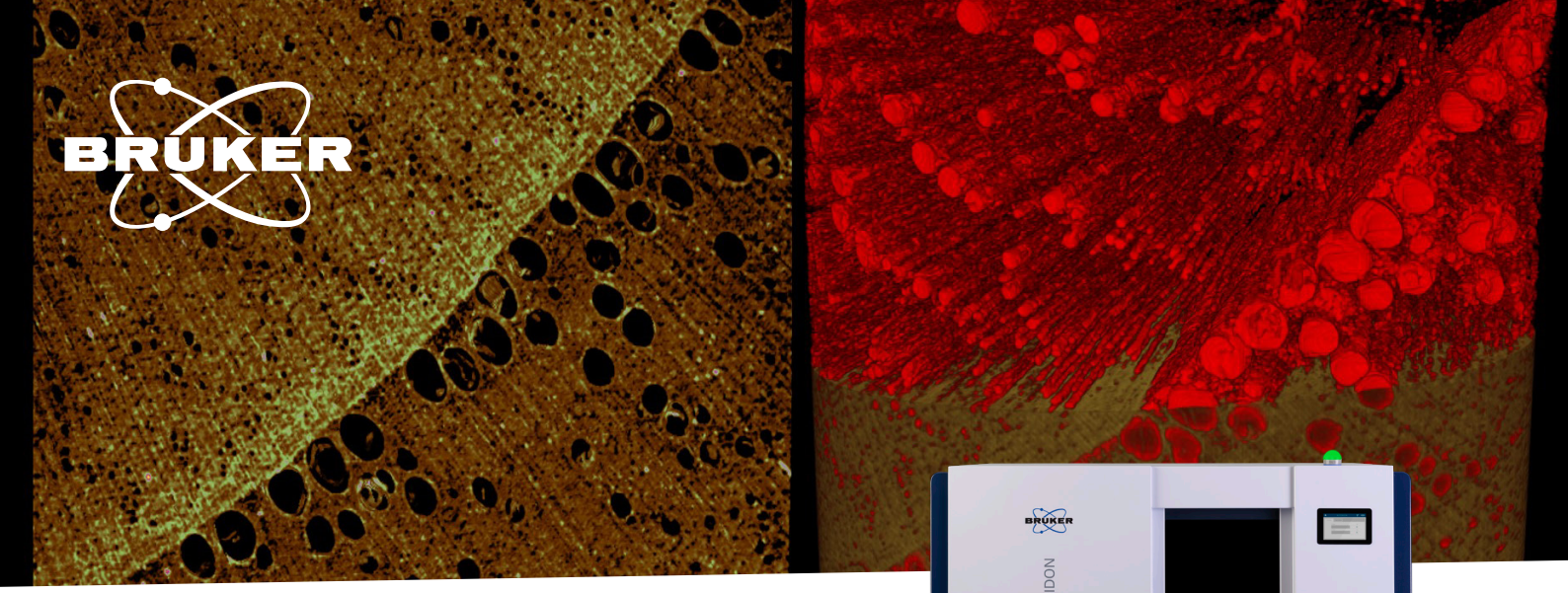

X-RAY MICROCOMPUTED TOMOGRAPHY

X4 POSEIDON – Wood core growth rings

Innovation with Integrity

MicroCT is a non-destructive imaging technique that provides high-resolution, three-dimensional visualizations of wood's internal structure. In recent years, its application in studying wood has significantly advanced, offering unique insights into its anatomical features, mechanical properties, and responses to various treatments.

Wood is a complex natural material characterized by a hierarchical structure, ranging from macroscopic growth rings to microscopic cellular elements such as tracheids and vessels. MicroCT systems can achieve resolutions down to the micron level, enabling detailed visualization of wood's cellular architecture. This includes features like tracheids, xylem and phloem vessels, and fibers, which are critical for understanding wood's mechanical and hydraulic properties. The boundaries of microCT have been pushed toward sub-micron resolutions, allowing for the exploration of nano-scale structures such as cell wall layers and nanopores.

MicroCT imaging plays a crucial role in detecting defects and degradation, enabling the identification of internal cracks, voids, or fungal decay without physically altering the sample. This non-invasive capability is vital for assessing timber quality and studying ancient or valuable wood artifacts. The study of fluid dynamics in wood benefits greatly from microCT imaging, which reveals how the material's porosity and interconnected vascular network facilitate fluid transport. By tracing the movement of liquids like water or resin through these capillary systems, microCT contributes to innovations in wood preservation techniques and coatings.

