

PixCell LED

Ultimate precision in perfect alignment

100+ individual cells with just 25 µm spacing, perfectly matrixed onto a single LED chip for intelligent headlamps

SAMSUNG



Editorial

New Challenges: Lighting For Machine Vision

A crucial new task for vehicle exterior lighting in the near future will be a light pattern which supports camera vision sufficiently. I don't mean L^4 or L^5 automated driving, nor even about L^3 , I mean L^{2+} and L^{2++} ADAS. This new L^{2++} means hands-off under good conditions, but the driver must be ready to take back control at all times.

The system boundaries of these L^{2++} systems exclude night driving; rain; fog; tunnels, and other adverse conditions mainly because of camera vision weaknesses. Even the state-of-the-art new L^3 Mercedes Drive Pilot system needs 'good light conditions' (whatever that might mean) according to the vehicle owner's manual.

In the car lighting industry, the work to develop light functions supporting camera vision has already started. First ideas were shown at the DVN Paris workshop 2 weeks ago. JLR's Irene Sanchez Funez presented new manoeuvring lamps for low-speed orientation for camera vision. During his presentation and the Q&A session, Phillip Röckl from Opel-Stellantis talked about the totally different requirements for camera vision compared with human vision—range; road luminance, and visibility angles. Porsche's Robert Hähle and Benjamin Hummel showed a super headlamp which has so much more to offer than just a beautiful design. Gerald Böhm from ZKW even gave a dedicated presentation about lighting for machine vision.

As usual in our business, we need close collaboration between automakers; suppliers, and the rulemaking authorities to be successful. Another new task is the tight integration of camera and image processing software experts, from inside the companies and from external sources—lighting never becomes boring!

Enjoy this week's DVNnewsletter.

