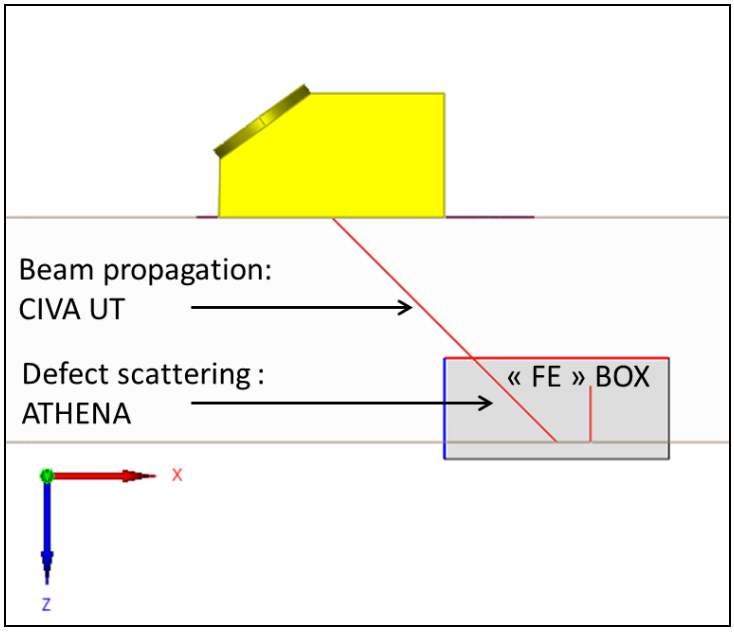
CIVA ATHENA 2D: New Module

This new tool consists of a hybrid module using both conventional semi-analytical methods of CIVA UT and the finite element method (FEM) code ATHENA.

The ease of use of CIVA, the power of Finite Elements… Faster !



In **CIVA ATHENA 2D**, a finite element rectangular box is defined. Outside of this box, the UT beam propagation is modeled with the conventional semi-analytical method of CIVA (pencil method). In the box, the calculation is made by FEM (using the incident beam, calculated on the box boundaries as an input). Typically, FEM will be used to simulate UT beam/defect interactions (and beam/geometry interactions) whereas the fast semi-analytic model is used to simulate the round trip propagation of ultrasound from the transducer.

Doing it this way, the computation is **faster than** a complete **finite element** computation, while **all phenomena are accounted for** regarding the beam/defect interactions.

The configuration is defined in the **user-friendly** CIVA interface, with very few specific parameters. Thus, CIVA ATHENA 2D is **easy to use**.

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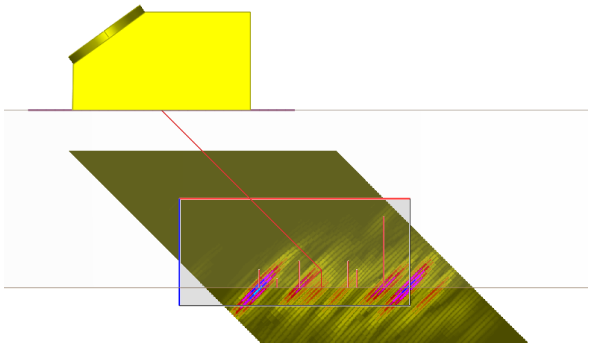
The results from this new module are the classical curves and images available in CIVA UT (A-scans, B-scans, 3D view, reconstructed view, etc.), but CIVA ATHENA 2D can give additional snapshots of the field/flaw interactions, providing a **better understanding**. It is even possible to create a **video** file, showing the propagation of the beam and its interactions in the FEM zone.

CIVA ATHENA 2D: Field of Application

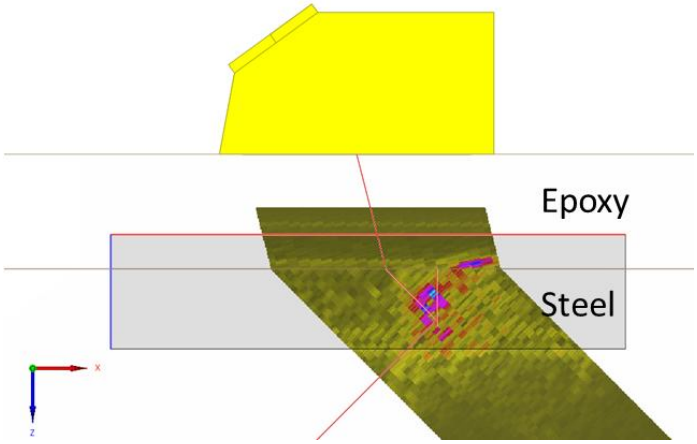
- *New capabilities: Account for all physical phenomena*

