Advanced PA UT Probes for TOPAZ64

Application Solution

March 2020

Overview

- Inspection Challenges

- Advanced PA UT Probes:

  - TFM-AL Linear Arrays

  - 2D-Matrix Arrays

- **TOPAZ⁶⁴** Portable Intelligence

- Benefits of Zetec Solution

Inspection Challenges

- For some inspection configurations and damage mechanisms, standard phased array probe and wedge combinations will not provide the required inspection capability

- Flaws considerably smaller than the ultrasonic wavelength (caused by e.g. HTHA, creep, …) cannot be reliably detected

- Misoriented or branched cracks can be missed or undersized

- Advanced focusing techniques (e.g. TFM) can improve detection, but also benefit from dedicated probe design

TFM-AL Probes

- Azimuthal, 1D-linear array probes in AL-type housing
- Compatible with standard AL- 55SW and AL-0LW wedges

BENEFITS :

- 64 elements, very small pitch, for *maximum effective PA UT steering range* and *improved TFM imaging*
- Curved active element for *better focusing* and *improved lateral resolution in passive plane* compared to standard azimuthal probes (AM, 16 or 32 elements) at equal frequency
- Smaller footprint than standard 64 element probes (LM) for *better access to weld* and HAZ

TFM-AL-5 MHz, DF 15 mm

passive plane 1 mm

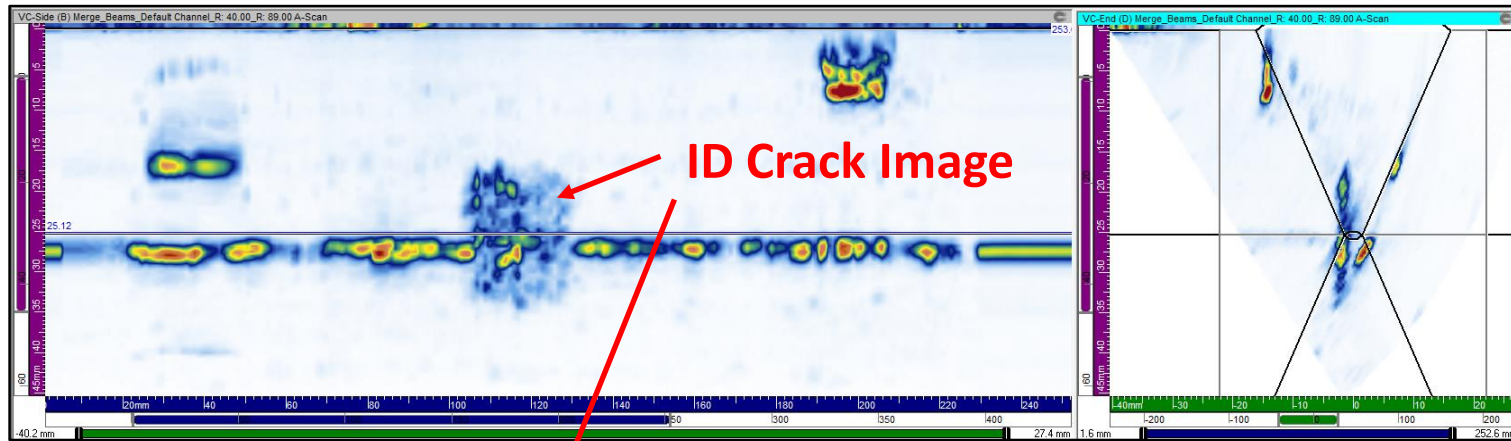active plane 1 mm

Depth of field 20 mm
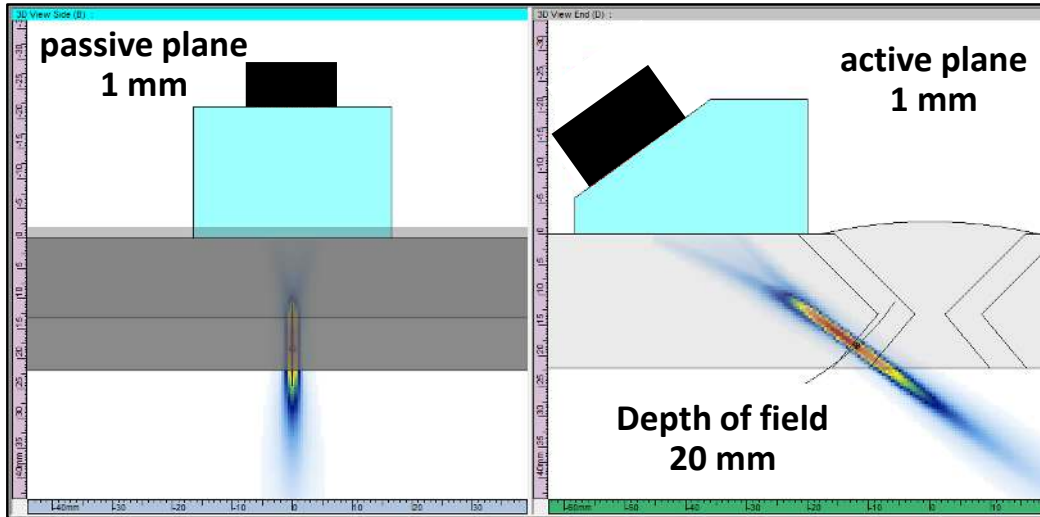
- Specifically suited for detection of clusters of small voids during detection and assessment of HTHA damage in typical vessels with wall thickness around 1 inch (25 mm)

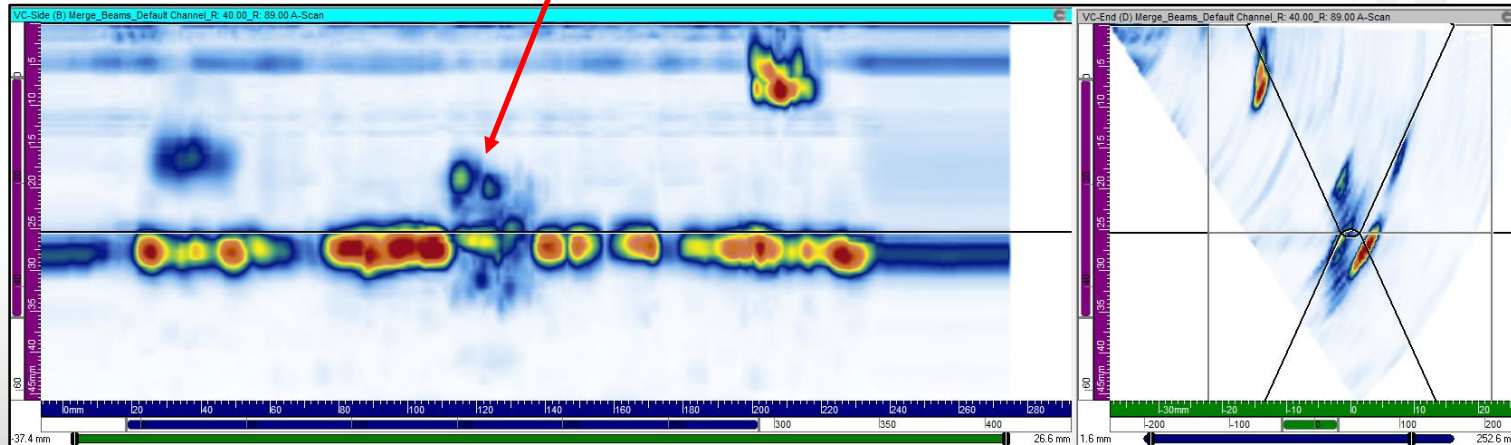- Beam dimension of 1 x 1 mm² (0.04 x 0.04 sq inch)

TFM-AL-5 MHz, DF 15 mm

xample - Welding Flaws (V-bevel, T = 1 inch)

