AbstractID: 8234 Title: Validation of dose calculations with PENFAST (a fast Monte Carlo code for TPS in radiotherapy) using a beam energy spectrum reconstructed by a least squares method

Purpose: Conventional treatment planning systems use fast but sometimes not enough accurate numerical calculation methods. Introduction of Monte Carlo (MC) methods allows better accuracy, especially in presence of heterogeneities. **Method and Materials:** Accuracy on the calculated dose with a MC method depends on the correct description of source parameters: energy spectrum, size or shape of electrons beam. A new method has been developed to determine the energy spectrum of the primary electron beam. It consists in using the least squares (LS) method associated to MC simulation with PENELOPE to reconstruct the spectrum. A phase space file (PSF) is calculated with PENELOPE using these optimized source parameters. This PSF serves as input data for PENFAST to calculate the dose distribution in heterogeneous phantoms (lung and bone). PENFAST is a fast transport algorithm based on PENELOPE and optimized for radiotherapy applications. Depth-dose and dose profiles calculated with PENFAST are compared to PENELOPE simulations and measurements performed at the LNHB (the French standard laboratory). Both 18 MeV electron beam and 12 MV photon beam generated by a Saturne 43 accelerator are studied. **Results:** The index gamma test shows that dose distributions simulated with PENELOPE from an energy spectrum reconstructed by LS methods fit the measurements in water much more precisely (3%) than those obtained assuming a gaussian energy spectrum as usual. The dose distributions simulated with PENFAST are also in good agreement with PENELOPE and measurements in the heterogeneous phantoms as well in water. **Conclusion:** This work demonstrates the ability of the LS method coupled to MC simulations to reconstruct the energy spectrum of a LINAC beam. The good agreement between measurements and MC calculations for depth-dose curves and dose profiles validates the PENFAST code in heterogeneous configurations.