



TINKER

ENABLING 3D INTEGRATION AND ADVANCED PACKAGING FOR NEXT LIDAR GENERATION FOR AUTONOMOUS VEHICLE DRIVING (PART 1)

23.10.2023

EPIC Online Technology Meeting on LIDARs on Chips

LiDAR in Automotive



This project has received funding from the European Union's Horizon 2020 research and innovation program under the Grant Agreement n°958472, project TINKER.

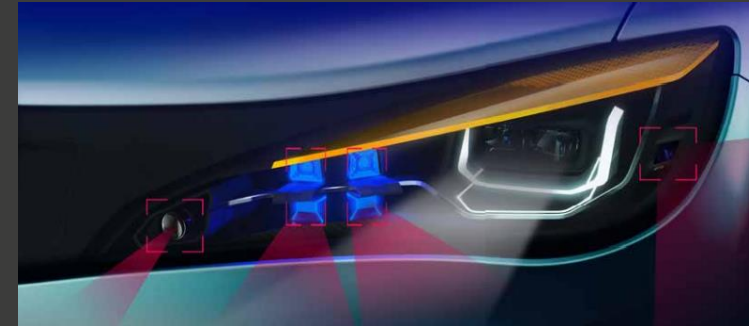
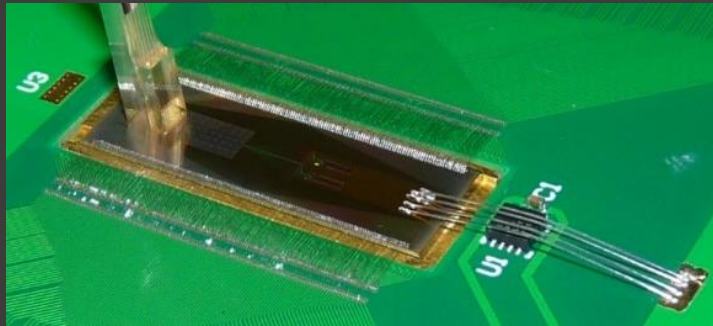
The TINKER project



15 partners targeting the development of a new reliable, accurate, functional, cost-affordable and resource-efficient pathway for RADAR and LiDAR sensor package fabrication using nanoimprint lithography, as disruptive and flexible manufacturing techniques in micro-part assembling.

www.project-tinker.eu

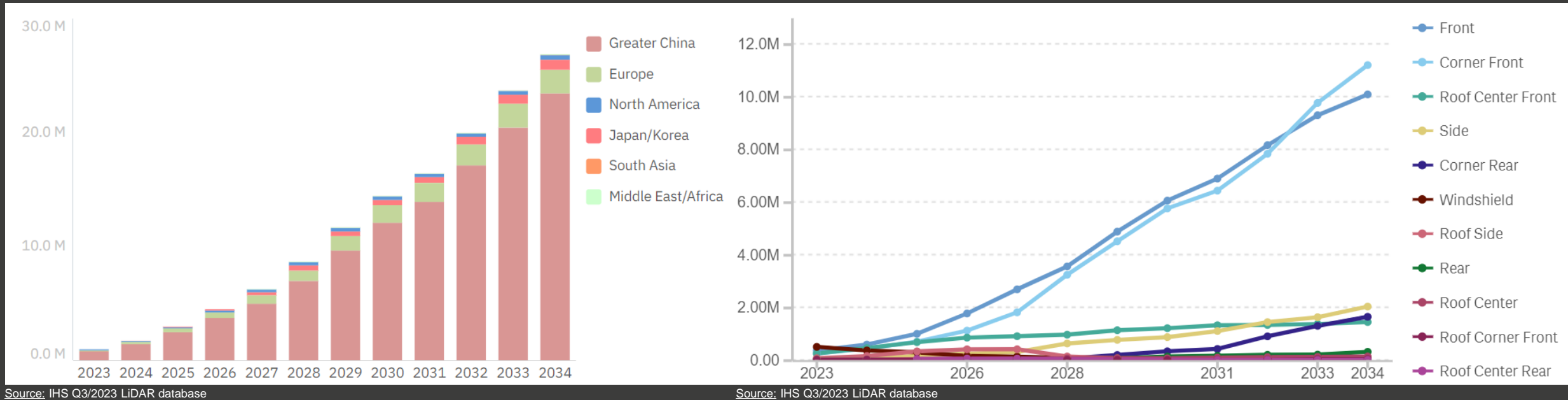
LiDAR in TINKER



OPA-based LiDAR demonstrator with NIL & TSV manufacturing
→ Suited for higher I/O density & faster production
→ A compact technology for easier integration in automotive space

