PIXEL LIGHT HEADLAMPS:
COST COMPETITIVE LENS SOLUTION

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DOCTER® OPTICS

WHAT'S ON THE ROAD TODAY

European leading pixel lighting systems

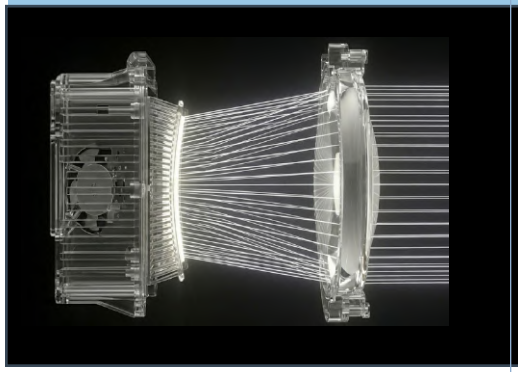
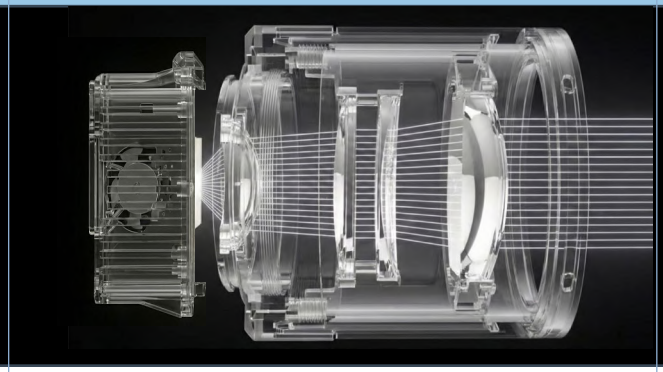
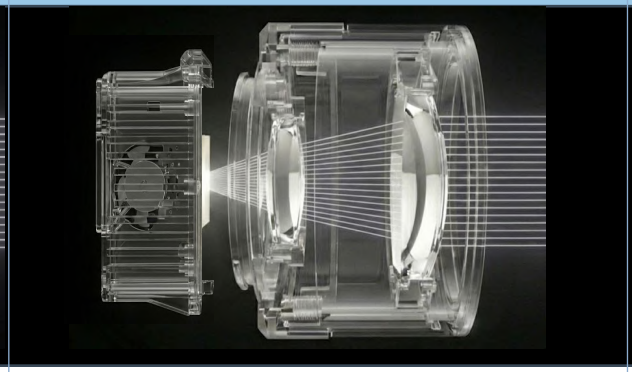
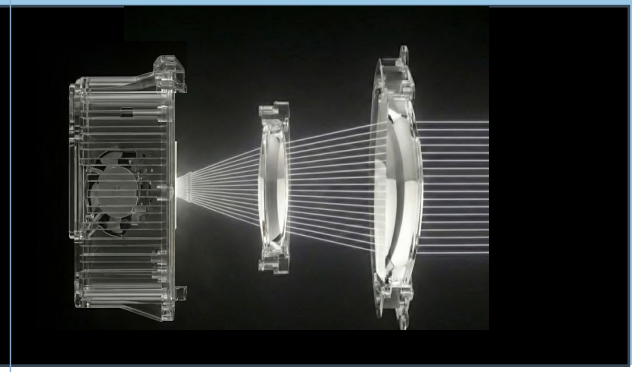
	A	B	C
			
Light generation	DLP	Pixel light	Pixel light
Optical complexity	*****	****	**
Resolution	*****	***	***
Efficiency	**	***	***
FOV	14°	24°	18°

