DVN-Lidar Conference 2023 – Special Report

The 6th annual DVN 2023 Lidar Conference on November 29th/30th in Wiesbaden was again the place to be if you want a clear understanding of the Market and Developments in Lidar Technology.

With almost 160 attendees incl. many OEM representatives (10% of the attendees), 20 exhibitors, and 31 speakers, it has again been a great success. The experts of the Lidar community met to discuss the key topics and news on Lidar technology.

Participant Voice (Olga Raz / Optica): “Thank you again for the invitation to join this event. I found it to be excellent. Well curated, well executed, of very high quality and most importantly, truly beneficial to all the participants. I liked the format.”

Here are the Take Aways

- Market Growth is accelerating, due to advanced ADAS features (i.e., Autopilot L2+). New applications will be related to Urban autopilot and memorized parking aids
- High volumes are expected in the Chinese Market which is growing fast and will continue to grow next year. Some suppliers expect to deliver over 500ku Lidars for ADAS applications next year and have put in place fully automated production lines, which they can scale to track the increasing demand
- Price - Lidar characteristics are different between the Chinese market (Autopilot L2+) and the European Market (L3 & High performance): this allows a lower price in China.
- Lidar’s integration into the car is getting easier: OEMs have now plenty of alternatives such as Roof Top, In-cabin behind windshield and Integration into headlamps. There is even a solution of collimated integration of radar/lidar/LEDs all together in the headlamp.
- Continuous Wave (Coherent) Lidar will be available soon on the market with higher performance (and cost) than pulsed Lidars
- The present report is sent to the attendees. Video recordings will be accessible to all attendees, and presentations (pdf) to gold members and speakers.

Some suppliers organized ride & drives to show the performance of their products The DVN 2023 Lidar Conference - the 6th Conference organized on Lidar - was again the place to be when you want a clear understanding of the Market and Developments of the Lidar Technology.

- 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.

- Special thanks to our exhibitors

Main Sponsors:

HAMAMATSU ficontec MicroVision nanosystec Wideye

Sponsors:

Valeo AEVA CANATU Opsys Technologies ams OSRAM CHASM onsemi

Ansys VERTILITE YOLE Group DEKRA TRIOPTICS Fraunhofer

- Some pictures of the conference and exhibition

AGENDA – DAY 1

Sessions: Applications; Ecosystem; Technology; Process; Software Tools & AI.

Wednesday, 29 November

11:30 REGISTRATION AND LIGHT WELCOME LUNCH

12:45 Opening of conference by DVN CEO

Keynote 1: VALEO, Benazouz Bradai, Director Innovation Autonomous Driving
"High Performance Sensors for Autonomous Driving"

Keynote 2: OPTICA, Olga Raz, Director of Technology for Optical/Optics Systems
"Optica's LiDAR Landscape: The Findings of our Technology Survey for 2024"

13:45-15:00 SESSION 1 • APPLICATIONS I

- Vincent Abadie, AD & ADAS Senior Fellow, STELLANTIS
  "Title tbd"
- Siegwart Bogatscher, Senior Technical Expert Lidar, TORC Robotics / DAI trucks
  "LiDAR for Level 4 Automated Trucks"
- James Reuther, VP of Technology, AEVA
  "FMCW As the End State: Exploring the Perception Advantages of Per-Point Instant Velocity Data"
- Wolfgang Schultz, Product Owner Lidar Perception, CONTINENTAL
  "Title tbd"

Q&A

15:00-16:00 SESSION 2 • APPLICATIONS II

- Matthaeus Artmann, Technology Manager Advanced Development, ZKW
  "Using Lidar for the protection of VRUs, pose interpretation and intention prediction"
- Oliver Ramoli, Business Development Manager, SCANTINEL
  Title tbd
- FKA GmbH, Amogh Sapkal, Co-Lead Development of Standardized Testing for Lidar
  "On the path to standardised testing for LiDARs"
- Arnold Gillner, Head of Business Development, FRAUNHOFER ILT
  "Smart Headlight - Integration of Light, LiDAR and Radar in a Headlight with coaxial beam guiding"

