CIVA 2023: New release of the reference Simulation & Analysis software for NDE & SHM

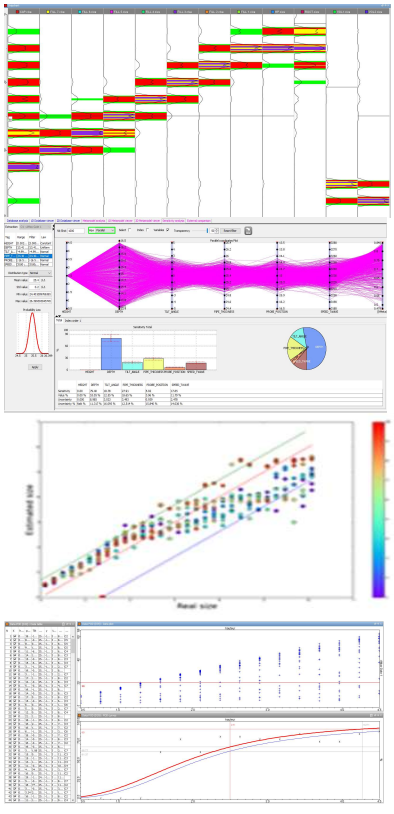
The simulation and analysis platform for NDE & SHM

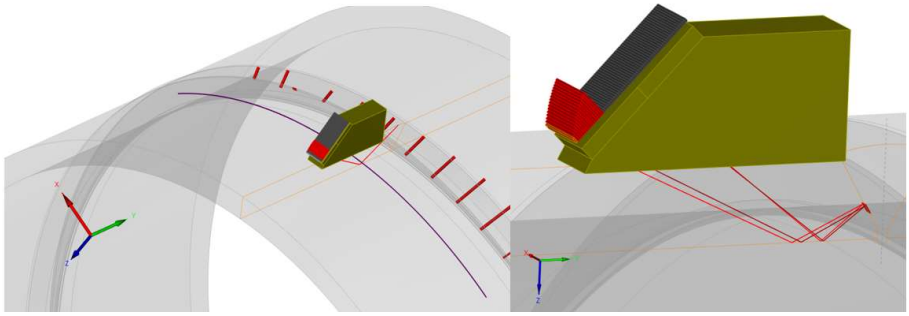
CIVA simulates the most common inspection methods used in the industry, plus new and innovative technologies.

CIVA 2023 features: a new **AUT-Pipeline** module, a new **Data Science** environment, **significant enhancements in the SHM module,** new **Phase Coherence** algorithms available in **TFM UT**, new acquisition data formats compatible with CIVA UT and ET, **Pulsed Phase Thermography** in CIVA TT**, 2D CAD specimen** now available in **ET Inspection Simulation,** new capacities and improved performance in the GWT module, **new IQIs** and better management of scattering computation in CIVA RT, and a "**SuperBatch**" manager to optimize computation times and robustness on multi-core computers. Check it out!

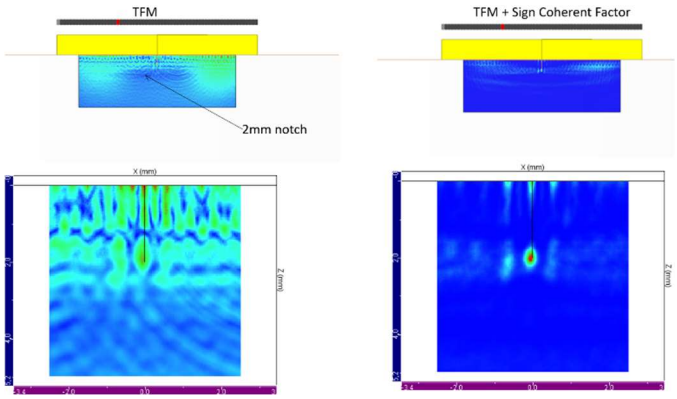
AUT-Pipeline for Girth Weld Testing:

