



Focused on 3D

MotionCam-3D

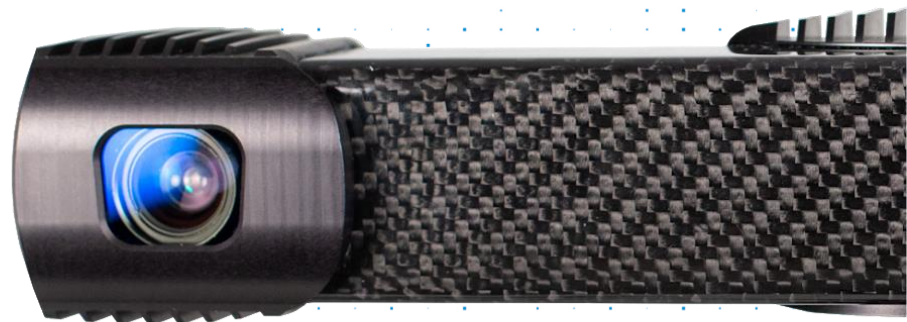
Next chapter of the 3D Vision



Marcel Švec
Director of 3D Sensing



Tomáš Kovačovský
CTO

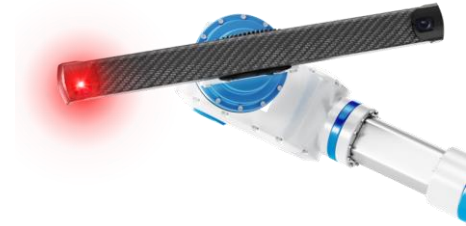


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Shanghai AST Automation Technology Co., Ltd.
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Outline

- **Technology** - Parallel Structured Light
- **Product** - MotionCam-3D
- **Applications** - Benefits of scanning in motion

- Q&A





Focused on 3D



Global presence with 150+ employees and 45+ distributors

Providing robot vision & intelligence for more than 1500 solutions worldwide



USA
Erlanger, Kentucky

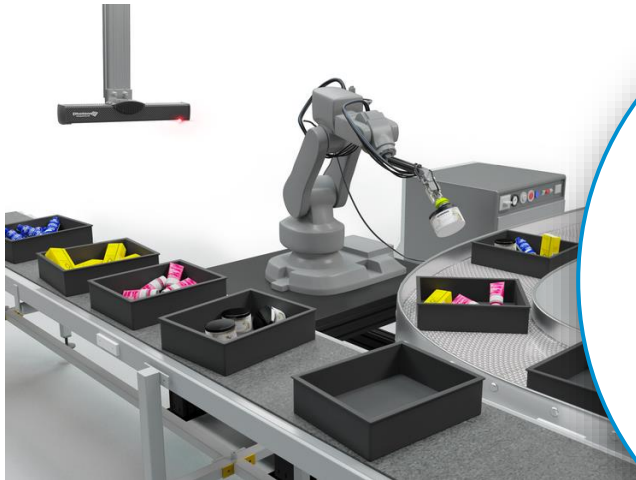
EU - Headquarters
Bratislava, Slovakia



World
Distributor network, 45 offices

China
Shanghai

Eyes & Intelligence for Smart Automation



Random Piece Picking



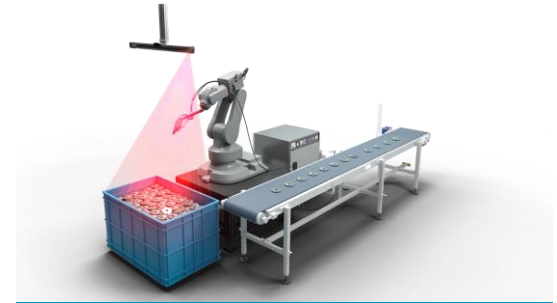
Universal Depalletization



Packaging



Sorting



Bin Picking

Eyes & Intelligence
for
Smart Automation



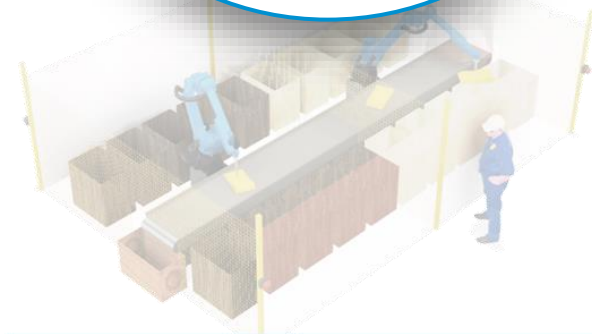
Random Piece Picking



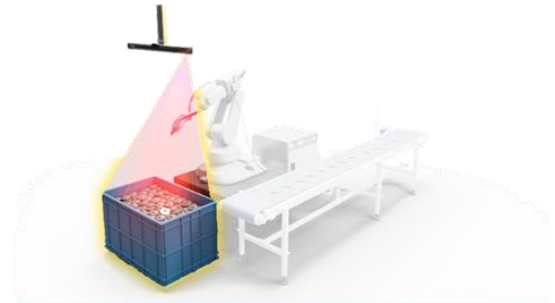
Universal Depalletization



Packaging

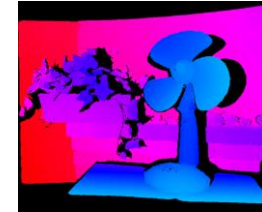
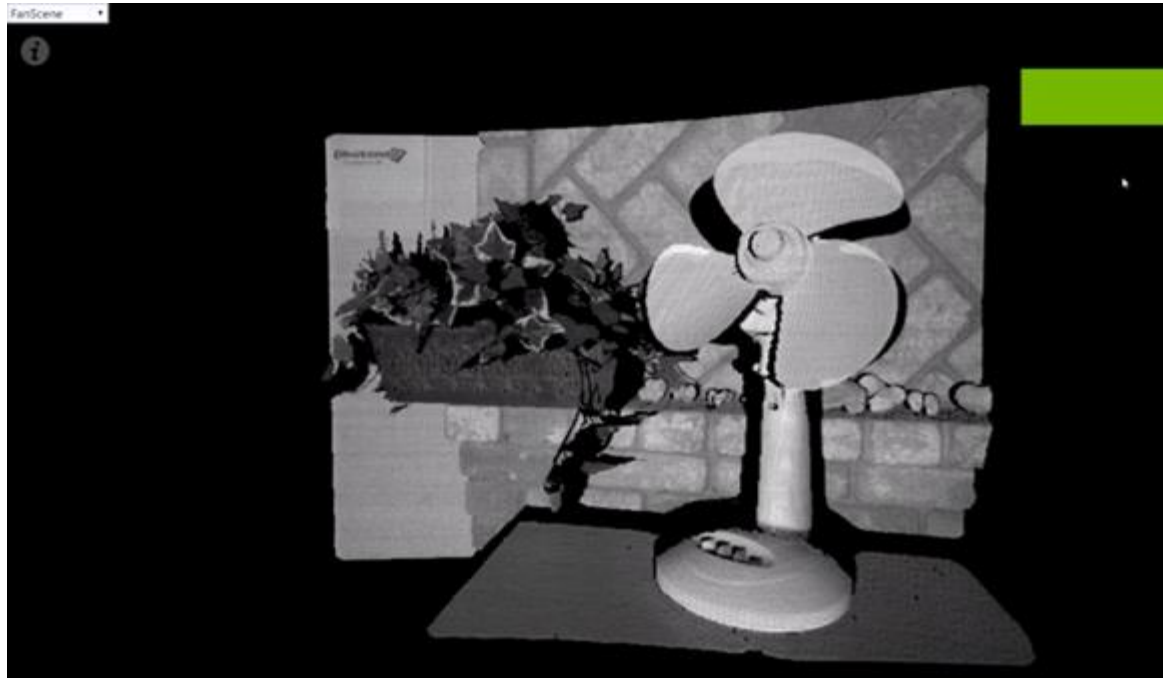


Sorting



Bin Picking

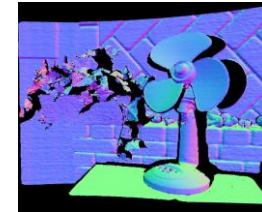
3D Sensing



3D (DepthMap)

