AbstractID: 7473 Title: Monte Carlo Dose verification and application of complex IOHDR geometries

Purpose: Dose computation algorithm may lead to serious dose errors in intra-operative high dose rate (IOHDR) brachytherapy due to the lack of scatter from one side of the applicator and/or complex geometries of treated areas. Our group has reported the inaccuracy in clinical dose delivery for general cases through several experimental approaches. However, more accurate Monte Carlo calculations are needed to quantify dose errors in IOHDR delivered with more complex geometries and scattering environment.

Method and Materials: Dose calculations were done using the EGSnrc Monte Carlo code system and the setup geometry including source structure was designed with the geometry package using EGSnrc C++ library class. User-code was developed from an existing EGSnrc user-code CAVRZnrc. To benchmark the code, a few steps were carried out to ensure that the accuracy of the cavity dose for a given simple geometry option and the ratio of cavity doses with the varying distance from the source to the center of cavity for different geometries. Based on accurate results of benchmarking geometries, test input files were developed to verify the accuracy of delivered doses for the measured known results that we had already reported the with linear array ion-chamber.

Results: For the 1.0 cm prescription distance, Monte Carlo results showed about 14 % higher for added tissue equivalent materials of 15 cm. Also, calculated doses were 1.5 to 2 % higher than measured doses for added materials of above 5 cm. However, Monte Carlo showed an excellent agreement for 1.5 cm prescription distance and simulated uncertainties of 0.01 % to 0.1 %.

Conclusion: Computed doses obtained using EGSnrc system for known geometries validate the results of ion-chamber measurement. This Monte Carlo calculation will improve the approach of dose calculations for complex geometries and the efficiency of dose delivery in clinical cases.