

# PAUT Solution for Austenitic Welds

## Difficulties

Austenitic welds present major inspection problems due to large grain structure:

- Large austenitic grains cause beam skewing, splitting and attenuation.
- Anisotropic tissues have a distorting effect on the acoustic path.
- The attenuation in weld is more serious than base material, causing reflection, refraction, and splitting between two interfaces.
- Conventional UT and PA shear wave cannot penetrate the weld with low signal-to-noise ratio.
- The longitudinal wave cannot cover the near-surface due to the limitation of the primary wave.
- Thick walls cannot be fully covered in one test.

## Solution

- DMA** Using dual matrix array probes.
- Two Groups** Two groups of elements and different angles to fully cover the whole weld area.
- TR Mode** Support transmit and receive longitudinal waves for better penetration and near-surface resolution.
- Adjustable Focus Area** The diamond-shaped focus area can be adjusted to cover the testing thickness.
- Creeping Wave** Excitation of creeping waves to cover near-surface.
- SNR** The "pseudo-focus effect" produces better focusing effect and signal-to-noise ratio.

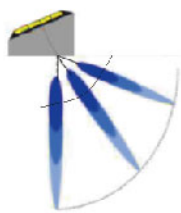
### ● Focusing Methods

Dual UT



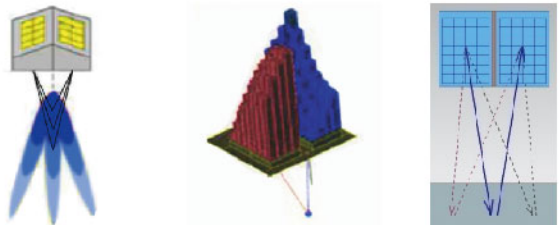
Acoustic focusing

Conventional PA



Electronic focusing

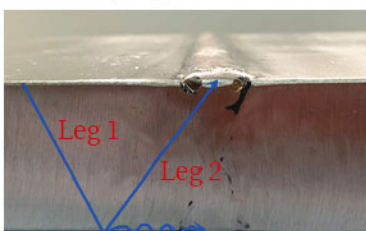
DMA



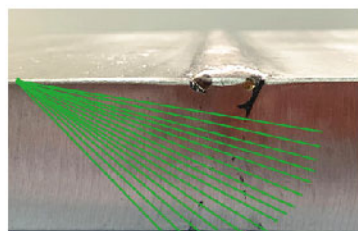
Acoustic focusing + electronic focusing

DMA: Acoustic beams can be deflected and focused in 3D space by controlling the excitation delay of the array elements in longitudinal and transverse directions. The focus area can be adjusted to the required depth to cover the whole weld area in one test without replacing the wedge. The focusing method concentrates sound field energy and has better resolution.

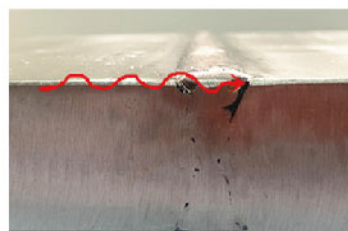
### ● Creeping Wave



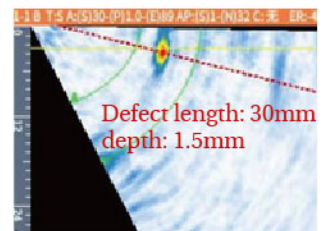
Leg 2 is not suitable for detection because leg 1 is converted at the bottom of wp.



The primary wave cannot cover near-surface.



Creeping wave has better near-surface detection ability.

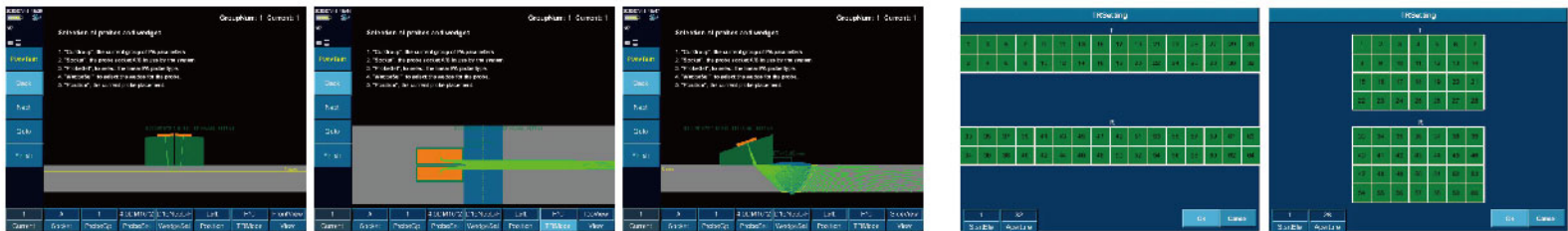


# Dual Matrix Array Probes and Wedges



- Support transmit and receive longitudinal waves for inspecting welds in grainy materials.
- Better penetration and near-surface resolution.
- The "pseudo-focus effect" enables the adjustable focal area for wide coverage.
- Excellent focusing effect and signal-to-noise ratio.
- Wedges with different AOD for good coupling.