This new simulation tool dedicated to Girth Weld testing applications has been designed for **Oil & Gas** stakeholders to support performance demonstration in **pipeline project validations** as well as to optimize inspection techniques and their reliability. Evaluating the impact of **essential variables** on inspection **reliability** is the key aspect of performance demonstration. With CIVA AUT-Pipeline, save money by reducing the number of iterations and trials thanks to the information and knowledge provided by simulations. Built from the CIVA UT module, CIVA AUT-Pipeline offers 2 ranges of tools: 1) **A dedicated set of modules** allowing you to quickly enter the project parameters (weld configuration, probe selection, channel definition) and **guiding you through the different steps**: Calibration, Sensitivity analysis, Sizing accuracy, and POD curves; 2) The **"generic" Beam Computation, Sensitivity coverage, and Inspection simulation tools of CIVA UT** are available for girth weld inspection modelling. This module is available for homogeneous welds first. CRA-CLAD welds will be available soon in a CIVA 2023 SPx release.





TFM - Coherence Factor techniques now available:



Participating in the development of cutting edge NDE techniques, CIVA UT includes new reconstruction algorithms for **TFM applications** based on **Coherence Factors**, such as Phase Coherence Imaging "**PCI**", Sign Coherence, or Phase Coherence factors (SCF, PCF), in addition to the classic one based on amplitude summations. This provides new features to enhance defect detection and sizing that can be tested on simulation data or acquisition data with CIVA UT.

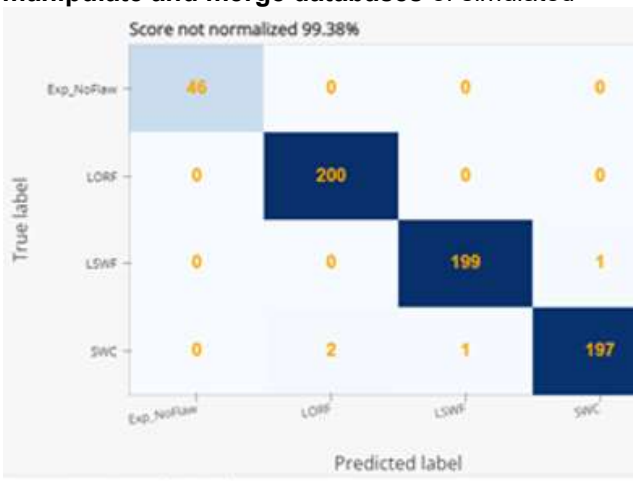
Other new features in CIVA UT:

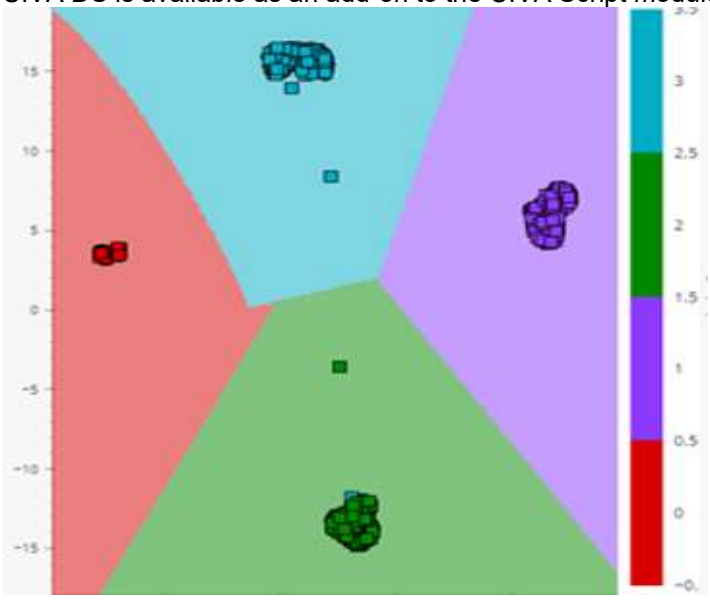
For the **FE Grid flaw model**, it is now possible to define a **circumferential flaw** in a tubular specimen. A large improvement can also be observed on computation times with the Transient FEM model within CIVA UT.
More flexibility is also provided for tandem PA transducers with the possibility to have **different element numbers for Tx and Rx arrays**. Other evolutions will come soon in future SPx releases for asymmetric PA probe configurations. Access to the probe library is faster, and the import management tool for **external focal laws** in CIVA has been improved.
In a future CIVA 2023 SPx release, new weld profiles will be available as parametric geometries in CIVA UT.

