

Glass Optics for UV-C LED Applications

Research & Engineering
Kopp Glass, Inc.
IUVA 2018



UV-C APPLICATIONS

► How do UVC LEDs fit into current applications?

Analytical
Instruments

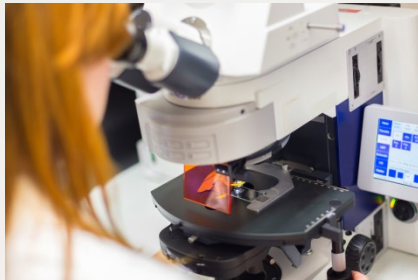
Laboratory
Testing

Phototherapy

UV Curing

Counterfeit
Detection

Water & Air
Purification



TRADITIONAL TECHNOLOGY

Traditional
Lamps

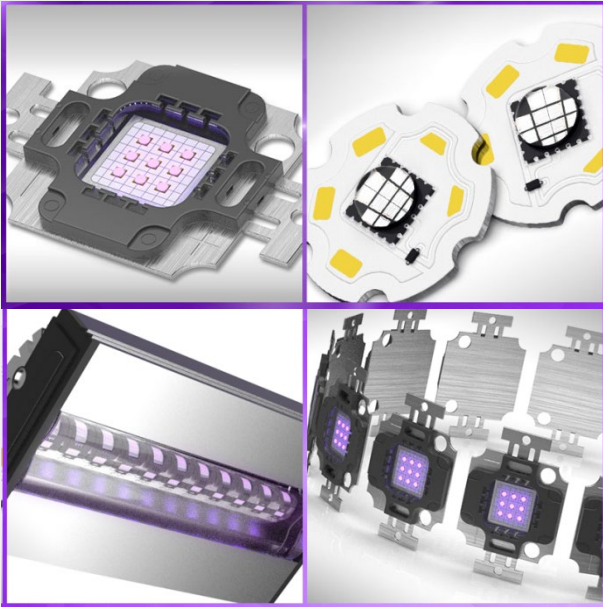


Quartz
Sleeves and
Tubes



ENABLING TECHNOLOGY: BREAKING THE MOLD

UV-C LEDs

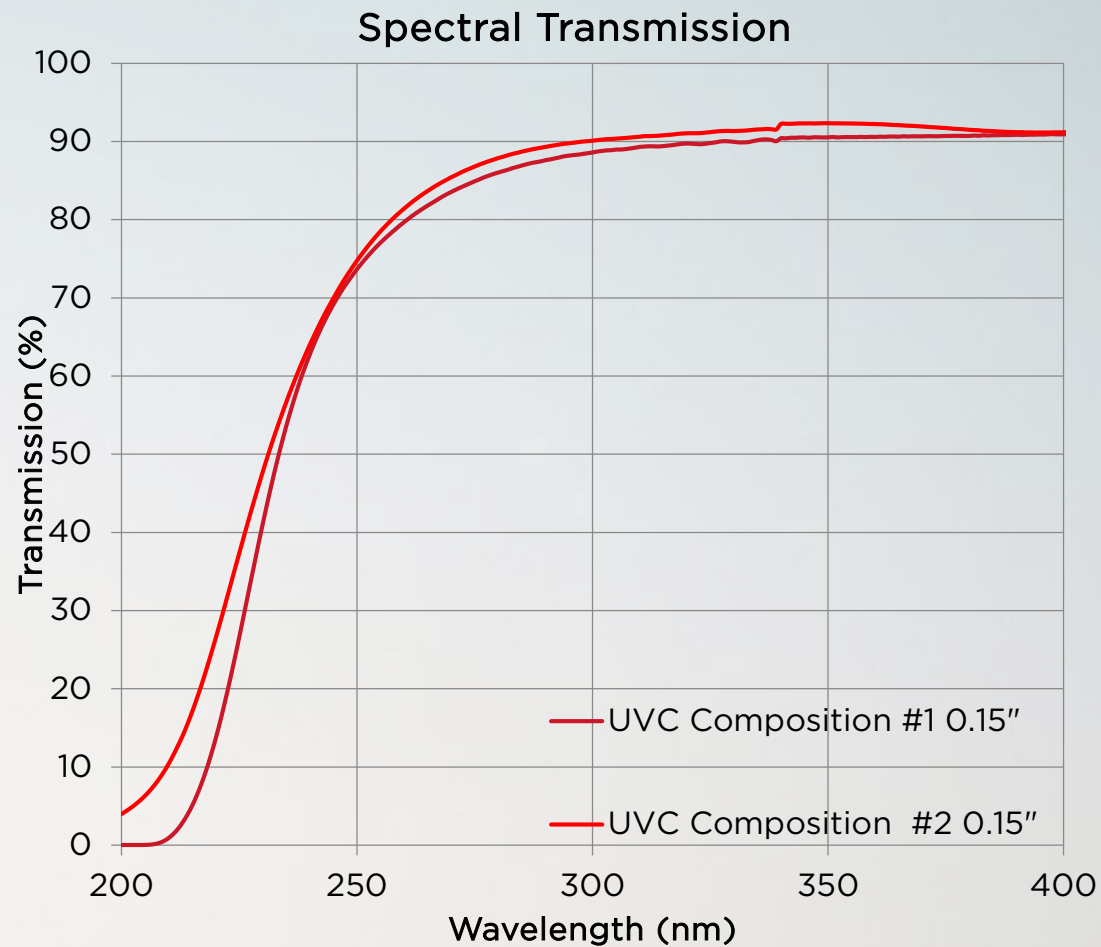


Molded
Glass
Optics

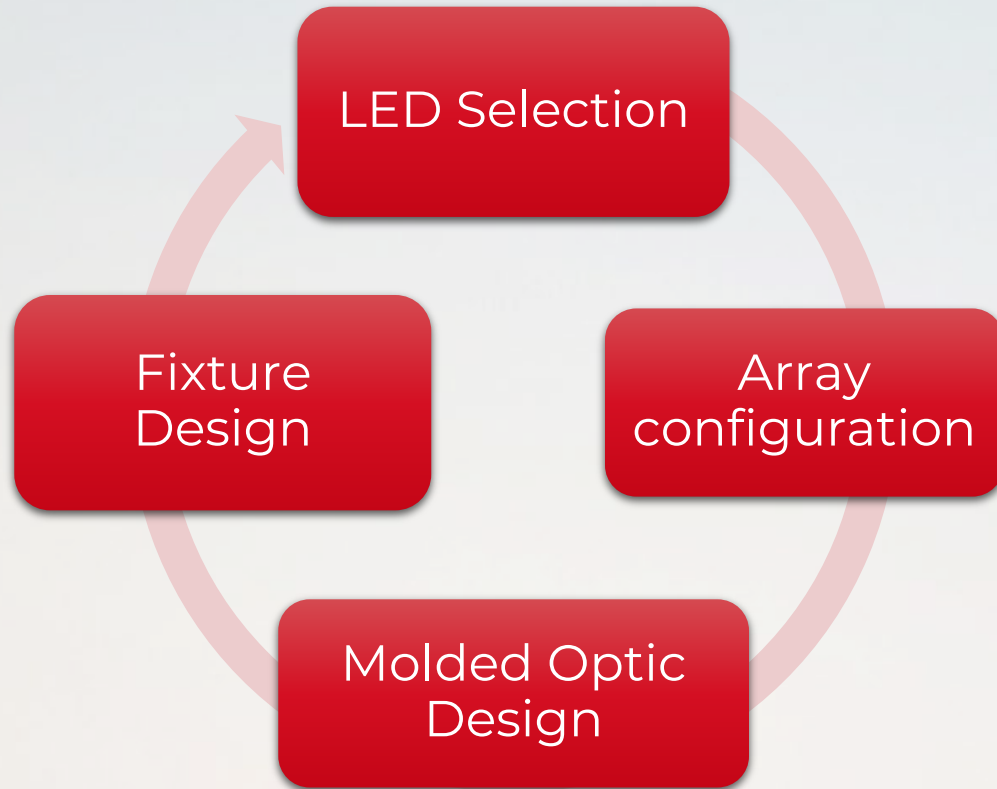


MOLDABLE GLASS

	#1	#2
CTE (E-7/°C)	81	34
Temperature Resistance	350°C 660°F	450°C 840°F
Thickness Range	0.100-10" 2.5-250mm	0.100-5" 2.5-125mm



WHAT ARE THE POSSIBILITIES?



