Contribution ID: **203** Type: **poster**

# Projection-based Metal Artifact Reduction in Spectral Photon-Counting Dental CBCT

While cone-beam computed tomography (CBCT) is the dominant modality in dentomaxillofacial radiology due to its balance of spatial resolution, cost, and radiation dose, it remains suboptimal for visualizing fine orofacial structures and is particularly prone to metal artifacts from implants and crowns. These limitations motivate the integration of photon-counting detectors (PCDs), which offer spectral data for improved image quality and material decomposition.

In this study, we present a projection-domain metal artifact reduction method for a dental photon-counting CBCT system. The system comprises a state-of-the-art PCD (XC-Thor FX40) from Varex Imaging Corporation (Salt Lake City, USA) with two adjustable energy thresholds (set to 10 keV and 65 keV), a 750 µm thick CdTe sensor and a pixel size of 100 µm. CT scans were performed at 130 kVp with an anthropomorphic head phantom from Quart GmbH (Zorneding, Germany), in which tooth repairs in the form of dental onlays and crowns are included. Our approach employs a material separation algorithm to decompose the projection data into material-equivalent thicknesses. Via adaptive thresholding, a Boolean mask is generated to locate metal regions within each projection. Prior to reconstruction, these regions are refined through iterative steps of binary dilation and erosion to reduce false-positive and false-negative detections. Subsequently, the regions are interpolated across neighboring non-metal pixels in both spatial directions, and the projections are then reconstructed using filtered backprojection.

Applied to virtual monochromatic and material-selective images of the anthropomorphic head phantom, the algorithm demonstrates a reduction in metal streaks and beam starvation artifacts, with improvements in contrast-to-noise ratios and the preservation of visibility of larger-scale structures.

## Workshop topics

Applications

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