



Editorial

21st DVN Workshop: Such Fruitful Lectures At First E-Workshop!

At the 21st DVN Workshop held online last week, 250 attendees were present from 100 companies, including 20 automakers and 25 Tier-1 companies. 15 countries were represented from Europe, North America, Japan, China, Korea, and India.

It was for me the best DVN workshop ever considering the content of the lectures. For this reason, DVN is publishing today an exceptional newsletter totally dedicated to the summaries and takeaways of all the lectures. Registered attendees have the possibility to follow the [VOD](#) of all the presentations until the end of this week. And for those who didn't register, [watch this video](#) to get a glimpse of the event spirit. Please use preferably Chrome browser.

What do we retain from this terrific first DVN e-Workshop?

- The lighting industry achieved this year great progress in ADB, as shown by Daimler, BMW, Volkswagen.
- The great future of ADB, from around 7% in 2020 to around 20% in 2025 (outside US), using various technologies like μ LEDs, DMD, Scanblade or LCD, with a large range of pixels going up to 100 kilopixels and even into the megapixel range to have a good marking light on the road.
- The needs to decrease power consumption is becoming more and more important; saving for example 50W in the two DRLs corresponds to a saving of 1g/km CO₂. It is a strong opportunity for lighting suppliers to offer new solutions in LEDs, optics, electronics, thermics, simulation, material.
- it is now possible to assess the performances of ADB not only in terms of lighting itself, but also in decrease of driver stress thanks ADB.
- Car interiors are becoming stronger product differentiators on the basis of extensive

software and electronics with artificial intelligence.

- Regulations are becoming more and more important. It was interesting to catch the latest information related to GTB and NHTSA, from GM's Michael Larsen, Audi's Wolfgang Huhn, and Varroc's Rainer Neumann.
- The last message from Geoff Draper, leaving GTB, and going to a deserved retirement is worth repeating: "We have to encourage governments—China and USA—to actively contribute to the development of the technical requirements in a common forum (the UN Working Party on Lighting and light-signalling, GRE) following the example of Korea and India to routinely introduce the updated technical requirements into their national legislation."

Indeed it was a very fruitful workshop. The feedback of many attendees confirms it.

Sincerely yours,

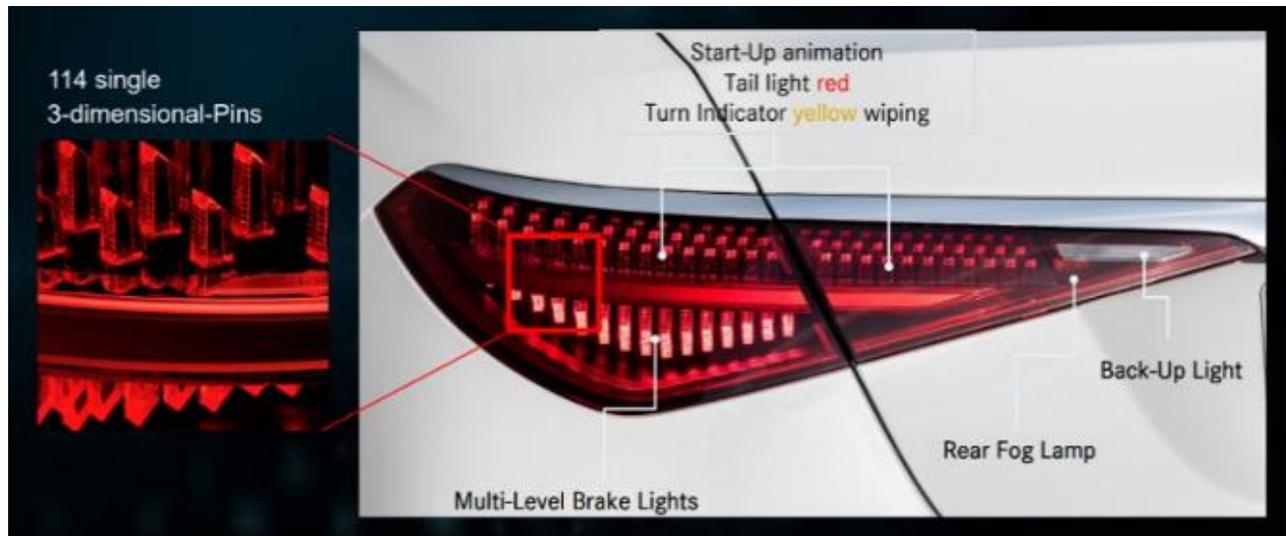


W. Frally
DVN CEO

Presentation Summaries

21st DVN WS: Session 1 • Automakers' Visions

PRESENTATION SUMMARIES



Digital Light in the new Mercedes S-Class

• *Markus Maier, Daimler-Benz*

Markus Maier explained how the previously optional **Multibeam LED** is now the **standard headlamp for the S-Class**. The optical system includes a low-resolution 84-Pixel Multibeam and a high-resolution DMD module with a $7^\circ \times 14^\circ$ field.



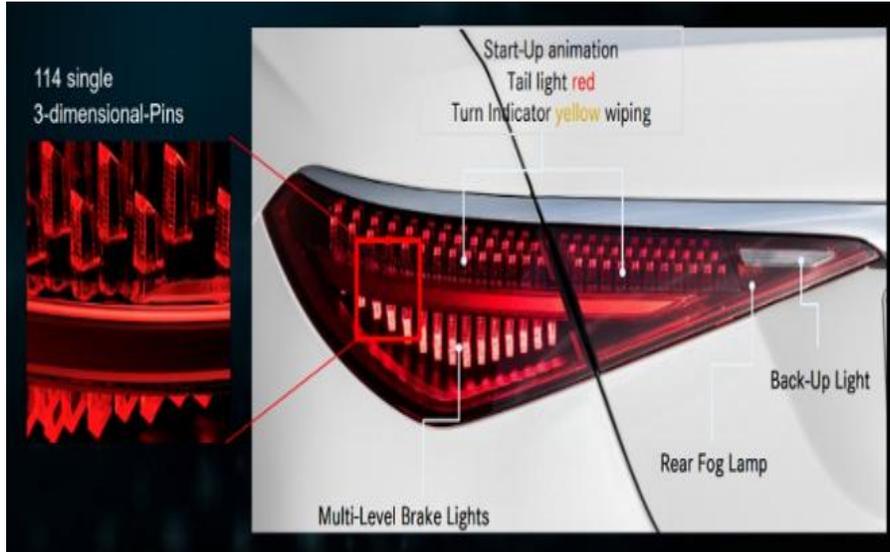
The DMD module is positioned to drive AFS and ADB and to provide symbol projection with the 3 targets performance, assistance, and communication.

Mercedes' "Digital Light" is made by the DMD module with three extremely powerful LEDs whose light is refracted and directed by 1.3 million micro-mirrors. It is a technology widely employed in video projectors.

With the help of intelligent headlamps, the S-Class can display digital light functions including:

- Stop warnings: A backwards pointing arrow with concave sides to warn the driver to stop—in case the driver misses a stop sign, a red light, a wrong-way sign, or suchlike;
- Roadwork warning and guidance lines with symbols to warn the driver when approaching roadwork, guiding lines are indicating the width of the vehicle during the roadworks, or supporting the driver to centre the vehicle in their lane.

