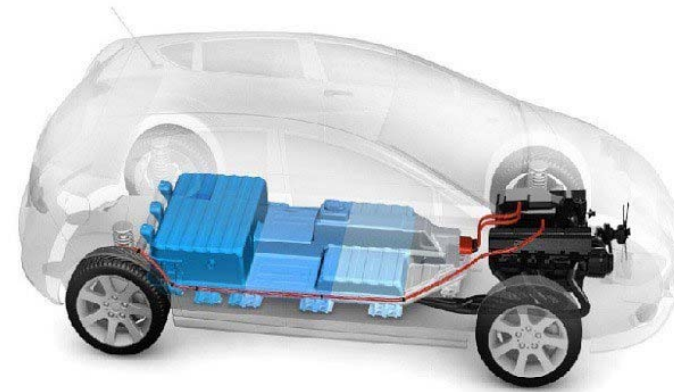


3D Inspection & Process Control for High Viscosity Applications in Battery Systems



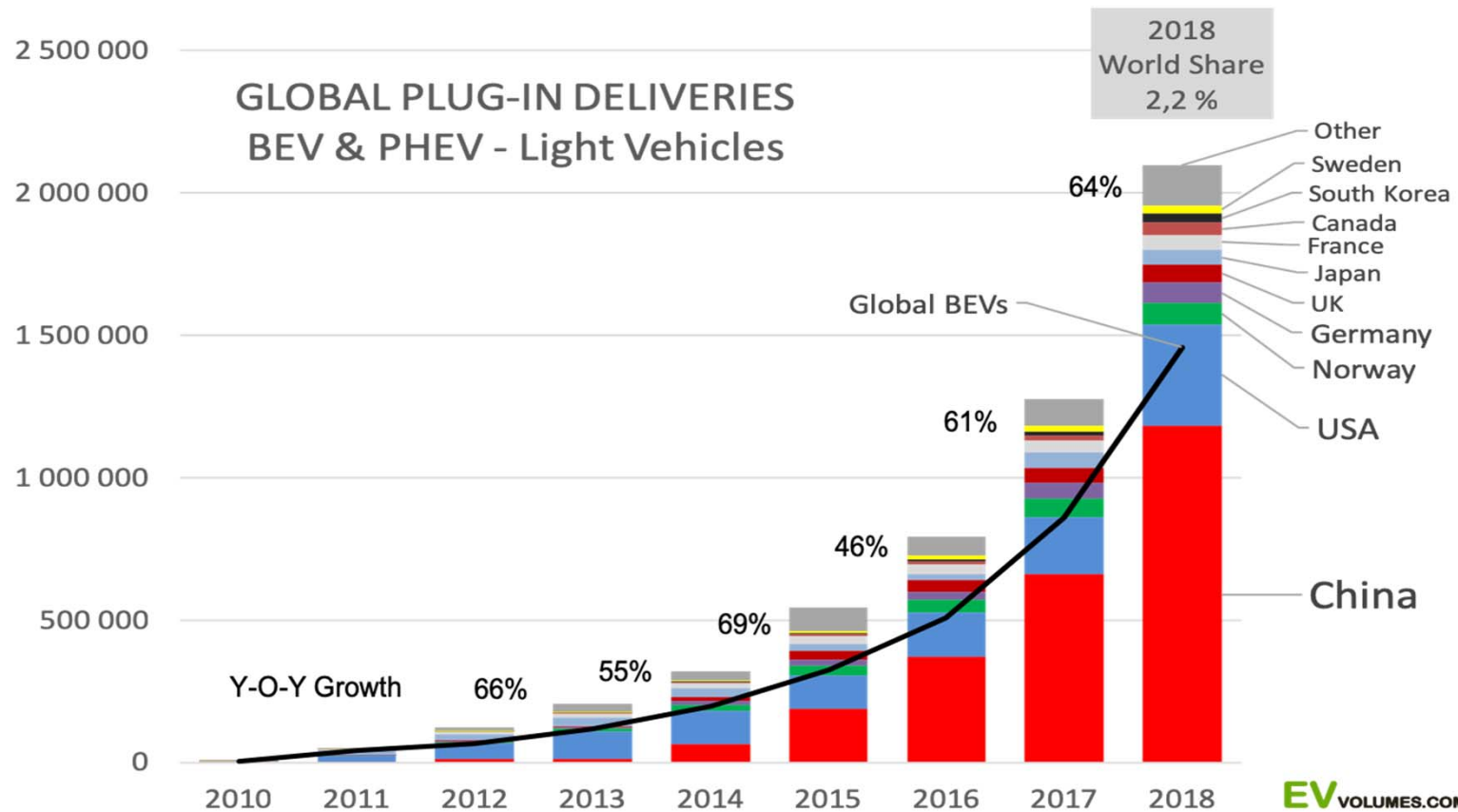
Coherix[®]
Eyes of Automation

Company Introduction

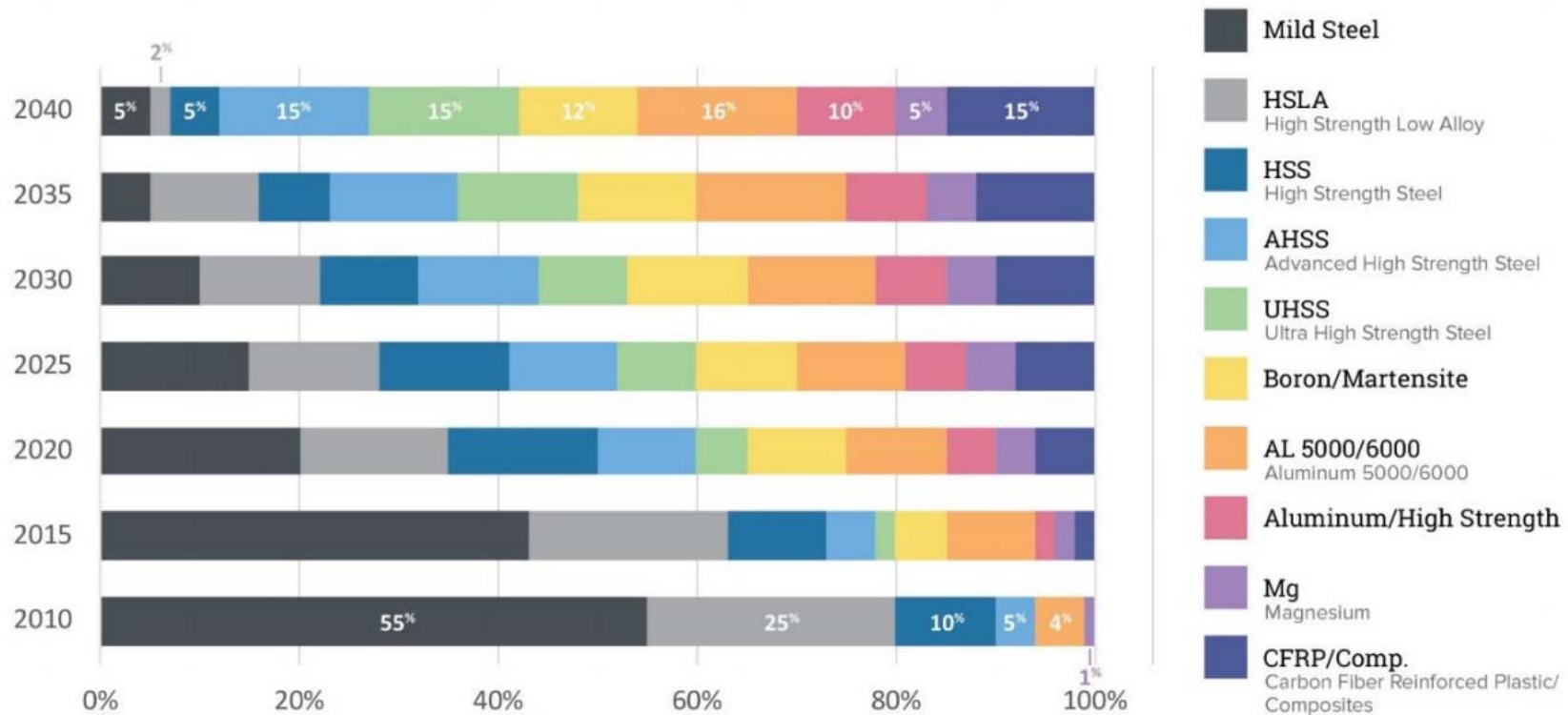