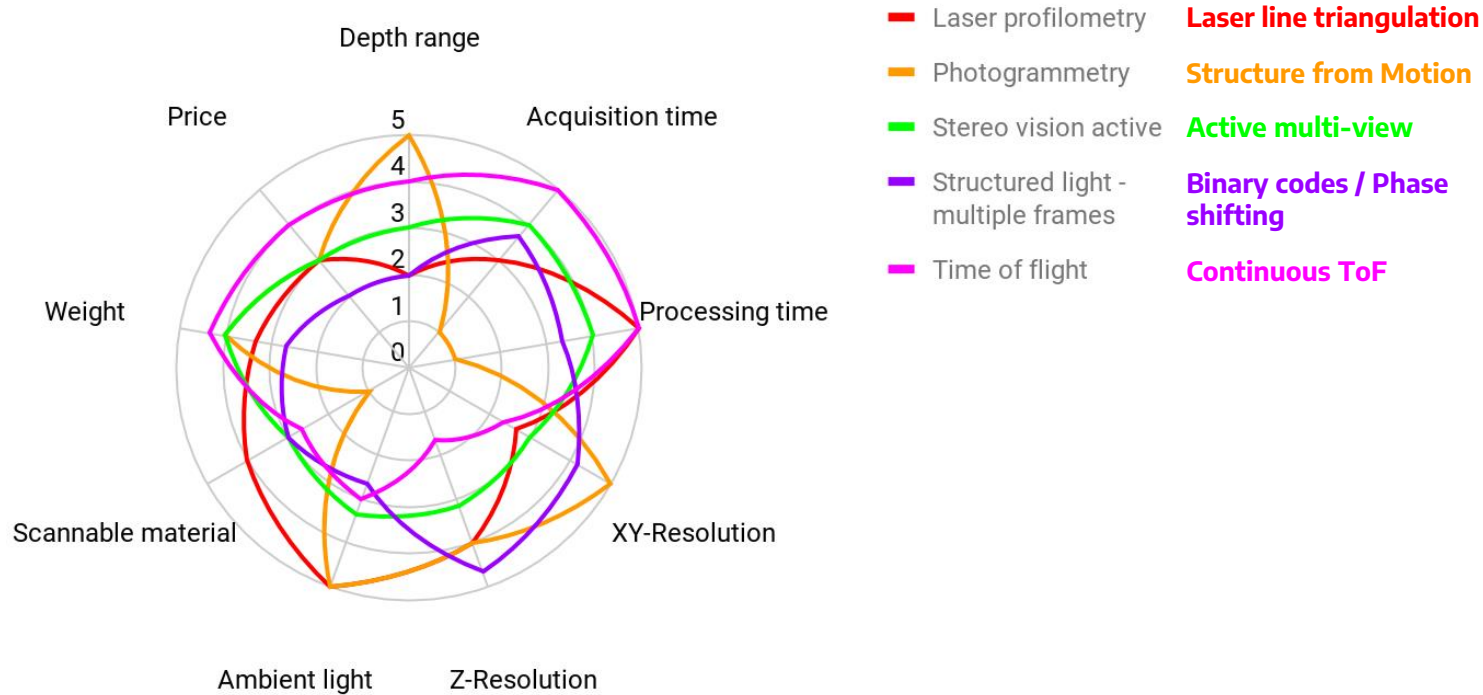


Texture

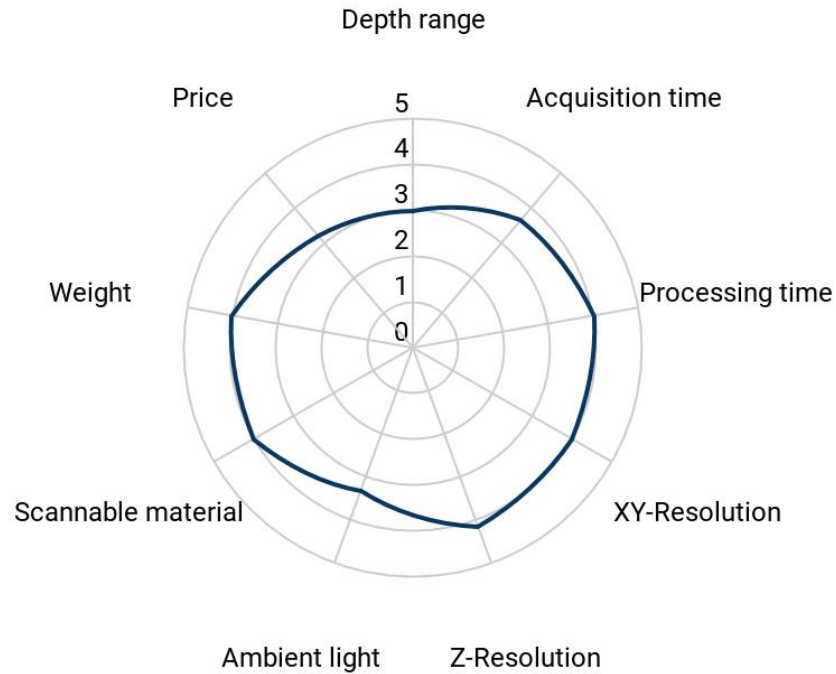


Normals

Feature balance - State-of-the-art technology



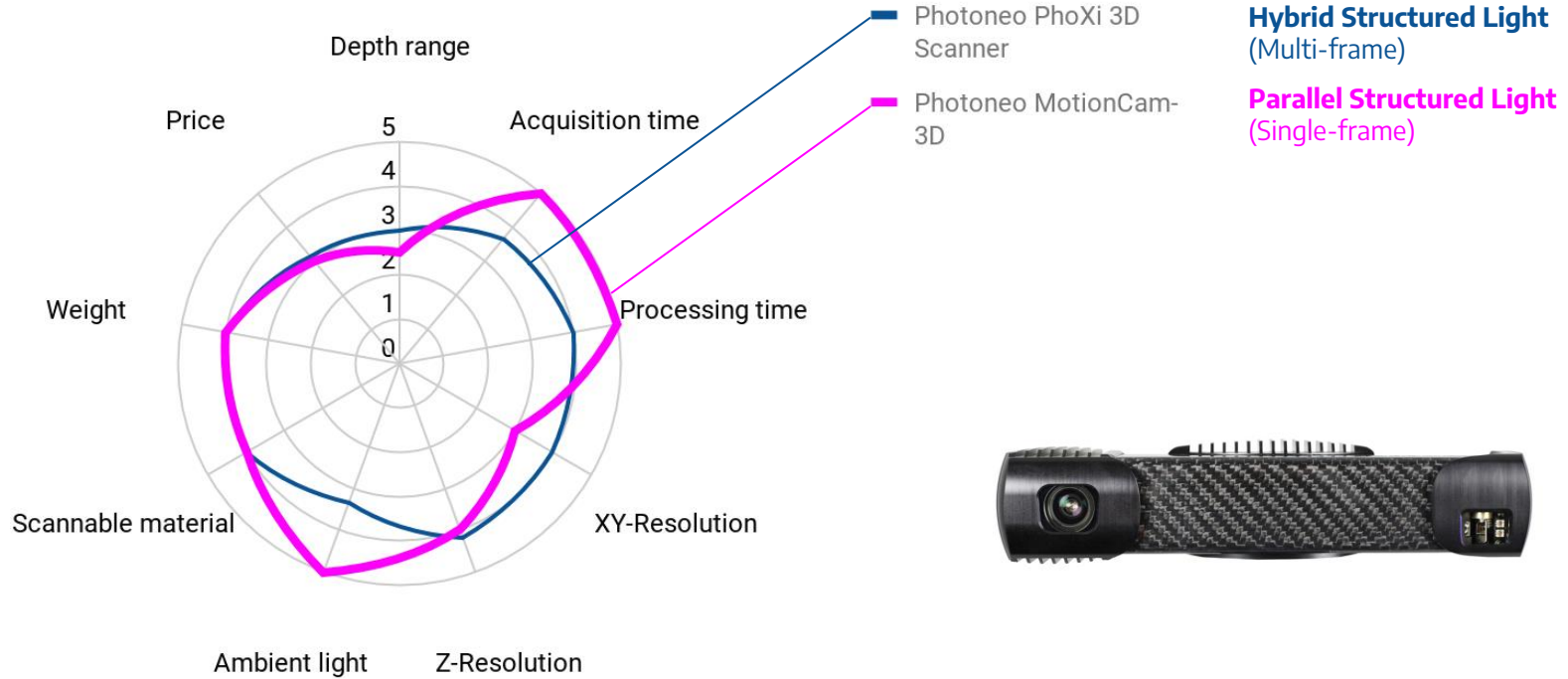
Feature balance - Structured Light



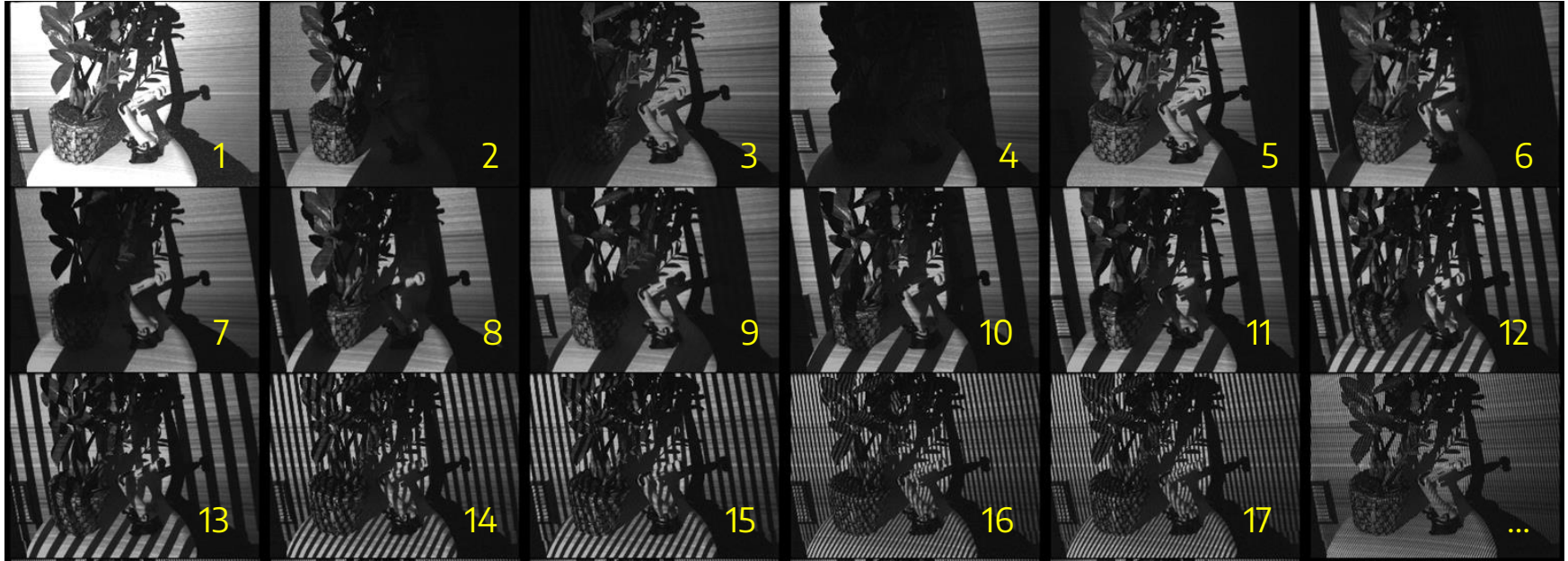
■ Photoneo PhoXi 3D Scanner



Feature balance - Parallel Structured Light



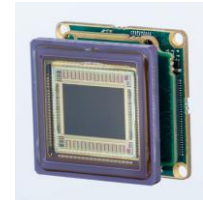
Parallel Structured Light → From Sequence to Snapshot



