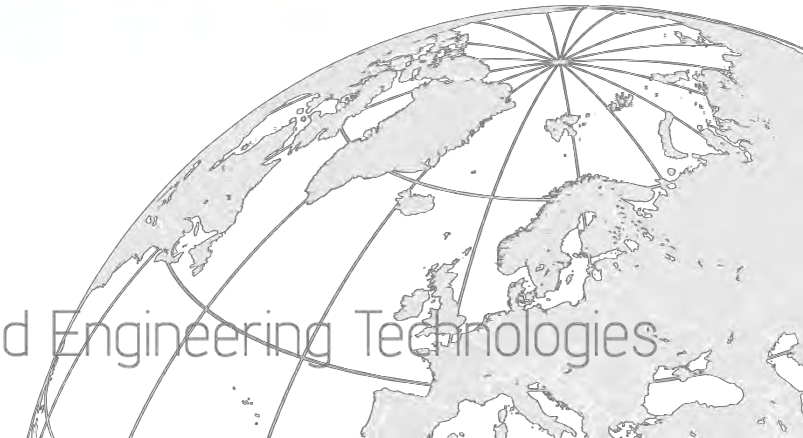
Developments in NDT

Dr James H Kern

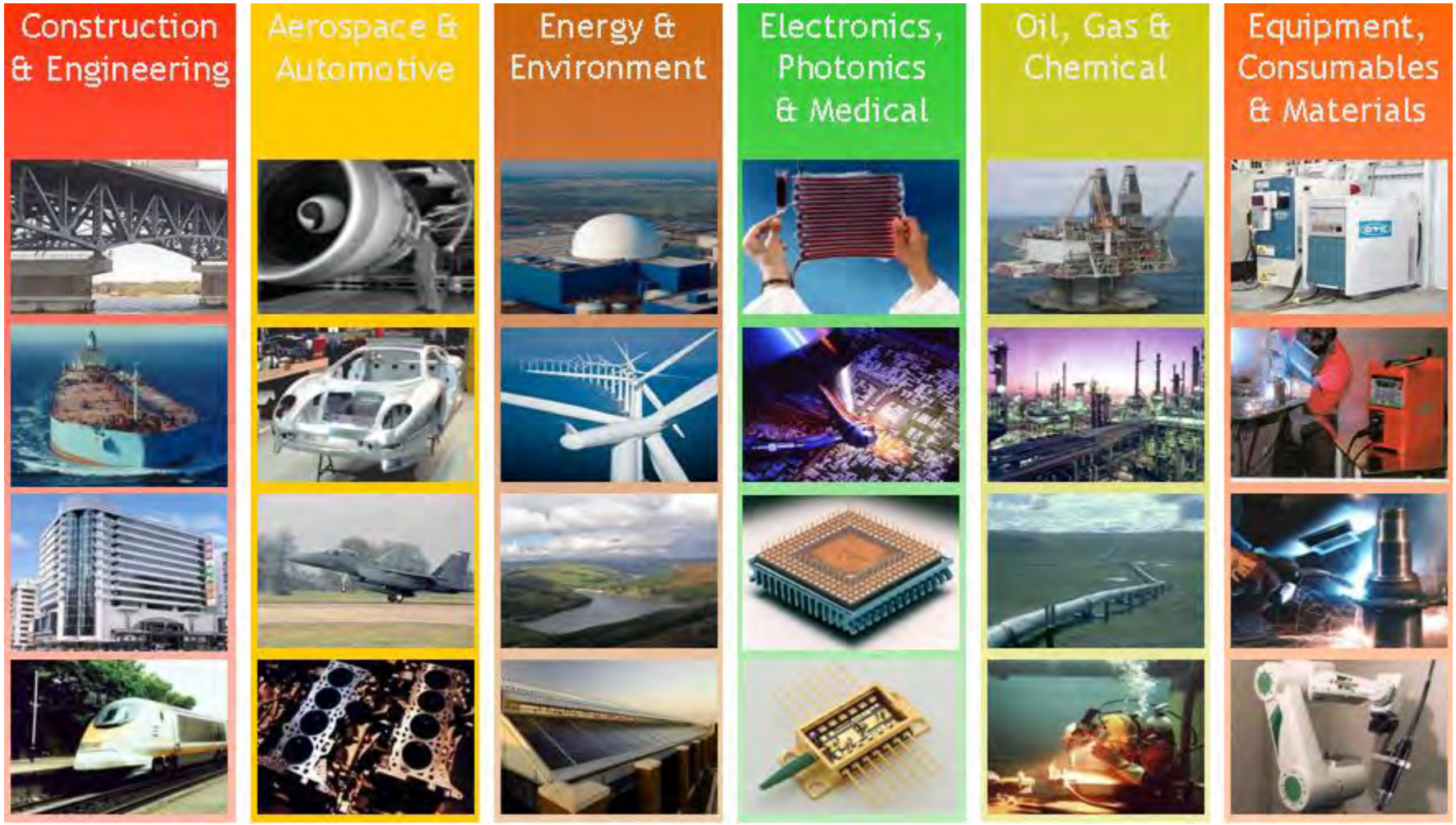


Materials Joining and Engineering Technologies

TWI – An Extension of your Resources

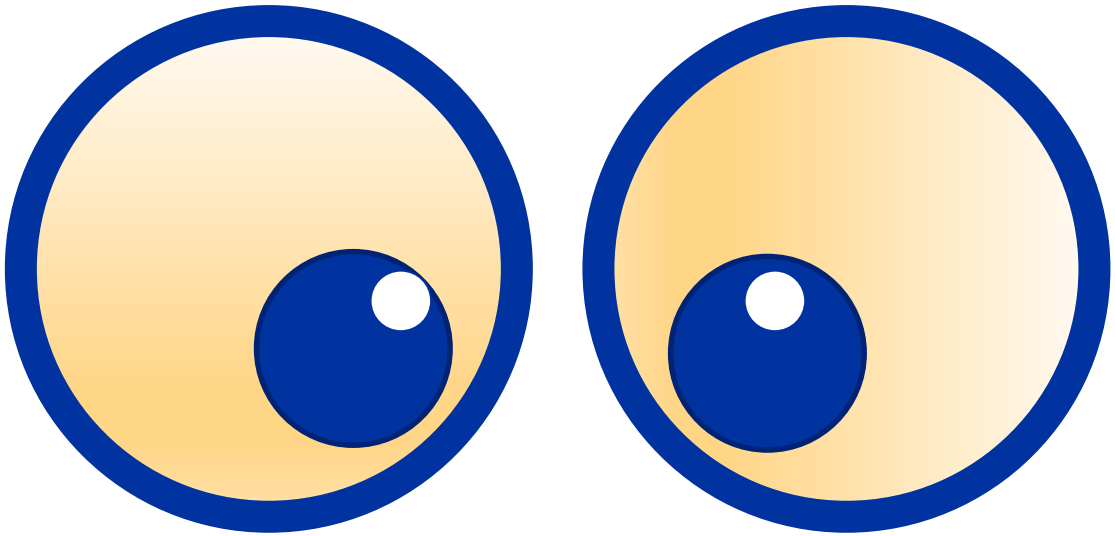
- Research & Technology Organisation
  - Established in 1946
- Industrial Membership based
  - Effectively owned by Members and run by representatives from Member Companies
- Non-profit distributing
  - No share holders
