CIVA 2021: A new major update of the leading Simulation & Analysis software for NDE & SHM

CIVA N·D·E 2021

The simulation and analysis platform for NDE & SHM

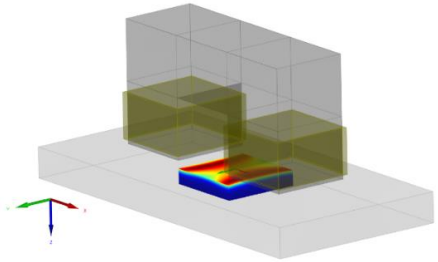
CIVA simulates the most common inspection methods used in the industry, plus new and innovative technologies.

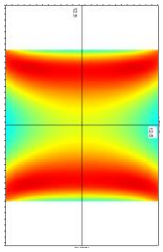
The new version **CIVA 2021** features: a new **Thermographic Testing** module, a dedicated tool for **Steam Generator Tube Eddy Current** inspection modelling, a new **"Sensitivity Coverage"** environment to give ultrasonic coverage and sensitivity maps, advanced features for PA UT TFM, new probes in CIVA UT (Daisy, Shear Waves 0°, etc.), a bridge to an advanced **analysis software in CIVA RT, more flaws and discontinuities** available in CIVA GWT, and a new organisation of the parametric studies and **metamodels** for more efficient design of experiments. Let's not forget also the recent **CIVA SHM** and **CIVA Script** modules that are, of course, still there in CIVA 2021!

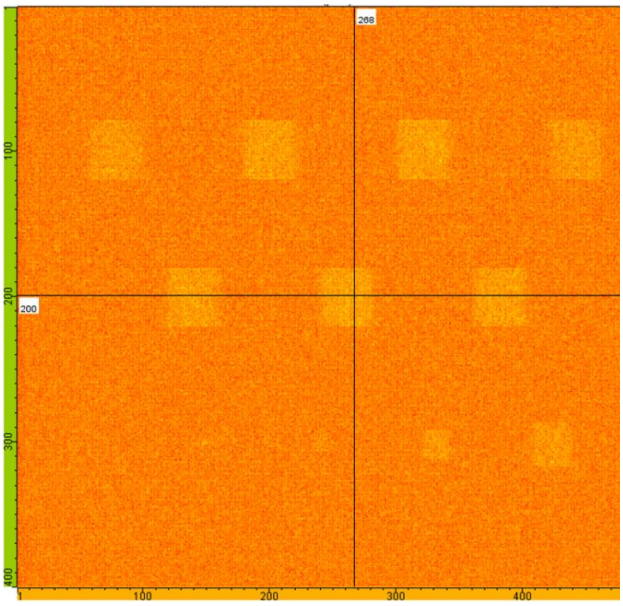
TT

Thermographic Testing in CIVA

Welcome the latest NDE method to join the CIVA platform! For this first version, **CIVA TT** is comprised of 2 parts, an **Inspection Simulation module** providing access to **optical lamp** thermographic techniques (Flash, Transient Lock-in) that simulate the thermal response of stratified planar components with defects, and an **Induction Heating computation** module that provides the power density maps generated by **electromagnetic inductors**, available for various flaw-free conductive specimen geometries (plates, cylinders, but also more complex ones).





