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MAUT

Matrix Array Ultrasonic Testing

Transducer Technology

Eskil Skoglund - Chief Research Officer

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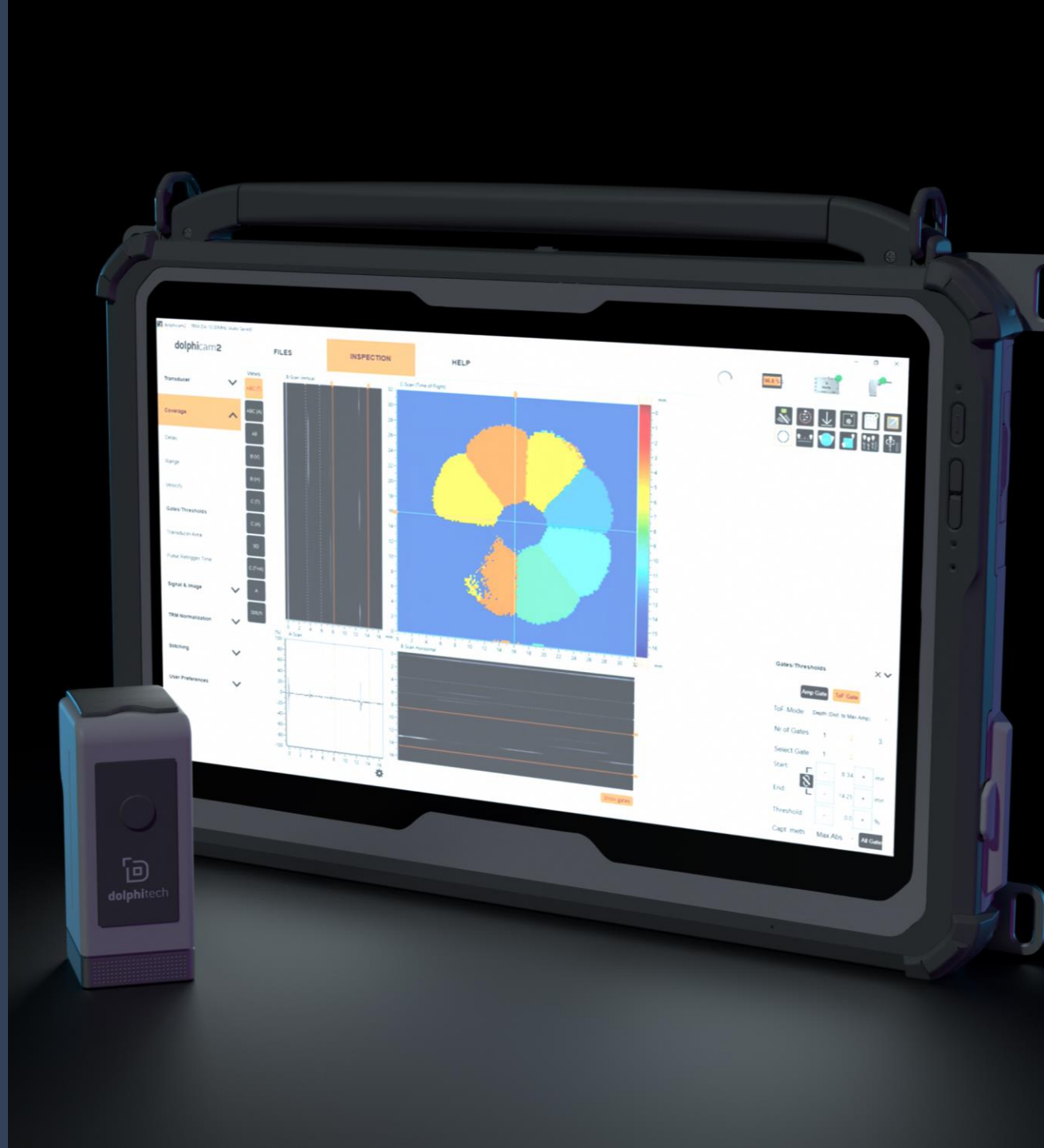
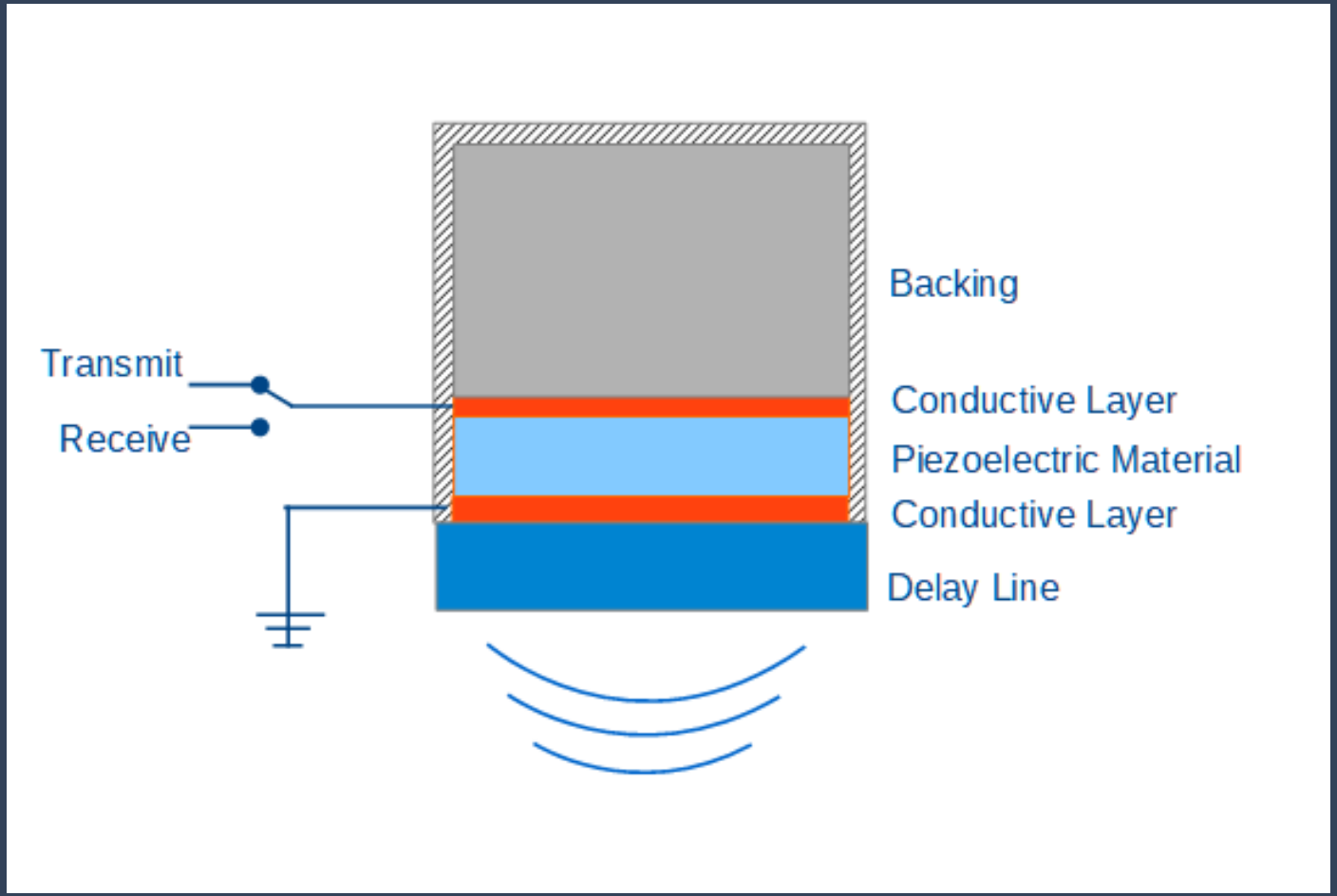
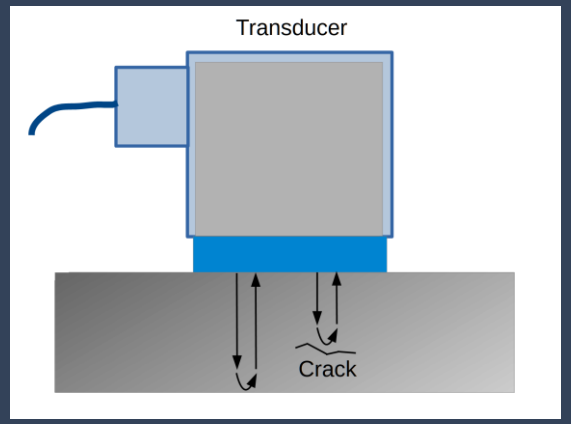