  - All income re-invested in the business for benefit of Members
- Five UK locations and 13 international offices

TWI – An Extension of your Resources



Traditional NDT techniques

- Traditional NDT
  - Visual



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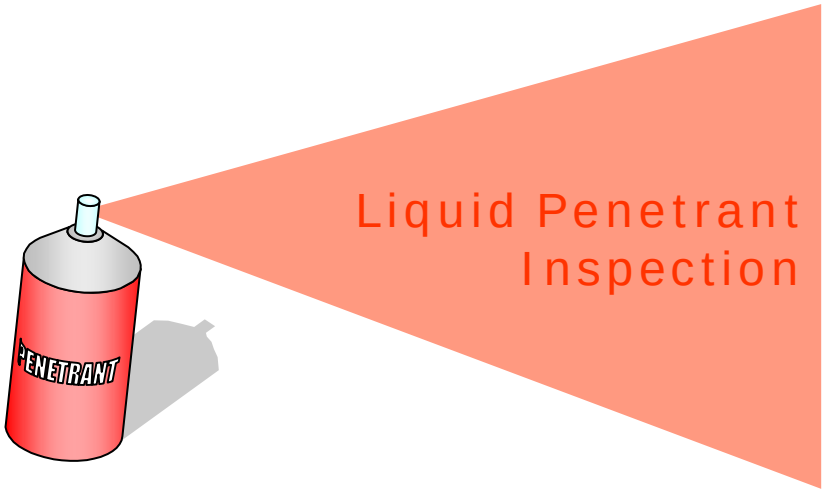

Traditional NDT techniques

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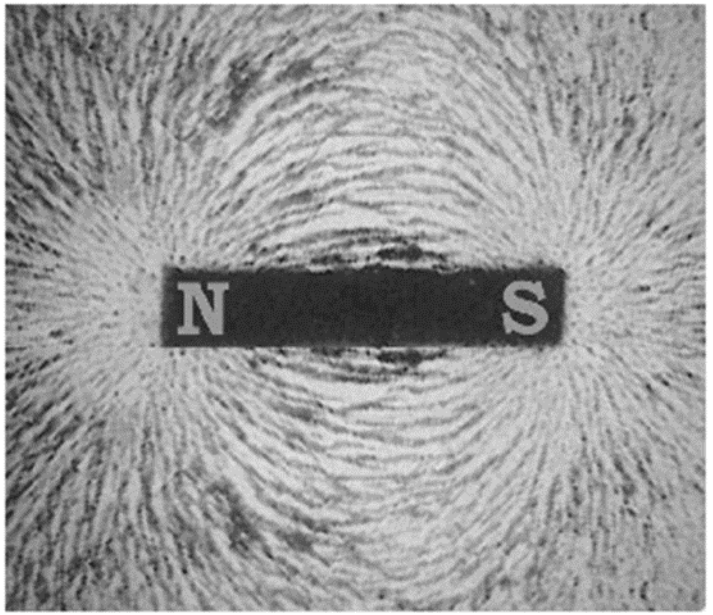
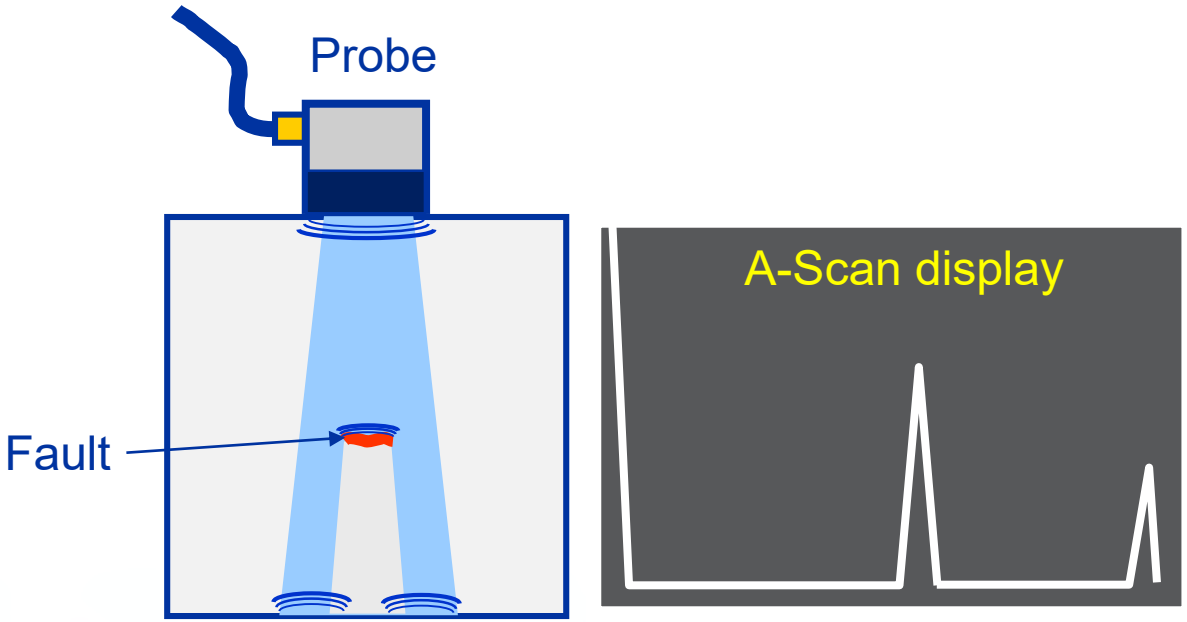


