AbstractID: 11002 Title: Deviation of Electron Density with CT Simulator Image Reconstruction Kernels and its Impact on Dosimetry in Radiotherapy

Purpose: Fifteen image reconstruction kernels are provided in Siemens Somatom Sensation Open CT Scanner to produce the images with different levels of edge definition and quantity of noise. After conversion of CT number, planning system assigns electron density to each volume of interest for dose calculation. This study quantitatively investigated the variation of tissue electron density with kernels and its impact on dosimetry in radiotherapy.

Method and Materials: CIRS electron density reference (EDR) phantom, RPC lung phantom, and a lung cancer patient were scanned in our CT scanner. The projection data was saved for image reconstruction with 8 selective kernels including “least noise” kernel and “best edge definition” kernel. All images were loaded in Pinnacle planning system to calculate the values of electron density relative to water (EDRTW). For PTV and each OAR, generalized equivalent uniform dose(GEUD) were computed from each image set. Three clinical treatment plans were used (one 6MV IMRT plan, two 3D conformal plans using 6MV and 23MV respectively). Same MUs were delivered and dose calculation included heterogeneity correction. The comparison was made for electron density and GEUD for target and various OARs.

Results: Values of EDRTW measured from EDR phantom, RPC phantom, and the lung cancer patient vary with kernels from -3.5% to 12.6%, -2.3% to 1.1%, and -1.9 to 9.6%, respectively. Larger fluctuations in values of EDRTW were observed in lower density materials and organs. But the fluctuations of values of EDRTW caused less than 2.0% changes in GEUD in both Phantom and the patient studies.

Conclusions: Utilization of EDR phantom for CT density table check could vary 12% from Kernel to Kernel. The dosimetry impact from selection of kernels is small on the lung cancer patient treatments when adaptive convolution algorithm is used. Because it is systematic error, the impact deserves our attention.