



Palm drive Palo Alto, CA  
Captured with the REV7 OS1



## We build the eyes of autonomy

- Largest US-based 3D lidar supplier
- Publicly traded on the NYSE as 'OUST'
- Customers include 4 of the top 10 largest companies in the US (by market cap)
- 14,000+ production sensors shipped as of Q2 2022



**10**

Global offices with HQ  
in San Francisco



**300+**

Employees  
globally



**600+**

customers across  
50 countries



**100,000+**

Current sensor  
manufacturing capacity





Over **600 customers**  
in **50 countries**



# The Value of 3D lidar

Broadway Bridge - Portland, OR  
Captured with a REV7 OS1

## More effective range

Dense point clouds provide long-range detection and better classification

## Reduced system cost and complexity

Replace multiple sensors and cameras with high resolution 3D coverage from a single lidar sensor

## Better spatial awareness

Increase robot operating speed and build cleaner maps with precise 3D data and a wider field of view

Raw Output

# Ouster OS2-128

Palm Drive, Palo Alto, USA

REV7 OS2



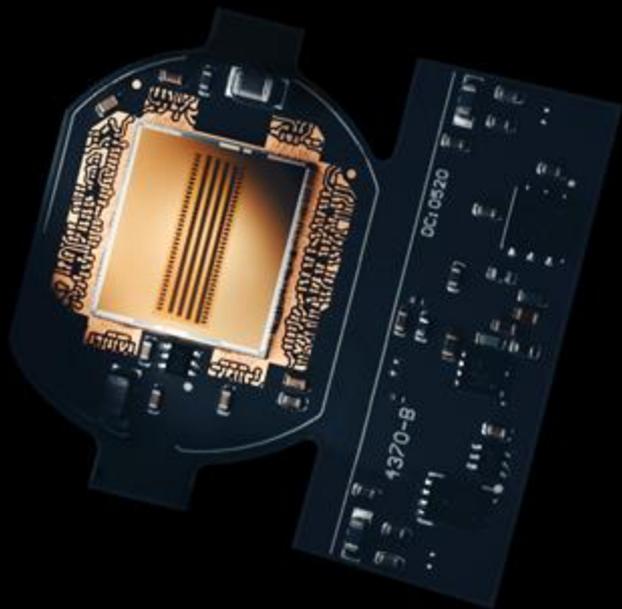
# Ouster's simple and reliable **digital lidar architecture**



- Full integrated,  
all semiconductor design
- High-resolution, 128 channels  
packed into the smallest form  
factor available today
- Highly reliable and rugged,  
high shock and vibe

# L3 Chip

The power of Digital Lidar silicon is a **step change in affordability and performance**



**21.47 Gmacs**

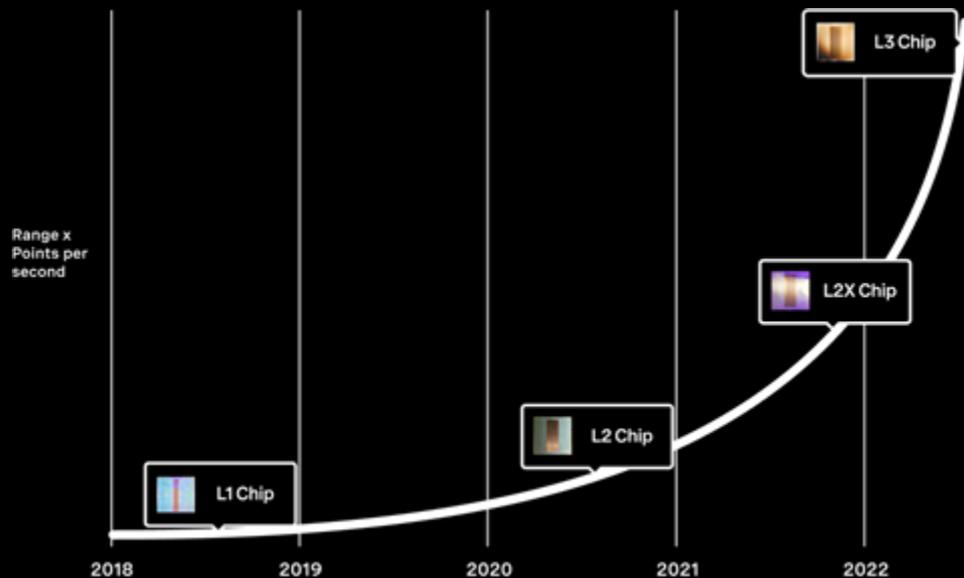
Of signals processing

**125 Million**

Transistors on chip

**5.2 Million**

Max points per second



# Ouster **REV7** lineup

the highest performing family of sensors on the market



## OSDome

Hemisphere



## OS0

Short-Range



## OS1

Mid-Range



## OS2

Long-Range



Simple and reliable digital lidar design



Highest resolution available on market



Market-leading range



High precision and accuracy

# Ouster REV7 Sensors



**OSDome**



**OS0**



**OS1**



**OS2**

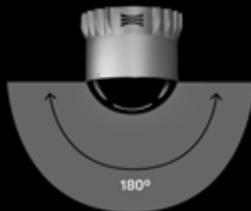
<b>REV7</b>	<b>Hemisphere view</b>	<b>Ultrawide view</b>	<b>Mid Range</b>	<b>Long Range</b>
<b>Resolution</b>	64 or 128 channels	64 or 128 channels	64 or 128 channels	64 or 128 channels
<b>Range @ 10% Refl.</b>	20 m	35 m	90 m	200 m
<b>Vertical FOV</b>	180 °	90 °	45 °	22.5 °

