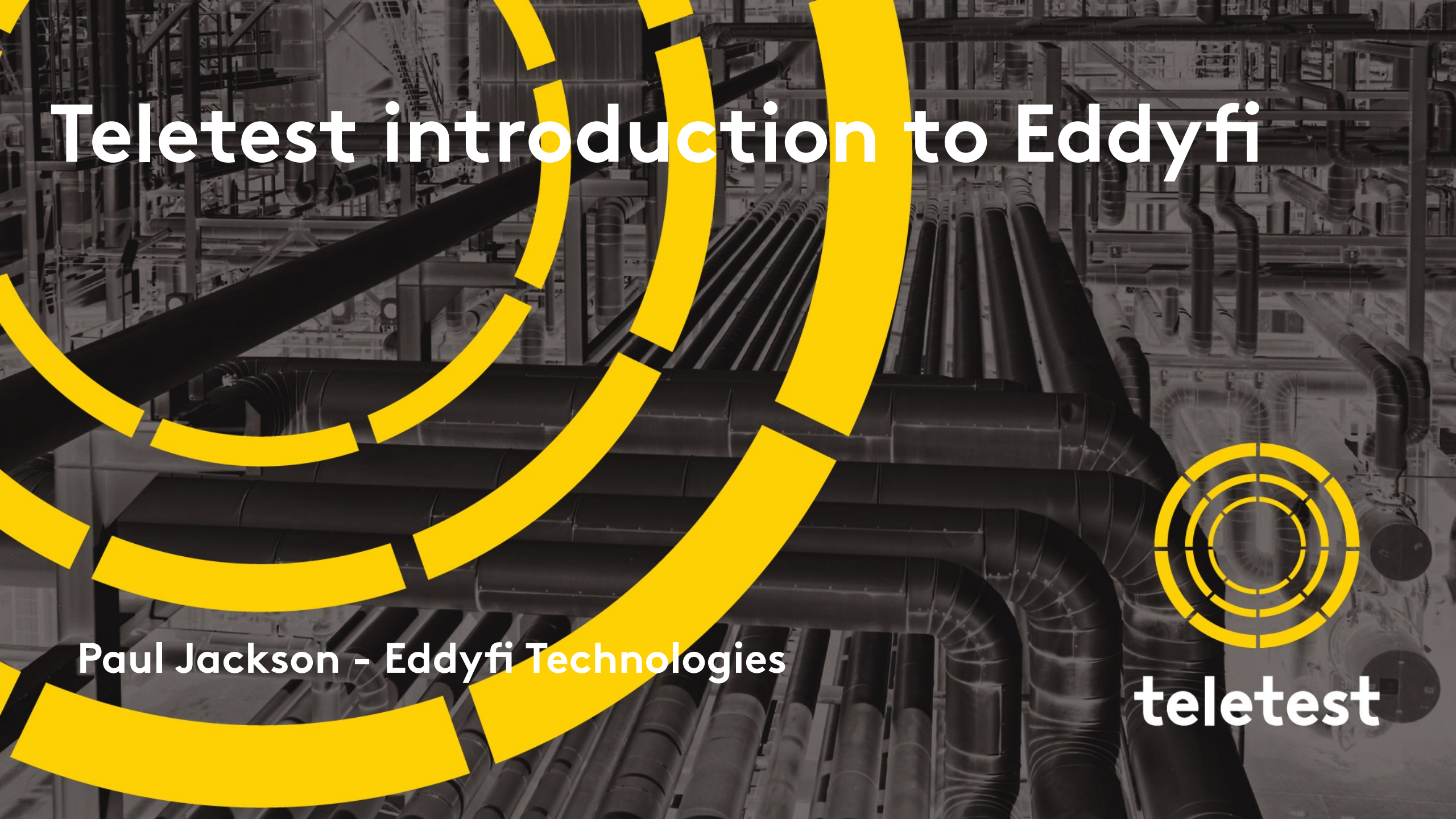
Teletest introduction to Eddyfi



Paul Jackson - Eddyfi Technologies

teletest

Teletest – 4th Brand for Eddyfi Technologies

teletest

TELETEST FOCUS+

October 2017

Eddyfi - Teletest

- Long Range Ultrasonic Testing
- Guided wave ultrasonics
- Involved in all aspects of Teletest
  - Manufacturing
  - Sales
  - Support services
  - R&D and bespoke solutions
  - Training
- Originally developed by TWI

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Guided Waves on Pipelines

- Low frequency Ultrasound (20-100kHz)
- Developed for Corrosion Under Insulation
- First introduced into the market in 1997 by TWI Ltd
- Established method for screening pipelines

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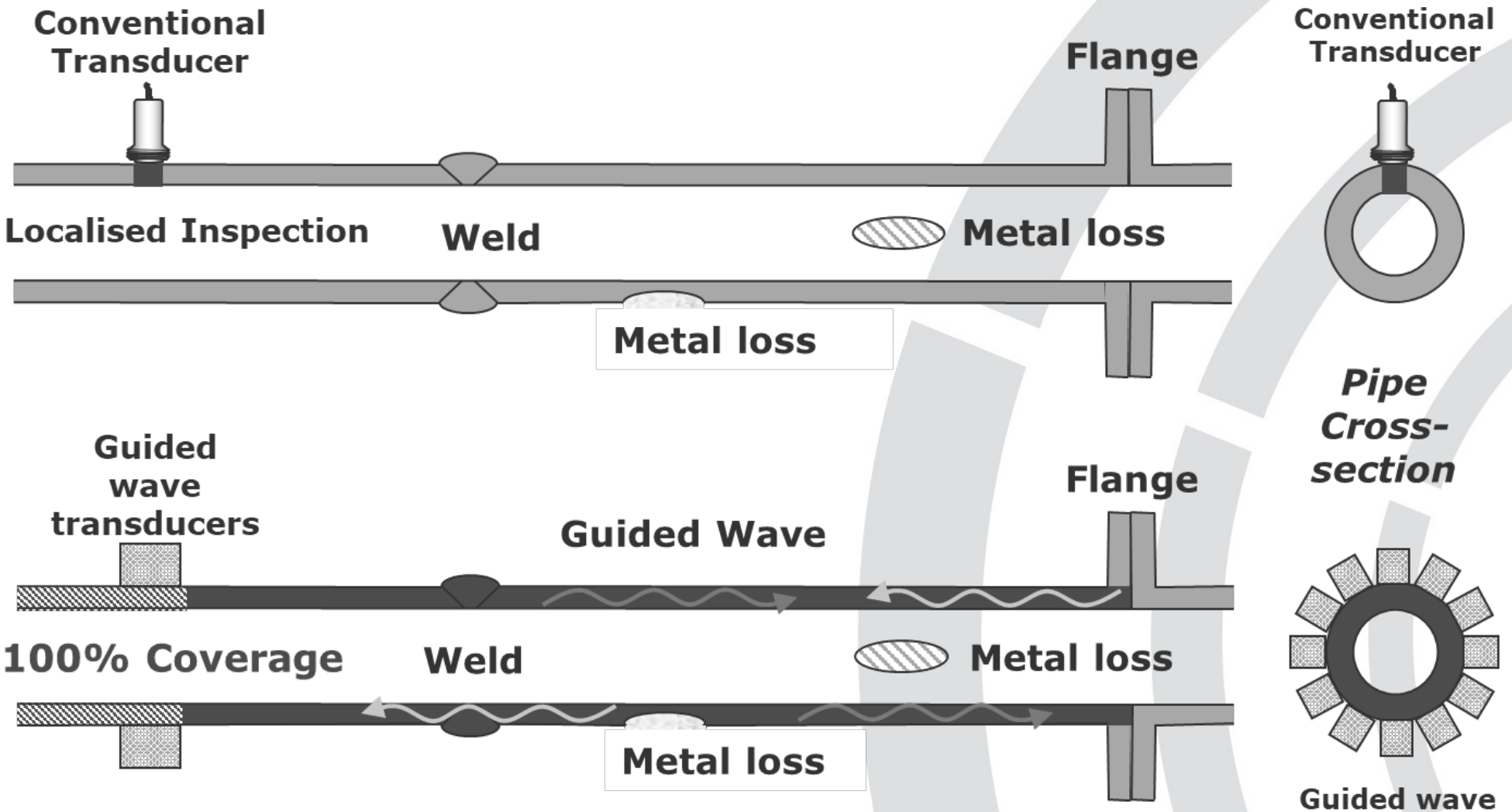
Guided Waves Offers

