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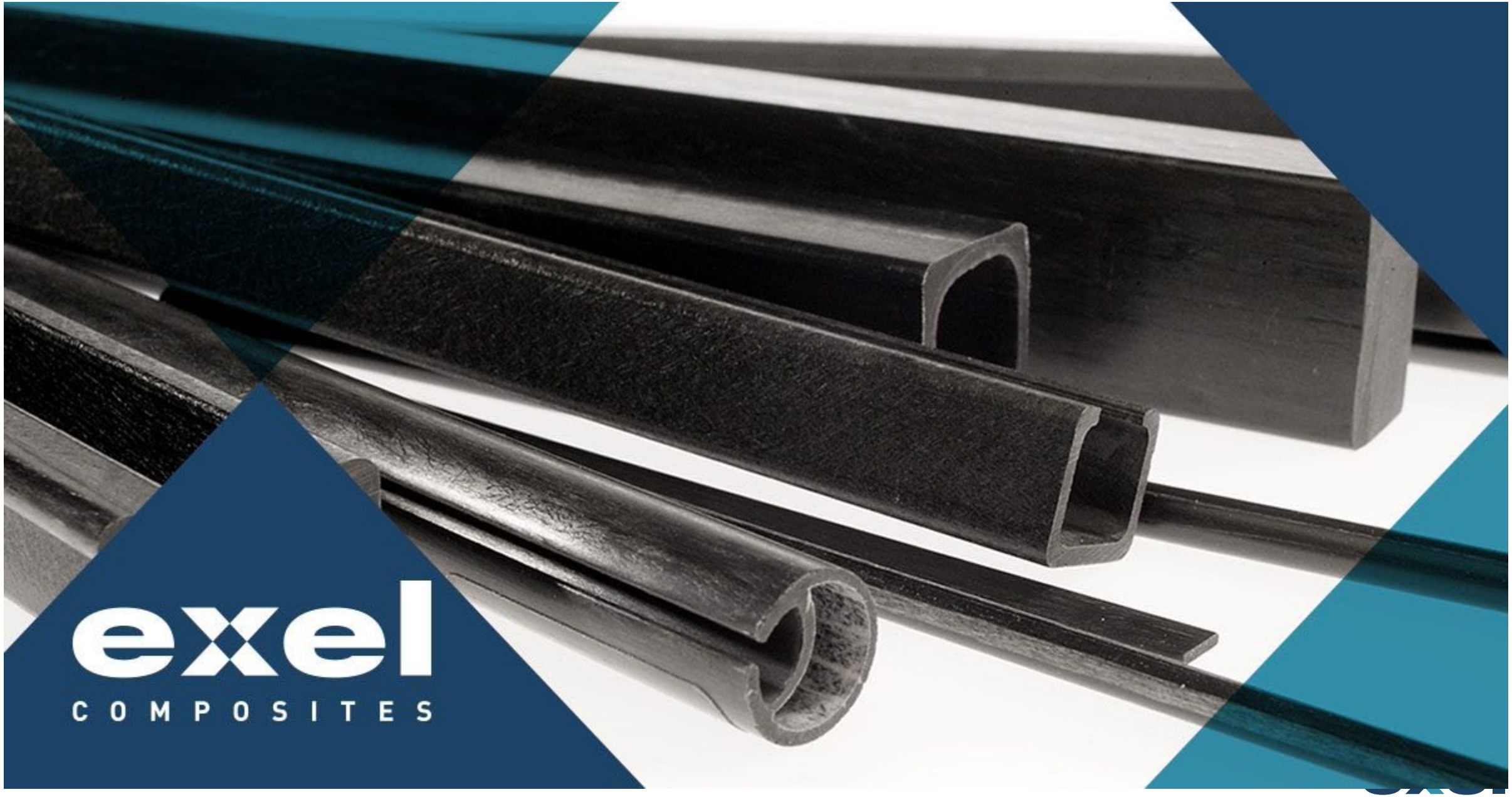
The Use of Non-Destructive Evaluation in the Quality Control of Pultruded Composite Profiles

N Dykes

May 2023

FOR FORWARD THINKERS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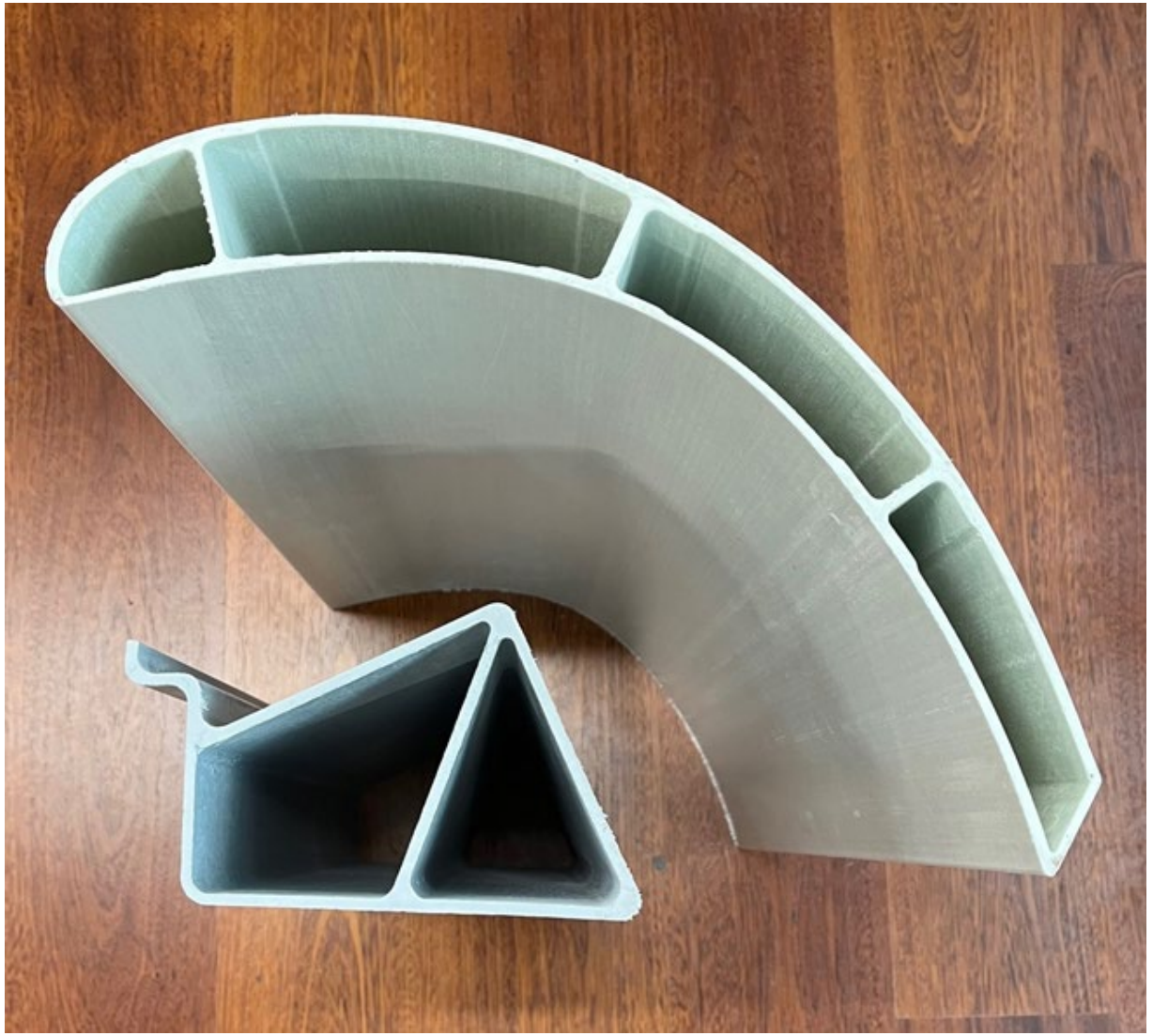
Glass rovings and mats converging with resin to form a profile

