DVN
Lidar

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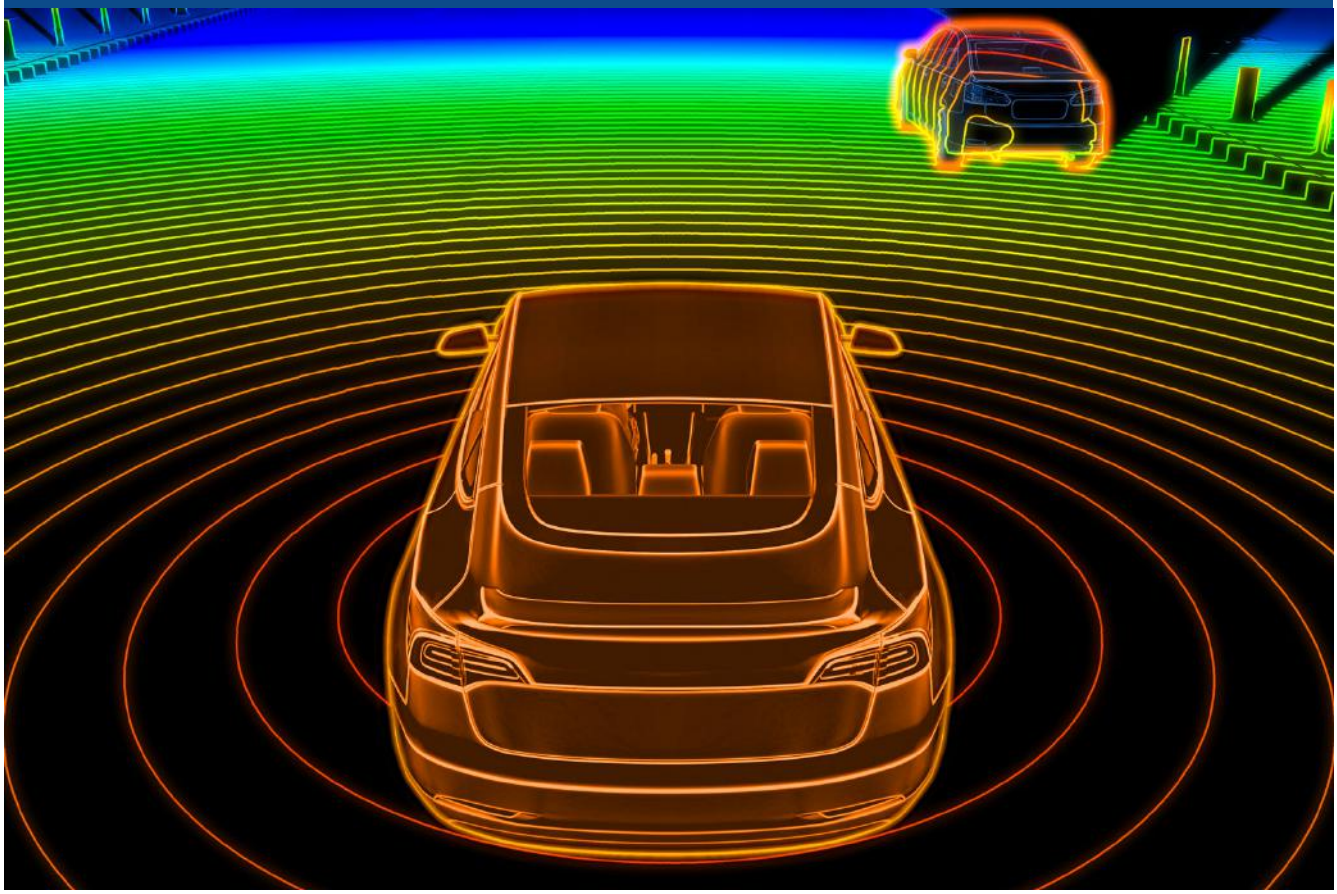


EDITORIAL

Lidar is Crucial For Autonomous-Drive Applications

When we met with Valeo's autonomous-driving research and innovation director Benezouz Bradaï at the ADAS & Autonomous Vehicle Technology Expo in Stuttgart, that's what he told us: *lidar is a key technology to make autonomous driving applications work*. That's a stark statement, and if we're going by real-world results, he's absolutely right. It's an idea that sparks deep insights regarding autonomous driving validations and robustness, and in this issue of your DVN-L Newsletter we bring you an interview with Dr. Bradaï, as well as a special report on the Stuttgart expo.
But perhaps lidar won't necessarily always be the one and only way to do a complete job; in today's Newsletter, you'll find coverage on a new technology developed by TriEye and Coherent for weatherproof multispectral 3D ranging as an alternative to lidar. There's also news about SILC's new compact and low-cost lidar solution; reports of Tesla trying yet another way of pretending not to need lidar, and several first/last mile projects in the pipeline.
And we've hurried to bring you the first details of our Lidar Deep Dive III, coming on 29-30 August in San Francisco. There, we will focus on 360° lidar systems and new lidar technologies such as FMCW.
On the horizon, be sure and save the date for the DVN-L Conference (Europe), 29-30 November in Wiesbaden, Germany.

We're ever so glad you're here with us in the DVN-Lidar community. Enjoy this twelfth newsletter!

All best,

Alain Servel

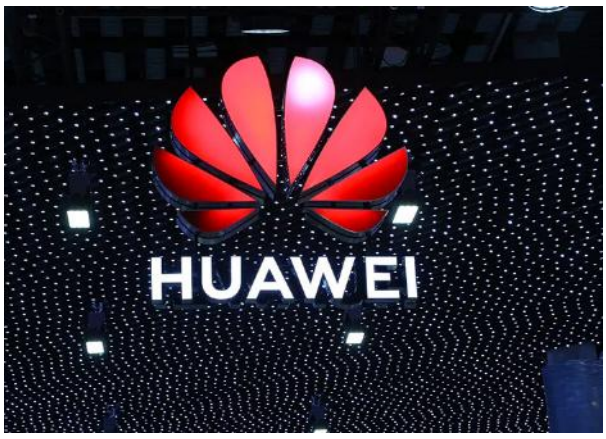
DVN LIDAR SENIOR ADVISOR

LIDAR BUSINESS

Lidar Business Newsbites

08.June / **China - In May**, the main NEV brands have been BYD (239,092 units), Tesla China (77,695 units – see graphic), GAC AION (45,003 units), SAIC (29,126 units), Li Auto (28,277 units), Geely Auto (27,036 units), Changan Auto (26,914 units).

In June, the premium EV brands which are using Lidars, have increased their sales again: Xpeng (8,6 ku) and Nio (10,7 ku).



12 June: Richard Chengdong Yu, Huawei's Executive Director and CEO of Huawei Technologies Consumer Business Group, as well as CEO of Huawei's Intelligent Automotive Solution Business Unit, announced that **China's L^3 autonomous driving standards are expected to be finalized by the end of June**. Currently, most new vehicles in China are equipped with L^2 advanced driver assistance systems, including models from Tesla, NIO, XPeng, and Li Auto.

LUMOTIVE

6 June: **Lumotive**, specialists in beam-steering chips based on the company's Light Control Metasurface technology, for advanced 3D optical sensors, and **Hokuyo Automatic**, a producer of sensor and automation technology, have revealed a multi-year production contract. This partnership will expedite the deployment of essential sensor technology in robotics and autonomous systems applications.