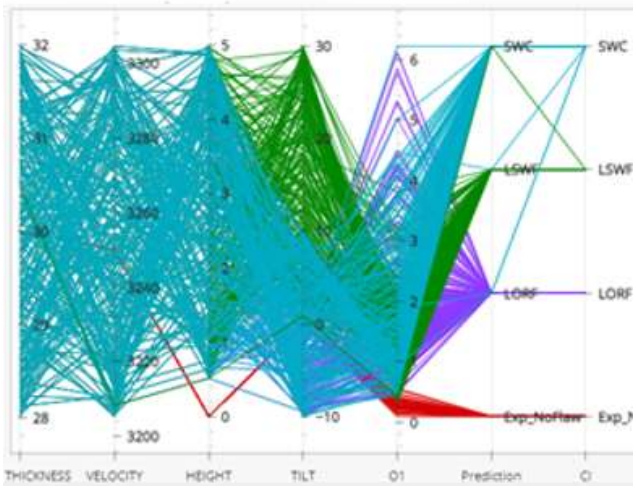
Data Science: CIVA steps into NDE Artificial Intelligence

A real use of "AI" in NDE suffers from the difficulty to get sufficient and relevant data to train algorithms. **Simulation can overcome this situation by efficiently and massively providing relevant data sets**, and of course CIVA can play a leading role for that! CIVA 2023 comes with a first version of a new "Data Science" module. It provides tools to **manipulate and merge databases** of simulated and/or experimental data, then develop and test **Machine Learning-based classification and detection** diagnostic models. It is connected to CIVA Script so that the user can try and test different **custom output criteria thanks to Python scripts**. CIVA DS includes different Scaler, Projection, and Classifier algorithms with relevant visualization maps and graphs such as 2D plots, parallel plots, and confusion matrices to set up training parameters. Once the diagnostic model is trained, you can try it on an external experimental database imported beforehand into CIVA DS and check its efficiency.

CIVA DS is available as an add-on to the CIVA Script module.



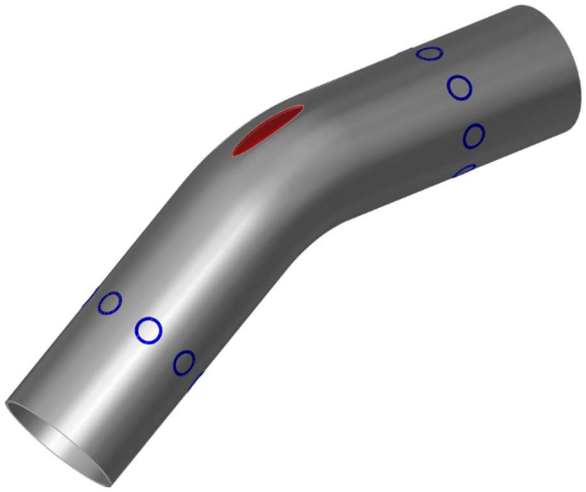




CIVA SHM "V2"

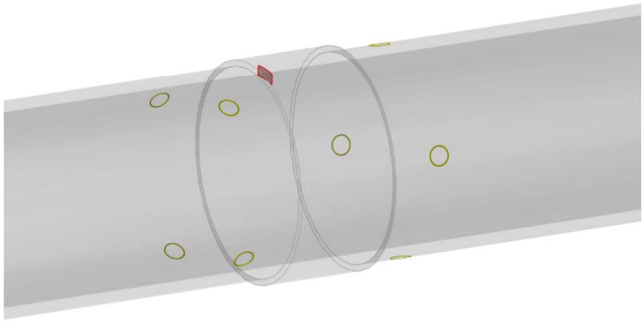
CIVA SHM is a quite recent module in the CIVA platform. Still focused on Guided Waves, this new version includes a significant list of new features in SHM and makes it as a real **"Version 2"** for this module. You can now simulate **tubes made of several materials and layers including fiber composites**. **Attenuation** can be accounted for, which is an important feature for more accurate and quantitative simulations, especially for composite materials.

