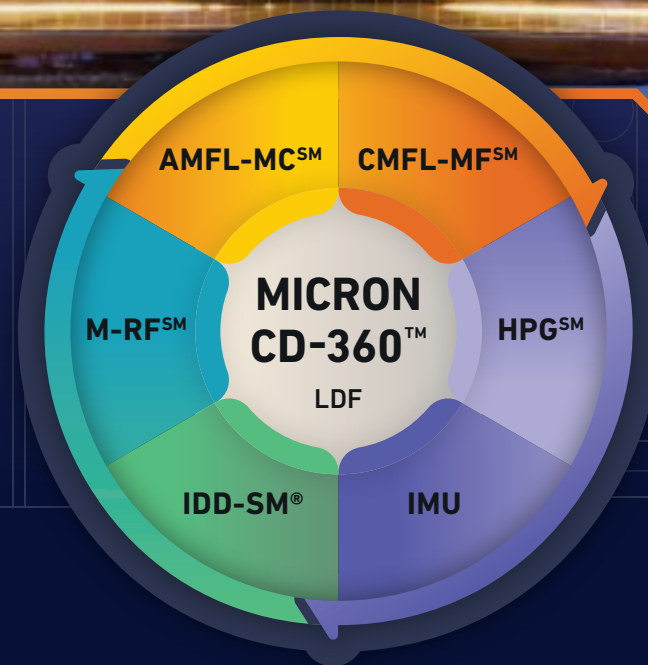


Crack Detection



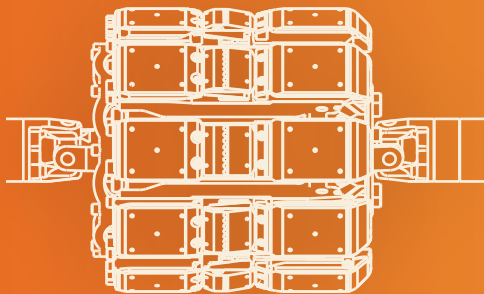
Selective Seam Weld Corrosion and Narrow Axial Cracking

ADVANCED INSPECTION SYSTEMS

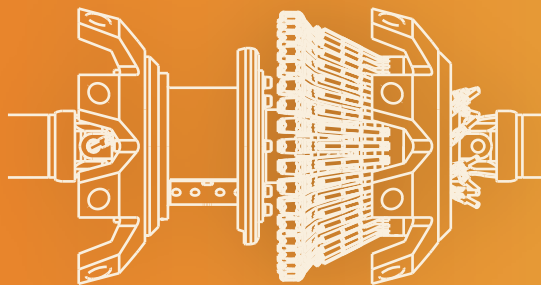


ADVANCED INSPECTION SYSTEMS

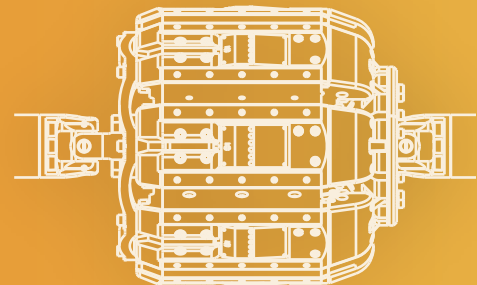
Giving you complete 360° coverage
for cracks & critical flaw detection



AMFL-MCSM



IDD-SM[®] + HPGSM
M-RFSM + IMU



CMFL-MFSM

► **AMFL-MCSM - Metal Loss & Crack Detection**

Capable of sampling up to 640 per square in”

► **CMFL-MFSM (Multi-Field) - Metal Loss & Crack Detection**

Capable of sampling up to 1000 per square in”

► **HPGSM (High Precision GeometrySM)**

Measuring from 0.5mm variations

► **IMU Mapping**

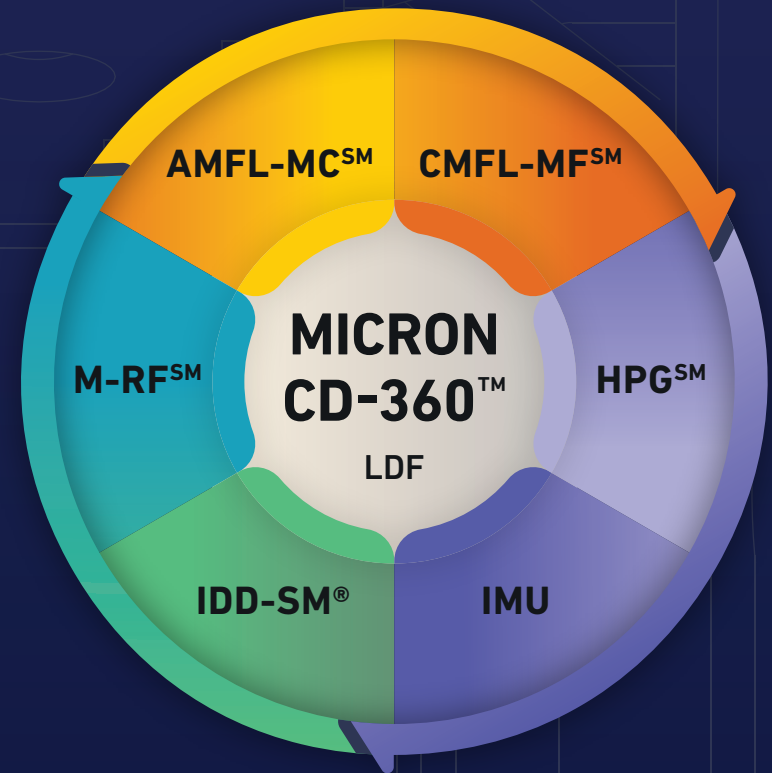
Utilizing the industry standard sub-meter accuracy

► **IDD-SM[®] - Detecting Elevated Stress of Circumferential & Off Axis Cracking**

Includes, SIASM (Stress Intensity AnalysisSM)

► **M-RFSM (Micron-Residual FieldSM)**

Detecting Severe Cracking



Emerging Technology Under Development:

ACDSM

Axial Crack
DetectionSM

Micron-RFSM

Residual Field
Sensor ArraySM

LDF

Low Drag
Force

THE POWER OF LEADING-EDGE INNOVATION

PIPELINE OPERATORS TODAY HAVE A WIDER RANGE OF CRACK DETECTION AND INTEGRITY MANAGEMENT SYSTEMS AVAILABLE THAN EVER BEFORE.

When selecting an ILI partner you should be considering the benefits of the latest Pipeline Inspection Technology that is consistently integrating accurate and dependable results.

Novitech's evolving Micron ILI Technology®, is playing a crucial role in mitigating and avoiding a number of risks that compromising anomalies left undetected, can pose for pipelines, including but not limited to:

- Environmental Threats
- Mechanical stress/failure
- Cracks and Corrosion
- Manufacturing Defects
- Poor Operational conditions
- Third-Party Damages

The precision of our High-Resolution sensor systems, coupled with our very own Noviview® Data Analysis software, are improving the way that potentially dangerous cracks are detected and identified in pipelines.

Novitech's Magnetic based Crack Detection Systems are designed to provide accurate and reliable critical flaw diagnostics.



“As recognized industry leaders; Novitech prides ourselves on approaching Pipeline Inspection, and Pipeline Integrity, by utilizing the most state-of-the-art ILI technology systems available.”

– Ron Thompson, President & CEO

After participating at the PPIM Exhibition and conference, Novitech Inc.® was granted the 2024 Innovation Award, for our presentation on our literary prospectuses regarding the Integrity Management of Off-Axis SCC and SSWC, by the direct detection through an ILI system and Engineering Assessment.



