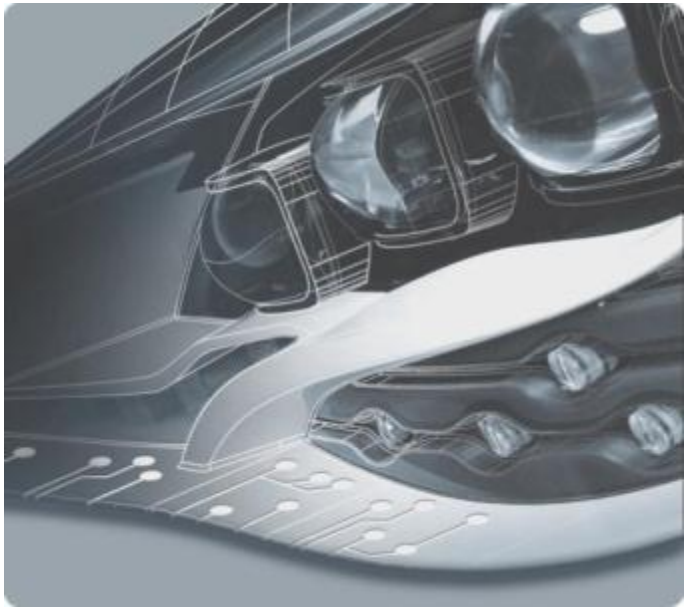
Overview Business Division Lighting



HELLA Group

Top Topics within the global Trends

	The HELLA lighting fields of innovation
	**Styling:** Supporting the emotional links to the car and making the topics environment and safety visible
	**Light based driver assistant systems:** Creating a maximum safety by giving the driver the best possible visibility under all driving and weather conditions
	**LED:** Energy efficient lighting systems with maximum efficiency to reduce the total energy consumption of the car and long lifetime to create a cleaner environment

HELLA Group
Motivation

The HELLA Lighting motivation

Approx. **30% of all accidents** occur **at night**

50 % of all accidents are the result of
shortcomings in visual perception

The human brain absorbs **90%**
of all information through the eyes

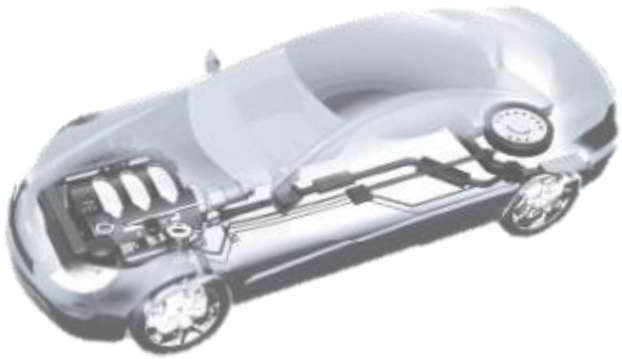
The eye is the weak link at night

Business Division Lighting
Competences

INTERIOR LIGHTING

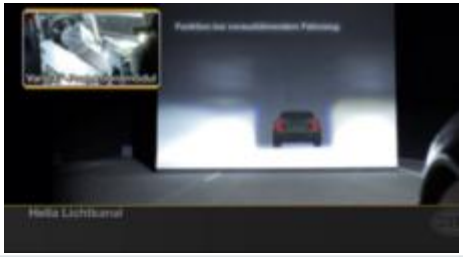
AUXILARY LAMPS

COMPONENTS



REAR LAMPS

LIGHT BASED DRIVER ASSISTANT SYSTEMS



HEADLAMPS

Business Division Lighting
LED – Light Source of the Future

Center High Mounted Stop Lamp (CHMSL)

1992

1st signal function (daytime running light) in a headlamp

2003

Full-LED headlamp

2008

1st headlamp with LED main beam function for the truck segment

2011

1st mechanical free glare-free high beam headlamp with 25 individual controlled LED chips

2013

2000

Hybrid rear lamps

2006

Full LED rear lamp

2010

Full-LED headlamp with AFS functions

1st vehicle with 100% LED low beam and optional camera based full-LED headlamp with glare-free high beam

Headlamps
Milestones from 1990 to 2004

1st electrical headlamp

1908

1914

1st low beam

Asymmetric light distribution

1957

1971

H4 halogen lamp

1st DE projection headlamp

1983

1988

Free-form reflector

1st generation of xenon headlamp

1992

1993

Approval of the first European headlamp with PC cover lens

1st Bi-Xenon headlamp

1999

2000

Light guide technology as a styling element

Static and dynamic bend lighting

2003

2004

LED as signal function (daytime running light)

Audi A8 W12

Headlamps
Milestones from 2006 to 2013

2006

1st full-AFS headlamp

Mercedes E-Class
Opel Insignia

2009

Camera based headlamp with adaptive Cut-off Line

Mercedes E-Class
(1st to market)