Traditional NDT techniques

- Traditional NDT
  - Visual
  - Dye and fluorescent pen
  - Magnetic particle
  - UT



Traditional NDT techniques

- Traditional NDT
  - Visual
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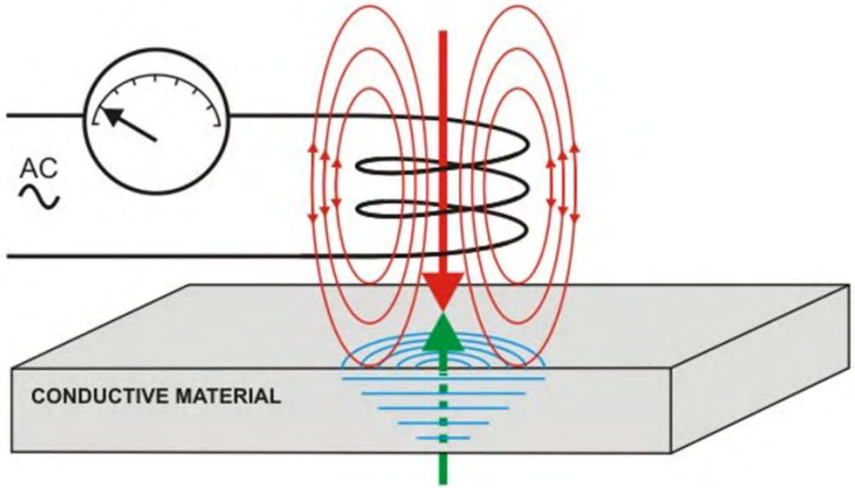
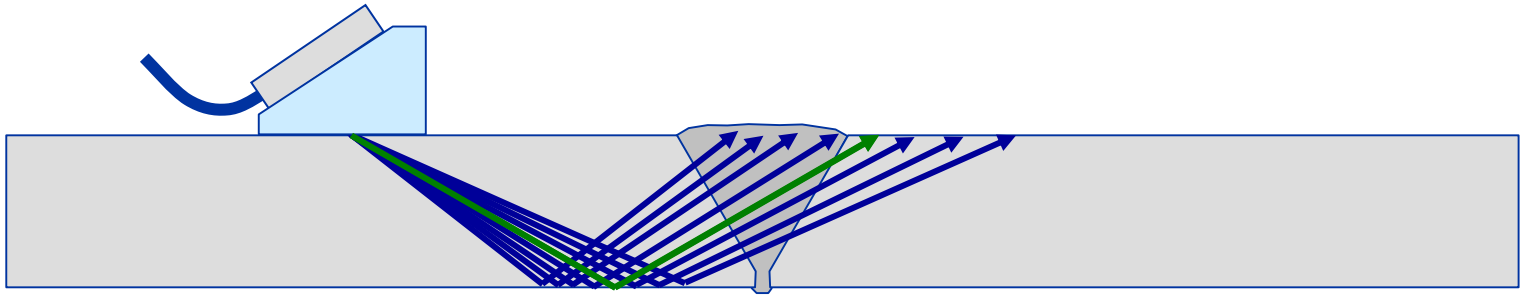
Traditional NDT techniques

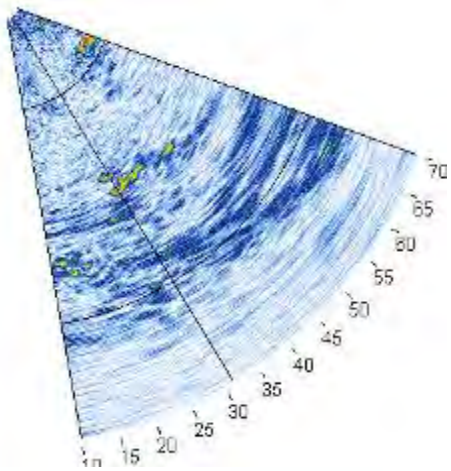
- Traditional NDT
  - Visual
  - Dye and fluorescent pen
  - Magnetic particle
  - UT
  - X-ray
  - Eddy current



Advanced NDT techniques

- Phased array (PAUT)

