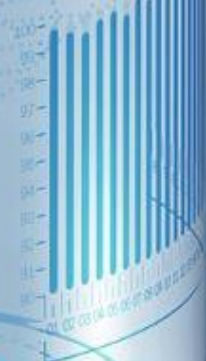**SICK**
Sensor Intelligence.

Increase Quality in
Production & Logistics

Quality Control Solutions
with camera's and LiDAR

Quality Control

What does this mean ...

> Ensure good and stable quality products for your customers

> Maximize production efficiency and increase productivity
>
> - Identify problems immediately
> - Minimize downtimes
> - Increase profitability – maintain competitive pricing
> - Reduce waste and save natural resources

> Deviate between high and lower quality products
>
> - Organic & natural products

> No faulty shipments

Quality Control
... in Production

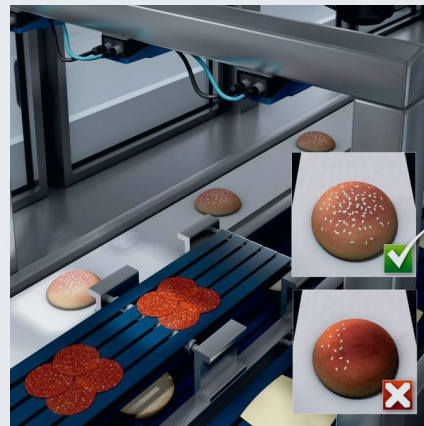| Defect Detection	Measurement & Quantification	Completeness Check	Foreign Object Detection
Label inspection / Dent detection	Food inspection / Volume inspection	Content verification / Assembly check	Objects on surface / Objects in process
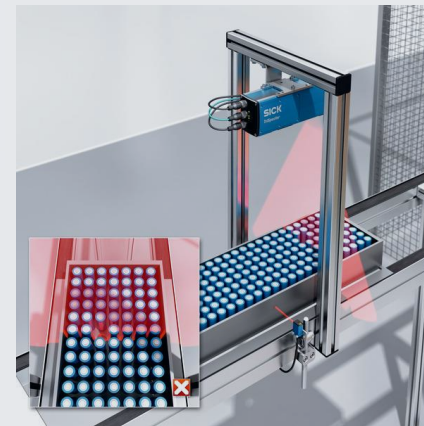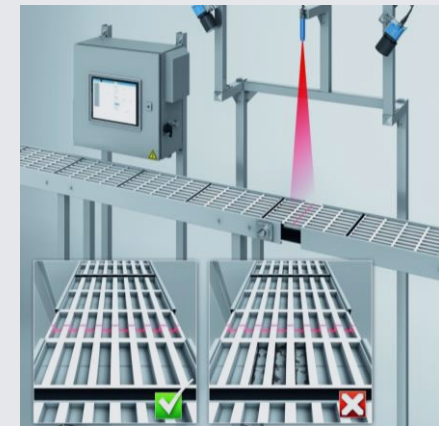
Quality Control
... in Logistics

Defect Detection	Measurement & Quantification	Completeness Check	Foreign Object Detection
Label inspection / Pallet inspection	Dimension inspection / Volume inspection	Content verification / Part presence	Objects on surface / Objects inside product
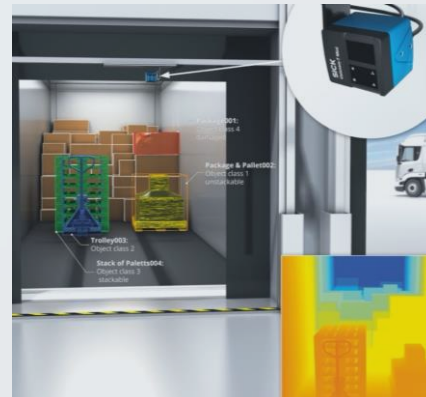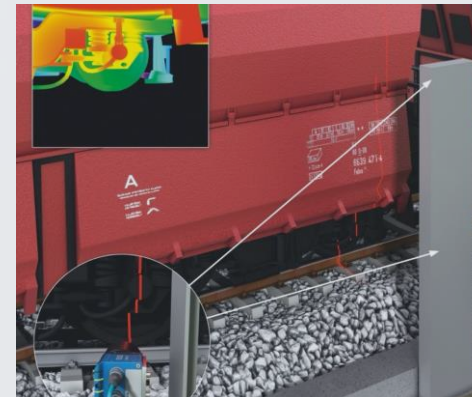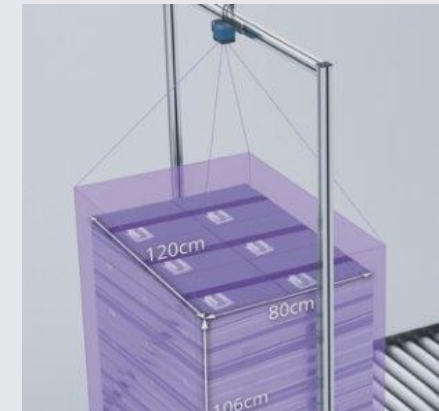
Technologies

Intelligent Questions have more than 1 answer

3D

2D

Inspect — Check?

Measure — Size?

E = 212.4
L/2 = 428.5
M = 429
T = 225
A = 226
G = 184

Position — Where?

Read — What?

2D Technology
Machine Vision

Basics

› Digital image/picture of an object

› Capture & process a 2-dimensional map (X, Y) of reflected intensity

› Comparing variations in intensity (contrast)

Ideal for …

› Barcode reading

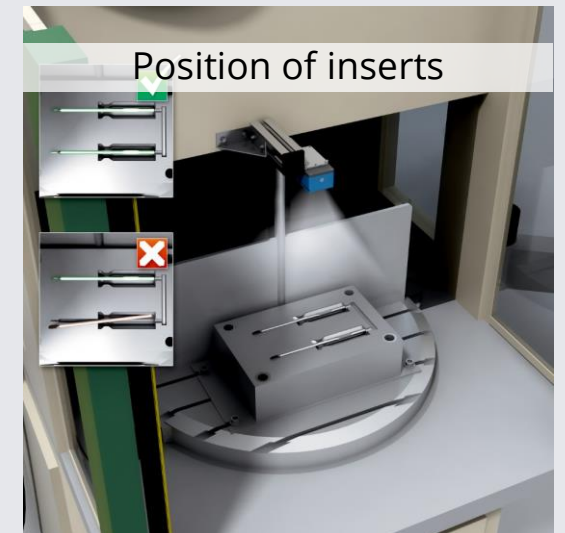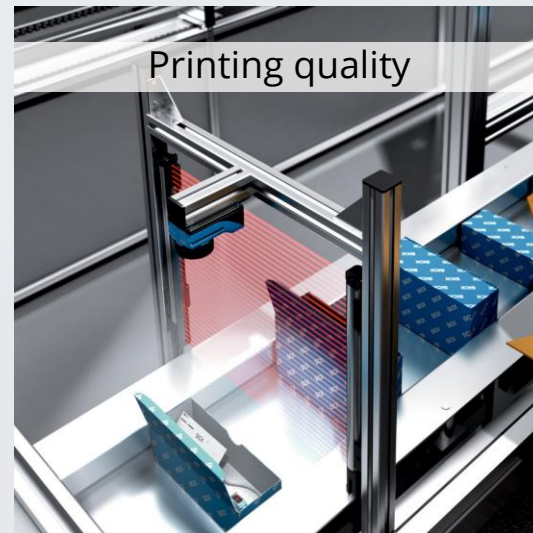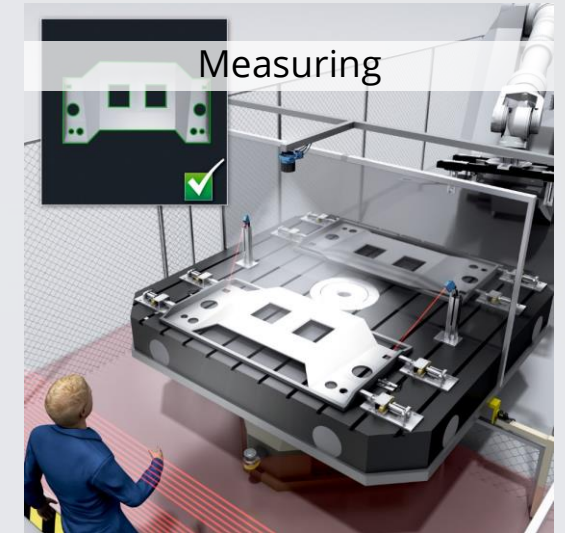› Presence Inspection

› Quality Inspection (shape color, …)

Required

› Lighting creating good contrast

2D Technology

Typical Applications

Content of packages

Inline quality control

Assembly verification

Measuring

Monitoring manufacturing and assembly

Printing quality

End-of-line quality control

Position of inserts

2D Technology
Vision Portfolio

SICK
Sensor Intelligence.