Bringing the Power of 3D to Manufacturing

„Once in a Generation Shift“ in the Auto Industry...

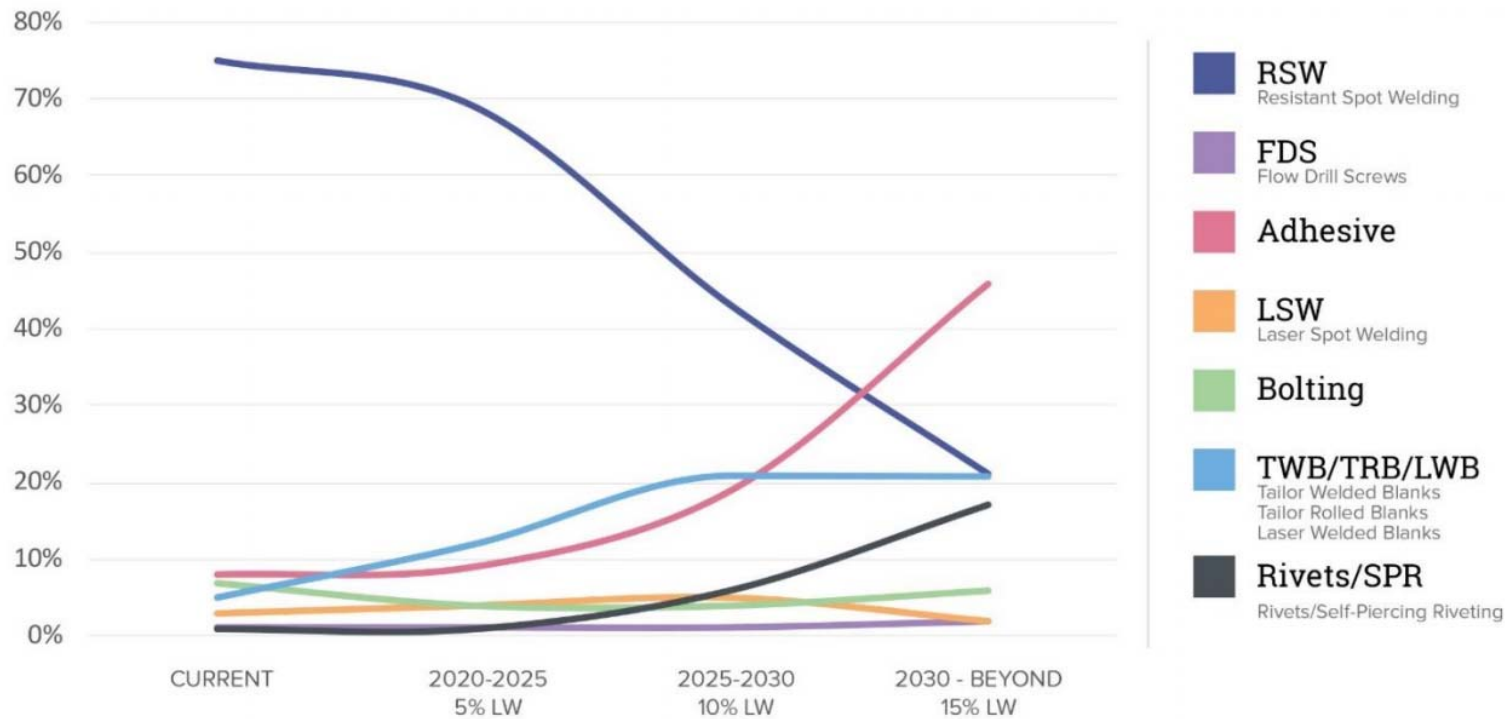


Material Mix in (EV) Body Structures



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
- ...



