

MICRO-LED FOR AUTOMOTIVE LIGHTING

OEM STAKES INSIGHT

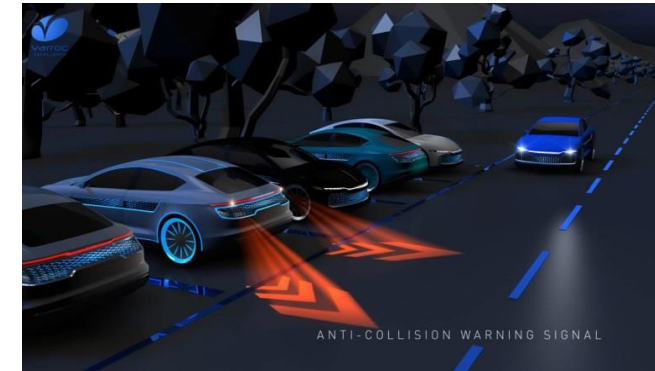
Paul-Henri MATHA

2023.03.13

What are the usage ?



Road marking



Source : Google

Lighting

Signaling & communication

Focus on lighting & intelligent lighting

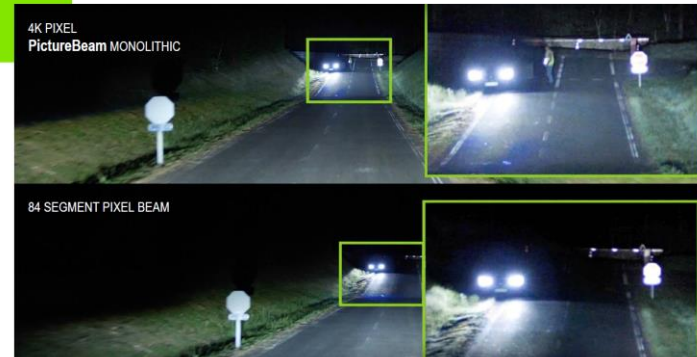
Target : To have always the maximum light on the road whatever the traffic to improve safety

Solution : Adaptive driving beam with partial high beam that will not glare oncoming cars



