ABICOR® GROUP

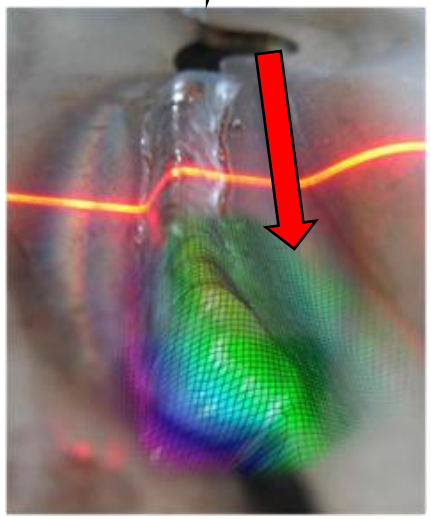
CUTTING
WELDING
SYSTEMS
COMPONENTS

# Automated Weld Inspection

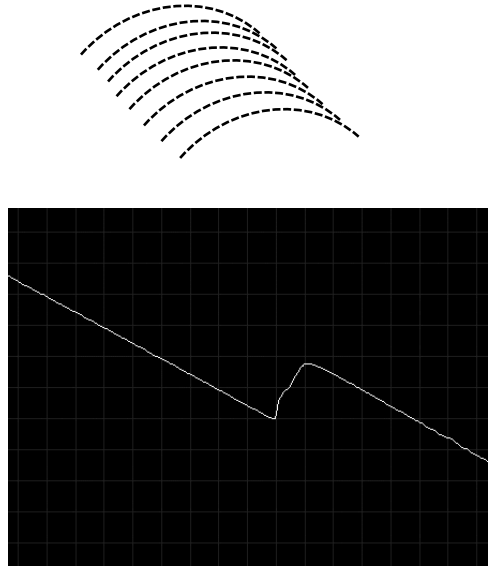
## Gathering Data and How to Use it

# **Automated Weld Inspection:** How it Works

Scan the weld



Capture 2D Profiles



Software creates a 3D Model to analyze

Software evaluates welds to set tolerances and passes or fails

OK

NOK

# What kind of Data can be collected by AWI?

## Features and Defects


- **Geometric Features**
  - Length
  - Width
  - Convexity/Concavity
  - Toe Angle
  - Reinforcement Height
  - Weld Position (off location)
- **Estimated Features** (some systems)
  - Throat Thickness
  - Crossectional Area
  - Leg Length
  - Asymmetry
- **Weld Defects**
  - Porosity
    - Single pore and Cluster
  - Burn Through
  - Edge Notching
  - Weld Skips
  - Missing Welds
  - Surface Inclusions
  - Spatter