Ultrasound Transducer Basics

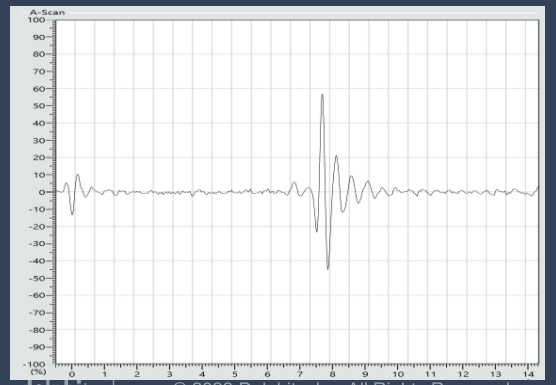


Different Ultrasound Technologies

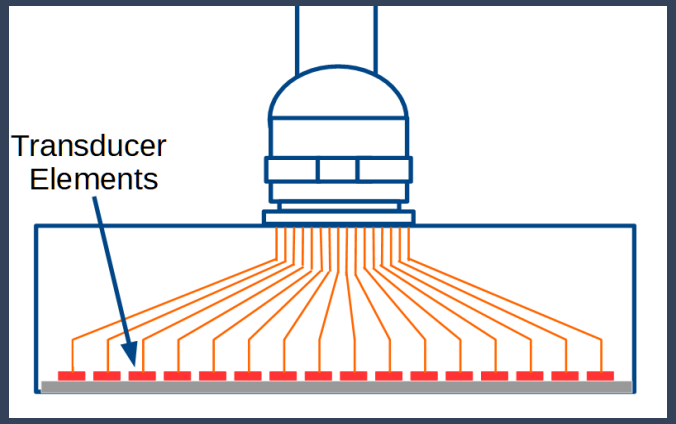
UT
Ultrasound Testing
Single Element



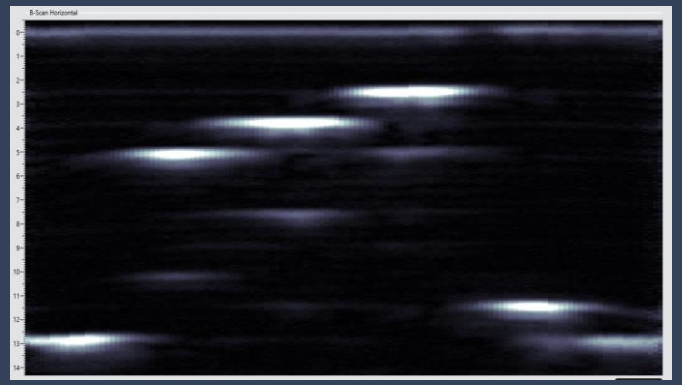
A-scan



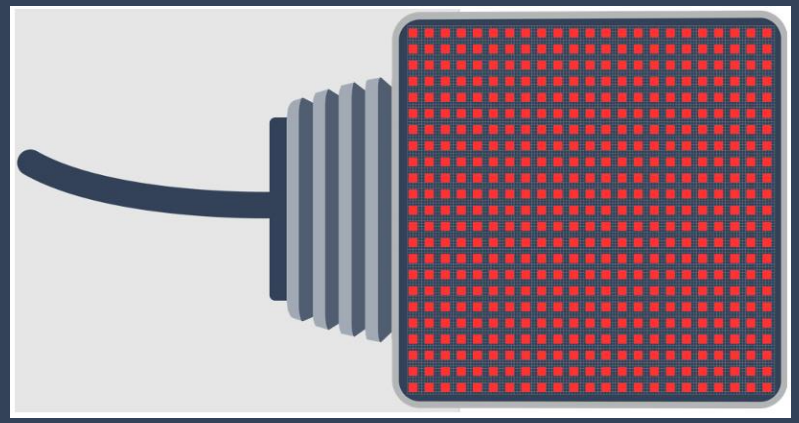
PAUT
Phased Array Ultrasound Testing
1D-Array



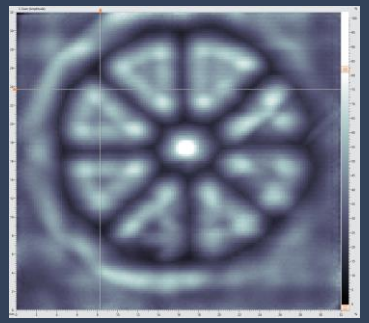
B-scan (Cross Section)



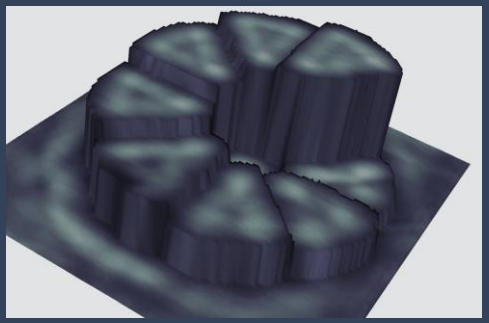
MAUT
Matrix Array Ultrasound Testing
2D-Array



