

“THE MICRO-OPTICS REVOLUTION” IN AUTOMOTIVE LIGHTING

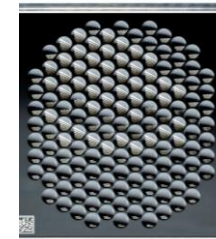
Dr. Wilfried Noell

Director R&D at SUSS MicroOptics SA
Switzerland

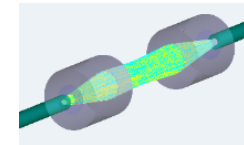
SUSS MICROOPTICS – WE SET THE STANDARDS



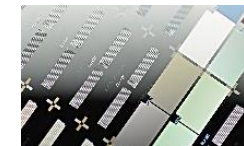
We are a leading supplier for **high-quality Micro-Optics** delivering **Key-Enabling Components** for **Data/Telecom, Sensing, Automotive, SEMI** and **Medical**.



Microlens Array



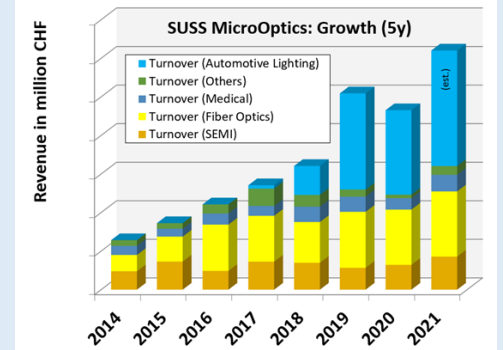
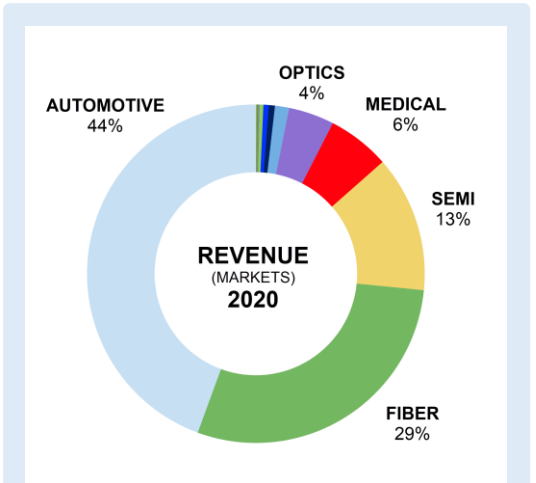
Fiber Coupler