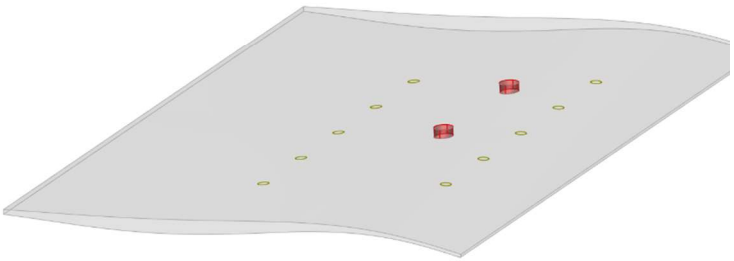
New specimen geometries can be accounted for: **Sleeves**, **elbows**, and **double curvature** applied to a panel. New types of defects are also available: **Inclusions** and vertical **crack**.

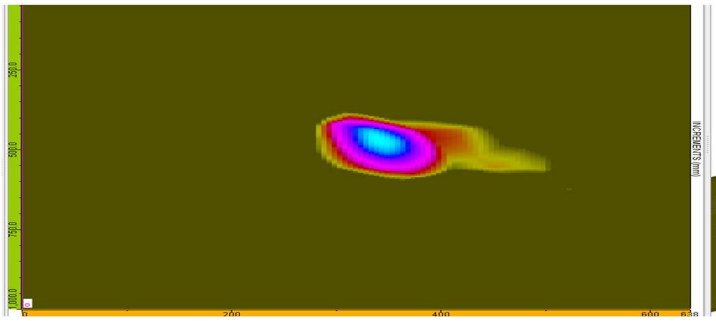


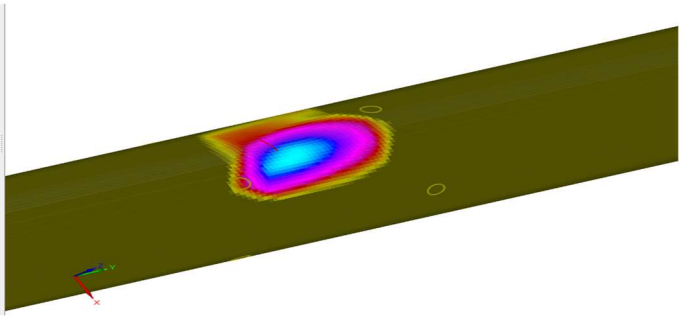
New signal and image processing tools will also help the user to post-process the raw data: **"RAPID"** imaging algorithm, integrated **"baseline" subtraction** tool, and easier exports of stress/displacements local measurements.

Overall improved performance can also be mentioned with a **faster solver** and less constraints regarding FE mesh generation for different sensor locations.





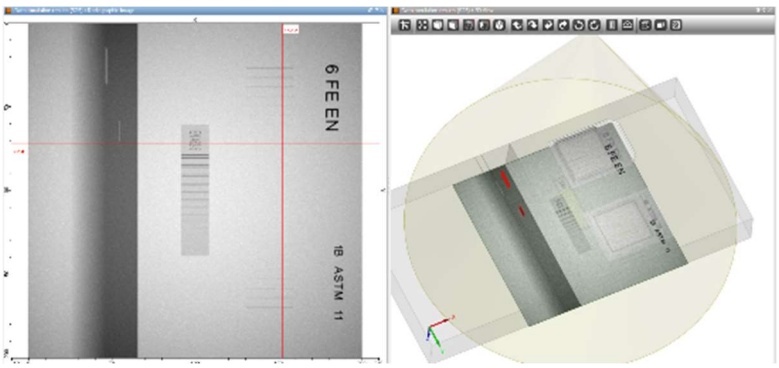




New IQI in CIVA RT

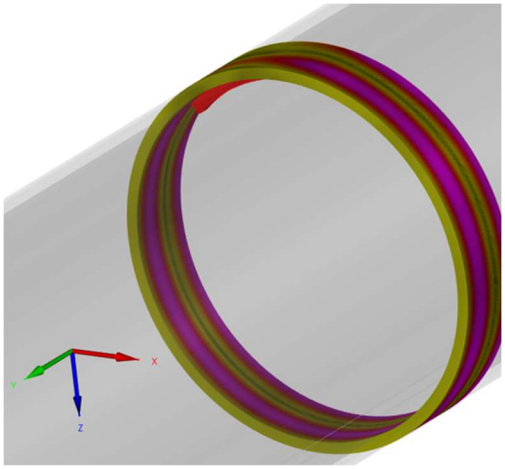
New **ASTM wire type** IQIs will be available in this new version. Another very important new feature for users is the possibility to **restart a Monte-Carlo from a previous one** if it is necessary to reach a better convergence for the scattering radiation: no need to restart from scratch with this heavy computation anymore!

