The Ultrasonic modeling code Athena 4

Athena 4/Milena 4 is a comprehensive 2D ultrasound NDE modeling package, comprised of the finite element engine Athena2D and the graphical user interface Milena. As opposed to general finite element engines, Athena explicitly targets ultrasound NDT, and uses commonly used parameters to define a given inspection configuration.

Version 4 is the first 64 bit release and allows to fully use available memory in personal computers running 64 bit versions of Windows 8.1 and Windows 10. Athena 4 does not run on 32 bit versions of these operating systems. With a completely rewritten memory management using dynamic resource allocation, Athena 4.0 is the foundation of a new generation of finite element engines, which will be extended to accommodate new features, which could not be integrated in the now obsolete 32bit static memory architecture used in Athena 3.x.

What's new in Athena/Milena?

Most of the modifications have taken place under the hood, and only become apparent for new, large configurations which previously exceeded the memory limits of a 32 bit application. But Version 4 also provides a number of new features.

1. New wedge model
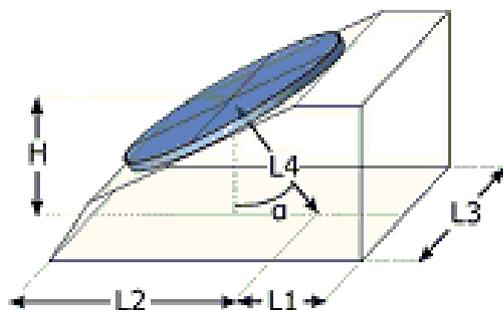
Version 4 has a new transducer model for contact transducers which closely resembles the definition of angle wedges used in the popular CIVA software package. The wedge height can be defined either in terms of the length of the central ray between the center of the piezo element and the index point, or in terms of absolute height. The transducer position for contact transducers now always refers to the index point, which is the natural reference for the ultrasound practician.

2. TOFD setup

Version 4 comes with a TOFD mode, which allows to conveniently define a TOFD configuration by just indicating the pitch-catch distance of both transducers. The parameters of the receiving transducer are automatically duplicated from the transmitting transducer. Of course, the general

emission/reception configuration is still supported, allowing complete freedom to define both transducers independently, and to control their respective trajectories during a scan.
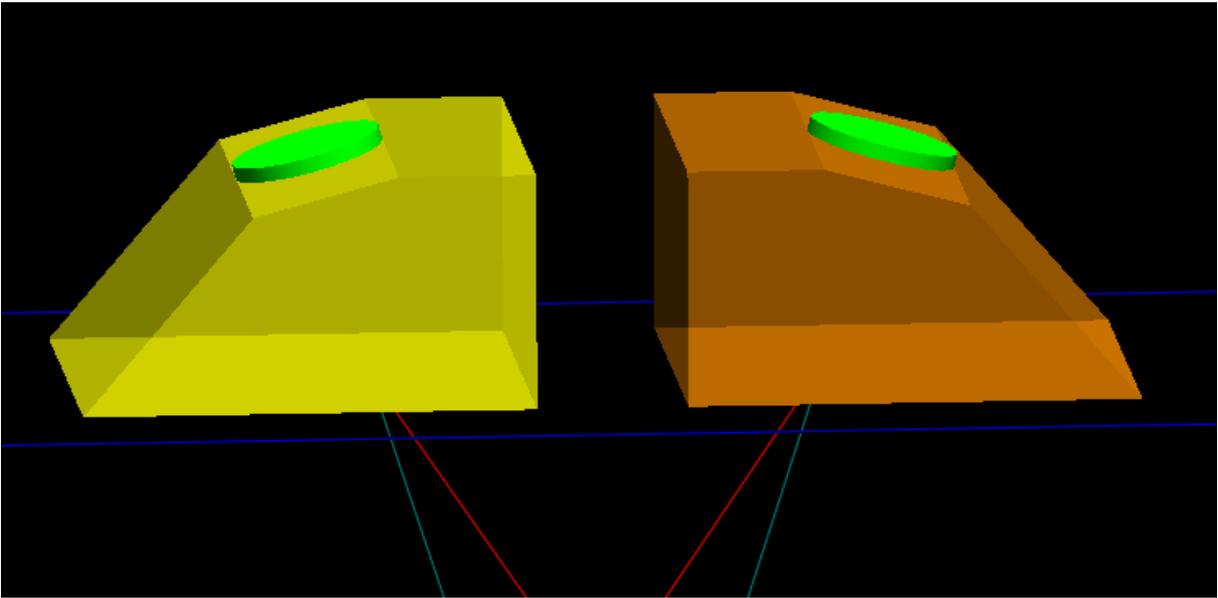