Scan parameters

- Detector: 16 MP sCMOS
- Voxel size: 2 µm
- Source: Transmission type
- Source settings: 40 keV, 4 W
- No filter
- Rotation step: 0.12° over 360°
- Phase retrieval (Paganin) reconstruction, β/δ ratio 100

Cover Image: an oak wooden core imaged at 2 µm isotropic voxel size

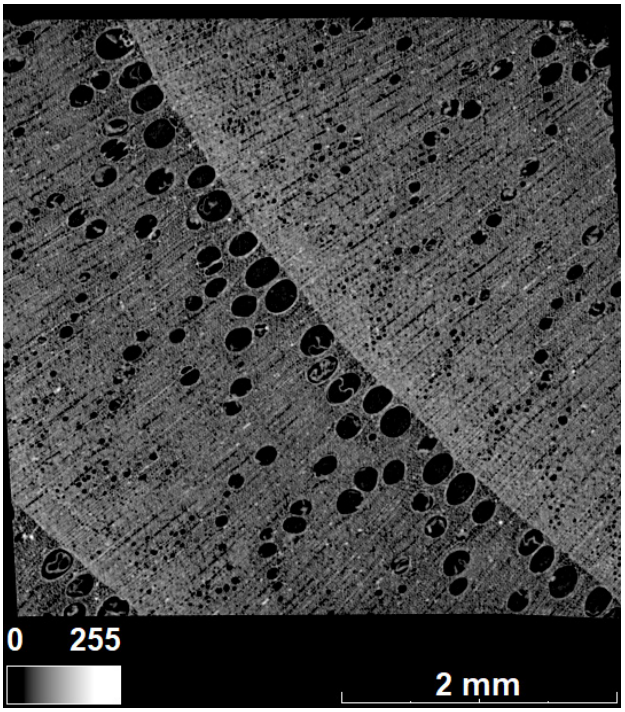

Figure 1: Cross-sectional image of an oak wooden core, with a 2 µm isotropic voxel size

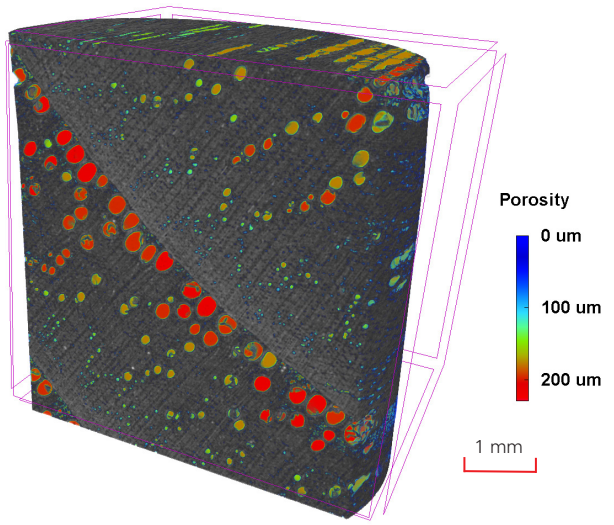

Figure 2: 3D analysis of voids in an oak wood core, color-coded for local thickness, with a 2 µm isotropic voxel size

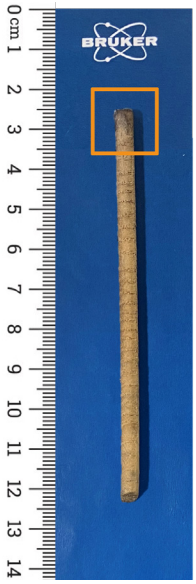

Figure 3: Photograph of the oak wooden core ; the scanned area is indicated with an orange box.

The X4 POSEIDON microCT system, featuring a high-resolution sCMOS detector, allows for precise analysis of wood's internal structure. Its application in assessing wood quality by revealing detailed information on grain patterns, porosity, and fiber alignment contributes significantly to advancements in both research and industrial applications. It can identify knots, cracks, and voids within the wood, providing valuable data for improving material selection and optimizing processing techniques. Furthermore, the system aids in evaluating the effects of treatments or aging on wood's structural integrity.

The Bruker 3DxSUITE software package includes all the necessary tools for image processing and analysis (Figure 2), allowing the creation of 3D models through volume and surface rendering algorithms.

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