2011

Camera based headlamp with glare-free high beam

VW Touareg
(1st to market)

2013

Full-LED headlamp with glare-free high beam

Mercedes E-Class
(1st to segment)

2008

Full-LED headlamp

Cadillac
Escalade
Platinum
(1st to segment)

2010

Full-LED headlamp with AFS-functions

Audi A8
(1st to market)

2012

Headlamp with LED main beam function for truck segment

DAF XF/CF
(1st to market)

2013

LED Matrix headlamp with glare-free high beam

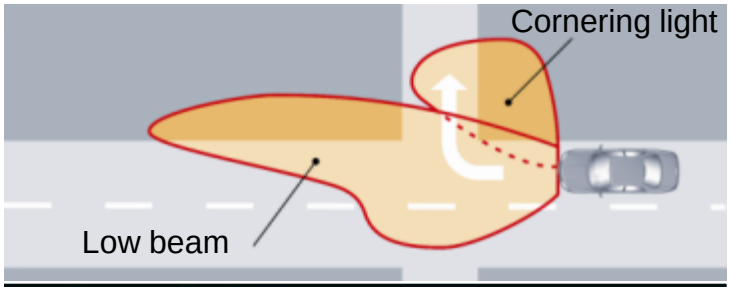
Audi A8 (1st to market)

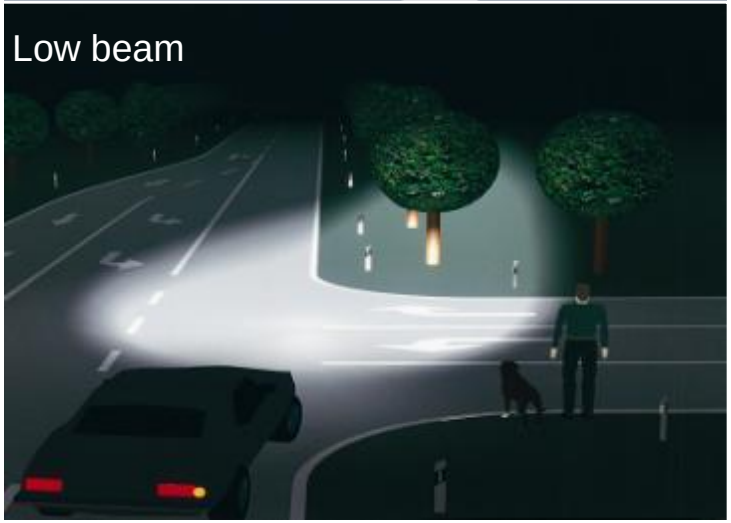
Headlamps I Dynamic Lighting Systems

Static Bend Light/ Cornering Light

Sensorial data of the vehicle infrastructure

In narrow corners, entry gateways or crossings an additional lighting system is switched on and accompanies the low beam. Through the light radiation of up to 90°, the lighting of the crossing area increases. An activation is effected by operating the winker or as a function of speed.