3. Better integration of the FEM solver

The new "Start Calculation" dialog box provides seamless integration of the console output of the ATHENA solver, allowing for easier error analysis and computation progress tracking. It's a minor addition, but it makes for a major improvement of the user experience.

### 4. New modern user interface

Version 4 comes with a brushed up new user interface with an intuitive ribbon, which guides the user through the preparation of an inspection configuration and which provides a more interactive user experience.
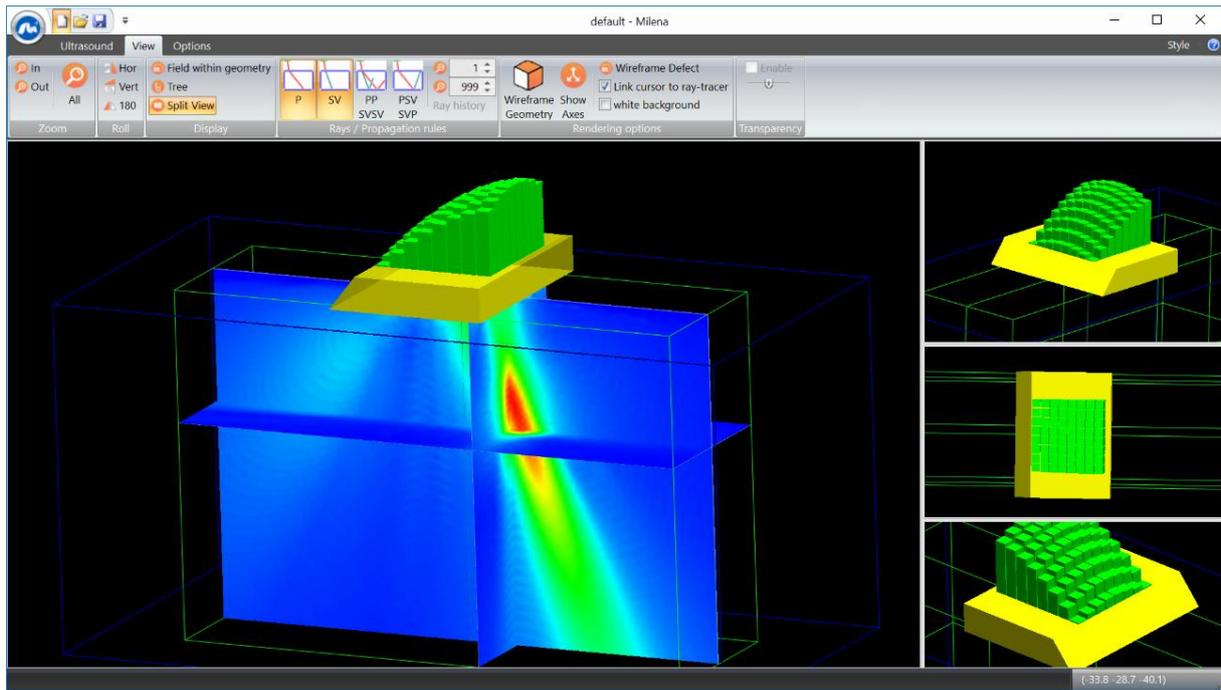
5. Animated wave movies