TFM-AL-5 MHz
Better resolution
Better SNR
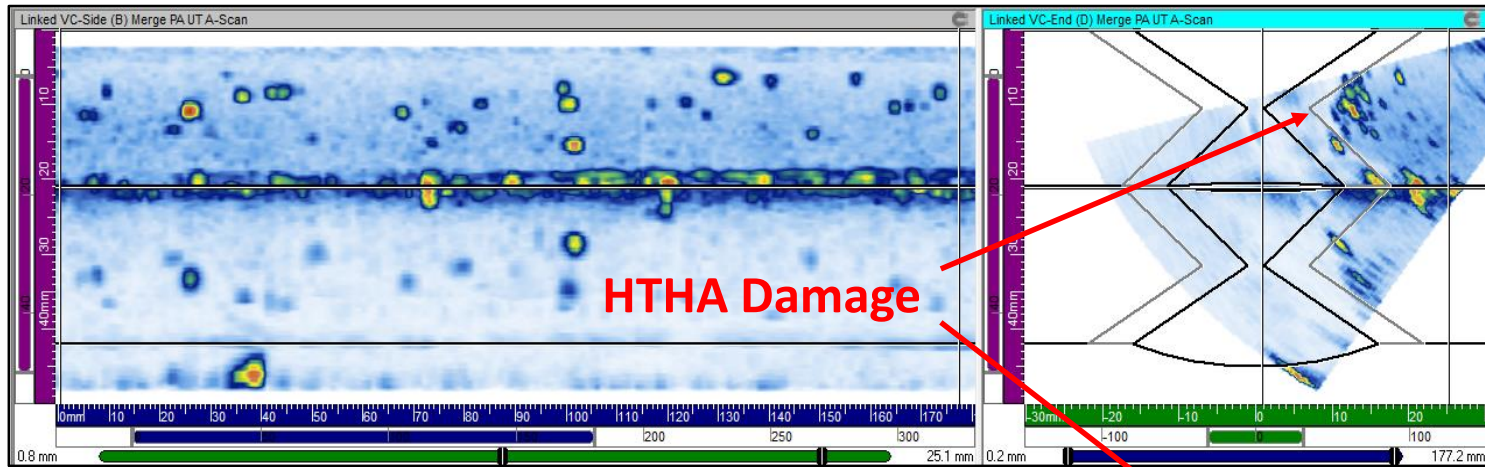
ID Crack Image

AM-5 MHz

AL-TFM, 5 MHz, DF 15 mm

Example – HTHA Damage (X-bevel, T = 0.9 inch)

