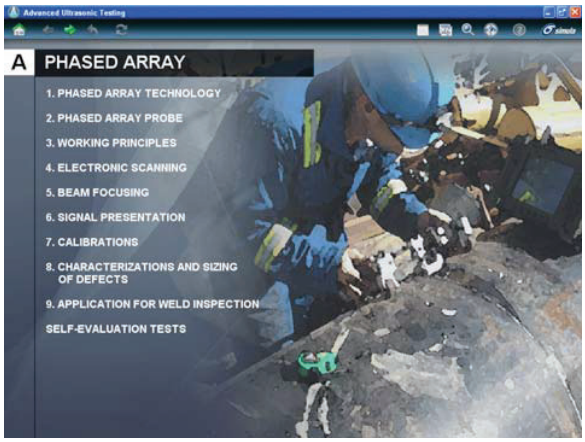
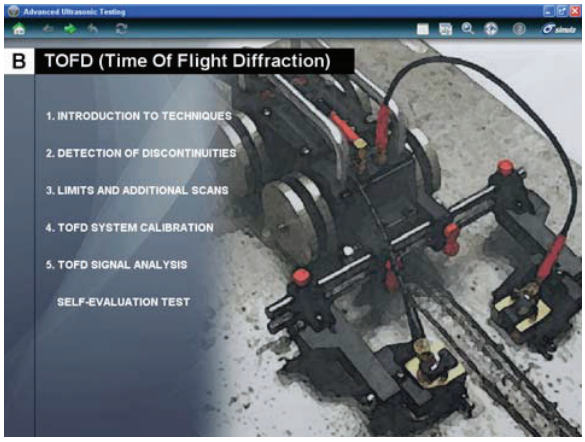
AUT - AUTOMATED ULTRASONIC TESTING (Phased Array & TOFD)

1. PHASED ARRAY



- 1.1 Phased array technology
- 1.2 Phased array probe
- 1.3 Working principles
- 1.4 Electronic scanning
- 1.5 Beam focusing
- 1.6 Signal presentation
- 1.7 Calibrations
- 1.8 Characterizations of defects
- 1.9 Application for weld inspection
- Self-evaluation tests
- **SimSCAN**

2. TOFD



- 2.1 Introduction to techniques
- 2.2 Detection of discontinuities
- 2.3 Limits and additional scans
- 2.4 TOFD system calibration
- 2.5 TOFD signal analysis
- Self-evaluation test
- **TOFD Images**

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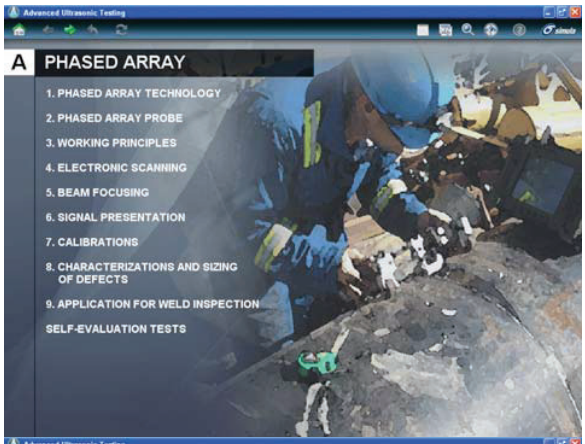
AUTOMATED ULTRASONIC TESTING: DETAILED INDEX

1. PHASED ARRAY (>> PA)

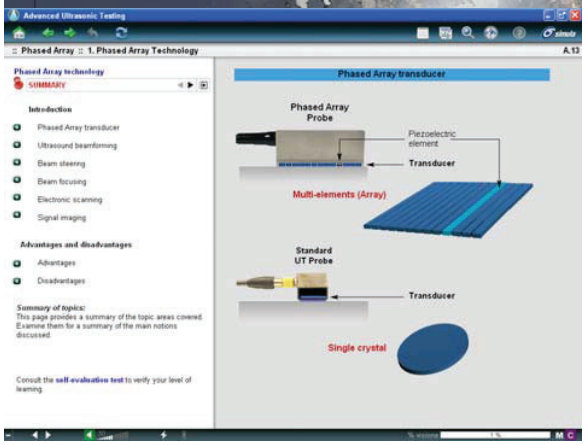
1.1 Phased array technology

- Introduction
- Phased Array transducer
- Ultrasound beamforming
- Beam steering
- Beam focusing
- Electronic scanning
- Signal imaging
- Advantages and disadvantages
- Summary



