



# LiDARs Leading the Autonomous Driving

# AutoL Business Overview

## ■ AutoL is a company specializing in high-resolution lidars for autonomous driving

- ✓ Launched as an in-house startup by Hyundai Motor Company in 2019
- ✓ The mission is to break the problems of size and cost of lidar, which are currently an obstacle to the popularization of autonomous driving.

## ■ General Information

Company/CI	AutoL Co.,Ltd.	
CEO	Yongsung Lee	
Founding Date	2021. 4.30	
Employees #	12 people	
Capital	\$200,000	
Major shareholders	Founders	72.2%
	Hyundai Motor Group	12.8%
	Schmidt Co.,Ltd.	10.0%
	Itops Automotive	5.0%

## ■ Main business and place of business

LiDAR development and sales	
Lidars for Autonomous vehicles and Logistics/Delivery Robots	Object recognition algorithm (planned) and application SW

Workplace		Location
Rep.of Korea	Head office	Pangyo 2nd Techno Valley, Seongnam-si, Gyeonggi-do

# Market Status and Problems

## ■ Problem 1 : Big size

- ✓ Self-driving cars of global companies are mounting multiple large lidars on their roofs, greatly damaging the appearance of the vehicles.
- ✓ Volume increases while using multiple light sources and light sensing modules.



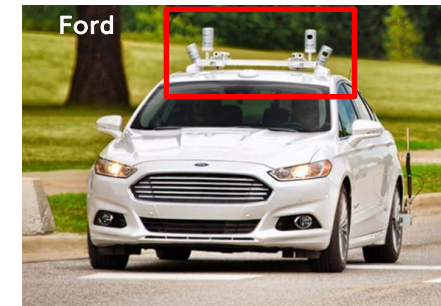
Google

[ HDL-64 :  $\phi$ 223 x 283mm ]



GM

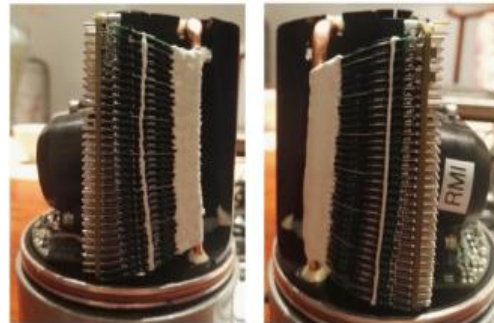
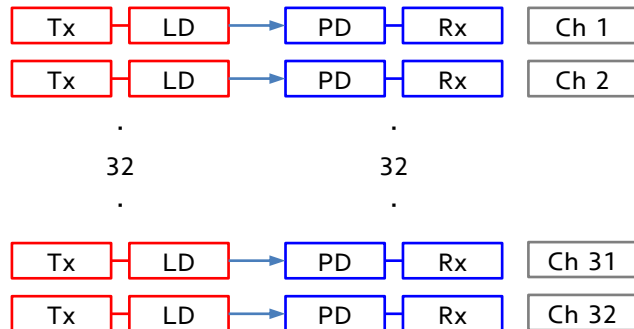
[ VLP-32 :  $\phi$ 103 x 87mm ]



Ford

[ HDL-32 :  $\phi$ 85 x 144mm ]

- ✓ Cause : Multiple light sources and multiple sensors are used for high resolution.














[Internal Tx/Rx module] of HDL-32

- 1 light sensor corresponds to 1 light source : Use of 32 Tx/Rx modules  
→ increase in volume
- When assembling, optical alignment of all channels is required  
→ Increase in manufacturing cost