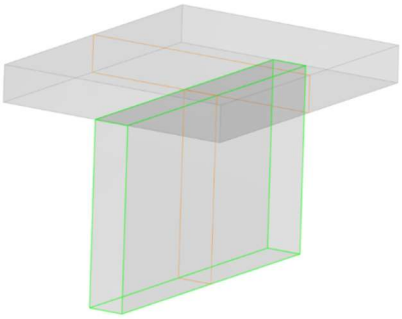
Let's also mention the possibility to **assemble parametric and CAD geometries** to build custom specimen geometries within CIVA, and a new detectability criterion (based on the contrast to noise ratio) in addition to the existing Rose, Fuchsia, and Ellipse ones.

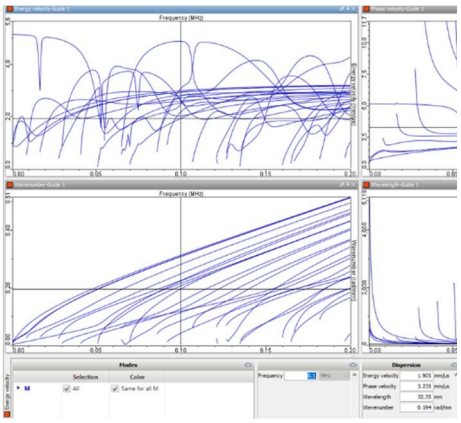


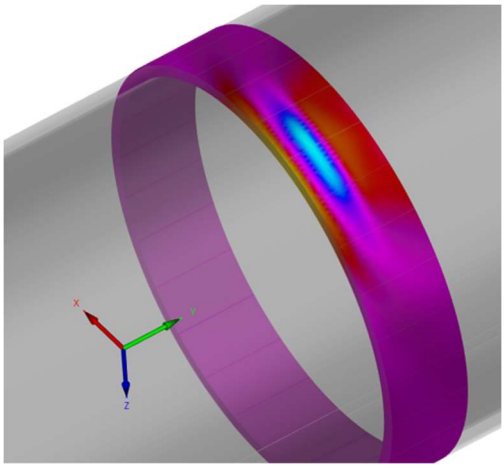
A continuous improvement of simulation performances and capacities

Dispersion curves can be computed for **tubes made of anisotropic materials, such as composites**. This mode computation module as well as the field computation one is also compatible with **heterogenous specimens** defined by its 2D CAD section. A new **FEM solver** is now available for 3D cases (2D CAD section components or pipes with complex defects): more efficient and more robust than the previous solver, it should allow configurations to run that might not have worked properly before.
In these 3D cases, you also now have the possibility to **display Guided Wave field snapshots** directly in the CIVA 3D view.
To be complete, let's also mention the possibility to **compute POD curves** in the GWT environment, to change the amplitude when different sensor arrays are involved, and, additionally, an easier calibration feature has been included.