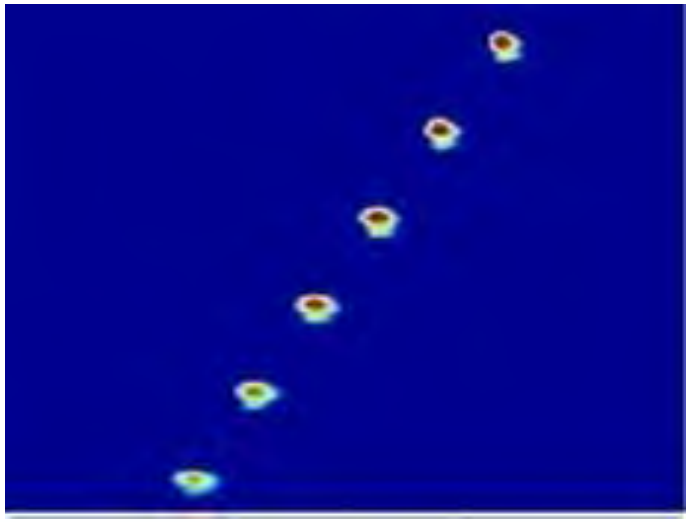




Advanced NDT techniques

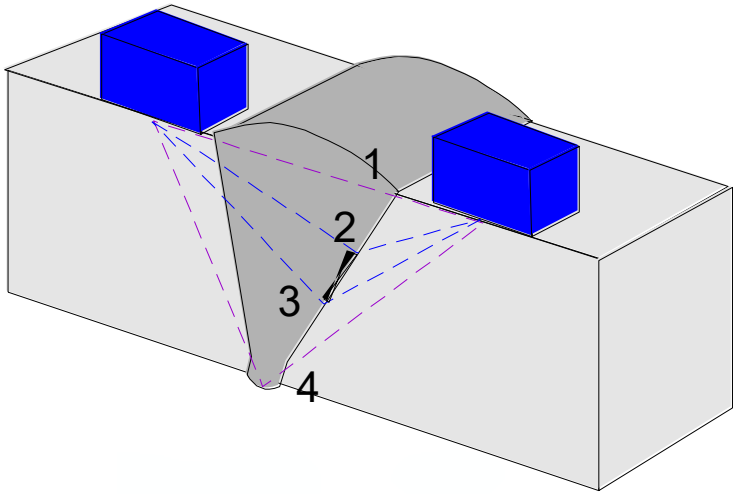
- Phased array (PAUT)

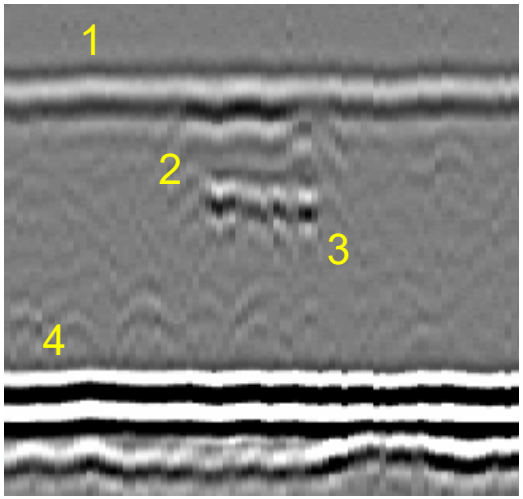
- Full matrix capture (FMC)



Advanced NDT techniques

- Phased array (PAUT)
- Full matrix capture (FMC)
- Time of flight diffraction (TOFD)





Advanced NDT techniques

- Phased array (PAUT)
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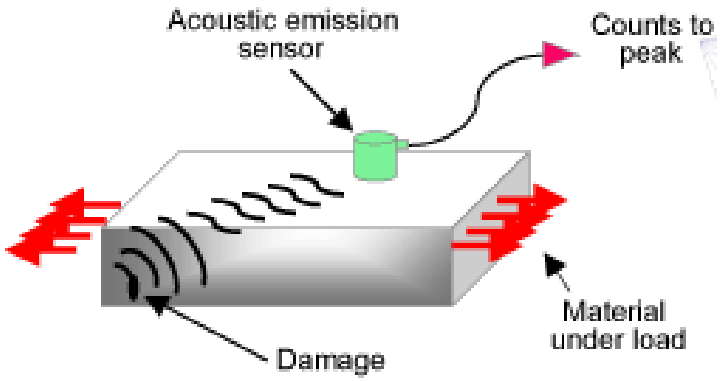
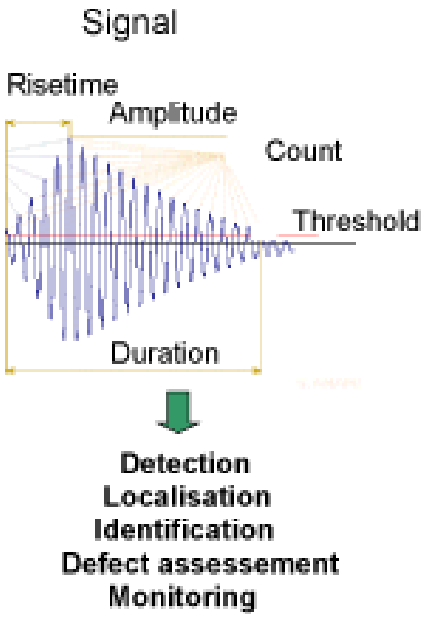
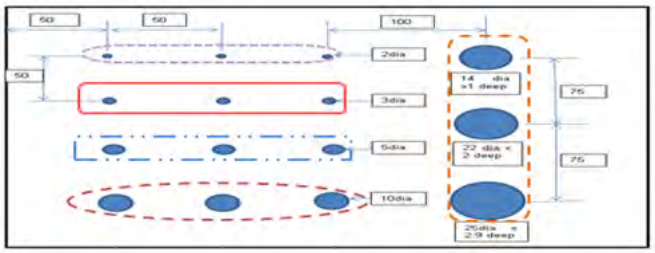
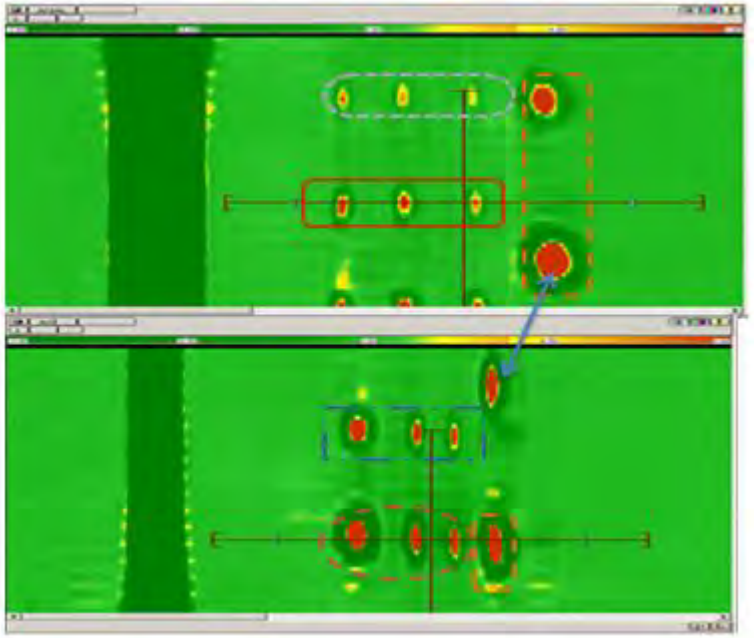