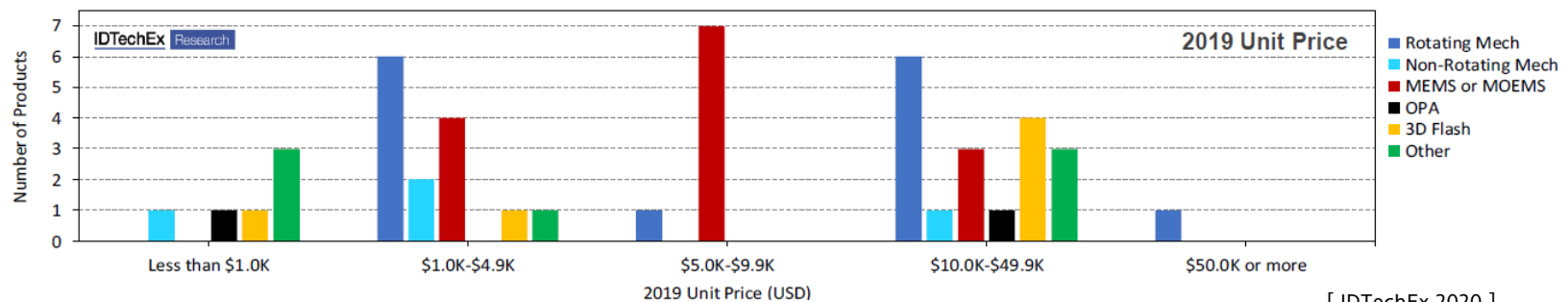
# Market Status and Problems

## ■ Problem 2 : Expensive price

- ✓ The lidar with 16 channels or more is priced in the range of \$2,500 to \$75,000.
- ✓ Lidars under \$1,000 are low-resolution and short range products.

라이다							
메이커	 	Velodyne LiDAR	Velodyne LiDAR	Velodyne LiDAR		OUSTER	ibeo 
모델	Scala2	HDL-64	HDL-32	VLP-16	RS-32B	OS-1	Lux (xx)
채널수	16	64	32	16	32	64	4-8
크기(mm)	107 x 94 x 65	223 x 283	85 x 144	103 x 72	114 x 108	80 x 74	85 x 128 x 93
가격(\$)	\$2,500	\$75,000	\$29,900	\$8,000	\$16,800	\$12,000	\$10,000~20,000

[ Yole Report 2019 ]



# Market Status and Problems

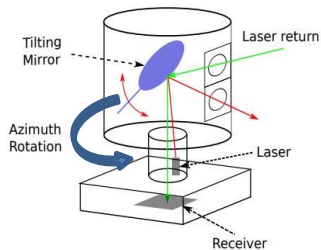
## ■ Problem 3 : Lack of durability

- ✓ Insufficient durability to the car environment exposed to extreme cold and heat.
- ✓ Lack of durability against road vibrations occurring during driving.



### Insufficient temp. resistance of slip ring

- The operating temp. of the slip ring is  $-10$  to  $60$  °C → Not suitable for automobile specifications ( $-30$  to  $105$  °C)



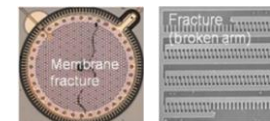
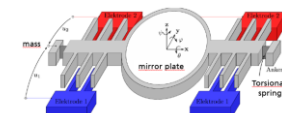
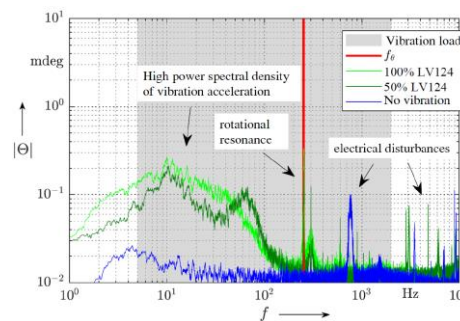
[Structure of rotating lidar]



[Slip ring of VLP-32]

### Vulnerable to vibration/shock

- Natural freq. of lidar parts is within the vehicle vibration freq. range → damage occurs

