

# Versatile use of LiDAR modules into Smart Corner and grille DVN 4<sup>th</sup> LiDAR Conference

November 15, 2021

# Marelli – a global player







# Marelli JDA with Xenomatix A partnership of strong Technologies

JDA and first related SOW has been signed beginning 2020





- Partner in LiDAR components development
- Technology provider: developer of the LiDAR core system
- Main interface to OEM with Tier1 responsibilities
- Leading the integration of the application with XenomatiX
- Responsible for :
  - Project timing and quality & costs
  - Final assembly
  - Delivery
  - Validation
  - Standards and norms compliancy (IATF, A-SPICE, ISO26262, SOTIF...)

# Marelli Lidar Modules Value Proposition Modular





ALX30 Module	
FOV (h x v)	30°x15°
Resolution (h x v)	0.15°x0.15°
Range@10%R	200m (656ft)



ALX45 Module		
FOV (h x v)	45°x22,5°	
Resolution (h x v)	0.22°x 0.22°	
Range@10%R	110m (361ft)	



ALX60 Module	
FOV (h x v)	60°x30°
Resolution (h x v)	0.3°x0.3°
Range@10%R	50m (164ft)

- Standard base modules can be combined to create different configurations
- Final LiDAR could be packaged around up to 4 modules
- Reuse of already validated base modules will
  - reduce risks
  - secure faster 'time-to-market'
  - Reduce development costs
  - limit investments

# **Modular approach** Key features

- No moving parts → A True full solid-state LiDAR
- No scanning → All declared performances values available at the same time
- High design flexibility and reuse → For Standalone, grille or Smart Corner integration: lower development effort and time
- Based on already proven and automotive qualified technologies → combination of standard CMOS imager and last generation VCSEL array
- Hosting a Classification ECU with our AI Software





# Versatile use of our LiDAR modules





# **ADAS Applications – Stand Alone LiDAR sensor** Traffic Jam Chauffeur/Highway Pilot solutions



We develop custom LiDAR solutions to deliver the required functionality. Below configuration is an example to support L3 or L4 autonomy.



Feature	Value
HFOV	120° with 30° center ROI
VFOV	30° with 15° center ROI
Max range	200m @10%R inside ROI 50m @10%R outside ROI
Embedded	Classification SW, de-icing, cleaning system



Actual part, embedding our Classification ECU



# Sensor Integration: Smart Corner<sup>™</sup> Advantages of sensor integration into lamps





# New EV grilles with sensors integration



Marelli and SMRP BV (Motherson Group) sign a technological partnership for Smart Illuminated exterior parts of vehicles

#### 2021/07/28



SMART ILLUMINATED PANELS AND GRILLS ENABLE INNOVATIVE DESIGNS WHILE INTEGRATING SENSORS AIMED AT ADAS AND AUTONOMOUS DRIVING

#### July 28th 2021

Name: Automotive Lighting the lighting division of leading disbel automotive suplimit Marelli, and Samardhana Methemas Automotive Systems Coroug (MME IIV), one of the world's largest manufacturers of interior and externs components for the automotive industry. These signed a MOO Meensandhum of Develorationful of teaplone may extended place and the second on the second and the second in the second second second second second second second second and hold have a second second the second second second second and hold have a second second the second second second second there automotive (MAC) and Automotive Development and Automotive Developments (MAC) and Automotive Direkt Second secon

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Lidar

DISPLAY

CAMERA

RADAR LiDAR

CARBODY LIGHT

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PREVIOUS NEWS

MAIN LIGHT FUNCTIONS

- SIGNAL LIGHT - GROUND PROJECTION

**ILLUMINATED LOGO** 

GROUND PROJECTION

1 LIGHTING

MAREL

# LiDAR & AI SW: our SmartMeUp technology offering

To secure a higher level of redundancy, a non-imposed and LiDAR specific AI SW solution is relevant.







#### Usual LiDAR outputs can be following:

- **Objects Detection & tracking** 1.
- 2. **Objects Classification**
- 3. Object 3D boxing («deep pose estimate»)

AUTOMOTIVE

MARELLI

Free Space identification 4.







3. BOXING

# **Classification Software**

Our solution



- Artificial Intelligence SW developed by a dedicated team inside Marelli organization
- Combined deep learning (Neural Network) and rules-based approach for redundancy (Safety)
- 3D objects detection and classification
- Road profile, free space and lane/barrier models recognition
- Scenario (construction,...) and sensor health information







# **Project facts**

#### Duration

**10.2020 – 09.2023** 

### Consortium:

- 10 key industrial partners
- 3 research institutions
- 2 consultancy and service associations

### Online pressence:

- Website: <u>www.project-tinker.eu</u>
- LinkedIn: <u>linkedin.com/in/tinker-eu</u>
- Twitter: twitter.com/project\_tinker





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



# **Motivation**

## Market need

- Lowered weight
- Lowered power consumption
- Lowered sensor size and costs
- Improved performance and reliability
- Improved safety of ADAS systems

# Industrial pull

- Improved miniaturization level
- Use of Through-Silicon Via (TSV) for interconnections
- Expand use of Nanoimprint Lithography (NIL)



<sup>©</sup>BFSI

**ASSEMBLY** 

Pick & Place

Bonding



#### Bare die

- LIDAR
- RADAR

# PILOT PLATFORM



Inspection

Compensation



ADDITIVE MANUFACTURING

Inkjet printing

Nanoimprint lithography



(TINKER)

#### Sensor package

- LIDAR
- RADAR



# Silicon chip-scale LiDAR developed at CEA-Leti



**OPA-based LiDAR demonstrator** 

Wire Bonding to Command board	Conventional interconnections with wire-bonding
	Inexions Thermal shifters command
	Wave guides & phase shifters
SOI substrate	
Si Substrate	



OPA-based LiDAR demonstrator with NIL & TSV manufacturing  $\rightarrow$  suited for higher IO density & faster production

#### Through-Silicon Via (TSV) for interconnections

TINKER







# 2021:

- Definition of market requirements
- Setup of dislocated pilot line and supporting tools
- Process and material development

# 2022:

Fabrication of RADAR and LiDAR prototypes via pilot line

# **2023:**

Demonstration and validation



# Thanks!