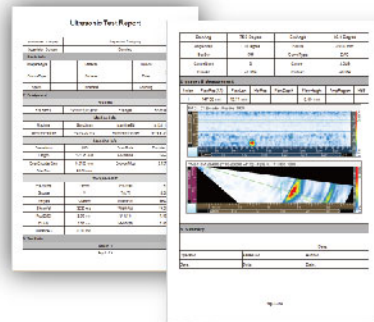
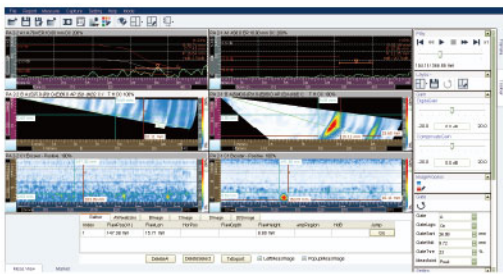
## Software



Beam coverage simulation to ensure the detected area is fully covered.  
 Front/ top/ side view to show the beam coverage situation.

TR setting interface

## SuporUp PC Software

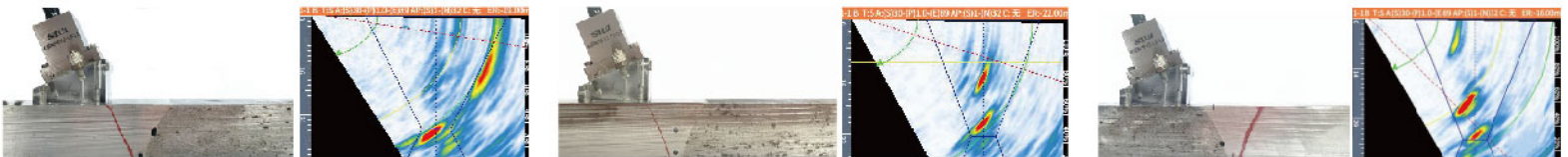


SuporUp is a data analysis software for the system, with features:

- data analysis offline
- dataplay
- image processing
- defect measurement
- report generation

## Test Result

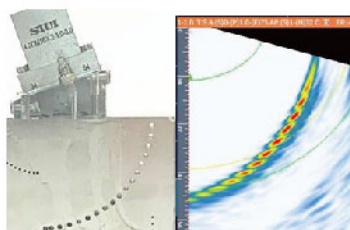
- Dissimilar materials: stainless steel and carbon steel



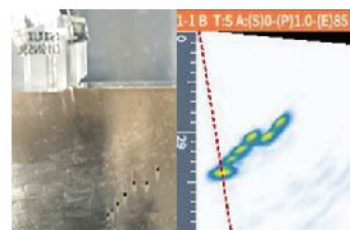
Bevel non-fusion and root incomplete penetration

Central and root porosity

Surface & root cracks and bevel surface porosity

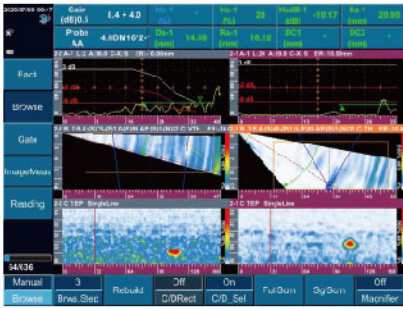


● Austenitic stainless steel test block type B

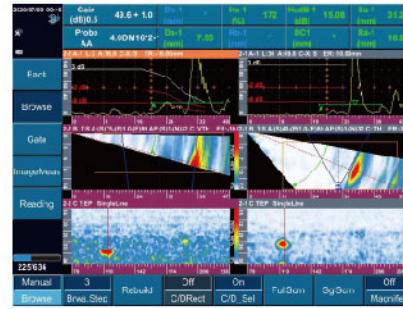


● Austenitic stainless steel test block type A

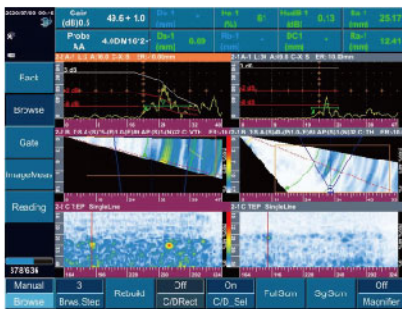
● 4.0DM16×2S-1.0-3.0 probe  
for testing austenitic stainless steel with thickness 15mm