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



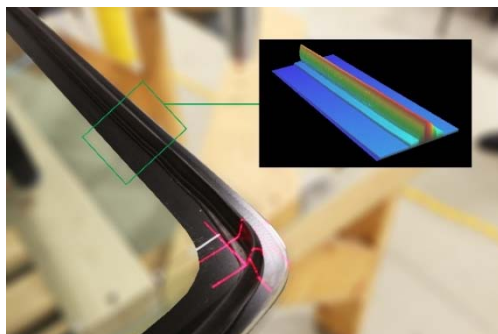
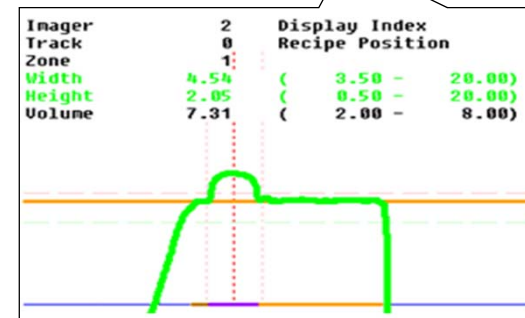
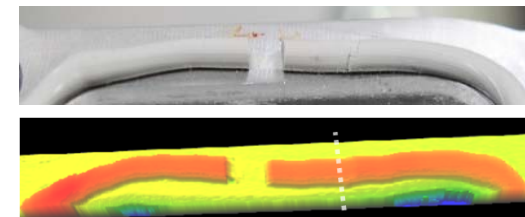
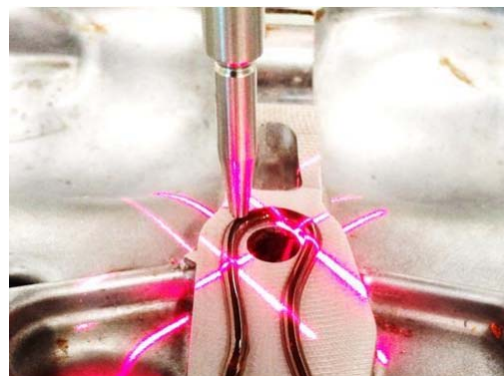
Traditional Bead Inspection Technology Review

- 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

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

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

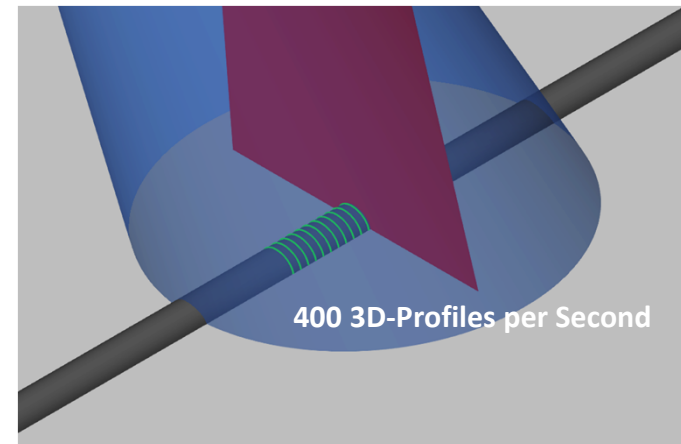
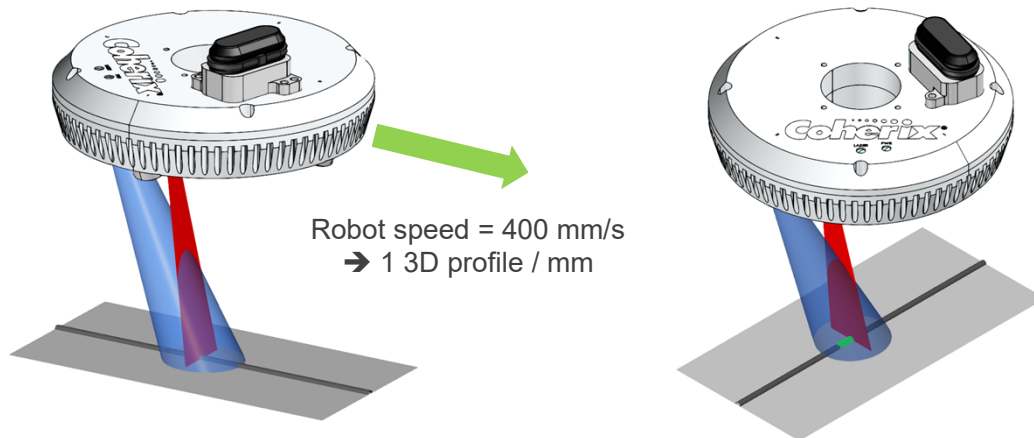
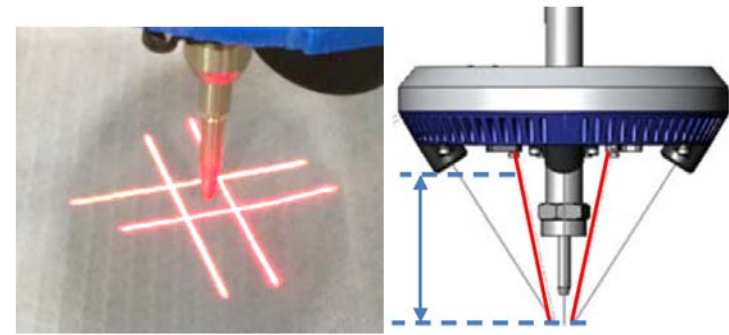
→ It tells you **how much** and **where** bead is dispensed at any instantaneous moment!