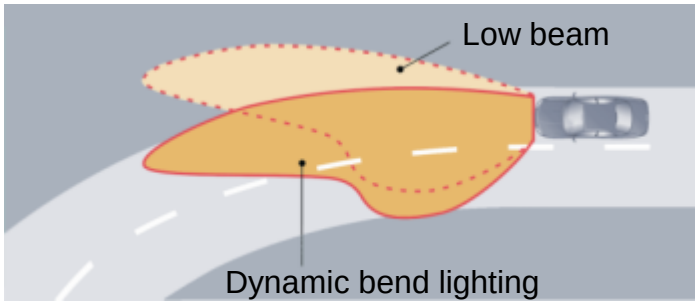


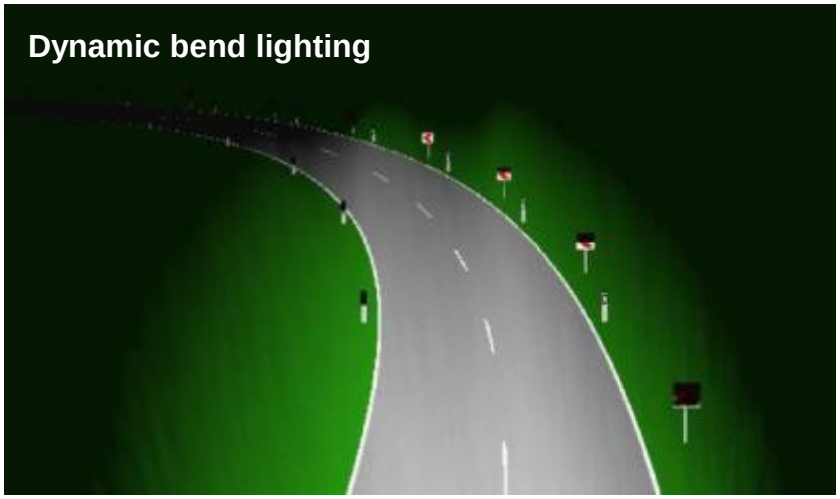


Headlamps I Dynamic Lighting Systems
Dynamic Bend Lighting

Sensorial data of the vehicle infrastructure

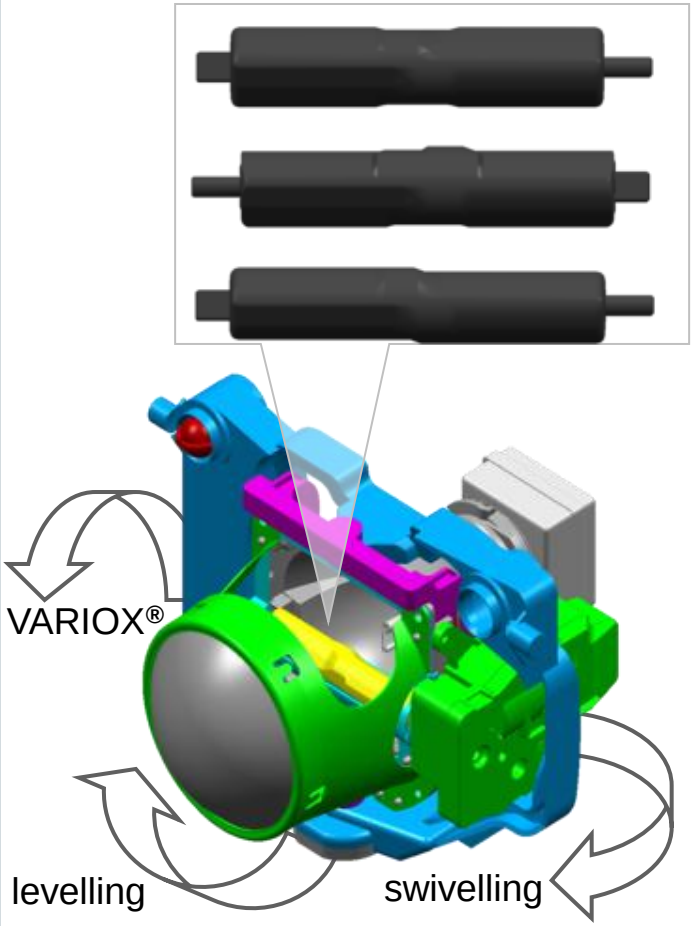
Low beam and high beam are turned via actuators based on the calculated bend geometry.





Headlamps I Dynamic Lighting Systems
Lighting Modules

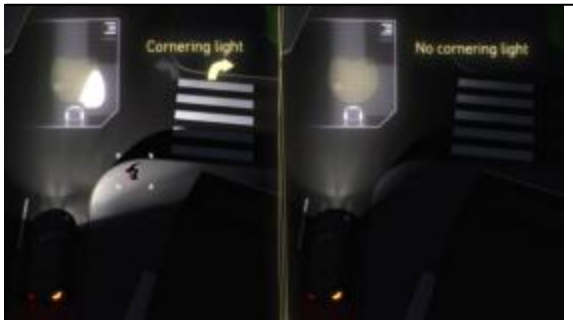
Modules



VarioLED

Adaptive frontlighting system (AFS)
Adaptive Cut-off Line (aCOL)
Vertical Cut-off Line (vCOL)

Headlamps I Dynamic Lighting Systems
Adaptive Frontlighting System (AFS)



