AbstractID: 11616 Title: Investigating Radiation Properties of a New Radioactive Seed for Concurrent Brachytherapy and Hyperthermia Treatments: A Monte Carlo Study

Purpose: Concurrent delivery of Radiation and hyperthermia has not been documented and is believed to be complementary. The purpose of this research project was two folds: a) to design a new thermobrachytherapy radioactive seed that can be used for concurrent delivery of radiation and heat by insertion of ferromagnetic materials for heat source, and b) to use MNCP5 Monte Carlo simulation code to model this new thermobrachytherapy seed and compare the TG-43 factors, to both the Book values and the calculated Best Model.
Method and Materials: A newly designed seed was modeled based on the BEST I^{125} seed Model 2301, where tungsten marker core is replaced with a ferromagnetic material, capable of producing heat when subjected to external alternating electro-magnetic field. Monte Carlo Simulations using MCNP5 was used to compute the AAPM TG43 factors and compare the results to Book values as published by Sowards et al and the TG43 report.
Results: In Liquid Water, the dose rate constant calculated for the Best Seed model #2301 is 1.056 ±0.0055 $Gy*h^{-1}*U^{-1}$ (Book value of 1.01: with a percentage difference of 4.6%). The value measured for thermobrachytherapy seed is 1.057 ±0.031 $cGy*h^{-1}U^{-1}$.Radial dose function was computed from 0.1cm to 10cm at 0.1cm intervals, and Anisotropy Function was calculated from 1cm to 7cm in 1cm increments at 0°-90° at 10° increments.
Conclusions: The newly designed thermobrachytherapy seed appears comparable in all TG43 factors to the existing Best seed model 2301. Maximum deviations for radial dose function and anisotropy function in the range of distance and angles studied were 4.5% and 4.8% respectively. Geometry function remained essentially unchanged.