Phased Array Inspection of Coarse Grain Welds (Austenitic, CRA, etc)

- Very high level of the structural noise makes regular shear wave ultrasonic inspection either conventional or PA practically inapplicable to the coarse grain welds. The solution may be found with use of longitudinal (compression) waves and reducing of the frequency of ultrasonic wave entered into material

- However the above measures do not guarantee the success yet…

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The *unique features* of Sonotron NDT PA instruments, namely:

- Powerful bi-polar square wave pulser
- 100 dB analogue gain reciever
- Ability of firing / receiving using apertures composed of large number of elements (>16)
- 32-tap FIR band pass digital filtering
- Ability of implementing sequence of frame forming focal laws with individually calibrated gain and other settings (time base, etc)
- DAC normalizing of ultrasonic images
- True-to-geometry imaging and dynamic focusing

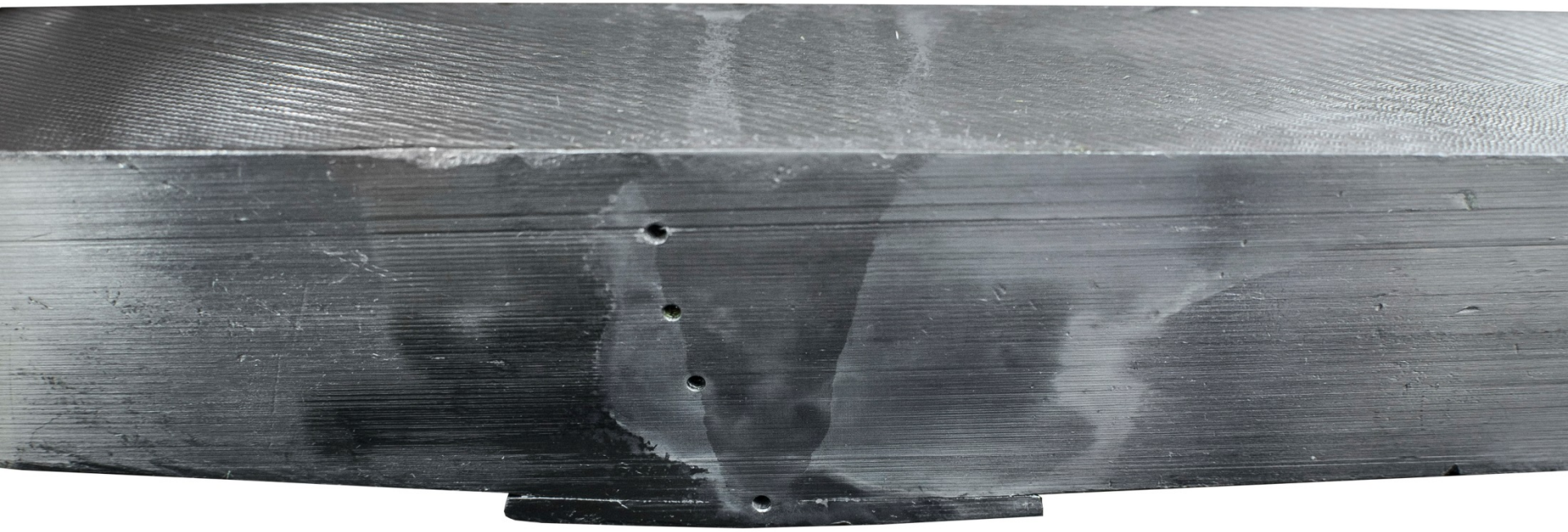
allow the best performance ever for such kind of welds

Phased Array Inspection of Coarse Grain Welds (Austenitic, CRA, etc)

Weld Sample # 1 (Nuclear Industry) - Machined Weld Cap

Longitudinal Wave Velocity:

- **Parent Material ~ 5700 m/s**
- **Weld material (CRA) ~ 5400 m/s**



Phased Array Inspection of Coarse Grain Welds (Austenitic, CRA, etc)

Solution based on use
ISONIC 2009 UPA Scope and 5 MHz 32-elements 1 mm pitch size linear array probe S 4922214381 (short name 214381) and specially designed wedge

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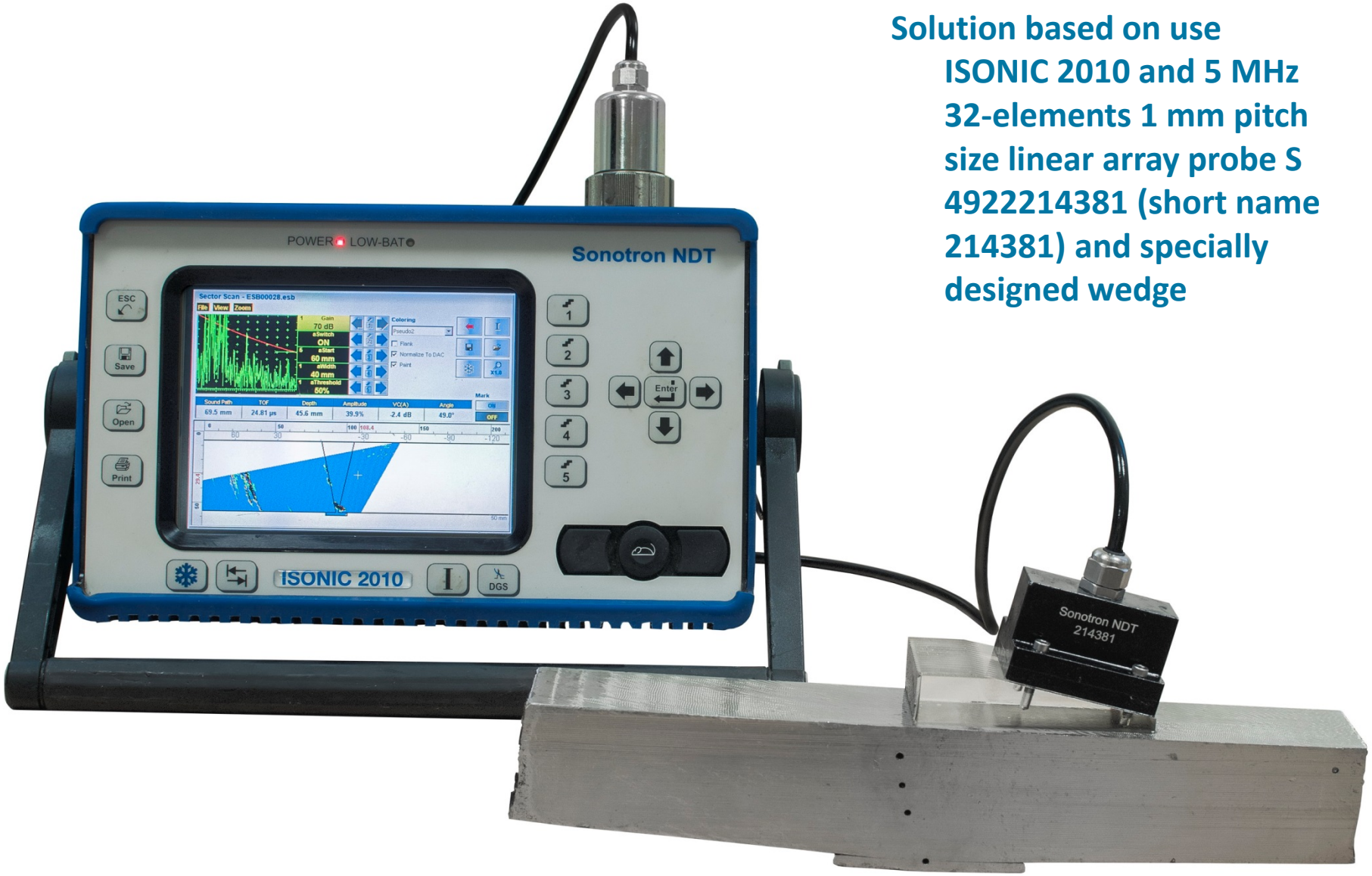

