

PURE SOLID STATE  
**EMBEDDING LIDAR**

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# LiDAR Bumper and Grill integration

- Simple integration, not interfering with design
- Good detection of small object (tire, palette)
- High exposure to stone chipping and dirt
- Limited FoV due to position
- Easily occluded by other traffic
- High risk of LiDAR damage in minor accident



# LiDAR Roof Integration

- LiDAR integration at front edge of the roof or header rail
- Good mounting position for far field FoV
- Good lane mark detection
- Good protection from damage
  
- LiDAR performance degradation by beauty cover
- Complex cleaning system
- Complicated thermal management
- Aerodynamic penalty
- Complex roof design and integration process



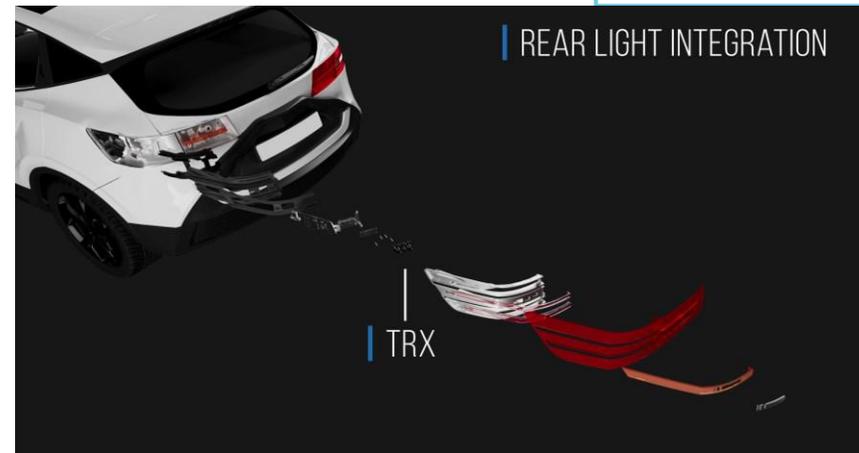
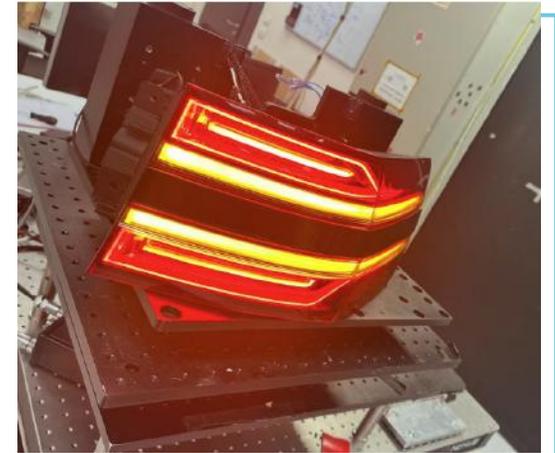
# LiDAR Windshield Integration

- LiDAR integration behind the windshield
- Good mounting position for far field FoV
- Good lane mark detection
- Good protection from damage
- Existing cleaning system
  
- Necessity to adapt sensor performance
- Size constraints for sensor
- Complex thermal management
- Strict noise requirements



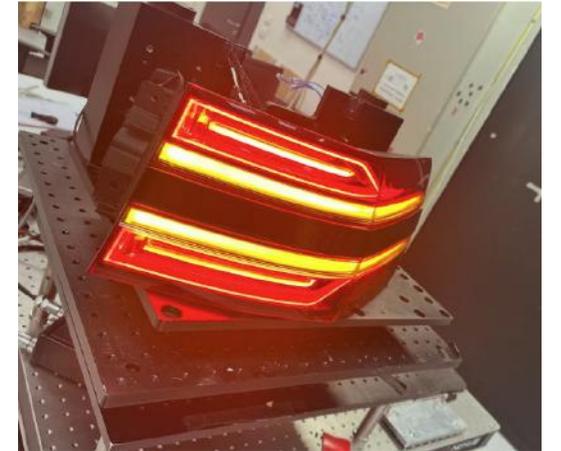
# LiDAR lamps Integration

- Integration into front or rear lamp
  - Good position for surround sensing system in corners of car
  - LiDAR is mounted as part of lighting block
  - LiDAR can act as design element
  - Already existing cleaning system (front lights)
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- Increase of lamp cost as spare part
  - Complex thermal management when high beam is running
  - Size constraint for sensor