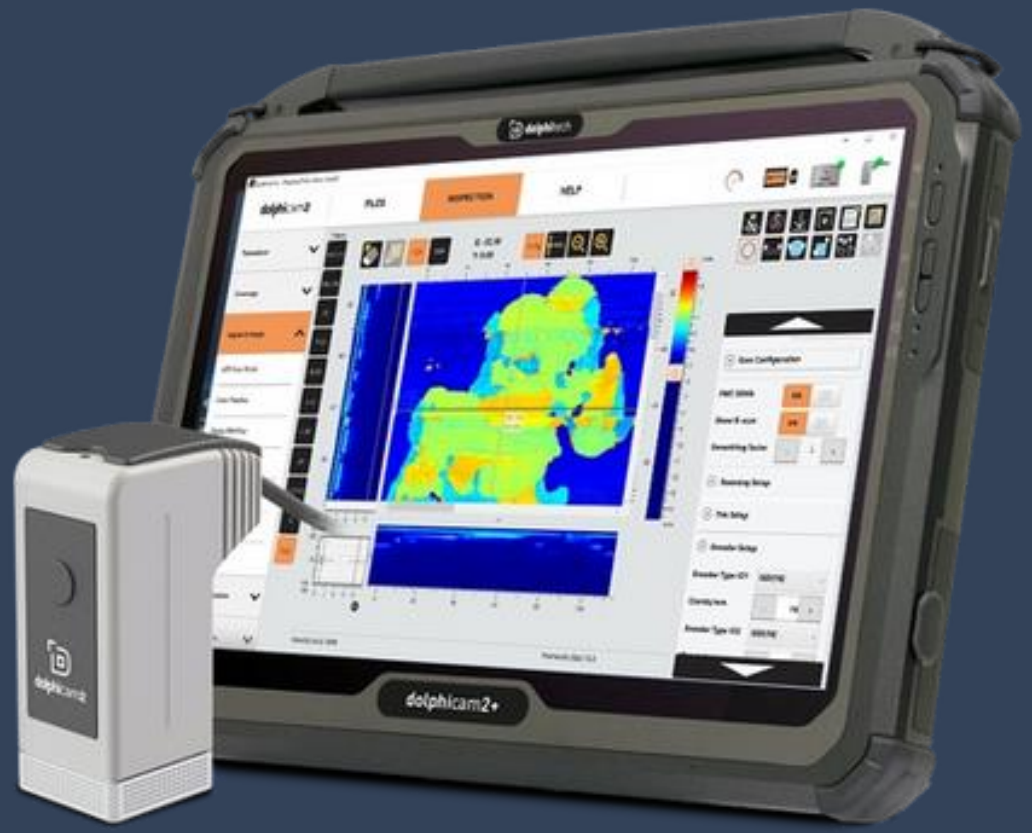
C-scan



3D Volume Data



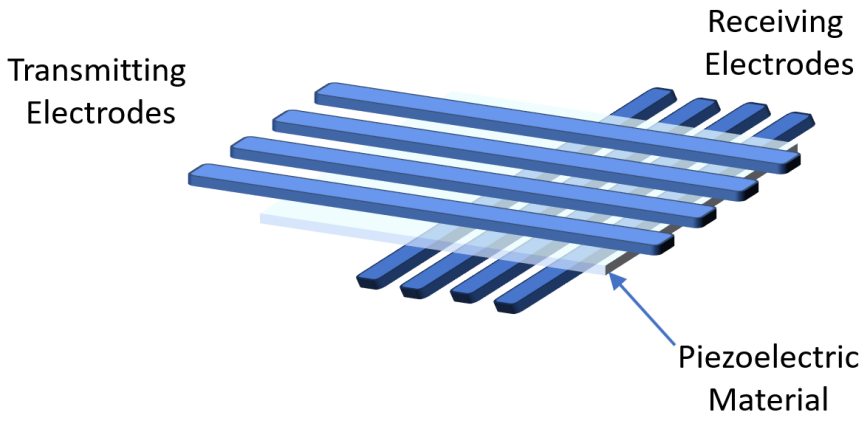
Demo ☺

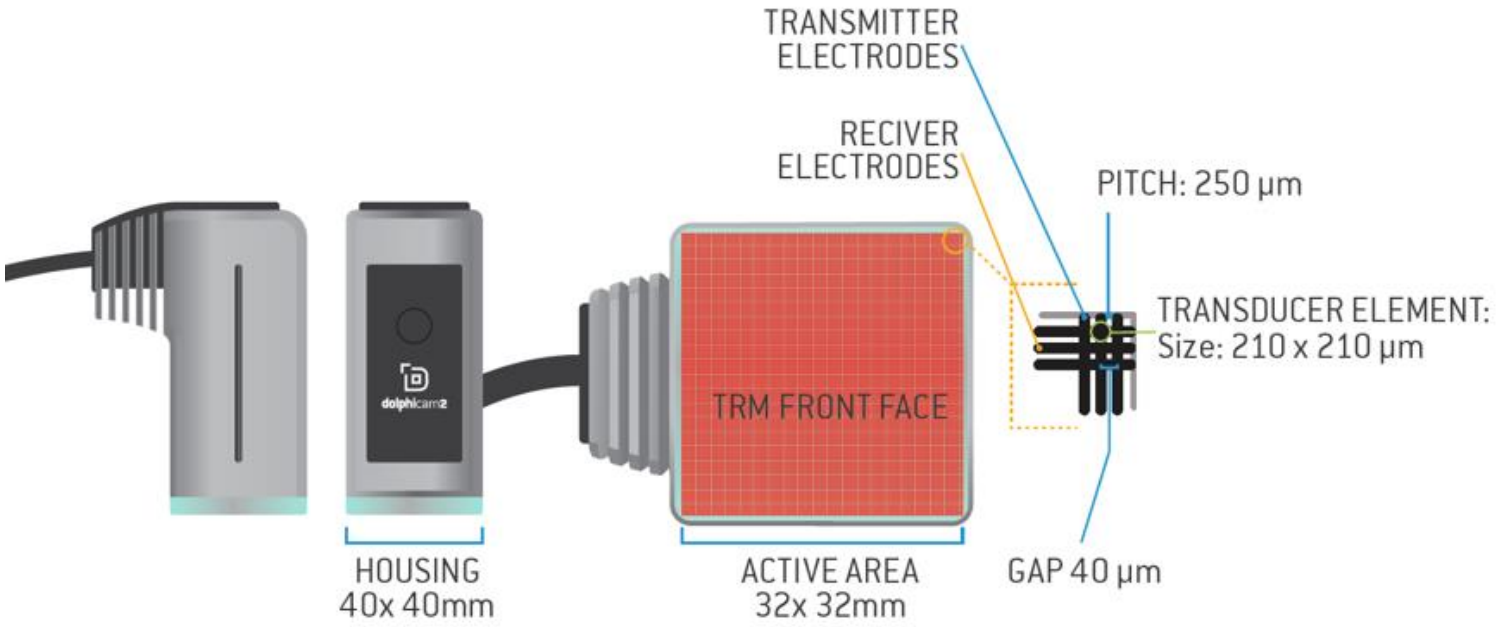


How does it work?

