Designing and Optimizing Reflectors with the TracePro 3D Interactive Optimizer

Presented by :

Lambda Research Corporation
25 Porter Rd.
Littleton, MA 01460

Presenter:

Dave Jacobsen

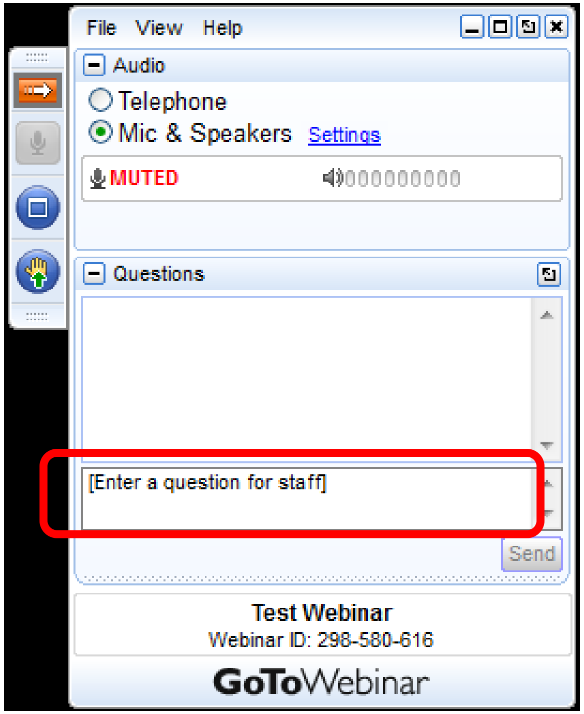
Senior Application Engineer

Lambda Research Corporation

Format

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

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



Additional Resources

- Past TracePro Webinars
  - http://www.lambdares.com/webinars/
- TracePro Tutorial Videos
  - http://www.lambdares.com/videos/
- TracePro Tutorials
  - http://www.lambdares.com/technical_support/tracepro/tutorials/
- Information on upcoming TracePro Training Classes
  - http://www.lambdares.com/technical_support/training/

Upcoming TracePro Training

- Jena, Germany
  - Introduction to TracePro – Sept. 17-18, 2013
  - **Advanced Topics with TracePro – Sept. 19, 2013**
- Littleton, MA USA
  - Introduction to TracePro – Sept. 30 – Oct. 1, 2013
  - **Optimization with TracePro – Oct. 2, 2013**
  - Stray Light Analysis Using TracePro – Oct. 3, 2013
  - Scheme Programming with TracePro – Oct. 4, 2013

Courses in **Bold** feature optimization with TracePro

Current TracePro Release

•**TracePro 7.3.5** – Released June 27, 2013

•This release can be downloaded by anyone with a current Maintenance and Support Agreement

•www.lambdares.com

TracePro

Lambda Research Corporation

Designing and Optimizing Reflectors with the TracePro 3D Interactive Optimizer

Webinar Topics

- Use a design goal to define the initial reflector in the TracePro 3D Interactive Optimizer

- Defining variables for the reflector to be optimized

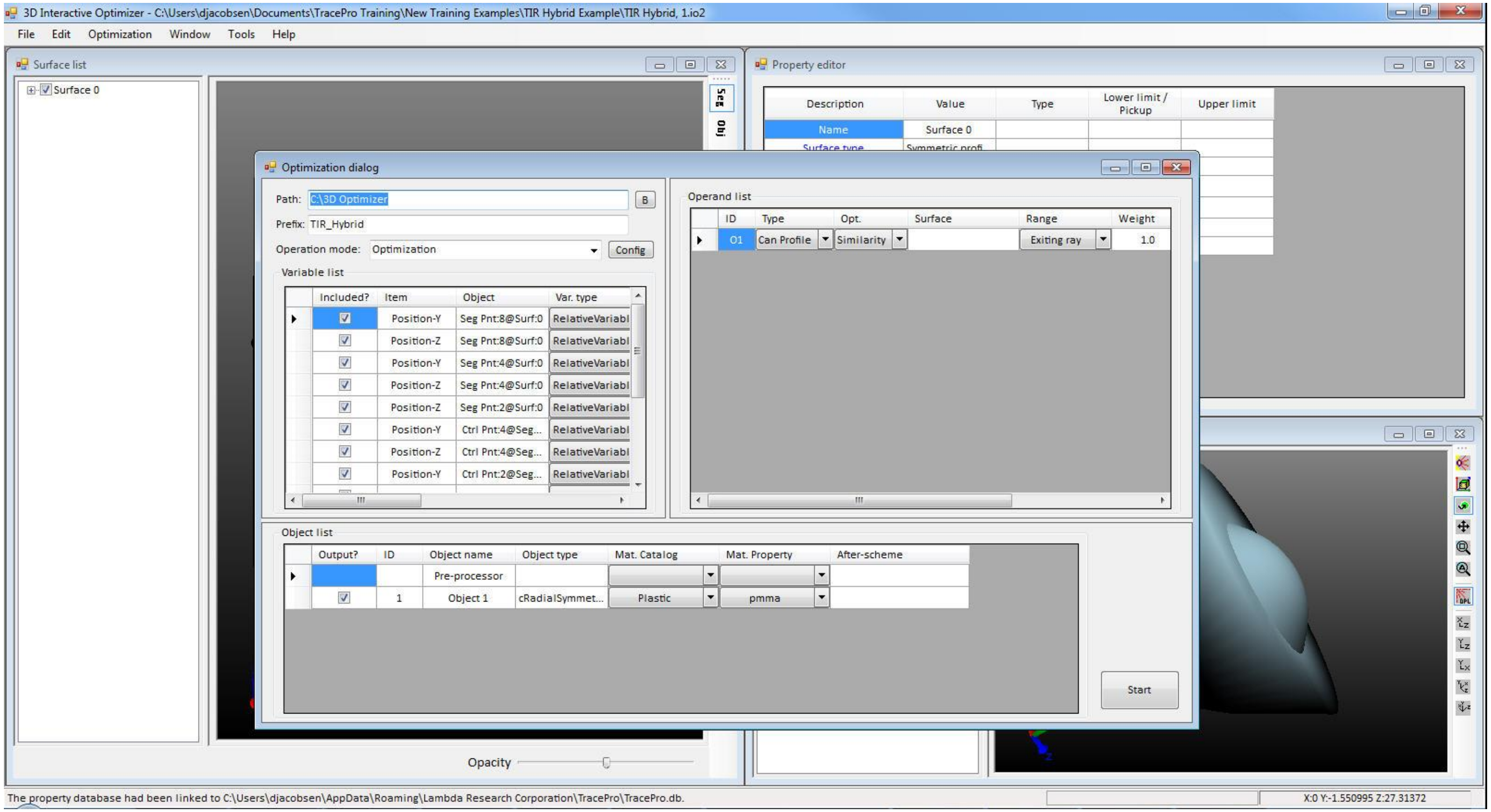
- Defining optimization targets or operands to define the goal of the optimization process

- Setting up the TracePro model including light sources and target objects

Webinar Topics

- Starting the optimization process
- How the optimization process works
- Reviewing the results
- Question and Answer session

The TracePro 3D Interactive Optimizer



TracePro

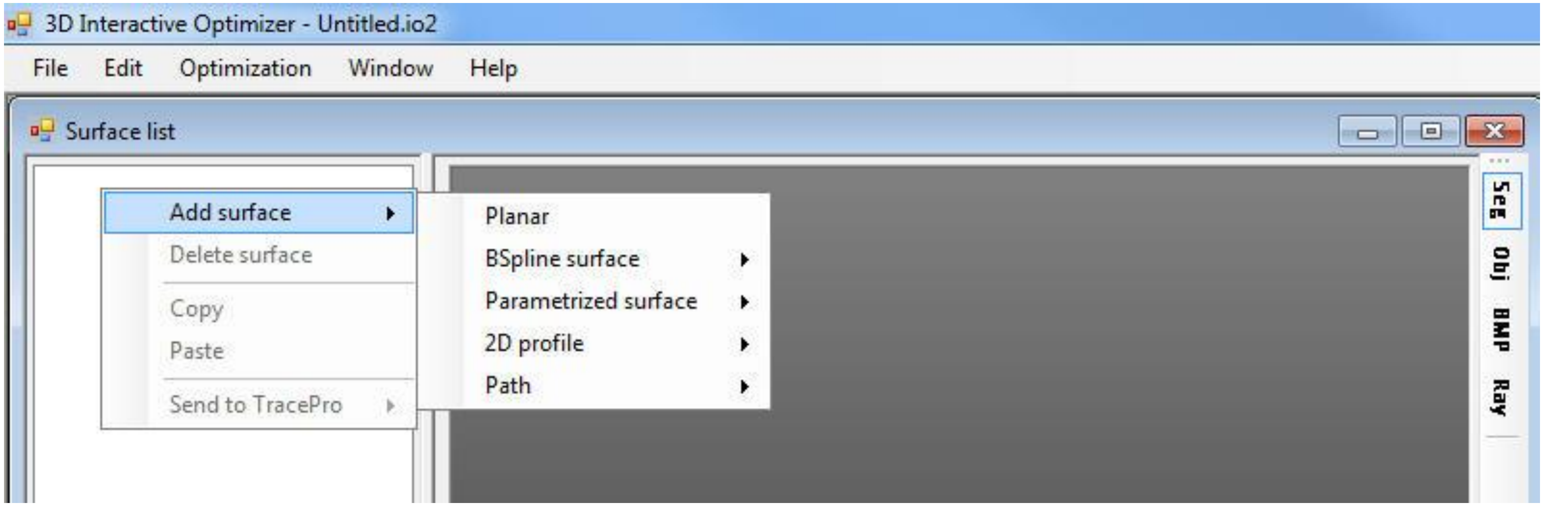
Lambda Research Corporation

The TracePro 3D Interactive Optimizer

- The 3D optimizer has 4 main windows:
  - Surface List window
  - Property Editor window
  - Object View window
  - Optimization window