# REV7 OSDome



Range  
20 m @ 10% reflectivity

Vertical field of view



Vertical angular resolution  
Up to  $0.7^\circ$

Horizontal field of view  
360°

Horizontal resolution  
Up to  $0.17^\circ$

Frame rate  
10 or 20 Hz

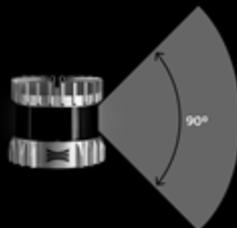


# REV7 OSO



Range  
**35 m @ 10% reflectivity**

Vertical field of view



Vertical angular resolution

**Up to 0.7°**

Horizontal field of view

**360°**

Horizontal resolution

**Up to 0.17°**

Frame rate

**10 or 20 Hz**

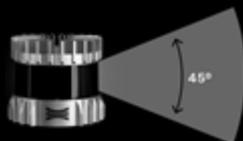


# REV7 OS1



Range  
**90 m @ 10% reflectivity**

Vertical field of view



Vertical angular resolution  
**Up to 0.35°**

Horizontal field of view  
**360°**

Horizontal resolution  
**Up to 0.17°**

Frame rate  
**10 or 20 Hz**



# REV7 OS2



Range  
**200 m @ 10% reflectivity**

Vertical field of view



Vertical angular resolution  
**Up to 0.17°**

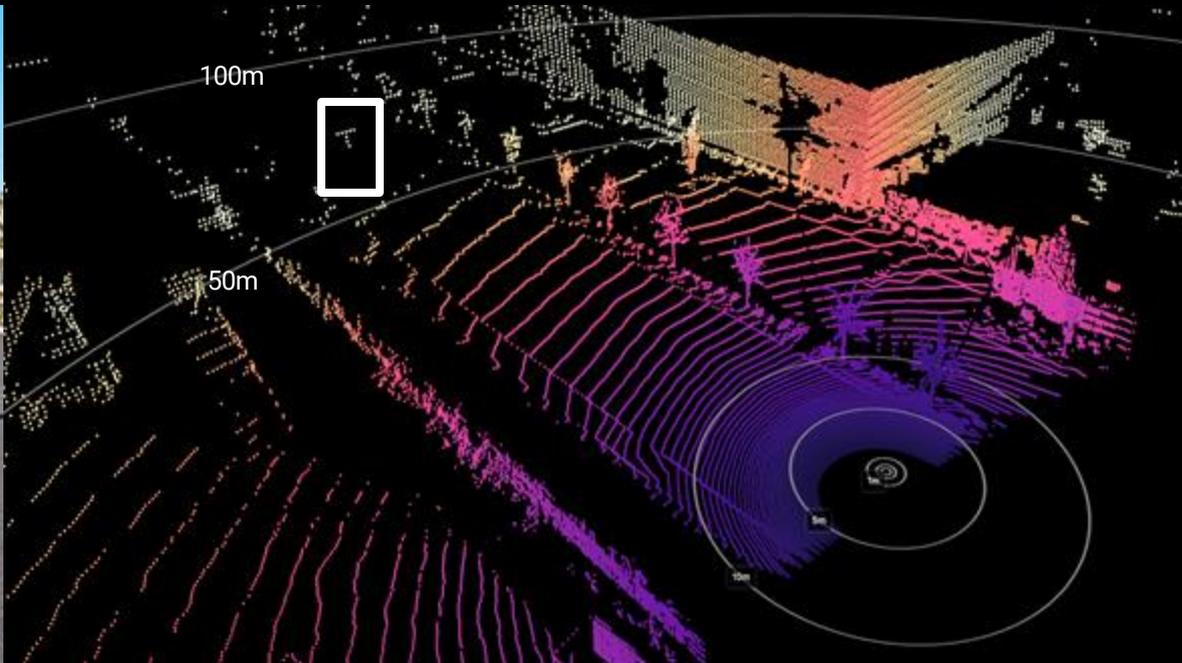
Horizontal field of view  
**360°**

Horizontal resolution  
**Up to 0.17°**

Frame rate  
**10 or 20 Hz**



# Detection Range



REV7 OS1 pedestrian dressed in all black @ 70m, arms extended

# Range Precision

10% reflective target, 5 m distance

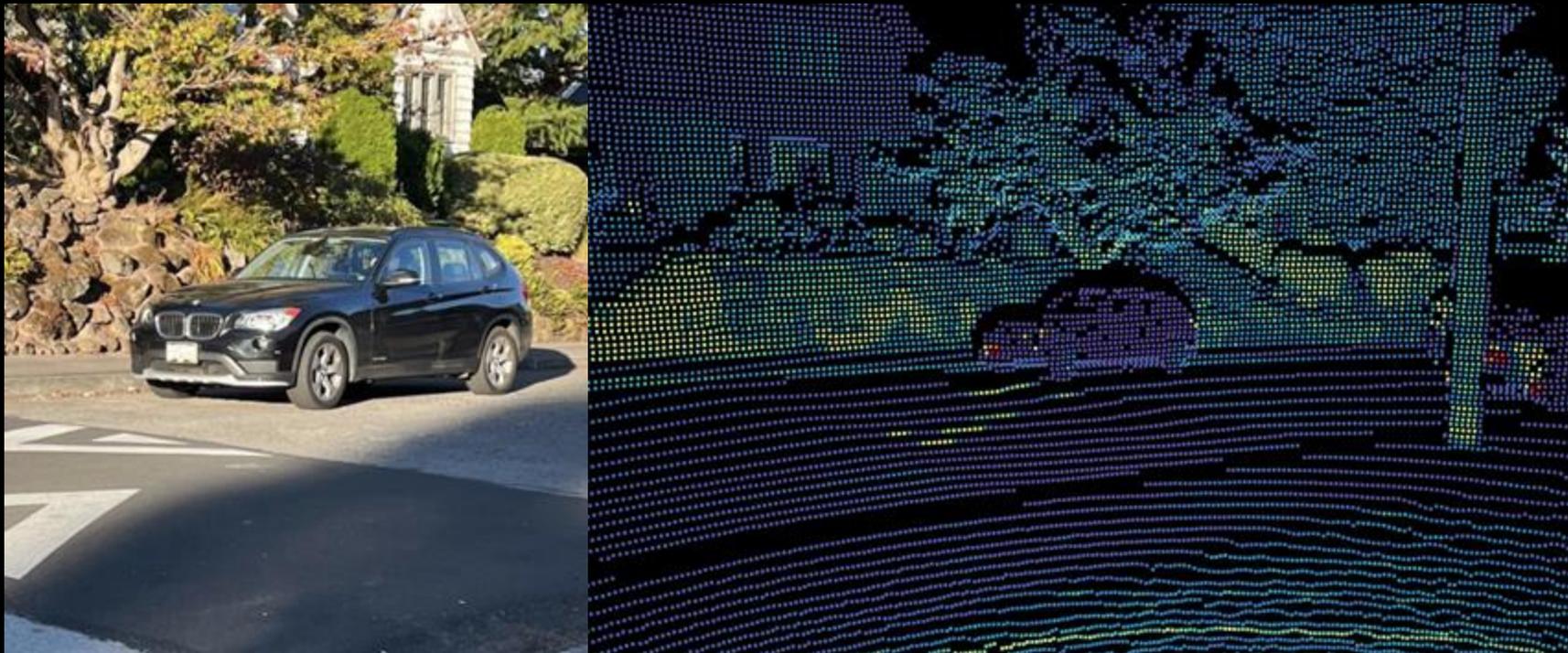


2.5 cm Width



0.5 cm  
Standard Deviation

# Dark Object Detection



REV7 OS1 black car @ 15 m

# NIR Imaging

With our digital lidar architecture, every OS sensor doubles as an embedded near infrared camera



Ouster OS2 Near-IR data with open source YOLOv5 object detection algorithm designed for camera perception

Instantaneous camera-lidar  
sensor fusion

Reuse existing computer  
vision algorithms

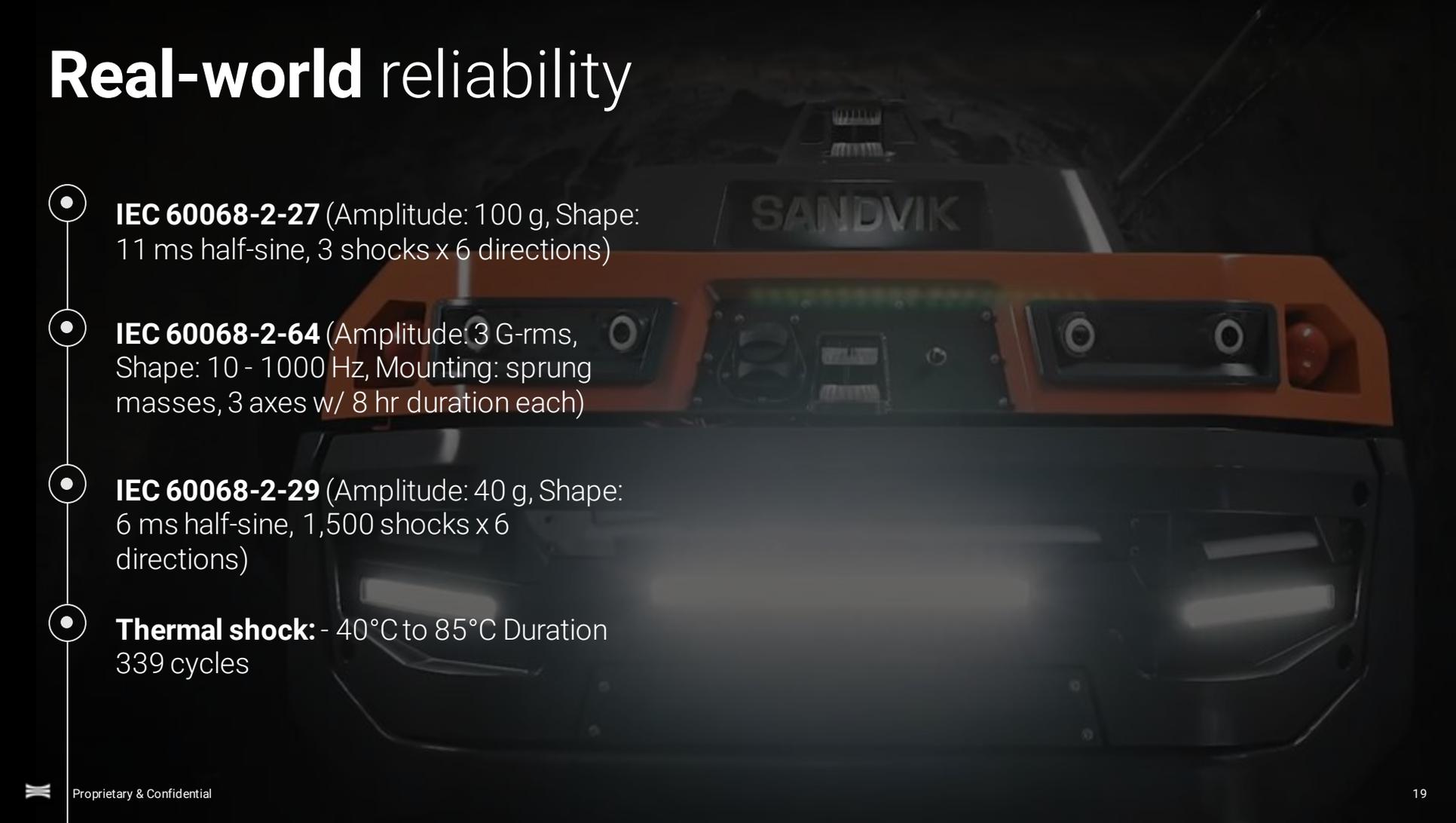
Add sensor redundancy to improve  
safety and efficiency of any system

