

AbstractID: 8411 Title: CT Artifacts of High-density Materials in Proton Radiation Therapy

**Methods and Materials:** A GE Lightspeed 16-slice CT scanner was used to obtain images for this work. CT image artifacts introduced by HDM including bone, aluminum, titanium and steel inserts in cylindrical acrylic phantoms with diameters of 16 and 32 cm and water phantoms with different shapes (rectangular and oval shaped) and sizes, were evaluated. The proton ranges in terms of water equivalent thickness (WET) of 50 mm radiating from the surface of each high-density implant in all directions were calculated from the CT images. The calculated WETs for the artifact-contaminated images were compared with the corresponding artifact-free images for the homogenous phantom. A modified scaling method for high-density artifact correction was implemented and applied to CT images containing HDM artifacts. The WETs after correction were compared with the WET values of before correction, and with the expected values.

**Results:** Presence of HDM generates radiating streak artifacts in CT images, depending on the shape and size of the phantoms carrying these objects. The most extended and severe artifact was observed for the sharp edge, rectangular phantom with large elongation. For a 1-inch diameter steel insert placed in this phantom, the associated proton range error could be up to 18 mm or 36%. The HDM artifact correction technique could reduce the range error to 2.4 mm or 4.8%.

**Conclusion:** Realistic phantoms with smooth surface shape and proper size should be used to study the HDM artifacts in CT images. High-density materials artifact reduction techniques could effectively reduce the range uncertainty but would not eliminate it.