

AbstractID: 13681 Title: Evaluation of metal artifact reduction using MVCT and model based image reconstruction

Purpose: To evaluate the performance of a model based image reconstruction in reducing metal artifacts in MVCT system in the image of a phantom representing bilateral hip prostheses, and to compare with traditionally reconstructed image. **Method and Materials:** A cylindrical plexiglass (19 cm diameter) phantom containing two steel inserts (2 cm diameter) was scanned using bremsstrahlung radiation from 6MeV electron beam passing through 4 cm thick solid water in Varian Clinac 2300C with bench-top MVCT system. Iterative maximum-likelihood polychromatic algorithm for CT (IMPACT) modified to include pair and triplet production for the MV spectrum was used with air, plexiglass, bone, and iron as base substances. Detector calibrated signal without beam-hardening correction was used to get filtered back-projected (FBP) image and used as an initial image in IMPACT. The final image at 1.25 MeV was obtained after 130 iterations. The second image was reconstructed using FBP with traditional signal and beam-hardening corrections. The quantitative analysis included calculation of average attenuation coefficient in various regions of interest and their comparisons with theoretical value. **Results:** Visual inspection of the traditional image shows that the region between two steel inserts is dark with additional white streaks. Attenuation coefficients in ROIs fluctuate largely and deviate from theoretical values. In the iteratively reconstructed image, metal artifacts are remarkably reduced leaving behind only faint shadings in between the inserts. The average attenuation coefficients in ROIs were close to theoretical values. Image profile through the steel inserts shows restored uniform background between them. **Conclusion:** This experiment emphasizes the importance of model based image reconstruction and MVCT system for the metal artifact reduction. The beam-hardening correction applied in conventional image reconstruction creates severe darkening and white streaks in the image. The complete removal of the metal artifacts requires further modeling and strategies which will be employed in future studies.