Maximizing ROI for Automated Weld Inspection

Welcome

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Advanced Fume Workshop: Breaking Down Fume Torches

Panelist

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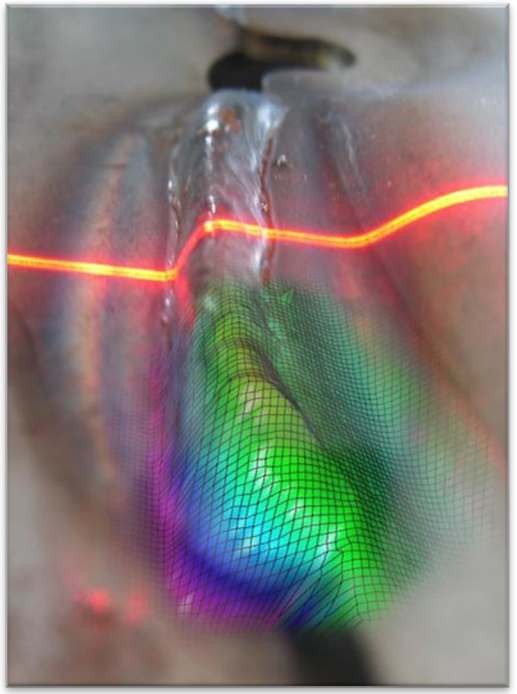
3D Weld Inspection Introduction

Justifying Return on Investment

- **Reduce Inspection Costs**
  - # of inspectors
  - Amount of floor space
  - # of C&E sections needed

- **Reduce Rework Costs**
  - Optimize the process
  - Reduce scrap
  - Improve/streamline heavy repair process
  - Reduce labor

- **Improve confidence in the quality process**
  - Improve containment
  - Reduce recall risk



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Containment

Resources needed

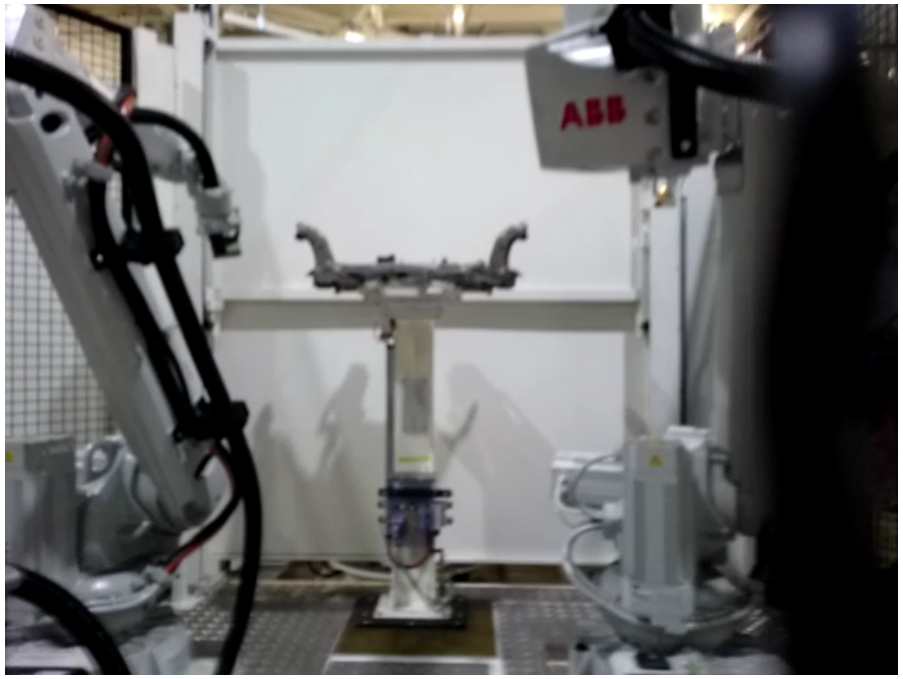
- **Small Quality Spill**
  - Containment In-House
    - Redirect labor to inspect product at your facility
      - Multiple shifts
      - # of heads needed
      - Cost per head
    - Labor sent to customer to repair on-site
      - Cost of travel
      - Cost per head
  - Customer fines for a missed shipment
  - Poor mark against your product quality

- **Multiple Quality spills**
  - May cost future work with that customer
  - Too many bad marks customer may require 3rd Party Inspection
    - Cost of direct labor reassigned to inspect outgoing product
    - High cost of contracting outside inspection
      - As high as $100,000 per week

