

InVista™ Inspection & LifeQuest™ Assessment



**Integrated Solution Set Addressing
Unpiggable and Difficult Pipelines**

Topics

1. Introduction
2. InVista™ Inspection Solution
3. InVista™ Comparisons
4. LifeQuest™ Data Viewer
5. Conclusion

Topics

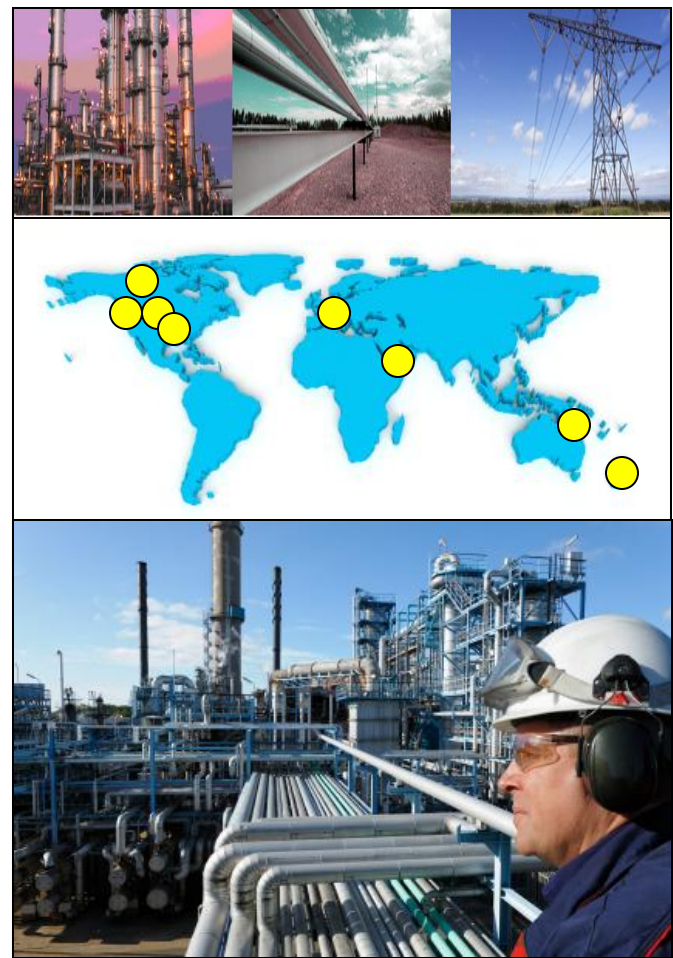
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Quest Integrity Group Introduction

Quest Integrity Group is built on a foundation of leading edge science and technology that has innovated and shaped the process, pipeline and power industries for nearly 40 years.

As a private business with a global presence, we are responsive to your needs and focused on empowering your operating and maintenance decisions.

Headquartered in Seattle, Washington, our team includes more than 100 employees with more than 60 dedicated engineers & scientists.



Abu Dhabi • Brisbane • Calgary • Denver • Eindhoven • Houston • □ Seattle • Wellington

Some of Our Clients



Agip

Nerefco



SK Corporation

Idemitsu Kosan



Asset Longevity | Pipeline Performance

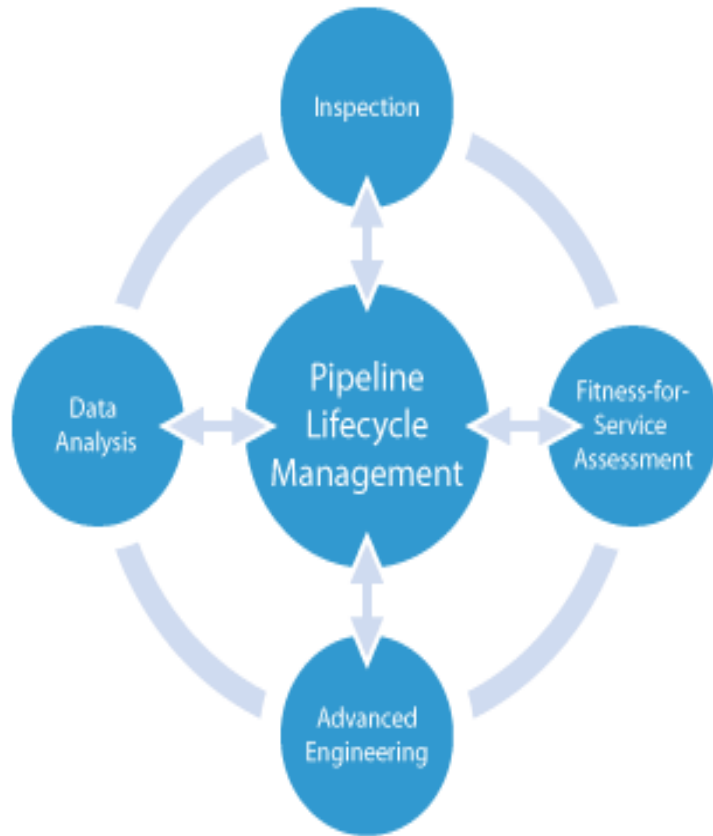


Process • Pipeline • Power

Quest Integrity Group Pipeline Services

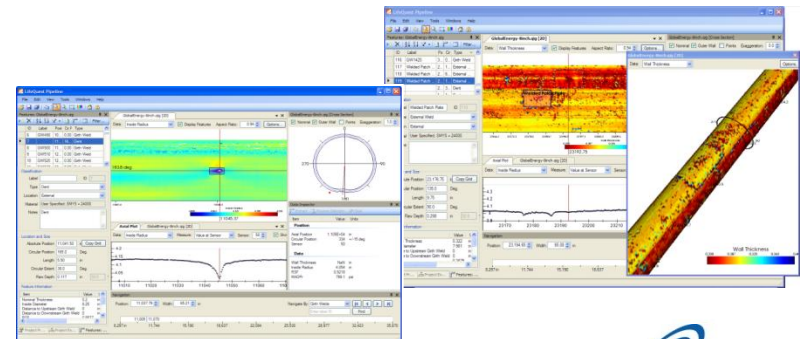


Providing Engineering Solutions



Asset Integrity is Our Core Business

Asset Performance Optimization	Computational Fluid Dynamics	Condition Assessment	Failure Investigation
Field and Laboratory Services	Materials Consulting, Research & Metallurgy	Process Engineering	Remnant Life Calculations
Risk-Based Inspection	Specialized NDT Solutions	Structural Integrity/Life Assessment	



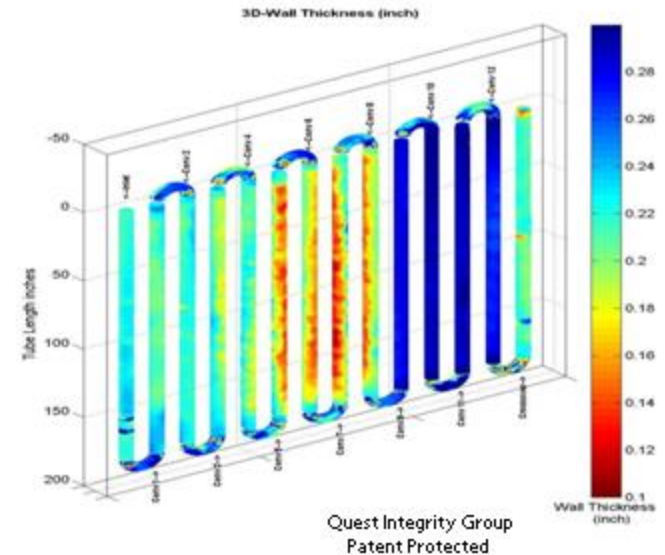
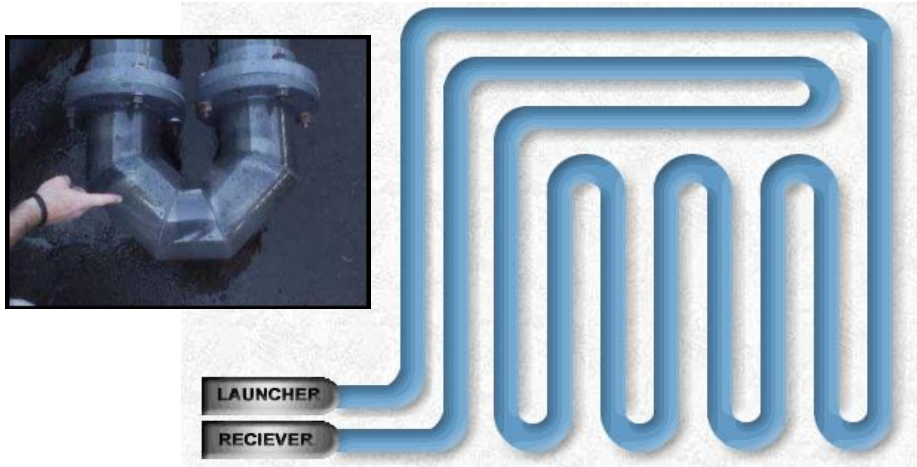
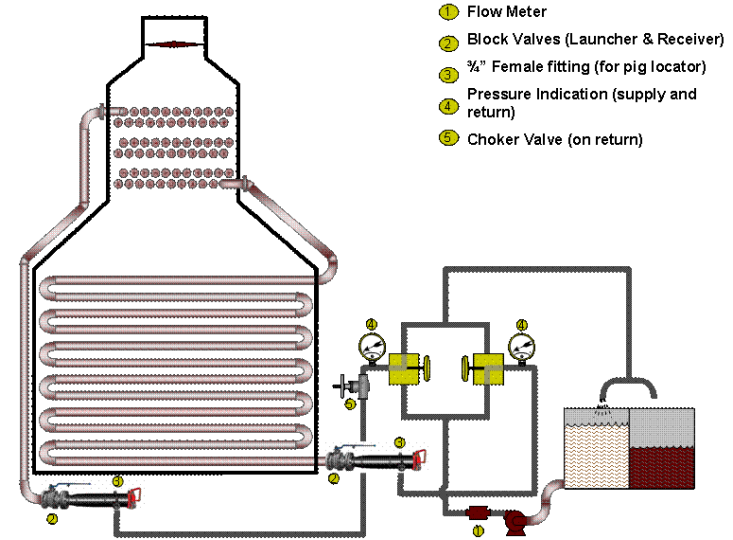
Asset Longevity | Pipeline Performance



InVista™ Technology Origin



Free Swimming UT Furnace Tube Inspection System – designed to fully navigate short radius - 1D serpentine coils in both radiant and convection sections



Targeting Unpiggable and Difficult Pipelines

World Pipelines

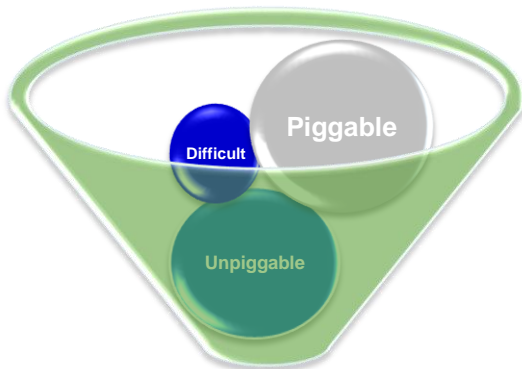


■ Unpiggable
■ Piggable



■ Difficult
■ Unpiggable
■ Piggable

- Industry consensus estimates 30-40% of the world's pipelines are classified as "unpiggable."
- At least another 10% of the piggable pipelines are so called "difficult" pipelines.

