

DVN-Lidar Conference 2024 – Special Report

SAE Level 0	SAE Level 1	SAE Level 2	SAE Level 3	SAE Level 4	SAE Level 5
<p>You are driving whenever these driver support features are engaged - even if your feet are off the pedals and you are not steering</p> <p>You must constantly supervise these support features: you must steer, brake or accelerate as needed to maintain safety</p> <p>These are driver support features</p> <p>These features are limited to providing warnings and momentary assistance</p> <ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 			<p>You are not driving when these automated driving features are engaged - even if you are seated in "the drivers seat"</p> <p>When the feature requests you must drive</p> <p>These are automated driving features</p> <p>These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met</p> <p>traffic jam chauffeur</p>		
<p>These features provide steering OR brake/ acceleration support to the driver</p> <ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 			<p>These automated driving features will not require you to take over driving</p> <p>These features can drive the vehicle under all conditions</p> <ul style="list-style-type: none"> • local driverless taxi pedals/ steering wheel may or may not be installed same as level 4, but feature can drive everywhere in all conditions 		
<p>These features provide steering AND brake/ acceleration support to the driver</p> <ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 					



Picture showing the huge gap between L2+ and L3,4,5 applications (source: Innoviz)

The 7th annual DVN 2024 Lidar Conference on November 18th/19th in Wiesbaden was again the place to be if you want a clear understanding of the Market and Developments in the Automotive Lidar Technology. With almost 150 attendees incl. OEM representatives, exhibitors and 33 speakers, it has again been a great success despite the current difficulties of the Automotive Business in Europe.

Here are the Take Aways regarding Lidar Growth

- The Lidar market is growing in China, volume will go up to >1,2 Mu in 2024. The number of design wins increased from 34 in 2023 to 68 – current stand in 2024 - and 14 vehicles are equipped with a 100% take rate.
- This is pushed by the high take rate of NOA applications for NEVs, which has doubled in one year to achieve 40%. NOA is much easier to implement than Level 3 (Traffic Jam / Highway Pilot).
- The L3,4,5 applications are not yet mature. Everybody is waiting for the first L3 Highway Pilot (130 kph in EU) launch which should happen in 2027. Even so, the huge development & validation effort required to launch these applications means it is unlikely to see any significant volume in this decade. Robotaxis, Shuttles, Logistics vehicles are also emerging but with limited volumes.
- Market growth is also pushed by a steep price reduction curve, the 200\$ lidar price (Chinese specs) will be reached in 2025. This helps avoiding the competition with High resolution radars which has a limited impact on Lidar’s growth in China (cheap lidars can do the job better). Nevertheless, a few car models are starting with vision only systems in the D segment, but with more limited features.
- Lidar’s integration in the car is getting easier: bumper and roof top integration are already validated, integration behind windshield will come but requires more work to optimize the performance.

Special thanks to our exhibitors



- **Special thanks to all the speakers** who have contributed to the conference and allowed us to have a clear view of the status and directions of the Lidar technologies and market.

SPEAKERS DAY 1

KEYNOTE



FORD
Peter Zegelaar



VALEO
Antoine Lafay

SESSION 1 - LIDAR APPLICATIONS 1



MERCEDES
Konstantin Fichtner



VALEO
Clement Nouvel



HYUNDAI MOTORS
Youhoon Park



HYUNDAI MOTORS
K.C.Kweon



Wideya by AGC
Raed El Makhour

SESSION 2 - LIDAR APPLICATIONS 2



CONTINENTAL
Wolfgang Schultz



FRAUNHOFER ILT
Arnold Gillner



CEPTON
Henri Haefner



KOITO
Saturai Kazutoschi



GRVA/UNECE
Francois Guichard

SESSION 3 - LIDAR ECOSYSTEM



SCHOTT
Maximilian Glanzer



SCHOTT
Sandra von Fintel



DEXERIALS
Ryosuke Endo



YOLE Group
Pierrick Boulay



Fka GmbH
Amogh Sapkal

SPEAKERS DAY 2

KEYNOTE



ROBOSENSE - Felix Yang

SESSION 4 - LIDAR TECHNOLOGY 1 / SENSORS



SEYOND
Leliei Shinohara



HESAI
Tilman Gasche



INNOVIZ
Nir Goren

SESSION 5 - LIDAR TECHNOLOGY 2 / MEASUREMENT & VALIDATIONS



TRIOPTICS
Dirk Seebaum



SCRAMBLUX
Mirvais Yousefi



KONRAD
Urban Claus



DEKRA
Uwe Burkhardt

SESSION 6 - LIDAR COMPONENTS



ams OSRAM
Clemens Hofmann



Suna Optoelectronics
Laurent Lengignon



RENESAS
Leonard Germic



ANSYS-OnSemi
David Auger



ANSYS-OnSemi
Colin Barry

SESSION 7 - NEW TECHNOLOGIES



PERSIVAL
Christoph Popp



VOYANT
Chris Phare



SCANTINEL
Stanislav Aksarin



VANJEE
Zhai Zhao

- **Special thanks to the exhibitors of demo-vehicles:** Cepton, Robosense, Seyond, Valeo, Vueron

Demo Vehicles (x 5)

- Pick up in the lobby
- Vehicles in front of the terrace

Registration / QR codes

VUERON - Perception Software



Scan the QR code to book your demo vehicle test slot >

Valeo - Lidar



Scan the QR code to book your demo vehicle test slot >

robosense - Lidar



Scan the QR code to book your demo vehicle test slot >

Seyond - Lidar



Scan the QR code to book your demo vehicle test slot >

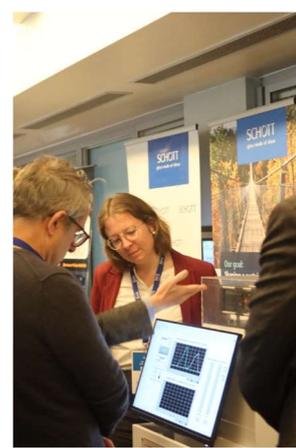
CEPTON - Lidar



Scan the QR code to book your demo vehicle test slot >

- Some pictures of the conference and exhibition





AGENDA – DAY 1

Chairman: Eric Amiot (event and session 1) and Alain Servel (sessions 2,3)

MONDAY, 18 NOVEMBER

Lidar Applications; Ecosystem

11:20-12:45 REGISTRATION AND LIGHT WELCOME LUNCH

TEST Democars:

Robosense, Seyond, Valeo, Vueron, Cepton

12:45-14:10 OPENING the Conference
(Eric Amiot – Head of DVN Lidar)

Introduction of the exhibitors
(2min pitch)

KEYNOTE 1:

FORD - Peter Zegelaar / LiDAR's essential role in highway automated driving

KEYNOTE 2:

VALEO - Antoine Lafay / AV Sensors & AI for a safe L2+/L3 driving

14:10-15:00 SESSION 1 • LIDAR APPLICATIONS 1

MERCEDES/VALEO - Konstantin Fichtner, Clement Nouvel - Insight Mercedes-Benz: Drive Pilot

HYUNDAI MOTORS - Youhoon Park, K.C.Kweon - A Research on Lidar behind the Windshield in Autonomous Mobilities & Need for Reliability Verification of Opto-electronic Semiconductor Devices for LiDAR sensors

Wideye by AGC - Raed El Makhour - Lidar integration scenarios and challenges: Way beyond a "Plug & Play" approach

