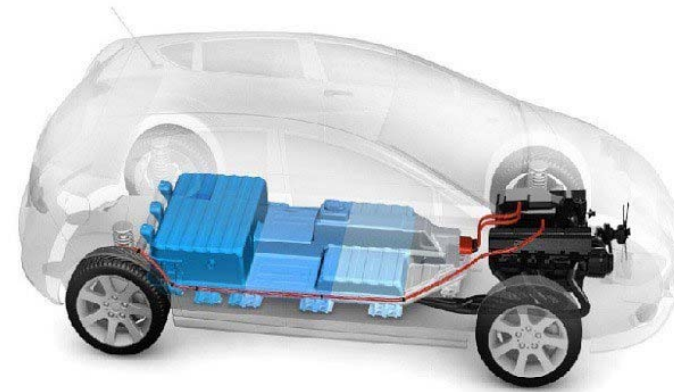# 3D Inspection & Process Control

for High Viscosity Applications in Battery Systems
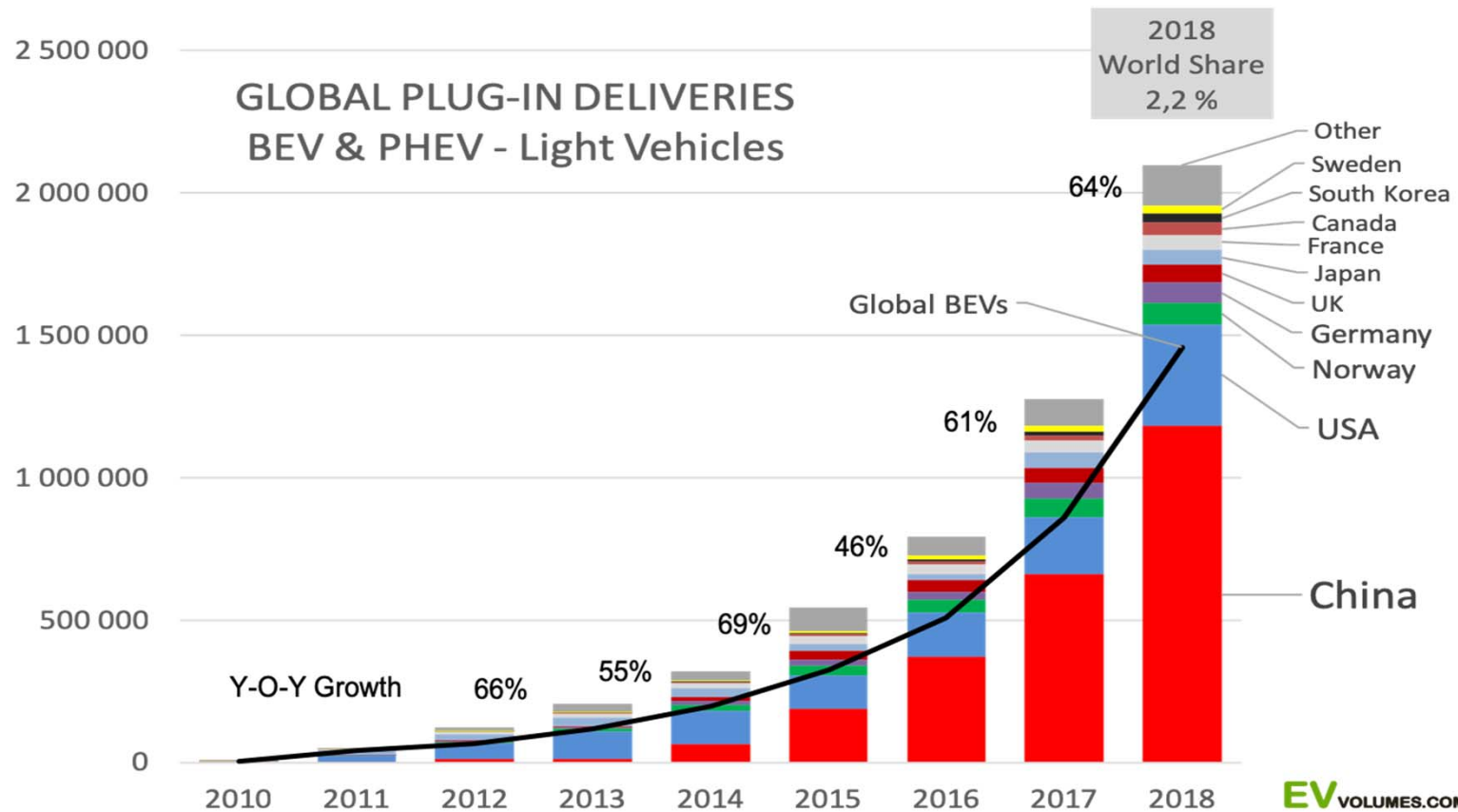

