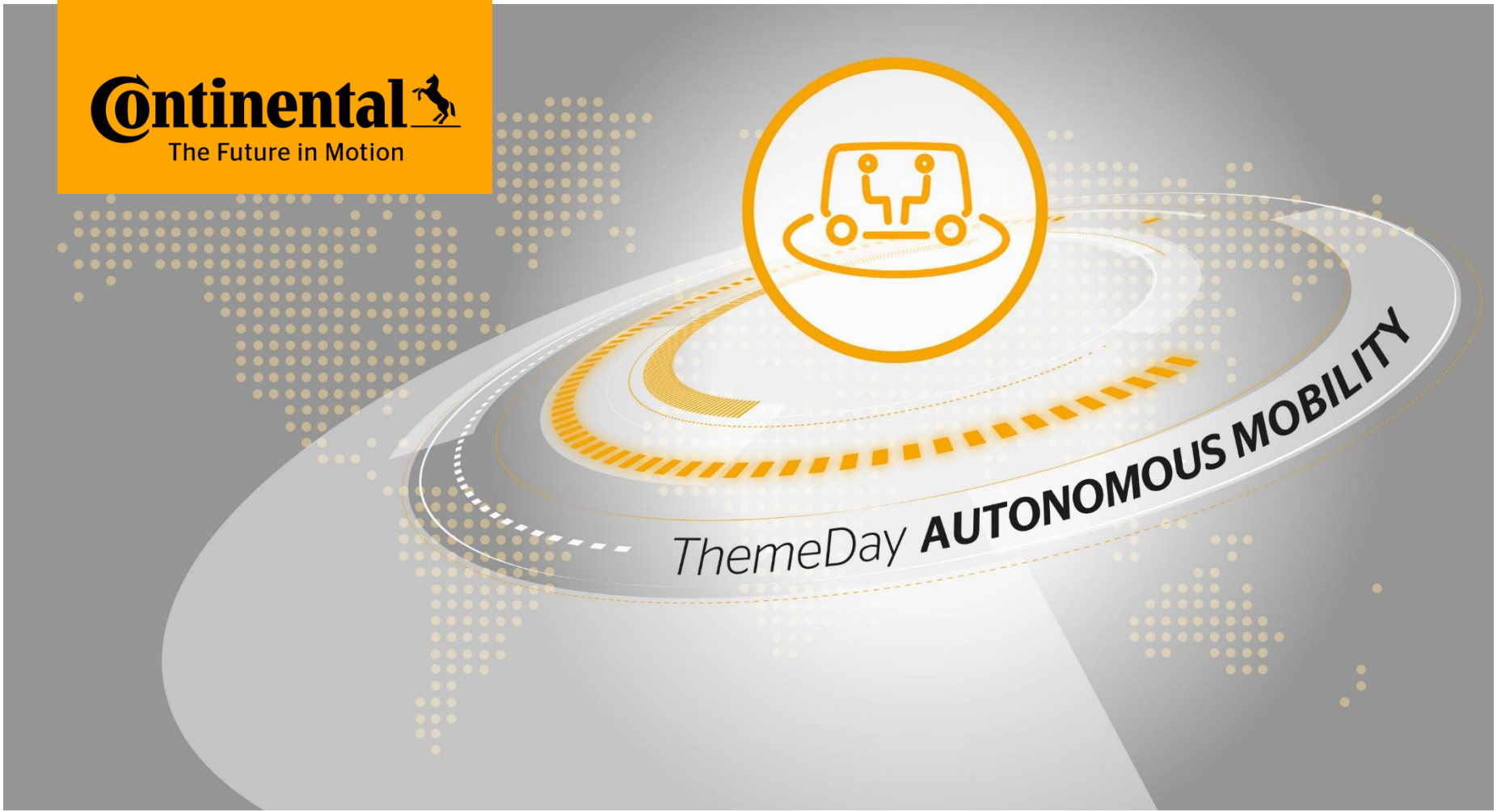

Continental
The Future in Motion
ThemeDay AUTONOMOUS MOBILITY

TechTalk

From Vision to Perception - Sensor Data Fusion and Comprehensive Environment Modelling