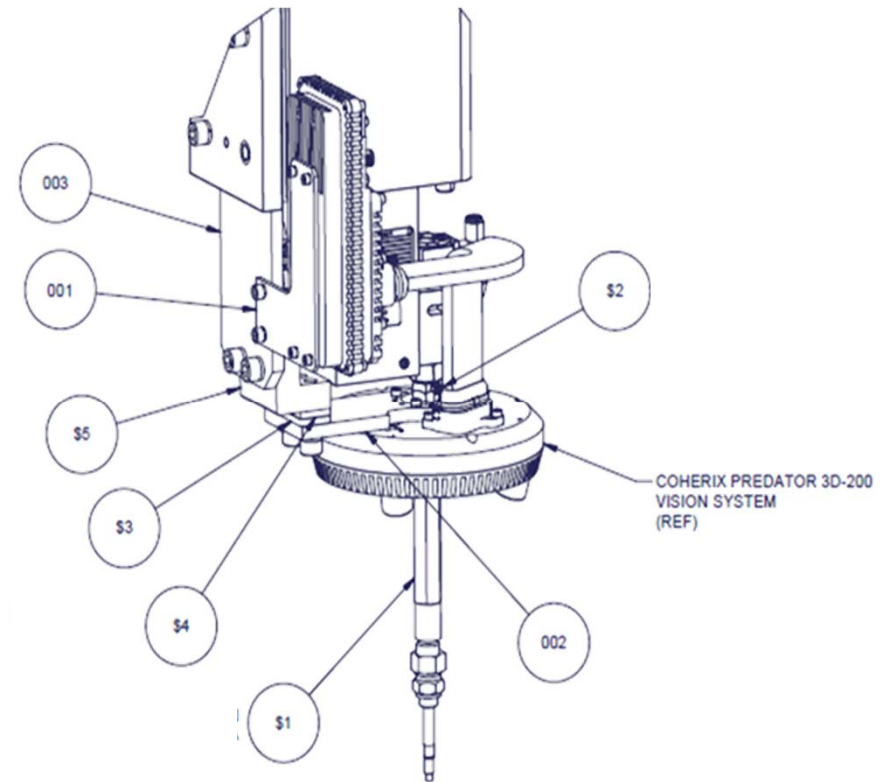
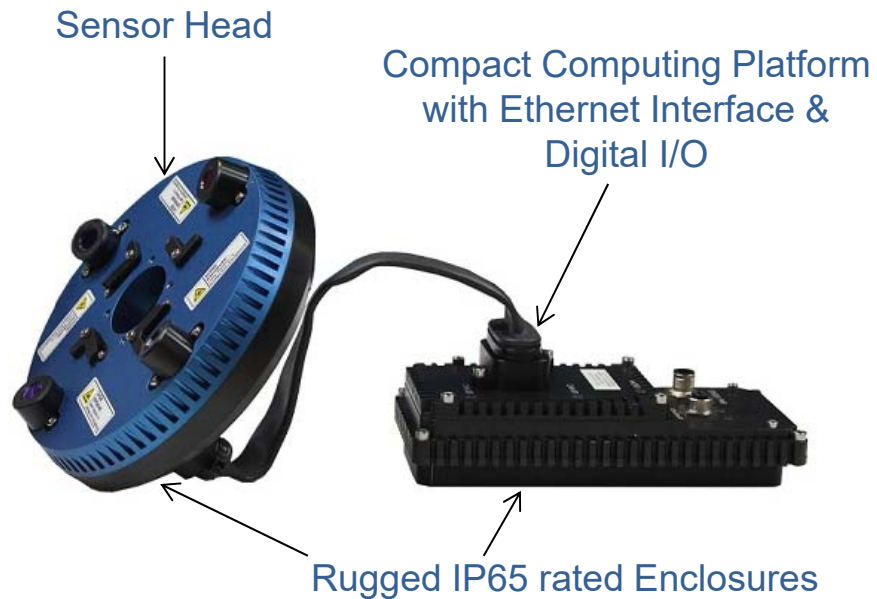
360°-3D-View
400 times per
second!

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



Completely Self Contained



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

Coherix i-Cite™ GUI

P32 Tools:Results

Failed 5 of 5 2 Pass (0x0001)
Failed 341 (MPS_V036_H110_V0_FD)
Maximal 2.05 (M32_WF19_C04_V0_F0)

P32 Tools:3D Measurement Profile

Inager	0	Display Index	7998
Track	1	Recipe Position	582
Zone	2		
Width	5.38	(2.50 - 30.00)	
Height	1.98	(1.25 - 10.00)	
Volume	7.42	(2.00 - 8.00)	

P32 Tools:Statistics

Execute / Statistics Time	0.00 (0.00 - 0.13)	0.00 (
Display Time / OnDraw() Sum	0.02 (0.01 - 1326.00)	27.13 (
Total Time	0.00 (0.00 - 1326.00)	
Display Index / Range	7998 - 1000	
Track / Recipe Position	1 - 582	

Results By Inager:

Processing	Running	Running	Running	Running
Current Processing Index	20255	20256	20256	20256
Last Available Processing Index	20254	20255	20255	20255
Last Retrieved Processing Index	20254	20255	20255	20255
Last Process Average Index	20253	20254	20254	20254
Last Process Surface Index	-1	-1	-1	-1
Last Process Surface Fit Index	-1	-1	-1	-1