The lighting innovations are not only in the front...



To be retained: The two main messages from Markus Maier are
- Now, the lighting has three functions : Performance, Assistance, Communication
- It is very important for a wide industrial success of high resolution systems to have a solid frame for projections like the proposal for amendments to UN Regulations N° 48 and 149.

Lighting concepts in the BMW 5 Series

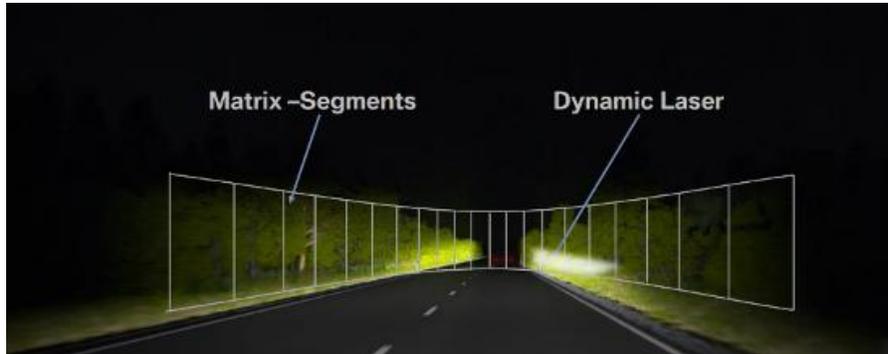
• **René Uebler & Thomas Priller, BMW**

The front and rear lighting are presented



HEADLIGHT OF BMW 5 SERIES WITH LOCATION OF FUNCTIONS

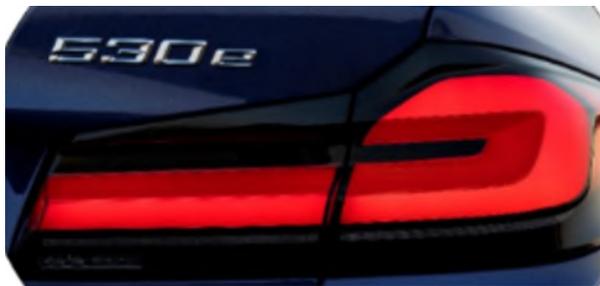
The front light uses for the ADB, a 12 segments/side matrix beam with a dynamic laser booster. No DMD to increase the resolution, but there are swiveling modules to make the Dynamic Laser Matrix Beam.



DYNAMIC LASER MATRIX BEAM

BMW 5 series presents several innovations, improving the styling differentiation

- Sculptural styling—rear lamp with highly 3D aesthetics
- No insight through outer lens, thanks to microoptics in the outer lens hiding the technology inside
- Tail and stop from one signature, implemented as bifunction
- High level of homogeneity



BMW 5 SERIES REAR LAMP

To be retained: BMW developshere a different concept for ADB, no DMD or microLED but swiveling laser module, with vertical cutoff.

Volvo's Sustainable Digital Lighting

• *Paul-Henri Matha, Volvo Cars*

Volvo's is one of the most ambitious climate plans in the whole of the automotive industry and the lighting teams want to be part of the task. Paul-Henri Matha proposes two ways to reduce the general consumption of lighting systems:

- Greater usage of digital light to improve safety, but within the constraint of a power consumption limit, seeking to decrease each contributor as DRL, Low beam, high beam, and ADB. This will require high resolution with the digital support.
- To propose to regulators a reduction of main beam specifications in case of cities with street lights, platooning, Traffic jam. Digital light could be used to put light just where we need (danger, object, ...) and will help to reduce power consumption.

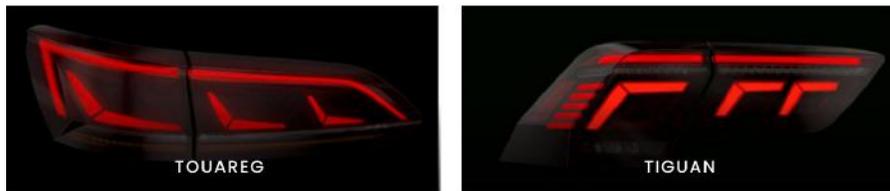
See for example, result of a study from TU Darmstadt: "when luminance of the road is enough, no need (or less need) to have low beam on the ground".

To be retained: Interesting lecture which shows that the new lighting technologies are increasing energy consumption and we must decrease this consumption. Two ways are proposed, one technical, one on regulation. An average reduction of more than 1g/km CO₂ seems possible.

IQ.Light—Volkswagen's New Light Vision

• **Ricardo Plöger, VW**

Ricardo Plöger started the lecture explaining how VW is working on the democratisation of lighting about technologies and functions from the high level range to lower range. One of the presented examples is the process from Touareg in 2018 (128 LEDs; 1,150 Lm low beam; 2,150 Lm high beam) to Tiguan in 2020 with 47 LEDs, 900 Lm low beam, and 1900 Lm high beam, both with matrix.



Same in rear lighting with VW's "clic-clac" function (different segments light up for stop vs. tail mode, augmenting the conspicuity of the stop lamps).

The second part of his lecture is dedicated to DRL power consumption and the VW work to reduce it. Two surprise numbers were presented: 44 and 1. 44W per side used in the ID3 DRL to have 1W from the light, because of styling losses, ECU losses, dissipation losses, and optical system losses. A lot of losses have to be avoided which should correspond to 1g/km CO₂ (equivalent to 50W).

Plöger presented in his third part an interesting concept for the lower range: providing ADB from only one side of the car.

Two-sided HD

- 3:1 chip aspect ratio sufficient
- 210lx in ADB per side possible
- A-Segment and above

One-sided HD

- 4:1 aspect ratio required
- 160lx in ADB per side possible
- A-Segment and below

Differentiation of Performance (Intensity, Resolution) via Software

To be retained: This meaty lecture demonstrated that

• democratisation is the strategy of Volkswagen: for safety reasons, lower range cars have to benefit from innovations of higher range, perhaps with minor changes.

- *all lighting players, optics, thermics, electronics, materials, have to work on reduction of losses of LED components and mainly DRL which is integrated in the WLTP (consumption in homologation cycle).*

What Means Digital Lighting for Renault

• **F. Bedu, Renault**

François Bedu started by the subject on the number of segments. Renault have made an internal study to evaluate different parameters of an ADB system by simulation done on 57 persons. 3-segment solutions were not perceived as real ADB, and no real difference noticed between 5 and 7 segments. His conclusion is that ADB can be acceptable with 5 segments in order to propose the function to a large number of customers. But for low number of segments, smooth transition is mandatory to maintain a sensation of comfort.

Bedu made an interesting explanation to prove that a fully dynamic road projection will require 70 to 100 kilopixels. For Renault, the road projection is a new function with safety benefit and must have a regulation frame which allows to implement it in all lighting functions. The road projection has to be available not only in ADB but in all other lighting functions as in low beam, high beam, or AFS.

He congratulates GTB for its great job to demonstrate the benefit of road projection for customer safety. He said that regulations must be technologically neutral and performance-based. Road projection must be a part of all lighting functions to give a large access to its safety benefit.