# Repair Reporting

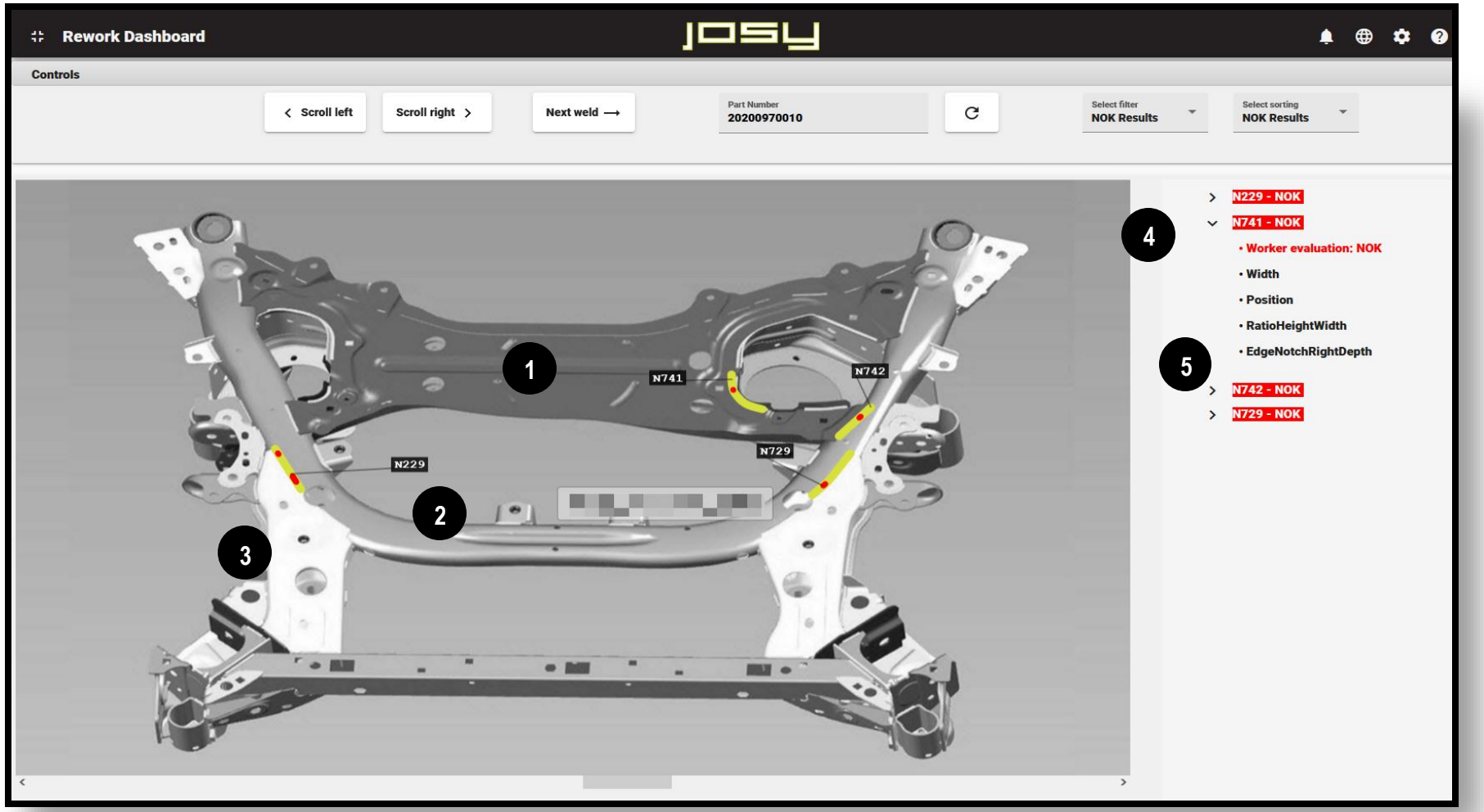
## After OK or NOK

- The part lands in the repair booth
- Results for the individual part are displayed on screen
- Guides the operator to defective welds
- Welds are repaired by the operator
- Repairs are recorded with the serial number of that part

# Repair Reporting

## Repair Visualization:

1. 3D model of part
2. Weld location w/ print #
3. Location of defect
4. List of failed welds
5. Description of defect