Multi lens DLP system

Objective lens out of 4 aspherical glass and aspherical polymer lenses

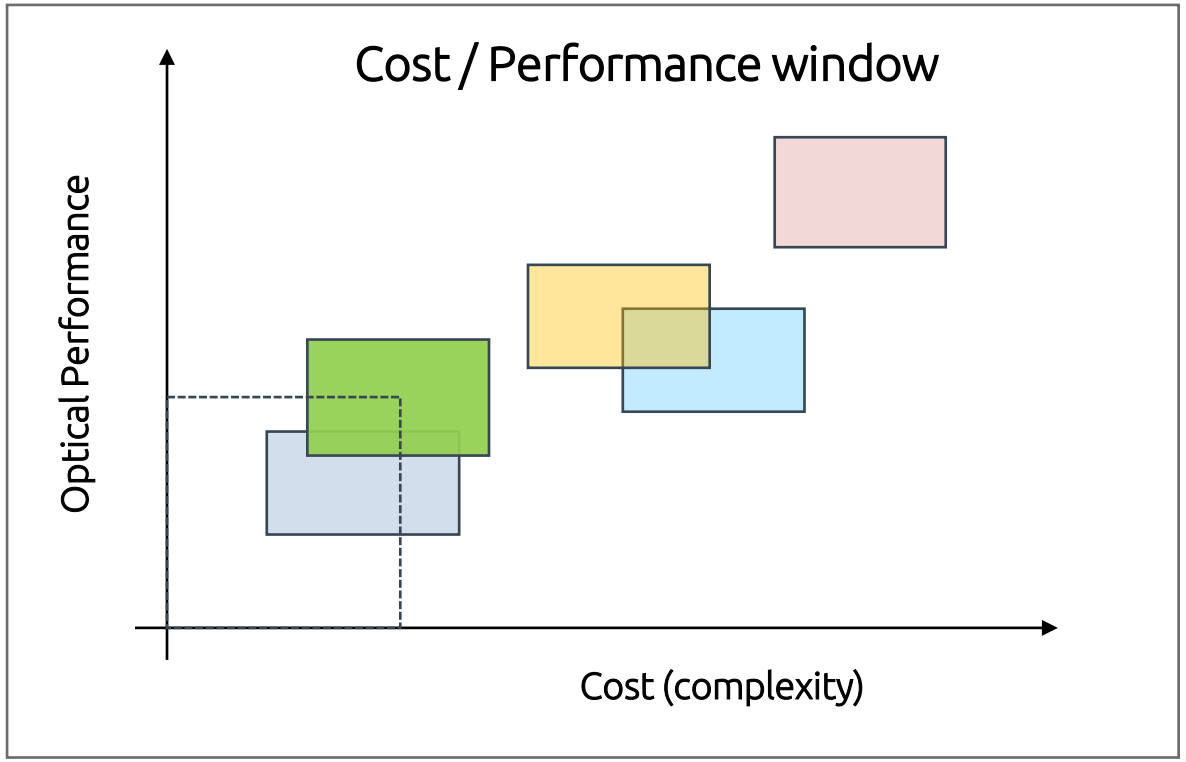
Objective lens out of 2 spherical glass lenses

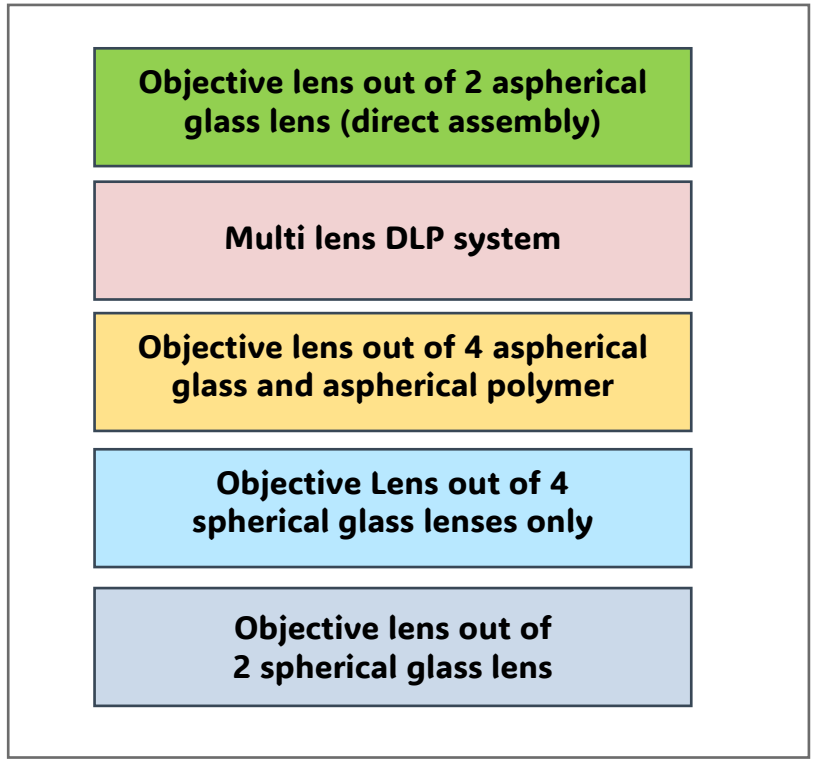
VALUE CHAIN - DESIGN COAST BREAK DOWN
Tier 1 / Tier 2

