...Engineering IoT Solutions

Select Industrial Automation Partner

3S Series
3D sensors

High-resolution, high-speed 3D sensors for static and dynamic dimensioning and inspection applications

Zebra_3S-CFP-UMD.001

Table of Contents / Agenda

Why Zebra?

Partner with a Proven Industry Leader

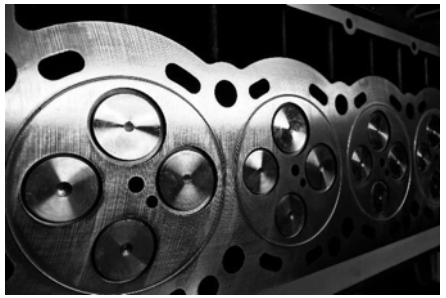
You Need It. We've Got It.

One source. One portfolio. Endless opportunities

Today’s Machine Vision Challenges

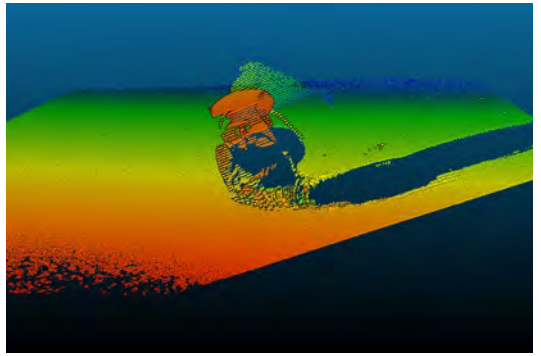
Beyond the Limits of 2D Machine Vision

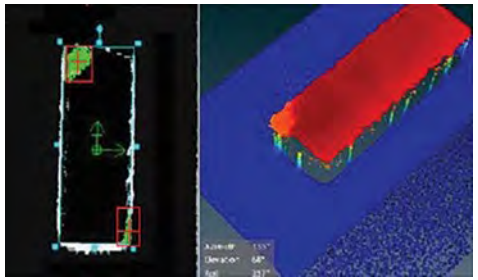
Some inspection applications cannot be efficiently addressed with 2D machine vision



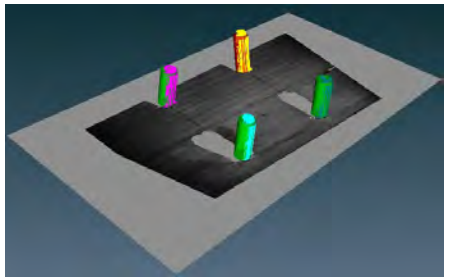
Applications with little to no contrast or reflective materials

Challenging to illuminate with conventional machine vision lighting

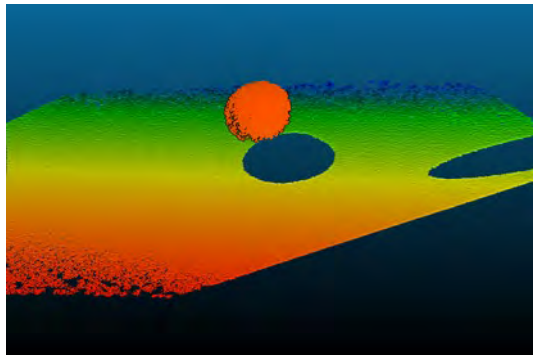




Dimensioning or measuring volume and flatness



Measuring angles in post assembly inspection



Object of interest vibrating or bouncing around on a conveyor

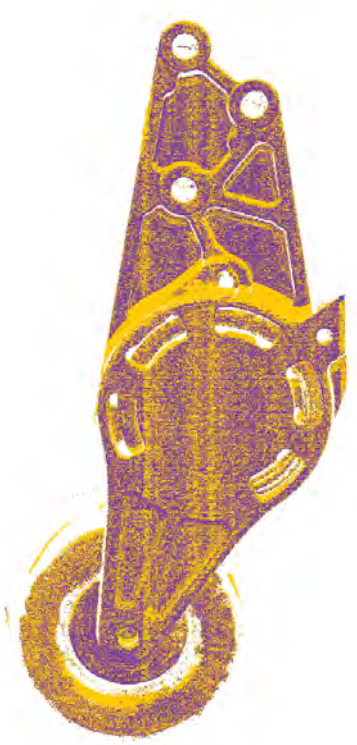
3D Machine Vision Solution Challenges

Implementing 3D machine vision in manufacturing and logistics inspection applications presents several challenges:

3D Data Complexity: 3D imaging generates a large amount of data, which can be complex to process and analyze. This complexity can lead to increased computational requirements and longer processing times.

Operating Speed: In high-speed manufacturing and logistics environments, 3D vision systems must capture and process data quickly. However, the high data volume and complexity of 3D vision can make it challenging to meet speed requirements.

Lighting Conditions: The accuracy of 3D vision systems can be significantly affected by lighting conditions. Achieving consistent lighting can be challenging, especially in large-scale industrial environments.



Training and Expertise: Implementing and maintaining 3D vision systems requires a certain level of expertise. There may be a lack of skilled personnel who can handle these systems effectively.

Integration with Existing Systems and Cost: 3D vision systems can be challenging to integrate with existing workflows and can be expensive to implement and maintain.

Increase manufacturing productivity and logistical throughput

3S Series 3D sensors help manufacturers improve:

Quality control

Production efficiency

Robotic guidance

Yields and reduce waste

Automation

3S80-4M

Medium Field of View for High-Speed Acquisition

Unsurpassed 3D resolution and accuracy for capturing dynamic and static scenes

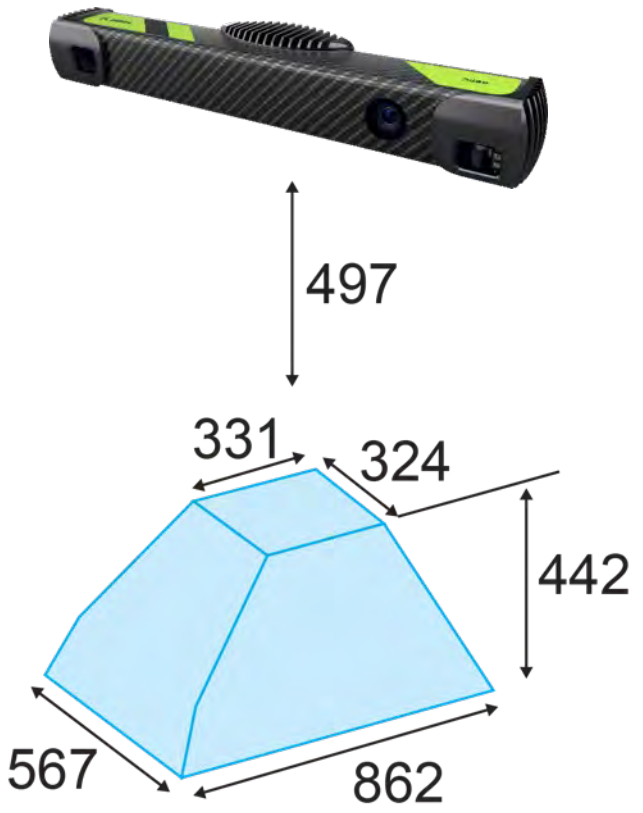
Parallel Structured light: Patented light sensor for dynamic and static scenes

Fast acquisition of 3D data: Up to 2 million 3D points (1680 x 1200) in a 45 ms scan

Shorter cycles times: Faster bin picking with shorter cycle times

Large scanning range: 19.6 – 37 in / 497–939 mm to capture objects large and small

Plug-and-play integration: Just point the 3S80-4M at a scene to capture an accurate high-density point cloud