- Accounts for **creeping waves** and **Rayleigh waves** generated on flaws
- Simulates **multiple scattering** by flaws
- Precisely calculates the response from **small flaws** with respect to the wavelength
- Computes **interface echoes**

Available flaws (including complex profiles)



Network of flaws (multiple scattering)

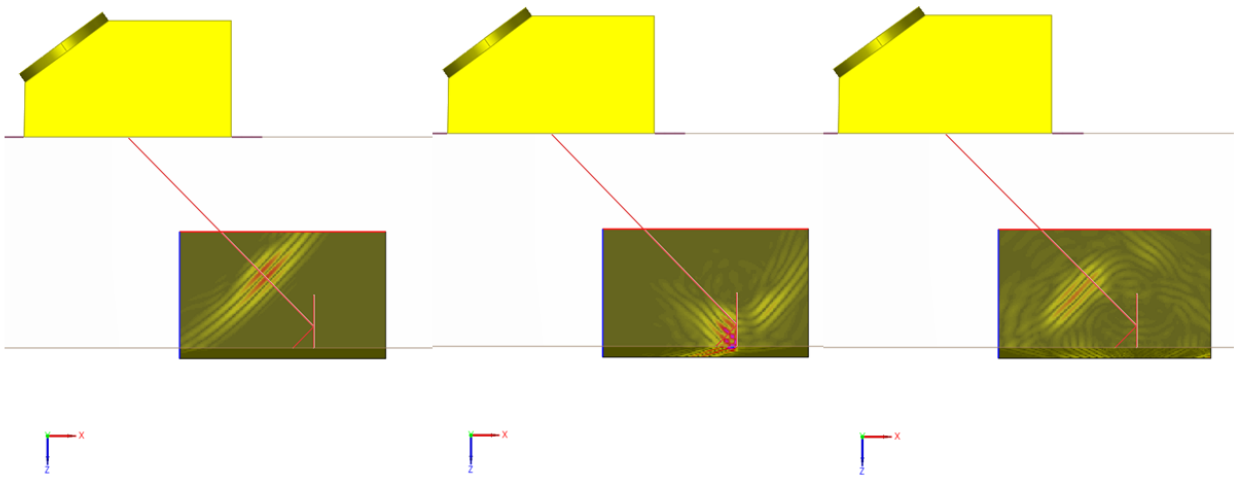


Interface echo and diffraction on a flaw located below a cladding

These possibilities allow for precise simulation of the response from clusters of flaws or from complex flaw profiles where **surface waves are generated**.

- *New capabilities: Visualize defect scattering*

- **Beam snapshots in the FEM zone** (maximum amplitude, **video**...)
- Classical scans (Ascans, Bscans...) and usual Civa views (3D views, reconstructed views...)



Snapshots of the beam/flaw interaction vs time

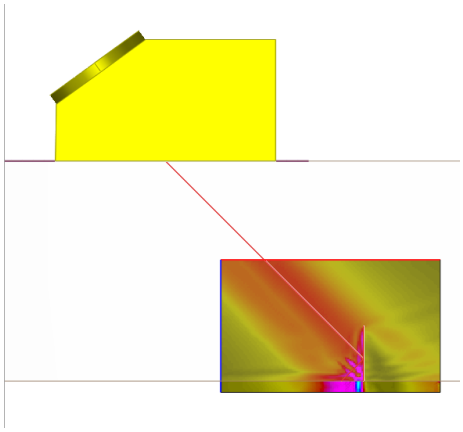


Image of the total beam in the box

- *CIVA ATHENA 2D is … a 2D module*

CIVA ATHENA 2D uses a 2D beam computation and a 2D FEM calculation from ATHENA.
3D effects are intrinsically ignored **while it gives very precise results as soon as the 2D hypothesis has been validated,** which means mainly:

- Considering only flaws that can be defined by their 2D cross-section: Planar notches, multifaceted or branched flaws and Side Drilled Holes
- Comparison of flaw responses independent from their extension in the orthogonal plane : Same extension and at the same depth, or extension larger than beam width
- Component geometries that can be locally considered as 2D

Out of 2D configurations, using CIVA ATHENA remains interesting for **qualitative analysis.**