AbstractID: 1638 Title: Monte Carlo source model for megavoltage photon-beam radiotherapy: photon source characteristics

A major barrier to widespread clinical implementation of Monte Carlo dose calculation is the difficulty in characterizing the radiation source within a generalized source model. This work aims to develop a generalized 3 component source model (target, primary collimator, flattening filter) for a 6 and 18 MV photon beam matching full phase space (PS) data. Sub-source-by-sub-source comparison of dose distributions using either full PS data or the source model as input allowed accurate source characterization, and has the potential to ease the commissioning procedure, since information about which sub-source needs to be tuned can be obtained. This new source model is unique in that it retains high level correlations among PS variables, which improves accuracy at non standard SSDs. Dose calculations have been performed for SSDs ranging from 50 to 200 cm and field sizes from 1×1 to 30×30 cm^2 as well as a 10×10 cm^2 field 5 cm off axis in each direction. 3D-dose distributions were normalized to the same integral dose and compared in terms of dose difference and distance to agreement. With this model, over 99% of the voxels agree within ±1% or 1 mm for the target and within ±2.5% or 2 mm for the primary collimator and flattening filter in all cases studied. The accurate and general characterization of each photon source and knowledge of the sub-source dose distributions should facilitate source model commissioning procedures by scaling the distributions of the source to be tuned.
Supported by Philips Medical Systems and ACS-grant IRG-73-001-28.