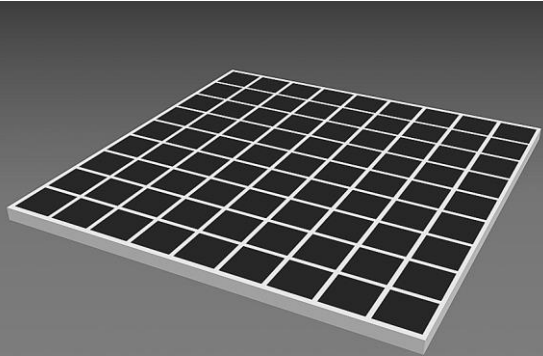
- Sequence of pictures requires time to take every picture. If the scene changes, the code is broken → broken data.
- Snapshot is just “1 picture” → allows movement that is “smaller than the acquisition time”.

Computational Image Sensor (COMPIS)

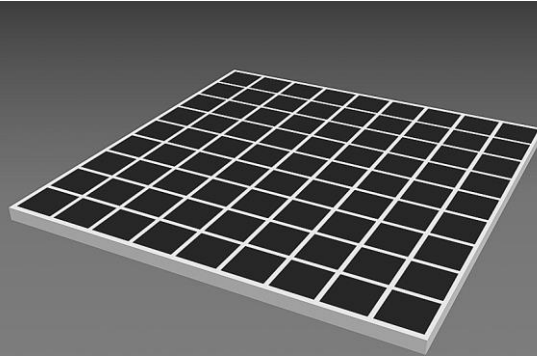
- It's not just another image sensor with "epsilon improvement" (like lower noise or higher resolution). It fundamentally changes the way how the image is captured and thus reveals a novel, valuable information.
- Broad applicability:
3D Scanning, HDR video, Motion Tracking, Image Deblurring, Compressive sensing



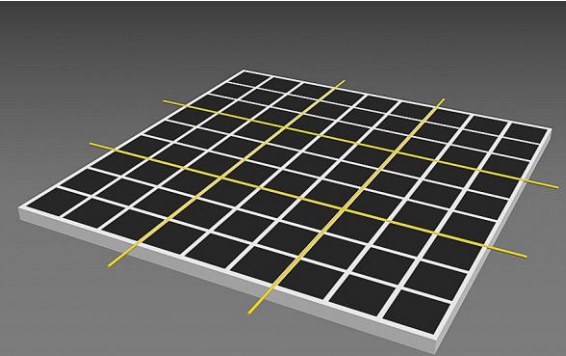
Rolling Shutter



Global Shutter

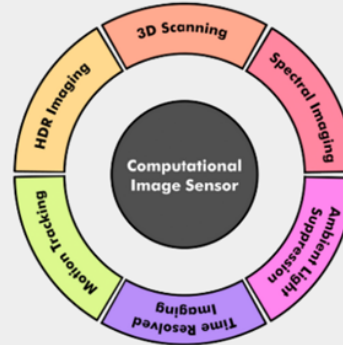


Mosaic/Matrix Shutter

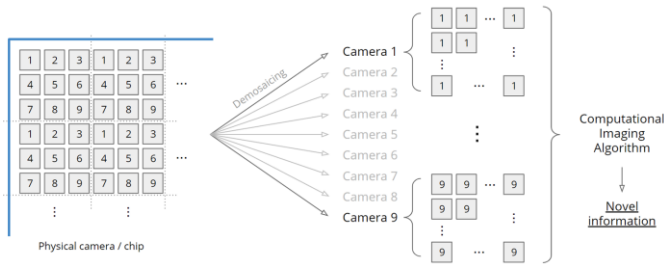


Basic principle

Multi frame
sensing approach

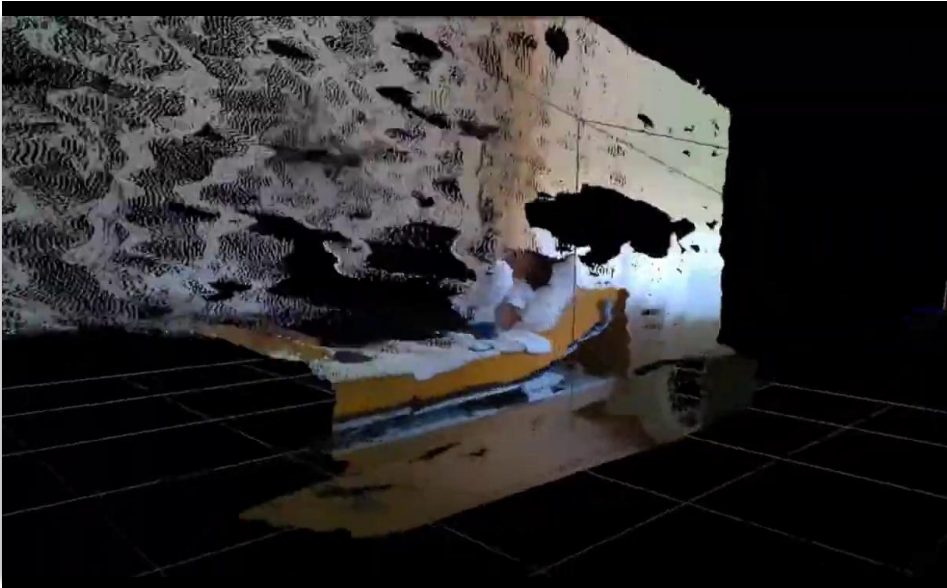


One frame
sensing approach



- 3D Video
- Speed Measurement
- HDR Video
- Ambient Light Suppression
- Photometric Stereo
- Depth Edges
- Motion Tracking
- Hyperspectral Imaging
- Time Gating
- Subsurface Scattering
- Light Field
- ...