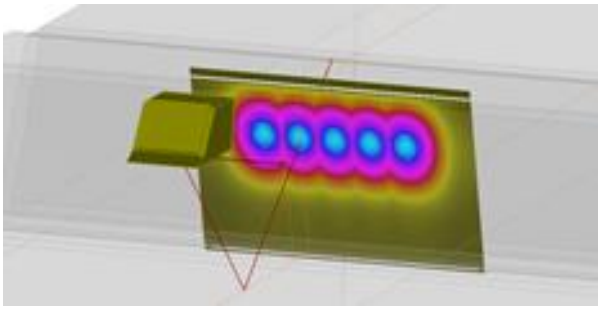


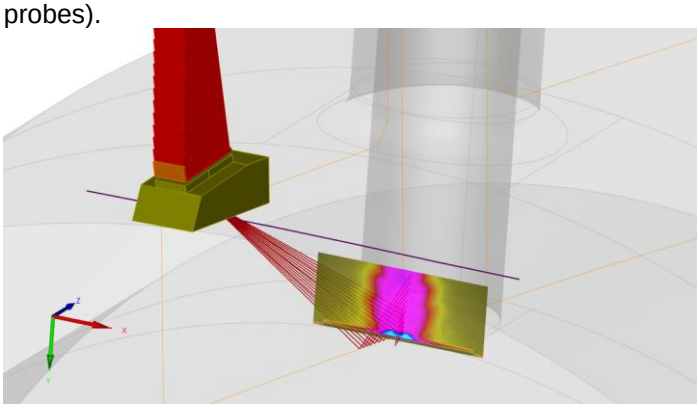
UT ANALYSIS

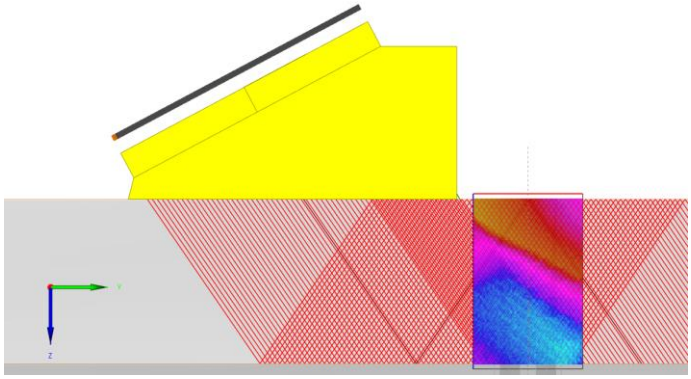
CIVA UT Analysis is now **compatible with Olympus X3** systems! By the way, let's remember that CIVA UT Analysis is a **unique multiformat analysis software** that can load and analyze Olympus data files (*.opd, *.oud, *.rdt, and X3 data), EddyFi data files (Gekko and Acquire files), TPAC data files (Prelude data and TFM *.h5 ones), as well as Zetec data files through text format and that other possibilities are offered thanks to the PlugIn tool. CIVA also has been improved regarding the **pdf examination report** (general enhancement, open to other data formats, etc.). Let's also mention that the **segmentation processing has been extended to TFM** data analysis and that a new **TFM Profiler** allows to generate DXF surface and backwall profiles from TFM images.

New "Sensitivity Coverage" tool

To help **prepare scan plans**, CIVA UT integrates a new tool to **cumulate field computations** on one image for a given scan path, including the evaluation of the **sensitivity to a certain defect orientation**. This new simulation "component", between a field computation and an Inspection Simulation, provides new tools to help design inspections efficiently (available for conventional, TOFD or PA probes).