LiDAR market trend

LiDAR Potentials (Mpcs/year/region)



Trend: 10Mp/yr in 2029. Front center & Front Corner steady growth of +1Mp/yr resp. from 2025 & 2026. Side and later Rear Corner to reach 2Mp/yr within 10yrs, Roof coming to a 1Mp/yr plateau from 2026.

STYLING WILL PUSH SENSOR INTEGRATION



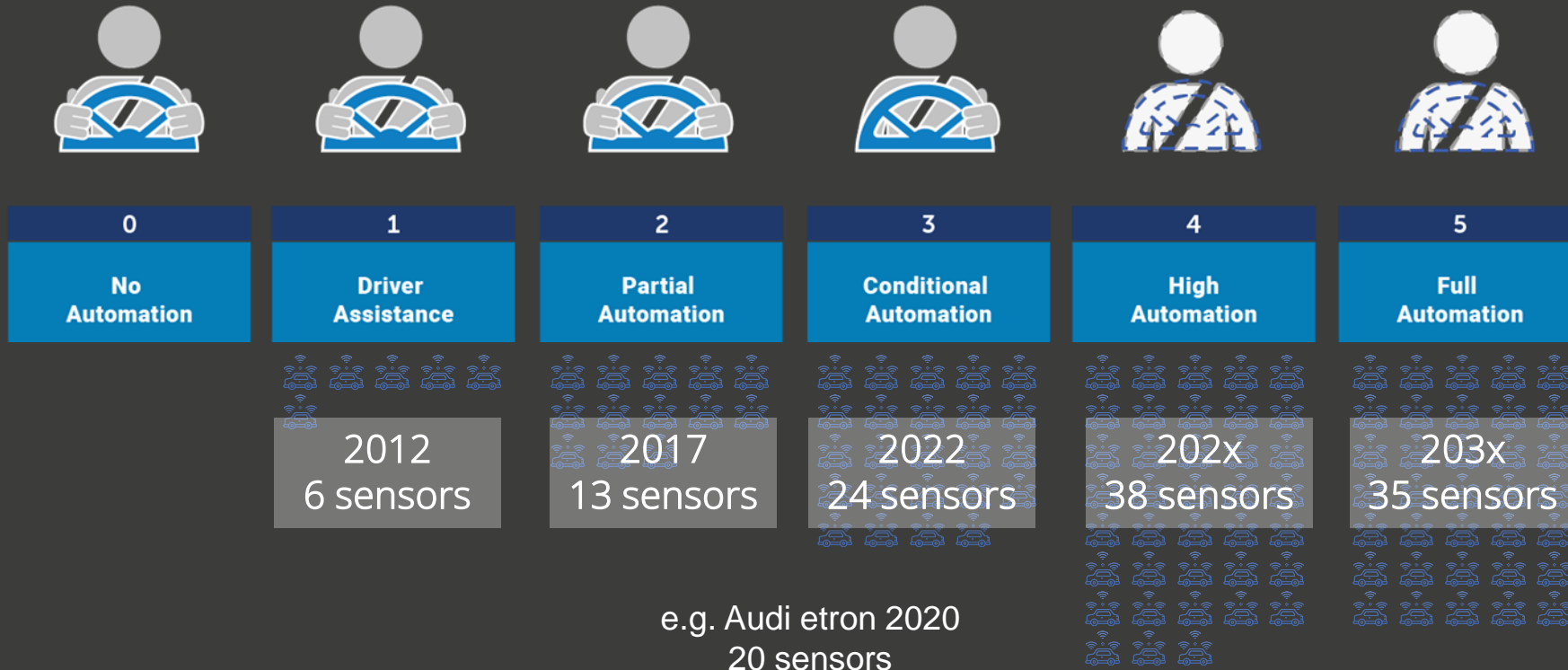
TODAY



FUTURE

Source: Waymo & Toyota

Growing number of sensors = need of space



sources: NHTSA National Highway Traffic Safety Administration <http://www.nhtsa.gov>
 icons flaticon.com
 Yole Imaging for Automotive report, 2019