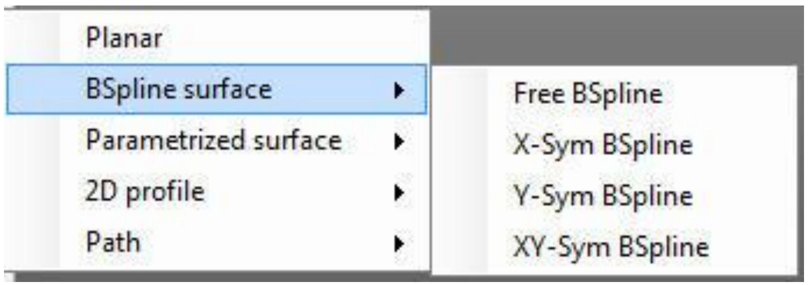
3D Interactive Optimizer - Surfaces

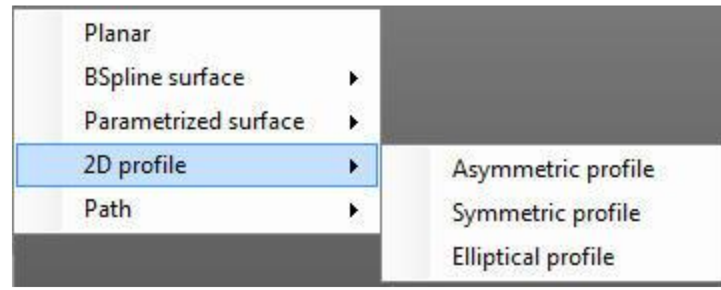
- Surface types available

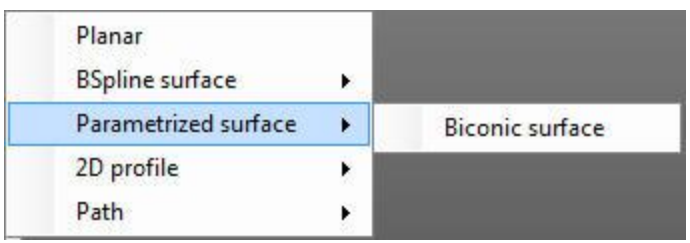


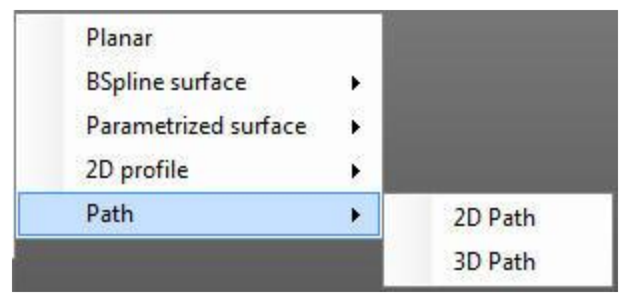
3D Interactive Optimizer - Surfaces

- Surface types available



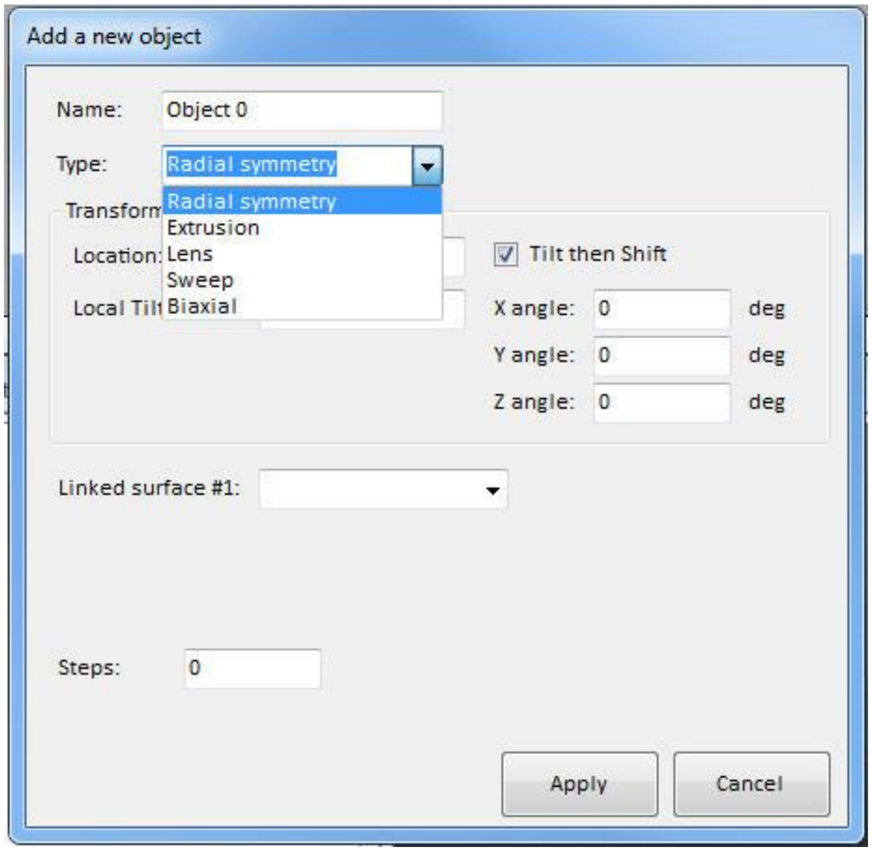






3D Interactive Optimizer - Objects

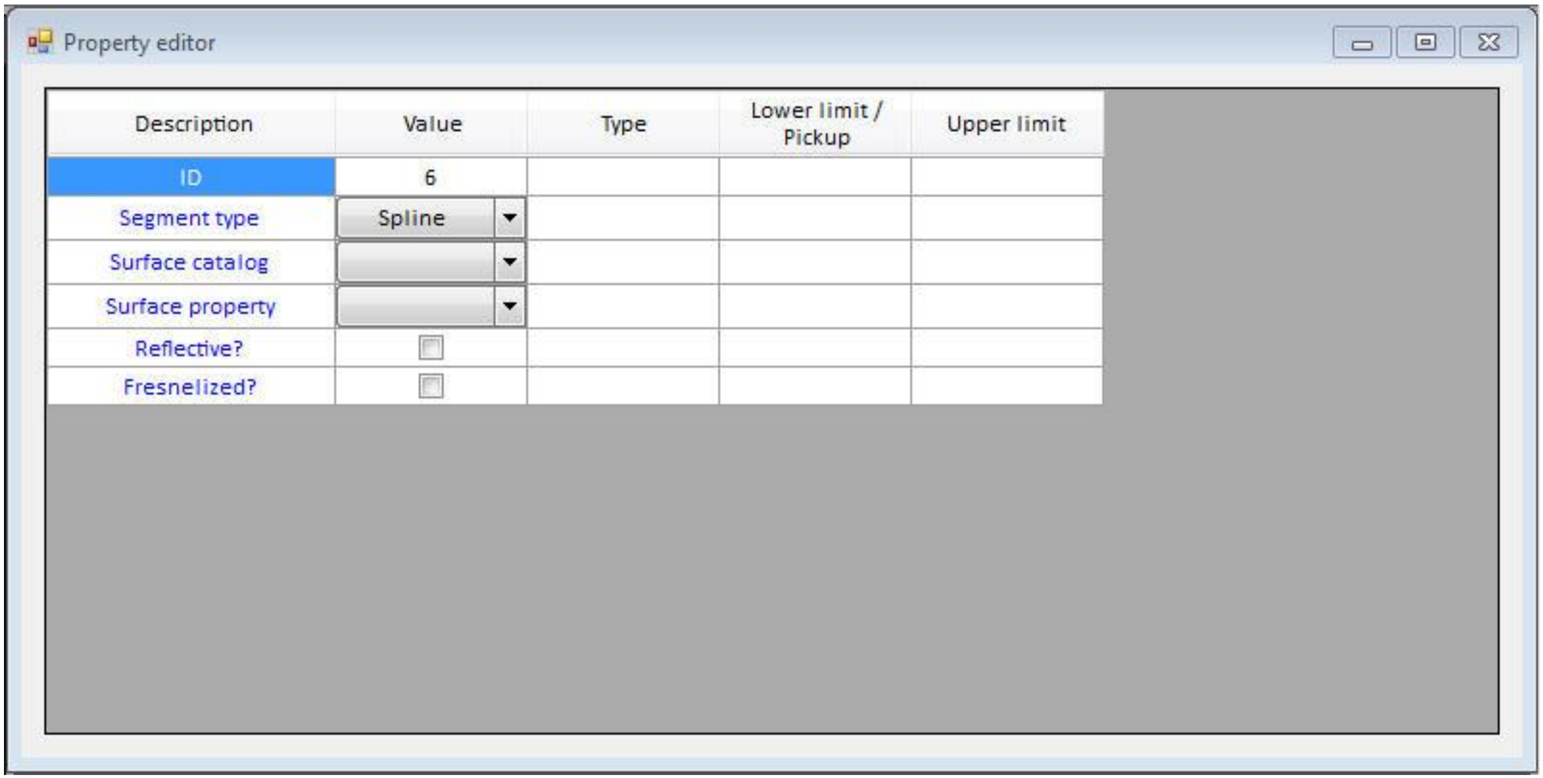
- Object types available



- Radial symmetry
- Extrusion
- Lens
- Sweep
- Biaxial

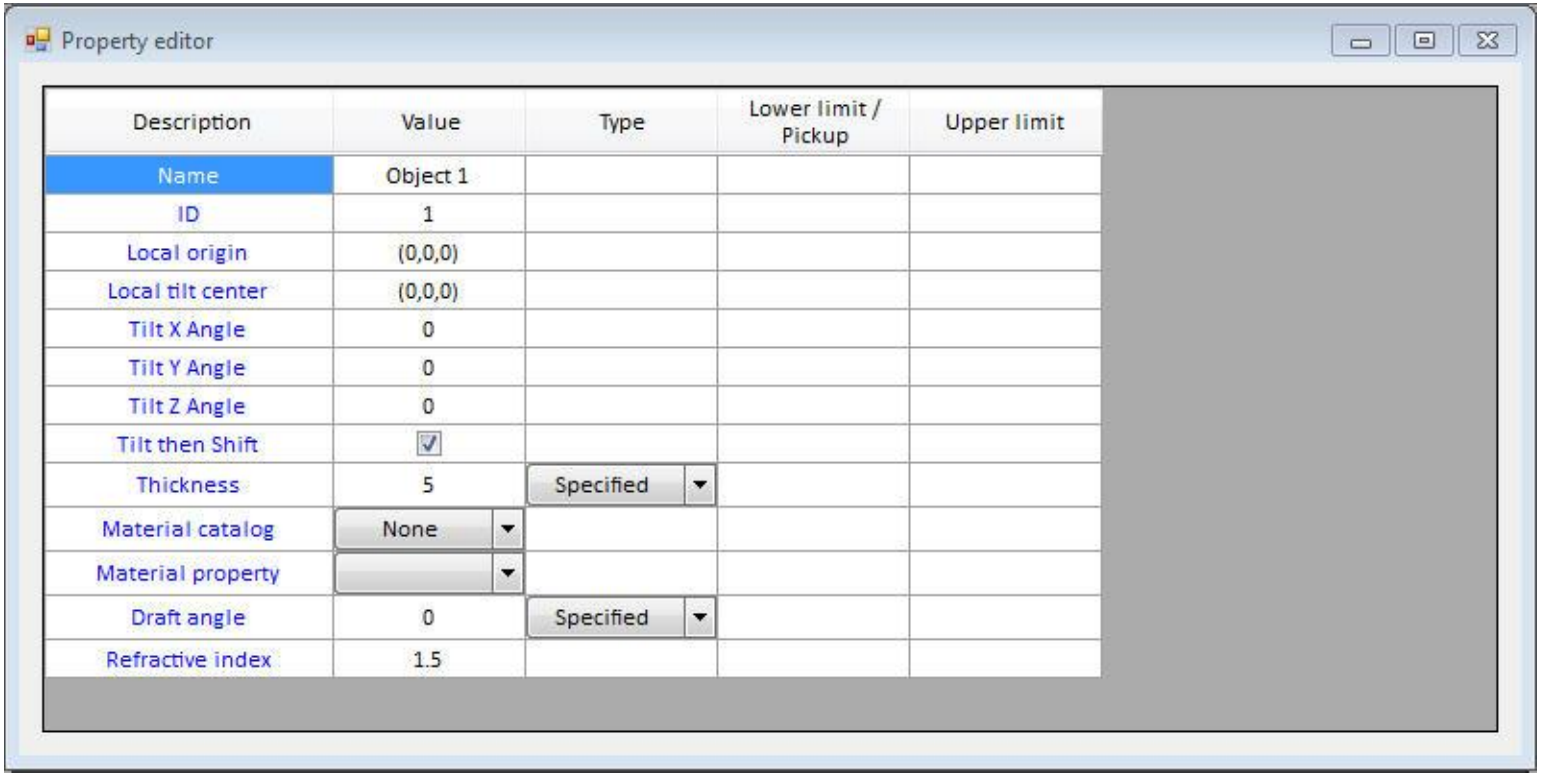
3D Interactive Optimizer - Property Editor

