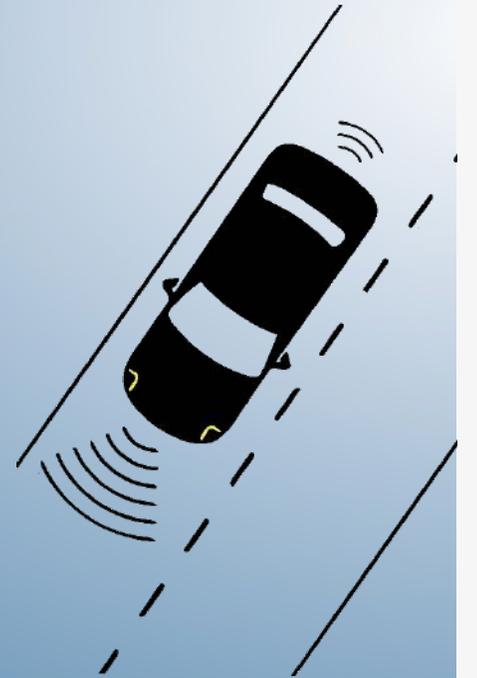
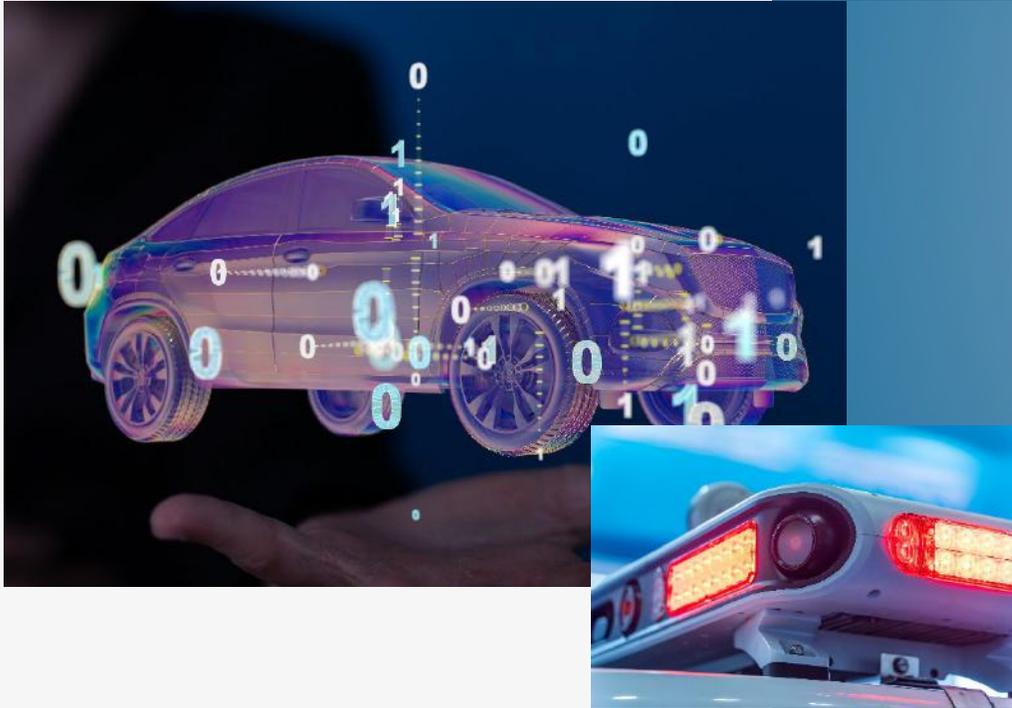


HIGH PRECISION OPTICS IN VOLUME



Multifunctional Lenses

 **DOCTER**[®] OPTICS

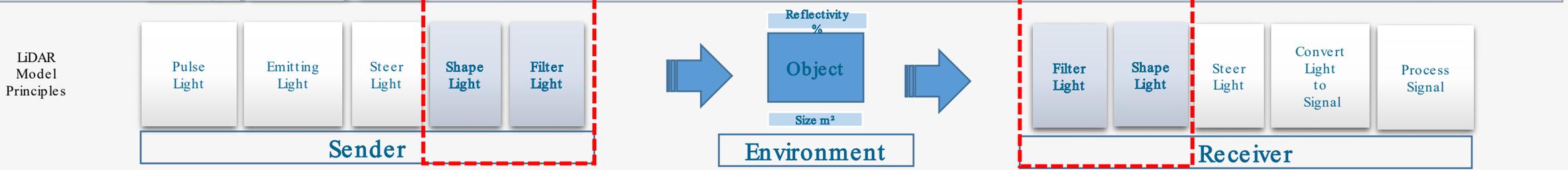


1. OVERVIEW
2. TECHNOLOGIES
3. GLASS PRODUCTION
4. MULTIFUNCTIONAL LENS SOLUTION
5. SUMMARY

OPTICAL SOLUTIONS FOR LIDAR APPLICATIONS

LIDAR APPLICATIONS

Overview



PATENTED PRODUCTION PROCESSES MEETS CUSTOMER AND MARKET EXPECTATIONS



2004

DOC3D[®]