Q&A

15:00-15:20 COFFEE BREAK-1 + TEST DEMOCARS

15:20-16:25 SESSION 2 • LIDAR APPLICATIONS 2

CONTINENTAL - Wolfgang Schultz - Multi-Modal Rare Events Detection for SAE L2+ to L4

FRAUNHOFER ILT - Arnold Gillner - Integrated Headlight with LiDAR and Radar Sensors

CEPTON /KOITO - Henri Haefner, Saturai Kazutoschi - Safe and autonomous transportation for everyone - Upcoming regulation & consumer ratings as driver for lidar adoption

GRVA/UNECE - Francois Guichard - Update on international regulatory activities for ADAS/ADS and outlook

Q&A

16:25-16:40 COFFEE BREAK-2

16:40-17:45 SESSION 3 • LIDAR ECOSYSTEM

SCHOTT - Maximilian Glanzer, Sandra von Fintel - Schott BOROFLOAT® - Pioneering the future of autonomous driving

DEXERIALS - Ryosuke Endo - Nanotechnology-Enhanced Anti-fogging and Anti-Reflection Solution

YOLE Group - Pierrick Boulay - The LiDAR Frontier: Exploring Supply Chain, Market, and Trends

Fka GmbH - Amogh Sapkal - Overview of Lidar standardization Activities

Q&A

17:45-18:10 DISCUSSION PANEL I
A safe L2+/L3 driving and an affordable Lidar as key factors for Lidar Growth

18:10-20:00 SOCIAL COCKTAIL + TEST DEMOCARS

20:00 WELCOME DINNER
(Conference Room)

Continental was replaced by Vueron (Joseph Kim)

AGENDA – DAY 2

Chairman: Martin Booth (session 4,5) and Leo Metzemaekers (sessions 6,7)

DAY 2

TUESDAY, 19 NOVEMBER:

Lidar Technology; AV Sensors & Fusion

08:25 **Opening Day2**

08:30-09:00 **KEYNOTE 3:**
ROBOSENSE - Felix Yang -
Driving into the Future: Innovations and
Prospects in Automotive LiDAR Technology

**09:00-10:00 SESSION 4 • LIDAR TECHNOLOGY 1 /
SENSORS**

SEYOND - Leilei Shinohara - High-
Performance Mid-Range Near-Field LiDAR
Sensors for ADAS & AD

HESAI - Tilman Gasche - Size Matters:
Improving Lidar Integration and Scaling
Mass Production

INNOVIZ - Nir Goren - Beyond the Basics:
Lidar Key Performance Indicators (KPIs)

Q&A

10:00-10:50 **COFFEE BREAK 1 + TEST DEMOCARS**

**10:50-12:00 SESSION 5 • LIDAR TECHNOLOGY 2 /
MEASUREMENT & VALIDATIONS**

TRIOPTICS - Dirk Seebaum - Tailor-made
optical alignment solutions: Bridging the
gap from custom LiDAR design to mass
production

SCRAMBLUX - Mirvais Yousefi -
Dynamic 4D LiDAR testing to accomplish
comprehensive sensor fusion qualification

KONRAD - Urban Claus (title tbc)

DEKRA - Uwe Burkhardt - Tool Chain for
ADAS/AD Validation

Q&A

12:00-13:45 **LUNCH & NETWORKING + TEST
DEMOCARS**

13:45-14:50 SESSION 6 • LIDAR COMPONENTS

ams OSRAM - Clemens Hofmann-Next
Gen EEL: improving efficiency and heat
management in LiDAR Sensors using
5-junction technology

Suna Optoelectronics - Laurent Lengignon
- Silicon cap solutions to achieve low loop
ESL for high performance & miniaturized
Lidar application

RENESAS - Leonard Germic-Rethinking
LiDAR Technology: Cost-Effective System
Integration with enhanced Safety Features

ANSYS-OnSemi - David Auger, Colin Barry
- Simulating LiDAR receiver SPAD response
using Speos workflow

Q&A

14:50-15:55 SESSION 7 • NEW TECHNOLOGIES

PERSIVAL - Christoph Popp - Towards
Credible Lidar Sensor Simulation in
Challenging Environmental Conditions

VOYANT - Chris Phare - FMCW Lidar using
photonic integrated circuits

SCANTINEL - Stanislav Aksarin - FMCW
LiDAR detection performance in adverse
weather conditions enables SAE L5

VANJEE - Zhai Zhao - How will VanJee
LiDAR+C-V2X Solution Create Vehicles with
Utmost Safety?

Q&A

16:05-16:30 **DISCUSSION PANEL II**
Key factors for low cost lidars
(specs, sensors, components),
competition with HD Radars

16:30-16:40 **CLOSURE (PROGRAM DVN 2025)**

16:40-17:40 **TEST democars**

PRESENTATIONS SHARING POLICY

Recordings are accessible on the web site for all attendees,

Presentations (pdf) are shared to Gold members - only after receiving an approval of the speakers

DAY1 – OPENING

Presentation by Eric Amiot / Head of DVN-Lidar

Eric Amiot reminded the audience about the compliance rules

DVN Team for the LIDAR Conference



DVN - LIDAR / ADAS Activities in 2025

In 2025, DVN will expand the scope of its activities to ADAS. There will be the

- Two separate newsletters: one for ADAS/AV sensors and one for ADAS/AV systems
- L2+ (NOA) Vehicle testing in China to confirm the added value of the lidar
- **DVN Lidar / ADAS conference in EU (Wiesbaden-tbc, 17-18 November)**
- **EAC Lidar / ADAS expo in CN (Hanzhou, 05-06 June), co-hosted by DVN**

The details of the activities (incl. 1 or 2 additional workshops) will be communicated soon

DAY1 – KEYNOTE 2



K2 - Antoine Lafay / VALEO – Director of Innovation and Autonomous Driving

ADAS features are growing fast. By 2034, 100% of cars will have park assist and active safety. 60% of cars will have L2/L2+ and 5-10% of cars with L3/4 with LiDAR as enabling sensor.

System Architecture should be scalable, basic system has smart front camera, 4x corner radars, DMS, 12x ultrasonics and rear camera. L2+ adds mid range radar, 3x surround cameras, HD rear camera. L2++/3 adds LiDAR, Long-range radar, 2x side radars, 5x HD Cameras and 2x rear long range Radars.

ADAS has evolved from ACC + LCA to highway Autopilot (e.g. GM SuperCruise) to L3 (Mercedes Drive Pilot). China moved to L2+ (e.g. Xpeng Navigation Guided Pilot for Urban), and Tesla (FSD for Urban pilot with camera for driver attentiveness). But the more “responsibility” the system takes, the more limited its ODD.

L2 China market- Urban Navigate on Autopilot can be with HD Map or Map free – both use LiDAR (Seres, Avatr, Xpeng, Nio, Li, Xiaomi, Geely). NOA already reached 20% penetration by 2024- and will be 40% in 2025.

To do urban NOA sensors are increasing, hardware (TOPS), better AI models, more data.

