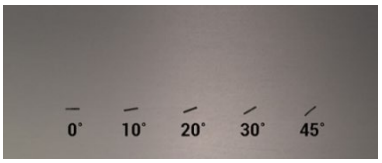
Full Matrix Capture (FMC) Total Focusing Method (TFM)

In-service inspection is generally concerned with the detection and sizing of anomalies caused by the process or external mechanical loading such as fatigue cracks or corrosion. Calling an indication as a defect can lead to considerable expense for the asset owner and therefore the inspector must be confident in their assessment. FMC/TFM provides high resolution inspection and is an ideal solution for these situations.

Full Matrix Capture (FMC) is a data acquisition strategy that acquires every possible transmit and receive combination for an array of transducers i.e. the complete acoustic information provided by all the elements of the probe. Each element fires individually, while all the other elements of the probe receive the returned signals. This generates a matrix of elementary A-scans, which composes the FMC data set. Total Focusing Method (TFM) processing makes sense of the data acquired by the FMC. The TFM algorithms use specific variables to sort the extensive elementary A-scan data contained in the FMC data set into wave sets.

1st Step: Data Collection with (FMC)

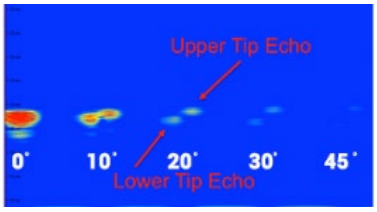
- This technique doesn't require any knowledge of the piece to be inspected (nor shape, nor velocities)
- Each element is activated (shot) one by one
- All the elements in reception are recorded and thus a Matrix of signals are stored in order to be processed



Notches cut into steel block at different orientations

2nd Step: Data Processing TFM

- Optimal focusing and spatial resolution everywhere
- Direct imaging of a large area for one probe position
- All reachable angles with the array simultaneously
- Defect characterisation
- Comprehensive imaging of defect
- 3D imaging



PAUT data struggling to detect 30°& 45° notches

Advantages

- Fully focused images
- High sensitivity to small flaws
- High resolution
- Real-time inspection
- Ease of inspection setup as no complicated focal laws involved
- Ease of interpretation



TFM Data demonstrating its advantage over PAUT

High Temperature Hydrogen Attack (HTHA) is the result of hydrogen dissociating and dissolving in the steel, eventually leading to fissures and cracking. Early stages of HTHA are very difficult to detect because of the small size of the methane voids, typically <0.1 mm. The degradation can build up over time ultimately resulting in unexpected plant downtime, reduction in productivity, employee safety hazards and even catastrophic damage to critical assets. FMC/TFM is ideally suited to this application.



HTHA Failure in plate material.