Smart Corner solution



HEAD LAMP, REAR LAMP, FRONT GRILLE & 360° PANELS AS HOST FOR SENSORS



RADAR
LIDAR
CAMERA (VIS, IR)
V2X COMMUNICATION (LIFI, MICROPHONES,...)

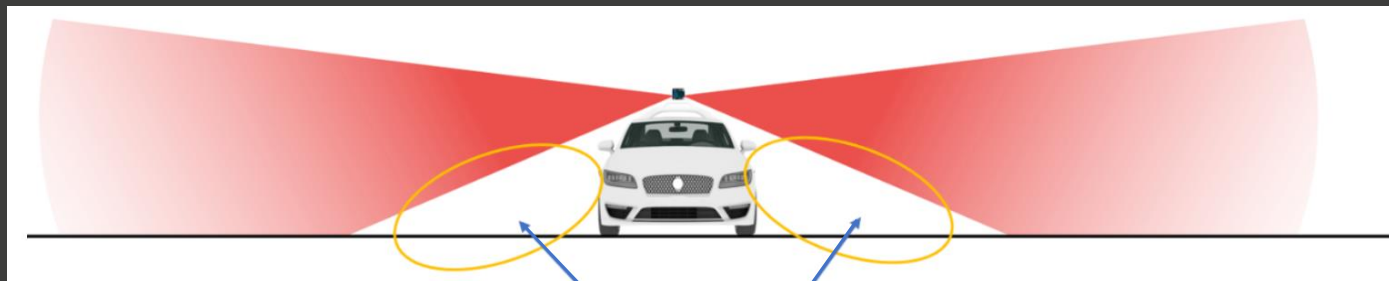


ILLUMINATION FOR SENSORS

LiDAR location?

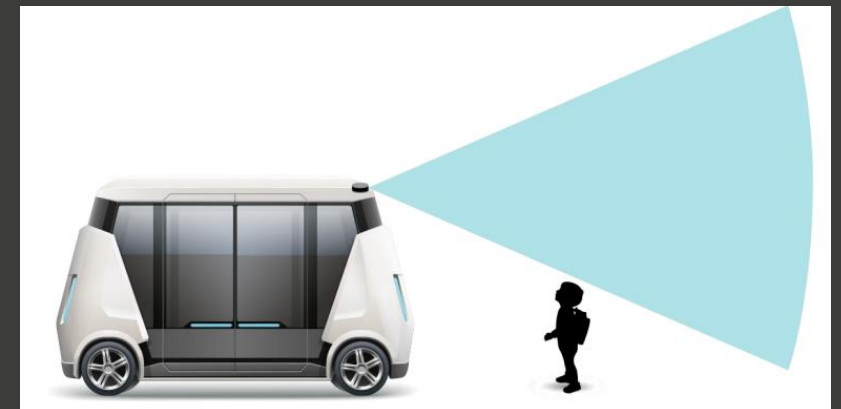
Sensor placement in vehicle must provide a comprehensive field of view (horizontal and vertical FOV)

- minimizing blind spots/dead zones
- maximizing coverage of the surrounding environment (according with the defined ADAS functionality and operating domain)
- considering potential complex occlusions such as mirrors, glass windows or thin pillars