30 May: **Valeo** and **DiDi Autonomous Driving** have unveiled a strategic cooperation and investment pact with a joint objective to develop safety solutions for L^4 robotaxis. The two companies aim to supplement the L^4 standard technology, responsible for the autonomous and secure navigation of the robotaxi, with another set of hardware and software: an **Automated Safety Pilot** to function as a redundancy to the primary system, providing a fallback in case of unexpected failures.

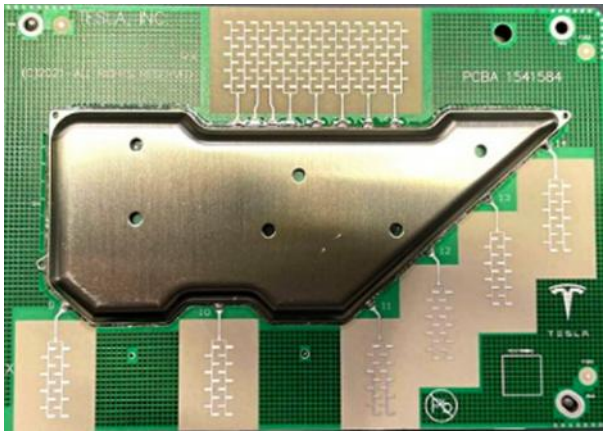
SCANTINEL PHOTONICS

GOLDBELL

6 June:the **MoveSG Accelerator program**, helmed by Goldbell, offers Scantinel Photonics valuable access to innovators, investors, institutions, and leading global and regional transport and mobility corporate partners in Asia-Pacific. Scantinel offers a unique FMCW lidar solution. MoveSG is a global acceleration programme o dedicated to piloting and nurturing cutting-edge technology solutions in the fields of mobility, transport and logistic. It has already supported about 70 early-stage startups..

6 June**: Luminar** and **Plus** confirmed their strategic partnership: Luminar exclusively supplies mid- to long-range lidar for PlusDrive, Plus' proprietary assisted-driving system designed for commercial vehicles. Plus is set to become the exclusive third-party provider of AI-powered driver assist software for Luminar's commercial vehicle makers. Luminar's Iris lidar is capable of long-range detections. Designed to meet the demands for class-8 commercial trucks, the lidar offers visibility up to 600 meters ahead.

29 May: **Blickfeld** has started mass production of their Qb2 laser sensor. Blickfeld technology relies on a single laser source and MEMS mirrors that deflect the laser beam onto the surroundings. Fabrinet supports Blickfeld in achieving cost-effective and high-volume production. The core of their sensors, the beam deflection unit, is still produced in Munich by Blickfeld, while Fabrinet handles the production of the laser detector module, the Qb2 assembly, and testing.



12 June: Elon Musk (and only Elon Musk) still likes to think lidar is for "losers" and those who use it are "doomed", so he's having yet another go at alternative reality: the first **Tesla** HW4-equipped vehicles have started rolling. The radar has 6 TX and 8 RX channels, giving a maximum virtual channel count of 48. Previous radars typically had 8 virtual channels, and the forthcoming Mobileye radar has over 2,000.

INTERVIEW

DVN-L Interview: Benazouz Bradaï, Valeo AD Innovation Chief

Dr. Benazouz Bradaï is Research & Innovation Director and Master Expert in Autonomous Driving at Valeo. In that role, he's made major scientific and industrial contributions. He is also a scientific co-director of the ASTRA (Automated systems for Safe TRAnsportation) joint lab with Inria in France.

Bradaï holds a PhD in automatic control from Haute Alsace University in France. His expertise and research interests include sensor fusion, precise localization and mapping, and system architecture. He is a member of IEEE, ADASIS Forum, SENSORIS Consortium, SAE, and SIA (French SAE) as an ADAS/AD expert. He graciously granted DVN-Lidar this interview.

DVN: Will you tell us about your career and work at Valeo?

Dr. Benazouz Bradaï: In 2003, I started a PhD thesis in multisensor fusion for ADAS in collaboration with Valeo in the framework of a CIFRE industrial contract (Conventions Industrielles de Formation par la Recherche, industrial agreements on training through research). At that time, I was working on fusion of cameras and maps for lighting automation and for Intelligent Speed Assist. In 2007, I got my PhD and have been hired by Valeo as an ADAS Engineer. I was promoted R&I Project Manager in 2012, then Autonomous Driving Innovation Platform Manager position in 2019. Since 2022, I am R&I Director on ADAS and Autonomous Driving. As a Research and Innovation Engineer, I have always been passionate about research and innovation. I continued working with academics at Valeo with supervision of several PhD thesis with Mines ParisTech and Inria Lab. Since February 2022, I am the Scientific Co-Director of a joint lab with Inria called ASTRA "Automated systems for Safe TRAnsportation". I have been evolving also as an expert from 2009 to Senior Expert in 2015 and finally a Master Expert in 2022.

DVN: What are the key milestones to achieve robust autonomous driving?

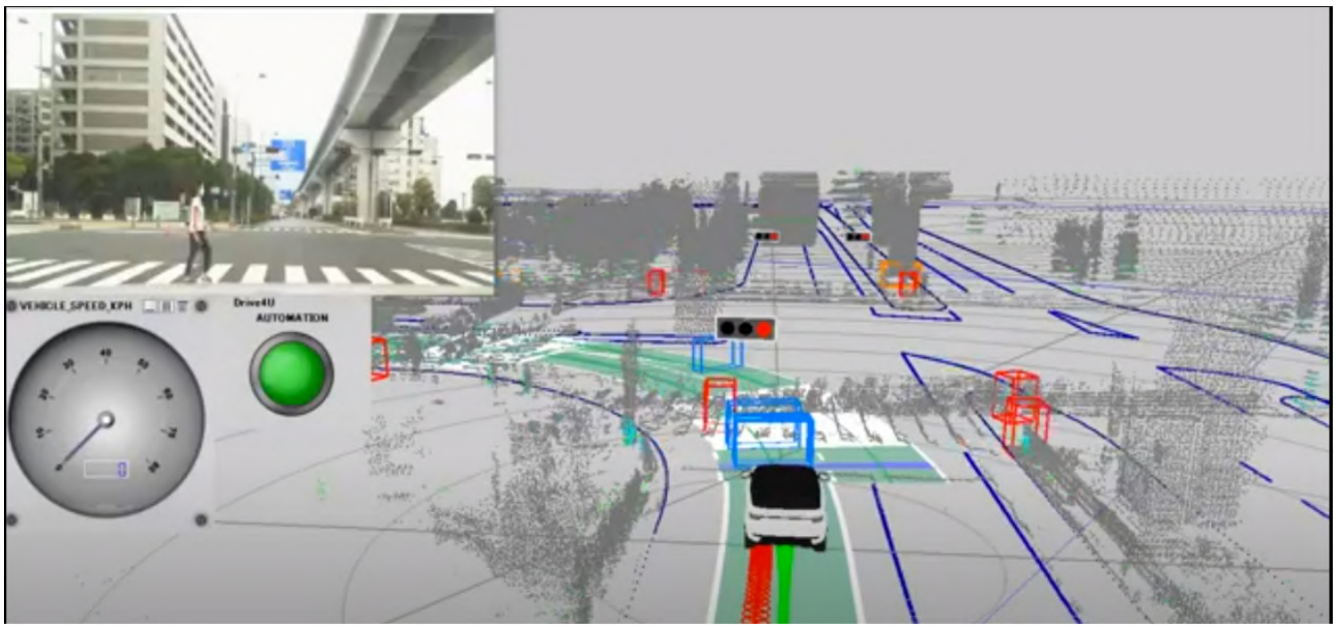
Dr. B.B.: Mercedes has achieved in 2022 the roll-out of the first homologated L^3 system in EU and soon in the US up to 60 km/h, in line with UNECE R157 (ALKS). In a few months, Hyundai-Kia will be bringing another L^3 system in various countries including South Korea, some European countries, and North America. To achieve this milestone, safety is a key element that needs to be proven at the homologation stage. The sensors' redundancy is important for safety, and lidar is an enabler for higher autonomy. The lidar is also enabler for corner cases like 'underdrivable' objects, reducing false positives, and overcoming issues other sensors have—like camera that can be blinded by the sun, or radar which can have false positives with regard to tunnels. It allows increased detection range and high-fidelity 3D environment modelling.