MAGNETIC BASED CRACK DETECTION

Electronic Dynamic Range (Inspection Systems)

- Necessary to cover everything from very small cracks, to large metal loss anomalies
- Recommended minimum signal to noise ratio for non-destructive testing is 3:1
- Crack signals can begin as small as 6 counts out of 4096 (maintaining signal to noise ratio >3:1)

No Data Compression

- All samples are stored allowing very small magnetic responses to be analysed
- Lossy data compression can degrade or remove crack responses from the magnetic system

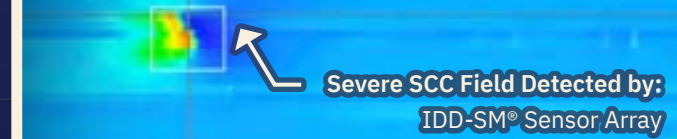
Uniform Magnetics and Optimized Flux Density

- Magnetic circuits designed to be uniform and have the optimum flux density in the pipe wall

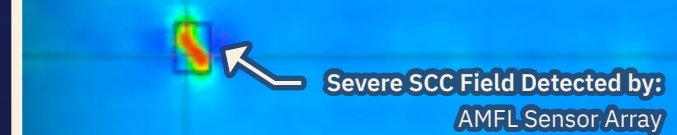
Sampling Density

- AMFL-MCSM up to 640 samples per square inch
- CMFL-MFSM up to 1000 samples per square inch (for standard circumferential inspection)
up to 1000 samples per square inch (for thinner wall pipe under development)
- All sensor systems combined up to 3000 samples per square inch capability

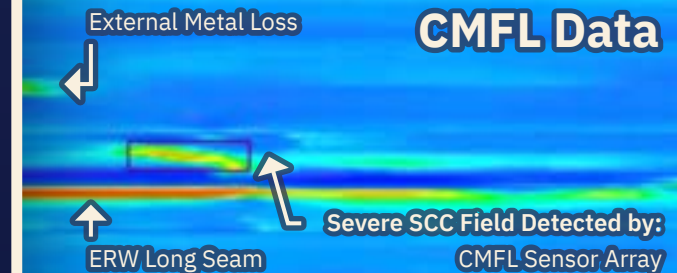
IDD-SM[®] Data



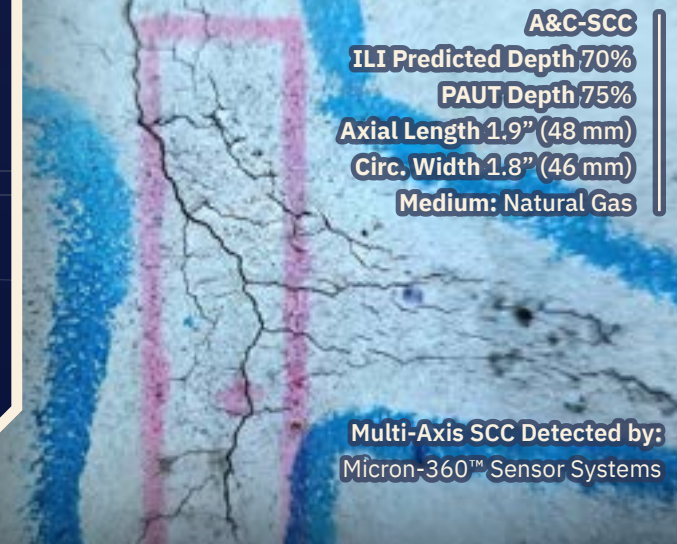
AMFL Data



CMFL Data



FIELD VERIFIED



COMPREHENSIVE CRACK & CRITICAL FLAW DETECTION

Anomalies include:

SCC
(Stress Corrosion Cracking)



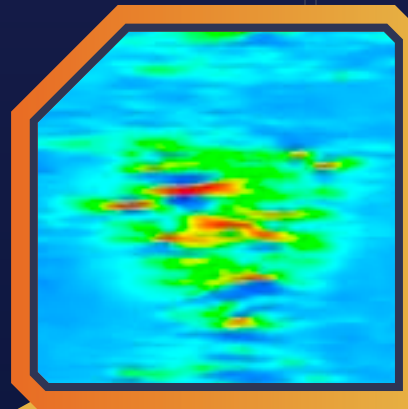
Comes in 3 variations:

- Circumferential Cracking
 - Axial Cracking
- Off-Axis Cracking

Narrow Axial Metal Loss



Selective Seam Weld Corrosion



Cracking In External Gouging



Comes in 3 variations:

- Circumferential Cracking
 - Axial Cracking
- Off-Axis Cracking

- Detected And Sized Using Both Micron AMFL-MCSM & CMFL-LDFSM Technology

NOVITECH INC. TECHNOLOGY® OFFERS COVERAGE IN ALL DIRECTIONS, ORIENTATIONS, TILT AND SKEW ANGLES.

Taking a comprehensive approach, using up to 6 primary sensor system technologies (including 2 sensor systems under development, with patents pending) to detect, identify and quantify very challenging and complex flaw types.

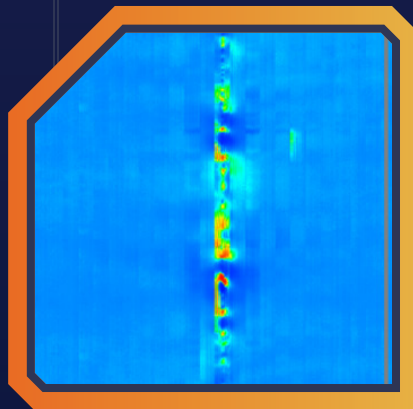
Seam Flaws



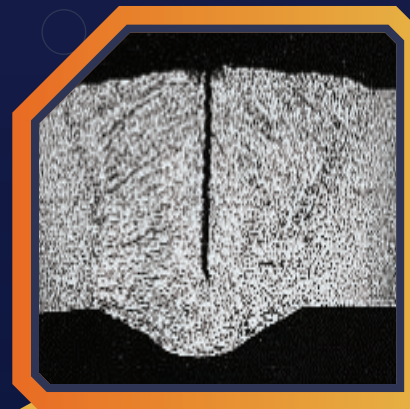
ERW & Flash Seam Weld Flaws:

- Misalignment of Long Seam Edges
- Under/Over Trim Identification
 - Hook Cracks
 - Lack of Fusion

Girth Weld Flaws Including Crack-Like Features

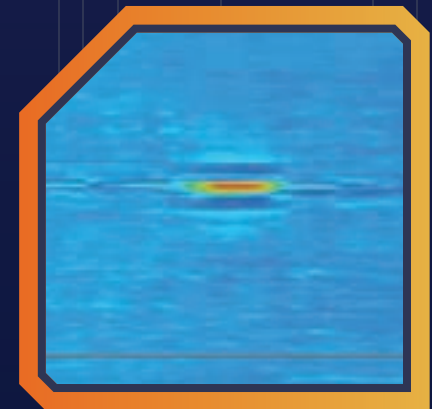


SAW / DSAW Girth Weld Flaws



- Circumferential Cracking
- Lack of Penetration
- Lack of Side Wall Fusion
- Weld Misalignment

Submerged Arc Welded Long Seam Flaws



- Lack of Penetration
- Lack of Side Wall Fusion
 - Axial Cracking
- Misaligned Long Seam Edges

SCC CRACKING

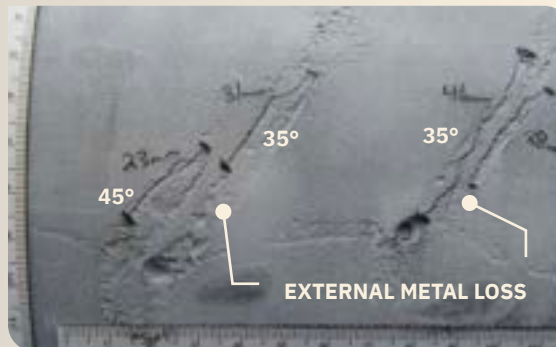
EXTERNAL STRESS CORROSION CRACKING, IS CAUSED BY A COMBINATION OF FACTORS THAT INCLUDE, FAILED PIPE COATING, A CORROSIVE ENVIRONMENT AND STRESS (EITHER RESIDUAL OR APPLIED). THE PIPE-MATERIAL CAN ALSO INCREASE THE SUSCEPTIBILITY TO SCC.