# All-weather performance



- Reliable perception in obscurants, such as **rain, fog, dust, and snow**
- Expanded temperature range down to **-40° C** for OS0 and OS1
- Rated **IP68** (immersion in > 1 m of water) and **IP69K** (withstands 2000 psi power washing)

# Real-world reliability



● **IEC 60068-2-27** (Amplitude: 100 g, Shape: 11 ms half-sine, 3 shocks x 6 directions)

● **IEC 60068-2-64** (Amplitude: 3 G-rms, Shape: 10 - 1000 Hz, Mounting: sprung masses, 3 axes w/ 8 hr duration each)

● **IEC 60068-2-29** (Amplitude: 40 g, Shape: 6 ms half-sine, 1,500 shocks x 6 directions)

● **Thermal shock:** - 40°C to 85°C Duration 339 cycles

# Proven manufacturing capabilities



- 100,000+ unit annual manufacturing capacity
- "Buy America" and "Buy American" certified
- Maintained 2 week lead times throughout pandemic
- ISO 9001/14001 Certified Facilities in US and Thailand
- IATF-16949 Certified and audited by leading auto OEMs



# The future is digital lidar, and REV7 proves it

- Fully integrated, **all-semiconductor** design
- **High-resolution** packed into the smallest form factor available today
- Simplified digital architecture results in highly **reliable and rugged** lidar sensors

**Palm Drive, Palo Alto, USA**  
Captured with a REV7 OS2





Lombard street San Francisco, CA  
SLAM captured REV7 OS1

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# Appendix

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# Led by board members from **auto and industrial giants**

## Ouster Board of Directors



**Susan Heystee**  
Chair of the Board  
Former SVP Global Auto  
Business, Verizon Connect



**Karin Rådström**  
CEO of Mercedes-Benz  
Trucks; Board member at  
Daimler Truck AG



**Emmanuel Hernandez**  
Board Director, ON  
Semiconductor Corp.



**Sundari Mitra**  
CVP IP Engineering, Intel  
Corporation



**Remy W. Trafelet**  
President and CEO,  
Trafelet & Company



**Jorge del Calvo**  
Partner at Pillsbury Winthrop  
Shaw Pittman, LLP

## Ouster Advisory Board [Non-Fiduciary]



**Barbara Humpton**  
CEO, Siemens USA



**Jim Cannon**  
President & CEO, AM  
General, former CEO of  
FLIR



**Maryrose Sylvester**  
fmr. President,  
Electrification, ABB USA



**Henio Arcangeli, Jr.**  
fmr. SVP, Automobiles,  
Honda & Acura



**Philipp von Hagen**  
fmr. Member, Executive  
Board, Porsche Automobil  
Holding SE



**Richard Freeland**  
fmr. President & COO,  
Cummins



**Sandy Stojkovski**  
CEO of Vitesco Inc;  
fmr President of N.A.  
Drivetrains, Marelli



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# REV6 vs REV7

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# Ouster REV6 Sensors



OS0



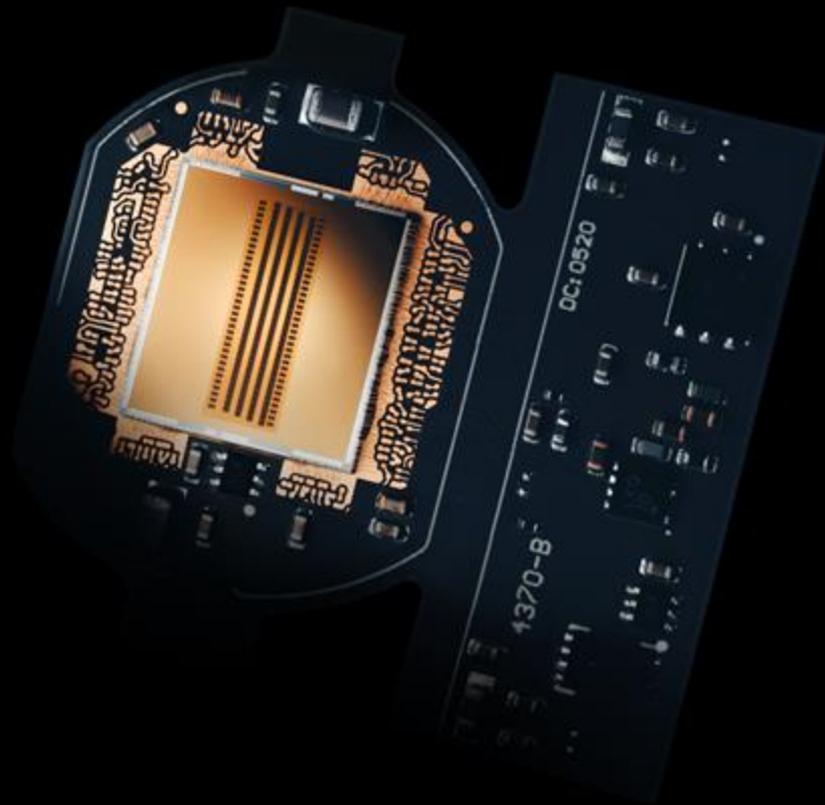
OS1



OS2

REV6	Ultra-wide view	Mid Range	Long Range
Resolution	32, 64 or 128 channels	32, 64 or 128 channels	32, 64 or 128 channels
Range @ 10% Refl.	15 m	45 m	80 m
Vertical FOV	90 °	45 °	22.5 °

