AbstractID: 7352 Title: Practical Implications of Cone-Beam Artifact on Edge Resolution

Purpose: Cone-beam CT utilizing circular trajectories fails to collect sufficient information to satisfy the inverse Radon problem. The lack of information has been characterized as a shift-variant cone of missing frequency that scales with distance from the source trajectory plane. This cone has been previously demonstrated in localized, simple geometrical objects (spheres and disks). The aim of this study was to verify the cone in larger, clinically relevant objects and examine the relative impact of the resulting artifact on edge resolution.

Methods: An excised rabbit spine with ribs and soft tissue was imaged at varying distances with respect to the source plane. Reconstructions were made using a modified Feldkamp filtered backprojection algorithm and were registered and compared for consistency. Inconsistent regions were examined with respect to surface orientation and planar extent. In addition, a section of human vertebra was similarly imaged. 3D Fourier Transforms of the vertebra were examined and regions of lacking frequency information were compared with theory.

Results: In both specimens, large planar surfaces oriented such that their dominant frequencies lied within the expected null cone degraded most notably with increased distance from the source plane. In particular, upper and lower surface resolution of the rabbit vertebrae were most affected and associated with increased streaks. In contrast, cellular regions of trabecular bone, as well as bony and soft tissue with surfaces of varying orientation showed largely consistent reconstruction regardless of vertical placement. Finally, the conical region of missing frequency power predicted by theory was clearly identified in the Fourier Transforms of the human vertebra.

Conclusions: Results support that cone-beam artifact associated with circular trajectories preferentially affects a small well-defined subset of surface orientations. In practice, cone-beam CT using circular trajectories is expected to be largely edge preserving, since surfaces that belong to this subset are limited in extent.