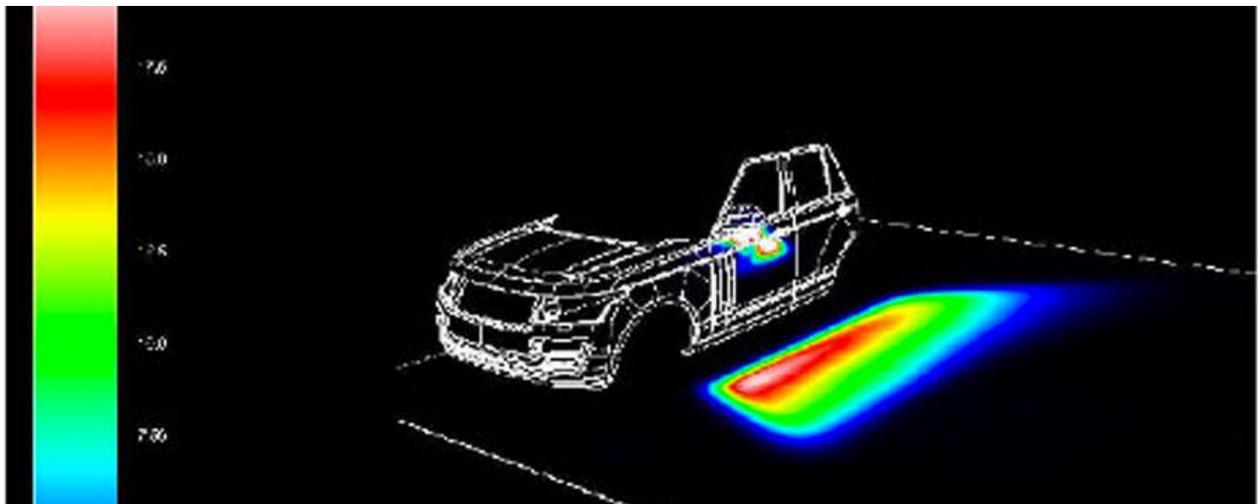


Wolfgang Huhn
DVN Senior Advisor

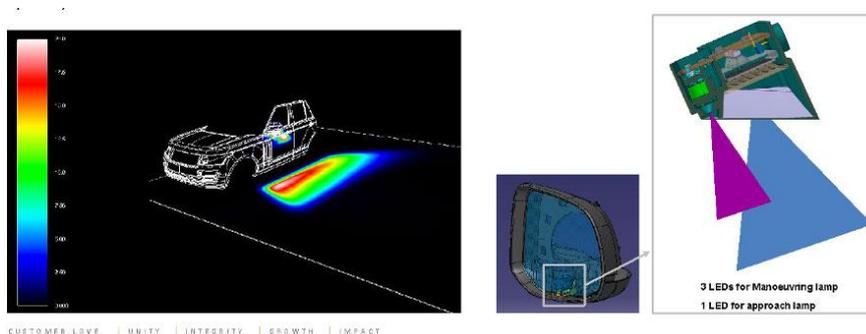
In Depth Lighting Technology



Takeaways from DVN Paris Workshop: Examples of Lighting for Machine Vision



At the DVN Paris Workshop, **Irene Sanchez Funez from JLR** showed how the new manoeuvring lamps dramatically improve the visibility in dark conditions in speeds up to 10 km/h according to UN Regulation 148. After studying proposals, the best location for manoeuvring light for achieving the width and intensity was side mirror, a unique light module combining puddle lamp and manoeuvring lamp was designed. Two functions in one module; two independent optical systems with a total of 4 LEDs.



HOW LIGHTING CAN IMPROVE ADAS SENSORS: MANOEUVRING LAMP LOCATION AND LIGHT CONCEPT

Without the manoeuvring lamps, cameras have not enough light to feed the display with any information about the surrounding. You can clearly see the difference in the following picture:

During the pre-development project Lighting team and side vision team worked together to find the best functionality of manoeuvring lights.



HOW LIGHTING CAN HELP ADAS SENSORS—CALIBRATION OF SIDE CAMERAS WITH ADAS TEAM

Especially in off-road conditions, this advantage can be the difference between easy orientation and a damaged car. Overall, the manoeuvring lamp is a surprising first application in the field of dedicated machine-vision support in cars.



Uwe Kostanzer from Mercedes-Benz started his presentation with some examples from the rich Mercedes history of lighting innovations. DVN liked especially the slide where Uwe showed what happened during the 15 years of DVN history.



Now additional requirements come into the game which are shown in the next picture.

ADDITIONAL REQUIREMENTS ARISE in the known fields

Software

- In-House Software Development
- Sensor Fusion
- OverTheAir Update □ The Key for a New Business

Energy Consumption

- Environmental Protection is our Responsibility

Styling

- Slogan „Lighting is the new chrom“

- Enables new features with faster development time
- The basic for reliability
- Always up to date with the latest development

- “Max Range“ is a „Customer Expectation“
- How do we combine this with new styling driven lighting function?
- Researching Alternative Materials
- Opportunities for Weight Reduction

- Create Customers Desire

Mercedes-Benz DIGITAL LIGHT | RD/KEL 22. Januar 2023 9

Uwe explained that in future we must combine increased safety with increased desirability. We have to face new challenges like consequent sustainability and energy saving using the resources we have in the company or externally available. Simulation tools will be a key point. Hardware needs software and vice versa. The lighting of the future will be very emotional.

Audi's Andre Hainzmaier showed in the conclusion of his software-focused presentation that innovative hardware is the base for software-defined lighting. One of the many aspects is a hardware (reflector-) or software (microLED-) based light distribution which can support both human and machine vision.

Conclusion

With digital light technologies, we start a new lighting era, opening completely new opportunities for safety, design, communication, wellbeing and entertainment.

Innovative hardware is the basis of software-defined lighting (→Product)

Customer-centricity is unlocking new possibilities in User Experience and Emotional Design (→Experience)

We can learn from Software-development to optimize processes and structures for Software-defined lighting (→Configuration)

CONFIGURATION

Profit Model

Network

Structure

Process

PRODUCT

Product performance

Product system

EXPERIENCE

Service

Channel

Brand

Customer Engagement

Philipp Röckl from Opel-Stellantis had a view to dedicated sensor-supporting lighting based on AI in his presentation: "The headlight gives more light where the camera needs it".