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Eyes of Automation

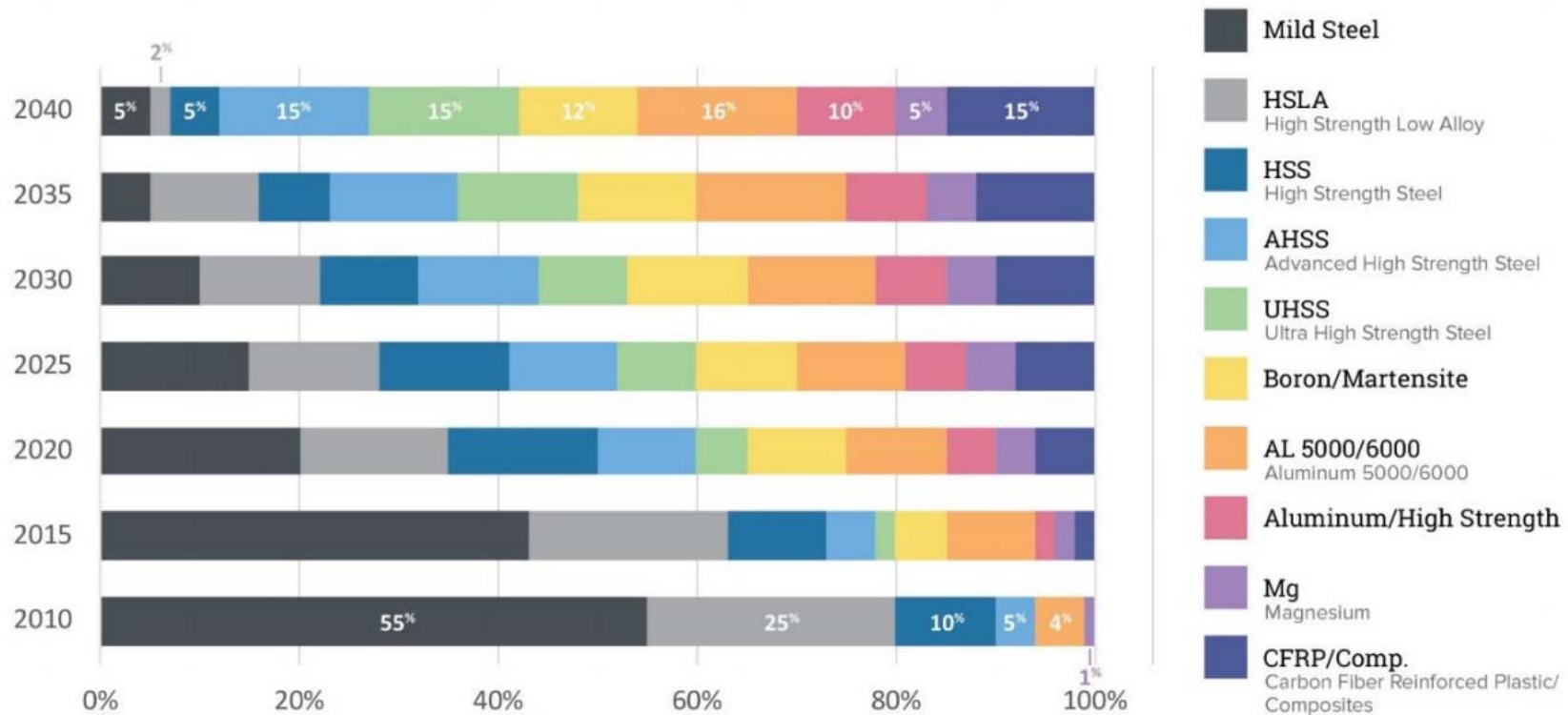# Company Introduction

Bringing the Power of 3D to Manufacturing

„Once in a Generation Shift" in the Auto Industry…

GLOBAL PLUG-IN DELIVERIES
BEV & PHEV - Light Vehicles

2018 World Share 2,2 %

Y-O-Y Growth: 66% (2012), 55% (2013), 69% (2014), 46% (2015), 61% (2016), 64% (2018)

Regions: Other, Sweden, South Korea, Canada, France, Japan, UK, Germany, Norway, USA, China, Global BEVs
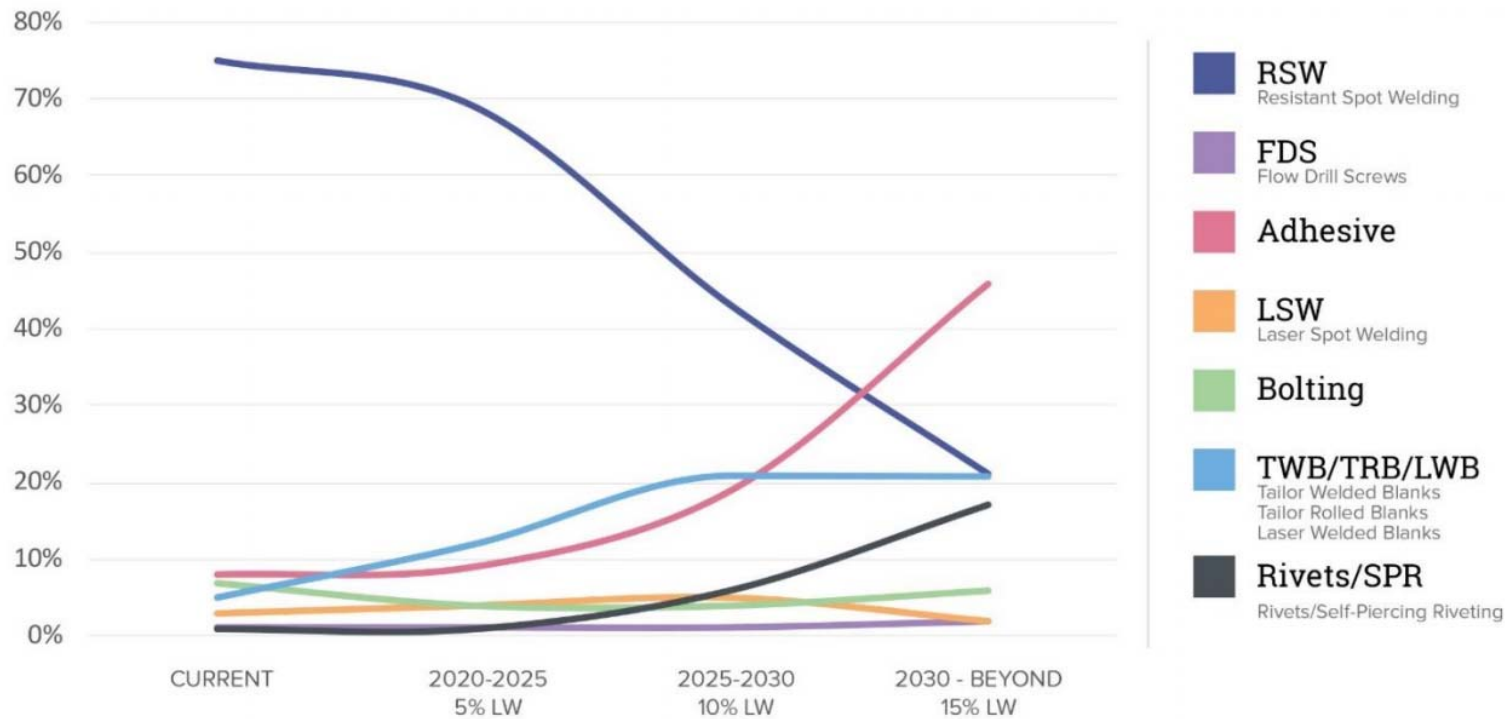
EV VOLUMES.COM

