AbstractID: 13144 Title: Dosimetry of low energy electronic brachytherapy X-ray source

Purpose: To determine dose delivered by electronic brachytherapy source of ~50kVp. Current protocol developed by AAPM task group 61 requires in air measurements to "would be the surface." This approach is not possible for the geometry used for brachytherapy treatment. The brachytherapy protocol by AAPM task group 43 requires knowledge of the dose rate constant not available for our source.
Method and Materials: The X-ray beam was generated by Intrabeam (Carl Zeiss Meditec, Jena, Germany) using 4 cm in diameter applicator. To minimize the effects of perturbation of photon fluence by the ion chamber and decrease the uncertainty in the position of point of measurement, small volume, 6.25 mm, thimble ion chamber was used (A1SL, Standard Imaging, Middletown, WI). The effect of fluence perturbation and stem were assumed to be negligible. Al Half value layer (HVL) of the beam was determined. Dose to air calibration factor N_k was measured in calibration laboratory (K&S Associates, Nashville, TN) for two HVL values and then interpolated for HVL value of the beam. Water measurements were performed. Effective point of measurement was determined analytically. Beam hardening, changing N_k and water to air ratio of mass energy absorption coefficient were neglected.
Results: Al HVL was 0.91+-0.10 mm. In the clinically significant range our measurements and vendor's data agreed within expected error (1.5 mm or 4%). Main error contributors are position of the effective measurement point and uncertainty in N_k; the latter has two components: from calibration laboratory and from beam quality determination. For larger distances measured dose is 7-15% higher, than vendor's data. This is likely caused by the increase in N_k due to beam hardening.
Conclusion: While measurement of dose was possible and our results agree with the data provided by vendor, further refinement of the method and use of alternative approach are necessary.