Best-fit camera for every application

picoCam2 & midiCam2 with SIM2x00
- 1.6 / 3.2 / 5.0 / 12.3 MP
- Monochrome & Color
- C-mount lenses
- Suitable for tight spaces

Inspector85x
- Powerful Quad-core CPU
- AI accelerator
- 5.1 and 12.4 MP monochrome
- Flexible optics and lighting, or Dynamic Focus (later launch)
- C-mount

Inspector83x
- Powerful Quad-core CPU
- AI accelerator
- Up to 5.1 MP monochrome or Color
- Flexible optics and lighting
- C-mount

InspectorP65x
- 2.1 and 4.2 monochrome
- Flexible optics and lighting, or Dynamic Focus
- C-mount

InspectorP64x
- 1.7 monochrome
- Flexible optics and lighting
- C-mount

InspectorP63x
- 1.3 and 1.9 MP monochrome
- Flexible optics and lighting

InspectorP62x
- 1.3 MP monochrome
- Pre-mounted optics and illumination
- Electric focus

InspectorP61x
- 1.2 MP monochrome
- Pre-mounted optics and illumination
- Option for Near-Infrared (NIR)
- Adjustable shape and color of illumination
- minuscule size!

2D Technology
Machine Vision

Basics

› Digital image/picture of an object

› Capture & process a 2-dimensional map (X, Y) of reflected intensity

› Comparing variations in intensity (contrast)

Ideal for ...

› Barcode reading
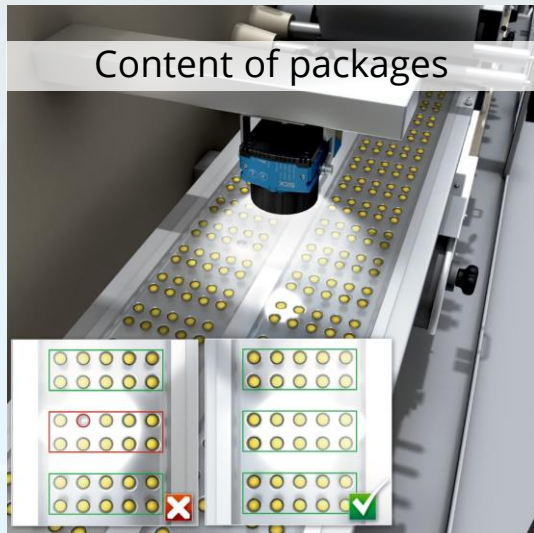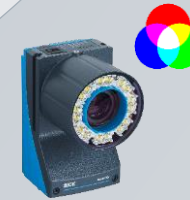
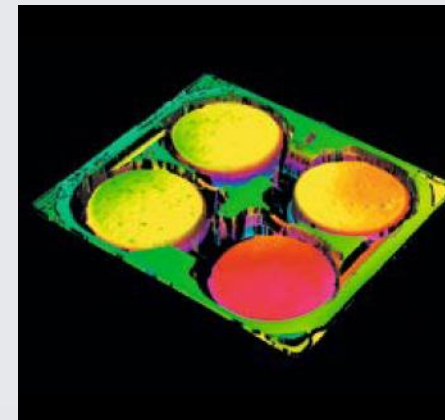› Presence Inspection

› Quality Inspection (shape color, ...)

When no height-information is needed

### Required

› Lighting creating good contrast

2D vs. 3D
See the world in its true dimensions

Our world is three-dimensional, something that a 2D image can't convey.
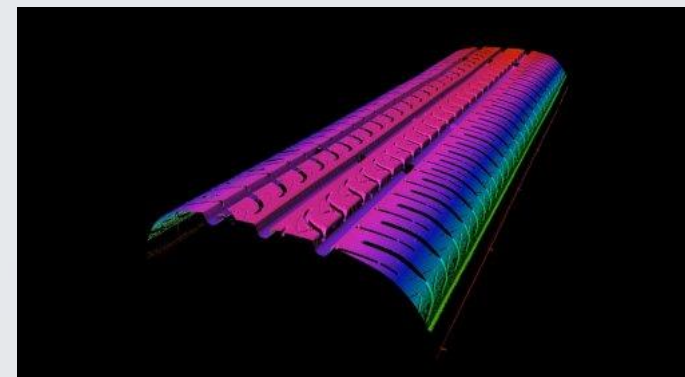
Benefits with 3D vision

› 3D shows height differences, distances and precise details.

› Reliable analysis of volume, shape and 3D position even under bad lighting conditions.

› Accurate size measurements regardless of position of objects.

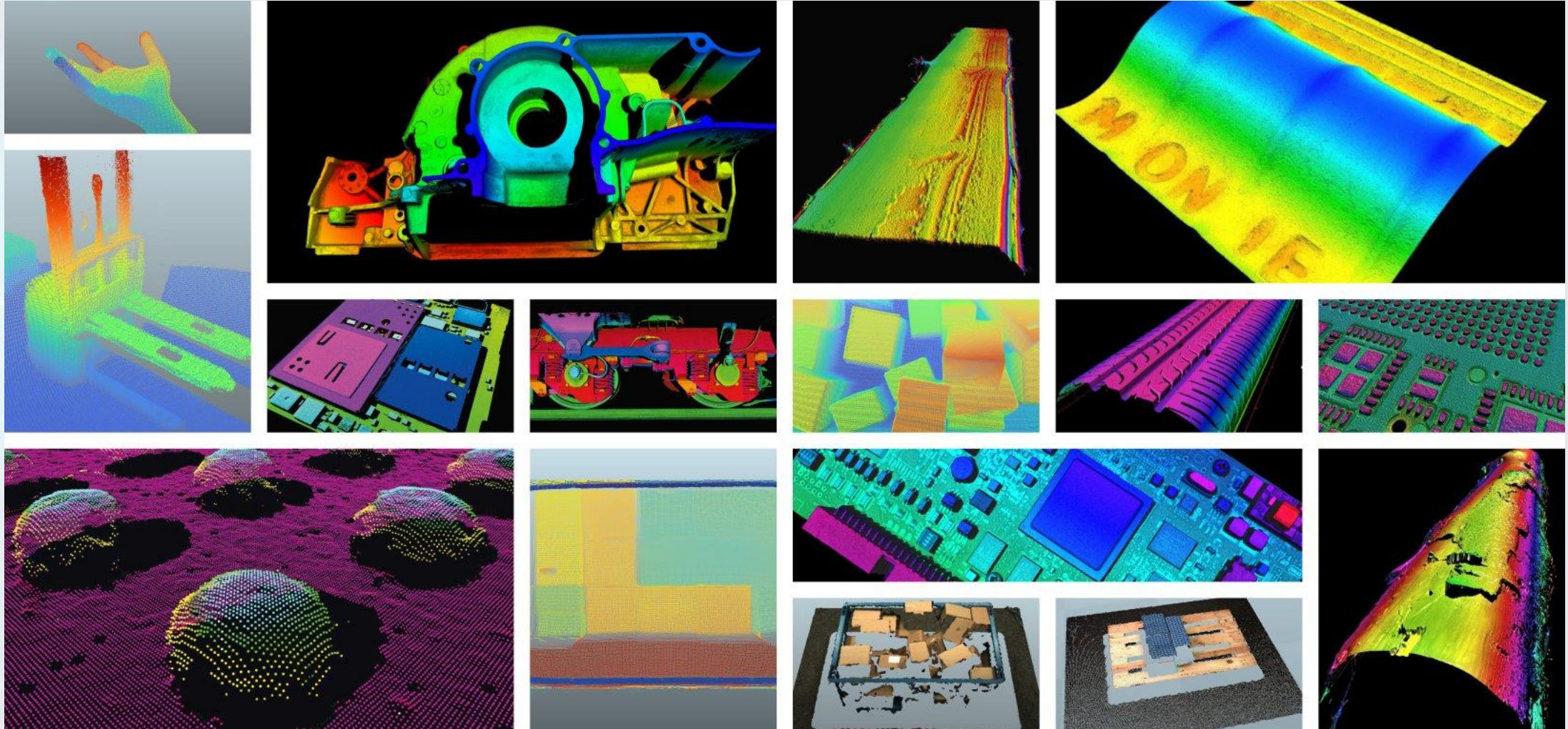› Detection of parts with low or no contrast.
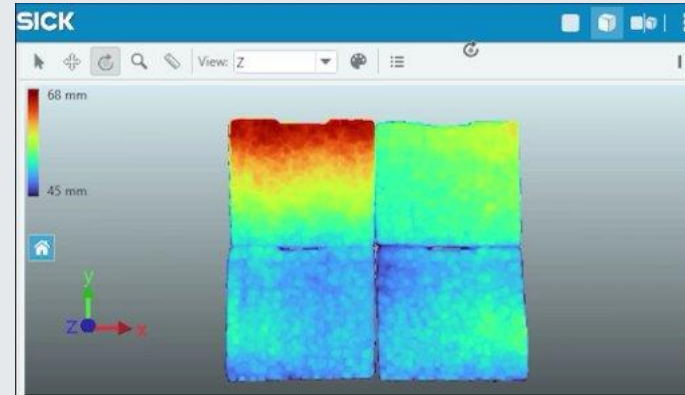
3D image (video)

