Non-destructive testing, using the ultrasonic method, has many industrial applications. Some of these applications require the inspection of component geometries that are sometimes complex making the inspection of them a challenging task; typical examples include, the inspection of some primary circuit components of nuclear power plants such as nozzle inside radius regions, and the complex geometries of rotors and blades of steam turbines.

Therefore, to aid inspection design and procedure development, and to provide supporting evidence for the qualification of these inspections, in-line with qualification methodologies such as ENIQ, for example, a universal modelling tool was developed - the iNTIlIGE NDT Modelling and Visualization-3D-SW Tool (iMaV-3D-SW Tool).

iMaV is an intuitive software tool that can be used to model complex geometry inspections (like the inside radius regions of nozzles) for the optimization of key inspection parameters, such as the mis-orientation of the ultrasonic beam to a defect, the particular beam angle at a defect and the coverage of the inspection area. The iMaV tool can also be used to visualize ultrasonic inspection results (whether conventional or advanced UT-techniques such as phased array) within the complex component geometry, which is particularly useful for defect sizing purposes. The tool is also an invaluable aid with regard to being able to satisfy demanding inspection qualification requirements, particularly those of the nuclear industry.

With the iMaV tool, the generation of the component (model) is done either in the ‘mesh generation’ or by using 3D-CAD SW like AutoCAD. The inspection and examination area can be ID or OD. In the manual mode, the beam angle can be visualized in the 3D model using input parameters like beam angle, skew angle and metal path. Mis-orientation and beam angle at the defect will be calculated in the ‘scan plan generation’ for a given value or range of probe skew and probe beam angle. Results can be presented in a table, in a 2 dimensional roll-out or directly in the 3D model. These presentations can also show the metal path to the defect and the coverage achieved. The recheck module shows the expected scanning quality of the final chosen parameters using selected beam spreads.

The iMaV software tool has also been fully validated using acquired UT data from test blocks containing implanted flaws, and has already been used many times. Typical examples from the recent Olkiluoto 3 NPP project, for the Finnish nuclear utility TVO, include the ultrasonic inspection, using phased arrays and time-of-flight diffraction (ToFD) techniques, of the inside radius regions of nozzles on the RPV, Pressurizer and Steam Generator, which are complex, difficult to inspect, geometries. iMaV has also been used in the rail and aeronautic sectors; examples include the modelling of rail disc inspection for the Chinese and the 3D presentation of results of ‘boresonic’ inspection.

The iMaV modelling tool is extremely versatile and can be used more or less for any complex geometry and any location of examination area and scanning area.