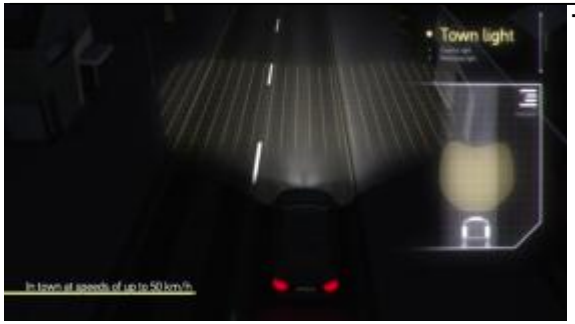
CORNERING LIGHT

DYNAMIC BEND LIGHT

ADVERSE WEATHER-LIGHT

MOTORWAY LIGHT

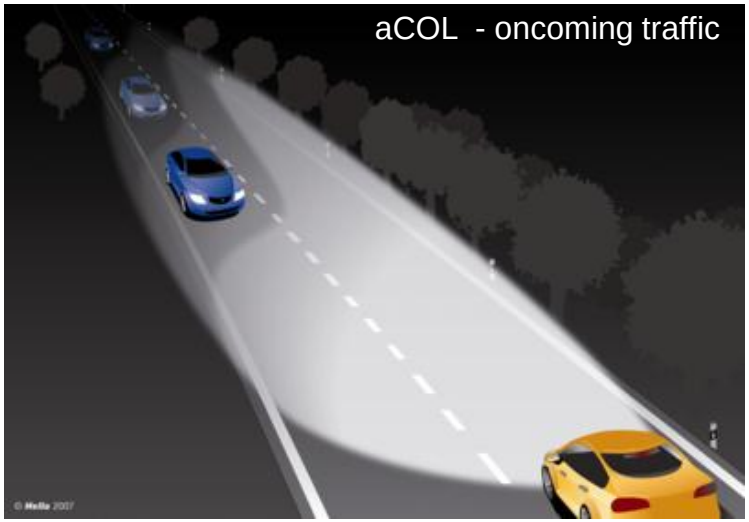
COUNTRY LIGHT

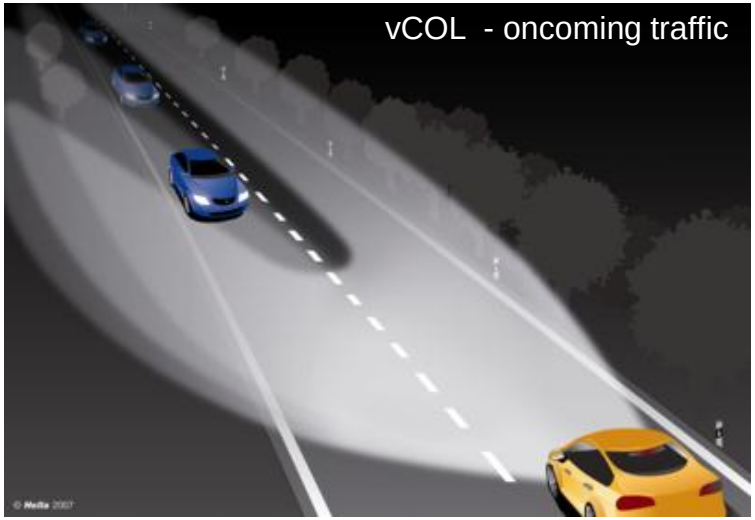


TOWN LIGHT

Headlamps I Dynamic Lighting Systems
Camera-based Lighting Systems

Glaring parts of the high beam lighting distribution are **automatically faded out.**
SOP 2010 in e.g. VW Touareg, VW Phaeton.



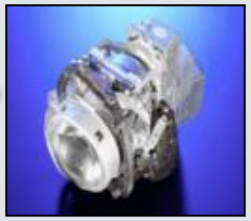


Components of a camera-based lighting system


Camera


Image processing


Lighting electronics

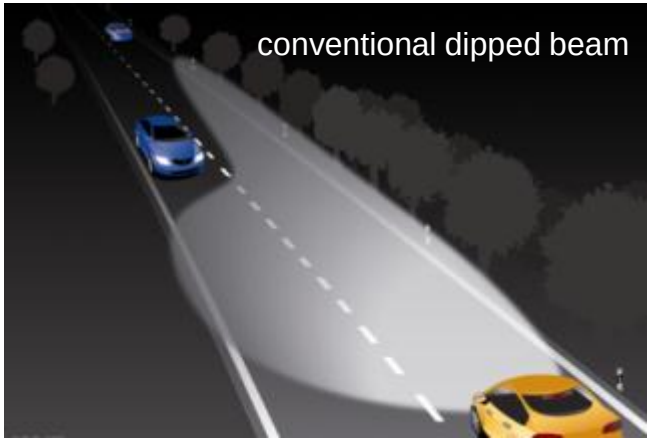

Lighting technology

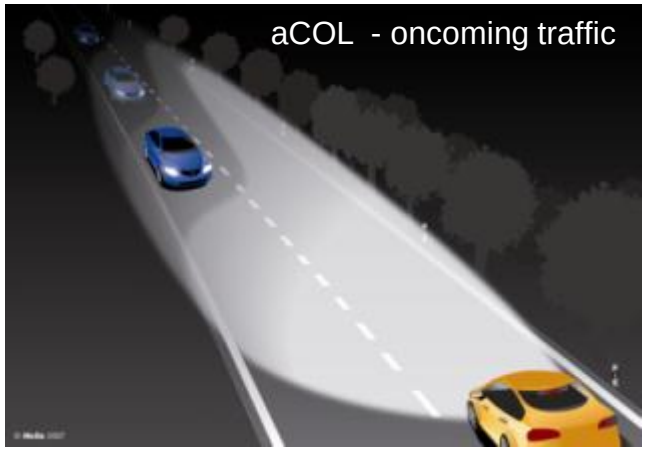

Headlamp

Headlamps I Dynamic Lighting Systems
Adaptive Cut-off-Line (aCOL)

Adaptive Cut-off-Line

The „Adaptive Cut-off Line“ controls the **light range** depending on the **distance** to **oncoming traffic** and to **traffic ahead**.
The **visibility range** of the **driver** is **increased – glare** of the traffic **is avoided.**