3S80-4M Field of View

3S80-4L

Large Field of View for High-Speed Acquisition

Unsurpassed 3D resolution and accuracy for capturing dynamic and static scenes

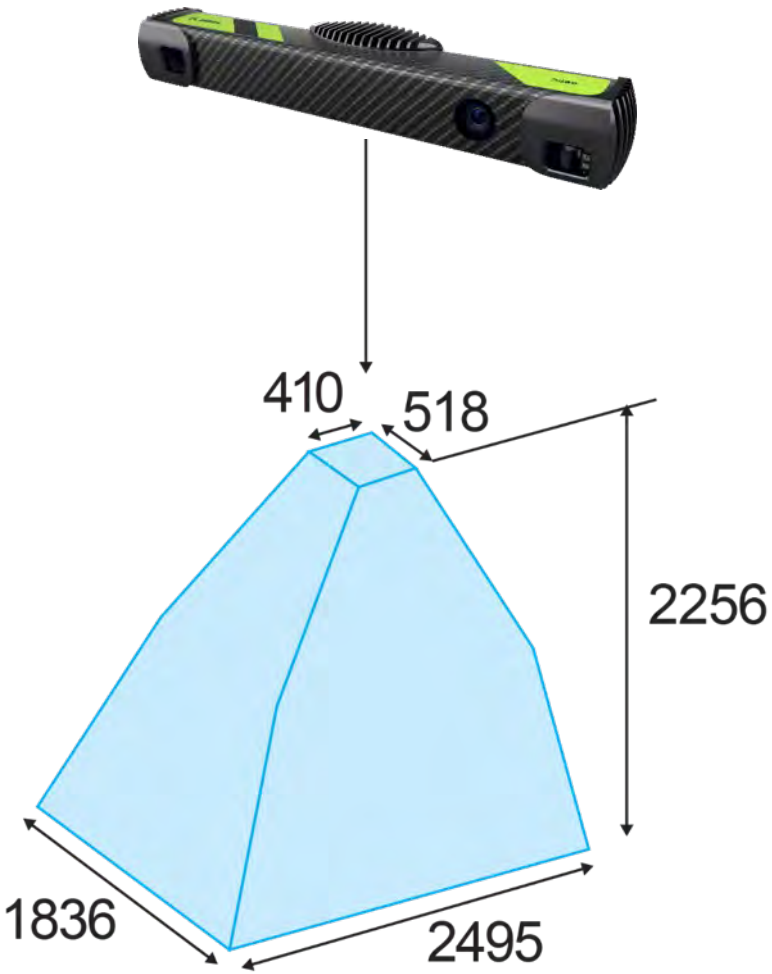
Parallel Structured light: Patented light sensor for dynamic and static scenes

Fast acquisition of 3D data: Up to 2 million 3D points (1680 x 1200) in a 45 ms

Shorter cycles times: Faster bin picking with shorter cycle times

Large scanning range: 30.6 – 119.4 in / 778 – 3,034 mm to capture objects large and small

Plug-and-play integration: Just point the 3S80-4L at a scene to capture an accurate high-density point cloud



3S80-4L Field of View

3S40

Large Field of View for Static Scenes

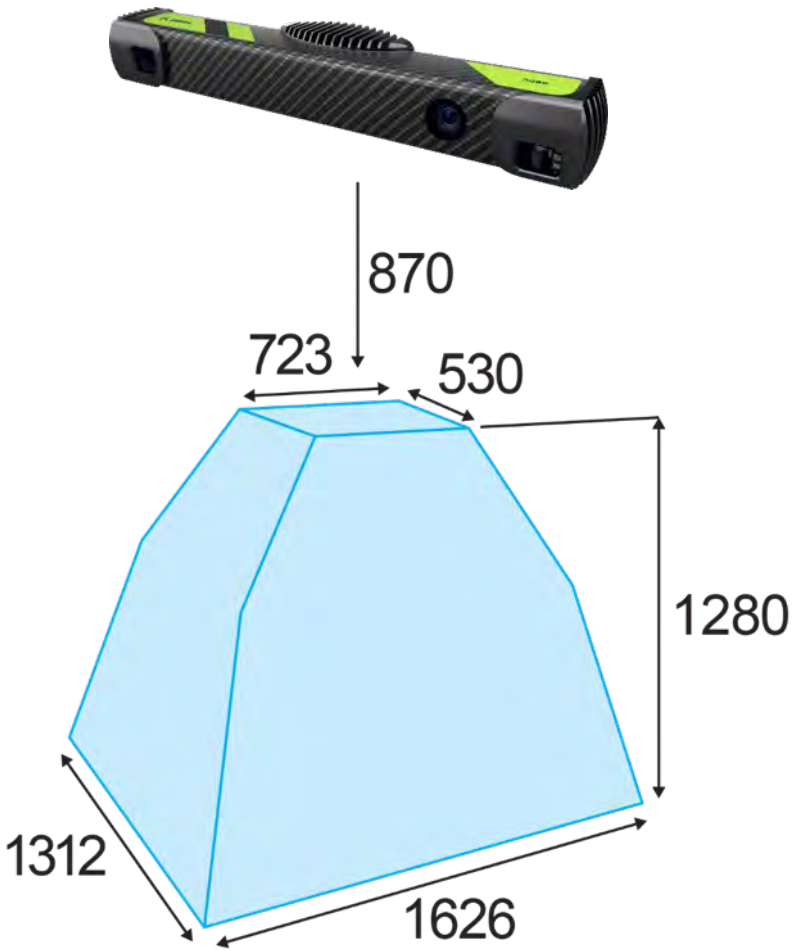
High-resolution 3D imaging for static dimensioning, inspection and depalletization applications

Structured light: Sequential structured light sensor for static scenes

Ambient Light Suppression: 1.5Mpix scanning with laser projection and ambient light suppression

Large Scanning range: 34.3 x 88.5 in /870–2150 mm to capture objects large and small

Plug-and-play integration: Just point the 3S40 at a scene to capture an accurate high-density point cloud



3S40 Field of View

3S Series

Available Solution Bundles

Pairs with Zebra Aurora™ software and the EV7 vision controller for optimized 3D performance

Bundled with Aurora Design Assistant or Aurora Vision Studio software

Optional Bundles Include Zebra 4Sight EV7 vision controller

Zebra **Aurora** Design Assistant™

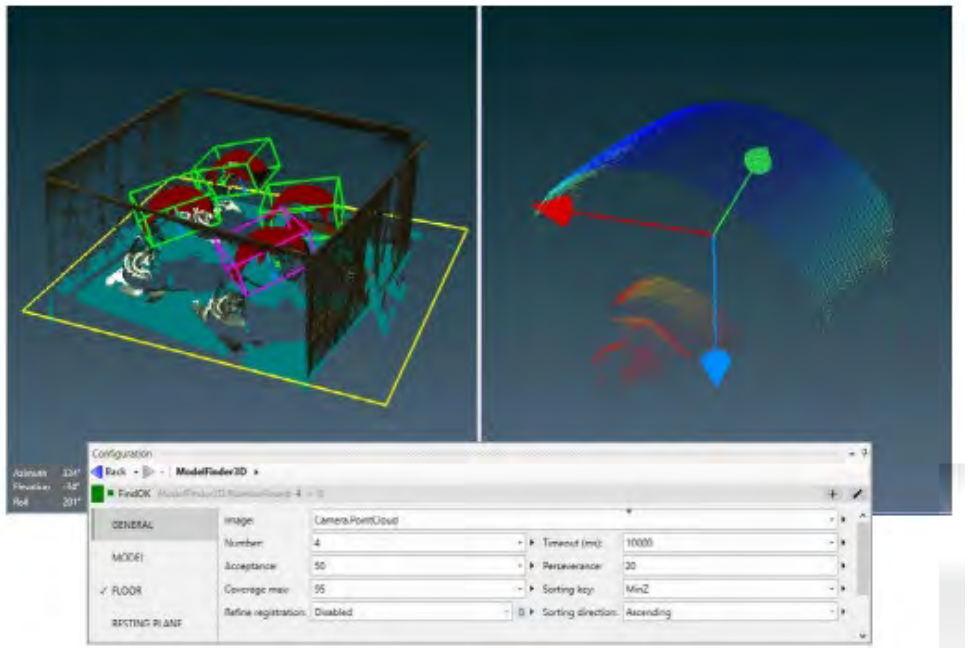
4Sight EV7

Zebra **Aurora Vision** Studio™

What Can Zebra Do in 3D Vision?