Inspection

Reducing Head Count

- $70,000-$100,000 Per year for each operator
- Better detection of weld defects with automated system
  - Faster and more reliable than manual
  - Less time needed to inspect parts
    - Inspection/repair workers only need to focus on "bad" welds



Inspection

Reduction of Floor Space

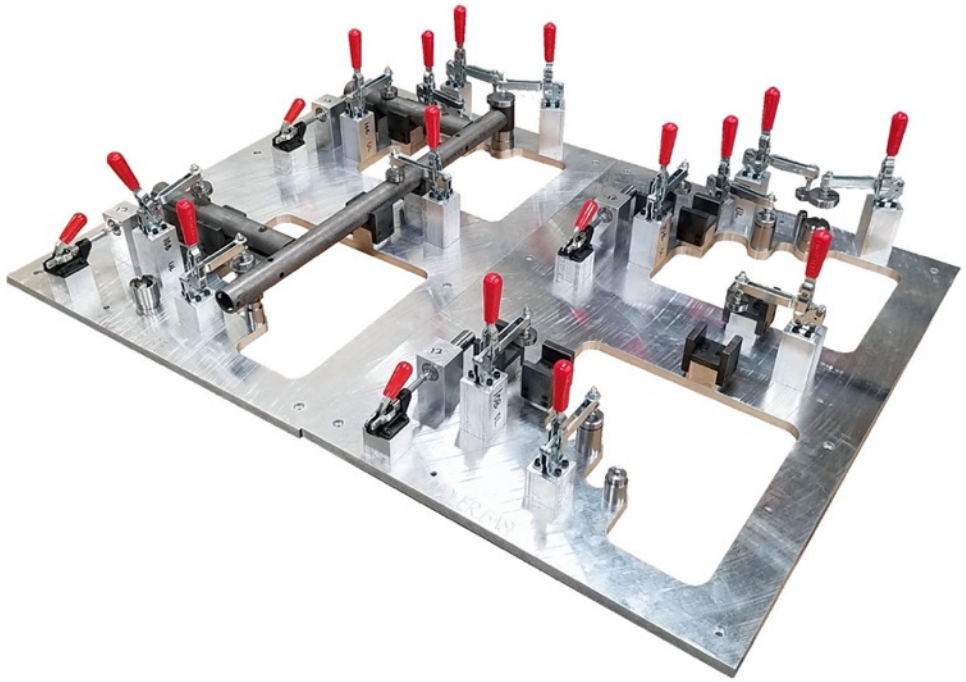
- **Cost of Floor Space**
  - Operating cost = $5,000,000/year
  - Factory Floor Space = 100,000 sq ft
    - 5,000,000/100,000 = $50 per sq ft per year

- **When detection of defects is more reliable…**
  - Workers only need to focus on weld defects found by the 3D weld inspection system
  - Less space needed for inspection
  - Less space needed for repair

Inspection

Reduction of Off-Line Tooling

- Cost of off-line tooling
  - $20,000-$30,000 per fixture, depending on complexity
- More repair can be done on-line
  - B/C faster detection of defects
  - Less time needed to inspect
- Reduces need for off-line tooling needed for inspection and repair



Quality Spill Scenario

What does it cost? Small Quality Spill

- 2 Additional workers needed to inspect and repair off line
  - $7,084 per head per month
  - 2 x 7,084 = $14,167 per month
  - Running a 2 shift operation = $28,334 per month

- 500 Additional sq ft needed for inspection and repair off line
  - $50 per sq ft per year
  - 500 x $50 = $25,000 per year
  - $2,084 per month