Press F1 for help

Predator3D | GME4 Pilot Line | ON LINE | NO LOT | microns

Predator3D™ - Applications

Body in White



- structural adhesives
- sealants

Powertrain



- FIGP

Battery Systems



- structural adhesives
- sealants
- thermal paste
- gap fillers

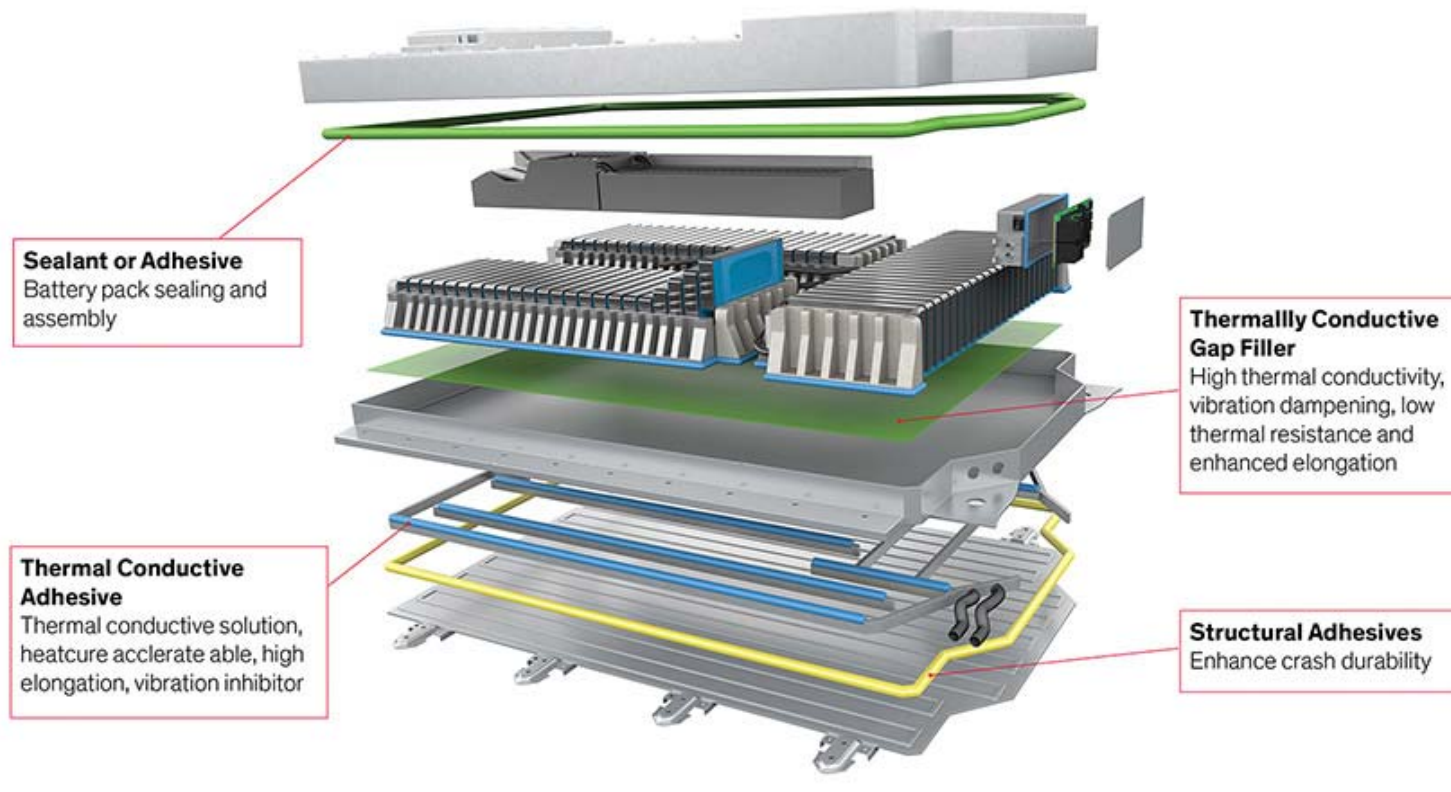
Final Assembly



- structural adhesives
- sealants

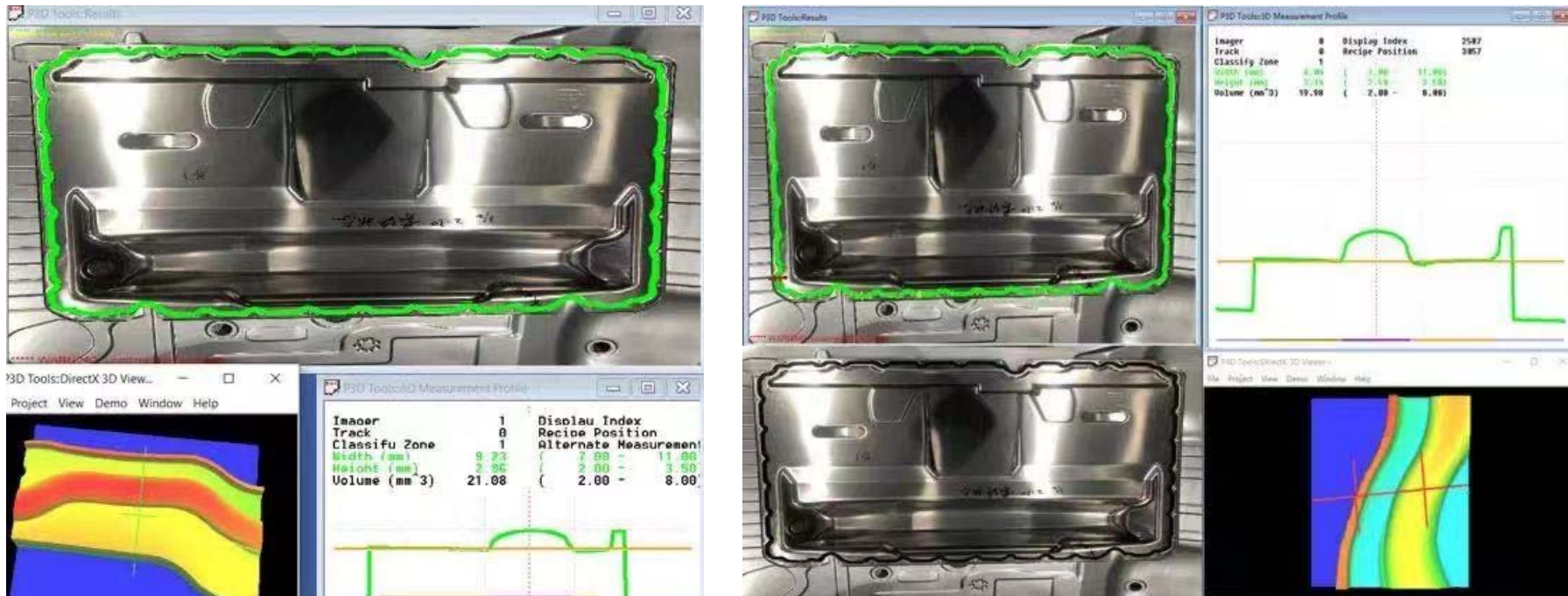


3D Inspection Tasks in Battery Systems

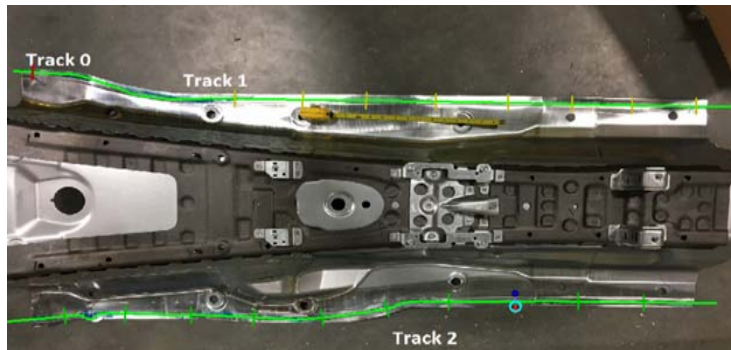


Source: DUPONT

Battery Pack Cover - Sealant Inspection

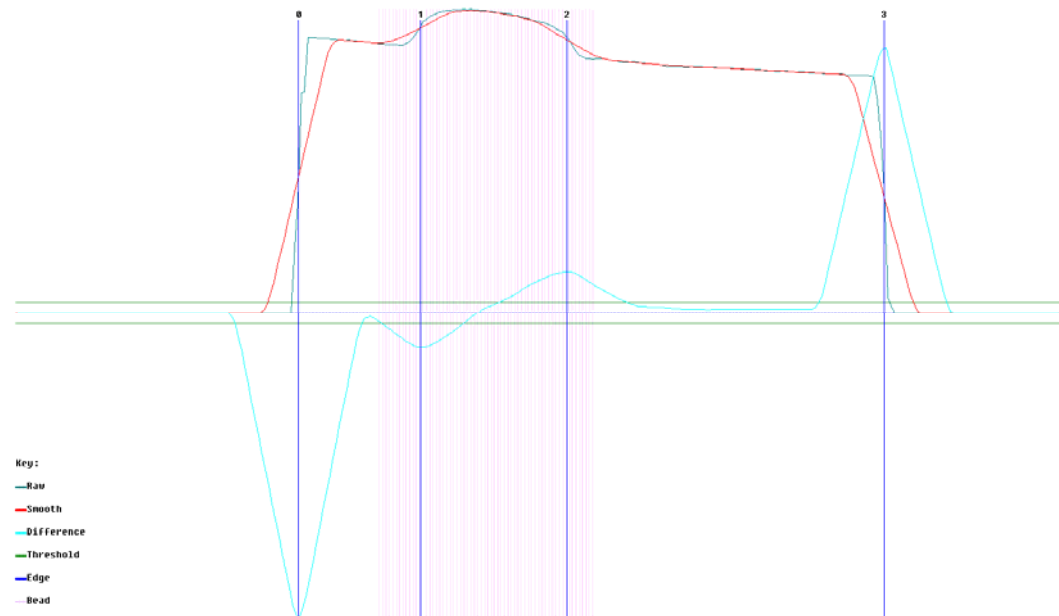


Predator3D™ Bead Location Inspection



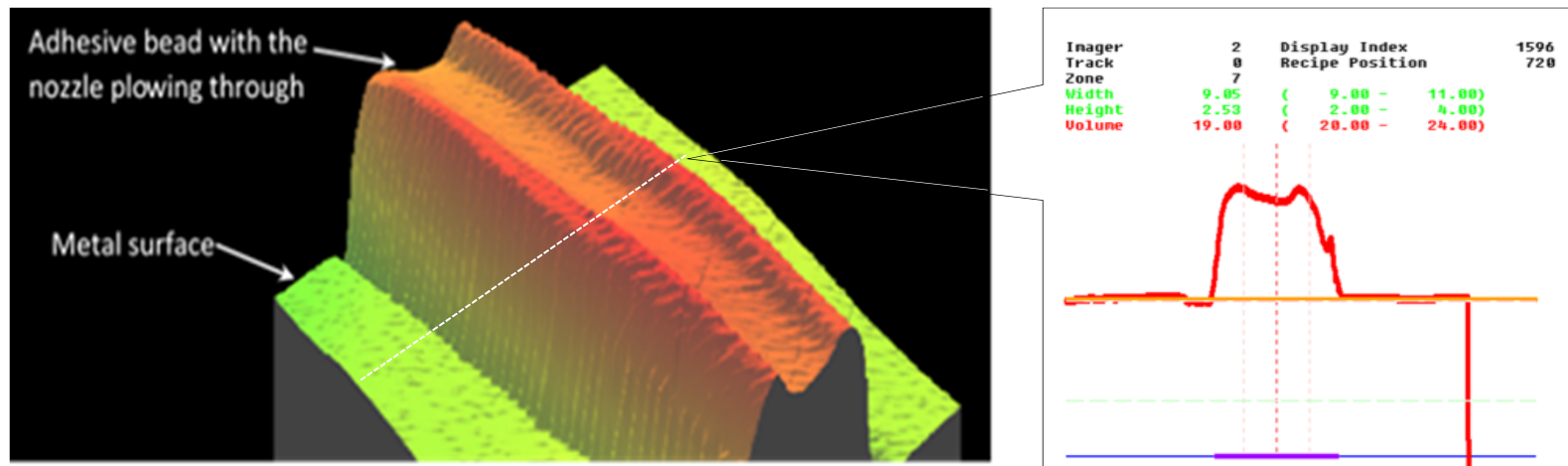
Feature Tool Details:

Index	Side	Feature Type	Distance	Minimum	Maximum	Pass	Missing	Result
0	Left	Nearest Passing Decline	10.25	7.52	13.57	NO		PASS
1	Left	Nearest Passing Decline	7.52	5.01	11.01	NO		PASS
2	Left	Nearest Passing Decline	7.50	5.00	11.00	NO		PASS