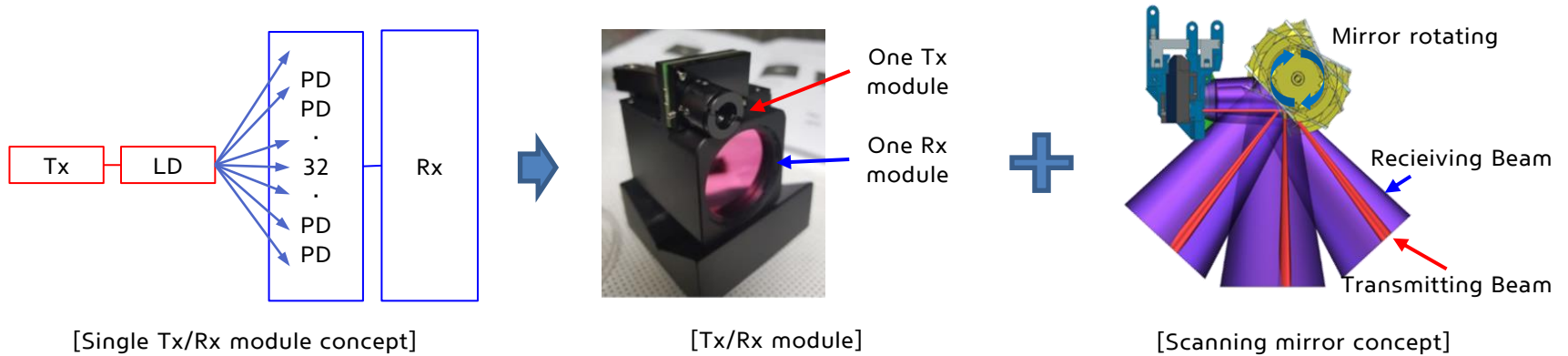


[ Fracture Analysis of MEMS mirror]

# Solution

## ■ Compact, low-cost lidar with automotive environmental durability

- ✓ 32-channel lidar with one Tx/Rx by applying high-sensitivity technology (Patent).
- ✓ Satisfies the performance and durability requirements of autonomous vehicles.
- Single Tx/Rx → Small size and low cost by simple structure and optical alignment



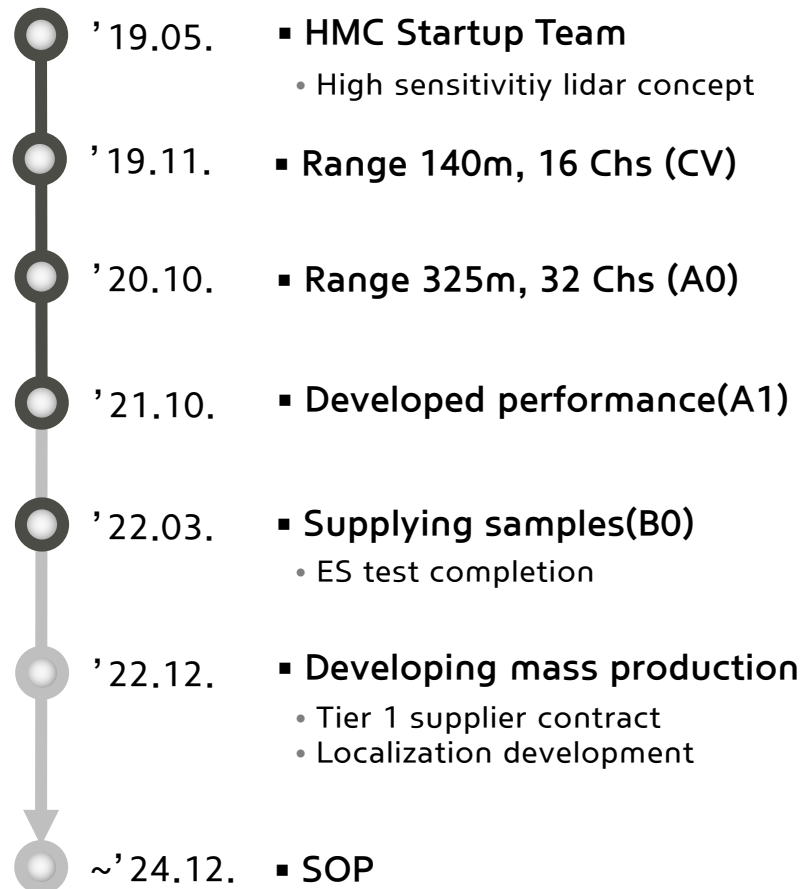
## • Satisfying Hyundai Motor's ES : Environmental durability evaluation