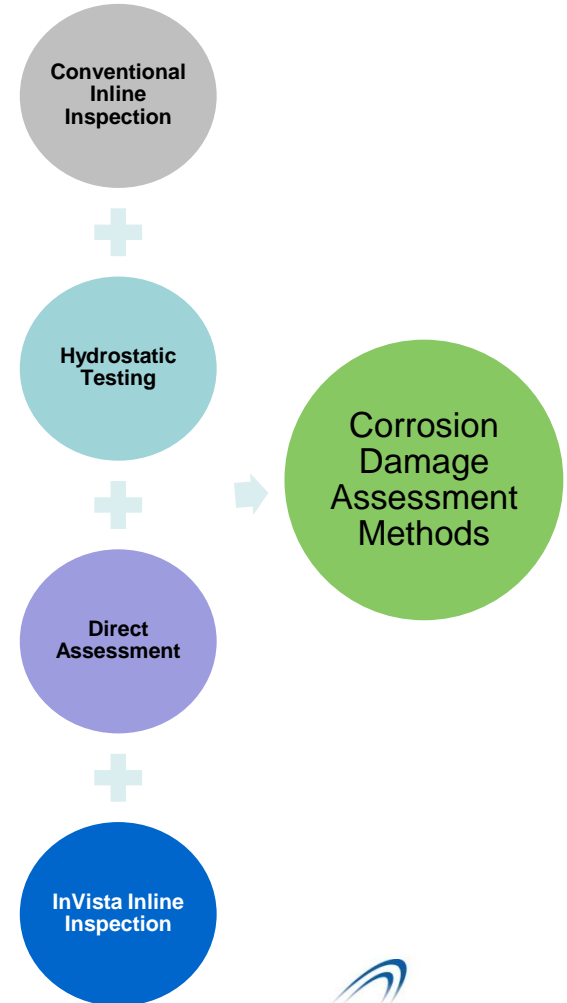


Regulatory Compliance



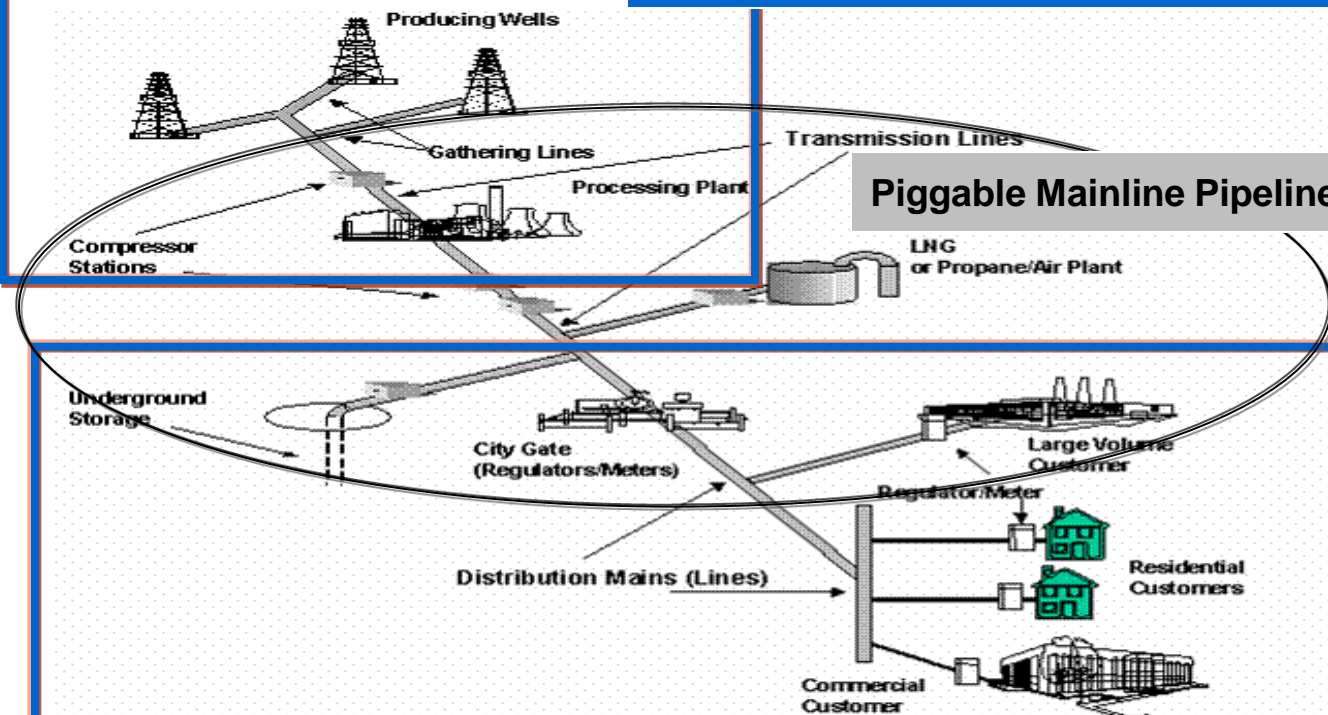
InVista™ Gives You Options Against conventional ILI tools in difficult or problematic inspections

Assessment Options



Solving Your Pipeline Inspection Challenges

Unpiggable Gathering & Delivery Pipelines



Piggable Mainline Pipelines

- Bidirectional & collapsible to > 30% ID reductions
- Bend radius to $\geq 1D$
- Back-to-back, mitres & tight $>90^\circ$ radius turns
- Multi-diameter & dual-diameter capabilities
- Minimal operating pressure requirements-down to 50psi
- Applicable for both ferrous and non-ferrous materials
- Inspection distances of >100 Miles

Unpiggable Transportation & Distribution Pipelines

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InVista™ Ultrasonic Inline Inspection



InVista™ provides:

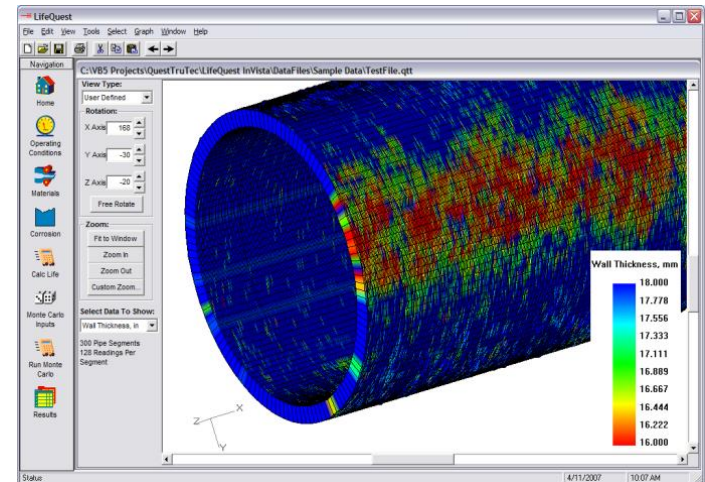
- High-fidelity ultrasonic inline inspection of unpiggable and difficult pipelines 3" (75mm) – 14" (355mm) in diameter
- Combined absolute wall loss and full geometry dimensions in a single pass
- Circumferential, longitudinal and ID/OD location of defects with referencing
- High-density direct measurement ultrasonic technology provides accurate, repeatable results measured to 0.005" (0.127mm) precision & 0.030" (0.762mm) remaining wall



InVista™ Advantages

InVista™ High-Fidelity Approach

- The term “high-fidelity” refers to the reproduction of sound and images with minimal distortion. Less distortion means superior, more accurate data.
- Signal distortion and other noise effects can reduce the ILI tool’s ability to fully discriminate and properly size pipeline flaws, thereby exposing you to increased risk.
- By design, InVista™ is not subject to the same noise effects associated with movement, pipeline disturbances and related wear challenges as conventional tools.
- Our advanced approach produces the highest quality images available in the industry today.



InVista™ Benefits



Safety and Flexibility

- Lightweight, self-contained, compact tools are handled easily; no lifting machinery required.
- Industry-leading passage, bend and bidirectional capabilities negotiate damaged or restricted pipe.

Reduced Operational Risk

- Unique design reduces wear effects and minimizes tool impacts compared with conventional ILI tools.
- Solutions oriented—analysis of all line data vs. individual boxed flaw locations.

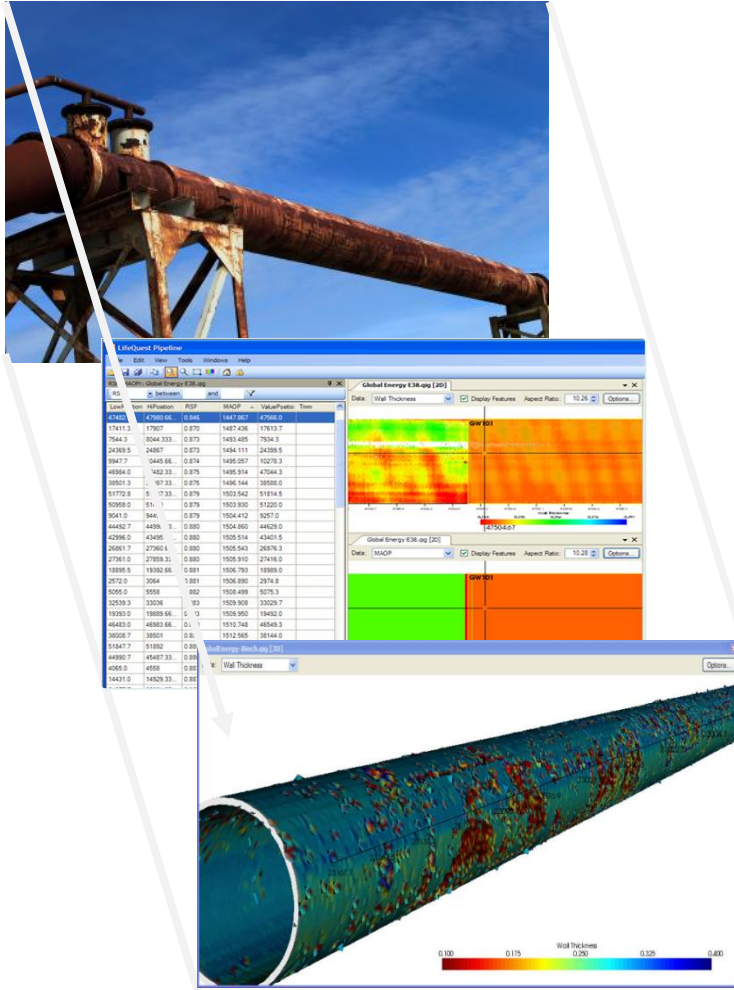
Cost-Effectiveness

- Linear UT sizing minimizes verification digs and improves excavation and repair confidence.
- Permanent line modifications are not required.

Time Efficiency

- Efficient inspections minimize offline status.
- Onsite turnaround and rapid data analysis allow real-time operating decisions.

InVista™ Delivers



High-Fidelity Ultrasonic ILI Survey

- Onsite technician certified NDT L II or greater.
- Report immediate conditions as defined by you and provided within 7 days standard, customized final report provided with approximately 30 days standard.

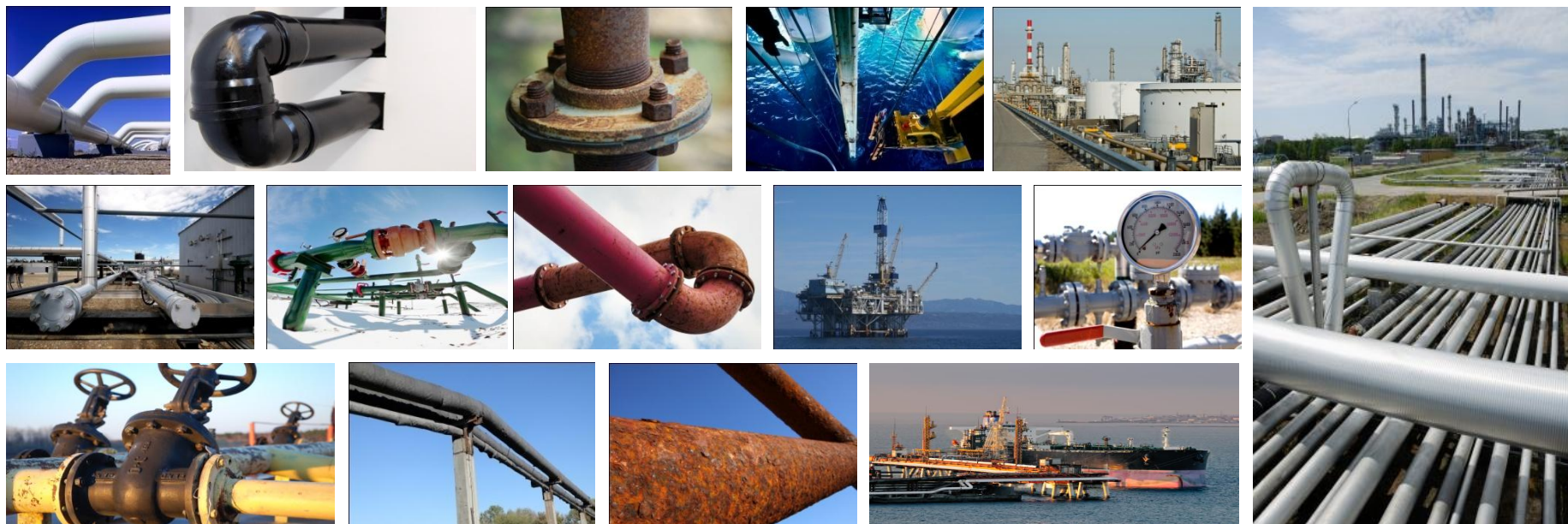
Fitness-for-Service Engineering Assessment

- Provides remaining strength and maximum allowable operating pressure (MAOP) for entire length of pipe vs. limited locations only.
- Follows API 579-1/ASME FFS-1 local thinning assessment methodology (accepted Level 2 methodology in ASME B31G-2009).