Examples of area scanning in motion

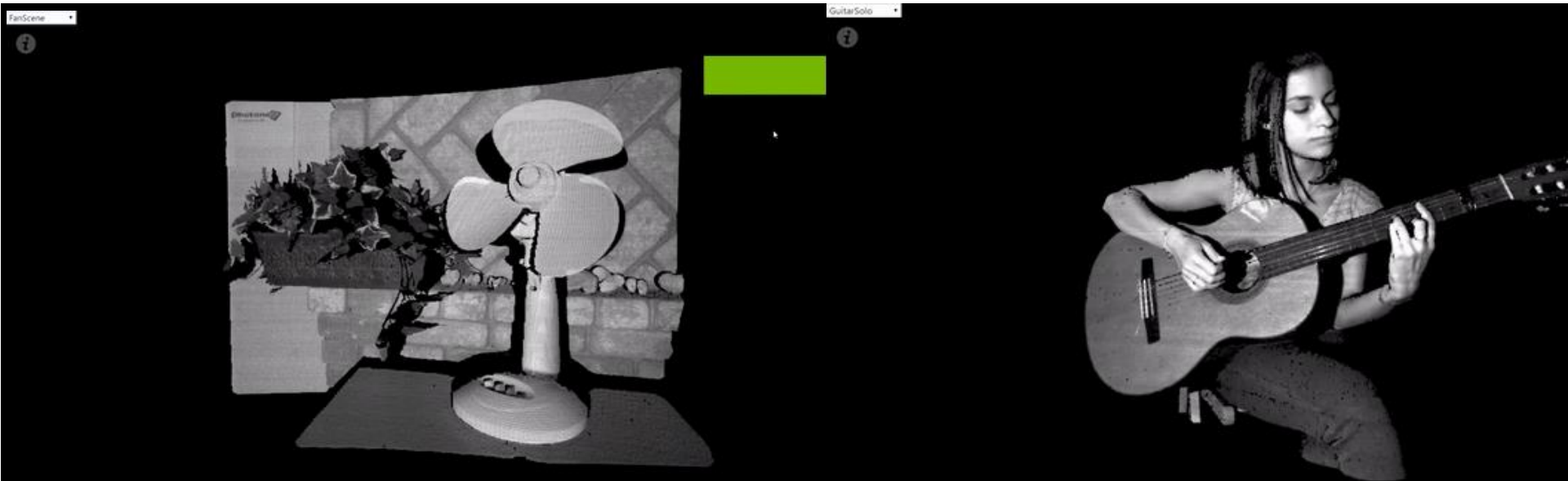


Structured dot-pattern



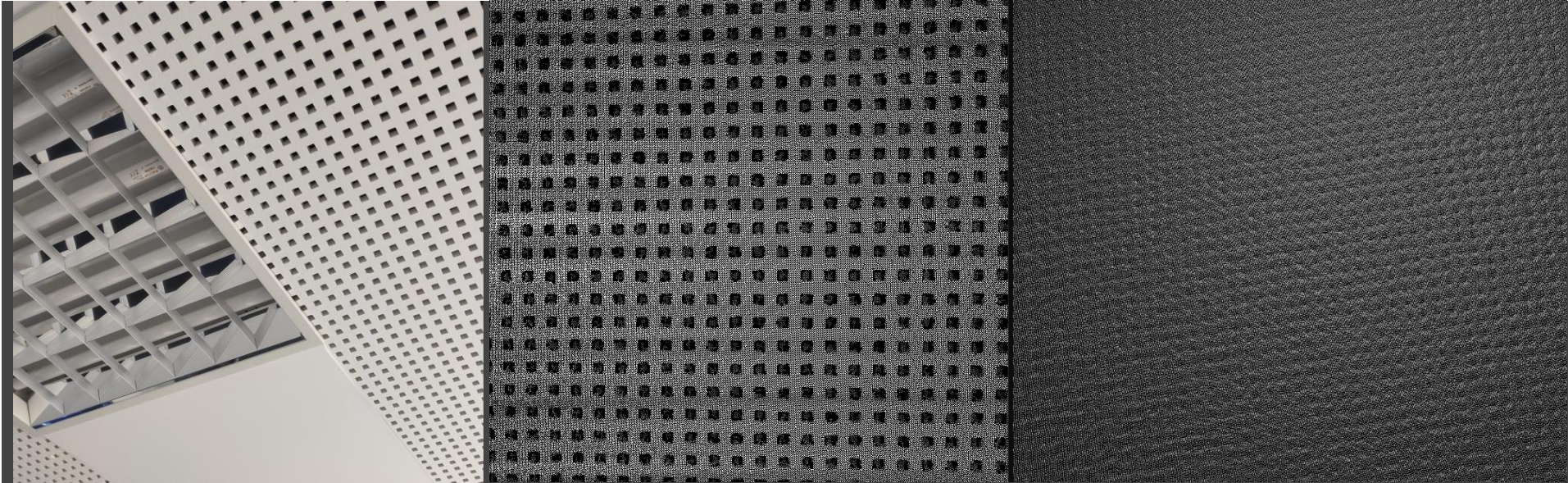
Time of Flight

Area scanning in motion by MotionCam-3D



Parallel Structured Light

Level of detail



Sound eliminating
ceiling

Parallel Structured Light

Time of Flight

Technology Comparison

	Line Scanners	Time of Flight	Passive Stereo	Structured patterns	Structured Light	Parallel Structured Light
True Resolution	High	Low	Medium	Low	High	High
Accuracy	Medium	Low	Medium	Medium	High	High
Robustness	High	Medium	Low	Medium	High	High
Acquisition speed	Medium	High	High	High	Low	High
Processing speed	Medium	High	Low	Low	High	High
Depth range	Medium	High	High	High	High	High

* Considering general use case for vision guided robotics.

Photoneo

Focused on 3D



The revolution in 3D vision is here

MotionCam-3D

Unique combination of speed & data quality



- **Scanning in rapid motion**
one frame acquisition, 40 m/s
 - **High resolution & accuracy**
2 MP, 0.150 mm
 - **Practical scanning range**
3 models: from 36 cm - 3 m
- **No motion blur**
10 μ s per pixel exposure time
 - **Industry ready**
IP65, PoE, Thermal calibration
 - **Plug & Play**
Practical application & API
- **Integrated computing unit**
Delivers 15 Million points per second
 - **Robust scanning**
Ambient light suppression methods
 - **Patented technology**
Parallel Structured Light

Body sizes

baseline



230 mm

S



350 mm

M



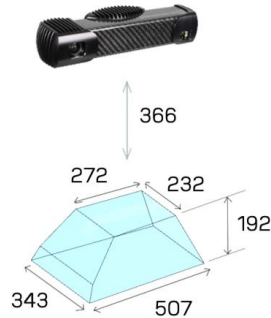
550 mm

L



Scanning ranges

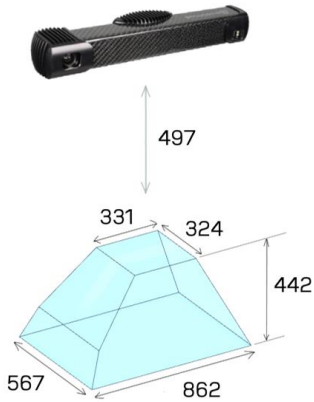
* all units are in mm



S

Small volume

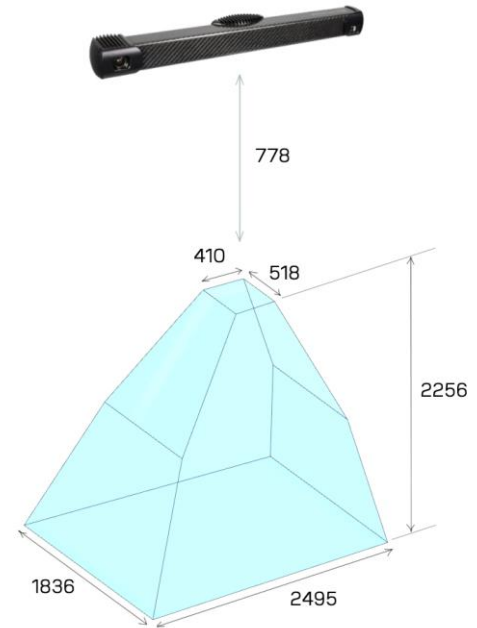
A4 x 20 cm



M

Medium volume

60 x 40 x 40



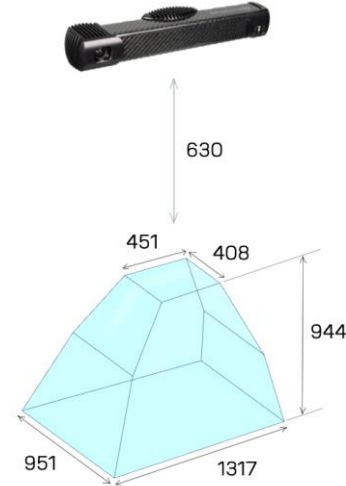
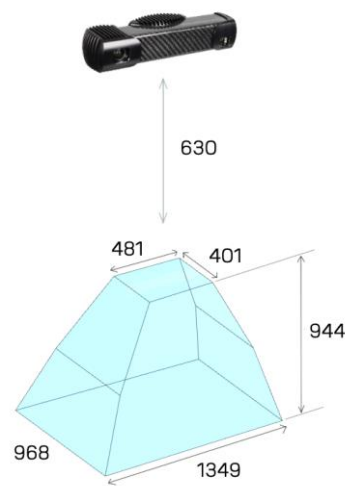
L