# Ease of Use

**Operators can easily see defects**

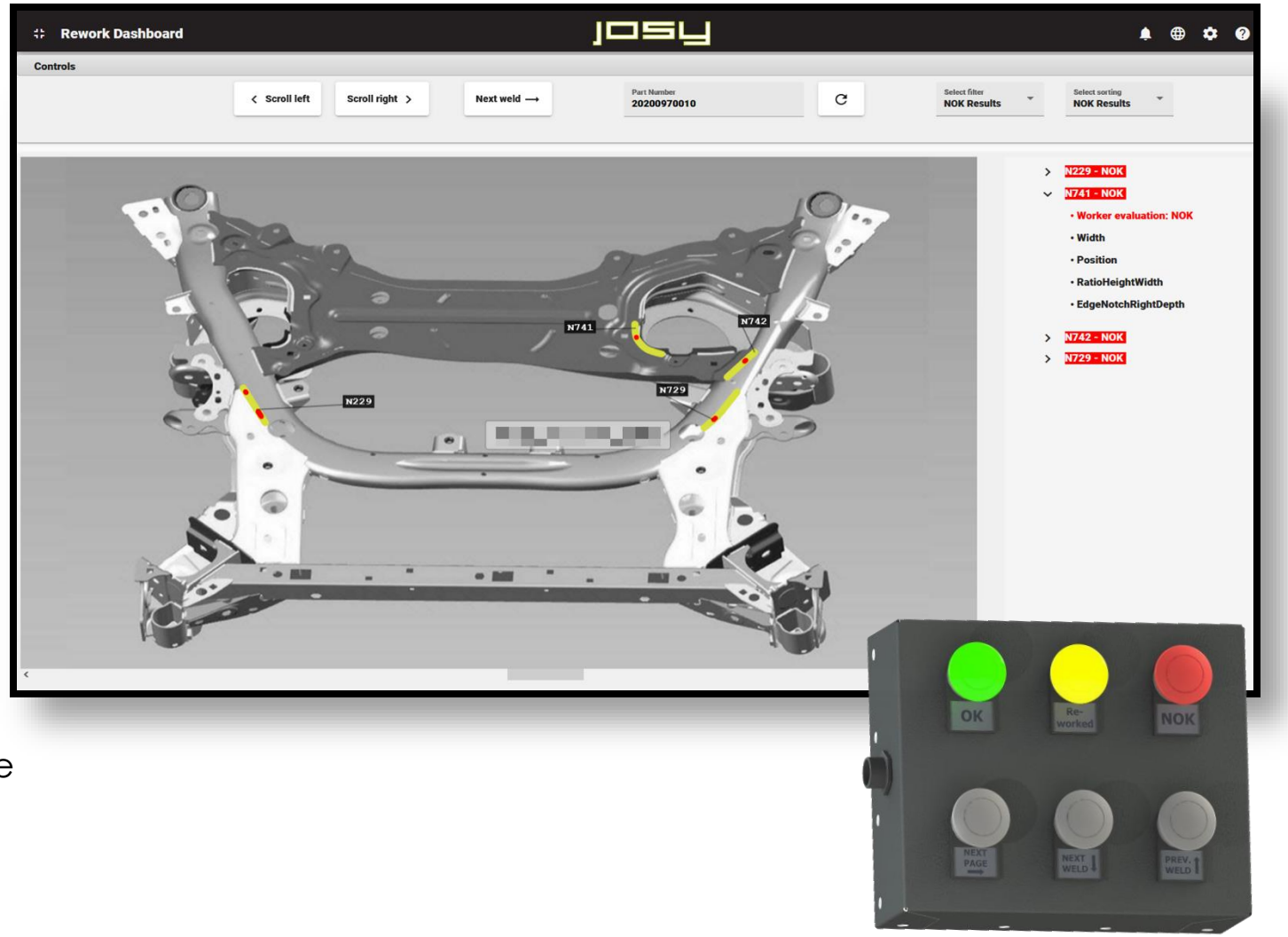
- The weld number of the failed weld
- The type of defect
- Location on the part

**Easy interaction with the system through a button box**

- Page through failed welds ?????
- Record welds that have been repaired
- Give feedback on results
- No need to remove welding gloves

**Streamline the repair process**

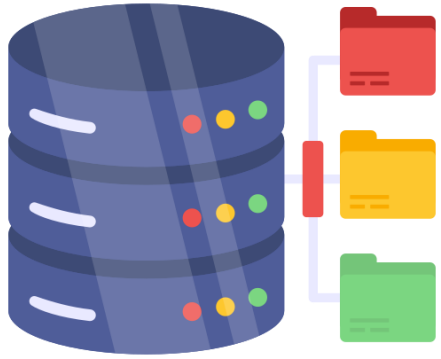
- Same objective analysis of weld quality every time
- Worked only focuses on failed welds ?????
- No more bottleneck at the repair station



# MES System Data

## Manufacturing Execution System

- Data is collected from the Automated Weld Inspection System
  - Weld criteria
  - Weld defects
  - Weld measurements
  - Weld images
- Data can be transferred to an MES System via MQTT/RestAPI interface
- Apps created within the MES System make the data easy to review
- Combine with data from other processes
- All manufacturing information is in one easily accessible database