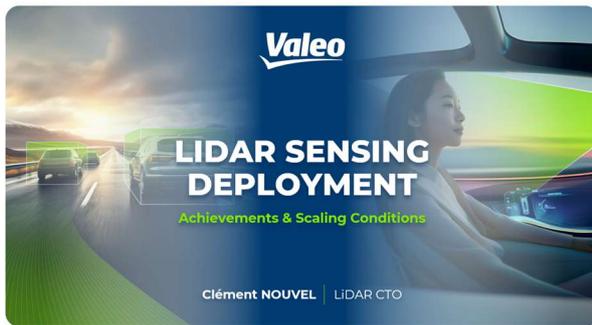
Valeo has moved from Gen1 16 line lidar (which is not sufficient to reach 130kmph) to gen3 (12.5 mps). High def. sensors complement each other. Thermal cameras good for pedestrian and animal detection and in adverse weather – but low resolution limits detection of small objects. HD radar can also work in rain and fog but has challenges for some scenarios. LiDAR is more expensive but has better resolution for objects and complements the other two sensors.

AI is also a key component after the sensor to make L3 work. Examples - fusing surround view cameras to detect objects. Improved parking with holistic “slot” detection.

Prediction of pedestrian and other driver intent is also key – you don’t want to trigger false braking.

Q&A – High-speed L3 will come between 2028-2030. Data for the examples shown was camera + point cloud data but could include other sensor data. Valeo can train a large model offline, and then optimize a smaller model for inferencing, AI safety is an issue, so modelling for all corner cases within ODD is required – but also important to detect when you are out of ODD. There is also diversity and redundancy in the AI approach needed for level3.

SESSION.1 – APPLICATION 1



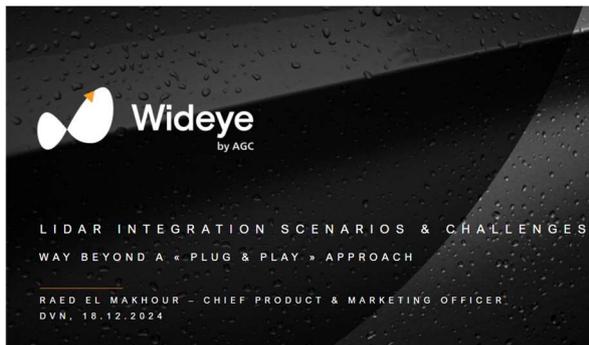
Need for Reliability Verification of Opto-electronic Semiconductor Devices for LiDAR sensors

beyond THE CAR



Kyoungchun Kweon
Senior Research Engineer
Hyundai Motor Group

HYUNDAI
MOTOR GROUP



Valeo/(Mercedes) – Clement Nouvel, Lidar CTO

Mercedes Drive Pilot can work up to 95km/h today – with some conditions. It is still using Scala 2 – but tuned perception stack – object detection is easier at higher speeds. Better perception for corner cases.

Corner cases include Night Driving, Trash and People on the road, Lost cargo. VRu behind vehicle, sudden object on road, and overhanging loads.

With more points, some perception cases become much harder to compute – adds cost to compute, thermals, sensor, training. AI must be able to use the additional sensor data.

The end-end stack is likely to be hybrid – some model based components– some AI.

L3 ODD is increasing. Price competitiveness is increasing.

Hyundai Motor – KC Weon, Youhoon Park – Reliability Verification of Opto-electronics

Lidar has moved from bumper to roof bump and in the future to behind the windshield. But Laser has to transmit through glass twice. Glass can be at a different angle and contaminated. So special glass and AR coatings are required for good transmittance.

The near IR laser is the key semiconductor component in the LiDAR. Verification of this device for automotive applications has been done by Hyundai. Edge emitter and VCSEL was studied in different packages.

AGC Wideye – Raed El Makhour – Lidar Integration Challenges

Wideye develops optical covers, glass trim and vision glazing - working with Audi, Lucid, Daimler. Toyota, Xpeng, BME and others. There is a large adoption in China with roof integration. Windshield integration will start in 2025 (FAW will be first). Side integration starting in 2027/28

Roof integration has the advantage of a high position, but still needs a cleaning system, and is a controversial styling option. Behind windshield integration solves those challenges but has a significant loss due to angle of the second glass.

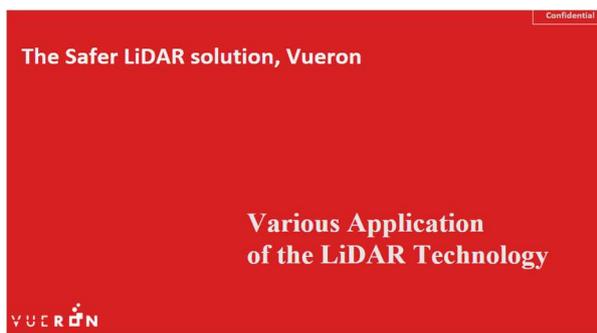
The Volvo EX90 integration is a black glass solution, meeting R43, with integrated heating, AR coating and water repellent.

A three party approach to design is required for success- the OEM, LiDAR manufacturer and glass vendor.

Q&A Session

Roof integration is relatively mature. Windshield integration removes cleaning issue, but other cost challenges remain. Front camera integration is mature now but will be different for Lidar. Volvo required same safety testing for roof glass as for windshield. Until now there was no spec for the “chipping” test – so Hyundai had to create one. AR coatings help on inner side of glass (but not on outer side). Lidar suppliers are working on total optical path to try to minimize the loss.

SESSION.2 – APPLICATION 2



Vueron – Joesph Kim – Various Applications

VueOne – Lidar perception Software for AV driving: for highway pilot, can detect and classify objects – tier1 takes that info to do the driving. Can do lane detection, road obstacle, ground height. Has test permits for Korea and CA/NV. Have partnered with many lidar companies and can run on TI, Rensas, Nvidia and other CPUs.

VueTwo – for smart infrastructure. Can monitor highways and intersections for traffic conditions. Can also do crowd analytics (at airport, street crowds, etc.). Rest area monitoring for usage patterns,

Lidar enhances safety through unknown object detection

Is implemented on: delivery van collision warning system (5 lidar system), Autonomous shuttle with Tier1 company (fused 5 lidar data), Headlight integrated LiDAR – perception solution. Other applications in parking, excavator safety, mining trucks, UAV.

Fraunhofer – Smart Headlights -Sonke Vogel

Design of the car drives the integration constraints (in EU). Windshield has thermal challenges (and steep angles make it hard to have good FOV). Headlight integration is a good solution for shortrange sensors and has solutions for cleaning.

Micro-optics used for beam steering – so unit can be 20mm high. Adding radar into the solution is a challenge. Silver thin film mesh is used as AR coating for the lidar and radar signals. 30mm aperture is possible. Solution provides small range loss and no imaging quality loss

Cepton/Koito – Henri Haefner, Kaz Sakurai – Regulation and Consumer Ratings

There have been over 80 companies talking about lidar concepts from 2004-2016. By 2017, the market for lidar was forecast to be \$3.5N by 2022. But by 2022, volumes didn't show up, consolidation started, OEM programs were delayed, volumes were small, actual market size in EU is small. China had strong growth, EU/US next gen SOPs now expected in 2026/2027.

Koito acquired Cepton. Koito has 110 years of production experience, a supply chain and integration technology. Headlight leveling system and steering system can benefit lidar. Koito also has 30 years of experience with headlight cleaning. Next generation long-range lidar with mirror scanning (not MMT) is on the demo vehicle here today.

UN-ECE – Francois Guichard – Working Party on AV

In 1998 UN agreed to Global Technical Regulations that are suitable for Self Certification and Type approval. Partners help develop the regulations that can then be used as a framework for country (or region) specific rules.

