

Computation of Radiotherapy Treatment Plans Based on CT to ED Conversion Curves

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Abstract : Radiotherapy treatment planning computers use CT data of the patient. For the computation of a treatment plan, treatment planning system must have an information on electron densities of tissues scanned by CT. This information is given by the conversion curve CT (CT number) to ED (electron density), or simply calibration curve. Every treatment planning system (TPS) has built in default CT to ED conversion curves, for the CTs of different manufacturers. However, it is always recommended to verify the CT to ED conversion curve before actual clinical use. Objective of this study was to check how the default curve already provided matches the curve actually measured on a specific CT, and how much it influences the calculation of a treatment planning computer. The examined CT scanners were from the same manufacturer, but four different scanners from three generations. The measurements of all calibration curves were done with the dedicated phantom CIRS 062M Electron Density Phantom. The phantom was scanned, and according to real HU values read at the CT console computer, CT to ED conversion curves were generated for different materials, for same tube voltage 140 kV. Another phantom, CIRS Thorax 002 LFC which represents an average human torso in proportion, density and two-dimensional structure, was used for verification. The treatment planning was done on CT slices of scanned CIRS LFC 002 phantom, for selected cases. Interest points were set in the lungs, and in the spinal cord, and doses recorded in TPS. The overall calculated treatment times for four scanners and default scanner did not differ more than 0.8%. Overall interest point dose in bone differed max 0.6% while for single fields was maximum 2.7% (lateral field). Overall interest point dose in lungs differed max 1.1% while for single fields was maximum 2.6% (lateral field). It is known that user should verify the CT to ED conversion curve, but often, developing countries are facing lack of QA equipment, and often use default data provided. We have concluded that the CT to ED curves obtained differ in certain points of a curve, generally in the region of higher densities. This influences the treatment planning result which is not significant, but definitely does make difference in the calculated dose.

Keywords : Computation of treatment plan, conversion curve, radiotherapy, electron density

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