

AbstractID: 6546 Title: Implementation of helical CT source in DOSXYZnrc/EGSnrc Monte Carlo code

Purpose: To implement and verify a new source type - phase-space source in helical mode in DOSXYZnrc/EGSnrc Monte Carlo (MC) code.

Method and Materials: To implement a new source type – “phase space source in helical mode” in DOSXYZnrc/EGSnrc, we modified the mortran and macro files related with DOSXYZnrc user code; dosxyznrc.mortran, srcxyznrc.mortran and srcxyznrc.macro. This source was implemented based on the source type 8 in DOSXYZnrc (isource=8: phase-space source from multiple directions). Different with other researcher’s approach (i.e. random sampling of possible particle locations with coordinate transformation in a spiral band) we introduced a step method which calculates the isocenter displacement in each step with a new parameter of table travel distance into srcxyznrc.mortran file. Conceptually this is easier to be comprehended and implementation is simpler. Accompanying with modifying the DOSXYZnrc source code, we also changed the GUI tcl/tk files of DOSXYZnrc to make users easy to build input files for MC simulations. To validate this new source geometrically, we established the Monte Carlo model of GE lightspeed RT using BEAMnrc/EGSnrc and simulated the helical beams to PMMA cylinder phantom using DOSXYZnrc. We have tested our source model with various pitch sizes and we have used DOSXYZ_SHOW to check whether the helical irradiation field is correct or not.

Results: By performing the distance measurements of isocenters in an axial irradiation field using DOSXYZ_SHOW, we found that the source model worked well without any geometrical errors.

Conclusion: In this study, we have implemented a new source model - phase-space source in helical mode in DOSXYZnrc/EGSnrc Monte Carlo (MC) code and verified the model using DOSXYZ_SHOW. In future, we will perform the dosimetric evaluations of this source with physical measurements.