

Helical tomotherapy applies intensity modulated radiotherapy (IMRT) in a helical pattern within the constrained geometry of a ring gantry. Three dimensional helical optimization of the individual pencil beam weights in this "continuous strip" of radiation presents many advantages but also has novel difficulties not yet encountered in standard IMRT. A number of three dimensional test cases ranging from a simple geometrical problem to semi-anthropomorphic and anthropomorphic problems will be demonstrated. Strict attention has been paid in the process of building phantoms and test cases with lateral electronic disequilibrium, particularly from slice-to-slice. Tests show the ability of convolution/superposition to adequately deal with this electronic disequilibrium. In order to reduce the process time, we first optimize the objective using TERMA and then continue to optimize with dose.

A number of solutions to helical problems will be discussed, including initial pencil beam weight selection, geometrical advantages, the inclusion of realistic machine characteristics, and the choice of helical pitch in order to avoid junction artifacts.