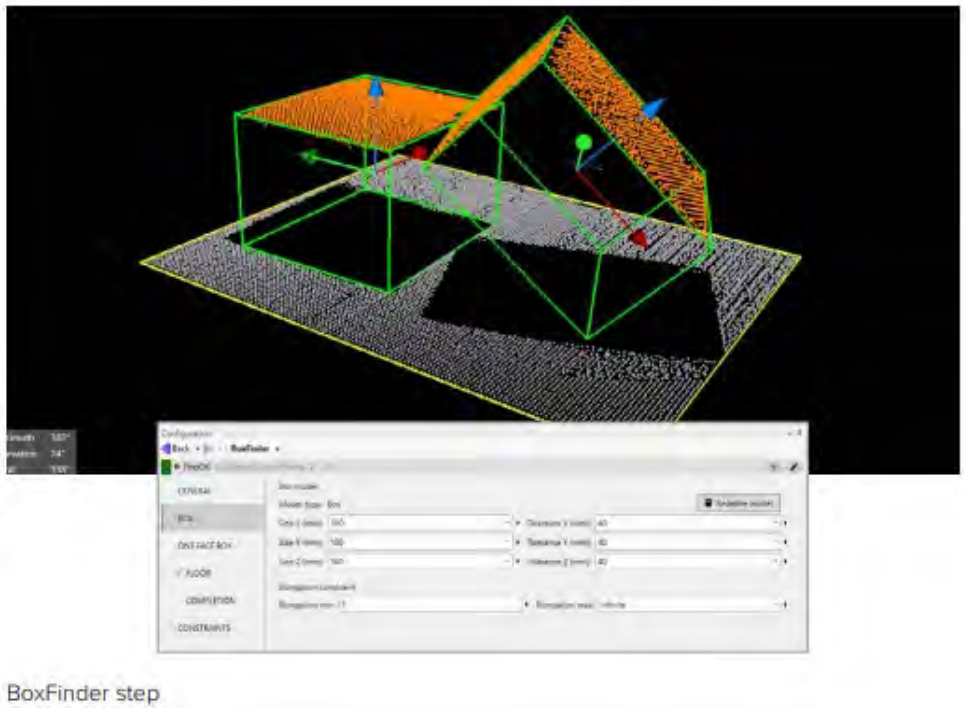
3D tools in Zebra Aurora

- 3D surface matcher
  - From point cloud or CAD (PLY or STL)



ModelFinder3D step

- 3D BoxFinder
  - Returns position, orientation and dimensions

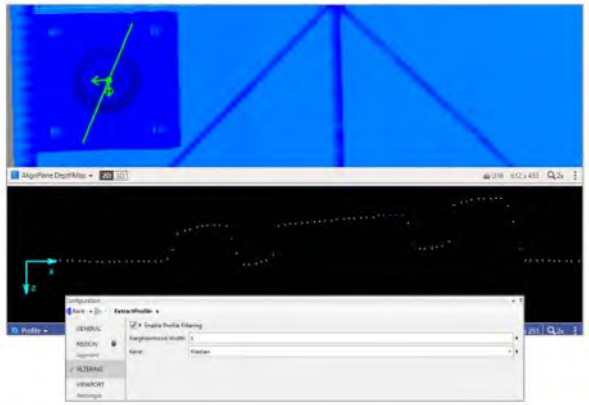


BoxFinder step

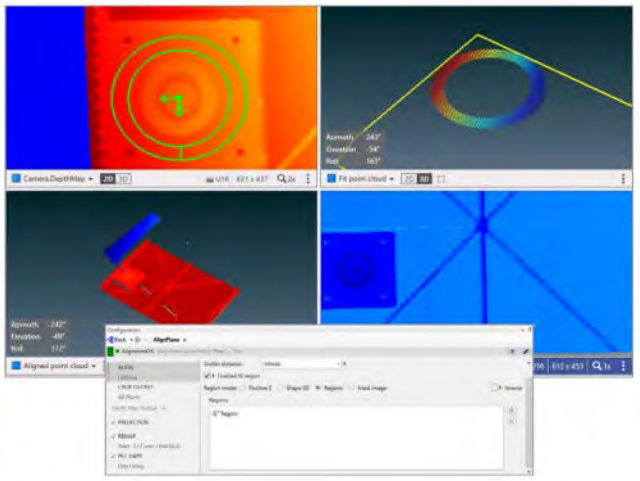
What Can Zebra Do in 3D Vision?

3D tools in Zebra Aurora

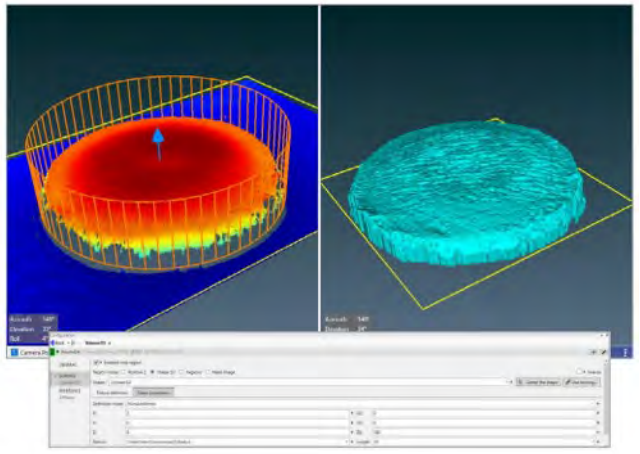
- 3D analysis and processing
  - Profile extraction
  - Volume measurement
  - Plane fit
  - Gap filling
  - Subsample
  - Mesh
  - Resample



ExtractProfile step



AlignPlane step



Volume3D step

What Can Zebra Do in 3D Vision?

Deep learning to further enhance solution quality

- Aurora Vision Studio Add On
  - Quickly design and deploy deep learning-based solutions
  - Graphical model training environment
- Learns from just a few samples
  - Typical applications require from 20-50 training images
  - OCR, Feature detection, Anomaly detection, and Classification
- Runs very fast on GPU and CPU
  - GPU required for training (Typical training time is 5-15 minutes)
  - Runs on GPU and CPU (GPU typically 3-10x faster)
  - Inference time varies depending on the tool and hardware (between 5 and 100 ms per image)

Benefits of 3D Vision Technology

Benefits of 3D Vision Technology

Point Cloud

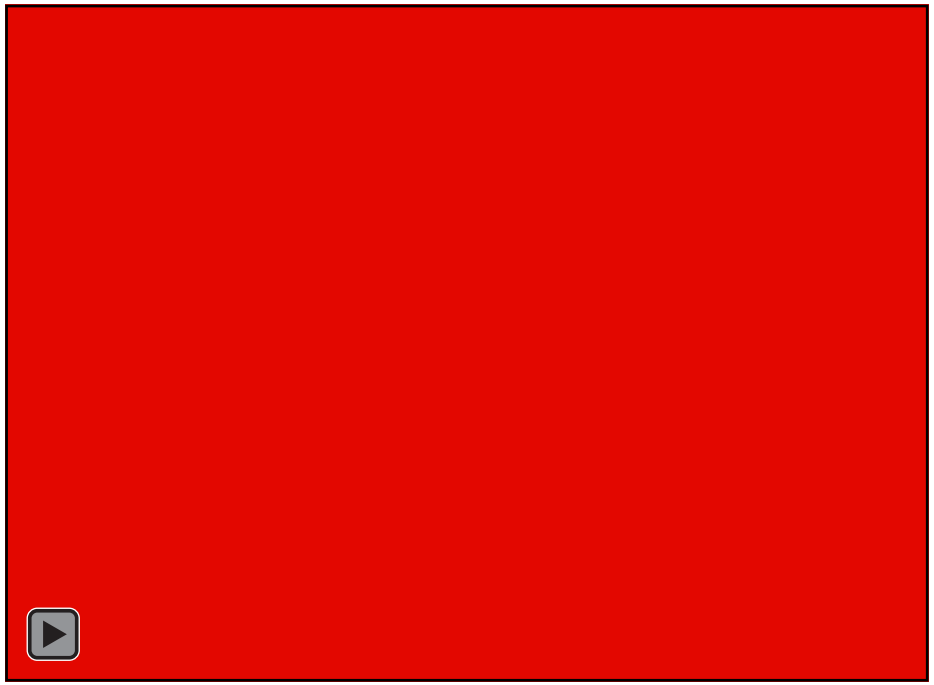
3D representation of a scene, where each point has X,Y, and Z coordinates