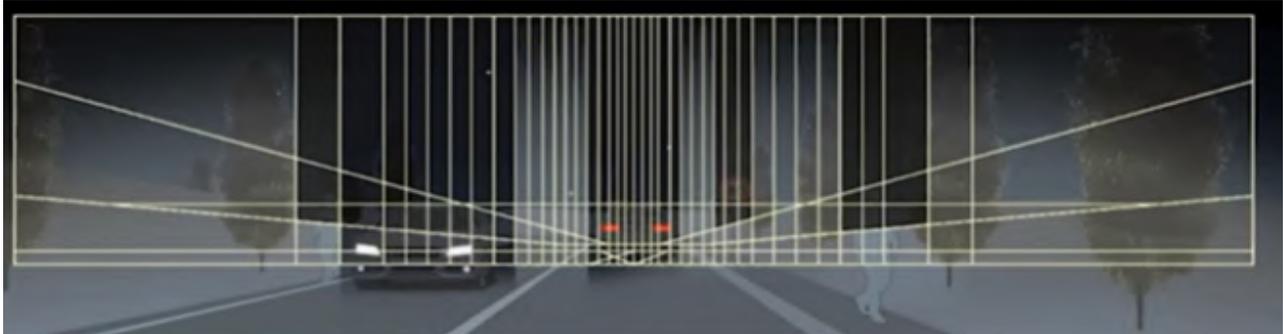
In the interior lighting, a new category of functions appears in cockpit for HMI: "Infolight" is a new group of functions with real customer value and will probably become a part of carmaker brand identity. The domain of application is new and large with AD intention, ADAS alert, A.I. incarnation, communication, Infotainment, EV charging and well-being. A dynamic light effect will lead to digital light implementation.

To be retained: *Interesting presentation on the Matrix ADB with the optimisation of 5 segments and on the ADB high resolution with road marking and the needed 70 kilopixels! Interesting remark that the road projection has to be available not only in ADB but in all other lighting functions.*

Useful message on Infolight and its real customer value.

21st DVN WS: Session 2 • Set Makers' Digital Light and HD Technologies

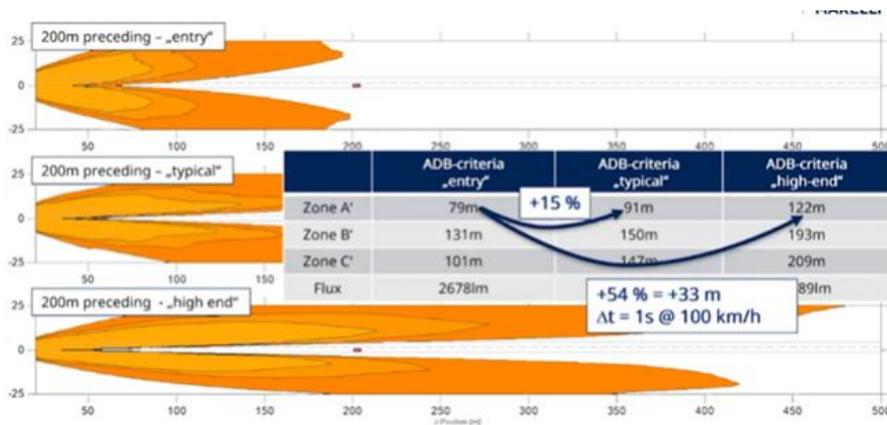
PRESENTATION SUMMARIES



ADB Rating Systems, from entry version up to high resolution

• *E.O. Rosenhahn, Marelli Automotive Lighting*

The evaluation of performance of traditional headlamps was defined in the past by the group CIE-TC 4-45 particularly by the measure of the range in three zones with the isolux 1, 3, and 5 lux.



But ADB systems have specific beam patterns and no internationally agreed system is currently existing. E.O. Rosenhahn is proposing a system inspired by the procedure defined by CIE-TC 4-45 but adapted to ADB. Some could consider the maximum intensity or the resolution or the gradient of the vertical cutoff as important for the evaluation of performance. But finally, the most important for safety is the range down the road, proposed as the main criteria for the rating.

One of the main interests of ADB is the good perception of pedestrians. The average height being 1.77 m for male and 1.64 m for female, the height of 1.5m is chosen for measurements of the beam. The different situations considered by the regulation ECE 123 for instance 200 m preceding car or on-coming car at 50 m, 100 m, and 200 m are used and the points with 1, 3, and 5 lux from the left side and the right side of the road are

measured.

The average of these distances is the base of the rating. The graph on the right is showing examples of measures of entry, typical and high end ADB.

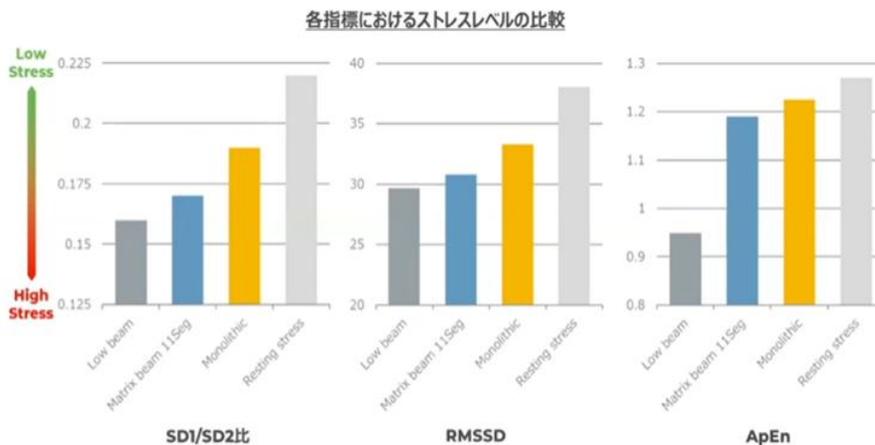
The complete headlamp rating with LB, HB, ADB weighted respectively 30%,30% and 40% can be done with the different levels Standard, Good, Advanced, Premium, Premium+.

To be retained: The target of this proposal is to introduce a reproducible assessment method for ADB systems with acceptable efforts providing a representative and easy to read result. Formulated with Darmstadt University, it will be available in 2021.

Stress Reduction with Monolithic

• Hiroyasu Onuki, Ichikoh

H.Onuki proposed an original method for the evaluation of the interest of ADB systems through a medical approach with the measurement of drivers' stress.



Three specialized parameters, SD1/SD2 (Activity balance of sympathetic and parasympathetic nerves), APEN (index of heart regularity), RMSSD (short term direct stress) were monitored with ten drivers using three types of beams: Low beam, Matrix beam 11 segments and the new High definition Valeo-Ichikoh system called “Monolithic”. It appears that Matrix beam is giving 36% less stress than simple Low beam, and “Monolithic” is giving a complementary 36% reduction of stress. The “Monolithic” ADB system will include 2,5K, 4K or 20K pixels.

This improvement for stress is supposed due to the high precision, high homogeneity, and high fluidity of the “Monolithic” beam.