Today, L^4 Autonomous Vehicles are very limited in series production. By L^4, we mean a safe system where the driver need not intervene at any moment and the system is ensuring the fallback in case of failure. Some experimentations or limited commercial services of L^4 systems—Robotaxis—are currently on in China and in the US in geofenced, pre-defined areas, but no real commercial use.

DVN: How important is lidar, and why?

Dr. B.B.: Lidar allows an increased range with a high accuracy of detections for highly retroreflective objects, height measurements, and 3D environment modelling capability.

From a safety point of view, lidar brings an essential technology redundancy that is important for the perception of the environment. Most approaches for L^3 automation use a triple sensor technology redundancy. Compared to the camera, the lidar cannot be blinded by the sun above the horizon, it increases the detection range, and has higher accuracy. Compared to the radar, it allows height measurements and has better angular resolution. In addition, lidar allows modelling the 3D environment and is very useful for precise localization and mapping. In urban environments when the infrastructure can be occluded by other road users or when there are no lane markings for example, it allows the availability of the function and thus extends the ODD (operational design domain). Valeo developed Drive4U Locate, a precise localization and mapping system based on our Valeo Scala lidar, which reaches 10-cm accuracy. It maps the environment and detects the change and updates the map by crowdsourcing.



Valeo Drive4U Locate: precise localization and mapping based on Scala lidar

DVN: Are there critical use cases which have been solved by Lidar?

Dr. B.B.: Lidar sensing technology is well suited to manage so-called 'under-drivable' objects such as sign gantries, bridges, or tunnels—elements of the infrastructure under which vehicles are supposed to drive freely. Traditional sensors such as radars and cameras usually perform poorly to classify these objects as under-drivable, and lidar brings the additional 3D information to reliably distinguish these objects from other road users such as cars.

One of the critical use-cases that lidar solves is the detection of debris (e.g., lost cargo) on the highway, a challenge that is directly related to the vehicle speed. The ALKS regulation has been amended and adopted in 2023 to have higher speeds on divided highways at 130 km/h, including automated lane changes. The lost cargo remains one of the challenging use-cases for this extension. With Valeo's Scala^3 lidar, these use-cases can be solved.

DVN: How does Scala^3 do with these use cases, compared to the previous Scala^2?

Dr. B.B.: Underdrivable detection tests have been performed with Valeo Scala^3 and confirm a better capability to minimize false positives (where underdrivable objects such as sign gantries or tunnels would cause unwanted braking) at sensor level, which will translate into a much better performance at system level, compensating the limitations of other sensors in such corner cases.

Of course, debris detection range will be greatly increased with Scala^3, and our first tests confirm at least a doubled detection distance for objects such as a small tire on the road. This capability will be crucial to bring the top operating speed of autonomous driving functions closer to 130 km/h.

Scala^3's potential is being evaluated as we speak, with deterministic and statistical campaigns being carried out for our first customers, especially Stellantis.

Lost cargo (mattress) on highway during Valeo Cruise4U test drives

DVN: Tell us about the V&V (validation and verification) process to launch an autonomous vehicle, will you please?

Dr. B.B.: To validate an automated vehicle of L^3 and beyond, the mileage target of validation is not achievable with a realistic budget, and even if it were, it still is not sufficient. Simulation and virtual validation are key to reduce this budget and cover all the scenarios. But simulation will not be the only tool to validate. Indeed, for homologation, the assessment method combines simulation, physical tests in proving grounds, and real world tests.

The simulation is mainly to assess the system's capacity to deal with critical situations that are not testable on proving grounds or public roads. Proving ground tests allow testing challenging scenarios that are not testable on open roads. It can be combined with simulation to test the vehicle behaviour with simulated data for repeatable scenarios and with injecting faults. This is called VIL, for vehicle-in-the-loop. Finally, validation on open roads is performed in order to assess the ability of the system to manage real-world situations especially in its interaction with other road users. It intends to verify that the system has not been overfitted to specific test scenarios.

DVN: How do Valeo sensors do in bad weather conditions?

Dr. B.B.: As it has been presented by my colleague Ahmed Yousif at the ADAS & Autonomous Vehicle Technology Expo Conference, Valeo develops three types of simulation sensor model:

- **High Fidelity Sensor Model** models the various components of the lidar, including the laser pulse and the optical path, in addition to effects such as blooming and noise. Each point is classified with a unique ID, class, and material to ease the development of the stack.
- **Phenomenological Sensor Model** is an object-based model to emulate the perception stack performance and metrics.
- **AI Trained Model** is an accelerator of the high-fidelity sensor model which is trained on both the simulated and real logs and data.

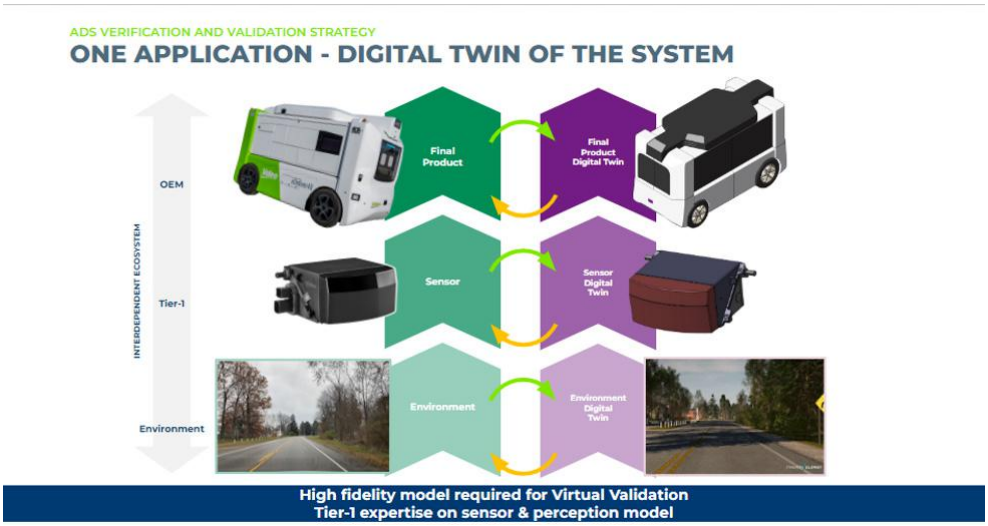
The high fidelity sensor model is developed taking into consideration weather conditions such as rain and spray. In addition to that, currently we are working on severe weather conditions such as fog. On the other hand, the phenomenological sensor model can emulate the lidar perception stack performance, taking into consideration all the weather conditions.

DVN: What are automakers' expectations regarding lidar sensor models?