Can be moved around in 3D view

- Right click to pan
- Left click to rotate

The color of the points is based on the Texture Source (Color, Focus, LED, etc.)

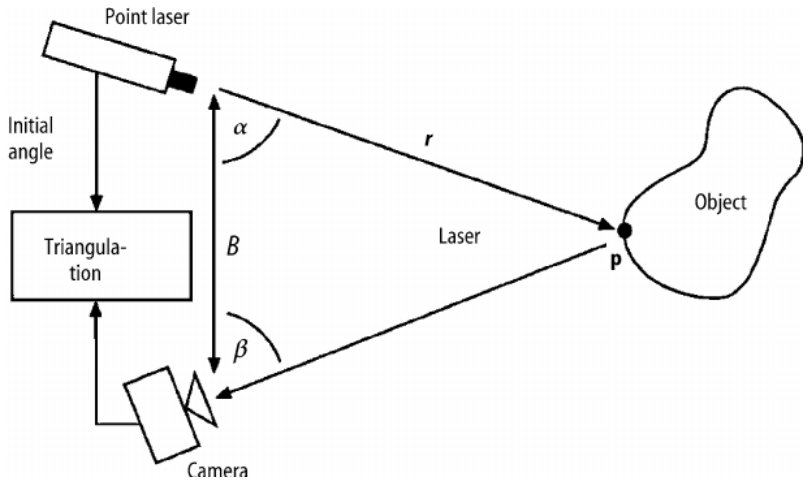
Measuring angles in post assembly inspection



Structured Light Technology

Basic principle

- Structured Light Technology is a triangulation technique
  - Laser / Object / Camera
- Light patterns are projected onto the object by the laser
- The stripes of light get distorted as they hit the object
- The object reflects the distorted light back to the camera
- By combining the information from the patterns with the known relative positions of the laser and camera, we can calculate the 3D position of the object

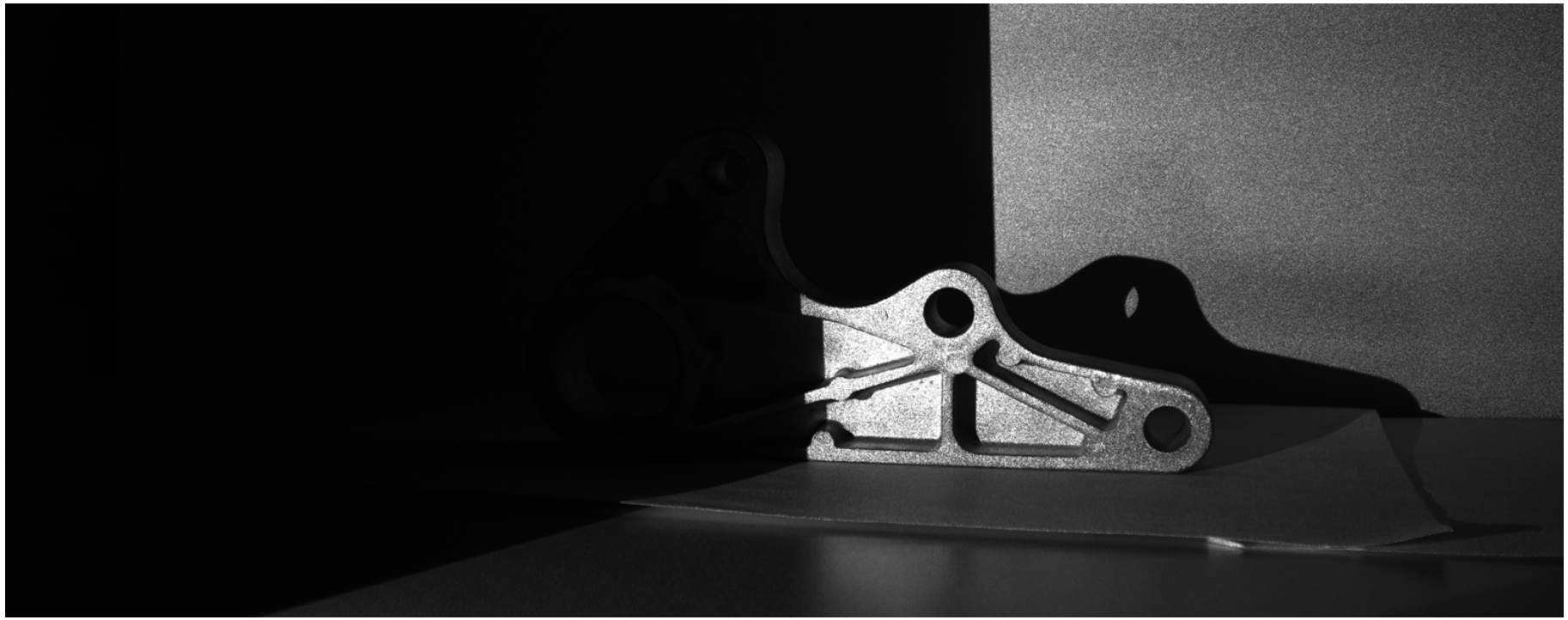


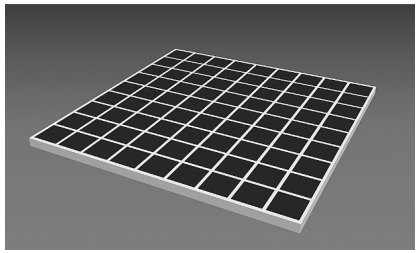
Methodologies and Techniques for Reverse Engineering–The Potential for Automation with 3-D Laser Scanners - Scientific Figure on ResearchGate.