Diffractive Optics

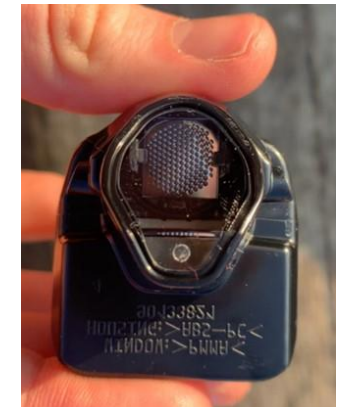
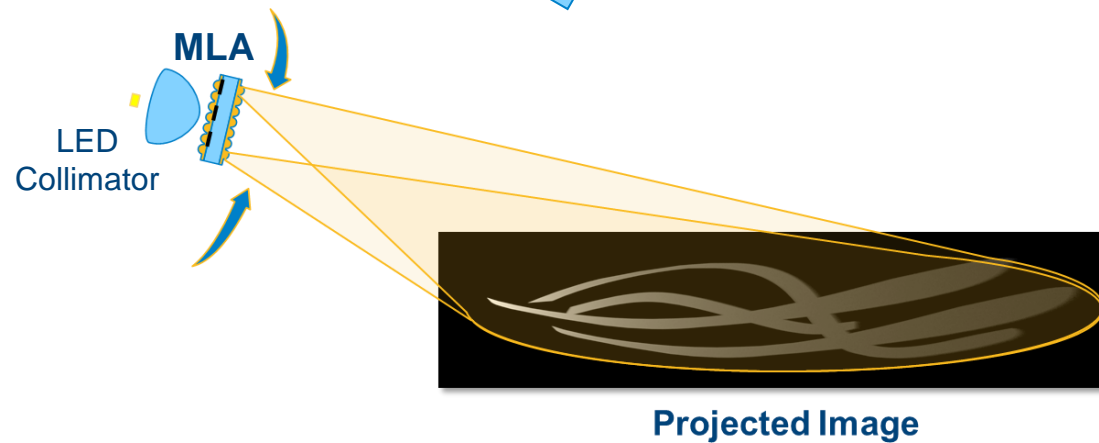
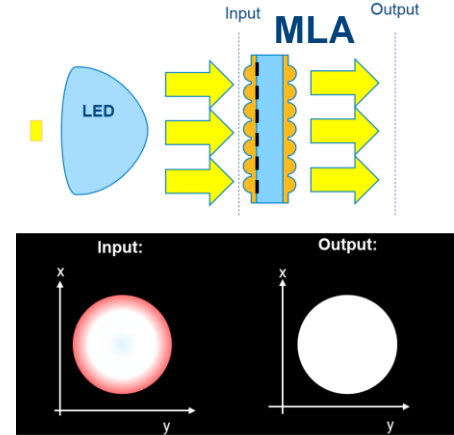
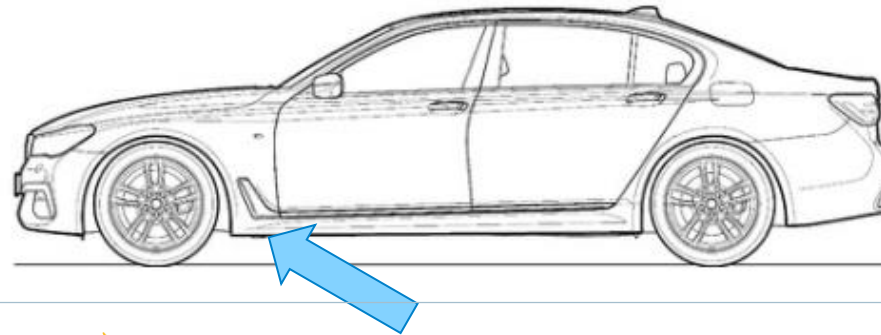


UV Illumination



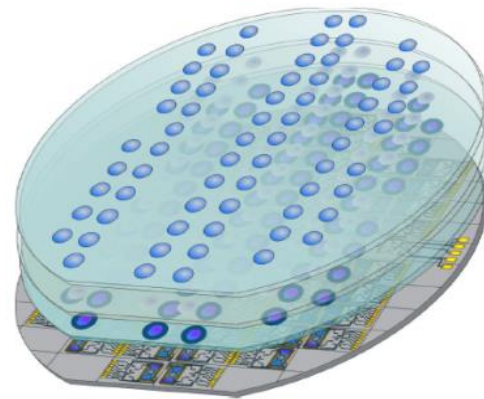
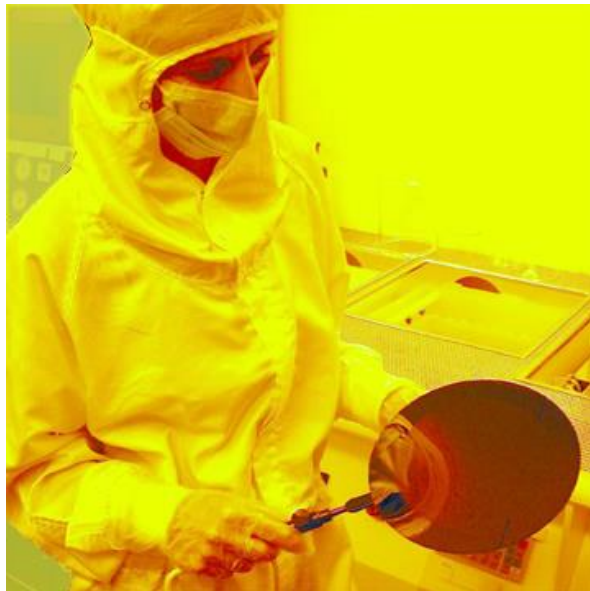
LIGHT CARPETS FOR BMW WELCOME LIGHT