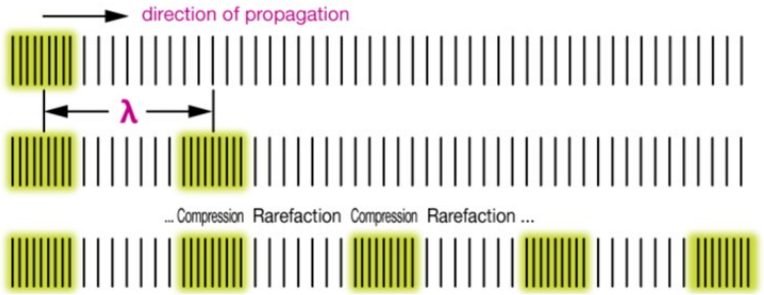


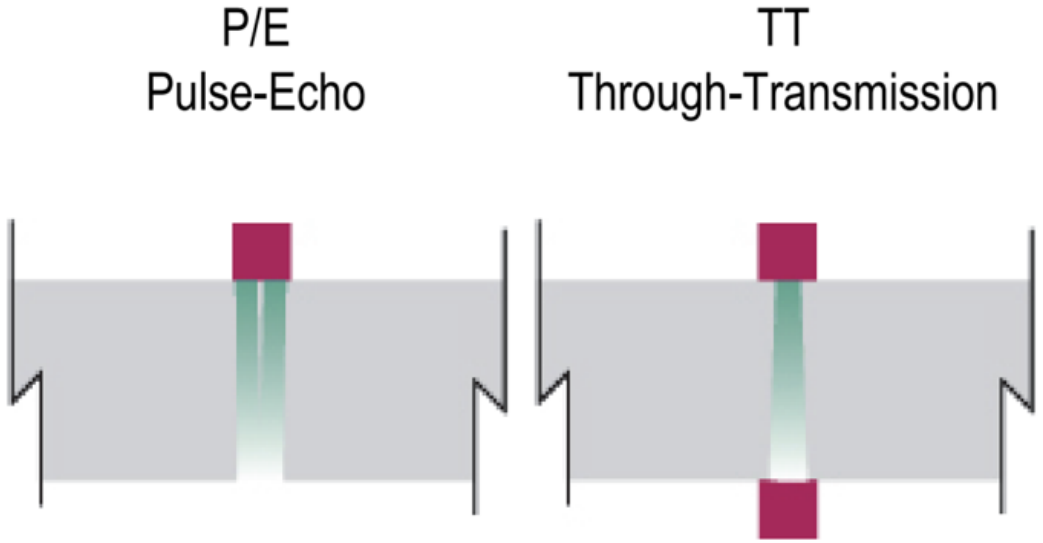
How do we know the Profile has been manufactured correctly?

Quality control using Ultrasonic Testing

Looking for: Delamination, Voids, Discontinuities

Ultrasonic sound waves injected into the profile.





Sound waves are reflected at changes in material properties

“Listen” for the Echo from a delamination or rear wall.
Time of Flight/2 x Sound Velocity gives distance