- 100% volumetric inspection over 10s of metres from one tool location.
- Rapid screening for in-service degradation,
- Reduction in costs of gaining access
- Avoidance of removal/reinstatement of insulation or coating, except at location of transducer tool
- Ability to inspect inaccessible areas i.e. clamps and cased or buried pipes

Conventional UT vs. LRUT



Pipe Cross-section

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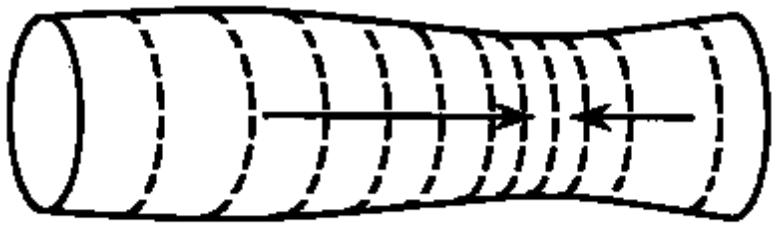
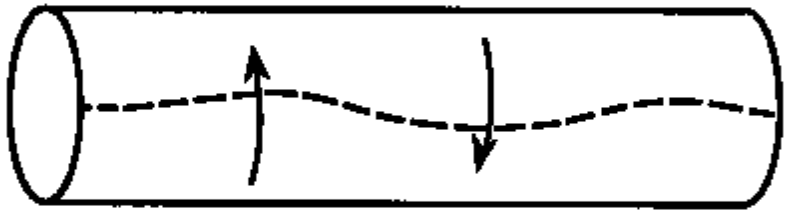
Wave Modes in Pipes

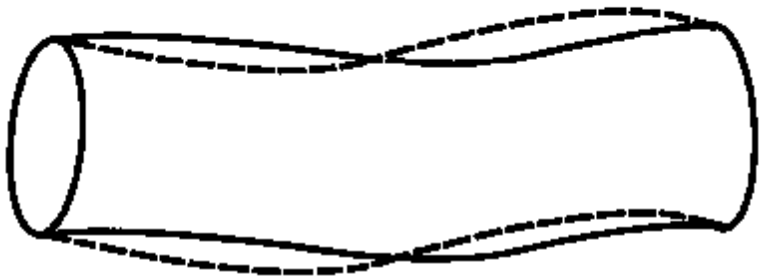
Longitudinal



Torsional



Flexural



How GWT is Performed

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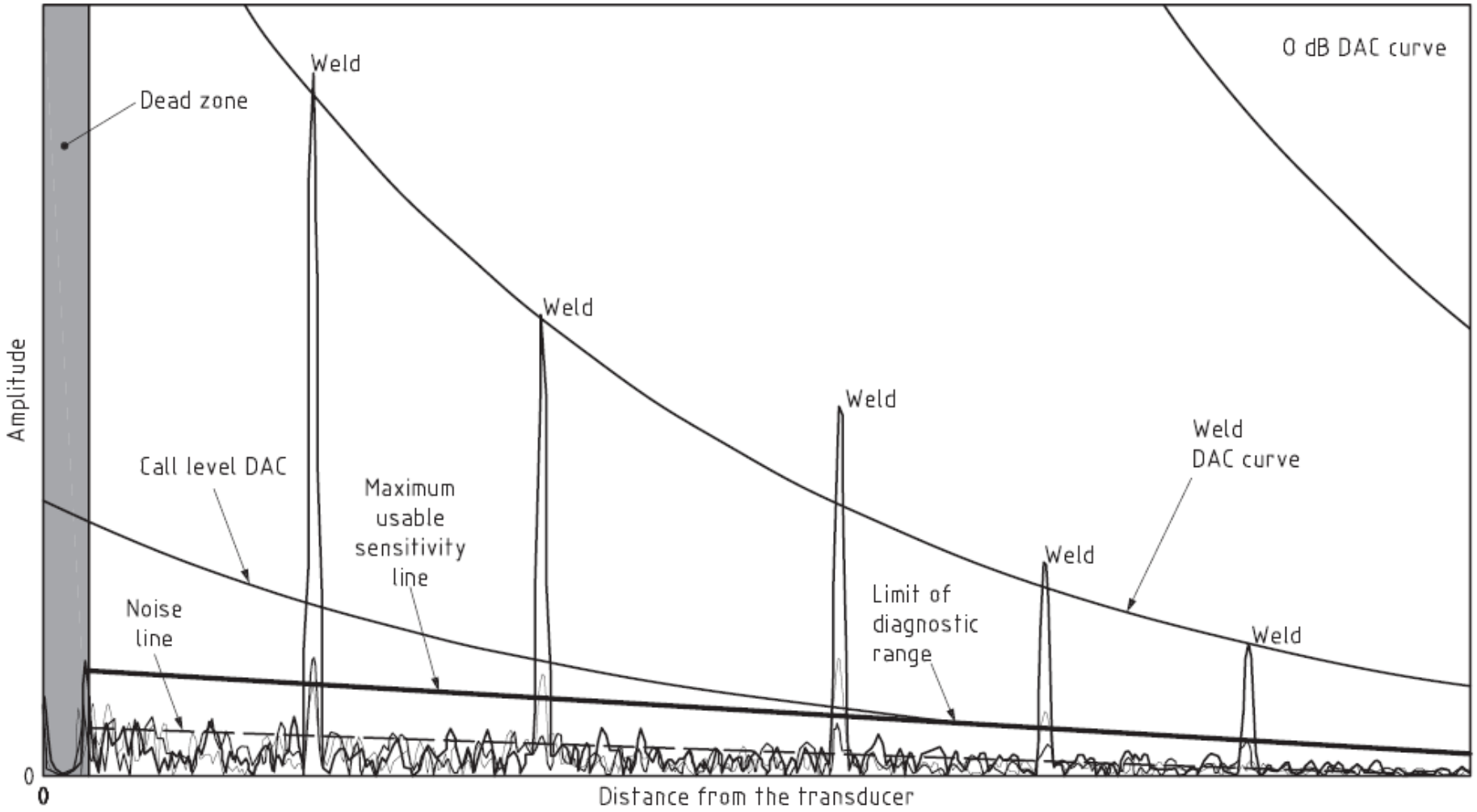
Test Data – A-scans



Source: BS 9690-2

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Detection

- Detection of internal or external metal loss

- Sensitivity
  - - Metal loss down to 3% of pipe wall cross-section
  - - Reliable detection of 5% metal loss flaws
  - - (equivalent to 5% amplitude reflection)

- Discrimination between flaws and pipe features; welds, bends, supports, etc.

- Longitudinal accuracy better than ±100mm

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Limitations

- Large volume of material examined from a single point has high POD of detection but limits sensitivity and resolution
- Pipe conditions (particularly coatings) and geometry influence test performance
- Currently no means of providing flaw sizing from GWT which can be used to determine fitness-for-service (R&D)

Currently a screening technique

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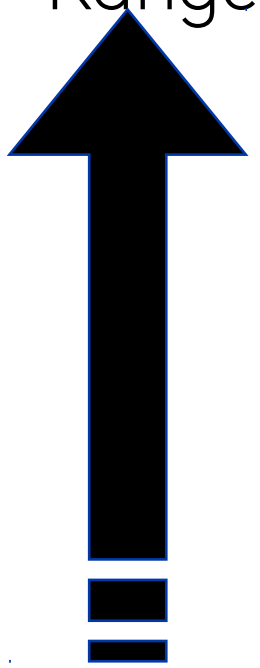
Performance Summary



Long Range

Short Range

Surface condition	Geometry	Contents
Bare metal	Straight lengths	Gas
Smooth well bonded paint		
Fusion bonded epoxy	Attachments/ Brackets	Liquid
Light pitting		
Heavy pitting		
Plastic, e.g. PVC	Branches	
Buried (earth or sand)		
Bitumen coated	Multiple bends	High viscosity
Concrete coated	Flanges	

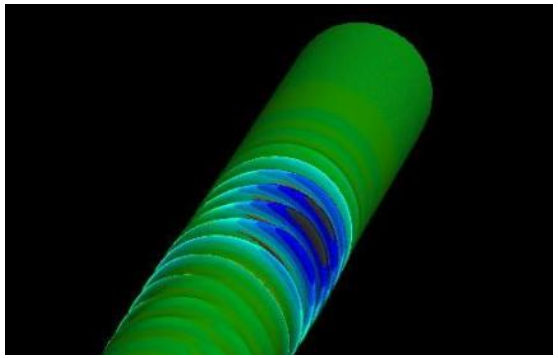
Applications

- Road and river crossings
- Power plant tubing
- Risers
- Offshore topsides pipework
- Jetty lines
- Refinery pipework
- Chemical plant pipework
- Tank farm link lines
- Sphere legs
- Pipe bridges
- Spiral welded pipe
- Austenitic stainless steel
- Nuclear Boiler spines