# Distributed system

- To avoid blind zones and cover different use cases Opsys' distributed system provides best solution
- For example, front sensing can be covered by next combination:
  - Long-range sensor behind windshield
  - Short-range sensor in the four lamps
- Extends system availability (added redundancy)

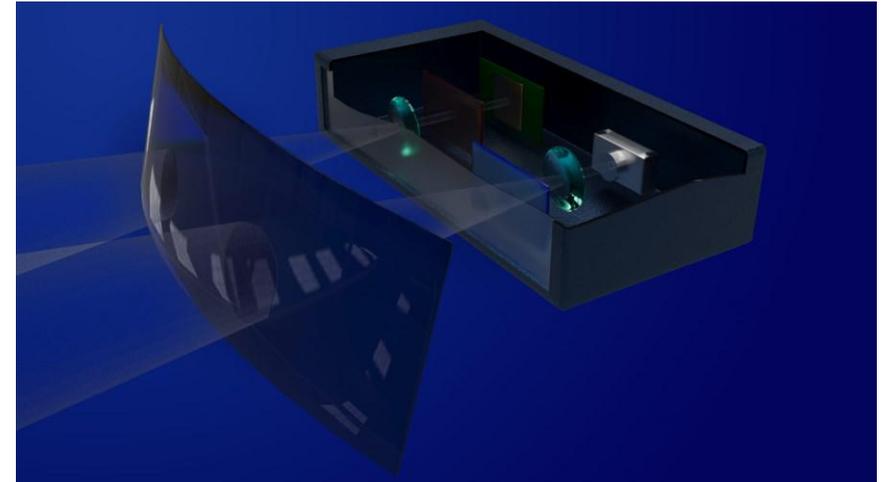


# “Box” Integration Challenges

- Majority of LiDARs comes as a “box” solution, with hermetically sealed housing
- Arrangement is necessary to protect optical path from contamination and displacement

## **This poses significant challenge for integration:**

- Inflexible size, requiring additional volume
  - Difficulty to seamlessly integrate in restricted volume without disturbing vehicle design
  - Complicated cooling mechanism due to lack of airflow or complicated thermal path
  - Performance issues due to additional cover element between LiDAR optic and outer surface (windshield or lamp cover)
  - Longer distance between LiDAR optic and outer surface
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- As a result, LiDAR integration often looks out of place and is not a fitting design



# Opsys LiDAR Base Module

## Compact, Reconfigurable & Scalable

- Opsys solid-state LiDAR sensor is based on semiconductor components that don't require any mechanically moving parts
- Compact module integrate complete LiDAR optical head, providing basic point cloud features as direct output
- Module contains necessary dust-proofing, does not require pristine environment
- Due to its smaller functional volume, can be variably integrated into different parts of vehicle without negatively affecting aesthetics



