Inspection Technique Selection

Inspection Techniques

There are almost as many inspection techniques as there are defect types and for every technique there are countless beliefs (and many misconceptions) regarding their capability and validity.

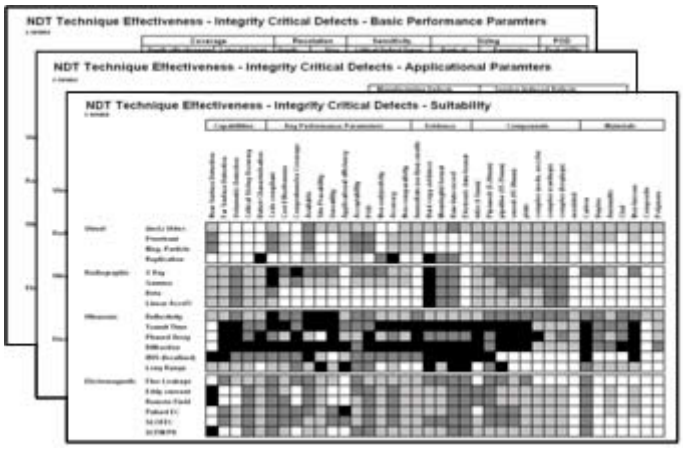
But the fact of the matter is that every technique (and every product variant) has limitations.

Some of the most comprehensively prescribed, longest established and frequently used techniques have the most profound limitations.

There is no panacea, no rod of gold, no magic wand.

These limitations do not just relate to technical effectiveness. They also affect practicability and cost.

For instance, the established use of internal visual assessment for pressure vessel condition assessment and re-certification is all well and good. But visual examination alone cannot determine through wall condition of the pressure containment fabric of the vessel and the technique can only be applied when access is available, i.e. during shut down.
The value and cost of performing this type of inspection is therefore a matter of debate.



However, most techniques are effective if used appropriately for what they are intended and many are continuously improving through technology advancement and increased awareness of their suitability.

As an entirely independent provider of inspection services with 35 years continuous trading experience and a team of people who have a great deal of experience with most inspection methods and their benefits and limitations.

We have no axe to grind in terms of which technique and which particular product to use. We are able to deliver most and we can afford to be highly objective in our choice of product.

The factors which influence technique suitability and those which we consider before applying any of the techniques we are able to deliver include -

- Technique Limitations
- Probability of Detection
- Coverage
- Resolution
- Reproducibility

We have produced a number of Selector Charts to help in the process of understanding the overall pros and cons of most of the available techniques. These charts are not intended to be definitive or fully comprehensive. They are made available to serve as a guide and an aid to assessing general suitability.

Technique Limitations

All inspection techniques have limitations and specifying an ineffective approach due to performance uncertainties about its performance capabilities is arguably worse than doing nothing at all because it can generate inaccurate or irrelevant information which can engender a false sense of security or lead to unnecessary remedial action.

These uncertainties are compounded by various manufacturers' claims about the capabilities of their particular offerings and the fact that many of the established techniques were 'incorporated' and prescribed before their limitations were fully appreciated.

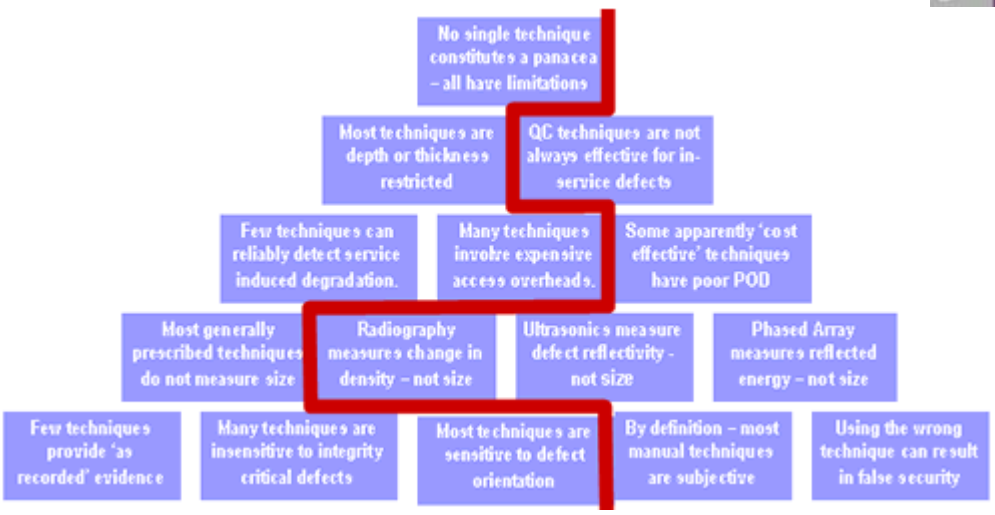
For instance, radiography - although highly effective at producing a recognizable visual image and highly suited to some manufacturing quality control functions - only records change in density. It is therefore, at best, a comparative means of defect size measurement. It is also orientation sensitive and, in today's safety and cost conscious world, it is now recognized as hazardous and logistically cumbersome. Despite these limitations, and the fact that more appropriate alternatives do exist, it is still prescribed as the prime inspection technique in many major fabrication codes and, consequently, is still in regular use today.