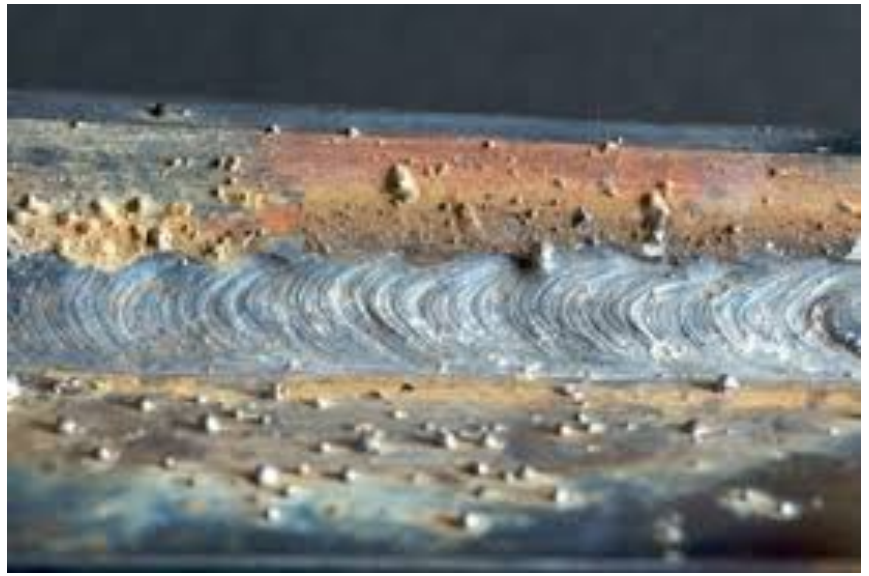
- 1 Additional inspection/repair fixtures needed
  - $25,000 per fixture

- Monthly Cost = $30,418 per month in labor (2 shifts) and floor space

- Capital Cost = $25,000 in fixturing

- 3 months of additional inspection and repair
  - 2 Shift Labor and Floor Space = $91,254

  - Total cost for 3 months = $116,254



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Quality Spill Scenario

What does it cost? Large Quality Spill

- 4 Additional workers needed to inspect and repair off line
  - $7,084 per head, per month
  - 4 x $7,084 x 2 Shifts = $56,672 per month
- 1000 Additional sq ft needed for inspection and repair off line
  - $50 per sq ft per year
  - 1000 x $50 = $50,000 per year
  - $4167 per month
- 2 Additional inspection/repair fixtures needed
  - $25,000 per fixture
  - 2 x $25,000 = $50,000 one time capitol cost
- Monthly Cost = $60,839 per month in labor and floor space
- Capital Cost = $50,000 in fixturing
- Total Cost for 3 Months = $232,517
  - This does NOT include 3rd party inspection costs