Camera detection

BEST-IN-CLASS LIGHTING SOLUTION THROUGH HIGH PRECISION



21 JANUARY 28&29, 2020 | DVN WORKSHOP | MUNICH

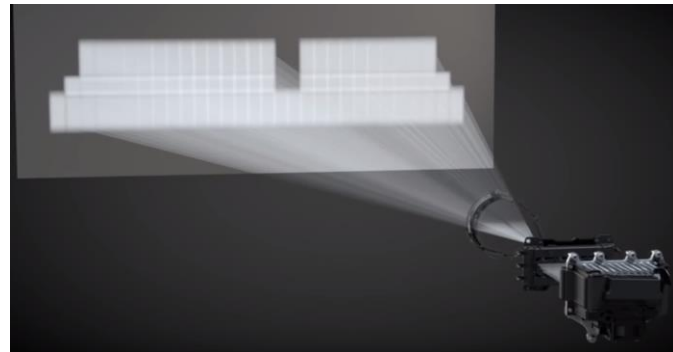
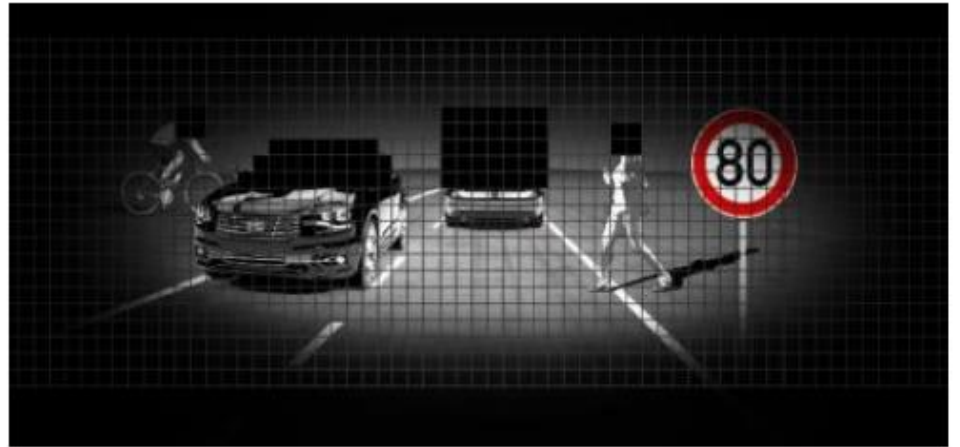
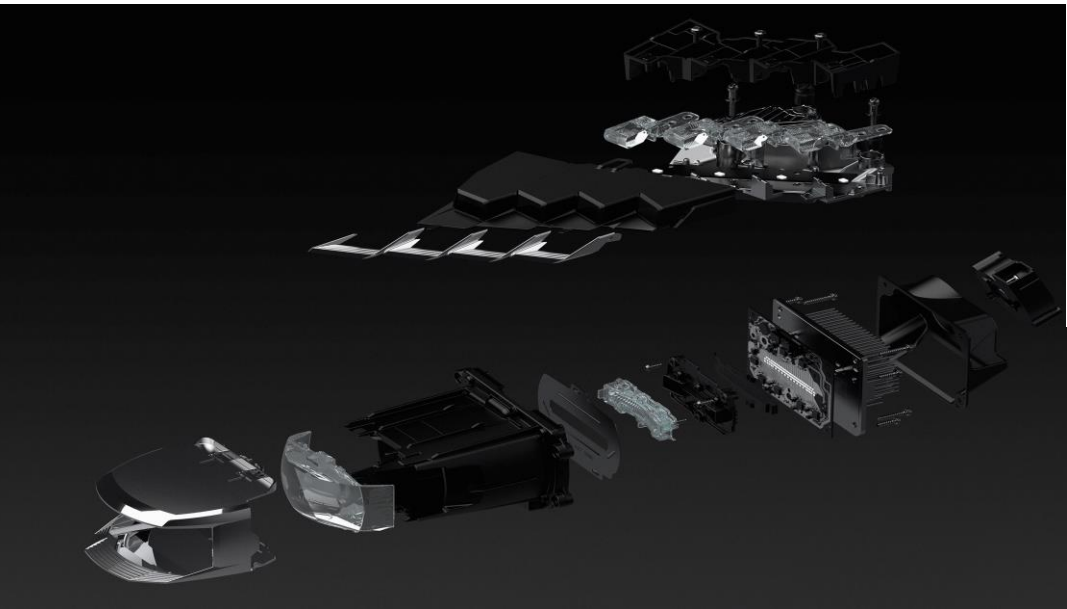
UNCLASSIFIED

Valeo

Source : DVN Munich 2020

Lighting beam pattern

VOLVO



Stakes for lighting

Usage of Micro LED to do High Definition headlamp

1/ Beam pattern :

- Lumen on the road : ~ 2000lm for low beam, 4000lm for low beam + high beam
- horizontal field of view : 90 degrees
- Vertical field of view : 20 degrees

2/ Power consumption

3/ Size

4/ high definition system (resolution) to have the maximum accuracy and minimum keep out zone (black area)