- ▶ UV LED and Optics promote
 - ▶ Design flexibility
 - ▶ Optimized solutions
 - ▶ Efficient design solutions
- ▶ Today, we will look at unique ways to use UV LEDs and optics



SIMULATION #1

CIRCULAR SURFACE

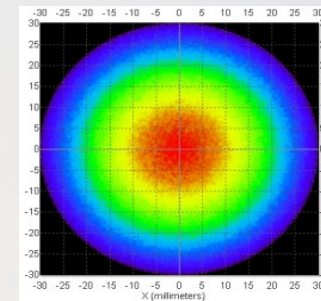
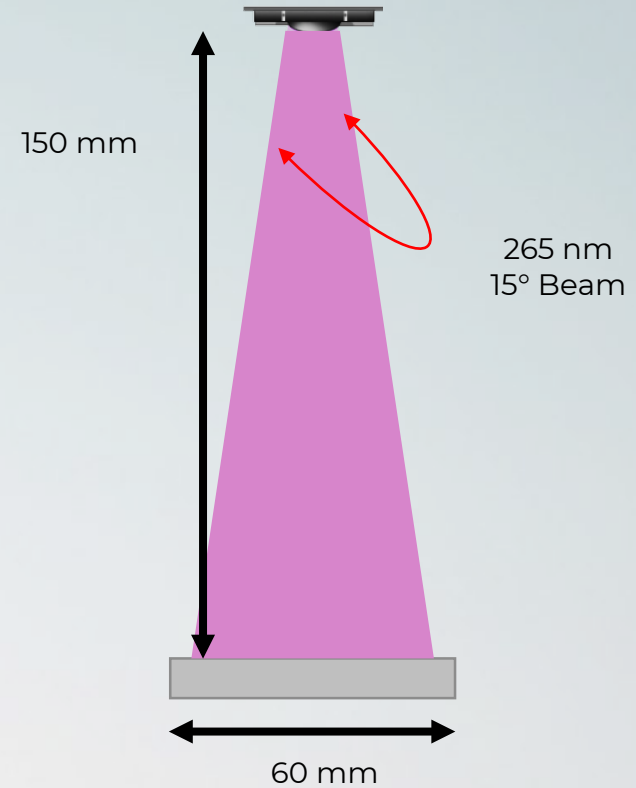