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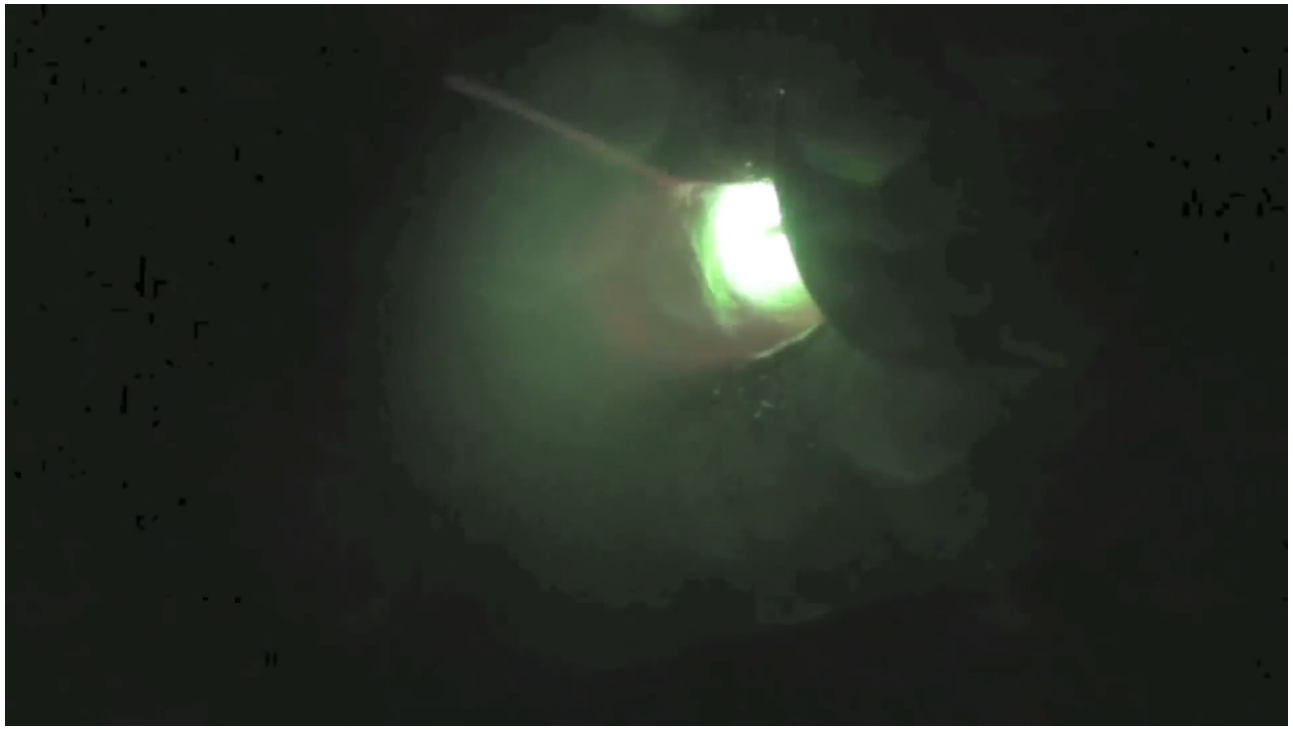
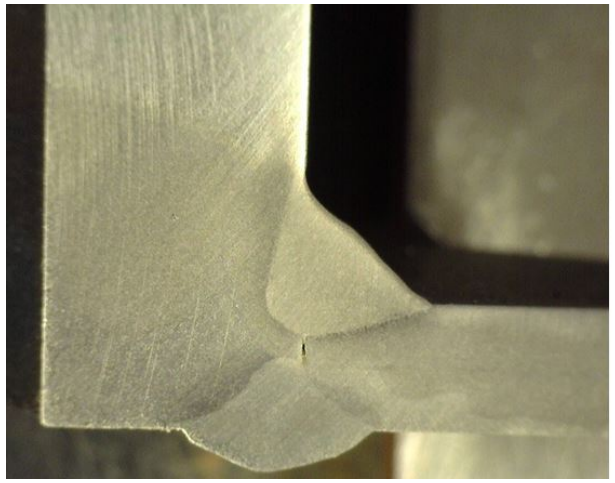
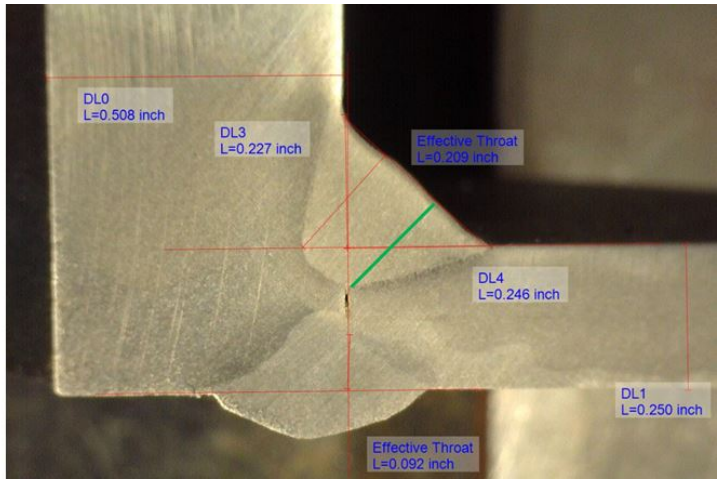
Inspection

Reduction of Cut and Etch Sections

- Cut and Etch operations are necessary
  - Expensive
    - Per Cut ≈ $8.00
  - Time consuming
    - 20 – 45 min per cut
  - C&E is a random snapshot in time
    - Not 100% inspection



