AbstractID: 12928 Title: Binary CT image reconstruction with limited number of projections for metal artifacts removal

**Purpose:** Metal streaking artifacts in X-ray Computed Tomography (CT) has long been recognized as a problem that limits various applications of CT imaging. The problem is aggravated when the number of projections is reduced. The purpose of this work is to develop a binary image reconstruction method that is capable of auto-determining the shape and location of metallic object(s) with only a limited number of projections.

**Methods:** In essence, we divide the system into two types of contents: metal(s) and non-metalic substance. The boundaries of the two types of contents are obtained by using a penalized weighted least-squares algorithm with adequate intensity gradient-controlled. To facilitate the finding of the shape and location of metal objects, a mechanism of "amplifying" the difference between metal(s) and non-metalic substance in the projection space is introduced. It is demonstrated that the "amplification" is necessary in order to accurate binary reconstruction when the projection data are sparse. Experimental studies are performed to evaluate the proposed approach.

**Results:** The results are compared with the ground truth, the known physical dimensions of the metals embedded in the phantom, and it is found that a spatial accuracy comparable with the CT pixel size is readily achievable in recovering the shape and location of the metals even for complicatedly shaped metal objects.

**Conclusions:** A novel binary image reconstruction technique has been proposed for accurate determination of location and shapes of metal objects. Combining the effective pre-processing of the projection data and a gradient-controlled WLS algorithm, it is shown that the accuracy comparable with CT pixel size is readily achievable in localizing the implanted metal objects. Given the widespread clinical use of CT imaging, the proposed method may have significantly implications in CT diagnostics and image guided interventions.