AbstractID: 3449 Title: The validation of a highly detailed multi leaf collimator model by comparing Monte Carlo simulations to measurements

Purpose: The validation of a highly detailed multi leaf collimator model by comparing Monte Carlo simulations to measurements.

Method and Materials:
The MCNPX Monte Carlo model of the treatment head consists of bremsstrahlung target, collimators, flattening filter, jaws, a variable multi leaf collimator, and shielding as well as structural support material. A set of dosimetric measurements (lateral profiles, depth dose curves, multi leaf collimator transmission, tongue and grove test) with 6-MV and 18-MV photon beams have been performed on a Varian Clinac 2100EX. The measured data were compared to Monte Carlo simulations.

Results:
The measured and simulated depth dose profiles are in very good agreement for both photon energies distal to the maximum dose. The average deviation is less than 1.1%. The simulated cross-plane and in-plane profiles are in excellent agreement with measurements (deviation 0.5% for 6-MV and 1.1% for 18-MV within the 80% plateau region). The measured photon transmission of a completely closed multi leaf collimator has a value of 1.72%±0.05% and 1.93%±0.05% for 6-MV and 18-MV respectively. The simulated transmission depends on the size of the inter-leaf air gap and the electron transport cutoff energy. Using an air gap of 0.047 mm and a cutoff value of 0.1 MeV results in a transmission of 1.78%±0.05% and 1.95%±0.05% for 6-MV and 18-MV. The tongue and grove test shows an excellent agreement of measurement and simulation.

Conclusion:
An extremely detailed model of a Millennium 120 multi leaf collimator has been constructed and simulations using this model were compared successfully to measurements. All results indicate that the model is valid and accurate. Complete IMRT treatments can now be simulated and the peripheral photon and neutron dose can be investigated.

Conflict of Interest (only if applicable):
N/A