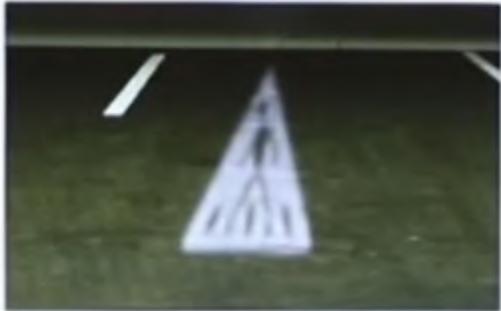
This stress reduction could improve time reaction and so safety as established by previous studies.

To be retained: This study is so consolidating the interest in safety and comfort of good beams particularly ADB HD.

Possibilities of next generation high-definition modules

• *Gerald Boehm, ZKW*

~ 15 000 Pixel System
24° H FOV - 0,1° = 240 Pixel
6° V FOV - 0,1° = 60 lines
Foreground projection 40 lines



~ 130 000 Pixel System
24° H FOV - 0,03° = 720 Pixel
6° V FOV - 0,03° = 180 lines
Foreground projection 120 lines



The target of the presentation is to analyse the possibilities of improvement of μ LEDs systems.

First systems under development with μ LEDs could have 15000 pixels, to be compared to 1,3 Mio pixels of DLP.

This resolution is enough for a good ADB, but not so good for projection. In fact, with 15K, we can have a 20° horizontal FOV and 6° V FOV. Vertically that means 60 lines, including 20 above the horizon, and so 40 lines on the road, not enough for projection.

An improvement could be to have 130 000 pixels with the same FOV. In that case, the foreground projection with 120 lines is giving a good precision to projected symbols. But for a good projection, it not enough to have a μ LED source with 130 000 pixels, the optical system must be also improved. A multi-lens system is so necessary giving precise imaging and good contrast, but at the price of complexity, cost and lower efficiency and intensity.

Another direction for improvement is the increase of the field of view. Today with 24° H FOV and 6° V FOV, the installed power is already at 150W while the average used power is at 50W, so with a system using “efficiency” of 30%.

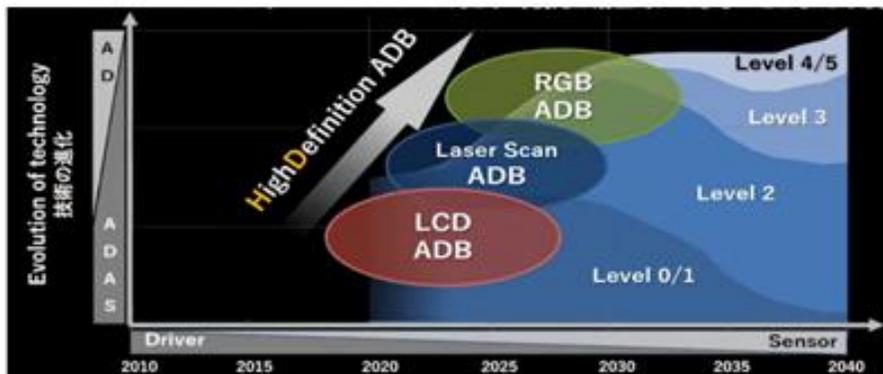
With the same pixel density than the previous 15K system with the increase of H FOV to 100° and the V FOV to 20°, the chip size would be 200 000 pixels and the installed power 2000W while the real used power would be 65W. So, with a system using efficiency of 3%.

A full digital headlamp with levelling aiming would even need 115° H FOV and 35° V FOV with 400 000 pixels. The installed power should be 4000W while the real power used would be 65W, so with a system using efficiency of only 1,6%.

To be retained: a resolution of 100 000 pixels will be a reasonable compromise for precise projection and cost, but the increase of FOV will need especially important decrease of cost of LEDs before implementation.

Evolution of ADB - Stanley never end the evolution of headlamps

• Yasushi Yatsuda, Stanley

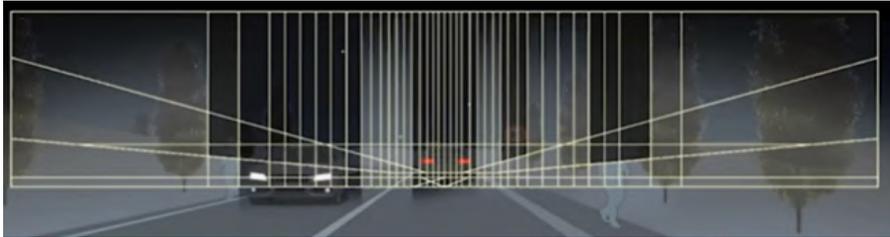


Stanley presented an LCD version of ADB, that would be a step before in the future Laser Scan ADB and later RGB ADB.

A specific technology was developed called PBT as Pure Black Technology.

First Stanley has defined the definition necessary to ensure a good safety. As 95% of accidents are on straight roads, this situation was consequently considered. The LCD pitch was after defined in relation to the horizontal field of view as shown on the right.

The LCD system is giving sharp cut-off and more than 100 luminance gradations. The global efficiency is 30%.



Stanley has chosen LCD for the following advantages compared to LED array: independence of segments (no superposition), segments can be thinner without extra cost with high contrast and possibility to control brightness, the shape of segments is flexible authorizing curve segments. Road projection for instance side lines can also be realized with LCD.

Stanley is considering that this system could be especially useful for motorcycles in curves. In that case, there would be no camera, a simple sensor directly giving the inclination to allow the horizontal stability of the beam.

A complementary argument for LCD is style freedom as these systems can be adapted to different shapes of headlamps.

To be retained : LCD is so representing another interesting solution in parallel to DLP and μ LED in the HD ADB race

21st DVN WS: Session 3 • Regulation

PRESENTATION SUMMARIES

Session 3

Innovation and Regulation
Time for a reality check!

Removing Barriers
to Innovation

Worldwide Harmonisation of
Technical Requirements

Geoffrey R Draper
President
The International Automotive Lighting and
Light Signaling Expert Group (GTB)

DrivingVisionNews.com
Adaptive lighting and driver assistance technologies
21st DVN Workshop
17th DVN Regulatory Session
02 December 2020

"Innovation and Regulation: Time for a Reality Check!"

Session chairman Geoff Draper started off by identifying the major difficulties associated with innovation and regulation:

- Barriers at the level of the UN Regulations, because the appropriate technical requirements have not been established.
- Although the technical requirements in the UN regulations are applied by most countries, with the notable exception of the USA, there are barriers to innovation because of delays in their implementation into national regulations.

This session provided an overview of the activities underway in GTB and SAE to address these fundamental issues.

ADB Regulation in the USA

• *Michael Larsen, GM (Sponsor of SAE J3069)*

Larsen explained that the FMVSS 108 ADB final rule was scheduled to be published by the end of October 2020 but there is further indefinite delay. Once it is published, the SAE Lighting Systems Group will hold a meeting to review the regulatory text as a group.

He reviewed the major requirements in NHTSA's proposed rule, highlighting where we have some information on how FMVSS108 will be amended.