Through transmission – amplitude indicates quality

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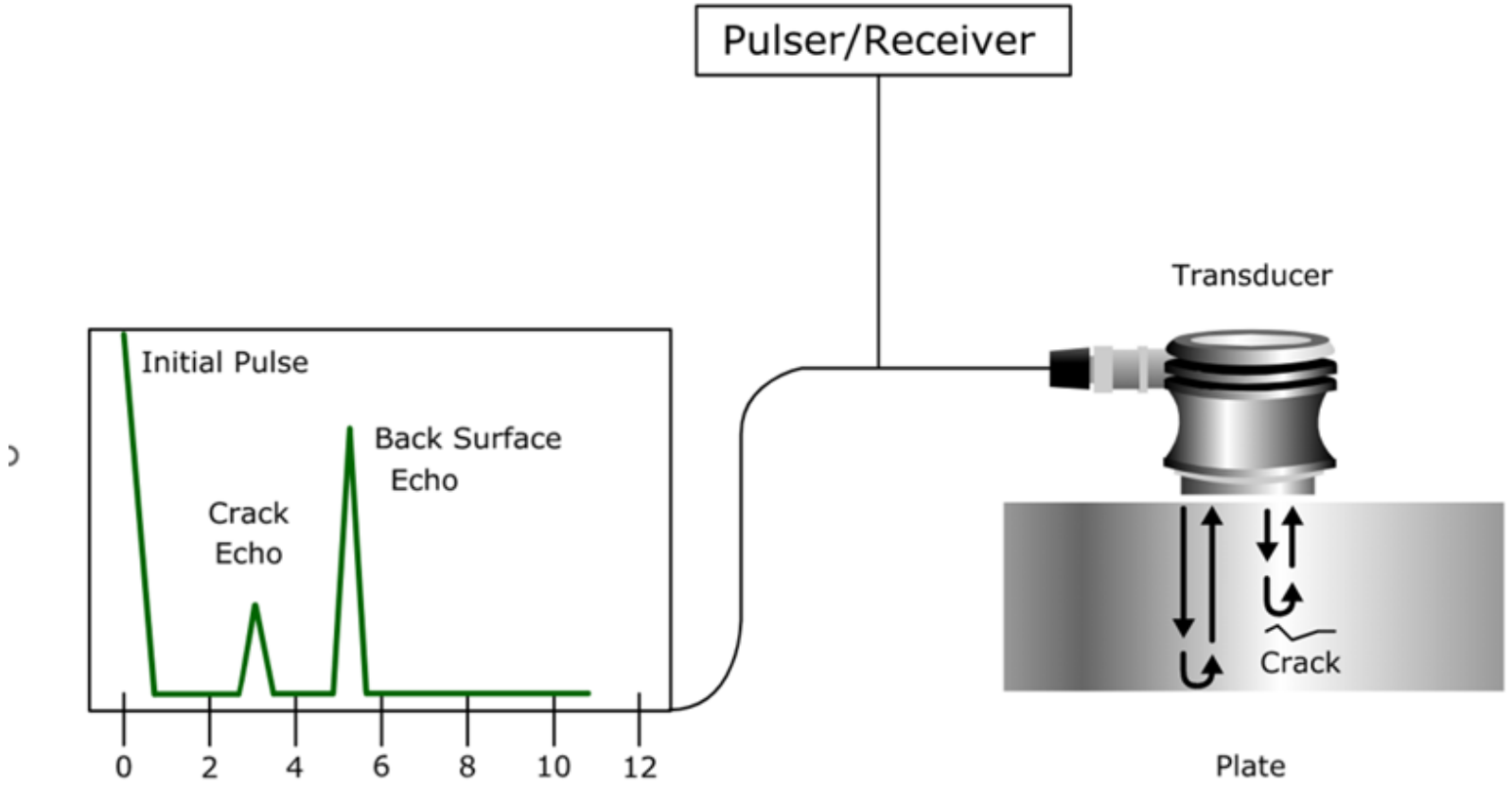
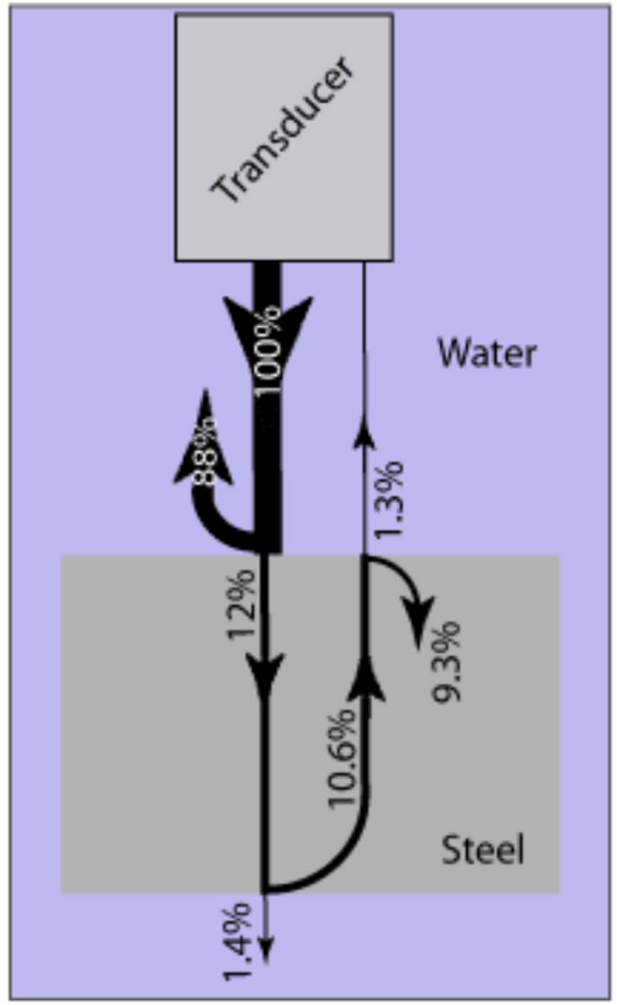
A-Scan Ultrasonic testing – through thickness





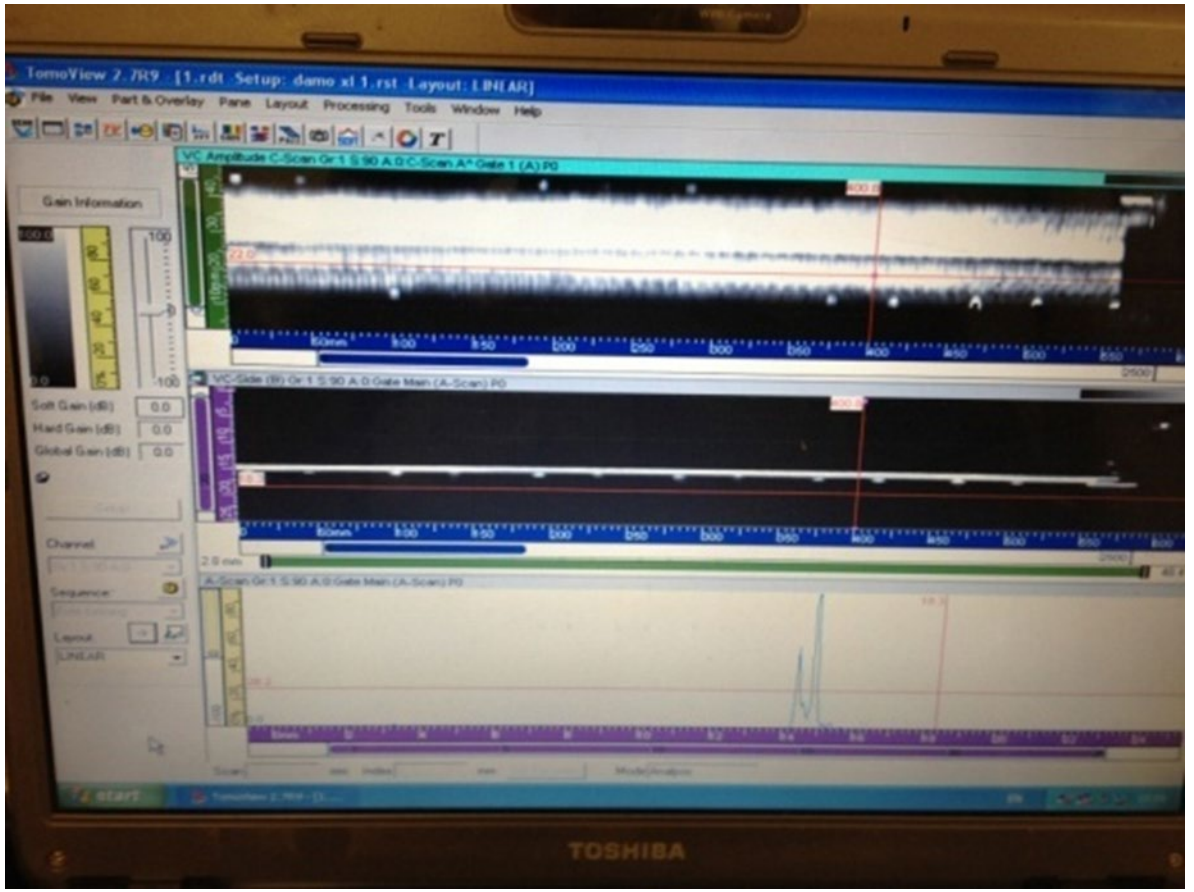
Time of Flight of the reflected signal indicates distance to a reflective feature.
Amplitude of reflection from rear wall indicates quality.