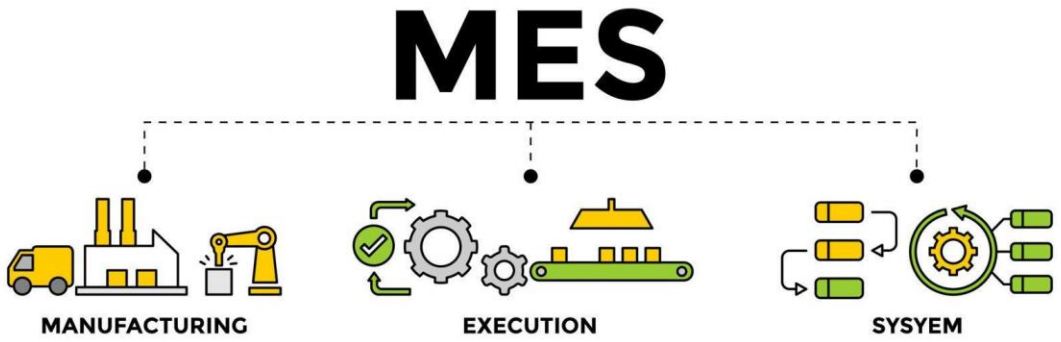


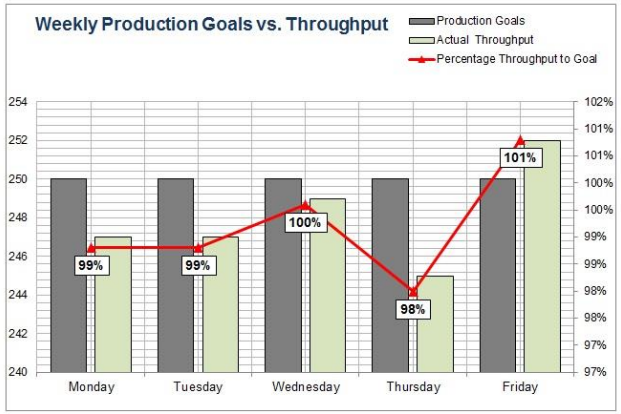
MQTT

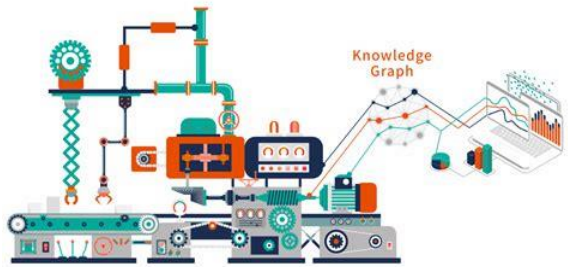
REST API

## What to do with the Data?

- Easily track weld defects through trend charts
- Create hotspot maps to direct maintenance to affected areas in the line
- Automatically generate Weld Health Reports by area
- Generate reports for maintenance to correct robot programs or weld parameters without waiting for C&E Results
- Combine weld inspection data with data from other manufacturing processes to find the root cause of issues
- Monitor consumable performance
- Automate messaging for maintenance actions (tip changes etc.)
- Help identify areas for Continuous Improvement projects



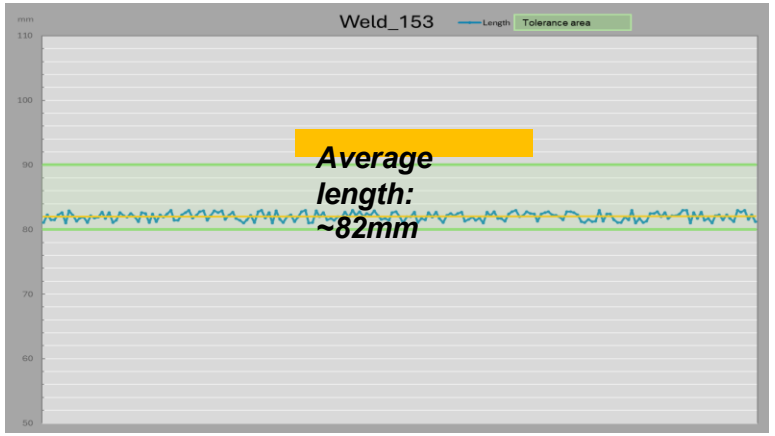



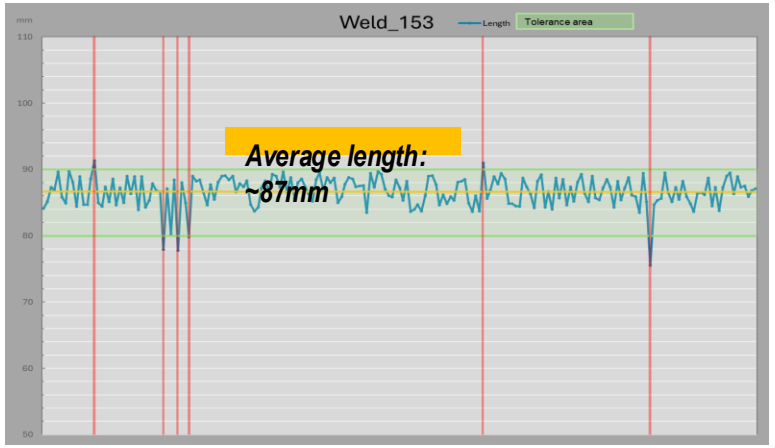
## Cost Savings Through Weld Length Reduction