+ Development by Fraunhofer IOF (Jena), started in 2014

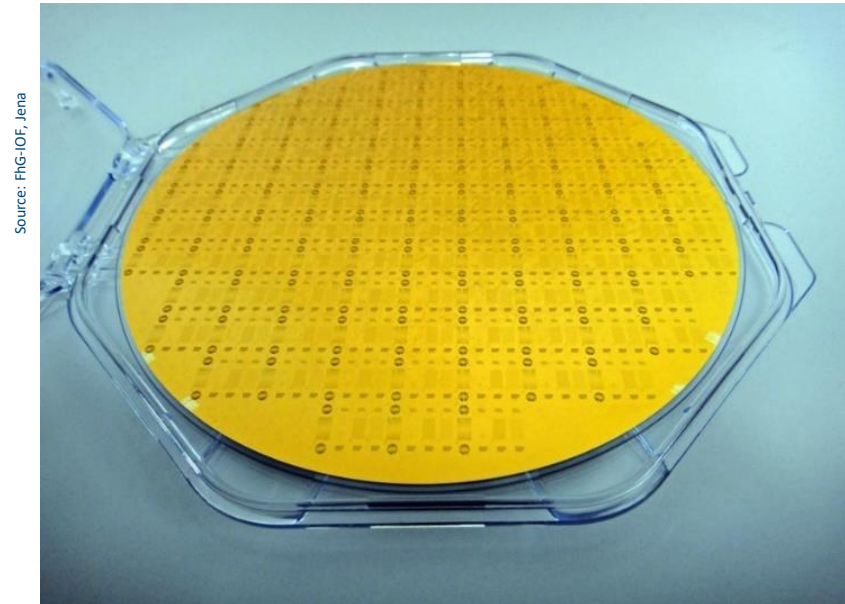


PLANAR MICRO-OPTICS ON WAFER-LEVEL

- + Semiconductor industry & technology enables micro-optics manufacturing.
- + Wafer-Level Micro-Optics



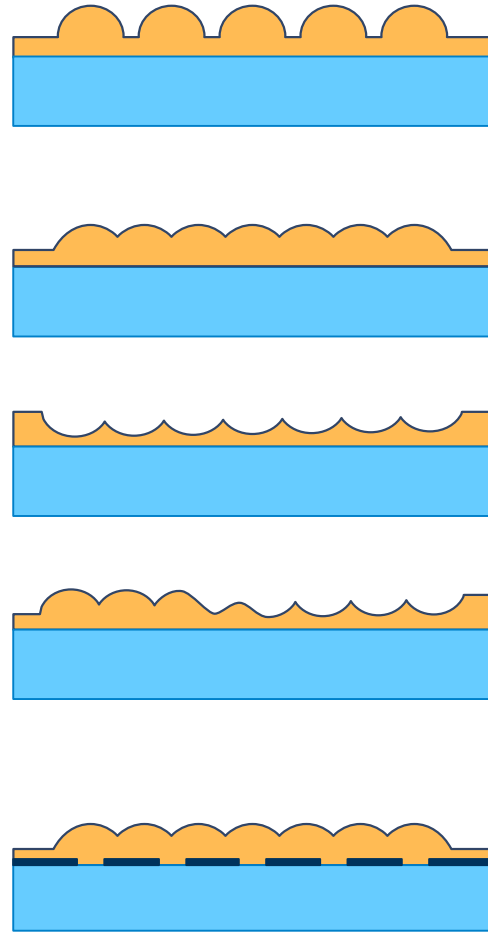
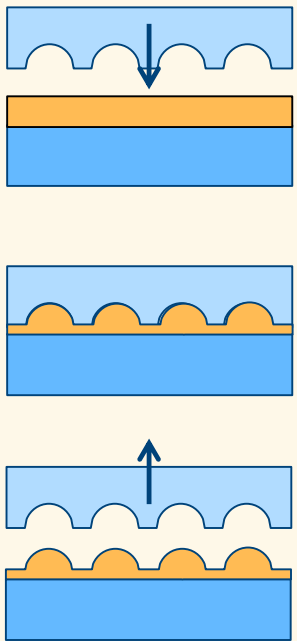
Wafer-Level Packaging