Coupling agent required from Transducer to Specimen (gel or water)

Higher Sound Frequency = Increased resolution 6000m/s and 5 MHz signal= 1.2mm wavelength

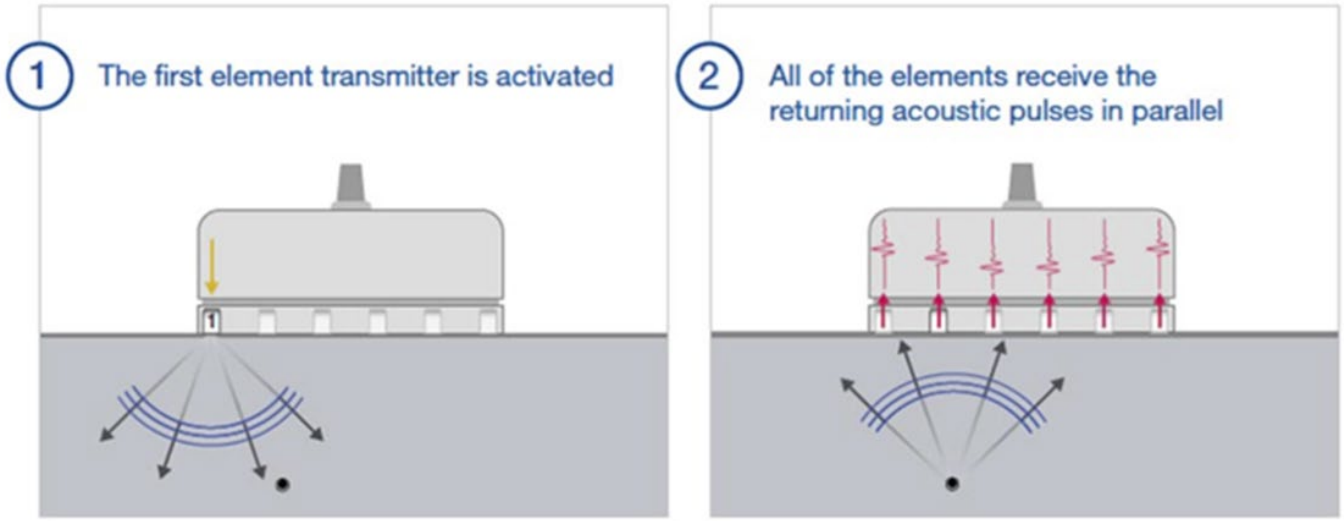
C-Scan:

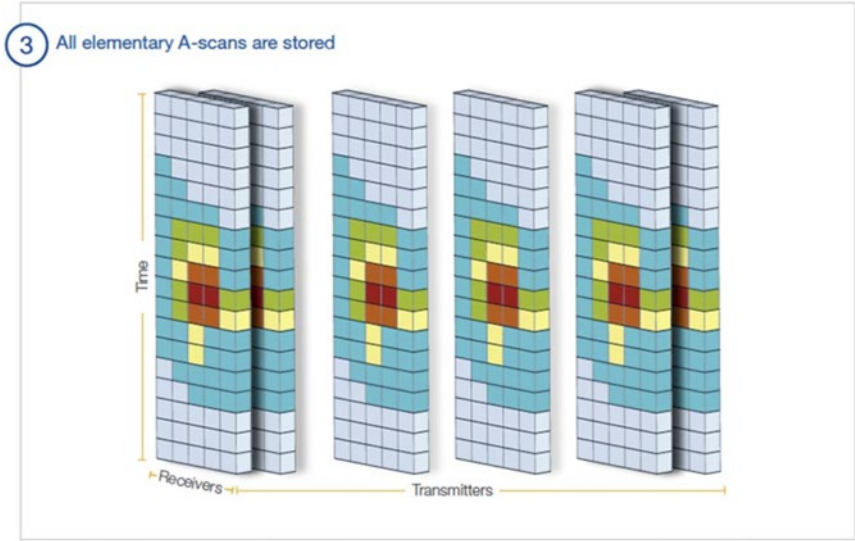
Rear face reflection amplitude recorded over surface - Defect “Map”



Wide Array Sensors –

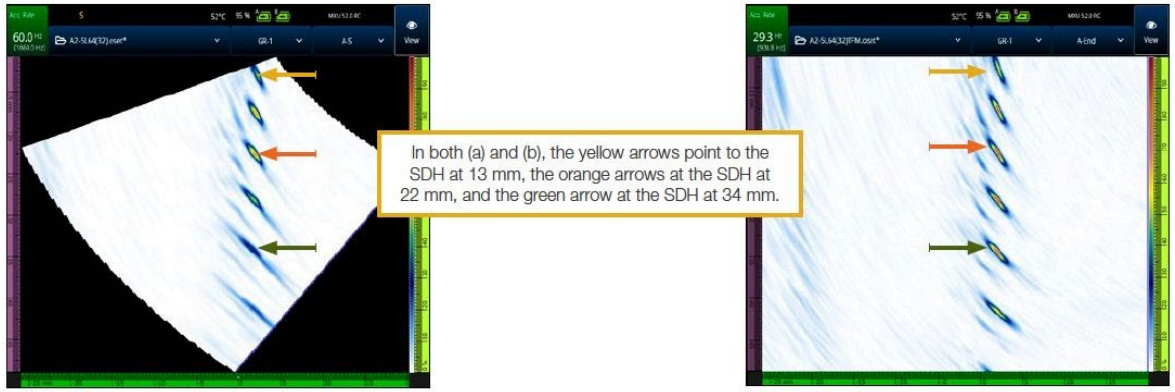
Full Matrix Capture and Total Focusing Method - Scans wide section in one pass





Full matrix capture (FMC) is an acquisition process that obtains all the A-scans (amplitude time series) between all individual pairs of transmitter and receiver probe elements.