Savings Scenario:

- Reduction per weld: 5 mm
- Welds per part: 80
- Parts per year: 250,000
- Total reduction per year: 100,000,000 mm
- Cost per mm: $ 0.01

➢ **Annual savings: $ 1,000,000**

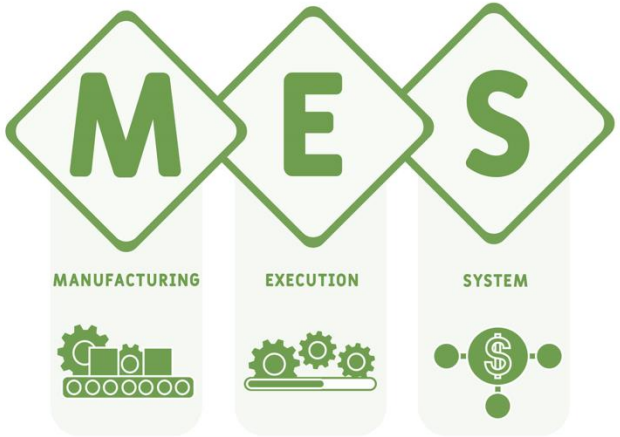


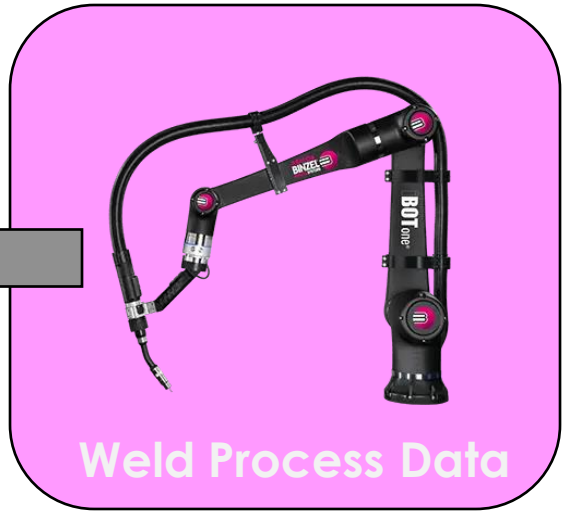



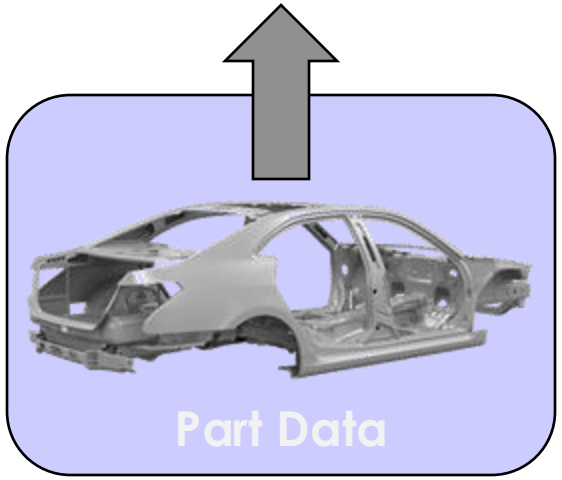

"Using measurement trend of feature "weld length" we can quickly analyze actual lengths and optimize to run in middle of tolerance band"

# MES System Data

## Combining Data from Other Sources

# MES System Data

## Overlay of In-Process Monitoring and Post Process Weld Inspection

## Combining Data from Other Sources

- **In Process Weld Monitoring**
  - Wire Feed Speed
  - Gas Flow
  - Voltage
  - Amperage
- **Aftermarket Sensors**
  - Can be used on any welding power source
- **OEM Built-in Reporting**
  - Most robotic power sources can monitor these parameters and report it out using their proprietary software