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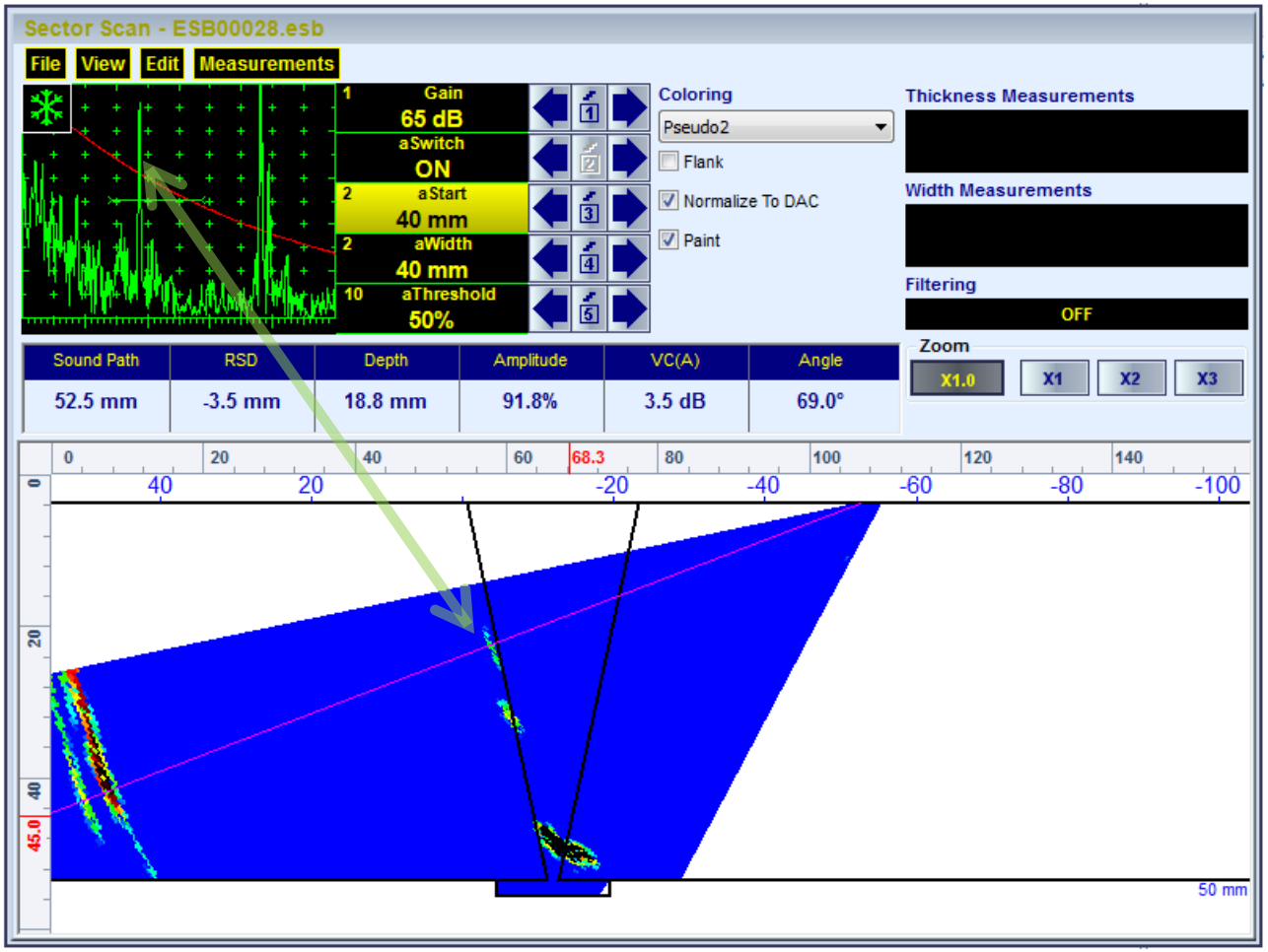

Despite of noisy A-Scans caused by strong structural reverberations the cross sectional images are clean and show actual artificial reflectors only

Application SW: EXPERT

Compression wave **is used for the inspection so half skip coverage only is possible in order to avoid misinterpretation**

Sector scan **is performed within the range 28…78°**

The *large emitting / receiving aperture composed of all 32 elements of the probe* minimizes the reverberations and prevents appearance of the phantoms caused by multiple reflections of ultrasonic wave on the way to / from discontinuity

True-to-Geometry Imaging, DAC/TCG - independent Angle Gain Compensation, DAC Normalization (see next 2 slides), **and *Dynamic Focusing* is involved**

The *US Velocity setting is 5605 m/s*, which allows indicating of 2 SDHs in the right location. As for the deepest SDH – it is shown on the cross-sectional image a bit higher than its actual position as most of the beam trace passes through the parent material