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Material Mix in (EV) Body Structures

Source: CAR Research

Trends in Joining Processes

Note: LW= Lightweighting
Source: CAR Research, Lucintel

Dynamics of the Dispensing Process

- Part-to-part variation

- Part fixturing imperfection

- Dispensing material condition variation

- Dispensing hardware design imperfection

- Robot programming imperfection

- …

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Common Deviation from Desired Dispensing Process

- **Too little**
  - Structural rigidity concern
  - Leakage, corrosion, heat accumulation, …

- **Too much**
  - Squeeze-out
  - Contact resistance variation on faying area
  - Dispensing material waste
  - Contamination of down stream processes


- **Incorrect location**

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Traditional Bead Inspection Technology Review

- Dispensing equipment
  - ➡ No info on how much and where on the part at any given point

- Manual
  - ➡ Subjective, no traceability, loss of productivity of operators' time

- 2D vision
  - ➡ Temperamental - high maintenance, no 3D info, penalty to cycle time

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Predator3D™ - In-Line 100% 3D Bead Inspection

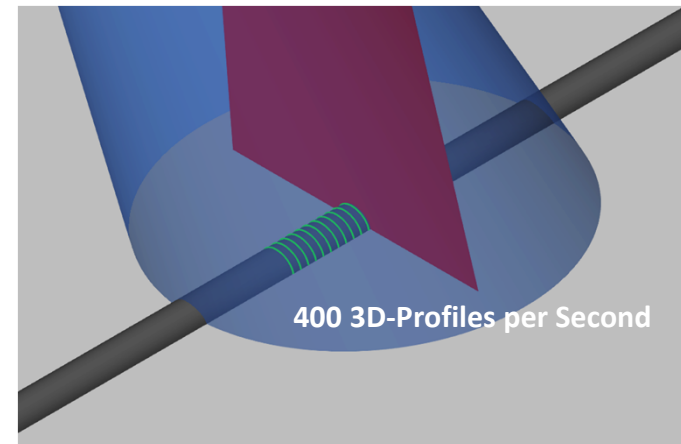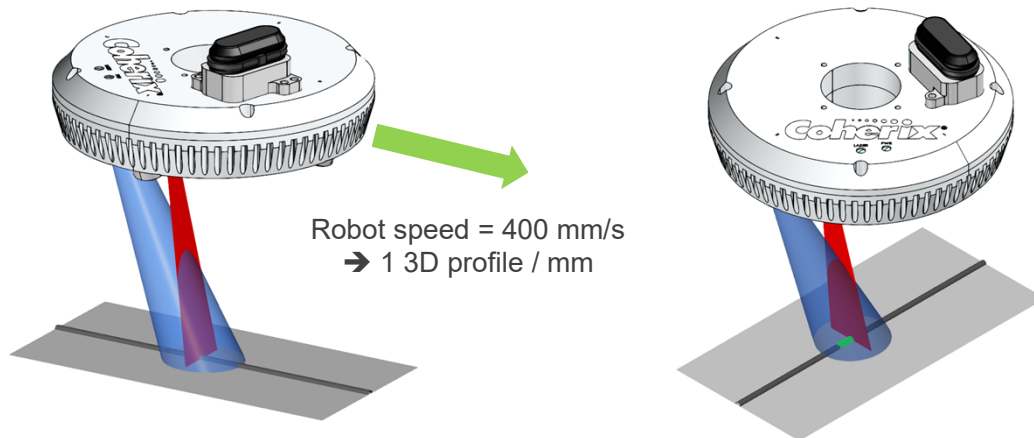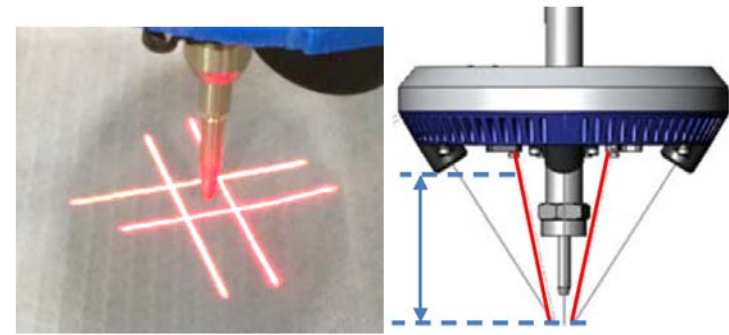Predator3D provides in-line 100% 3D inspection of the bead as it is being dispensed