•Varies depending on selection - Segment selected



3D Interactive Optimizer - Property Editor

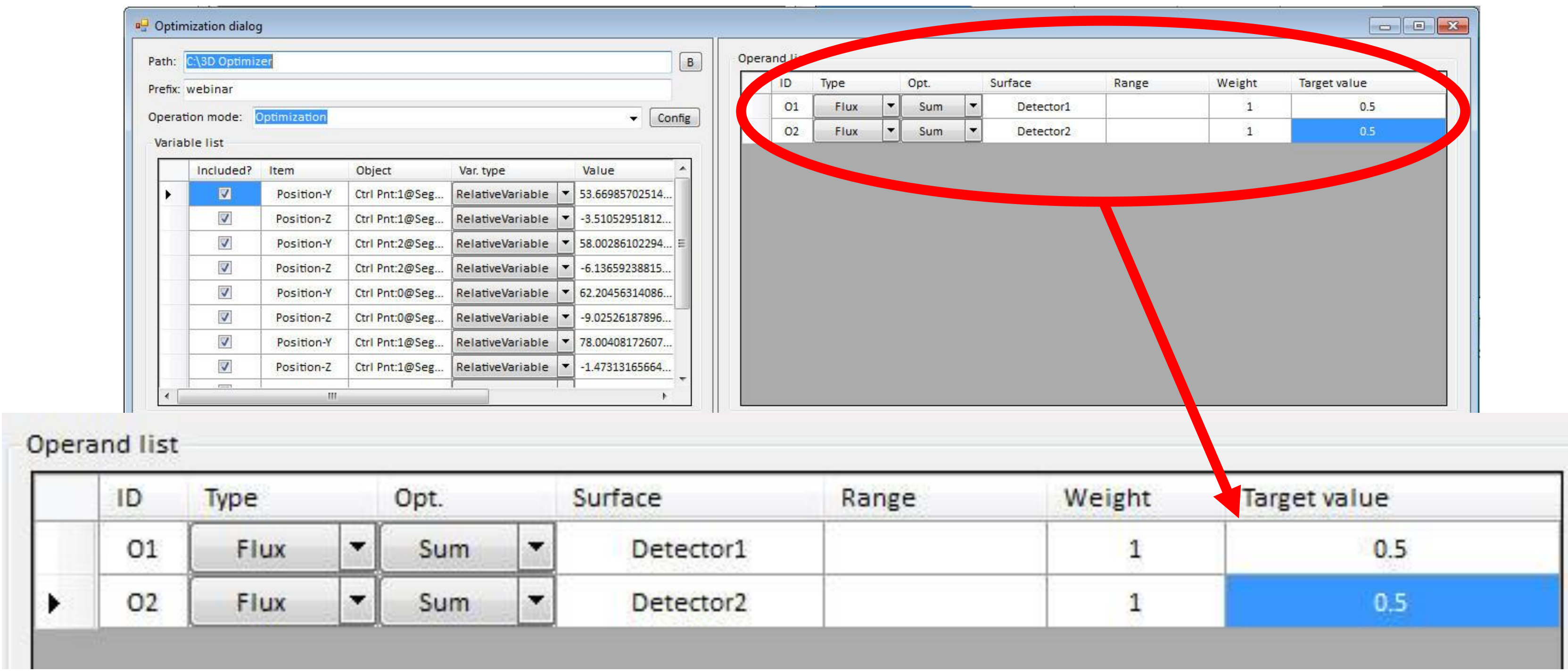
- Varies depending on selection - Object selected


Property editor

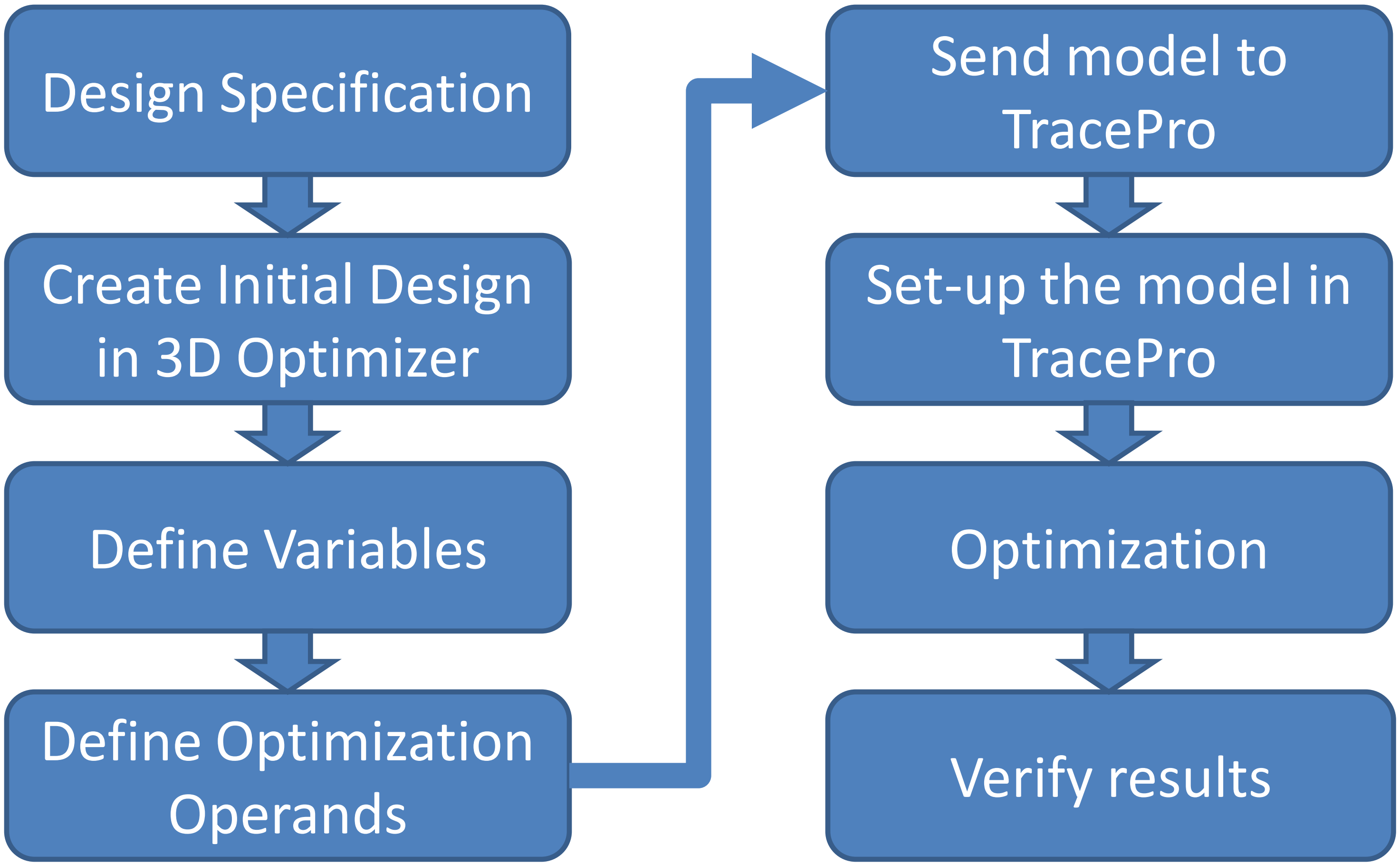
Description	Value	Type	Lower limit / Pickup	Upper limit
Name	Object 1			
ID	1			
Local origin	(0,0,0)			
Local tilt center	(0,0,0)			
Tilt X Angle	0			
Tilt Y Angle	0			
Tilt Z Angle	0			
Tilt then Shift	☑			
Thickness	5	Specified		
Material catalog	None			
Material property				
Draft angle	0	Specified		
Refractive index	1.5			