Leg1	Leg2	Leg3	Leg4	Leg5	Leg6	Leg7

Confidential

# Product Developments

- ✓ B sample is provided in March of '22 and the target of localization of automobiles in '24
- ✓ Since Feb. '22, a headlamp with built-in lidar is being developed with a lamp company



## Stand alone type ( '22. 3. Sample offer)



### ❖ M32 (B Sample)



- Range 150m@10%
- Size 90 x 70 x 60mm

### ❖ G32 (B Sample)



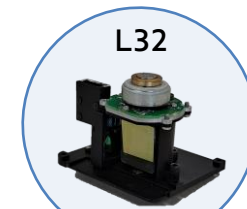
- Range 300m@10%
- Size 133 x 99 x 65mm

## Built-in lamp type ( '22.2 ~ '22. 12 Development)



L32

- M32 module



FoV(H) 135 °

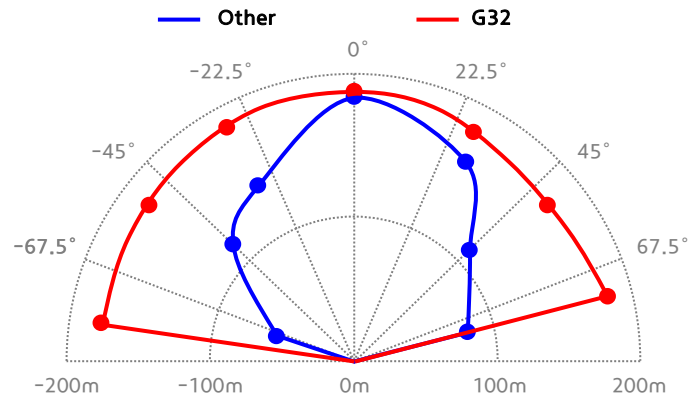
- FoV 135 ° x 16 °
- Range 150m@10%
- Size 85 x 60 x 45mm
- Joint development

# Detection Performance

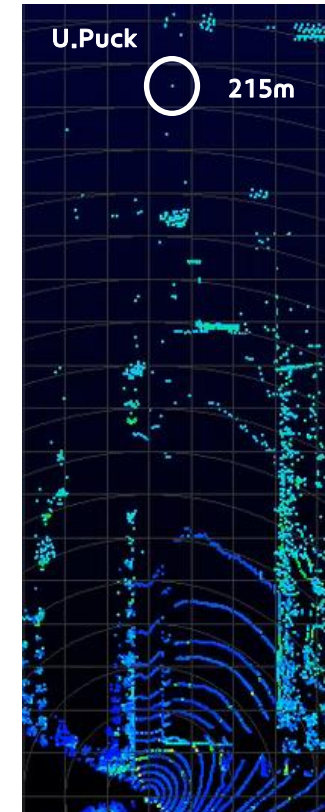
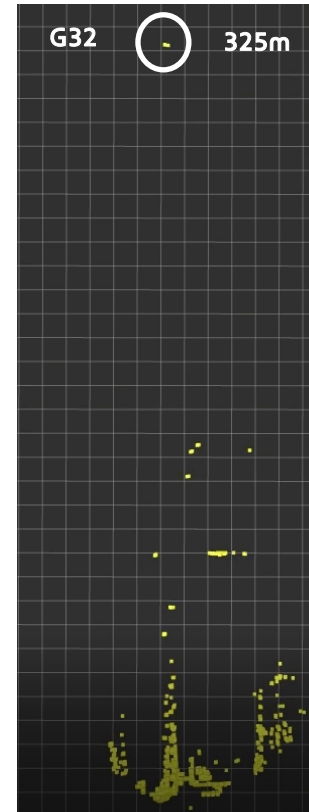
- ✓ The outdoor detection performance of the G32 A0 sample was superior to V's Ultra-Puck.
- ✓ Detection performance remains uniform across the entire horizontal field of view.



