

Optical Design Process

- ALERA LIGHTING
- ARCHITECTURAL AREA LIGHTING
- BEACON PRODUCTS
- COLUMBIA LIGHTING
- COMPASS LIFE SAFETY
- DEVINE LIGHTING
- DUAL-LITE
- HUBBELL BUILDING AUTOMATION
- HUBBELL INDUSTRIAL
- HUBBELL OUTDOOR
- KIM LIGHTING
- KURT VERSEN
- LITECONTROL
- NORLUX
- PRESCOLITE
- PRECISION-PARAGON [P2]
- PROGRESS LIGHTING
- SECURITY LIGHTING SYSTEMS
- SPAULDING LIGHTING
- SPORTSLITER SOLUTIONS
- THOMAS RESEARCH PRODUCTS
- STERNER
- WHITEWAY



Sponsored by Hubbell lighting

Optical Design Process Example

Product Design Example

- Design of Dental Light
 - Requirements: Illuminate the area equal to a dollar bill (6" x 3"). Minimize light outside this area. Use of the shelf components.



- Outcome: Started with TIR optic, ended up with planar Fresnel optic at completion of project.



Target Optical Specifications:

Measured spot size: **6" x 3"**

Measured splash size: **None specified**

Lux on axis: **25,000 Lux @ 700mm**

Lux @ 2.5" _x: **18,750 Lux (75% of maximum) @ 700mm**

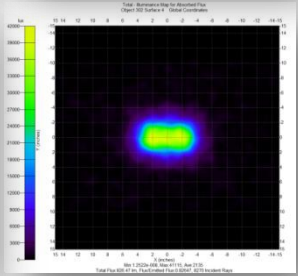
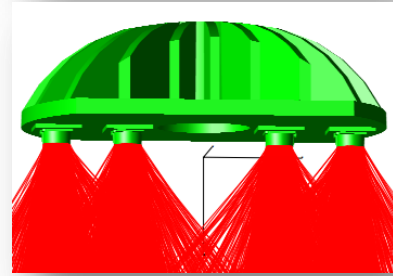
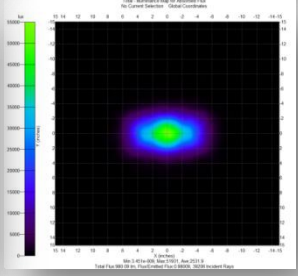
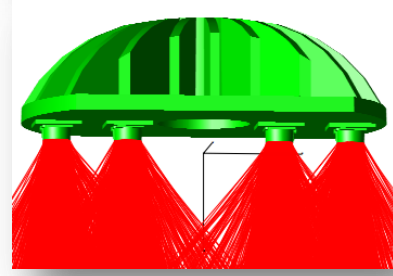
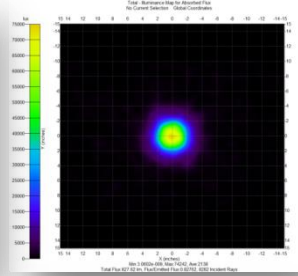
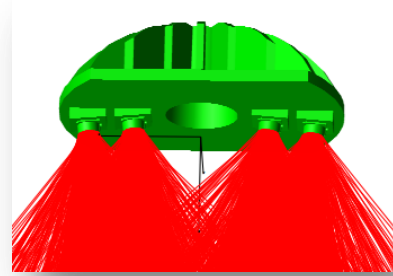
Lux @ 1" _y: **18,750 Lux (75% of maximum) @ 700mm**

Lux @ 2.5" _y (63.5mm): **Less than 1300 Lux @ 700mm**

Lumen Output: **1,100 Lumens minimum**

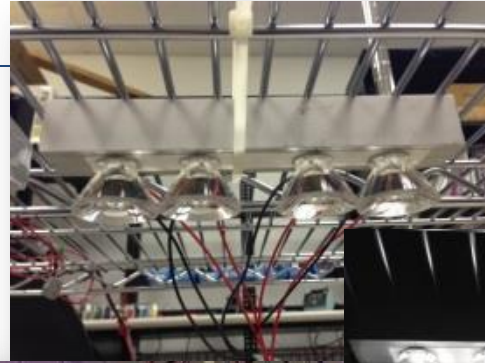
Discovery Phase

- Crude CAD models
- Simulate early and often
- Analyze feasibility and develop design direction