For AV – covers passenger cars as well as mobility services. The framework for automated driving was adopted in 2019 with revisions after that. Its intended to be used by the regulators in US/EU/CN/JP. The ADAS guide came into force in September 2024. For L3 and beyond, the regulation is expected in March 2025, but will not include urban environments yet.

AI in the context of Autonomous Vehicles is also being discussed. Other regulations cover cybersecurity, OTA, and vehicular comms.

Q&A Session

Fraunhofer has a patent on its solution. At lower positions, short range sensors are appropriate (for cross traffic for example), but windshield placement might be more appropriate for long-range. Koito believes long-range is possible in the headlight, but they would need to work with OEMs on specific designs. Optimizing lidar and radar transmittance is possible at the same time.

SESSION.3 – ECOSYSTEM



Schott – Maximilian Glanzer/Sandra von Fintel – Borofloat™ Glass

Borosilicate glass contains 13% B₂O₃. Has great impact resistance (for stones, ballistic) and thermal shock resistance. Used in MEMs sensors, microlens arrays, and other applications

Great transparency – especially in Lidar wavelengths, low dielectric constant (suitable for 77GHz Radar for example), high chemical durability. Perfect solution for Lidar unit front glass (and for camera systems). At least 2% better than other solutions

Dexerials – Ryosuke Endo – Nanotechnology Enhanced Coatings

Products include automotive AR films, optical alignment glue and photonics solutions, including 30GHz photodiode.

Conventional antifogging solutions are based on transparent heating films with AR coating. An alternative solution is a moth-eye surface with water-absorption film. Nanostructures are made with roll mold or imprint technology.

The moth-eye film has lower reflectance at lidar wavelengths and better performance at wide incident angles. Has been used for HUD and other display applications. For anti-fogging, hydrophilic coatings tend to fade over time due to contamination. Water absorption films last longer. Both properties can be combined into a single film. No heating is required!

Yole Group – Pierrick Boulay – Supply Chain, Market and Trends

In 2024 lots of cars released with lidar at under \$50K. (D Class Segment). 128 cars released in China in 2024, 3 in Japan/Korea, 10 in EU and 2 in US.

China lidar is ~ \$450-\$500 – ROW is \$700-\$1000. Approx 70% of the BOM comes from US suppliers (FPGA dominates). Hesai and Robosense have developed their own devices and have a larger share of China sourced components.

For 905 lidar emitter and receiver cost is \$10-\$44. For 1550, cost is \$78 (for Fiber laser and APD). VCSEL and EE laser may be mixed in some cases. Robosense reduced component count by 20% from M1 to M2 – and cost by ~25% (\$200 BOM est)

FMCW lidar is coming many small vendors, and a few larger ones, spread globally. Silicon photonic integrated chips address cost – and 1d or 2d scanning may also be integrated. There are still a lot of challenges related to testing and integration. FMCW remains a niche with challenges before they can reach volume production

Yole current forecast is the market grows from \$400m in 2023 to \$3B in 2029

Fka – Amogh Sapkal – Standardization Activities

Evaluation can be done on point cloud level or feature level. Different environments can be tested. Safety, endurance and interference can be considered, and static or dynamic tests can be done

China published the first standards in 2021 – using static tests for probability of detection. The ISO standard is being driven by Valeo and Hesai- and considers adverse weather and interference.

Fka released the DIN SAE Spec 91471 last year with scenarios for point cloud evaluation, 6 simple geometry targets, a sensor motion platform, measured ground truths and 12 key performance indicators.

Now they have moved on to testing performance in adverse weather, with a consortium of partners. They are also looking at contamination and interference. Testing can be done with the raw point cloud, and also with the perception stack. A final report is expected by Feb 2025.

Q&A

What are China lidars used for? L2 Navigation on Autopilot – not yet L3.

For testing in the rain, is the sensor in the rain? Yes, fka tests this as “contamination”. For dynamic test, they evaluate driving through the rain.

Mechanical testing – Fka is not inventing new standards for that.

PANEL 1 DISCUSSION – “Lidar Growth Engine”

Yole may take down TAM, not due to volume, but due to ASP

Ford believes L3 will be the application that drives lidar. AEB could also drive lidar, but cannot tell yet.

Valeo believes L2+ ODD grows due to Lidar, for sure in China, but maybe in ROW as well.

Robosense believes lidar will be critical for safety in L3. Tesla does not have redundancy – so driver still has to be in control.

Innoviz – up to 9-12 lidars per vehicle are used for L4 – so truck volumes could become significant.

Does AEB mean lidar has to be in the car ? The system has to be tuned differently for AEB. The price must be low to compete with cameras, so wide spread adoption of lidar is questionable. Conti had a 2 pixel lidar for that application. For EU there is no need at present.

DAY2 – KEYNOTE 3



Keynote 3: ROBOSENSE by Felix Yang

Limitations and benefits of LiDAR: LiDAR is an essential component for the safety of autonomous vehicles, despite its challenges such as detecting static objects and the need to filter out noise.

Comparison with cameras: LiDAR offers more accurate perception than cameras, especially in low-light and nighttime conditions, by providing objective data to monitor the environment.

Impact on emergency braking systems: Automatic emergency braking (AEB) systems incorporating LiDAR significantly improve collision frequency and mitigation scores, according to tests conducted by insurance companies.

Reduced reliance on HD maps: LiDAR helps reduce reliance on expensive HD maps by providing 3D models and quickly adapting to infrastructure changes.

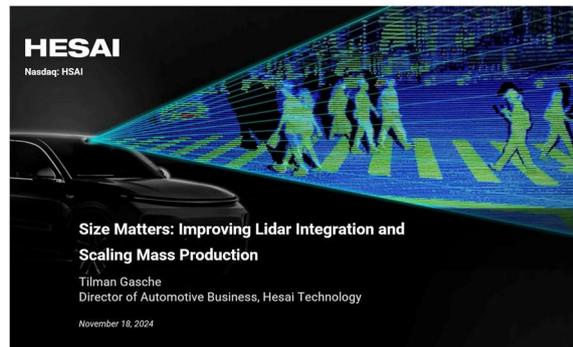
Growing Adoption in China: In China, the adoption of LiDAR in vehicles is on the rise, with more than 100 new vehicle models equipped with the technology expected by next year.

V2X communication technologies: V2X communication technologies are essential for L3 and L4 levels of autonomous driving, enabling the exchange of information between vehicles and road infrastructure.

Advantages of Roadside Units (RSUs): RSUs equipped with LiDAR provide more accurate 3D perception and better object detection compared to cameras, improving road safety.

Q&A: M1 is by far the best-selling model, focused on the NOA applications. Lidar is not a luxury feature any more. There are applications mostly for the 30.000-50.000\$ segment, but also sometimes for car models in the 20.000-30.000\$ segment.

SESSION.4 – TECHNOLOGY 1 (Lidar Sensors)



SEYOND by Leilei Shinohara

High Performance Mid-range Near Field Lidar sensors for ADAS and AD

Advanced lidar portfolio: Seyond's lidar portfolio includes models like the Robin W with a range of 300m and the Falcon K with a range of over 500m.

Use Cases

-Parking Assist: Lidar sensors are used for parking assist, allowing vehicles to park automatically and detect surrounding obstacles.

-Driving in complex urban environments: Lidar sensors are essential for driving in complex urban environments, detecting obstacles and varying traffic conditions.

Mass production: Since 2020, Seyond's lidar sensors have been mass-produced and integrated into NIO vehicles, with more than 400,000 units delivered to date.