Phased Array – single focus depth



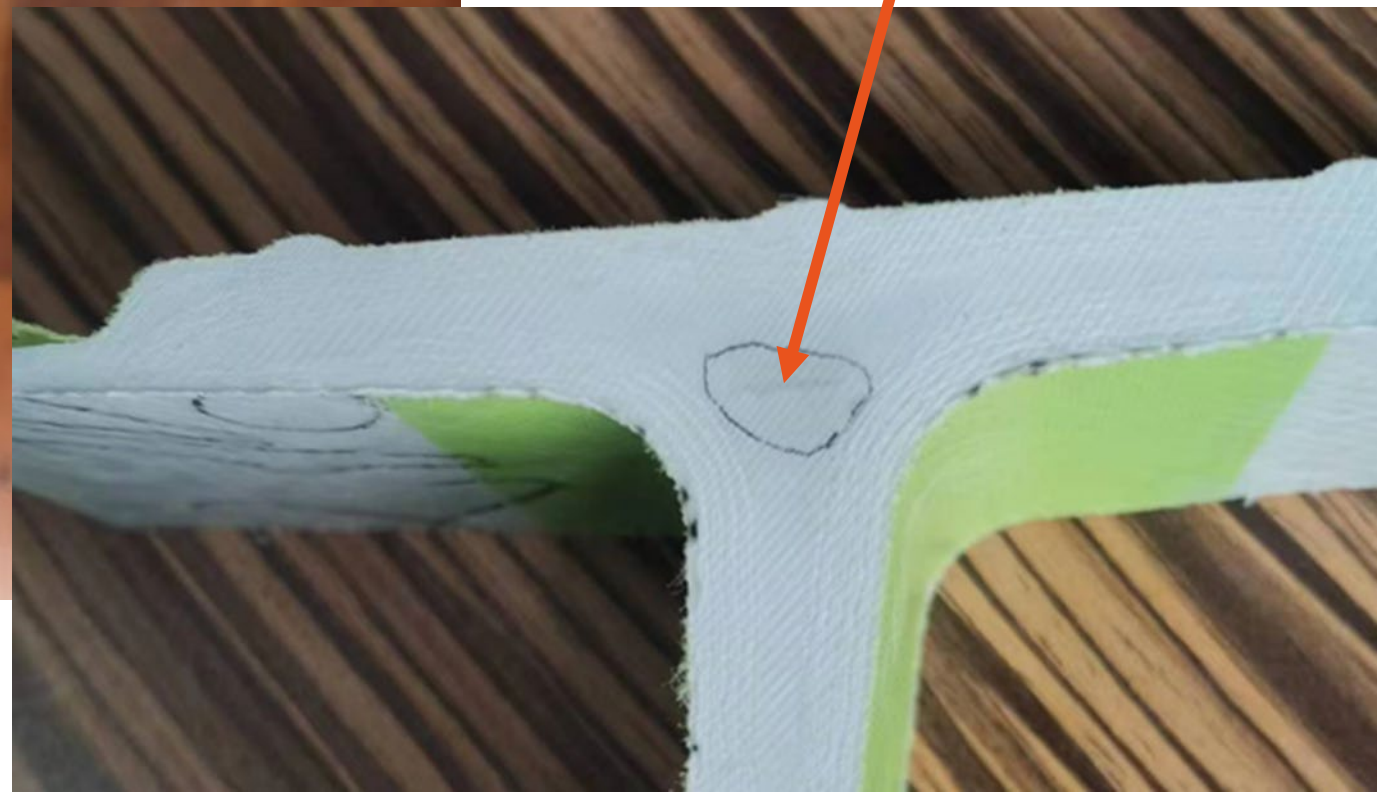
PAUT S-scan image (a)

TFM image (b)