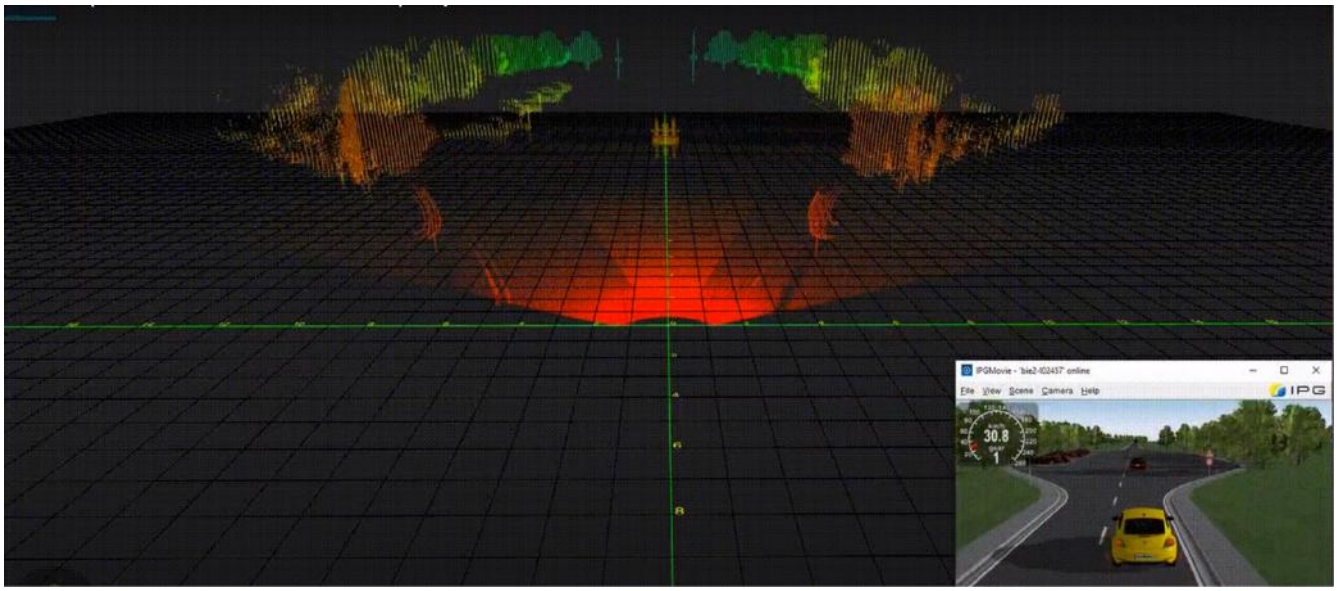
Dr. B.B.: Different OEMs use the sensor models in various applications. Here is a summary of the use cases:

- High Fidelity Sensor Model: perception stack and functions development; raw data fusion.
- AI Trained Model: integration to XiL (HiL/ SiL/ Overall HiL); perception stack and functions development, raw data fusion.
- Phenomenological Sensor Model: object-based fusion and integration to HiL and SiL.

The high fidelity sensor model is required for virtual validation and the verification with respect to real word test drives. At Valeo we also validate, with digital twin, the targeted autonomous driving functions where we can test with the simulation using the high fidelity sensor models and with real data as well as the tests in the real world.



Validation vs real world - Digital Twin



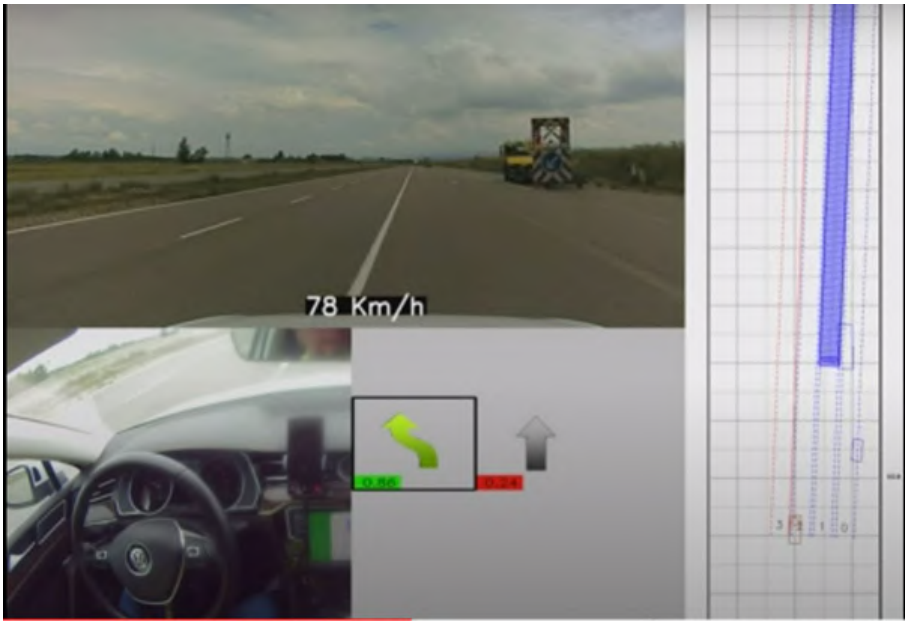
Example of the high fidelity sensor model used in simulation

DVN: What's next to improve the ODD for L^3 and L^4 autonomous driving systems?

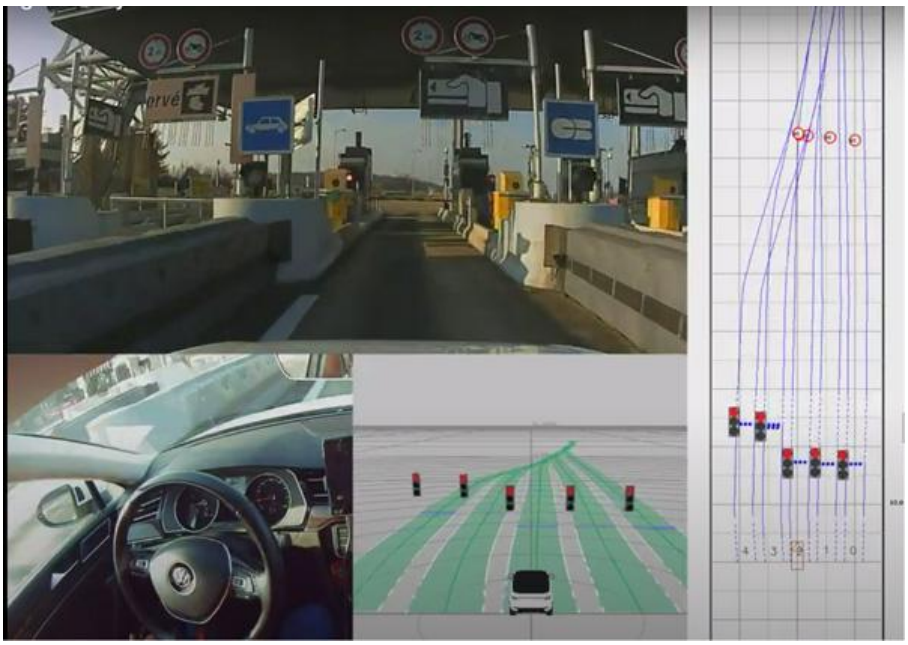
Dr. B.B.: Even as ADAS becomes increasingly a standard, L^2 and L^{2+} automation will still be dominant as they will represent more than 50 per cent market share by the end of decade. These hands-off systems up to 130 km/h will be with progressive ODD extension including automated lane change, intersection support exit ramps management between highways, etc.