LifeQuest™ Visualization and Analysis Software

- High resolution 2D and 3D views of wall-thickness and inner profile for 100% of your data.
- Fully synchronized data display windows for rapid examination of your inspection results.
- Client configurable feature table compatible with GIS systems and exportable to Microsoft Excel®.

InVista™ Applications



- Bore restrictions, step changes, reduced port valves
- Cased crossings, pipe-in-pipe, vertical support members (VSM)
- Limited or missing launcher/receiver facilities
- Limited or unknown pipeline conditions
- Low flow or limited flow conditions
- Non-standard, bulging, oval, or offset pipe
- Offshore risers
- Significant wall-thickness variations
- Single entry/exit, line stoppage, plugged valves
- Unbarred tees and wyes

Case Study 1 - Requirements

Louisiana USA

This 4" (100mm) line develops a leak and regulators mandate that the line be taken out of service and inspected for repair.

Adding to the operator's sense of urgency was the fact the crude was selling around \$130 per barrel.

"We need this pipeline back in service ASAP..."

InVista™ is Successful



Launcher

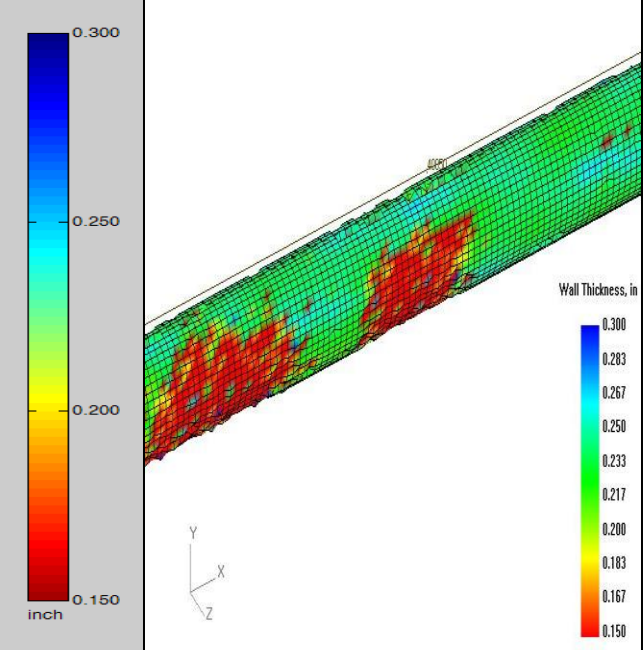
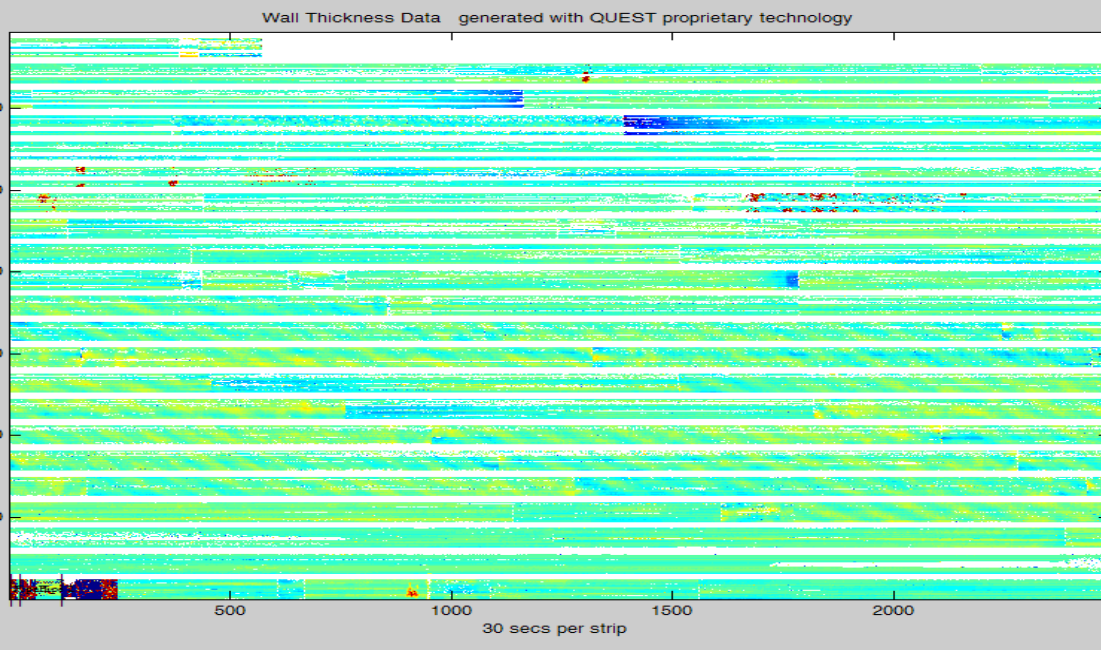
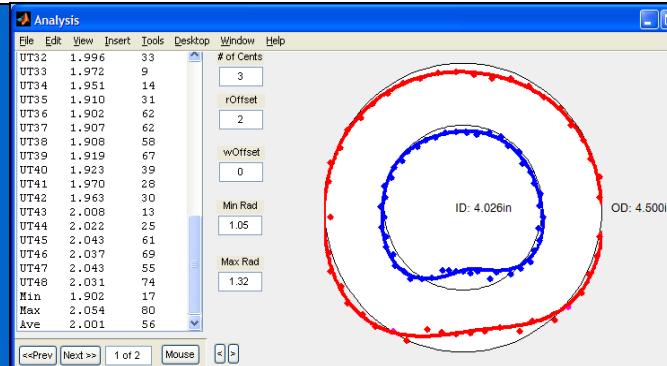
- Minimal working area
- Minimal trap length
- Unbarred 6" x 6" (150mm) tee at 6 o'clock

Receiver

- Minimal nominal pipe after valve
- Minimal trap length
- Line was not properly cleaned prior to ILI

Case Study 1 - Results

- 7 major corrosion and pitting flaws detected
- Client verified each flaw with alternate manual NDT method (i.e. pit gauge and/or manual ultrasonic scope)
- Repairs were made to all areas based upon InVista™ inspection results



Case Study 2 - Requirements



California USA

Major client received an allotted budget to upgrade and make piggable all regulated assets.

After meeting with Quest this Operator realized it could inspect these lines for a small fraction of its entire budget.

“We do not want to spend the money to modify our pipelines unless it is absolutely needed...”

InVista™ is Successful



Pipeline Details

- Same location for both launch and receive using client-owned 14” barrel.
- Multi-diameter pipeline was easily inspected using two tools at client’s request:
 1. Ran 8” (200mm) tool to 6” (150mm) reducer and back out.
 2. Ran 6” tool through 8” line, through 6” and back out.
- Inspected over 1 mile of pipe below city streets with limited access.
- No prior inspection due to tight bends, unbarred tee and plug valves
- Legacy line—no original drawings

Case Study 2 - Results



External flaw at 688 feet

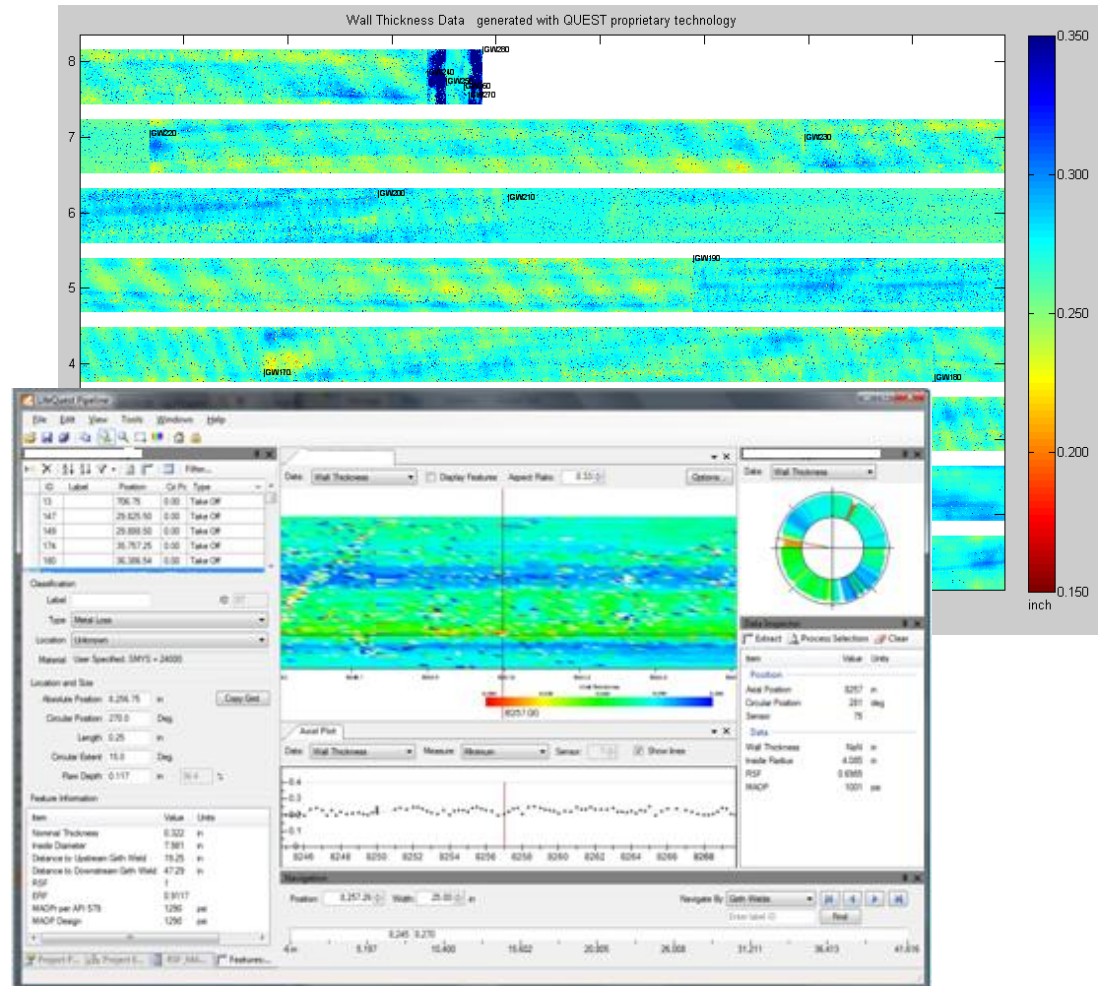
- Length = 1.0 in (25.4mm)
- Width = 0.25 in (6mm)
- Depth = 0.122 in (3.1mm)
- 39% wall loss

RSF = 0.699

MAOPr = 1001 psi (69.03 bar)

B31G = 1415.3 (97.6 bar)

1. Verified with prove-up dig
2. Location within one inch
3. Wall loss within one percent



Case Study 3 - Requirements



Alaska USA

Major client had problems with conventional ILI tools becoming stuck repeatedly and needed a solution.

Compounding issues: these pipelines contained cased crossings and there were minimal traps with limited space availability.

“We cannot risk getting another pig stuck because it will shut down our entire operation...”