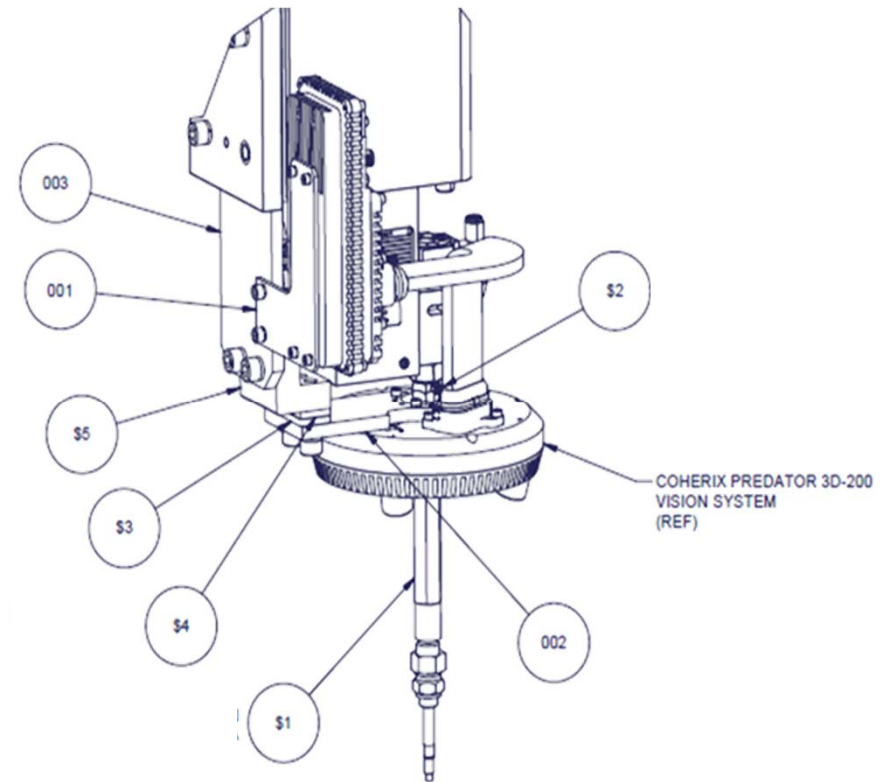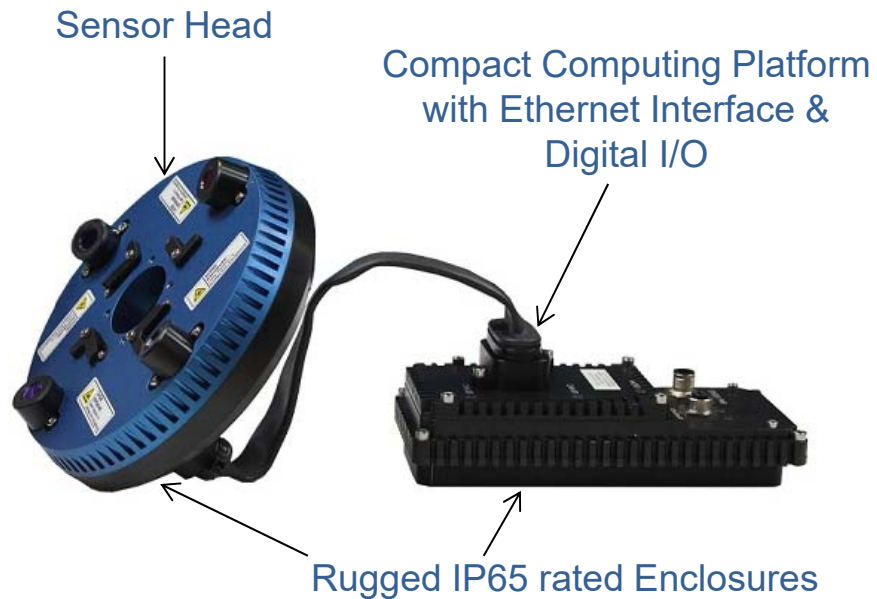➔ It tells you how much and where bead is dispensed at any instantaneous moment!
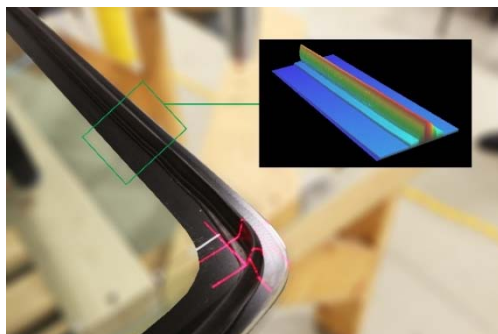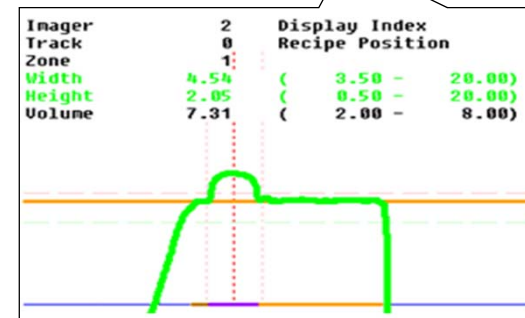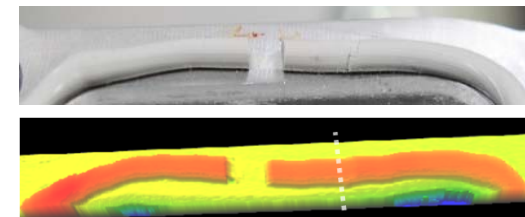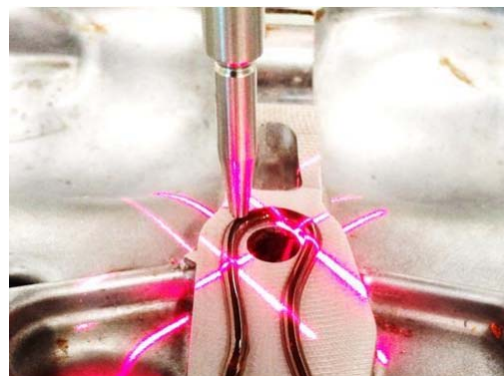
360°-3D-View
400 times per
second!

3D Inspection Principle

- 4 laser sample profiles continuously surrounding the dispensing nozzle

- Laser profile sampling is independent of robot speed or direction

- 400 profiles per second are sampled for each laser (max. 1000 profiles / sec.)