For L^3 and L^4 systems, the ODD is also increased progressively. The first L^3 systems on the road will be based on ALKS up to 60 km/h, then ALKS up to 130 km/h with automated lane change starting from 2026-2027.

Lidar technology is key to manage the related critical use-cases as the lost cargo for example. There is a trend in China to have lidar from L^{2+} in order to prepare the next generation of L^3 and L^4 systems when the regulation is adopted. Regarding safety, at least a second sensor technology is required for managing these critical use-cases. Other sensor technologies will be introduced to extend the ODD, like the thermal camera to manage adverse weather situations and VRU (vulnerable road users). Connectivity deployment will allow more ODD extension. For example, at Valeo we are working on innovation for extending the L^4 highway speed to new challenging use-cases like toll booths and work zones, using connectivity combined with the vehicle sensor perception.



Valeo Cruise4U highway extended ODD using connectivity: work zone management



Valeo Cruise4U highway extended ODD using connectivity: toll booth management

DVN: What should be the safety targets for an AV?

Dr. B.B.: Autonomous vehicle behavior must be safe whatever the potential root causes. Compliance with ISO 21448 SOTIF (Safety Of The Intended Functionality) is one of the major challenges in AV design and architecture. For that, the first difficulty automakers are facing is the definition of the acceptance criteria.

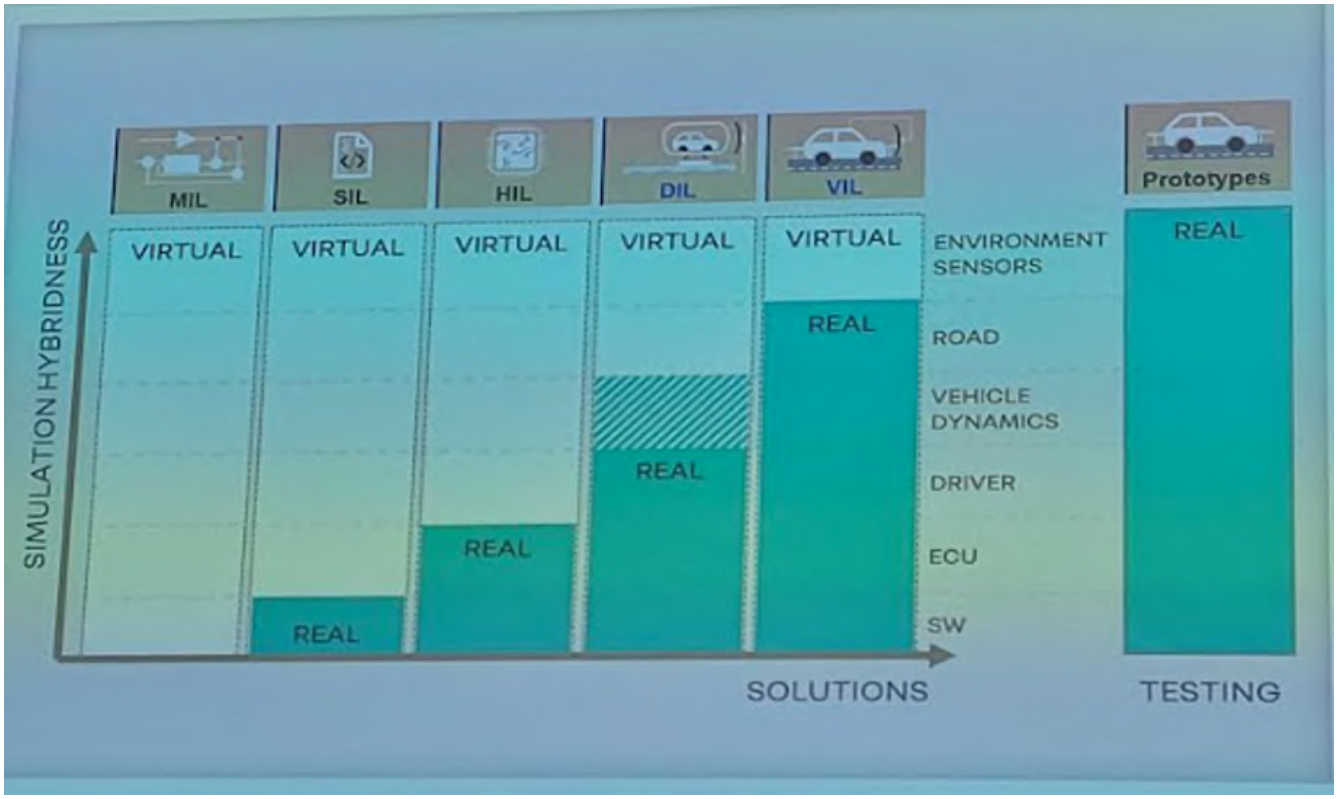
A PFA (French Automotive Platform) position paper from March 2019, "Safety Argument for SAE Automation Level 3 and 4 Automated Vehicles", suggests using the GAME method (French acronym meaning *globally at least equivalent*) to define these objectives. This method is also recommended by the ISO 21448 standard and the new coming ISO/TS 5083 on Safety Demonstration of Automated Driving Systems. The principle being that the residual risk induced by the AD system must be less than or equal to the one induced by an average human driver.

There are other methods like MEM (minimum endogenous mortality), ALARP (as low as reasonably practicable), and positive risk balance. Today there is no worldwide, nor European state of the art. However, a common approach is to take into account the accidentology statistics for similar use cases and to derive the acceptance criteria. The target of the acceptable fatal accidents rate induced by the autonomous driving system shall be lower than the fatal accidents rate induced by human driving divided by a safety factor. This safety factor can mitigate all the uncertainties arising from the calculation. It can also take into account that accident rates evolve from one year to another or that they can be different from one country to another.

Considering the GAME method, this target can be a factor of 10—a number used for decades by the safety community. There is still no consensus, but the common approaches are converging towards this factor. There are currently activities in different working groups and this factor might be updated.

ADAS & AUTONOMOUS VEHICLE TECHNOLOGY

ADAS & Autonomous Vehicle Technology Expo Stuttgart



Over 150 exhibitors, over 120 conference speakers, and thousands of visitors from across the European vehicle safety, validation and autonomous driving sector attended the ADAS & Autonomous Vehicle Technology Expo Europe 2023.

Renault's Stéphane Reignier - Immersive Simulation Expert Leader

- Digital homologation is on its way, step by step.
- Simulation serves a shift-left approach, with earlier and continuous utilisation. Simulation environments are key (scenario databases).
- Simulation must be part of the homologation; Renault has a partnership with UTAC, and active discussions with UNECE.
- Interoperability and standards will be required.
- The main issue is to verify the simulation tools are reliable, which requires to benchmark the simulation software and the real world.

Stellantis' Vincent Abadie ADAS and AD Senior Fellow

• AD is not ADAS: a reliable detection is key, including sensor redundancy.
• No compromise between false positives and false negatives,
• 3 pillars for validations: simulation (functions), test track (scenarios), open road (data collection).
• Safety targets: global target but also target by scenario.
• “Simulation software is not yet mature for all sensors; a 100% virtual validation is not realistic”.