Importance of Side Sensors: Side lidar sensors are crucial for detecting obstacles coming from the sides and for automated parking manoeuvres. See Robin W

High Resolution and Accuracy: Lidar sensors provide high resolution and accuracy, which is vital for high-speed driving and long-distance obstacle detection.

Robotic applications: Lidar sensors are also used in robots for long-distance sensing and precise navigation.

Continuous development: The development of lidar sensors continues, with a focus on side-mounted sensors to improve safety and autonomous driving capabilities.

HESAI by Tilman Gasche

Size Matters: improving Lidar integration and scaling mass production

HESAI's Lidars are produced in-house with a manufacturing capacity of 1.5 million units per year on an own production line.

Production automation: The production cycle is fully automated with a cycle time of 40 seconds.

Production targets for 2023: The goal was to produce 500,000 units in 2023.

Challenges and opportunities of the Chinese market: The Chinese market presents challenges and opportunities, especially in terms of the cost and complexity of lidar technology, but it also offers opportunities for significant growth.

Importance of cost reduction: Cost reduction is crucial to enable wider adoption of lidar technology, especially in China where competition is driving down prices.

Vertical integration and production control: Vertical integration and production control are essential to ensure quality and reduce costs, by developing components in-house and ensuring rigorous testing.

Adoption of lidar technology: Lidar technology is becoming more widely adopted, especially in China, and it is expected to become widespread in Europe and North America as well in the coming years.

INNOVIZ by Nir Goren

Beyond the Basics: Lidar Key Performance Indicators

Difference between Autonomous Driving Levels 2 and 3: The presentation emphasizes the importance of distinguishing between Autonomous Driving Levels 2 and 3, especially with respect to driver responsibility and system redundancy.

Sensor fusion: Properly merging information from different sensors, and considering the confidence levels of this information, is crucial to improving the accuracy of systems.

Importance of lidar: Lidar is a key sensor for most autonomous driving decisions, accounting for more than 80% of decisions in some systems.

Challenges of environmental conditions: Autonomous driving systems must be able to handle various environmental conditions such as rain, wind, and other harsh weather phenomena.

Artifacts and reflections: Artifacts and reflections, such as retroreflectors and traffic signs, can cause errors in lidar systems, requiring specific solutions to manage them.

Real-world testing: The presentation emphasizes the importance of testing autonomous driving systems in real-world conditions to validate their performance and reliability.

Q&A:

Reducing costs and increasing efficiency, especially with modular designs and sensor fusion solutions, is crucial to making sensor technologies more accessible and efficient.

There is a need to ensure that production capacity meets growing demand, while also considering the constraints of the consumer environment where speed to market is critical.

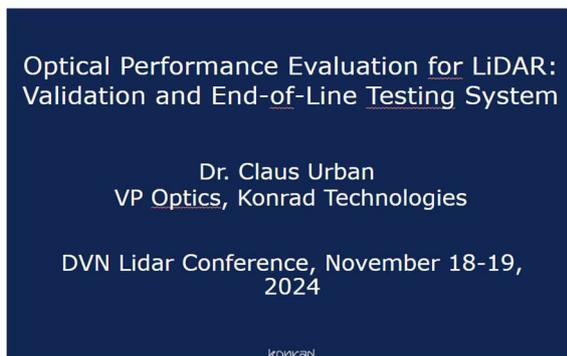
The use cases of robotaxis differ from other autonomous vehicles, with a focus on 360° sensing and urban coverage, as opposed to long-range sensing on highways.

Sensor technologies, including imaging radars and lidars, are rapidly evolving with reduced costs and improved performance, making it possible to integrate them into Level 3 and Level 4 autonomous vehicles.

SESSION.5 – TECHNOLOGY 2 (Measurements and Validations)



Dirk Seebaum, Tim Dürfeldt, Felix Maaß, Frederike Dehn; November 2024



TRIOPTICS by Dirk Seebaum

Tailor made optical alignment solutions: Bridging the gap from custom Lidar design to mass production

The presentation from Trioptics describes the assembly, optical alignment, and testing of LIDAR systems, with a focus on Opsys' solid-state LIDAR sensor and the solution developed by Trioptics.

Trioptics Overview: Trioptics helps customers with the assembly, optical alignment, and testing of LIDAR systems, with each customer product requiring tailored production solutions due to their uniqueness.

Opsys Solid-State LIDAR Sensor: Opsys' solid-state LIDAR sensor is a sophisticated system with modules based on addressable pixel arrays, reconfigurable lenses, and high extension frequencies.

Optical alignment challenges: Challenges include aligning three different optical systems (two transmitters and one receiver), with object distances varying from finite to infinite and different sensor geometries.

Active alignment solution: Trioptics has developed an active alignment solution for transmitters and receivers, using motorized collimators, telescopes, and software algorithms to optimize production.

Results and Benefits: Results include 0.1 micrometer alignment repeatability, full process automation, and cost and space optimization for mass production.

SCRAMBLUX by Mirvais Yousefi

Dynamic 4D Lidar testing to accomplish comprehensive sensor fusion qualification

Introduction and Background: Mirvais mentioned that he would address the challenges and solutions related to the qualification of sensor fusion for lidars.

Cost Optimization: importance of reducing costs by optimizing manufacturing and integrating multiple components simultaneously.

Tools and Methodologies: The testing system allows to test different types of lidars with a short cycle time and without the need for large test tunnels.

Tests and Scenarios: The system allows to simulate different weather scenarios and test the performance of lidars under various conditions.

Current Status and Future Plans: Currently, the alpha system is ready for use, and plans are underway to develop manufacturing systems and testing for OEMs.

Call for Collaboration: The speaker invites participants to collaborate and test their lidars with their system, emphasizing the importance of developing global metrics for lidar testing.

KONRAD by Urban Klaus

Optical Performance Evaluation for Lidar

Urban explains the testing and validation of LiDAR systems, with a focus on modular approaches and the technical challenges associated with simulation and testing in real-world conditions.

Modular approach to testing: The document describes a modular approach to LiDAR testing, with different test stations running specific tests to ensure the functionality of the systems after production.

Resolution and geometry testing: Testing includes verification of LiDAR resolution, scale factors, and viewshed-field geometry.

Use of cameras and detectors: Cameras and detectors are used to measure the power and ensure the safety of LiDAR systems.

Real-target simulation: Real-target simulation is essential for testing LiDARs, using FPGA based simulation systems to reproduce different distances and scenarios.

Distance and signal testing: Testing includes measuring distance and modifying the signal to observe how distance information is influenced.

Temperature testing: Validation testing includes temperature adjustments to simulate extreme conditions, with test equipment capable of operating between -40 and 85 degrees Celsius.

Importance of accuracy: Test accuracy is crucial, requiring handling systems to ensure angular resolution and accurate distance measurements.

DEKRA by Uwe Burkhardt

Tool chain for ADAS/ AD validation

The speaker exposes technologies and test methods for automated driving, with a focus on the importance of AI.

Company Introduction: Dekra Company, founded in 1925, focuses on testing, inspection, and certification services, with a global presence.

Test infrastructure: Dekra has a technology center and a test center in the south of Berlin, with several laboratories and a modern test track for automated driving.

Evolving test requirements: Test requirements for ADAS systems are evolving, requiring more complex scenarios and varied weather conditions.

Simulations and real-world scenarios: Simulations alone are not enough, it is necessary to combine real on-track tests to validate the scenarios.