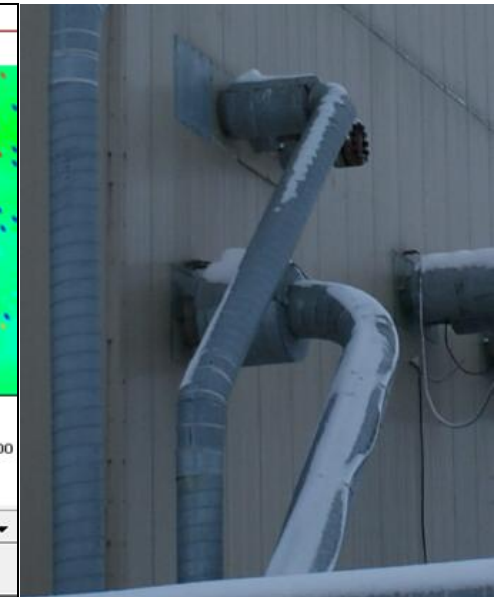
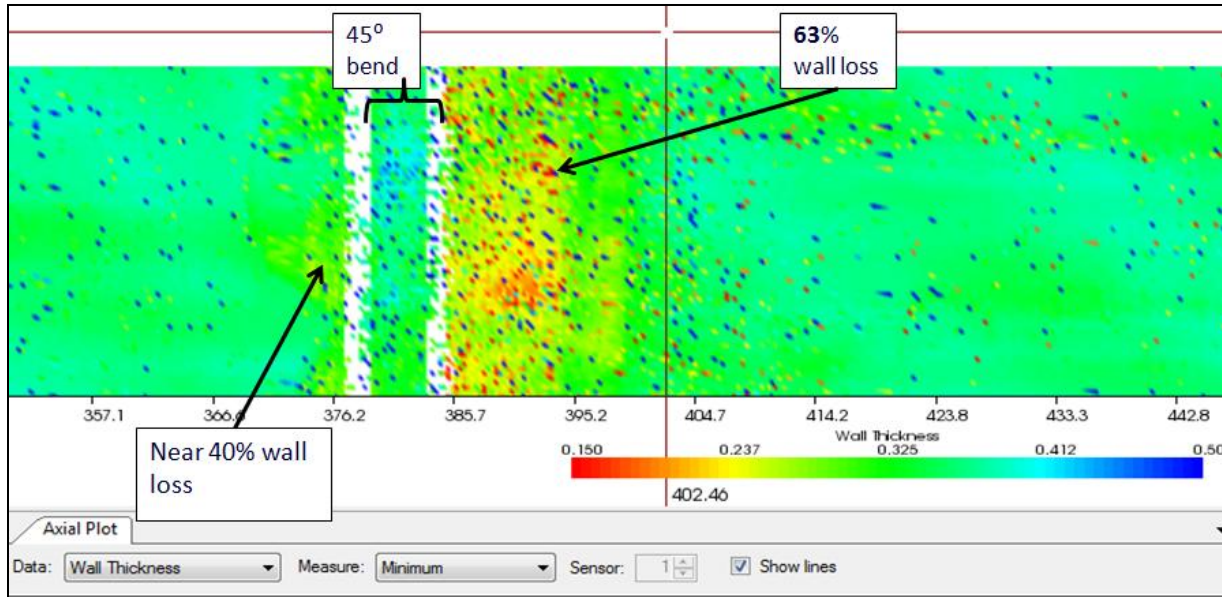
InVista™ is Successful



Pipeline Details

- Two 6" (150mm) produced water pipelines tied together for approximately 7 miles
- Pipeline pressure 1500 PSI (103.4bar) and 150 degrees
- No prior inspection due to limited trap lengths--No modifications required for InVista
- Launcher reduced from 12" (305mm) to 10" (250mm) to 8" (200mm) then to 6" (150mm) nominal in one instance
- Insulated pipe could normally be inspected with manual UT, but this was >100 ft (33M) from the ground.

Case Study 3 - Results



Severe corrosion found and MAOP reduced—
Fitness-for-Service delivered in < 24 hours

Topics

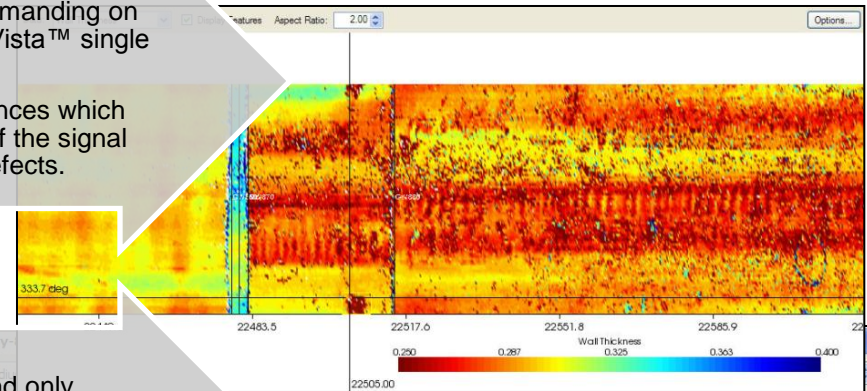
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Historical Assessment Methods

Conventional ILI

(includes tethered & BIDI)

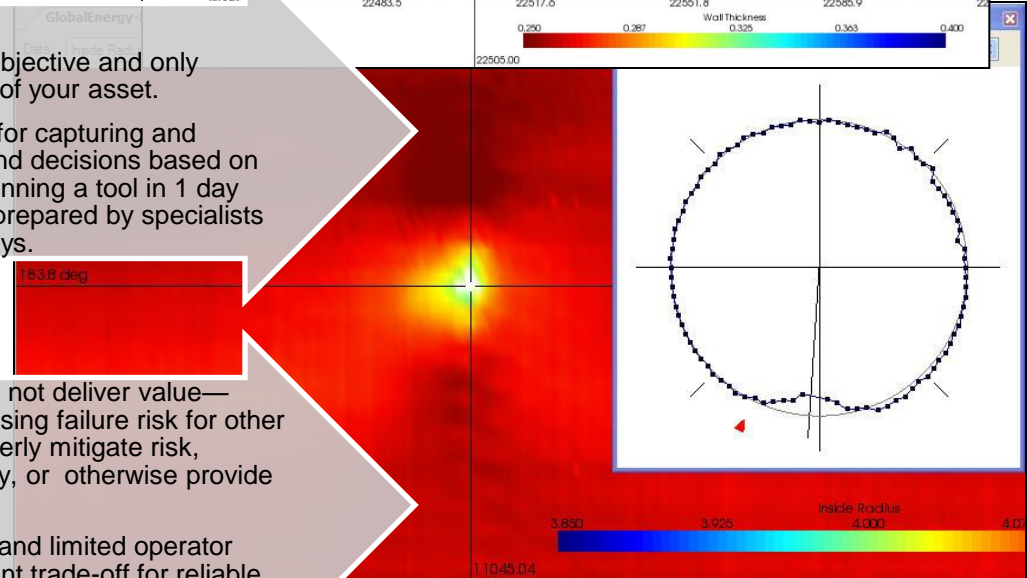
- Conventional ILI tools are more demanding on operator and less capable than InVista™ single tool packaged solution.
- MFL is subject to secondary influences which can mask important components of the signal affecting detection and sizing of defects.



Direct Assessment

(includes guided wave & localized UT)

- Direct Assessment is subjective and only incorporates snapshots of your asset.
- Compare time required for capturing and assimilating field data and decisions based on presumptions against running a tool in 1 day with quantitative report prepared by specialists delivered in about 30 days.



Hydrostatic Testing

- Hydrostatic testing does not deliver value—bursting pipe and increasing failure risk for other locations; does not properly mitigate risk, improve pipeline integrity, or otherwise provide actionable information.
- Operational constraints and limited operator assurance is not sufficient trade-off for reliable, accurate direct pipeline assessment.

Conventional ILI Comparison

Area of Interest		Traditional MFL	Traditional UTWM	InVista™	Operator Benefits Because:
Onsite Handling	Tool Transport	Heavy & Hazardous (magnets)	Heavy	Light / Safe	Quest incorporates air travel as our primary logistical option giving you the most cost-effective mobilization/demobilization method.
	Lifting Equipment	Heavy Equipment Required	Heavy Equipment Required	All Tools < 100 lbs	Transport between work areas or facilities is simplified as no lifting equipment or associated personnel are required.
	Tool Length	Start at 6 feet	Start at 6 feet	All Tools < 6 feet	Small working spaces are sufficient and InVista easily accommodates short traps--all we need is a pipe opening large enough to insert the tool.
	Standard Overhaul	day(s)	day(s)	hours	Rapid onsite turnaround is standard--our unique design minimizes areas that can become damaged by pipe wall, debris, and/or wear.
Tool Passage	Movement	Regulated Pressure >350 psi	Regulated Pressure >350 psi	Near-neutral buoyancy	InVista requires only a 10-15 psi differential pressure and very low line pressure requirement (50 psi).
	Direction	Downstream	Downstream	BIDI including odometer	Bidirectional capabilities minimize pipeline modifications.
	Collapsibility	15-25%	15-30%	50-60%	Heavy ID restrictions or passage issues are mitigated.
	Propulsion & Centralization	Cups / Disks	Cups / Disks	Brushes	Brushes offer better wear, less jeopardy from pipeline effects, and capabilities for maneuvering in oval and offset pipe.
	Sensor Lift-Off	Assembly Rides Pipe Wall	Assembly Rides Pipe Wall	Unaffected	InVista sensors do not ride along the pipewall and therefore are not affected by disturbances, welds, mechanical damage, etc.
	Multi Wall	Available	Available	Standard	Same tool can be calibrated to nominal OD based on specific needs.
	Bends	1.5	1.5	1.0	Tightest bend capability on the market--180 degree back-to-back capability.
Measurement	Method	Indirect (Qualitative)	Direct (Quantitative)	Direct (Quantitative)	Repeatable, objective, faster data processing is a standard UT attribute.
	Feature Base	Nominal W/T	Exact (Actual)	Exact (Actual)	UT data is ideally suited for integrity assessment, FFP studies, and of particular use in pipeline up-rating process.
	Combination Tool	Available	Available	Standard	InVista is the most compact combined metal-loss and deformation tool on the market, providing the most critical information in a single tool pass.
Performance	Accuracy	± 10% of w/t	± 0.005"	± 0.005"	Better Probability of Detection (POD) and sizing provide precise feature calls.
	Confidence	80%	95%	95%	Higher confidence levels provide considerable savings by minimizing required digs and extending repair programs over longer time periods.
Analysis	Standard Reporting	60 day final	60 day final	30 day final	Faster data assessment delivers faster results.
	Data Verification	May require calibration dig	Not Required	Not Required	UT stores actual w/t value for every location within the pipe.
Repair	Feature Calls	Subjective	Objective	Objective	UT data measures pipeline characteristics directly and with better tolerance when compared with MFL indirect approach.
	Demagnetization	Likely	Not Required	Not Required	MFL tools permanently magnetize the pipe and this can complicate welding during repair work.

Standard	Best Available
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Consequence of Tolerance

The magnitude of your rehabilitation and repair work is greatly affected by tool tolerances. *“The best tolerances result in the least repairs, which means money saved in the repair program.”*

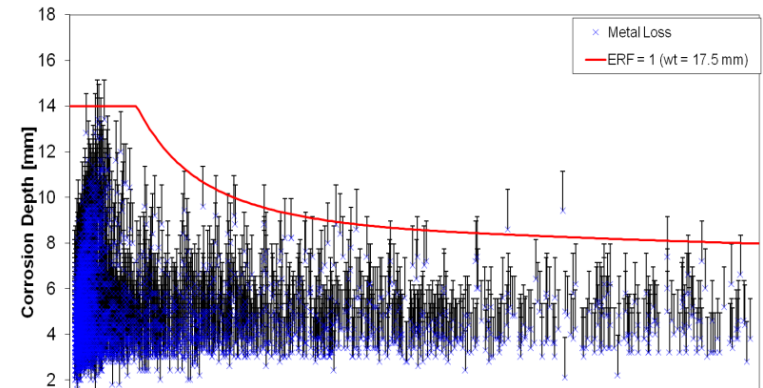
Choosing to run tools with better tolerances increases your efficiencies and decreases waste, allowing more effective decision-making.

UT Inspection → higher return on investment because of accuracy driven efficiencies.

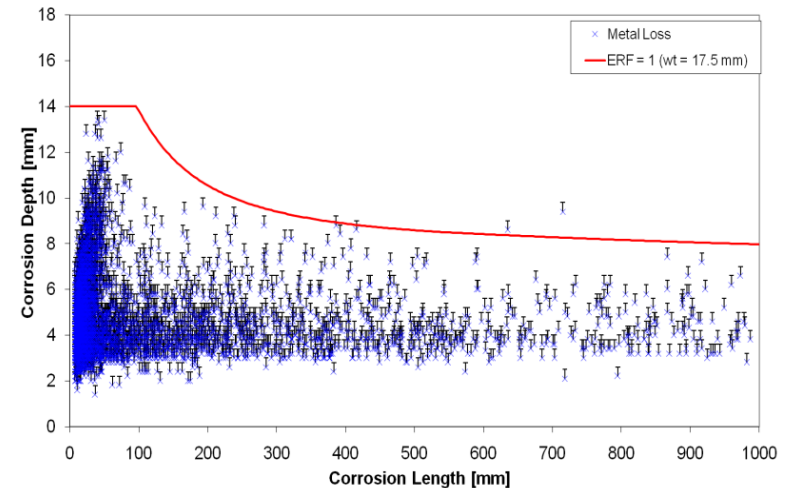
The higher accuracy and confidence that InVista™ offers increases your profitability, maximizes limited resources, and results in more effective risk mitigation when compared with MFL tools.