[Detection range test of G32 A0 sample]



[Detection range with horizontal field of view]

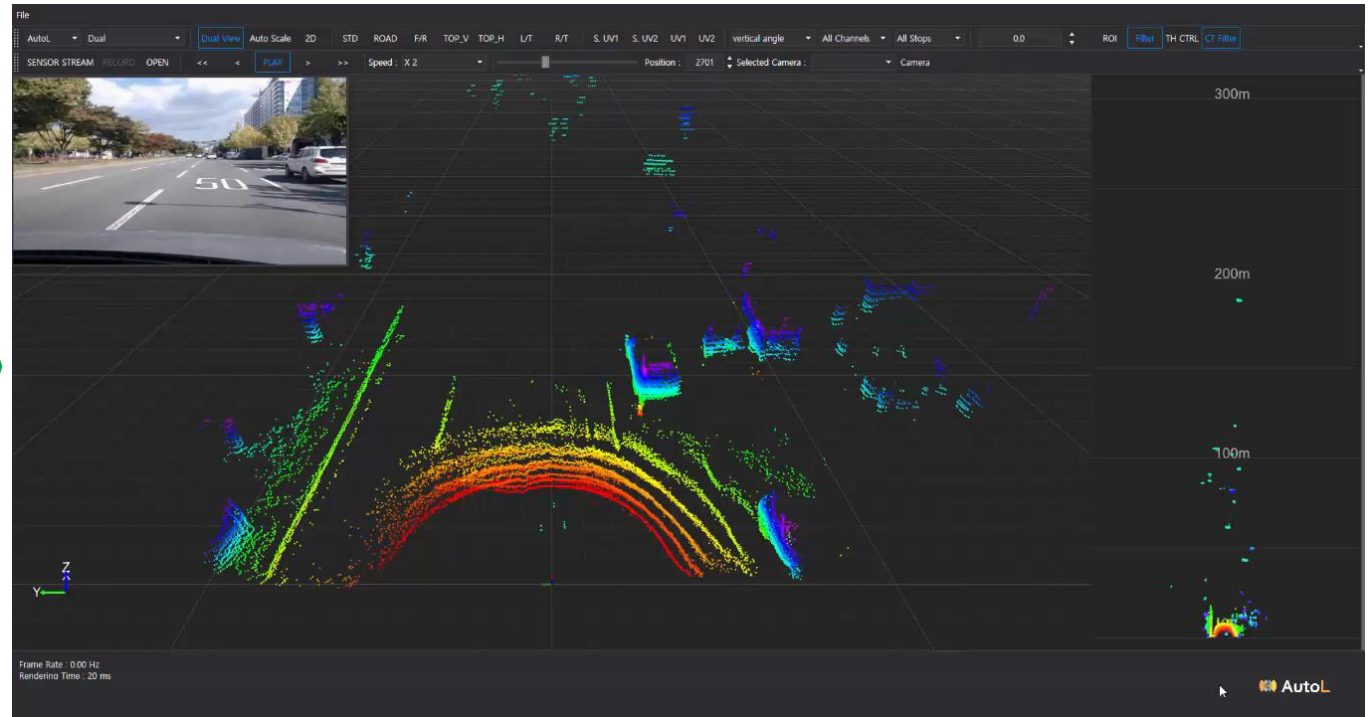


[Detection range : G32(left), Ultra-Puck(right)]



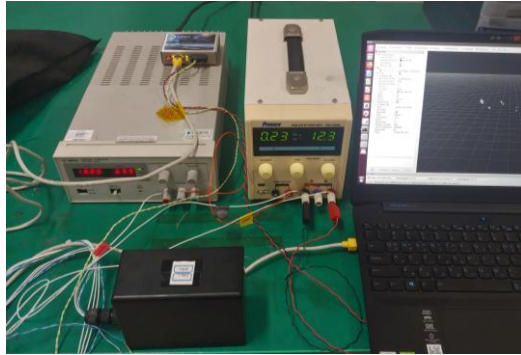
# Detection Performance

- ✓ Vehicle-mounted driving evaluation of the G32 A1 sample
- ✓ Front 180° detection is possible by installing two lidars (Exhibited at the 2021 DIFA)