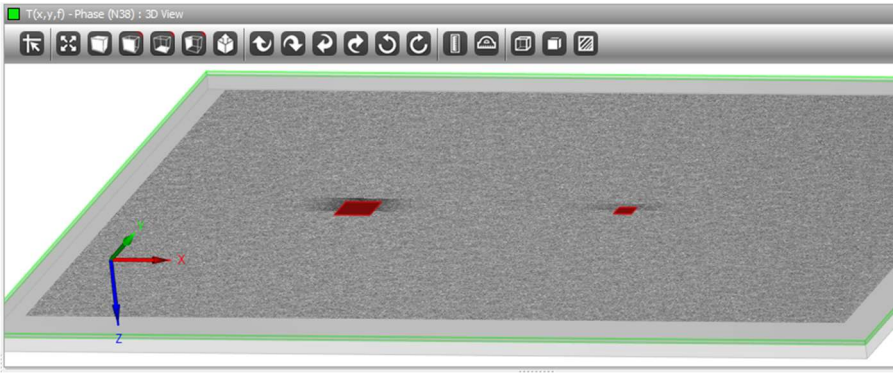


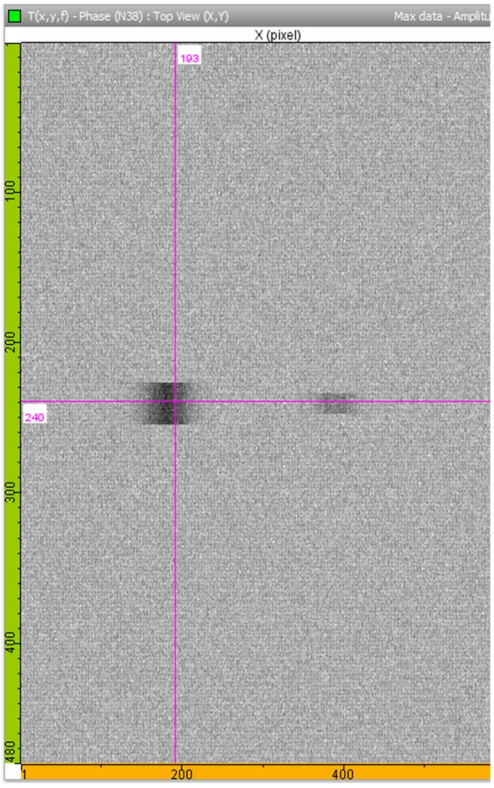




Pulse Phase Thermography available!

CIVA Thermography now includes **a Phase thermogram** display of the results (i.e., phase of the FFT obtained from the raw time domain thermogram), which is more suitable and adapted to what users are accustomed to analysing, especially for Lock-In thermography. Users will also benefit from a "differential" output signal corresponding to a subtraction of the thermogram digital levels with and without flaw giving access to the **analysis of a local contrast** quantity. Let's also mention an **adaptive color palette** that is linked to the current temperature min/max at a certain time, and a better organization of input parameters menus.





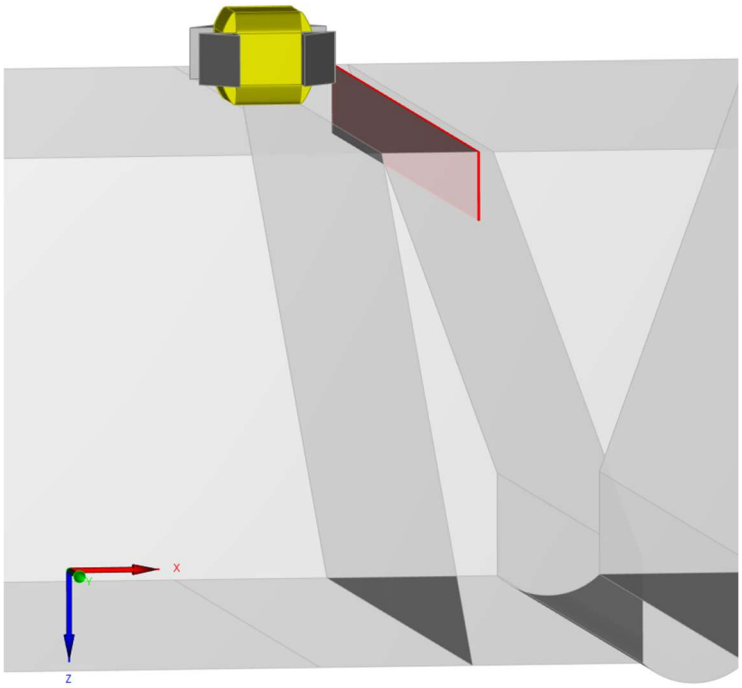
2D CAD specimen geometries available for Inspection Simulation 3D