Double side molded from gob



Wide range of geometries on large production scale with high cost efficiency



2011

DOCFast[®]

from liquid glass



Shortened process chain with more complex geometries



2018

DOCLight[®]

Injection molding of polymer lenses



Short cycle time polymer lens production for high volume application



2021

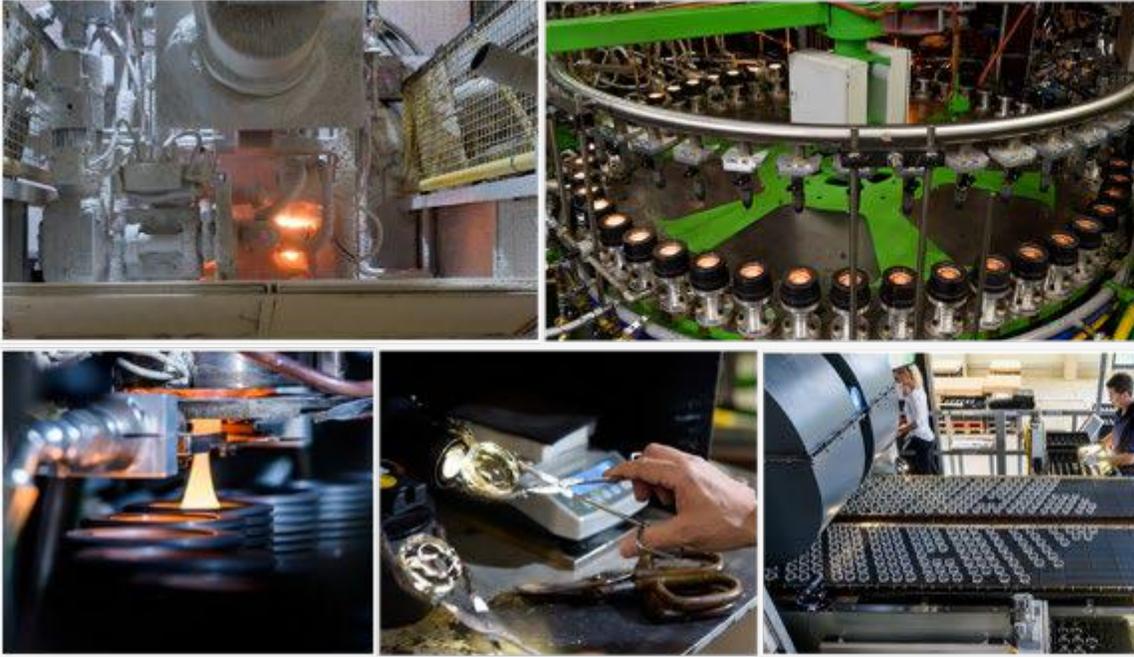
DOC μ Tec[®]

Double side molded free form optics with high precision

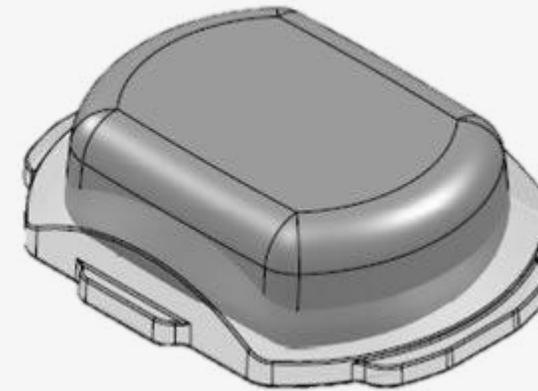


DOC3D driven to next level of accuracy for new markets (e.g. LIDAR / VR / pixel light systems)

INHOUSE GLASS PRODUCTION SINCE 2014 DOCTAN®



- Production glass blanks “gob” in house – quality and shape similar to final product
- Diverse shape design possible (round, rectangular, cone) depending on lens design
- Short feedback loops in development process