# REV7 | the biggest upgrade in the history of lidar



## Range +100%

OS0



10%: 15m  $\Rightarrow$  35m

OS1



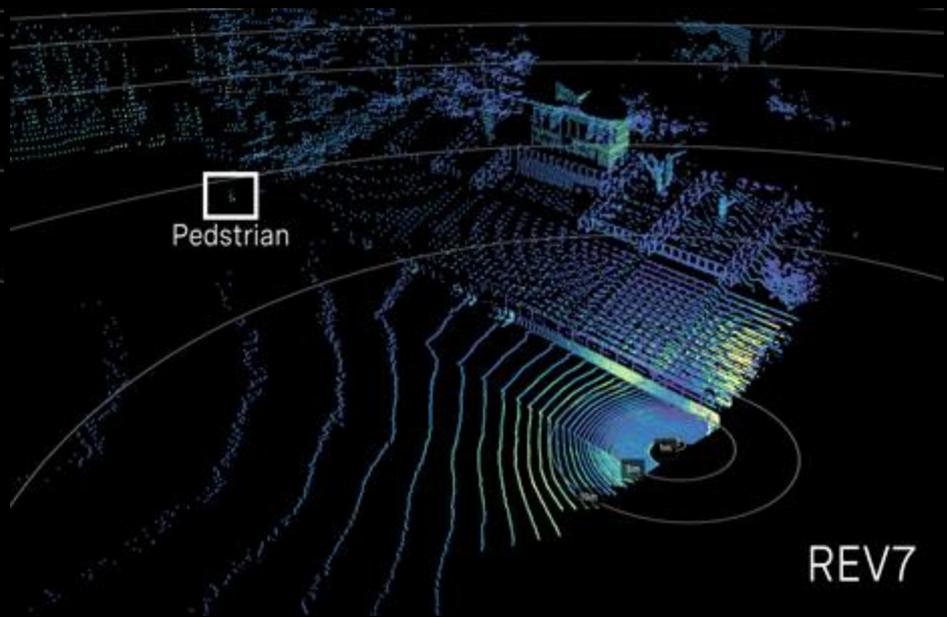
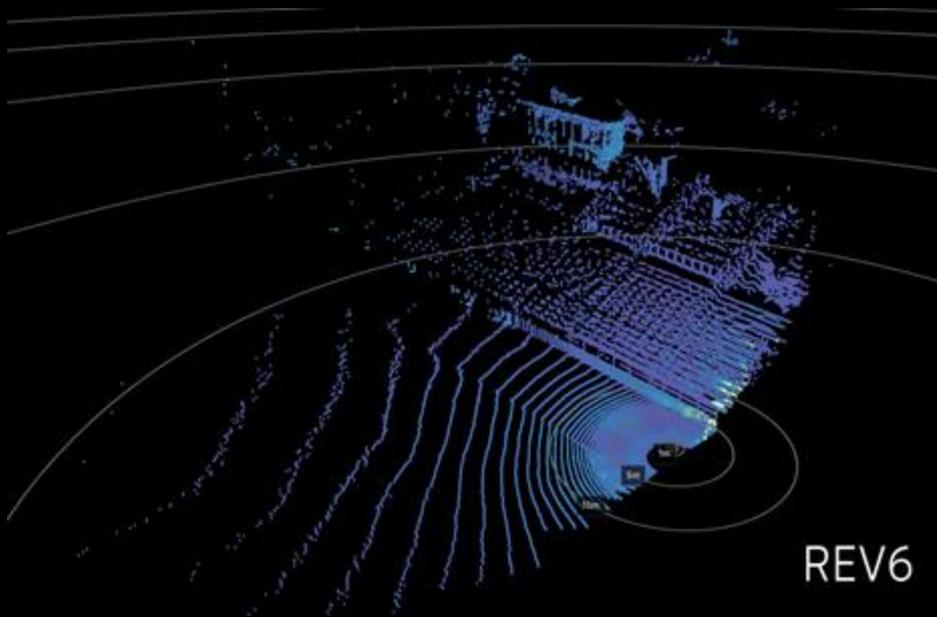
10%: 45m  $\Rightarrow$  90m