Advanced NDT techniques

- Phased array (PAUT)
- Full matrix capture (FMC)
- Time of flight diffraction (TOFD)
- Acoustic Emission (AE)
- Eddy current array





Surface corrosion type flaws under 4 mm of non-conductive insulation

Advanced NDT techniques

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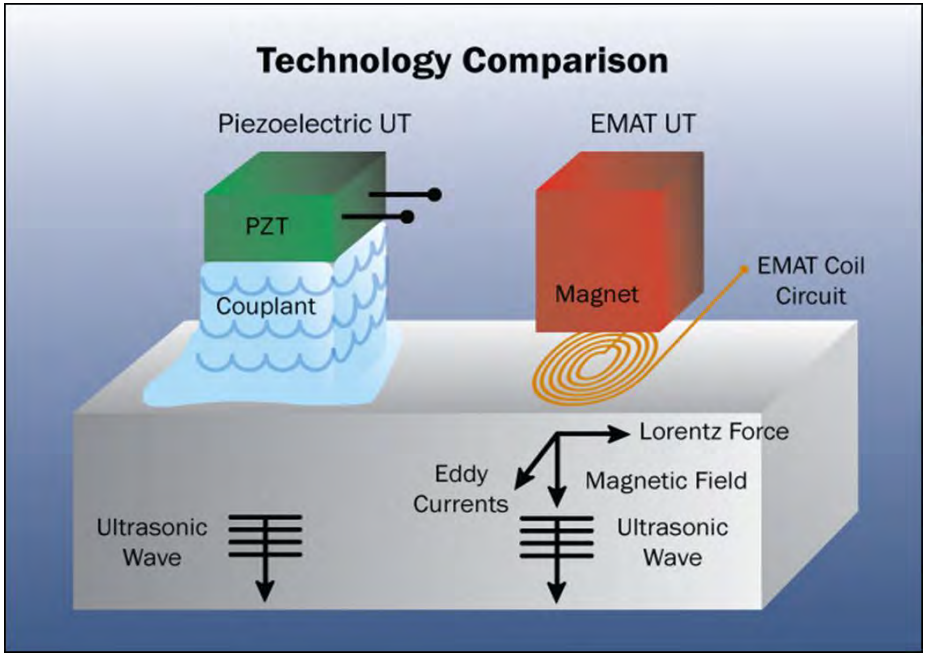
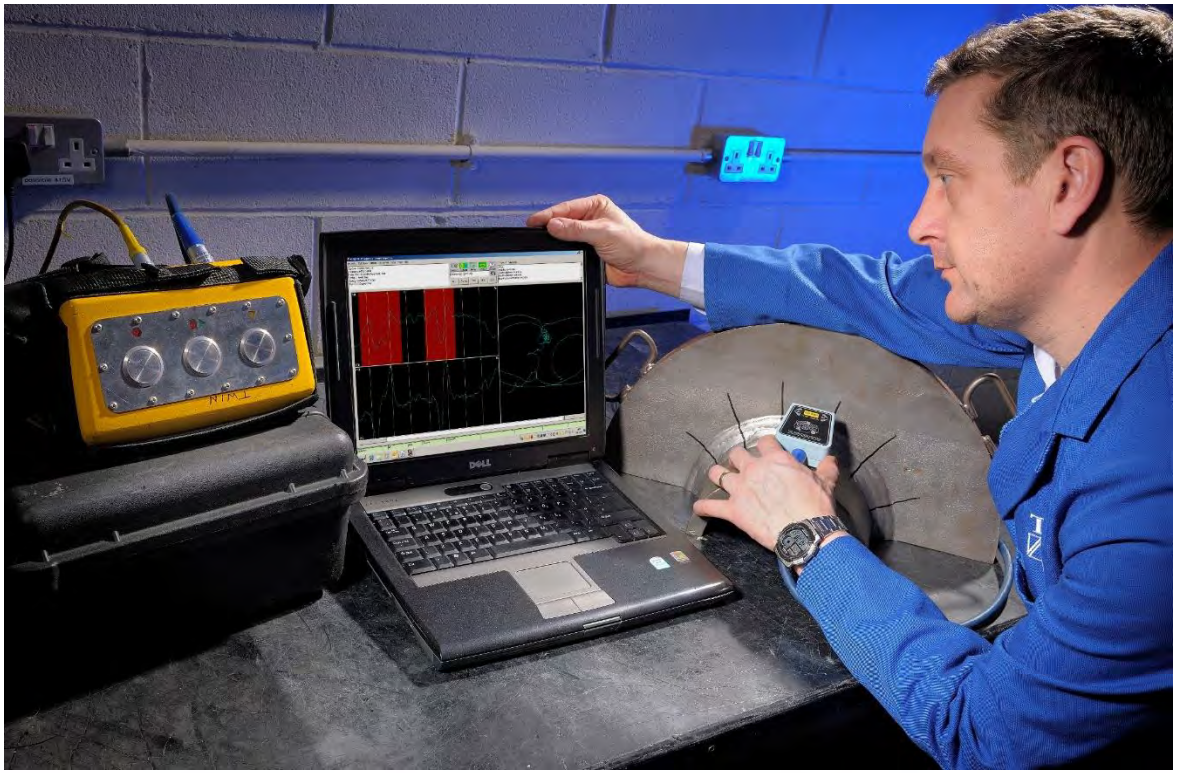
- Eddy current array



