AbstractID: 5011 Title: Initial Experience with a Commercial Monte Carlo Electron Treatment Planning System

Introduction:

Monte Carlo modeling of clinical electron beams has the potential to substantially improve accuracy and quality of treatment planning, as excessive compute time and lack of commercial availability has hindered its application. Here we present a preliminary evaluation of a commercial electron Monte Carlo algorithm.

Methods and Materials:

Percent depth dose and profiles of 6-20 MeV electrons and 6x6 – 25x25 cm cones were measured in a water tank at 100 cm SSD using a Farmer chamber for electrons. Absolute output was measured at 110 and 100 cm SSDs. Outputs and distributions of two extreme test cases were measured: a 2.1 cm x 3 cm insert in a 6x6 cone and a 2.8 cm x 15.7 cm long slit on a 25x25 cone. The algorithm's ability to accurately model relative and absolute dose of an obliquely (30°) oriented beam was evaluated ionization chamber measurements. Clinical cases with were checked using Mosfet dosimeters *in vivo*. Monte Carlo calculations were performed with a 2 mm grid, and smoothing filters provided with the algorithm were applied to minimize noise in the data.

Results:

Agreement of 2% of measured and modeled doses was found over the evaluated range of energies, cones, obliquities and SSDs. Compute times of 1-5 minutes were a function of increasing field size. Visual comparison of the shapes of the profiles was in agreement with measurement. Profiles of the eccentric geometry test cases appeared to be to be physically unrealistic (e.g. an inverted V) in the smaller dimension suggesting that the beam model was not valid.

Conclusions:

The Monte Carlo electron algorithm provides accurate distributions for most clinical cases. For extreme cases, measurements should be made to test the accuracy of the system, and further development of the algorithm is recommended.