Easy Mile's Fabian Schäfer – Sales Manager

• Business model: first/last mile for public transportation operators.
• Partnership with Renault & Keolis, commercial applications in 2025.
• Deployment: certification for the EU market as a first step.
• New shuttle ready in 2025 (17-20 seats, speed up to 40 km/h).
• Sensor suite: lidars and cameras.
• Key topic: ODD and sensor cleaning.
• "The biggest limitation for the deployment is related to the localization which requires precise reference points / landmarks".

Valeo's Benazouz Bradaï – AD Innovation Platform Manager

• AD homologation: audit, test tracks (scenarios), open road
• Audit to check the understanding of the AD system; the design/validation process must be complete and consistent.
• Scenarios: some can be tested, some not (simulations).
• Safety targets: the definition of quantitative targets is key.
• “Sensor digital twin: a high-fidelity sensor model is available for the Valeo lidars, also working for bad weather conditions”.

Valeo's Ahmed Yousif – Lidar System Simulation Expert

• Valeo's lidar sensor model uses the ASAM OSI Open Simulation Interface.
• It includes an ideal data manager, a tracking module, a KPI manager module with an option to simulate bad weather conditions.
• It can manage multiple object categories such as vehicles, trucks, pedestrians, buildings, lanes…
• "A good sensor model must simulate the occlusion and merged objects effect, and keep some memory of the tracks out of the FoV"

Ansys' Olaf Kath – Product VP

• MBSE is systems engineering with system architectural models,
• MBSE is using its own system engineering language,
• MBSE must demonstrate the safety of AD functions through linking safety by design with structured safety analysis, safety by V&V with massive parallel physics-based simulation and safety management plan, and compile the safety case,
• "Key is to connect all safety validations, with tools and analysis".

DVN comment

Most of the presentations were related to the V&V process (validation and verification) required for homologation of autonomous vehicles. The consensus was to add more simulations at the start of the project (shift-left approach in the cycle) to reduce design modifications later in the project and set up mode- based systems Engineering (MBSE) to build a consistent safety case along the development.
Nevertheless, simulation tools must also be validated as such, and be correlated to the real world. Vinfast found the correlation ratio was only 72 per cent, showing the current limitations of the simulations. Radar sensors are the most difficult.
Only a few presentations were related to lidar technology; there was an interesting presentation about lidar sensor simulation models from Valeo. Velodyne's VP Sunil Khatana was to expound on the economics of enabling technologies for lidar, but that regrettably didn't happen.
Some lidar suppliers were present as exhibitors: Robosense, LS Lidar, Ouster, Microvision.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Hesai's ET25 Claims Quiet Lidar Revolution

Hesai's new ET25 lidar is placed behind the windshield, enabling a sleek vehicle design that covers practical functionality without affecting aerodynamics. However, it is inevitable for lidar to produce noise during operations. This effect is particularly noticeable in electric vehicles, where even a slight squeaking sound can become very noticeable. Therefore, the NVH requirements for in-cabin lidar solution are also tighter. The ET25 has a noise level of less than 25 dB(A) during operation; the driver can hardly perceive it.

To minimize the vibration of moving parts during operation, the ET25 was designed to achieve extreme balance with its internal components, distributing its mass evenly. By adjusting the internal architecture, dimensions, shapes, and other design elements, the scanner's centre of gravity is positioned as close to the axis of rotation as possible. This helps minimize deviation errors, effectively suppressing imbalanced vibration and resonance. As a result, both noise and vibration levels are significantly reduced.

In addition, the interactions between internal lidar components, and the interactions between the lidar casing and the vehicle body, can contribute to the formation of resonance, resulting in an adverse NVH experience. Hesai used modal analysis and simulation tests, taking various elements into account, including the connection conditions with the vehicle body, and the effects of internal non-mechanical components. This comprehensive approach ensures the ET25 lidar casing is seamlessly integrated with the vehicle, cleverly suppressing the path of vibration and noise.

However, evaluation of NVH is highly subjective. The passengers' experience can be affected by their seating location, and even by noise in a certain frequency range. Different automakers establish different standards based on their specific circumstances. Hesai has adopted a dual approach that includes a 1/3-octave band and overall sound pressure level evaluations to ensure low noise in each frequency range.

DVN comment

The ET25 uses a mechanical scanning principle that can be too noisy, especially if the sensor is integrated behind the windshield in the cockpit. Working on reduction of noise which has originally a level of less than 25 dB(A) induces the optimization of all moving parts in the lidar box. This optimisation can offer, in parallel an increase of sensor’s life duration.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Coherent, Trieye Show Laser Shortwave IR Imaging System

Semiconductor laser specialists Coherent Corporation and shortwave infrared (SWIR) imaging experts TriEye have demonstrated a jointly-developed laser-illuminated SWIR imaging system for automotive and robotic applications.

The growing number of use cases for SWIR imaging, which expands vision in automotive and robotics beyond the visible spectrum, is driving demand for low-cost mass-market SWIR cameras. The companies leveraged TriEye's spectrum enhanced detection and ranging (SEDAR) product platform and Coherent's SWIR semiconductor laser to devise a laser-illuminated SWIR imaging system, the first of its kind to reach lower cost points while achieving very high performance over a wide range of environmental conditions.

Coherent's Chief Marketing Officer Dr. Sanjai Parthasarathi says the new system "combines best-in-class SWIR imaging and laser illumination technologies that will enable next-generation cameras to provide images through rain or fog, and in any lighting condition, from broad daylight to total darkness at night. Both technologies are produced leveraging high-volume manufacturing platforms that will enable them to achieve the economies of scale required to penetrate markets in automotive and robotics".

And TriEye cofounder and CEO Avi Bakal says "We are happy to collaborate with a global leader in semiconductor lasers and to establish an ecosystem that the automotive and industrial robotics industries can rely on to build next-generation solutions. This is the next step in the evolution of our technology innovation, which will enable mass-market applications. Our collaboration will allow us to continue revolutionizing sensing capabilities and machine vision by allowing the incorporation of SWIR technology into a greater number of emerging applications".

DVN comment

The combination of laser illumination proposed by Coherent and TriEye's SEDAR would allow to enhance fog's backscattering rejection in the 3D image. It can represent an alternative to the classical Lidars with the benefit of a pure solid state solution working simultaneously in three different light spectra.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

SiLC's New Compact, Powerful Machine Vision Solution

SiLC Technologies, experts in machine vision, have launched their new Eyeonic™ Vision System, which they're calling the industry's most compact and powerful coherent vision system. It has the highest resolution and precision and longest range while remaining the only FMCW lidar to offer polarization information.

The Eyeonic Vision System integrates the company's unique photonics technology into the industry's first available turnkey vision solution—a highly flexible subsystem that reduces time to market for manufacturers seeking to incorporate machine vision into their products. Targeted to robotics, autonomous vehicles, smart cameras and other advanced products, the EVS delivers the highest levels of vision perception to identify and avoid objects with very low latency, even at distances of greater than a kilometer.

At the heart of the EVS is the company's fully integrated silicon photonics chip. With roughly 10 milli-degrees of angular resolution coupled with millimeter-level precision, it provides more than 10 times the definition and precision of legacy lidar offerings. This enables the EVS to measure the shape and distance of objects with high precision at great distances.

The new Vision System couples the Eyeonic Vision Sensor and a digital processing solution based on a powerful FPGA. The compact, flexible architecture of the new system enables synchronization of multiple vision sensors for unlimited points/second. The Eyeonic Vision System is highly versatile, supporting multiple scanner options and providing customers with the flexibility to tailor their designs to maximize performance for distance and field of vision for their application. It is accompanied by a broad range of accessories.