2D image

3D image (video)
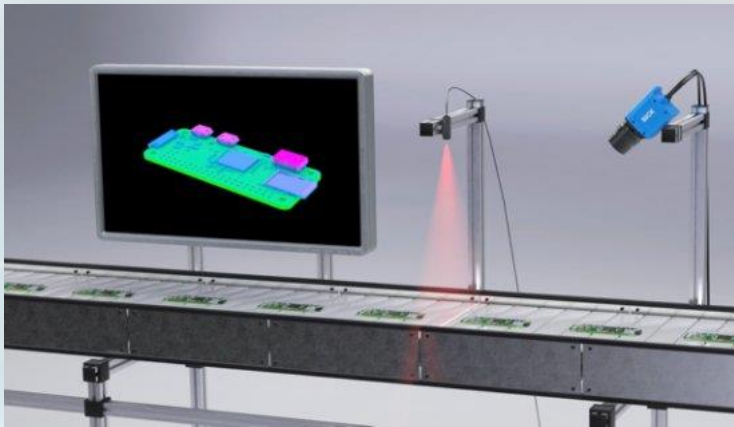
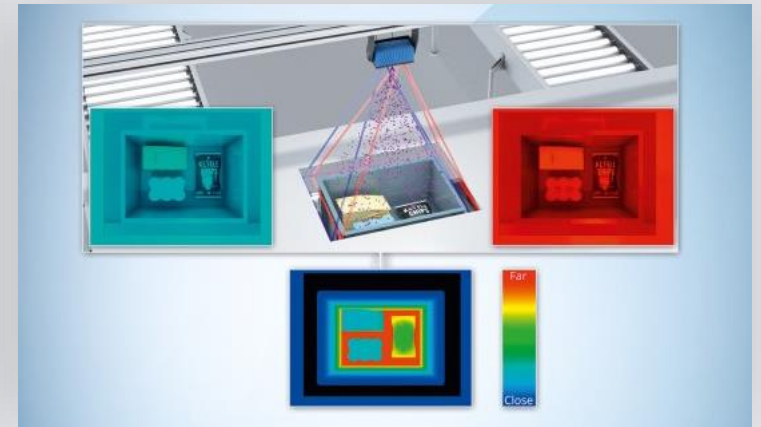
2D image

See the world in 3D

3D Technologies

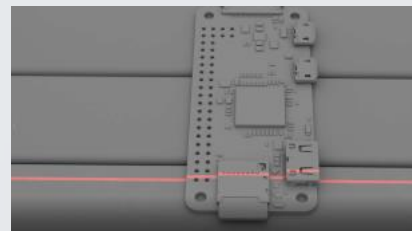**Laser Triangulation**

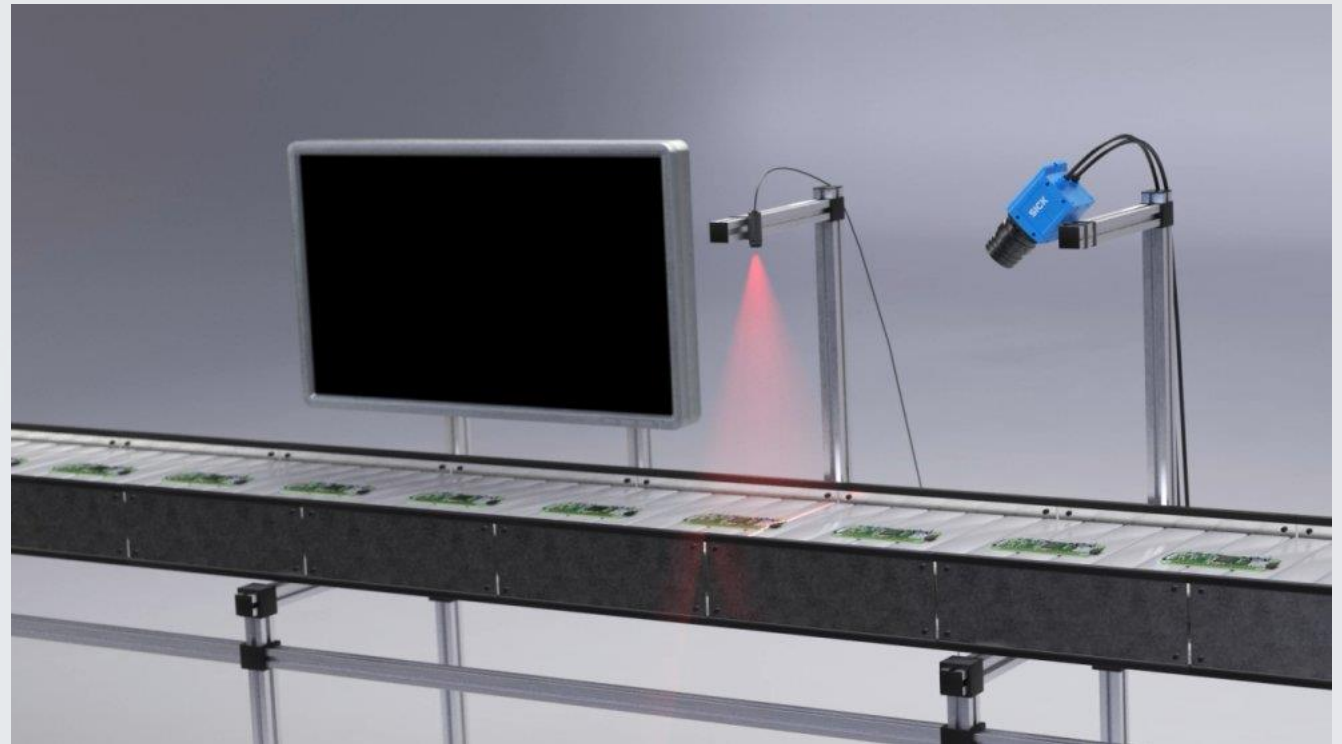**Time-of-Flight (ToF)**

Active Stereo

Laser Triangulation
3D technologies

› Resolution and accuracy : High

› Light source : Line projection by laser

  › No need for ambient light

› Measurement range : Relatively short

› Technology : Laser triangulation

› Motion is needed to acquire 3D images

› Occlusion possible when laser is hidden behind an object

Step 1: A laser line is projected on the object.
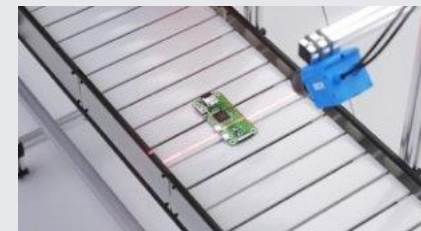
Step 2: The height profile is recorded by the camera.
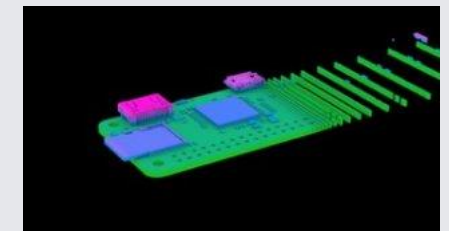
Step 3: By movement, multiple height profiles are collected and results in a 3D image.