Q&A

16:15-16:45 COFFEE BREAK

16:45-18:00 SESSION 3 • ECOSYSTEM

- Pierrick Boulay, Senior Technology & Market Analyst, YOLE intelligence
  "Mapping the Future: Navigating LiDAR's Supply Chain, Market Dynamics, and Emerging Trends"
- Raed El-Makhour, Chief Product & Marketing Officer, Wideye by AGC
  "Solving LiDAR integration challenges: glass solutions to cope with Performance, Reliability & Aesthetics"
- Juha Kokkonen, CEO, CANATU
  "Autonomous driving in any weather with Canatu film heaters"
- Dan Skiba, COO, CHASM
  "Transparent Heater Foils for ALL ADAS Sensors"

Q&A

18:00-18.45 DISCUSSION PANEL I

"The Lidar Growth Engine"

18:45-20:00 Social Cocktail

20:00 WELCOME DINNER

AGENDA – DAY 2

Sessions: Applications; Ecosystem; Technology; Process; Software Tools & AI.

Thursday, 30 November

07:30 BREAKFAST

08:30 **Keynote 3:** HESAI, Bob in den Bosch, VP of Global Sales
"From Robotaxis to Passenger Cars, Lidar Enters Mass Production Era"

09:00-10:15 SESSION 4 • TECHNOLOGY I

- Thomas Luce, VP Business Development at MICROVISION
  "Solid state LiDAR for short- and long-range applications"
- Henri Häfner, Director Product Marketing & Business Development at CEPTON
  "Slimmer, Smaller, Smarter: Optimizing Lidar Design for Today's Automotive Trends"
- Alex Leuta, Business Development Manager at OPSYS
  "Embedding LiDAR with Opsys' technology"
- Chan M Lim, Managing Director - Head of Solid-state Lidar division at SOS LAB
  "Solid-state LiDAR Ready for Softward-defined Vehicle : Never Compromising on Vehicle design"

Q&A

10:15-10:45 COFFEE BREAK

10:45-12:00 SESSION 5 • LIDAR TECHNOLOGY II

- Clemens Hofmann, Senior Principal Engineer Lidar at ams-OSRAM
  "System design considerations for a short-range segmented flash LiDAR"
- Li Zhao, COO, VERTILITE
  "MJ VCSELs toward ultra high power and reliability for Lidar applications"
- Luigi Ghezzi, Technical Marketing Engineer, HAMAMATSU
  "2D image sensors for Lidar"
- Wilfried Noell, Senior Principal Scientist, SUSS MicroOptics
  "Micro-Optics, An Enabling Technology for LIDAR Optics"

Q&A

12:00-14:00 LUNCH

14:00-15:30 SESSION 6 • TECHNOLOGY III & PROCESS

- ELMOS/Mechaless, Fabian Finkeldey, Product Architect
  "Fully integrated 1ns laser Driver for multi-channel Lidar"
- SONY Semiconductor Solutions, Alexis Vander Biest, Senior Manager – Automotive Department
  "How silicon-based SPAD sensors enable reliable and cost-optimized lidars today"
- SCRAMBLUX/ficonTEC, Mirvais Yousefi, CTO
  "A new approach to comprehensive LiDAR End of Line test and calibration for ficonTEC LiDAR production lines"
- JABIL, Simon Schwinger, Business Development Director
  "Precision alignment for Lidar"
- TRIOPTICS, Dr. Dirk Seebaum, Product Manager Automation
  "Every sensor is different - Toolbox for the matching optical alignment solution for today's LiDAR sensor principles"

Q&A

15:30-16:15 SESSION 7 • SOFTWARE TOOLS & AI

- David Auger, Senior Application Engineer, ANSYS
  "Virtualizing Autonomous Driving Testing: Simulating Lidar Sensors with Ansys"
- Samer Galal, Head of Driver Assistance Systems and Self Driving Transport, DEKRA
  "ADAS and Autonomous Driving"
- Sandeep Kumar Chilumula, cross functional team leader, DEEPEN.AI
  "LIDAR Data Calibration and Sensor Fusion"

16:15-17:00 PLENARY DISCUSSION PANEL II
"Affordable Lidars and Validations"

17: 00-17:15 CLOSURE

OPENING DAY1 – OPENING & KEYNOTES 1,2

Paul Henri Matha – COO DVN

Presentation of DVN-Lidar Activities & reference to DVN Compliance rules included in Booklet