Test Bench Control Center: The test bench control center orchestrates all moving objects and static infrastructure on the test track.

Environmental conditions: Environmental elements such as rain, snow, and fog are incorporated into the test tracks to simulate real-world conditions.

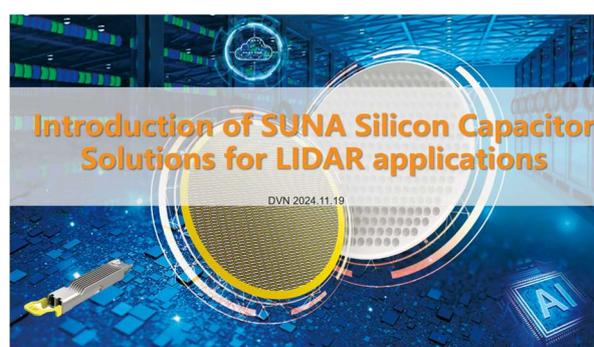
Importance of digital twins: Creating high-precision digital twins is essential for testing, requiring advanced measurement systems.

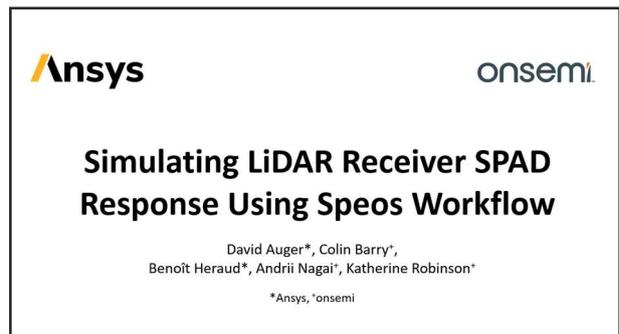
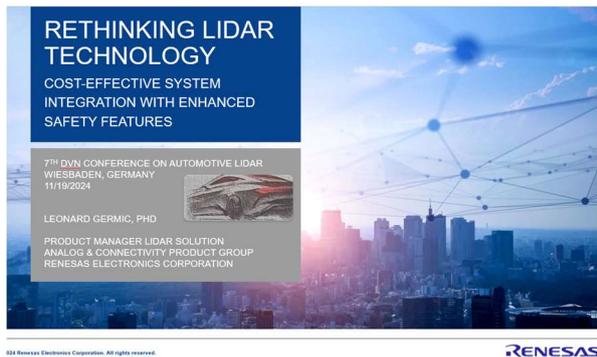
Q&A

The time required for L2 driving validations was discussed, emphasizing the importance of common and edge cases, mostly tested in simulation.

Interest in partnering with China to deploy the LIDAR technology was also mentioned.

SESSION.6 – TECHNOLOGY 3 & PROCESS





Ams OSRAM by Clemens Hofmann

Next Gen EEL: improving efficiency and heat management in Lidar sensors using 5 junction technology

Lidar Applications: Lidar systems are used in various situations such as traffic jams, highway driving, urban navigation, parking, and self-driving taxis.

Lidar Specifications: Lidar specifications include range, resolution, field of view, and frame rate, which are crucial for detecting objects at different distances and under various driving conditions.

Thermal management: Heat management is essential for the operation of Lidar components, especially to maintain the efficiency and lifespan of lasers.

Wafer Emission Laser (ELL): ELTs are described as having a duration of 5 ns and a repetition of 5 μ s, allowing for a peak power allowance of 1000W due to the duty cycle of 0.1%.

EEL Enhancements: The new generation of 5-junction EEL lasers offers 150W peak power, increased efficiency, and simplified thermal management, compared to 3-junction lasers.

Efficiency and Power Consumption: 5-junction lasers feature a power conversion efficiency of more than 50%, reducing power consumption and heat dissipation by half.

Impact on Lidar Performance: Improved lasers allow for greater range, better resolution, higher frame rate, and reduced power consumption, resulting in overall improved performance of Lidar systems.

Suna Optoelectronics by Laurent Lengignon

Silicon Cap solutions to achieve low loop ESL for high performance & miniaturized Lidar application

Suna is a spin-off of the Institute of Nanotechnology of the Chinese Academy of Sciences, founded in 2014, with 6- and 8-inch manufacturing facilities.

Company growth: In 2022, Suna achieved a turnover of around €10 million and expects to reach €25 million in 2023, with a workforce increasing from 200 to 350 employees.

Capacity expansion: Suna plans to double its manufacturing capacity from 5000 to 10000 square meters by January 2025.

Capacitor Technologies: Suna develops silicon capacitor technologies with high capacitance density and increased reliability for applications requiring high performance.

Targeted Applications and Markets: The company targets high-reliability applications such as the automotive industry and optical data, with technology specifications up to 160 GHz.

Advantages of Silicon Capacitors: Suna's silicon capacitors offer improved miniaturization, capacitance stability, and better photoelectric conversion efficiency, meeting the needs of next-generation circuit designs.

RENESAS by Leonard Germic

Rethinking Lidar technology: Cost effective system integration with enhanced safety features

The presentation focuses on Renesas' solutions for integrating components and sensors in the automotive, industrial and IoT fields.

Targeted Industries: Renesas focuses on the automotive, industrial, IoT infrastructure, and consumer sectors, bridging the gap between the digital and analogic worlds.

Vertical integration: The company pursues vertical integration to offer complete solutions rather than individual components, making it easier for customers to do so.

Cost reduction and complexity: Renesas aims to reduce total cost of ownership and technical complexity for manufacturers, by providing reference designs and starter kits.

Automotive safety: Safety is a priority, with modular designs and built-in diagnostics to monitor systems and keep drivers safe.

Sensor fusion and AI: Renesas integrates sensor fusion and AI to improve the detection and evaluation of raw data, offering intelligent lidar solutions.

ANSYS- OnSemi by David Auger & Colin Barry

Simulating Lidar receiver SPAD response using Speos workflow

The presentation deals with ongoing projects and simulations related to response systems, in particular in the context of LIDAR technology for vehicles.

Project Introduction: Ongoing projects and their response systems are discussed, with a focus on simulations to improve communication and validation of systems.

Prototyping and validation: Subsystem prototyping and destructive system validation are essential for generating reliable responses and creating collaborative projects.

Simulations and optimization: Simulations and simulation software are used to optimize components and improve system responses, considering specific noise conditions and scenarios.

Modelling and integration: A comprehensive receiver model is developed to process simulation data, allowing for rapid evaluation of customer requests and validation of results.

Model validation: The model is validated by comparing simulation results with real-world measurements, showing good agreement and building confidence in the model.

Future plans: Future plans include sharing the full workflow with certain customers and optimizing post-processing calculations.