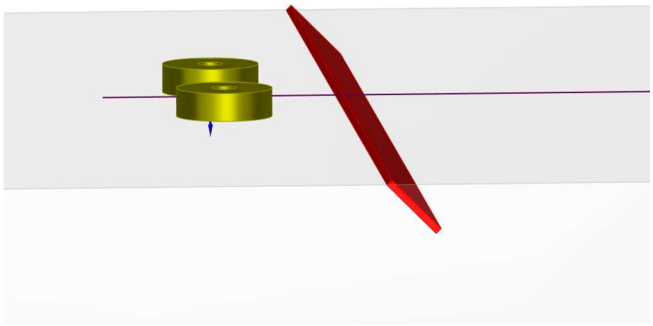
In the previous version, 2D CAD specimen and more complex parametric geometries (weld profiles, blade root, etc.) could be loaded and simulated in the Field computation module of CIVA ET. This is **now available in the Inspection Simulation 3D** module! Based on a 2D Finite Integration modelling Technique (FIT), it significantly **enlarges the scope of applications** of CIVA ET: accounting for component **edge or mass effects**, **heterogeneous components** (such as bimetallic weld), **corroded and/or complex specimen** backwall, **tilted flaws**, etc. In this version, the flaw shall be “infinitely long” and the sensor scanning side of the component shall remain flat. Future evolutions will continue to enlarge the application cases!

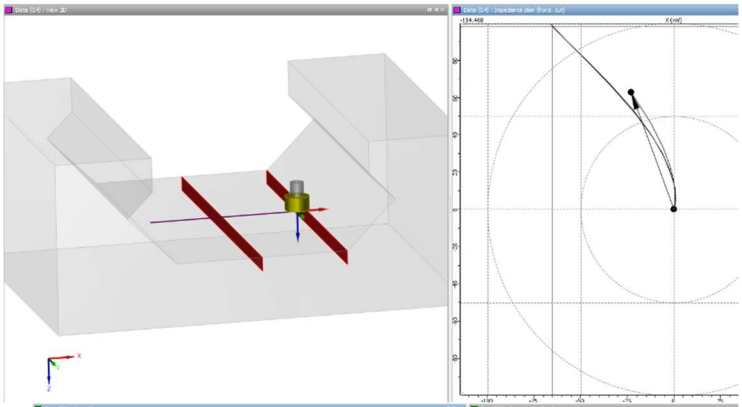
There is a **more realistic representation of the +Point sensor type** with locally enlarged coil thickness where windings overlap.

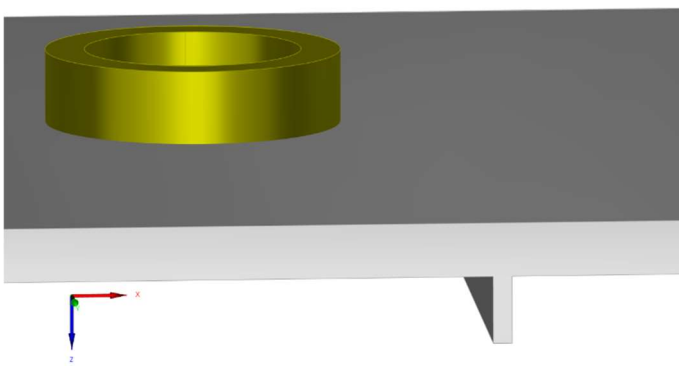
In the **SG tube module**, it is now possible to simulate several frequencies in the same model allowing the user to perform frequency combination in post-processing.

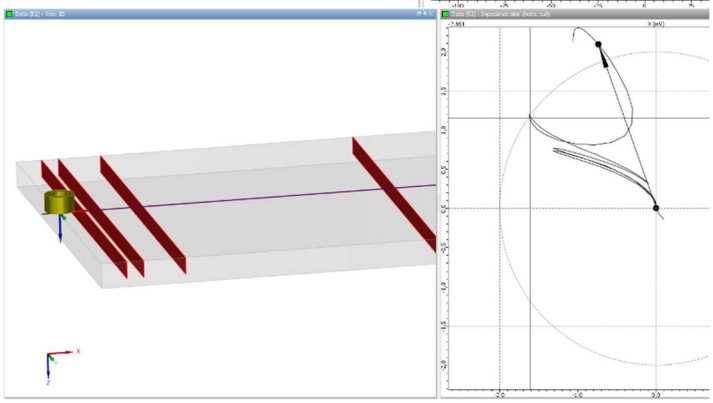
Another major new feature is the ability **to load experimental data into CIVA ET**. CSV files can be loaded offering a generic and simple format for acquisition data exported from any inspection system.