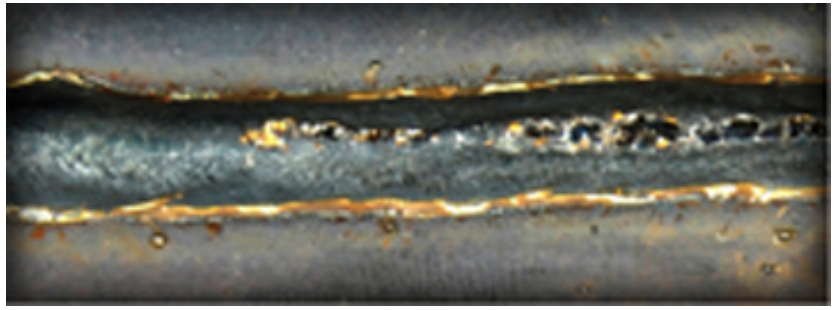


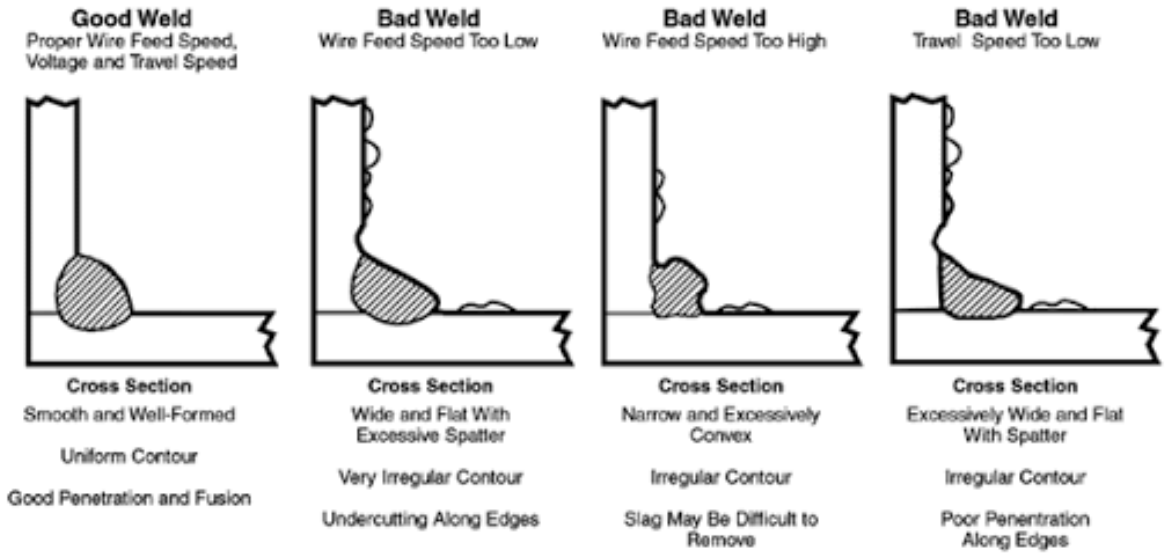


Inspection

Reduction of Cut and Etch Sections

- Combining Weld Parameter Monitoring with 3D Weld Inspection
  - Monitor the welding arc for parameters that fall out of set windows (Realtime)
    - Amps
    - Volts
    - WFS
  - Inspect weld with for defects with Sensor
    - On-seam
    - Porosity
    - Length
    - Weld Profile





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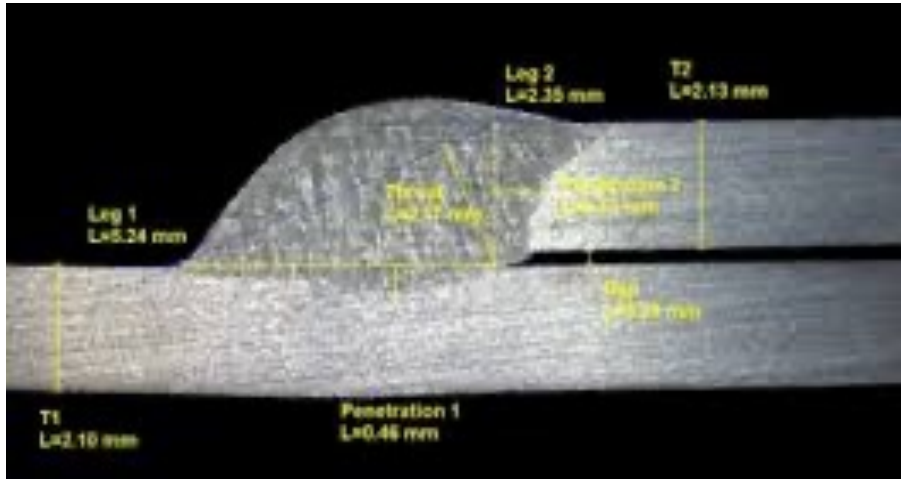
Inspection

Reduction of Cut and Etch Sections

- Knowing the weld is running at the right parameters…
- Knowing the weld is free of surface defects and meets size and profile requirements…
- Having the data to prove it and connect it to each individual assembly for traceability…
- When properly correlated the combination can…
  - Reduce the need for daily cut and etch to weekly or monthly
  - Reduce the need for large Batch-and-Hold lots
  - Greatly save on scrap costs