Q&A:

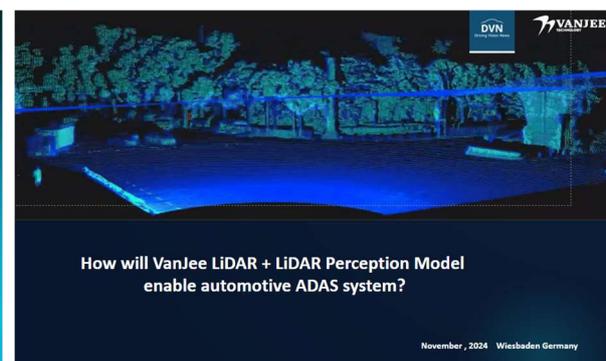
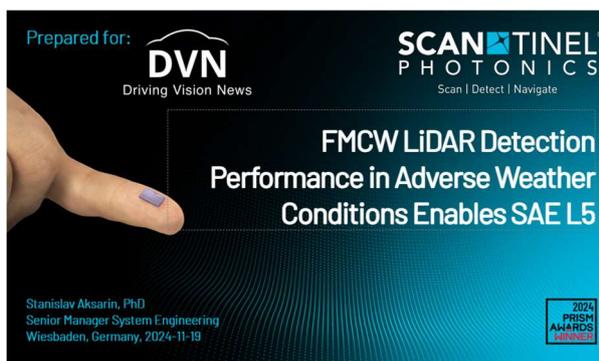
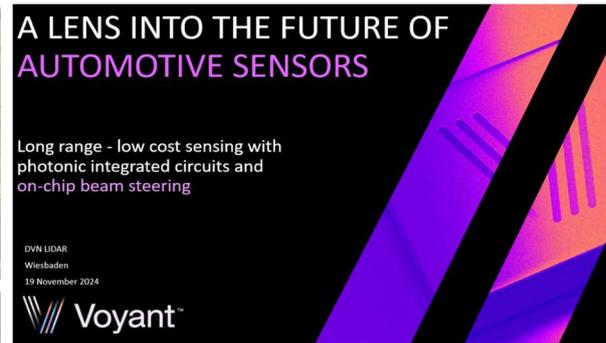
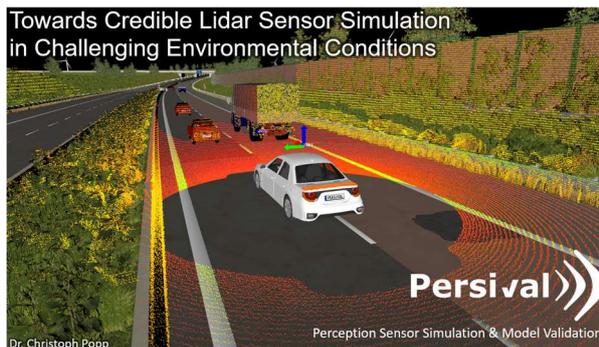
Renesas customer target – is tier1 lidar suppliers, not just in automotive

Onsemi – did compare raytracing with tradition simulation method

Osram – did have option with prism in the package for EEL to output light from top

Suna – costs will be driven down as volumes ramp, and lidar is not the only market for this

SESSION.7 – NEW TECHNOLOGIES (FMCW...)



PERSIVAL by Christoph Popp

Towards credible Lidar sensor simulation in challenging environmental conditions

Environmental sensor simulation focuses primarily on LIDAR sensors, with a focus on safety validation through the simulation of validated sensor models.

Purpose of simulation: The goal is to validate safety in simulation using simulation models of environmental sensors like LIDAR and radar, which must be highly credible.

Simulation architecture: The general architecture of simulation involves the production of sensor simulation models that require standardized interfaces and realistic assets with correct material properties.

Sensor positioning and tracing: Sensor positioning and ray tracing take into account weather effects and the angle of incidence of light on surfaces to obtain raw data.

Collaboration with sensor manufacturers: Sensor manufacturers must collaborate to create realistic models, although reverse engineering is an alternative if the details of signal processing are not shared.

Influence of weather: Weather, such as fog and rain, affect sensor signals, leading to false-positive detections and attenuation of signals.

Measurement and validation of meteorological effects: A meteorological test bench is used to continuously measure the effects of real-world weather conditions on the sensors, allowing simulations to be validated and optimized.

VOYANT by Chris Phare

FMCW Lidar using photonic integrated circuits

Chris Phare, co-founder and chief scientist of Voyant, presented the benefits and challenges of embedded LIDAR systems for automotive applications.

Automotive perception problem: LIDAR is essential for L3 and higher levels of autonomous driving, requiring high resolution and long range to detect objects on the road.¹

High cost of current LIDARs: Current LIDARs are expensive because they are assembled from discrete optical components, limiting their widespread adoption.

Performance issues: Traditional LIDARs suffer from performance issues, including artifacts and poor accuracy under certain conditions.

Benefits of FMCW sensors: FMCW sensors offer benefits like immunity to sunlight and the ability to measure the speed of objects, while remaining safe for the eyes.

Photonics integration: Voyant uses large-scale manufacturing processes to integrate photonic components onto silicon chips, reducing costs.

Design optimization: Optimized design allows chip sizes to be reduced while maintaining high performance, integrating only the necessary components.

Large-scale production: Voyant statistically tested its components to ensure high-throughput production, allowing for efficient and inexpensive LIDAR manufacturing.

SCANTINEL by Stanislas Aksarin

FMCW Lidar Lidar detection performance in adverse weather conditions enables SAE L5

Company Introduction: The company is based in Germany, has approximately 60 employees and focuses on developing technology solutions for autonomous vehicles.

Autonomous Driving Technology: The goal is to enable driverless driving in all conditions, including night, sunrise and sunset, summer and winter, as well as harsh weather conditions like rain, fog, dust, and snow.

Sensors needed for different levels: For level 3, the sensors required are the camera, radar, and viewers, while for level 4, LiDAR is a must. However, for Level 5, it is discussed whether these systems are sufficient.

Challenges of LiDAR in harsh environments: The paper explains the challenges faced by LiDAR sensors in fog and dust conditions, which can create false positives and spatial distortions.¹

FMCW Technology: FMCW technology is touted as a potential solution to overcome the limitations of LiDAR by integrating light and separating the frequencies of different targets.²³

Tests and results: Tests show that FMCW technology can detect objects accurately even in dense fog conditions, without creating false positives.³⁴

Progress and integration: The company is making progress in the development of low-cost integrated chips for sensors, aimed at reducing production costs and improving the performance of LiDAR systems.

VANJEE by Zhai Zhao

How will VanJee Lidar + C-V2X solution create vehicles with Utmost safety?

The company presented is a global leader in intelligent transportation systems, robotics and automotive, with a presence in more than 30 countries and 12 years of experience.

Targeted Industries and Technologies: The company focuses on three main industries: intelligent transportation systems, robotics, and automotive, developing technologies to measure dimensions and regulate trucks overseas.

Technology Challenges and Solutions: Key challenges include the perceived value of technologies and the difficulty of finding algorithm experts for vehicles. Society uses perception models to detect and classify objects accurately.

Perception Models and Data Fusion: Society's perception models use sensors and cameras to locate and identify objects, allowing vehicles to make informed decisions. Merging data from lidars and cameras is key to improving accuracy.

Q&A

Scantinel typically looks at data at the point cloud level. Performance in fog depends on the density of the fog.

Persival – does physical modeling of the beam propagation off angled surfaces. The correct material properties of assets are crucial because they affect the intensity of LIDAR signals. Bleeding effects and reflections on glass are phenomena considered in the simulation, affecting the accuracy of LIDAR points. Weather conditions like fog and rain have a significant impact on sensor signals, leading to false positives and increased signal attenuation. A meteorological test bench is used to measure the impact of real-world weather conditions on sensors, to validate simulations against real-world conditions.

Scantinel – with velocity information, fewer points might be required to detect objects. Irregular points on a vehicle can be more easily associated with a moving vehicle versus road debris for example.
Voyant – narrow line width lasers are possible at FMCW frequencies
Scantinel/Voyant – FMCW lidars will come to market “sooner than you think”

PANEL 2 DISCUSSION – “Affordable Lidars, competition with HD radars”

Seeyond – most customers are looking for the same spec lidar at a lower cost . You cannot really reduce the range or the number of lines for ADAS.

