AbstractID: 14137 Title: Dosimetric assessment of a CT metal artifacts reduction algorithm in IMRT delivery

Purpose: To quantify the dosimetric impact of a metal artifacts reduction algorithm for CT images in the framework of Intensity Modulated Treatment dose delivery.

Materials and methods: A Gammex 467 Phantom featuring 16 tissue equivalent materials was imaged with a GE Lightspeed RT16 scanner. Three scans were acquired: 1) phantom without metal inserts (Ground Truth, GT), 2) phantom filled with two 3 cm diameter cerrobend inserts (Large Metal Artifacts, LMA) and 3) phantom filled with two 1 cm diameter titanium inserts (Small Metal Artifacts, SMA). The image sinograms, affected from metal artifacts, were processed and restored by an in-house Metal Artifact Reduction (MAR) algorithm thus obtaining other two image set: LMA_MAR and SMA_MAR. A 5 field IMRT plan was designed on GT to cover 3 cm diameter lung density PTV. Monte Carlo dose calculation was run on the 6 image set. Comparison between SMA vs. SMA_MAR and LMA vs. LMA_MAR was performed in terms of PTV and Volume of Interest (VOI) dose coverage.

Results: The initial dose error at the 95% of PTV between GT and LMA and SMA was 12.59% and 0.34% respectively. After MAR correction it was reduced to 0.29% and 0.09%. Two VOIs representing breast and brain tissue respectively, were affected by dose variations caused by LMA. In this case dose underestimation up to 0.5 Gy was found. These inaccuracies were completely corrected after applying the MAR algorithm.

Conclusions: This preliminary phantom study showed the importance of restoring CT images, affected by metal artifacts, not only to increase the image quality for diagnosis and contouring purposes, but mainly to avoid large dose prediction errors in radiotherapy delivery. The MAR algorithm will be evaluated for patient IMRT treatments with metal artifacts to assess the related clinical benefit.