Benazouz Bradai / VALEO – Director of Innovation and Autonomous Driving

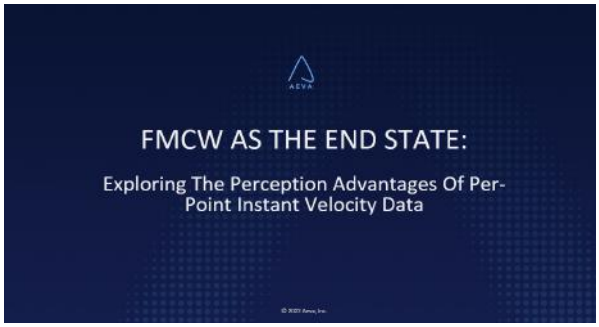
Requirements for ADS – Only 2 vehicles on market with L3 today – Honda Legend, Mercedes S Class - Limited ODD. (No Rain etc.). For Highway Pilot, the minimum range is 150-180m at 130kmph. Consider small objects are "overdrivable". Means 120x25 FOV and 0.05-degree resolution. Must also consider weather, based on defined ODD. Reality is different from regulations – more complex. Showed example drives with mattress on highway, pallet truck / forklift on road and "strange bike". Safety dictates redundancy. Performance is key to extend the ODD. Only camera can detect traffic lights and lane markings today. More situations need to be managed to add features – and LiDAR becomes key. Visual cameras are a given – but the redundant sensor could be thermal cameras, HD Radar and/or LiDAR. Radar works in all weather but has limited resolution. LiDAR has better resolution but is affected by weather. Valeo SCALA-3 achieves 12MP camera-like resolution.

Lost cargo case can be covered by radar and lidar – but if object is close to guard rail, lidar will be better. Thermal camera is best for detecting animals/pedestrians at night. Thermal cameras extend the ODD to more adverse conditions like on-coming high beam, fog etc. LiDAR works best for occluded objects on the road. LiDAR can achieve 10cm position accuracy. LiDAR can be used for real-time map change updates (roadworks etc.) using crowdsourcing.

Olga Raz / Optica

Optica is an industry association dedicated to commercialization of optics and photonics. Has extensive library of market research and deep bench of technical experts. Around 35K a year road death in the USA. In EU, road accidents are declining, but pedestrians are a larger percentage of the deaths (19%). The UN and EU are targeting to ½ the number of accidents by 2023. LiDAR is one solution to drive down accidents, however adoption has been slow so far. Optica LiDAR survey on key challenges and advantages for LIDAR. Cost is the biggest issue today. Size and complexity and reliability are the other key issues. Trumpf is looking at scaling consumer LiDAR towards automotive – with VCSEL integrated backside optics. Hamamatsu is developing both sources (stacked EEL) and detectors (SPADs and SiPM arrays with integrated ASIC). Novel optics are also being developed by Norcontech to increase detection range. Delo is showing better bonding solutions (for assembling of the components). FMCW adoption will be driven by chip integration (SilC and Voyant). Solid state beam steer will reduce size and improve reliability. And finally, integration will continue to drive down cost.

SESSION.1 – APPLICATION 1



Vincent Abadie – Stellantis / ADAS & AD Senior Fellow

L2+ is hands-off/ eyes on, and L3 is eyes off. L3 is currently only low speed ODD – under study to increase speeds. Stellantis is looking at extra radars and lidars for high speed. Redundancy is still an open question. The sensors must provide complementary performance. Corner cases include unexpected objects on the road, road pertubations, weather. LiDAR advantages are free-space measurement, mapping and self-localization capability, lane detection, precise 3D measurement and can close some of the gaps in the corner cases (but doesn't solve them all). This leads to a set of performance requirements including 140x25 FOV, 300m Range, 20x20cm obstacle at 200m, 0.05x0.05 angular resolution and precise distance and velocity measurement. The device should be robust over its lifetime, small size and cost target similar to radar (eventually), which went from >$1000 to ~$50 over 20 years or so. Stellantis is working with FMCW suppliers, VCSEL/OPA and Multispectral LiDAR.

Siegwart Bogatscher – Torc Robotics / Senior Technical Expert Lidar

Working on L4 trucks. Based in VA, USA. Is now a subsidiary of Daimler Truck. Goal is to reduce traffic accidents, low vehicle utilization, driver shortages and high cost per mile. They will start with hub-hub self-driving in the US market using Freightliner platform. The truck has redundant steering and brakes. Using simulation to test system under different conditions – based on analytics from real-world driving. ODD and System Capabilities define the LIDAR sensor suite. High range and resolution needed to detect debris. Another key edge scenario is vulnerable road users next to emergency vehicles and lost cargo. Minimum distance of a side lidar needs to be very short. Height clearance needs to be detected. LiDARs need to work for 3-4 years or 25K hours. There are additional specific requirements, including stricter vibration spec. Ultra long range, long range and short range LiDARs are required.