*Opsys' LiDAR is smaller than a credit card*



**Fast scanning**



**High-resolution**



**Automotive-grade**



**Infinitely scalable**



**Low power consumption**

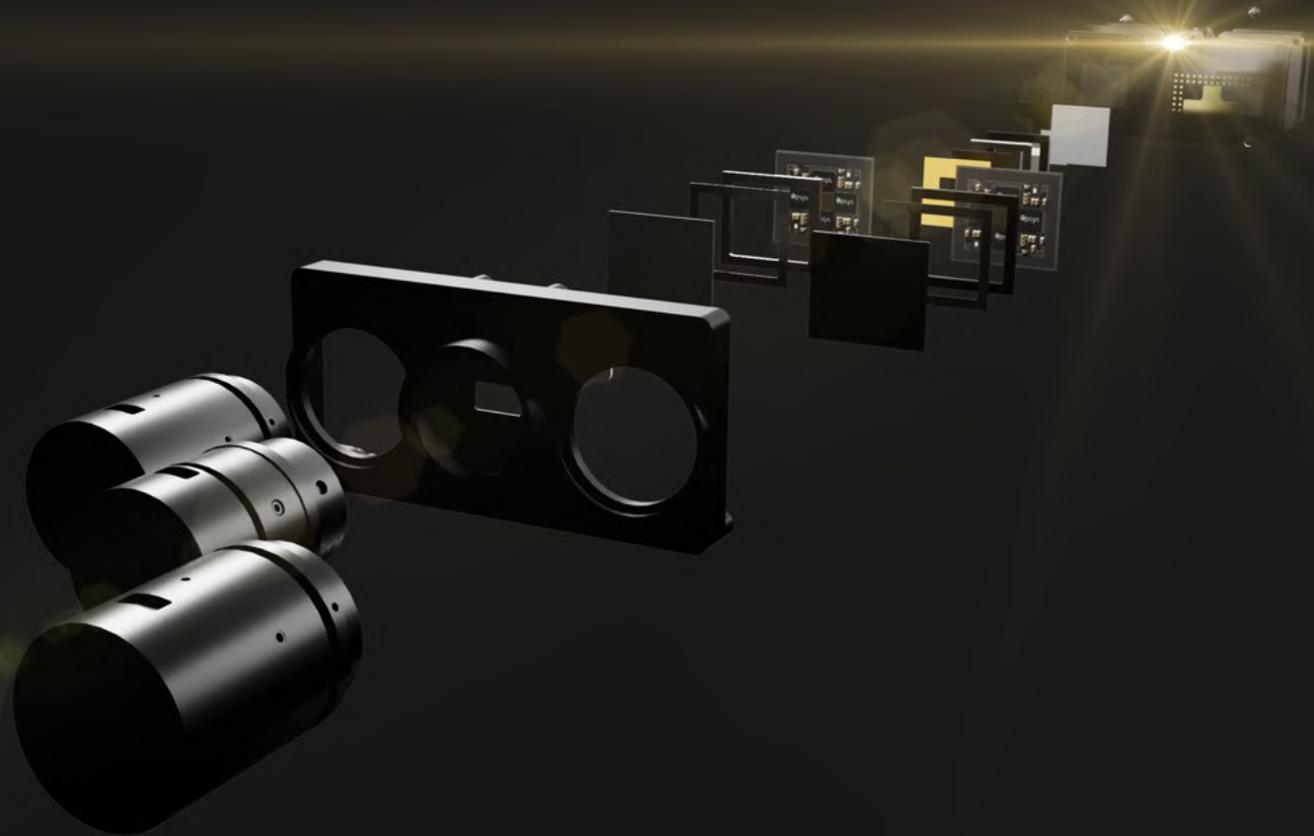


**Cost-saving**



**Semiconductor-based**

# INTRODUCTION VIDEO



<https://youtu.be/bF4FPXkw8zw>

# Windshield Integration Demo

## Opsys' Solution

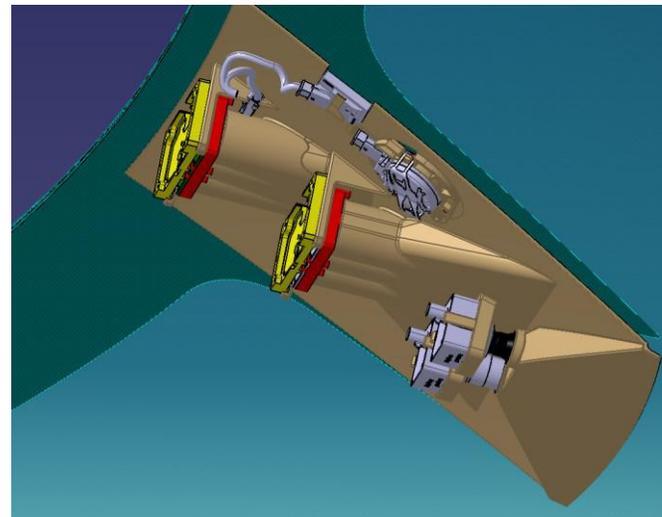
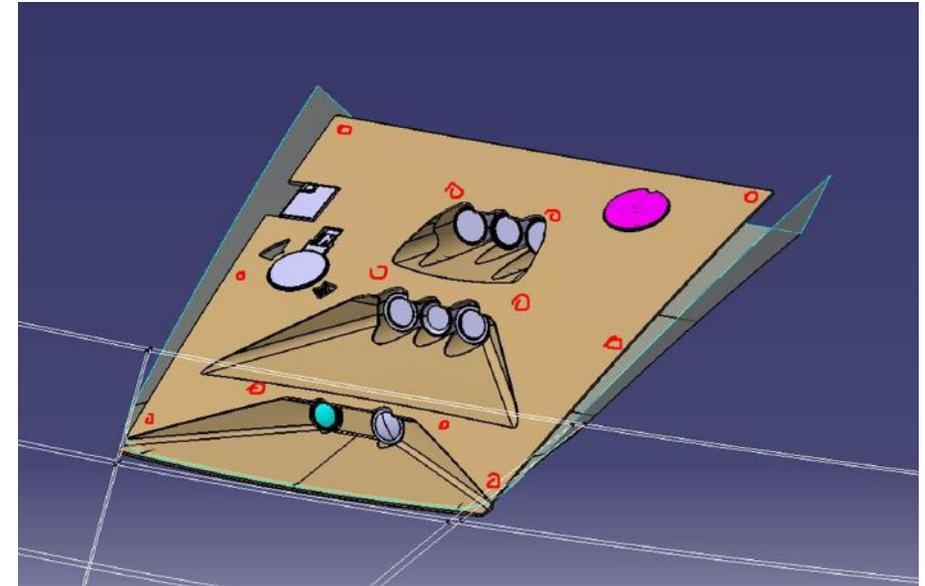
- Example of vertical stack of modules for 80°x 23° FOV
- Collaboration with Wideye
- Less than 10% difference on effective range compared to standalone solution

### Opsys: B-Sample maturity level

- Regulation fit
- Thermal management analysis performed