- Electro-Magnetic Acoustic Testing (EMAT)

Advanced NDT techniques

- Alternating Current Field Measurement (ACFM)



Advanced NDT techniques

- Alternating Current Field Measurement (ACFM)
- Thermography (TIR)

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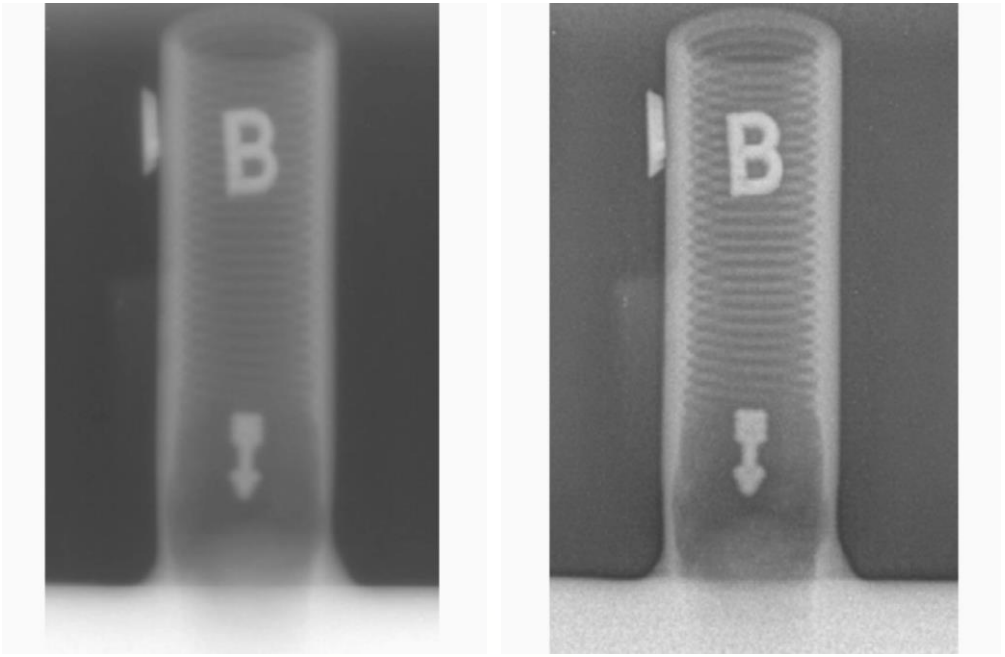
- Long Range UT (LRUT)

Advanced NDT techniques

- X-ray
  - Computed tomography (CT) Film of 3D part
  - Computed radiography (CR)
  - Digital radiography (DR)

Example of enhanced edge definition using CR



CT Computer tomography

Application

- Traditional
  - Man with a probe

Application

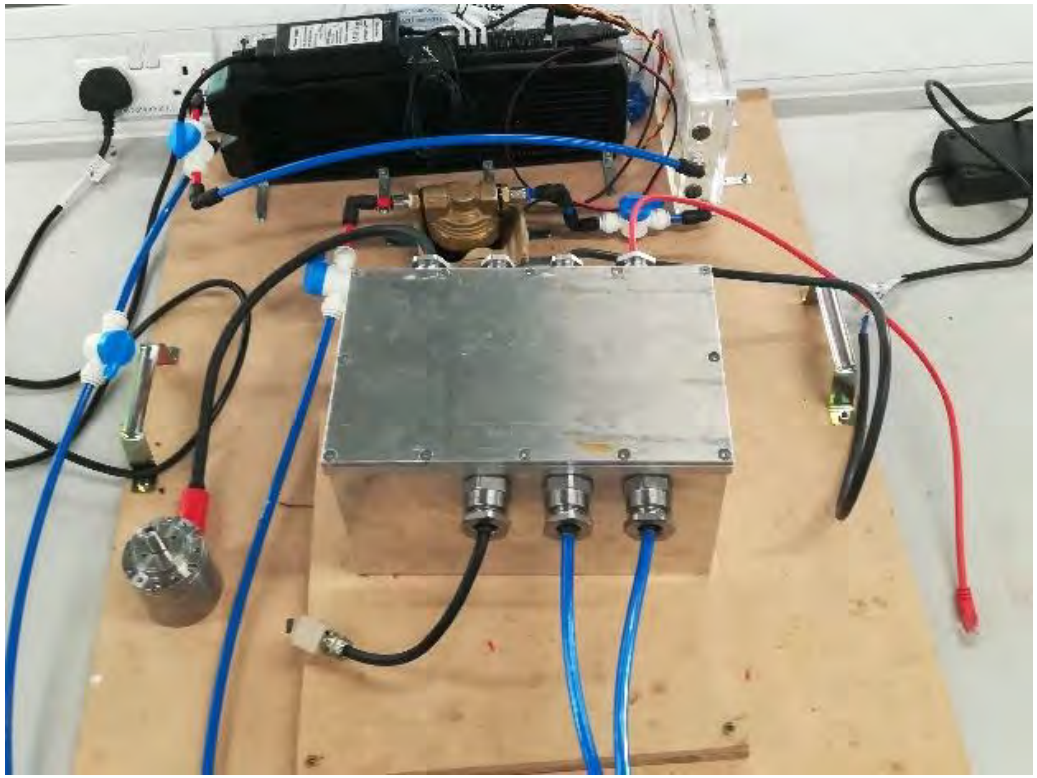
- Traditional
  - Man with a probe
- Issues
  - Safety
  - Environments