OS2



10%: 80m  $\Rightarrow$  200m

# L3 Chip | Range



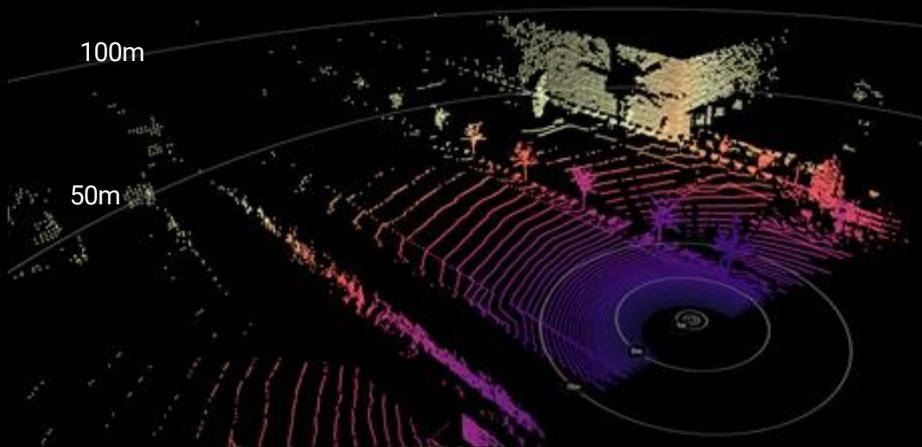
REV6 OS1 vs REV7 OS1

# Example | OS1 Range Improvement

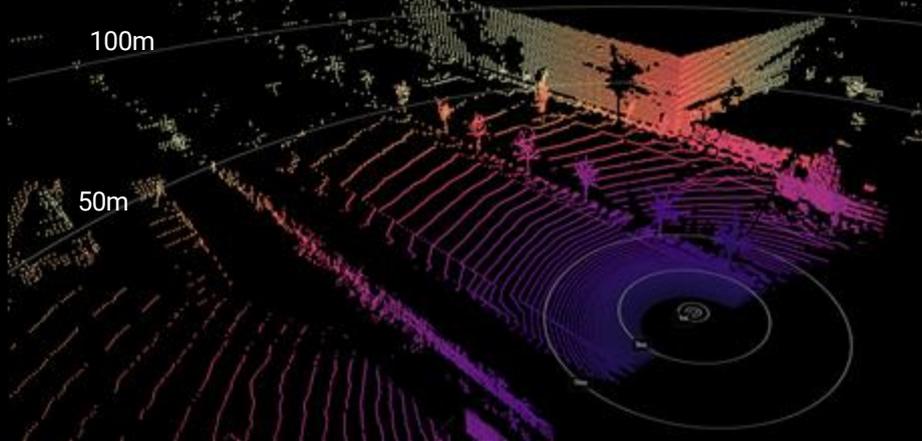
Pedestrian @ 70m, arms extended



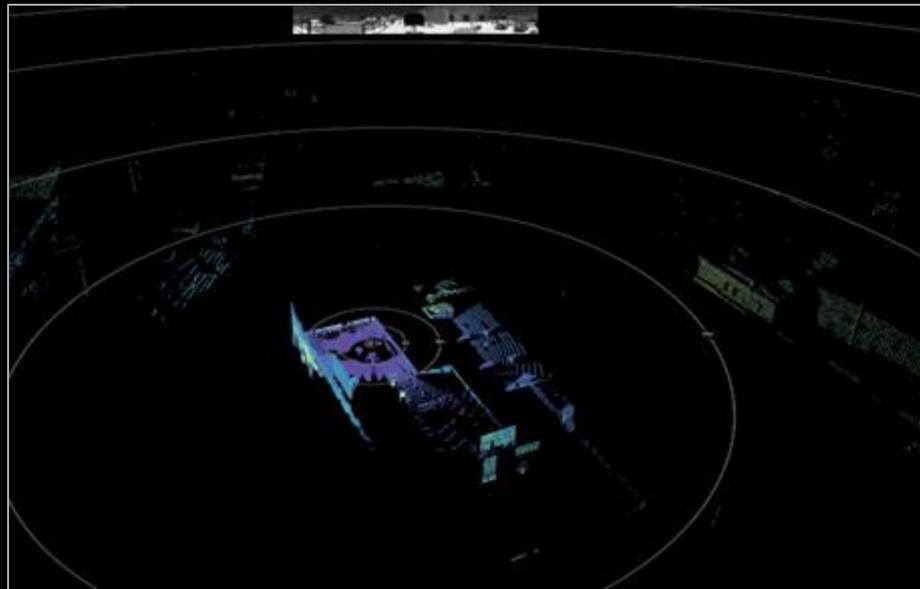
REV6



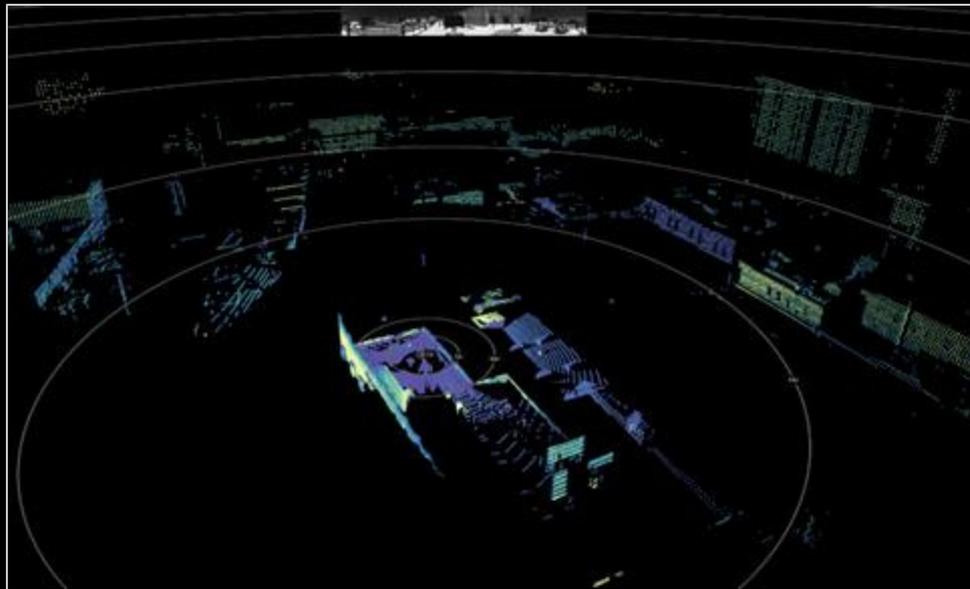
REV7



# REV7 KPIs | Range Improvement



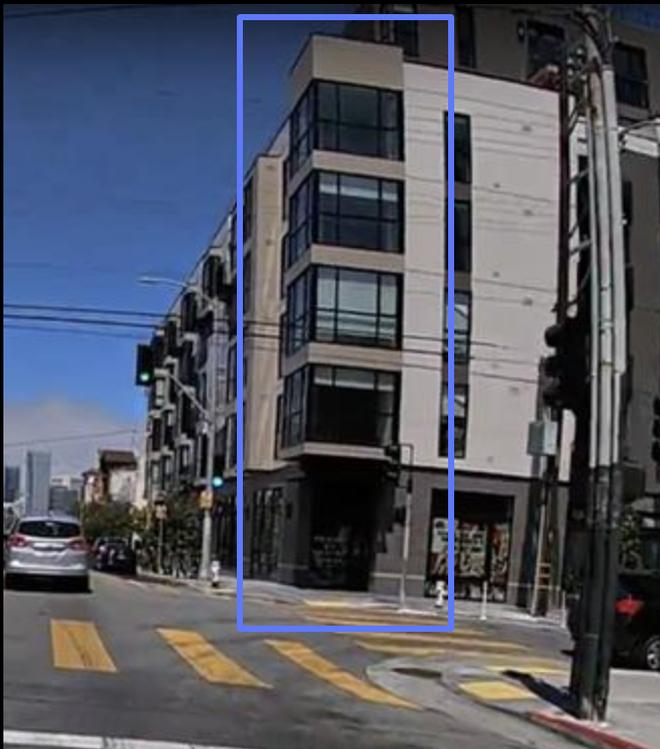
Rev6 (L2X Chip)



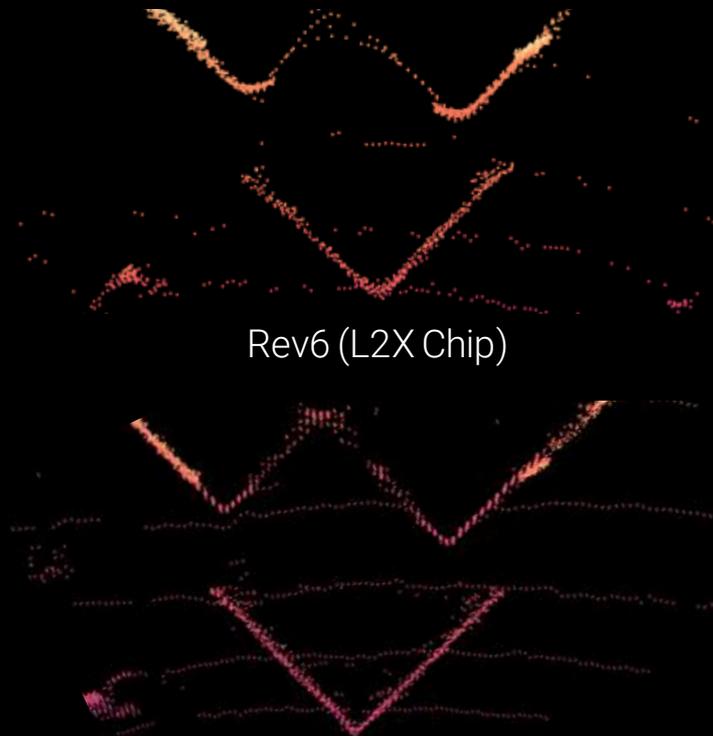
Rev7 (L3 Chip)

REV6 OS1 vs REV7 OS1

# L3 Chip | Precision

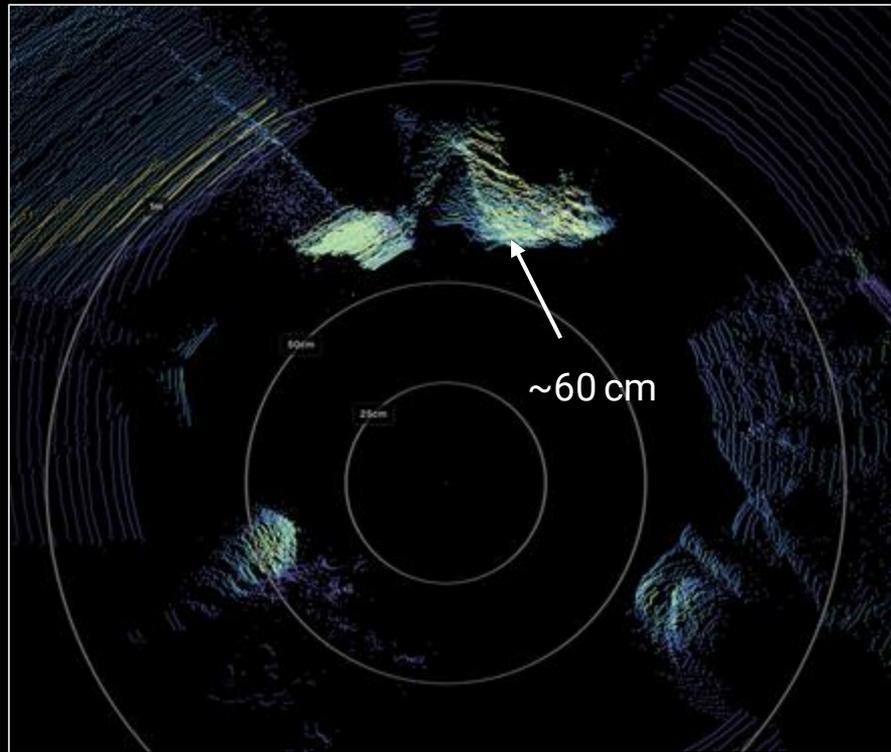


Building Corner - Top View



Rev7 (L3 Chip)

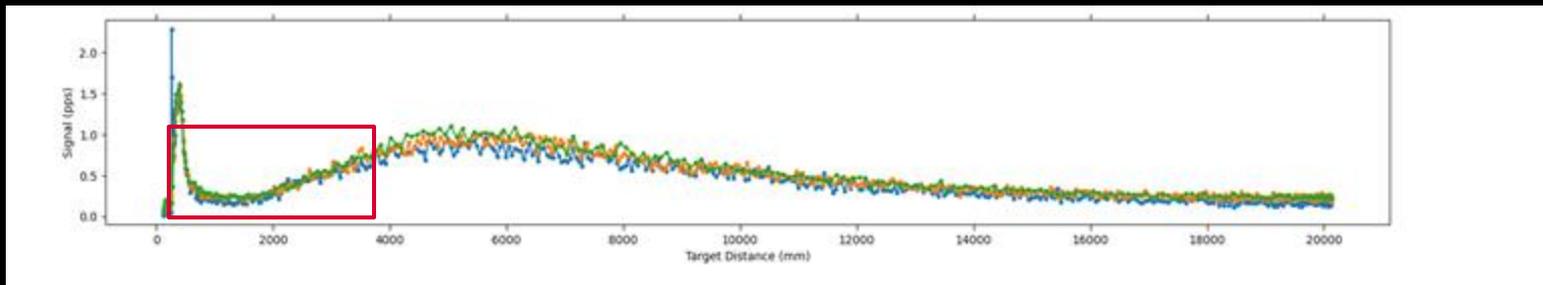
# L3 Chip | Improved Near Range Performance