Reflectivity based ultrasonic methods suffer similar limitations yet, by virtue of established practice, enjoy similar status.

Our view is quite simple - if an inspection technique isn't capable of reliably detecting and accurately reporting defects or its application is inappropriate from a commercial or safety perspective, then that technique is not valid if used in isolation.

Awareness of technique performance capabilities and limitations is crucial if any value is to be derived from their usage and their effective usage can help protect vital assets.

This brick pyramid gives a few of the cracks in the technique capability equation-



Probability of Detection

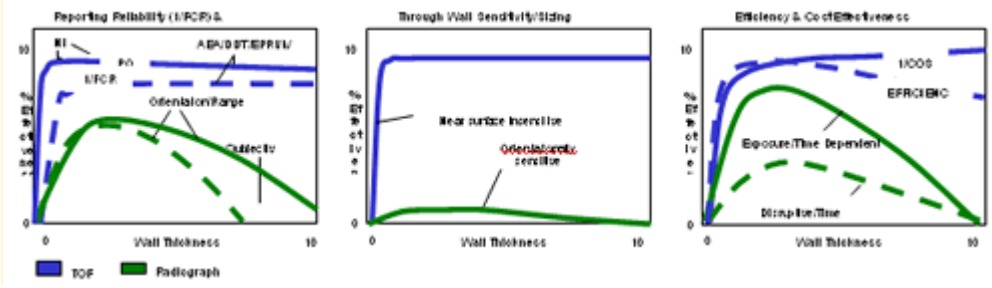
Irrespective of the basic physics of the method involved, the ability of any inspection technique to reliably detect the presence of integrity affecting defects is subject to a number of parameters.

These include; material wall thickness, density & structural composition; defect type, orientation & aspect ratio and applicational factors which can include surface condition, access and environmental conditions.

In addition to these technical issues there are as many temporal and commercial factors to be considered for full effectiveness.

But effectiveness is crucial if the right results are to be achieved.

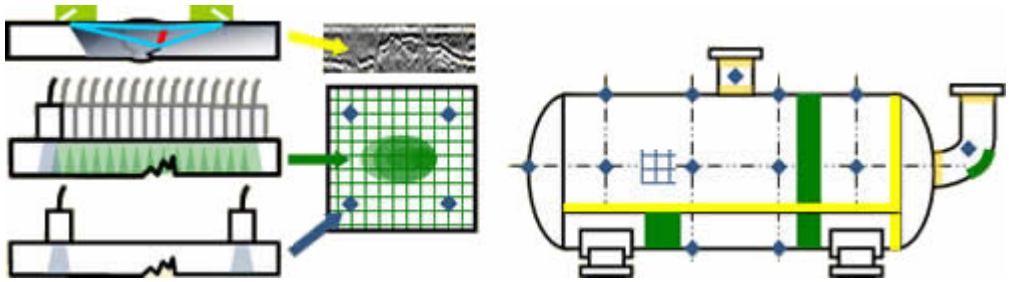
That's why place so much emphasis on ensuring that we assess those factors which might affect performance before we apply any of the methods at our disposal and why we have such a variety of solutions to offer.



Coverage

There is always a trade off between coverage and resolution which has an inevitable knock effect on probability of detection, accuracy and cost.

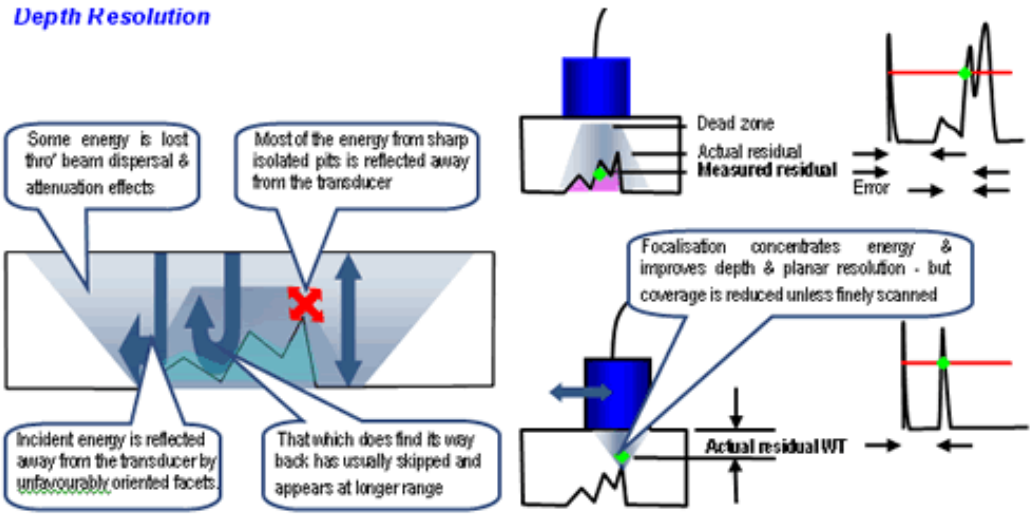
- Too little coverage @ low resolution = low POD, poor repeatability & limited cause/effect characterisation
- Too much can mean unnecessarily high cost
- Fast & efficient volumetric screening can be used to 'clear' none problem areas & highlight critical areas
- This focus can be maximised by understanding the probable causes & nature of integrity critical defects based on historic condition, process & service knowledge
- Different techniques required to address different coverage regimes & defect types