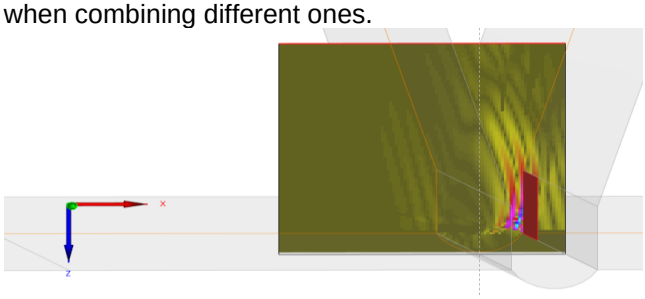


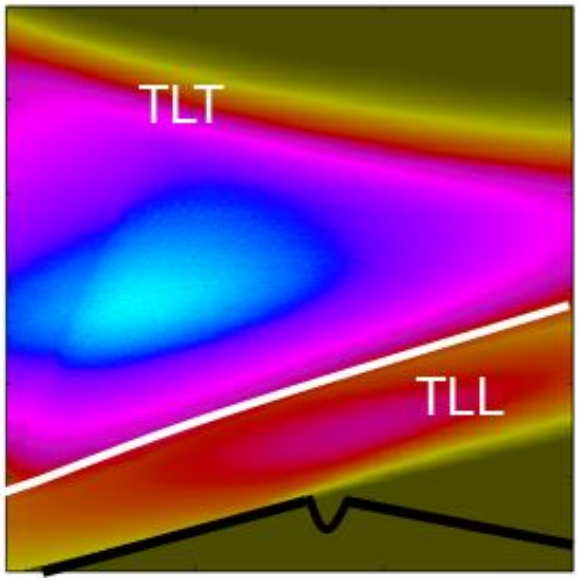




Advanced features for PA UT TFM

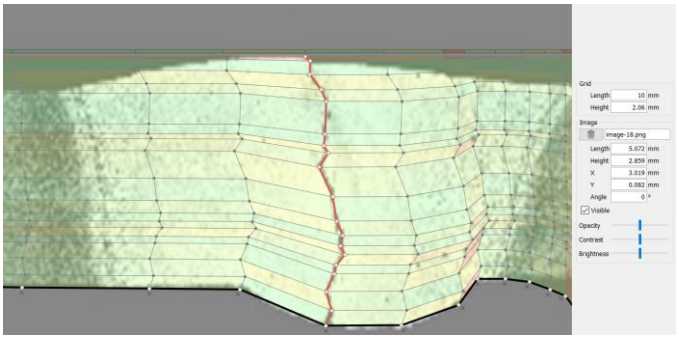
The **Total Focusing Method** (TFM) has become more widely used for various applications where it demonstrates advantages compared to other UT techniques. While TFM features have already existed in CIVA for a while, they have been enhanced with the computation of **sensitivity maps to help select the most relevant modes** for flaw detection and characterization, since this is often the tough part. **Several sensitivity algorithms** are available ("See", Diffraction, "Rays Counting"). The user interface has also been improved and allows for the possibility to adjust the gain for each mode when combining different ones.

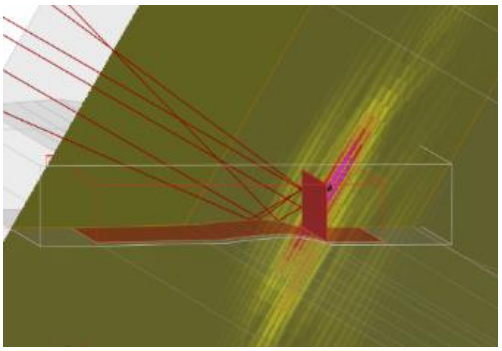




Increased use of FEM models within CIVA UT

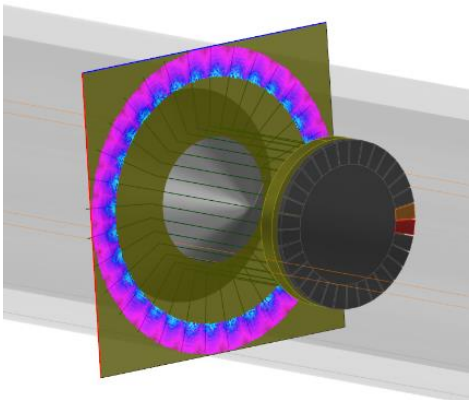
To provide alternative models to users who face the limitations of semi-analytical ones, the FEM beam/flaw interaction model embedded in CIVA UT has been extended to **Side Drilled Holes** and also to **planar or crack-like** surface breaking defects located in the vicinity of **complex front or back wall** geometries. Let's also mention the capacity to **load a macrograph** in the "FE Grid" designer to help draw a realistic defect, surface or back wall.