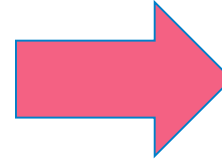
Source: FHG-IOF, Jena

IMPRINTED MICROLENSES – WAFER-LEVEL – DOUBLE-SIDED

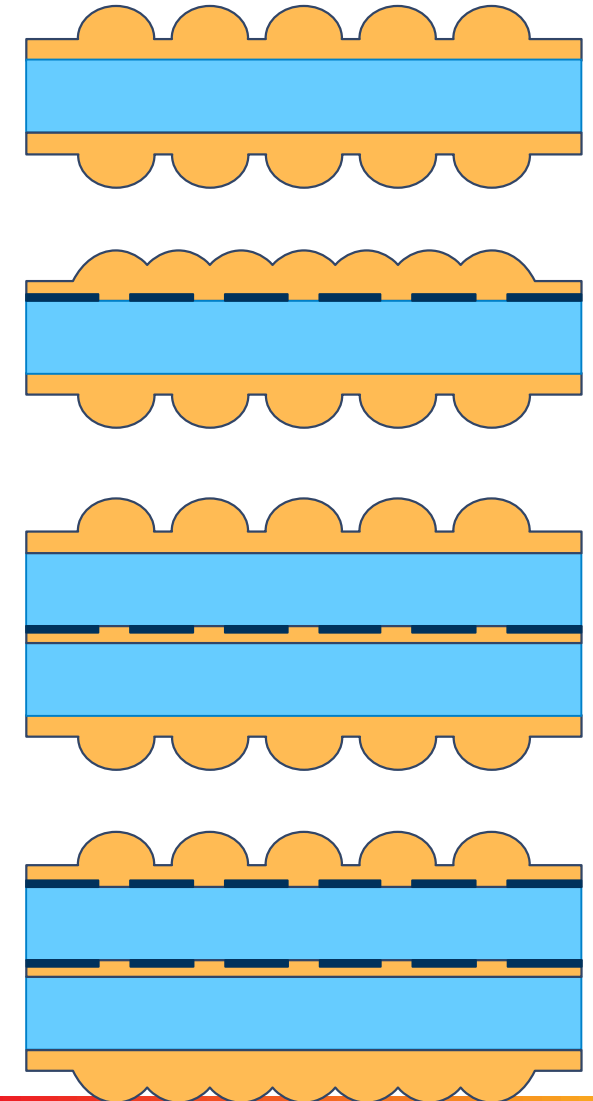
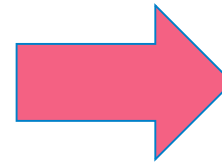
UV imprint of a liquid polymer layer on a glass substrate



