AbstractID: 5610 Title: Generic Source Models for Commonly Used Clinical Accelerator beams for Monte Carlo Treatment Planning

Purpose: To develop measurement-based generic source models for clinical beams from commonly used medical accelerators for Monte Carlo treatment planning.

Method and materials: Source modeling and beam commissioning are key elements in the clinical implementation of Monte Carlo techniques. Monte Carlo studies of dose distributions in patients for radiation therapy would benefit from generalized models of accelerator beams especially when the model could be generated by direct measured data. Several previous studies on Varian accelerators have shown that it is possible to derive source model parameters from measured beam data. In this research generic measurement-based source model is developed where energy spectra are derived from depth dose distributions, fluence distributions are derived from measured profiles and the head scatter information is derived from in-air output factor measurement. The new photon source model uses a small extended photon source to represent primary photons generated in the target, a large extended source to represent scattered photons from the primary collimator, flattening filter and other linac components, and an extended electron source to represent contaminant electrons emerging from the treatment head. A four-source model will be used to reconstruct electron beams, which represent direct electrons, contaminant photons and electrons scattered from the first two scrappers of the electron applicator, respectively.

Results and Conclusions: An independent program is developed to generate source model parameters with measurement data automatically. The source parameters can be used by Monte Carlo dose calculation codes directly for phase space reconstruction. Comparisons have been done between dose calculated by Monte Carlo using this source model and measurement data for Varian and Siemens accelerators for different beams and energies. The results show excellent agreement (within 1%/1mm), which means that the measurement-based source model is acceptable for clinical use.