# Standalone Data Reporting

## What if you don‘t have an MES System?

- Some Automated Weld Inspection solutions have the option of a built in feature to display your weld data for you
- No need to export the data from the system
- No need to develop apps to use the data
- Typically, the software is Web Based so it can be viewed in many different ways:
  - Desktop
  - Laptop
  - Phone
  - Tablet
  - HMI Display on the line
  - Smart Screen on the shop floor
- Can define areas for continuous improvement
- Can be used in conjunction with MES Systems for even better data analysis
  - Pre-programmed charts, graphs, and tables can be a great complement to other applications created in the MES system

# Standalone Data Reporting

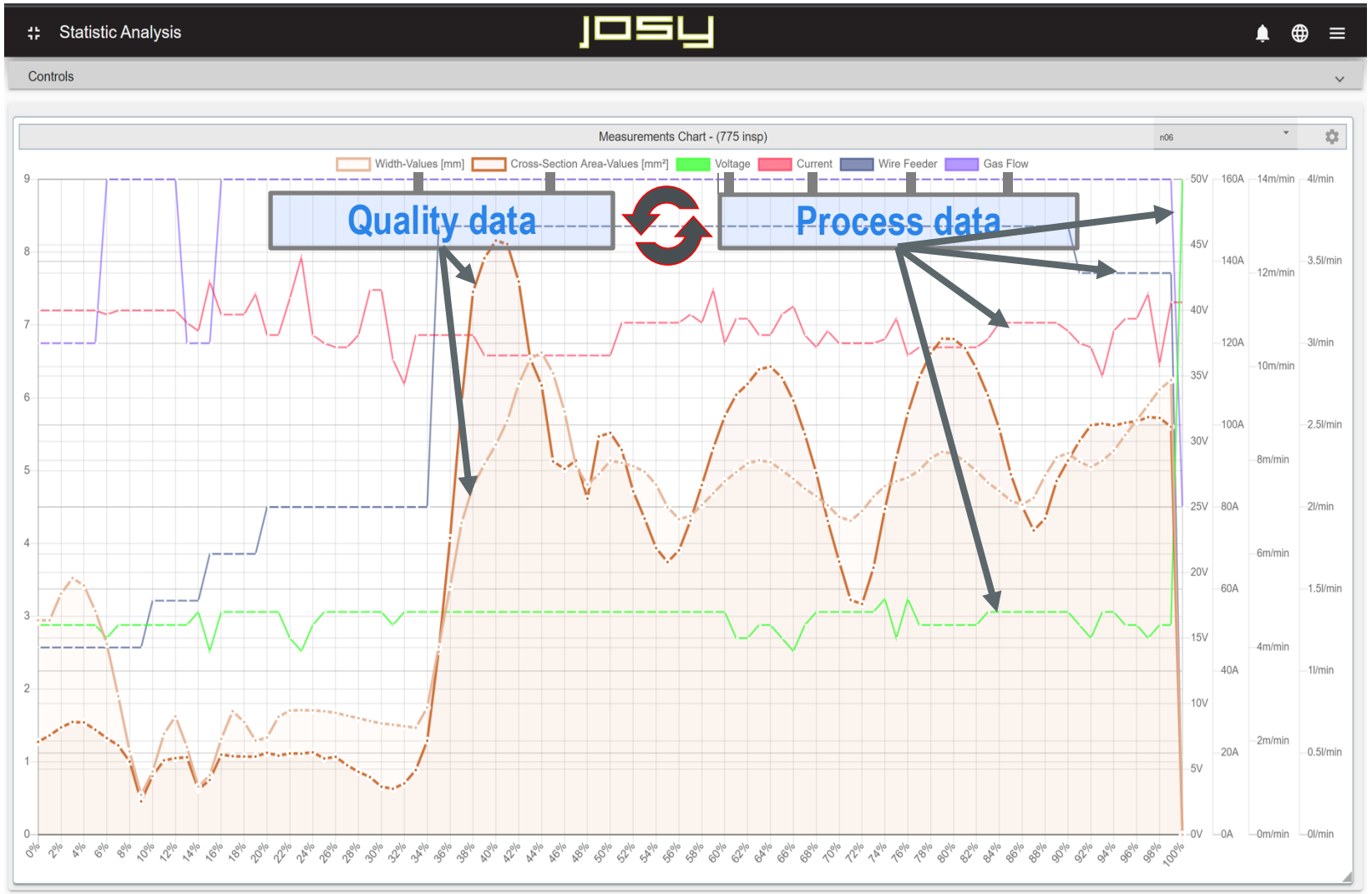
## What to Expect

- Real-time Process Monitoring
  - Gives immediate feedback
- Pareto Charts
  - Pass/fail by part type
  - Pass/fail by individual weld
  - Weld failure by defect
- See where defects land in the weld area
- Plant quality over time