Renesas – removing the FPGA is key.

HMC – reliability of complex optical path is an issue (Mems, Voice coils etc.)

Seeyond – moving processing to vehicles domain computer will reduce costs of the sensor

Renesas – do you want to do sensor fusion on the raw data or at the point cloud level. Using one SoC for camera/radar and lidar will reduce cost.

Flash lidar for short-range has higher integration.

Seeyond - There is no strong competition between Lidar and HD radars in China. Lidar is closing the gap in term of costs and the HD radar cannot compete with the high resolution of the Lidar.

Closing Remarks

DVN will soon communicate the details of the 2025 events

There are already 2 conferences confirmed in China (June 11/12) and November 17/18 (Germany)

APPENDIX-1 - List of Attendees

Prénom	Nom	Organisation
Raed	El makhour	AGC Wideye
Christoph	Weidinger	AIT Austrian Institute of Technology
Teresa	Baur	ams OSRAM
Ilaria	Finardi	ams OSRAM
Clemens	Hofmann	ams Osram
Tobias	Hofmeier	ams OSRAM
Peter	Staebler	ams OSRAM
Eugen	Meier	Ansys
David	Auger	Ansys/Onsemi
Killian	YOUNG	ARAYMOND
Mauricio	Balbinot	Braslux
Leo	Chen	Cepton
Henri	Haefner	Cepton
Daniel	Skiba	Chasm Advanced Materials
Wolfgang	Schulz	Continental
Uwe	Burkhardt	DEKRA
Rolf	Kurz	Dekra
Yanik	Pfaff	DELO
Ryosuke	Endo	DEXERIALS
Shiori	Kitamura	Dexerials corporation
Kohei	Okado	Dexerials corporation
Yosuke	Sasaki	Dexerials corporation
TOMOYUKI	TOYODA	Dexerials Corporation
Niklas	Andermahr	DIOPTIC GmbH
Jens	Fischer	Docter Optics
Eric	Amiot	Driving Vision News
Martin	Booth	Driving Vision News
Cindy	Freixeda	Driving Vision News
Christophe	Lameiras	Driving Vision News
Leo	Metzemaekers	Driving Vision News
Emilie	Ogot Bonnet	Driving Vision News
Ralf	Schafer	Driving Vision News
Alain	Servel	Driving Vision News
Olov	Von Hofsten	Eclipse Optics
Lanseer	XU	Enablence Technologies Inc.
Maximilian	Schwab	ficonTEC
Simon	Viets	ficonTEC Service GmbH
Amogh	Sakpal	fka GmbH
Gašper	Matoša	Forvia
Sönke	Vogel	Fraunhofer ILT
Arnold	Gillner	Fraunhofer-ILT
François	Guichard	GRVA
Bob	Bob in den Bos	Hesai
Tilman	Gasche	Hesai
Johan	Liberg	Hesai
Kevin	Mensah	Hesai
Youhoon	Park	HKMC
KAZUO	MATSUURA	Honda

Colston	Pollard	Honda
Jan	Thielmann	Honda
Mike	Vivar Vasquez	Honda
Julius	Focke	Honda R&D Europe (Deutschland) GmbH
Amr	Eltaher	Hybrid Lidar Systems AG
Achim	Freiding	Hyundai
YOUHOON	Park	Hyundai
Hyeongseon	Kim	Hyundai Motor Company
Christian	Bornhoeft	Innoviz
Nir	Goren	Innoviz
Nimrod	Ari	Innoviz Technologies
Thomas	Handke	Jabil Optics Germany
Takuya	Inaba	Koito
Kazutoshi	Sakurai	Koito
Carmen	Hervas Lara	Koito Czech s.r.o
Seiji	Nemoto	Koito Czech s.r.o.
Katsuda	Takayuki	KOITO MANUFACTURING
KAZUTOSHI	SAKURAI	KOITO MANUFACTURING CO., LTD
Konomu	Yoshimura	KOITO MANUFACTURING CO.,LTD.
Urban	Claus	KONRAD
Ralf	Holzheu	Konrad
Harsh	Rami	Konrad
Hyunhan	Lee	KOTRA Munich
Alexander	Montag	Luminar Technologies
Bernd	Reichert	Management Consulting Automotive
Konstantin	Fichtner	Mercedes
Axel	Ganz	Mercedes-Benz AG
Thomas	Wohlgemuth	Mercedes-Benz AG
Guenter	Hummelt	nanosystec GmbH
Jan	Kallendrusch	nanosystec GmbH
Helmut	KÖNIG	Neuman Aluminium
Tomoyuki	Yamada	NTT Innovative Devices
Eduardo	Margallo	Ommatidia LiDAR S.L.
Colin	Barry	onsemi
ANDRIL	NAGAI	Onsemi
Christophe	Popp	PERSIVAL
Remus	Nicolaescu	Pointcloud
Leonard	Germic	Renesas
Jan	Leuckfeld	Renesas
Adrian	Stenzel	Renesas Electronics
JUERGEN	KERNHOF	Renesas Electronics Europe GmbH
Nour	Nour Eddin Eineh	Robosense
Mingzhe	Sun	Robosense
Felix	Yang	ROBOSENSE
Pauline	Girard	Saint-Gobain
Stanislav	Aksarin	Scantinel
Davide	Canavesi	Scantinel
Andy	Zott	Scantinel
Maximilian	Glanzer	SCHOTT Technical Glass Solutions GmbH
Sandra	Von Fintel	SCHOTT Technical Glass Solutions GmbH

Mirvais	Yousefi	scramblux
Max	Dr. Sundermeier	SCRAMBLUX GmbH
Yang	Han	Seyond
Leilei	Shinoharai	Seyond
Oli	Ramoli	SEYOND Europe
Cheolwon	Oh	SL
Taewan	Kim	SL Corporation
SEONYEONG	LEE	SL Corporation
Olivier	Decroupet	Sony Depthensing Solutions
Azamat	Kenesbekov	Sony Depthensing Solutions
Ryosuke	Kondo	Stanley Electric
Arno	Seyfarth	Stanley Electric
François	SIMOENS	STEERLIGHT
Fei	He	Suna
Han	Li	Suna
Qinghuai	Zhang	Suna
Laurent	Lengignon	Suna Optec
Wu	Haihua	Suzhou Suna Opto
Li	Xuefei	Suzhou Suna Opto
Thomas	Knieling	Technischer Berater
Dirk	Seebaum	Trioptics
Steffen	Reinl	TRIOPTICS GmbH
Sönke	Tanz	TRIOPTICS GmbH
Thanushan	Kugathanan	Université de Genève
Antoine	Claudepierre	Valeo
Antoine	Lafay	VALEO
Clement	Nouvel	Valeo
Christoph	Parl	Valeo
Thomas	Schuler	Valeo Detection Systems
Bao	Yong	VANJEE
Zhai	Zhao	Vanjee
Harmeet	Singh	VanJee Technology
Zhao	Zhai	VanJee Technology
Zhao	Li	Vertilite
Chris	Phare	VQYANT
Joseph	Kim	Vueron Technology
Shinho	Yoon	Vueron Technology
Gilles	Back	Wideeye by AGC
Kevin	Dumon	Wideeye by AGC
Kevin	Osmont	Wideeye by AGC
Pierrick	Boulay	YOLE