Source: Robosense

blind spots



Source: LeddarTech

Challenges of integration of LiDAR on vehicles

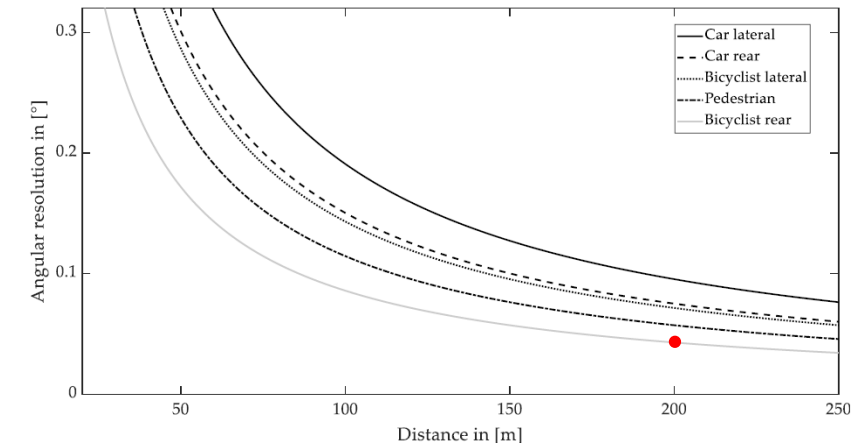
- Cost
- Size and form factor
- Minimizing the impact of weather and environmental condition on LiDAR performance
- Balance of range, accuracy and resolution
- Calibration and synchronization of LiDAR with other sensors
- Real-time data processing

To consider on top, when integrating:

- Reflection, Fresnel reflection losses, Absorption, Ray path
- Beam deflection
- Beam distortion

Considering a motorway speed limit of 130 km/h, LiDAR systems require a minimum detection range of 200m to avoid the worst case of collisions.

Required angular resolution for different objects detection as a function of distance: $0,04^\circ \times 0,04^\circ$ for cyclist/motorcycle at 200m



Source: "Requirements for Automotive LiDAR Systems", Zhouqun Dai et. all, Sensors 2022