dolphicam2

- Crossing Electrodes
- 128 x 128 Elements
- 16.384 A-scan data
- Pitch 250 µm





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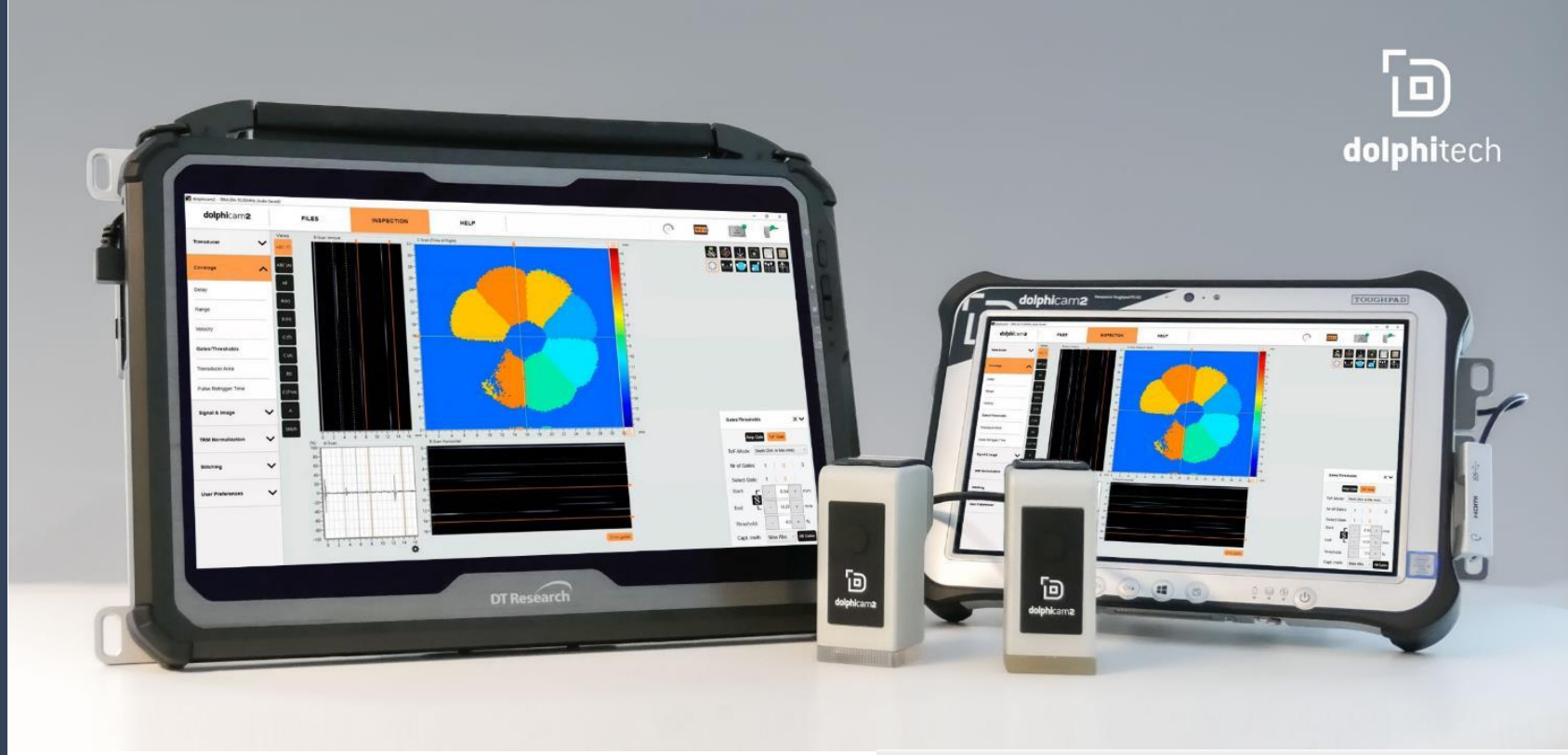
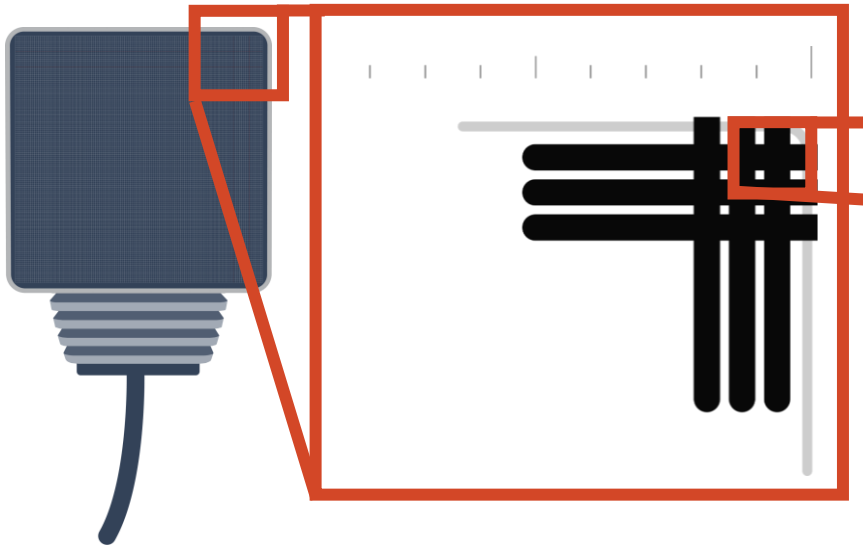
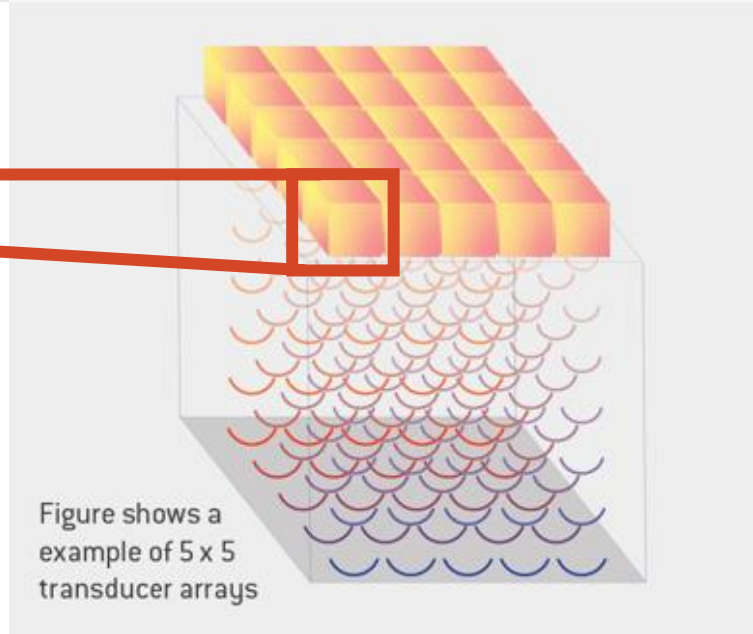
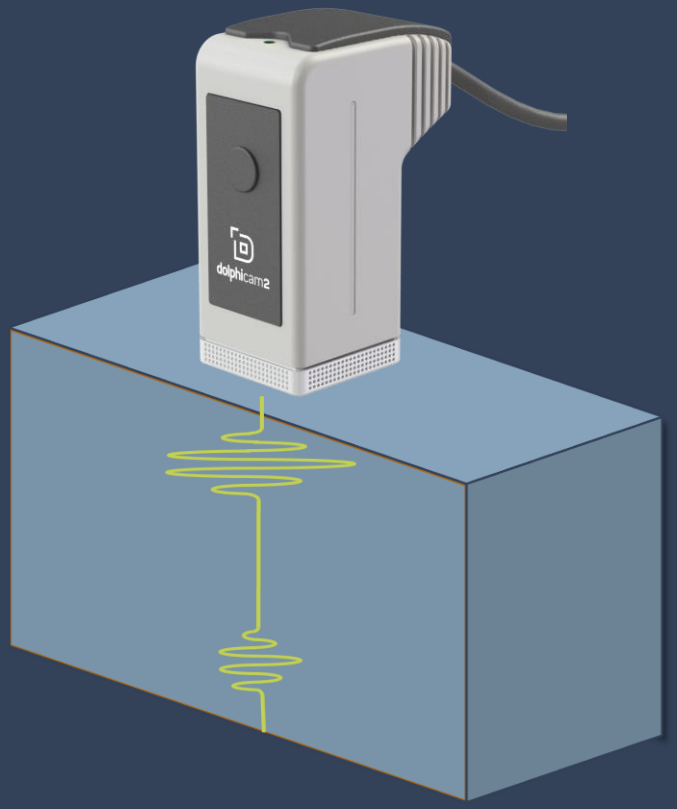
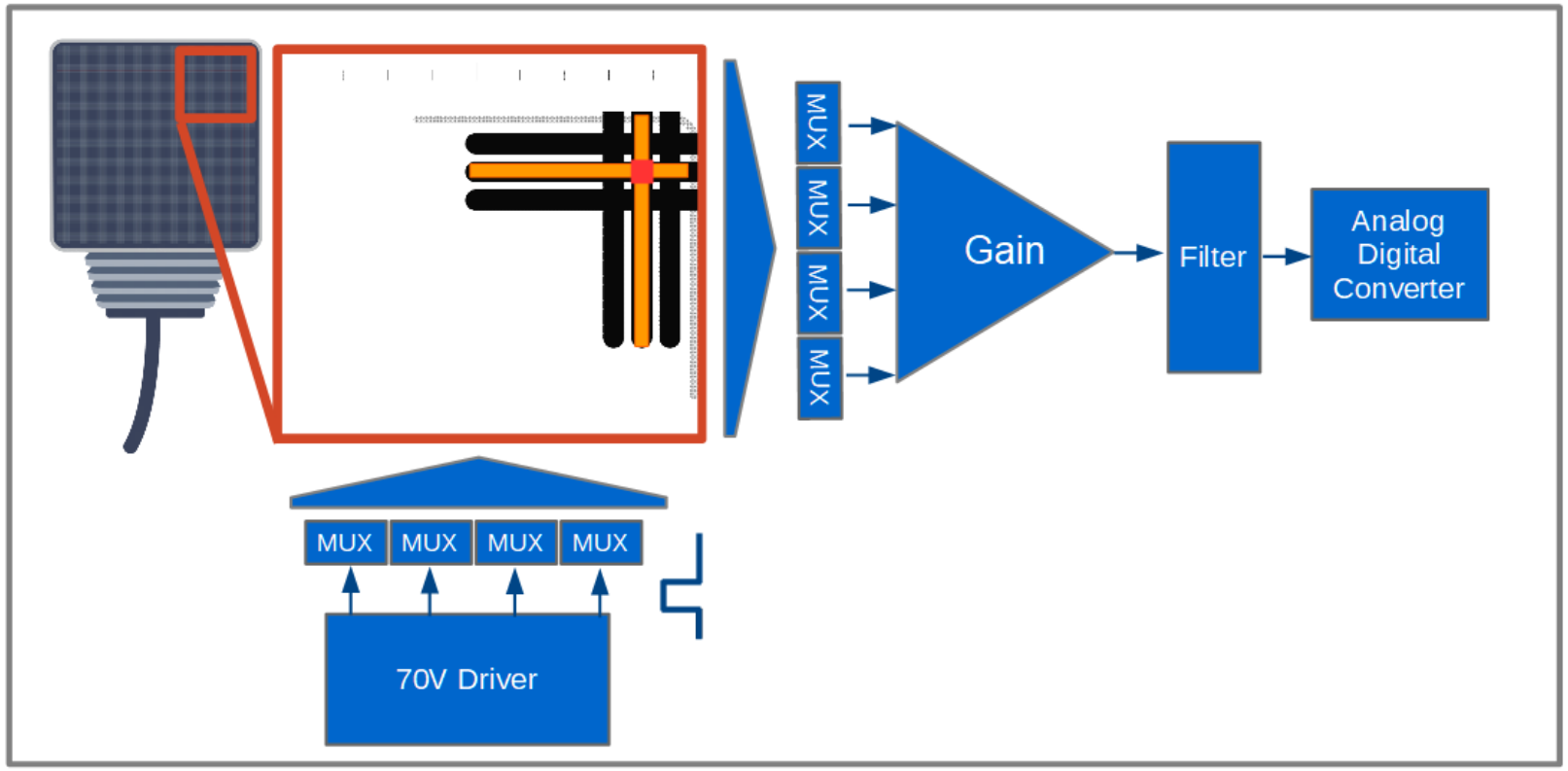






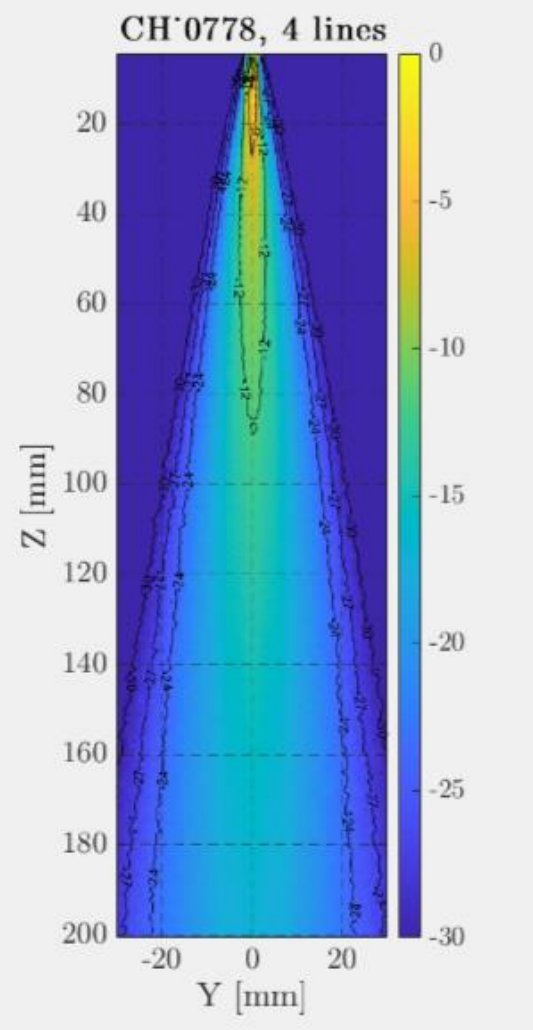
Inside the TRM (Transducer Module)

