Purpose: To evaluate a metal artifact reduction algorithm (MAR) developed by Philips Medical Systems Inc. for accurately reconstructing the density of a material obscured by metallic streaking artifacts due to a prosthetic hip implant.

Methods: Two inserts with known densities of 1.84 and 1.15g/cm³ were placed in a water tank at distances of 0 and 20cm from a titanium hip prosthesis. CT images were acquired with the inserts at both positions, and each set of images was reconstructed twice: once with and once without MAR. The physical densities of the inserts in these CT images were determined by a clinical treatment planning system (Pinnacle 8.0) and were recorded and compared to the known values.

Results: With MAR reconstruction, for inserts proximal to the titanium prosthesis, the measured physics densities were closer to the known values. The 1.84 g/cm³ insert had a mean density of 1.444 g/cm³ without MAR and 1.546g/cm³ with MAR, an improvement of 5.5%. The standard deviation of the measured density also decreased from 0.298 to 0.213. The 1.15 g/cm³ insert had a mean density of 0.744g/cm³ without MAR and 0.890g/cm³ with MAR, an improvement of 12.7%. Standard deviation decreased from 0.33 to 0.178. For inserts distal to the prosthesis, the measured densities were minimally changed by the MAR reconstruction, as the artifact did not affect the inserts. For the 1.84g/cm³ insert: 1.801 without MAR, 1.816 with MAR. For the 1.15 g/cm³ insert: 1.138 without MAR, 1.138 with MAR.

Conclusions: Our experiments show that the MAR algorithm improves accuracy of reconstructed densities proximal to hip prosthesis, although up to 22% error in the physical densities may still be present depending on the specific materials. For tissues distal to the prosthesis, the MAR reconstruction algorithm does not adversely affect the reconstructed physical densities by the treatment planning system.