- Optical integration analysis and tests performed

### Solution includes other typical sensors & parts:

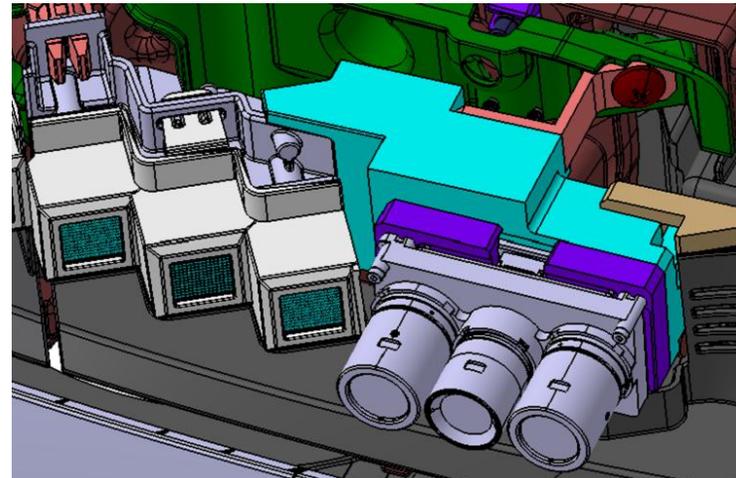
- Rain/Light sensor
- Wide FOV camera
- Narrow FOV camera
- Cable harness
- Pressure / humidity valve



# Headlight Integration Demo

## Opsys' Solution

- Demo covers typical set-up for Highway Pilot: wider FOV with high-resolution Rol in the center
- Modules are distributed between both front headlight
- Modules don't need a special optical cover, they use the regular lamp cover
- Modules within lamp are synchronized and controlled by Headlight Control Module
- TRX is utilized as design element



T H A N K Y O U

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