AbstractID: 7099 Title: Radiochromic Film and Ion Chamber Dosimetry for Monochromatic X-rays in PMMA

Purpose: K-edge capture radiotherapy using monochromatic, keV x-ray beams necessitates accompanying dosimetry methods. This work compares radiochromic film and ion chamber dosimetry methods potentially suitable for use with monochromatic x-ray beams.

Method and Materials: X-rays were produced at the LSU CAMD synchrotron by passing a 1.3-GeV electron beam (≈200-mA) through a 7-T superconducting wiggler. The resulting polychromatic beam was passed through a double multilayer monochromator to generate an approximately 0.1×2.8-cm^2, 35-keV x-ray beam. A 2.5×2.8-cm^2 broad beam was produced via oscillation of phantom and dosimeters by a triangular waveform. Central-axis depth dose was measured in a 10×10×12.5-cm^3 PMMA slab phantom using 5.12×5.12-cm^2 GAFChromic® EBT films and an air-equivalent, cylindrical ion chamber (0.23-cm^3). Films were digitized using the red channel of a flatbed scanner, and pixel values were converted to dose using both 6-MV x-ray and ^{125}I brachytherapy seed calibration curves. ^{125}I doses were calculated using AAPM TG-43 formalism. Ion chamber charge readings were converted to dose using the AAPM TG-61 protocol for kilovoltage x-ray beam dosimetry.

Results: Measurements in a PMMA phantom yielded film depth-dose curves from film that were 2.5-4.4% higher than those from the ion chamber for depths of 0 to 9 cm when using the ^{125}I seed calibration. Using the 6-MV x-ray dose calibration for film resulted in doses approximately 35% lower due to a significantly different film calibration curve compared to that using ^{125}I seeds.

Conclusion: These methods should be suitable for future dose measurements required for cell and small animal irradiations. The discrepancy between 6-MV x-rays and ^{125}I seeds is contrary to previously reported results and currently under investigation.