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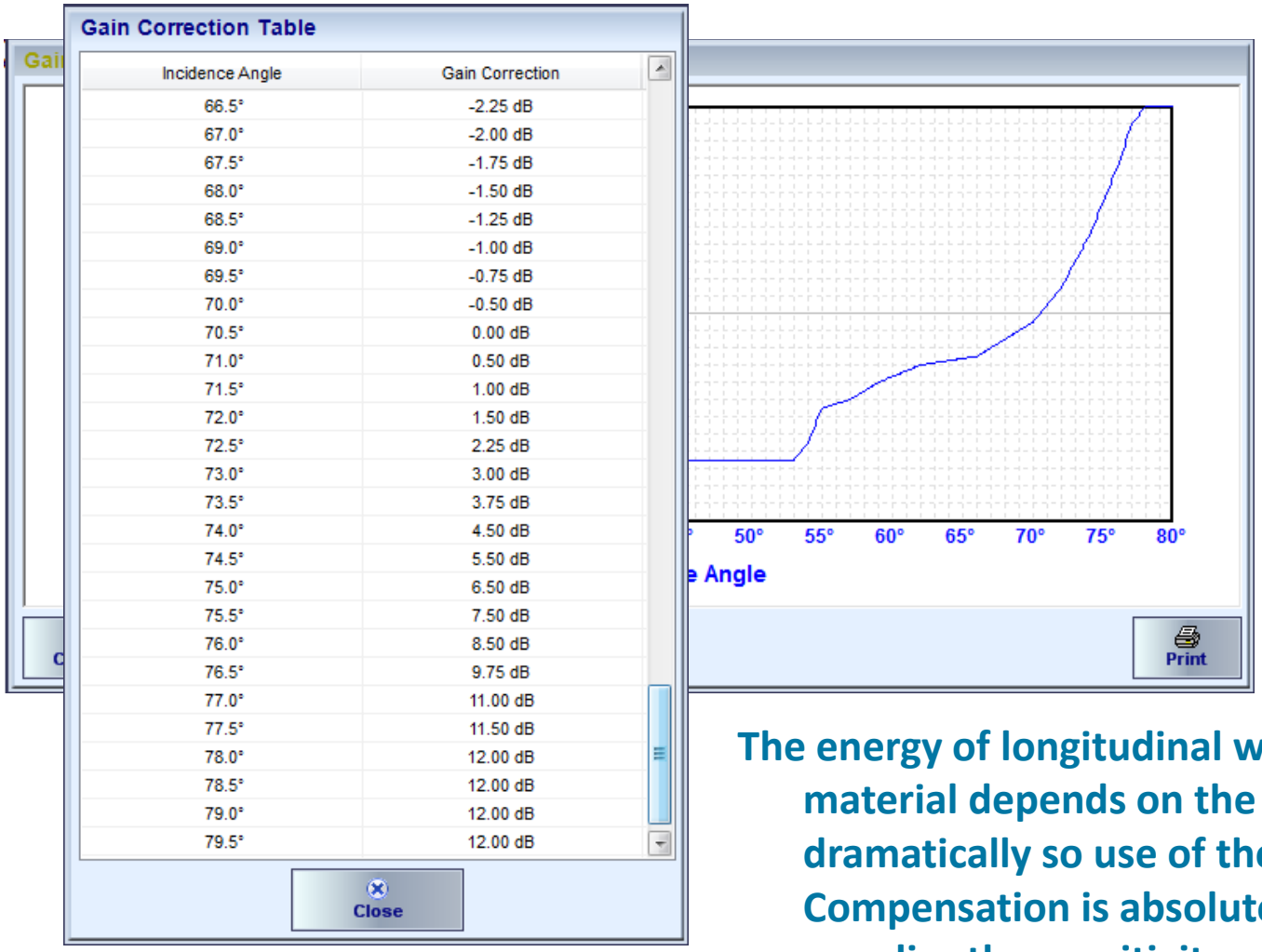
Phased Array Inspection of Coarse Grain Welds (Austenitic, CRA, etc)



The energy of longitudinal wave entered into material depends on the incidence angle dramatically so use of the Angle Gain Compensation is absolutely necessary to equalize the sensitivity within entire cross section of the material covered through the beam steering

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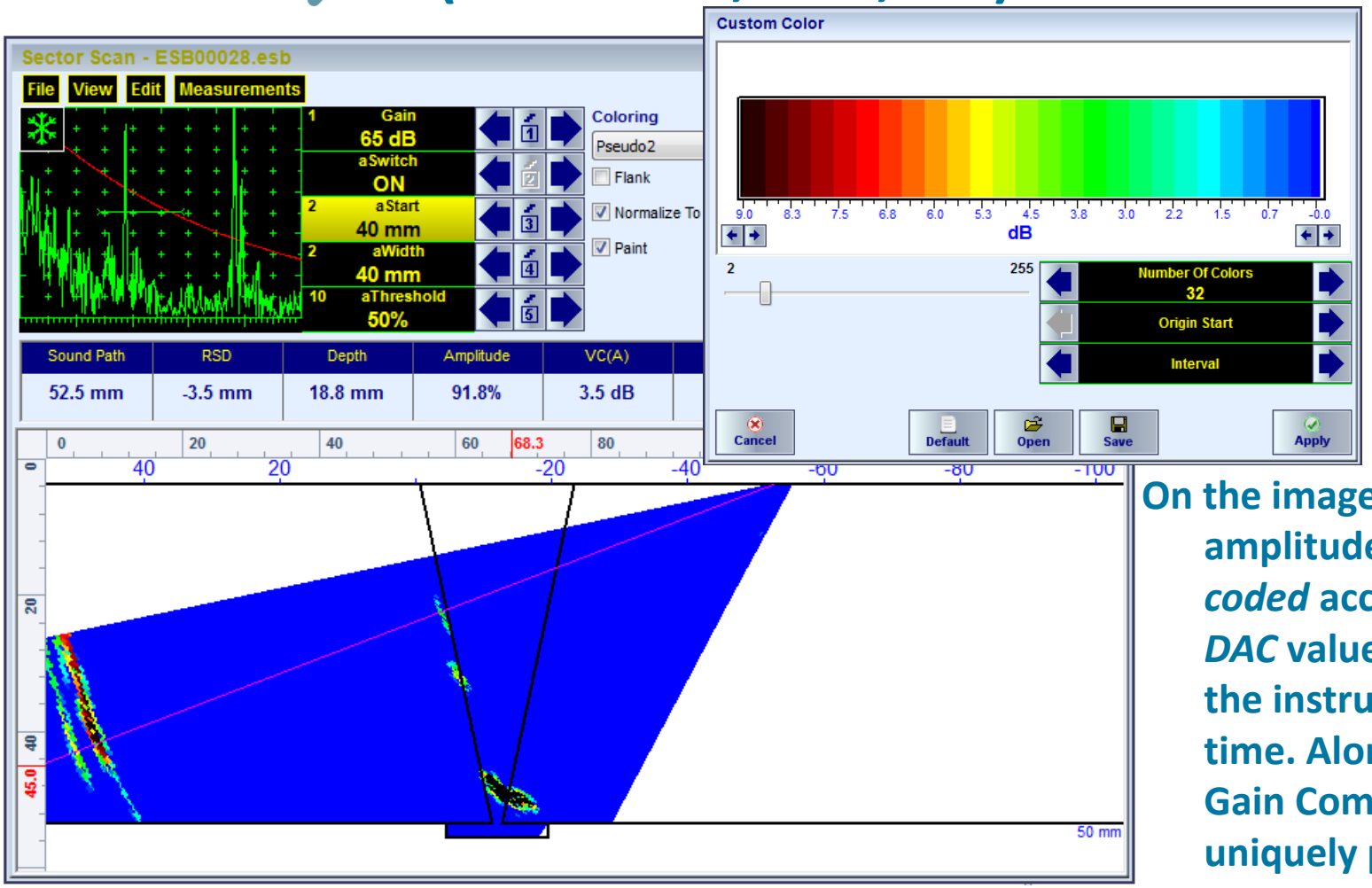

