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# iWeld

intelligent weld inspection



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## iWeld Project

### Structure-informed imaging

iWeld seeks to improve the ultrasound inspection of austenitic welds by taking into account the metallurgical structure of welds, to compensate for performance degrading effects induced by the anisotropy and the local variation of the sound velocity of ultrasonic waves.

But being able to take known information about a weld structure into account is only one building block: How do we obtain this vital information? The traditional technique consists in building a mockup using the same welding procedure and analyzing it destructively, assuming that it is representative of the actual component. Within iWeld, we pursue two alternatives:

#### Weld tomography

One method, successfully demonstrated within Advise, consists in using ultrasound for weld tomography, reconstructing the local structure. This approach relies on a good initial guess, and a simplified model of a weld with a limited number of parameters. By iteratively adjusting model

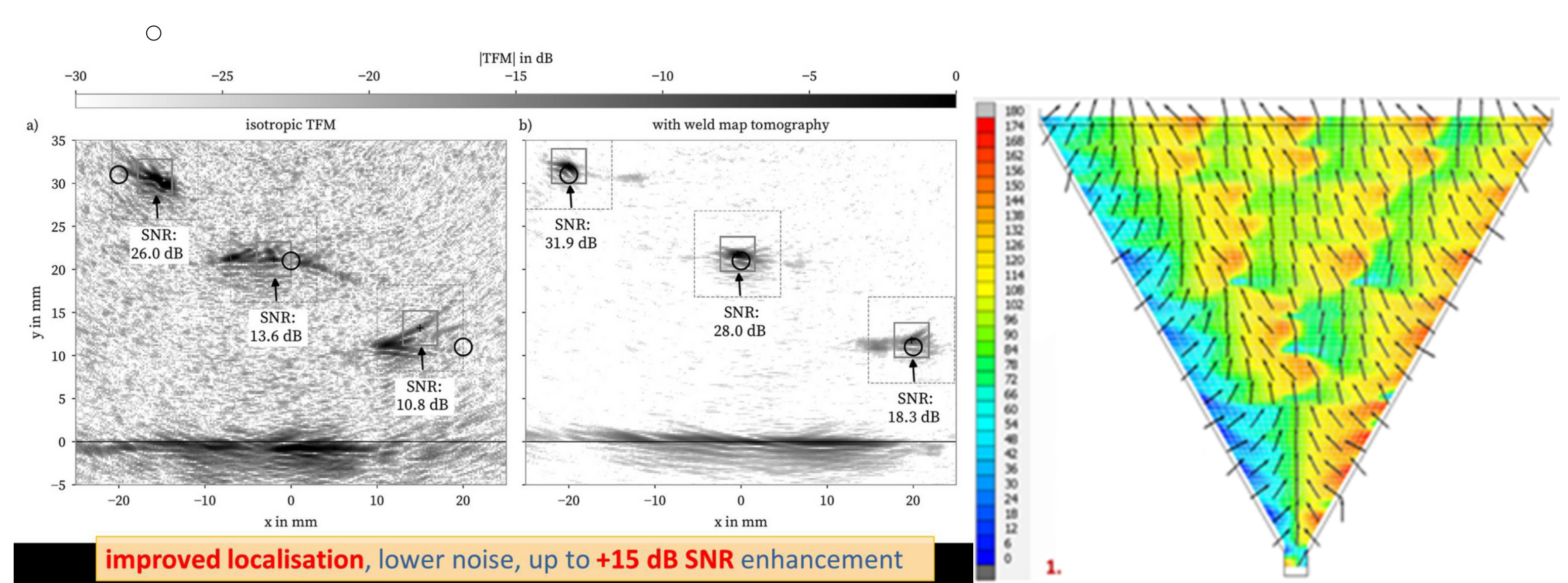
parameters to match calculated time of flight information with actual measurements, weld tomography converges towards a reasonably good macroscopic weld description, which can then be used in the imaging algorithm.

#### Weld simulation

Another approach uses a solidification model to simulate each welding pass as it adds a filler material and produces a local melt pool. If the process parameters are known and well controlled, this method is able to predict not only the macrostructure, but also microstructural characteristics, albeit at a high computational cost. A machine learning based meta-model is therefore used to interpolate weld structure maps between a limited number of simulate pivot welds.

#### A cross-sector deployment

An industrial advisory board representing non-nuclear technology sector (oil & gas, chemistry) provides guidance to ensure a deployment of the iWe



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