Structured Light Technology

Sequential structured light **(3S40)**

- One laser sweep per projected pattern
- The patterns are created by turning off the laser periodically

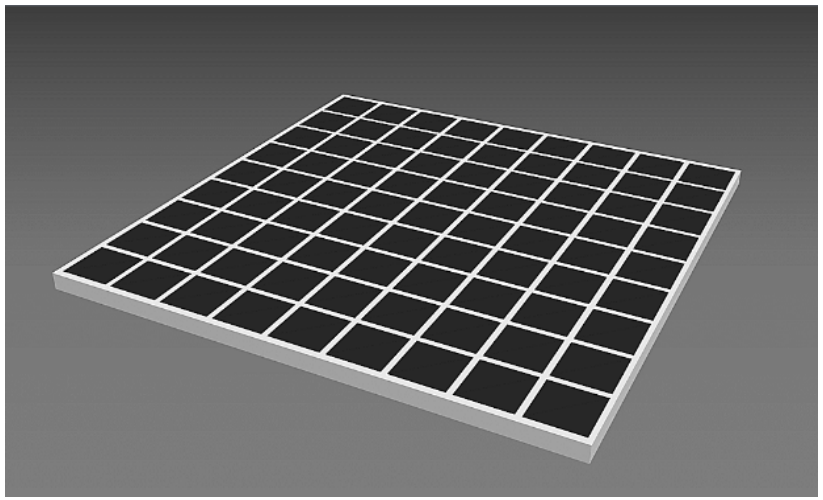




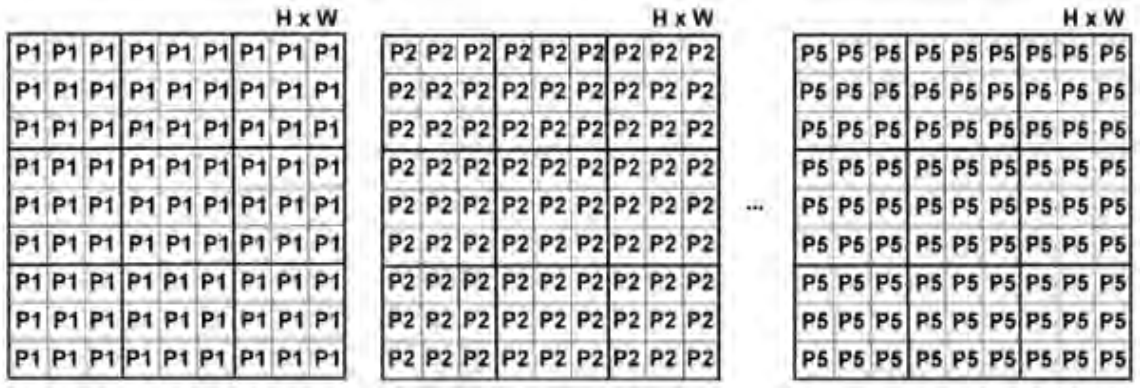
Structured Light Technology

Sequential structured light **(3S40)**

- Image sensor exposure:



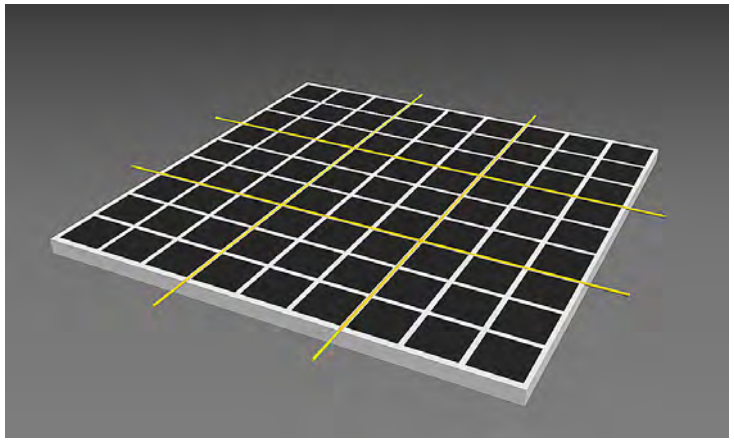
- Resulting images:
  - Each pixel has information about all the patterns

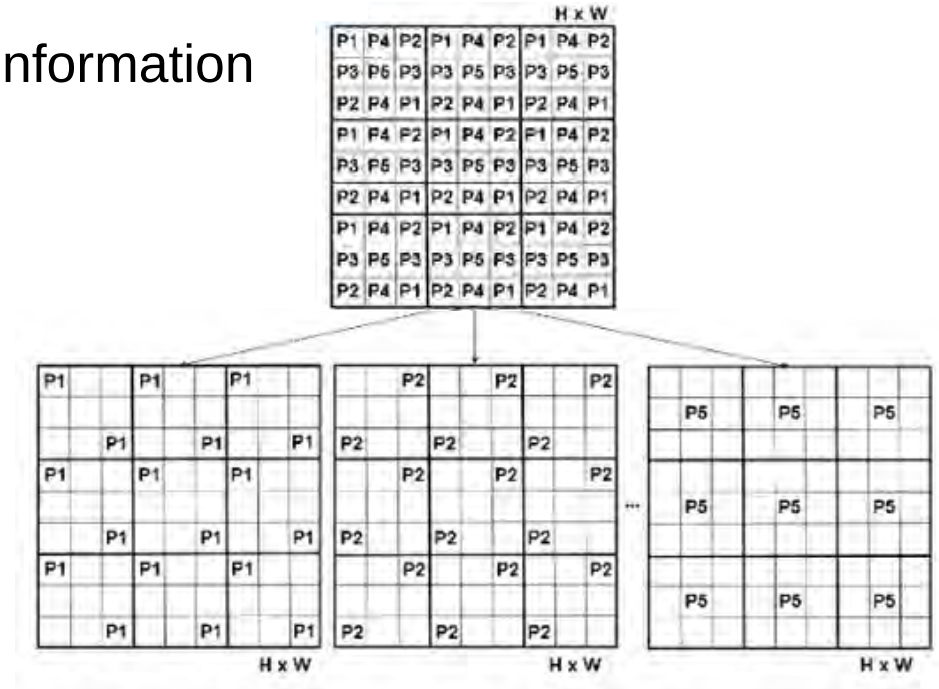


Structured Light Technology

Parallel structured light **(3S80)**

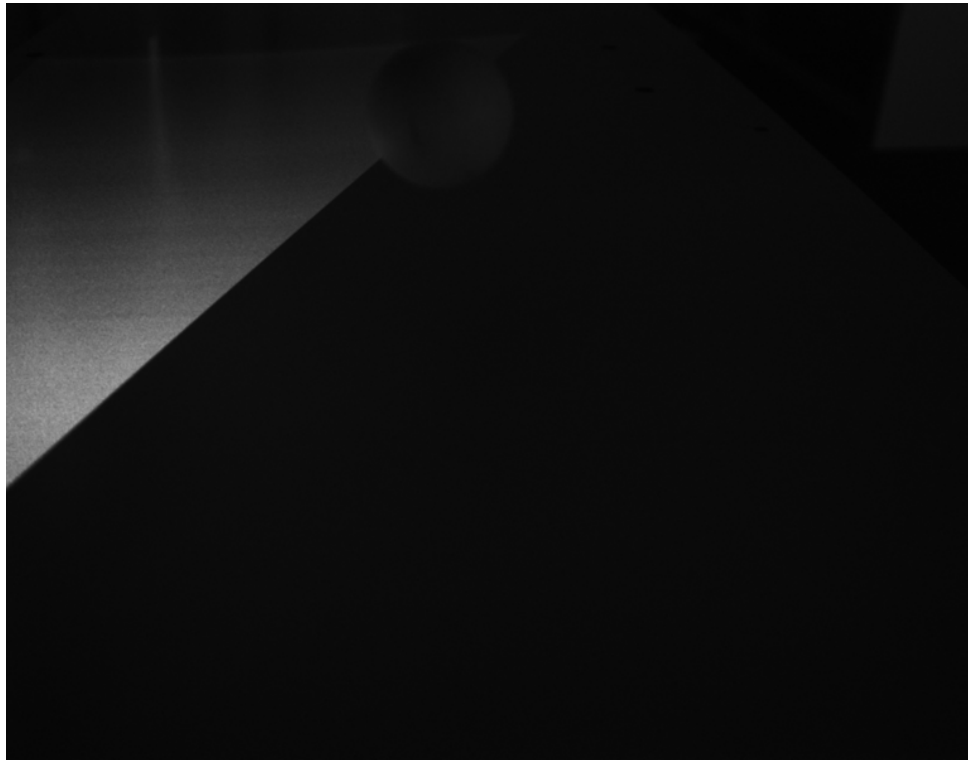
- The laser is on during the whole sweep
- Pixels are “turned off” individually at the sensor level to create multiple patterns in one sweep
- Each pixel has information about 1 pattern only
- The data is interpolated to compensate for the missing information