- Tilt angle of dispensing nozzle of up to 30° possible

Robot speed = 400 mm/s
➔ 1 3D profile / mm

400 3D-Profiles per Second

Completely Self Contained

Sensor Head

Compact Computing Platform with Ethernet Interface & Digital I/O

Rugged IP65 rated Enclosures

003

001

$2

$5

$3

$4

002

$1

COHERIX PREDATOR 3D-200 VISION SYSTEM (REF)

4 models for 60 mm, 90 mm, 125 mm and 200 mm standoff

Coherix®

Coherix i-Cite™ GUI

Select position of bead profile view by mouse click

Predator3D™- Applications

Body in White	Powertrain	Battery Systems	Final Assembly
• structural adhesives • sealants	• FIPG	• structural adhesives • sealants • thermal paste • gap fillers	• structural adhesives • sealants

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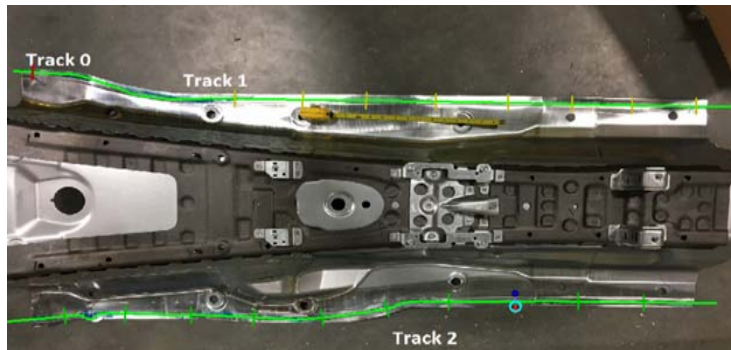# 3D Inspection Tasks in Battery Systems

Sealant or Adhesive
Battery pack sealing and assembly

Thermallly Conductive Gap Filler
High thermal conductivity, vibration dampening, low thermal resistance and enhanced elongation

Thermal Conductive Adhesive
Thermal conductive solution, heatcure acclerate able, high elongation, vibration inhibitor

Structural Adhesives
Enhance crash durability

Source: DUPONT

conerix®
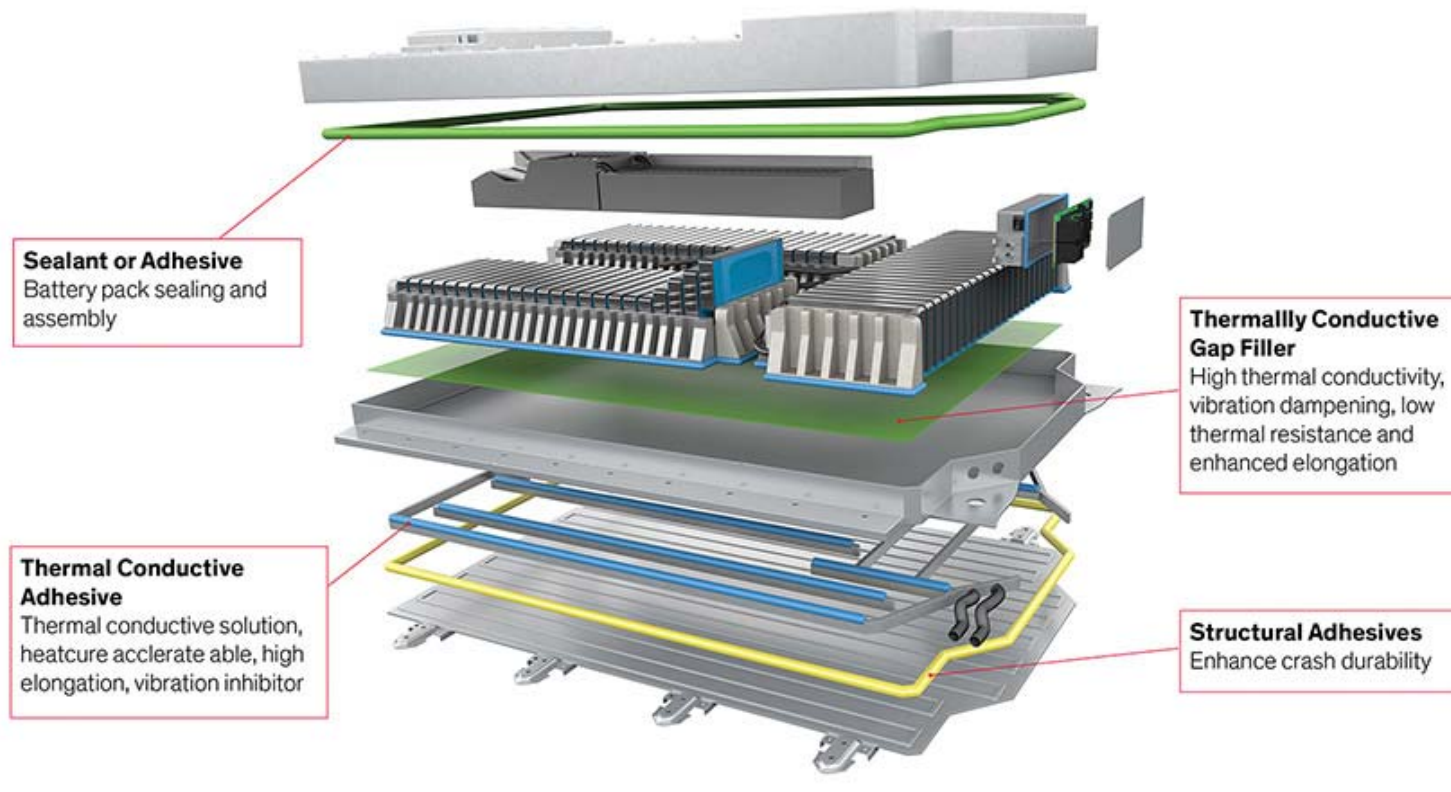
Battery Pack Cover - Sealant Inspection
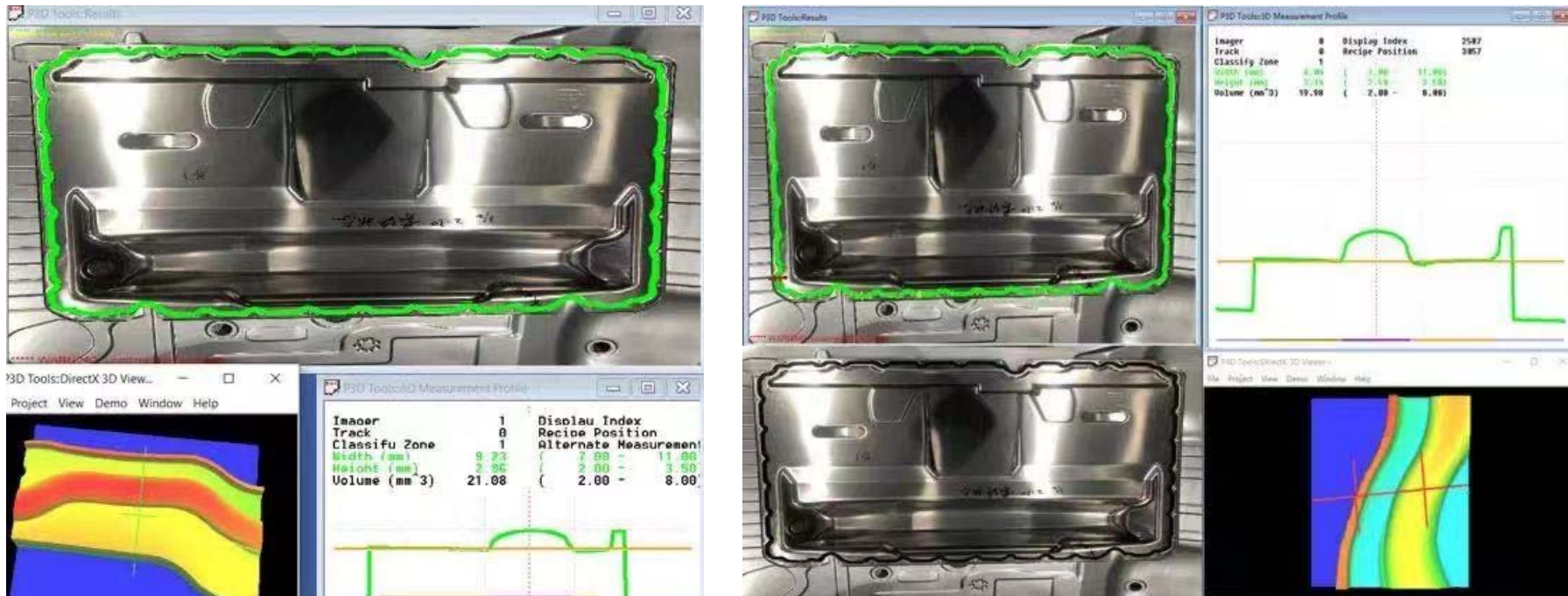
Predator3D™ Bead Location Inspection