Rework

Optimization/Reduction

- Operators only need to focus on "bad" welds
  - Less time need in-line to inspect parts
    - Cycle-time decrease
  - Reduces over-welding
    - One inch of repair weld ≈ $0.25
    - 1 min of labor ≈ $0.50
  - Reduces unneeded repair
    - Cost of a bad repair
    - Cost of wasted time on repairing a "good" weld
      - Min of an extra $0.75 per assembly for 1 inch of unnecessary weld repair

Rework

Scrap Reduction

- Cost of Scrapped Stamping
  - Close-Out welds
    - Optimized Detection of a weld defect before close-out
    - Reduced labor to cut off, fix and reweld post process

- Cost of Scrapped Assembly
  - Major Defects (not repairable)
    - Burn through
    - Misassembled components

  - In-Line detection can find these before the assembly is finished
    - Don't need to scrap whole assembly
    - Kicked out of line

Rework

Process Optimization

- Manual Inspection Reduction
  - Keep Parts moving in the line
  - Only send parts to Inspection/Repair stations when a defect is found
  - Less labor needed on-line

Rework

Truck Frame Lines – Heavy Repair

- Heavy Repair
  - Reduced inspection time = more on-line repair time
    - Less need to send assemblies to Heavy Repair
  - Only send large repairs to Heavy repair
    - Less stacking and unstacking frames
      - Reduced logistics in plant post process
      - Reduced labor needed for Hi-LO drivers for Heavy Repair and EOL
      - Less labor needed for Post Process Repair
    - More frames can go off EOL straight to E-Coat/Finishing

Reduced Risk

Warranty/Future Work/Recall

- Manual inspection is only 80% accurate at best
  - Worker Fatigue
  - Multiple checks needed on same weld to ensure quality

- Automated inspection can be up to 99% accurate
  - No need for Multiple checks
  - Accurate defect reporting
    - Data record of defect and repair
    - Defend against warranty claims

- Cost of shutting down the customer
  - Up to $10,000 per min

- Cost of warranty claim
  - Quality status revoked by customer
  - Future work from customer jeopardized
  - Poor reputation may spread to other customers

- Cost of recall
  - Millions of dollars in fines and repairs
  - Buy Back of affected vehicles
  - Industry "Black Eye"

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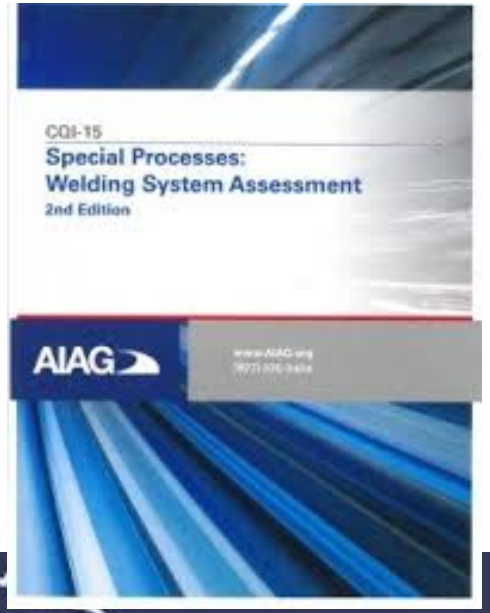
Quality System Improvement

How Automated 3D inspection can help

- Customers are requiring more stringent inspection and data recording
  - Industry 4.0
    - Centralized Tracking of defects and repair on specific parts
    - Data records
      - Repairs completed
      - Outgoing weld quality
  - CQI 15
    - Ford
    - FCA
    - GM
  - Can Help reduce RPN #'s for FMEA's
    - Accurate Detection
    - Accurate recording of data