SCC, is a form of environment-assisted cracking. It is typically characterized by, appearing as small cracks that are individual from one another, abutting in an array or colony, on the external surface of the pipe. Overtime, these individual cracks may coalesce, forming one larger crack that can lead to pipeline leakage, or even failure.

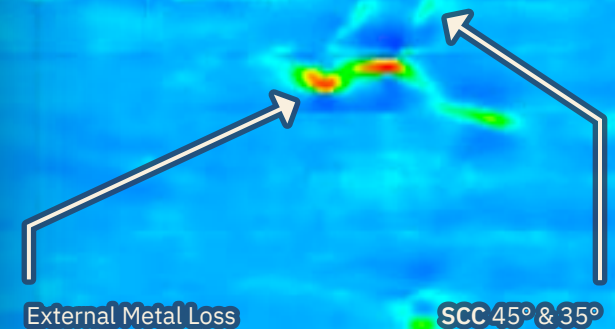
Novitech Micron ILI Technology® provides accurate ILI investigation reports, that are required to carefully characterize and size SCC and the presence of other crack like anomalies, so that their severity can be evaluated and determined thoroughly.

SCC on 45° & 35° Degree Angles

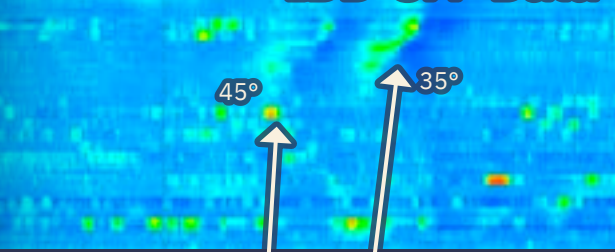
Using our Micron IDD-SM® Sensor Technology, coupled with our Micron A&C-MFL™, we are clearly separating corrosion, from SCC.



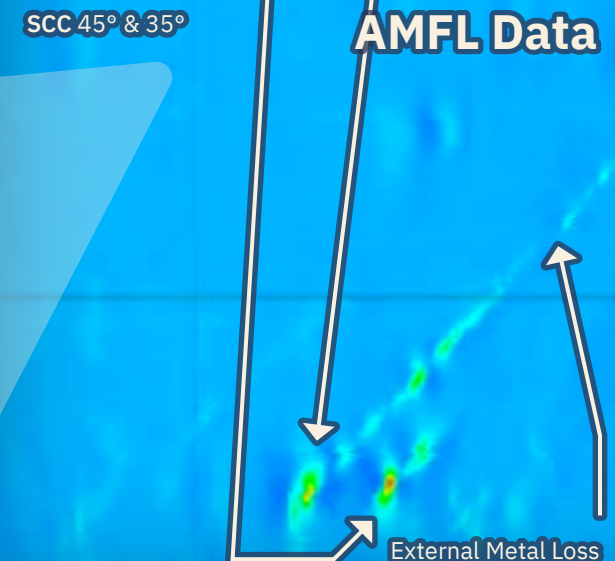
CMFL Data



IDD-SM® Data



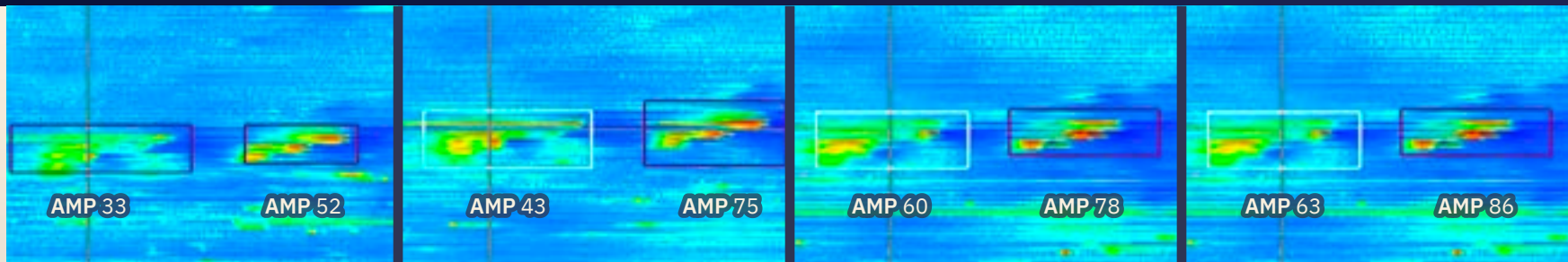
AMFL Data



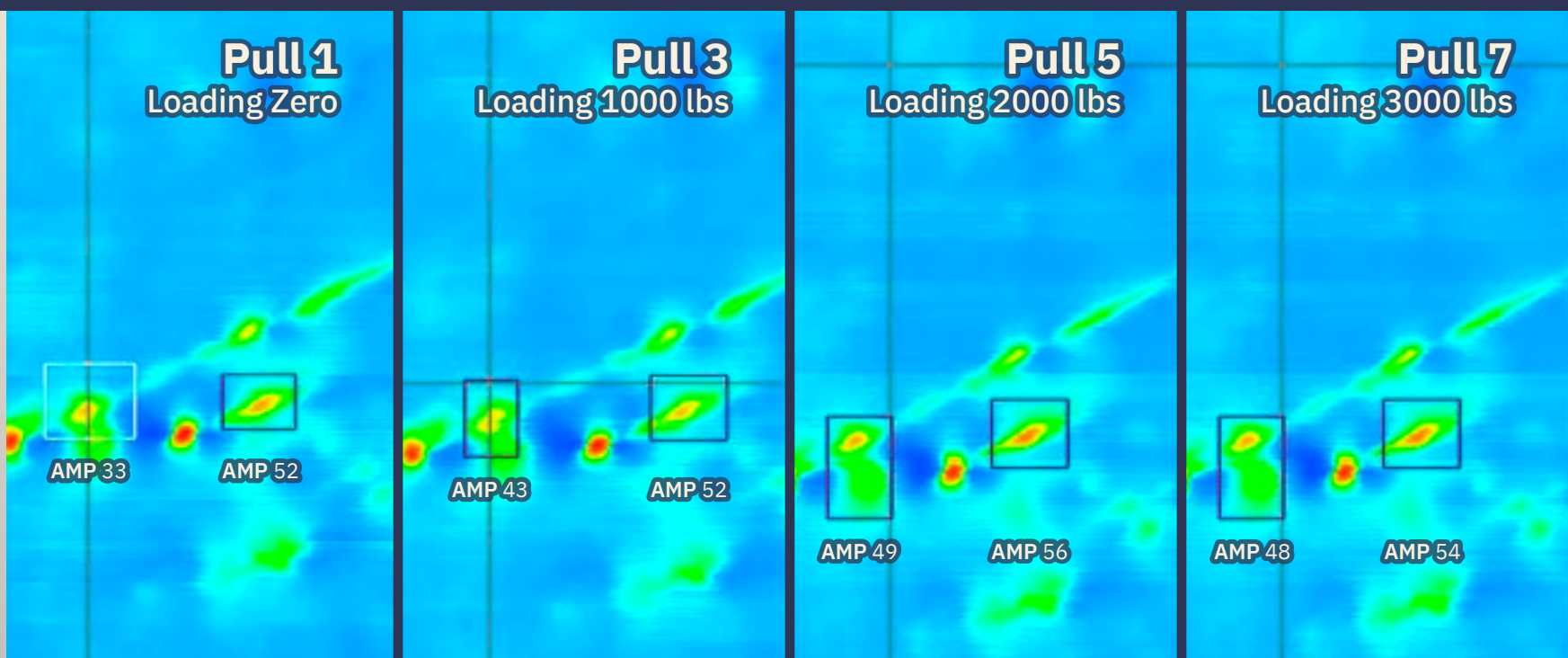
SIASM (Stress Intensity Analysis) – Using AMFL-MCSM & IDD-SM[®]

← SCC ON 45° & 35° ANGLES

IDD-SM[®] DATA



AMFL-MCSM DATA



← AMFL-MCSM SAMPLING DENSITY - 640 PER SQ " SPACING 2.0 MM

DETECTING CSCC

CIRCUMFERENTIAL STRESS CORROSION CRACKING, CAN BE FOUND IN BOTH OPERATIONAL LIQUID AND NATURAL GAS PIPELINES AND IS NOT AS EASILY DETECTABLE AS ASCC.