On the image the signals amplitudes are *dB-color-coded* according to *dB-to-DAC* value determined by the instrument in real time. Along with Angle Gain Compensation this uniquely provides the same color for equal reflectors independently on their location in the material

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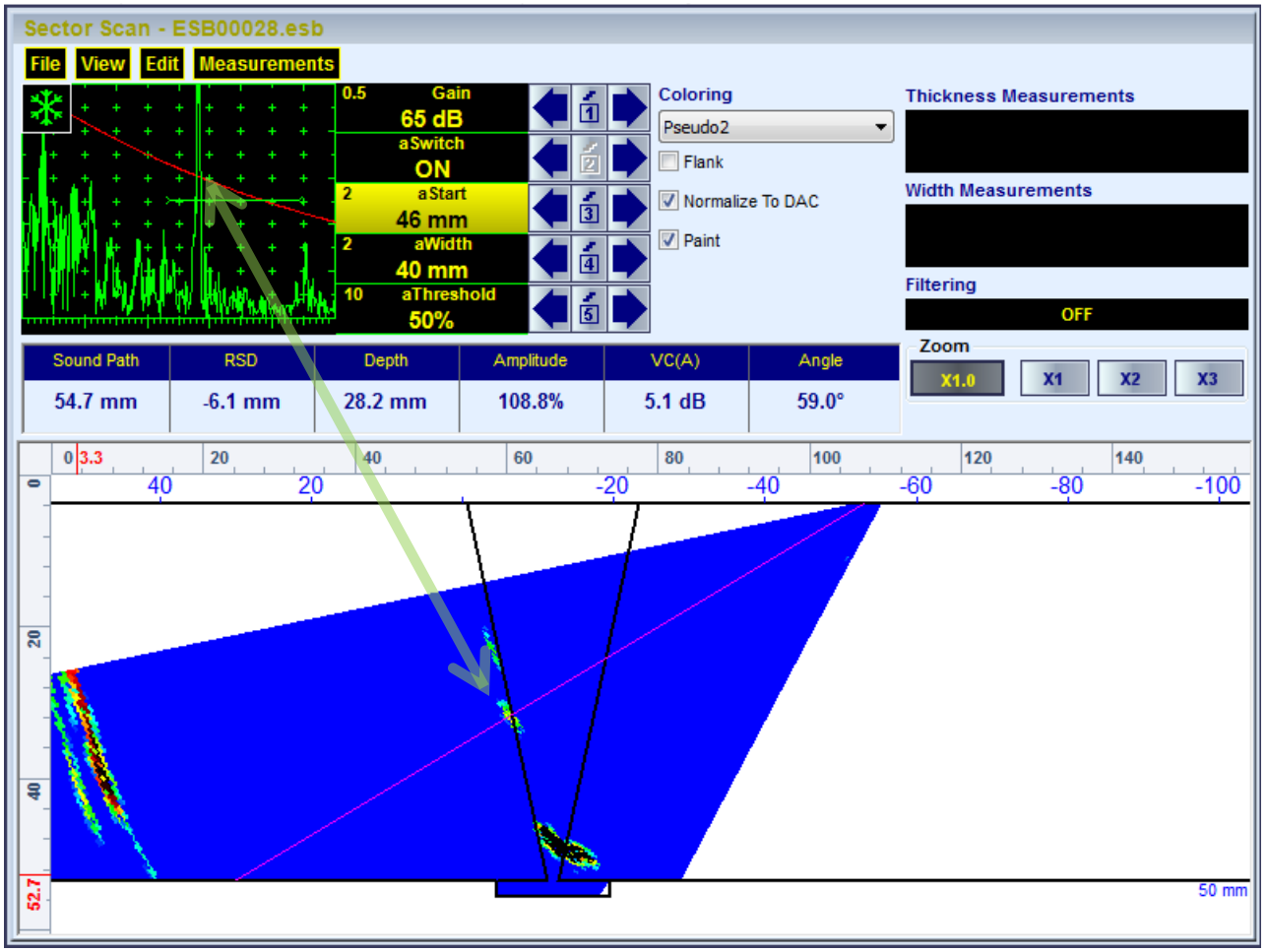

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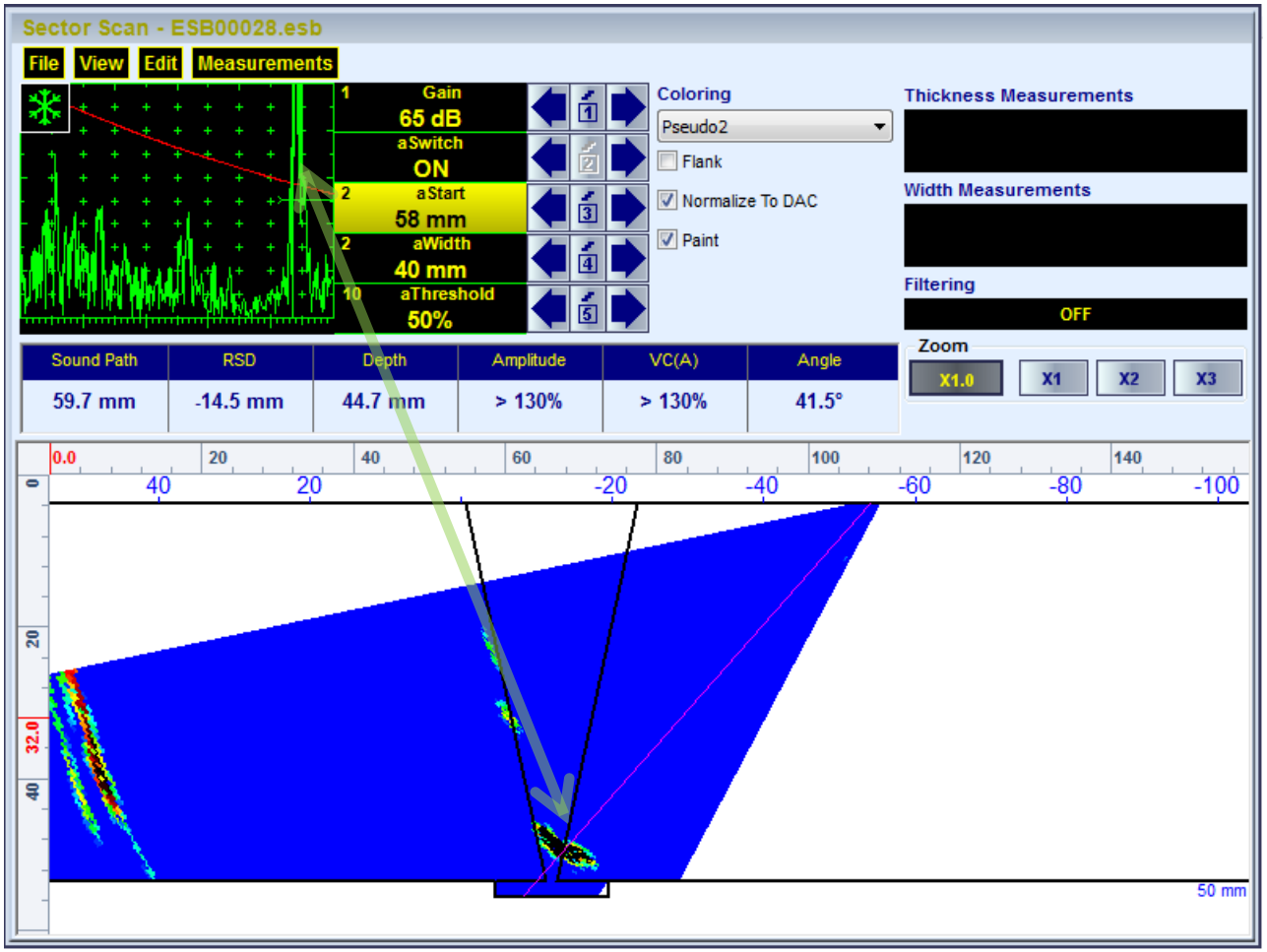

