

Purpose: Cone-beam artifacts can be a significant contributor in the degradation of brain image quality. The purpose of this study is to evaluate the frequency split cone-beam reduction reconstruction algorithm as a means of improving IQ in brain imaging. The design of the frequency split filters and their effect on image quality and noise are evaluated. Also the potential of increasing the x-ray beam collimation and reducing total scan time for head imaging is investigated.

Method and Materials: Head scans from Philips iCT 256 slice and Brilliance 64 scanners, and simulations based on the Philips iCT 256 slice scanner were used in this study. The scans were reconstructed using conventional reconstruction techniques and frequency split reconstruction.

The level of cone-beam artifacts introduced when using larger beam collimations and the effectiveness of frequency split reconstruction for reducing cone-beam artifacts were investigated. Also, the effect of the filters parameters in frequency split reconstruction on image quality and on noise texture were evaluated. The pediatric head IQ from the clinical data sets, and especially the delineation of the bone-brain boundary and contrast detail in the posterior fossa, were evaluated.

Results: Review of images reconstructed with frequency split reconstruction show significant reduction in the level of cone-beam artifacts. Clinical images show significant improvements in uniformity and contrast in the posterior fossa. Improvement in image uniformity of up to 15 HU has been realized by frequency split reconstruction. With proper design of frequency split filters, the change in image noise and NPS and can be minimized while achieving significant reduction of cone-beam artifacts.

Conclusions: Cone-beam artifacts can be a significant contributor to image artifacts. The optimized frequency split reconstruction algorithm realizes significant IQ improvements in heads imaging. The frequency split cone-beam reduction algorithm could also result in shorter scan times by allowing wider collimations during scan.

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Authors are employed by Philips Healthcare