The NHTSA Adaptive Driving Beam NPRM requirements are extensive and substantial and it is expected that the requirements for the final rule will be relaxed. However, it is still expected that the final US ADB regulatory requirements will be stringent, requiring updates to ECE ADB calibrations

It is expected that there will be a requirement for a horizontal Vehicle Headlamp Aiming Device (VHAD) if a horizontal adjuster is installed, potentially driving design changes to ECE compliant ADB systems.

Activity Report

• Wolfgang Huhn, GTB WG-S Chair

GTB Working Group Strategy was founded in April 2017 to advise the GTB General Assembly and Technical Steering Committee on GTB process improvements, new topics for study and their priority and to define the pre-conditions for the scientific basis of proposals for new regulations.

It is a special group in GTB because it operates with a Chair and two Vice-Chairs and currently has 26 company members represented by CTO's, VP's, and General Managers. All the member companies agree to pay a fee to sponsor independent university studies. There is a good participation (~80%) at each meeting.

Wolfgang reviewed nine research projects that are being funded by GTB, some already completed and presented to GRE. He also presented a list of future items to study as part of the GTB roadmap 2020-2030.

GTB Safety and Visual Performance WG

• Rainer Neumann, GTB SVP Chair

GTB WG SVP (Safety and Visual Performance) is taking the tasks from WG Strategy to execute research studies with neutral, objective institutes and universities on important topics. The target is to use the findings to convince the legislation authorities in GRE to accept the release of new lighting systems and functions with an approval.

Results so far are available from research sponsored at TU-Darmstadt (Germany), Embedded Lighting Systems (ELS) (France), Karlsruhe Institute of Technology (Germany) and Literature Studies by Fudan University (China) and Lighting Research Centre, Rensselaer Polytechnic Institute (USA)

SVP work items include Driver Assistance Projections, Signal road projections, AV Communication to other Road Users, Potential Disability Glare of Super Small Lamps, Potential Photobiological risk with blue lights, and Headlamp Safety Performance Rating (HSPR)

Removing Barriers to Innovation

• *Geoff Draper, GTB President*

Geoff summarised the current status of global harmonisation:

Technical requirements of UN Regulations are adopted by the majority of the 63 countries signatory to the UN 1958 agreement.

The Chinese GB standards are being updated to follow the UN technical requirements but synchronisation remains a problem.

The Korean KMVSS 108 standards are routinely updated to follow the UN technical requirements even though Korea operates a self-certification system.

The Indian Automotive Industry Standards (AIS) are regularly updated to align with the latest technical provisions of the UN Regulations.

The US Federal standard FMVSS108 is partially harmonised with the UN Regulations but there are major issues because the subjective requirements in the UN regulations are not considered acceptable by NHTSA for its self-certification system. Consequently AFS and ADB are not currently possible in the US, and different approaches to the definition of the apparent surfaces have to be resolved.

Currently there is no political will to develop Global Technical Regulations (GTR's) under the UN 1998 Agreement. To overcome this ongoing situation, Draper believes that a pragmatic approach to remove barriers to innovation should be considered, based upon the Korean regulatory system. This pragmatic approach would be based upon the following elements:

- Encourage governments (Primarily China, and USA) to actively contribute to the development of the technical requirements in a common forum (the UN Working Party on Lighting and light-signalling, GRE).
- Encourage the USA and China, to follow the example of Korea and India to routinely introduce the updated technical requirements into their national legislation.
- Ideally USA and China would agree to jointly chair the GRE informal group

There are some important questions to be addressed relating to how GTB may wish to start a discussion in GRE and whether the UN World Forum (WP29) would be prepared to support such an approach.

21st DVN WS: Session 4 • Future Car Interiors

PRESENTATION SUMMARIES



In the introduction of this session, chairman Carsten Befelein from DVN & DVN-I underlined that the car interiors are becoming in future stronger product differentiators on the basis of extensive software and electronics with artificial intelligence. New vehicles are facilitating new activities and UX (user experience) in the car interior like relaxing, working, conferencing, watching movies, etc. Autonomous driving vehicles will transform the *driving* experience into a "passenger" experience. Lighting and displays for homes and offices will be seamlessly transferred into the rolling autonomous-driving homes and offices on wheels. The car interior is the space, where the customer experience happens! [Subscribe](#) to the new DVN-Automotive Interior Newsletters and reports.

Smart Lighting Integration

•**Monica Ai and Julien Adillon, Grupo Antolin**

Monica Ai (Lighting Director, China) and Mr. Julien Adillon (Corporate Management, Grupo Antolin China) presented very impressive aspects of future interior components, sustainable materials, functional surfaces, and smart interior lighting and electronic solutions of Grupo Antolin.



Surface Backlighting for Future Automotive Interiors

• *James Gourley, DesignLED*

James Gourley, DesignLED CEO, gave an interesting view on the backlighting of light transmissive surfaces, market and economic aspects, interior use cases, technology, and emotions as a contribution to the trends of rolling living spaces, emotional personalisation, wellbeing, and smooth and flat designed smart surfaces in the future car interior.



Turn Any Automotive Window Into An HMI Display

• *Brandon Seiser, Texas Instruments*

Brandon Seiser from TI's DLP® Products Group gave an overview of automotive macro trends, need for communication, HMI window displays on the basis of light projection and film architecture. He presented the DLP technology for small efficient projectors up to 1,000 lumens RGB for window displays with night- and daylight brightness.



Accelerating Development of Ambient Lighting with seddLED

• Eric Toh Chip Hock, Dominant

Eric Toh Chip Hock talked about “Smart Embedded Digital Driver LEDs” which combine RGB LED, LED Driver and advanced communication link integrated into a single package with a great future for the new car interior lighting functions.



SEDDLED AMBIANT LIGHTING SYSTEM DIAGRAM

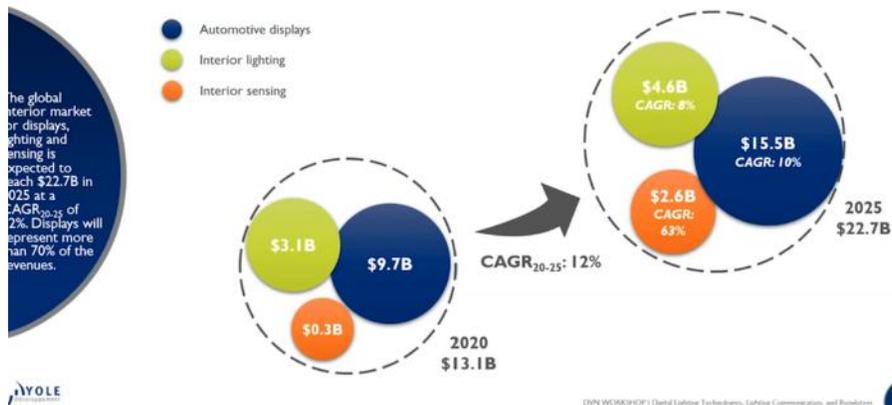
Car Interior Highlighting, Lighting, Sensing and Display Synergies

• Martin Vallo, Yole Development

Martin Vallo from Yole Développement made a lecture about CASE, UX, HMI, System architecture, Interior lighting, displays, sensing and market developments.