FMC-TFM
Virtual focus on each pixel.
Better resolution

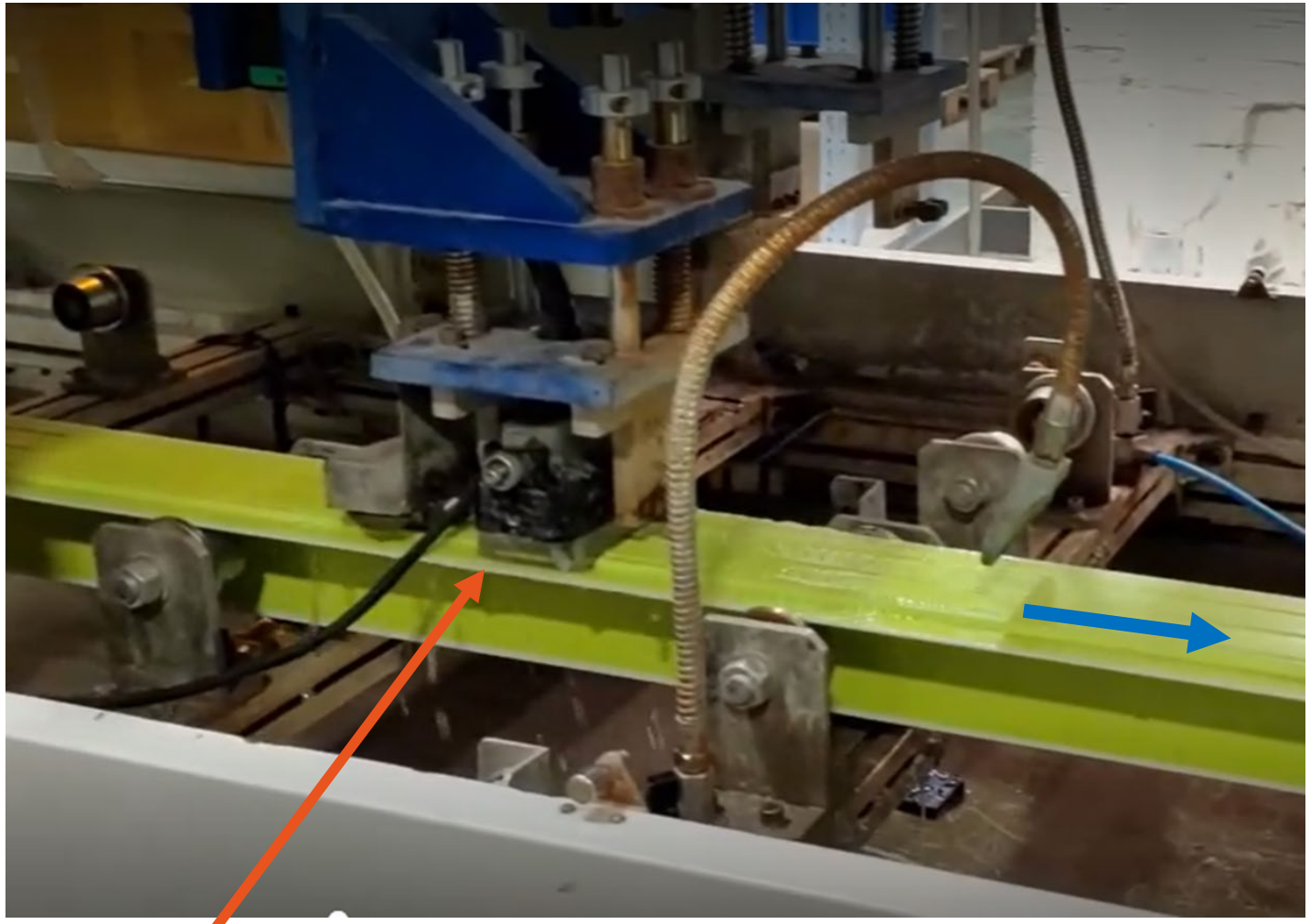
Automated UT Inspection line

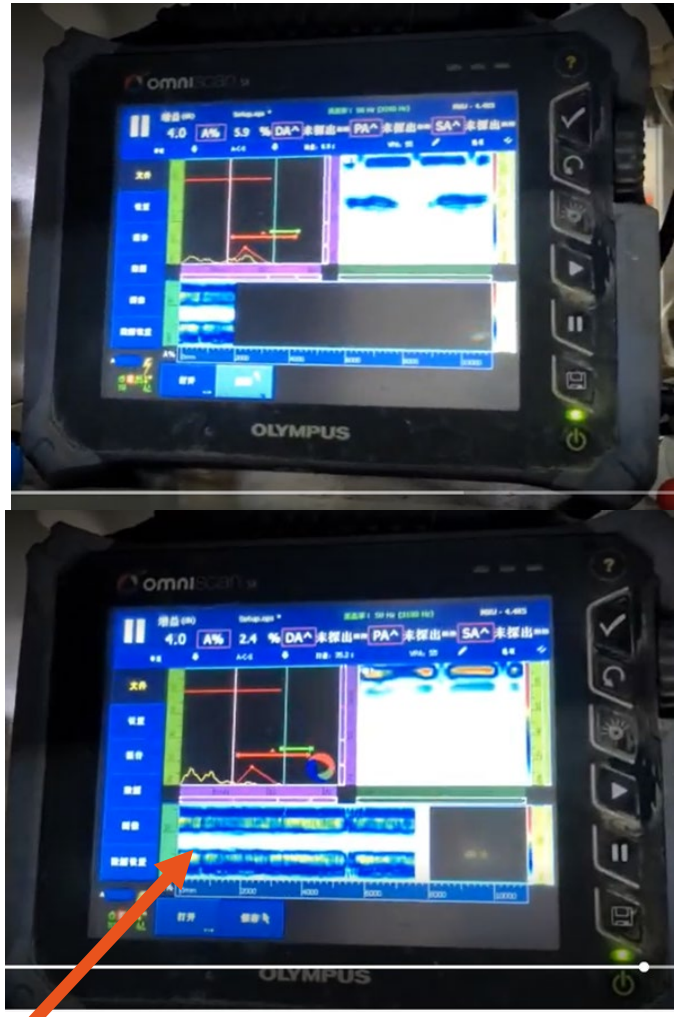
T profile – good profile and example of discontinuity