Todays Speakers

Dr. Ismail Dagli

Senior Vice President R&D, Business Unit ADAS

Dr. Gunnar Juergens

Head of LiDAR Segment, Business Unit ADAS

Dr. Sascha Semmler

Head of Program Management Camera, Business Unit ADAS

Continental's Portfolio for Automated Driving

Increasing Content and Complexity due to higher Automation Levels

Continental technology	in series	in series	from 2021	from 2021/22
	Partly Automated Driving (SAE L2)	"L2 Plus" L2 "Performance"	"L2 Plus" L2 "Premium"	Highly Automated Driving (HAD) (SAE L3/L4)
			HAD Ready	
Plan				
Software	**Highway Assist** NCAP[1] **5 stars**	**Traffic Jam Companion** (hands-off ≤ 80 kph)	**Highway Companion** (hands-off ≤ 130 kph) **L2** in **extended** "Operational Design Domain"	**Cruising Chauffeur** **Traffic Jam Chauffeur**
AD High Performance Computer	optional	1	1	2
Sense				
Radars	1 – 5	5 – 7	5 – 7	7
Cameras	1 – 2	6	6	9
Lidars			optional	≥ 2
Content per vehicle	**L2**	**> 2x L2**	**> 4x L2**	**> 10x L2**

[1] New Car Assessment Programme

Continental's Autonomous Mobility Business

Leading Player with Track Record of Profitable Growth

> 100 mn
Units delivered
2017 – 2019
Radars
Cameras
Lidars
AD[1] Control Units

25	OEMs
50	Brands
> 300	Models

[1] Assisted / Automated Driving

Complex driving situation in real world

Complementary Sensor Technologies and Fusion / Driving Policy required

Ground obstacles

Complicated lighting

Lateral entry of vehicles

Complex/dense traffic

Pedestrians

Adverse weather

LiDAR – Required for Safe Automated Driving

Full-range LiDAR portfolio

Short-range LiDAR

Solid-State 3D Flash LIDAR™

Long-range LiDAR

Strategic cooperation with LiDAR pioneer

AEYE

MEMS* Scanning LiDAR

Highlights

- Patented technology
- No gaps in image/data; No motion distortion
- High accuracy object and free space detection

Target application:

Urban, traffic jam, robotaxis, people movers

SOP **2021**

L2+
L3

Highlights

- Patented novel advanced MEMS technology
- Dynamic spatial resolution enabling concurrent far range, high resolution and high sensitivity at minimized power consumption

Target application:

Highway

SOP **2024**

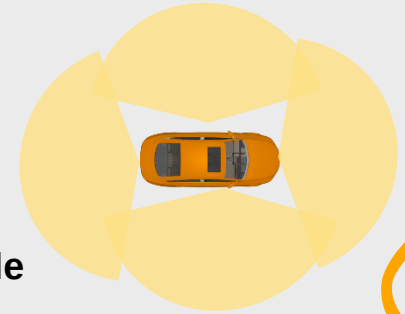
L3

*MicroElectric Mechanical System

HFL110 Solid-State 3D Flash LiDAR

SOP **2021**

Short Range (50m) Sensor KPIs

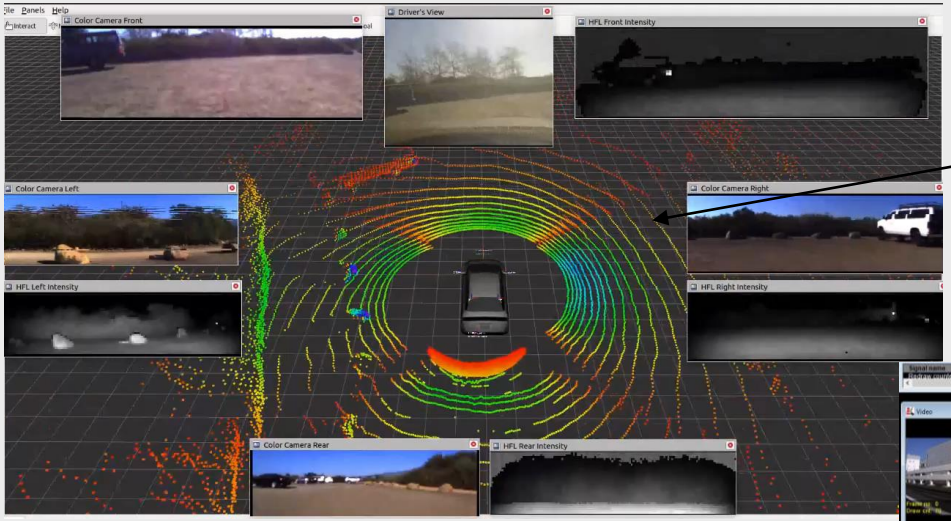


- **Automotive grade, solid-state LiDAR**
- **IP6k9k robust packaging**
- **Wide field of view (120°) for surrounding vehicle**
- **High frame rate (25Hz)**
- **Instant point cloud data capture**
- **Contiguous pixels**
- **Degraded visual environments operation**
- **Premium OEM launch**
- **Non-automotive, autonomous applications engagements**

HFL110 Short-range LiDAR

1st to SOP for High-resolution Automotive Grade LiDAR

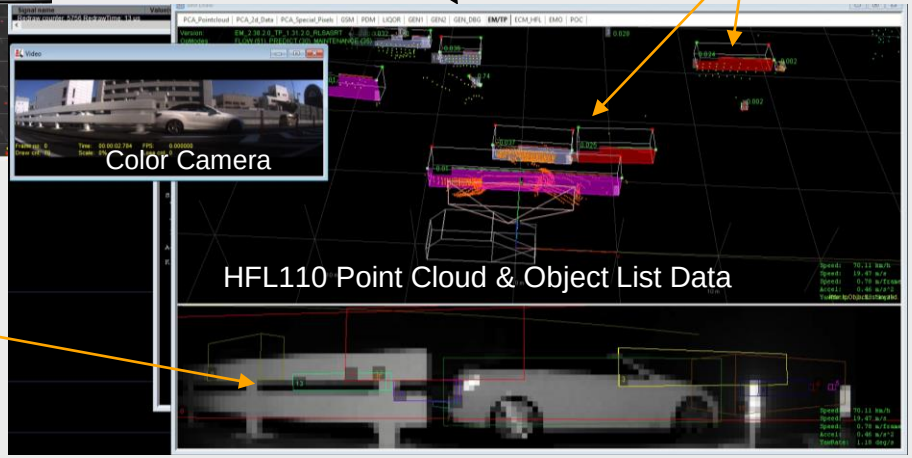
Existing Product!



HFL Solid-state Surround

Point Cloud

Objects (List)



Intensity Video

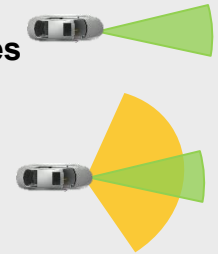
HRL 131 Long Range LiDAR

High performance, Intelligent Sensor

Ultra-Long-range, High Performance Scanning LiDAR

Automotive and Commercial Vehicle Applications

“Acquires” Objects at Long Ranges



- Overpasses and signage at 1000m
- Vehicles at 300m+
- Tires, bricks, debris, etc. at 160m+

Intelligent Software & Firmware

- Software configurable to customize OEM’s Use Cases and mounting locations
- Instantaneous resolution improving detection probability and reducing false positive rate

Incorporated bi-static architecture provides flexible, low-power design for integration ease:

- Flexible mounting location options: Grill, windshield, roof

SOP **2024**

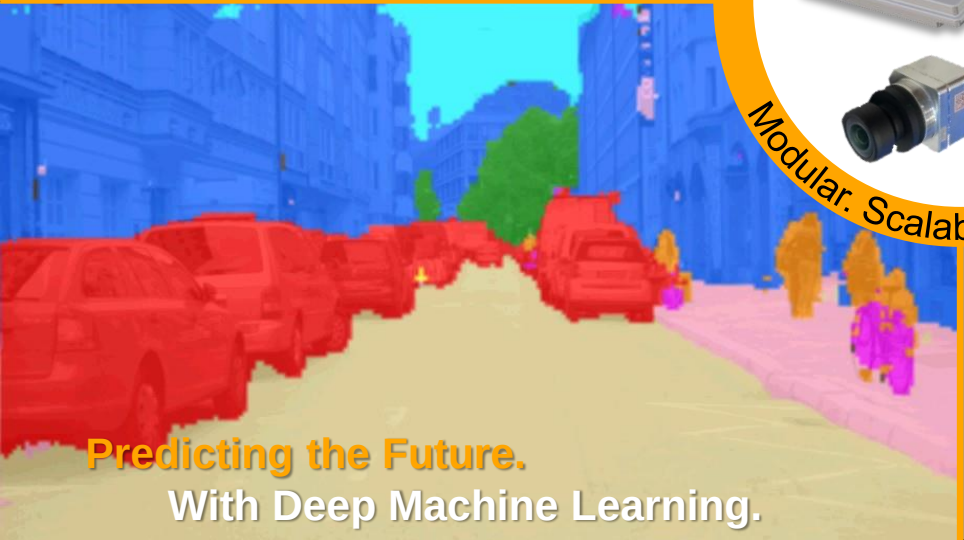
L3/L4

HRL131 Long Range LiDAR

Highway Driving Demonstration – 1,000-meter detection


Excellent Low Light Performance.
With Up To 8.3 Megapixel. In Full Color.

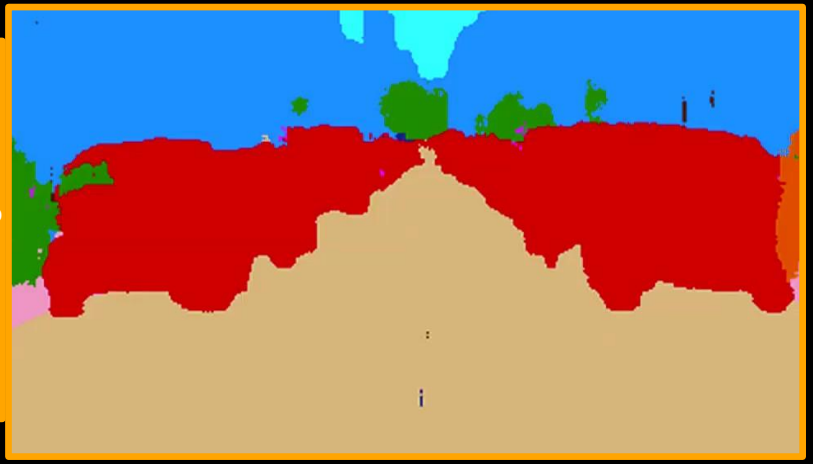

Broadening Our Horizon.
With Wide Field of View.


Predicting the Future.
With Deep Machine Learning.

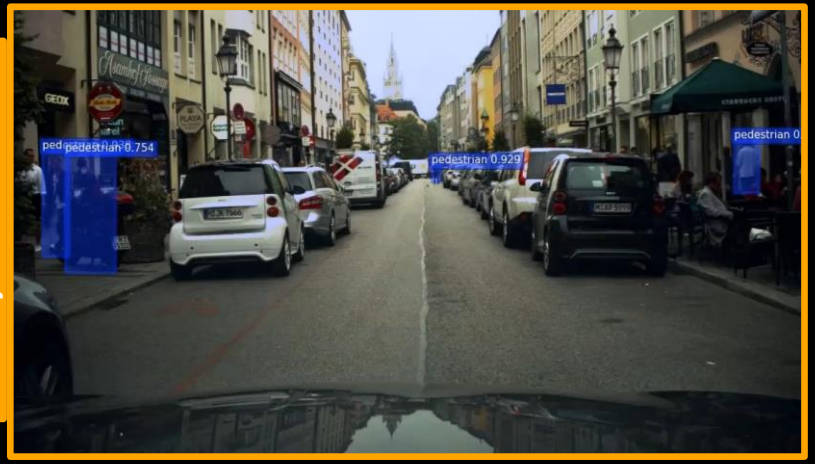

80
Always Up-to-Date.
With Road Database & Updates Over-the-Air.


Continental ADAS Camera Solutions
Modular. Scalable. Connected.