Teletest Focus+ State of the Art

- Practical – User friendly unit and collar design for fast inspection

- Focusing – Simple identification of defect distribution around pipe circumference (secondary phase
  ıg)



- Multimode – Longitudinal and torsional wave modes on one tool

- Wi-Fi data collection
- On-site report capability

Teletest Features

- Diameters – 1.5" to 48"
  - up to 78" with three collar link up
- 100% volume of pipe wall inspected
- Test Range
  - Typical ±30m above ground
  - Ideal conditions ±180m been achieved
- Productivity
  - Data collection minutes
  - Typical 10 locations per day
  - Under ideal conditions 3km has been achieved
- Standard Service Temperature up to +120°C
- High temperature equipment to 350°C

Teletest Focus+ Unit

Most advanced on the market:

- Unique 24 transmit Channels
- Wireless
- Integral battery
- 12 hours site operation on 1 charge
- Unique Integral air pump
- Status LED's for communication
- Rugged carry bag and accessories

Collar Design

- Robust composite construction
- Integrated clamp and bladder
- Collars link for >24″ up to 48″

- 78″ with special procedures
- Multimode
- Lightweight
- Cost efficient

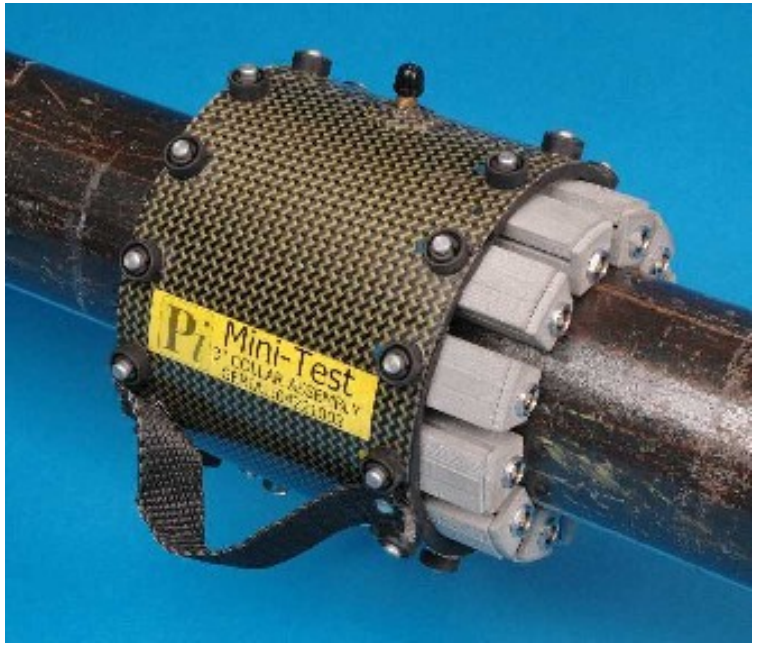
Large Collar Sizes

- Daisy linked collars:
  - For pipe between 26″ and 48″
  - Combination of two multimode collars
  - Three collars to 78″

  - Use of a special dedicated kit comprising 4 rollers, a air hose splitter and a special bridge to install between collars

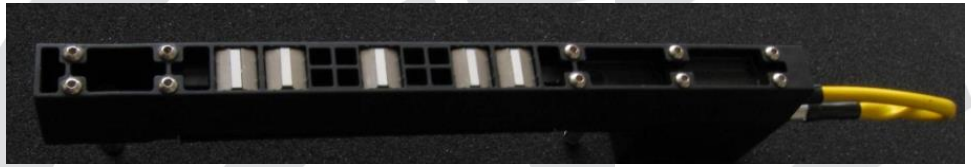
Minitest

- 1.5-6” Diameter Pipes
- Racked pipes close together
- Limited access
- Single mode either longitudinal or torsional
- Lightweight design and easy packing
- Modular
- Versatile for non-ASME pipe sizes



Torsional Only Modules

- 3 Ring torsional only modules
  - 3rd Ring Provides 66% greater sound energy



- 5 transducers at 2 spacings
  - 30mm
  - 45mm
- Provides broad frequency range for inspection

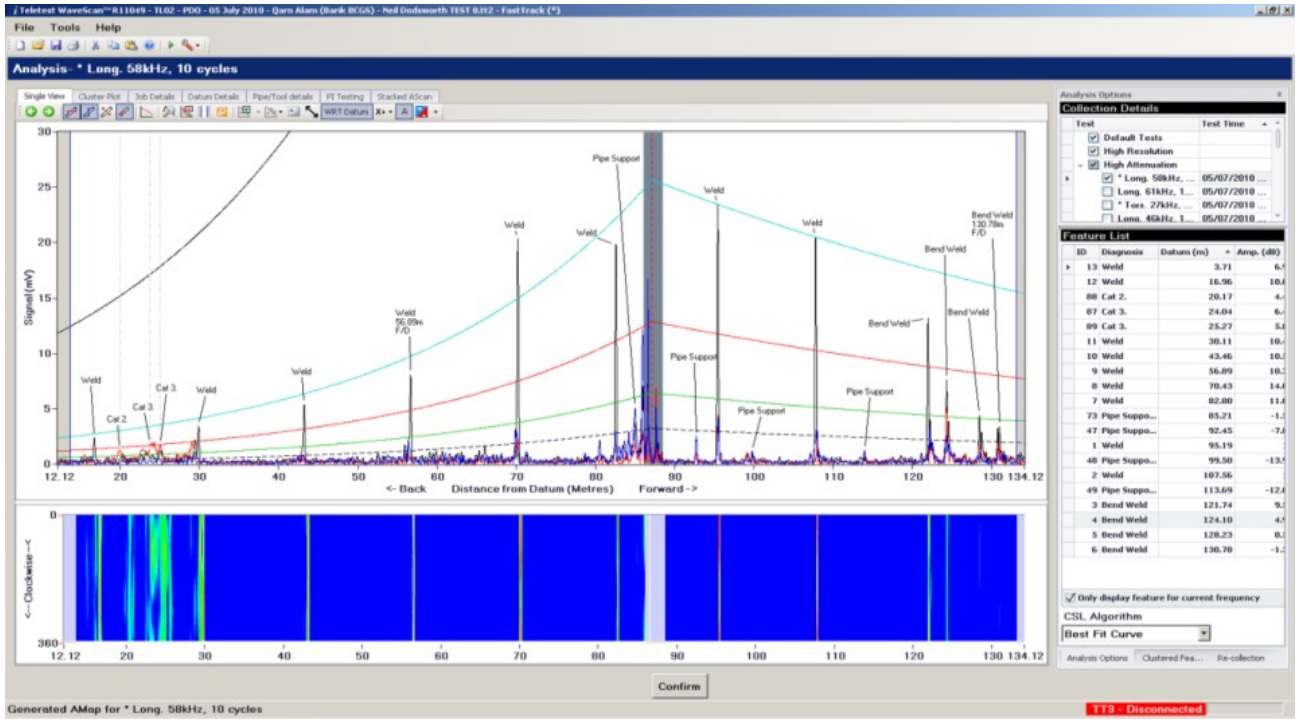
- Specifically for lines unsuitable for Longitudinal
  - Liquid filled lines
  - Thick pipes

- Proven better penetration over 2-ring

- Only Teletest can do this

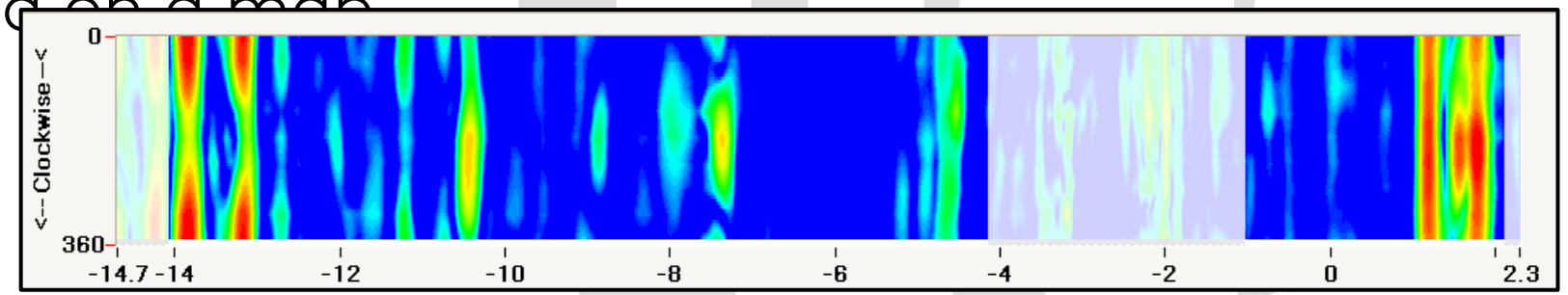
Fast Track Software

- Automated set-up
- Fast and reliable defect detection
- Multimode
- Simplified Analysis
- On-site MS Word report generator
- <5 min data collection time/location
- Focussing only 1-click