CASE STUDY

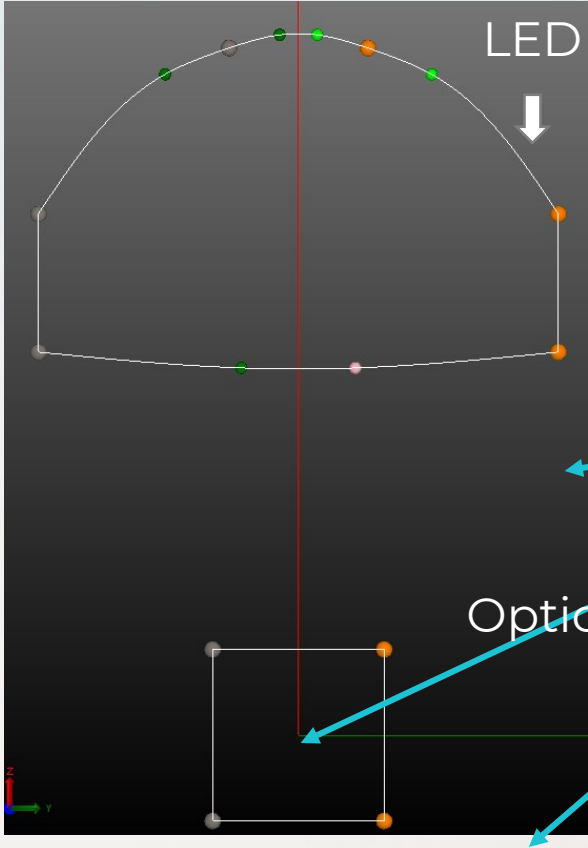
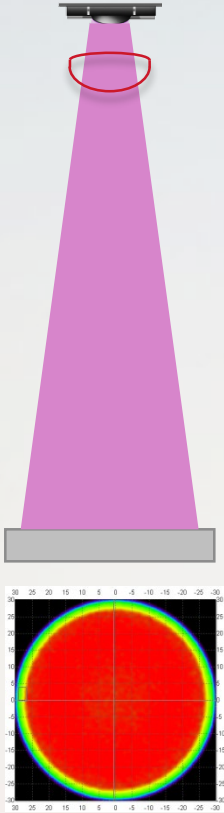
- ▶ Desired performance
 - ▶ Homogenous exposure to UV energy
- ▶ Target Area
 - ▶ 60 mm diameter, circular area
- ▶ Applications
 - ▶ Laboratory testing
 - ▶ Sample exposure
 - ▶ Dish or equipment disinfection



OPTICAL SYSTEM



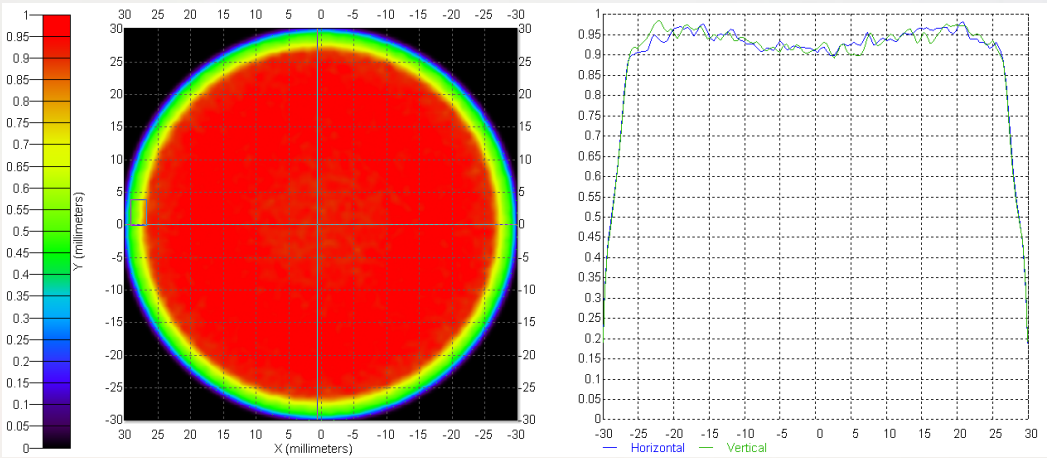
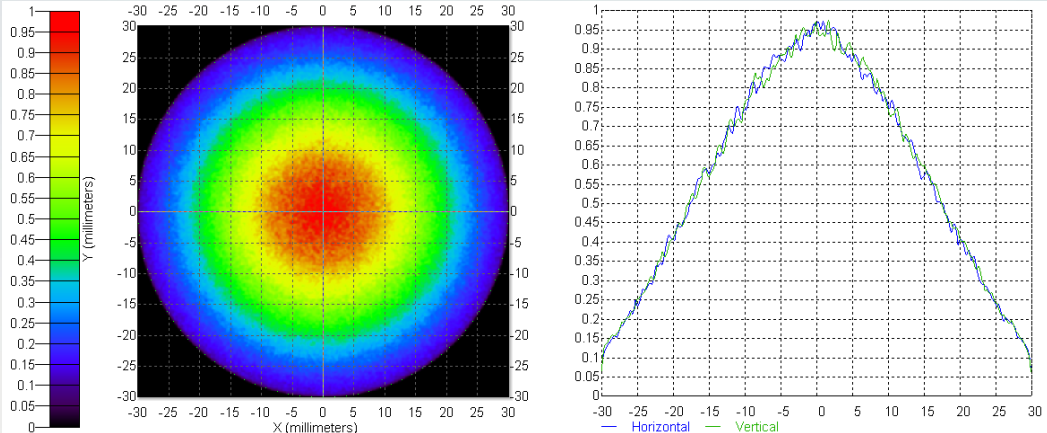
MOLDED GLASS OPTIC