Large volume

two euro-pallets

Extended scanning ranges

Extended scanning volume -
very practical for hand-eye
approach



S

M

S+

M+

L

Extended medium
volume in
small body factor

Extended medium
volume
and accuracy

Switching modes

20
fps

Camera

0.9 MP
resolution

from
0.300 mm
accuracy

Software on-
the-fly
switch



Scanner

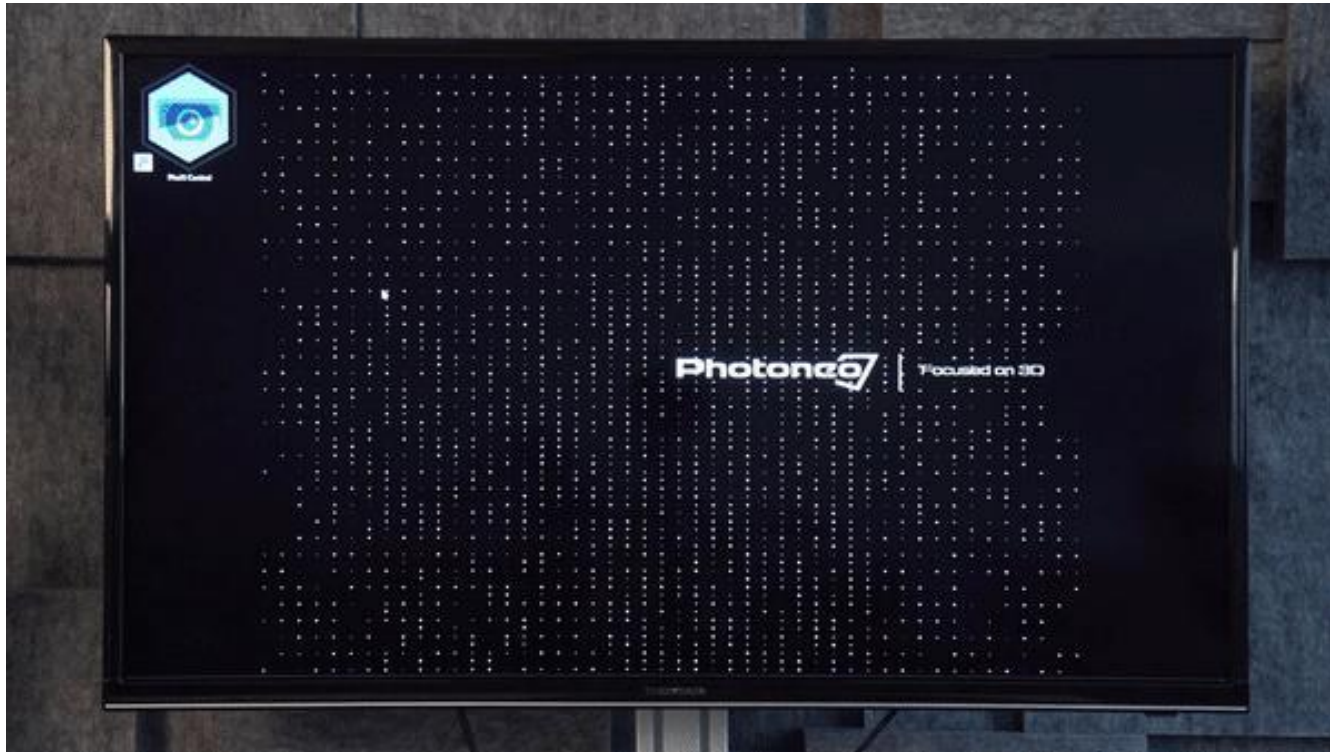
2 MP
resolution

from
0.150 mm
accuracy

Scanning quality

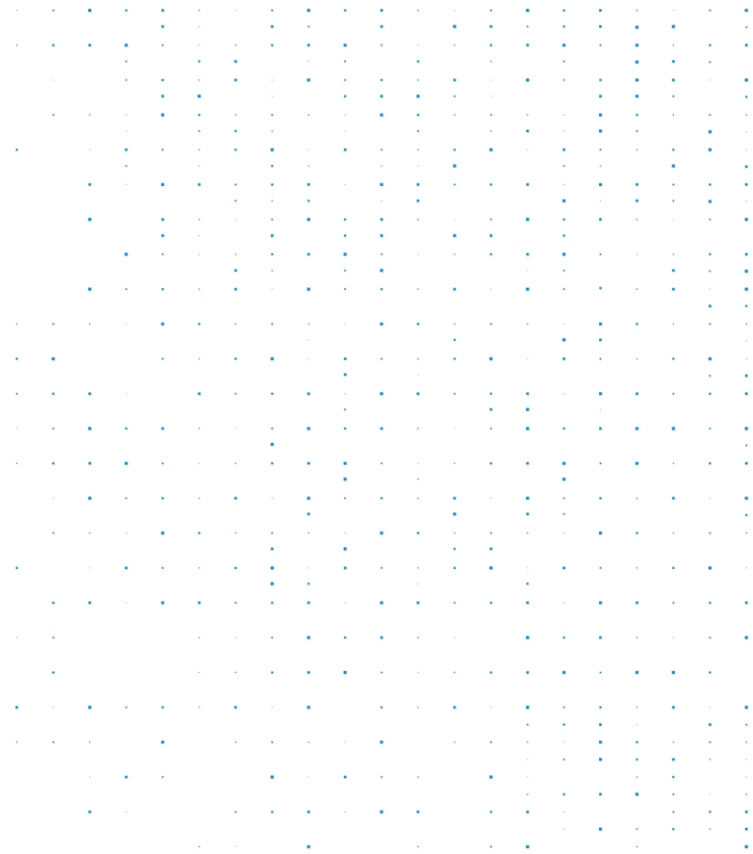
	MotionCam-3D S	MotionCam-3D S+	MotionCam-3D M	MotionCam-3D M+	MotionCam-3D L
Scanning range	366 - 558 mm	630 - 1574 mm	497 - 939 mm	630 - 1574 mm	778 - 3034 mm
Scanning area	272 x 232 mm @z=366 mm 376 x 278 mm @z=442 mm 507 x 343 mm @z=558 mm	481 x 401 mm @z=630 mm 784 x 560 mm @z=900 mm 1349 x 968 mm @z=1574 mm	331 x 324 mm @z=497 mm 539 x 416 mm @z=650 mm 862 x 567 mm @z=939 mm	451 x 408 mm @z=630 mm 793 x 558 mm @z=900 mm 1317 x 951 mm @z=1574 mm	410 x 518 mm @z=778 mm 976 x 783 mm @z=1239 mm 2495 x 1836 mm @z=3034 mm
Camera Mode					
- Point size	0.37 mm @z=442 mm	0.76 mm @z=900 mm	0.55 mm @z=650 mm	0.76 mm @z=900 mm	1.05 mm @z=1239 mm
- Accuracy	< 0.300 mm	< 1.000 mm	< 0.500 mm	< 0.600 mm	< 1.250 mm
- Temporal noise	< 0.100 mm	< 0.150 mm	< 0.100 mm	< 0.100 mm	< 0.150 mm
Scanner Mode					
- Point size	0.25 mm @z=442 mm	0.52 mm @z=900 mm	0.37 mm @z=650 mm	0.52 mm @z=900 mm	0.72 mm @z=1239 mm
- Accuracy	< 0.150 mm	< 0.500 mm	< 0.250 mm	< 0.300 mm	< 0.900 mm
- Temporal noise	< 0.050 mm	< 0.100 mm	< 0.050 mm	< 0.050 mm	< 0.100 mm
sub-millimeter accuracy					

Familiar PhoXi Control eco-system

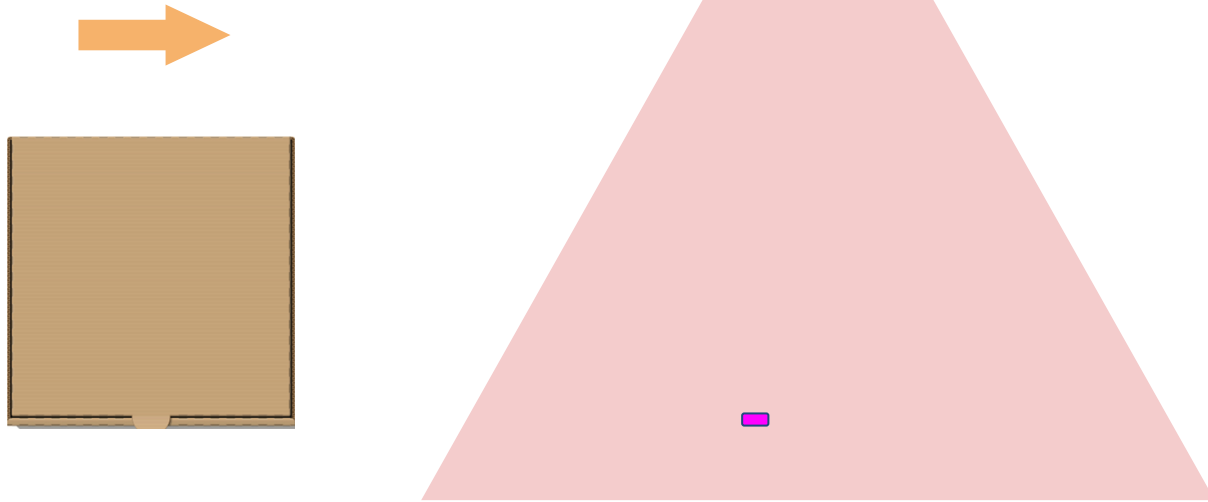


PhoXi Control 1.4. (on the website)