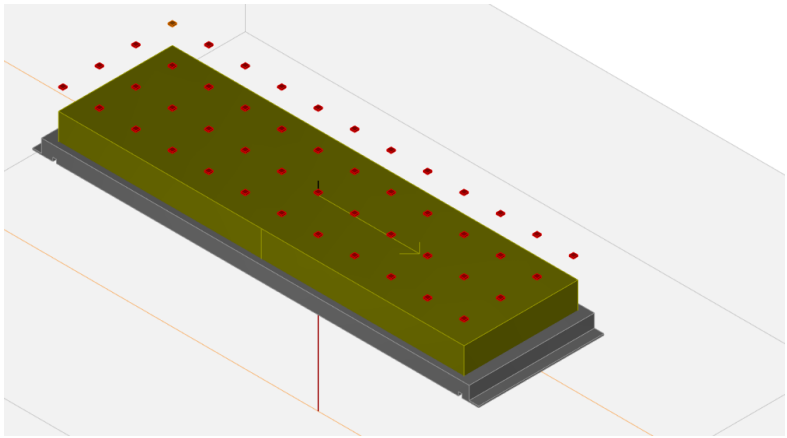


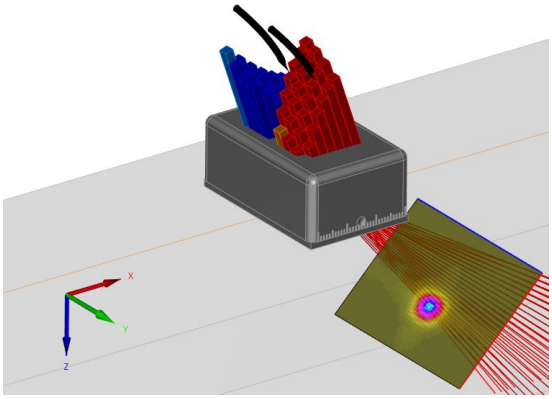


Simulate new probes

The “**Daisy**” probe is now available as a built-in probe type, including more generally speaking the possibility to simulate a **probe with a mirror**. CIVA now also includes the capacity to simulate **S0° probes** (shear waves generated at 0°), typically used for concrete inspections, with the possibility to account for a direction of polarization different from the traditional “piston” Piezo electric mode that was available up to now in CIVA. Let’s also mention that the **transducers library now includes new DLA and DMA probes from Olympus** in addition to other Dual PA probes already available.



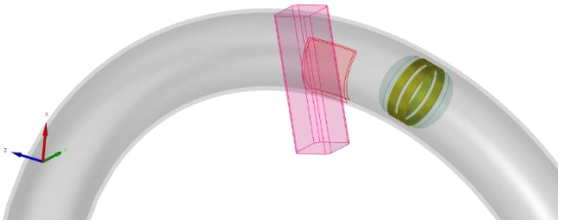


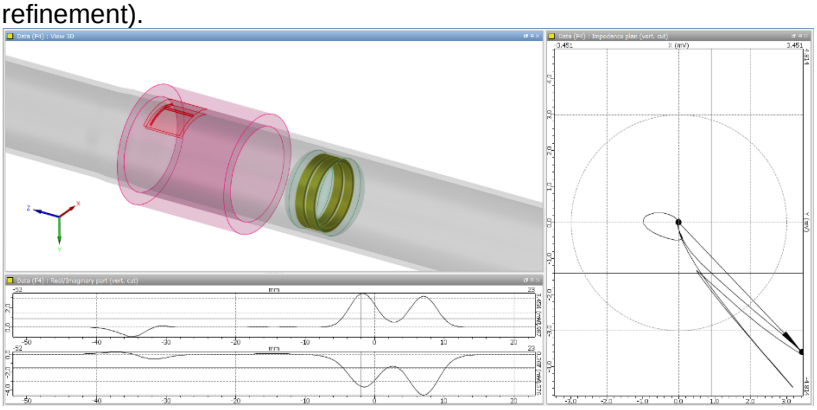


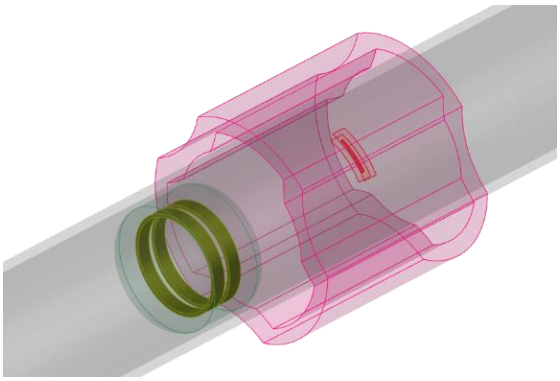
Dedicated tool for complex Steam Generator Eddy Current Inspection

It is now possible to account for **many complex parameters** inherent to Eddy Current SG tube inspection such as **U-Bends**, expansion zone, radius and **section distortions**. The model can involve external parts that affect the Eddy Current signal such as **support plates** (cylindrical, trefoil, quatrefoil), **anti-vibration bars**, deposit and **clogging**.