C-Scan to Complement A-scans

- Also called synthetic focussing
- Single wave mode transmitted
- Pipe features cause mode conversion
- The collection of reflected modes is analysed
- The inferred location and extent of features is presented on a map



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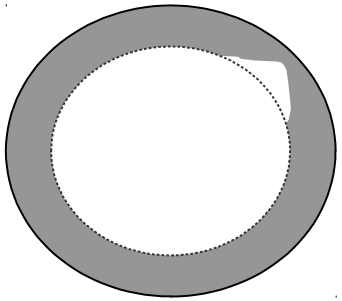
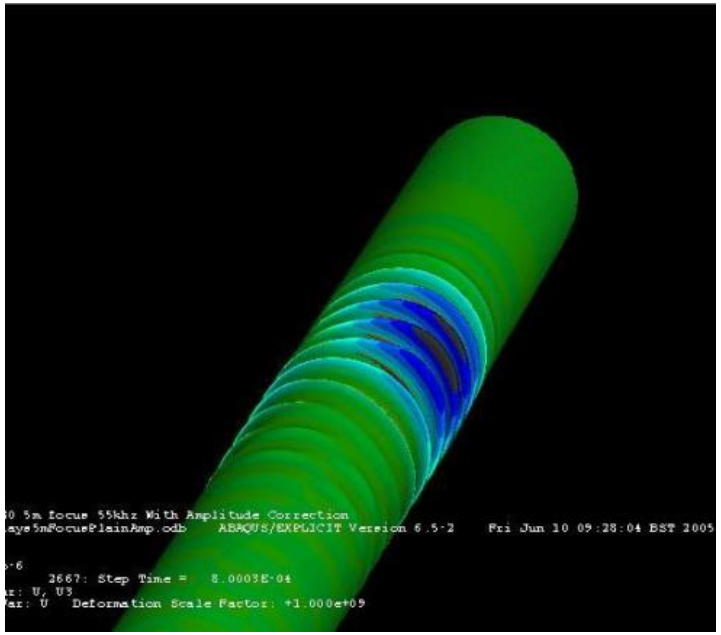
Secondary Focusing

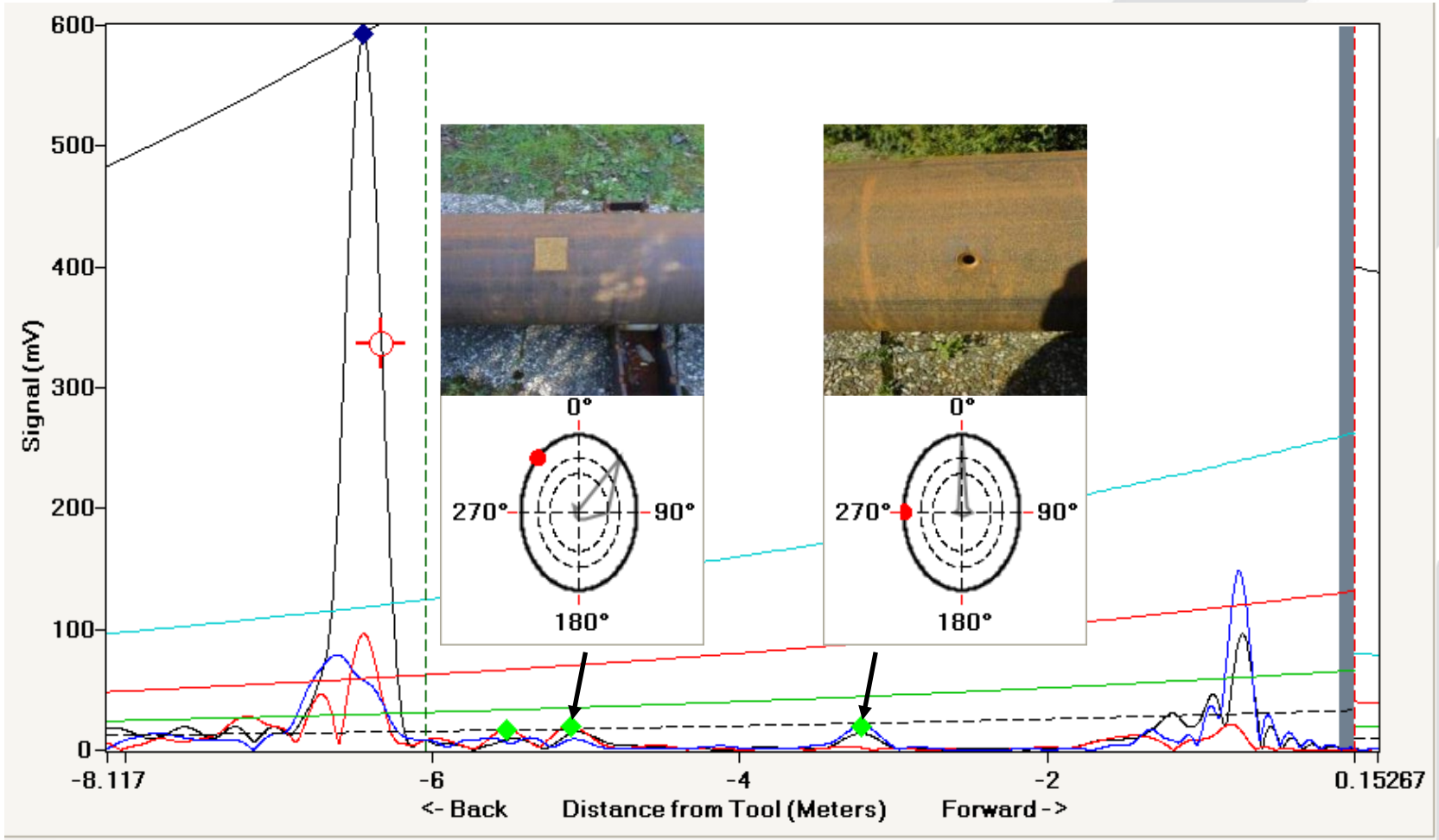
Focusing allows the energy to be concentrated where the defect is, increasing sensitivity and giving position and size information

- Sound energy concentrated in one region
- Focus results link directly to Report Manager
- Rotation 8 times around pipe
- 4 times greater sensitivity
- Multi defect focus capability