Current High definition headlamp on the road

DLP solution

Light source + micro-mirrors

100% of light source ON whatever the light on the road

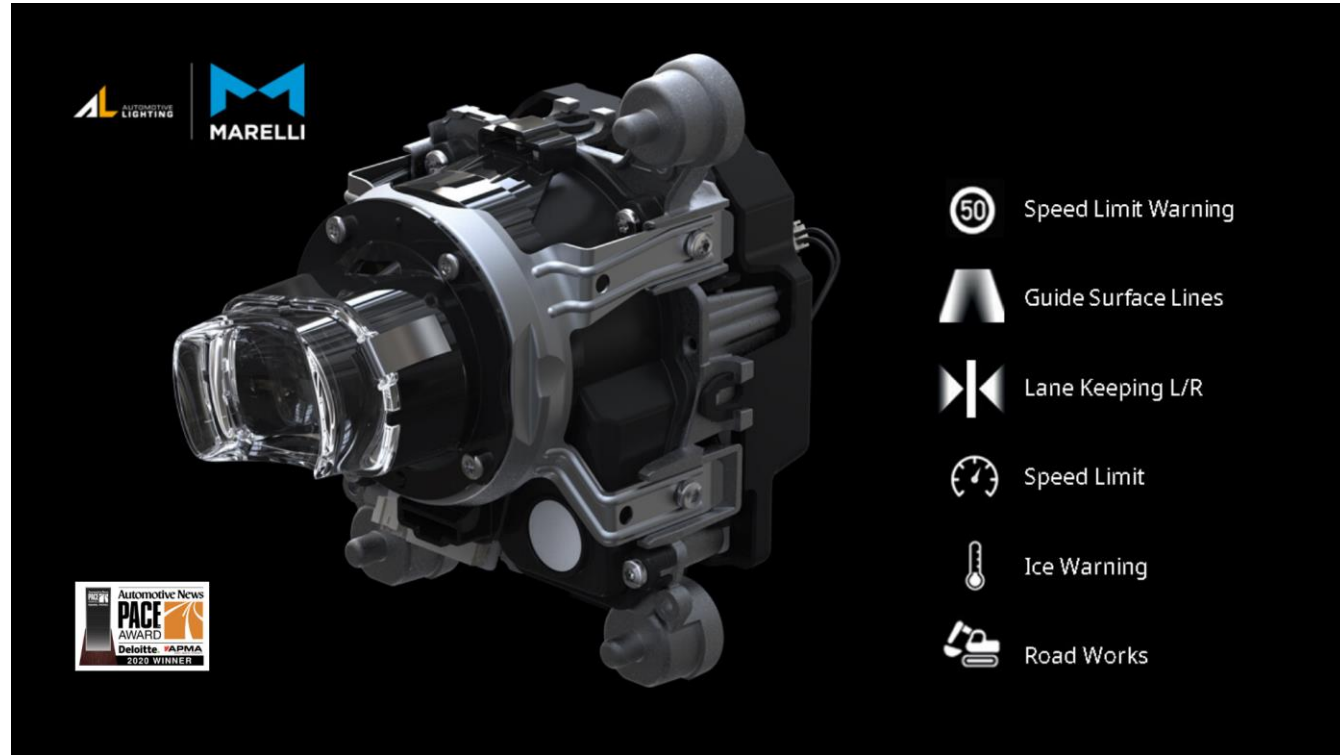
Estimated Size : 150mm x 150mm x 150mm

Estimated Power : 60 W

Estimated horizontal Field of View : +/-7 degrees

Estimated vertical Field of View : +/-4 degrees

1,3 Millions Pixels



Source : Google

Current High definition headlamp

Estimated Size : 150mm x 150mm x 150mm

Estimated Power : 60 W

Estimated horizontal Field of View : +/- degrees

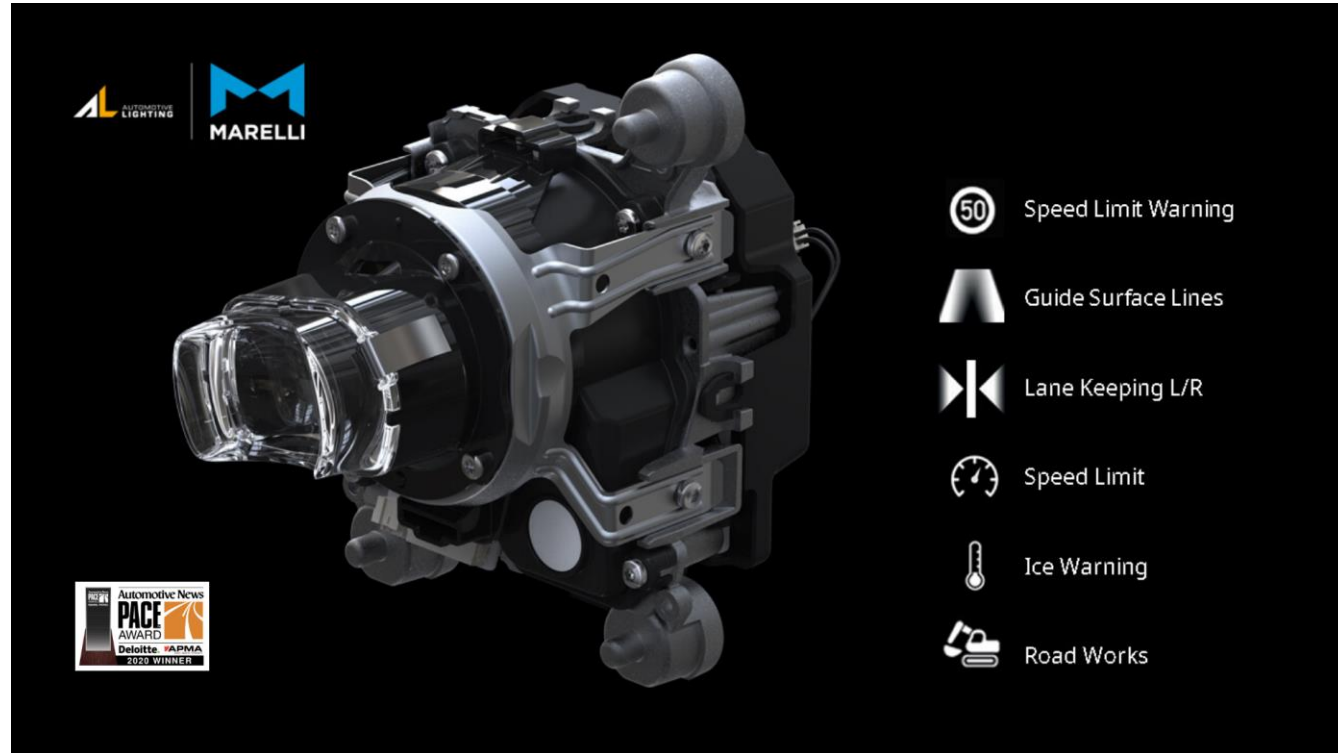
Estimated vertical Field of View : +/-4 degrees

1,3 Millions Pixels

⇒ Need an additional low beam module and high beam module

⇒ Low beam + high beam ~ 200 W / cars

⇒ 4g CO2 / autonomy of battery if BEV



Source : Google

High definition headlamp with Microled – 1st proposal

Estimated Size : 105mm x 90mm x 125mm

Estimated Power : 55 W

Estimated horizontal Field of View : +/-17 degrees

Estimated vertical Field of View : +/-4 degrees

25 K Pixel

⇒ Need an additional low beam module and high beam module

⇒ Low beam + high beam ~ 200 W / cars

⇒ 4g CO2 / autonomy of battery if BEV

⇒ Not enough improvement

VALEO'S PictureBeam™ OFF-THE-SHELF MODULE



- Flux on the road: 900 lm
- Emax: 130 lux
- FOV: H 35° x V 8°
- Segment quantity: 3 696
- Dimension: H105 W90 D125mm
- Resolution: 0.28
- Module consumption: 55 W

- THE BEST LIGHTING PERFORMANCE EVER
- THE NEXT STEP AFTER MATRIX & PIXEL ADB
- SYSTEM ARCHITECTURE EXPERTISE

SAFETY IS OFF-THE-SHELF !

Source : DVN Munich, January 2020

High definition headlamp with Microled

What would be a target ?