Novitech Inc.® has inspected over a total of 1000 miles (1600 kms) and identified greater than 1000 Cracks to date.

- Proving there to be approximately one crack every 1 miles (1.6 km).
- Roughly 20% of all cracks reported have been lab, or NDT verified.

CSCC grows in a circumferential, or off-axis directions, which can make it harder to detect than SCC (which is often thought as cracks that grow in an axial orientation, often due to, internal hoop stress from operating pressure). Similar factors that may introduce SCC to a pipeline, including bend strain, may apply to CSCC as well. The main difference is that the primary direction of stress is circumferential or off-axis.

Over the past 7 years Novitech has published a comprehensive series of papers on CSCC and off-axis SCC.

M-RFSM Data

NPS: 10.750"

WT: 0.188" (4.8 mm)

Tool Velocity: 2.8 mph (1.15 m/s)

Medium: Natural Gas

Severe Crack Field Detected by:

M-RFSM Sensory Array

IDD-SM[®] Data

Severe Cracking Detected by:

IDD-SM[®] Sensory Array

AMFL Data

CSCC Predicted Depth: 73%

Circ Length: 2.5" (64mm)

CSCC Predicted Depth: 63%

Circ Length: 4.2" (107mm)

Severe Cracking with Corrosion

Detected by: AMFL Sensor System

Metal Loss

CMFL Data

ERW Long Seam

Metal Loss Detected by:

CMFL Sensor System

PAUT Depth: 83%

PAUT Depth: 43%

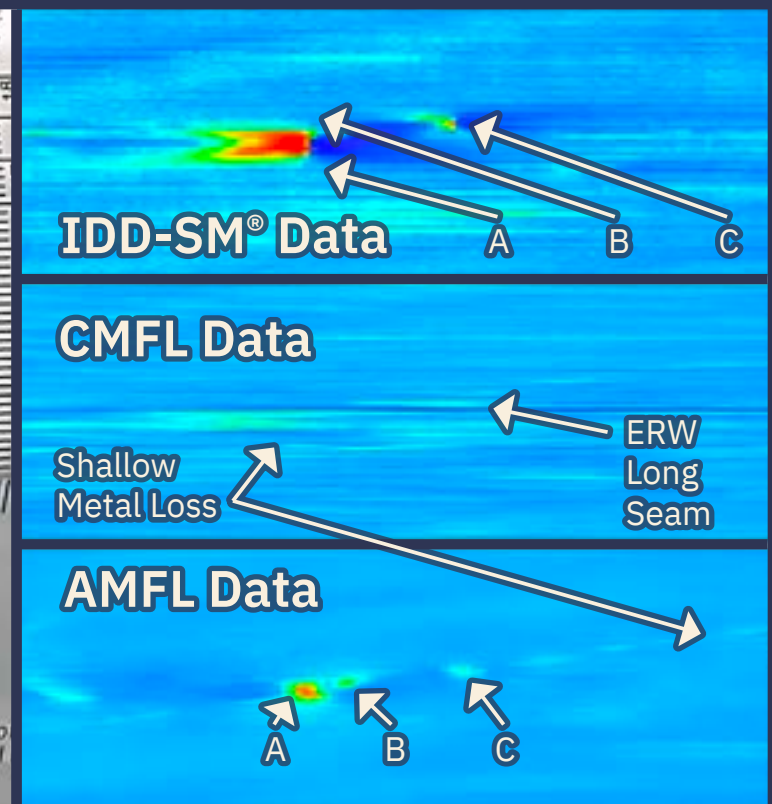
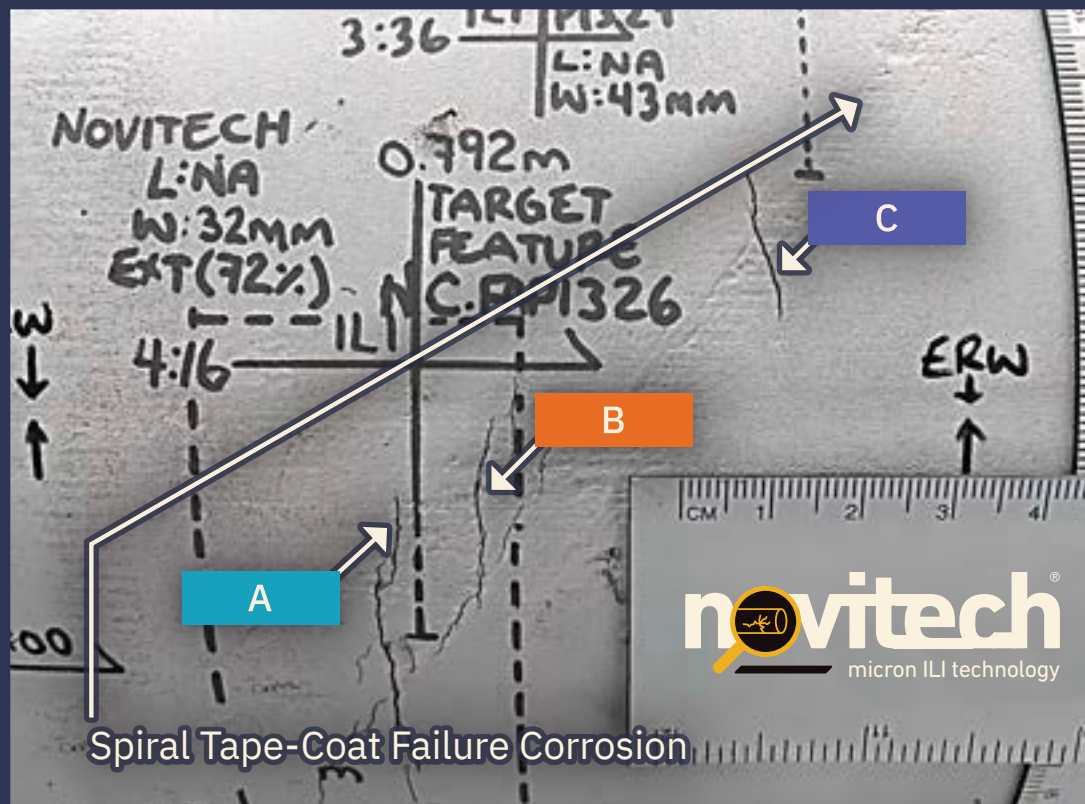
Severe CSCC In Complex Corrosion: >70%

Anomalies Analyzed by Five Sensor Systems

CSCC Without Evidence of IMU Bending Strain

MICRON ILI TECHNOLOGY® V.S. UTCD | FIELD UT RESULTS

	A	B	C
Micron ILI CSCC Depth	72%	35%	51%
Field UT CSCC Depths	63%	48%	42%
UTCD CSCC Depths	42%	NR*	NR*



ASCC (Axial Stress Corrosion Cracking)

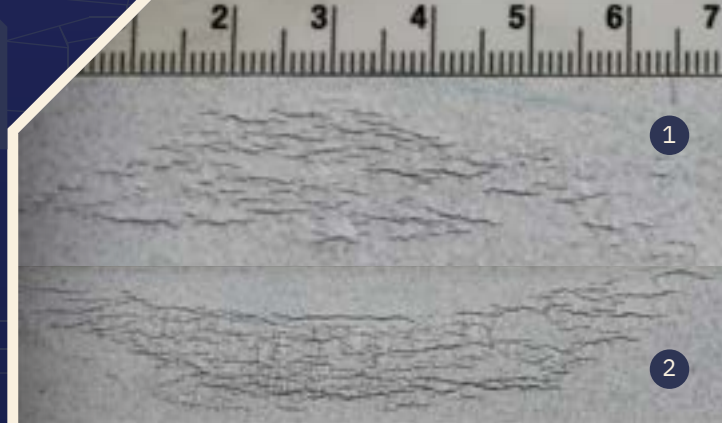
IN PIPELINE INTEGRITY MANAGEMENT, AXIAL STRESS CORROSION CRACKING, INDEPENDENTLY IS A SERIOUS THREAT THAT CAN LEAD TO CATASTROPHIC FAILURE.