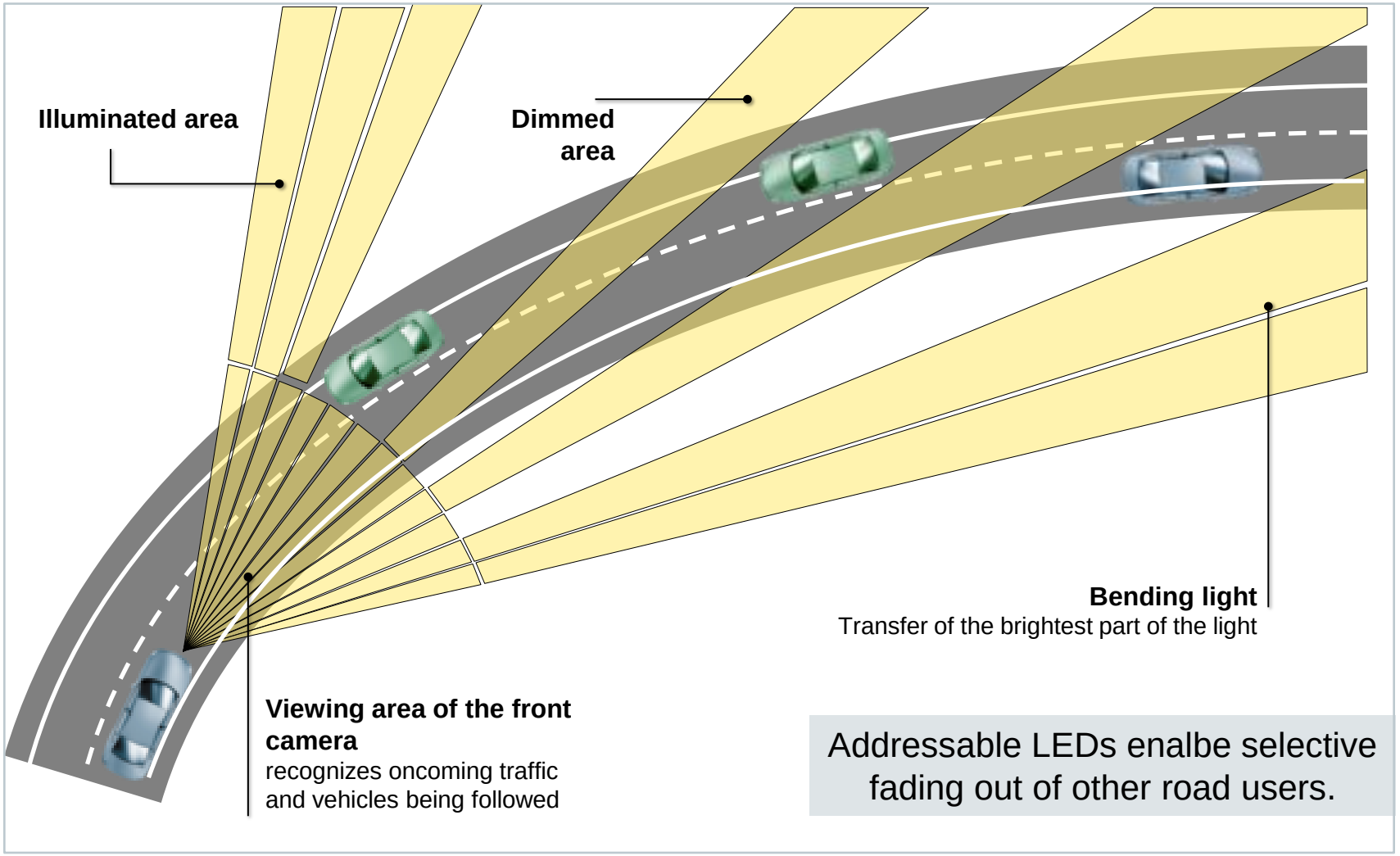
Headlamps I Dynamic Lighting Systems
Glare-free High Beam (vCOL)

Glare-free high beam with Xenon and LED

With **glare-free high beam** in **most traffic situations** a **light distribution comparable to high beam is available for the driver**.
In case of **oncoming or heading traffic** the **glaring parts** of the high beam lighting distribution are **automatically faded out**.