How much unnecessary planning, man hours, resource scheduling, and/or pressure down-rating can you and your company afford?

Assessment Chart: Modified B31G
Metal Loss: MFL Specification (+10% wt)
=> 34 Repairs



Assessment Chart: Modified B31G
Metal Loss: UM Specification (+0.4 mm)
=> 4 Repairs



Topics

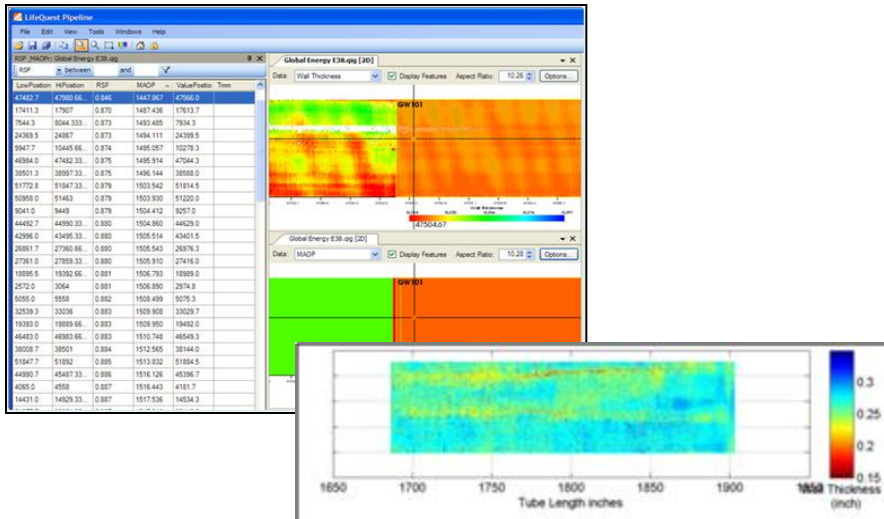
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LifeQuest™ Data Viewer



Level 2 API 579 Fitness-for-Service

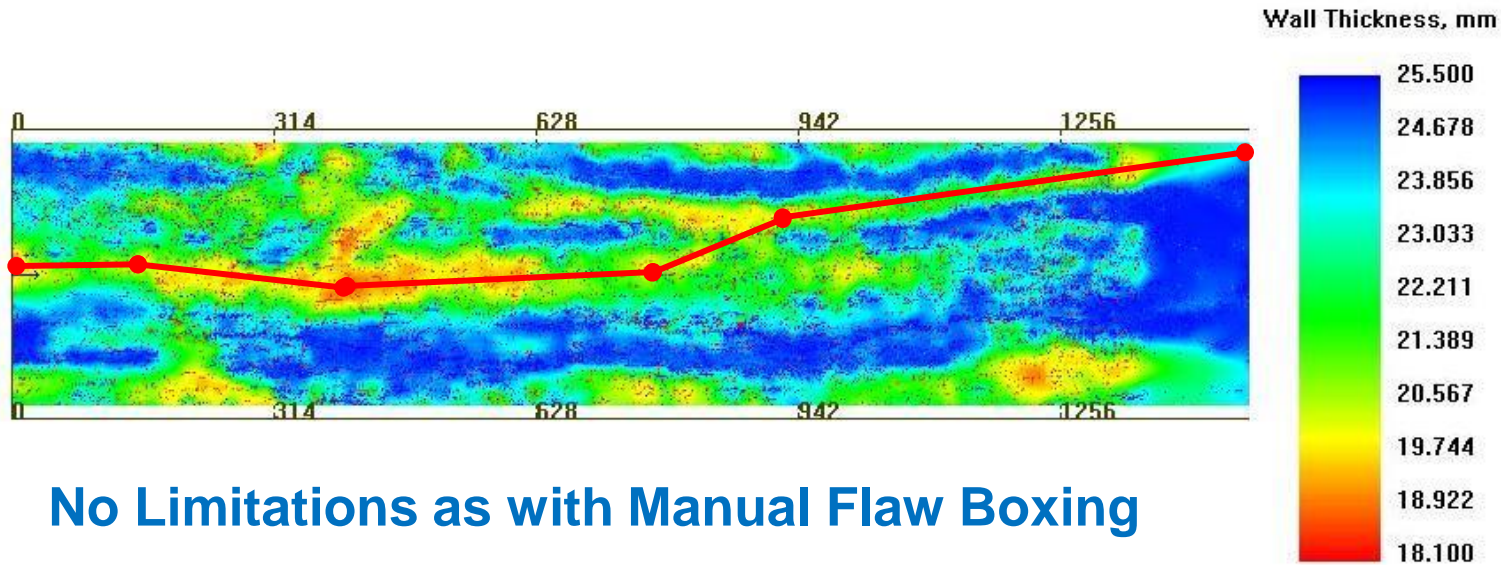
- Section 5 Level 2 API 579 Fitness-for-Service assessment performed on 100% of inspection data
- Remaining strength factor (RSF) and reduced maximum allowable operating pressure (MAOPr) calculated along entire length of pipeline
- Calculations summarized for each section of pipe
- Double-clicking on a row will cause the view windows to interactively pan to that position



Quest Integrity Group - Patent Protected

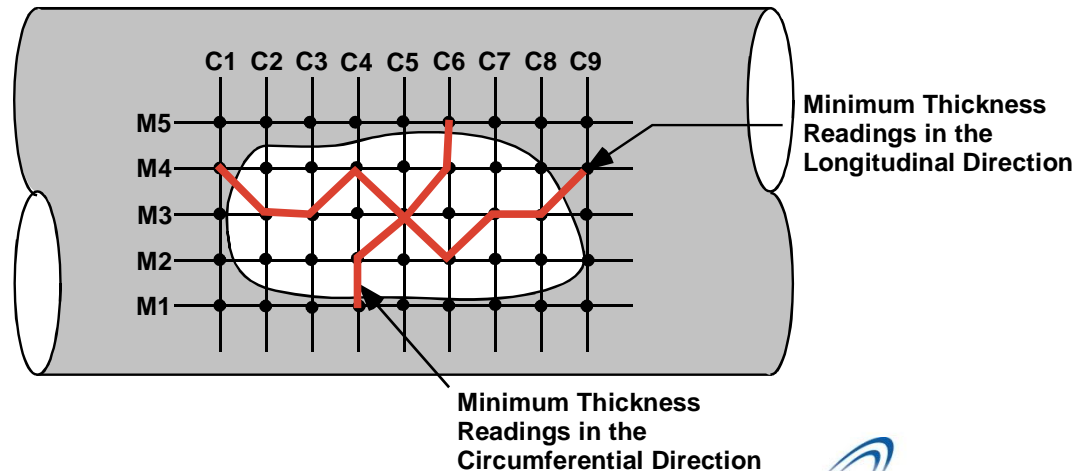


Assessing Your Entire Asset



No Limitations as with Manual Flaw Boxing

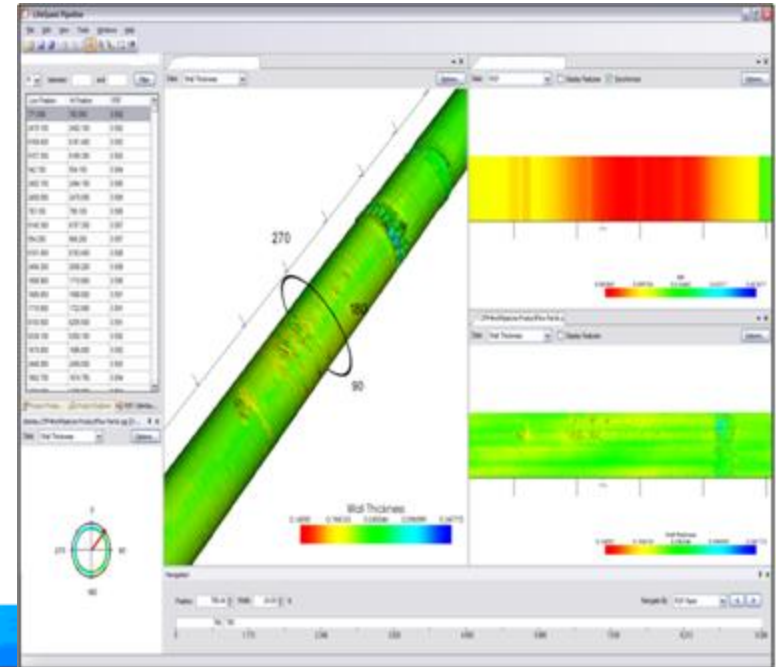
- Obtain thickness data from inline inspection
- Compute RSF at short segments
- Rank corrosion damage over various segments



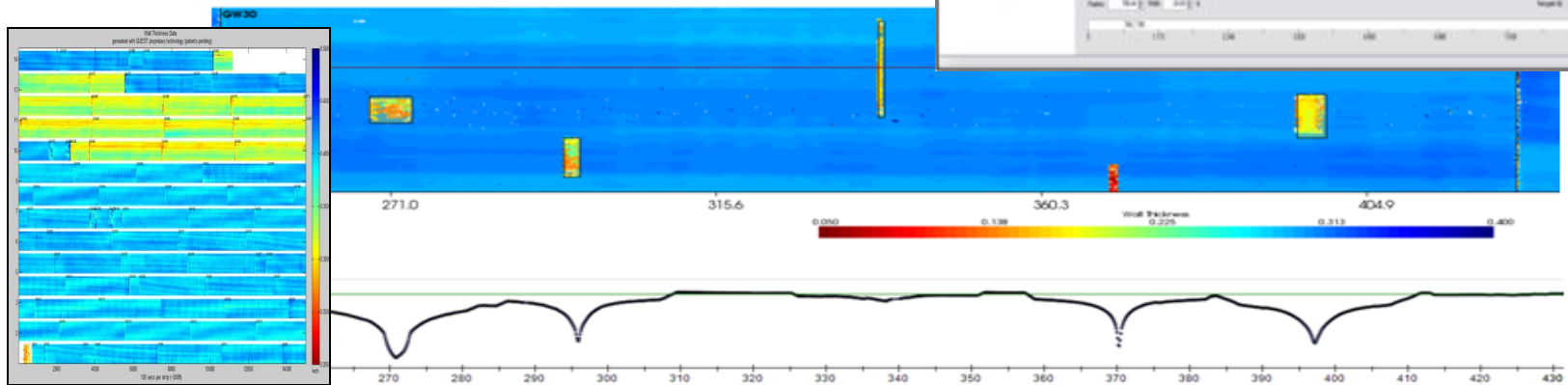
LifeQuest™ Advanced Visualization

Converts ILI data sets into synchronized 2D and 3D views

- Better defect characterization
- Simultaneous visualization of multiple data values
- More accurate defect growth models
- Visualization allows operators to improve mitigation
- Advanced analysis improves Fitness-for-Service assessment



Measured Wall Thickness



Calculated RSF

Deformation Data

LifeQuest Pipeline

File Edit View Tools Windows Help

Features: GlobalEnergy-8inch.qig

ID	Label	Posi	Cir.F	Type
6	GW490	10...	0.00	Girth Weld
7		11...	16...	Dent
8	GW500	11...	0.00	Girth Weld
9	GW510	12...	0.00	Girth Weld
10	GW520	12...	0.00	Girth Weld

Classification

Label: ID 7
 Type: Dent
 Location: External
 Material: User Specified; SMYS = 240
 Notes: Dent

Location and Size

Absolute Position: 11,041.50 in
 Circular Position: 165.0 Deg.
 Length: 5.50 in
 Circular Extent: 38.0 Deg.
 Flaw Depth: 0.117 in

Feature Information

Item	Value	Units
Nominal Thickness	0.2	in
Inside Diameter	8.25	in
Distance to Upstream Girth Weld	0	in
Distance to Downstream Girth Weld	0	in
RSF	0.927	

GlobalEnergy-8inch.qig [2D]

Data: Inside Radius | Display Features | Aspect Ratio: 0.94

183.8 deg

A 5.5" (140mm) dent, 0.117" (4.5mm) depth

GlobalEnergy-8inch.qig [Cross Section]

Nominal Outer Wall Points Exaggeration: 1.0

0 270 90 180

Data Inspector

Item	Value	Units
Position		
Axial Position	1.105E+04	in
Circular Position	334	+/-15 deg
Sensor	50	
Data		
Wall Thickness	NaN	in
Inside Radius	4.054	in
RSF	0.9218	
MAOPr	799.1	psi