AL-TFM
Better resolution
Better SNR

HTHA Damage

LM 5 MHz

TFM-AL-5 MHz, DF 50 mm

passive plane
2 mm

active plane
3 mm
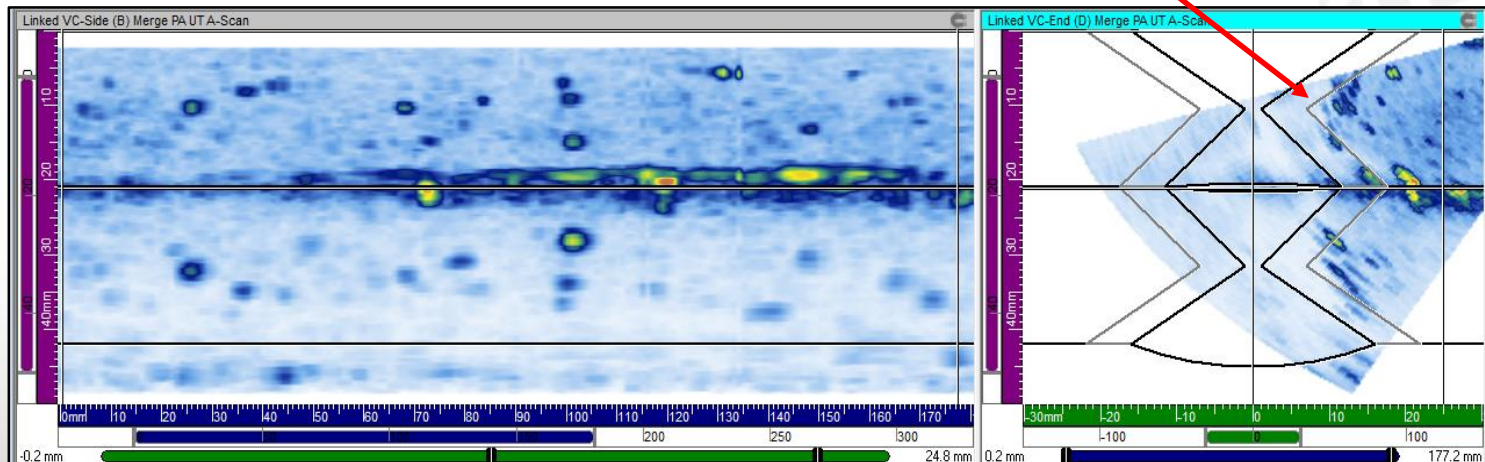
Depth of field
42 mm
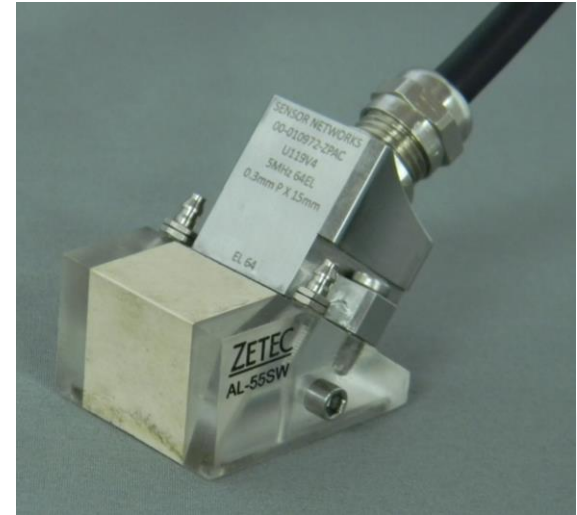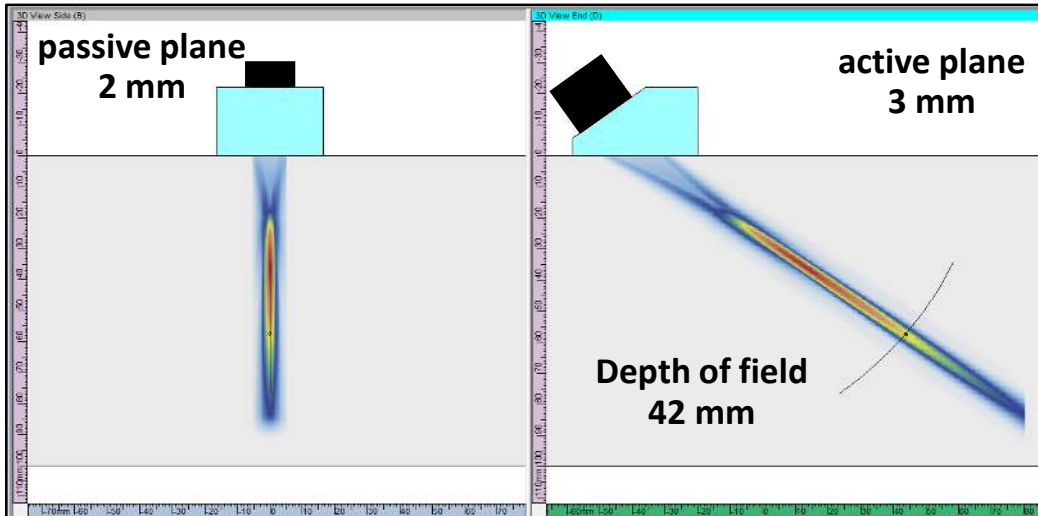
- Suited for detection and characterization of small flaws in components and welds in wall thickness range 25 to 100 mm (1 to 4 inch)

- Beam dimension of 3 x 2 mm² (0.12 x 0.08 sq inch)

8

AL-TFM Probes – UV Database

Probe Name	Frequency	Elements	Pitch
AT - 7.5 MHz - 16	7.50 MHz	16	0.50 mm
AT - 7.5 MHz - 32	7.50 MHz	32	0.25 mm
AT - 10 MHz - 32	10.00 MHz	32	0.25 mm
AT - 10 MHz - 16	10.00 MHz	16	0.50 mm
TFM-AL5-DF15	5.00 MHz	64	0.30 mm
TFM-AL5-DF50	5.00 MHz	64	0.30 mm