Alpha Prototype Phase

- Develop crude prototype(s)
- Test initial analysis and compare to simulation results

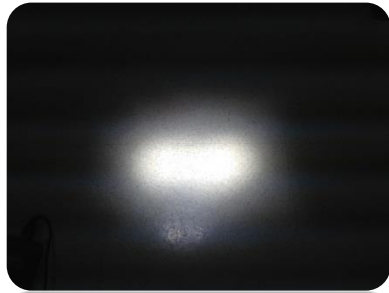


Alpha Prototype Phase

- Test alpha prototype(s) and collect data
- Re-analyze feasibility and design direction



*CREE XP-G w/ LEDiL
10 DEGREE*



*CREE XP-E w/ LEDiL
8 DEGREE*



*CREE XP-G w/ KHATOD
5.5 DEGREE*

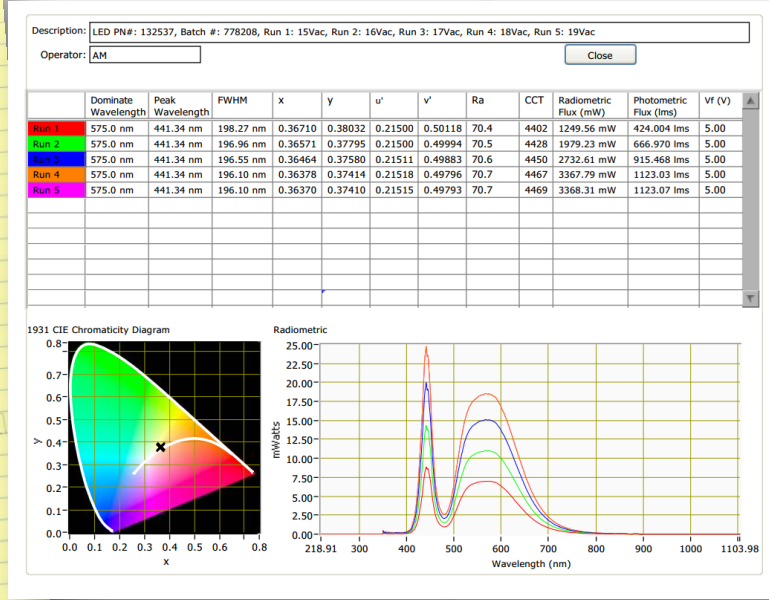


HALOGEN FIXTURE

Data Collection

- Collect data from alpha prototype(s)