Focusing



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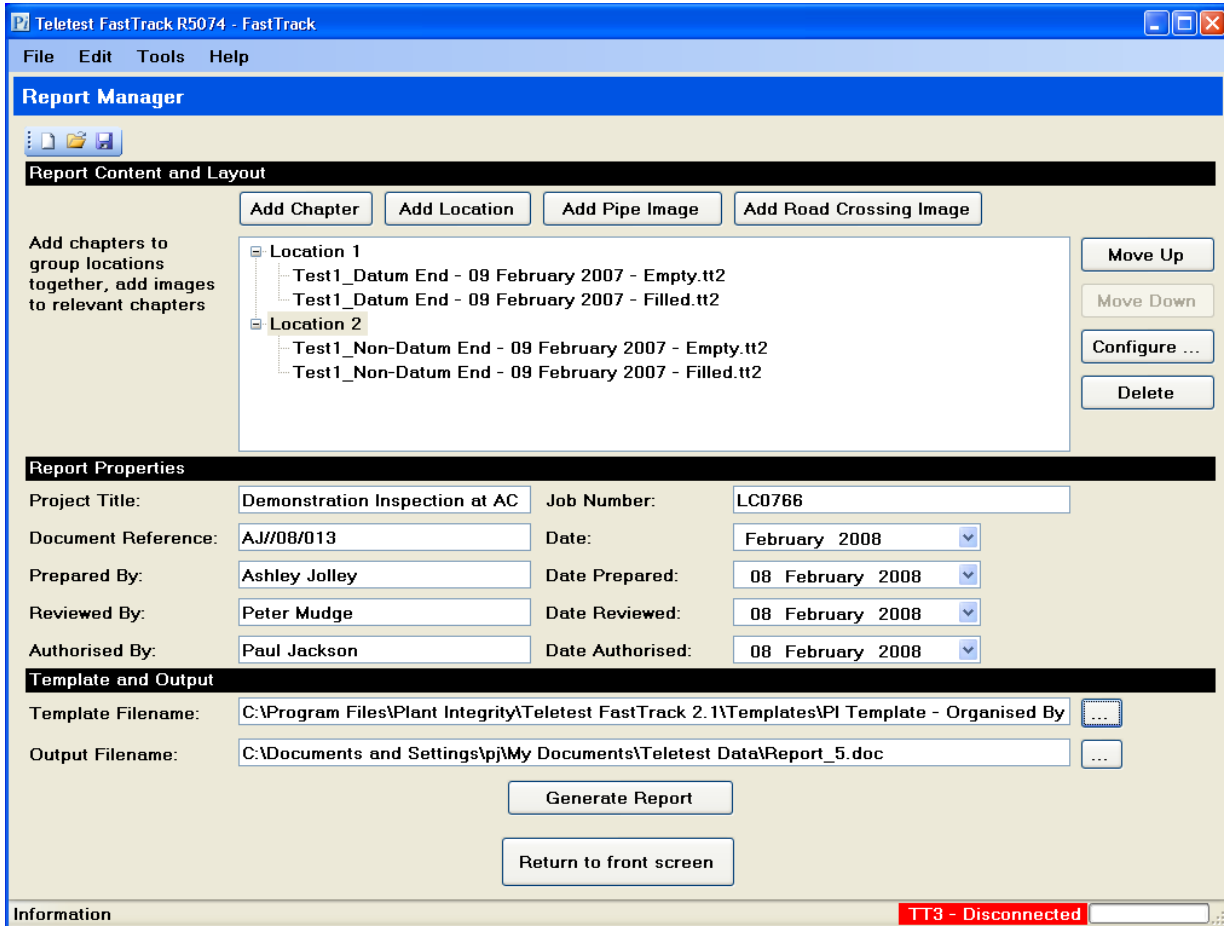
Report Manager Generator



- Increase speed of reporting
- User friendly interface
- Microsoft Word document
- Fully editable
- Various templates for different reports

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GWT Training and Certification

- CSWIP Independent Certification

- Level 1,2 and 3
  - Level 1 - 80 hours
    - aim 40 hours distance learning
  - Level 2 – 40 hours

- Compliance with ISO 9712 (1)

- Manggement and Technician LRUT Training

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International Standards

Teletest is compliant with all international standards

- BS 9690:2011 Parts 1 and 2 Guided Wave Testing
- API 570:2009 Paragraph 9.2.6 for buried piping inspection methods
- NACE RP 0502 Appendix B
- ASME Boiler & Pressure Vessel Code - Section V ARTICLE 19 - Guided wave testing method for piping
- PHMSA Guidelines (18 point checklist)

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Tank Farm Pipework

Ideal for application of guided waves:

- Long lengths of pipes
- Insulated line
- Link lines
- Jetty line inspection
- Bund wall penetrations
- Culvert Inspection
- Road crossings

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Refinery Pipework

- Corrosion under Insulation
- Corrosion at simple Pipe-supports
- Hot pipe inspection – max 350°C
- Inspection of elevated pipe
- Flare line inspection
- Jetty pipe work

Eddyfi Technologies teletest

Eddyfi Technologies teletest

Offshore Applications

- Corrosion under insulation
- Riser inspection
- Deck penetrations
- Splash zone inspection
- Fretting on Caissons
- Caisson inspection
- Top side pipework
- Seals for deck hatches and fire seals

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Other inspections

- Road Crossings
- River Crossings
- Transmission lines
- Unpiggable pipelines
- Buried pipelines
- Insulated Sphere legs
- Air-soil interface

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Tank Farm Pipework

Ideal for application of guided waves:

- Long lengths of pipes
- Insulated line
- Link lines
- Jetty line inspection
- Bund wall penetrations
- Culvert Inspection
- Road crossings

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Case Study – Jetty Lines

Ideal for application of guided waves:

- Inaccessible without scaffolding
- Insulated line
- Salt water can provide corrosive environment
- None piggable due to close proximity of bends
- 100% inspection between scaffolding possible

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Case Study – Jetty Lines

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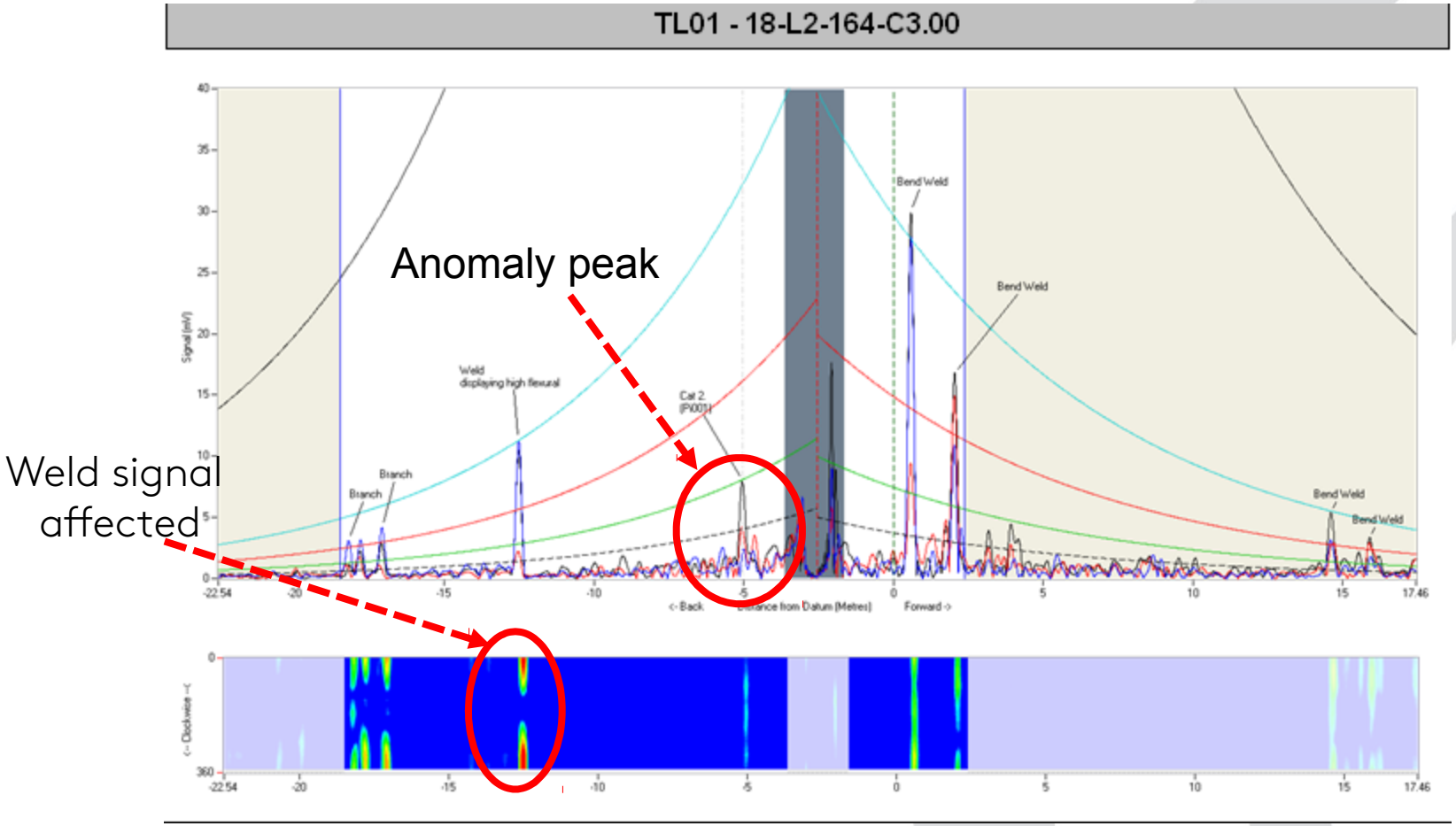
Jetty line – A scan and Map



A-Scan of Jetty line with corrosion area

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Corrosion found at 180°

This area of corrosion was approximately
1 meter in length and 35% wall loss

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Refinery Pipework

- Corrosion under Insulation
- Corrosion at simple Pipe-supports
- Hot pipe inspection - 240°C
- Inspection of elevated pipe
- Flare line inspection
- Jetty pipe work