Estimated Size : H80mm x W80mm x D100mm

Estimated Power : 30 W

Estimated horizontal Field of View : +/-45 degrees

Estimated vertical Field of View : +/-10 degrees

No additional module to do low beam and/or high Beam

xxx K Pixel

Xxx lumen : 1000lm for Low beam on the road, + 1000 additional lm for High beam

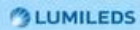
EPIC members are welcome on board to find solution

Status 2023

Complete High beam field of illumination with 2 HD module

Status 2023

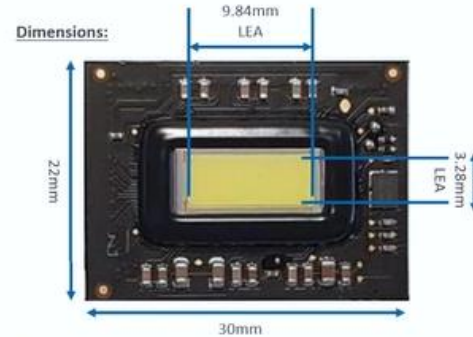
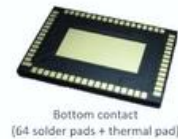
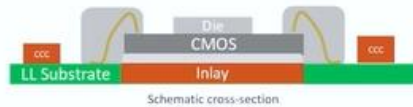
Complete High beam field of illumination with 2 HD module



Direct Imaging Light Sources: MicroLED

Lumileds MicroLED specifications:

Pixel count	20,172	82x246 pixels
Typ. Luminance	> 72 cd/mm ²	T _j @110°C, HB profile
	max. 110 cd/mm ²	Single-pixel max. rating, T _j @110°C
Efficacy	50 lm/W	Flat field profile
Contrast	> 1:150	3 rd pixel (120 μm)



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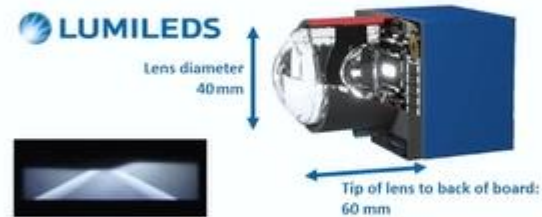
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DVN Paris, January 2023



Direct Imaging for MicroLED

Benefits of **system compactness** and **efficiency** remain



Lumileds demonstrator reference system:

- PMMA/PC lens system with 40 mm diameter
- Field of view: 21° x 7°, angular resolution 0.085°
- Optical system efficiency: 33% (incl. cover lens losses)

Status 2023

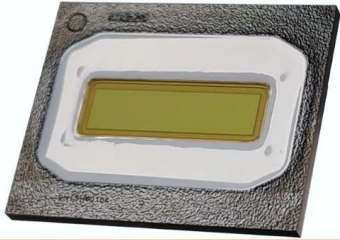
Complete High beam field of illumination with 2 HD module

Agenda | Motivation | Field of View | Visualization | Light Source | LSM Architecture | Demo Architecture | Thermal Simulation | Symbol Projection and Aiming | Summary

EVIYOS® 2.0 Active LED Array

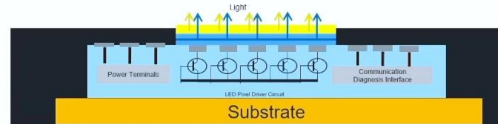


Top View:



- 40 μm Pixel Pitch
- High Contrast $\gg 250:1$
- Low $R_{th} \ll 1.0 \text{ K/W}$
- Two Versions:
 - 240 pixels x 80 pixels 19.2 k LEDs
 - 320 pixels x 80 pixels 25.6 k LEDs

Cross Section:



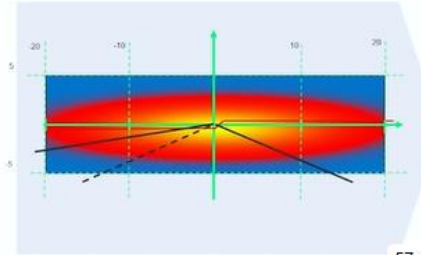
amli OSRAM

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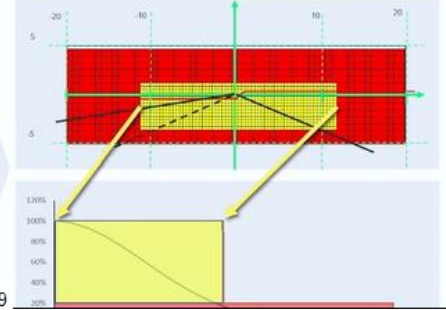
Spanning the large Field of View