Application

- Traditional
  - Man with a probe
- Issues
  - Safety
  - Environments
- Advanced
  - Drones
  - Robots
    - ATEX Certification

ATEX

- TankRob
  - First ATEX certified Zone 0 PAUT system



Materials

- Traditional
  - Steel
  - Stainless steel

Materials

- Traditional
  - Steel
  - Stainless steel
- Advanced
  - Plastics
    - Polytest
  - Composites
  - Ceramics
  - Electronics

Materials

- Predicted 10 billion meters of plastic pipeline world wide in 2020

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- Containing 1 billion welds

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- Welds are considered to be the pipelines weakest link

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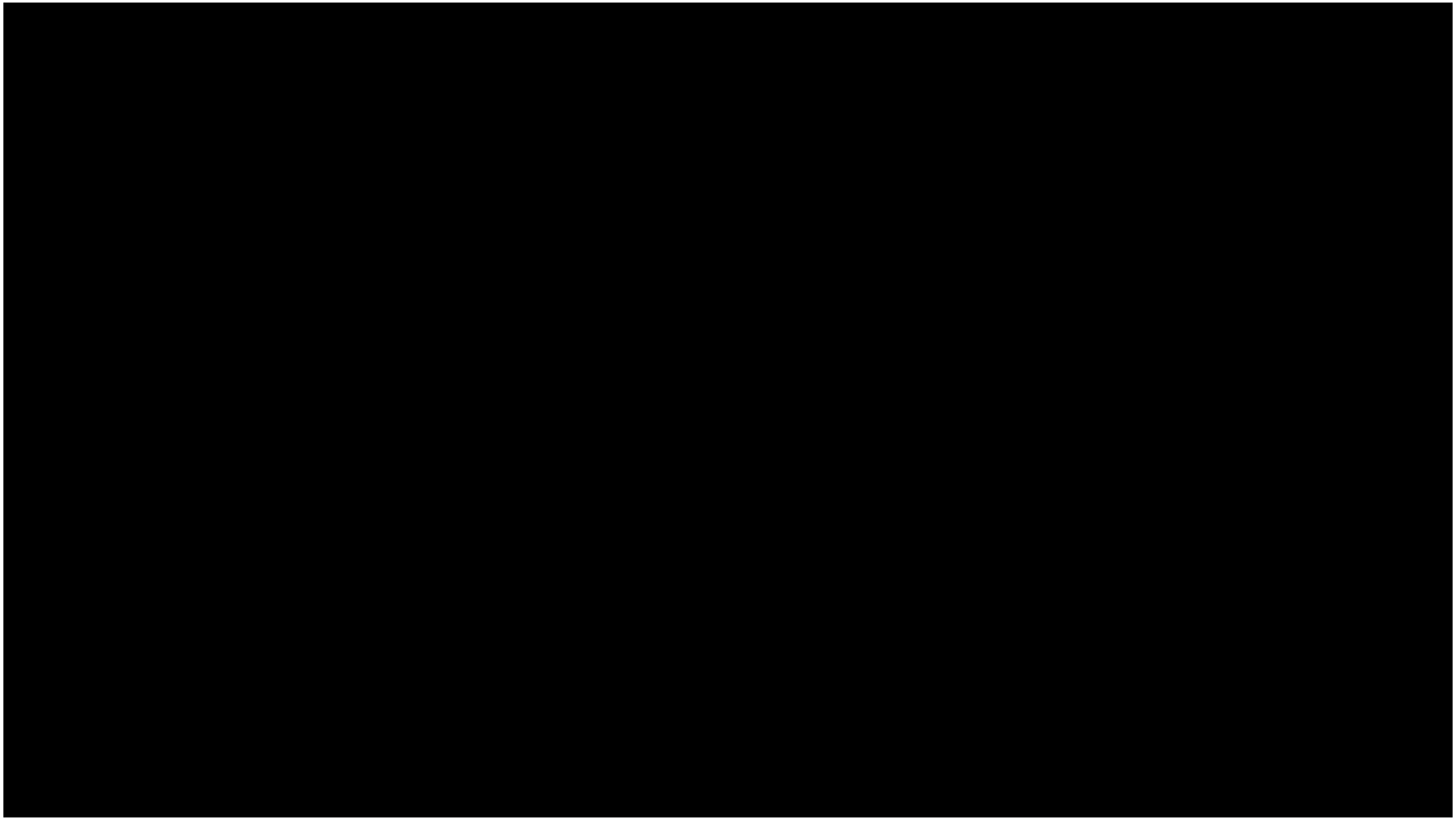
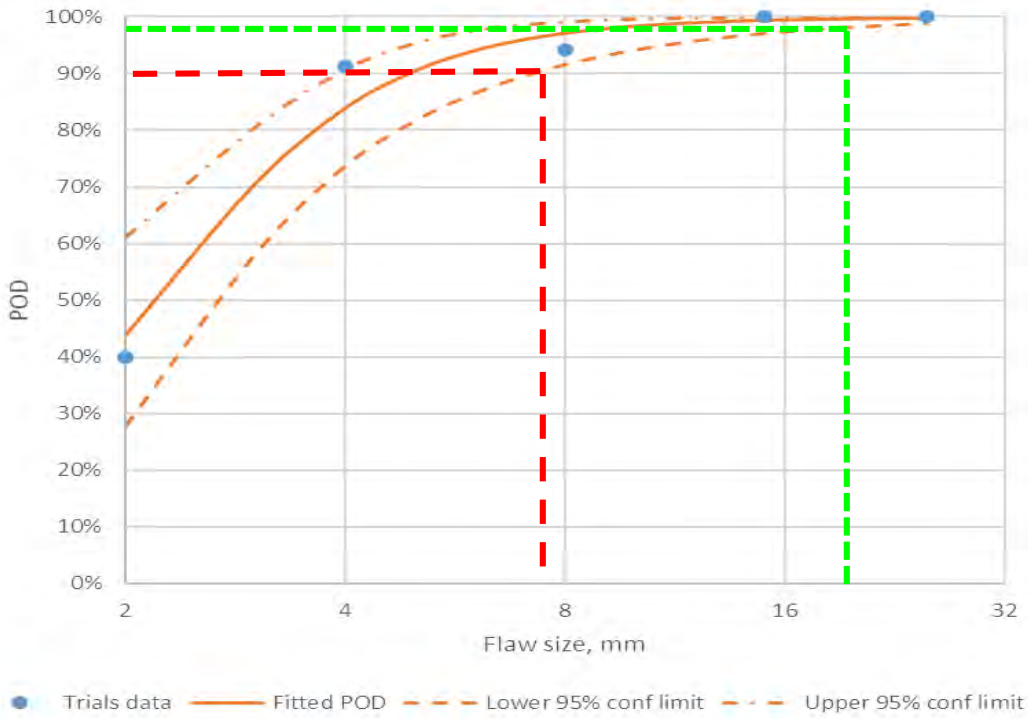
- Predicted 10 billion meters of plastic pipeline world wide
- Containing 1 billion welds
- Welds are considered to be the pipelines weakest link
- NDT allows 100% of welds to be inspected

