Purpose: A dual detector cone-beam CT (CBCT) system could potentially allow for dual energy CBCT and dual-view DTS. However, image quality in this system is severely degraded by the presence of scatter between the two imaging chains, i.e. cross-scatter. The aim of this work is to develop a measurement-based method for correcting cross-scatter without increasing scan-time or exposure and without adding additional hardware.

Methods: The dual detector CBCT imaging system has two tube/detector pairs mounted orthogonally; each 40x30 cm detector has an anti-scatter grid. The cross-scatter distribution was measured at a certain angular intervals by firing a single x-ray tube and reading out both detectors. Cross-scatter at intermediate angles was estimated by cubic spline interpolation. The cross-scatter estimates were subtracted from the projections prior to reconstruction. The angular interval between cross-scatter measurements was optimized for an anthropomorphic pelvic phantom. Accuracy of scatter interpolation was evaluated by comparing to directly measured cross-scatter. Effectiveness of scatter correction was evaluated by measures of contrast and contrast-to-noise ratio (CNR) in reconstructions of an image quality phantom from projection data acquired with and without cross-scatter.

Results: For the pelvic phantom and an angular interval of 11 degrees, interpolated cross-scatter distributions were within 2.5% of measured cross-scatter distributions. This error remained constant as the angular interval decreased below 11 degrees and rose sharply to about 90% as the angular interval increased to 34 degrees. The contrast was 58.0%, 70.8% and 70.8%, in the uncorrected, corrected, and cross-scatter free reconstructions and similarly the CNR was 23.6, 22.8 and 24.9.

Conclusions: This measurement-based method effectively corrects for cross-scatter without any additional hardware or imaging dose.

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