Novitech, using its Micron CD-360™ Systems is applying our comprehensive learnings from CSCC, Off-Axis SCC and complex corrosion, to solve the Axial SCC integrity threat for all pipeline mediums that include liquids and natural gas.

Using our high sampling density, Novitech is able to carefully detect and size complex cracking and corrosion.

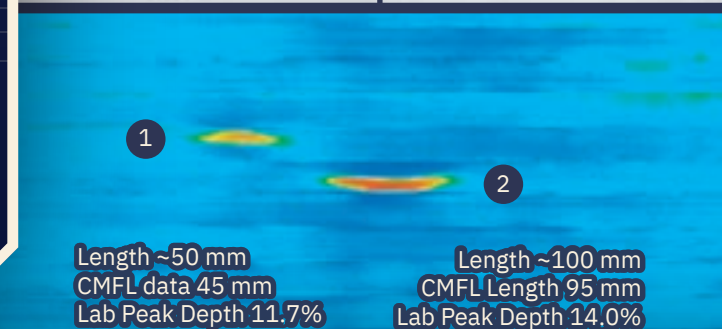
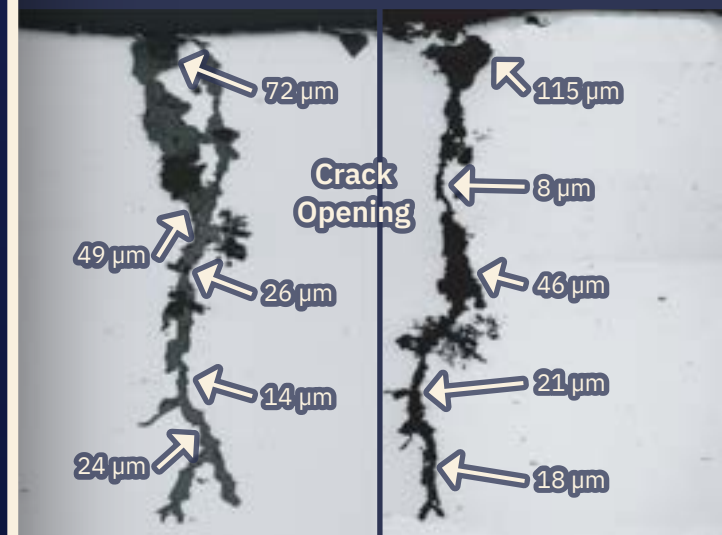
- Alternative ILI technologies that include, Ultrasonics and EMAT cannot reliably detect or characterize these combined Axial and Circumferential SCC flaws.

Novitech is ready to take on the next chapter in crack and critical flaw detection by further tackling axial stress corrosion cracking and selective seam weld corrosion (SSWC).



Axial SCC Colonies Detected by Novitech's CMFL-MFSM Micron ILI Technology[®]

- Sampling Density ~ 1,000 per sq inch
- 16" Diameter Total CMFL Sensors 1152
- Sensor Spacing 1.1 mm



OFF-AXIS SCC Analyzed by 5 Sensor Systems

Geometry Data

No Detectable Anomalies from the High Precision Geometry Array

M-RFSM Sensor Array

Severe Off-Axis SCC | NPS 16" WT: 0.250"
>80% deep by 6" Circ Width
Medium Natural Gas

IDD-SM[®] Data

AMFL Data

Long Seam Weld

Corrosion

Cracking

CMFL Data

CSCC Location

Only Corrosion Visible in CMFL Data

Long Seam Weld



CMFL Data

Severe Off-Axis SCC
analyzed by 5 sensor systems

OFF-AXIS SCC IN SPIRAL METAL LOSS

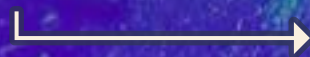
OFF-AXIS SCC IN
SPIRAL METAL LOSS



SPIRAL
METAL
LOSS



OFF-AXIS SCC IN
SPIRAL METAL LOSS



SPIRAL
METAL
LOSS



Fluorescent MPI Crack
Inspection was performed

GEOMETRY DATA

No Detectable Anomalies from the
High Precision Geometry Array

M-RFSM SENSOR ARRAY

Off-Axis SCC



IDD-SM[®] DATA

Off-Axis SCC



Medium: Natural Gas
Tool Velocity: 6.9 mph (3.1 m/s)
Off-Axis SCC
ILI Predicted Depth 60%
Field Predicted Crack Depth by ECA 48%
Circ. Length 5.1" (56 mm)
Crack Angle 16°

AMFL DATA

Off-Axis SCC in Spiral Metal Loss



SEVERE CRACK FIELD DETECTED

New Micron-Residual FieldSM Sensor Array
used to detect and confirm >70% very severe cracking