Manage   Accept

9

TFM-AL Probes - Offering

Part Number	Item	Detailed Description
10058571	**TFM-AL-5MHz DF 15 mm**	ZPA-PB1D-TFM-AL-5MHZ-64E-DF-15MM-REX-3.0M-ZPAC 1D Linear phased array probe designed for **focused azimuthal scanning and TFM in depth range 5 to 30 mm - 5 MHz** - 64 elements - AL probe casing - Active surface of 19.2 mm x 15.0 mm - Curved in the passive plane - ZPAC connector (TOPAZ) - 3.0 m cable length
10058568	**TFM-AL-5MHz DF 50 mm**	ZPA-PB1D-TFM-AL-5MHZ-64E-DF-50MM-REX-3.0M-ZPAC 1D Linear phased array probe designed for **focused azimuthal scanning and TFM in depth range 25 to 100 mm - 5 MHz** - 64 elements - AL probe casing - Active surface of 19.2 mm x 15.0 mm - Curved in the passive plane - ZPAC connector (TOPAZ) - 3.0 m cable length
10058574	**TFM-AL-10MHz DF 50 mm**	ZPA-PB1D-TFM-AL-10MHZ-64E-DF-50MM-REX-3.0M-ZPAC 1D Linear phased array probe designed for **focused azimuthal scanning and TFM in depth range 25 to 100 mm - 10 MHz** - 64 elements - AL probe casing - Active surface of 19.2 mm x 15.0 mm - Curved in the passive plane - ZPAC connector (TOPAZ) - 3.0 m cable length

2D-Matrix Array Probes

- Azimuthal, 2D-matrix array probes in AM and AL-type housing

- Compatible with all standard AM and AL wedges, for LW and SW beam generation

BENEFITS :

- 9 x 7 elements, small pitch, for 2-plane steering capability: refracted angle and skew angle can be varied simultaneously, for both LW and SW beams

- Specifically suited for improved detection and characterization of skewed reflectors and misoriented flaws

- Simultaneous multi-skew inspection, no additional inspection sequences required

11

AM 5MHz 9 x 7 Elements, Wedge 55SW

Acoustic beam simulation, for typical configuration :
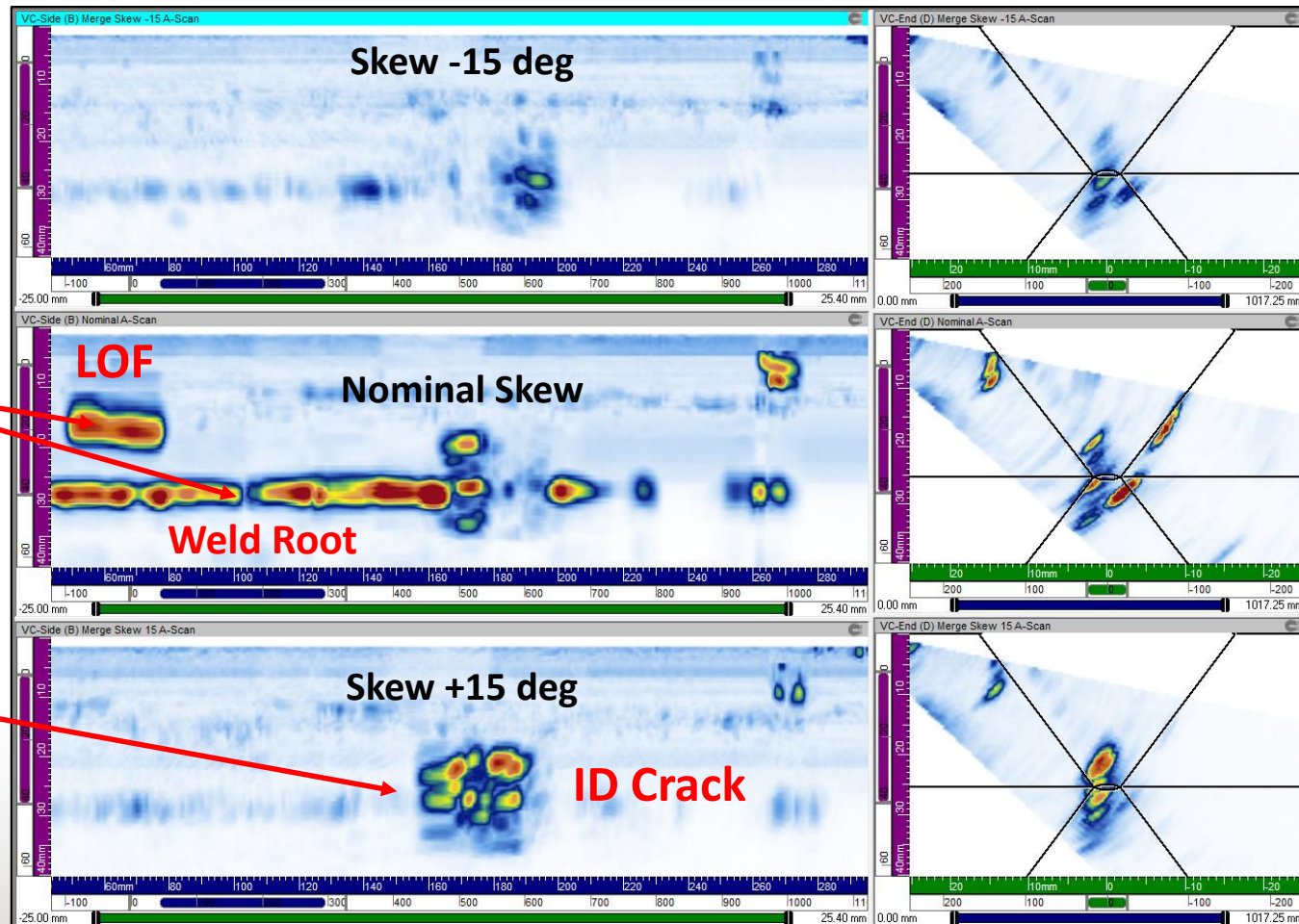SW beams with skews ± 15⁰