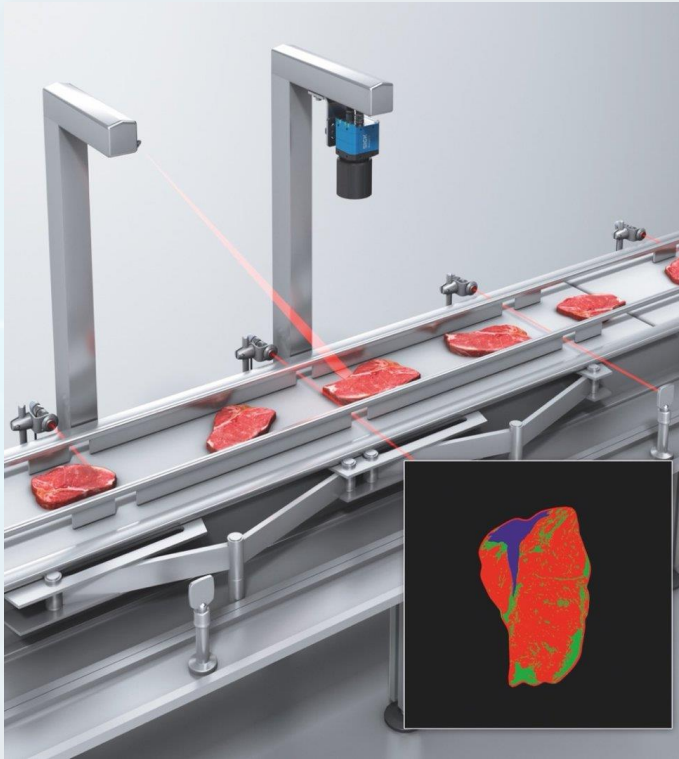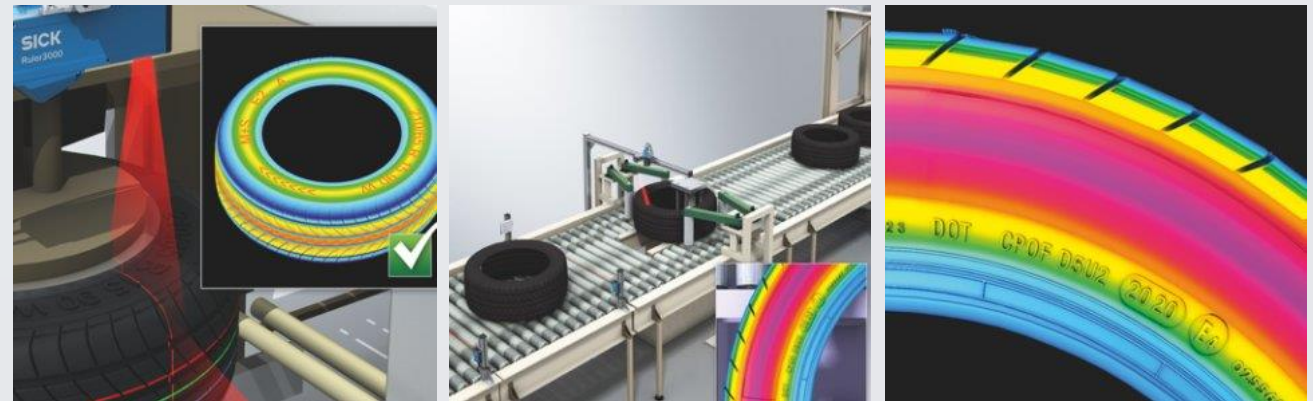# Laser Triangulation

Typical Applications

Food portioning and grading
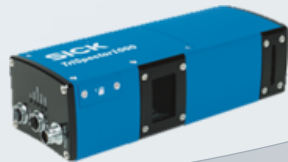

Box content verification
- Correct content
- Full content

Quality assurance of tires

Laser triangulation
Portfolio

SICK
Sensor Intelligence.

Ranger3

- 3D streaming camera
- CMOS sensor with ROCC technology
- GigE Vision and GenICam compliant
- IP65/67

Ruler3000

- 3D streaming camera
- CMOS sensor with ROCC technology
- Pre-calibrated
- GigE Vision and GenICam compliant
- Height-resolution : 8 .. 265µm
- IP65/67
- Options of red and blue laser in class 2 and 3R

▪ Programmable

TriSpector1000

- All-in-one 3D camera
- Available as configurable, programmable and streaming device
- Pre-calibrated
- Height-resolution : 20 .. 670µm
- IP67

Time-of-Flight (ToF)
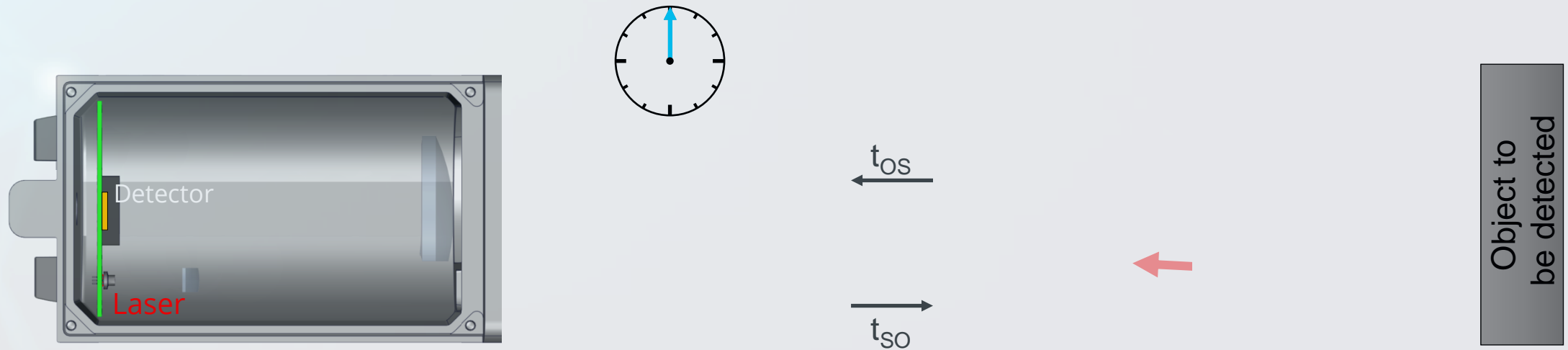
Basic Principle

› Multiple laser pulse signals are sent out

› The reflected light is detected by the receiver element
  - The time from sending to receiving the signal is measured and evaluated
  - The distance is calculated based on the time and the speed of light