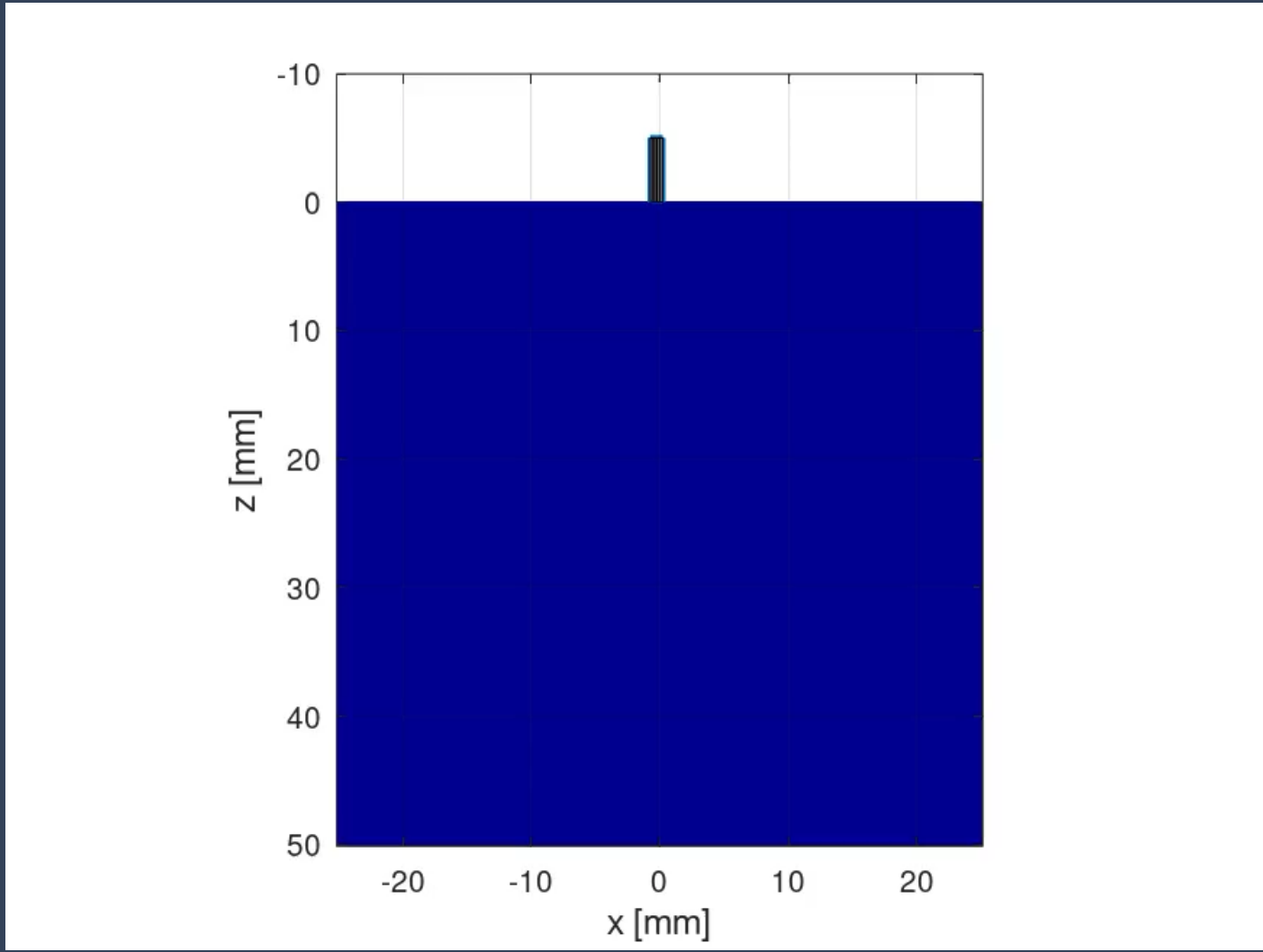




Sound Field Profile

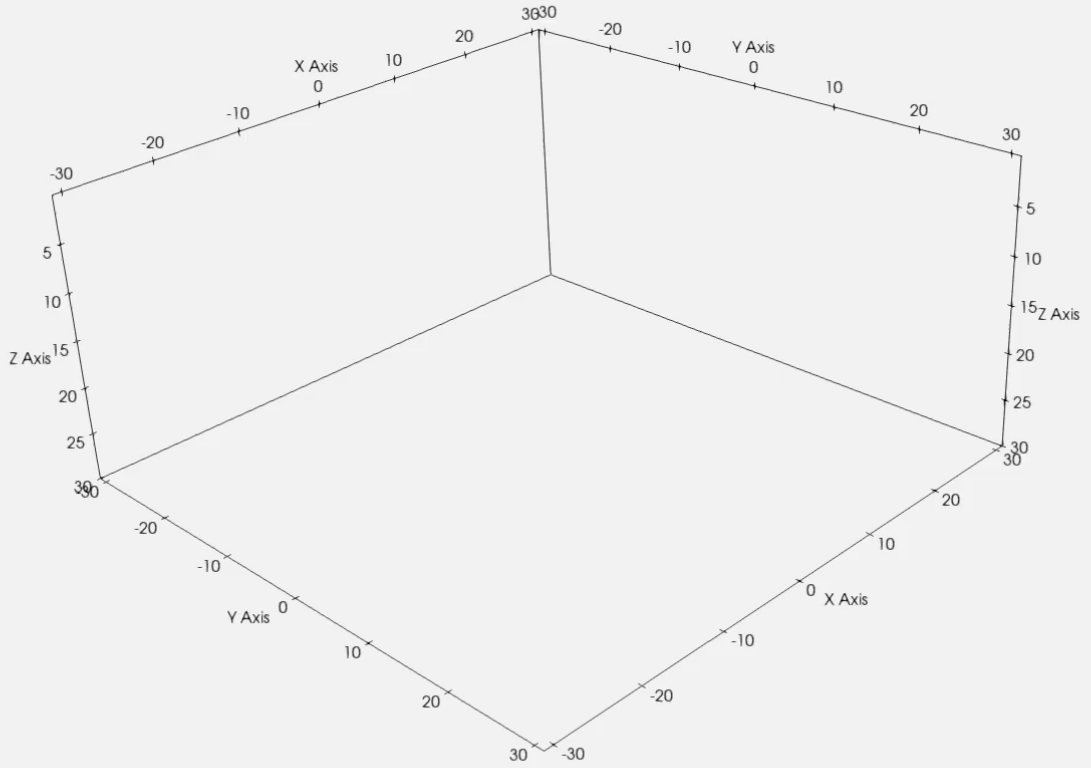
2D-Simulation 4 Transmit Electrodes





Sound Field Profile

3D-Simulation 4 Transmit Electrodes



NDT Examples
MAUT
Matrix Array Ultrasound Technology

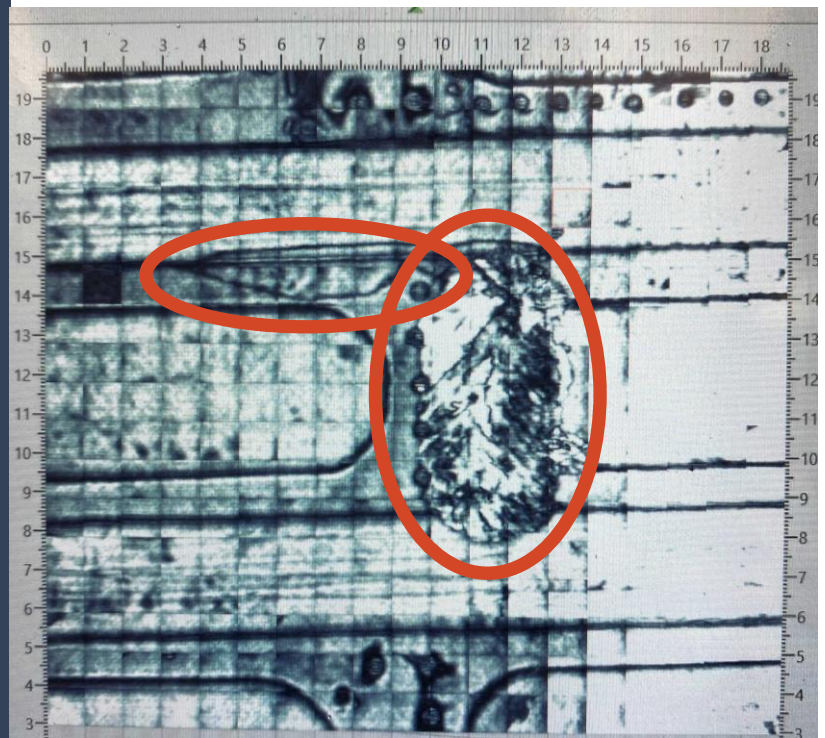
dolphicam2

787 impact damage

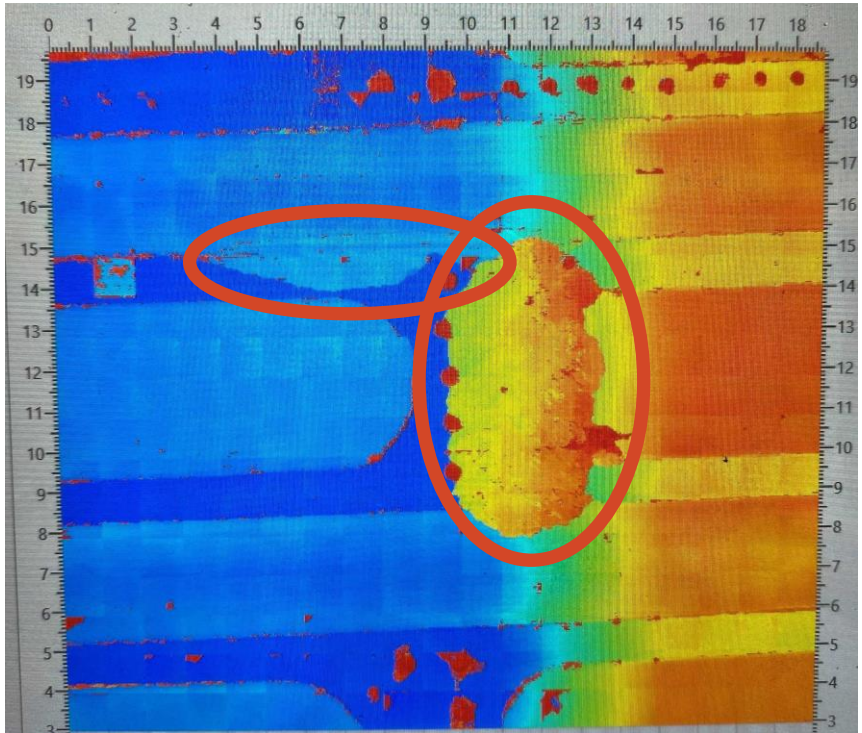
- Impact event on the fuselage of a Boeing 787 Dreamliner
- 480x480mm area mapped with the dolphicam2
- Main impact zone and disbonded stringer clearly visible

- Aircraft photograph

- Amplitude C-scan



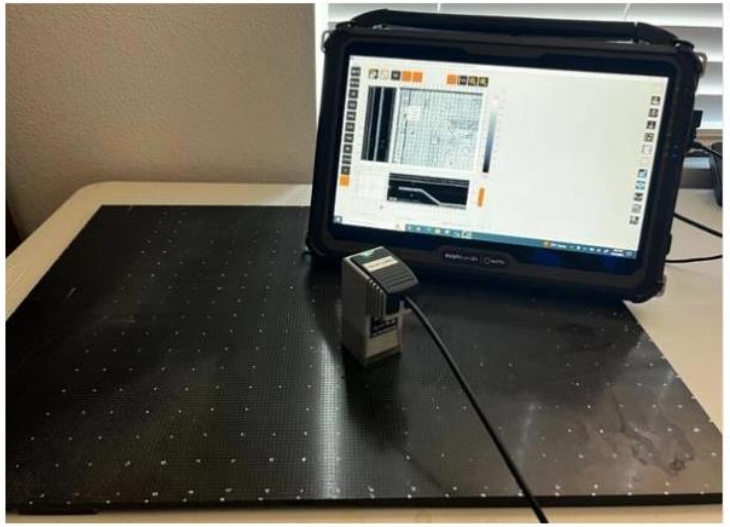
- ToF (Depth) C-scan

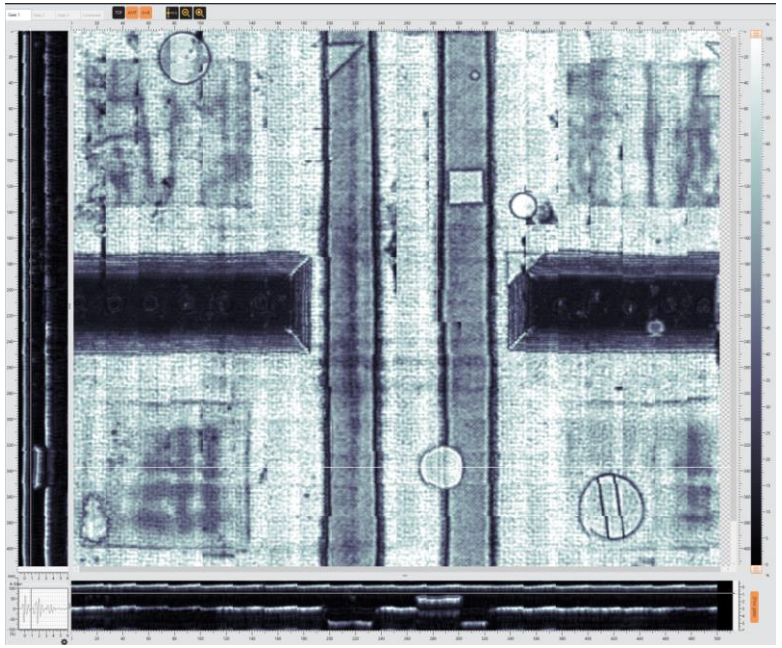


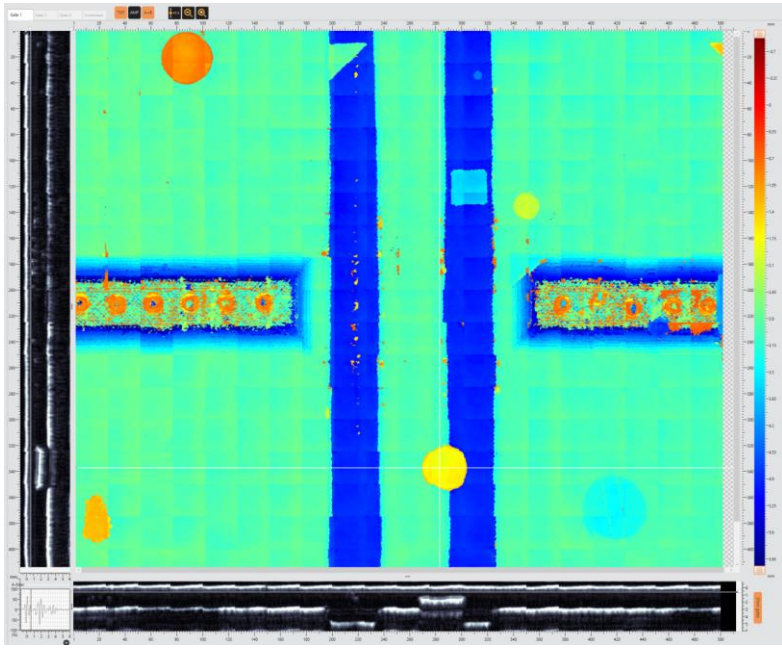
FAA

CFRP Panel

Item #	Flaw type	Size (")	Ply layer
1	Missing sealant	As shown	Between ply 8 & shear tie flange
2	Pillow Insert	Ø2.00	Between ply 16 & sound damper