Version 4 provides an improved snapshot mode, allowing to capture images of the displacement velocity magnitude (or other properties of interest) at chosen time intervals. Upon first import of the snapshot file, a binary version is created, which allows for much faster load times and easier manipulation. It is possible to define a time window of interest, to limit the wave movie capture for example to the interaction with a defect.
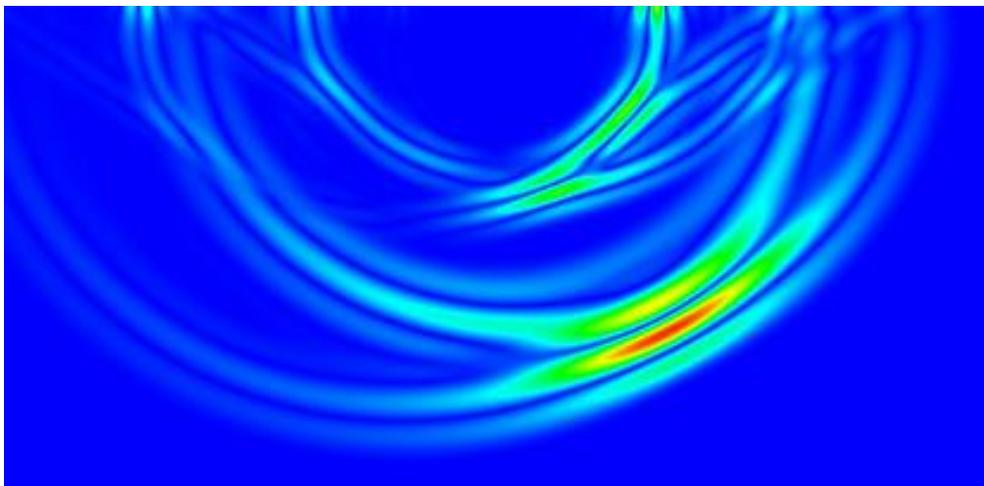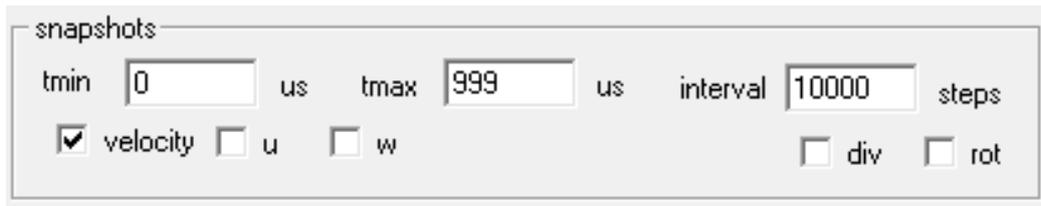
5. Complex weld modeling