3D Interactive Optimizer - Optimization

- Optimization operands



3D Interactive Optimizer – Work Flow



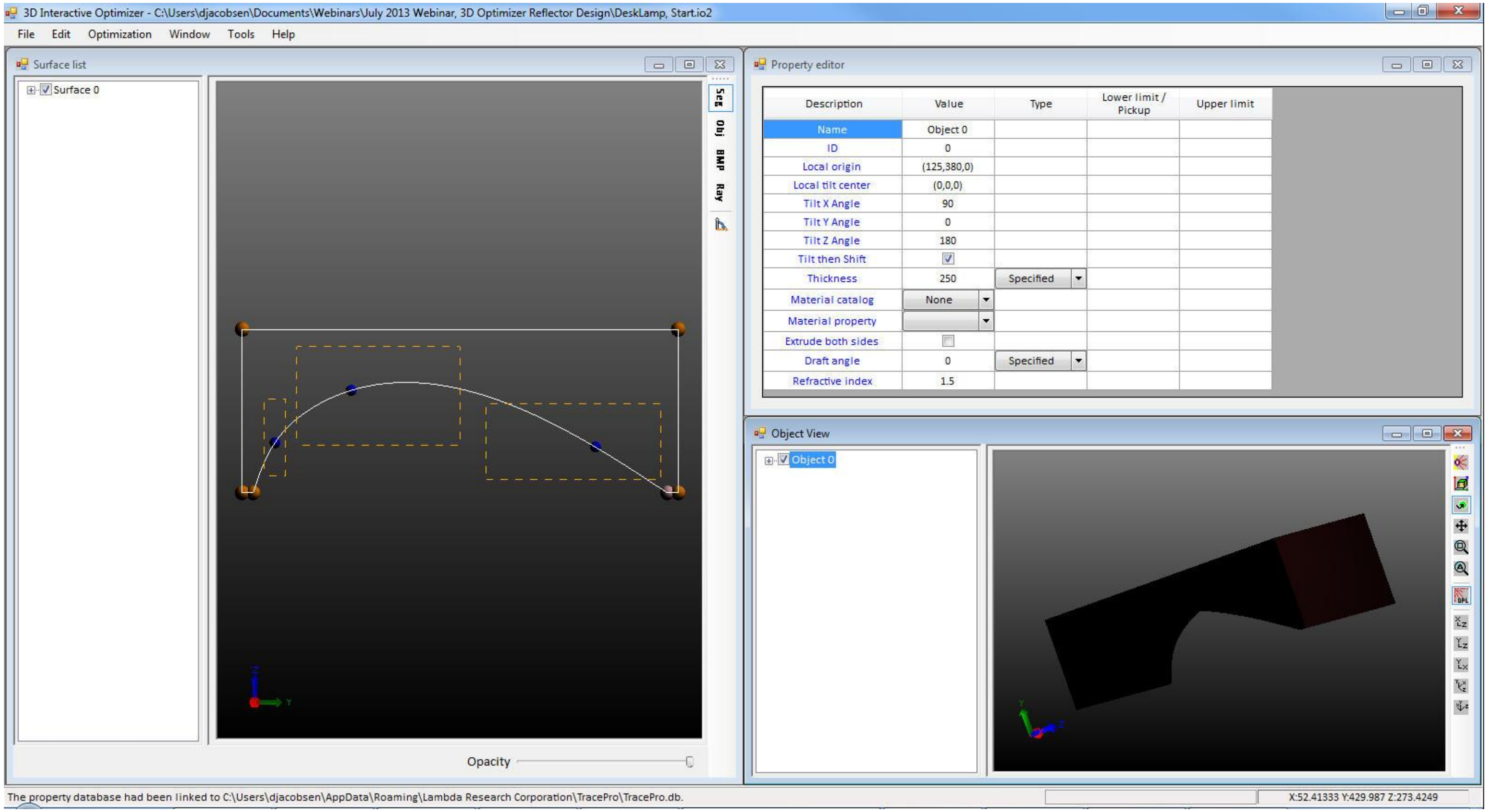
3D Interactive Optimizer – Specification

- LED Desk Lamp design specification
  - Uniform illumination on a desk top 750mm deep
  - Bottom of reflector is 380mm above the desk top
  - 5 LEDs used for sources, 100 lumens each
  - Length of the luminaire to be 250mm
  - Depth of luminaire to be 200mm
  - Height of luminaire to be 75mm
  - Reflector material to be Alanod Miro 6

TracePro

Lambda Research Corporation

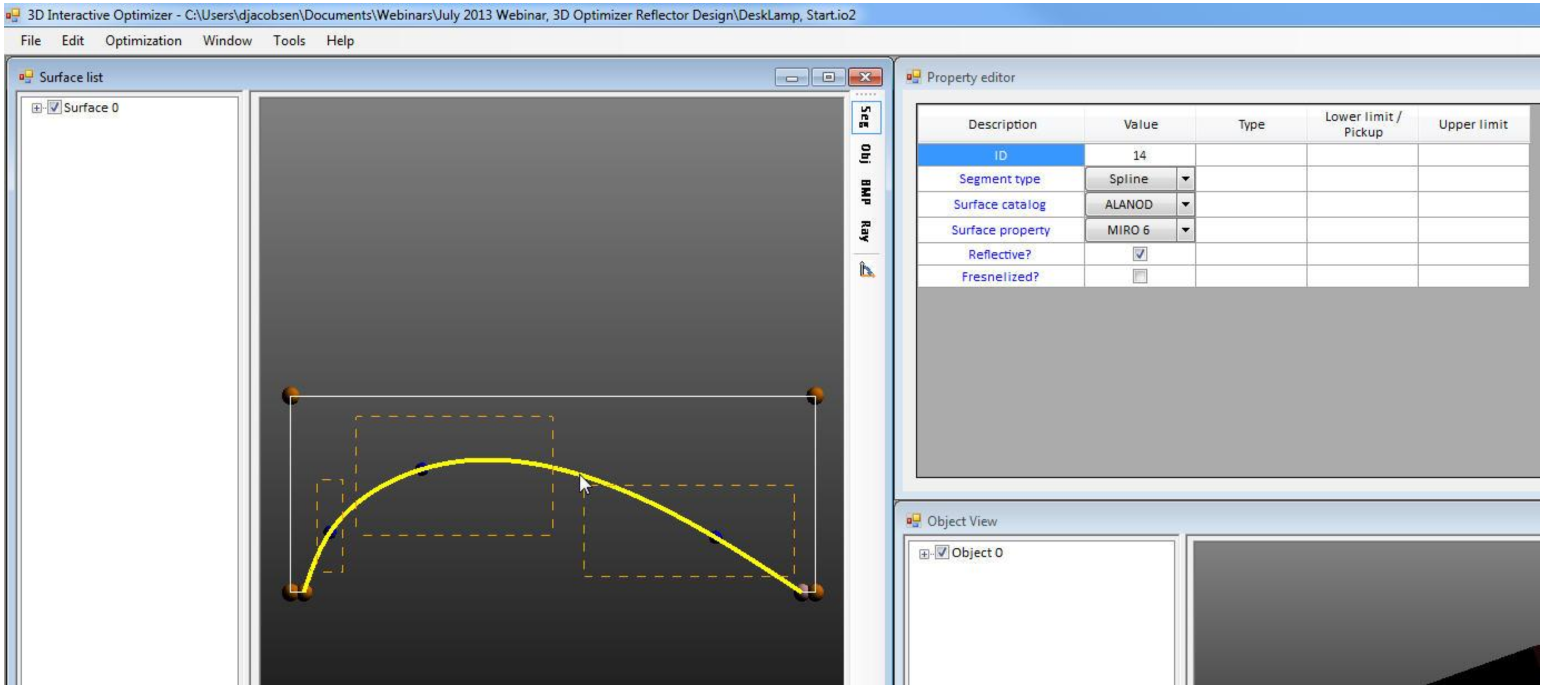
3D Interactive Optimizer – Initial Design