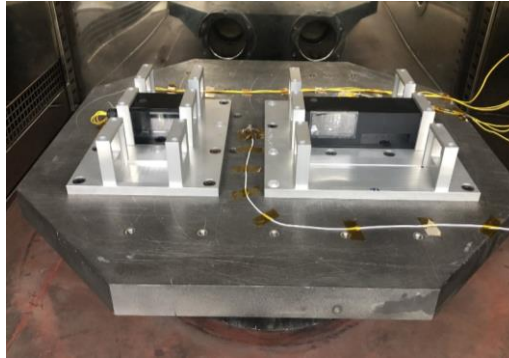


# Environmental Durability Test

- ✓ Hyundai Motor Company's ES tests are in progress.
- ✓ All items are OK except for high temperature and drop test → Improve for the B0 sample



[Over voltage test]



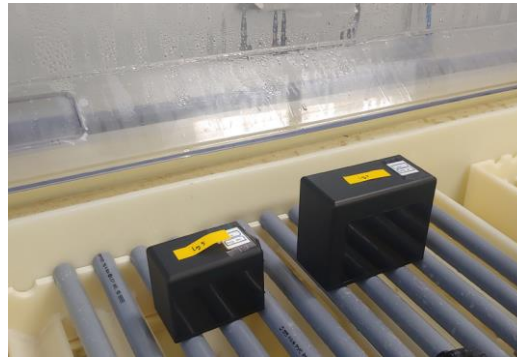
[Vibration test]



[Water proof test]



[Temperature cycle test]



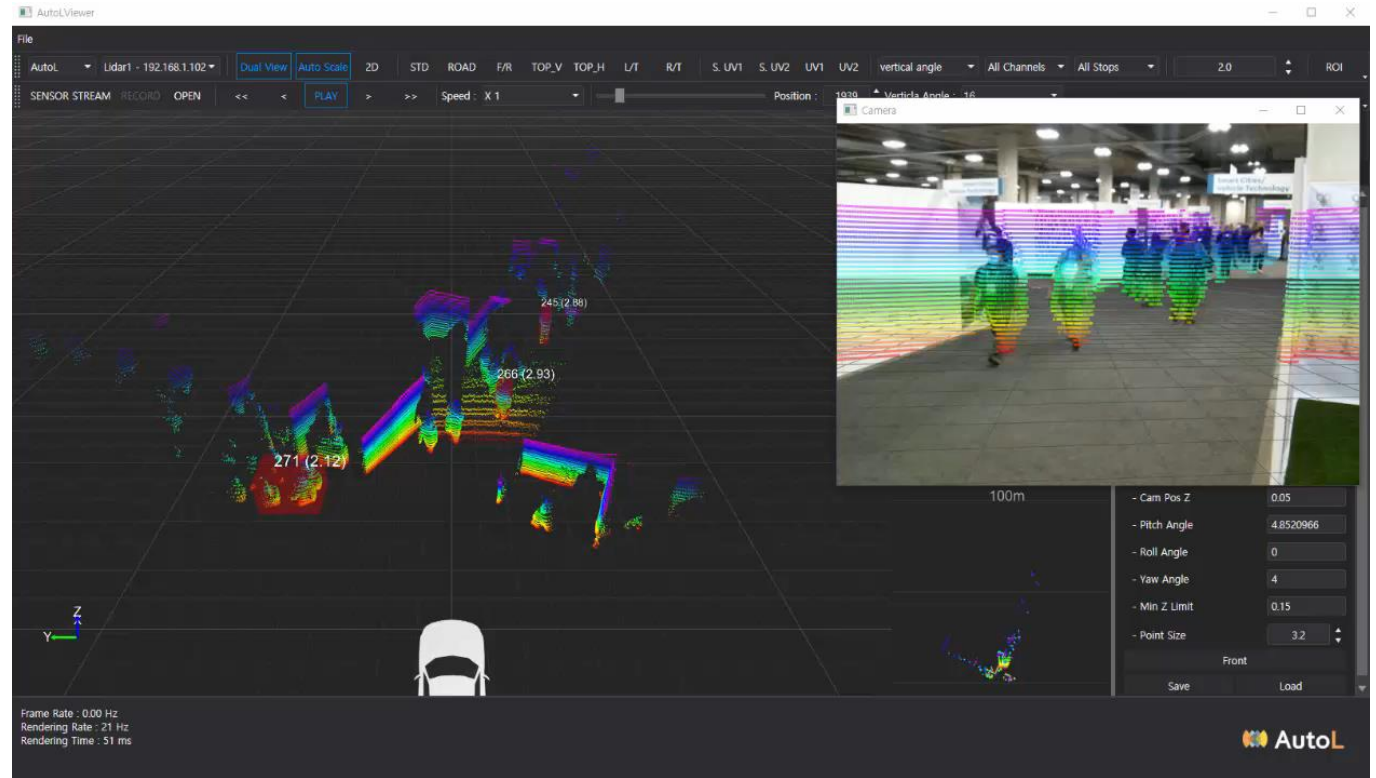
[Salt spray test]