MARKET FORECAST

Global interior market revenue forecast (\$M)



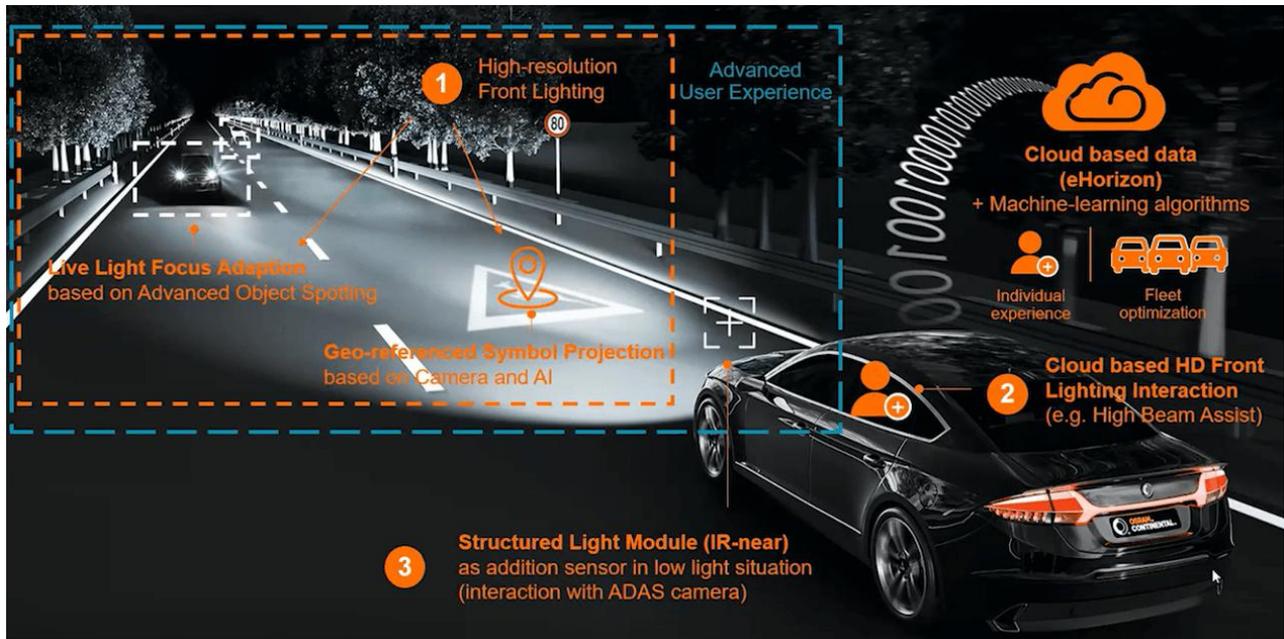
A lot of questions from the attendees showed the great interest in the "Future Car Interior" subject as related to lighting. Daniel Pardo from Grupo Antolin answered questions about software and electronics capabilities as full system supplier and the company's vision of the future interior lighting. James Gourley from DesignLED compared the advantages and disadvantages of backlighting and light projection. He considered a roadmap, developing complete light components for a perfect light system by integration of light modules into the interior components. Brandon Seiser from Texas Instruments explained how to make car windows to HMI displays, what is the size of a projector with DLP technology for window displays on day - and night brightness level and what are the system costs.

Mr. Eric Toh from Dominant Opto Technologies was asked for competitive smart LEDs to the seddLeds, the first digital LEDs. He confirmed a roadmap for the development of a smart seddLed also for exterior lighting, e.g. for the communication light of AVs.

Mr. Martin Vallo from Yole Développement was asked why he sees in the revenue forecast 2020 till 2025 a very strong revenue increase for displays and sensing systems and only a slight revenue increase for interior lighting. He explained, which HMI solutions will be realised in the future and that our cars will have only one centralized supercomputer in 2035.

21st DVN WS: Session 5 • LED & ADB Innovation & Democratisation

PRESENTATION SUMMARIES

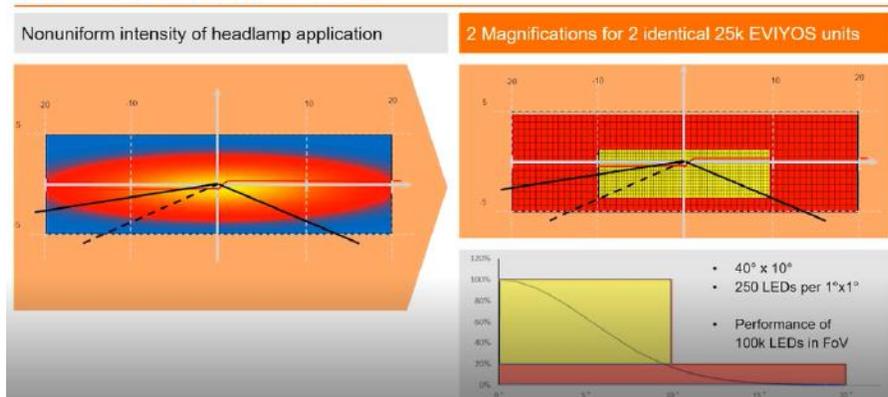


High-Resolution Active Pixel-LED

• **Stefan Grötsch, Osram**

The presentation was titled: Future Lighting Technologies and Demo of a High -Resolution Active Pixel-LED. Grötsch gave a detailed presentation of Osram’s second generation active LED pixel device named Eviyos 2.0. This device has 25,600 active, singly-addressable micro LEDs, and is Osram’s technology response to support future high-resolution head lamp applications. Osram also made a demonstrator which contained 2 Eviyos devices per headlamp.

Spanning the large Field of View



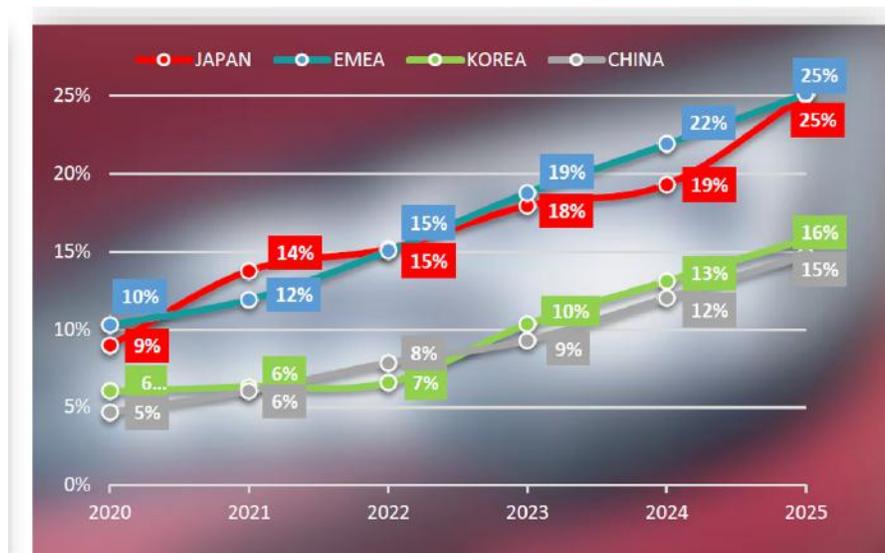
SPANNING THE LARGE FIELD OF VIEW

This to find the best compromise between a high-resolution centre zone and a large zone outside the center with a lower resolution. This enabling technology will enhance safety and comfort for future headlights with the following features: swivelling HB, bending light, ADB, lane marking, symbol projection.