James Reuther – AEVA / VP of Technology

All Tx and Rx and optics components are integrated into a single hermetically sealed module. Current demos have been with A/B- samples, C samples will be announced at CES (Jan 24). FMCW has benefits in interference immunity (e.g., vehicles driving into the sun), clearer vision (no blooming / ghosting around retro targets), and direct velocity detection, which makes perception easier. NASA is looking at Aeva LiDAR for future lunar missions (for mapping with GNSS). Can build higher resolution frames by looking back at previous frame's static data.

Wolfgang Schutz – CONTINENTAL / Product Owner Lidar Perception

Discussed requirements for long-range LiDAR based on ODD and use cases. Brake strategy impacts requirements (how hard you come to a stop). The perception stack also dictates requirements (how many points do you need on a target to detect) and probability of detection threshold also impacts requirements. Vertical and Horizontal fields of view requirements can be calculated from distance and velocity assumptions. Resolution depends on distance and points on target required by the perception. Long-range LiDAR has to hand-over to short-range at some minimum distance.

SESSION.2 – APPLICATION 2

Matthaeus Artmann - ZKW / Senior Manager AD

Smart project is a consortium from TU Wein, eMotion3D and ZKW. Used Luminar 1550nm Lidar for testing (with multiple cameras). Looked at how to do pose estimation and intention for pedestrians by fusing camera and lidar data. Looked at 3 approaches to add depth information, using LIDAR data, estimating from image and using LiDAR to correct estimate. Combining camera and LiDAR data of course gives the best results. Error increases over distance, especially for the camera, but for LiDAR, it actually decreases above a certain distance. Some fused data was shown on real-world examples that showed good detection accuracy.

Oliver Ramoli – SCANTINEL / Business Development & Sales Manager

The future of autonomous driving needs increased speed, weather immunity and lower cost and size of the system. Single chip FMCW is a path to that. Integrated 1D scanning with detector on chip , laser and lens are also integrated into a module. Working towards 2027 SOP.

Amogh Sapkal – fka GmbH / Co-Lead Development of Standardized Testing for LIDAR

LiDAR testing standardization can be done on point cloud (see DIN 91471), perception stack or entire ADAS feature. The DIN spec concept will be extended on performance under adverse weather and contamination (fka-DVN project starting with an industry consortium). Other standardization activities: China also released a test standard and NHTSA/VTI is looking at LiDAR interference in the US. UTAC (FR) is looking at weather testing at the system level. SPIE (US) is also running a test project. FKA's latest test standard project is for performance under adverse weather, scheduled to end in 2024. Still open to more partners to join.

Arnold Gillner – FRAUNHOFER / Head of Business Development

Looking at integration of lidar and radar into the headlight. Data can be fused in the headlight. The headlight already has cleaning and heating systems and is in a good position to add lidar. A

multispectral combiner is used. Interference suppression is also used. A modular platform is provided for system integration.

SESSION.3 – ECOSYSTEM

Pierrick Boulay – YOLE Intelligence / Senior Technology & Market Analyst

Yole has tracked 120 design wins for cars that will be released between 2023-2025. China dominates with more than 100 of those, US/EU less than 10 cars and Japan/Korea 4. Chinese LiDAR ASP is $600-$800. There are a lot of new EV players in China, pushed by the government, and now they are moving towards automated driving aggressively. In US/EU, the EV transition is still on-going, and they are more conservative to move towards AD. Only luxury cars with low volume have that feature today, with perhaps the exception of Tesla that is a camera only system. 225K Lidars were shipped in passenger cars in 2022. Innovusion is the leader in 2022 followed by Valeo and Hesai. In 2023 Yole is expecting 625Ku, with Hesai taking the share lead, followed by Robosense. In 2022 passenger car LiDAR was approximately the same $ size as Robotaxi. By 2028, passenger car volume should dominate. In US/EU, Luminar should ramp next year with Volvo and Mercedes.

