Big Science Business Forum 2024

TRIESTE
1 – 4 OCTOBER 2024

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Technology Transfer Track Posters

NDT PHASED-ARRAY UT TECHNIQUES

The Phased-Array UT technique (PAUT) uses probes with a large number of elements with linear or matrix configuration, to electronically change the ultrasonic beam. Their excitation can generate a focused ultrasonic beam with the ability to modify parameters such as angle, focal distance and beam size through software tools.

PAUT inspection procedures have been developed by Tecnatom (a company of Westinghouse group) for the inspection of welds in several ITER components, such as the Vacuum Vessel (VV) and the Toroidal Field Coil Cases (TFCC) closure welds, among others.

To ensure the mechanical integrity of these critical components, welds must be 100% examined, applying surface and volumetric Non-Destructive inspection (NDT) methods. As a result of its inherent nature, closure welding can only be inspected from one side, being ultrasonic inspection (UT) the alternative to Radiographic Testing.

It is recognized that UT testing of austenitic stainless-steel welds are severely hampered by the anisotropy and sound scattering at the grain boundaries. In the present case, weld inspection is also subject to restricted accessibility, large and variable thicknesses, and highly demanding qualification requirements.

To overcome these challenges, Tecnatom has developed a combination of advanced PAUT inspection techniques based on linear and Dual Matrix Arrays (DMA), combining the advantages of TRL (Transmit-Receive-Longitudinal) probes with those of PA technology. Dual probes create a natural focus in which sensitivity is maximized, while unwanted wedge echoes are minimized.

On the other hand, two-dimensional PA probes allow electronic steering in the primary axis along with skewing the beam in the secondary axis, with the main purpose of focalizing at different depths.

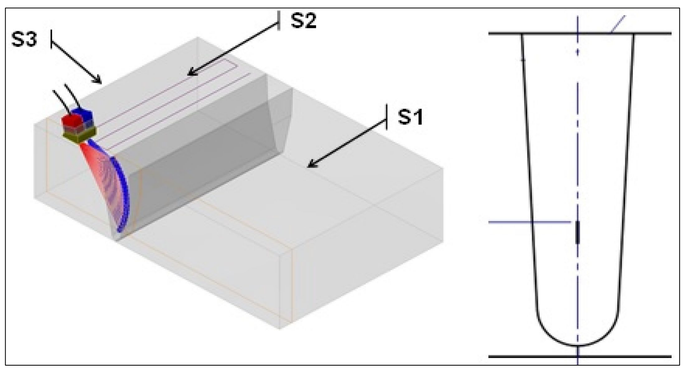
Detection and characterization capabilities have been shown in representative test pieces. Postulated defects were volumetric and planar (open and embedded), with orientations longitudinal and transversal to the weld. This type of flaws is reproduced in the test pieces by means of side-drilled holes and millimetre-sized notches (parallel and transverse to the weld).

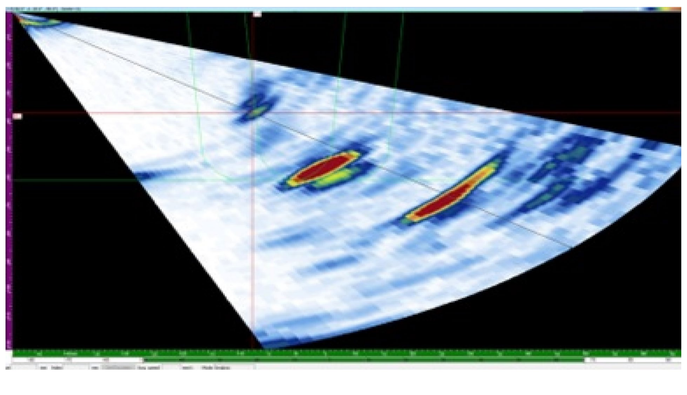
Experimental tests are combined with CIVA simulation models, to support technical justifications.

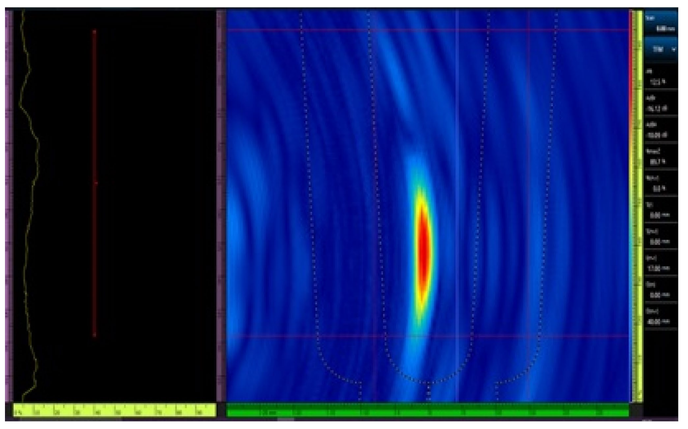
New techniques as TFM-FMC use a region of interest segmented into a grid of positions, or “pixels,” and focusing through phased array beamforming applied to every pixel in that grid.

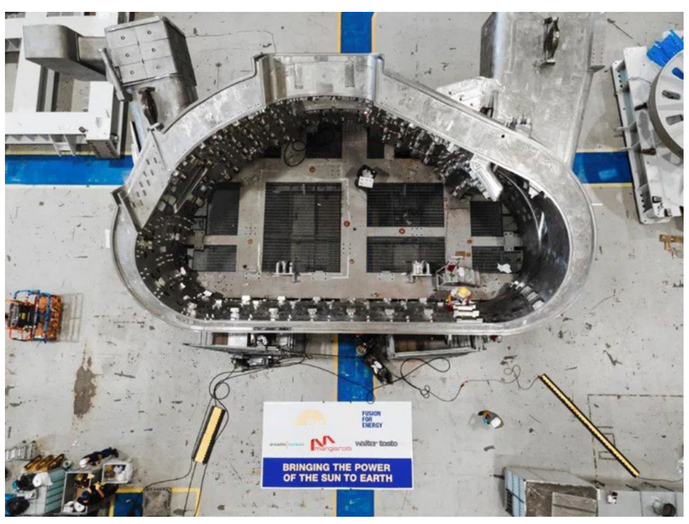
PAUT inspection procedures can be useful and adaptable to other ITER components and Fusion facilities, such as the International Fusion Materials Irradiation Facility (IFMIF), Jules Horowitz Reactor, JT60-SA, as well as in nuclear fision plants, aerospace, railways, maintenance of oil&gas plants, etc.

Quality control is required in the manufacture process and also in maintenance (in-service inspection) during component life cycle. Tecnatom-Westinghouse has proven a large experience in qualification methodologies (RCC-MR code, ENIQ, ASME…), under the strict supervision of regulatory bodies.









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