› Multiple pulses are evaluated using statistical methods
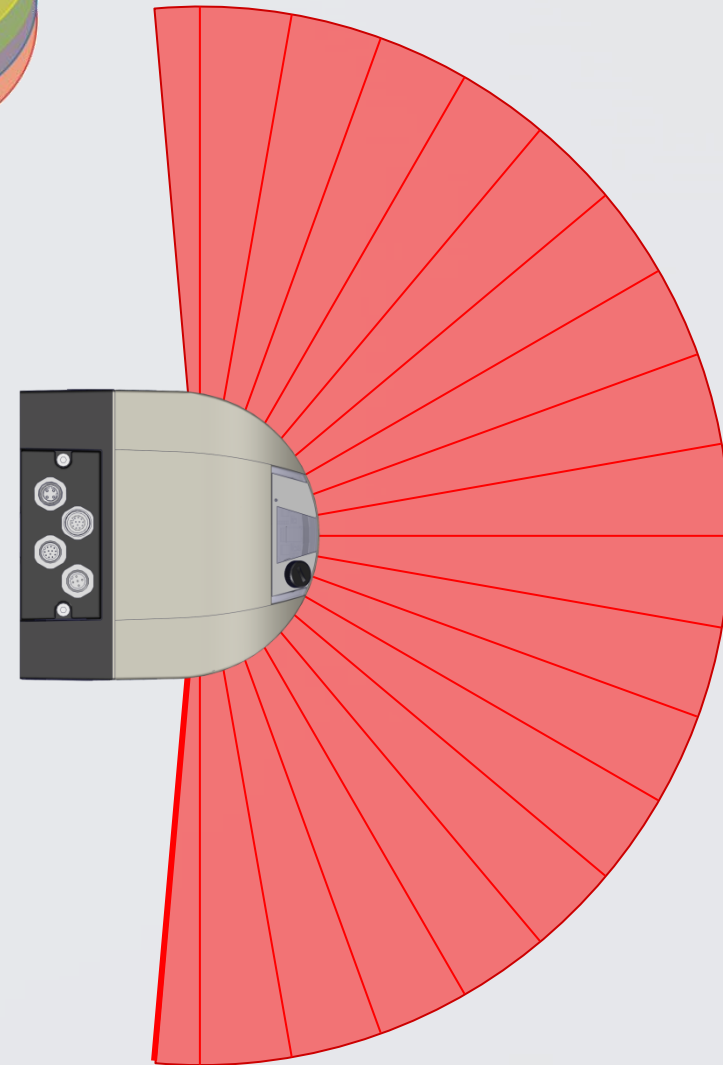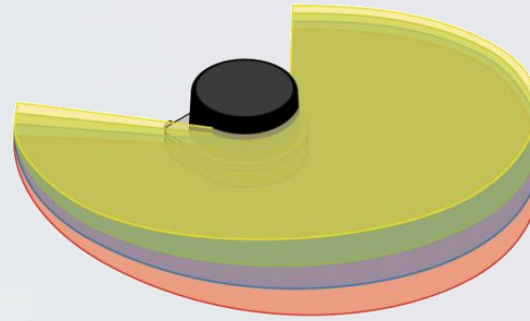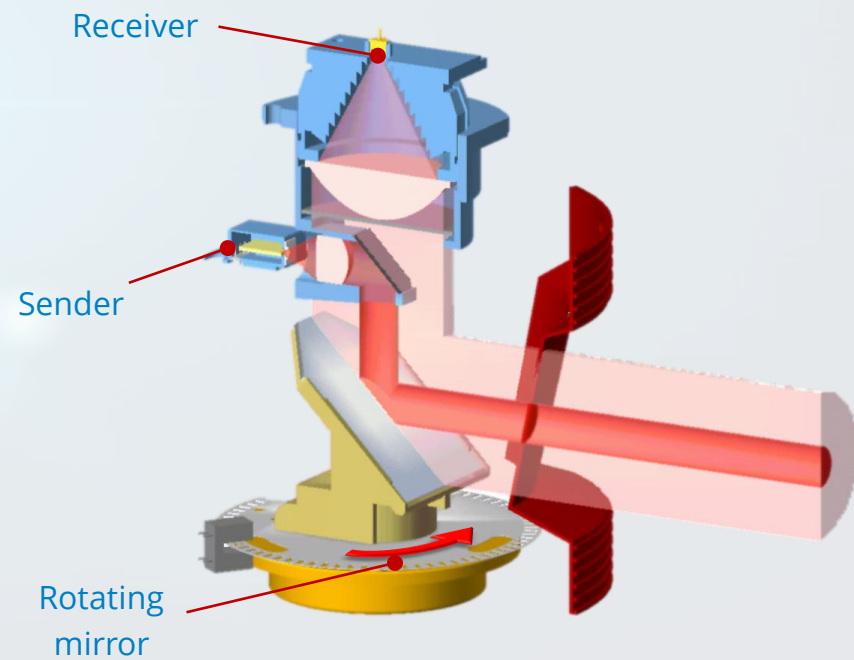
Detector

Laser

t_{OS}

t_{SO}

Object to be detected

Time-of-Flight (ToF)
LiDAR

LiDAR

› **Li**ght **D**etection **A**nd **R**anging

› **L**aser **i**maging **D**etection **A**nd **R**anging

Receiver

Sender

Rotating
mirror

Time-of-Flight (ToF)

3D camera

› Resolution and accuracy : Moderate

› Light source : amplitude modulated IR light

  › No need for ambient light

› Measurement range : Long range (up to 9m)

› Snap-shot camera - Works in static scenes

illumination
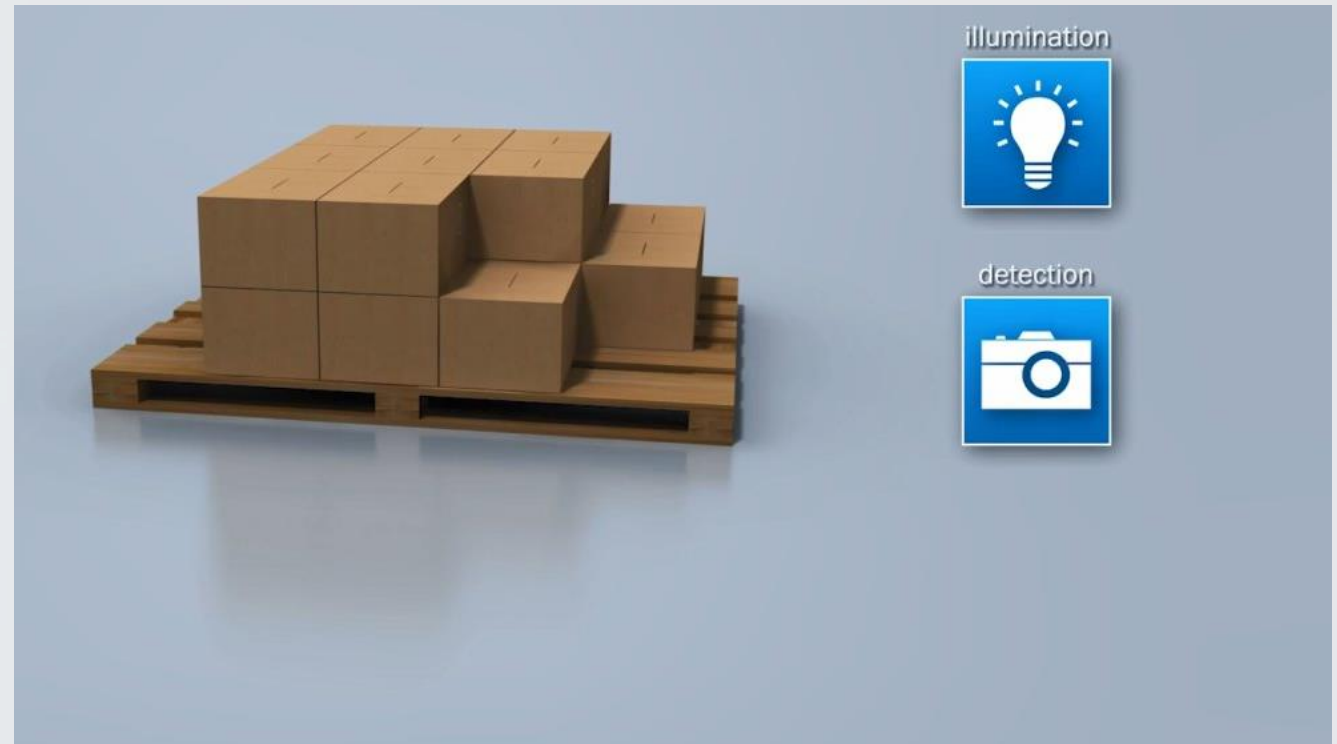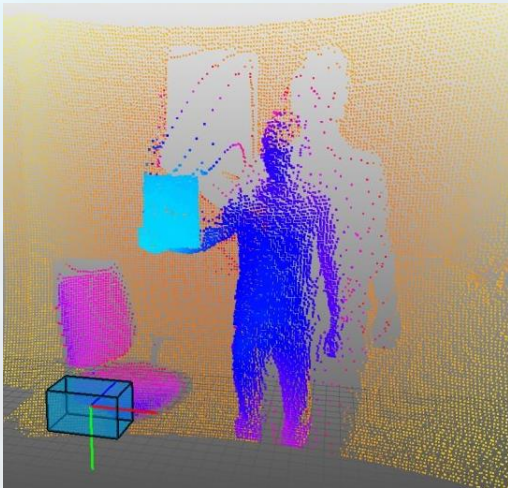
detection

Step 1: In phase-shifted-based ToF, modulated light is emitted and then …

… captured by the camera after the reflection from the object.
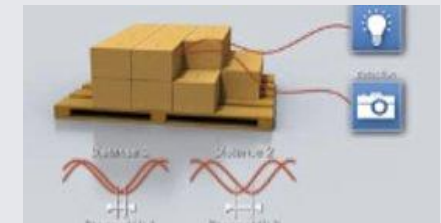
Step 2: The distance is calculated by detecting the phase shift.