China has a large ecosystem of component suppliers including lasers, photodetectors, optics and other ICs. Yole has done some teardowns and showed examples of Valeo Scala 2, Robosense and Innovusion. Xilinx is used for processing. Robosense uses 5 optical modules and 2D mems with an estimated BOM cost of $179. Innovusion cost is dominated by the fiber laser.

Raed EL Makhour – AGC Wideye / Chief Product & Marketing Officer

AGC has 25% share of the automotive glass market and Wideye focuses on ADAS sensor integration. Solutions include IR transparent optical glass covers, glass trim for seamless integration on the body, and vision glazing for integration behind the windshield. Integrations started behind the bumper and grille in 2008 but is now coming on the roof (from China OEMs, followed by Volvo/Polestar for the global market) and Mercedes going public on the CLA. Going forward, windshield integration will become more common (1 SOP, 3 pre-dev and many RFIs). Side integration will also happen. Roof integration gives a high vantage point, and glass trim can have integrated heating, AR and water repellant coatings. Windshield integration benefits from shared resources with the cameras and

existing heating and cleaning solutions. Range specs can be relaxed to the side of the FOV. Wideye works with the OEM from prototype to simulation to production.

Juha Kokkonen – CANATU / CEO

Canatu is a carbon nanotube material company and is applying this to various applications including extreme UV and automotive. Their current production line can support 1Mu a year of thin-film ADAS heaters which is also driving costs down by an order of magnitude. A heater reduces impact of fog, snow and frost. For LiDAR the integration can be in various places in the car – and supports curved glass applications and in or on glass lamination. Typical IR absorption is 2-3%. CNT Thin film has advantages over wire heating with even coverage over the surface, no optical distortion and 40% lower power. Canatu is working with partners like Denso, Covestro, Webasto and Minth.

Jan Skibba – CHASM / VP of Printed Electronics

CHASM LiDAR heaters aim to improve bad weather performance of LiDAR sensors. CHASM delivers rapid, uniform heating at 12V, low beam deflection, high robustness and applications for multi-sensor solutions. The technology is based on a 2um copper micromesh coated with a 1um carbon nanotube layer on a PET film substrate. Validation testing has been done with LiDAR looking at point cloud loss and comparing heater on and heater off performance. Up to 92% transmission is seen at 905nm with AR coated glass. Beam deflection is minimal.

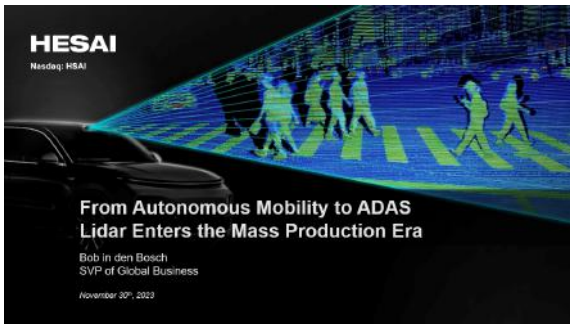
PANEL 1 DISCUSSION – “Lidar Growth Engine”

(Hesai, Yole, Continental, Torc, AEVA, Hyundai, AGC-Wideye, Valeo)

What will cause accelerated LiDAR adoption ?

Information restricted

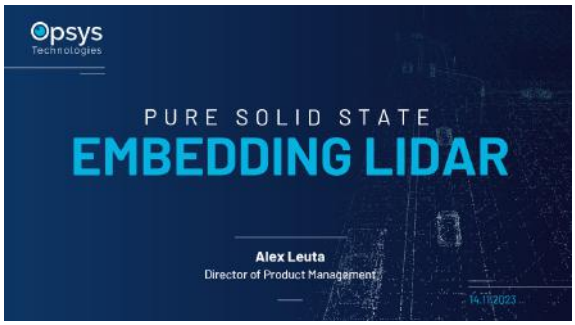
DAY2 – KEYNOTE 3



Bob in den Bosch – Hesai / VP Global Sales

HESAI: Winning business today is more about performance and quality. Lidar is taking off in China, the first brand launching with Hesai was Li Auto. 50 brands are now developing with Hesai. 500k volume in 2024. Market started with Robotaxis then in 2022 moved to ADAS with volumes from 10k/y up to 1M/y. Vertical integration is a key to reduce costs. 905nm will keep a good cost/performance ratio. 100p working in ASIC design & strategy. Automized production lines (90%+) with 45s tak time allows scaling volumes. Can duplicate Lidar's production line in 6 months. ADAS will be growing significantly.