Lens production 2pcs	Lens production / 4pcs	Lens production 2pcs	Lens production 2pcs
	Barrel production Spacer production Lens alignment and barrel assembly Objective Lens assembly	Barrel production Spacer production Barral assembly Objective Lens assembly	
Headlamp assembly 1) Alignment of light source and primary optics 2) Alignment secondary optics	Headlamp assembly 1) Alignment of light source Objective lens	Headlamp assembly 1) Alignment of light source Objective lens	Headlamp assembly 1) Alignment of light source and first lens 2) Alignment second lens
			
▪ Proven concept ▪ Limited resolution ▪ High value creation at Tier 1	▪ Increasing number of lenses ▪ Add barrel and spacer as additional components ▪ Increasing optical performance ▪ Increased complexity in value chain	▪ Use 2 spherical glass lenses out of different material for color correction ▪ Minimize effort on barrel assembly and spacers ▪ Balance optical performance ▪ Increased complexity in value chain	✓ Use 2 aspherical lenses out of different glass material for **color correction** and increased beam performance ✓ Direct delivery of lenses to Tier 1 => skip barrel, reduce complexity ✓ Direct assembly at Tier1

KI generated pictures

POSITIONING AND SOLUTION

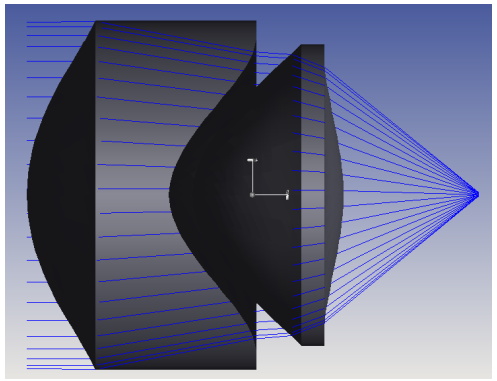


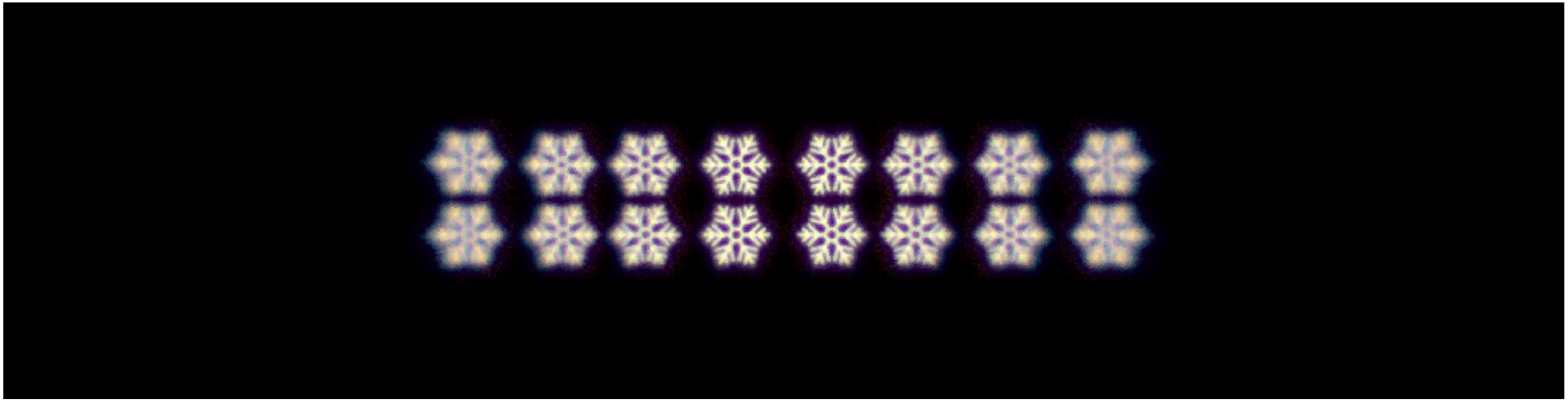


- 2 aspherical glass lenses offer a visible improvement in optical performance compared to spherical lenses;
- Reduce complexity;
- Not just a compromise: Engineered for *future-proof* automotive lighting requirements.

PERFORMANCE VALIDATION: OBJEKTIVE LENS 16° FOV

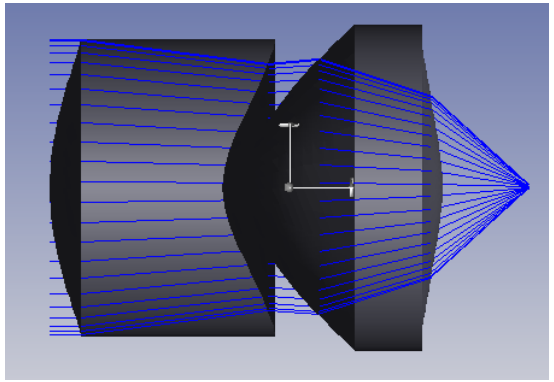
- **FOV:** 17deg
- **EFFL:** 26mm
- **Size of LED Array:** 12.8mm x 3.2mm
- **Efficiency:** 32% (including Coating)
- **Image Distance:** 10m