3	Left	Nearest Passing Decline	7.27	4.38	10.58	NO		PASS
4	Left	Nearest Passing Decline	8.23	5.18	6.28	NO		FAIL
5	Left	Nearest Passing Decline	8.04	5.08	11.08	NO		PASS
6	Left	Nearest Passing Decline	7.14	4.14	10.14	NO		PASS
7	Left	Nearest Passing Decline	7.45	4.71	10.81	NO		PASS
8	Left	Nearest Passing Decline	6.97	4.50	10.50	NO		PASS
9	Right	Nearest Passing Decline	11.00	8.00	14.00	NO		PASS
10	Right	Nearest Passing Decline	11.27	8.00	14.00	NO		PASS
11	Right	Nearest Passing Decline	12.35	9.00	15.00	NO		PASS
12	Right	Nearest Passing Decline	10.48	8.00	14.00	NO		PASS
13	Right	Nearest Passing Decline	11.88	9.00	15.00	NO		PASS
14	Right	Nearest Passing Decline	12.49	9.50	15.50	NO		PASS
15	Right	Nearest Passing Decline	12.81	10.00	16.00	NO		PASS
16	Right	Nearest Passing Decline	13.62	11.00	17.00	NO		PASS
17	Right	Nearest Passing Decline	11.66	9.00	14.00	NO		PASS
18	Right	Nearest Passing Decline	13.59	12.00	16.00	NO		PASS