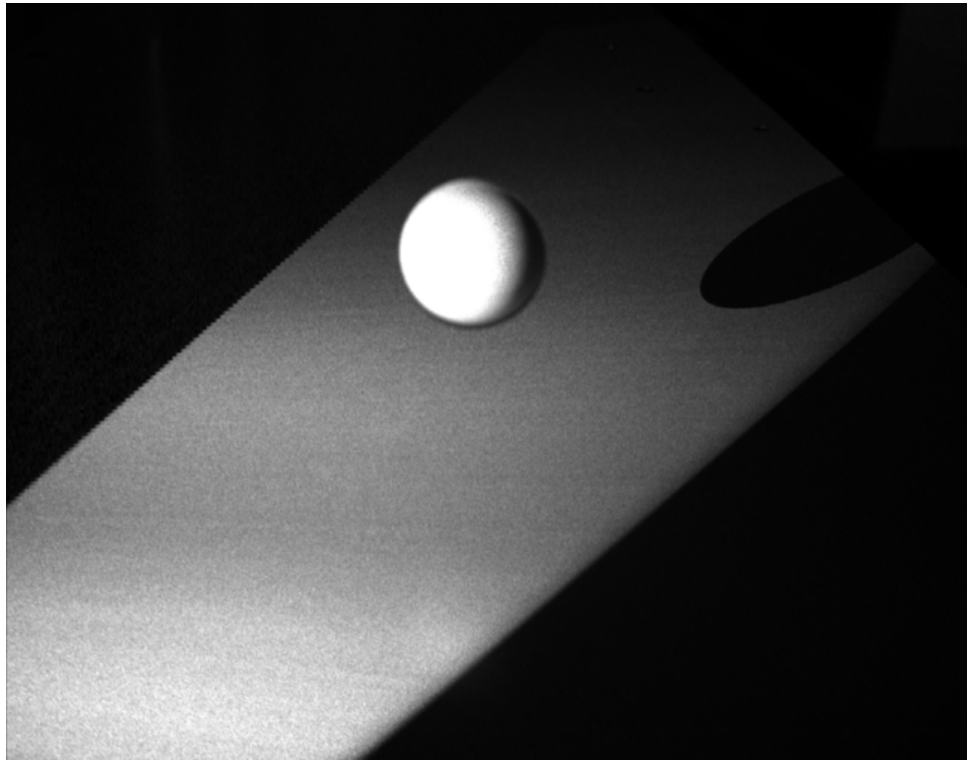




Sequential vs. Parallel Structured Light – Raw data

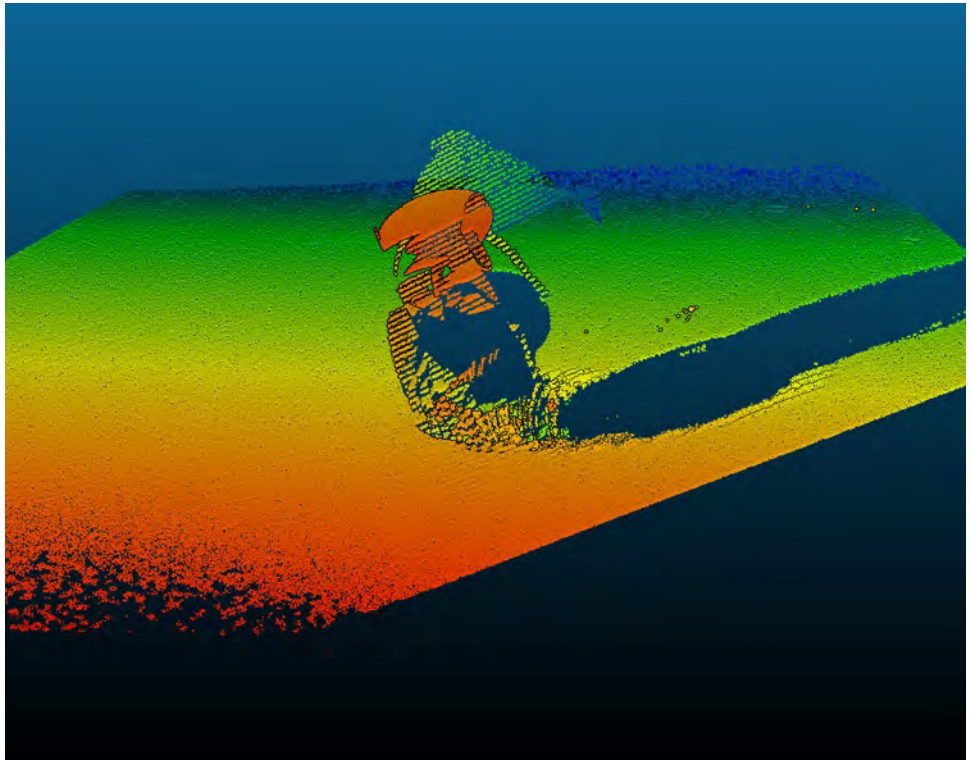
3S40 vs 3S80

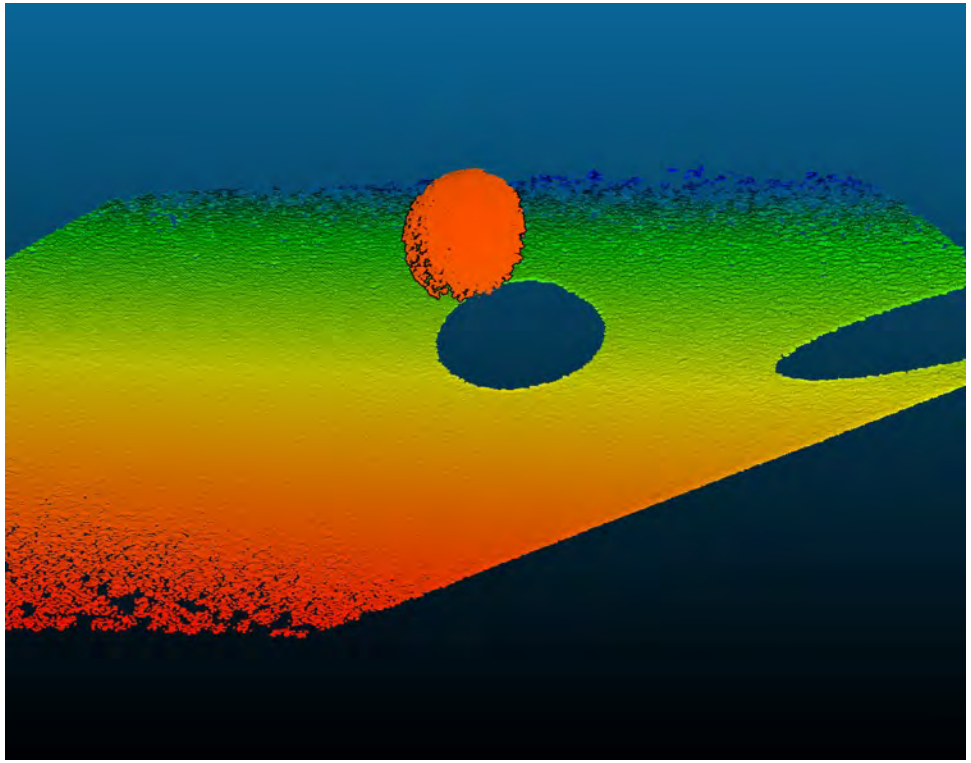




Sequential vs. Parallel Structured Light – Resulting point cloud

3S40 vs 3S80





Use-Case Applications

3D Applications

Transport & Logistics

- Volume measurement
- Pick and place
- Box dimensioning
- Defect detection

Palletizing/Depalletizing

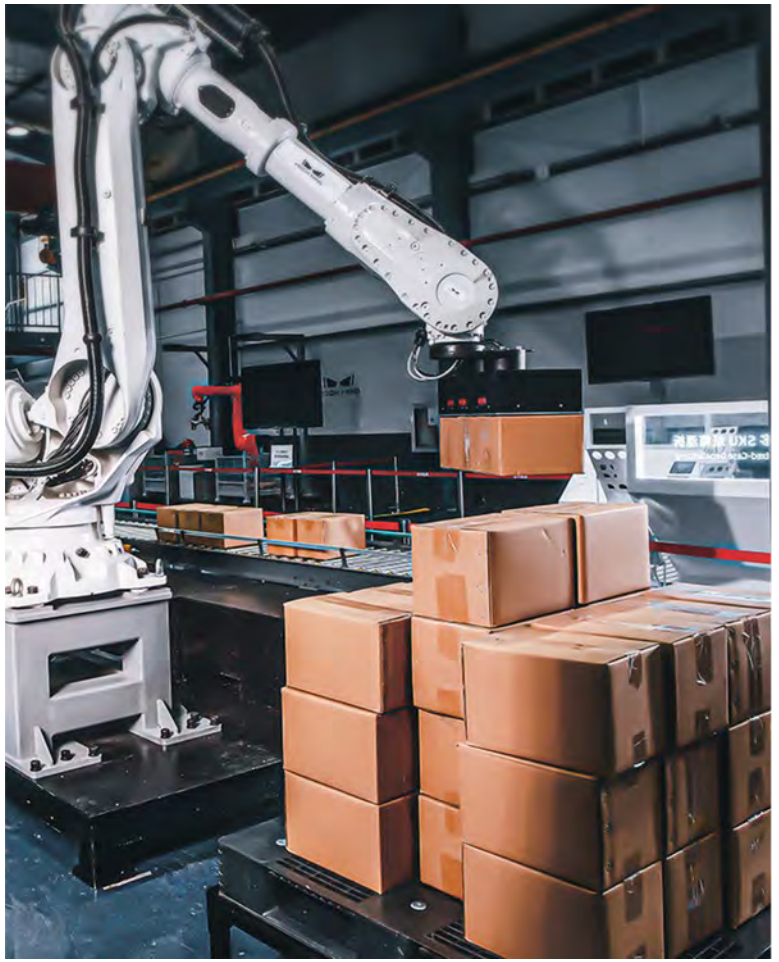
Efficiently palletize and depalletize items of various sizes

Efficiently palletize and depalletize various size bags, boxes, totes and other items.

Identify tightly stacked bags with slight deformations

Optimize stacking and support universal pallet patterns

Reduce cycle times to even the most aggressive requirements using fast acquisition



Logistics

Object Dimensioning

Measure object width, length and height (or bounding box)

Each object on the conveyor is 3D modeled by two synchronized 3D sensors

Fast acquisition with best data quality-to-speed ratio

High-speed precision dimensioning of both regular and irregularly shaped items

Improve the density of storage and effectively sort products

Estimate shipping costs more accurately

Logistics

Box Dimensioning

Consistent, real-time scanning of box dimensions in rapid motion

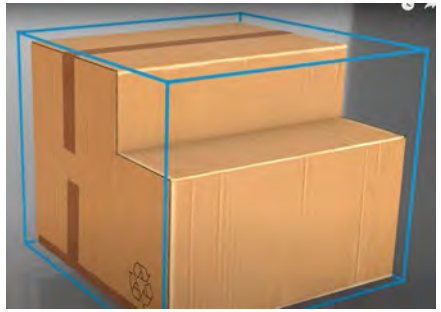
High-resolution, high-accuracy volume measurement at speeds up to 40 m/sec

Counting

Bounding box estimation

Sorting

Deformation detection



Mixed-SKU Piece Picking

Pick items from a source bin and place/drop them in a destination bin

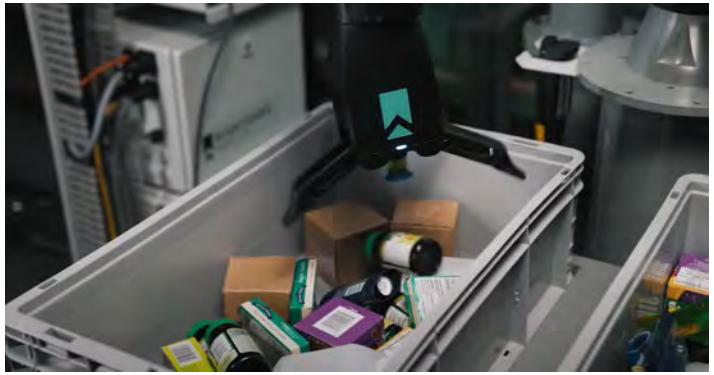
Perform pick tasks precisely, accurately, and reliably without breaks due to fatigue, monotony and environmental distractions

Reduce labor costs by automating repetitive and tedious tasks, as well as heavy lifting

Streamline warehouse and supply chain operations by automating pick, pack and transport tasks

Reduce cycle times to even the most aggressive requirements using fast acquisition

Reduce the risk of errors using robotic order fulfillment



Logistics

Pick and Place, Pick and Drop and Robotic Sortation

Ensure optimal robotic placement of products:

Maintain a strict minimum of empty space in individual parcels

Separate, identify and sort

Optimize logistics processes within the company, for example, stock densification