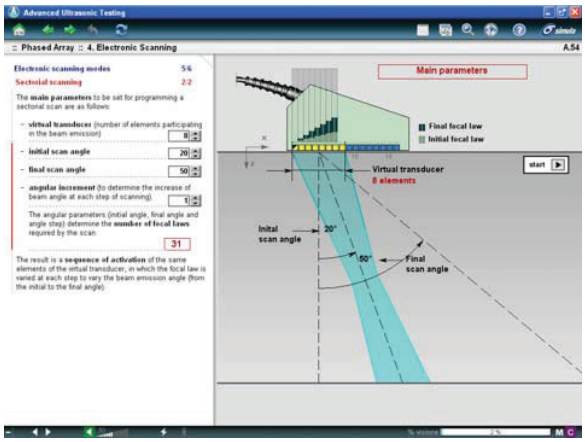
1.2 Phased array probe

- Probe structure
- Transducer
  - Transducer shape
  - Dimensional parameters
  - Wedge and types of waves
- Wedge-shaped base
  - Zero-degree wedge (Plates)
  - Wedge for complex shapes
- Summary



1.3 Working principles

- Beam forming
- Beam steering
  - Virtual transducer
  - Focal laws
  - Straight beam: Constant focal law
  - Angled beam: Linear focal law
  - Focused beam: Quadratic focal law
  - Angled and focused beam
- Acquisition cycles
  - Emitting
  - Receiving
- Summary

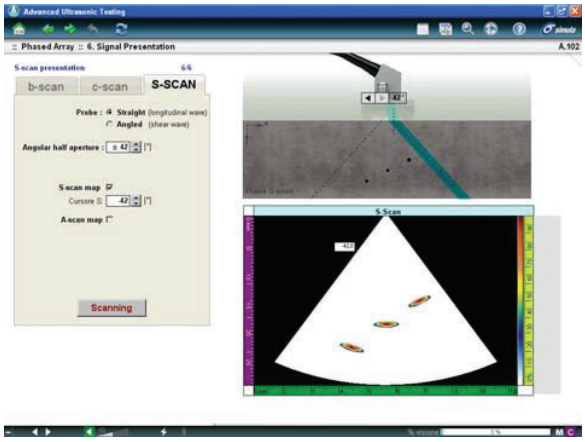


1.4 Electronic scanning

- Electronic beam steering
- Electronic scanning modes
  - Fixed angle scanning
  - Sectorial scanning
  - Combination of base scans
  - Multichannel mode

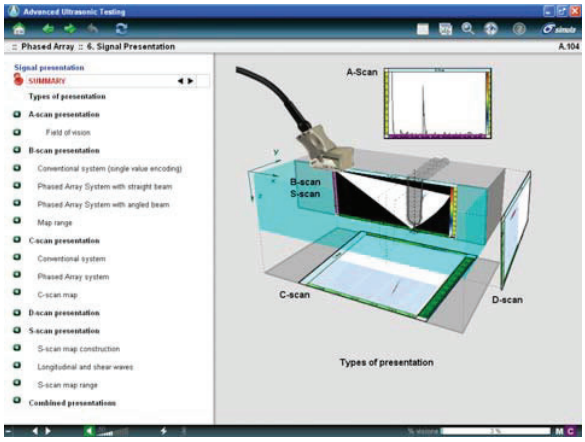
- Summary

1.5 Beam fucusing



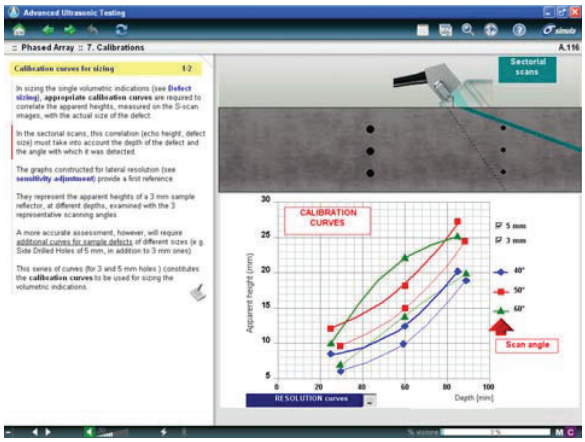
- Focusing control
- Focusing modes
  - Constant focal distance
  - Changing the focal distance
- Dynamic focusing
- Spatial resolution
  - Spatial resolution
  - Lateral resolution
  - Elevation resolution
- Probe resolution and characteristics
  - Probe frequency
  - Virtual aperture of the transducer
  - Virtual aperture and lobes
  - Summarizing table
- Summary

1.6 Signal presentation



- Types of presentation
- A-scan presentation
- B-scan presentation
- C-scan presentation
- D-scan presentation
- S-scan presentation
- Combined presentations
- Summary

