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# ***Moving Toward the Goal of Zero Incidents Through Better Anomaly Detection and Characterization:*** PHMSA R&D Summit

**Working Group # 3 Anomaly Detection and Characterization**

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# Enhancing Pipeline Safety Through...

## > Improved Analytics of Anomaly Characterization & Remediation

- ILI Technology: more direct characterization & measurements of anomalies
- Engineering Analysis: better methods & validation performance of uncertainties with technologies
- Data Analytics: data integration & risk analysis
- Visual Analytics: data visualization & image analysis
- Data & Visual Analytics: what other information about the pipe condition is in the data sets collected by the ILI tools?
- Improves the evaluation and decision of appropriate repairs & remediation of anomalies

## > Having Redundancy When Looking for Anomalies

- More than one technology/technique, more than one “look” at the anomaly
- Higher level of characterization and measurement of the anomaly before excavation
- Increase focus on the largest anomalies that inspection tools/systems can miss...rather than the smallest they can detect and report

# Detection & Characterization of Integrity Threats: *An Integrated & Systematic Approach*



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Above Ground Surveys

Indirect Measurements of Pipeline Conditions

In-line Inspection Surveys

Direct & Inferred Measurements of Pipeline Conditions

In-Ditch Non Destructive Examination Technologies

Direct Measurements of Pipeline Conditions

Validation Performance of Detection & Sizing

Addressing the Uncertainties on Detection and Sizing of Anomalies

Anomaly Repair and Remediation

Direct & Inferred Measurements of Pipeline Conditions Feed into Engineering Analyses that Drive Repairs & Remediation

Working Group #3

Working Group #4

# Detection & Characterization of External Corrosion: *Research Needs*



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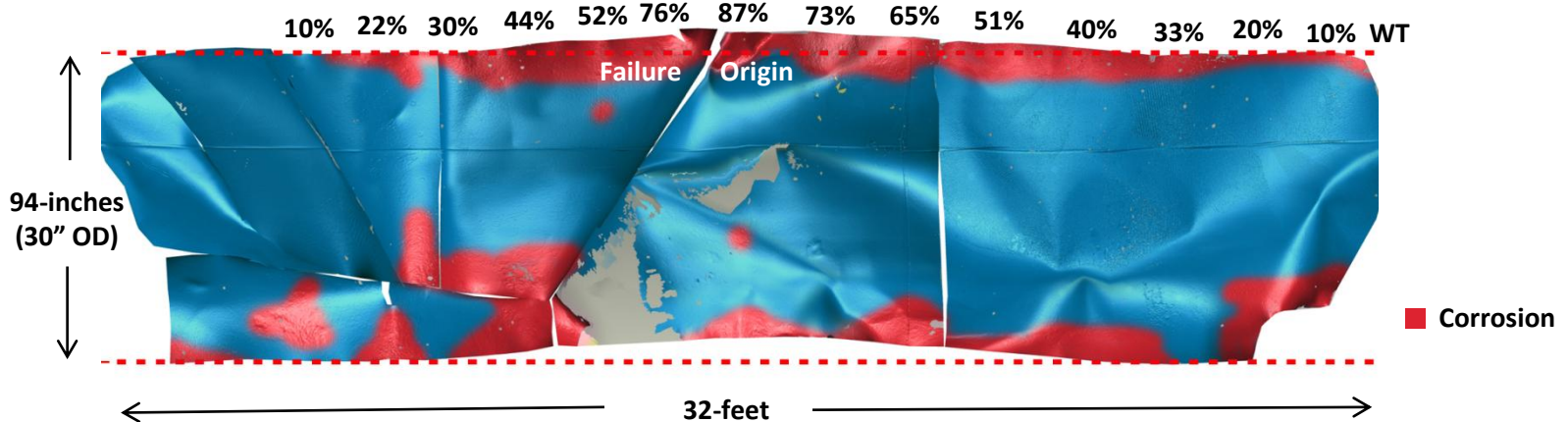
## External Corrosion