Time-of-Flight (ToF)

Comparison

2D LiDAR

3D LiDAR

3D Camera

Time-of-Flight (ToF)
Typical Applications

Object recognition
(on industrial vehicles)

Scanning of
Bulk-materials

Filling-level monitoring

Palletizing / de-palletizing

Filling-level control

Volume measurement

Time-of-Flight (ToF)

2D LiDAR - Portfolio
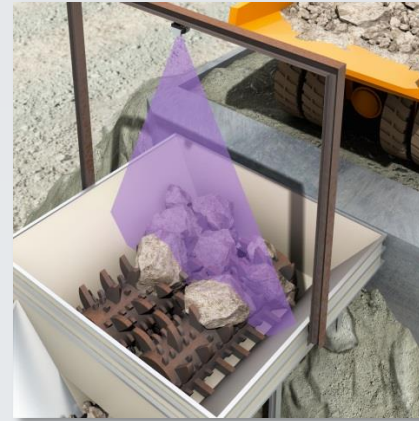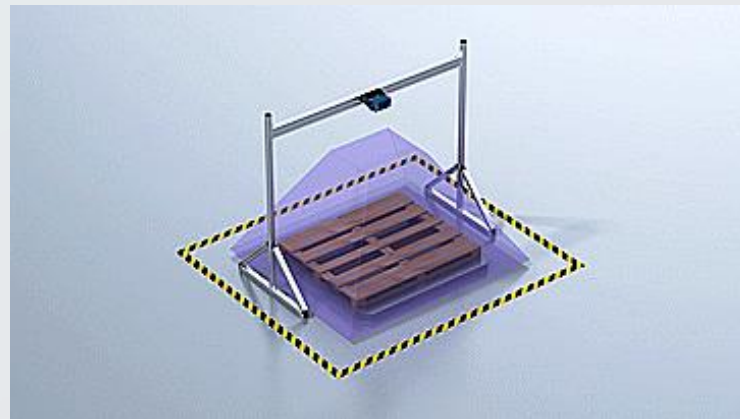
SICK
Sensor Intelligence.

LRS4000
- Angular resolution up to 0,02°
- Long range up to 130m
- Field of view: 360°

LMS1xx
- Indoor & outdoor version
- Range up to 50 m
- Field of view: 270°

LMS5xx
- Accurate with 5-echoes
- Range up to 80 m
- Field of view: 190°

LMS4000
- High measurement accuracy
- Range up to: 3 m
- Frequency: 500 Hz
- Visible laserline

TiMxxx
- Small & lightweight
- Low power consumption
- Range up to 25m
- Field of view: 270°

LMS1000
- High speed (200 Hz)
- Outdoor immunity (HDDM+ and 3-echoes)
- Range up to 64m
- Field of view: 275°

picoScan100
- Compact ranging, detection & navigation
- Indoor & outdoor
- Range up to 70 m
- Field of view: 276°

Time-of-Flight (ToF)
3D LiDAR - Portfolio

SICK
Sensor Intelligence.

multiScan100
- 16 layers
- Range up to 60 m
- Field of view: 360° x 65°

MRS1000
- 4 layers
- Range up to 64m
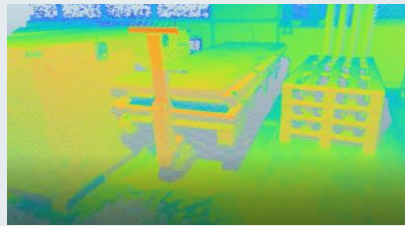- Field of view: 275° x 7,5°

Time-of-Flight (ToF)

3D Camera - Portfolio

Visionary-T mini CX

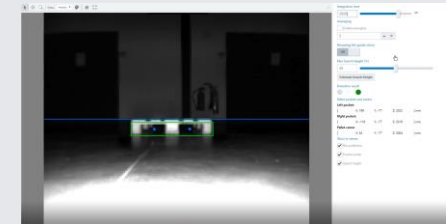› Streaming of enhanced 3D data for external processing

› Provides configurable embedded filtering and optimization functions

Visionary-T mini AP

› Flexible programming for device-internal data evaluation

› GUI accessible through browser

› Ready-made apps can be installed on the device

safeVisionary2

› Safety functions (PLc)
  – Field evaluation
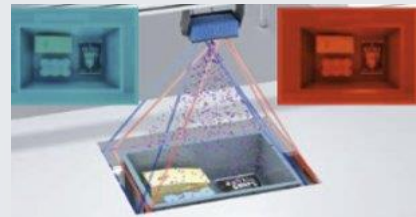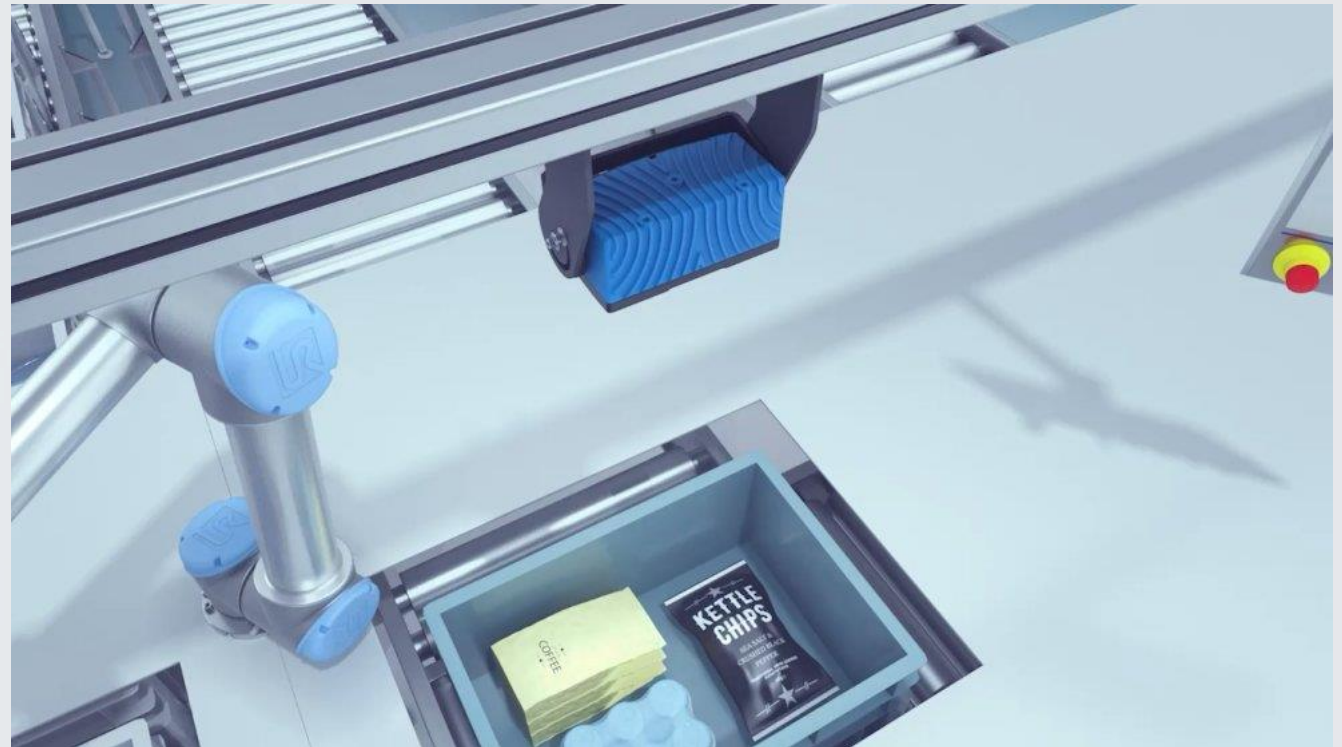 – Contour detection

› Non-safe streaming data

Active Stereo
3D technologies

› Resolution and accuracy : High

› Light source : Structured IR light

    › No need for ambient light

› Measurement range : Medium (0,5..2,5m)

› Technology : 3D snapshot - no moving parts

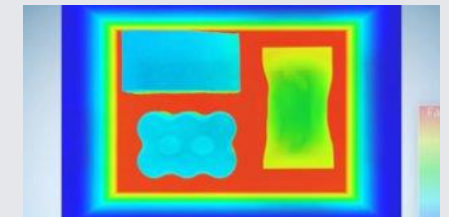› Works in static scenes

› Possibly blurred object edges

Step 1: Acquisition of two images from slightly different perspectives.
The scene is illuminated by the integrated structured light.