IN HOUSE GLASS PRODUCTION

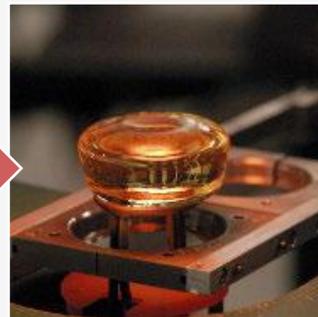
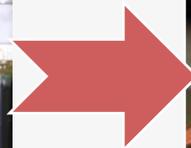
Glass Production Processes



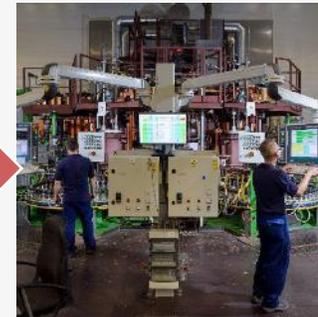
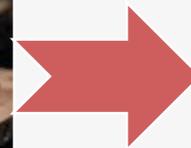
Gob Handling



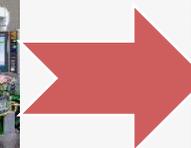
Gob Heating



Gob Handling



Moulding

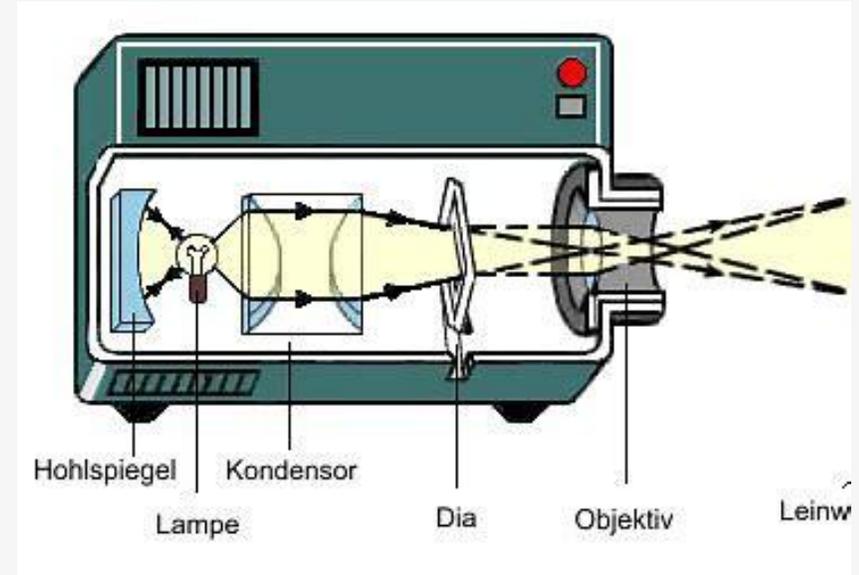


Annealing

- Non-isotherm molding process with short cycle times (molding 20-30s / annealing 1-3h)
- Annual capacity > 20 Mio. pcs
- Lenses for automotive headlamps → round, rectangular, aspheres, biconvex, plane, concave

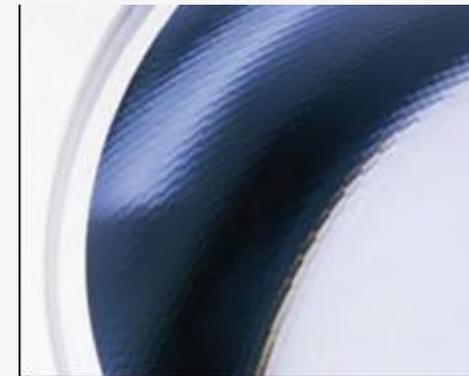
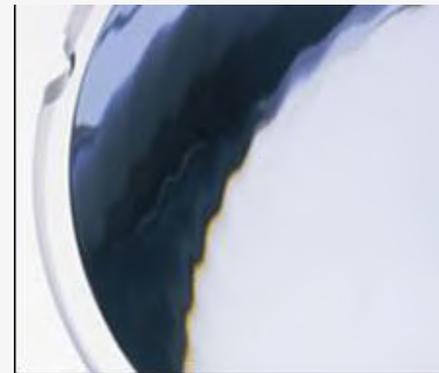
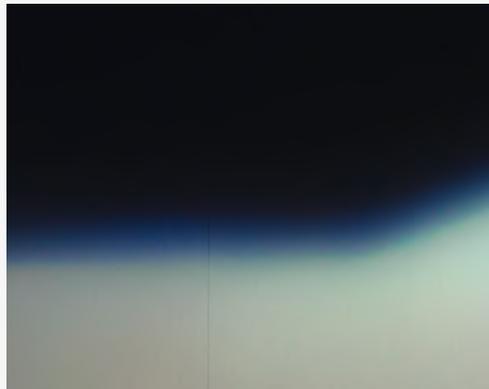