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Weld Sample # 2 (Military Industry) - Machined Weld Cap

Longitudinal Wave Velocity:

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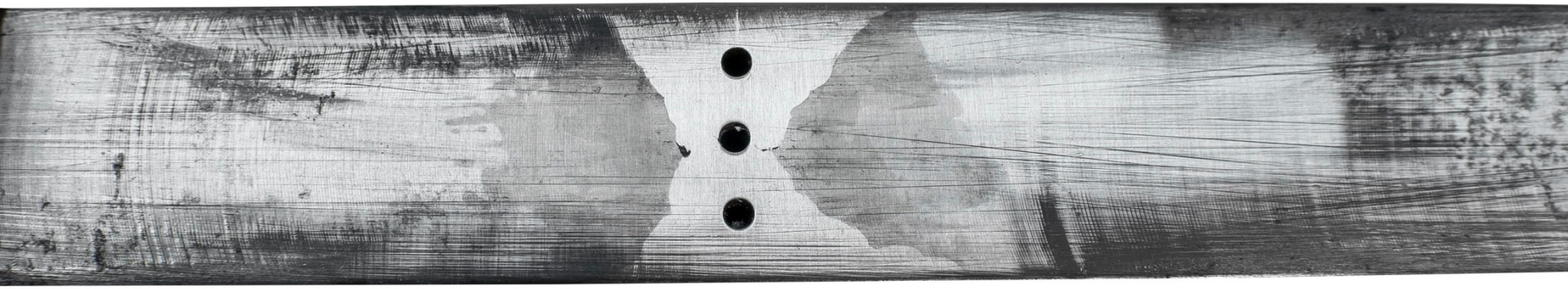
- **Weld material (CRA) ~ 5400 m/s**



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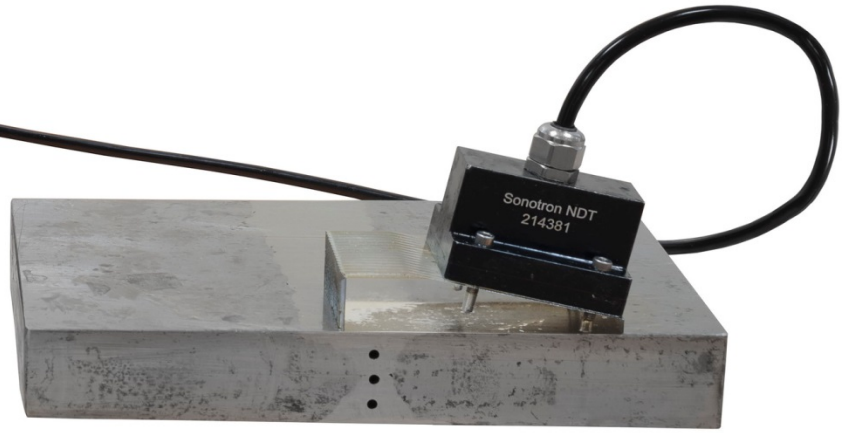

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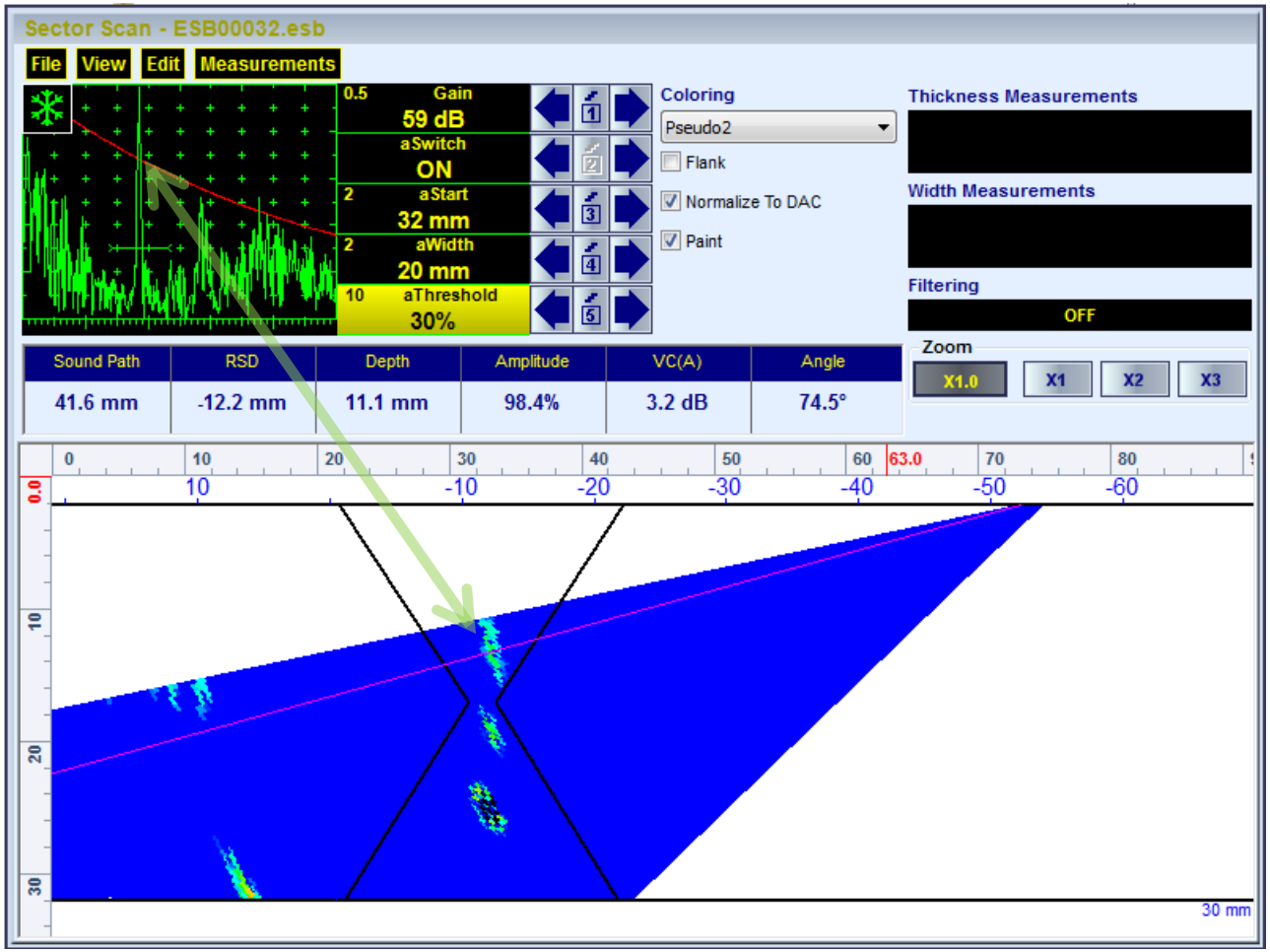

