AbstractID: 10576 Title: Advanced techniques to determine plan-class specific reference field correction factors for accurate dosimetry of nonstandard beams

Purpose: To establish experimental reference dosimetry techniques for measuring plan-class specific reference field correction factors $k_{Q_{\text{pcsr}},Q}^{f_{\text{pcsr}},f_{\text{ref}}}$ for the proposed new formalism for reference dosimetry in nonstandard fields.

Methods and Materials: A Lucite cylindrical phantom filled with water was constructed in the center of which reference absorbed dose to water for an IMRT delivery was measured. A plan-class specific reference (pcsr) field for a typical head and neck IMRT delivery was created on CT images of the phantom. The absorbed dose in the pcsr field normalized to that in a 10×10 cm^2 field was measured using three reference dosimeters: Gafchromic® EBT films, a diamond detector, and an in-house developed guarded liquid ionization chamber (GLIC-03). Pcsr correction factors $k_{Q_{\text{pcsr}},Q}^{f_{\text{pcsr}},f_{\text{ref}}}$ were determined for five air-filled ionization chambers (Exradin A1SL, Exradin A12, Exradin A14, PinPoint® 31006, and NE2571) in a fully-rotated delivery and in a delivery from a single angle (collapsed delivery).

Results: The relative dose measurement accuracy of the three dosimeters was 0.56%, 0.10%, and 0.29% for the film, diamond detector, and GLIC-03, respectively. The combined relative standard uncertainty in measuring $k_{Q_{\text{pcsr}},Q}^{f_{\text{pcsr}},f_{\text{ref}}}$ using the three techniques was 0.3%. For all chambers and the pcsr field selected, $k_{Q_{\text{pcsr}},Q}^{f_{\text{pcsr}},f_{\text{ref}}}$ was unity to within ±1% and in the range of 0.990-0.993 and 0.990-1.003 in the fully-rotated and collapsed deliveries, respectively. The correction factors were the same for the chambers in the fully-rotated delivery. In the collapsed delivery, the Farmer-type chambers (Exradin A12 and NE2571) had a larger but consistent correction factor (0.990 and 0.991, respectively). The correction factors for the smaller chambers were close to unity but showed chamber type dependence.

Conclusions: Our techniques provide a potential to improve the dosimetric accuracy in suitable plan-class specific reference fields. The techniques of determining the correction factor $k_{Q_{\text{pcsr}},Q}^{f_{\text{pcsr}},f_{\text{ref}}}$ will be extremely valuable for other nonstandard field deliveries.