PROJECTION SYSTEMS AND WHERE THEY CAME FROM

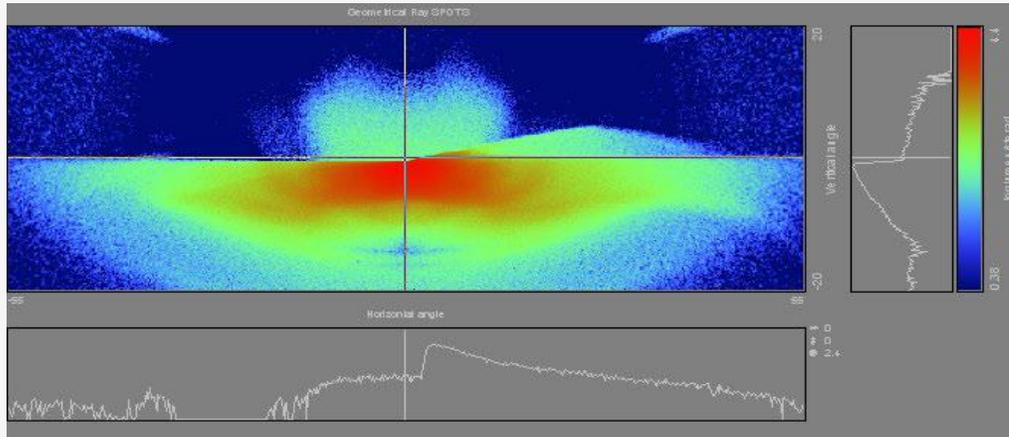




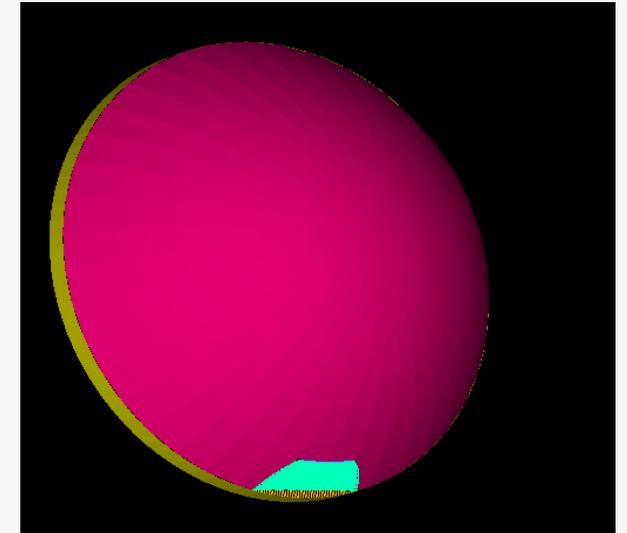
Microstructures as
diffuser to reduce cut off
line sharpness