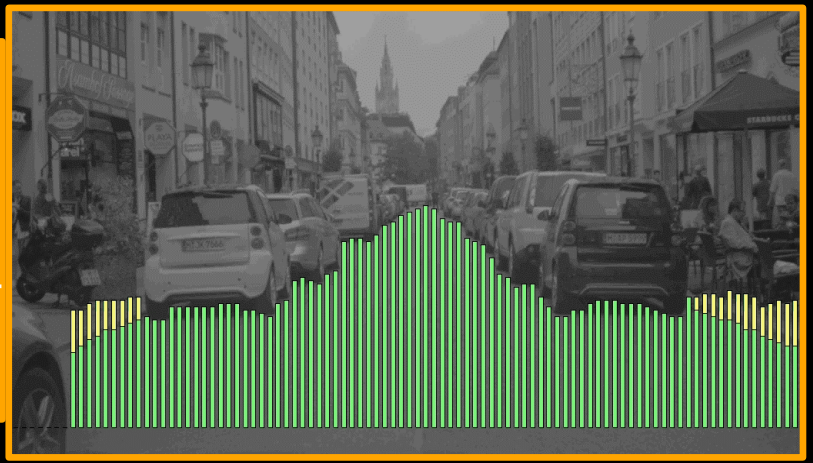
Semantic Segmentation



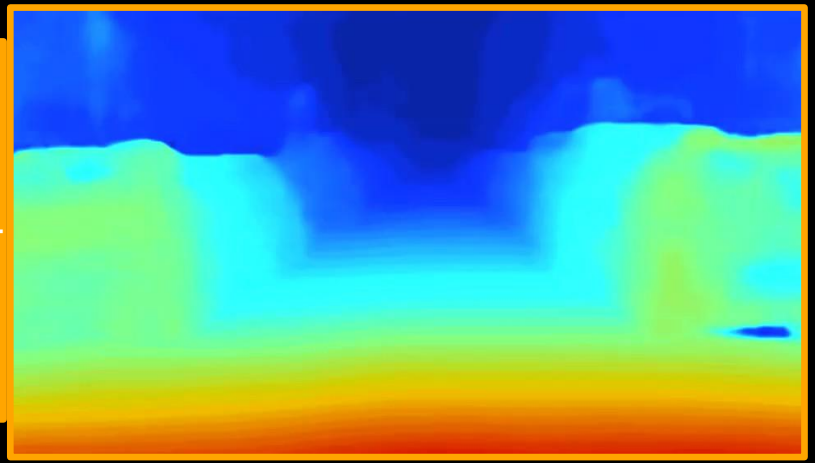
Object Detection



Freespace Detection



Monocular Depth Estimation



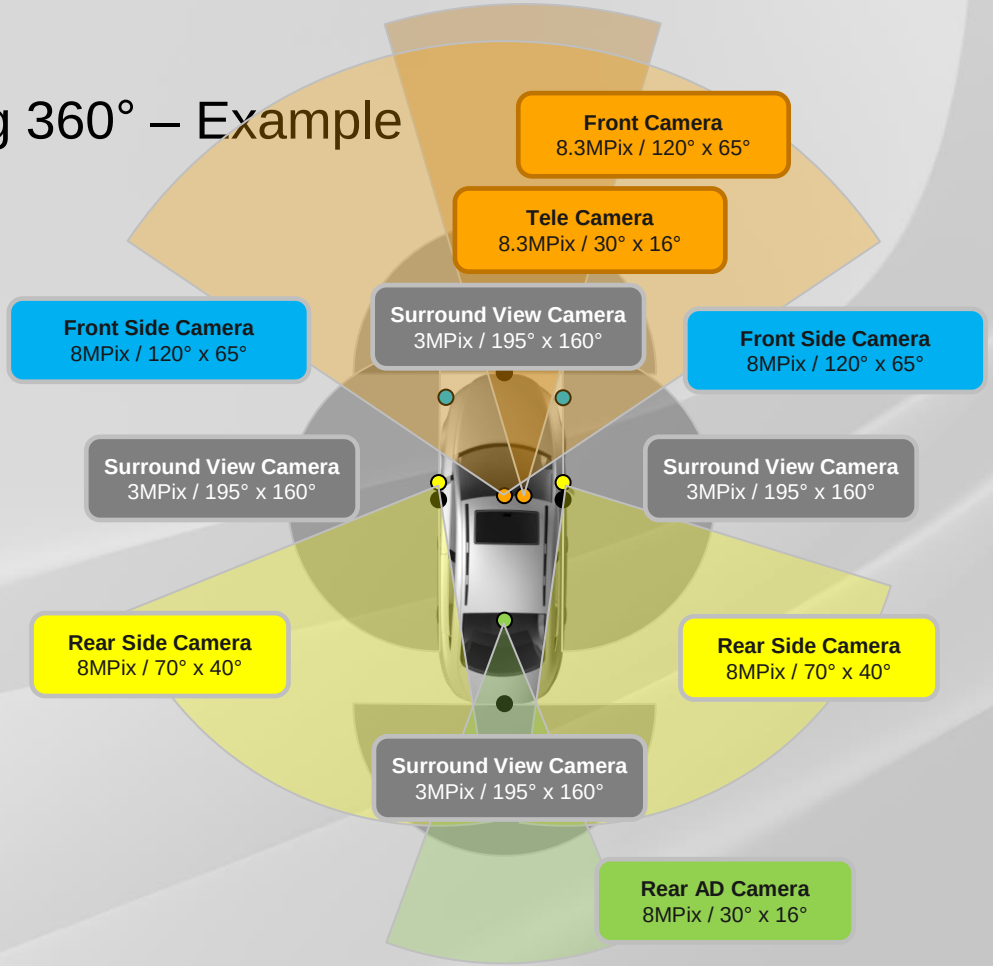

KUNSTHUIS AMSTERDAM

ADAS Camera Solutions

Camera Belt Solutions Covering 360° – Example

Satellite Cameras (Front/Side/Rear):
› High resolution imager with 8.3 MPix
› 120°x 65° + 70°x 40 + 30°x16° (FoV)
› Excellent low-light performance

Satellite Cameras (Surround):
› High-end imager with 3 MPix
› Lenses with 195° x 160° FoV
› Merging Surround View (Human Vision) and Assisted / Automated Driving (Computer Vision) applications within one camera.



