AbstractID: 11584 Title: Source Modeling for CyberKnife Monte Carlo Dose Calculation Using the IRIS Variable Aperture Collimator

Purpose: The goal of this project is to model the Accuray CyberKnife Linear Accelerator ("Linac") using the Iris Variable Aperture Collimator for Monte Carlo treatment planning. We developed and tested a straightforward source modeling and commissioning process for clinical Monte Carlo calculations.

Method and Materials: The Iris Collimator consists of a dual bank of six-sided collimators that dilate and contract in unison. The two banks are rotated 30 degrees with respect to each other in order to provide dodecahedral shaped collimation. The Iris collimator will have 12 configurations that correspond to 12 field sizes that vary from approximately 5 to 60 mm (projected to 800 mm). Our commissioning process of fitting treatment planning system data includes fitting the source energy spectrum, source space distribution, matching penumbra fluence blurring and the collimator scattering. The source distribution was de-convoluted from the fluence penumbra distribution. The source energy spectrum is determined from the measured central axis PDD in water at 80 cm SSD using a 60 mm cone. Scattering radiation from the Iris collimator is modeled as a ring source at the bottom of the lower bank with a Gaussian angular distribution.

Results: We tested our methodology on dose distributions between calculations using the source model, calculations using the Monte Carlo simulated phase space and measurement. The agreements in percentage depth dose curves and dose profiles between the two were generally within 1%/1mm for all the collimators from 5 mm to 60mm.

Conclusion: In this work we investigated the method of source modeling for the Cyberknife Linac system with the Iris collimator. Dose calculation using the source model demonstrates the efficiency and the simplicity of the new model, which lays the groundwork on a simple source model from a set of measurement data that can be easily obtained clinically.