MULTIFUNCTIONAL SOLUTION

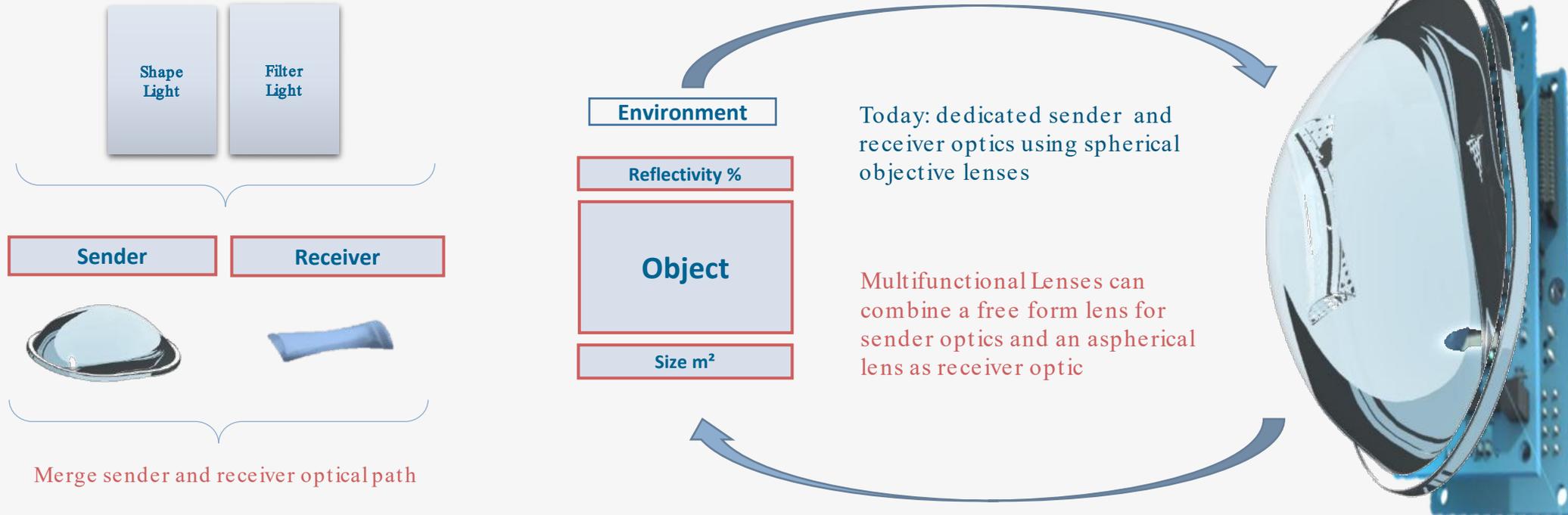


Overhead Signlight
solutions



MULTIFUNCTIONAL SOLUTION

Precision Optics with DOC μ Tec[®]



- ✓ Reduce space => improve integration of LIDAR Systems in Application
- ✓ Reduce complexity => improve robustness and industrialization
- ✓ Reduce weight => ready for E-Mobility

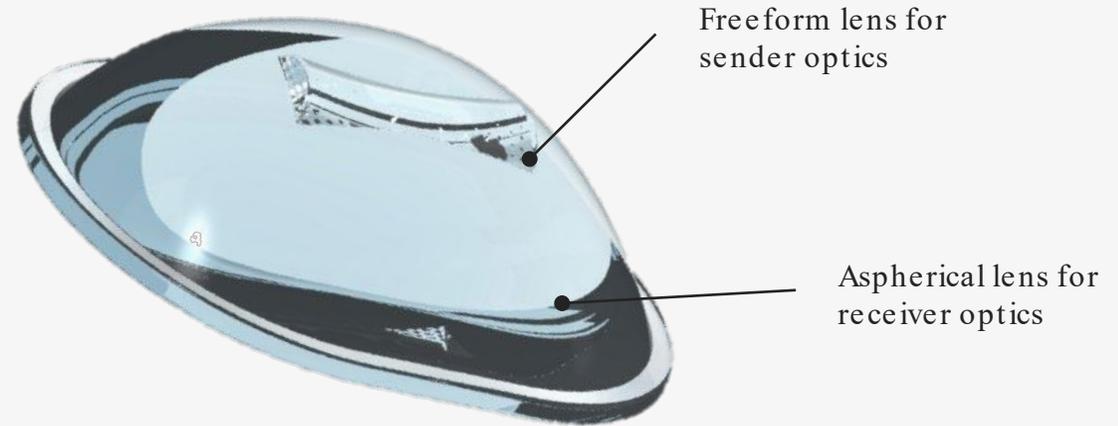
→ Scalable solution to address mass market

FREE FORM MOLDING FOR HIGH PRECISION SUMMARY

Material DOCTAN

- ✓ Backside plane
- ✓ multifunctional design (design related)
 - Peak to valley <math>< 2\mu\text{m}</math>
 - RMSi <math>< 1\mu\text{m}</math>
- ✓ Non-Isotherm 25sec/pcs
- ✓ Draw 3-5°

LIDAR Lens (example of a multifunctional optic)



✓ superior temperature stability (-40 to +200°C)

✓ low thermal expansion

✓ nonflammable

✓ Mass production scalable due to low cycle time

✓ No degradation at high laser density (no yellowing)

✓ AR coating multi layer @ 905nm

✓ 100% recyclability

✓ zero water absorption

✓ 100% degassing free

Office: +49 36481 27-300
Mobile: +49 170 21 00 777
Web: www.docteroptics.com
Mail: jens.fischer@docteroptics.com



Jens Fischer
Senior Key Account Manager
Automotive International



**VIELEN DANK FÜR IHRE
AUFMERKSAMKEIT!**