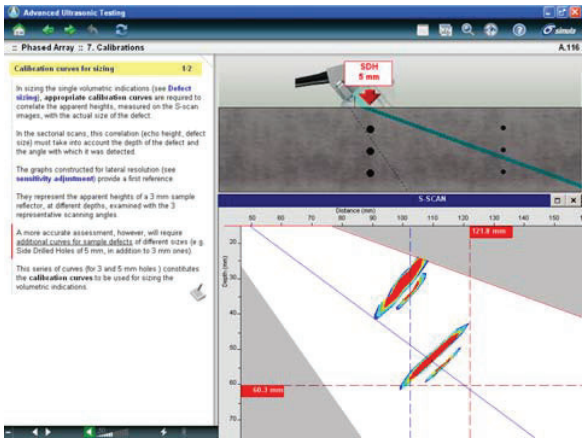
1.7 Calibrations



- Introduction
- Calibration block
- Sensitivity adjustment
- Construction of DAC curves
- Determining the lateral resolutions
- Calibration curves for sizing
- Summary
- Standard reference

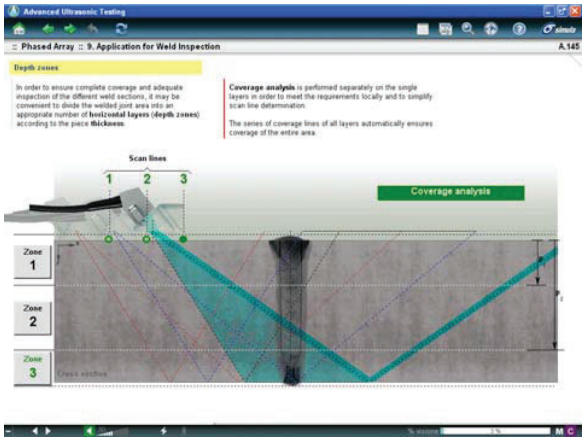
1.8 Characterizations of defects

- Introduction
- Types of defects
- Defect sizing
- Defect position
- Summary



1.9 Application for weld inspection

- Inspection with Phased Array
- Probe movement
- Scan lines
- Depth zones
- Multi-channel mode (virtual probe)
- Gate setting
- Focusing for welding
- Inspection speed
- Scan plan
- Summary



Self-evaluation Test

- Phased Array technology
- Phased Array probe
- Working principles
- Electronic scanning
- Beam focusing
- Signal presentation
- Calibrations
- Characterisations of defects

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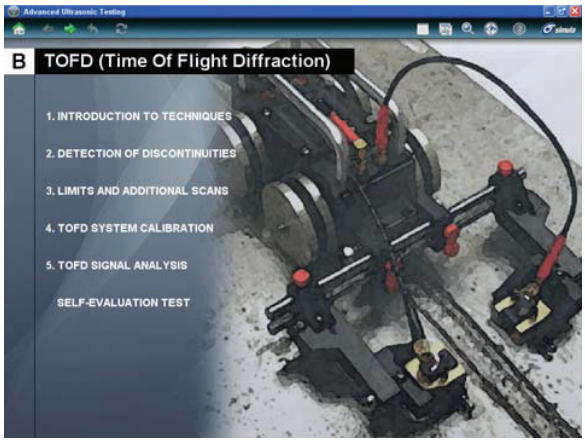
2. TOFD (Time Of Flight Diffraction) (>> TOFD)



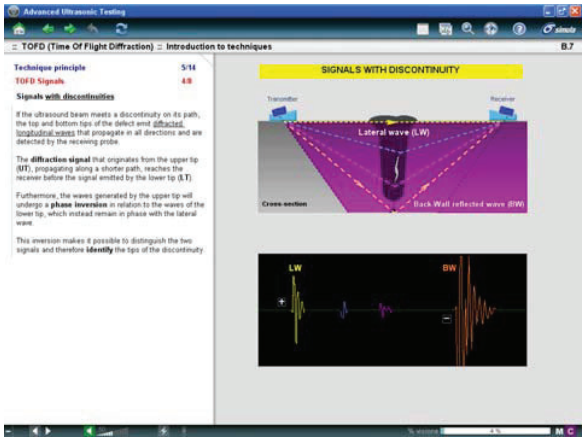
2.1 Introduction to techniques

- Technique principle
  - TOFD Signals
  - Types of waves and signals produced
  - Sizing a discontinuity
  - Scan zones and dead zones
  - Suitable scan materials

  Summary

- Advantages and disadvantages of TOFD
  - Advantages of TOFD
  - Disadvantages of TOFD

  Summary
- Data visualization
  - A-scan presentation
  - B-scan presentation
  - Summary