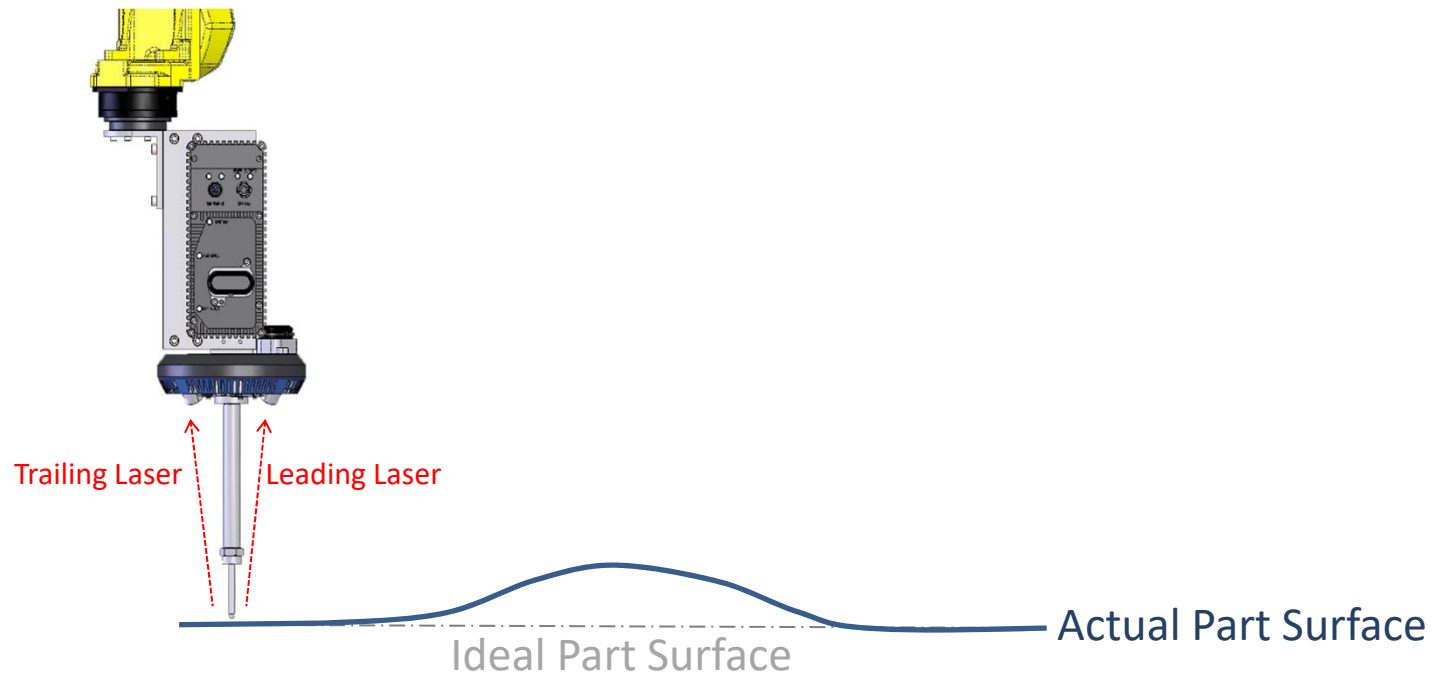
3D Volume - Case Study

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.

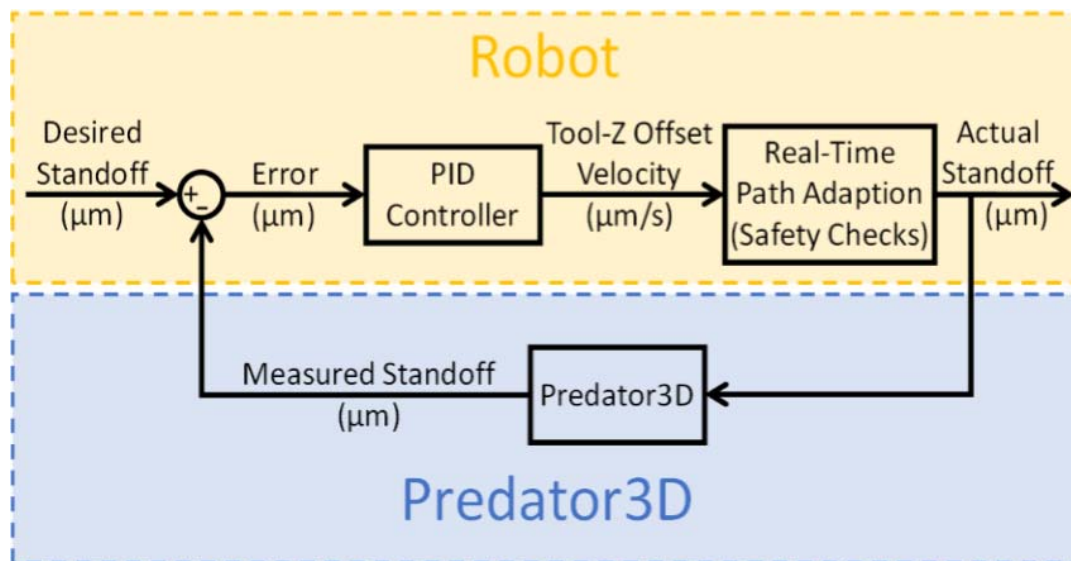
Predator3D™ Z-Tracking for Process Control



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

Coherix
PRODUCTION FRAME REPORT

CELL NO : 6.7L Light Duty Sills 160A PART STYLE : 11
RUN DATE : 01/26/2018 RUN TIME : 12:34:58
SERIAL NO : <Unknown Type>

Results Summary
Scan Number: 42
Failed 6 of 8 Zones (0x0001)
Failures: 596 (M196, W144, H362, V0, F0)
Marginals: 59 (M196, W144, H362, V0, F0, AM11)