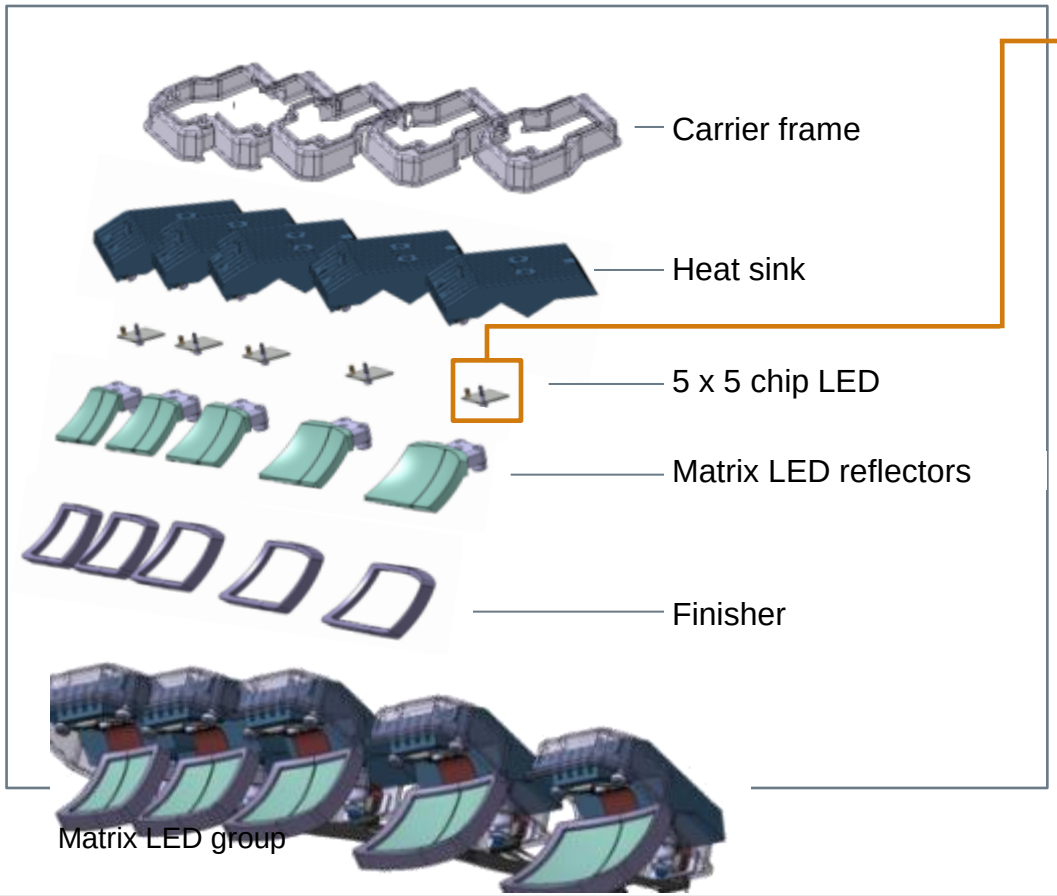
Headlamps I LED Matrix Beam

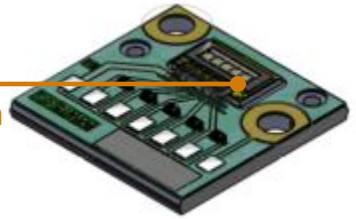
Operating Principle



Headlamps I Matrix LED
Market Innovation

USP: 5 reflectors, each with a 5 chip LED





MARKET INNOVATION

Each LED Chip on the PCB is controlled **individually**. Up to now it was only possible to switch on/off the whole cluster/package.

ELECTRONIC APPROACH

LED is the only light source that can be continuous **dimmed** btw 0 and 100%. This characteristics is been used to create an dynamic light system **without mechanical moving parts**

- Masking out of up to **8 different road users**
- Driving with high beam **without glaring**

Rear Lamps
Milestones from 1995 to 2013

1995 – Free-form technology

1999 – World premiere with the use of light guides in connection with LEDs

2001 – Macro reflex reflectors

2003 – Multistage stop light

2004 – 1st full-LED rear lamp

2005 – Multi-color LED function for tail and direction indicator

2006 – 1st application of 3D-shaped light guides

2008 – 1st application of crossing light guides

2009 – Light curtain technology: 1st complete illuminated rear lamp

2010 – EdgeLight technology in combination with light curtain

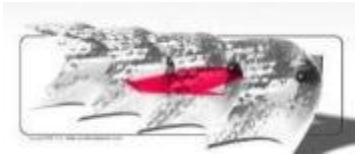
2011 – Glowing body technology

2013 – Tail/ brake light with mirror tunnel technology

Rear Lamps I Current Styling Trends
Technical Accentuation – HELLA Solutions

DIRECT REFLECTOR

- → Relative simple design especially for compact to mid size cars
- → Each LED has its own reflector

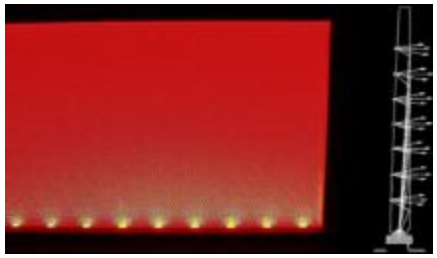


INDIRECT REFLECTOR

- → LEDs not visible
- → “Light coming from nowhere”
- → Separate reflector sections for each LED

