AbstractID: 7338 Title: The development of a new radiochromic film protocol for three-dimensional and beta dosimetry

Purpose: To develop a film-specific correction factor for radiochromic film (RCF) when exposed to ^{60}Co in a parallel geometry and to use this technique with three-dimensional and beta dosimetry.

Method and Materials: Radiochromic films were placed in a Virtual Water^{TM} phantom at 100 SSD and exposed to ^{60}Co radiation using both parallel and orthogonal exposure techniques. The dose rate was determined using an Exradin A12 ionization chamber at 5 cm depth in the same phantom. Response curves were generated for each technique using a novel film readout protocol employing an i900 Microtek flatbed scanner and localized background subtraction. Several film readout techniques were investigated including transmission and reflective modes. All films were scanned simultaneously using a film template to ensure millimeter alignment for pre- and post-irradiation scans. A correction factor was determined to account for the different response of RCF to parallel and orthogonal exposures. This correction factor was then applied to a parallel ^{60}Co exposure to allow comparison with an orthogonal exposure from a NIST-traceable ^{90}Sr ophthalmic applicator. The ophthalmic exposure was conducted using a certified technique.

Results: The depth dose exposure method resulted in an average over response at depths > 1 cm of 5% and 15% and was proportional to film thickness. Film-specific correction factors were determined for EBT and HD-810 radiochromic films. Using these correction factors, the parallel exposure method was within the 3.5% uncertainty of the ophthalmic applicator. An accurate film readout protocol was essential to obtaining precise results and it was determined that the reflective black and white protocol was the most reliable and reproducible.

Conclusion: A “many points” calibration method was developed using a single film exposed to ^{60}Co in a parallel (on-edge) geometry. This technique, along with a film-specific correction factor, allows for improved accuracy when applied to 3D and beta dosimetry.