X-RAY MICROCOMPUTED TOMOGRAPHY

X4 POSEIDON – Plant materials

Innovation with Integrity

MicroCT has revolutionized plant research by providing a non-destructive means to explore complex internal structures in three dimensions. Its applications span from studying root-soil interactions and leaf anatomy to assessing fruit quality and investigating aquatic plants. MicroCT is poised to offer insights into plant biology, contributing to advancements in agriculture, horticulture, and environmental science.

Understanding root system architecture is essential for improving crop productivity and resilience. MicroCT allows for the visualization and quantification of root structures within soil matrices, providing insights into how roots interact with different soil textures and compositions.

By capturing high-resolution images, vascular structures, cellular arrangements, and tissue compositions can be analyzed. This information is crucial for understanding physiological processes such as photosynthesis, transpiration, and mechanical support.

Non-destructive imaging of fruits enables the evaluation of internal structures, detection of defects, and monitoring of changes during ripening and storage, supporting a detailed assessment of fruit development and quality.

MicroCT has also been utilized in the study of aquatic plants, allowing for the examination of internal structures without the need for staining or sectioning, preserving the integrity of delicate aquatic specimens.

Scan parameters

- Detector:
  7 MP flat panel or 16 MP sCMOS
- Resolution:
  Ranges from several microns for large samples down to submicron pixel sizes for small samples
- Source:
  Reflection or transmission type X-ray source
- Energy settings:
  Plant materials are typically low dense and therefore imaged at low X-ray energies
- Scan duration:
  Varies between a few minutes for low resolution scans up to several hours when imaging at submicron pixel sizes.

Cover Image: Volume rendering of a rose flower imaged at 20 µm voxel size

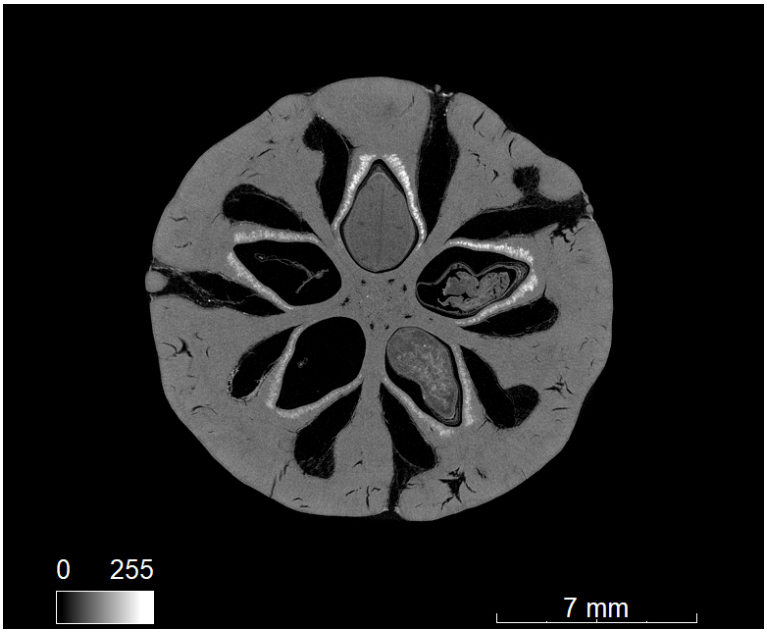

Figure 1: Cross-sectional image of a Choerospondias seed acquired at an isotropic voxel size of 12 µm.

Figure 2: 3D volume rendering of a pinecone acquired at an isotropic voxel size of 21 µm

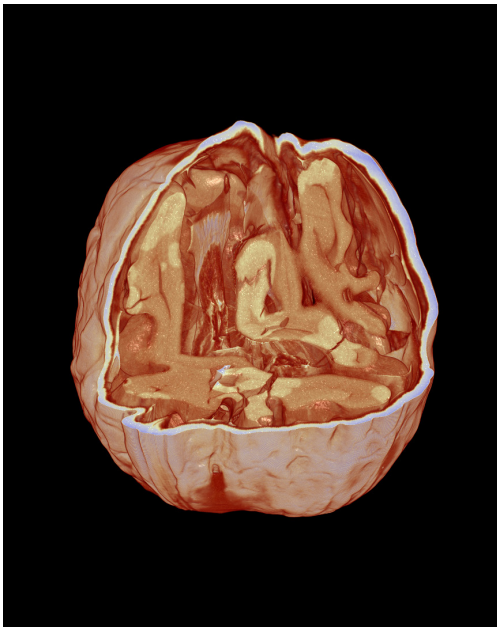

Figure 3: 3D volume rendering of a walnut, imaged at a 21 µm isotropic voxel size.

The X4 POSEIDON microCT system, equipped with a flat-panel detector in combination with the reflection type source, allows for precise analysis of plant's internal structure.
The high resolution and low noise active pixel performance of the flat panel detector enables the fast acquisition of a large sample size.

The Bruker 3DxSUITE software package includes all the necessary tools for image processing and analysis, allowing the creation of 3D models through volume and surface rendering algorithms (Figure 2 and 3). It also allows measurements of parameters such as tissue volume, surface area, porosity, vascular density, cell size distribution, and the spatial arrangement of internal structures.

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