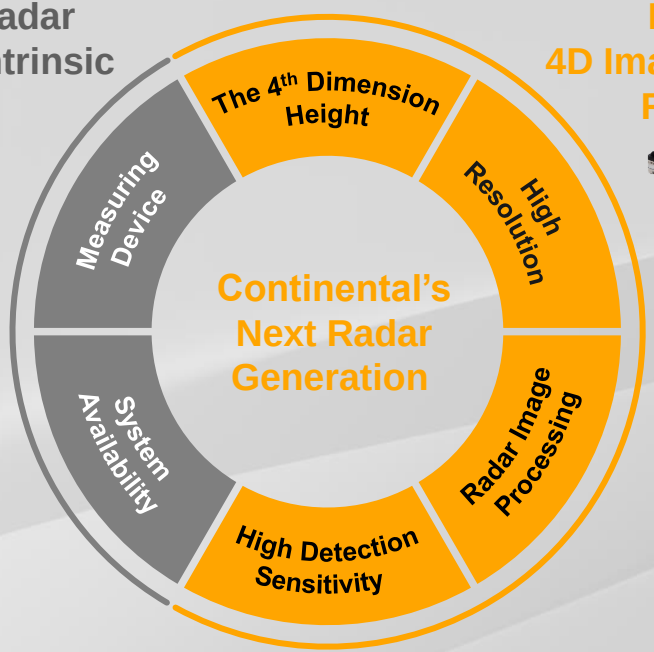
Radar – Fundamental for ADAS and AD

4D Imaging Radar Securing Technology Leadership

Precise distance and speed in real-time

Adverse weather conditions

Radar intrinsic



NEW! 4D Imaging Radar

Underridable elevated objects

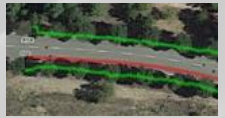
Non overridable ground obstacles

Road boundaries

Debris/potholes

Complex/dense traffic

Landmarks



Success

Expected **first to market**

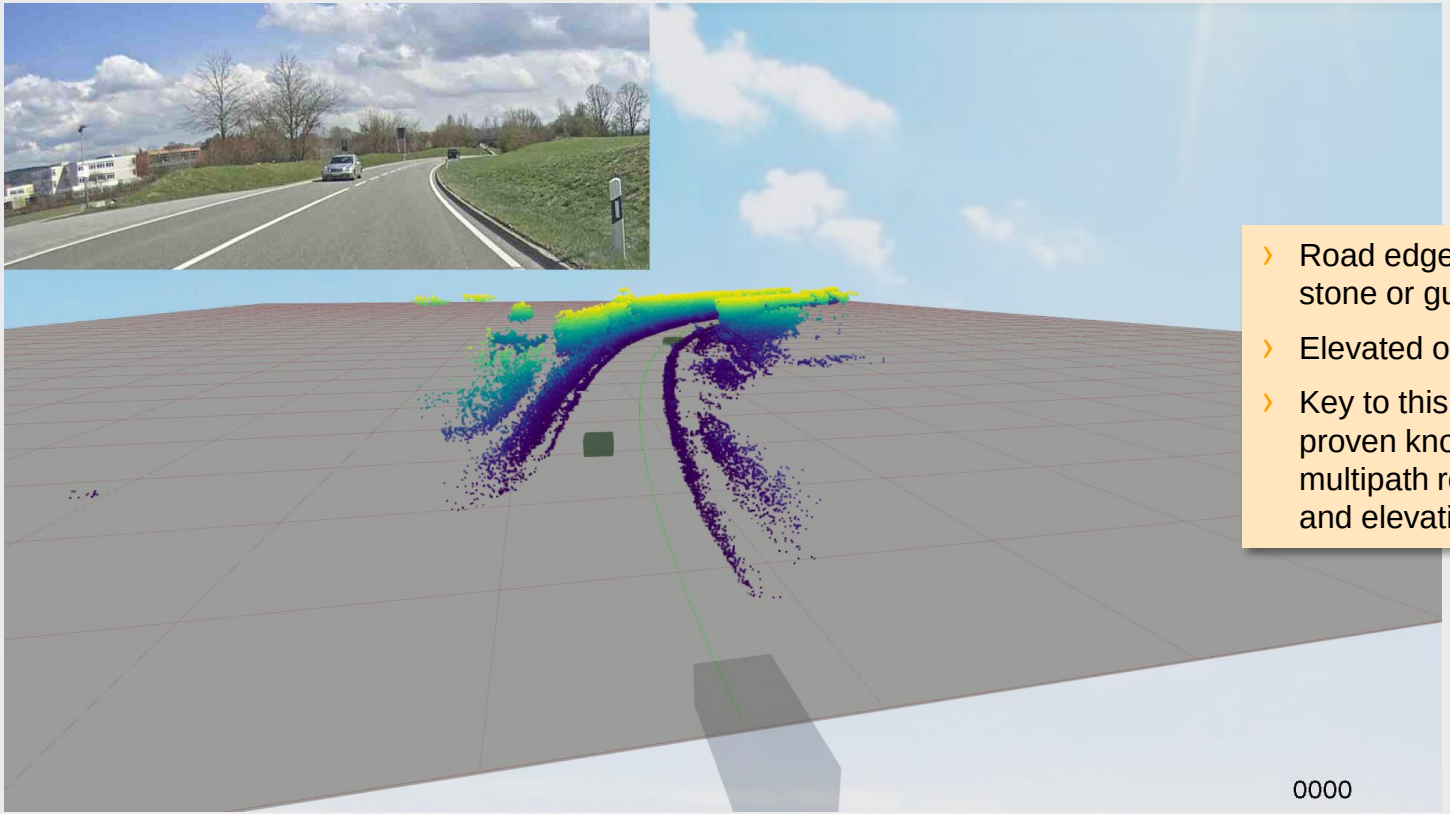
SOP: **2021**

L2+

SOP: **2024**

L2+

4D Imaging Radar –ARS540:
Dense point cloud and elevation measurement



- Road edge (even without curb stone or guardrail)
- Elevated objects & bridges
- Key to this performance is our proven knowledge to eliminate multipath reflections in azimuth and elevation

Next Radar Generation

Latest Radars Increase Performance, Reduce Complexity and Cost

4D Imaging Radar

- First to market with scalable, 4D solution for L2-L5 applications
- Accurate calculation of object location, elevation (= height) and speed up to distance of 300 meters
- Able to classify radar echoes by type of participant (i.e., cars, trucks, bicycles, pedestrians)

Success

L2/3  SOP: 2021/ 2023

L2+  SOP: 2024

Radar 6th Generation

- Scalable solution combines long-range and surround radars to provide 360° environmental detection at ~200-250 meters
- Patent-pending solutions and compact size allow for flexible placement (i.e., hidden behind bumpers, in vehicle sill)
- Shared hardware and software platform to reduce complexity and development costs; compatible with different E/E architectures