### The Challenges

Capturing gradual thinning wall & long corrosion features using ILI tools.  
Capturing the actual pipe wall thickness

### What We Need

More direct measurements and better definition of long corrosion features and wall thinning as well as pipe wall thickness



# Detection & Characterization of Mechanical Damage: *Research Needs*



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## Mechanical Damage & Pipe Deformations

### The Challenges

Defining if the metal loss near or in dents as reported by ILI tools is gouging, cracking or corrosion

Better definition of strains as reported by ILI tools and those captured during in-ditch measurements

### What We Need

More direct measurement of mechanical damage present on dents, buckles & wrinkle bends by ILI tools



# Detection & Characterization of Seam & Girth Weld Anomalies: *Research Needs*



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## Seam & Girth Weld Anomalies

### The Challenges

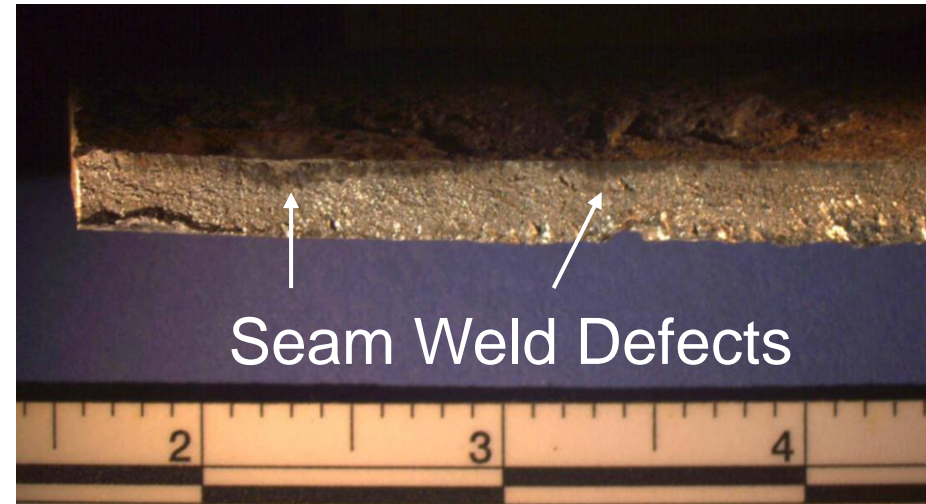
Irregular depth profile of lack of fusion/cold weld features in the presence of HAZ

Finding incomplete girth welds anomalies in the presence of HAZ & weld crowns

### What We Need

Improved ILI technologies that can deliver higher characterization of planar defects in seam (lack of fusion/cold welds) and girth weld (cracking in HAZ, lack of penetration, etc)

In-ditch measurements that produce the depth profile of the lack of fusion/cold welds



# Detection & Characterization of Cracking: *Research Needs*



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Environmentally Assisted Cracking

The Challenges

Finding irregular Stress Corrosion, Corrosion Fatigue, Hydrogen Induced Cracking colonies

Finding and sizing in the ditch the deepest cracks within colonies

What We Need

Improved ILI and in-ditch technologies that can find tight cracking in pipe body and dents/buckles/wrinkle bends



# Summary



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- > Our ability to achieve higher levels of safety of our pipeline facilities hinges on consistently obtaining, integrating and analyzing reliable data sets about the condition of the pipeline
  - Data & visual analytics of anomaly characterization & remediation
  - More than one technology/technique, more than one “look” at the anomaly

## **Research Needs: ILI Process (Technology, Algorithm & Analyst)**

- Obtain more direct measurement/better definition of anomaly dimensions (corrosion, seam & girth weld planner defects, mechanical damage, cracking, etc) and actual pipe wall thickness
- Find out what other information about the condition of the pipe is being collected by the ILI tools
- Develop a comprehensive pull through test program using pipe with anomalies of interest that all ILI Providers have access to and agree on a performance validation matrix

How much longer do we want to wait to obtain more reliable and meaningful advances in anomaly detection & characterization by the ILI Process?