Digital Headlighting: Enabling Light Source Solutions

• *Norbert Lesch, Lumileds*

Norbert Lesch shared Lumileds market view on the global adoption for ADB.



ADB REGIONAL MARKET ADOPTION OUTLOOK

In the next 5 years it is expected that the adoption of ADB will increase up to 16% to 25% per region. With the usual exception of the USA, where the situation remains unclear due to regulatory delays.

Lumileds' response is to develop enabling light source technologies: discrete small LEDs which allow very narrow spacing and which have very narrow tolerances for basic ADB functionality with single and multi row LED spacing. Typically, these applications will use about 12 (single row) to 100 (multiple row) LEDs per headlamp.

For advanced high-resolution headlight applications, Lumileds announced their development of a high-resolution microLED light source device. This is a technology like that shown by Osram in the first presentation of this session.



Future of Digital Lighting Technology Starts with Nichia

• *H.Kuroda, and K. Ichikawa, Nichia*

Nichia shared their enabling light source technologies to support future applications. These applications are in the interior: high luminance coloured LED and laser technology to support HUD projections on the windscreen, including augmented reality (AR). AR will even support a seamless transition between the interior (lighting) and exterior of the car.

For exterior, Nichia will also develop further white laser technology: light on light projection with ultra-high luminance laser light. And Nichia are also developing their own active pixel LED device with 16,384 pixels. It's being designed in partnership with Infineon. Full automotive qualification is currently in process, market introduction is expected in 2023-24.

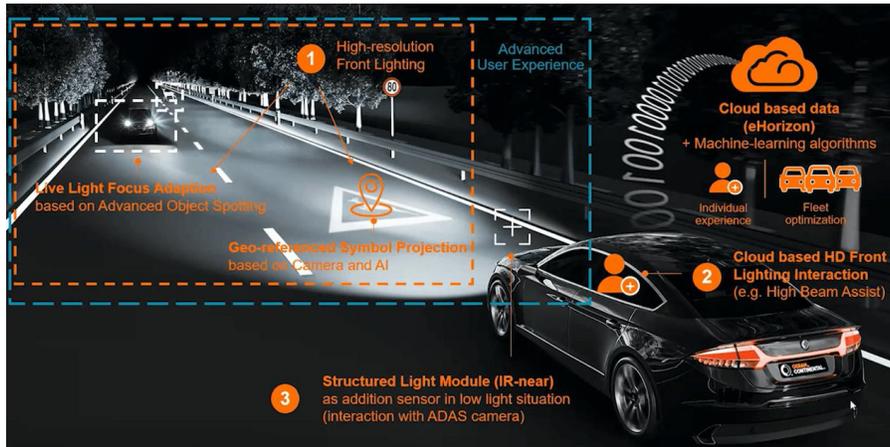


TECHNOLOGY PORTFOLIO

Sensor Fusion for HD Lighting

• *M. Austerer, Osram-Continental and D. Spiesswinkel, Elektrotbit*

The ambition of the coöperation between Osram-Continental and Elektrobit is to bring high-definition exterior light to the next level. We have seen from Osram, Lumileds and Nichia that they are all working on the concept of high-resolution active pixel LEDs. The idea of Osram Continental and Elektrobit is to control those micro LEDs in the most intelligent, fastest, most precise way. This is done by using all sensors available: cameras, radar, lidar but also GPS and map data. A proper working system will allow a good overall system architecture (role of Osram-Continental) and software including sensor fusion (role of Elektrobit). The result is an ultra-fast and precise high-resolution digital pixel driving beam, including augmented reality, 360 degrees round the car.

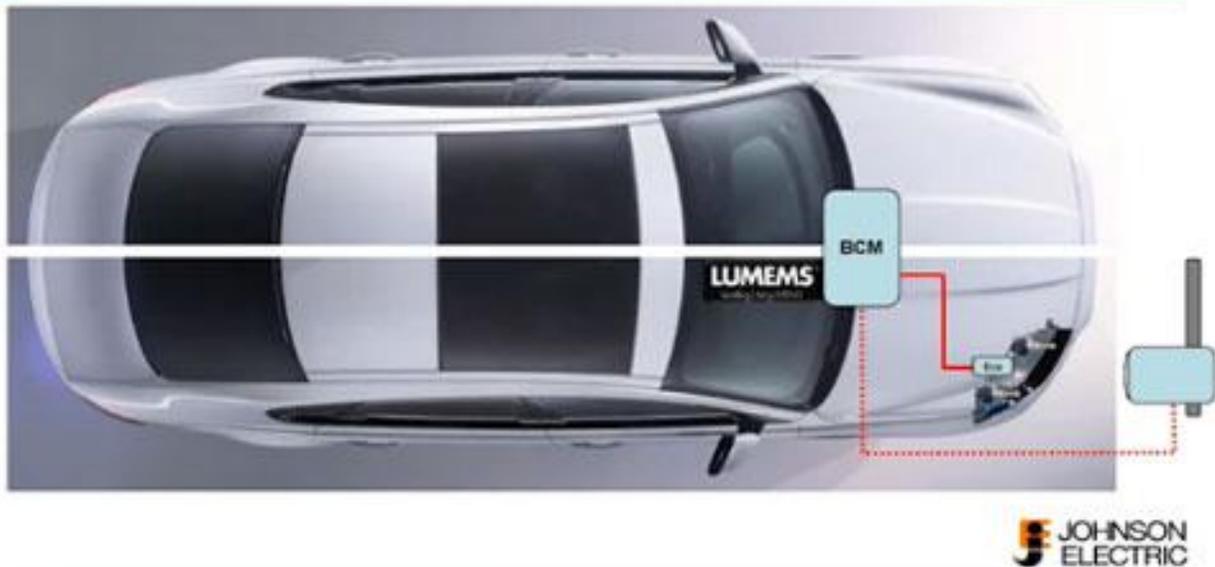


INTELLIGENT HD LIGHTING FUNCTIONS – USER EXPERIENCE THROUGH A HOLISTIC APPROACH

21st DVN WS: Session 6 • Electronics, Aiming, Materials, Measurement

PRESENTATION SUMMARIES

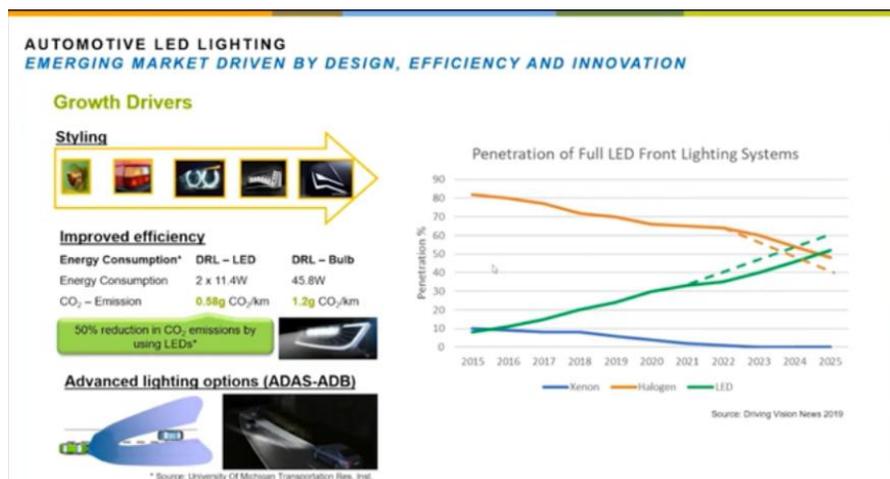
Ideal Aiming and Leveling architecture



During session 6, the last of this workshop, a mixture of topics were addressed comprising control electronics, aiming and levelling, measurement systems and last but not least new materials.