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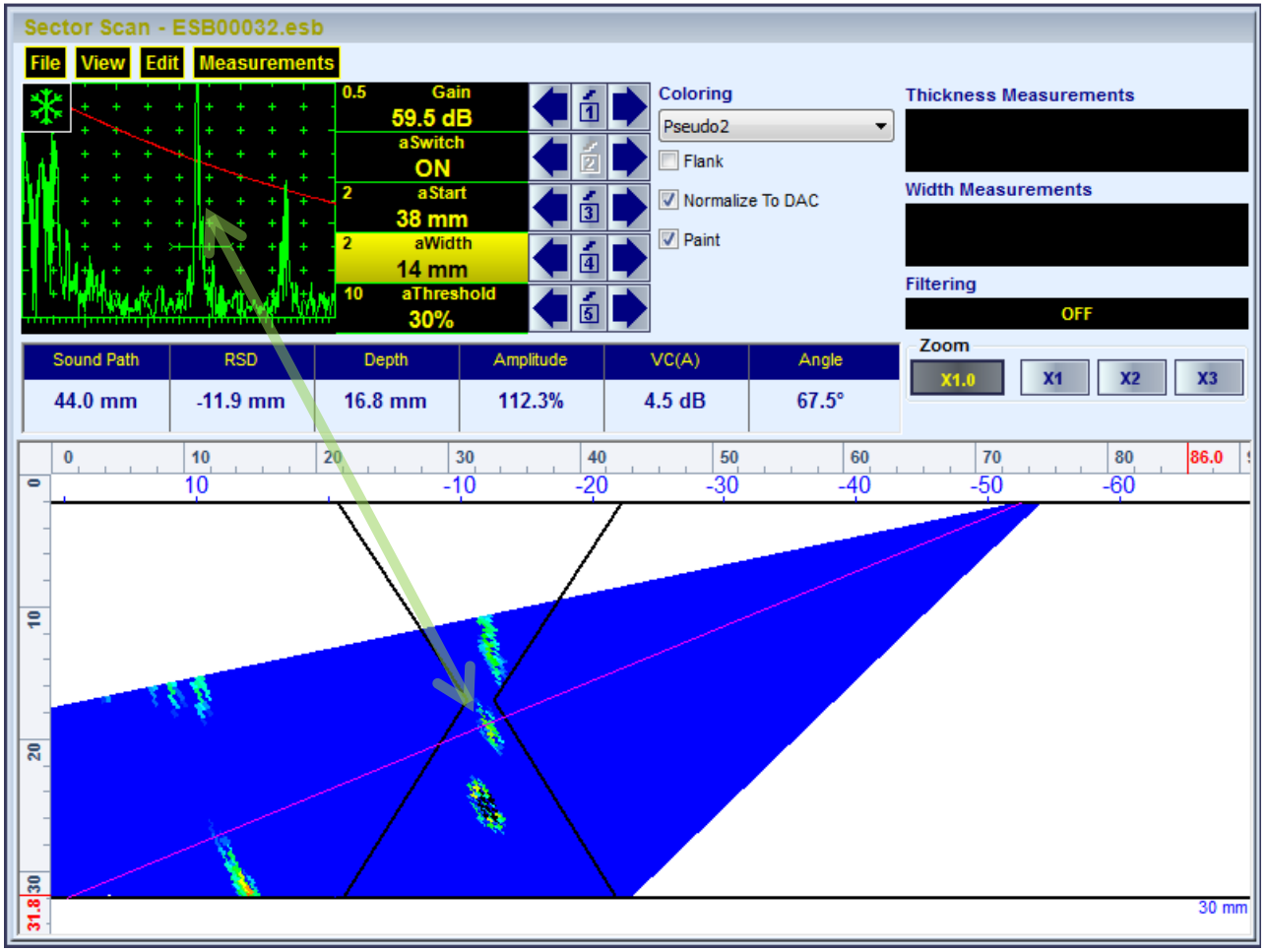