Speed up deliveries and lower shipping costs

Precisely assemble several products in a package

Automotive

Glue, Epoxy, and Sealing Bead Inspection

Automotive manufacturers rely heavily on bead inspection

Ensure the presence of the adhesive bead

Efficiently detect bead overfill, underfill, continuity and gaps

Measure correct quantity and location

Automotive

Defect Detection

Inspection and quality control of large metal parts in motion

Inspect large metal parts moving on a conveyor

Reduce cycle times to even the most aggressive requirements using fast acquisition

Check small details inside the sheets, such as holes and cuts, for accuracy with up to 2-megapixel resolution

Scan large objects such as metal sheets and B-pillars

Tolerates random object movements or vibrations on the conveyor

Automotive

Defect Detection

Identify defects and anomalies in an object's surface

Check that all components have been assembled correctly

Accurately measure height, width, texture and other characteristics

Detect minor surface variations, including dents, scratches and other irregularities

Check for paint runs, sags and bubbles that could affect the paint's appearance or durability

Detect minute variations in the surface of car parts

Automotive

Gap-and-Flush and Presence/Absence Inspection

Check that all components are installed correctly and that no unwanted elements exist

Ensure that doors, hoods, and trunks are aligned properly and that gaps are not excessive

Inspect the quality and presence of seals in components such as doors and windows

Verify the presence of screws, clips, fasteners and other critical components

Make sure welds are present where they are needed and absent where they are not

Measure the position and gap between components

Electronics

PC Assembly

Assembling PC motherboards involves precisely positioning various electronic components on a printed circuit board (PCB)

Precisely assemble various electronics components such as memory modules, CPUs and heatsinks

Quickly switch between different board variants to meet specific customer requirements

Locate a wide range of components, from tiny resistors to larger integrated circuits

Assemble motherboards into PC chassis and housing

What Makes Our Portfolio Different?

Speed

Simplicity, Flexibility, Longevity, Value

What makes our 3D sensor portfolio different?