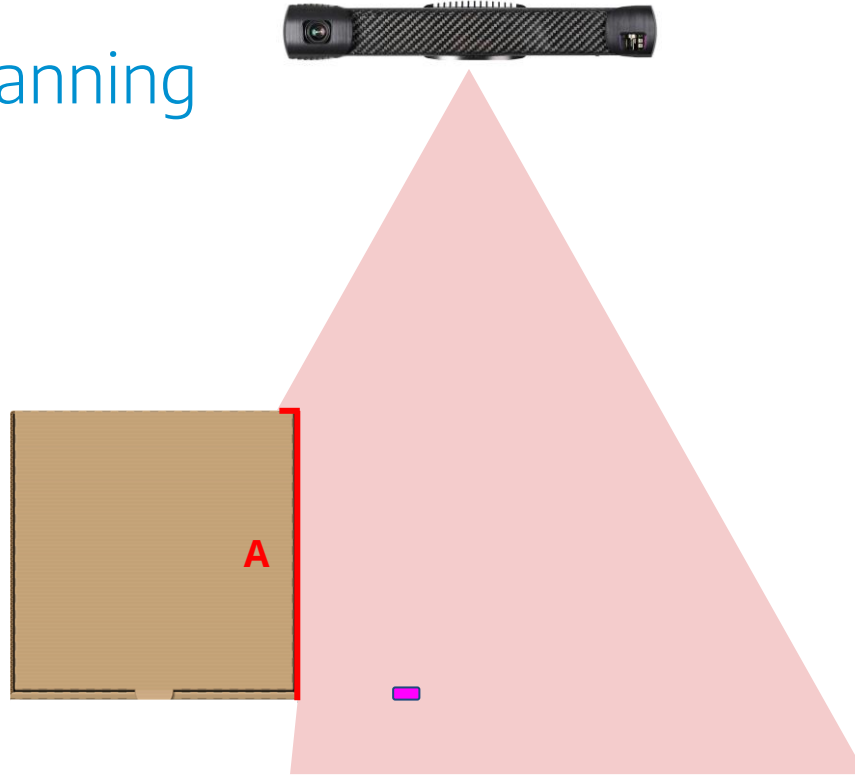
3D Area Scanning in Motion



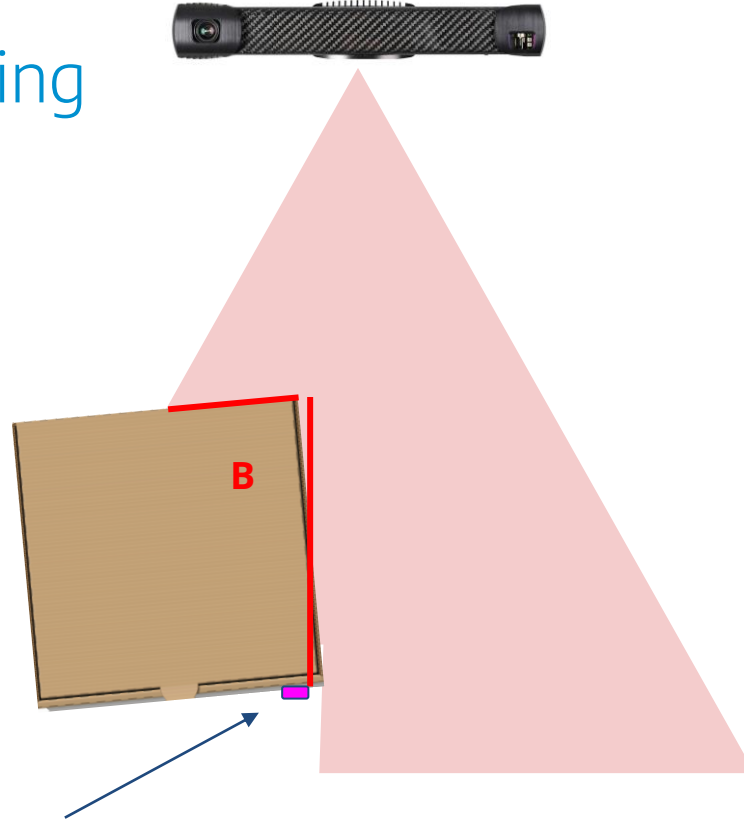
3D Area Scanning



3D Area Scanning



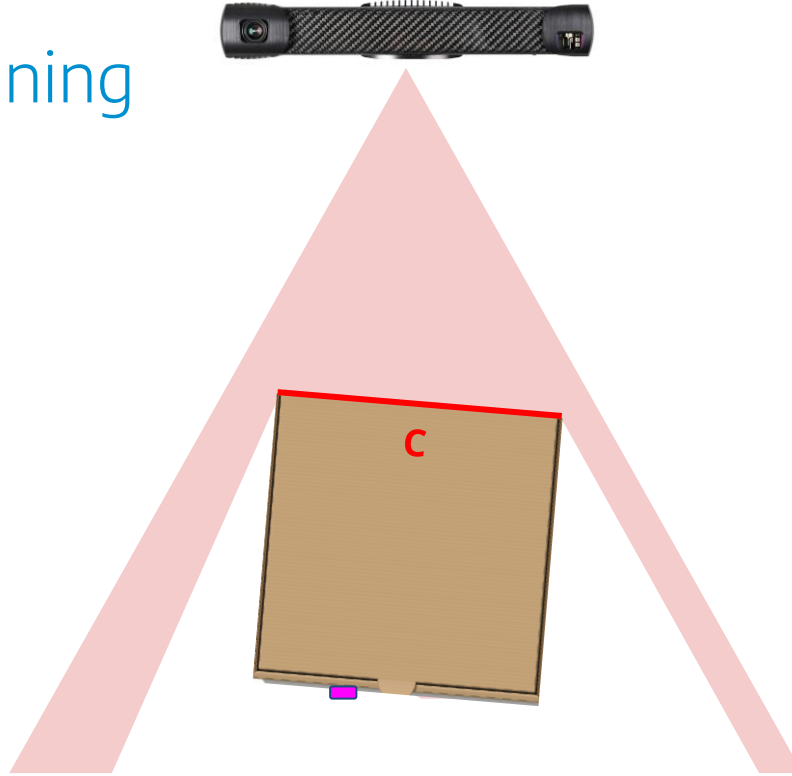
3D Area Scanning



Argh! There is a bump
(or vibration).

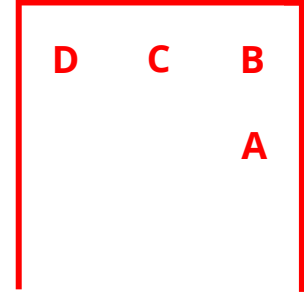
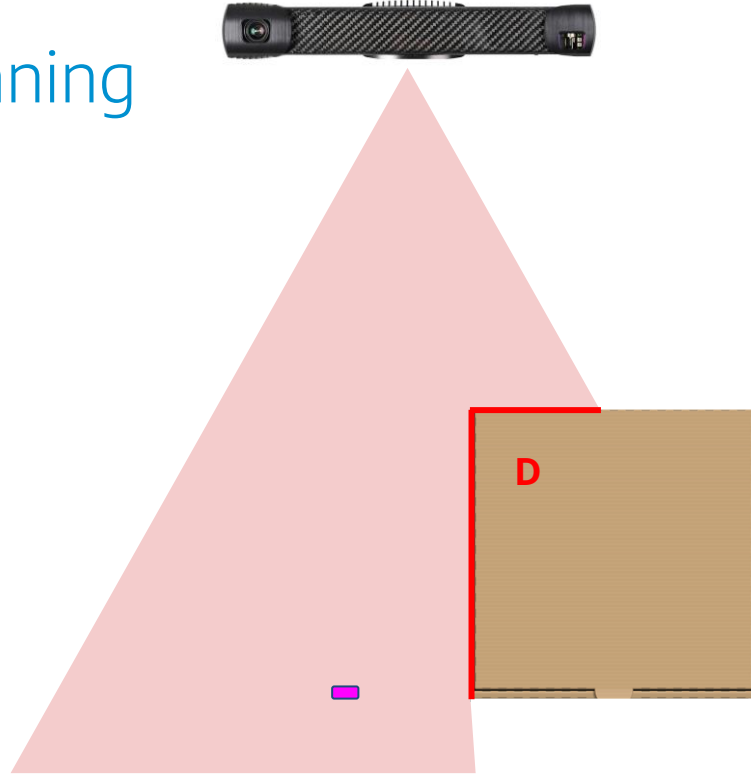
Alignment relies on
the data itself, not on
the conveyor.

3D Area Scanning



Alignment relies on the data itself, not on the conveyor.

3D Area Scanning

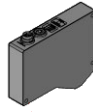
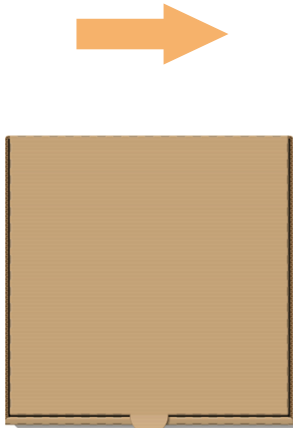


Alignment relies on the data itself, not on the conveyor.

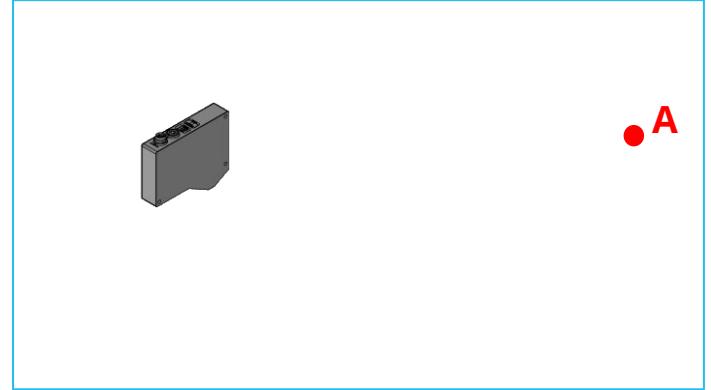
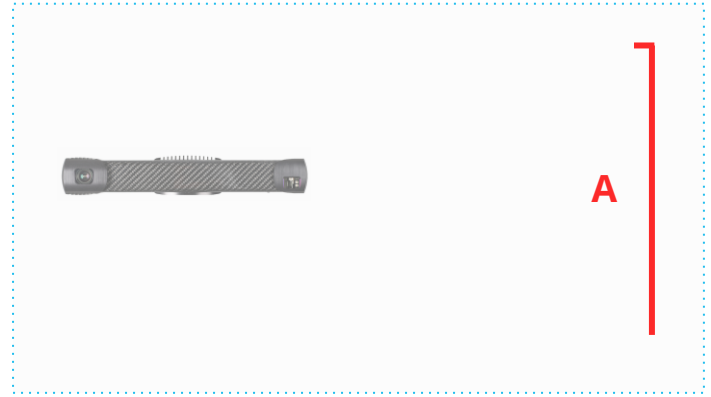
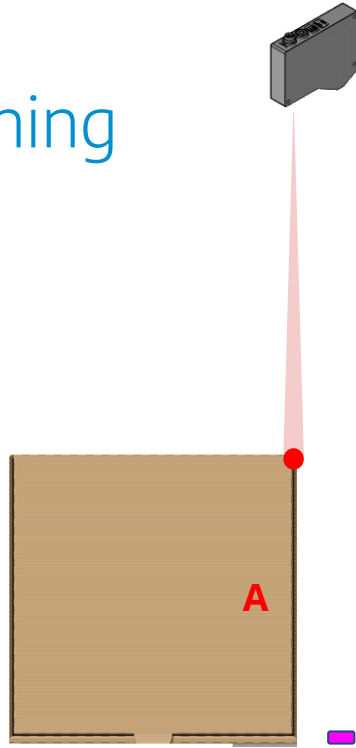
Potentially 270° reconstruction from one camera!

Result: Correctly aligned object.