Large capabilities are also offered in terms of defect geometries: from standard calibration built-in defects to complex grooves and notch profiles, **combined defects** as well as wears. Defects can even be produced in the model by defining **vibrations on the external objects**. For this first version, SG tubes involve bobbin coil inspection only. Based on a full 3D BEM solver, this tool remains simple to use with the same environment as other modules and an automated mesh (but providing the option for expert mesh refinement).

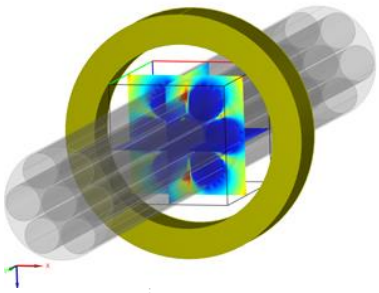


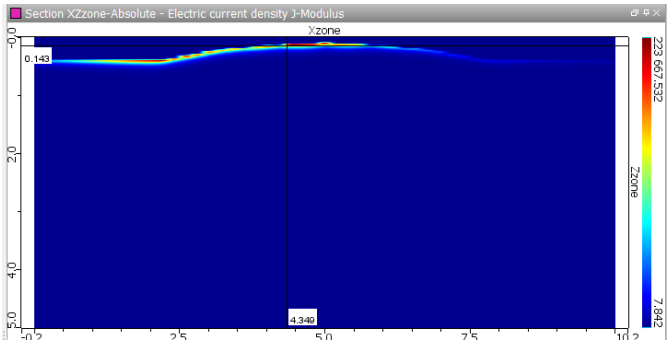


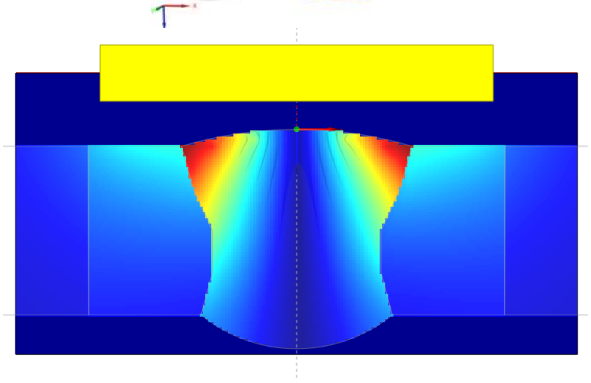


CAD geometries in CIVA ET (field)

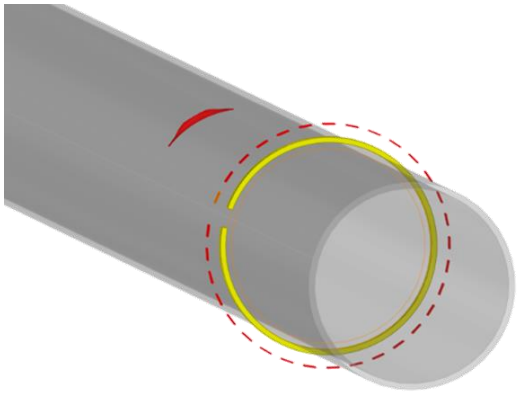
Up to now, CIVA ET was mainly limited to canonical specimen geometries (planar, cylindrical). The **Field Computation module** now provides the option to account for complex models including **curvatures, mass and edge effects**. The following geometries are available: **2D CAD**, welds, blade root and blade groove, fastened plate and tube expansion. It is a first major step before including these components in the Inspection Simulation 3D module.

