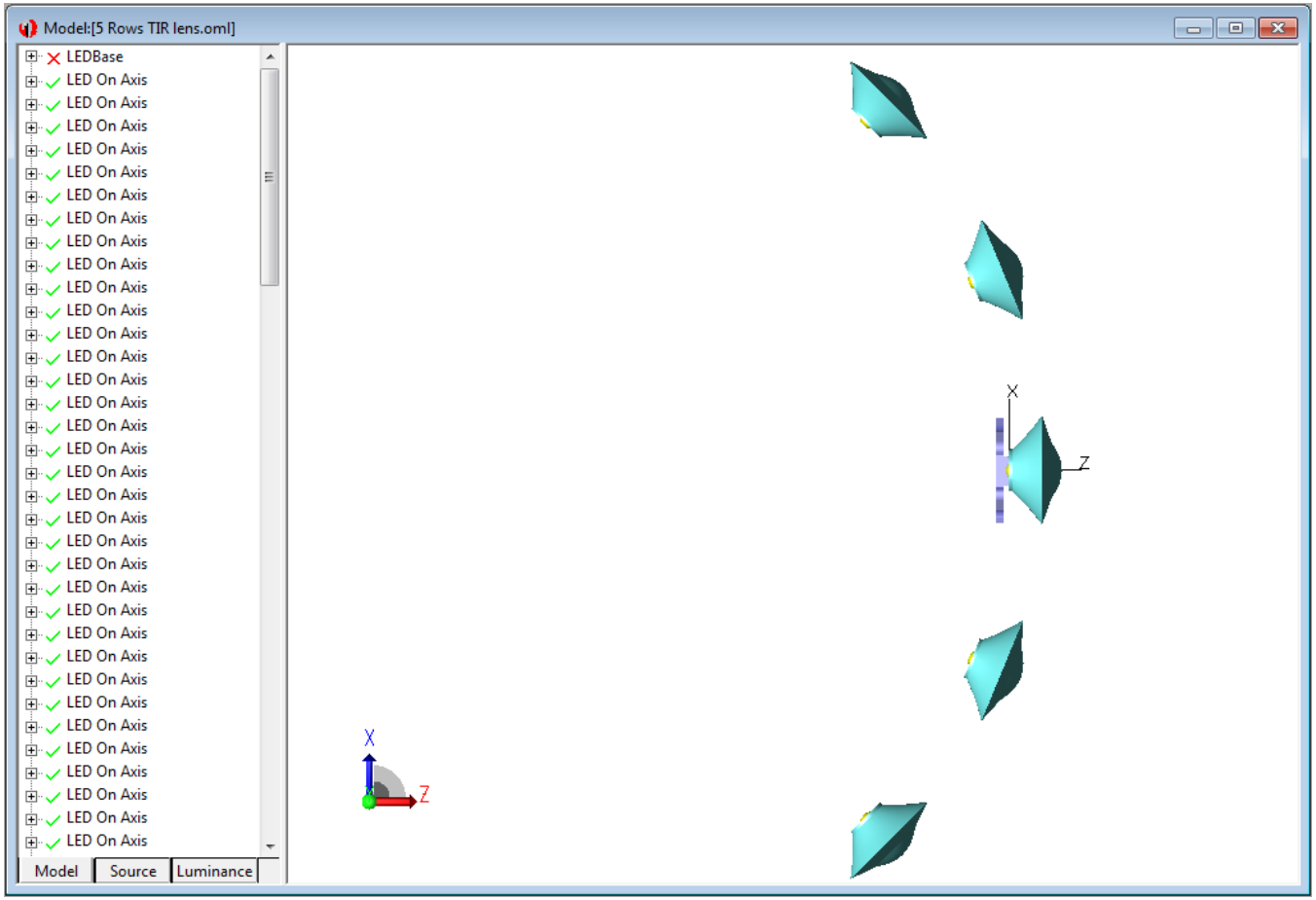

Generate CAD models, in SAT, STEP, or IGES file formats, of the lens for fabrication.

# Output the Design




Generate IES/LDT files in TracePro for use in other programs such as LITESTAR 4D from OxyTech.

# Using Interactive Optimizer and the Scheme Macro Language to Optimize Position




A Scheme Macro run through the Interactive Optimizer can be used to find the optimal angular separation for the columns of LEDs.

# Additional Resources

- Past TracePro Webinars available at http://www.lambdares.com/webinars/
  - February 2010, Interactive Optimizer
  - March 2010, Interactive Optimizer
  - July 2010, Modeling Light Sources in TracePro
  - September 2010, Interactive Optimizer
  - October 2010, Using IES and Eulumdat Files in TracePro
  - February 2011, Design Verification and Analysis Tools in TracePro
- Tutorial Videos available at http://www.lambdares.com/videos/
  - Making an LED Surface Property

# Acknowledgements

We would like to thank the AMOC of Hong Kong Polytechnics University for providing the initial design for this luminaire.

# Special Offers

## Special Offer #1

$1000 USD off the price of the TracePro Bridge for SolidWorks

## Special Offer #2

Save 50% on back maintenance and support.

Contact your local sales representative for full details.

Offers valid May 1st – July 31st, 2011

# Thank You

# Questions and Answers

# For Additional Information Please Contact:

**Lambda Research Corporation**
**Littleton, MA**
**978-486-0766**
**www.lambdares.com**