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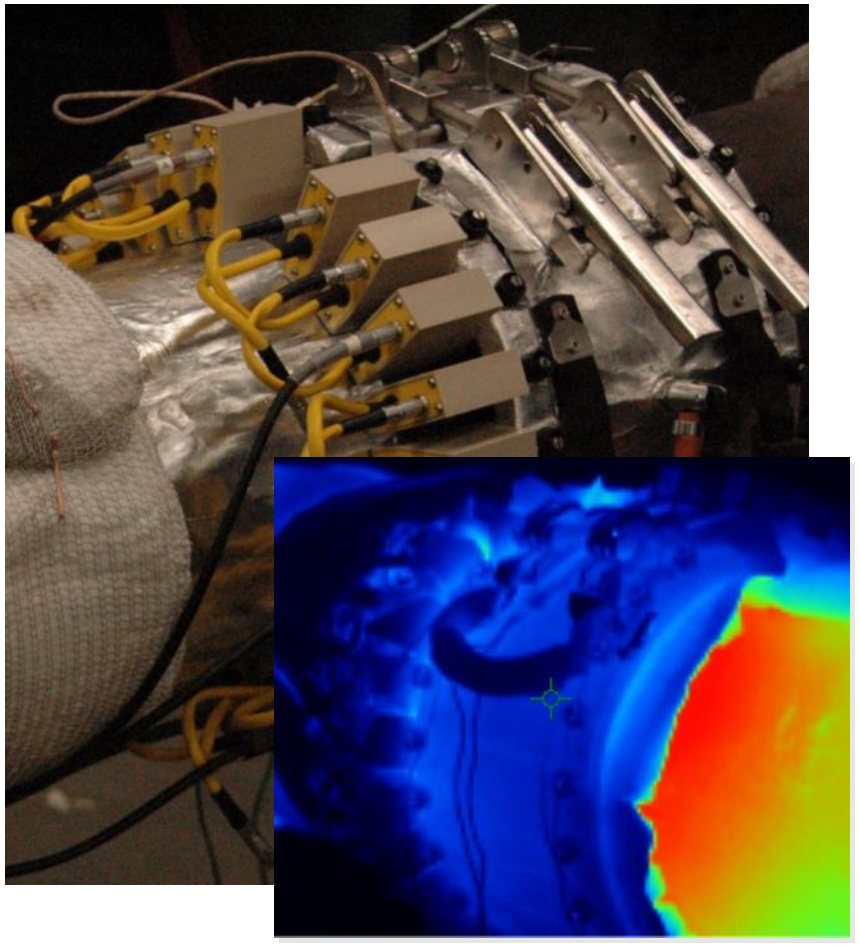
Teletest Focus HT



- Capable of all functions of Teletest Focus+
- Uses current collar with an insulating adapter
- Inspection up to 240°C
- Separate HT modules and transducers
- Special HT Tool Lead
- Available for rent or purchase

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Corrosion detected with GWT

External corrosion on a vertical pipeline. Located at a circumferential insulation clamp.

Offshore Applications

- Corrosion under insulation
- Riser inspection
- Deck penetrations
- Splash zone inspection
- Fretting on Caissons
- Caisson inspection
- Top side pipework
- Seals for deck hatches and fire seals

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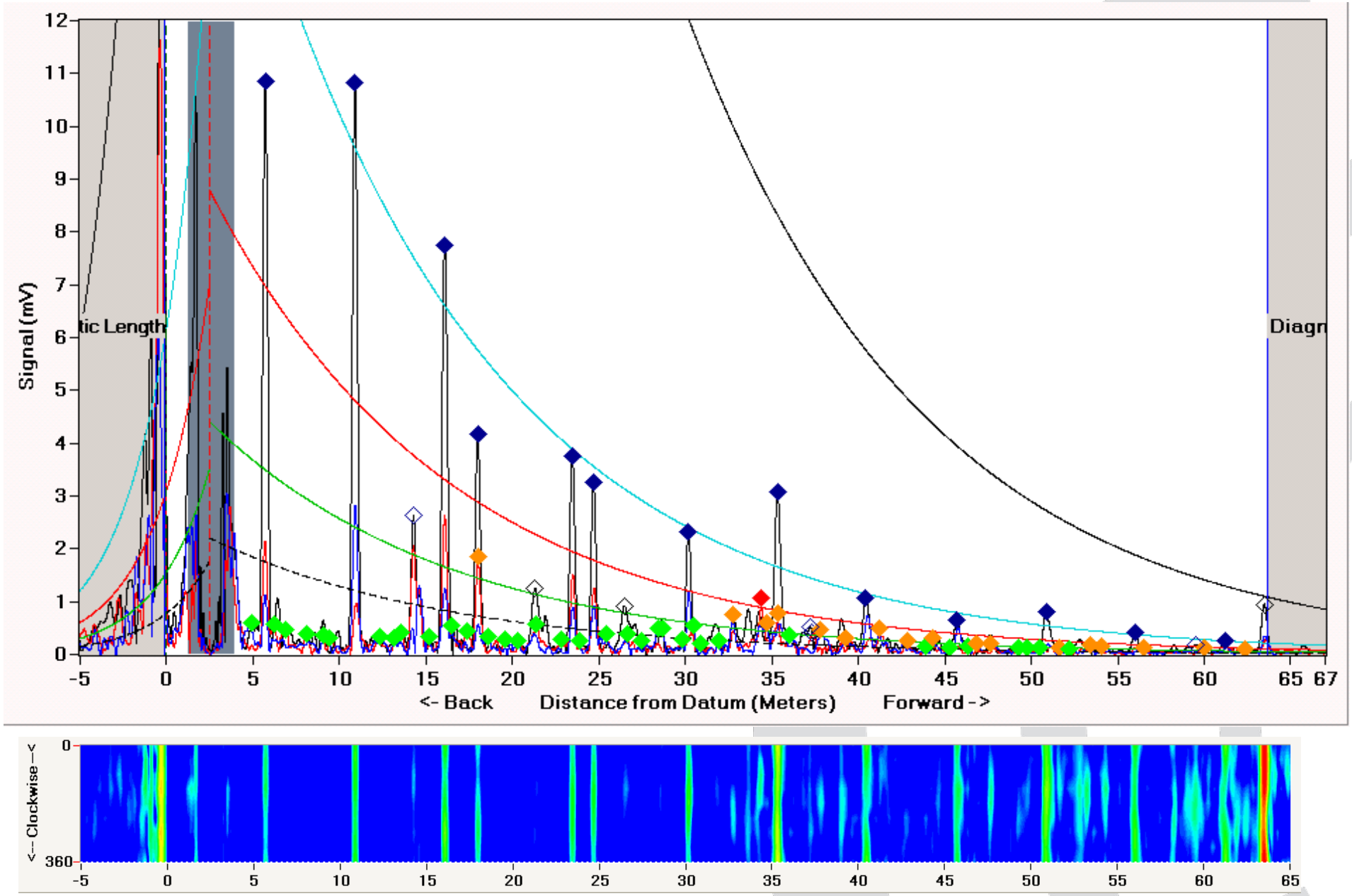
Caisson Inspection

- Access difficult due to inaccessible
  - Teletest could inspect from Spider deck
- Whole length inspection from topside
- Due to thick wall Torsional wave mode optimum
- Splash zone inspection was possible
- Caisson end (65m) was detected
- Showed the caisson was in good condition
- Raised area of corrosion at the


Signal (mV)
tic Length
Diagn
<- Back
Distance from Datum (Meters)
Forward ->
<-- Clockwise -->

Other inspections

- Road Crossings
- River Crossings
- Transmission lines
- Unpiggable pipelines
- Buried pipelines
- Insulated Sphere legs
- Air-soil interface

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Road Crossings Case Study

- GWUT since 1998 with follow-up NDT data since 2003
- Road crossings up to 75m wide (cased)
- Diameter 3 to 30in
- Contains oil, gas, water or combinations
- Insulated with Polyurethane foam
- Corrosion at field applied weld packs
- GWUT to PHMSA 18 point checklist

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Road Crossings Case Study

- End-user excavates a number of lines annually
- Excavation is based on GWUT data and other factors
- Other factors include: regulatory reasons, replacement programmes, risk ranking, etc
- All data from excavations is fed back from client

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Road Crossings Case Study

Cased crossings tested	598
Crossings excavated	104
Indications confirmed by NDT	117