Automated UT

Scan image – B Scan and C-Scan





Sensor Array with water jet coupling

Progressive C-Scan

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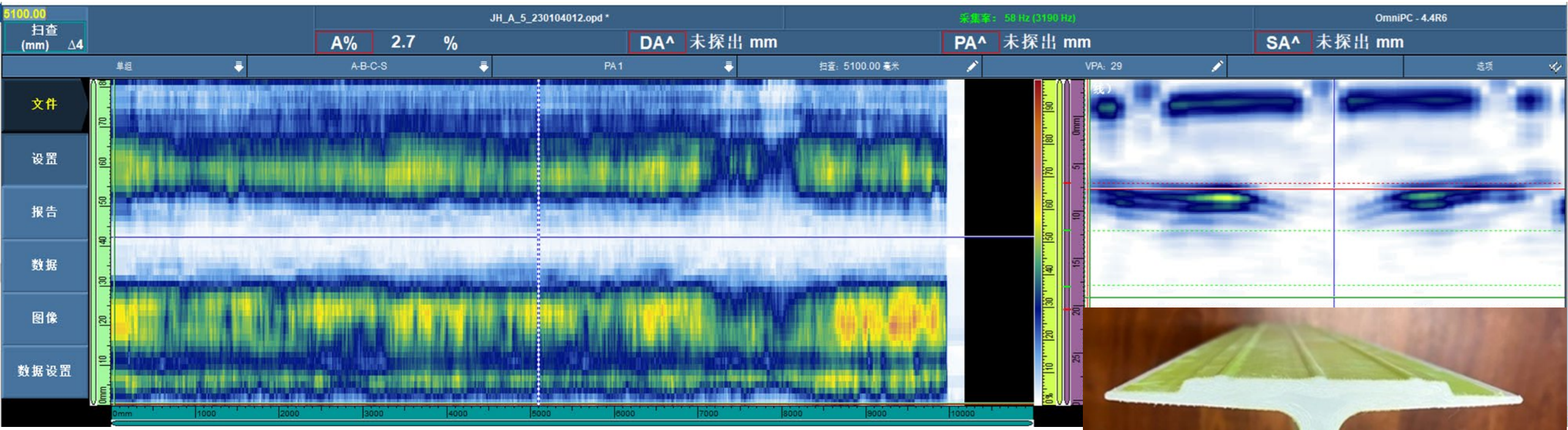
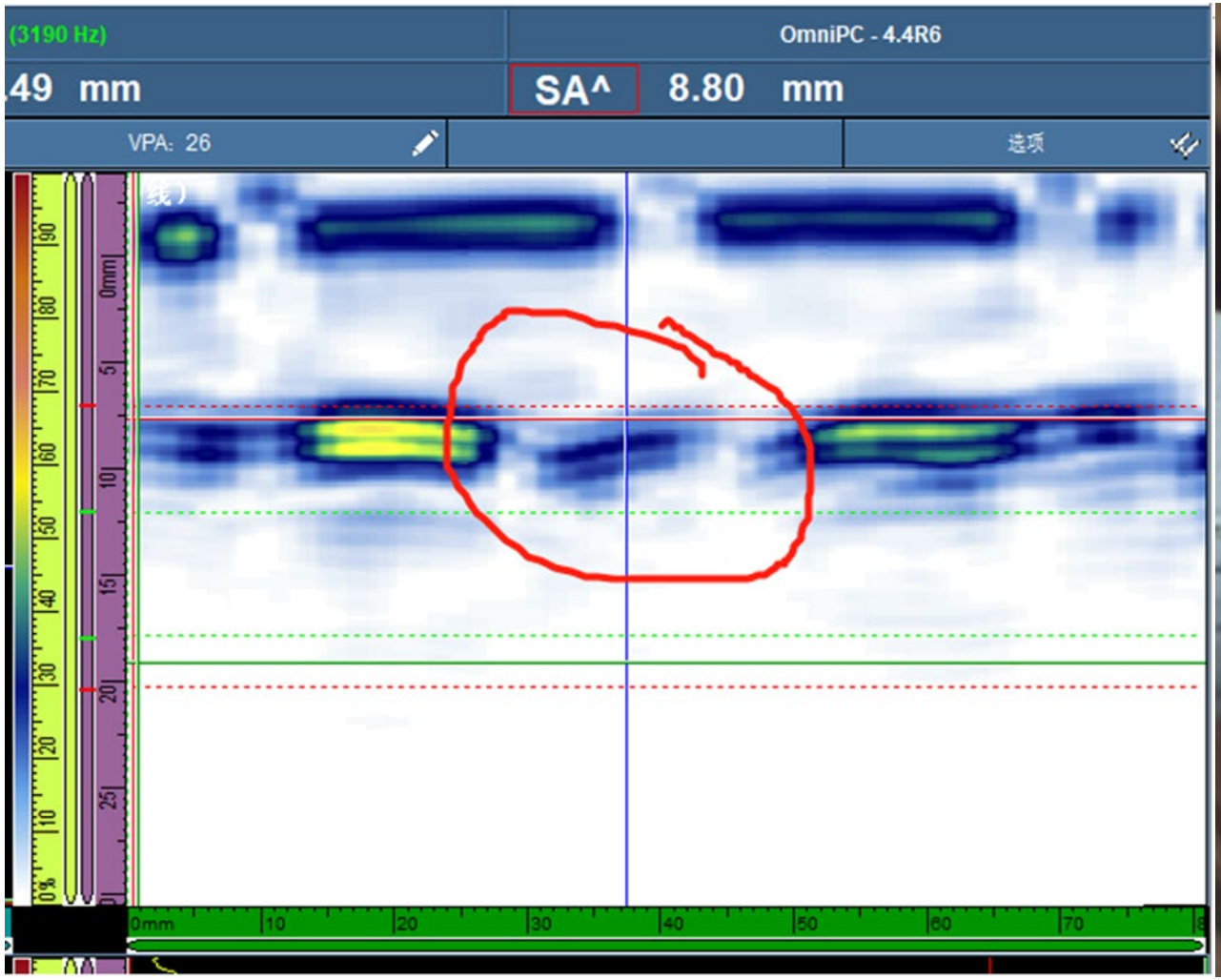
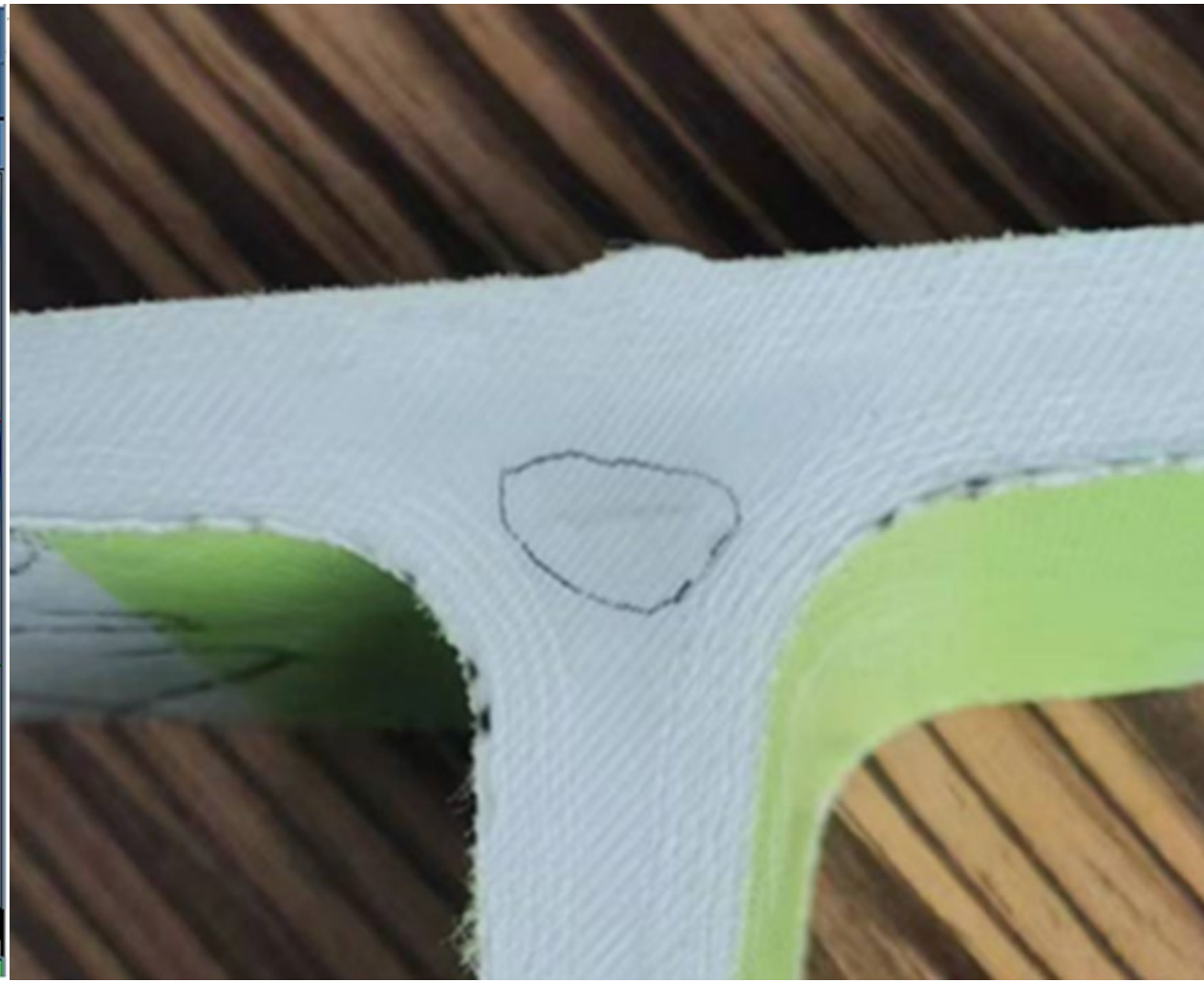
C Scan “Map” and B Scan cross section