TracePro

Lambda Research Corporation

3D Interactive Optimizer – Initial Design

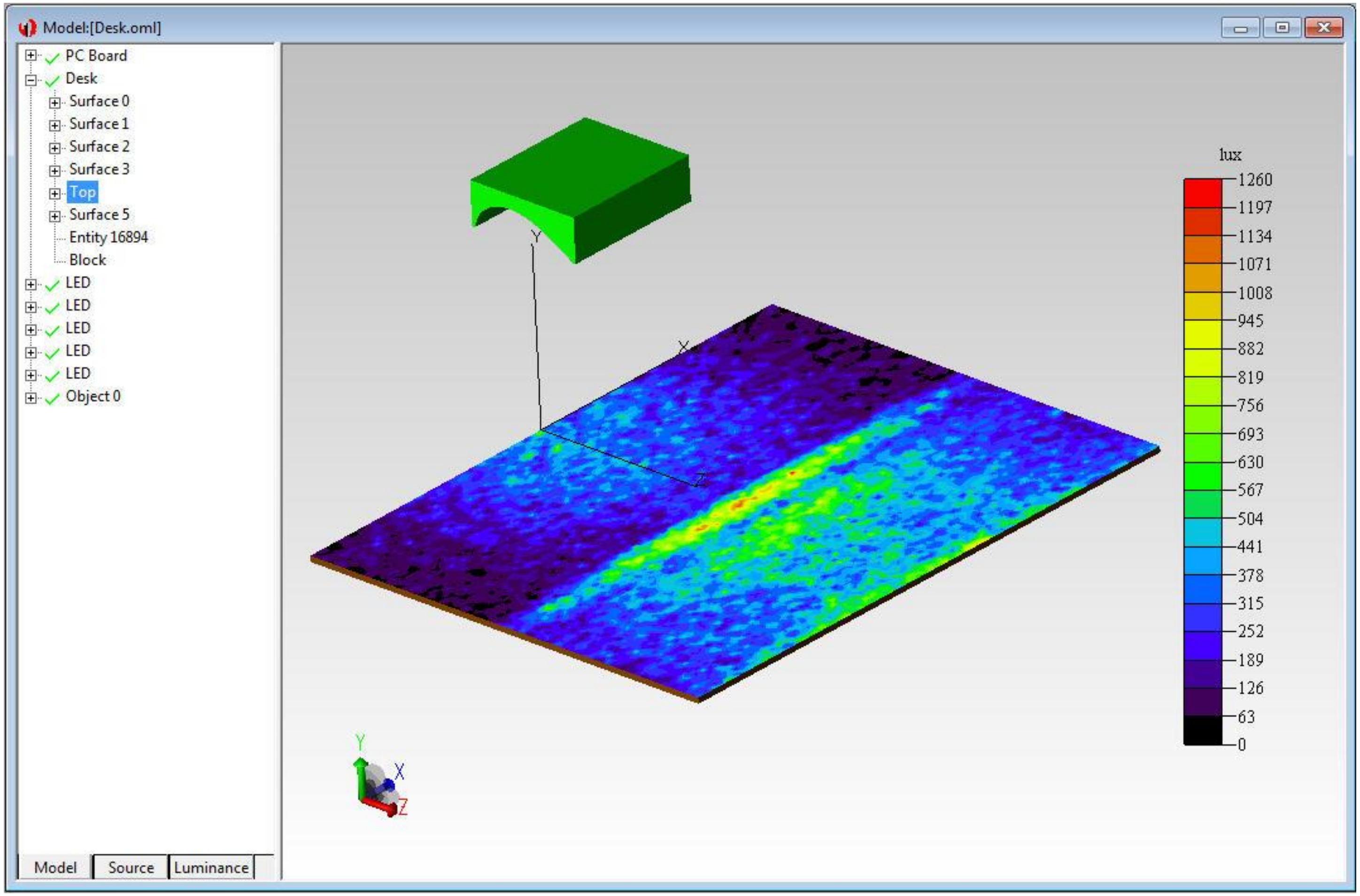


3D Interactive Optimizer – Initial Design

Property editor

Description	Value	Type	Lower limit / Pickup	Upper limit
Name	Object 0			
ID	0			
Local origin	(125,380,0)			
Local tilt center	(0,0,0)			
Tilt X Angle	90			
Tilt Y Angle	0			
Tilt Z Angle	180			
Tilt then Shift	☑			
Thickness	250	Specified		
Material catalog	None			
Material property				
Extrude both sides	☐			
Draft angle	0	Specified		
Refractive index	1.5			

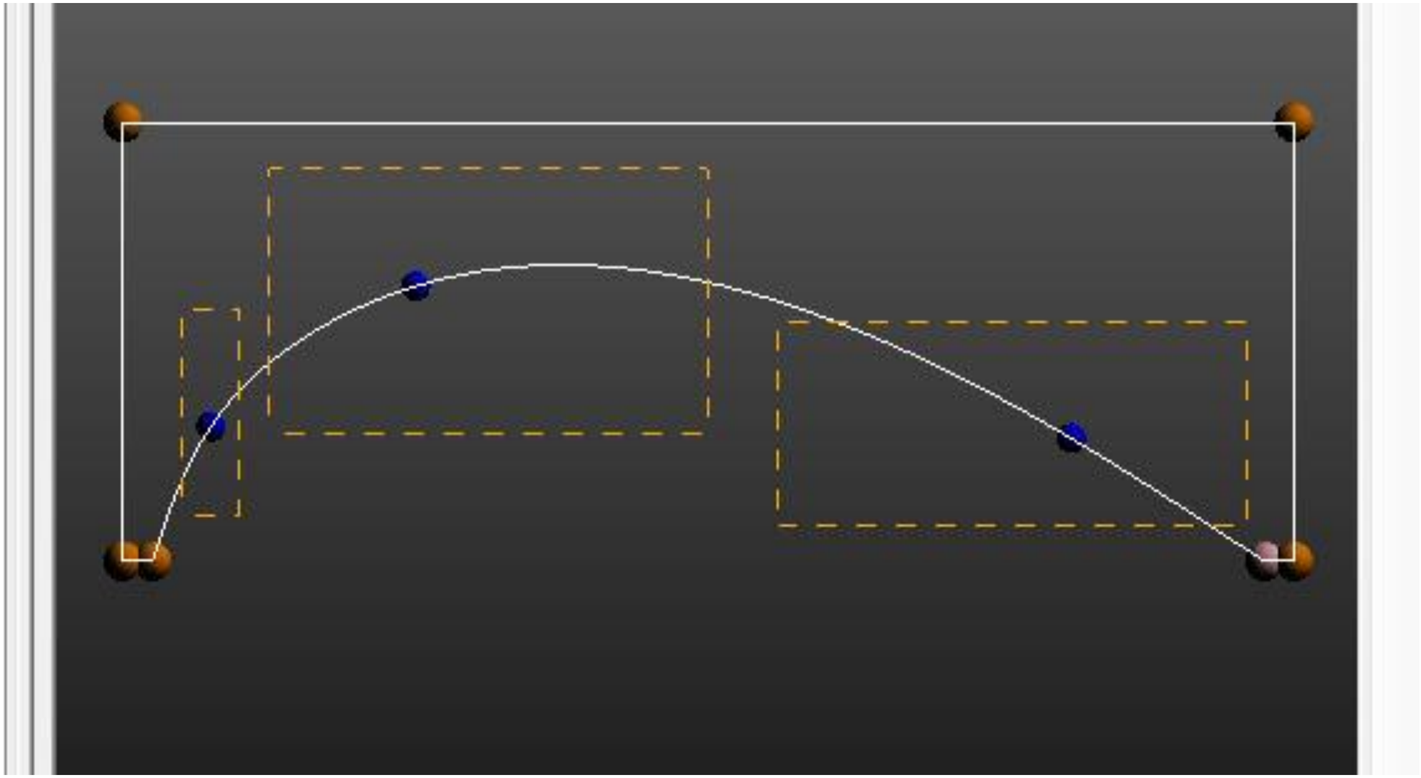
3D Interactive Optimizer – Initial Design