Success

L2+  SOP: 2024

L2/3 

AI is Key for Sensor Fusion and Scene Interpretation

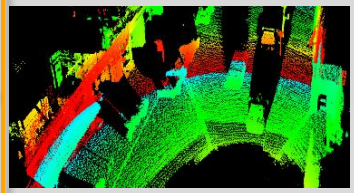
SENSE

Perception

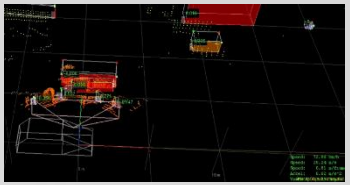
Detection | **Tracking & Env. Modeling**

LiDAR

Point Cloud



Features

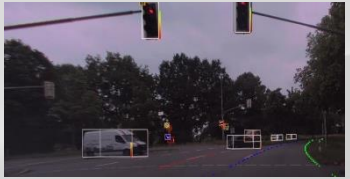


Objects

Camera

Pixels

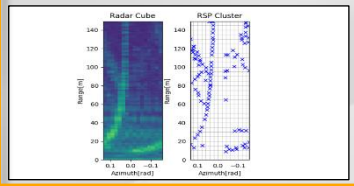
Features



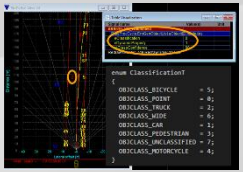
Objects

Radar

Point Cloud



Cluster



Objects

Fusion & Comprehensive Environment Modeling

PLAN

ACT

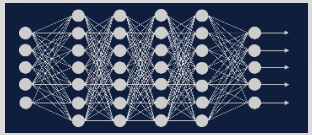
High Level Fusion	Detection	Tracking & Env. Modeling	**Fusion / CEM**
Mid Level Fusion	Detection	**Fusion / CEM**	
Low Level Fusion	**Fusion / CEM**		

We Are Ready for the Challenges of the Future

AI and Simulation for the Next Era of AD Technologies

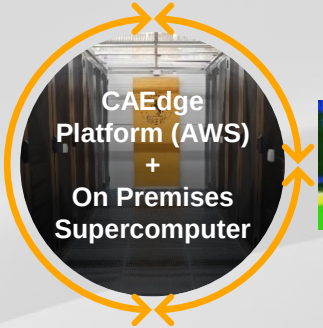
The Vital Importance of Data Quality & Efficient Data Management

Neural Network Development



Global Test Vehicle Fleet

Collecting around 100 terabytes of data each day – equivalent to 50,000 hours of movies



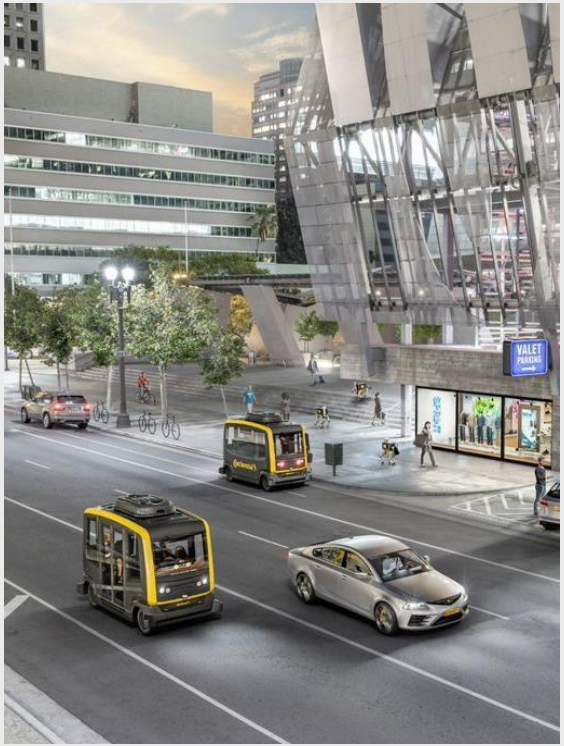
Synthetic Data Generation

Validation & Simulation

AI Competence Center

- **Core development** of AI technologies
- **Roll-out** to product development teams

Key Messages



- Continental provides complete sensor and super computer (ADCU) portfolio for assisted and automated driving
- Data fusion is essential for performance in higher automation levels
- Complementary sensor technologies are combined with complementary data fusion concepts to ensure safety and robustness of AD solutions
- High integration and economy of scale will drive democratization of assisted and highly automated systems
- In 2025 we will deliver complete L3/L4 system solutions below 5000 €


TechShow
2021
THANK YOU!