[Drop test]

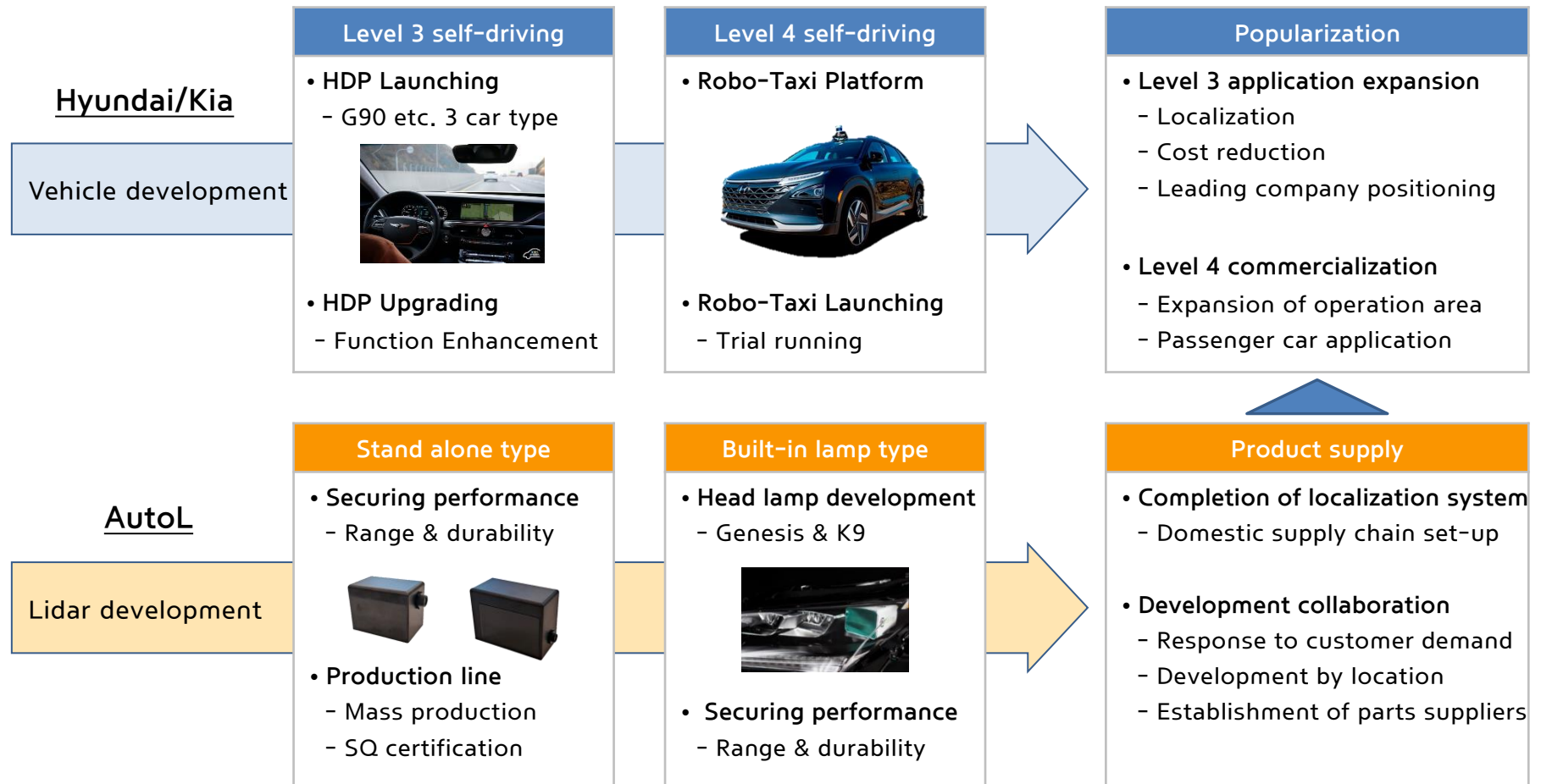
# Participated in CES 2022

- ✓ Exhibited at Eureka Park Zone ('22.01.05 ~ 07)
- ✓ Demonstrated moving target detection with M32 A1 sample, attracting a lot of attention



# Collaboration with Hyundai Motor/Kia

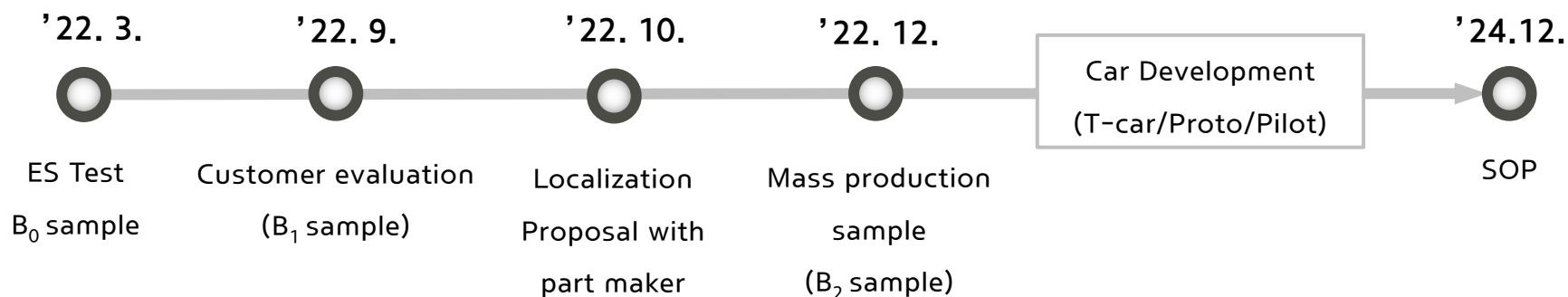
- ✓ Hyundai Motor/Kia develops world-class self-driving cars in a timely manner.
- ✓ AutoL develops and supplies lidar meeting the requirements of Hyundai Motor/Kia.



# Milestone

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- Mar. 2022 : Securing ES and providing samples (B0) to primary parts makers
- Sep. 2022 : Evaluation of primary parts makers and reflection of requirements
- Oct. 2022 : Proposal for localization development (design/purchase)
- Dec. 2022 : Car models selection and start of mass production development
- Dec. 2024 : Development and mass production application



# Appendix. Product Specification

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G32

- A high-resolution LiDAR suitable for forward detection of autonomous vehicles with a range of 300m or more.



M32

- A high-resolution mid-range LiDAR suitable for lateral detection of autonomous vehicles with small size.

## ➤ G32 / M32 Specifications

- No. of channel : 32
- Detection range : 300m / 150m @10% reflectivity
- Distance resolution / accuracy : 4mm / Up to 30mm
- Field of view / resolution : 135° H x 16° V / 0.1° H x 0.5° V
- Frame rate : 25fps
- Size (L x H x W) : 133 x 65 x 99mm / 90 x 70 x 60mm

Thank you



**AutoL**