Front- and Backside Optics



- ❖ Double-sided MLAs
- ❖ Precisely aligned
- ❖ Embedded apertures



LIGHT CARPETS: DESIGN AND SAFETY

Future



Sources: BMW, www.glowwing.com

INTERIOR LIGHTING

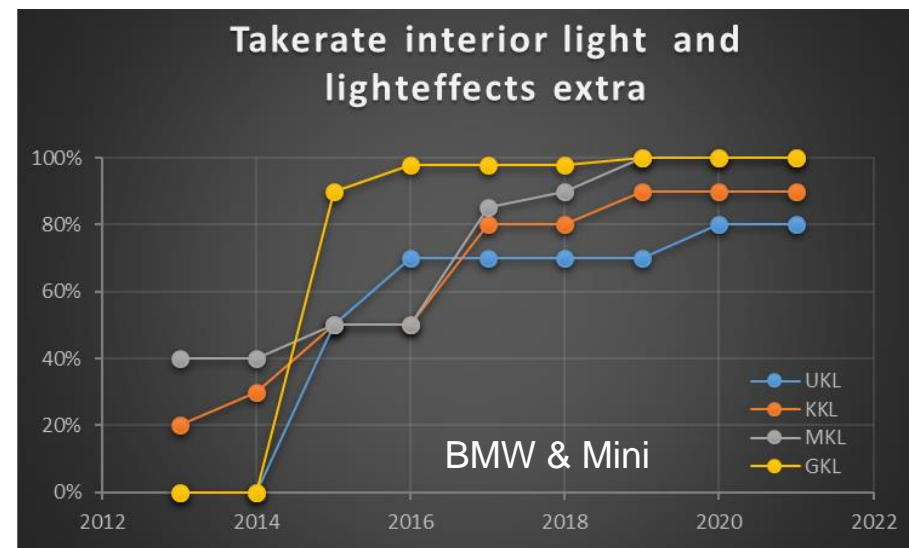
Direct sight on projection at high quality

Semi-dynamic projections

Curved surfaces

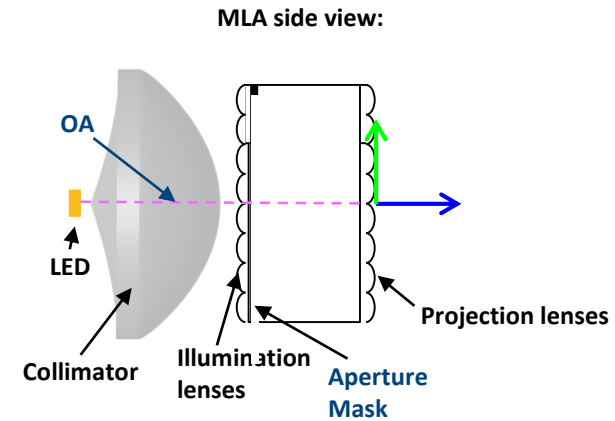
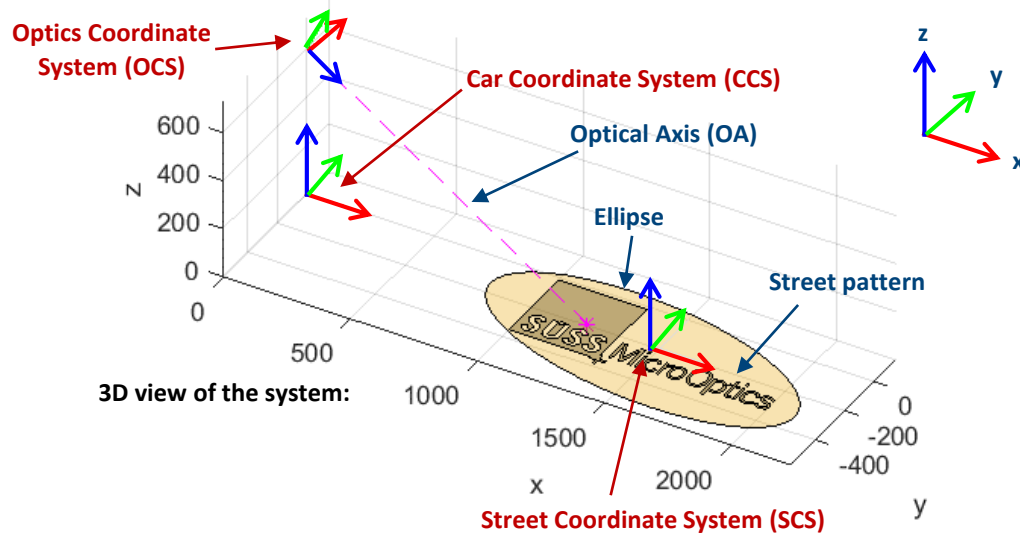