Step 2: Overlay and correlation of the left and right image, enhanced by using the pattern of the non-visible structured infrared illumination.
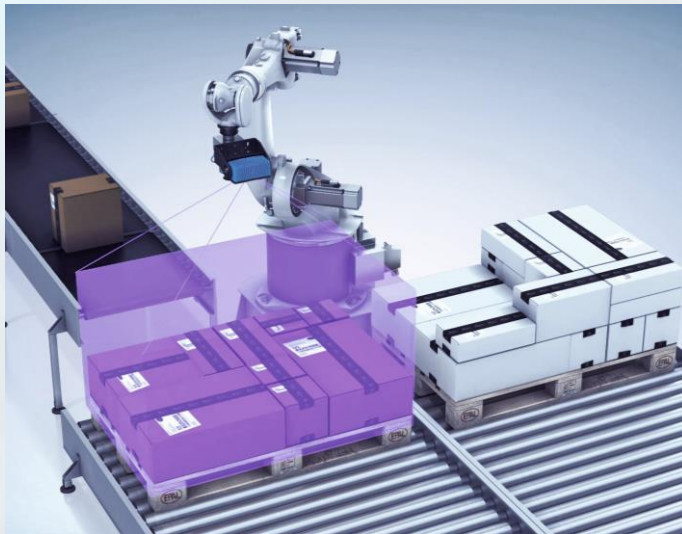
Step 3: An image with depth information is created.

Active stereo
Typical Applications

Volume measurement

of bulk or pallets
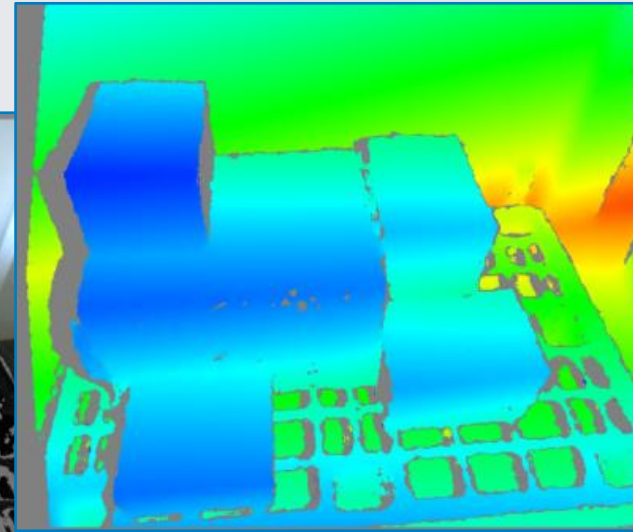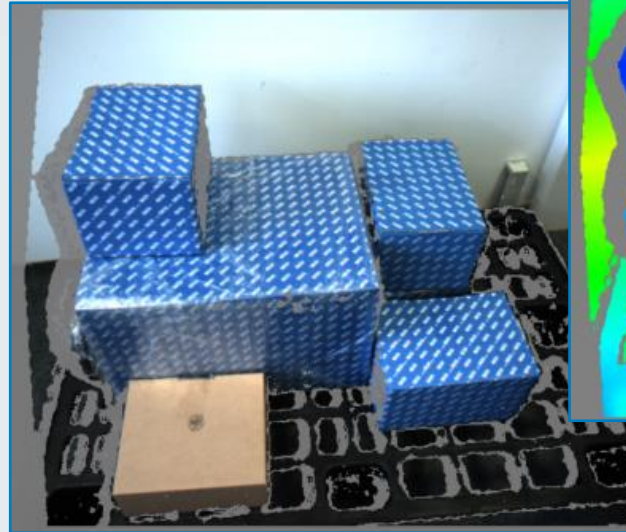
De-/palletizing & Dimensioning

Robot Guidance

Completeness Check
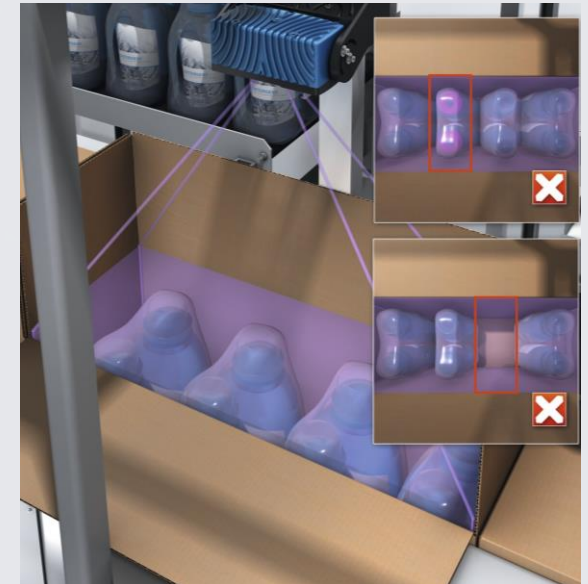
Active Stereo
Portfolio

Visionary-S CX

› Dedicated streaming

› Various filters and parameters for stream

› Pre-calibrated

Visionary-S AP

› Self-processing based on apps

› GUI accessible through browser

› Program apps for specific applications running on the device

› Pre-calibrated

Some ready-to-use Solutions

LBC – Label Checker

Measuring Label dimensions

Check numeric sequence

Check the presence of pictograms

Reading characters and check if expected tekst matches

Read & Verify 1D & 2D codes

Check print quality

Measuring position of the label

Check printed pattern

Use of the best-fit camera for the application

Production statistics

DATE	TIME	PASS	FAIL
1.1.2018	0:00	575	25
1.2.2018	0:00	580	20
1.3.2018	0:00	590	10

PLOC 2D

Part LOCalization 2D

Single and multiple part detection on conveyers and anyfeeders

› Index motion – part standing still during localization

› Continuous motion – part moving during localization
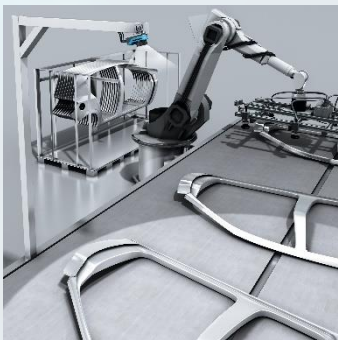
Robot belt picking
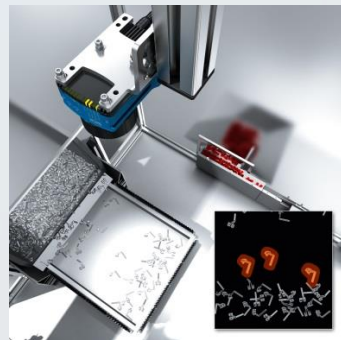
Robot picking from anyfeeders

Robot picking of kitted parts

Robot picking of trays

Robot machine tending

3D Belt Picking

Stand-alone solution for providing 3D coordinates and measurements of products on conveyor belt

› Covering belt widths up to 1680 mm

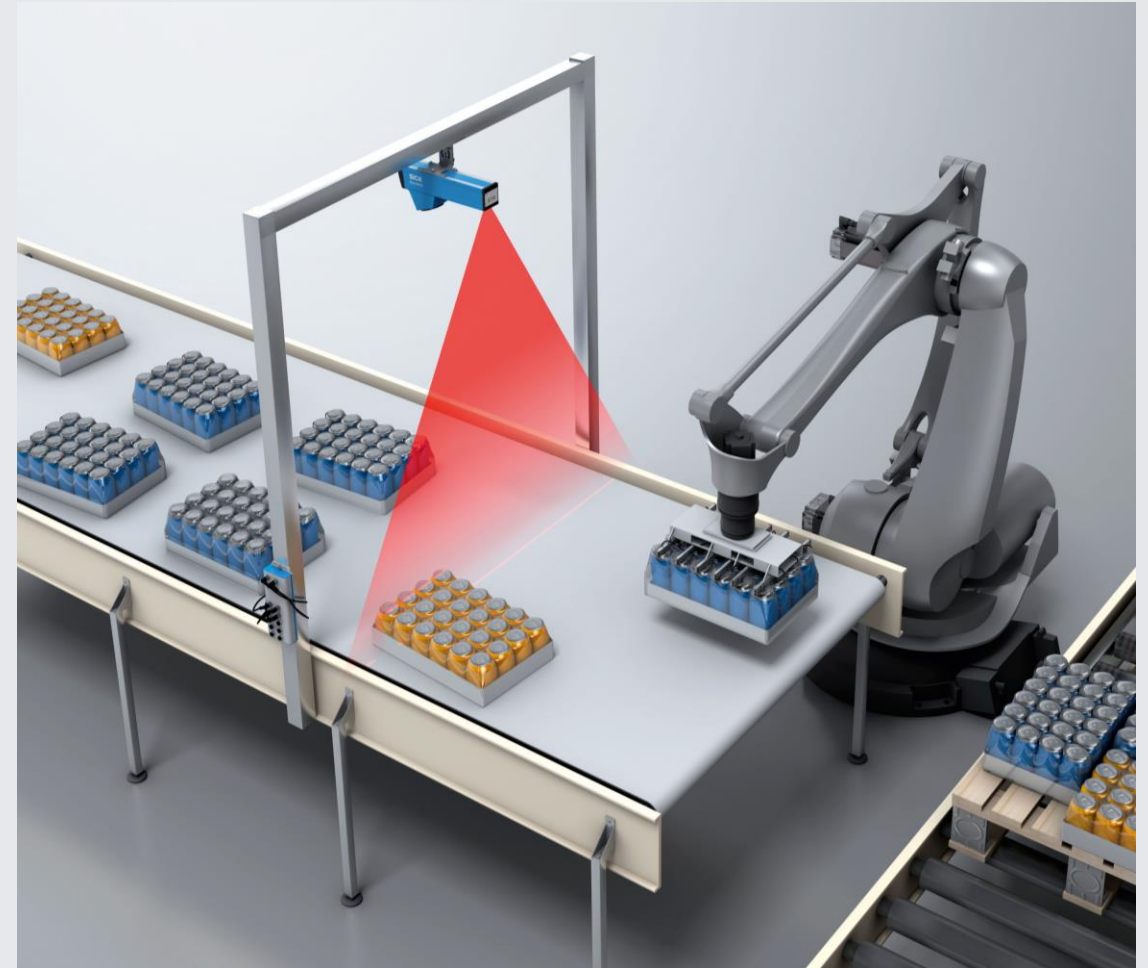› Easy to integrate with selectable interfaces for ABB PickMaster™, Stäubli and Universal Robots