Advances in Intelligent Automotive Exterior Lighting

• Prem Sharma, NXP



The first speaker was Prem Sharma, focussing especially on the control of matrix and pixelated lighting systems. For long term sustainable and cost effective systems it is mandatory for the semiconductor industry to supply flexible and scalable solutions targeting to allow platform designs. Technology wise, diagnostics of multi-pixel assemblies, signal processing and interrelation to vehicle networks become key and will require new architectures. As outlined in the presentation, NXP has developed a number of building blocks like LED drivers, Matrix controllers, SBC and Micro controllers to face this challenge of industry.

Considerations for Dynamic Rear Light LED using bus based semiconductor architectures

• *Jatin Thaker, Elmos Semiconductors*

POSING CHALLENGES TO DESIGN, INTEGRATION, INTELLIGENCE elmos[®]

- Future feature concept **density demanding** to handle "more in less"
- Keeping up with pace of **innovations vs. investments**: more being introduced in shorter time
- Need to sync with **technology transformations** at OEMs for delivering total lighting solutions

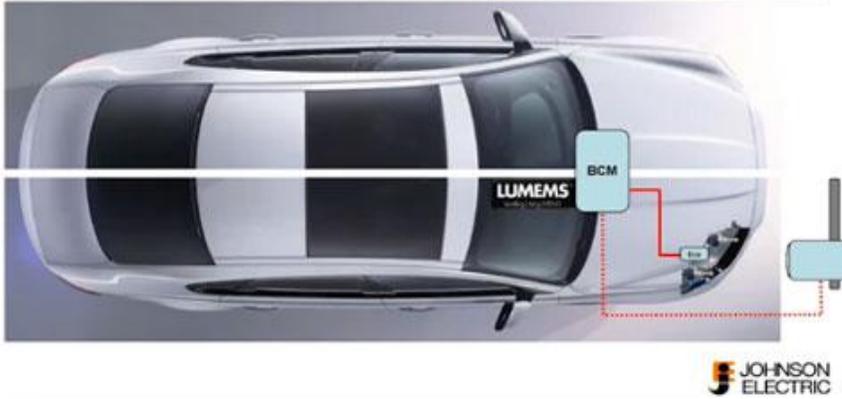
OEM	IC Supplier
<ul style="list-style-type: none">- Digitization of light- Centralized control architectures- Software and hardware scalability- Software ownership and reuse- Light Bus architectures	<ul style="list-style-type: none">- Individual pixel control- Smart, integrated intelligence- Scalable, Configurable solutions- Emulations, Digital Twin capability- Protocol compatibility

Jatin Thaker gave the next presentation. Main elements of his talk addressed the topic of scalability and configurability as well as intelligent IC integration for this type of application. He emphasised that product ranges should focus on building a family based on same technology to serve high end performance for premium as well as affordability for main stream cars. A key element to penetrate further on this way has to be a close co-operation of the industry partners, but also involving end users. A further promising aspect is that this technology could also be used for interior applications.

When levelling and aiming merge into digital Headlamp Setting

• *Ludovic Toulisse, AML Systems*

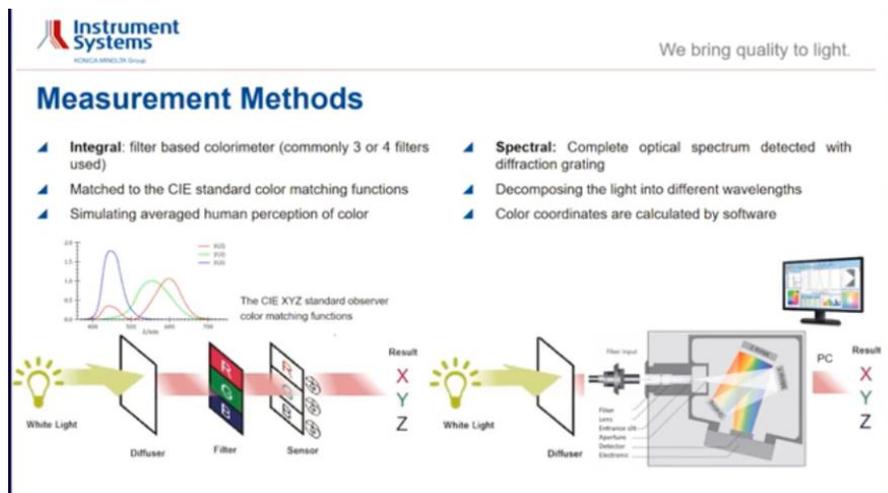
Ideal Aiming and Leveling architecture



Ludovic Toulisse addressed the hot topic of vehicle light aiming. His contribution was driven by the overall target to create a common solution for headlamp aiming and merging it with digital technologies developed for levelling. He explained the concept of a Hardware/Software module called LUMENS to improve the aiming at vehicle maker production lines.

Methods to measure the luminous colour of white and coloured LEDs

• *Hassan Gargouri, Instrument Systems.*



During his talk, Hassan presented new equipment and process for beam measurements. The system is based on beam measurements enabled by a new camera. All relevant components are integrated into one system and thus allow superior system development and control. The set-up of the system has lasted quite some time and is front running other solutions. Especially the accuracy of colour measurements of white and RGB LEDs is outstanding with an accuracy of colour coordinate measurements of 0.001, compared to the allowed deviation of 0.005 compared to certified institutes. Another key element of this measurement is the outlook on its duration of only “few seconds”, a key element for industrial application.

“Driving Ahead of the curve: Visionary Headlamp Concept with Polycarbonates”.

Paul Platte and Jim Lorenzo, Covestro



MONO-MATERIAL HEADLAMP SYSTEM

In the last presentation of this session, Paul Platte and Jim Lorenzo, from Covestro introduced the audience to an innovative material family of Polycarbonate materials called Macrolon TC and Macrolon DS801 and based on this material development they presented a visionary headlamp design incorporating not only lights but also sensors. The main advantages of using Macrolon TC and DS801 can result in

- Significant weight reduction of the headlamp contributing to sustainability
- Considerable reduction of components also contributing to sustainability
- Shorter headlamp design saving space under the motor hood
- More styling flexibility
- Better optical performance

As a total result, the application of these new materials are expected to facilitate performance improvements combined with cost savings. First OEM applications are on the brink to go to market. Nevertheless the competition with established, well-known materials like aluminium will still need due time before a considerable change will occur.