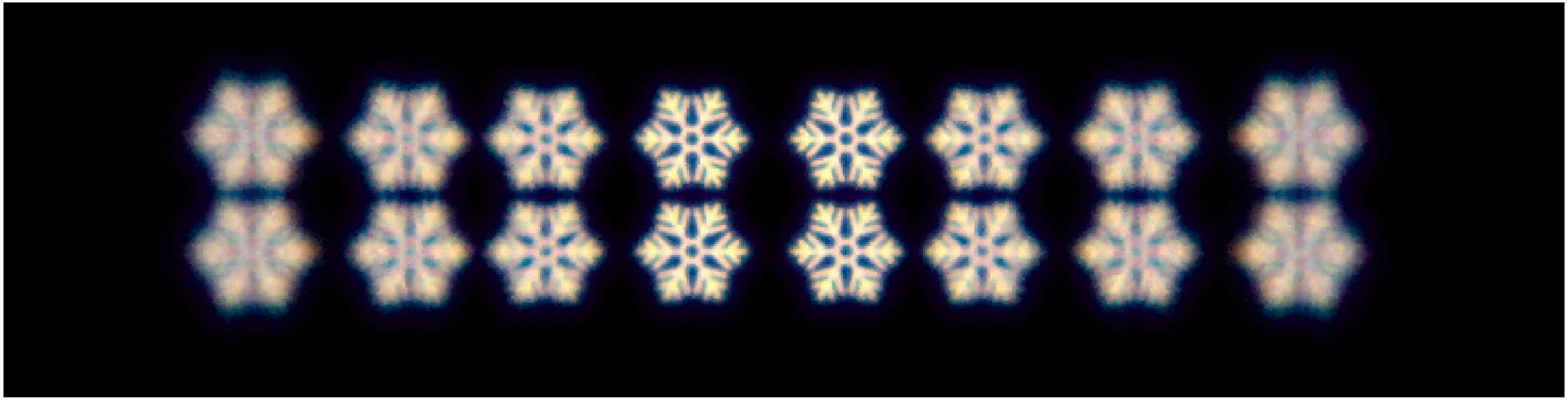




PERFORMANCE VALIDATION: OBJEKTIVE LENS 30° FOV

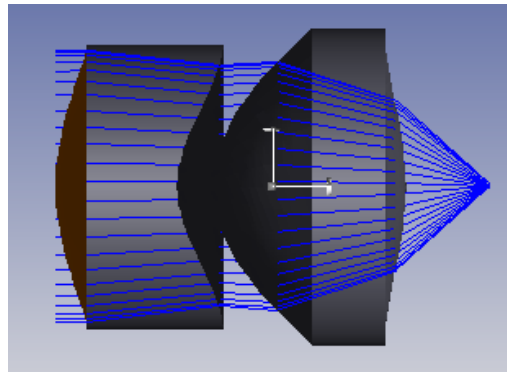
- FOV: 30deg
- EFFL: 26mm
- Size of LED Array: 12.8mm x 3.2mm
- Efficiency: 39% (including Coating)
- Image Distance: 10m

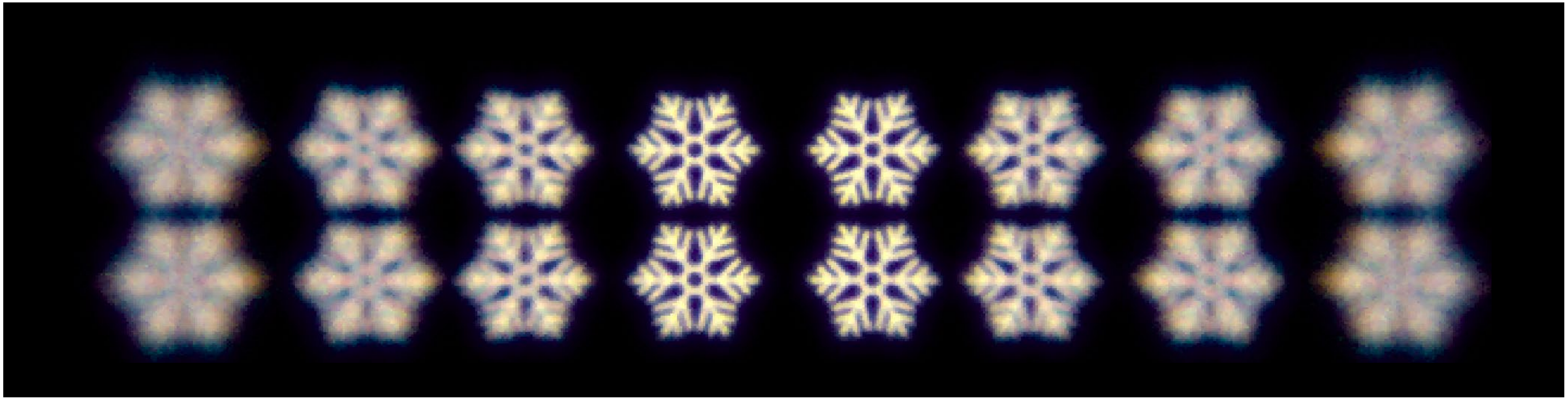




PERFORMANCE VALIDATION: OBJEKTIVE LENS 35° FOV

- **FOV:** 35deg
- **EFFL:** 21,8mm
- **Size of LED Array:** 12.8mm x 3.2mm
- **Efficiency:** 39% (including Coating)
- **Image Distance:** 10m





CUSTOMER BENEFITS

✓ Simplified Supply Chain:

- No extra housing needed
- Direct order of molded glass lens

✓ Easy Integration:

- Direct assembly
- Direct module mounting (no extra housing needed)
- Assembly on existing assembly line

✓ Cost reduction:

- Lower number of parts
- Simplified assembly
- Lower NREs

✓ Reduction of Risks:

- Smaller number of optical and mechanical parts

✓ Low Thermal Load:

- Lower heat impact on optical performance (no polymer lenses)
- Lower thermal expansion

✓ High Efficiency:

- High light transmission because of AR coating
- High numerical aperture because of glass lenses

✓ Reduced Reflections:

- Multi-layer anti-reflection coating reduces ghost images
- Reduction of stray light

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