AbstractID: 7181 Title: Verification of a Beam Model in a Treatment Planninng System Using an Monte Carlo Approach

Todays treatment planning systems (TPSs) have to be able to calcualate the dose distribution for very complex beams, i.e. highly modulated multi-leaf collimator (MLC) beams, to meet clinical requirements. To achieve a high accuracy it is common to separate the dose calcualtion into a beam modelling phase, describing the beam exiting the accelerator, followed by a subsequent dose calculation in the patient.
The aim of this work was to set up the Monte Carlo (MC) code system EGSnrc (incl BEAMnrc and DOXYZnrc) to study the head scatter as well as the transmission through MLC and diaphragms for an linear accelerator (Elekta Prec*i*se). These MC results are then be compared the beam model used in a commercial TPS (MasterPlan, Nucletron B.V.). Vendors data regarding the geometry of the treatment head of the linac was the basis for simulations performed with BEAMnrc. The collimation in the MLC direction consists of the leafs complemented with backup diaphragms. The characteristics of the electron beam, i.e. energy and spot size, impinging on the target have been varied to match measured data.
Phase spaces from simulations of the treatment head were used to extract the scatter from, e.g., the flattening filter and the collimating structures. Similar data for the source models used in the TPS were extracted from the treatment planning system, thus a comprehensive analysis was possible.
Simulations in a water phantom, with DOSXYZnrc, were used to study the modelling of the MLC and the backup diaphragm by the TPS. The results from this study will be helpful to understand the limitations of the model in the TPS and also providing knowledge for further improvements of the TPS source modelling.