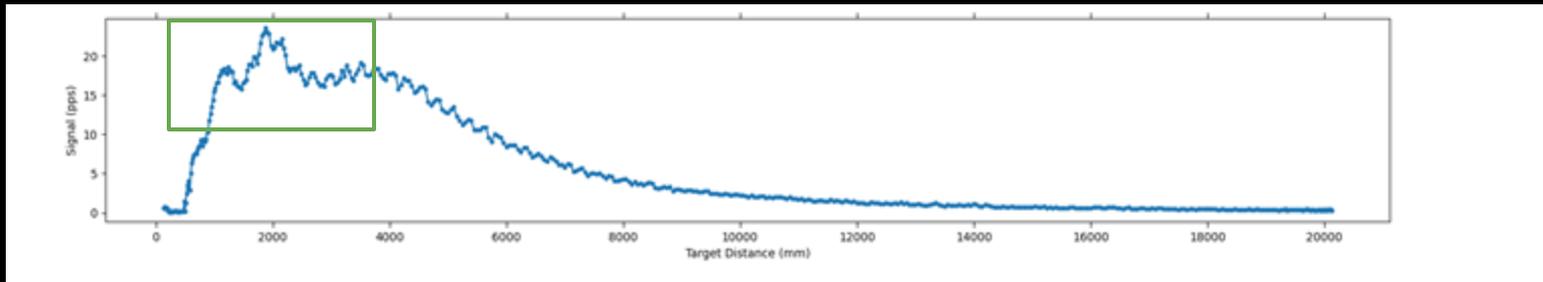
# L3 Chip | Improved Near Range Performance

Signal over range

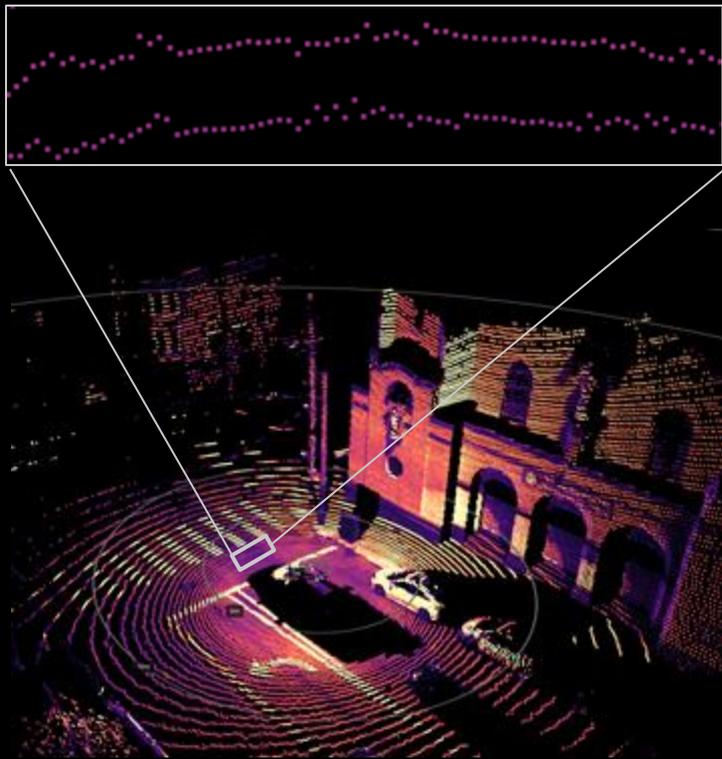
L2X Chip



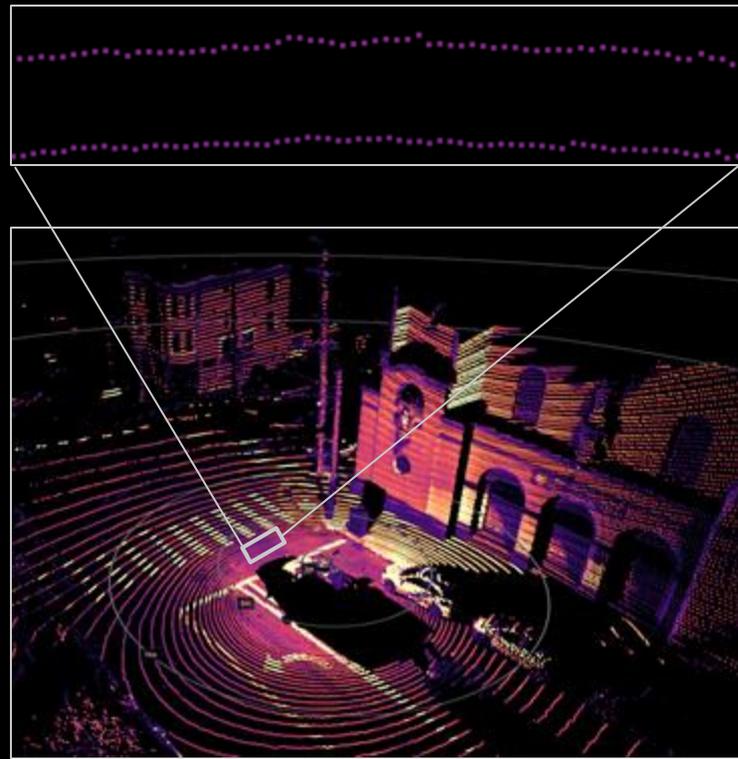
L3 Chip



# L3 Chip | Improved Precision

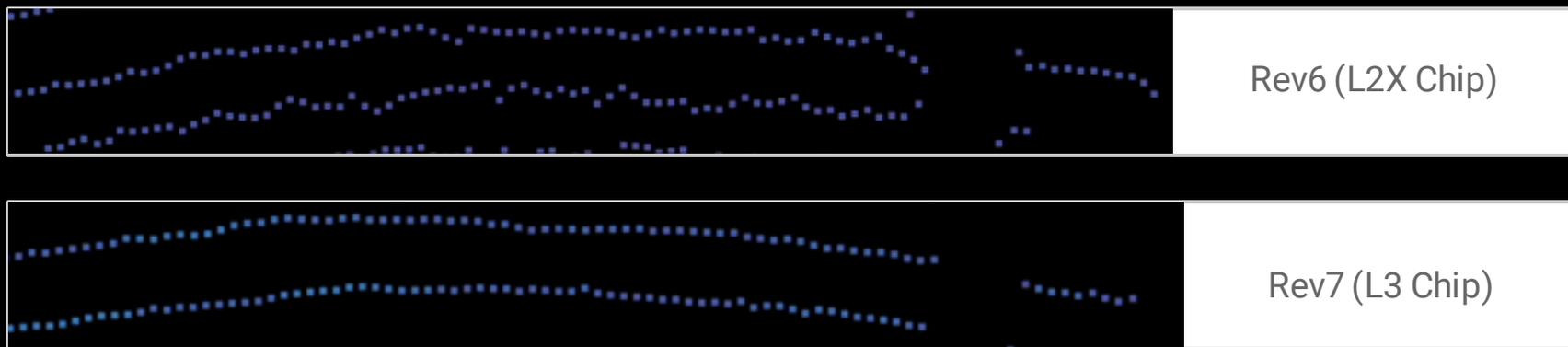


Rev06 (L2X Chip)



Rev07 (L3 Chip)