3D Volume - Case Study

Due to the imperfection of the part fixturing mechanism, the dispensing nozzle turns out to be plowing through the bead as it is being dispensed and the bead ends up with a deep trough. The traditionally-used tolerancing parameter - bead width, even the bead height - would pass for this case.
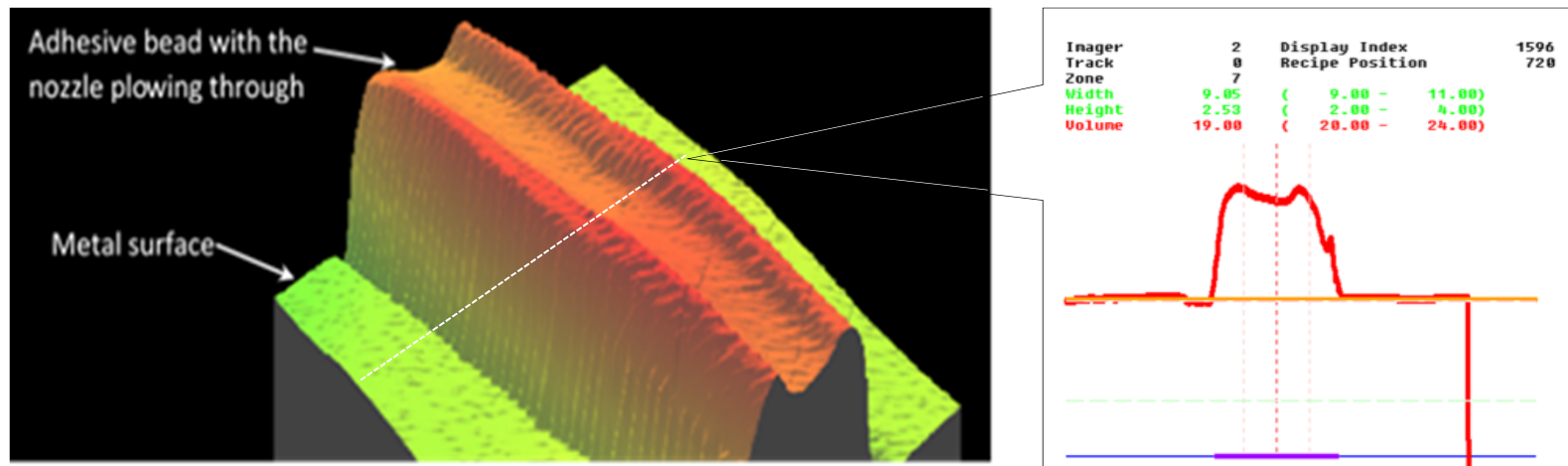
The Predator3D-only tolerancing parameter - **instantaneous volume** - kicked in as another level of assurance and failed this part as it is supposed to. This saved the customer a potentially major quality incident.
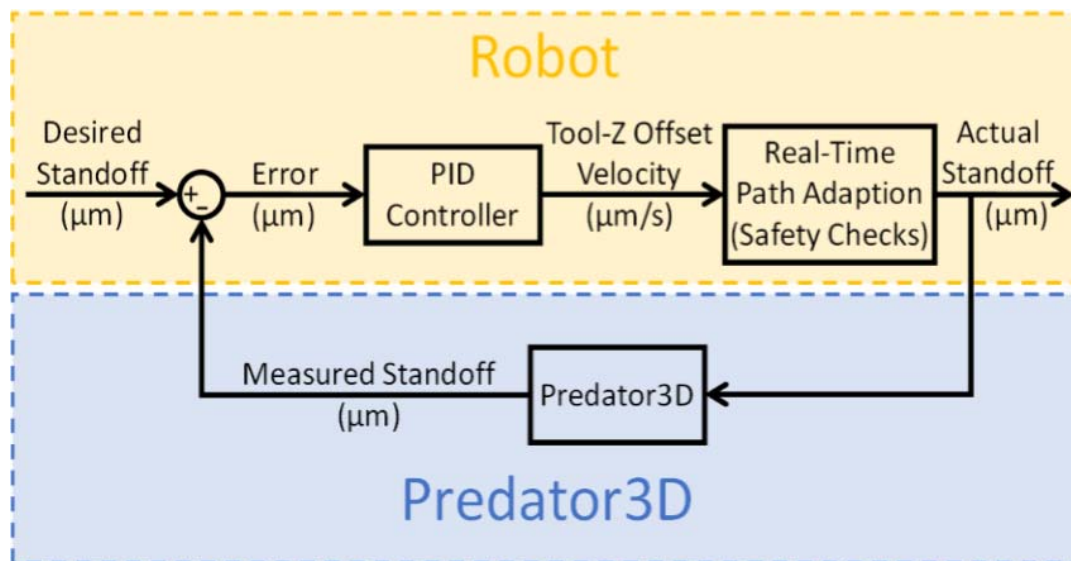
Predator3D™ Z-Tracking for Process Control