IDD-SM[®]
SENSOR ARRAY



AMFL
SENSOR ARRAY



CMFL
SENSOR ARRAY



Off-Axis SCC
Predicted Depth 64%
Crack Angle 22° Axial Length

0.85" (22 mm)
Circ. Length 2.11" (54 mm)
Medium: Natural Gas

M-RFSM
SENSOR ARRAY



IDD-SM[®]
SENSOR ARRAY



AMFL
SENSOR ARRAY



Metal Loss — Coating Failure

CMFL
SENSOR ARRAY



Off-Axis SCC
Predicted Depth 88%
Crack Maximum Angle 22°

Circ. Length 2.2" (56 mm)
Medium: Natural Gas

MULTI AXIS STRESS CORROSION CRACKING

Interacting with the
ERW long seam
as it exits a casing

IDD-SM[®] SENSOR ARRAY

CRACK DEPTHS RANGE: 25% 70%



AMFL SENSOR ARRAY

CASING



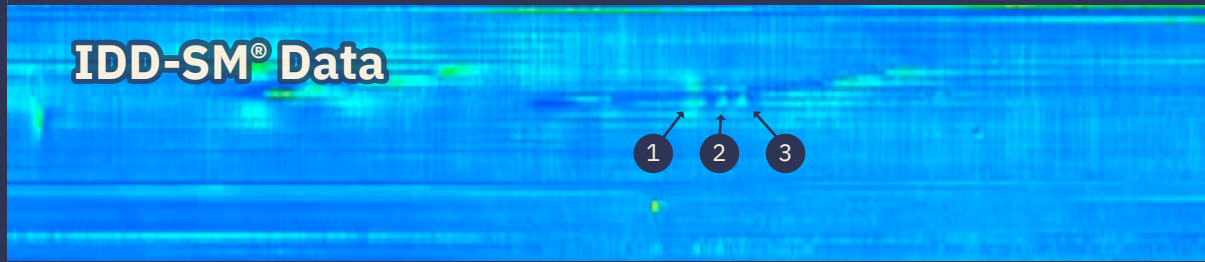
FLOW DIRECTION



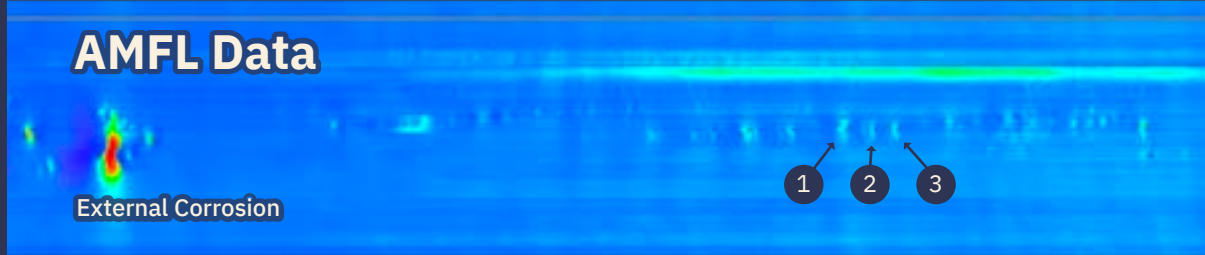
CRACKING IN GOUGES



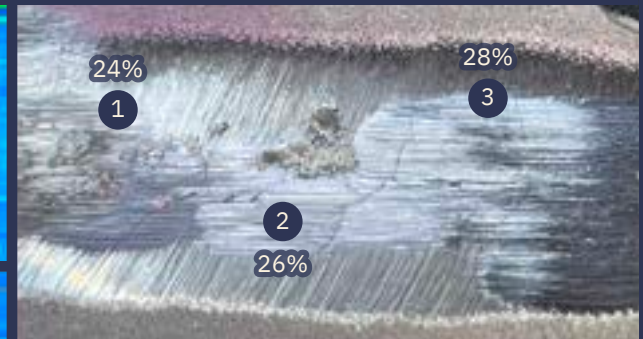
IDD-SM® Data



AMFL Data



CMFL Data



Three Cracks

1, 2, 3 in Gouge Location

CMFL DETECTION AND SIZING OF LACK OF FUSION



FLAWS IN THE ERW SEAM

Item A

Depth 42%, Length 1.47"

16" Diameter, WT 0.312"



FLAWS IN THE ERW SEAM

Item B

Depth 30%, Length 1.08"

16" Diameter, WT 0.312"



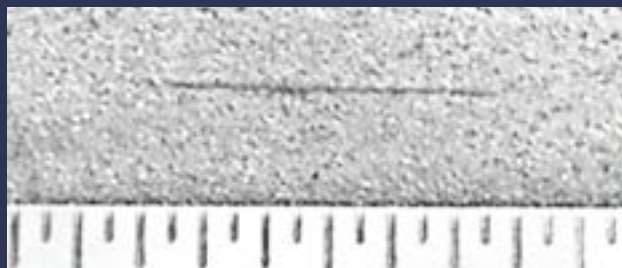
FLAWS IN THE ERW SEAM

Item C

Depth 32%, Length 1.05"

16" Diameter, WT 0.250"

LACK OF FUSION – Verification by PAUT



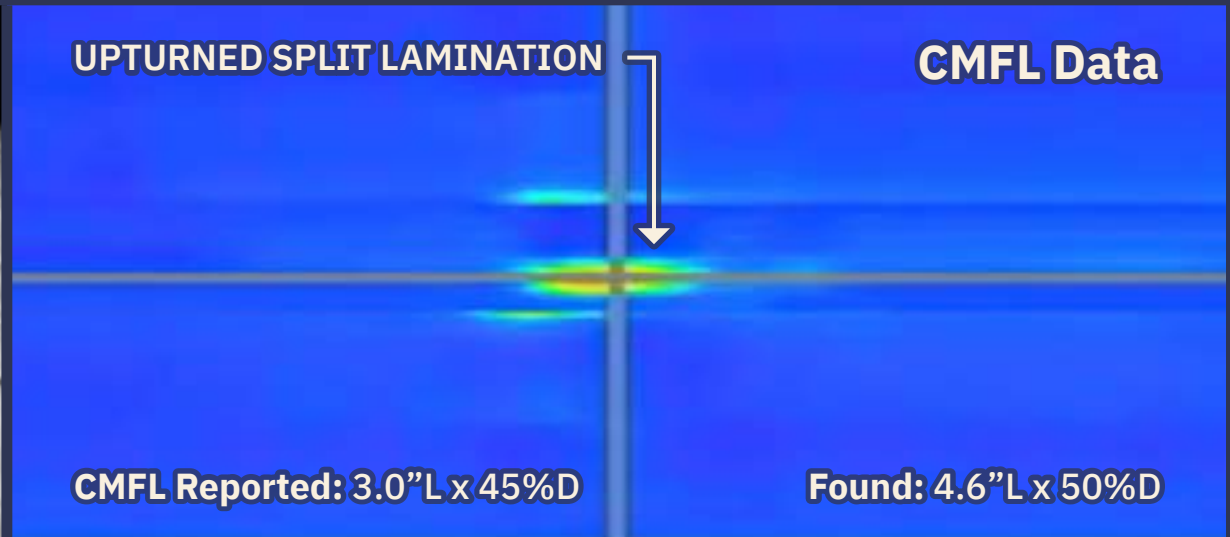
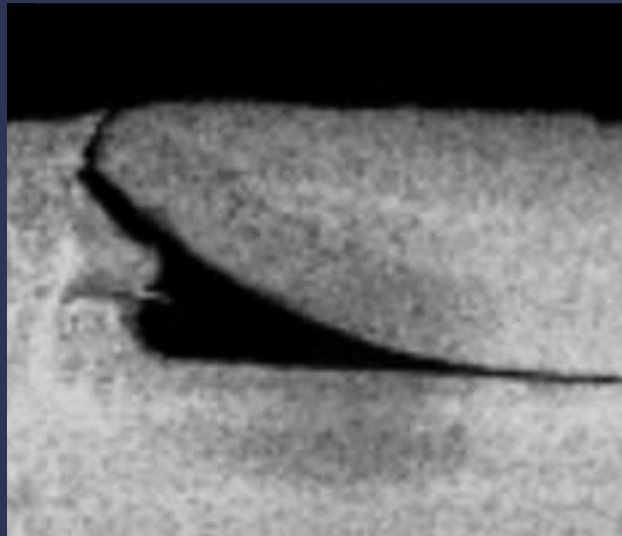
LACK OF FUSION ERW SEAM