Materials



Probability of Detection

225mm EF Joint



- 95% confident that we can detect a 7.4mm flaw with a POD of 90%

Maximum brittle decohesion length, according to ISO 4437-3, is 19.3mm

- > 95% POD at a 95% confidence limit

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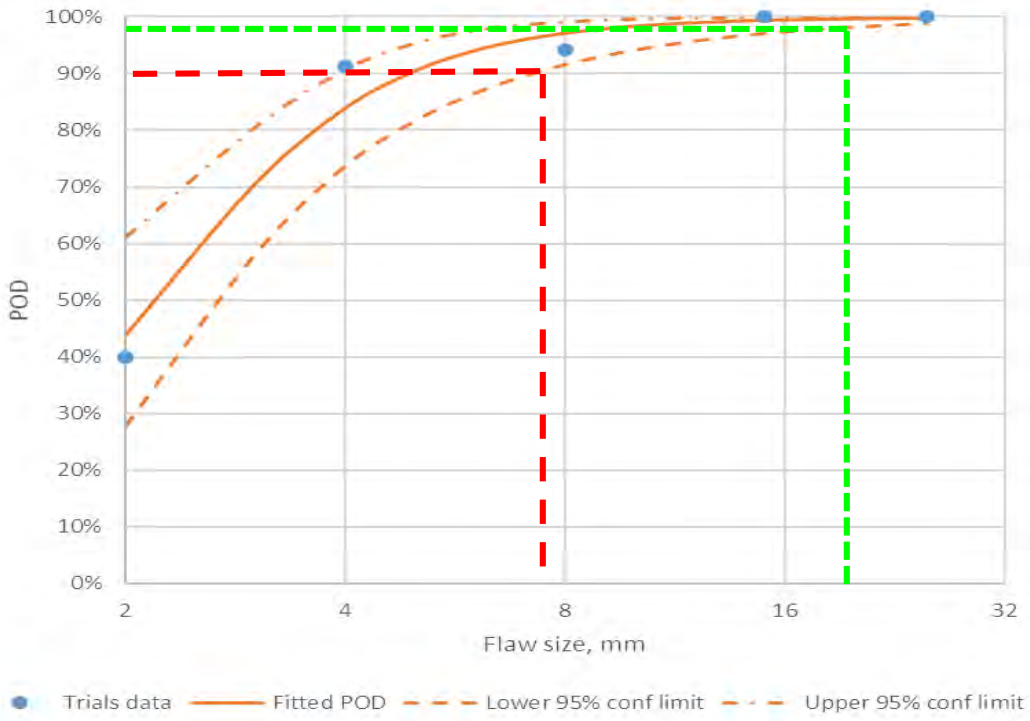
225mm EF Joint



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Comparison with mechanical tests

- POD for 19.3mm flaw using ISO 13954
- 4 test specimens
- Width of each specimen = 25mm
- Pipe circumference = 707mm
- POD = 36%

Materials Integrity Technology Transfer (MITT) project

- Technology transfer – funded by Tees Valley Combined Authority
- SMEs only (250 employees, not part of larger group)
- Tees Valley companies only
- Support for 35 companies
- Start 23 February 2018; end February 2023
- Seven days of free support available
- Business impacts targets – jobs and turnover, created and safeguarded

MITT 1:1 technical support

Product & Process Review (PPR) initial
2-days – visit, technical support, scoping, brief report/proposal

Feasibility Study (FS) follow-on 5-days – further visit(s), tests, trials, concludes with Final Report

For further information:

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