CT NUMBER - ELECTRON DENSITY CONVERSION RELATIONSHIP: EFFECT OF TISSUE INHOMOGENITY ON DOSE DISTRIBUTION

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The main aspect of an imaging technique is the ability of incorporating the tissue inhomogeneity corrections to the dose calculations. This could be fulfilled only if the relationship between the CT number and the electron density is established for each CT scanner used in a facility. This study describes a method of establishing a relationship between the CT number and the electron density and the effect of a tissue inhomogeneity on the dose distribution.

An electron density reference phantom with 17 different tissue substitutes was scanned using the Siemens Somatom Sensation Open CT scanner to establish the relationship between the CT number and the electron density. These images were downloaded to the Nucletron Oncentra Master Plan *v*3.3 SP1 treatment planning system. At the treatment planning workstation the average CT number of each insert was determined. The mean CT value was plotted against the relative electron density of the tissue equivalent insert. A linear relationship was obtained between the CT number and the relative electron density separately for CT numbers between -1000 to 0 and 0 to 1000.

To investigate the dose distribution due to a tissue inhomogeneity the electron density reference phantom was scanned using the Siemens Somatom Sensation Open CT scanner. A randomly chosen tissue insert of the phantom was replaced by a metal insert and the scan was repeated. A treatment plan was done for the images with and without the metal insert at the treatment planning workstation. The isodose distribution map and the dose – volume histograms (DVH) of the two images were compared. With the metal insert 50% of the PTV received a dose greater than that of the dose received without the metal insert. The dose coverage is affected by tissue inhomogeneity, leading to changes in the dose distribution. This leads to geometrical misses of the target. Therefore, to maximize the therapeutic benefit of radiation therapy it is important to investigate the difference in the dose distribution due to tissue inhomogeneity.