CMFL Data

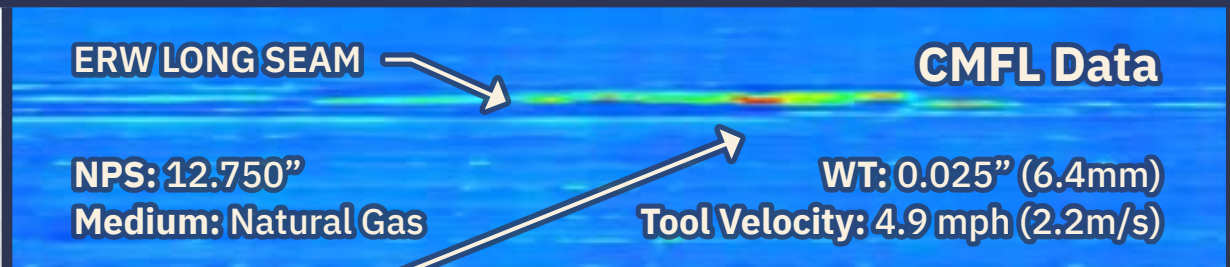
CMFL Reported: 1.3"L x 33%D

Found: 1.35"L x 38%D

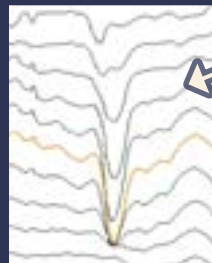
HOOK CRACK — Interacting with ERW



ERW SEAM FLAW



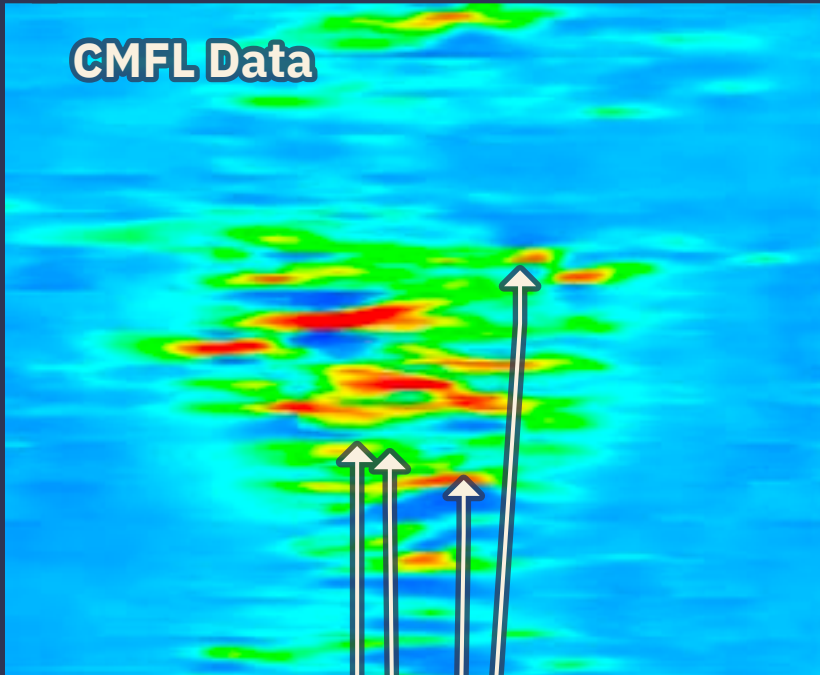
**CMFL B-Scan
Showing Detection
with Six Sensors**



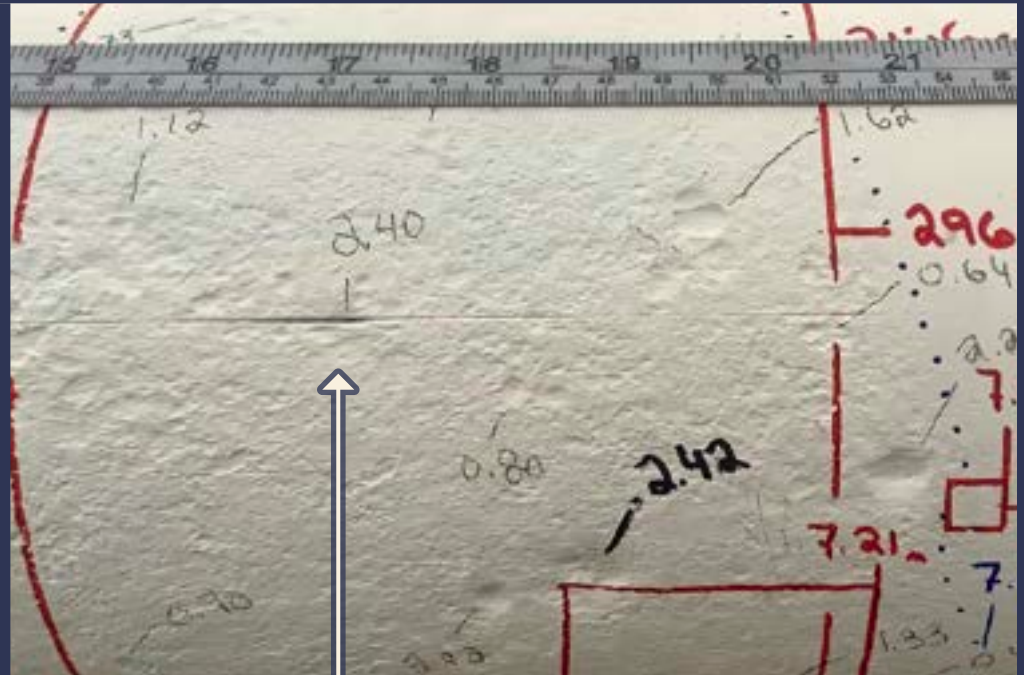
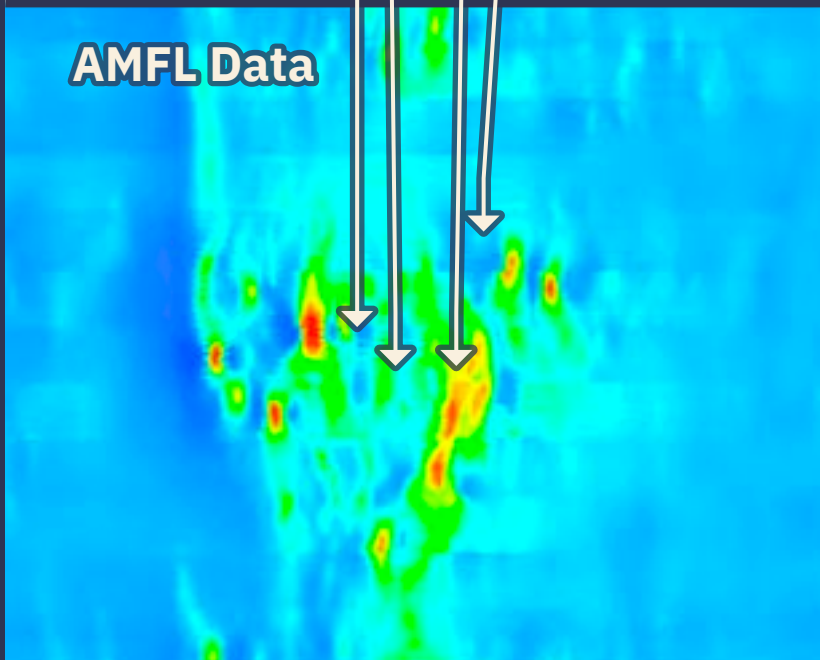
ERW Hook Crack ID
Connected Depth: 38%
Length: 2.2" (56mm)

SSWC (SELECTIVE SEAM WELD CORROSION)

CMFL Data



AMFL Data



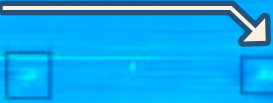
75% SSWC

Selective Seam
Weld Corrosion

NARROW AXIAL EXTERNAL METAL LOSS

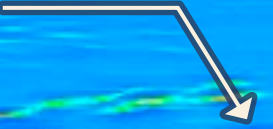
IDD-SM® DATA

Axial Metal Loss



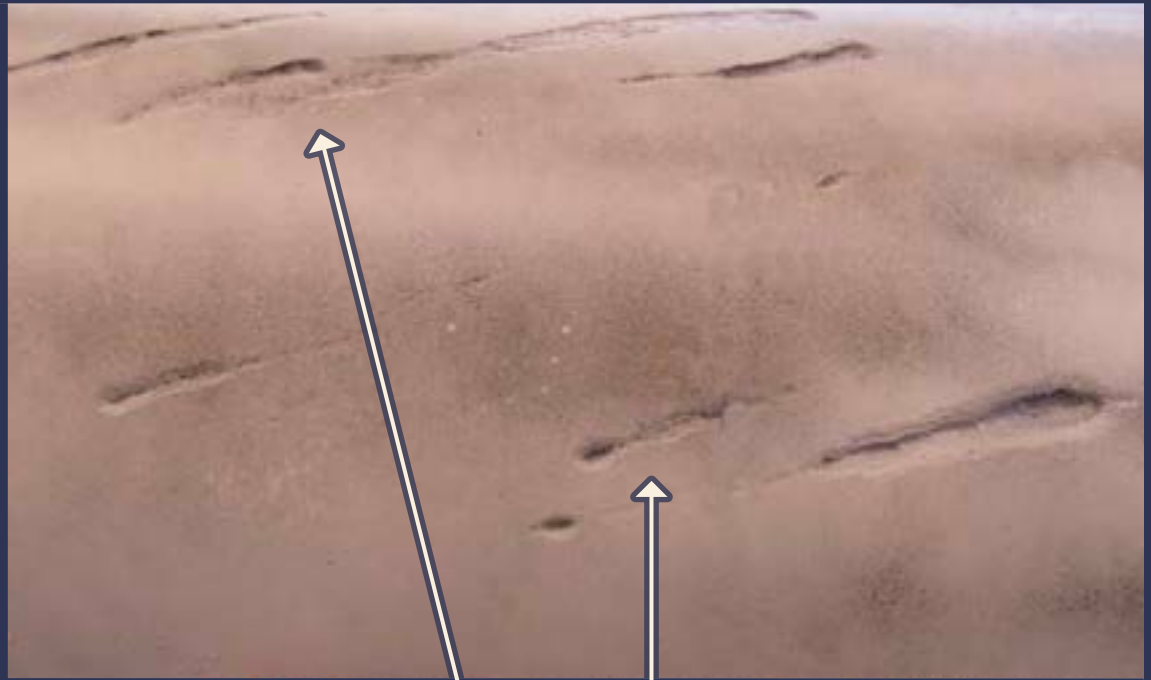
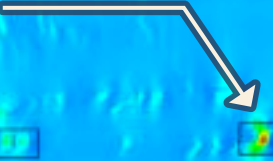
CMFL DATA