LIGHT CURTAIN

- → Light guide as planar surface
- → LEDs along the edge
- → Optical structures on the surface



EDGE LIGHT TECHNOLOGY

- → Illumination of small lighting edges
- → Light emits from the edge by using structures or optics

Rear Lamps I Current Styling Trends
Technical Accentuation – HELLA Solutions

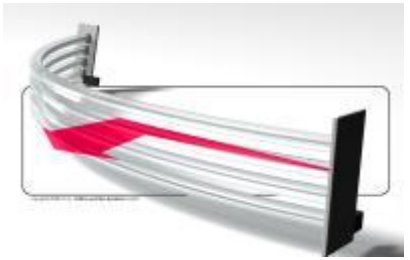
GLOWING BODY

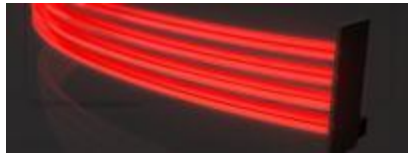
- → 3-dimensional bar, which seems to glow
- → LEDs on substrate emit the light directly
- → Homogeneous lit structures




PRISM LIGHT GUIDE

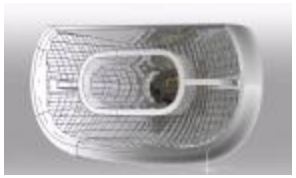
- → Linear and homogenous illumination
- → Two- or three-dimensional designs possible





DOUBLE REFLECTOR

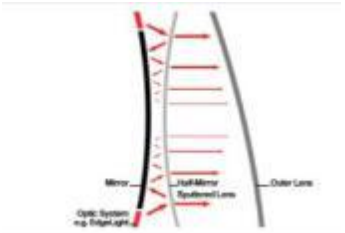
- → two-dimensional background light
- → High photometric efficiency
- → Single-part system or matrix of multiple reflectors

MIRROR TUNNEL

- → Tunnel-type depth effect
- → Open or closed contour possible
- → Reflective paths are controlled via mirror surface



Interior Lighting
Milestones from 1969 on 2013

Display lamp as after-market product

1969

1st European central patent for light guide symbol lighting with only one LED Volvo

1995

Europe-wide 1st application of light guide technology for ambient interior lighting BMW

2001

Leading role in the field of using complex light guide technology in overhead consoles

2010

RGB-LED ambient lighting
Further projects: Material backlighting

Opel Adam, Range Rover

2013

1984

1st Europe wide integration of electronic in interior lighting

Volvo

1998

Worldwide unique patented process to produce radar covers

2007

Installation space optimized interior reading light in LED technology for convertibles

Audi

2012

Light guide in panoramic roof and door panels

VW Golf 7, Peugeot 208

2014

RGB-LED ambient lighting. Further projects: Complex overhead consoles

BMW X5

Interior Lighting
Product Range

DOME LAMP

ROOF CONTROL UNITS

AMBIENT LIGHTING

MINIATURE LAMPS

LIGHTING AND ELECTRONIC MODULES

SENSORS

RADOMES*

** Radomes belong to the product portfolio of HELLA Innenlicht-Systeme GmbH (HIS) that is competence center for interior lighting*

Interior Lighting
Ambient Lighting

Concept development, optical design, simulation, manufacturing of optical components, light source integration, electronical control units, class A-surface capabilities as HELLA core competences

USP HELLA Lighting

L-LAB (Light laboratory)

- → Results can be transferred directly into innovations
- → Large competency fields due to open research in cooperation with public institutions (e.g. universities)
- → Short distance to HELLA

Development of lighting technologies

Member of Light.Sight.Safety

- → A CLEPA initiative
- → Promotion of life-saving assistance systems (e.g. Intelligent Lighting Systems)
  - → Committed to inform the society and increase awareness of good quality car lighting

Light Sight Safety

Lighting tunnel

- → Europe‘s largest light testing facility
  - Subjective impression can be gained under almost natural surroundings