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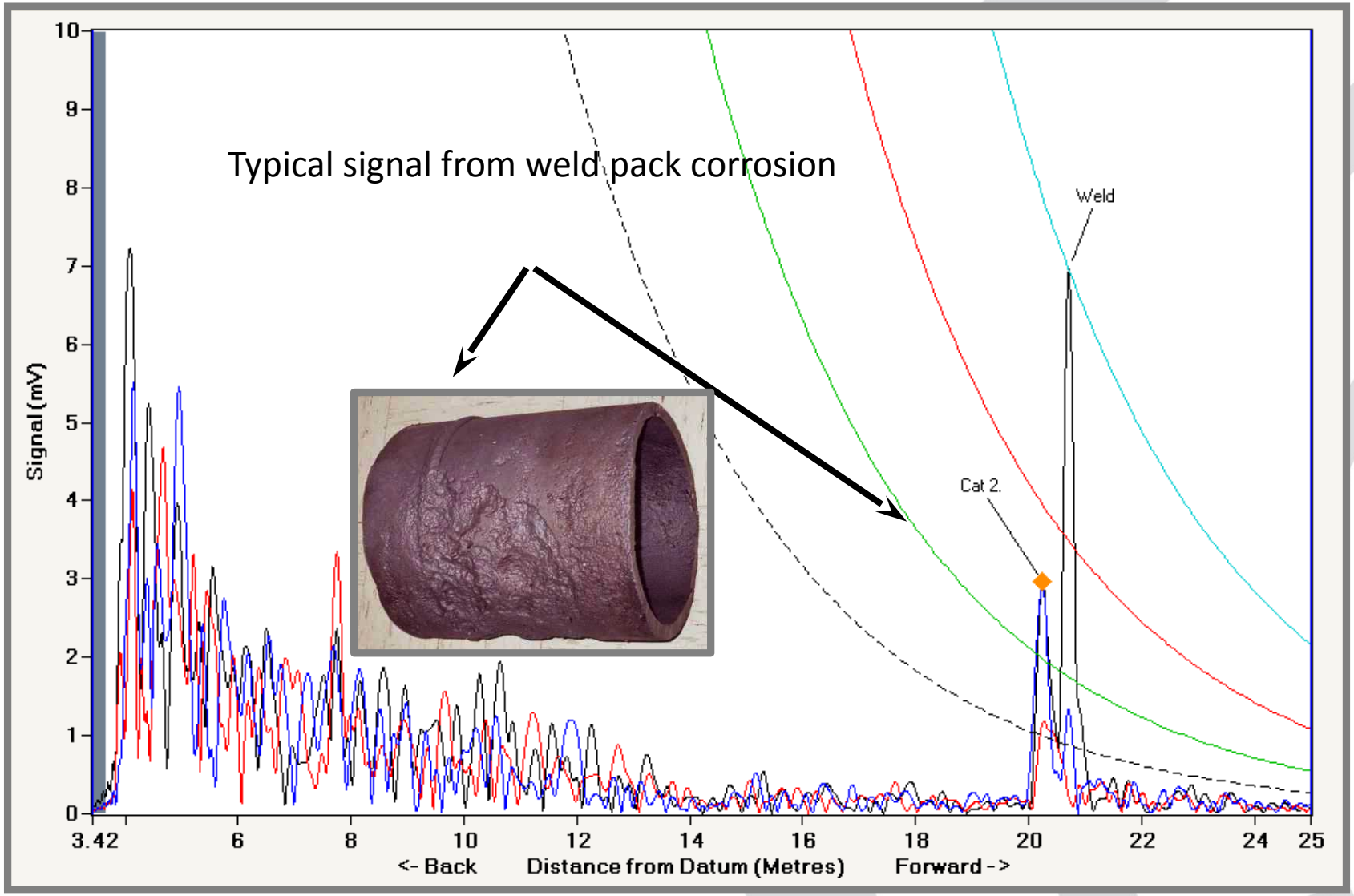
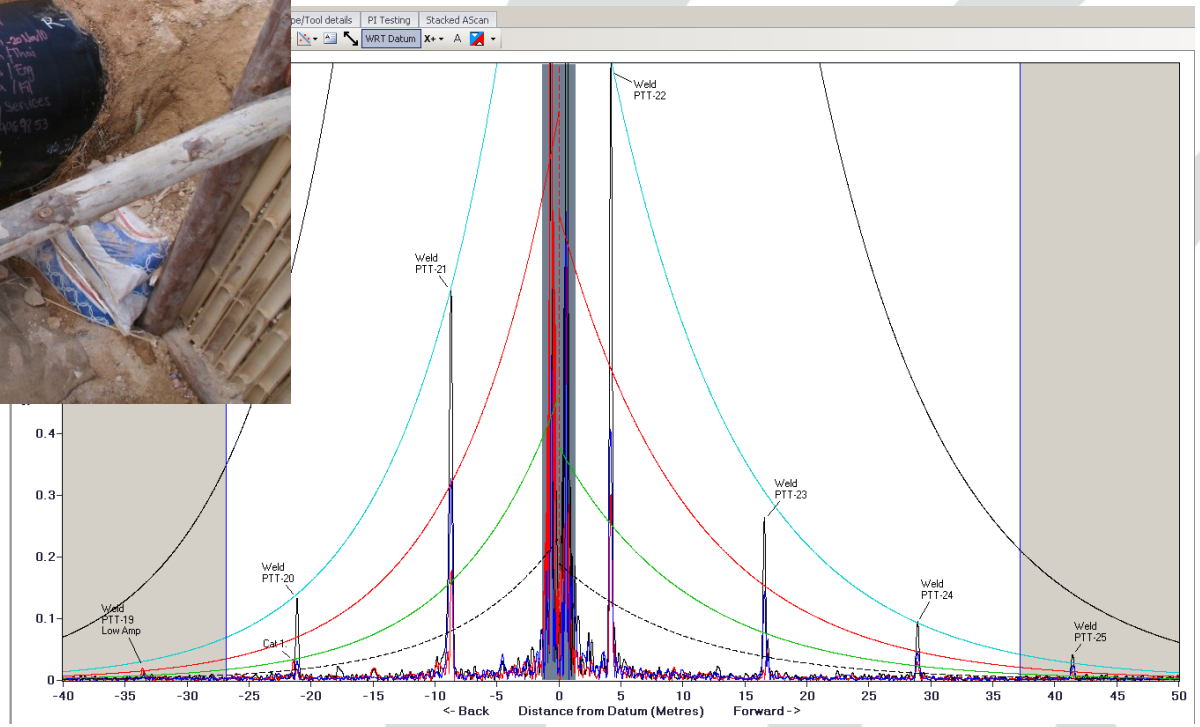
Road Crossings Case Study



Buried Lines

60m Inspection



Corrosion Detected with GWT

External corrosion identified on a buried gas pipeline.

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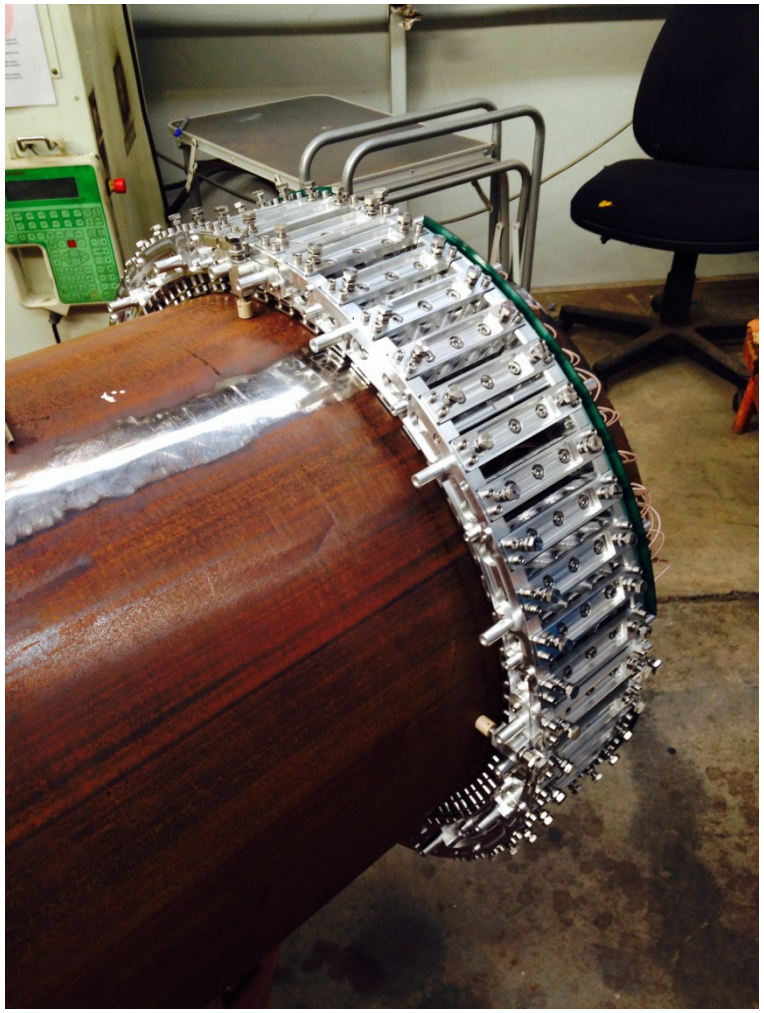
OTHER PRODUCTS AND APPLICATIONS

High Temperature Monitoring - EDF



- Tool developed for high temperature monitoring
- 200°C operation
- 32 installed in the field
- Continuous monitoring option installed
- Online monitoring available

From concept to installation in 12 weeks.