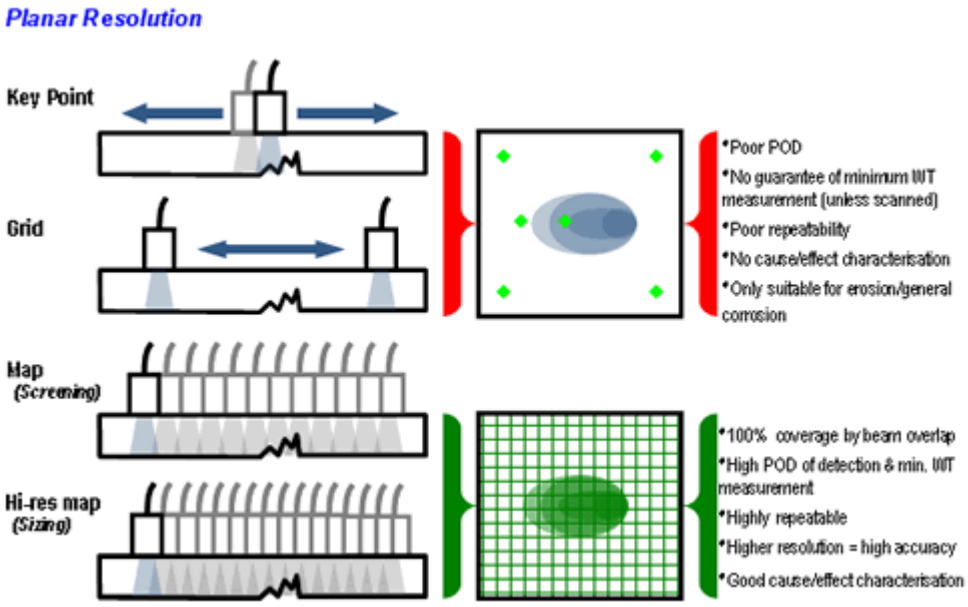


Resolution

Inspection resolution is important irrespective of the technique in use - but particularly so where defect size and characteristics are an important consideration.

Ultrasonic testing is used in both fabrication quality control and in-service fitness for purpose but integrity critical defects such as cracks and pitting corrosions are not usually perfectly reflective or favourably orientated. This reduces the probability of detection and impairs both depth and planar sizing accuracy. Measures therefore need to be taken to ensure that the technique and its application, are optimized to overcome these limitations -

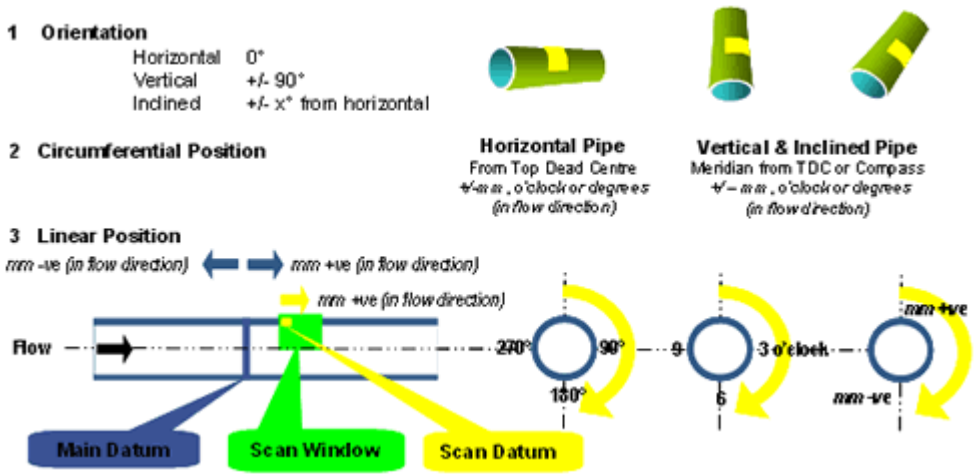




Reproducibility

Repeatability is crucial where baseline surveys and condition monitoring is call for.

The precursor for this, irrespective of the technique or deployment method, is effective identification of an identifiable scan datum and scan convention.



Once these have been established, the emphasis is then on controlled coverage of the area under test.

Encoded automated or mechanized scanning ensures that all readings can be related to a known position - the accuracy of which can be within a fraction of a millimeter.

The importance of this becomes clear where known defects or degradation conditions exist which could propagate in service and where very accurate defect sizing is required to determine fitness for purpose.

- Improved speed & efficiency
- More controlled & assured coverage
- Improved accuracy & repeatability
- Reduced disruption & access cost
- On stream application & temperature
- Controlled 'coupling'
- Multi-channel operation
- Reduced subjectivity
- Better reporting possibility
- Reduced labour intensity
- Cost effectiveness