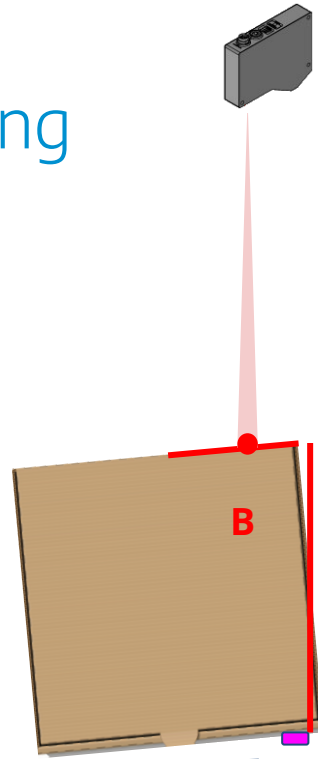
3D Line Scanning



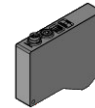
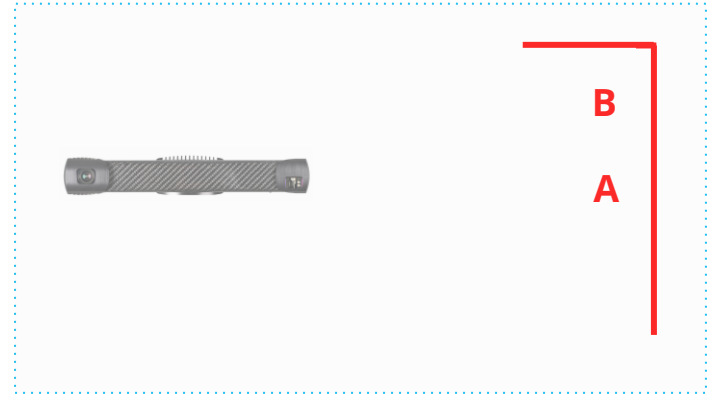
3D Line Scanning



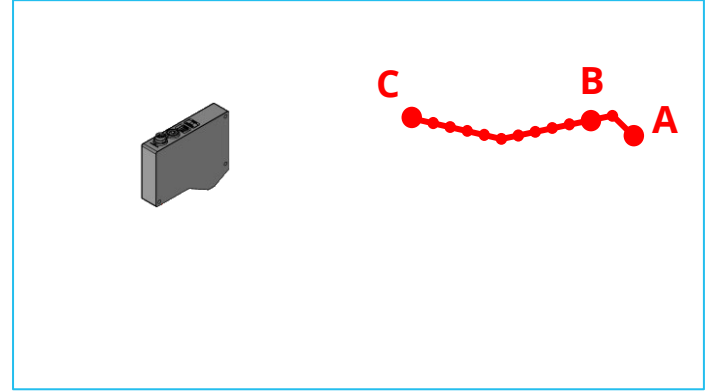
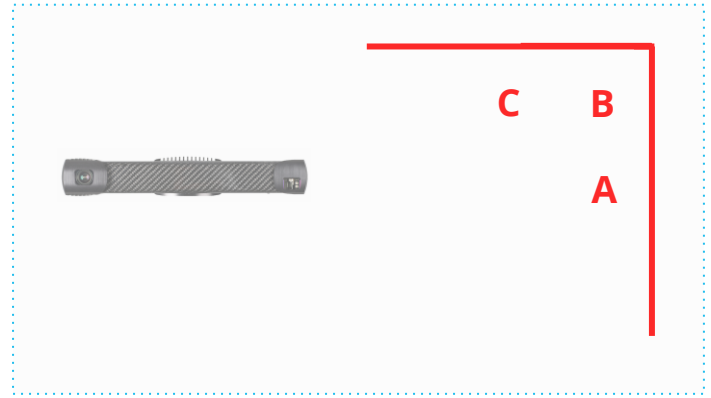
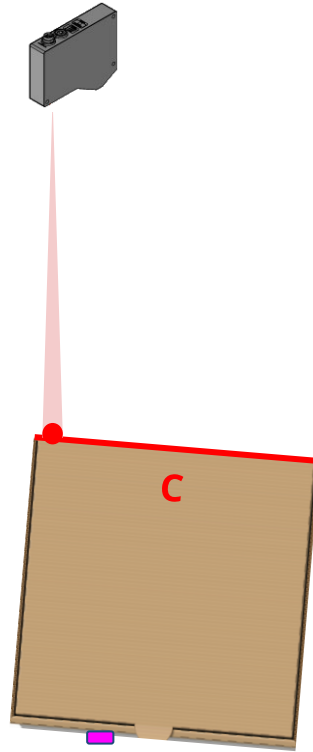
3D Line Scanning



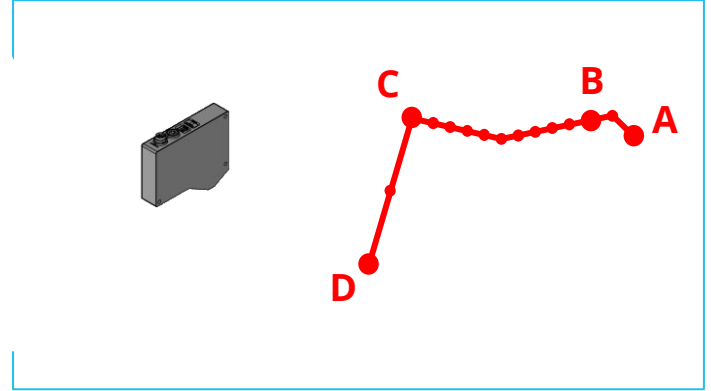
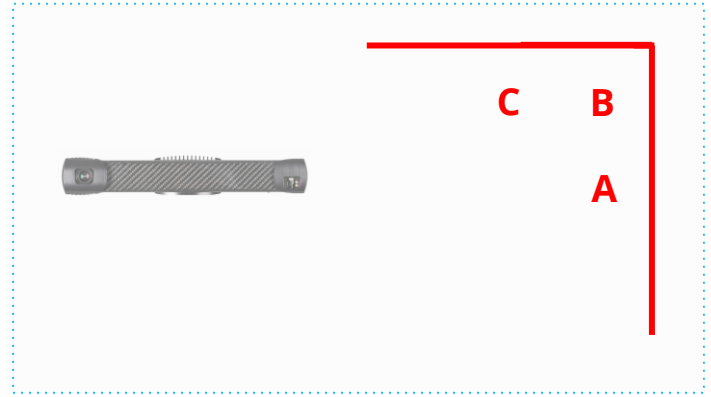
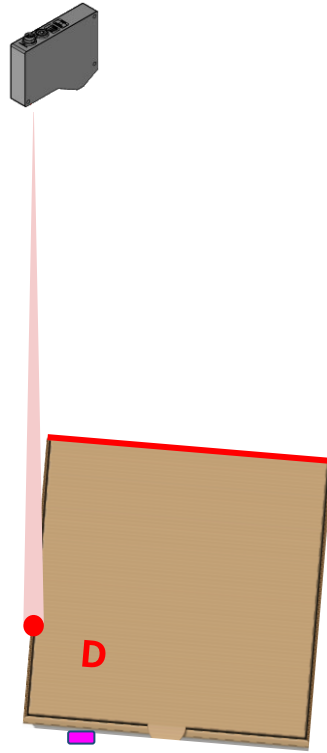
Argh! There is a bump.



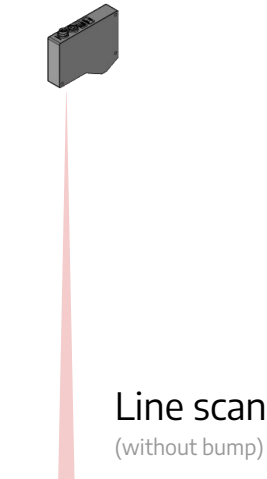
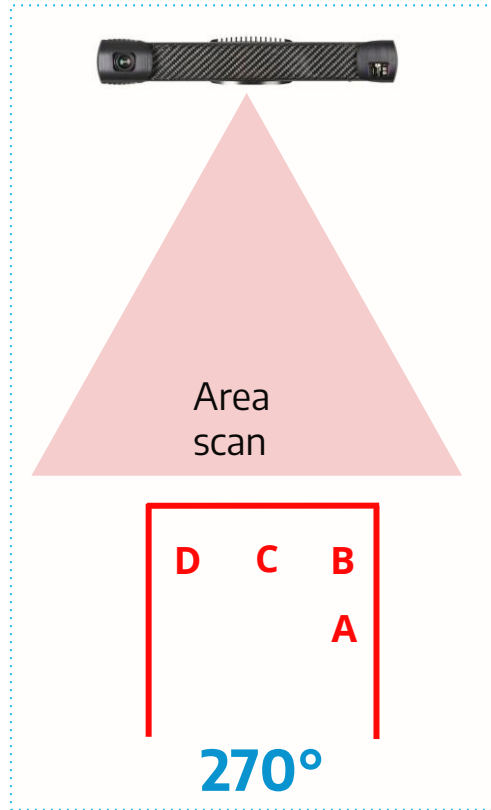
3D Line Scanning