DVN comment

SiLC will participate in our next Deep Dive 3 in California. Utilizing FMCW at the 1,550-nm wavelength, SiLC's optical engine is now integrated in a chip.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Ouster Shows New Perception Software at Transport Tech Show

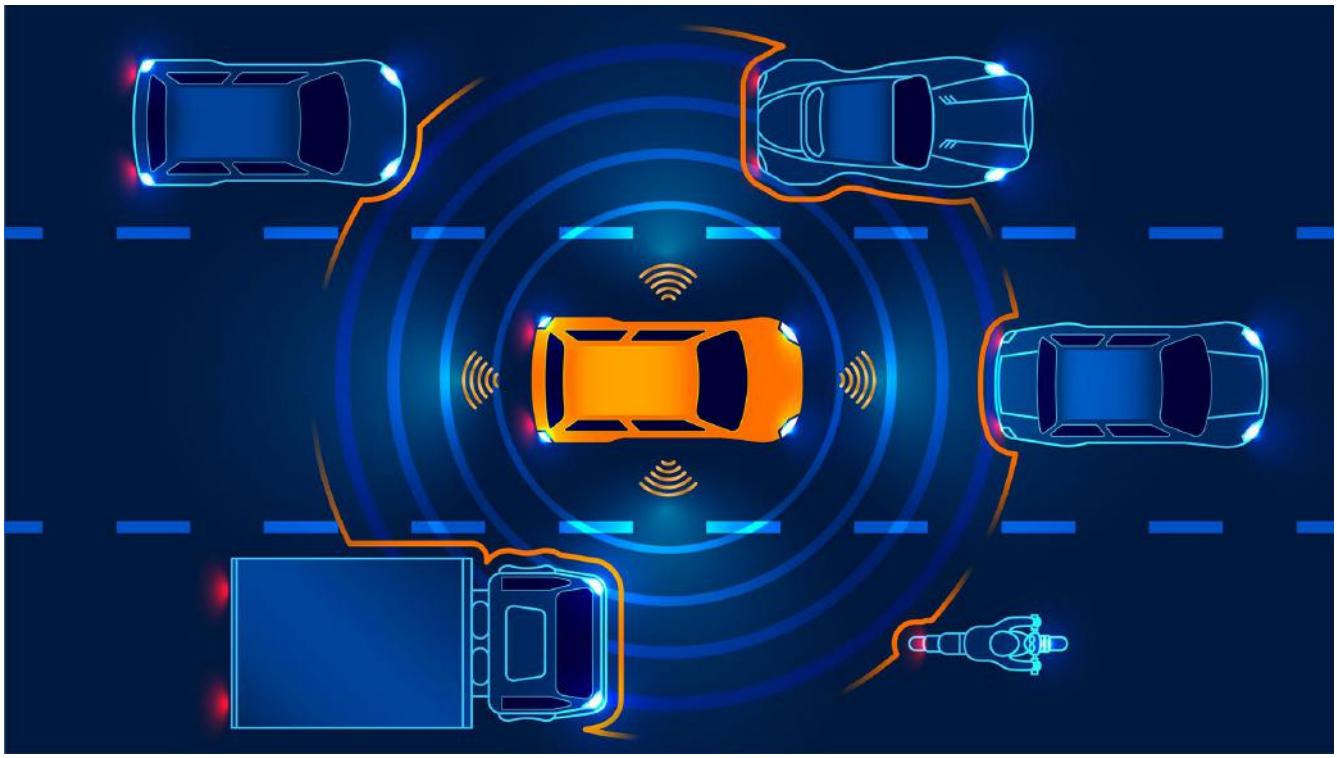
ITS America is the premiere tradeshow to learn about new advancements in transportation technology nationwide. Experts with decades of experience as traffic engineers, DOT officials, and technology integrators understand that lidar brings distinct advantages over cameras and radar for traffic control. This year in Dallas, Texas, Ouster demonstrated powerful new software solutions built on their high-resolution digital lidar to improve the safety and efficiency of roadways.
Perception performance is critical to be able to perform actuation of traffic control signals and output accurate, useful data for signal performance measures (SPMs). With its high resolution, Ouster's detection system not only detects the pedestrian, vehicle, or bicyclist, but also classifies the object accurately and continuously tracks it throughout the monitored space. Lidar also provides deterministic distance data, meaning the exact location of every object is measured rather than calculated. Camera technology can detect and classify objects in ideal weather conditions, but require inference to determine the estimated location (and therefore speed) in space of objects, leading to inconsistencies that output inaccurate SPM insights. Radar technology provides deterministic distance data in all weather conditions, but it does not have high enough resolution to detect slow and/or smaller objects such as pedestrians and provide accurate classification, a critical parameter in ITS applications focused on the safety of vulnerable road users.
Data robustness in any weather or lighting condition is key to this industry since systems are always operating outdoors. Cities cannot risk safety just because it is raining or snowing on any day. And with 75 per cent of pedestrian fatalities occurring in low-light conditions, camera technologies simply cannot move the needle of safety in our cities. Ouster's lidar penetrates environmental obscurants to maintain high detection performance in all weather conditions. And compared to cameras that can be blinded by sun glare or headlights, lidar operates outside the visible spectrum and therefore is unaffected by harsh lighting or complete darkness.

DVN comment

Ouster his also providing lidars for Robo-taxi fleets; Motional, a global leader in driverless technology, has chosen Ouster as the exclusive supplier of long-range lidar sensors for an all-electric Ioniq 5-based robo-taxi fleet. Under the serial production agreement, Ouster will supply Motional with Alpha Prime™ VLS-128 sensors through 2026.

AUTOMATED DRIVING

Autonomous Driving Newsbites



20 June: **WeRide** will operate autonomous minibuses (Robobus), Robotaxis, and autonomous sweepers (Robosweepers) for pilot applications or commercial operation in the Nanshan District in China. In December 2022, WeRide became the first company permitted to conduct passenger-carrying demonstration operations in Shenzhen using its mass-produced Robobus. the world's first mass-produced L^4 autonomous driving minibus designed specifically for urban open roads. It primarily focuses on microcirculation public transportation in cities, with a maximum speed of up to 40km/h.

15 June: **F Services UK** launched their next-generation autonomous L^4 shuttle at the MOVE 23 event in London. This pioneering shuttle incorporates ZF's most advanced AD hardware and software, andboasts a flexible interior for customizable configurations, fulfilling various operational requirements and accommodating up to 22 passengers.

12 June: **Milla Group**, a French startup, is starting the industrialization of their autonomous shuttles, with a production volume expected to grow up to 1,000 vehicles per year in 2030. The vehicles are permanently connected to a supervisor, and can communicate with infrastructure such as traffic lights. Milla has several projects and partners: Carrefour for food delivery, Vinci for autonomous shuttles operating from the train station of Massy/Paris, and the city of La Rochelle, to operate autonomous shuttles in the countryside.

9 June: **Mercedes-Benz** secured the first-ever certification from California authorities for an L^3 AD system system in a standard-production vehicle. With this, the Drive Pilot system will be available in the 2024 Mercedes-Benz S-Class and EQS Sedan models as an optional feature. Initial deliveries of equipped vehicles equipped will commence in late 2023.

14 June: **Buick**'s 2024 Envision will have GM's acclaimed Super Cruise system. It's the first Buick model to be equipped with Super Cruise, a system compatible with over 400,000 miles of roads across the U.S. and Canada. Buick's trajectory has made it the fastest-growing mainstream brand in the U.S., with a stunning 76.4-per-cent growth recorded up to May 2023.