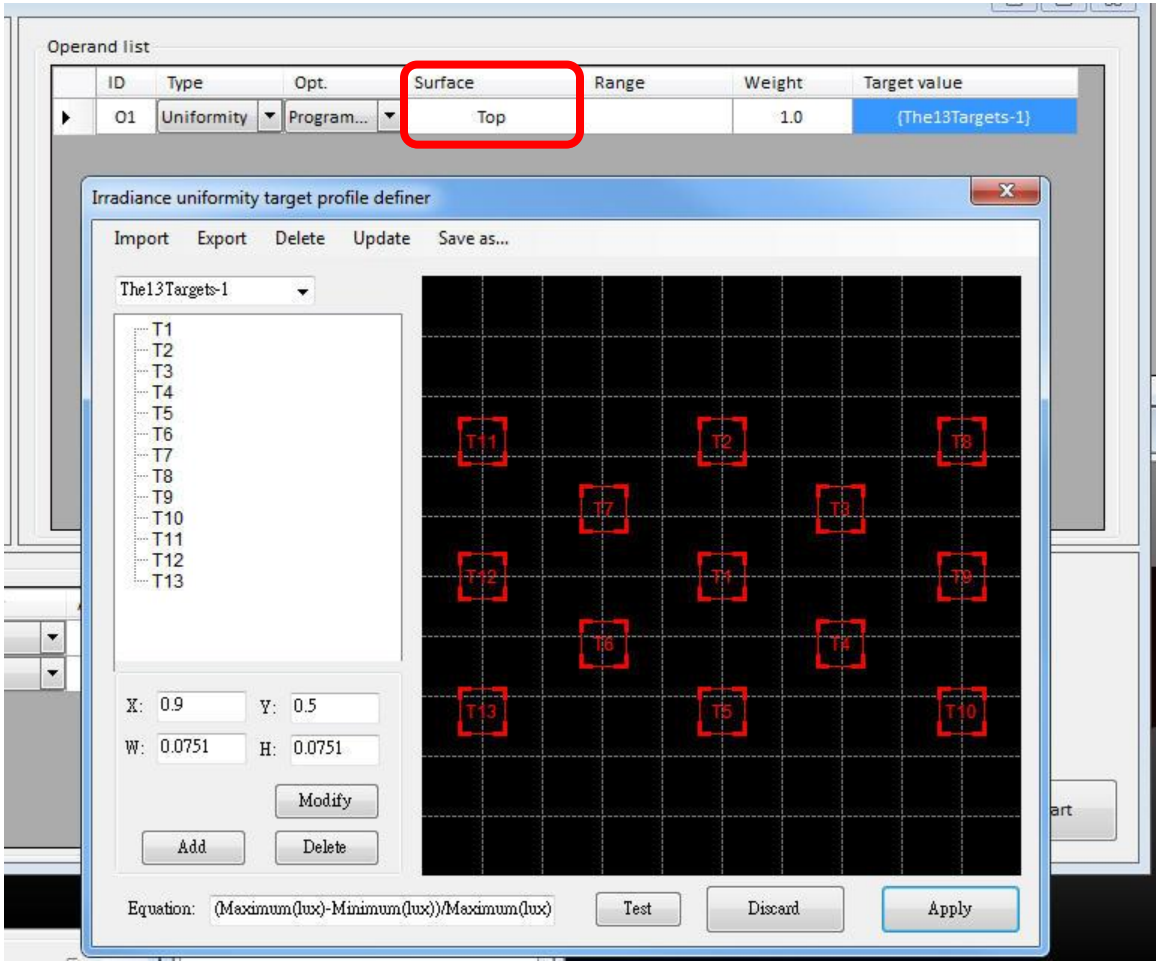
TracePro

Lambda Research Corporation

3D Interactive Optimizer – Variables



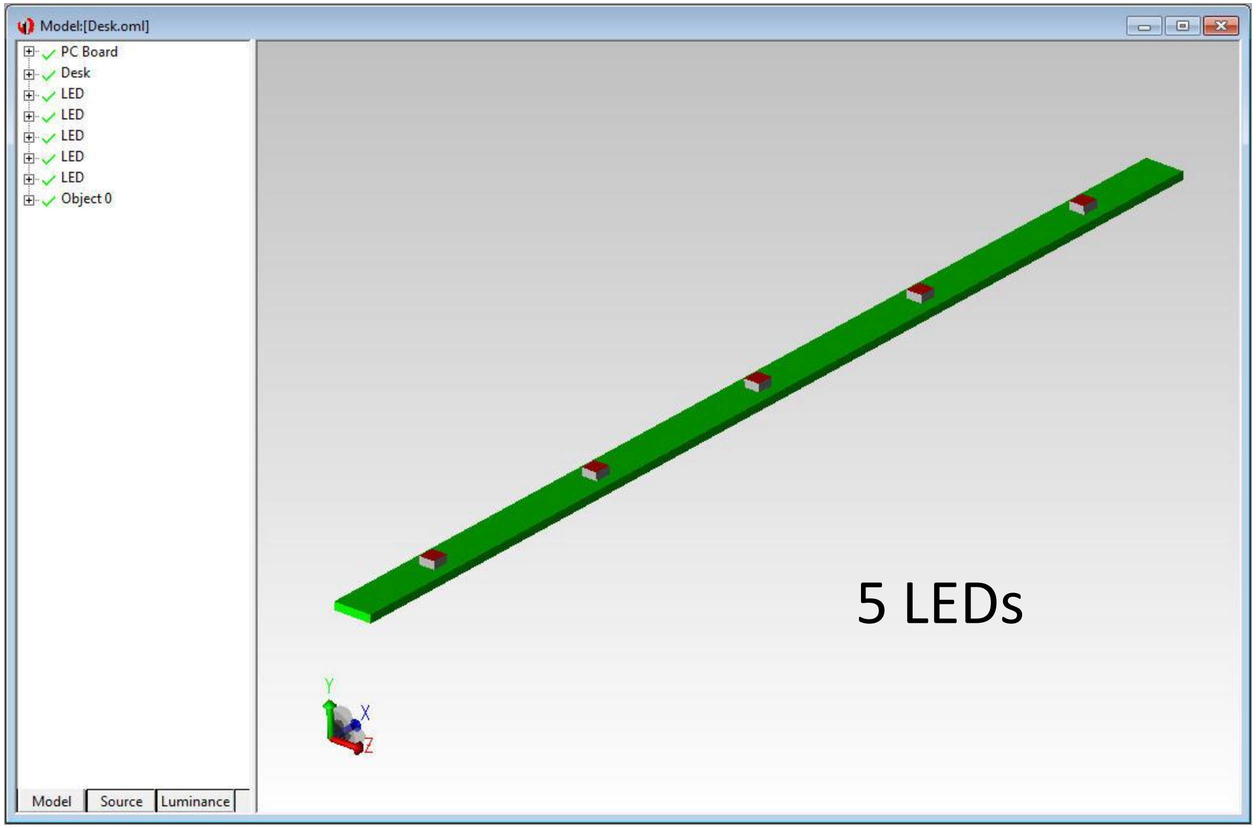
3D Interactive Optimizer – Operands



TracePro

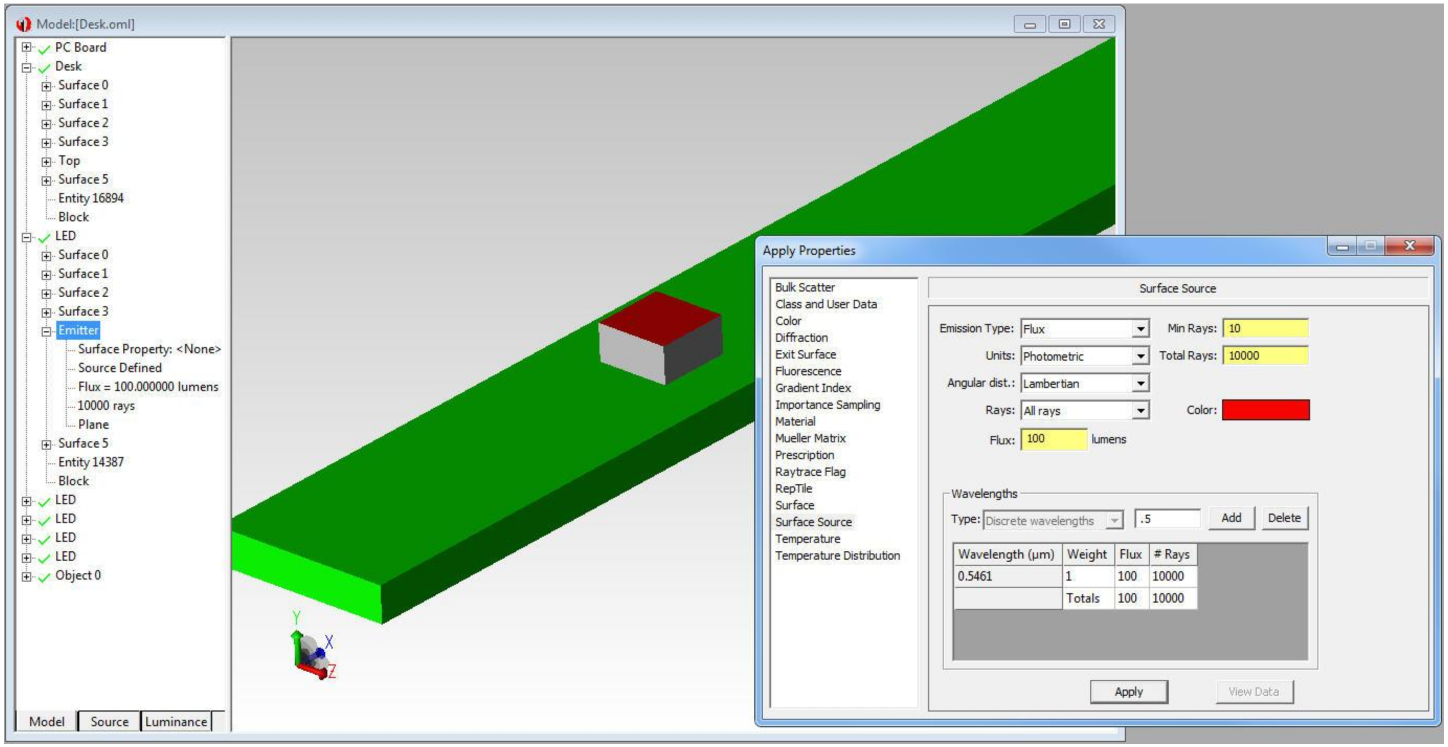
Lambda Research Corporation

3D Interactive Optimizer – TracePro model

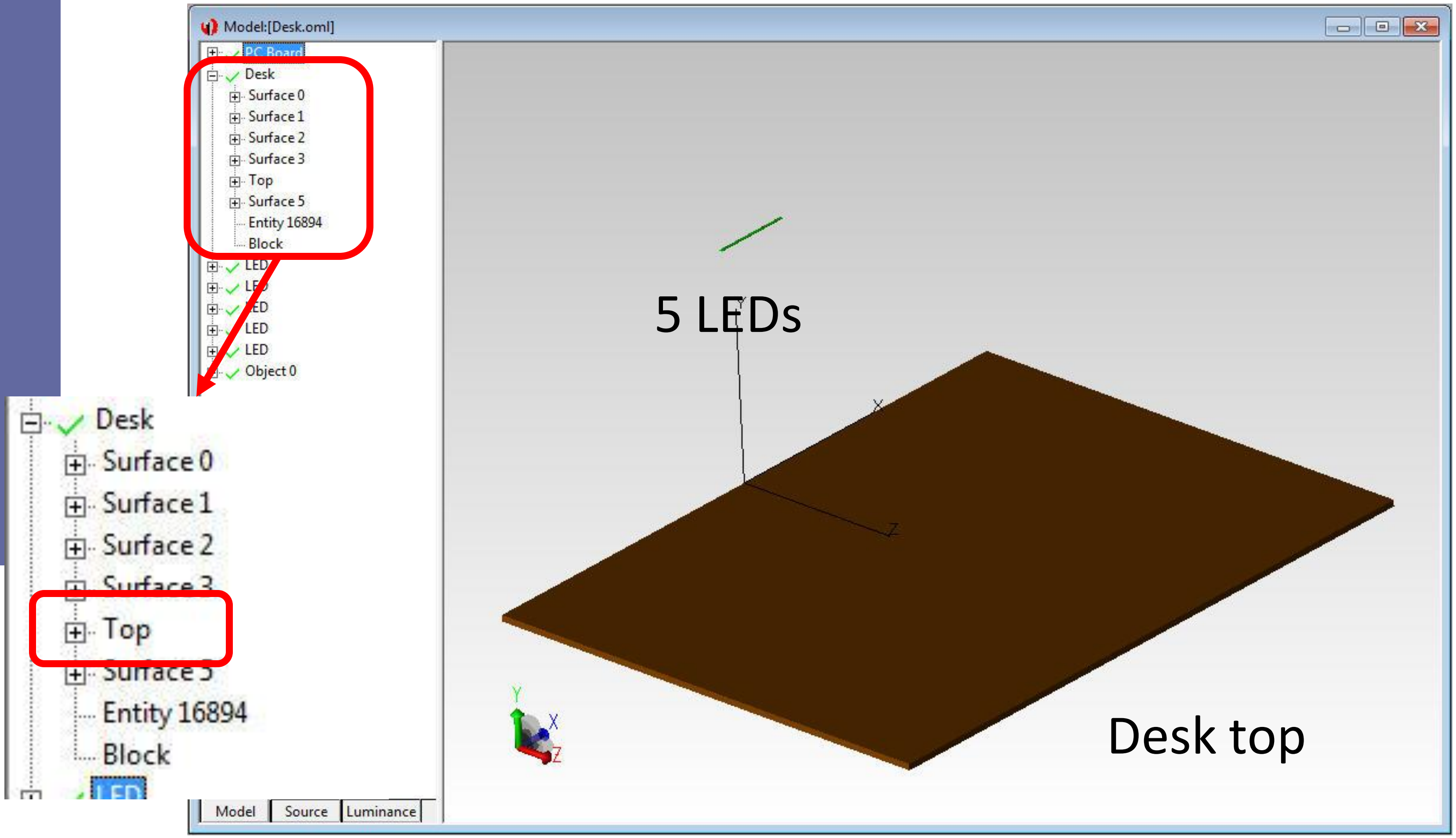


5 LEDs

3D Interactive Optimizer – TracePro model



3D Interactive Optimizer – TracePro model



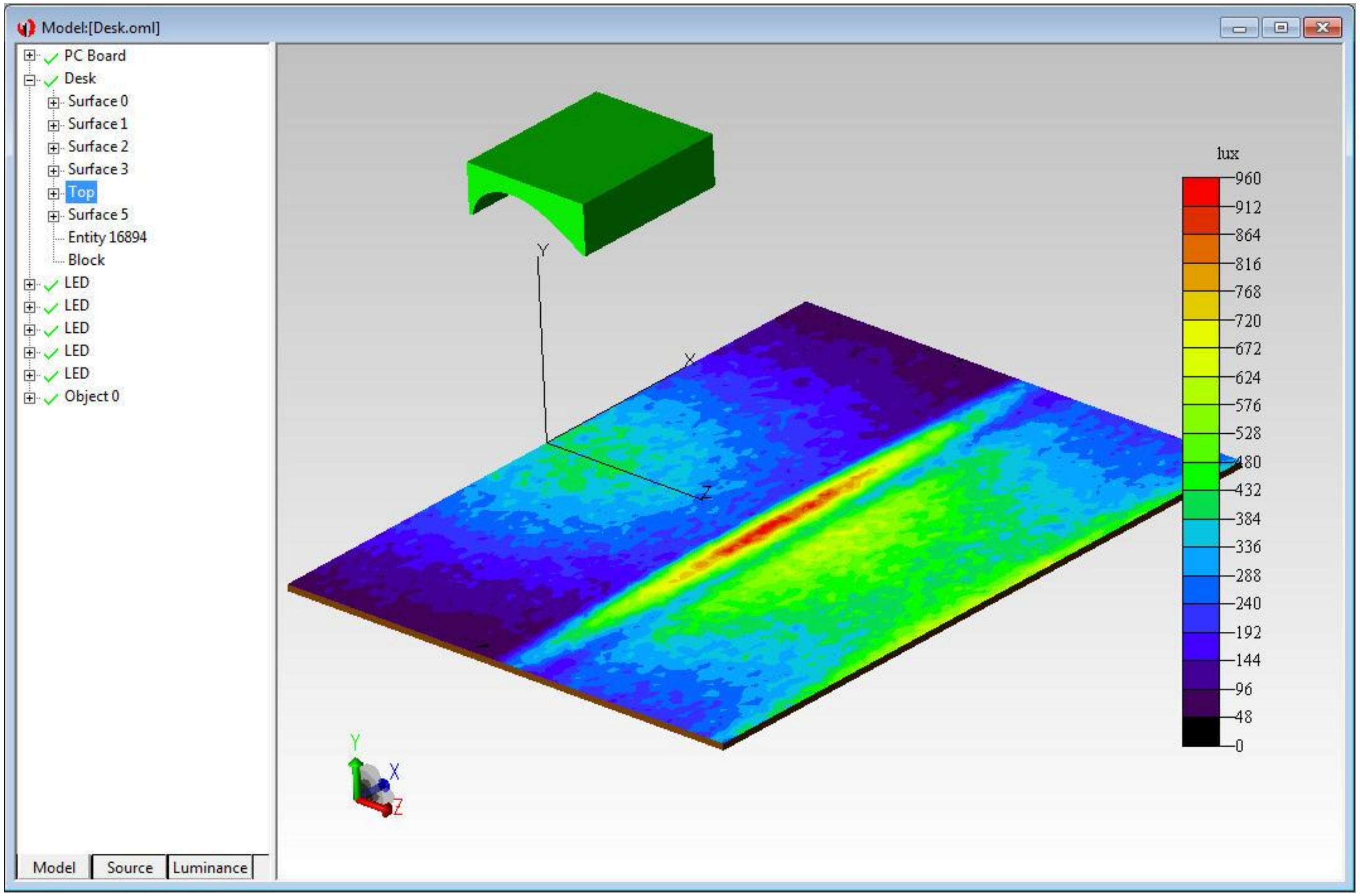
Live Demonstration

Live Demonstration

TracePro

Lambda Research Corporation

3D Interactive Optimizer – Initial results



3D Interactive Optimizer – Optimization Log

Optimization Log

	ID	Err	Var.	Tir
	94	0.8873253	{154.783276850841,23.2674775853429,46.53922513084...	7/15/201
	95	0.8863083	{155.044617871061,23.180988421142,46.558765392012...	7/15/201