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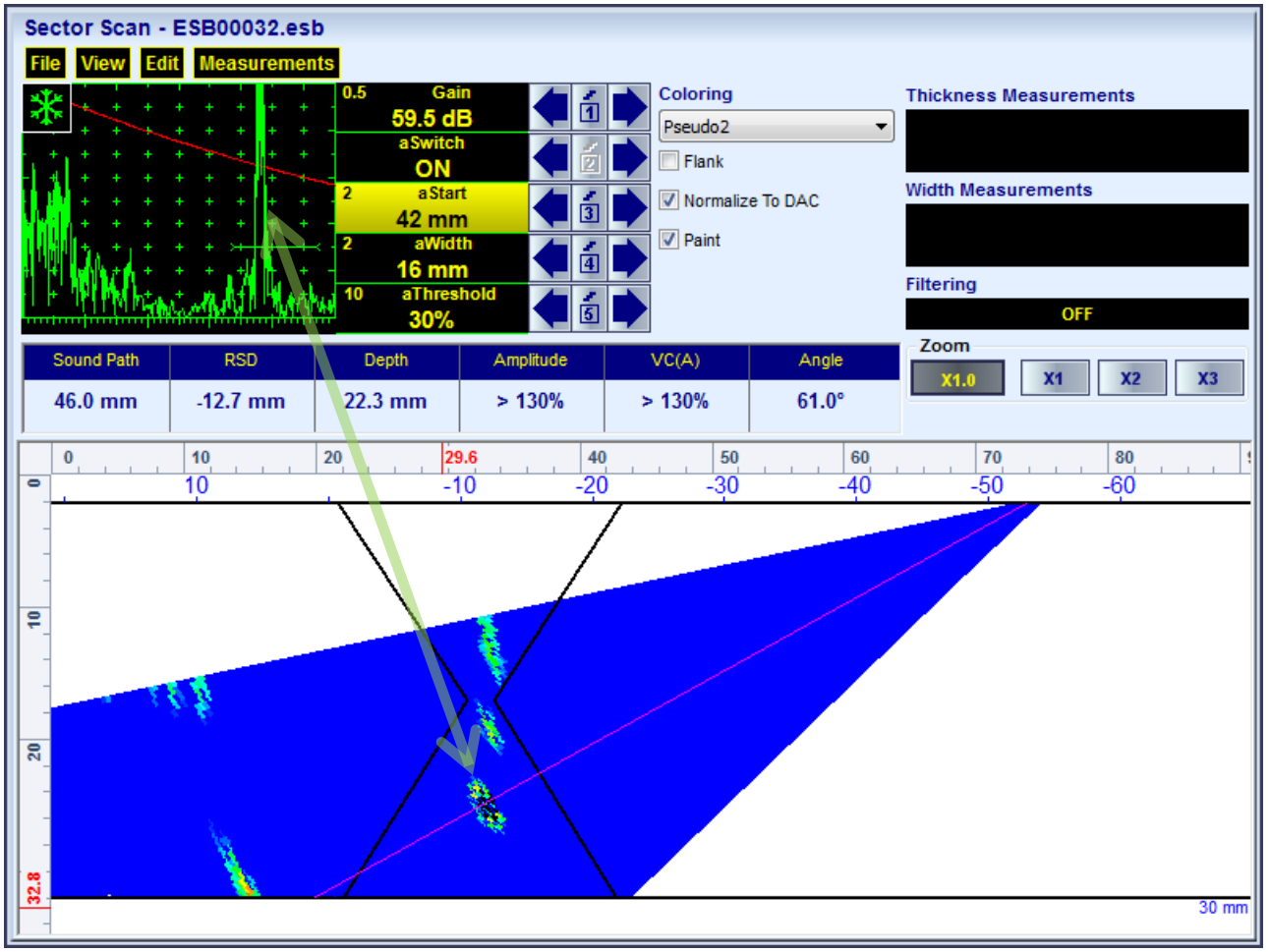

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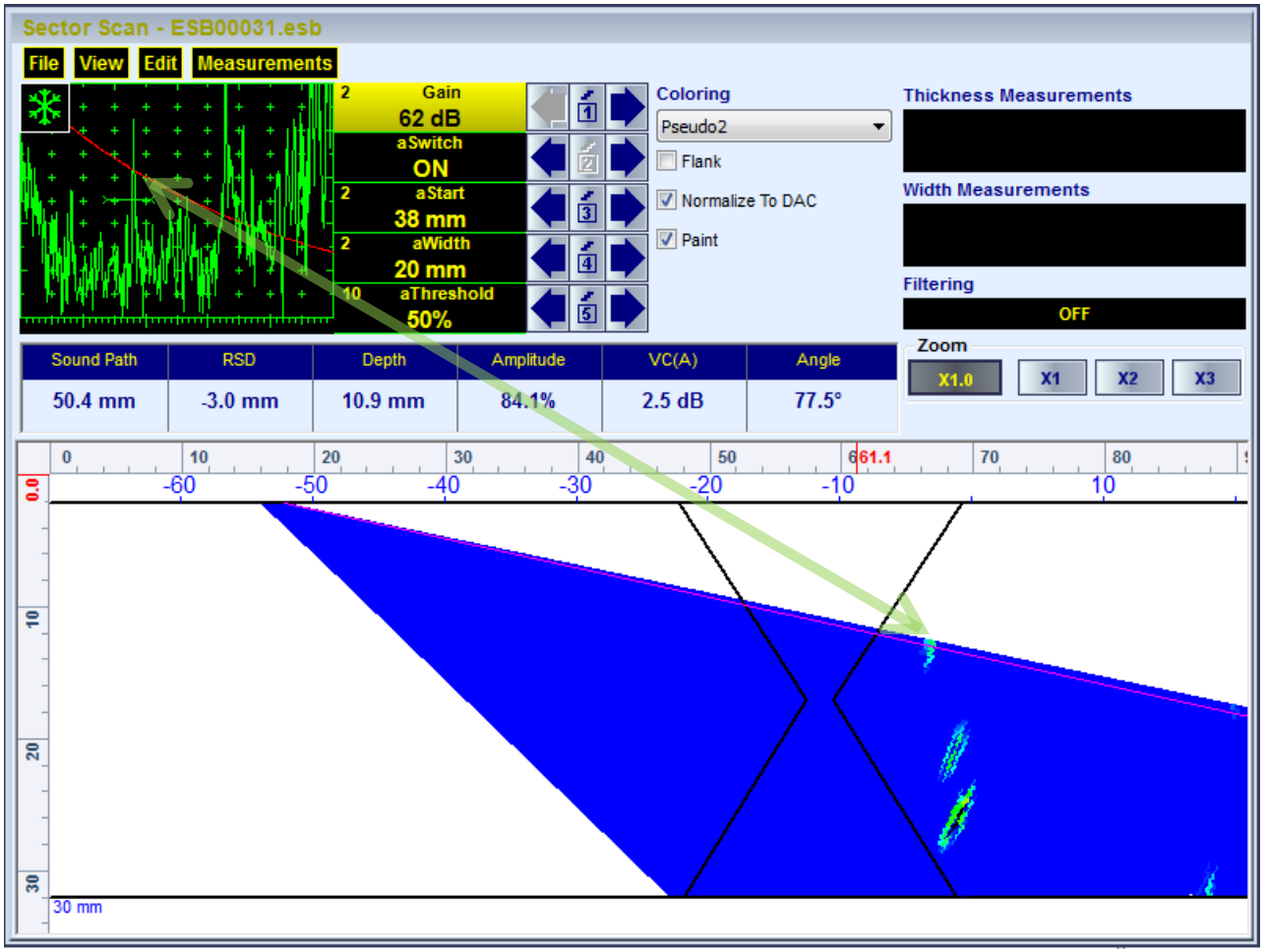

