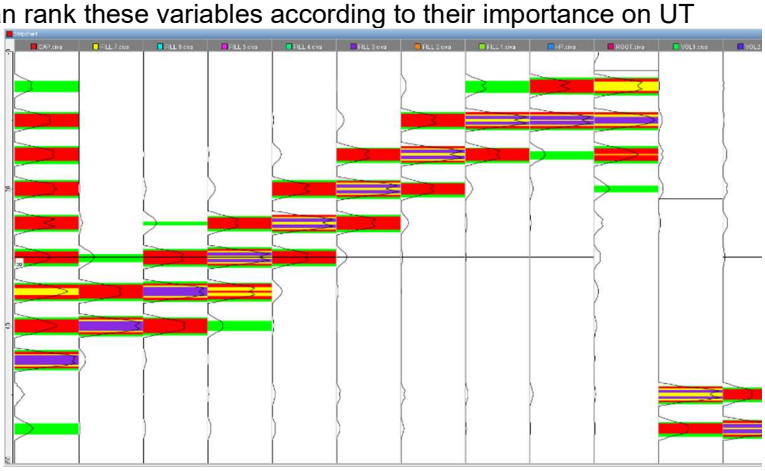
CIVA AUT PIPELINE

Simulation for efficient weld inspections and performance demonstrations

For oil & gas offshore and onshore projects, pipeline **girth weld** integrity is mainly verified thanks to dedicated **Phased Array UT systems**. Governed by DNV-ST-F101 standards and DNV-RP-F118 recommended practices, inspection techniques require proper **performance demonstration** tests. This new dedicated simulation tool, relying on the recognized and powerful CIVA simulation technologies, has been designed for **Oil & Gas** stakeholders to support pipeline project validation as well as to optimize inspection performance and reliability.

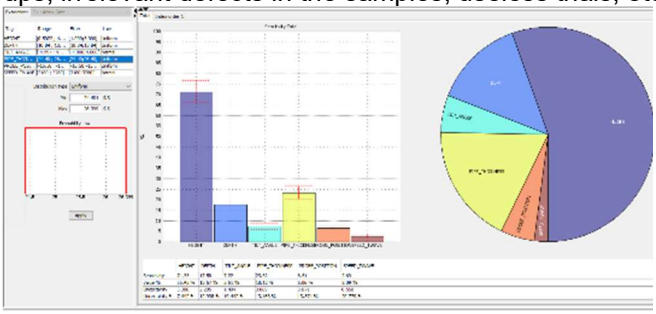
Support project specific validations and reduce costs:

Evaluating the impact of **essential variables** on the inspection's **reliability** is the key-aspect of performance demonstration. With **CIVA AUT Pipeline**, you can rank these variables according to their importance on UT signals, estimate their influence on flaw detectability and sizing accuracy, compare one inspection with an already qualified project to identify deviations from these essential variables, and build **POD and sizing accuracy indicators** based on simulations. While all these stages usually require heavy preparation and experimental campaigns, modelling can **limit the experimental trials to a reasonable sample set**. This can reduce mock-ups and save time by reducing the number of iterations and trials thanks to the information and knowledge provided by the simulations. At the same time, you can **explore numerous inspection scenarios**. Thanks to dedicated interfaces, CIVA AUT Pipeline **does not require extensive modelling skills** as is needed for other simulation tools**.**



Prepare qualification campaigns:

An experimental qualification campaign can include inefficient or unnecessary tests due to non-adapted mock-ups, irrelevant defects in the samples, useless trials, etc., which dramatically increase costs.