3	Pillow Insert	1.00×1.00	Between lam ply 16 & shear tie pad ply 1
4	Pillow Insert	1.00×1.00	Between ply 2 & 3 of the stiffener
5	Pillow Insert	Ø1.50	Between ply 4 & 5 (25%)
6	Pillow Insert	1.75×0.50	Between ply 4 & 5 of the shear tie pad
7	Pillow Insert	Ø1.25	Between ply 8 & 9 (50%)
8	Pillow Insert	Ø0.50	Between ply 6 & 7 of the shear tie pad
9	Dremel cut	~0.05×1.00	Shear tie flange as shown
10	Flat bottom Hole	Ø0.25	0.015" ↧ (Between plies 6 & 7)
11	Flat bottom hole	Ø0.75	0.030" ↧ (Between plies 6 & 7)
12	Prepreg backing	1.25×1.25	Between ply 16 & stiffeners ply 1
13	Prepreg backing	2.00×2.00	Between ply 8 & 9 (50%)
14	Grease	Ø1.50	Between ply 8 & 9 (50%)
Item #	**Description**	**Quantity**	**Designation**
15	Flat head bolt	12	100° FL HD, 1/4-20UNC-2A × 0.500
16	Hex nut	12	1/4-20UNC-2B
17	Shear tie flange	2	See shear flange drawing
18	Sound damper	4	4.5"×5.0" SMACSONIC pads
19	Sealant	As needed	