SENSOR BASED LIGHTING STELLANTIS



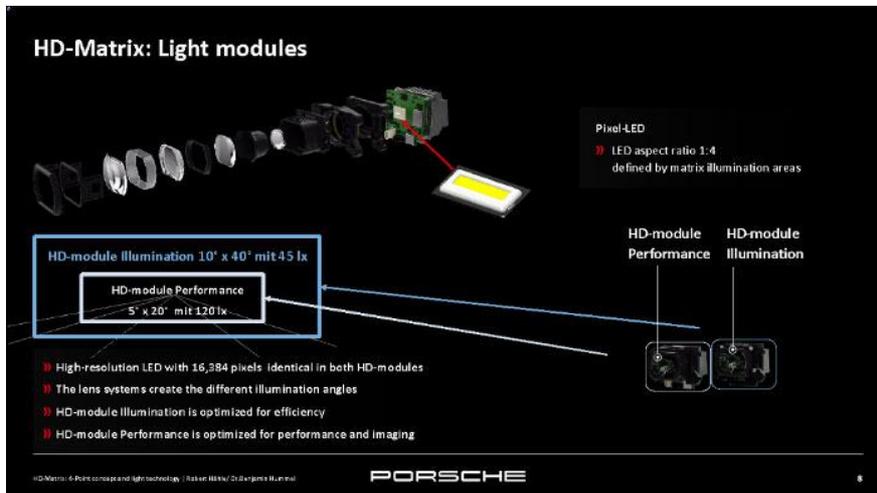
- Optimization of headlights for highly automated vehicles
 - Goal: Maximize the detection quality of cameras
- Control loop between headlamp, camera and on-board computer
- The headlight gives more light where the camera needs it





Porsche's Robert Hähle and Benjamin Hummel gave a preview of a headlamp which is not yet in production; we look forward and expect, after all the technical superlatives inside, nothing more than the best headlamp in the world. Time (and test drives) will tell! Another point is that the two 16-kilopixel Nichia microLED chips and integrated Infineon ASIC

in this Forvia-Hella headlamp have the best pre-conditions for supporting camera systems where they need more light.



HD-MATRIX: LIGHT MODULES

Gerald Böhm from ZKW gave a strong presentation about light requirements from human driver to sensor support. Obviously, ZKW are doing a lot of dedicated research to figure out how the cameras can be supported best by lighting without causing glare problems to other road users. If you want to dive a bit deeper, please watch Gerald's presentation in the VOD section of the DVN website. The three following slides should arouse your curiosity on this on-point presentation:



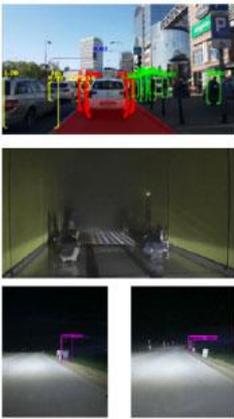
Motivation

Status today

There are some advanced driver assistance systems (ADAS) that especially in good weather conditions work reliably, with improvements being made incrementally.

At night, the camera is best at detecting very bright or reflective objects
Traffic signs, road markings, illuminated vehicles,...

However, it has disadvantages in detecting very dark, non- or poorly illuminated objects and situations with very high contrast.