3 different freeform curvatures not defined by functions or radii



RESULTS: 10 MILLION RAYS



	LED	LED with Optic
Efficiency (F/EF)	87.1%	83.9%
Average Flux	43.1%	85.2%
Uniformity (%90)	21.6%	88.3%



SIMULATION #2

SQUARE SURFACE

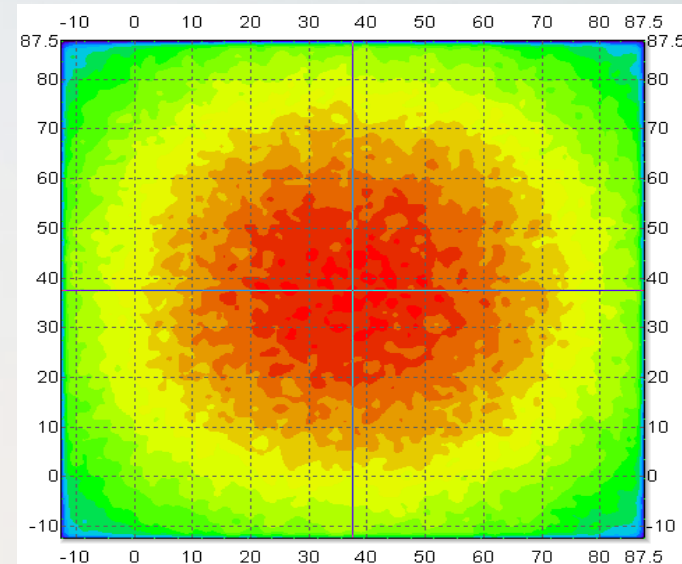
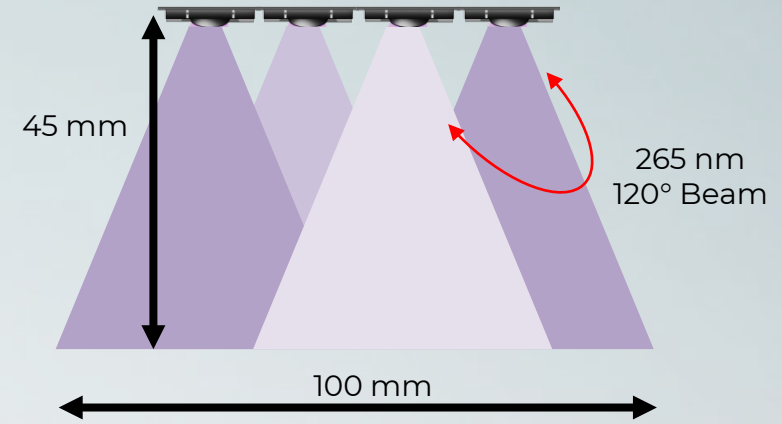