Trailing Laser   Leading Laser

Actual Part Surface

Ideal Part Surface

Coherix®
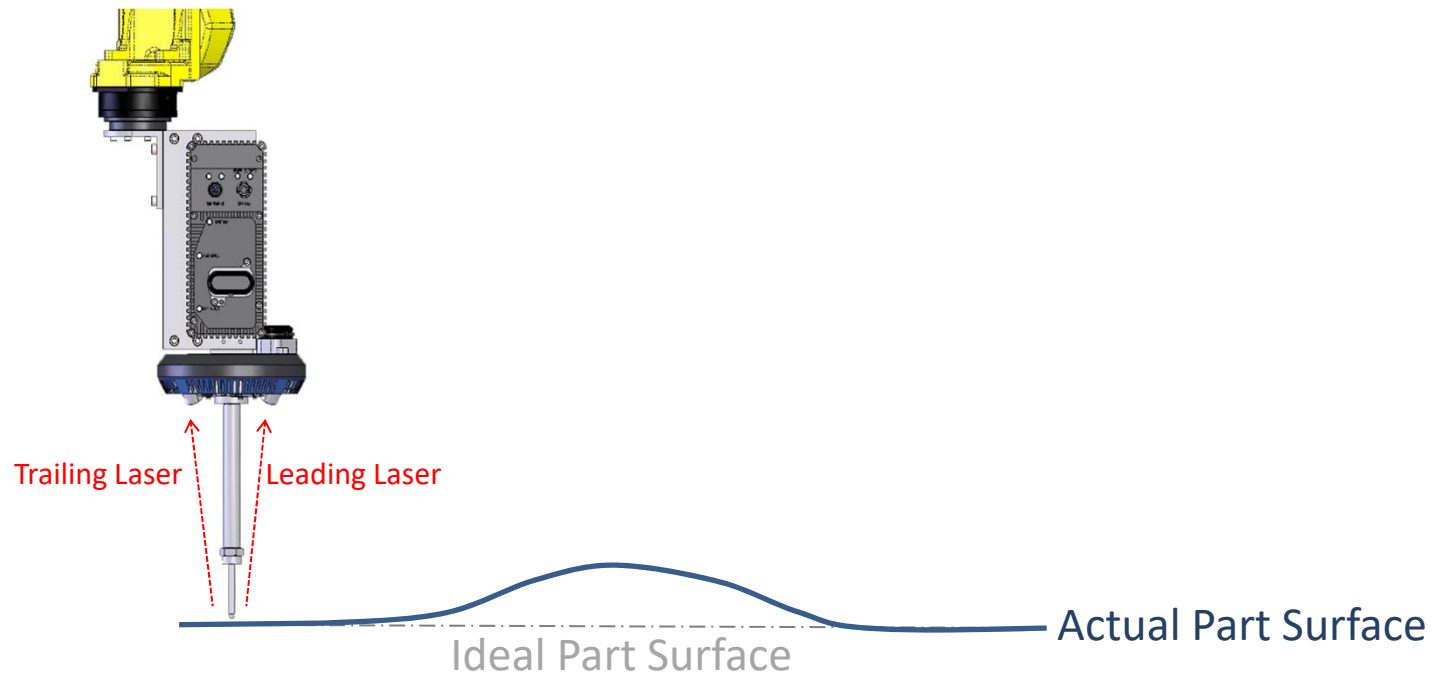
Predator3D™ Z-Tracking for Process Control

Key Z-Tracking Capabilities

✓ Real time robot path control for constant tip to part distance

✓ Measurements available from any combination of the four Predator3D laser scanners

✓ Measurements can be saved to a CSV file to monitor and investigate part variation

