

#### Designing and Optimizing Reflectors with the TracePro 3D Interactive Optimizer

Presented by :

Lambda Research Corporation 25 Porter Rd. Littleton, MA 01460





#### **Presenter:**

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#### 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 •<u>http://www.lambdares.com/videos/</u>

TracePro Tutorials

•http://www.lambdares.com/technical\_support/tracepro/tutorials/

Information on upcoming TracePro Training Classes
 <a href="http://www.lambdares.com/technical\_support/training/">http://www.lambdares.com/technical\_support/training/</a>





# 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





#### Designing and Optimizing Reflectors with the TracePro 3D Interactive Optimizer







•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

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# 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

e E	dit Optimization Windo	w Help	
Surfa	ace list	d 1	
	Add surface 🕨 🕨	Planar	
	Delete surface	BSpline surface 🔹 🕨	
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	Send to TracePro 🕨	Path >	
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# **3D Interactive Optimizer - Surfaces**

#### •Surface types available

Planar	-	
BSpline surface	•	Free BSpline
Parametrized surface	×.	X-Sym BSpline
2D profile	E	Y-Sym BSpline
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Planar	- 8	
BSpline surface	ж	
Parametrized surface	•	
2D profile	•	Asymmetric profile
Path	•	Symmetric profile
		Elliptical profile

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2D profile	•	
Path		

Planar		
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Parametrized surface	•	
2D profile	•	
Path	•	2D Path
		3D Path





# 3D Interactive Optimizer - Objects

#### •Object types available

Name:	Object 0			
lype:	Radial symmetry	-		
Transform	Radial symmetry			
Location	Lens	Tilt th	nen Shift	
Local Til	Biaxial	X angle:	0	deg
		Y angle:	0	deg
		Z angle:	0	deg
Linked sur	face #1:	•		
Steps:	0			







# 3D Interactive Optimizer - Property Editor

#### •Varies depending on selection - Segment selected

Description	Value		Туре	Lower limit / Pickup	Upper limit	
ID	6					
Segment type	Spline	-				
Surface catalog		-				
Surface property	1	-				
Reflective?						
Fresnelized?						





# 3D Interactive Optimizer - Property Editor

#### •Varies depending on selection - Object selected

Description	Value		Туре		Lower limit / Pickup	Upper limit	
Name	Object 1	8					]
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	V	- 0					
Thickness	5		Specified	-			
Material catalog	None	-					
Material property		-	<i></i>				
Draft angle	0		Specified	-			
Refractive index	1.5		C				





# **3D Interactive Optimizer - Optimization**

#### •Optimization operands

Path:	C:\SD Optimiz	er			B		10	Tree	0.00		Current		Dance	Waisht	Transition
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		Position-Y	Ctrl Pnt:2@Seg	RelativeVariable •	58.00286102294 ≡										
		Position-Z	Ctrl Pnt:2@Seg	RelativeVariable	-6.13659238815										
		Position-r	Ctrl Pnt:0@Seg	RelativeVariable	-0.02526187896										
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# 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

















Description	Value		Туре		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	V						
Thickness	250	ſ	Specified	-			
Material catalog	None	-					-
Material property		-					
Extrude both sides							-
Draft angle	0	(	Specified	-			
Refractive index	1.5						











#### 3D Interactive Optimizer – Variables







# 3D Interactive Optimizer – Operands







### **3D Interactive Optimizer** – TracePro model







### 3D Interactive Optimizer – TracePro model







# **3D Interactive Optimizer** – TracePro model







# Live Demonstration **Five Demonstration**





# 3D Interactive Optimizer – Initial results







#### **3D Interactive Optimizer** – 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:
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### **3D Interactive Optimizer** – Optimization Log







### 3D Interactive Optimizer – Optimized results







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.







#### **3D Interactive Optimizer** – Optimization process



Numerical Methods Using Matlab 4<sup>th</sup> Edition





# **Ouestions & Answers Onestions & Vusmers**





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 <u>Sales@lambdares.com</u> <u>www.lambdares.com</u>