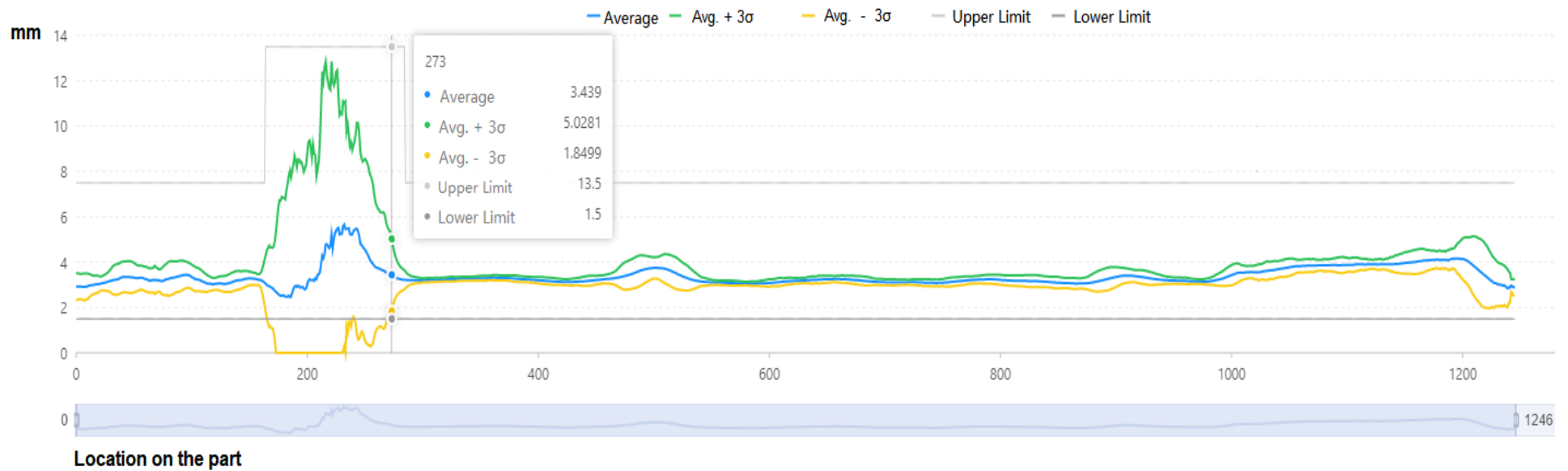


Inspection Details
Failure Code: 1

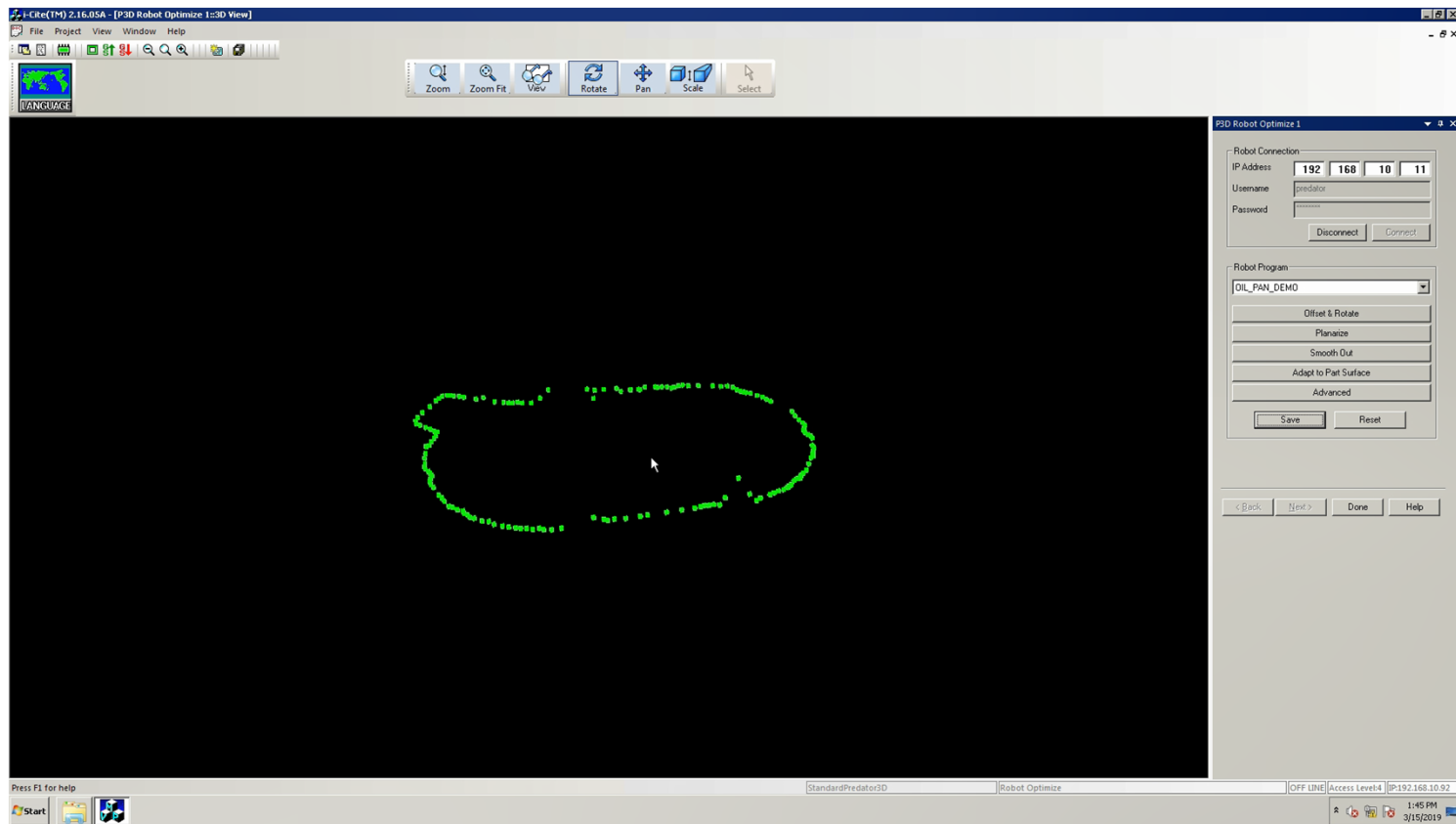
Scan Date	Scan Time	Zone No.	Zone Status	Ave Width	Ave Height
2018-01-26	12:33:09	1	0	4.0816	1.0794
2018-01-26	12:33:13	2	0	4.7645	1.6745
2018-01-26	12:33:18	3	0	3.7554	1.6814
2018-01-26	12:33:22	4	1	7.5751	0.6533
2018-01-26	12:33:26	5	1	3.0283	0.5860
2018-01-26	12:33:30	6	1	3.3328	1.6426
2018-01-26	12:33:36	7	1	3.4096	1.6006
2018-01-26	12:33:40	8	1	3.2738	1.4737

- ✓ 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

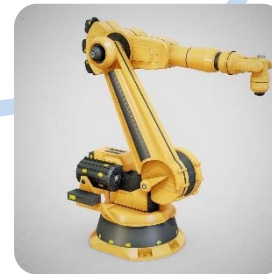


Outlook - From Inspection to Process Control

Volume
Autonomous
Control
with Predator3D



Robot
Autonomous
Control
with Predator3D



THANK YOU!

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mobile: +49 160 30 44 188



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DESIGN
2018 **Innovators
Awards**
GOLD