Version 4 has improved facilities to import and handle complex structured material representations. These structures can be imported in various formats, and in particular interface seamlessly with the MINA weld modeling code. Local grain orientation is now visualized within each region, and the resulting finite element mesh can be directly verified. The integrated ray tracer allows to appreciate beam deviation due to local variations of the microstructure.
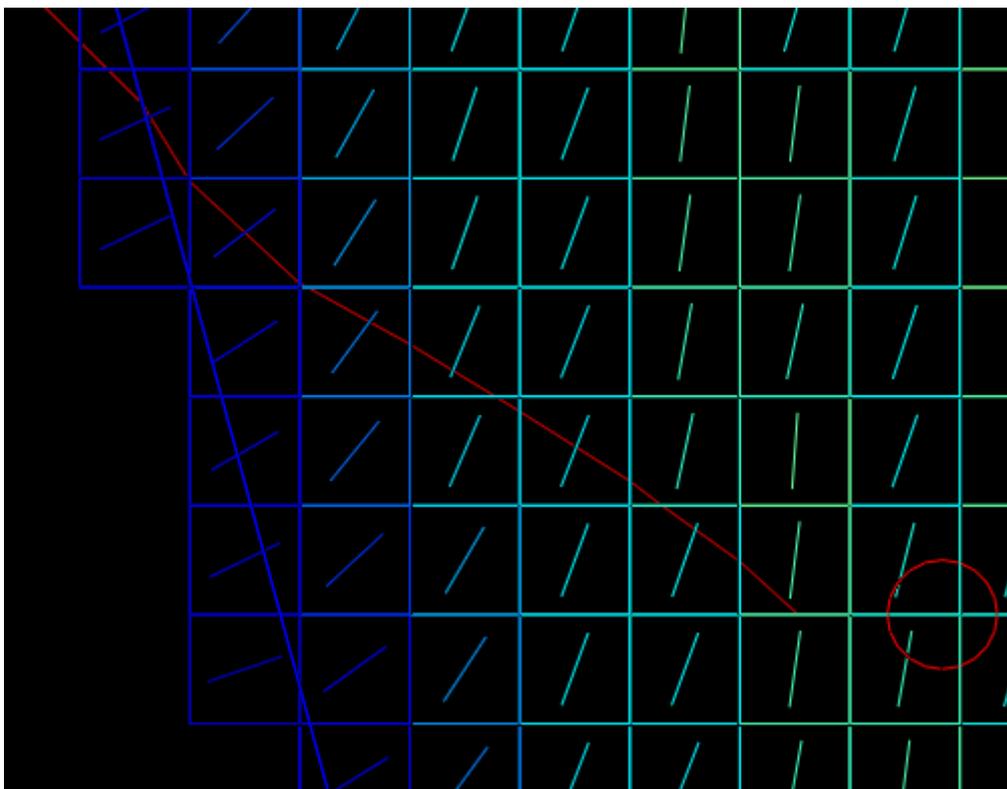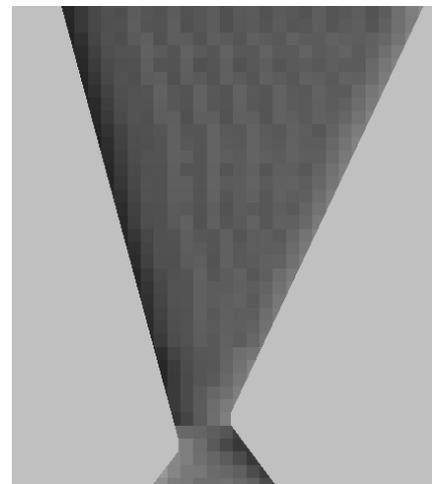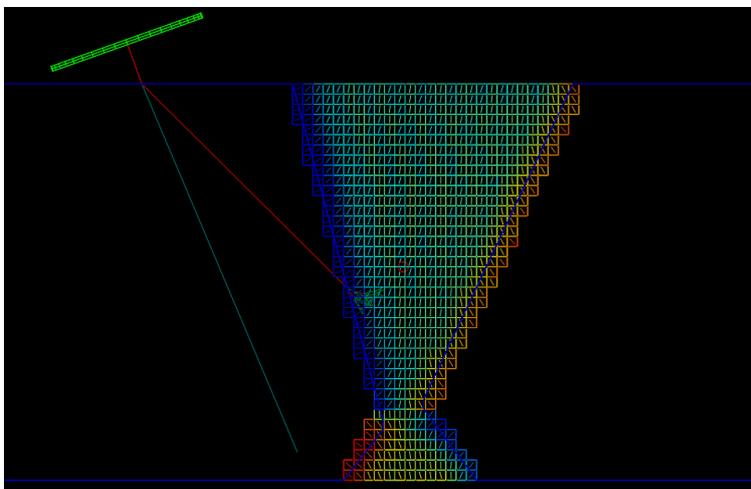
Phased array transducers