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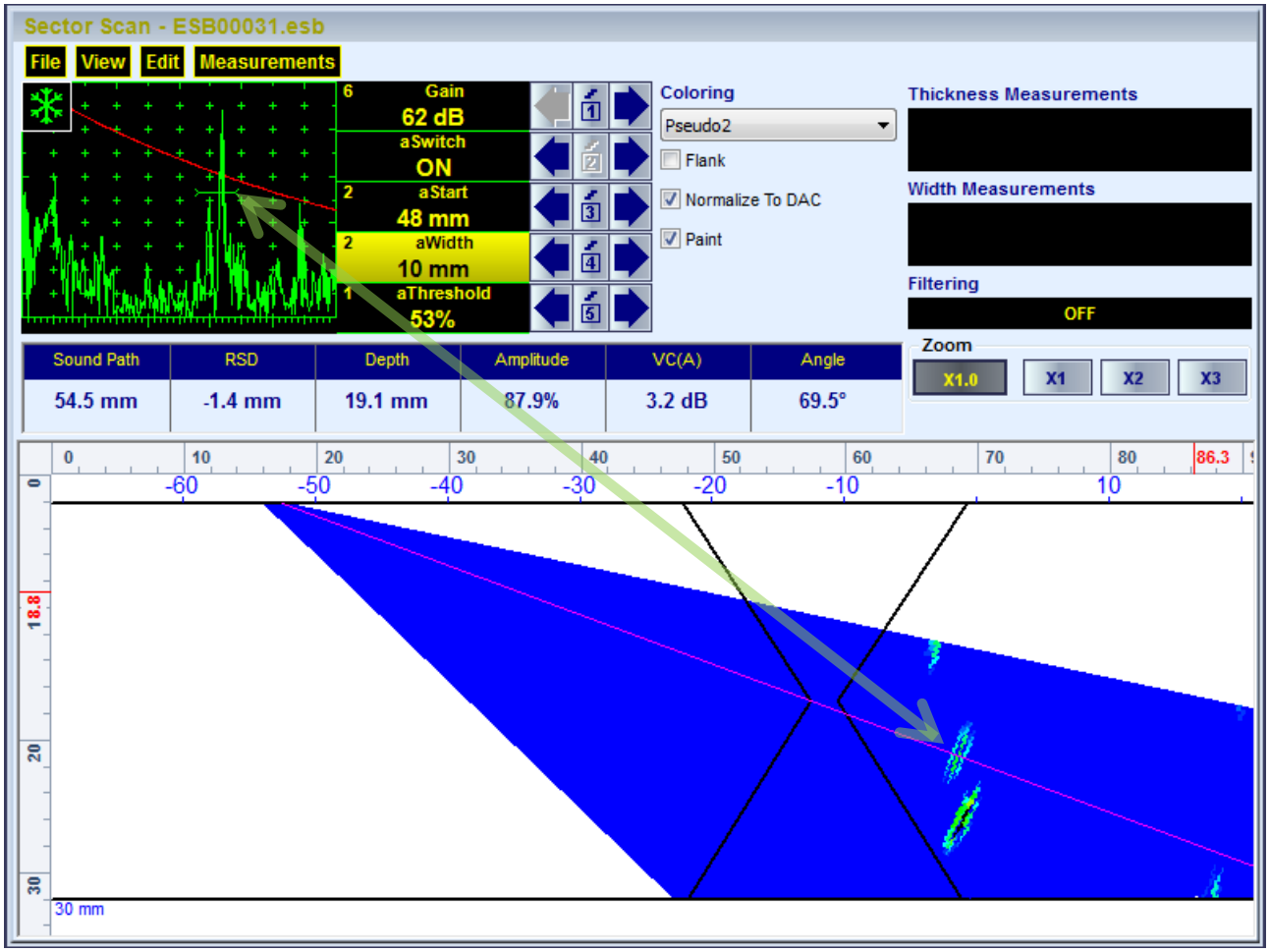

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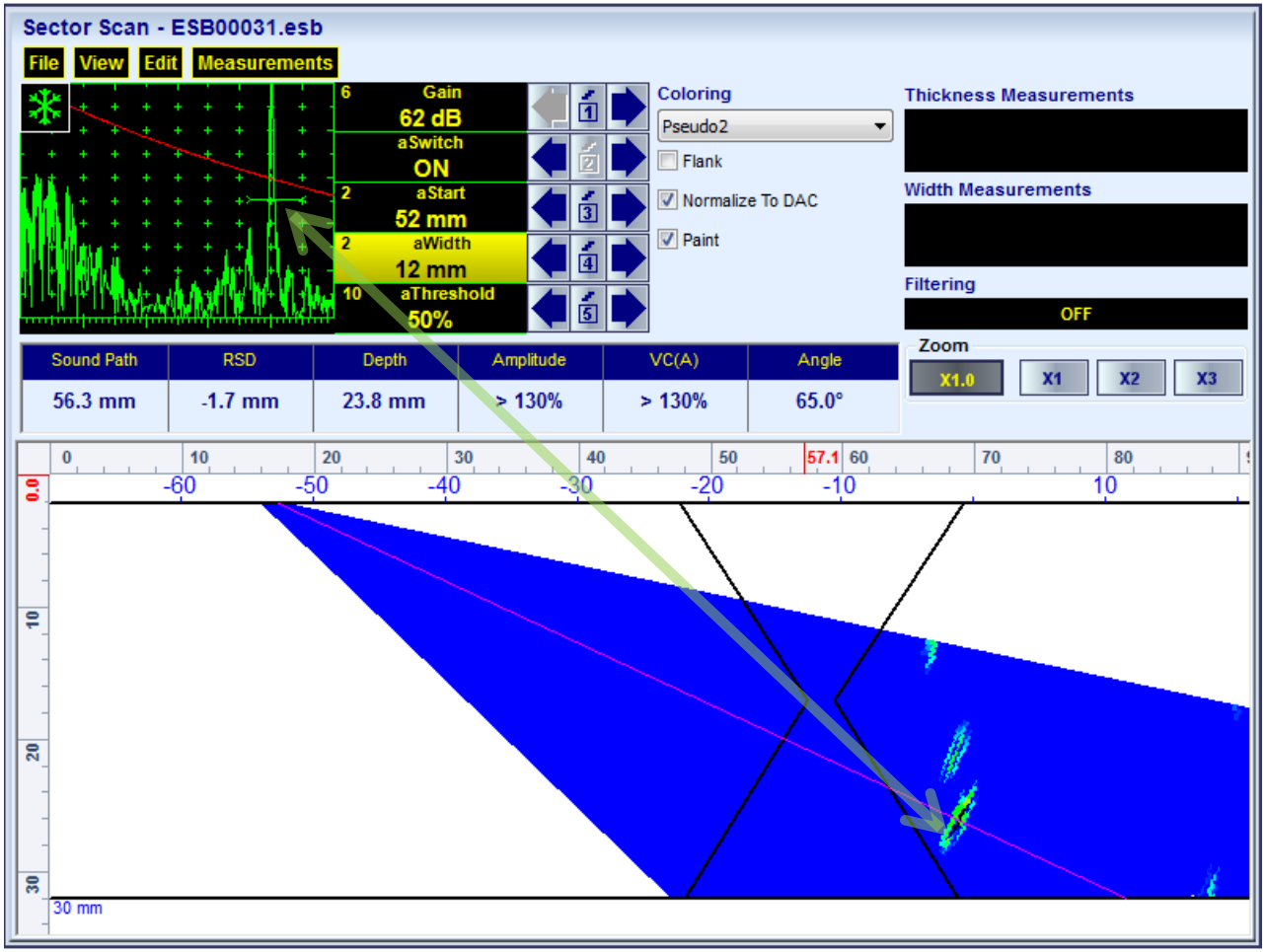

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