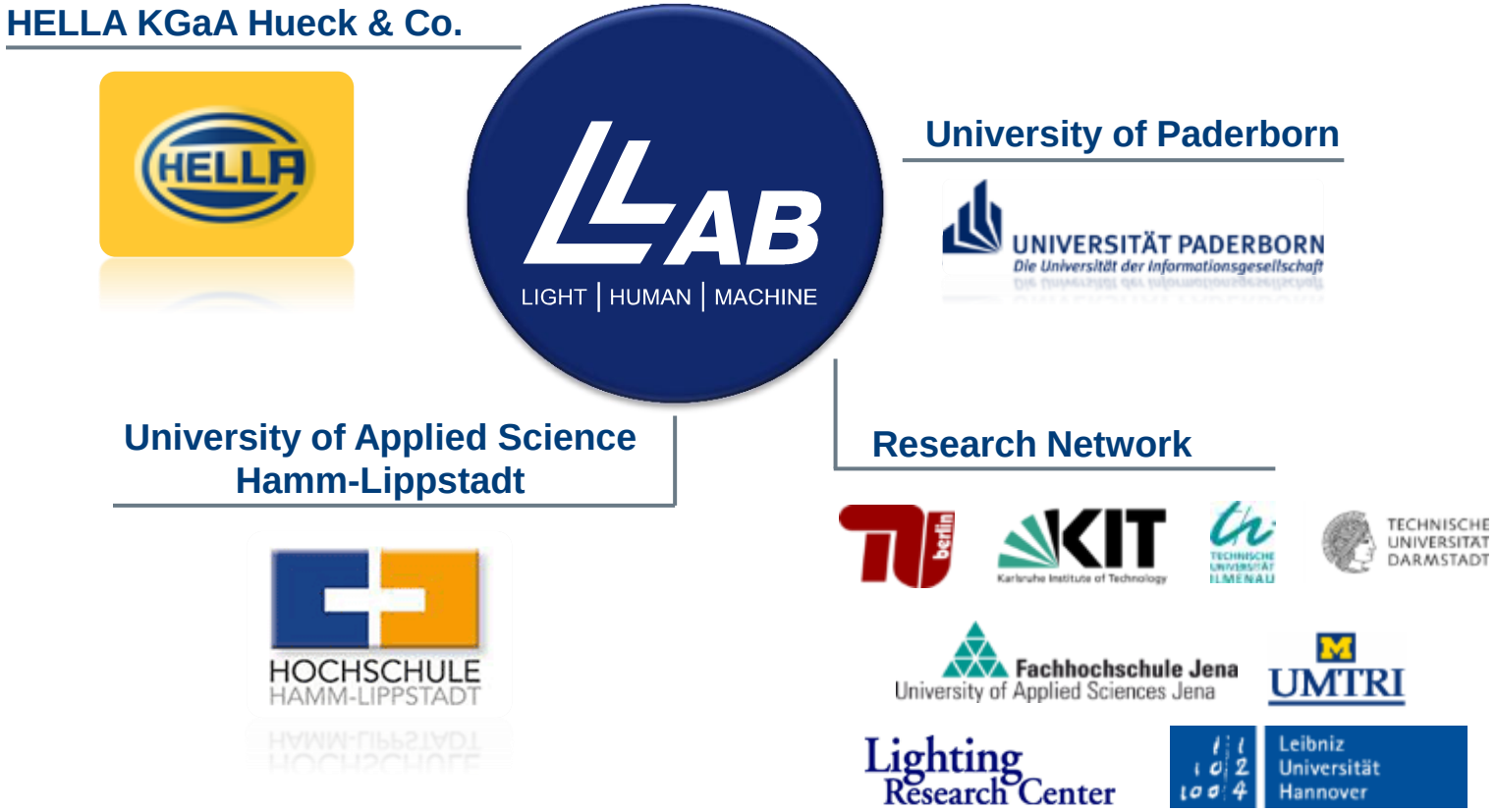
Inhouse styling department

- → Inspiration
- → Ideation
- → Visualization

USP HELLA Lighting

Unique international Research Platform for Light Technologies

Partners of the L-LAB: Mutual transfer of knowledge

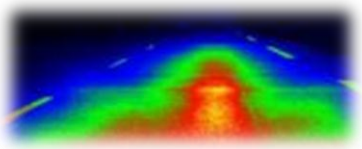


USP HELLA Lighting

Unique international Research Platform for Light Technologies

Research topics of the L-LAB

Mesopic vision
Measurement techniques
Effects of different light sources
Evaluation of headlamp light distributions



Active lighting
Sensor systems
Algorithm & data fusion

oLED
Long term and perception tests

Materials and optical design
Transparent silicone rubber
Primary optics and flexible lenses

Human-machine-interaction
Field tests, acceptance, safety

USP HELLA Lighting

Light Testing Facility I The largest of its kind in Europe

Light testing facility

- → **Situated in Lippstadt**, the centerpiece of HELLAs technical competence
- → The **140m long and 11m wide** facility gives an illuminating, realistic and subjective impression, complementing simulations and calculations
- → Used to **test spread, light color, light distribution and the homogeneity of the light** when developing **for a customer** and also to test the **wide range of in-house developments**
- → **Almost natural surroundings** can be created in this unique light testing facility

USP HELLA Lighting

Light.Sight.Safety I An Initiative of the Lighting Suppliers

"Good light = Good safety"

→ Coalition of several European automotive lighting companies

→ Targets

- To bring **technological advancements** to the automotive lighting market
- To communicate the **benefits** of **good vehicle lighting** to the market
- To improve **performance, comfort, safety** and **environmental friendliness** of car lighting
- To **increase awareness** and understanding of advantages of good quality car lighting **at end users**, **carmakers** and relevant decision-making authorities