# REV7 KPIs | Precision Improvement



# REV7 KPIs | Dark Car Detection Improvement

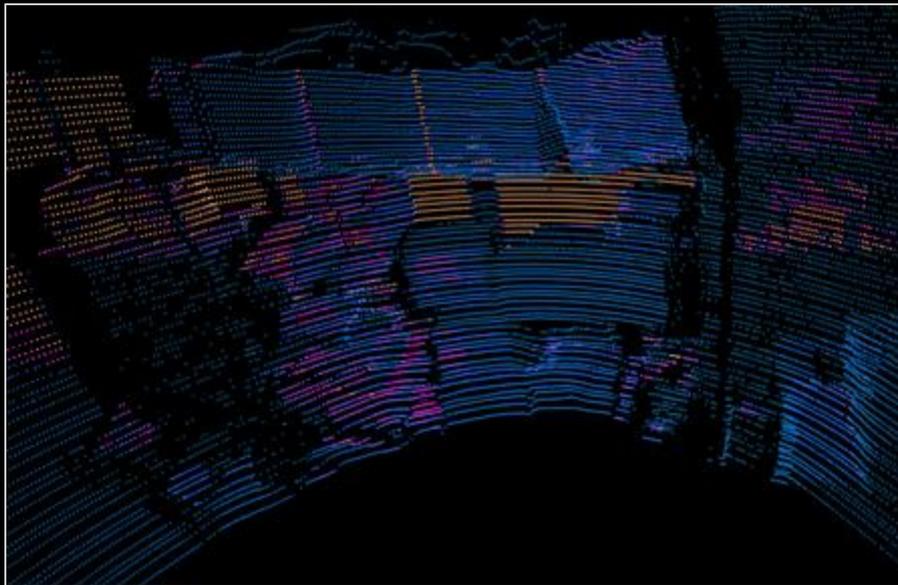


Rev6 (L2X Chip)

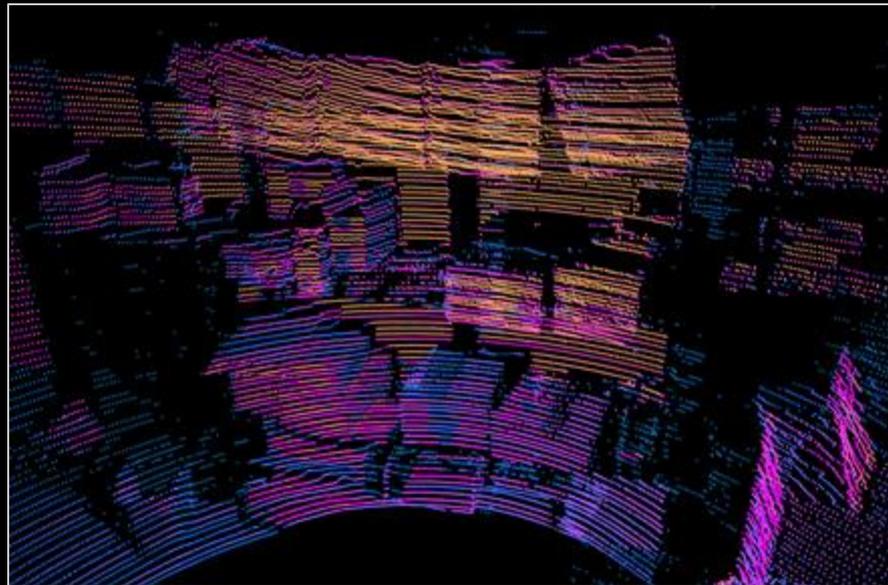


Rev7 (L3 Chip)

# L3 Chip | Improved Near Range Signal



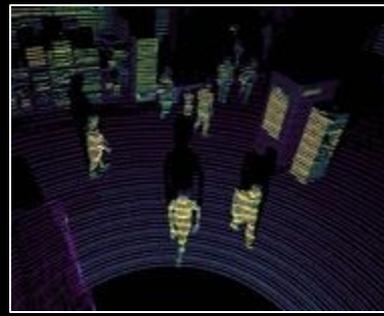
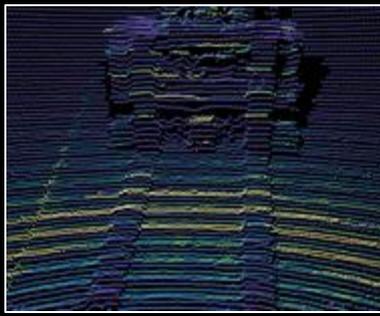
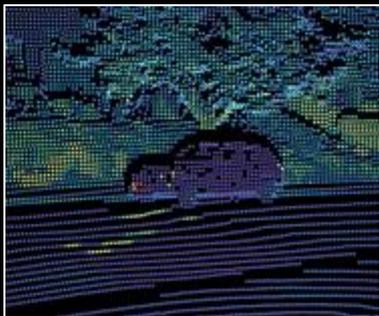
Rev06 (L2X Chip)



Rev07 (L3 Chip)

Warehouse boxes at a distance of 1m

# REV7 solves edge cases across markets.



Automotive



Industrial



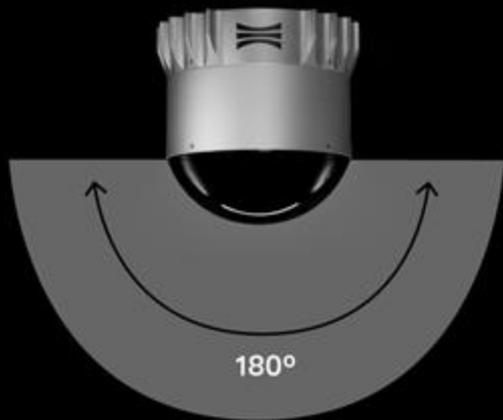
Robotics



Smart Infrastructure

# OSDome

## Crowd Monitoring



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# Lidar vs Camera

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# Autonomy in Real-Life | Pedestrian Detection at Night