Axial Plot

Data: Inside Radius | Measure: Value at Sensor | Sensor: 50

4.2 4.15 4.1 4.05

11010 11020 11030 11040 11050 11060 11070

Position: 11,037.79 | Width: 65.21 in

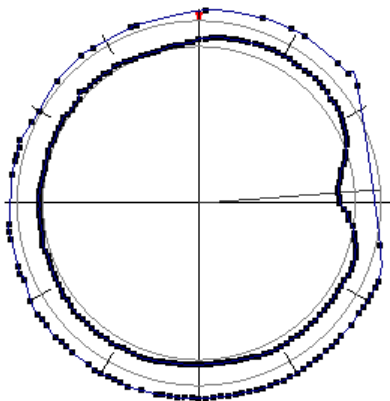
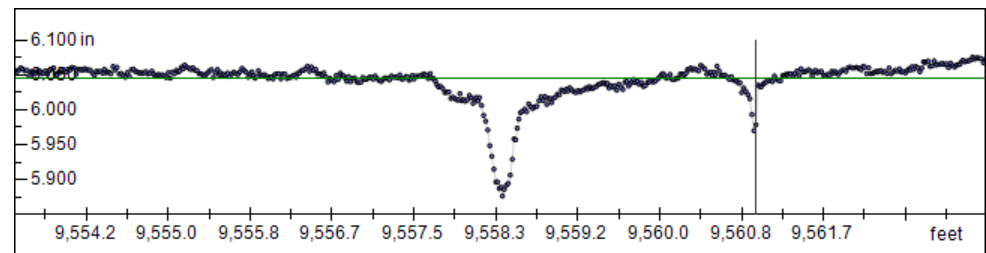
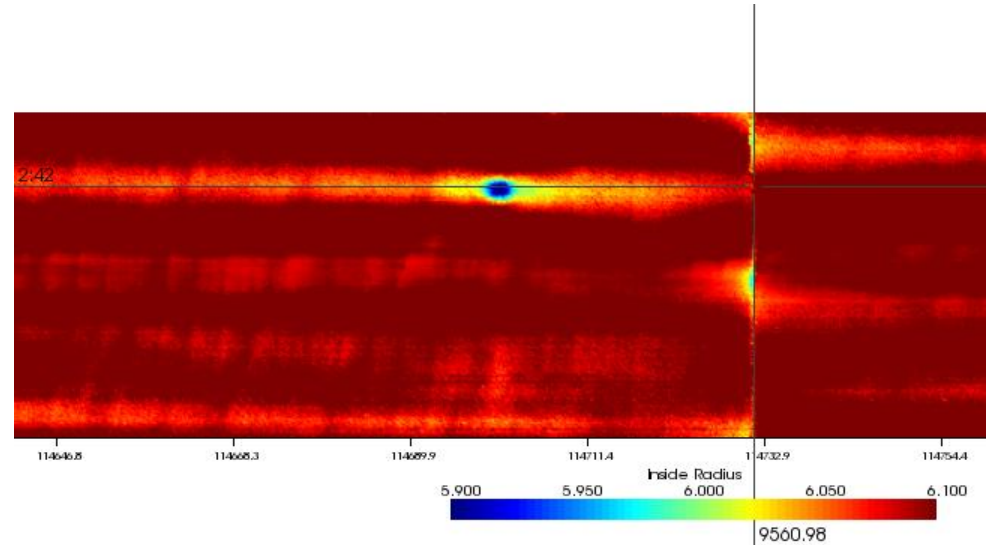
Navigate By: Girth Welds

8,297 in 11,005 11,070 15,190 18,637 22,084 25,530 28,977 32,423 35,870

2% Topside Dent

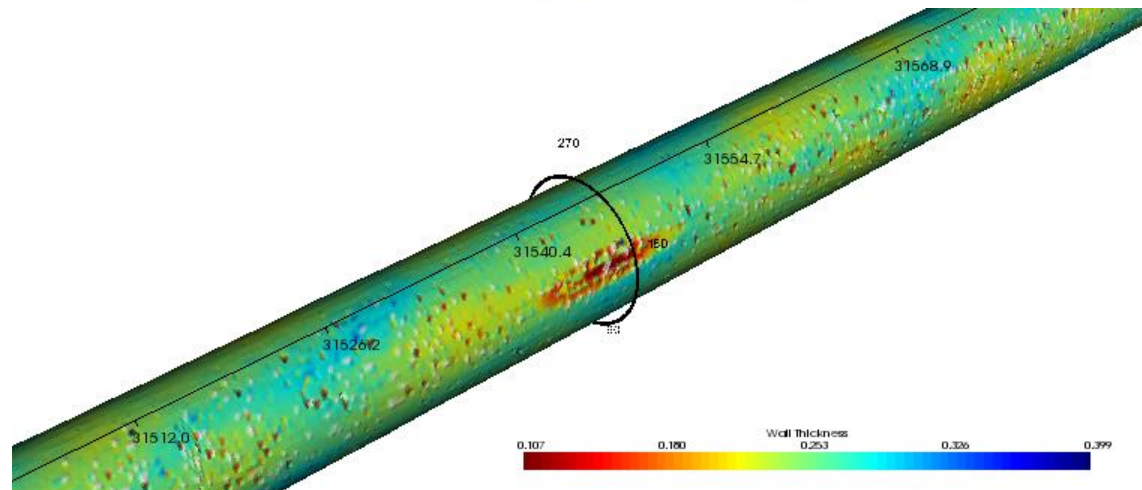
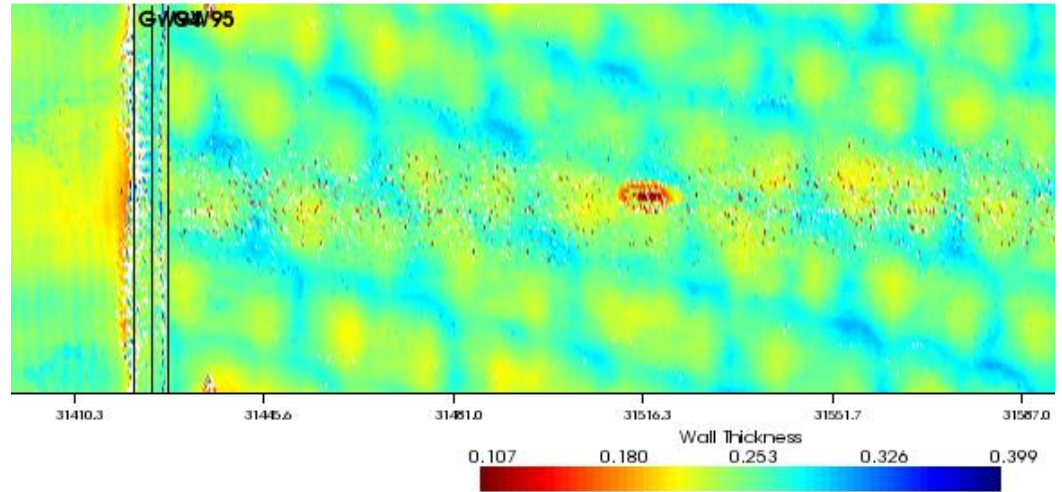


- Inspection of 12" (305mm) petroleum line under streets in a major metropolitan area
- Over 100 dents detected in 3 mile section
- Radius plots of worst dent shown here (~ 2%)
- Dent is located in top half of pipe and thus is a mandatory repair



External Corrosion

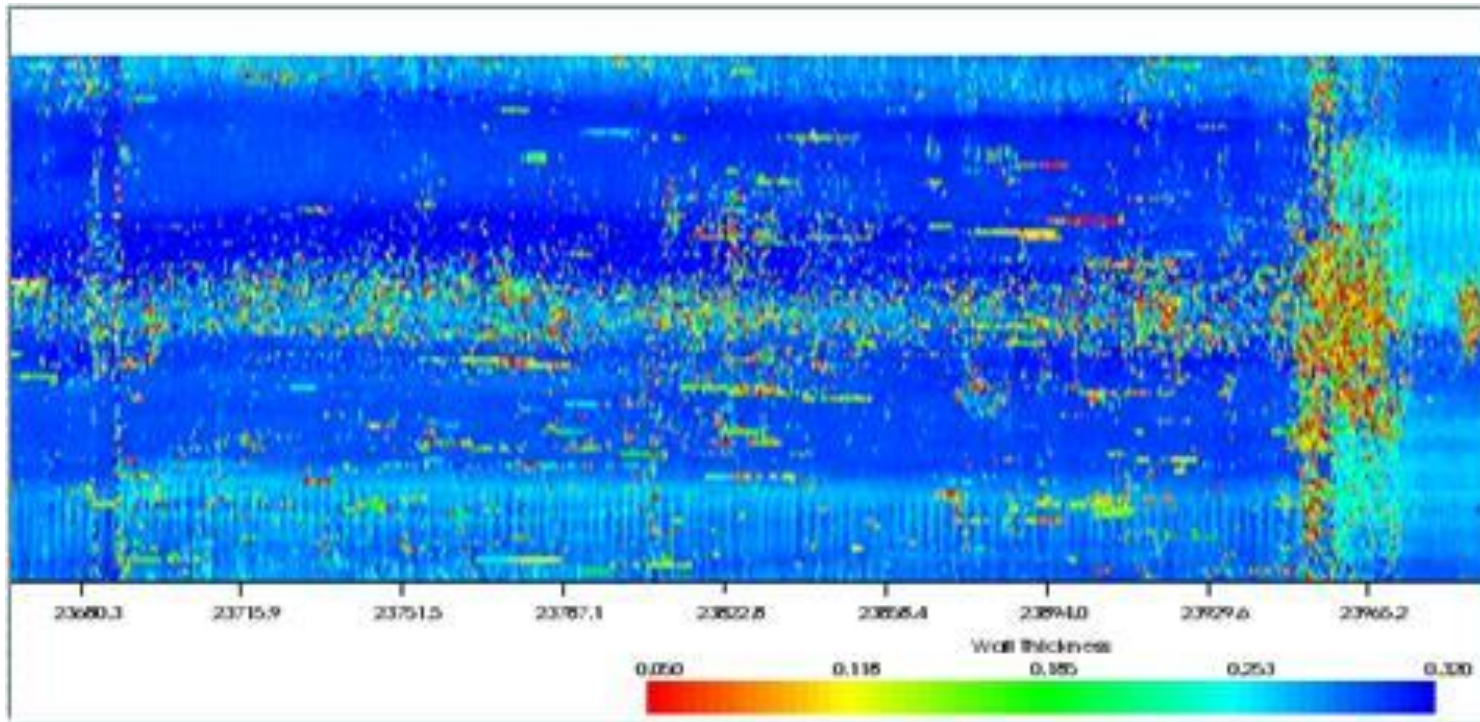
- Inspection of 8" (200mm) wharf acid line
- Remaining wall thickness less than 0.100" (2.5mm).
- Pipe was rubbing on a support.
- Client removed section and verified damage.