Smart Corner advantages



 ENVIRONMENTAL PROTECTION

 CLEANING SYSTEM

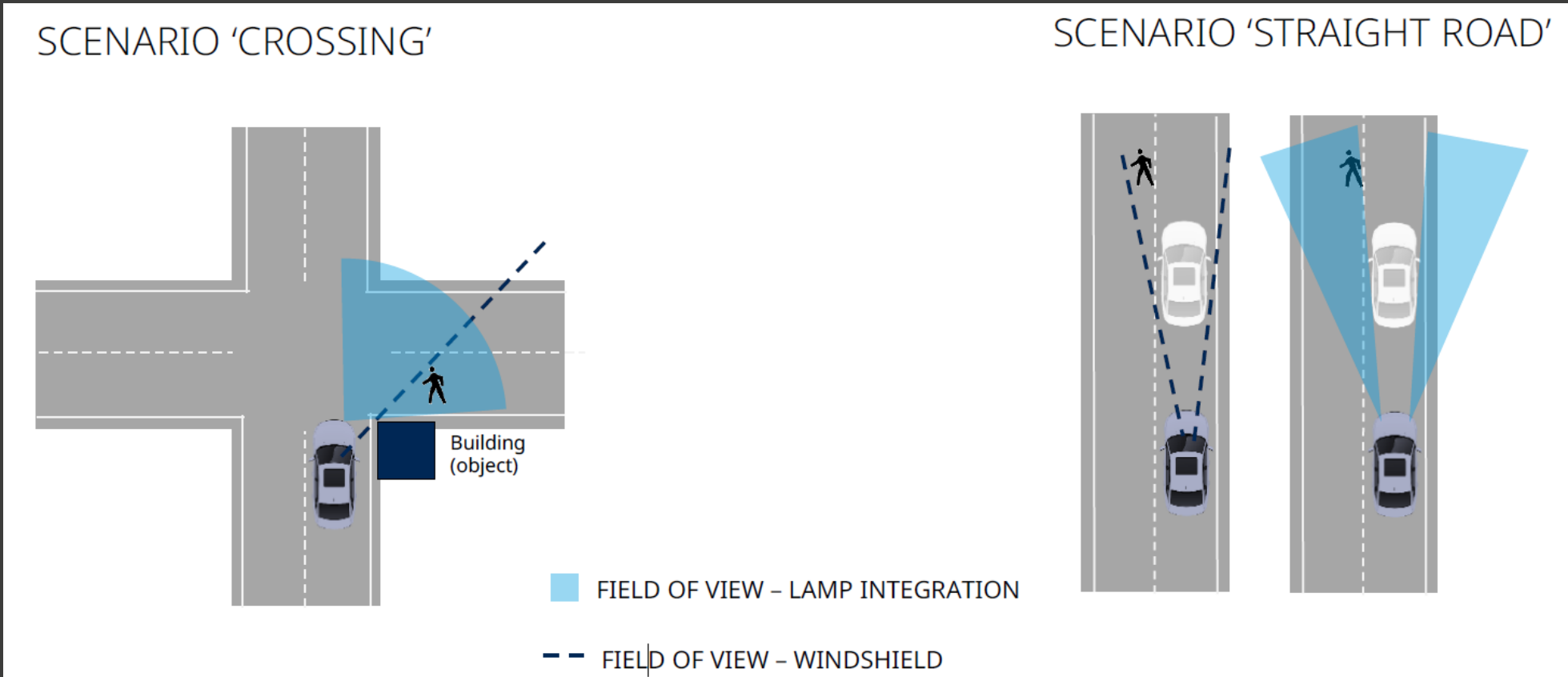
 HEATING SYSTEM

 WIRING

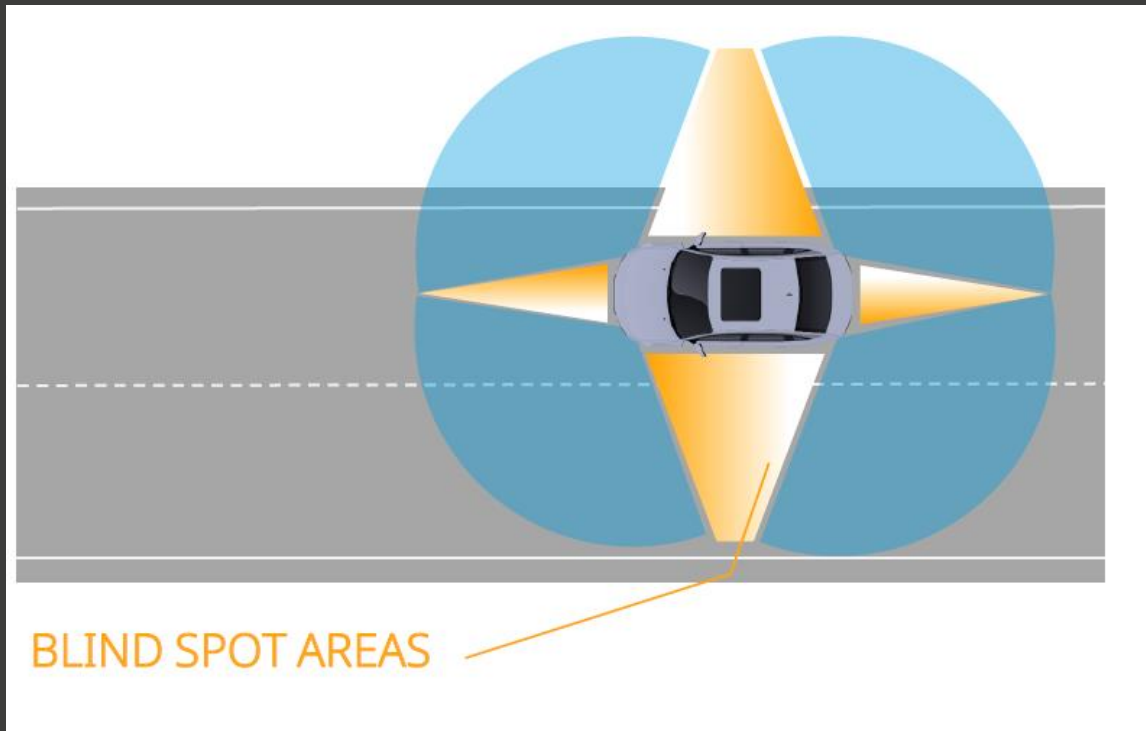
 FIELD OF VIEW LEVELING

 AESTHETICAL INTEGRATION

Field of view benefit



Limits



Sensors in Headlamps and Rear Lamps:

- Can recognize Objects Earlier
- Can provide an larger Sight angle
- But cannot bring 360° Surround View



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Thank you!