	96	0.8846804	{154.435081518729,23.1616118944571,46.26116975906...	7/15/201
	97	0.8866095	{154.451837056132,23.2290747758911,46.48426206190...	7/15/201
	98	0.8892089	{154.450623278652,23.2815843525671,46.57192882366...	7/15/201
	99	0.8857302	{154.550129522433,23.2007770902951,46.44177682516...	7/15/201
	100	0.885694	{154.501415924445,23.2152195506925,46.43431277333...	7/15/201
	101	0.8861154	{154.64271679752,23.092191293223,46.269883378558,...	7/15/201
	102	0.8887707	{154.705129600502,23.099073042343,46.286090579203...	7/15/201
	103	0.8860742	{154.515160192224,23.1965743425041,46.43471919122...	7/15/201
	104	0.8872122	{153.935862892628,23.1523547042127,46.17023851549...	7/15/201
	105	Invalid	{154.767429126452,23.1738299919097,46.46163367288...	7/15/201

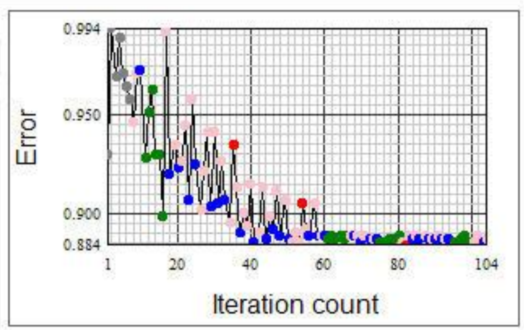
Graphs | Trend chart

View item:

Sum

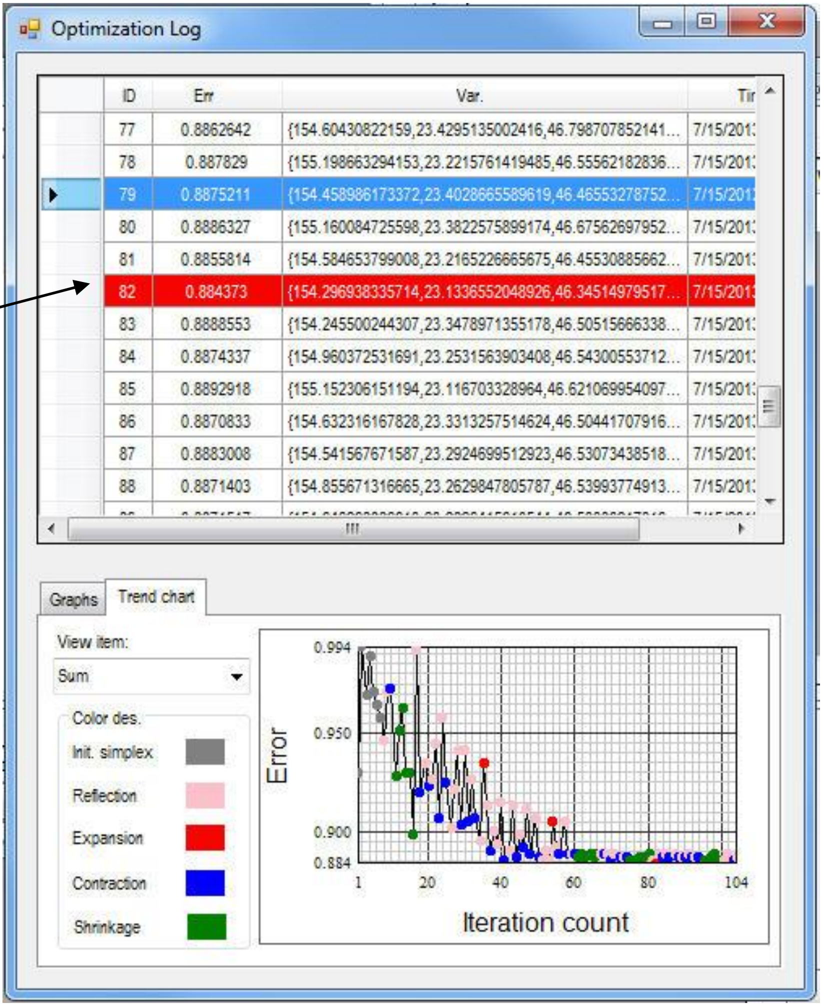
Color des.