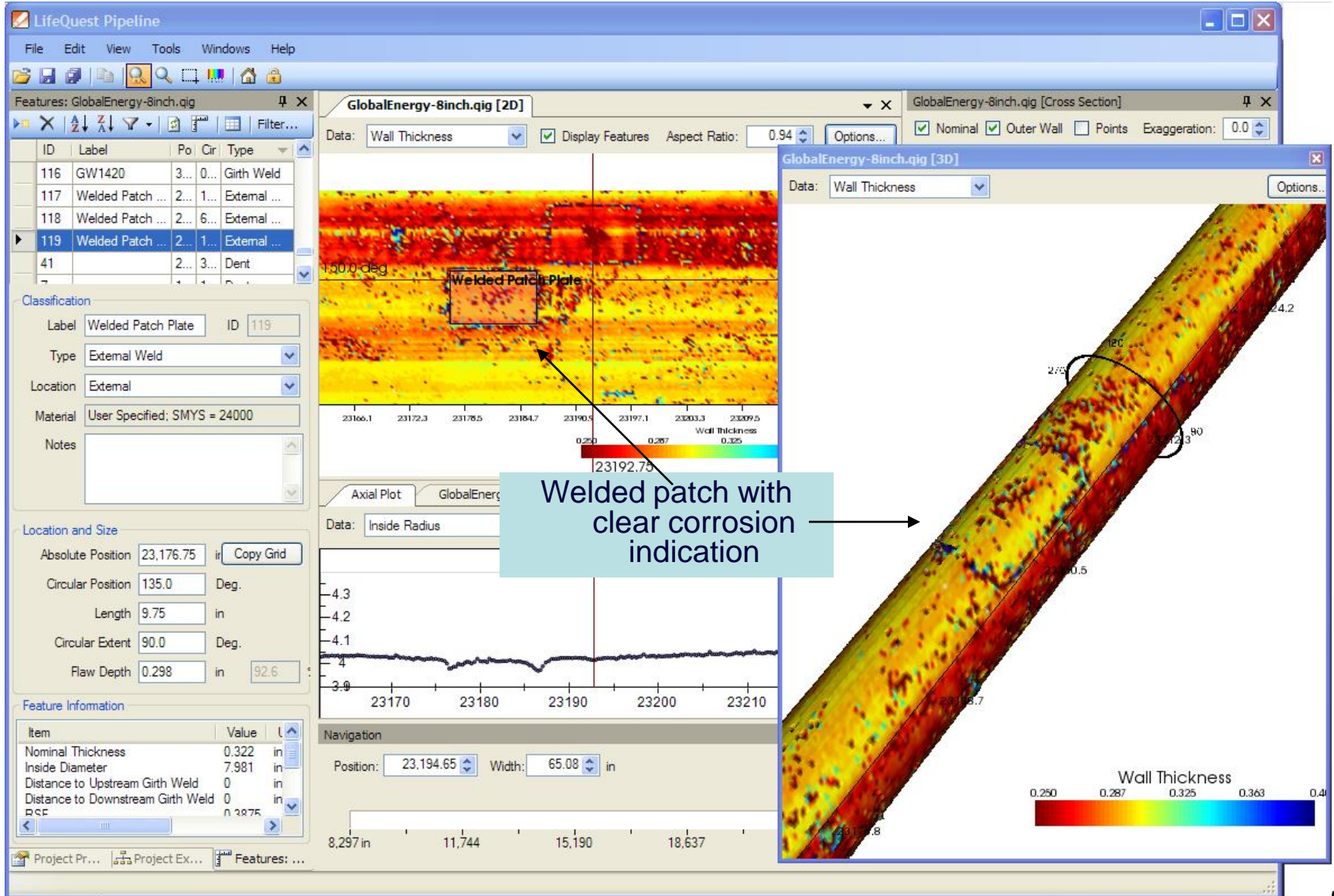
Widespread Corrosion



Representative area of widespread corrosion - over 80% wall loss shown:

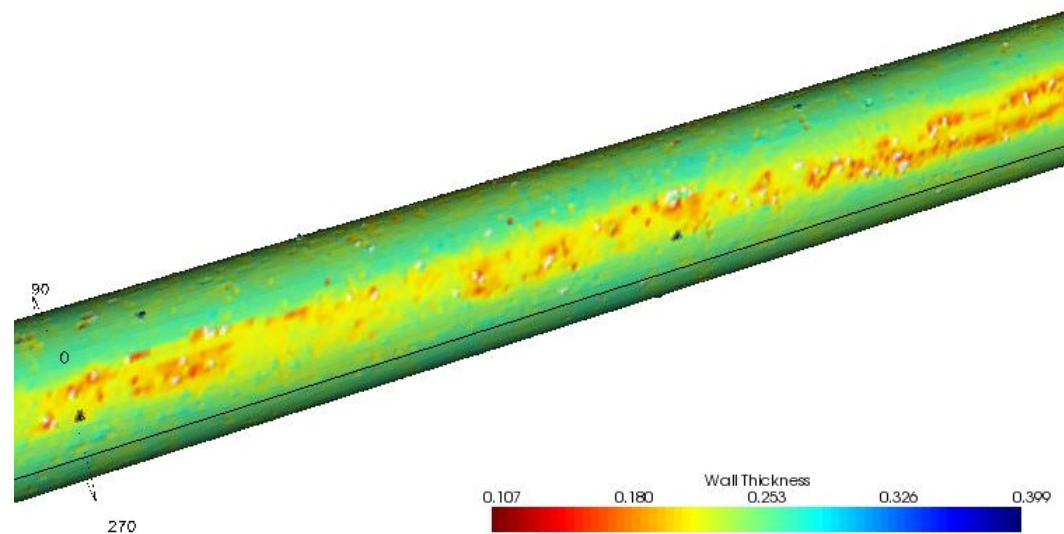
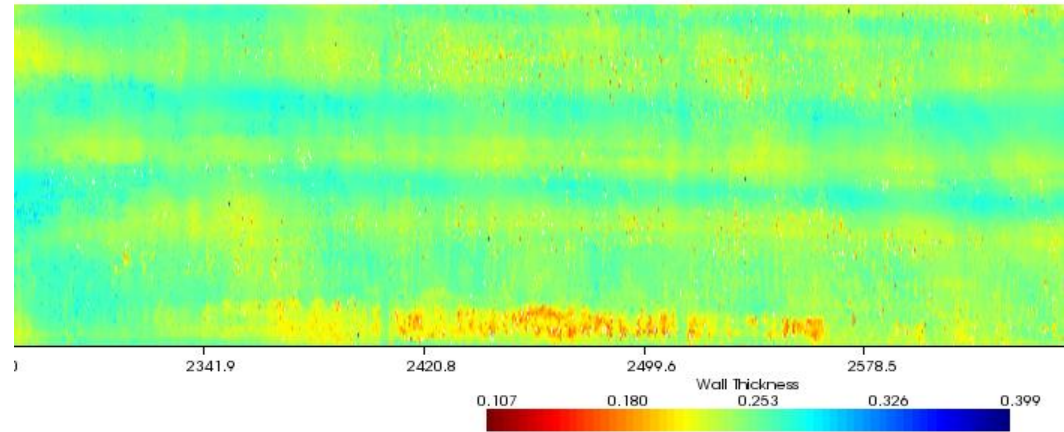


Welded Patch with Corrosion



Road Crossing

- Inspection of 8" (200mm) wharf acid line
- $T_{mm} = 0.163$ in. (4.14mm) (33% wall loss)
- Corrosion is located under road crossing.
- Satisfies API 579 Fitness-for-Service criteria for continued operation at current operating pressure.



New Pipe Transition

The screenshot displays the LifeQuest Pipeline software interface. The main window shows a 2D wall thickness map for a pipe section. A new pipe transition is highlighted in the 2D map, and the cross-section view shows the pipe's geometry. The Data Inspector provides details for the selected position.

GlobalEnergy-8inch.qig [2D]

Data: Wall Thickness | Display Features | Aspect Ratio: 4.40

GlobalEnergy-8inch.qig [Cross Section]

Nominal | Outer Wall | Points | Exaggeration: 0.0

Data Inspector

Item	Value	Units
Position		
Axial Position	2.254E+04	in
Circular Position	338	+/-15 deg
Sensor	47	
Data		
Wall Thickness	0.2477	in
Inside Radius	4.066	in
RSF	0.2233	
MAOPr	320.1	psi

Navigation

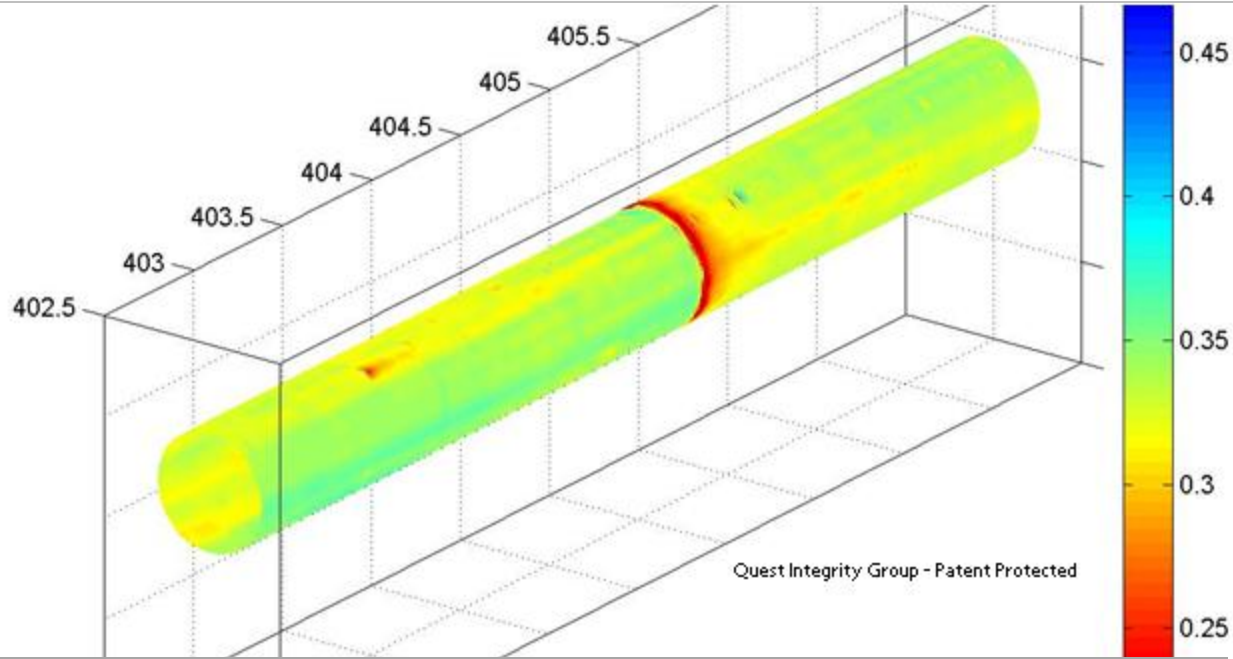
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Navigate By: Girth Welds