Monitoring, Reporting, Data Archiving and Traceability

✓ Part identification information

✓ Visual display

✓ Customizable

✓ Multiple levels of data archiving with full traceability

    ✓ CSV - Track of every part for process monitoring

    ✓ RTF - Detailed record of failures on the part

    ✓ 3D Scan - Full traceability for 3D visualization & problem-solving

Data Analytics - Process Variation Monitoring
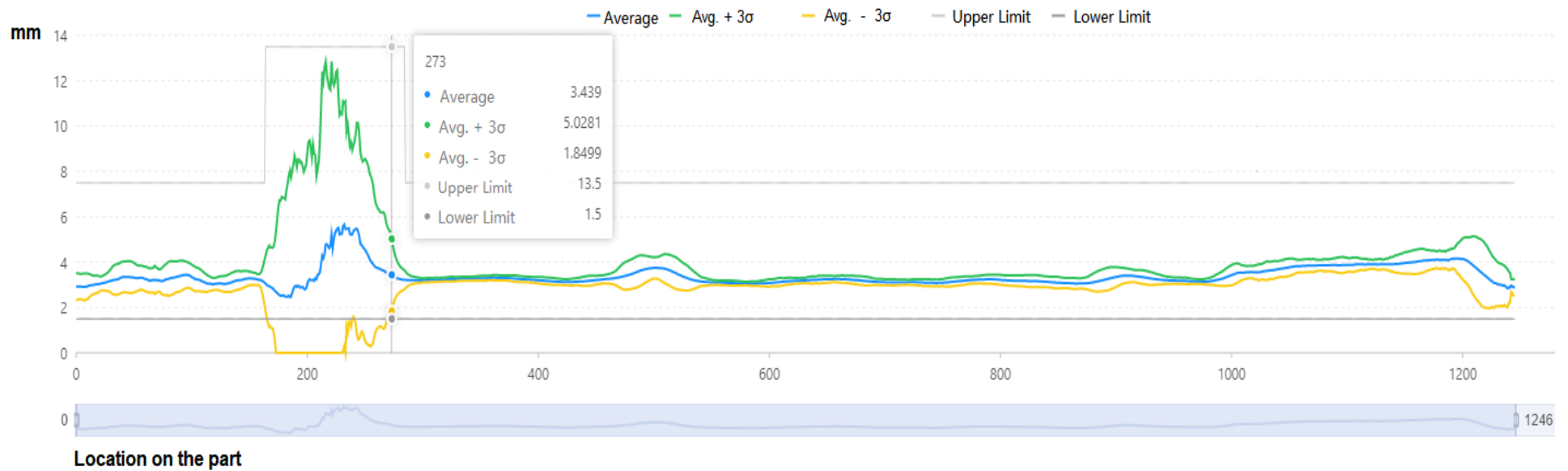
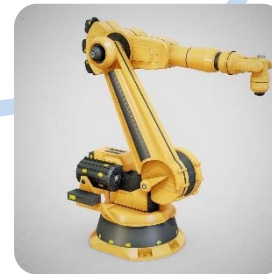# Predator3D™ Robot Program Optimization
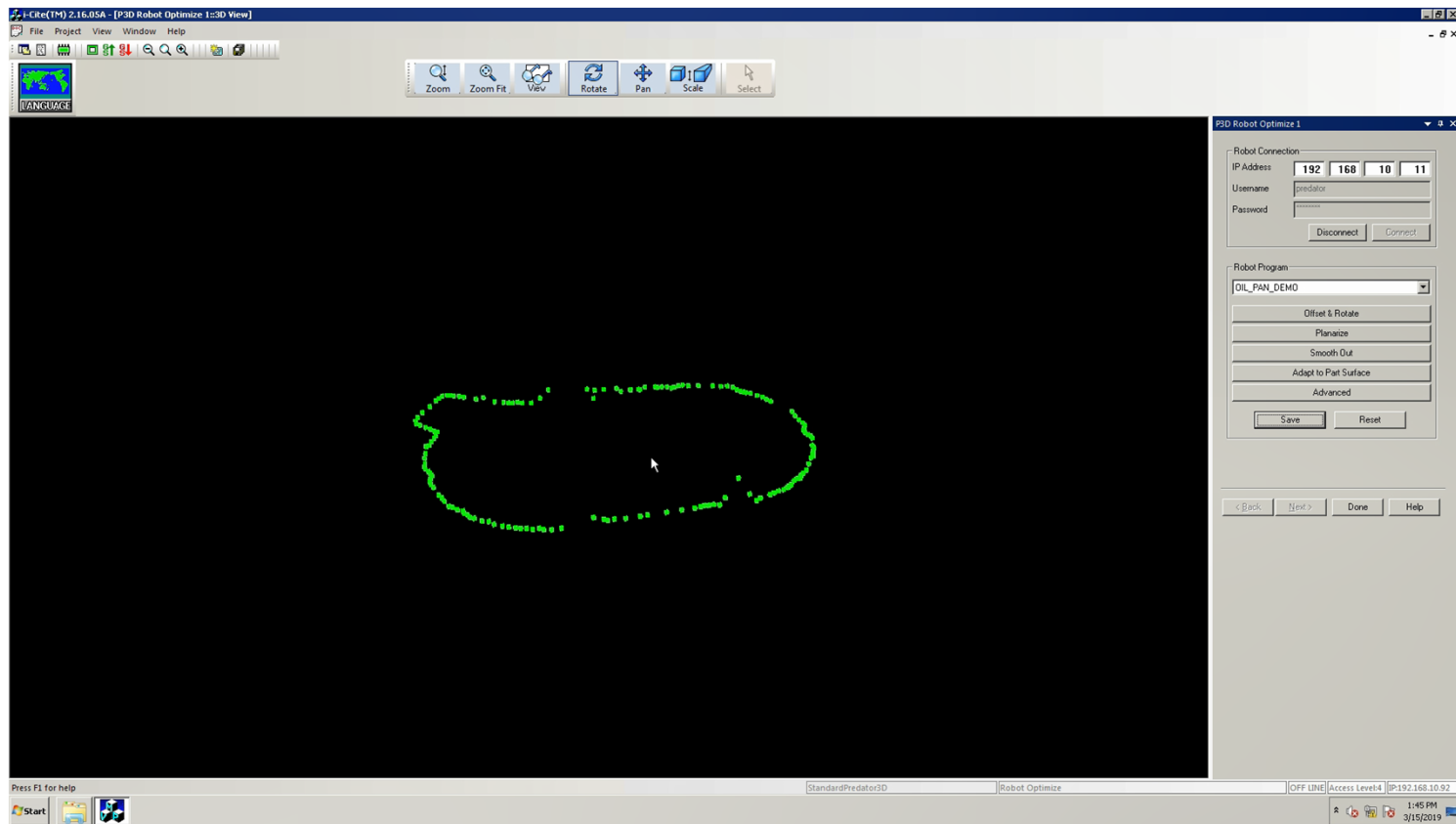
Outlook - From Inspection to Process Control

Volume
Autonomous
Control
with Predator3D

Robot
Autonomous
Control
with Predator3D

THANK YOU!

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