- Init. simplex
- Reflection
- Expansion
- Contraction
- Shrinkage



3D Interactive Optimizer – Optimization Log

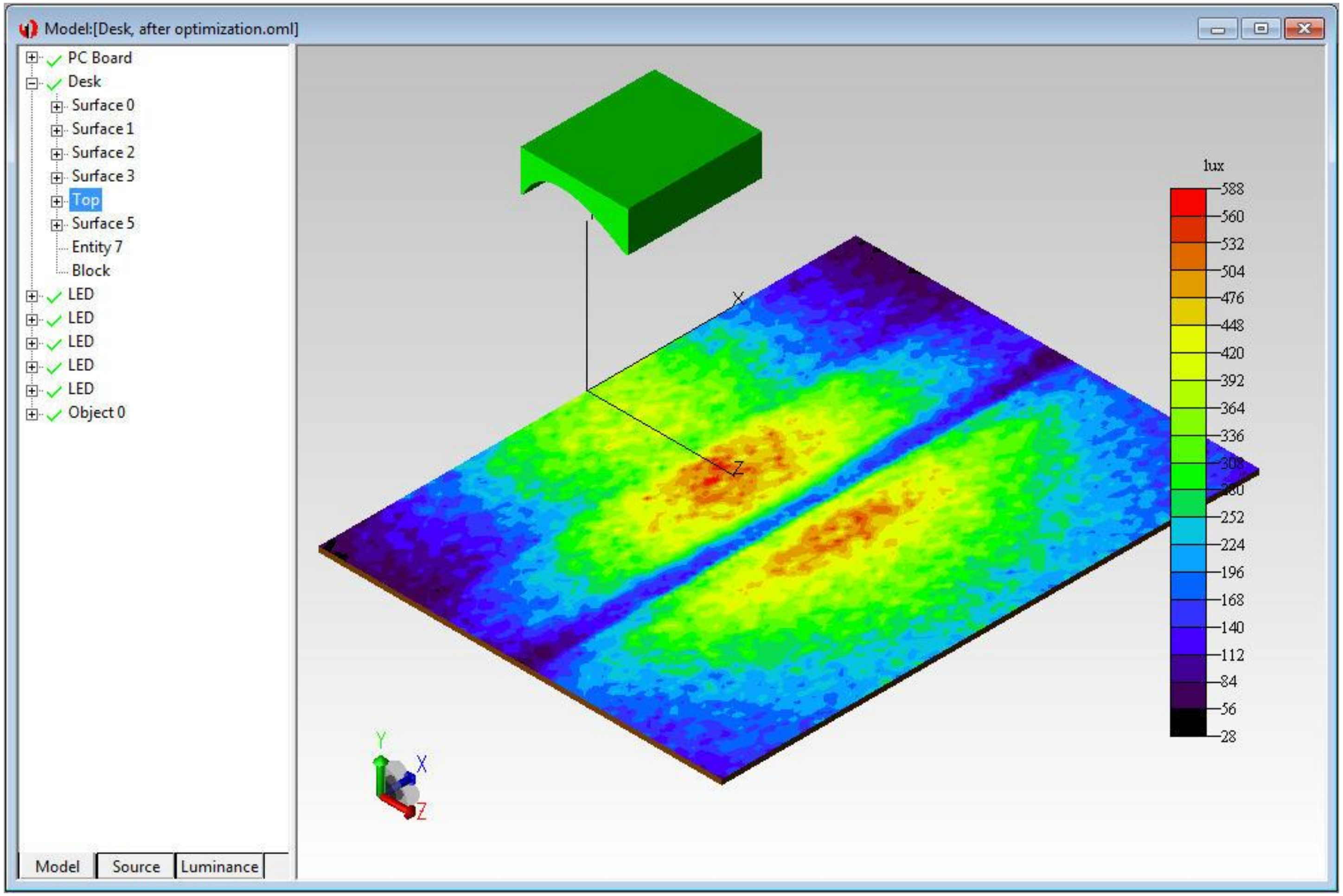
Best result



TracePro

Lambda Research Corporation

3D Interactive Optimizer – Optimized results



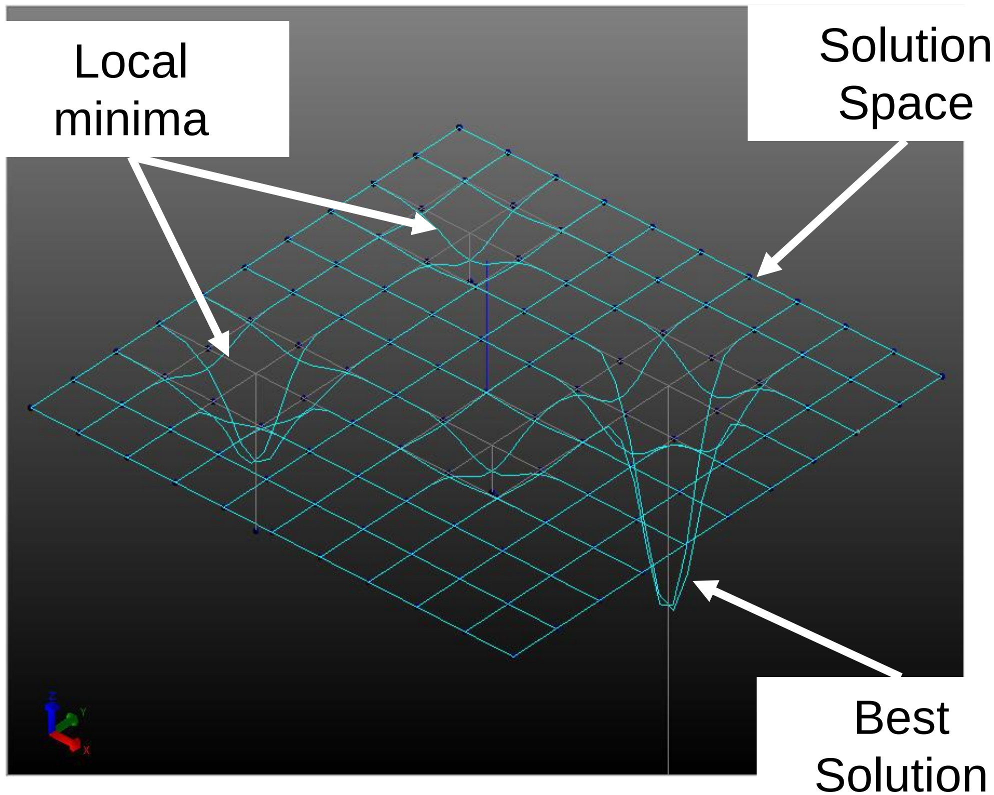
3D Interactive Optimizer – Optimization process

The TracePro 2D and 3D optimizers use the Downhill Simplex, or Nelder-Mead, method for optimization. Proposed by John Melder and Roger Mead in 1965.

The downhill simplex method is a local optimizer. It will converge to the solution closest to the starting point. It is possible that a better solution is available. Changing the initial starting conditions can be used as a test to see if a better solution is available.

3D Interactive Optimizer – Optimization process

Solution space for optimization problem. The solution found will depend on the starting point.

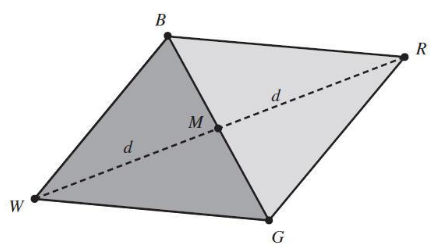


TracePro

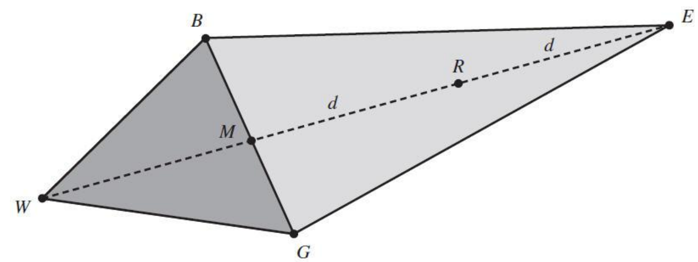
Lambda Research Corporation

3D Interactive Optimizer – Optimization process

Methods for calculating new simplex vertices

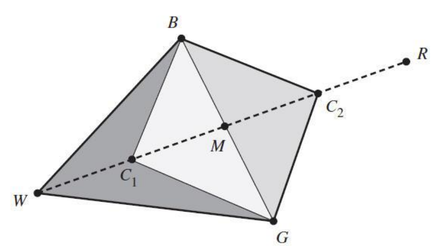


Reflection

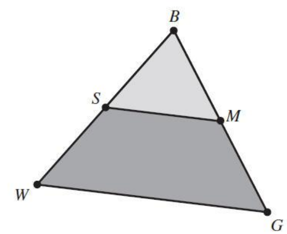


Expansion

B = lowest error function
G = middle error function
W = highest error function



Contraction



Shrinkage

Source:
Numerical Methods Using Matlab 4th Edition

TracePro

Lambda Research Corporation

Questions & Answers

Questions & Answers

A recording of this webinar and a copy of the slides and example files will be available shortly in the Webinars section of our website:

http://www.lambdares.com/webinars/

Thank You

For Additional Information Please Contact:

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