9 June: **AVATR**, the EV brand jointly owned by Changan Automobile, Huawei, and CATL, is launching their advanced ADAS premium package which includes **city navigation and control assistance (City NCA) and automated valet parking (AVP)**, providing a smart driving experience for highway, urban, and parking scenarios. Users can choose between a monthly subscription for C¥640 (USD $89), an annual subscription for C¥6,400 (USD $890), and a lifetime subscription for C¥32,000 (USD $4,435). AVP perception software is based on 34 sensors. City NCA will be available in Shanghai, Guangzhou, Shenzhen, Hangzhou, and Chongqing.

12 June: Nissan recently demonstrated ongoing developments in ADAS tech based on lidar, unveiling a new feature for intersection collision avoidance. The event took place at a Nissan facility. This latest development is part of Nissan Ambition 2030, the company's long-term vision, according to Takao Asami, Senior Vice President and head of Nissan's Research and Advanced Engineering Division. The company is poised to develop next-generation lidar technology for collision avoidance by the mid-2020s.

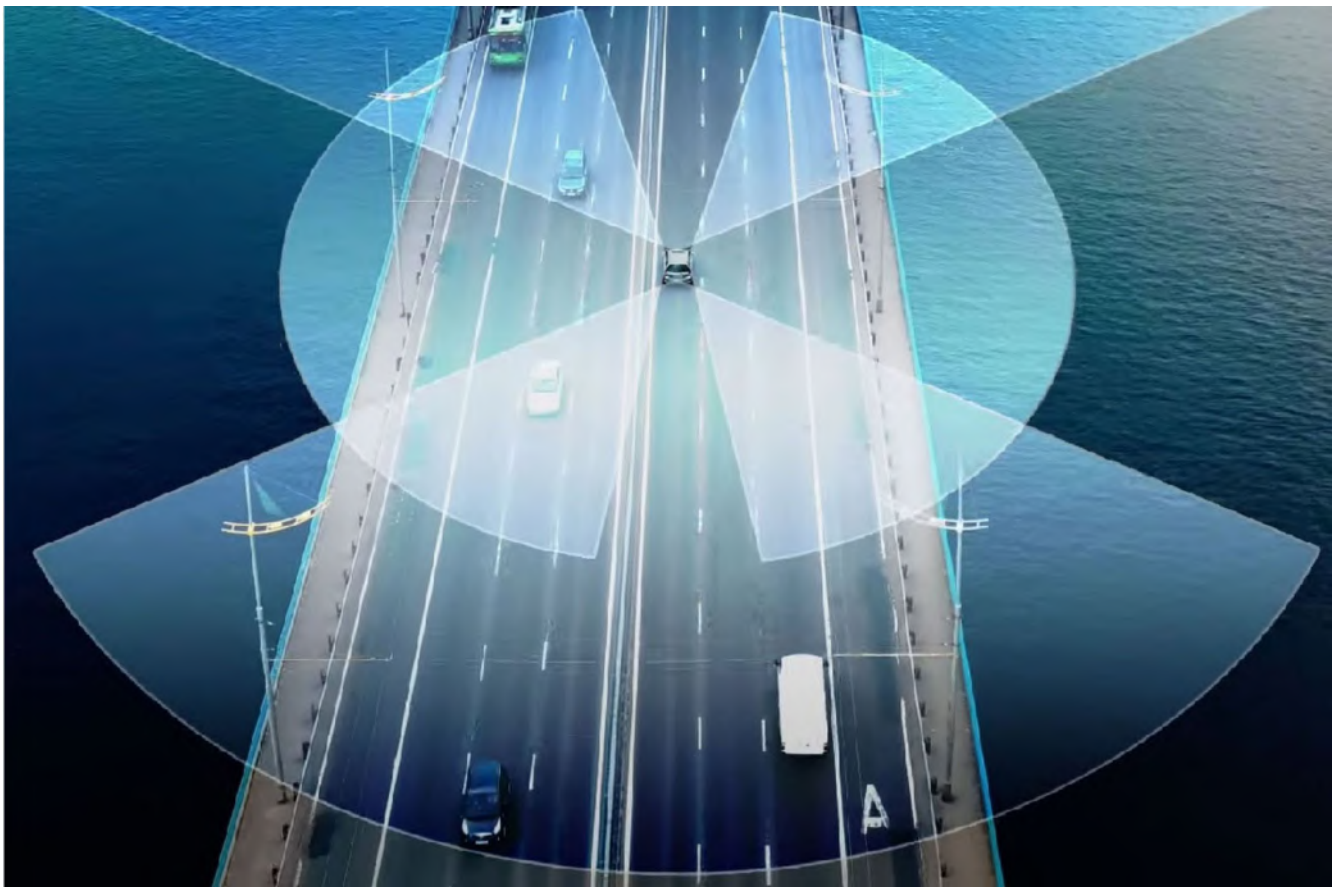
26 May: A huge data dump based on a whistleblower's leak of internal **Tesla** documents shows that problems with Tesla's automated driving technology may be far more common than media reports and regulators have let on, according to the Handelsblatt. The files contain more than 2,400 complaints about sudden acceleration, and more than 1,500 complaints about braking problems, including unintentional emergency braking and phantom stops, when the car suddenly brakes for no apparent reason. Find further DVN coverage **here**.

16 June: **TuSimple**, an autonomous driving solution provider, announced that it has achieved a significant milestone by successfully conducting China's first fully-unmanned testing of autonomous heavy-duty trucks on public roads, over 62 km of public roads. TuSimple's fully unmanned testing project in China has been underway for over two years, focusing on the development of an autonomous driving system that meets the requirements of SAE L^4 autonomy.

8 June: **TuSimple** announced their entry into the Japanese market, commencing autonomous driving tests on the Tomei Expressway. The testing route connects the three major metropolitan areas of Tokyo, Nagoya, and Osaka, making it one of Japan's crucial logistics transportation corridors. As reported by Japanese media, the government plans to establish dedicated autonomous driving lanes on sections of the Shin-Tomei Expressway as early as 2024, with commercial operation of L^4 fully autonomous heavy-duty trucks starting in 2026.

DVN-LIDAR DEEP DIVE

DVN-Lidar Deep Dive 3 Docket · 29-30 August in San Francisco



The DVN Triple Workshop is is free for DVN members to attend; find expo booth offerings and nonmember registration fees as well as all other signup information **here**.

29 August

18:30 Welcome of live participants
19:00 Cocktail
20:00 Dinner

30 August

8:30 Opening and introduction of participants

Session 1: Lidar 360° Systems

9:00 Lidar applications for Cars / Trucks (Navistar - tbc)
9:20 Lidar applications for Robotaxis (Hesai-tbc)

Session 2: Lidar Perception Software & Simulations

9:40 Lidar new technologies (Valeo)
10:00 Lidar perception SW & simulations (Siemens-SW)

10:20 Conclusion: 4x questions to the community

10:25 Coffee Break

10:50 Two breakout groups, each discussing two questions.
11.50 Breakout groups - reporting and discussion

12:35 Lunch Break

Session 3: Lidar FMCW Technology

13:50 Lidar components for FMCW lidars (Hamamatsu)
14:10 Lidar components for FMCW lidars (SILC)

14:30 Conclusion: two questions to the community
14:35 Two breakout groups, each discussing two questions.

15:30 Coffee Break

16:00 Breakout groups - reporting and discussion
16:30 What did we learn together?

17:00 Closure