Axial Metal Loss



AMFL DATA

Axial Metal Loss

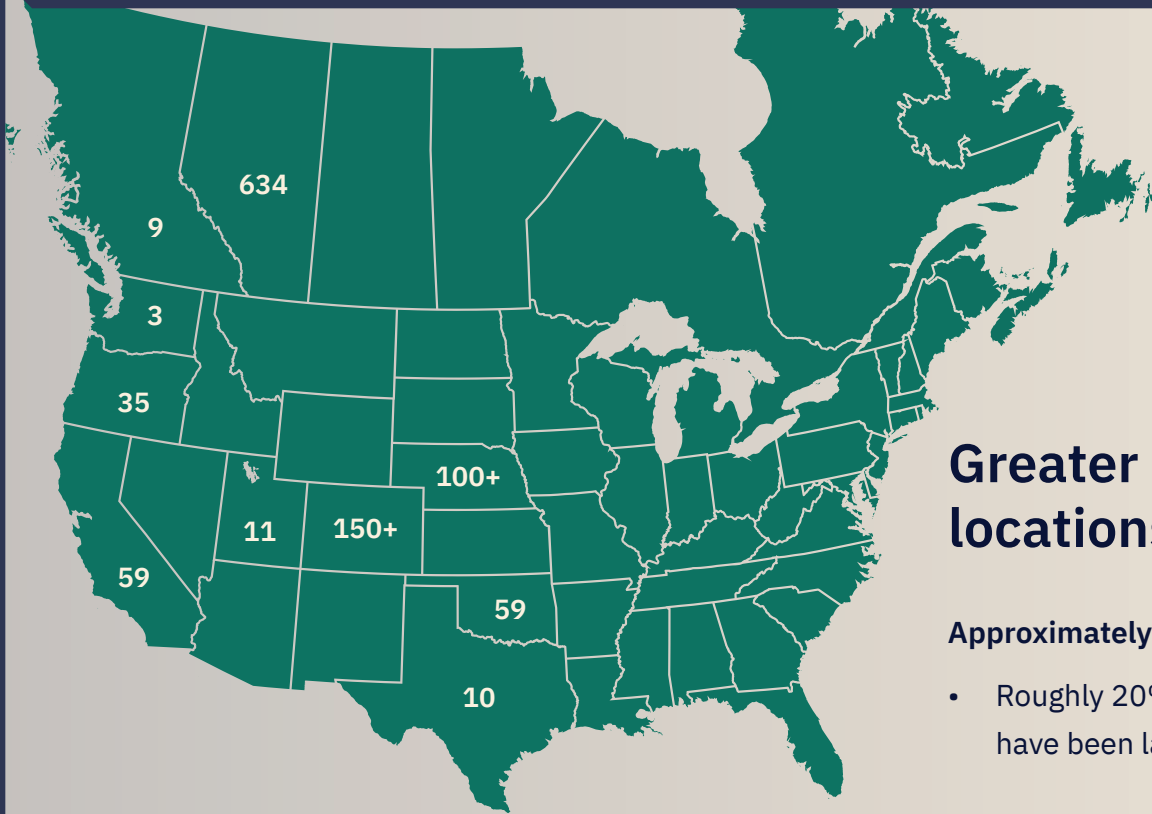


**Deep Narrow
Axial Metal Loss**

Axial Corrosion

CRACKING SITES IDENTIFIED

This does not include ASCC, SSWC,
Long Seam and Girth Weld Flaws.



Greater than 1,000 total cracking locations identified as of 2024.

Approximately 1 crack every mile:

- Roughly 20% of all cracks identified have been lab or NDT verified

Novitech remains focused on our intentions to advance our pipeline-integrity efforts further into North America, as well as expanding our tool fleet into a larger range of diameters in 2025.

As Novitech Inc® prioritizes our business development plans for growth, the scope of our pipeline inspection capabilities that we are currently able to provide our clients with will widen as well.

- *Our mission is to continue to reach new heights with the inspection capabilities that we're able to offer our clients, using our Micron ILI Technology®.*

RESEARCH AND DEVELOPMENT

WE ARE PERSISTENTLY INTRODUCING NEW DEVELOPMENTS AND IMPROVEMENTS TO OUR MICRON ILI TECHNOLOGY® AND PIPELINE INSPECTION SERVICES.

Novitech Inc.® Research and Development encompasses the systematic process of conducting scientific investigations and experimentations for the specific objective of innovating Pipeline Inspection technologies.

2024

Micron CD-360SM

To emphasize total coverage of the pipe surface for all threats that include cracking, metal loss and mechanical damage.

Micron-ACDSM

(Axial Crack Detection)
Further development of Axial Crack Detection using six or more of our inspection systems.

Micron-LDFSM

Further development of Low Drag ForceSM that include AMFL, CMFL tool versions and diameters.

Micron-MFSM

(Multi-FieldSM) CMFL — The combination of Full Field / Mid-Field CMFL tool technology for Axial Crack Detection, Selective Seam Weld Corrosion and narrow axial metal loss.

Micron-RFSM

(Micron-Residual FieldSM)
For crack detection, identification and severity prioritization.

Micron-SIASM

Stress Intensity AnalysisSM for identifying and ranking severity of elevated stress at flaw locations.

4" LDFSM

Crack detection and metal loss tools in both AMFL and CMFL Versions.

Larger Tool Development

From 20-22" (both AMFL and CMFL LDF-versions).
From 24-26" (both AMFL and CMFL LDF-versions).

Micron-R2RSM

(AMFL & CMFL, Run to Run synthesis)
Used to compare two or more runs using automation and Flaw Image Layering with Noviview®.

2025

+

Micron CMFL-LDFSM Magnetizers on rollers

- New Low Drag Force (LDF) designs can reduce frictional forces by up to 5 times over the standard magnetizer designs. Less speed excursions reducing the risk of tool damage.
- Less stoppages at wall thickness changes, bends, valves and other features.
- Less wear and tear on the drive cups, which extends run lengths.
- Designed to induce a controlled 360-degree rotation about every 200 meters of axial distance traveled.
- Smooth velocity and controlled rotation will ensure a more precise sensor scanning of Axial Cracking, Long Seams Flaws, Narrow Axial Metal Loss, and Selective Seam Weld Corrosion.
- Rotation rate will also reduce uneven wear of all contact components of the tools and increase precision of IMU devices for mapping.
- Tethered work can be performed with lower winching forces.
- Tethered work can negotiate a greater number of bends increasing the value to the customers.

Our efforts to offer our clients newer and better solutions, to meet their pipeline inspection needs is constant and undertaken by our teams most highly skilled and experienced industry engineers and professionals.

Novitech is committed to continuous development and technological advancements to meet the very challenging needs of our customers and integrity partners.



**Tool Development
& Analysis Center:**

321 & 331 Cityview Blvd, Unit 1
Vaughan, Ontario, L4H 3M3

**Western Canadian
Operations Center:**

10555 - 74th St. SE
Calgary, Alberta, T2C 5P6

**US Operations
Center:**

5690 East 56 Ave.
Commerce, Colorado, 80023