12
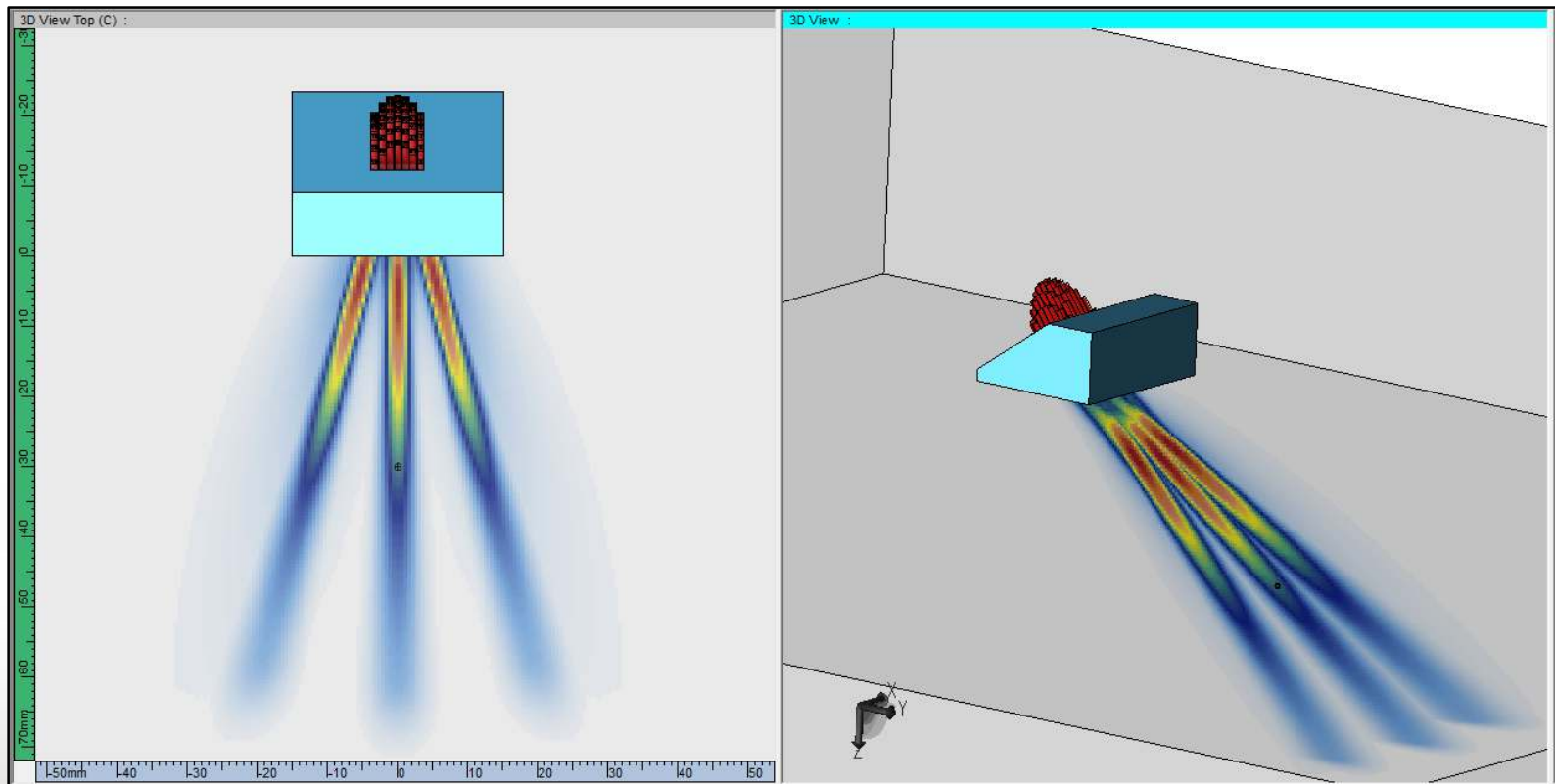
AM 5MHz 9 x 7 Elements, Wedge 55SW

Actual weld data: improved flaw characterization

LOF and weld root ONLY detected with nominal skew

Skewed ID Crack BETTER detected and sized with skewed beam

Skew -15 deg

LOF

Nominal Skew

Weld Root

Skew +15 deg

ID Crack

13

2D-Matrix Probes – Typical Working Range

Probe	Wedge 55LW	Wedge 55SW
AM 5 MHz 9x7 elements	25º to 85º LW skew ± 25º	40º to 70º SW skew ± 15º
AL 2.25 MHz 9x7 elements	10º to 85º LW skew ± 30º	40º to 70º SW skew ± 25º

2D-Matrix Probes – UV Database

Probe Name	Frequency	Elements	Pitch
00-010781	5.00 MHz	32	0.75 mm
00-010828	5.00 MHz	32	0.75 mm
TFM-DLA10-DF20	10.00 MHz	64	0.35 mm
AM-5M9x7E9.9-7.7	5.00 MHz	9	1.10 mm
AL-2.25M9x7E15.8-12.3	2.25 MHz	9	1.75 mm
1.5M8x4E20-12	1.50 MHz	8	2.50 mm

Manage   Accept

2D-Matrix Probes - Offering

Part Number	Item	Detailed Description
10057197	**AM 5 MHz 9x7 elements**	ZPA-PB2D-AM-5M9x7E9.9-7.7-REX-3.0M-ZPAC Generic 2D Matrix Phased Array Probe - 5 MHz - 9 x 7 elements - Active surface of 9.9 mm x 7.7 mm - Impedance matching to rexolite (2.45 Mrayl) - 3.0 m cable length - ZPAC connector