Nonuniform intensity of headlamp application



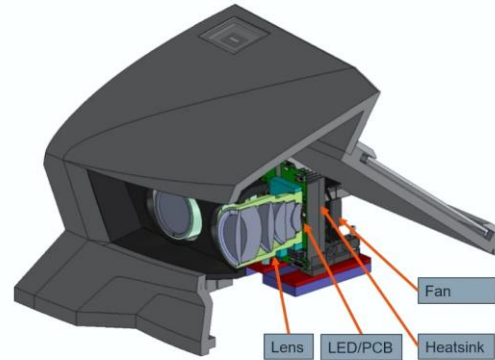
2 Magnifications for 2 identical EVIYOS units



57:49

Agenda | Motivation | Field of View | Visualization | Light Source | LSM Architecture | Demo Architecture | Thermal Simulation | Symbol Projection and Aiming | Summary

Mockup-Design



Demo- Setup:

- Tablet-PC for GUI
- 2 EVIYOS Units
 - 24° x 6° lens 0.075°/px
 - 40° x 10° lens 0.125°/px

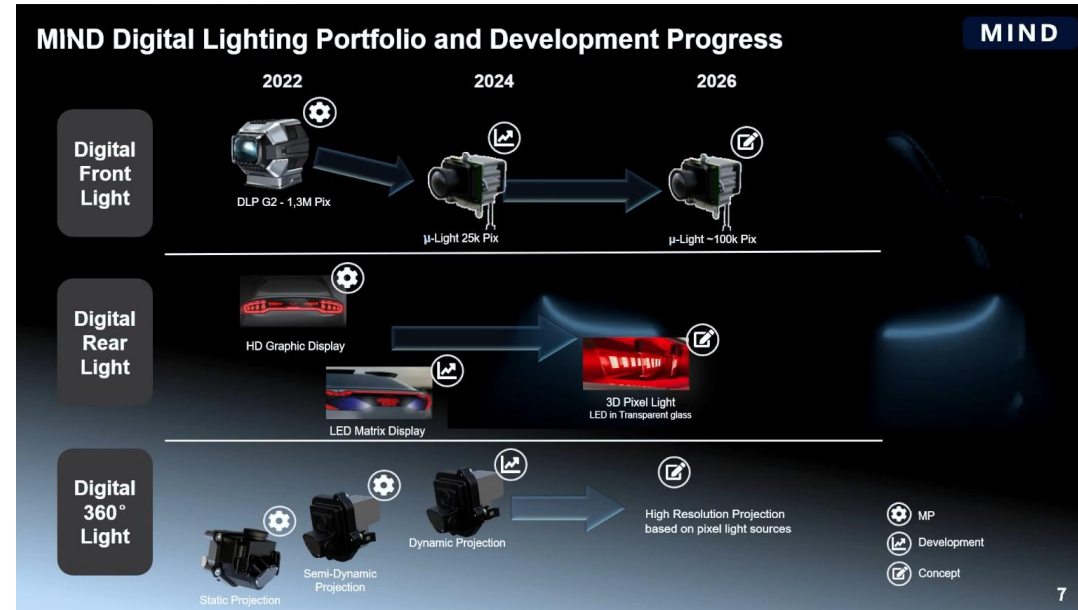
- Separate AC/DC Power Supplies
 - 12 V Electronics
 - ~ 4.5 V LED Power
- Heatsinks with fans
- HDMI to 2 GMSL Unit

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Status 2023

100 kPix in 2026

Complete low beam field of illumination seems to be Not enough



DVN Paris, January 2023