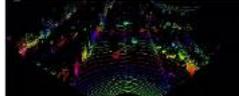


STATUS TODAY

The reliability of object detection and recognition of Radar / Lidar is severely limited in some situations. Especially at night, **coordinated high-resolution lighting / video systems (camera)**, could make an essential contribution to the clarification of **object recognition and identification** uncertainties above all via **color, texture and supplementary 3D information!**

Requirements for successful optical perception

Well-aligned combination of illumination and sensing, specific to the sensor problem at hand
Delivering the desired information, despite uncontrolled, ever-changing environment



Low beam - only 50% confidence level



ADB High beam - ZKW Digital Light - 96% confidence level



BUILDING TRUST TO AUTONOMOUS DRIVING – LIGHT AND SENSOR

- > **Glare-freeness is basically solved** in terms of lighting technology
 - > Efficiency has to be increased further
 - > Control can still be significantly optimized: Relevant integration of sensor technology

- > **Object highlighting / contrast optimization**
 - > Detection still needs to be significantly improved: Combination of sensor technology
 - > Limited by legal maximum luminosities and installed power held in reserve for rare cases
 - > Leads to rather complex solutions

- > **Effect of novel light distributions still little researched on**
 - > E.g. significance of lateral illumination still unclear

SUMMARY OF ZKW PRESENTATION

The support of machine vision by lighting systems is a new field for the lighting business. That means new chances for growth, for technology development, and of course for new risk. The transformation towards the integration of lighting; electronics, and software is unavoidable; the revolution is under way.

Find more information on the DVN Paris Workshop in the [DVN report](#) published today.

Lighting News

A2MAC1, LMI Deliver Advanced Lighting Insights

LIGHTING NEWS



KAMISLAV FADEL, STEPHAN WENG, PASCAL POPIS, MATTHIEU BLARY

A2MAC1 and LMI joined forces to provide clients with deep, comprehensive insights on lighting technology options. Their combined expertise and competence have given rise to a new service, Advanced Exterior Lighting Insights, further extending their exterior lighting benchmarking activities and consolidating A2MAC1's performance, technology, and costing insights.

A2MAC1 have been serving their clients with competitive insights for more than 25 years, deconstructing and analysing complex product assemblies. In recent years, they've extended their core technical benchmarking offering with performance and cost benchmarking data, introducing unique 360° vehicle insights. The company have been benchmarking vehicle exterior lighting, dismantling, and analysing around 20 headlamps a year, and more recently adding performance insights thanks to goniometry.

LMI bring more than 50 years of combined experience in the likes of R&D; product management, and manufacturing processes. They will benefit from the synergies established between A2MAC1 and their clients in benchmarking, and their deep understanding of the lighting market will further complement A2MAC1's 360° insight offering. LMI cofounder Kamislav Fadel says "Joining forces with A2MAC1 guarantees LMI's further development. We know that the automotive sector will experience important changes in the future. Exterior lighting management will be critical to automotive manufacturers. A2MAC1 understands this critical shift and we are honoured that they value our niche knowledge in the lighting design industry".

Fadel and A2MAC1's Vincent Keromnes together gave a talk at the DVN Paris Workshop: Exterior Automotive Lighting Benchmarking Challenges. Find a summary of that talk, along with the others, in the DVN Report on the Workshop.

Brightek's New ISELED 3023 for Smart Lighting

LIGHTING NEWS



As the first Taiwanese member of the ISELED alliance, Brightek bring their talents to market in innovative ways—like their newly-released smallest ISELED LED, the 3023. At $3.0 \times 2.3 \times 0.9$ mm, it saves 30 per cent space for ambient light designers and boasts excellent thermal resistance (30K/W).

Compared to other ISELED products with thermal resistance of $>100^{\circ}\text{C/W}$, the junction temperature rise of the 3023 is only 25 per cent under the same driving condition. This allows for more flexible arrangement in vehicle interior applications. And the 3023 adopts the advanced reflective coating packaging technologies for avoiding absorption between the IC and LED dies to have excellent efficiency. Dies arranged on the top side means the soldering pad area at the bottom can be twice that of other ISELED LEDs. Currently, the general method to package an ISELED LED is to put the IC on the bottom the lead frame, which tightly limits the lead size for soldering.