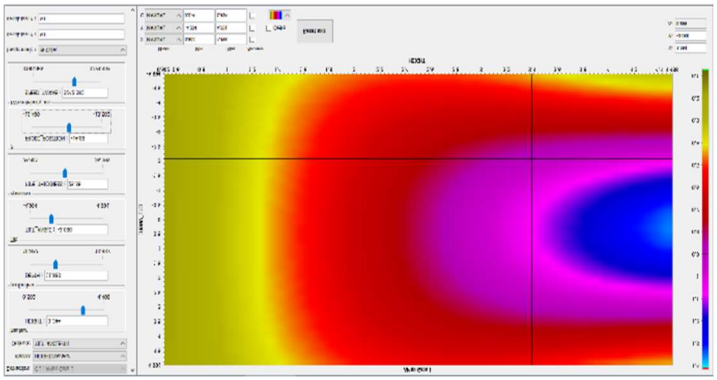


Instead of assessing these deficiencies at the end of the whole process and launching new trials, modelling helps to understand, check, and **prepare in advance a relevant set of test cases** (relevant flaws for the different channels, checking Phased-Array setup, etc.).

As a result, the experiment's design can be adapted and the **overall time and cost for the qualification will be reduced**.

Optimize inspection set-up:

Besides the tools provided to evaluate inspection performance, CIVA AUT Pipeline also includes **field mapping**, **zone coverage** and target **flaw response simulation** tools to work on the inspection technique itself. You can **design** the most relevant transducer characteristics (element size, wedge, frequency, etc.), **optimize** Phased-Array setup (number of elements per channel, focal laws), and adjust probe positions and acquisition gates to increase performance (detectability, sizing, positioning) and reliability.

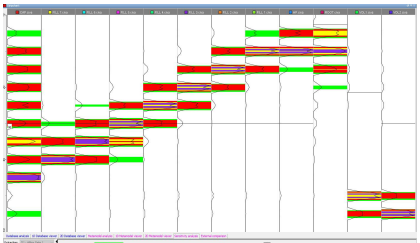


INSIDE CIVA AUT PIPELINE…

Built from the UT module of CIVA, the world leader in NDT simulation, CIVA AUT Pipeline offers 2 ranges of tools:

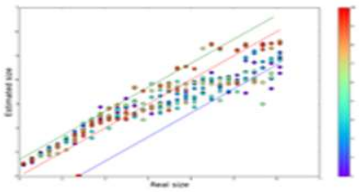
1. **A dedicated set of modules** allows you to quickly enter the project parameters (weld configuration, probe selection, channel definition) and **guides you through the different steps** one after the other:

   - **AUT CALIBRATION:** Run channel calibration**,** verify the relevance of a set-up, visualize the **beam coverage** of different weld zones, and set sensitivity levels.

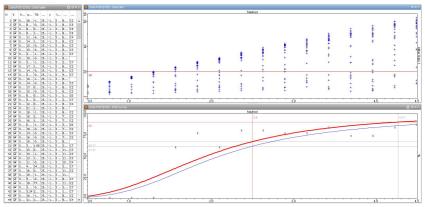


   - **AUT SENSITIVITY:** Define a range of variables for **essential parameters** and evaluate their influence through many potential scenarios in a “real-time” analysis environment powered by metamodels: Sensitivity curves or 2D maps, variable ranking utilizing Sobol indices, and multi-dimensional parametric analysis with parallel plots.

   - **AUT SIZING:** Evaluate **sizing accuracy,** display true vs predicted flaw size graph and associated under/oversizing limit percentiles, and estimate which parameters influence sizing errors.



   - **AUT POD**: Compute **POD** curves (Probability Of Detection versus flaw size) for one or several channels, beam of POD curves, 2D Heatmaps, and check which parameters degrade (or could optimize) POD.



You can address the standard **“Zonal Discrimination Method” (ZDM)** approach or the latest “**Total Focusing Method” (TFM)** with its imaging capabilities.

2. **The “generic” Beam Computation, Sensitivity coverage and Inspection simulation tools of CIVA UT** are also available in CIVA AUT Pipeline for girth weld modelling. While they are less guided, these tools will let you work on transducer selection, focal law definition and calculation, and **designing and optimizing** your inspection techniques or qualification mock-ups. These tools can account for different flaw types including planar flaws, branched flaws, porosity, inclusions, etc.