CASE STUDY

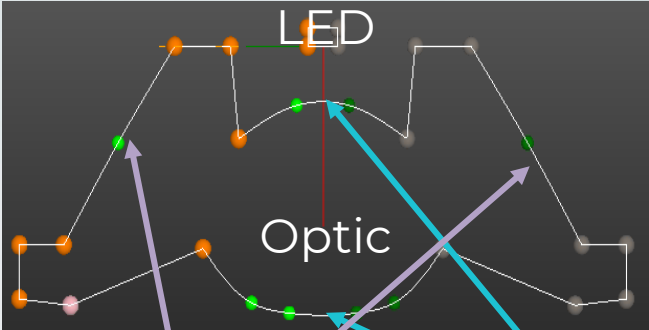
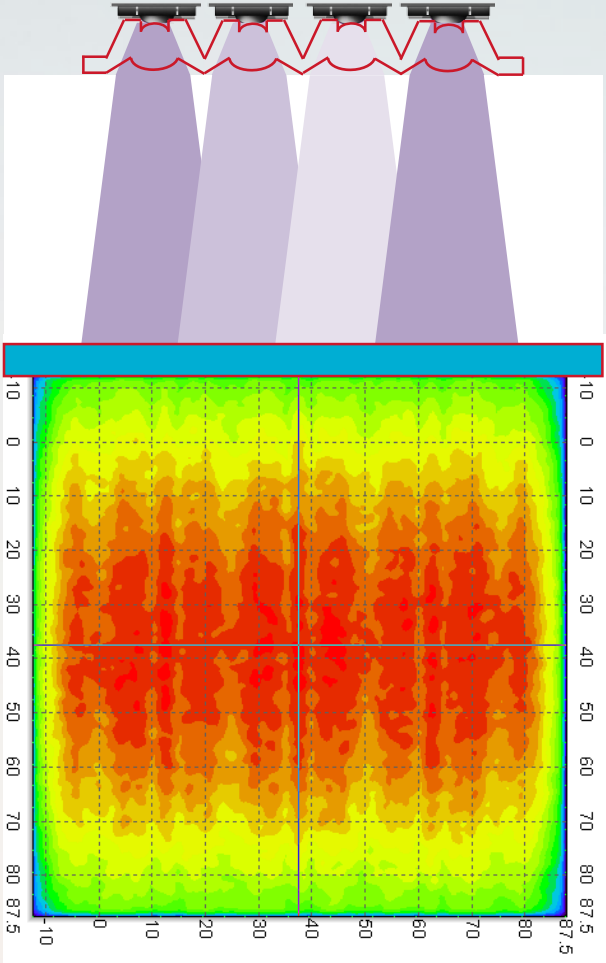
- ▶ Desired Performance
 - ▶ Homogenous exposure to UV energy
- ▶ Target Area
 - ▶ 100 x 100 mm area
- ▶ Applications
 - ▶ Laboratory testing
 - ▶ Sample exposure
 - ▶ Item disinfection