Program easily for simple implementation and sophisticated performance

Leverage an extensive library of tools

Deploy faster, solve applications quicker

Capture dynamic scenes with unsurpassed 3D resolution and accuracy

Minimize or eliminate training

Tackle More 3D Applications With Both Zebra Offerings

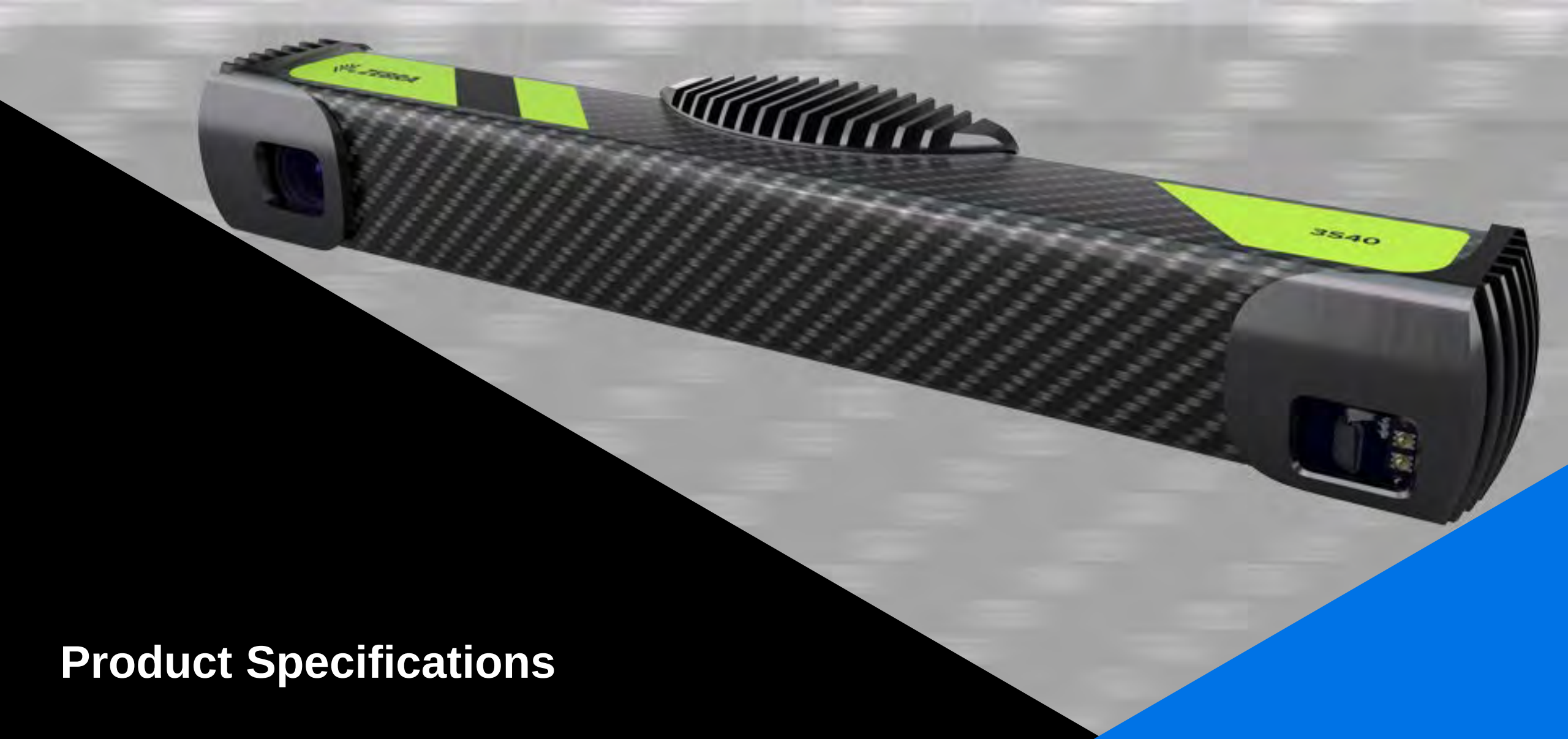
Solve the most challenging applications with 3D sensing solutions from Zebra

AltiZ

- Applications requiring high resolution and high accuracy
- Inspection of small features
  - Surface inspection
  - Precise measurement
- Application with continuous movement
  - For example conveyor belt with encoder

3S Series

- Easy to set up
  - No encoder required
  - No hardware trigger
- Static scenes
- Dynamic scenes
  - Arbitrary movement
  - Vibration



Product Specifications

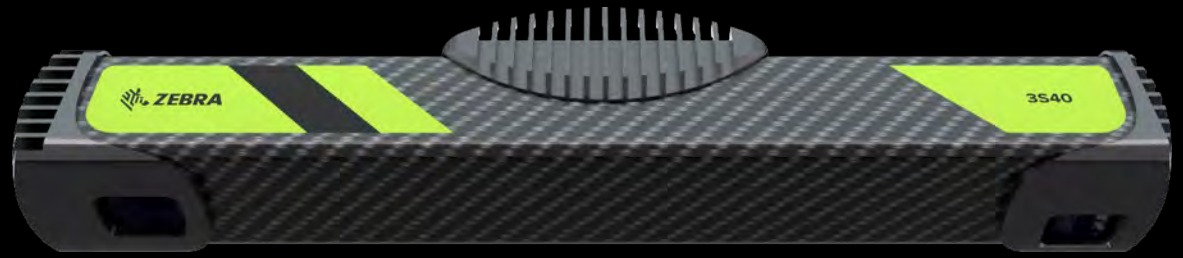
3S40 Specifications

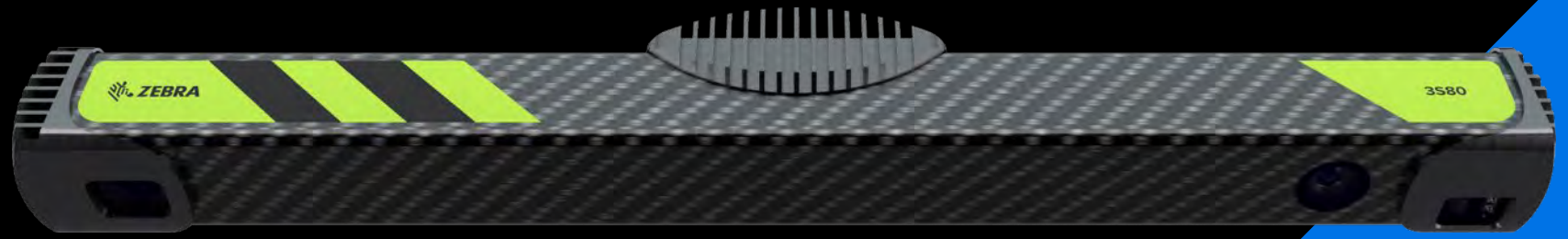
	3S40-4L
3D sensing technology	Structured light
Scanning range	34.3 x 88.5 in /870–2150 mm
Maximum scan rate	2 fps
Scanning time	from 450 ms
Point size	0.82 mm @z = 1245 mm
Accuracy	< 0.50 mm

3S80 Specifications

	3S80-4M	3S80-4L
3D Sensing Technology	Parallel Structured Light	Parallel Structured Light
Scanning range	19.6 – 37 in / 497–939 mm	30.6 – 119.4 in / 778 – 3,034 mm
Maximum scan rate	20 fps	20 fps
Scanning time	10 ms	20 ms
Dynamic mode		
Point size	0.55 mm @z = 650 mm	1.05 mm @z = 1239 mm
Accuracy	< 0.500 mm	< 1.250 mm
Static mode		
Point size	0.37 mm @z = 650 mm	0.72 mm @z = 1239 mm
Accuracy	< 0.250 mm	< 0.900 mm

UMD
Value Add





UMD Value Add

Engineering IoT Solutions

Design

Design & manufacture:

- IoT devices and interfaces
- Cables
- Modify products
- Mechanical design and assemble

Support

Through our extensive professional services in

- Engineering
- Software
- Deployment
- Support

Source

- Data capture & ICT products and from our many agencies
- Systems Integration
- Solutions Architecture
- Systems Engineering

Full Stack Solution Provider

Encompassing

- Data Carriers (barcode, RFID, sensors)
- Edge devices and gateways
- Own and manage PCI-DSS compliant Data Center
- Middleware and Cloud Application Broker
- Software: cloud, mobile and embedded applications
- Design, deploy and managed services

Thank you!

For more information, visit, www.zebra.com/3s-series

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