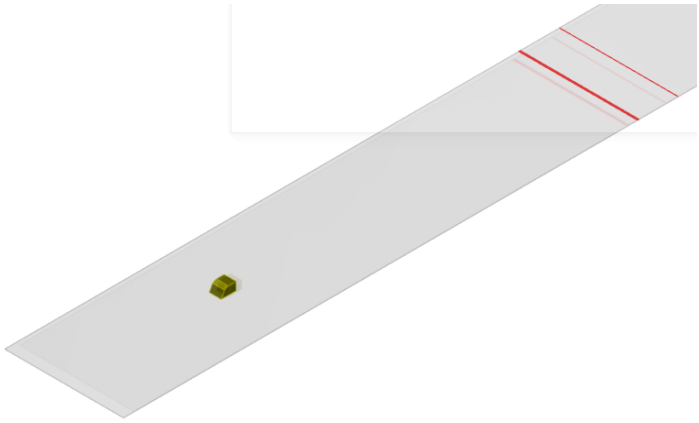


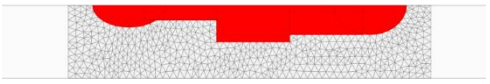


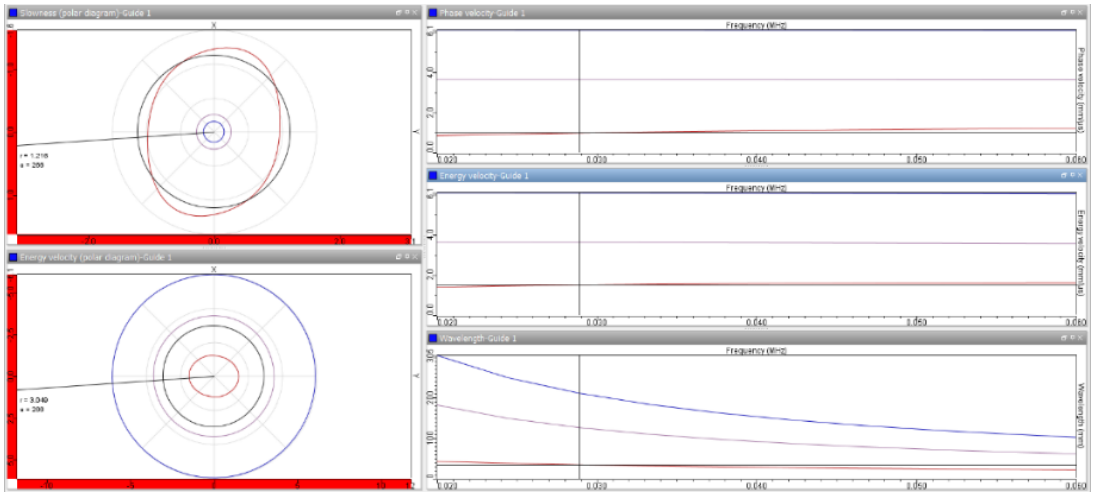


In the Guided Waves module, **multiple and complex defects and discontinuities** are now available in components with a planar extrusion. It is also possible to simulate complex defects, such as a corrosion profile, for tube inspection simulations involving the use of the 3D FEM model. And let's not forget the ability to compute **dispersion curves in composite** multilayer structures.