OPTICAL SYSTEM



MOLDED GLASS OPTIC

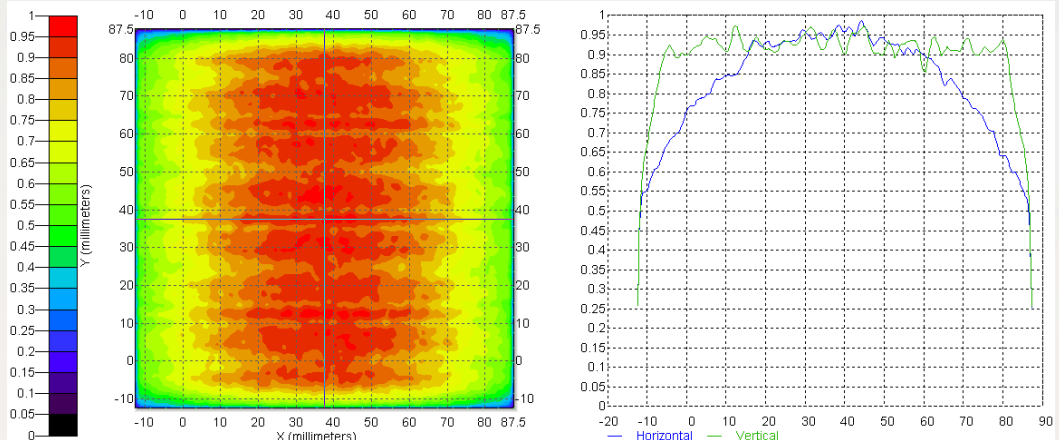
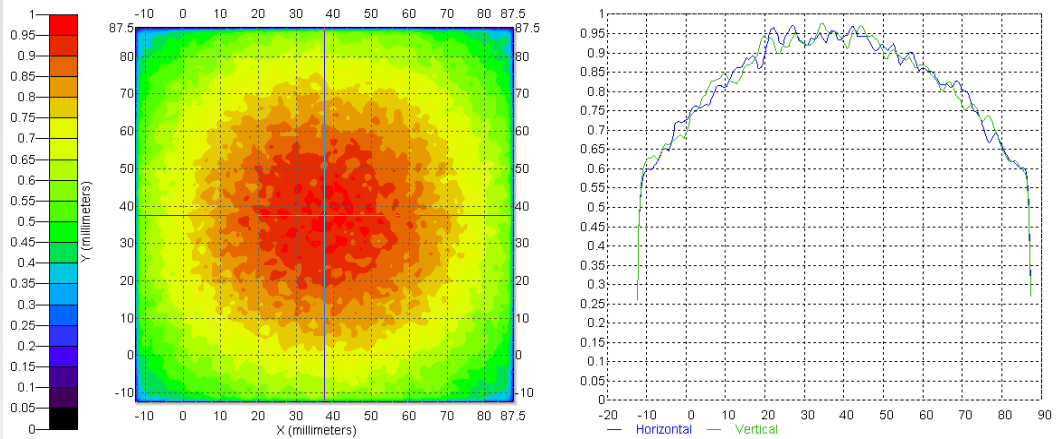


TIR surfaces

2 freeform surfaces



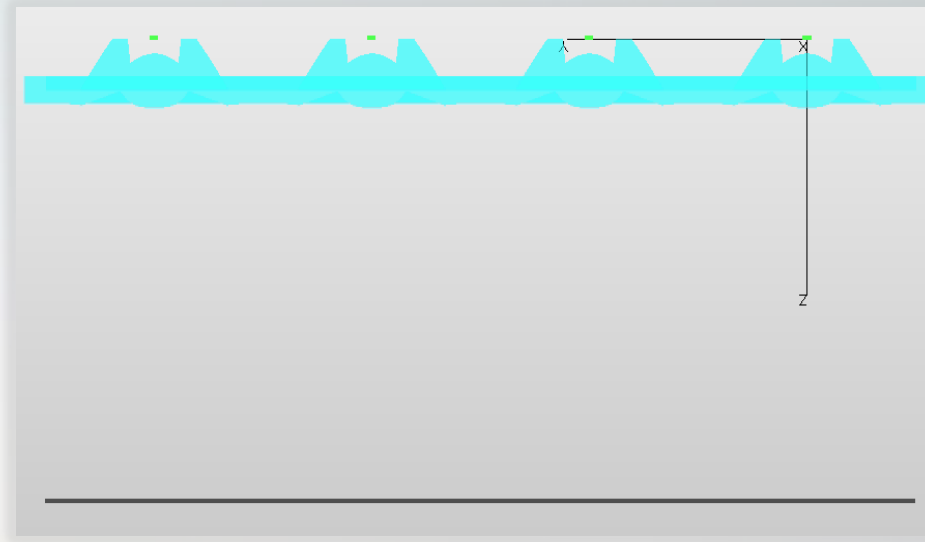
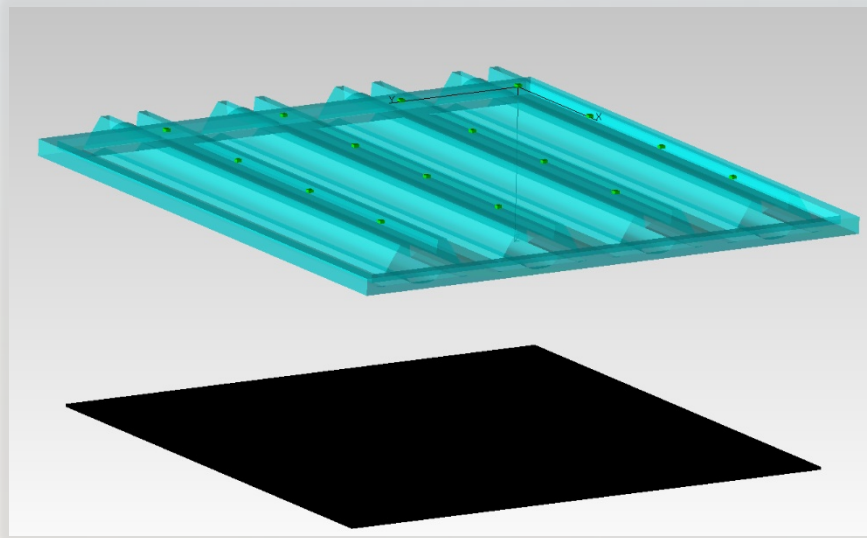
RESULTS: 8 MILLION RAYS