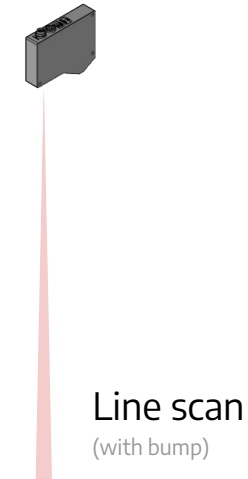
3D Line Scanning



3D Area vs. Line Scanning

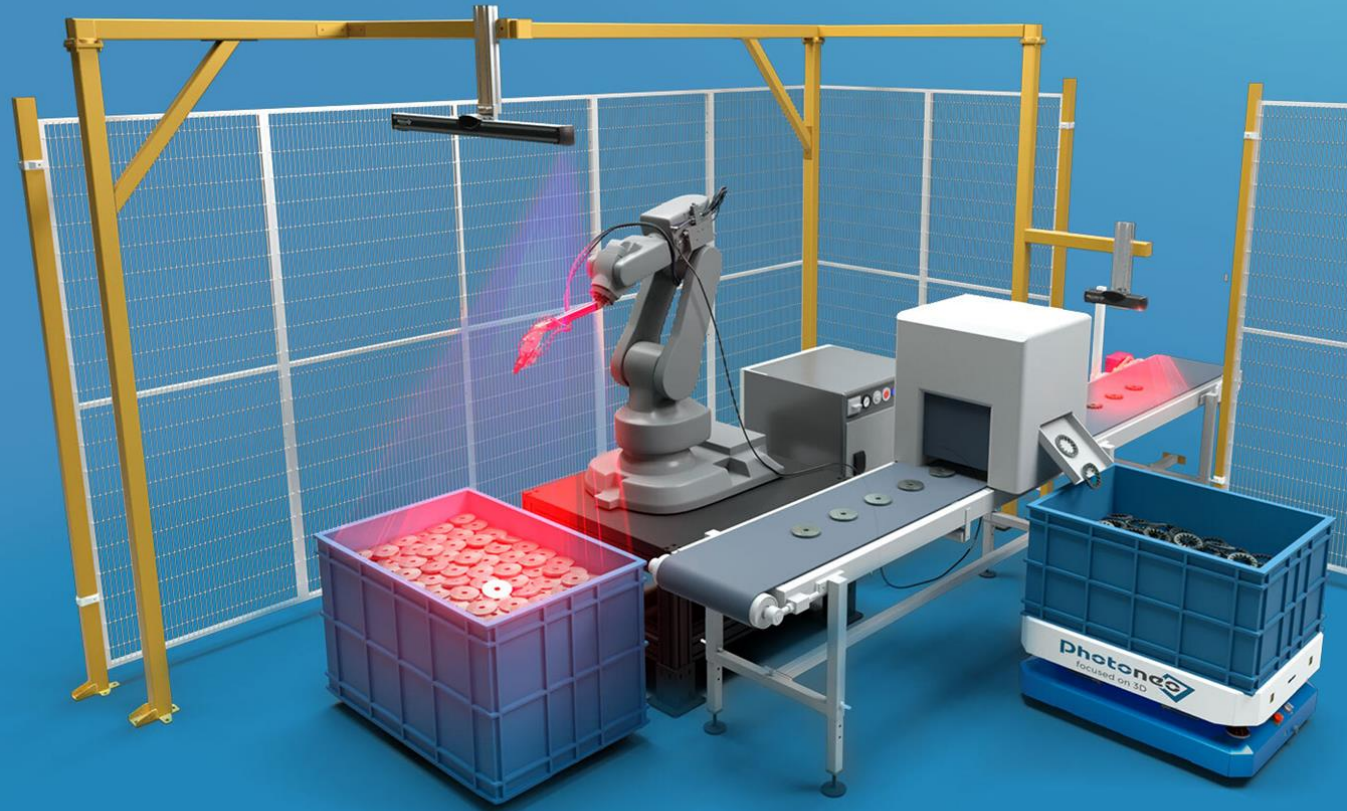


Ortho

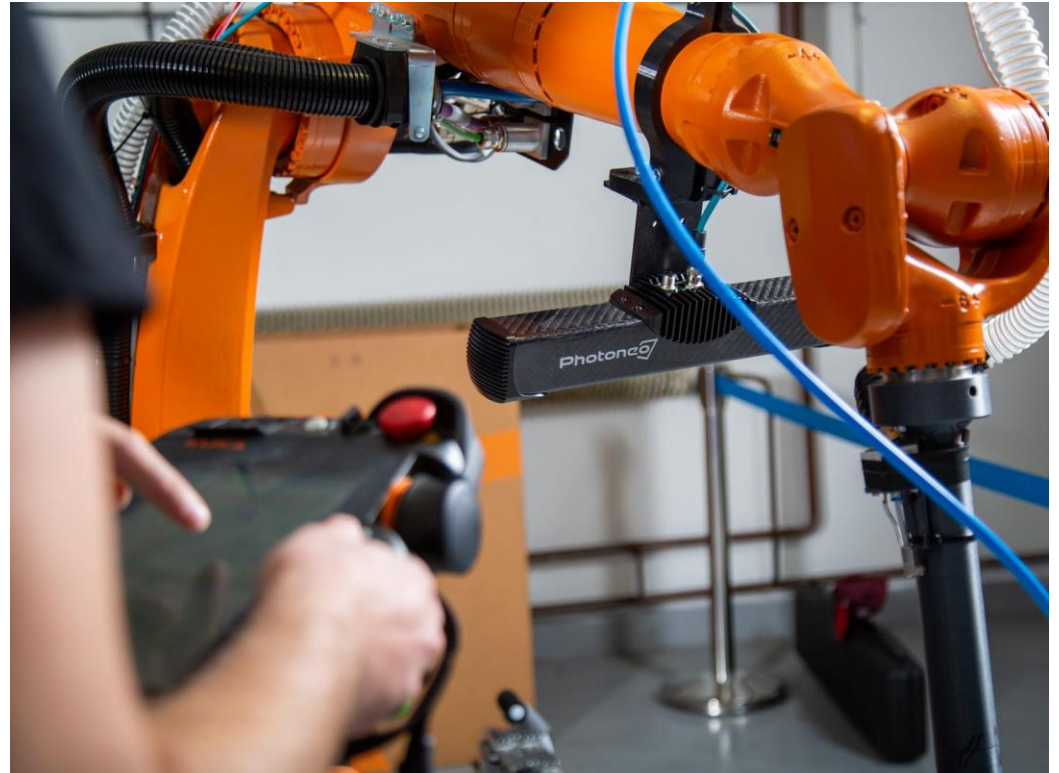


Errors

Applications



Hand-eye object handling



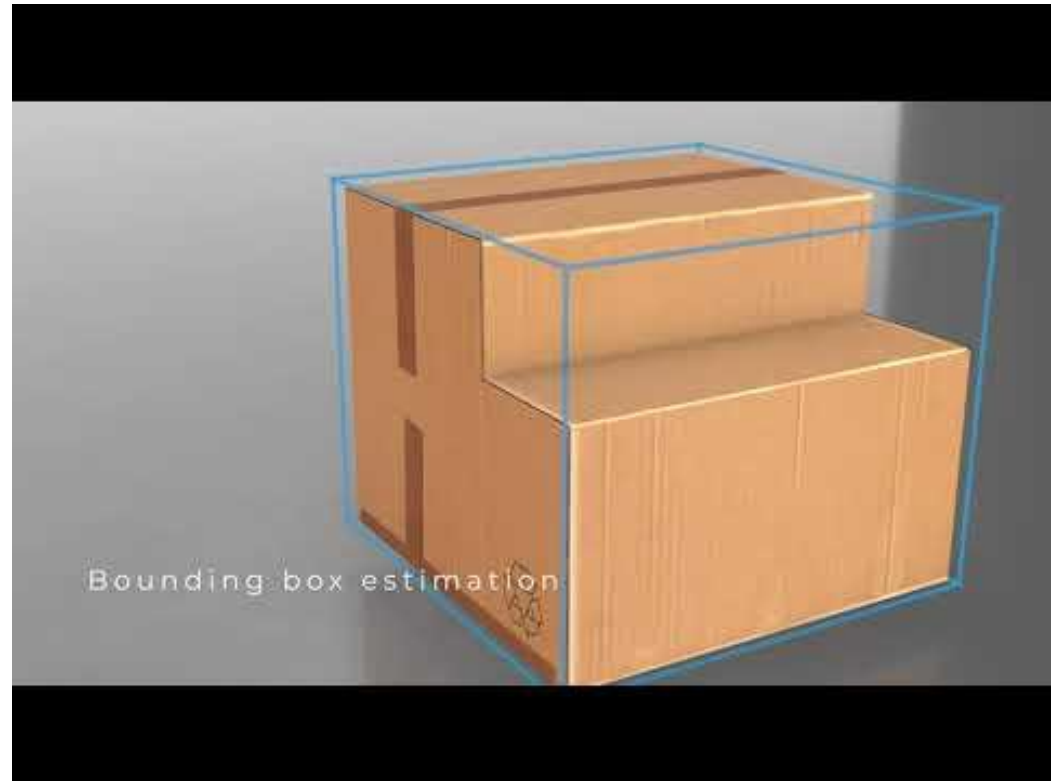
Collaborative robotics



Belt picking / picking in motion



Dimensioning



Dimensioning



Inspection of large spaces (on AMR)



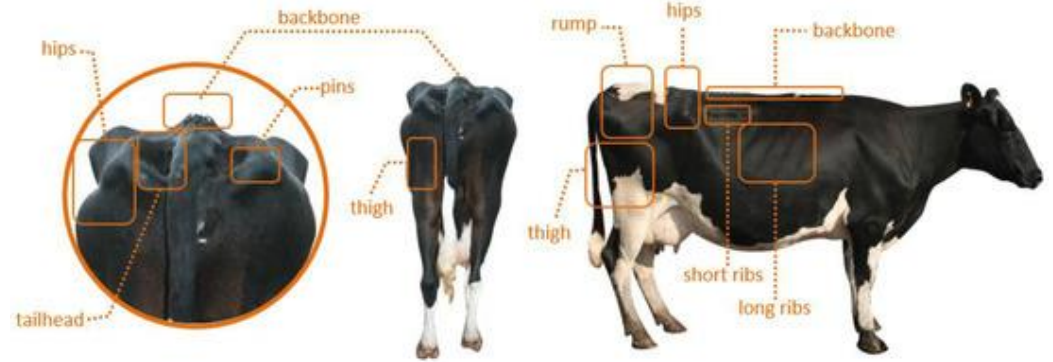
Large field scanning (on vehicle)



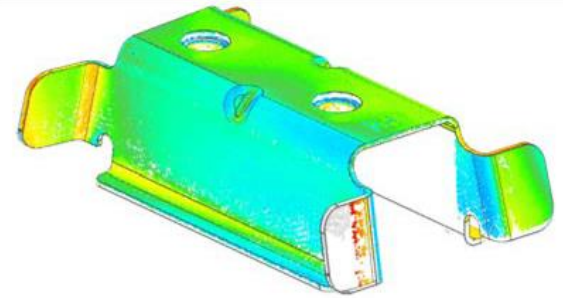
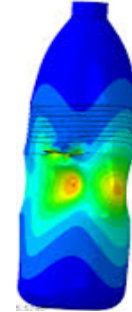
Recognition,
sorting,
volume measuring



Object Monitoring / Feature recognition



100 %
Quality Control



Overhead conveyors



Thank you for your
attention!

Q&A time

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Email: berttang@yeah.net