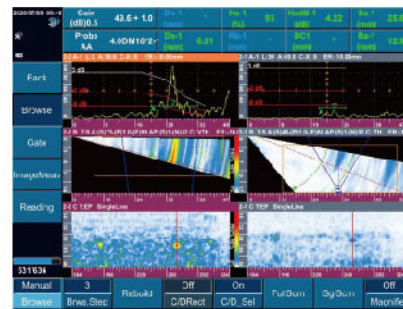
Root crack



Bevel non-fusion

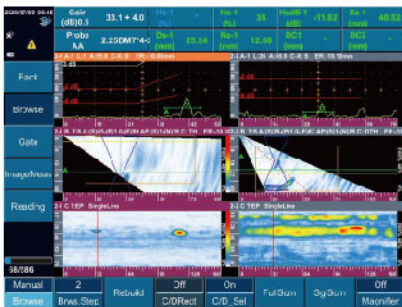


Porosity

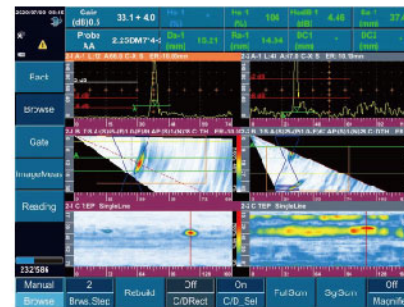


Groove on weld face

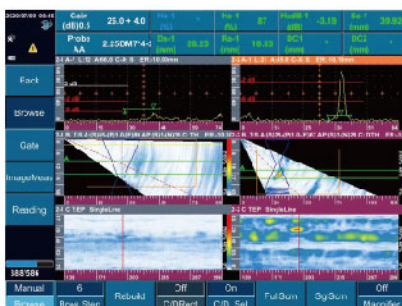
● 2.25DM7×4S-2.71-3.0 probe  
for testing austenitic stainless steel with thickness 40mm



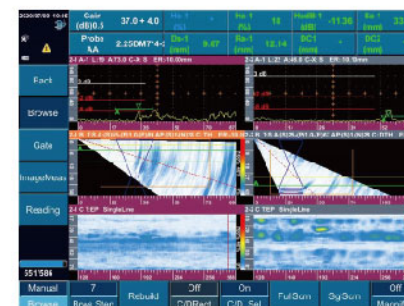
Lack of penetration



Non-fusion

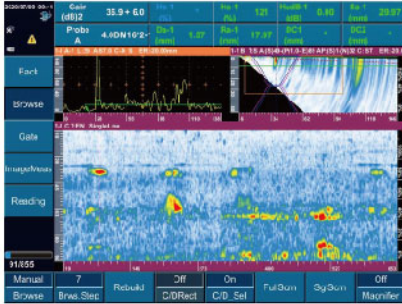


Slag inclusion

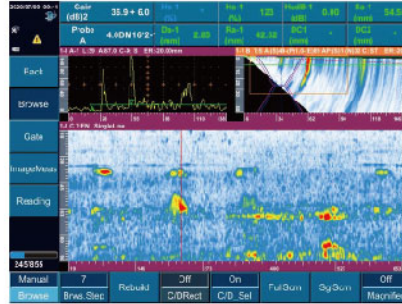


Groove on weld face

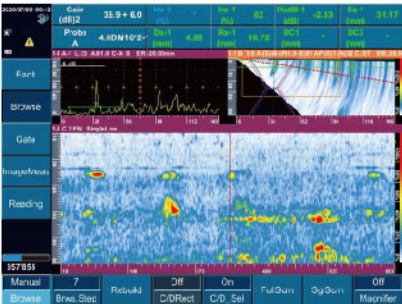
- 4.0DM16×2S-1.0-3.0 probe for testing stainless steel pipe ( $\phi 273 \times 26.5 \text{mm}$ )



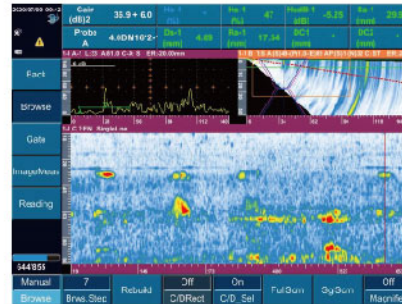
Defect #1



Defect #2



Defect #3



Defect #4

## Ordering Information

Description	Model	Quantity
PA ultrasonic flaw detector	SyncScan 2	1 unit
DMA probes and wedges	4.0DM16×2S-1.0-3.0 with wedges	1 pc
	2.25DM7×4S-2.71-3.0 with wedges	1 pc
Crawler	TSE/ CPS	1 pc
Irrigation device	IH-05	1 pc
Analysis software	SuporUp	1 pc

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