› Generic interface for other brands

Basis

› TriSpectorP1000

or

› Ruler3000 with SIM1012/2x00

PALLOC

Depalletizing of boxes by robot

Automatic picking of boxes by a robot

› Locate the individual boxes for the robot to pick them one by one

Gain

› No manual handling of heavy boxes

› No time-consuming manual boxes picking from the pallets

Basis

› Visionary-S

PACS
Pallet Classification System

Automatic type classification of pallets

› Determine whether the pallet is compulsory-deposit or not

› Gain inbound transparency.

Functionality

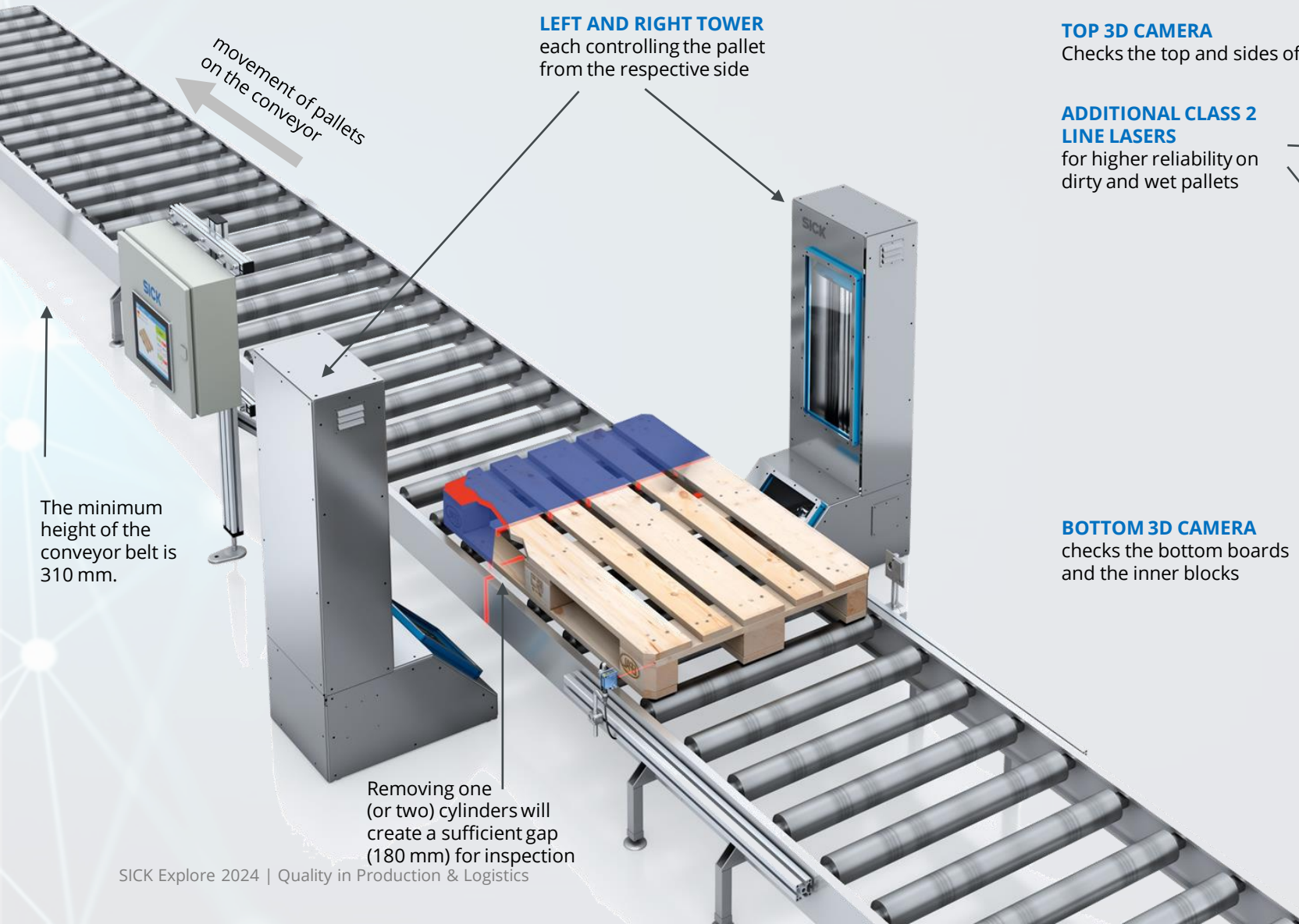Automatic reading of the text in the pallet blocs to determine it's a deposit or non-deposit pallet

Also color of the pallet blocs is taken into account

Basis

› midiCam

Pallet Integrity Inspection System

SICK
Sensor Intelligence.

movement of pallets on the conveyor

LEFT AND RIGHT TOWER
each controlling the pallet from the respective side

TOP 3D CAMERA
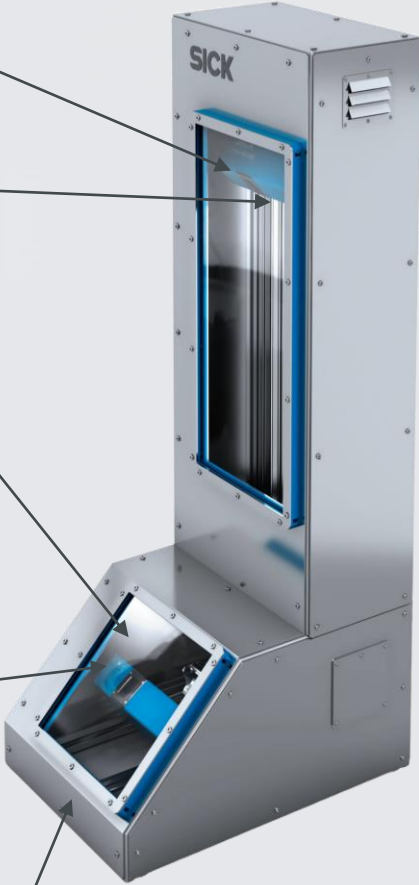Checks the top and sides of the pallet

ADDITIONAL CLASS 2 LINE LASERS
for higher reliability on dirty and wet pallets

The minimum height of the conveyor belt is 310 mm.

BOTTOM 3D CAMERA
checks the bottom boards and the inner blocks

Removing one (or two) cylinders will create a sufficient gap (180 mm) for inspection

HEAVY DUTY STAINLESS STEEL HOUSING
Protects against impact, dirt and aggressive cleaning agents

Conclusion

Conclusion

SICK
Sensor Intelligence.

Wide portfolio of ...

› Technologies and hardware

› Solution knowledge

To deliver ...

› Best-fit solution for almost every application

› From low-cost (DIY) stand-alone solutions to streaming for software-based solutions

But ...

What is the added-value of **AI** and how can you benefit from this ?

Increase Quality in
Production & Logistics

marcel.dejonge@sick.be