What the  
CAMERA sees



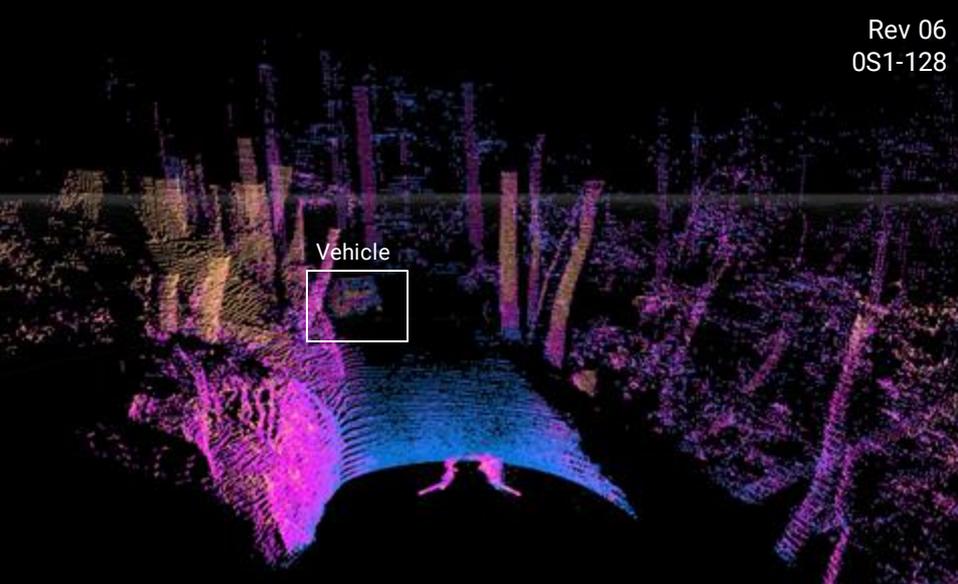
What the  
RADAR sees



What the  
LIDAR sees

# All Weather Performance | Dust

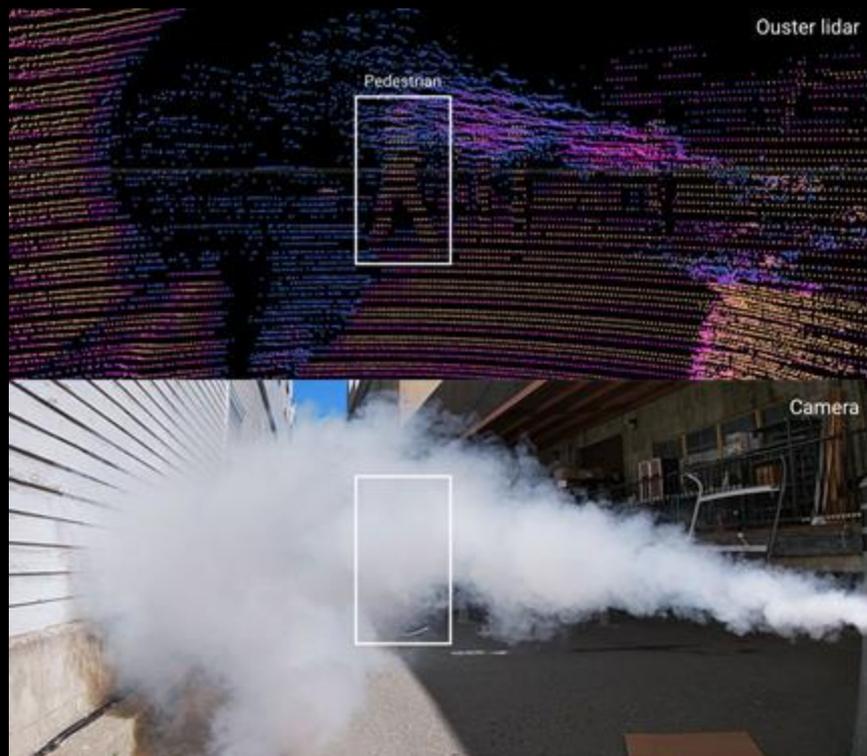
Ouster's dual returns-enabled Rev 06 sensors accurately detect objects through obscurants



Full drive video: <https://www.youtube.com/watch?v=8jM4t9tloKU>

# All Weather Performance | Fog

Ouster's dual returns-enabled Rev 06 sensors accurately detect objects through obscurants



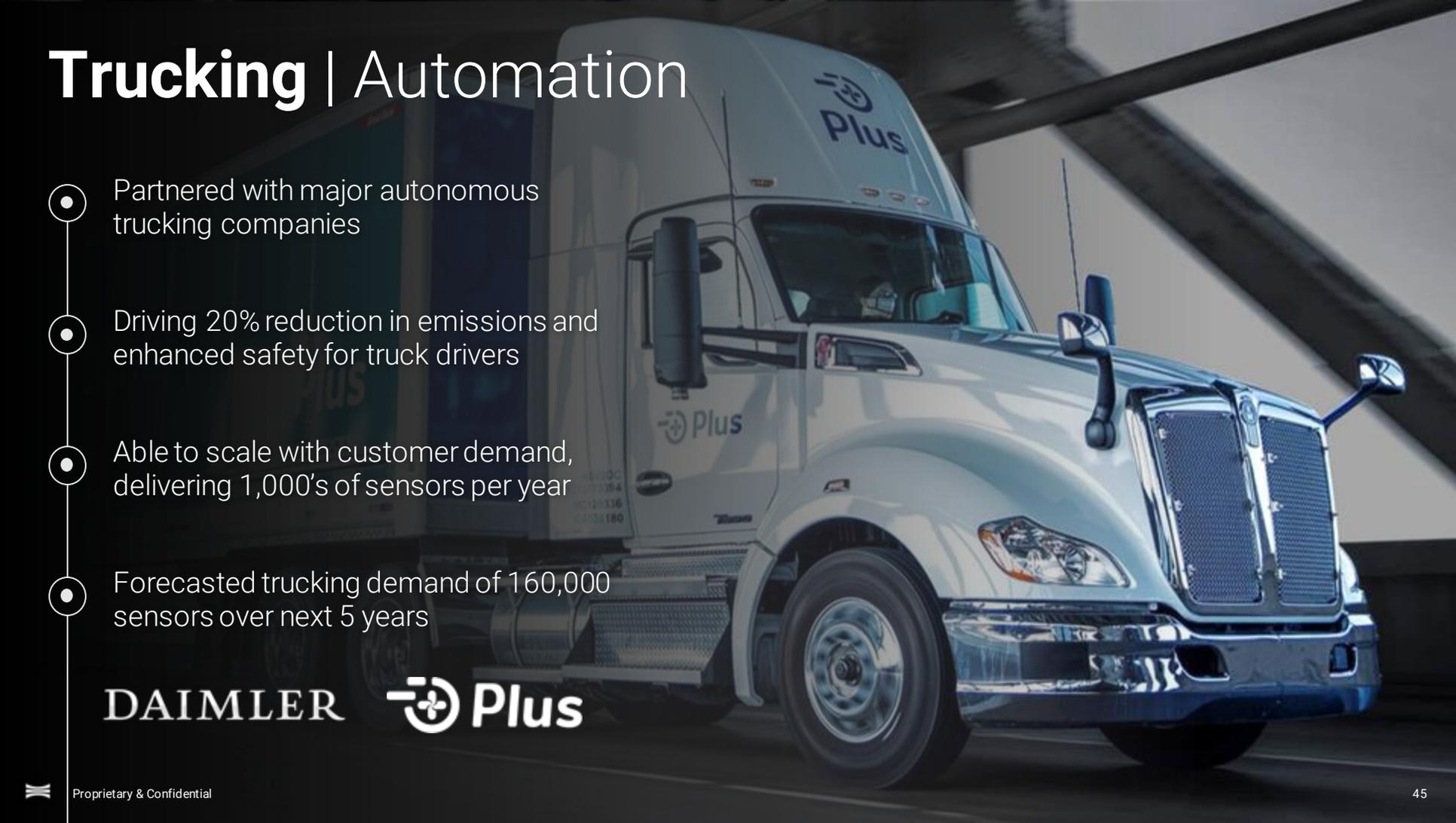
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# Success **Stories**

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# Trucking | Automation



Partnered with major autonomous trucking companies

Driving 20% reduction in emissions and enhanced safety for truck drivers

Able to scale with customer demand, delivering 1,000's of sensors per year

Forecasted trucking demand of 160,000 sensors over next 5 years

DAIMLER

 Plus

# Industrial | Off-Highway Vehicles

- Partnered with Sandvik to develop autonomous electric mining loaders
- Sandvik AutoMine program improves asset utilization, while reducing carbon emissions and improving worker safety
- Partnered with leading Chinese mining automation providers. Currently in operation in Baorixile open pit mine in Inner Mongolia (pictured)



# Industrial | Material Handling

- Partnered with Balyo for warehouse forklift automation
- Autonomous forklifts and warehouse equipment improve warehouse efficiency and improve worker safety
- Replacing multiple 2D lidar sensors with a single OS0 sensor for localization and safety sensing

**BALYO**



# Robotics | Drones

- Partnered with Scout Drone Inspection for indoor industrial infrastructure inspection
- Scout Drone Inspection saves cost, saves inspection time, and improves worker safety
- Partnered with Mainblades for drone aircraft inspection
- Autonomous aircraft inspection improves efficiency and keeps workers safe from dangerous inspections



# Industrial | Agriculture

- Partnered with Blue White Robotics for agricultural automation
- Autonomous agricultural platform improves efficiency and safety of agricultural heavy machinery
- OS1 sensor selected for high reliability in offroad and dusty conditions



# Industrial | Ports & logistics centers

- Partnered with leading yard automation and port material handling companies
- Yard automation reduces turn time, boosts space utilization, improves safety, and reduces emissions
- Crane and port deployments improve efficiency and reduce collisions and workplace injuries

**KONECRANES®** **Outrider**

# Smart Infrastructure | Intelligent Transportation Systems

- Currently have 13 active projects and 52 projects in development across EMEA, APAC, and North America
- Partnered with multiple software providers to deliver traffic and pedestrian analytics
- Wrong-way detection solution to improve vehicle safety
- Traffic and pedestrian analytics improve roadway efficiency and improve safety for all road users



# Over 600 customers in 50 countries