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Inspection of Furnace Tubes

'Reproduced courtesy of Petro-Tech Heaters Ltd'

- Difficult to inspect using conventional techniques
- Cut the U-bends off for access and an internal tool
- Expensive in cost and time
- Guided Waves can screen pipes quickly during shut-down
- Access is difficult for conventional tooling

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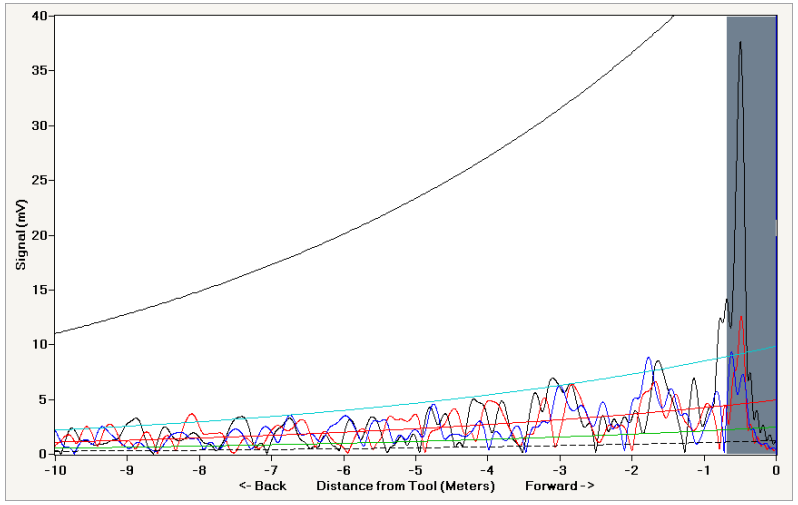
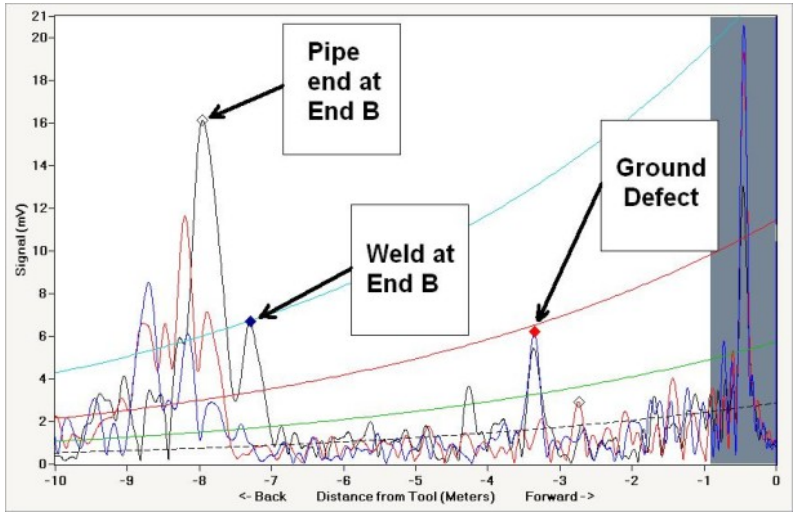
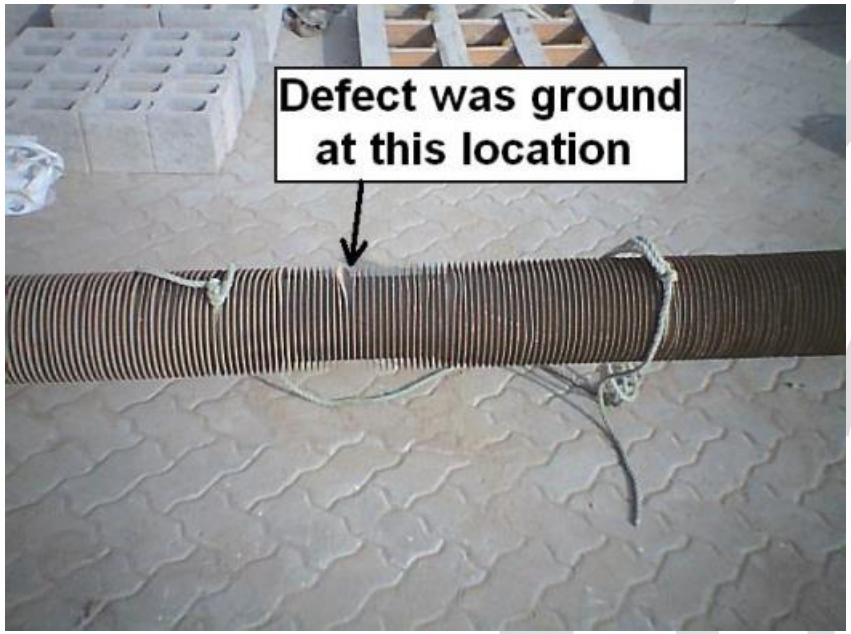
Inspection of Finned Tubes





- Torsional: nothing could be seen using Torsional mode



- Longitudinal: both the pipe end and the defect could be identified
- Only Teletest capable of

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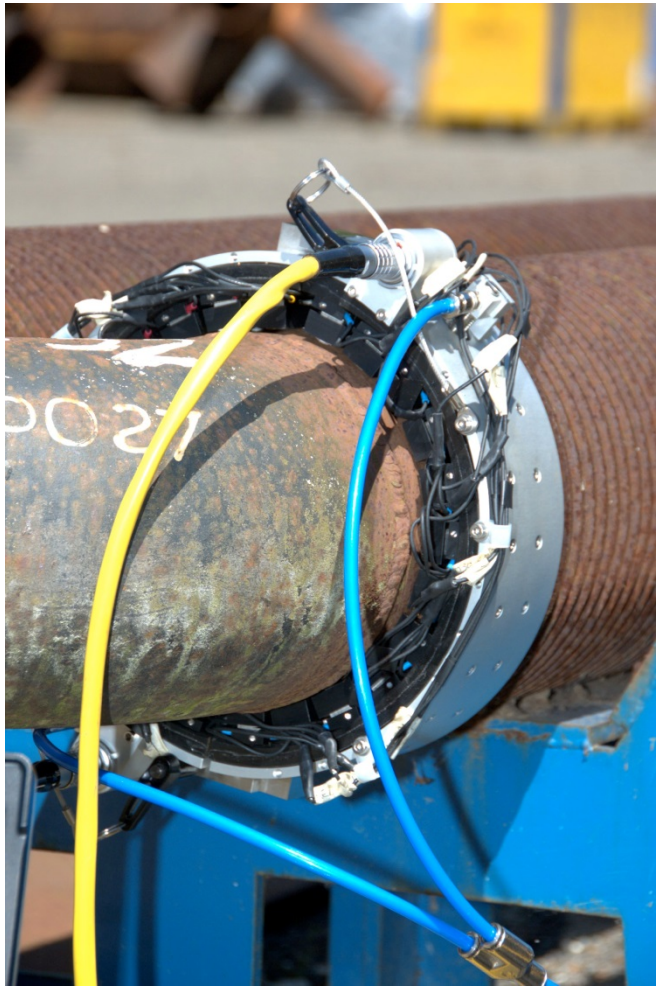
Special tool developed for access



- Test loop built
- Tool developed
  - Low profile
  - Modified spacing
  - Longitudinal
- Clam shell design for easy application
- All connections on the side
- Only 3” (76mm) space needed between first fin and bend weld

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Summary

- Guided Wave Testing can inspect 10s of metres of pipe from one location with good probability of detection.
- A screening tool the allows operators to prioritise localized inspection where needed.
- Extremely valuable for inspection of inaccessible areas.
- A cost effective method for inspection of non-piggable pipe
- An important tool for inspection of pipe

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