	LED	LED with Optic
Efficiency (F/EF)	39.2%	61.8%
Average Flux	70.4%	76.3%
Uniformity (%90)	45.5%	80.9%

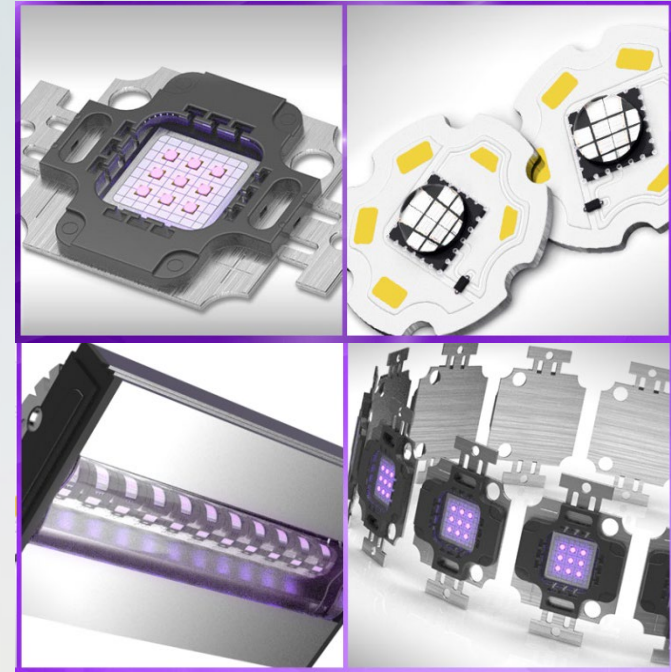


MOLDED GLASS OPTIC



OPTIMIZE YOUR DEVICE WITH THE LATEST TECHNOLOGY

- ▶ Light control for improved testing and application results
 - ▶ Significant gains in uniformity
 - ▶ Increased flux on target surface
 - ▶ Increased fixture efficiency





HIGH-PERFORMANCE GLASS

- **FLEXIBLE VOLUMES:** Flexibility to scale volumes and minimize lead times through a range of production capabilities, glass melts that can range from 0.5lbs — 2,500lbs.
- **GLASS SCIENCE:** In-house engineering specialize in formulating on the atomic level. Custom glass development and formulations.
- **GLASS TESTING LAB:** Sophisticated measurement and testing instruments — thermal properties, spectral transmission, chromaticity, refractive index, and more.
- **PRECISION MOLDED:** Integrated manufacturing capabilities with in-house mold designers and fabricators. Our unique molding process allows for a variety of complex shapes and unique forms. Filter glass is molded to nominal thicknesses.

CONTACT

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STATS

Year Founded: 1926

Ownership: Closely Held

Location: Pittsburgh, PA, USA

Number of Employees: 150

Facility: 127,000 square feet

Quality System: ISO: 9001 Certified

MISSION

Our mission is to make the world safer and more productive through excellence in glass science, collaborative innovation, and the production of technical glass for unique and demanding applications.