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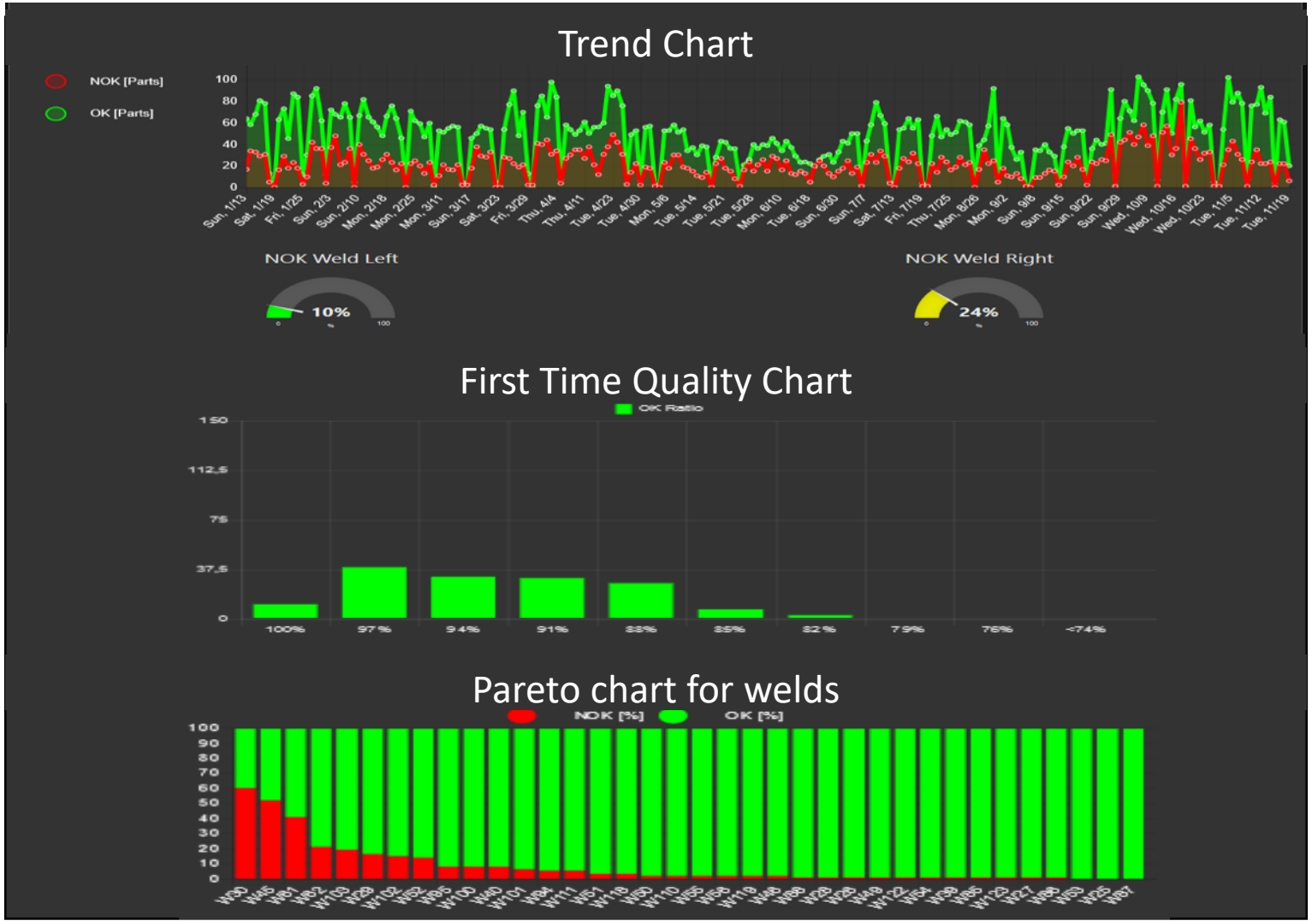
Quality System Improvement

How Automated 3D inspection can help



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Conclusion

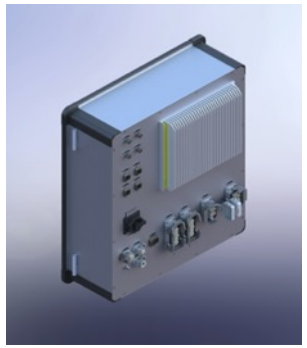
Automated 3D Weld Inspection

- Quality spills and the labor to support is very expensive
  - Containment
  - 3rd Party inspection

- Automated weld inspection can help reduce Cut and Etch expenses
  - Reduced sections
  - Reduced frequency

- Automated weld inspection can optimize your rework system
  - Manual inspection reduced
  - Pinpoint weld defects for repair

- Automated weld inspection can reduce risk
  - Weld Quality Insurance
  - Data collection gives traceability to every assembly
    - Also makes you compliant to CQI 15
  - Warranty Claims/Recalls



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Weld Inspection

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