10057198	**AL 2.25 MHz 9x7 elements**	ZPA-PB2D-AL-2.25M9x7E15.8-12.3-REX-3.0M-ZPAC Generic 2D Matrix Phased Array Probe - 2.25 MHz - 9 x 7 elements - Active surface of 15.8 mm x 12.3 mm - Impedance matching to rexolite (2.45 Mrayl) - 3.0 m cable length - ZPAC connector

TOP△Z 64 - Versatile PA UT Unit ZETEC

- Fully integrated, portable PA UT unit
- Excellent *64 active element PA UT*
- 2 high-SNR TOFD channels at 200 V
- *12" Hi-Res multi-touch* display
- Support of 2D-matrix arrays
- Best-in class *« live » TFM*
- Parallel recording of PA UT & TFM
- *Bipolar pulse (150Vpp)* option
- Driven by *UtraVision Touch*

Benefits of Zetec Solution

- Complete offering of high-quality standard and advanced PA UT probes required for efficient detection and characterization of challenging flaws, e.g. small voids, skewed reflectors, misoriented cracks

- **TOPAZ 64** portable unit, includes all required tools and features to efficiently set up and deploy advanced PA UT probes and examination techniques, including live TFM

- Advanced data analysis (Volumetric Merge, Indication Table, …) and reporting, using on-board *UV Touch™*