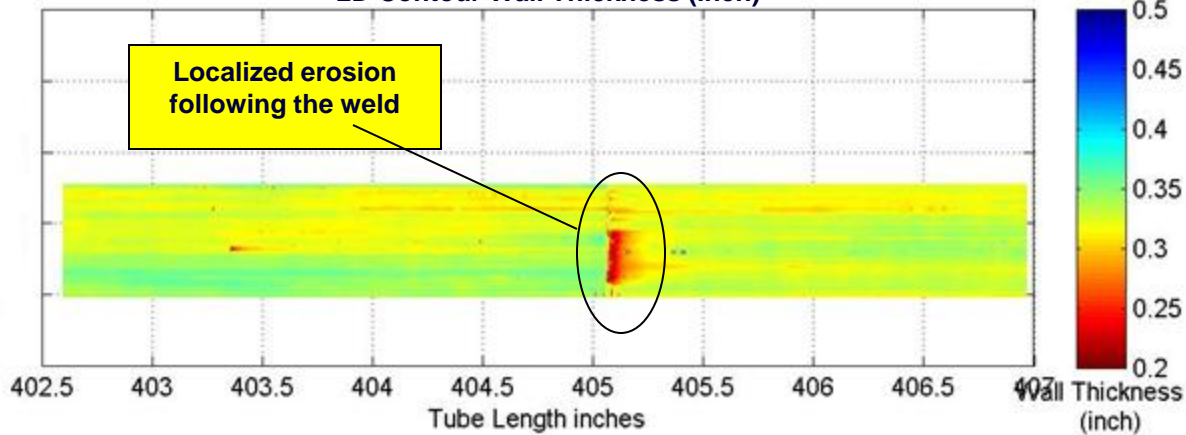
Enter label ID | Find

New pipe to severe corrosion transition

Excessive Weld Penetration & Erosion

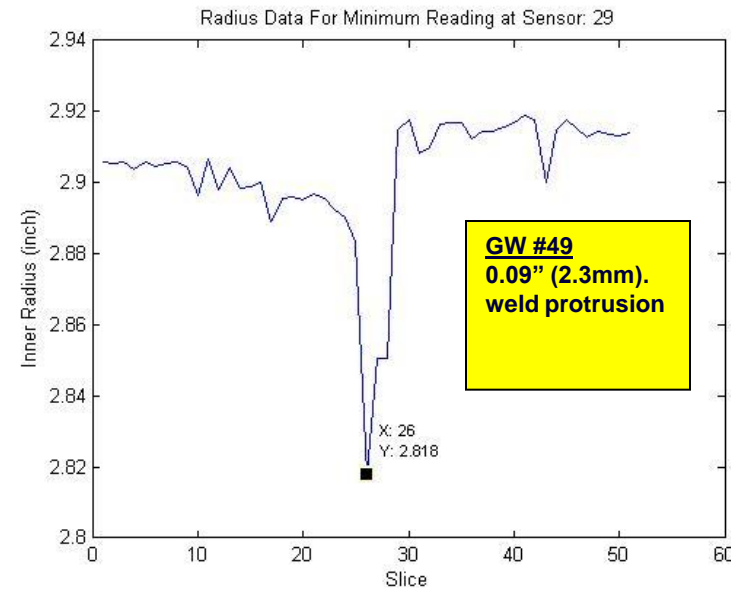
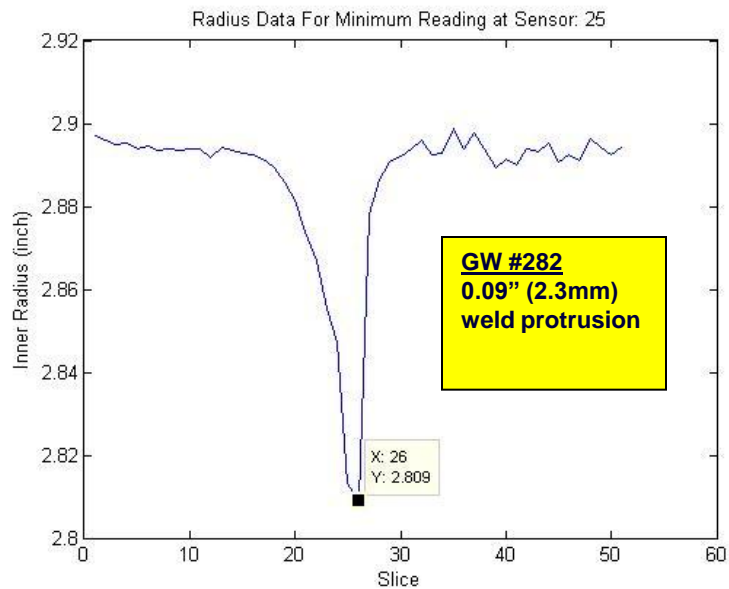
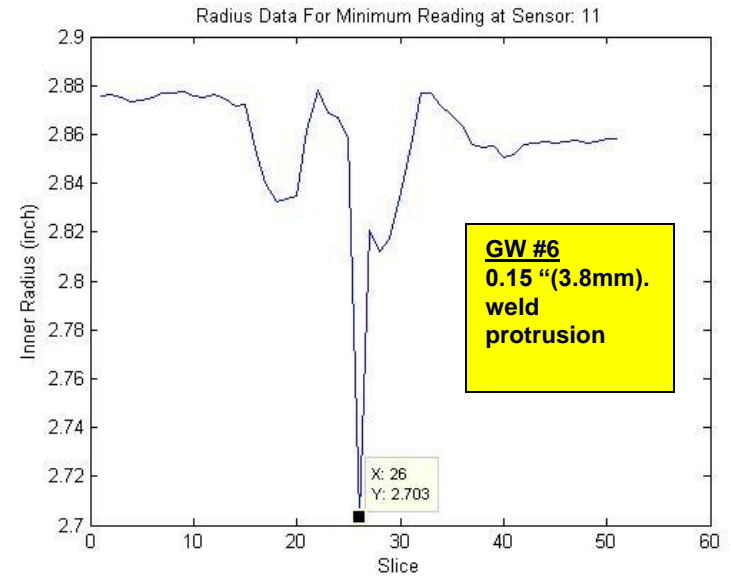
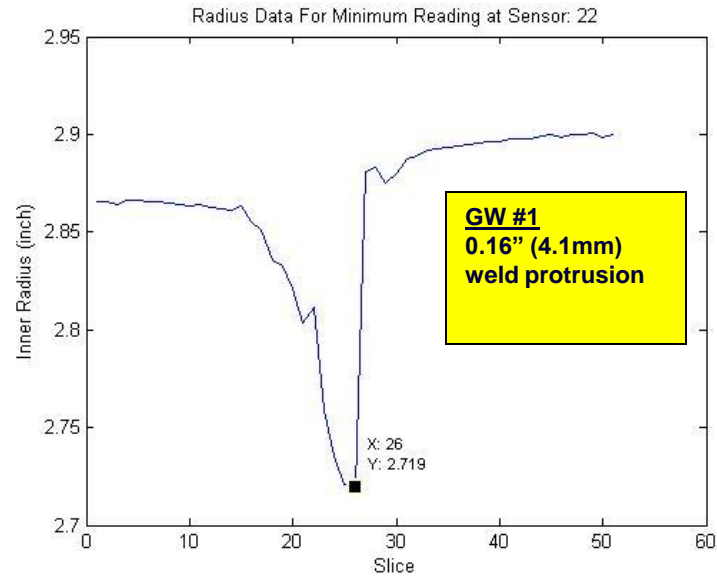


2D Contour Wall Thickness (inch)



Quest Integrity Group - Patent Protected

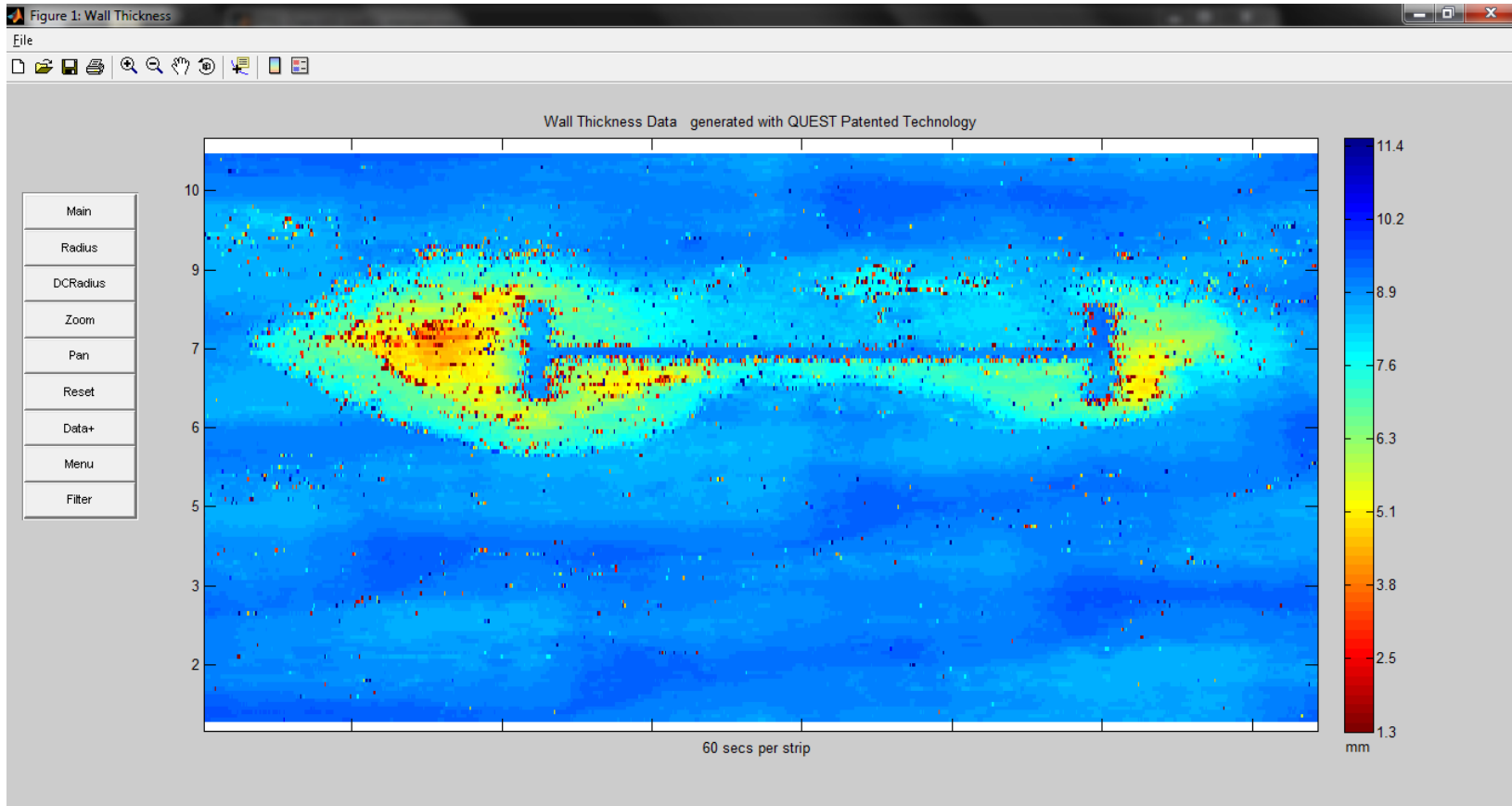
Special Weld Penetration Analysis



Pipeline supports



Pipeline supports



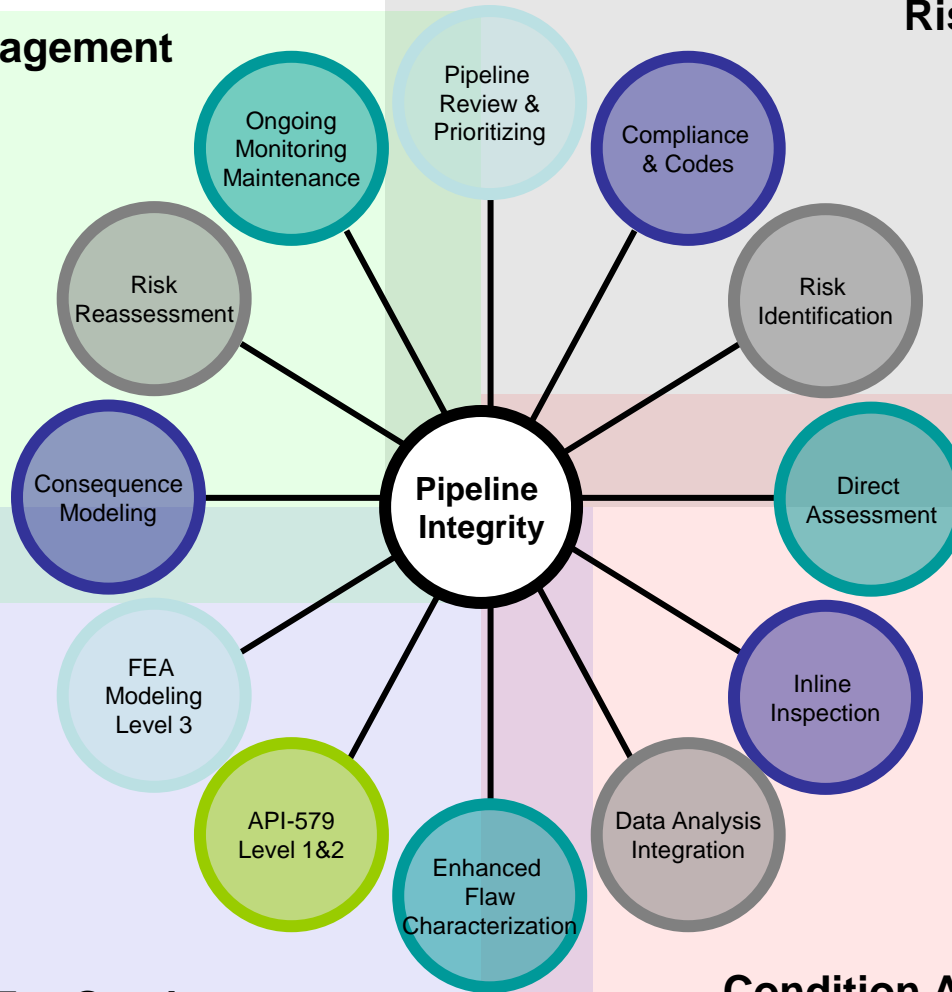
Topics

1. Introduction
2. InVista™ Inspection Solution
3. InVista™ Comparisons
4. LifeQuest™ Data Viewer
5. Conclusion

Collaborative Engineering Solutions

Risk Based Inspection

Life Cycle Management



Fitness-For-Service

Condition Assessment

Helping the Unknown Become Known

In Summary:

1. InVista™ ultrasonic inline inspection overcomes challenges associated with pipelines that until now have limited the capabilities of conventional pigging systems.
2. LifeQuest™ data delivers more actionable and timely information that is as reliable and regulatory credible when **compared to** today's cumbersome, conventional analytical approach.
3. Quest Integrity Group offers an unmatched global pool of engineering talent, cutting-edge assessment technologies, and a culture of client responsiveness, understanding and **professionalism**.



InVista™ Gives You Options

and finally.....



*Thank you for your attention.
Enjoy the rest of the PPSA
event.*

QUEST

PIPELINE RESOURCES
Asset Longevity | Pipeline Performance