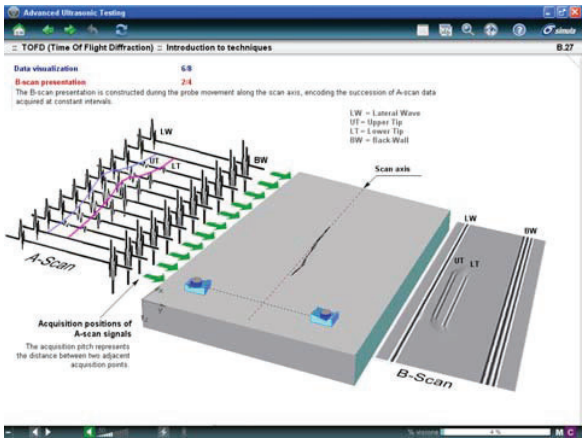


2.2 Detection of discontinuities

- Defect inspection
  - Scan types
  - Non-parallel scan
  - Parallel scan
  - Combined scans

  Summary
- Defect characterisation
  - Phase relationships between signals
  - Types of discontinuity

  Summary
- Defect sizing
  - Depth calculation
  - Height calculation
  - Measuring time of flight
  - Calculation time of flight
- Summary



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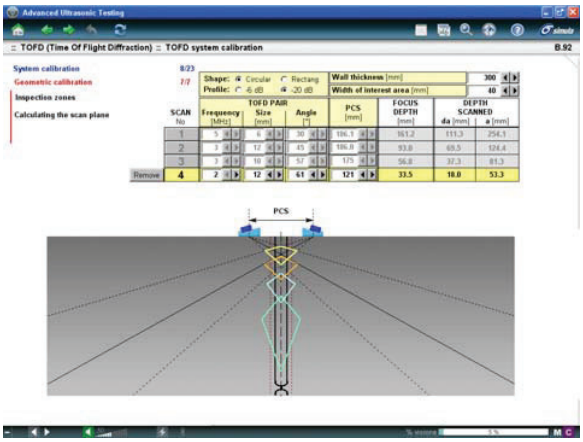
2.3 Limits and additional scans

- Limitations of the technique
  - Locating accuracy
  - Calculation error in locating
  - Spatial resolution
  - Dead zones
  - Calculating spatial resolution and dead zone
- Additional scans
  - Scans with different frequencies
  - Scans with different emission angles
  - Scans with offset distances

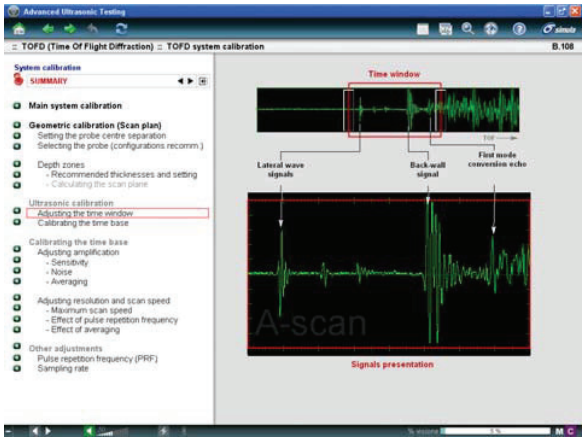
  Summary



2.4 TOFD system calibration

- TOFD system structure
  - Operation and characteristics
  - Ultrasound probes

  Summary
- System calibration
  - Geometric calibration
  - Ultrasonic calibration
  - Calibrating the acquisition system
  - Other adjustments
- Reference blocks
- Image quality
  - Basic requirements of TOFD image
  - TOFD image anomalies
- Summary

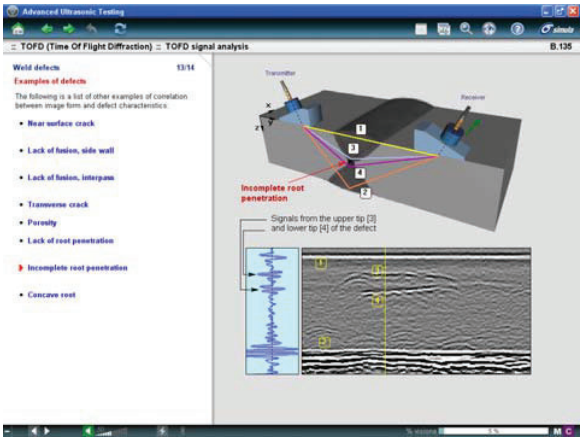


2.5 TOFD signal analysis

- Introduction
- Weld defects
  - Examples of defects

  Summary
- Sizing defects
  - Measuring depth and height
  - Measuring length
  - Examples of sizing

  Summary
- TOFD references



Self-evaluation Test

- Introduction to techniques
- Detection of discontinuities
- Limits and additional scans
- TOFD system calibration
- TOFD signal analysis

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