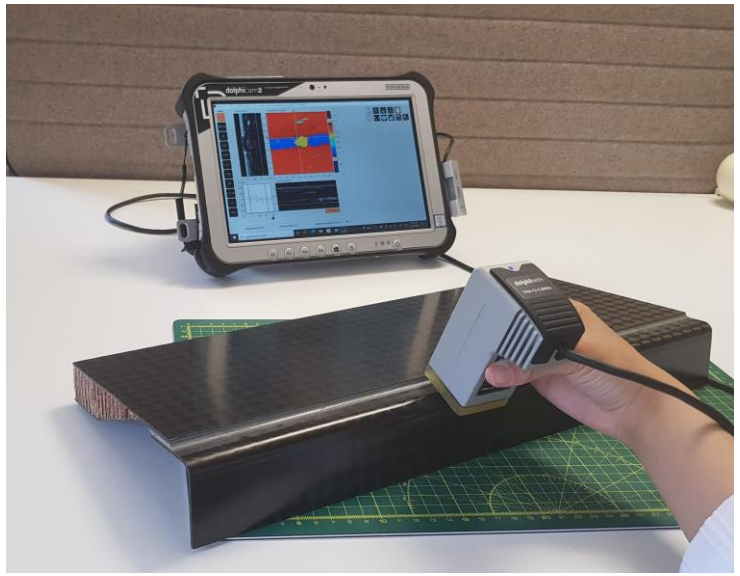


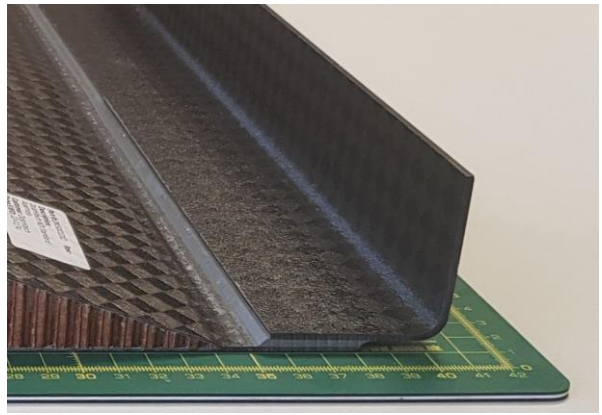


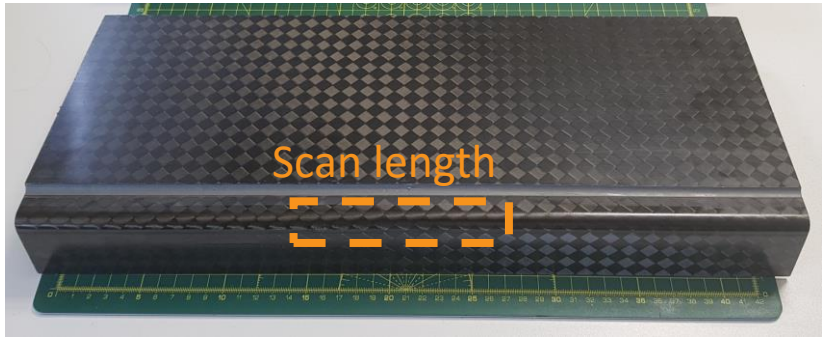


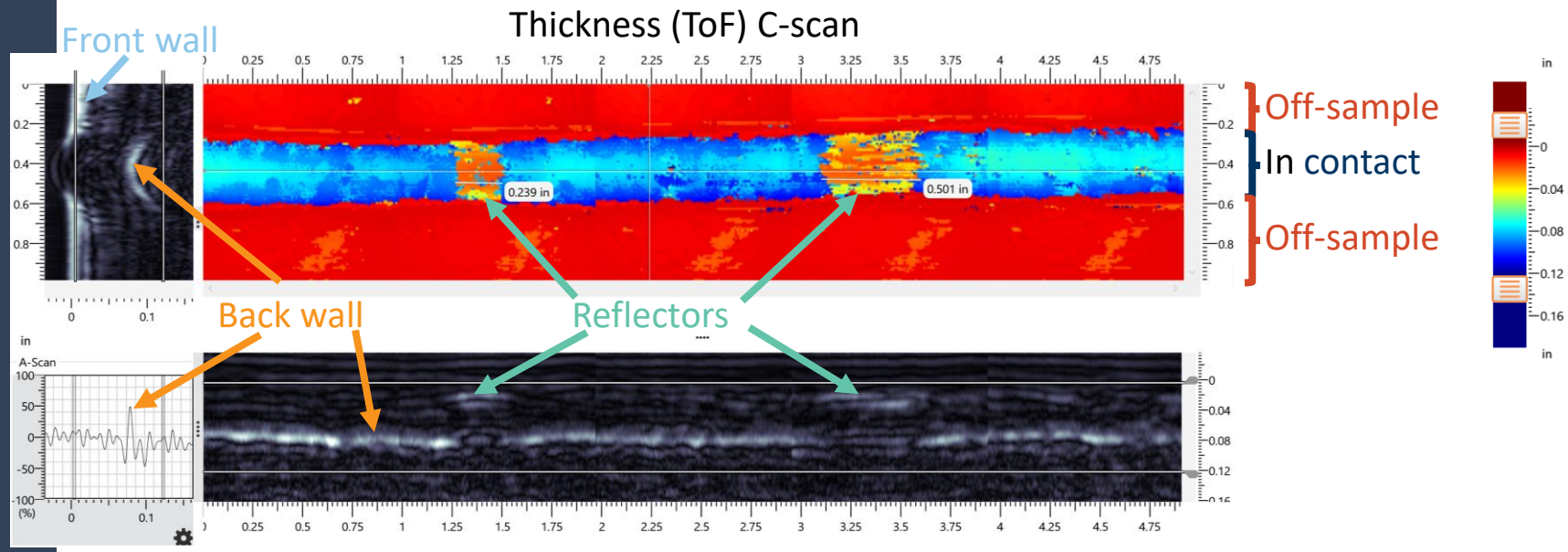
CFRP radii

- Tight corner radius of 0.09” thick carbon fiber laminate.
- Nominal radius of curvature is 0.3125” (~8mm).
- Circular reflectors are embedded, which are nominally 0.25” and 0.5” in diameter.