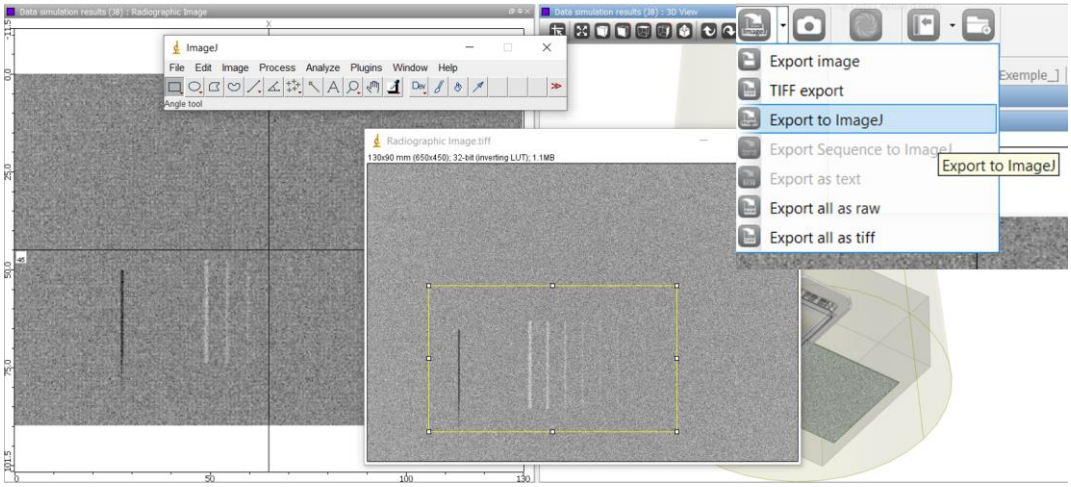


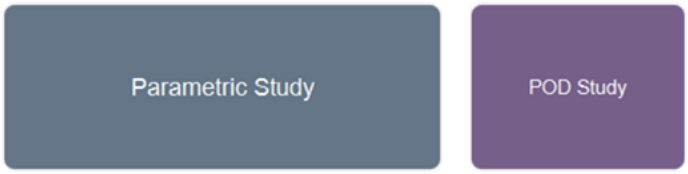






In the RT-CT module, a bridge has been built with the freeware analysis tool "**ImageJ"**, to enhance and ease your simulation analysis. In the CT module, you can now export the iso-surfaces of the reconstructed volumes in **STL format**. Let's also mention that the **CT reconstructions can be embedded** in the same process as the main simulation in which the RT projections are computed. It means that CT simulations can be much more easily customized and run in series using the batch manager. Users can also define the images and format (raw, tiff, etc.) wished to be saved.



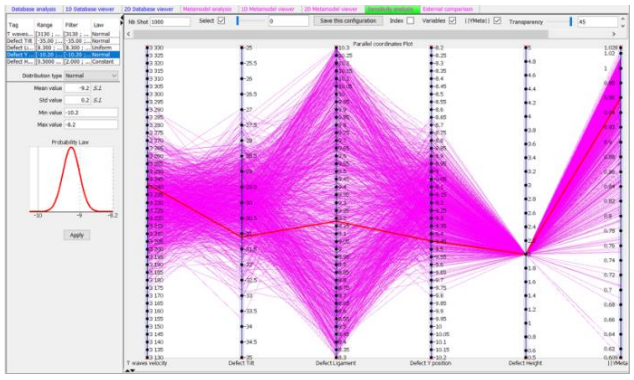


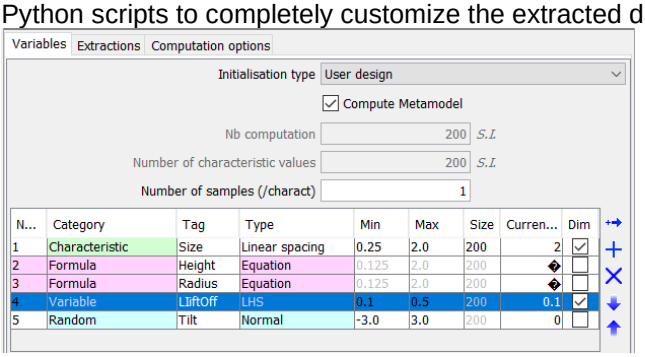
Metamodels, parametric & POD studies:

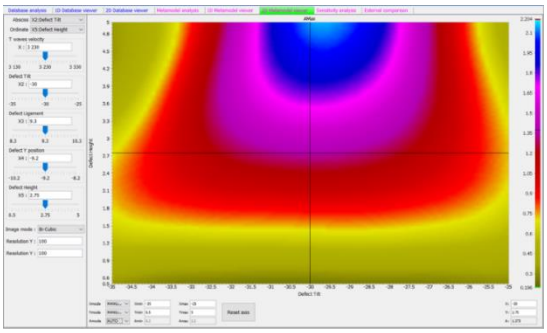
To understand and quantify the impact of **influential parameters** on an NDT inspection in the framework of a qualification, a design or an optimization study, simulation in CIVA is particularly well adapted since it is easy to precisely change and monitor parameters and **metamodels** are available for multiparametric studies and **real time sensitivity analysis**.

To easily check the variation range that has been defined by the user, a **"Play button" animation** enables the visualization of the changes in the 3D view.

Additionally, to optimize your design of experiments especially when multiple parameters are involved, the **definition of the variation laws has been enhanced** (for instance, automatic sampling for some variables can be mixed in the same computation with user-defined sampling schemes for other variables) and homogenized whether you wish for a simple parametric study or a metamodel. It also includes more options to extract relevant data from your parametric analysis. Thanks to the add-on module **CIVA Script**, you can also create your own Python scripts to completely customize the extracted data.







Last but not least, ***UNDO is now available in CIVA!*** Just key-in "Ctrl" + "Z". It was definitely missing…

We hope you will enjoy this new version and its many improvements. Of course, we are pleased to continue collecting your feedback on CIVA. Your input drives the CIVA roadmap for the future!

Please find a complete description of CIVA 2021 on our website: www.extende.com