SESSION.4 – TECHNOLOGY 1



Thomas Luce – MICROVISION / VP Business Development

MICROVISION can provide LR, SR Lidars and Auto-Annotation Software.,. Is the only company proposing full solid-state products with segmented flash technology. High resolution 13Mio pts/s – up to 350m range for cars, individual pulse coding for immunity to interference. VCSEL & SPAD array to achieve low power / low-cost solutions. A row of lasers is active at a time. C-sample and production line ready. Believes the Solid state lidars at 905nm is the future standard.

Henri Häffner – CEPTON / Dir. Product Management, Marketing & Business Development

CEPTON has a Partnership with Koito on validation and manufacturing side to meet the automotive requirements. Seamless and nice top roof integration is possible (pick-ups in the US), as well as integration in headlamps or side mirrors. Has a Ultra slim & compact lidar design, also developing ASICs with Front End processing and Back End point cloud processing.

Alex Leuta – OPSYS / Business Development Manager

OPSYS: propositions for seamless Lidar integration in bumpers or ultra-thin lighting systems. Top roof integration proposals with good performance, Windshield nice but with some performance degradation. Box integration challenges. Full integration kit (multi sensing) to be shown at CES 2024

Chan M Lim – SOS LAB / Co-Founder & COO

SOS-LAB: wants to go public by end 2024. Path to high volumes Lidar is about Size and cost first, showing the technology roadmap for low-cost. The new ML-A generation (86 x 35 x 88,5 mm) can be integrated in ultra-thin headlamp. Performance 60 x 17,5 deg at 200m range. (resolution?). Partnership with SL corporation one of the largest Automotive Tier-1 in KR. One key performance is blooming rejection, also working in Fog conditions. Archi with LCU + 4 slave lidars. Colorization image possible combining Camera and Lidar.

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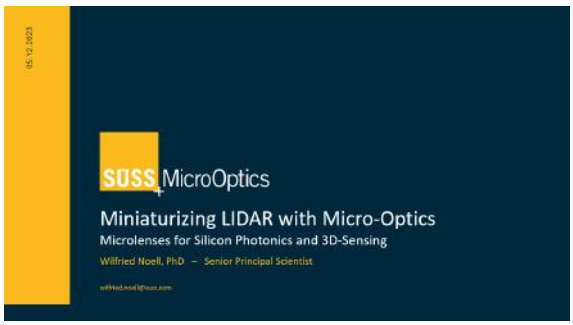
SESSION.5 – TECHNOLOGY 2



Clemens Hoffman – OSRAM / Senior Principal Leader Engineer

Urban Pilot, Parking Robotaxis for SR Lidar – demand increasing for segmented flash technology 1D scanning (H), requires the correction of optical distortions, and a good matching between VCSEL & SPAD to use the same optic. A good design compromise is to use reduce the complexity of the SPAD (large aperture, homogeneous line concept). Road to success: close alignment and discussions with customers to do the best compromise. AMS offers both solutions with 905nm laser and 940nm is in development.

Li Zhiao - VERTILITE / COO

For automotive applications beam quality and power are key. 6 junction VCSELs can already exceed EEL in BPP. VCSEL spot arrays are used in long range mechanical Lidars. 1D addressable arrays and 2D arrays are used for mid-range. For flash arrays, high power is needed and that limits range. Vertilite is moving to 8j and has demoed 14j that can achieve peak powers over 1000W. Testing has been done for >5000hrs life with low FIT.

200 customers, top players in consumer electronics. In-cabin and NIR illumination active. Techno Multi-Junction MJ-VCESL. VCSEL spot array (20m), 1D addressable(80m), 2D addressable(80m), VCSEL Array which requires ultra-high power(Flash Lidar). Spot array can achieve 40W+ power and 13deg FoV 8-14 Junction VCSEL for mech lidars.

Luigi Ghezzi - HAMAMATSU / Technical Marketing Engineer

Produces a large range of detectors for short to long range LIDARs. Microlens can be used to improve detection in the SPAD. Wirebonding is used today to bond the ASIC to the SPAD/MPCC but this is not ideal for automotive applications. New back illuminated 2D SPAD arrays solve some of those challenges. MPPC uses multiple diodes connected to a single channel output. By 2025, a 2D MPCC with ASIC will be delivered with 320x240 channels and a 15x15um or 10x10um SPAD size at AEC Grade 2 qualified. Evaluation boards are available. The ASIC includes ToF measurement and can be customized.