Version 4 contains a transducer model for linear and matrix phased arrays, and comes with an integrated delay law calculator. It is also possible to import delay laws from CIVA or to export to CIVA. A fast Rayleigh Integral method allows to verify properties of the resulting 3-dimensional sound field, such as the focal spot size and depth or the appearance of side and grating lobes.
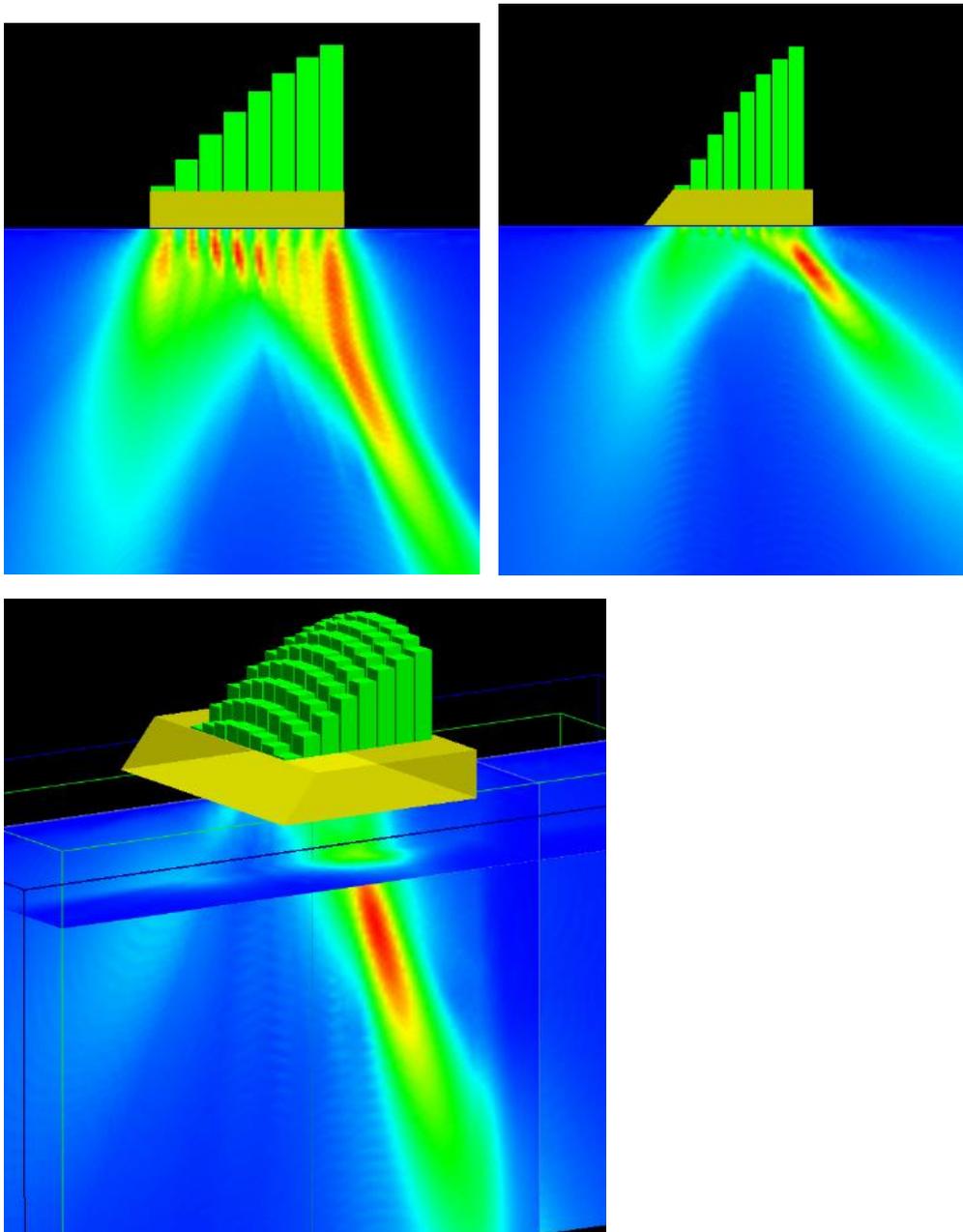
Requirements

Version 4 requires a 64bit version of either Windows 8.1 or Windows 10, and an installation of the Microsoft Visual C++ 2013 Redistributable Package for x64 platforms. For details please refer to the install.txt file that comes with the package.