AbstractID: 5328 Title: A Fast Variable-Intensity Ring Suppression Algorithm

Purpose: Gain drifts and nonlinearities in amorphous silicon flat-panel x-ray detectors can produce ring artifacts in reconstructed cone-beam computed tomography (CBCT) images. We have found that the magnitude of these artifacts can exceed 50 HU in clinical situations, and that the intensity of a given ring may not be uniform throughout an image. In some cases (e.g. half-fan pelvic scans), discrete arcs may be produced. The goal of this study was to develop a post-processing algorithm to efficiently suppress such variable-intensity rings in axial slices.

Method and Materials: Our approach builds upon the work of Sijbers and Postnov who showed that constant-intensity rings can be estimated via radial median filtering of the input image after its transformation to polar coordinates. To characterize variable-intensity rings and arcs, we developed a 2-D estimation technique that uses a combination of row-based (radial) and column-based (angular) filters operating in the polar domain. The 2-D estimates were transformed back to Cartesian space for subtraction from the original image. The new algorithm was implemented in C++ and tested on clinical and phantom CBCT images acquired using a Varian 4030CB detector.

Results: Correction times (3.2GHz Intel Pentium4 processor), including coordinate transformations, averaged 55 msec/slice for 512x512 matrix sizes. Rings and arcs were reduced in intensity by more than an order of magnitude to levels well below the background noise intensity. By subtracting ring estimates in Cartesian space, the polar matrix size could be reduced without sacrificing spatial resolution in the final image. This permitted for a 4x reduction in execution time compared to the original Sijbers-Postnov approach where subtraction occurs in polar space.

Conclusion: The Sijbers-Postnov algorithm ring suppression algorithm was modified to provide improved image quality and fast execution times suitable for clinical implementation.

Conflict of Interest: Funding provided by Varian Medical Systems.