The new 3023 has excellent output: 1,400 mcd. It's got onboard temperature compensation, and it's qualified to strict AEC-Q standards, both AEC-Q100 and AEC-Q102. It boasts 8-bit RGB brightness resolution and 2 Mbit/s communications; offers highly consistent light colour ($<3\text{SDCM @ D65}$), and unlocks new ways to create stylish and performant lighting modules for enriching vehicle cabin ambience.

Aldo Kamper is New ams OSRAM CEO

LIGHTING NEWS



This past 30 January, the ams OSRAM supervisory board announced that Alexander Everke will step down as CEO after seven successful years. He's being succeeded by Aldo Kamper as Chairman of the Management Board and CEO later this spring. Since 2018, Kamper has been CEO of Leoni, and he's spent over 15 years in different management positions with Osram, including as general manager of the Opto Semiconductors business unit.

For continuity, Everke will actively support the transfer of his responsibilities and remain in an advisory role to the company through the end of the year.

Margarete Haase, Chair of the supervisory board of ams OSRAM, says Kamper "will continue and further develop the strategic focus of the company. His technological competence and management experience form an excellent basis to exploit the opportunities from combining sensing and LED technology. He promoted early stages of the development of microLED technology at Osram and will drive the successful industrialisation of this technology".

Aixtron, ams OSRAM Qualify μ LED System

LIGHTING NEWS



ams OSRAM have qualified the Aixtron AIX G5+ C and G10-AsP MOCVD systems on 200-mm wafers for a microLED application.

The MOCVD systems offer Aixtron planetary technology, which is paving the way for the next generation of high-resolution μ LED displays.

MicroLED technology offers significant advantages including higher pixel density; longer lifetime; higher brightness; faster switching; a wider color gamut, and low relative energy consumption. These make μ LED technology ideal for upcoming generations of smaller display-equipped consumer devices which provide very limited space for batteries.

MicroLED production has special requirements; volume production includes a special transfer process wherein multiple thousands of LED chips (arrays) of just micrometres in size are picked up and transferred. Any defect can result in dead pixels that can render useless an entire array. So, an almost error-free epitaxy process is necessary to minimise defects and allow for high yield and economically viable production.

Aixtron's new G10-AsP epitaxy tool has been designed to address the specific needs of this application. It is the world's first fully automated AsP reactor offering cassette-to-cassette wafer loading as well as a cleaning mechanism based on in-situ etching. Together, these two features have a major impact on the yield performance.

Driver Assistance News

Tesla Flops in AD System Performance Tests

DRIVER ASSISTANCE NEWS



Consumer Reports rigorously evaluated 12 driver-assist suites that combine adaptive cruise control and lane centring assistance to aid with highway driving. The assessment criteria were ease of use; capability and performance; keeping the driver engaged; how they handle an unresponsive driver, and how clearly they indicate when it is safe to use them.

Ford's BlueCruise (called ActiveGlide in Lincolns), which allows drivers to take their hands off the steering wheel on approved highways, got the best grade. General Motors' similar Super Cruise feature came in second, and Mercedes-Benz's system took third. Tesla Autopilot fell to seventh place this year, from second in 2020. That, according to Consumer Reports, is because Tesla haven't made any significant upgrades to Autopilot's core functionality in years —it still doesn't allow collaborative steering and doesn't have an effective driver monitoring system.

The top-rated Ford and GM systems use driver monitoring systems that require drivers to keep their eyes on the road even while the systems are automating steering, acceleration, and braking. Both point infrared cameras at the driver's face and sound an alert if the driver stops paying attention to the road, even if just for a few seconds. If the driver doesn't turn their eyes back to the road, the system slows the car down and takes other safety measures.

Polestar, Luminar expand partnership

DRIVER ASSISTANCE NEWS



Polestar and Luminar are continuing their collaboration by integrating Luminar's long-range lidar technology into future Polestar models. The expanded partnership lays the groundwork for collaboration on industrial design and integration of Luminar's 3D laser scanning technology that will be used in future Polestar vehicles. This now includes the Polestar 5, the four-door electric GT based on the Polestar Precept concept car, which is expected to go into series production in 2024.