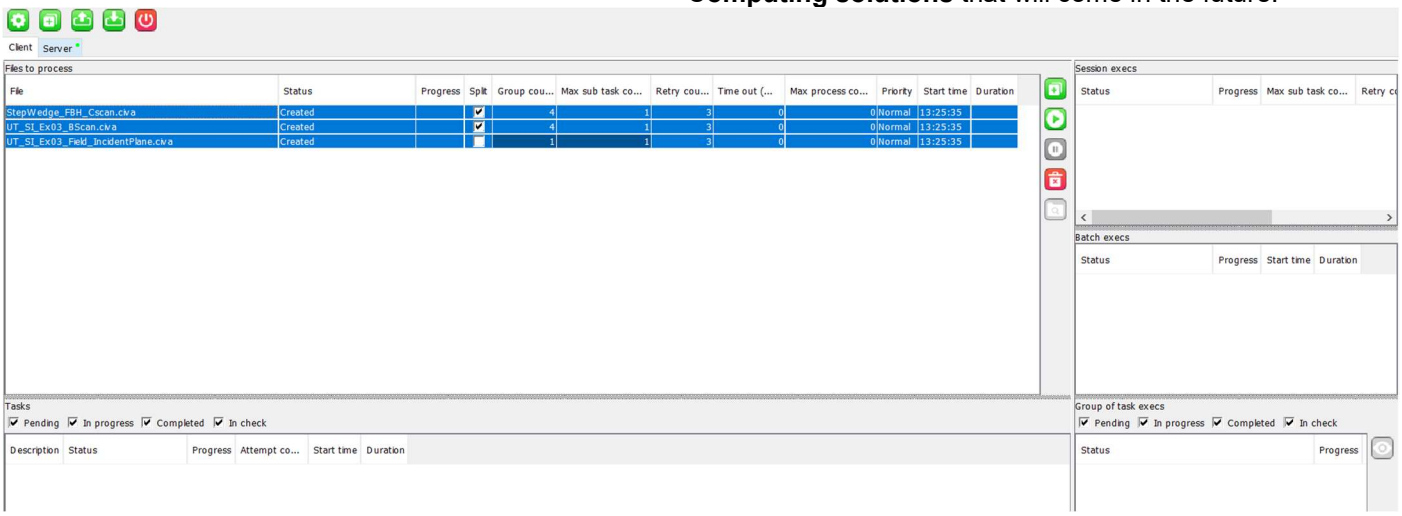




CIVA UT Analysis is now **compatible with** Sonatest **UT data** (A-Scan, C-Scan, S-Scan, E-Scan and TFM data) which enlarges again its **multi-format interoperability.** CIVA UT Analysis is of course still compatible with **Acquire, Gekko, Olympus** files including **X3** ones**, TPAC** Prelude and TFM data**,** and text data exported from **Zetec** systems.

CIVA "SUPER BATCH"!

A new batch manager is now available to benefit from **powerful multi-core machines**. This batch manager allows to split the simulations more efficiently onto different cores available on a machine. Different levels of **computation subdivision then parallelization** can be done (individual cases extracted from a parametric study but also individual shots, sequences and positions extracted from a single simulation configuration). It is also more robust with **"Retry"** and **"Time Out"** features and keeps "safe" the simulation groups that already have been completed in the case of computer, software, or memory problems, even with a computer restart.
It is the **first step towards more advanced High Computing solutions** that will come in the future!



For all modules, regarding **POD simulations**, let's also mention the availability of **"2D Heatmaps"** which allows you to plot a "2D curve" versus two parameters and an improvement of the "Multi-channels" POD feature.

We hope you will enjoy this new version.
Of course, we are pleased to continue collecting your modelling experiences with CIVA.

Your feedback drives the CIVA roadmap for the future!

You will find a complete description of CIVA 2023 on our website: www.extende.com