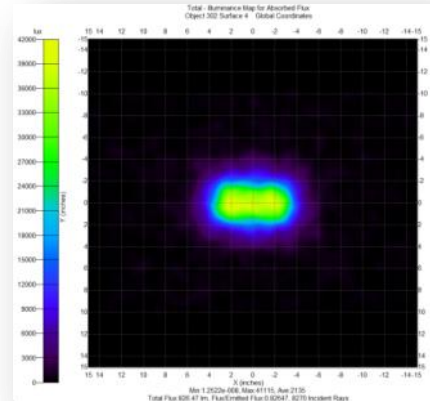
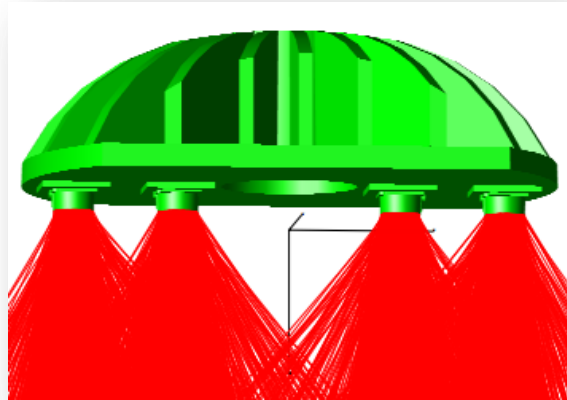
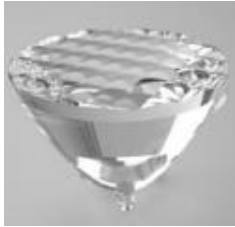
8" FWHM CREE XP-E W/ LED LAMBDA OPTIC: P# 1-2
 HEIGHT: 27.25" SWAY: 40VAC @ 2.8A (700mA/LED)
 SPOT SIZE: 4" x 2.5"
 SPLASH SIZE: 13" x 8"
 LUX ON AXIS: 31,000
 LUX @ 2.5": 25,000 - 26,000
 LUX @ 1": 24,000 - 27,000
 LUX OUTSIDE SPOT: 8,900 LUX (~8,000 LUX)
 10" FWHM CREE XP-G W/ LED LAMBDA OPTIC: P# 3-4
 SPOT SIZE: 9.5" x 3.5"
 SPLASH SIZE: 23" x 18"
 LUX ON AXIS: 24,000 LUX
 LUX @ 2.5": 19,600 LUX
 LUX @ 1": 23,000 LUX
 LUX OUTSIDE SPOT: 13,000 LUX
 5.5" FWHM CREE XP-G W/ LED FLIGHT ON OPTIC: P# 5-6
 SPOT SIZE: 6" x 3"
 SPLASH SIZE: 11" x 6"
 LUX ON AXIS: 30,500 LUX
 LUX @ 2.5": 27,100 LUX
 LUX @ 1": 22,100 LUX
 LUX OUTSIDE SPOT: 2,900 LUX
 LUX IN THE HOT SPOT: 40,000 LUX



Prototype Optical Test Data	
Hi Setting	Low Setting
8" x 3"	8" x 3"
24" x 19"	24" x 19"
24,000 Lux	13,200 Lux
24,000 Lux	11,000 Lux
23,900 Lux	11,900 Lux
1670 Lux Up, 3200 Lux Down	881 Lux Up, 1900 Lux Down
1123.07 Lumens	667 Lumens

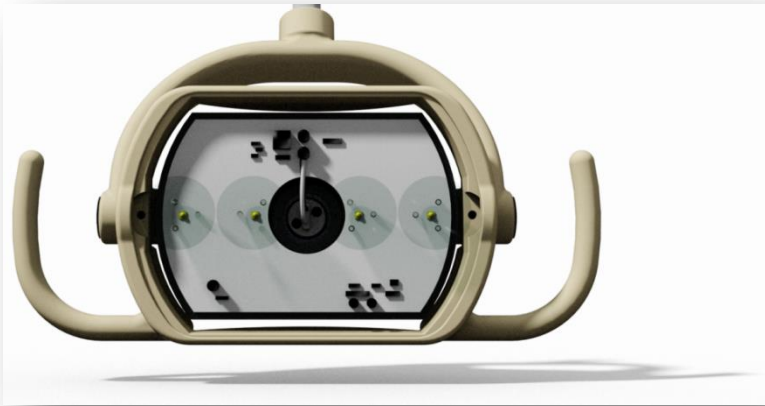
Decision – Phase gate

- Analyze data
- Develop path to move optical design forward
- Move to detail design phase



Detail Design Phase

- Further develop CAD models
- Electrical design and PCB layout
- Additional simulations



Beta Prototype Phase

- Beta prototype testing
 - Looks like – functions like prototype



Decision - Phase Gate

- Analyze data
- Phase gate/milestone decision
 - Pivot if necessary
 - Know when to consult with subject matter expert
 - Repeat process if necessary