Small integration space

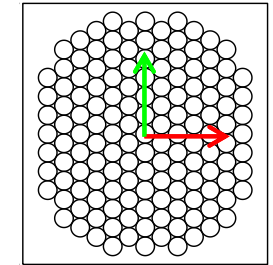


FULL OPTICAL DESIGN CAPABILITIES IN-HOUSE

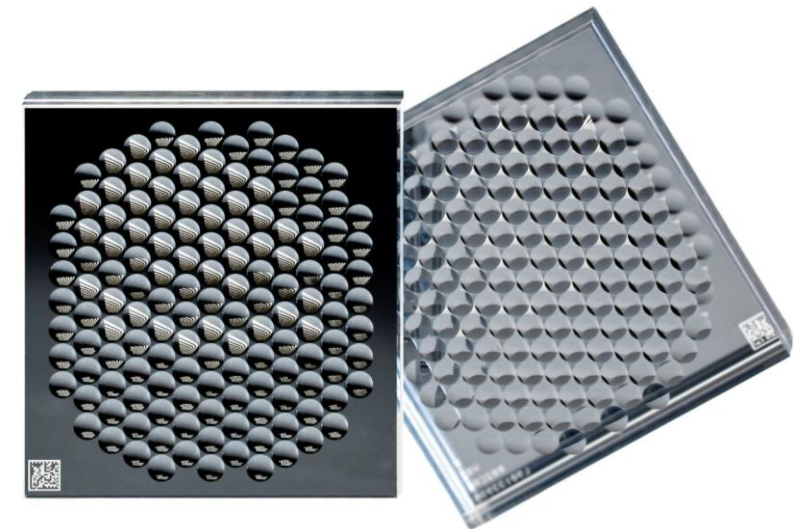
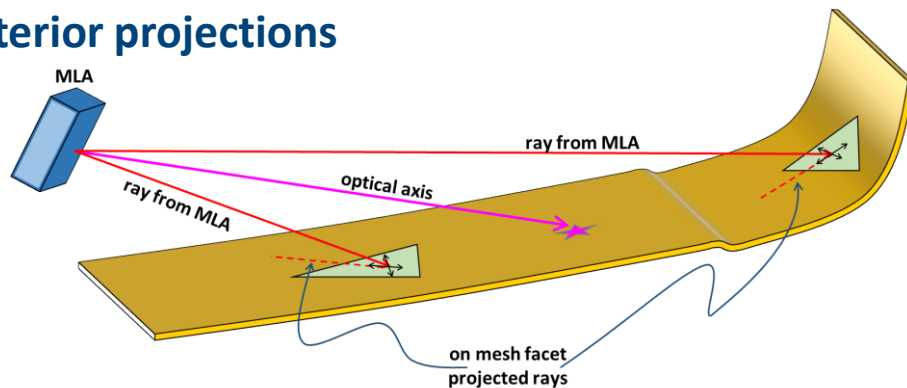
+ Planar surface for decorative and safety



MLA front view:



+ Non-planar / curved surfaces
+ For interior projections



MICROLENS - ULTRA-SLIM HEADLIGHTS

- + Why do people buy new cars?
 - Innovative features, technology
 - Design, beauty and uniqueness
- + 1st microlens headlamps in cars in 2021
- + Ultra-slim headlamps are the new trend