Identification of Defect





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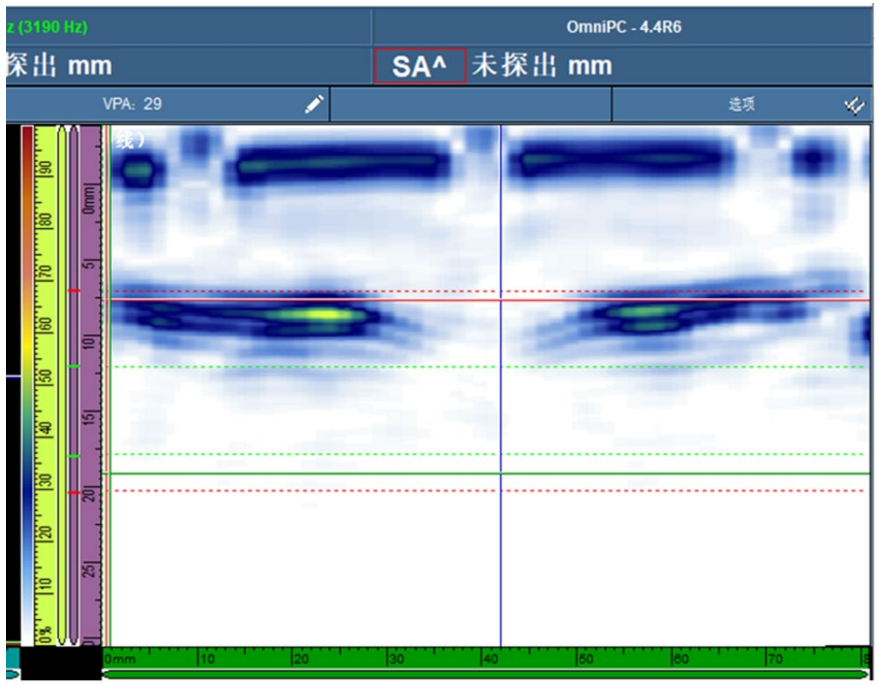
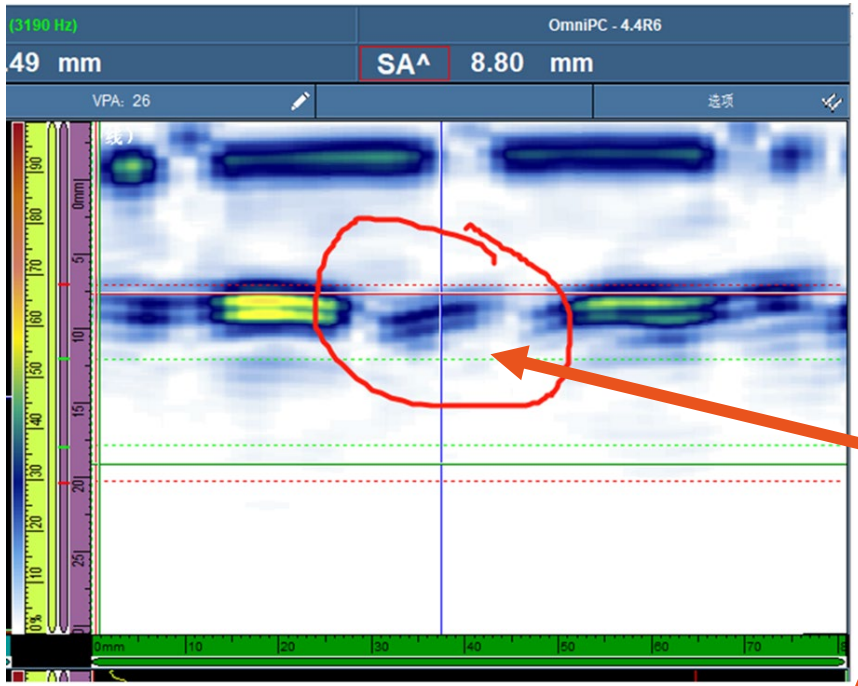
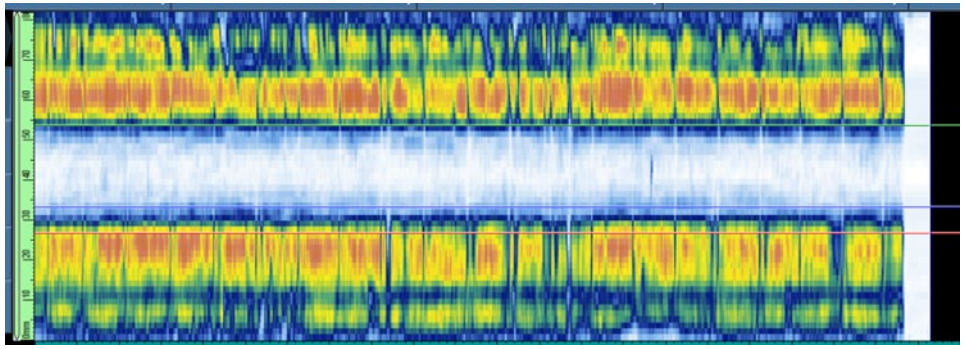
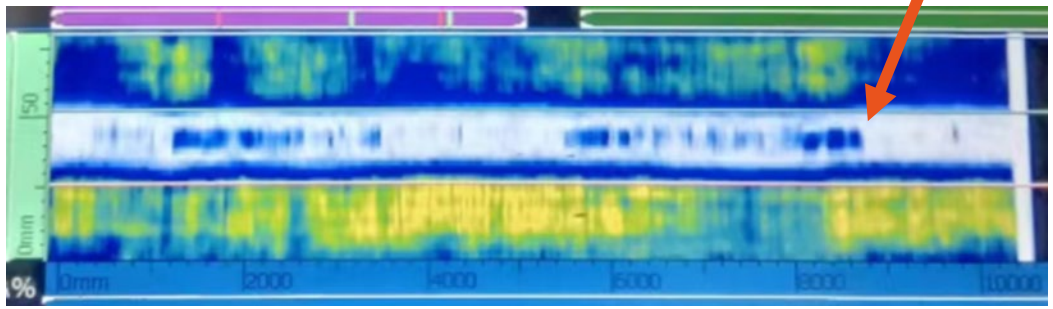
“Good” profile Scan compared to “Bad”





Defect





Critical profiles are checked to avoid this situation

Any Questions?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