

## X-RAY MICROCOMPUTED TOMOGRAPHY

# X4 POSEIDON – Dental restoration fillers

### Innovation with Integrity

MicroCT has become an indispensable tool in dental research, providing high-resolution, non-destructive imaging capabilities that allow for detailed examination of tooth structures and dental restorations. Its applications are particularly significant in evaluating the quality of dental fillings, including the detection of voids and gaps that can compromise the longevity and effectiveness of restorations.

In restorative dentistry, microCT has been widely used to evaluate the marginal and internal fit of filling materials. These assessments demonstrate that the type of material significantly influences the adaptability of the restoration, with some achieving lower marginal and internal gap values. Such findings highlight the utility of microCT in ensuring the precision and clinical success of dental restorations.

Furthermore, microCT has been used to analyze void formation in root canals filled with various obturation systems, including those utilizing advanced carrier materials. These analyses often focus on identifying voids, particularly in the apical third of the root canal, to evaluate which systems achieve lower void percentages. Such assessments underscore the significance of material selection and technique in ensuring optimal root canal filling.

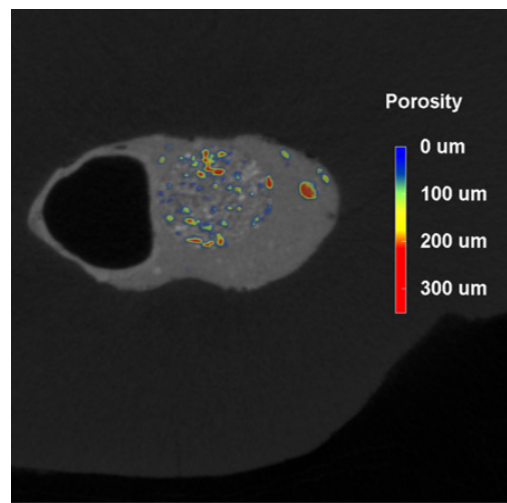
The versatility of microCT extends beyond mere detection of voids; it also facilitates comprehensive analyses of tooth-restoration interfaces, aiding in the development of improved dental materials and techniques. Its non-destructive nature allows for repeated evaluations over time, making it invaluable for longitudinal studies in dental science.

### Scan parameters

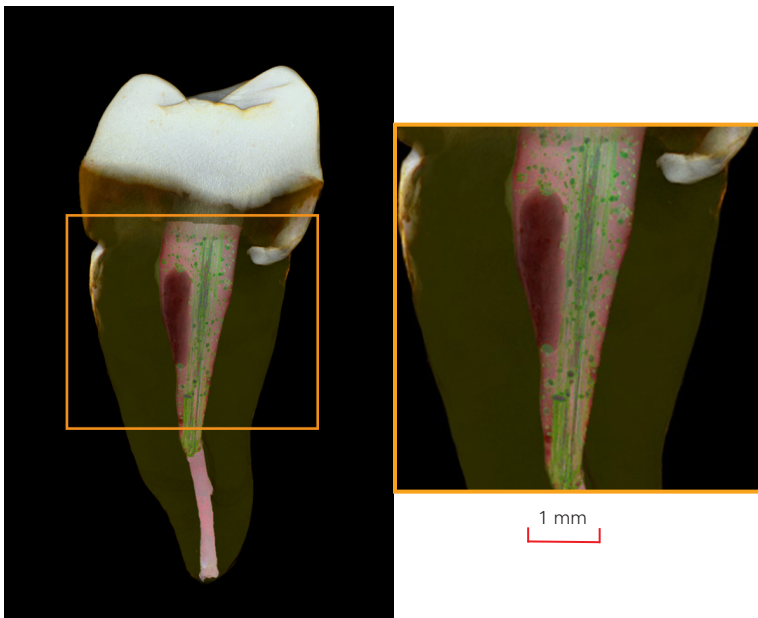
- Detector: 16 MP sCMOS
- Voxel size: 4  $\mu\text{m}$
- Source: Transmission type
- Source settings: 90 keV, 9 W
- Filter: 1 mm Al + 0.1 mm Cu
- Rotation step: 0.2° over 360°



**Figure 1:** Reconstructed slices visualizing gaps between the cavity restoration and access cavity walls, and voids within the cavity restoration, 4  $\mu$ m isotropic voxel size



**Figure 3:** 3D analysis of gaps in the filler, color-coded for local thickness, 4  $\mu$ m isotropic voxel size



**Figure 2:** Pseudo-colored 3D volume rendering of a filled human tooth, enabling the segmentation of voids, 4  $\mu$ m isotropic voxel size

The X4 POSEIDON microCT system, equipped with the high resolution sCMOS detector, provides detailed insights into the microstructural integrity of teeth and dental restorations, as shown in Figures 2 and 3. Its application in evaluating the quality of dental fillings, detecting voids, and assessing the fit of restorations contributes significantly to advancements in dental research and clinical practice.

Additionally, automated segmentation algorithms have streamlined data processing, reduced time and improving accuracy.

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).

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