# Standalone Data Reporting:

## Incorporating In-Process Weld Monitoring

- Some Vendors can incorporate the weld process data with their data reporting solution
- Make correlation easy by overlaying in-process and post-process data
- Similar to what can be done with an MES system, but doesn‘t require any extra programming

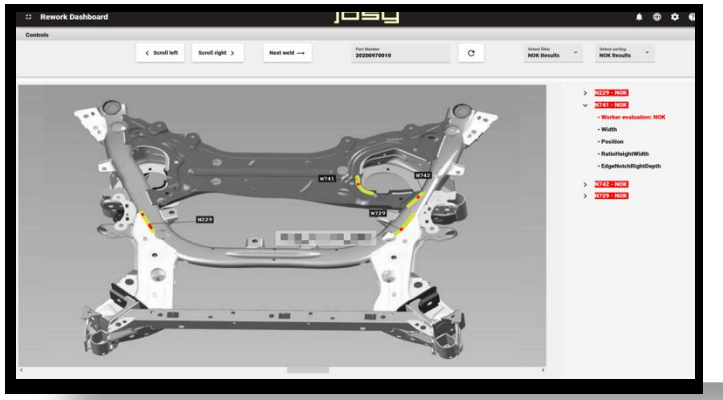


# In Conclusion:

## Different ways to use Weld Inspection Data:

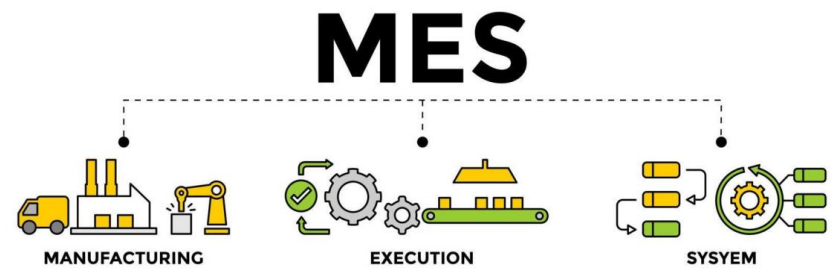
### Repair Station Reporting

- Streamline Repair Stations
- The same objective opinion on weld quality every single time
- Improve tracability on parts even after they have been repaired
- Decrease variable cycle time in repair operations on-line




### MES Reporting

- Create custom applications to use weld inspection data
- Identify problem areas in the line easily
- Create custom reporting for maintenance work orders and for upper management
- Combine data streams to help correlate conditions and troubleshoot root cause





### Standalone System Reporting

- Similar to using an MES, but already programmed for you
- Easy access to data analysis from anywhere in the plant
- Great for plants that don‘t have an MES System
- Can be a great complement to any MES applications

# SmartRay JOSY: Weld Inspection System

SmartRay

**Built-in Repair Reporting System**

- Easily guide rework operators in online repair

**RestAPI/MQTT Interface**

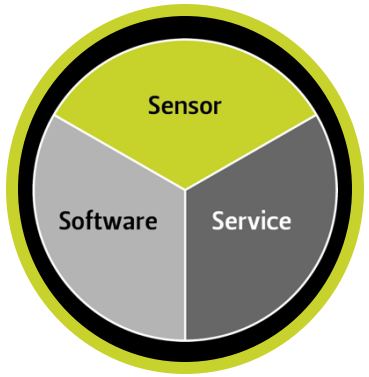
- Have all of the weld inspection data transferable to your MES System for custom reporting on existing Industry 4.0 architecture

**Management Dashboard**

- Built-in reporting for weld quality
- No need to program any apps
- Great addition to any MES System

**Full Turnkey Solution**

- Design Support
- Integration support
- Custom programming done by SmartRay Tec
- Post Project Support Team




# Questions

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# Thank You!