Evaluation of a 3D treatment planning system for dose computations in the kilovoltage energy range

Because of high doses in interventional radiology procedures, knowledge of the dose to various organs from diagnostic x rays has become increasingly important. In an attempt to determine the dose from these, as well as orthovoltage x rays, we have used the ADAC Pinnacle^3 treatment planing system to calculate the dose to phantom from kilovoltage x rays. The planning system's capabilities for dose computation have been extended to lower energies by addition of energy deposition kernels in the 20 to 110 keV range and the 60, 80, 100 and 120 kVp beams have been modeled using the system.

We compared the dose calculated by the planning system versus that measured using thermoluminiscent dosimeters (TLDs) placed in various positions within several phantoms. The phantoms consisted of a homogeneous solid water phantom, a solid water phantom with added lung inhomogeneity, a solid water phantom with added bone inhomogeneity and the Rando anthropomorphic phantom. A simple treatment plan was then generated using Pinnacle on CT scans of each of these phantoms and point doses at the positions of TLD chips were calculated. The results of the comparisons between TLD measurements and point dose calculations will be presented and the areas of strength and weakness of the planning system in calculating dose in various phantoms will be discussed.