

Purpose: To reduce the over-beaming dose in conventional helical scans by acquiring and reconstructing the same image volume using a reduced scan range through an axial-like reconstruction algorithm.

Methods: In the proposed framework, the reconstruction volume is split into two types of regions along the z-direction when the helical scan range is reduced: one central region where conventional reconstruction methods are applied and two boundary regions that have historically not been recoverable. In the boundary regions an axial-like reconstruction algorithm which combines 3D view-weighting and modified back-projection is introduced. The 3D view-weighting satisfies consistency condition for a ray and its conjugate ray while taking into account the view-angle, cone-angle and the distance of the image slice from the center view in a unified framework. The same view range as the edge slice of the middle region is used for reconstructing the boundary region, which makes the reconstruction similar to axial reconstruction.

Results: Extensive experiments have been performed using both phantom and clinical scan data on volumetric CT scanners with various detector configurations and helical pitches. Experimental results demonstrated for the same prescribed image volume the xray scan range can be reduced by up to $\frac{1}{4}$ of the x-ray beam width in z on each end of the helix compared to conventional scans. This means we may save an additional 8% and 5% dose in routine chest and abdomen scans, respectively, on top of the dose saving achieved with the dynamic collimation method. The proposed method has also been applied to multi-energy CT scans with similar results.

Conclusions: A new axial-like helical reconstruction method is proposed that reconstructs the prescribed image volume with a reduced xray scan range. Experimental results indicate the new method can reduce the over-beaming dose significantly. The method can be easily applied to multi-energy scans.

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The authors are with GE Healthcare, Waukesha, WI.