The two companies have an existing partnership through Polestar parent Volvo Cars, with Luminar supplying Lidar technology for the Polestar 3. This first SUV from the automaker, launched in October 2022, is now going on sale in its first markets with Luminar's lidar technology. To coincide with the announcement, sales of the Polestar 3 have been brought forward; orders are being taken now. Deliveries, though, are not expected until next year.

In addition to Polestar, Luminar supply other premium vehicle manufacturers with lidar technology—Mercedes-Benz and Volvo, for example. Luminar also supply other suppliers, such as Nvidia and Mobileye.

Hesai Technology Go Public on NASDAQ

DRIVER ASSISTANCE NEWS



Hesai Group officially landed on the NASDAQ and raised USD \$190m through an initial public offering—one of the largest by a Chinese company in the U.S. market.

Cofounder; CEO, and Director Li Yifan said in an interview that the company chose to list in the United States in the hope of more exposure on the global stage: "We want to be able to compete directly with our peers and be transparent in the wider market", he said, adding that his company are discussing business cooperation opportunities with several automakers.

According to Hesai's filings with the U.S. Securities and Exchange Commission, the company's sales have grown steadily over the past three years to nearly \$112m, and their net loss shrank to \$23m in the nine months ended 30 September, 2022. Chinese and international companies including Baidu; Xiaomi; Meituan, and Bosch are strategic investors.

Hesai Technology are experts in three-dimensional lidar solutions. Their lidar products suit a wide range of applications in passenger and commercial vehicles. Hesai integrate lidar designs with an in-house manufacturing process, facilitating rapid product development while ensuring high performance; consistent quality, and affordability.

General News

Faurecia Aptoide, Catappult Launch World-First Car App Store

GENERAL NEWS



Apps for cars have been available almost exclusively through the respective vehicle manufacturers. This is now set to change: Faurecia-Aptoide and Catappult plan to jointly launch an app distribution service for cars.

The two companies are already well-established in the vehicle software market. Faurecia Aptoide Automotive is a joint venture between Forvia and Aptoide that brings together automakers and app developers. The company's portfolio currently includes more than 250 apps. Faurecia Aptoide already collaborates with major automotive brands such as Volkswagen, BMW and Mercedes-Benz.

Catappult is an app distribution platform that offers Android developers a one-stop shop to distribute their products worldwide. With the new service available at Catappult, developers can now design and tune their apps for cars; manufacturers can customise their app stores, and users will have access to a wide range of apps and games tailored to their own interests and car capabilities.

Developers will be able to distribute their apps in the major global app stores, and newly also in the top car brands to enhance the in-car digital experience.

BEV Sales in Europe Up 29% Year-on-Year in 2022

GENERAL NEWS



European sales of gasoline and diesel cars totaled 4,145,000 units and 1,640,000 units, respectively, in 2022 for a combined share of 51% of demand, down from 86% (13.9 million units) in 2018, (and 54% of demand with other combustion engine cars as NGV). Combined sales of all electrified cars, from BEVs to mild hybrids, totaled 5.2 million units, or 46% of 11.3 million units sold during the year.

Battery-electric vehicles continued to make inroads in the European market in 2022, according to ACEA, the European automakers group. Sales grew to nearly 1.6 million units, up 29% over the previous year's total, and accounted for 13.9% of new-car demand in the market. Compared with seven years ago, sales were up sevenfold.

Last year's BEV sales leader was Germany (471,000), followed by France (267,000) and the U.K. (203,000). Battery-electrics accounted for 17.8% of new-car sales in Germany, 16.6% in the U.K. and 13.3% in France.

Sweden had the largest share of BEV sales at 80%. Slovakia and Czech Republic were the lowest at 1.8% and 2.0%, respectively.

Total sales fell for the third consecutive year from 2019 levels due to the semiconductor shortage.