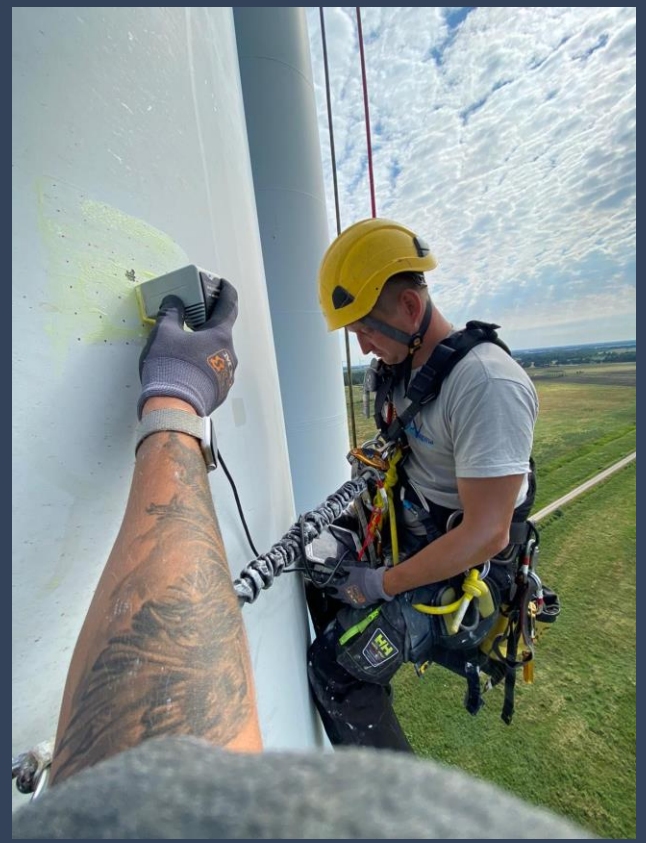




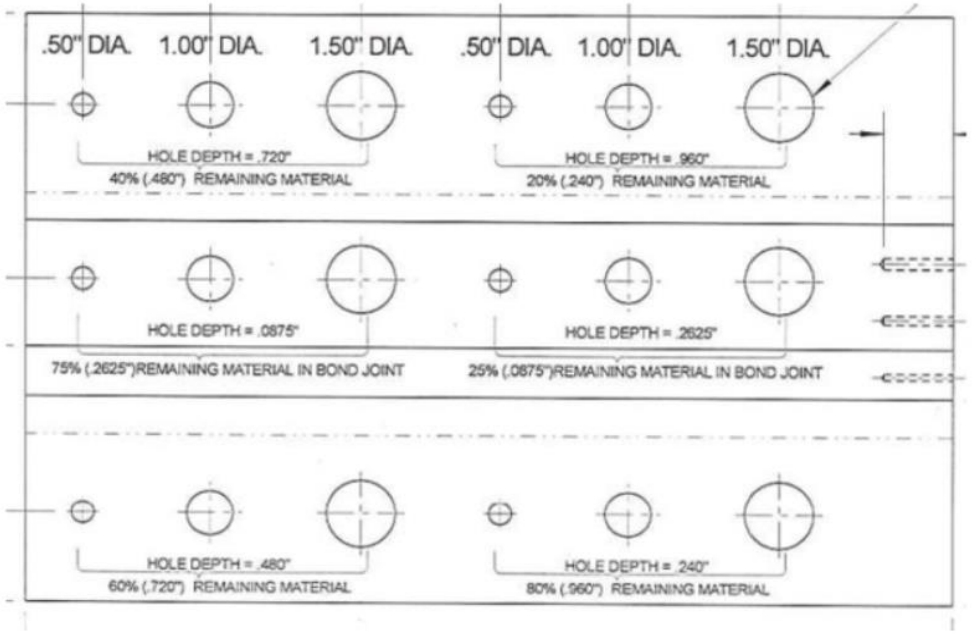




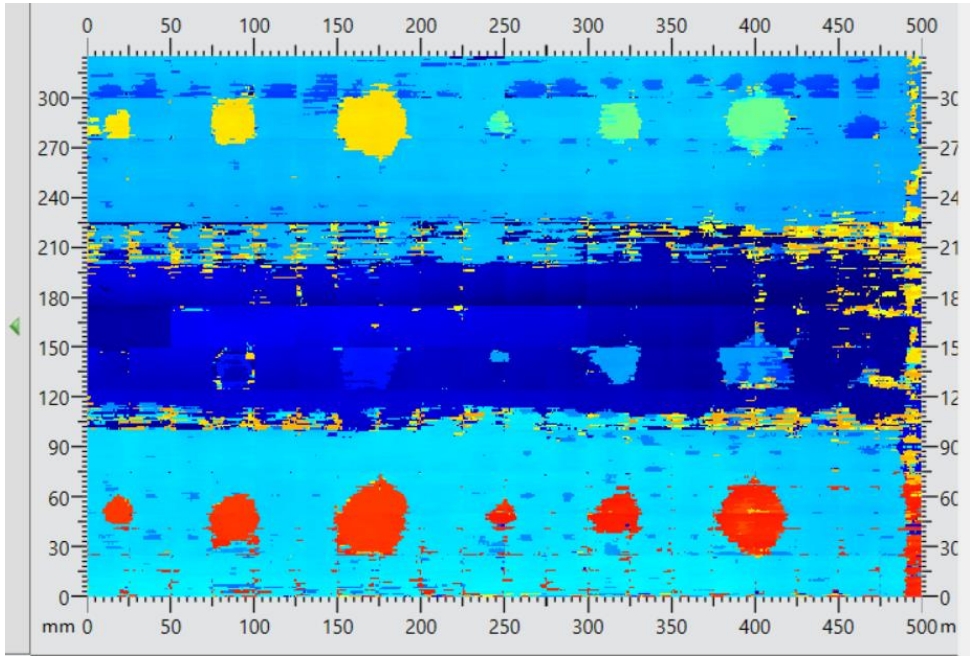
Wind blade GFRP



– Technical drawing



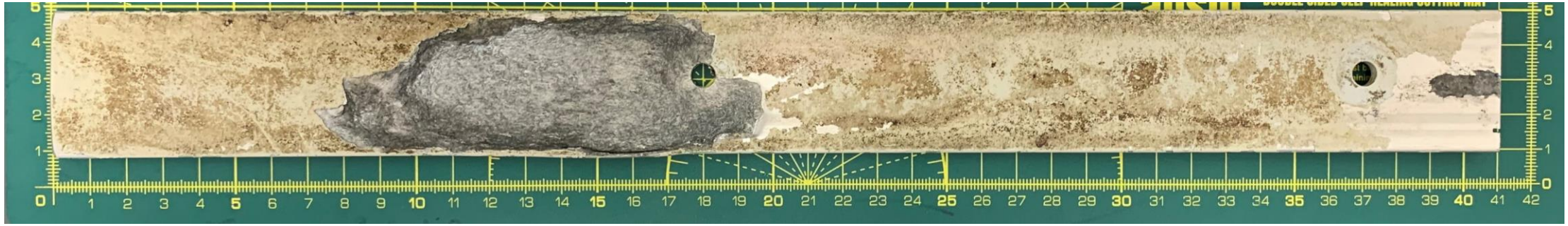
– ToF (Depth) C-scan



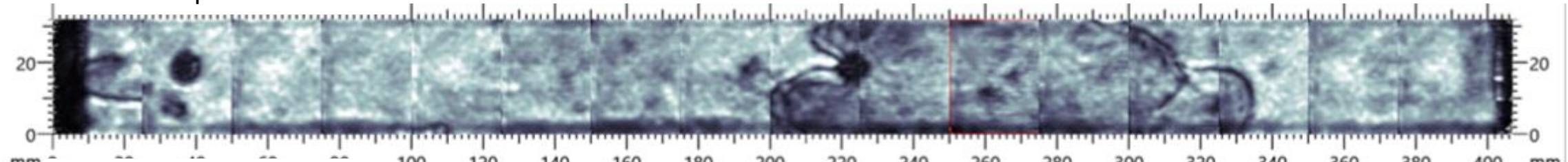
General corrosion

– 3.5mm thick aluminium alloy

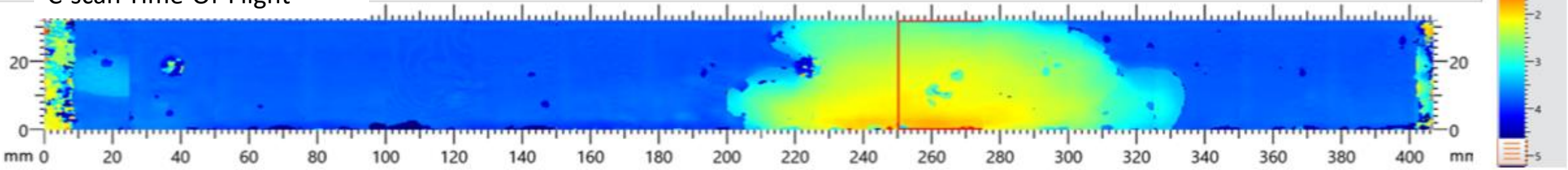
Corrosion in 3.5mm aluminium alloy



C-scan Amplitude:



C-scan Time-Of-Flight

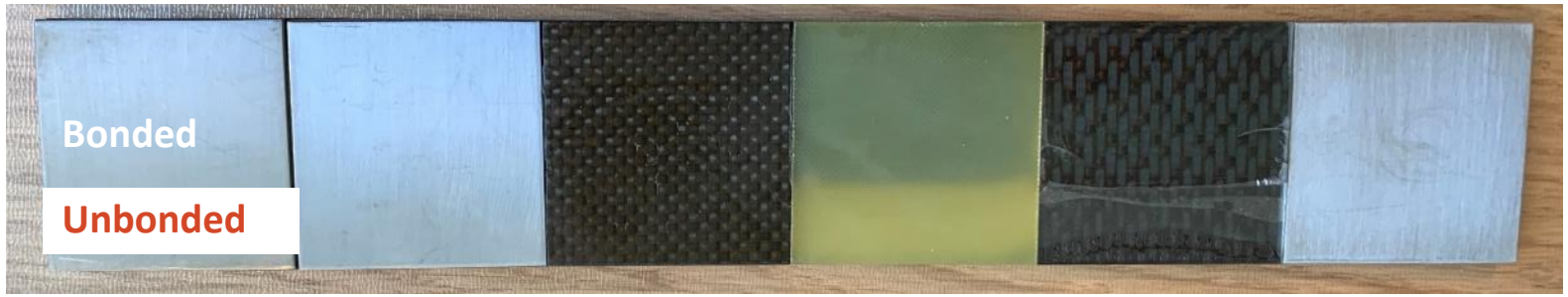


Material bonding

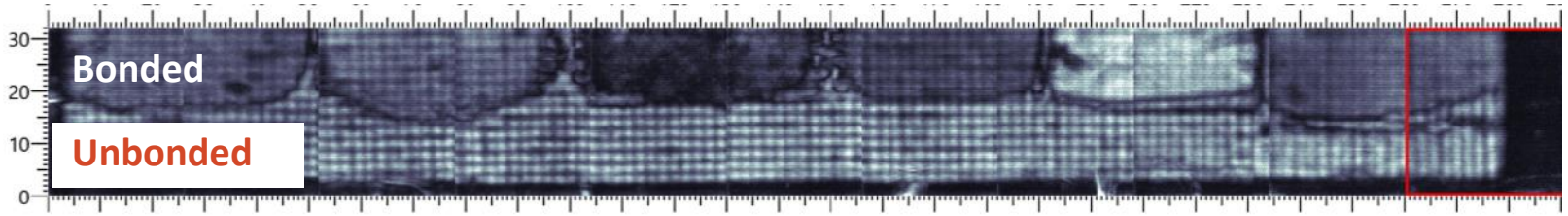
- 2mm thick woven CFRP with six different material tiles adhesively bonded to back face
- Half of each tile is bonded, half is left unbonded
- Difference between bonded and unbonded is clearly visible for all tiles
- Each tile has a different characteristic bonding signature enabling material discrimination

– Inspection face

– Back face



– Amplitude C-scan



– ToF (Depth) C-scan