Wilfried Noell – SÜSS Micro Optics / Chief Product & Marketing Officer

Suss will be acquired by FocusLight early next year which will allow for more vertical integration. Optical design is done by simulation and ray tracing. Diffractive and refractive optics can be combined. Micro lens arrays have been used for ground projectors in car mirrors and is starting to be used in car headlights. Microlenses are used in LiDAR for laser collimation, beam shaping and on the SPAD detector. PIC systems are starting to come to market, with Scantinel and SiLC as examples. Micro optics are used for beam collimation and refocusing. Optical Phase Arrays for beam steering use microlenses to collimate the beam. Microprisms can be used with edge emmiters to steer the beam by 90 degrees. Wafer level processing is used to add the microlens array to the CMOS wafer.

SESSION.6 – TECHNOLOGY 3 & PROCESS

Fabian Finkeldey – ELMOS Mechaless / Product Architect

Elmos is a supplier into the automotive industry for ultrasonic ICs, motor control, gesture recognition and lighting. For Laser Drivers, Elmos works with 905/940nm EEL or VCSEL. The driver aims to achieve as short pulses as possible, which gives more information per Watt and makes detection easier. Capacitors and the laser can be die stacked on top of the driver for low inductance and more efficiency. Up to 300W of power can be achieved from a single light source.

Alexis Vander Biest – Sony Semiconductor Solutions / Senior Manager – Automotive

Sony has developed SPADs for 850/905/940nm ToF LiDARs. The Gen2L SPAD supports up to 300m range and will work with mechanical scanning LiDARs at up to 20fps. For parking applications, short-range lidar needs wide horizontal and vertical FoV. The IMX459 is a 576x178 SPAD detector (each pixel is a 3x3 SPAD). The chip integrates A/D, Logic (ToF calc) and output circuits which simplifies overall lidar design.

Dr Mirvais Yousefi – SCRAMBLUX / CTO

End of line testing and calibration is critical for lidar production. Scamblux has partnered with ficonTEC who has an end-end production system. Calibration is a bottleneck today and can require a

large space in the factory. Beyond short cycle time and small footprint, customers also want full range testing and capturing full FOV in one measurement. There are no optics in the test path and the system performs direct measurement. Different environmental conditions can also be generated inside the system.

Dirk Seebaum - TRIOPTICS/ Product Manager Automation

Trioptics has a background in assembly and testing of optical systems. Started working on LiDAR aligners in 2018 and now has a fully automated alignment and test solution. A typical alignment task is to align the transmitter and receiver. Beam scanners and FMCW have different requirements. Active or passive alignment is possible. Integration from R&D into the production line is also a key consideration.

Hendrik Zachmann

Jabil is developing LiDAR products with customers and can manufacture worldwide for its customers. Alignment is a big challenge in the manufacturing process and Jabil has developed a solution.

SESSION.7 – SOFTWARE TOOLS & AI

David Auger (Senior Application Eng.) & Petr Fomin (Leading Application Eng.) – ANSYS

LiDAR sensors are important for L3 driving, and simulation of the optical path is needed to aid the AD development. Different light sources must be simulated, environment, materials, and the receiver path. Ansys is using the DIN-SAE 91471 standard as a framework to simulate sensor performance. Weather impacts can also be evaluated, including rain on the sensor. Ansys trained a neural network with simulated data and real data and found 80% reduction in real data is possible to achieve similar performance.

Samer Galal – DEKRA / Head of ADAS Systems and Self Driving Transport

DEKRA provides services for safety on the road, including vehicle inspection and validation testing for digital products. Dekra has three proving grounds and can collect real-world data. Their Dresden track is optimized for testing autonomous vehicles. Dekra has locations in 60 countries to collect on-road data. They can do data annotation and anonymization for customers.

Sandeep Kumar Chilumula – DEEPEN.AI /

LiDAR can go out of calibration due to accidents, mechanical wear and other reasons. Current ways of calibration are not scalable. Deepens Calibration Cloud can solve the challenges of LiDAR calibration. Deepen also offers annotation services for images and video.

PANEL-2 DISCUSSION “Affordable Lidar & Validations”

(Hesai, Opsys, Cepton, Sony, Ansys)

Information restricted