Lucid Motors, Hyundai

MICRO-OPTICS HEADLIGHTS



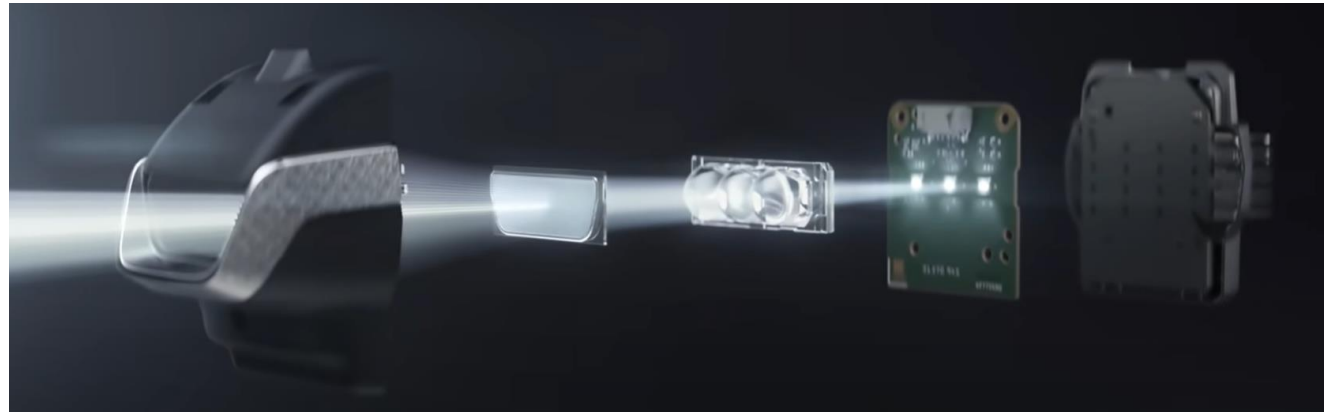
Lucid Air, top view



Headlight

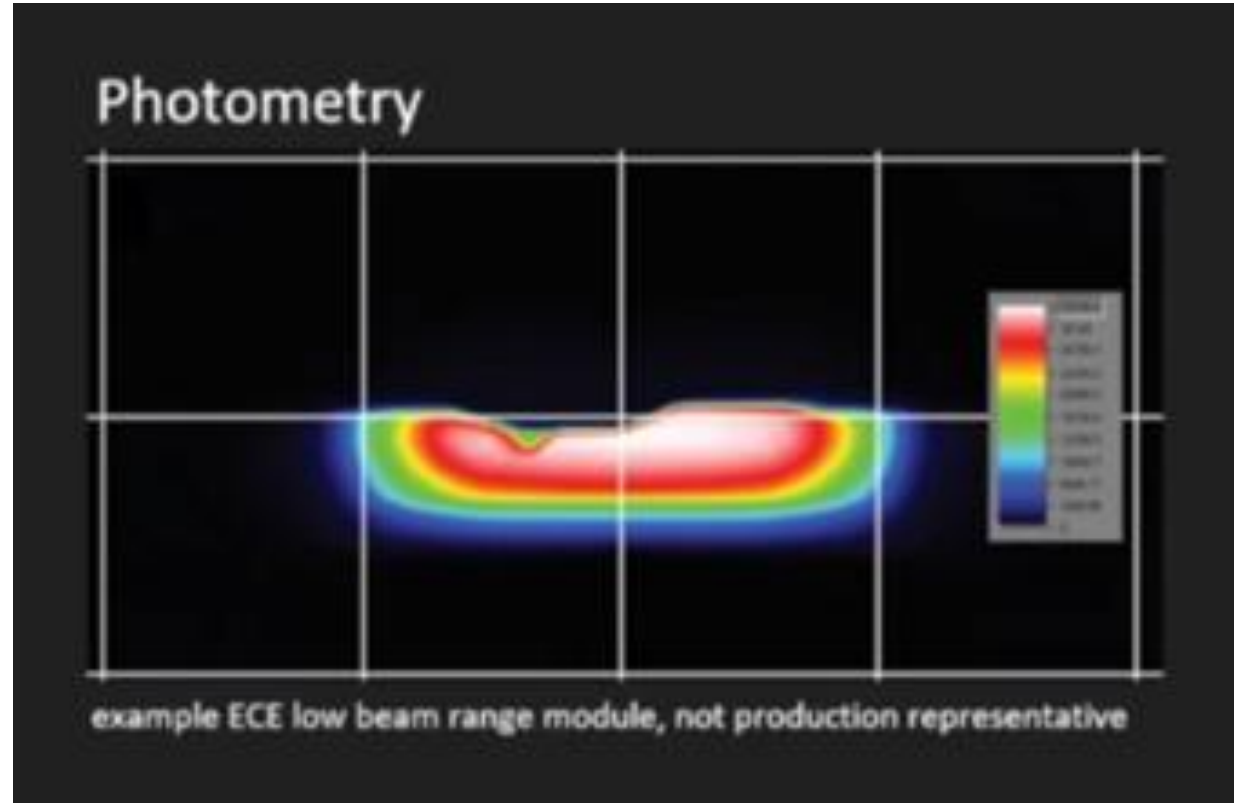
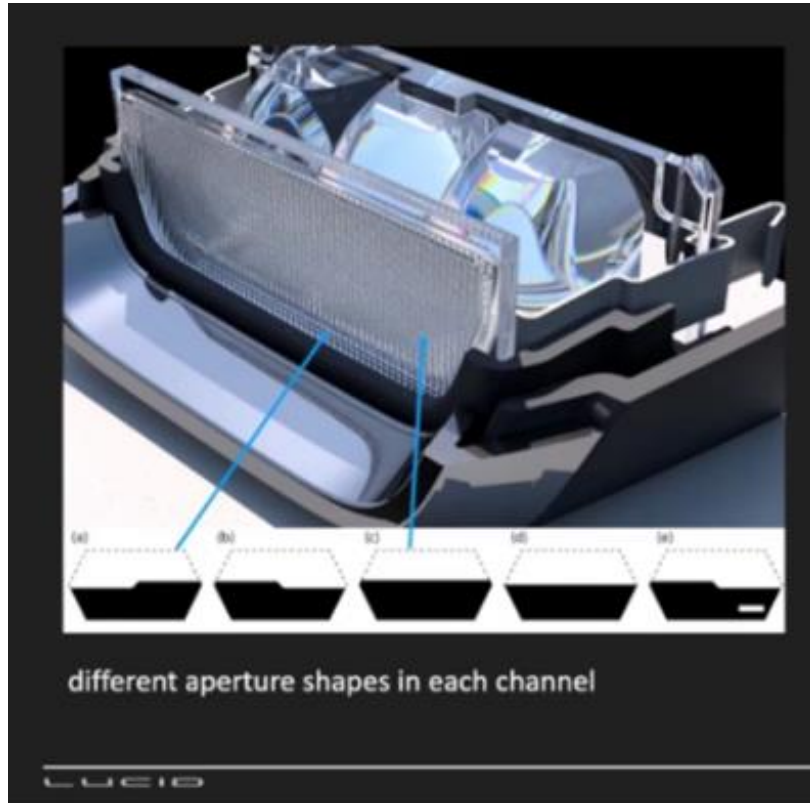


Module



Module, exploded view

MICRO-OPTICS LIGHT SHAPING



The Opportunity

- + Headlamps integrated and hidden in the design
- + Not many concepts out there for miniaturization
- + Micro-Optics is by far the most-promising approach for the next generations of automotive lighting solutions.

Challenges and Key Developments

- + Design flexibility
 - Size, weight and power consumption
- + Higher efficiency
 - Lower energy consumption (EV)
- + Visible innovation and uniqueness
 - Premium cars, individualization
- + Cost reduction



BMW Laser Light (ZKW)



Lucid Air – Microlens Head Lights

A close-up photograph of a hand holding a black marker, writing the words "Thank you!" in a cursive script on a white surface. The hand is positioned on the right side of the frame, and the marker is in the process of finishing the exclamation point.