

AbstractID: 13284 Title: Extraction of Perturbation Factors for Parallel-Plate Chambers in Electron Beams using a Plastic Scintillation Detector

Jack Fowler Junior Investigator Submission

Purpose: To present a method to experimentally extract the overall perturbation factor P_Q (the product of P_{wall} and P_{repl}), in megavoltage electron beams for NACP and Roos parallel plate chambers using a perturbation-free plastic scintillation detector (PSD).

Method and Materials: We used a single scanning PSD mounted on a high precision scanning stage to measure depth dose curves in 6, 12 and 18 MeV clinical electron beams. We also measured depth doses using NACP and Roos parallel plate chambers. Perturbation factors were extracted by comparing PDDs measured using the Roos and NACP chamber to PDDs measured using the PSD. Monte-Carlo simulations using EGSnrc were performed to validate that the PSD is a perturbation-free detector in electron beams.

Results: Our experimental results show excellent concordance with the Monte-Carlo simulation results of various authors on the subject. We show that the perturbation factors for the NACP and Roos chambers increase substantially with depth, especially for low energy electron beams. We show that using an effective point of measurement (EPOM) placed inside the air cavity reduces the variation of perturbation factors with depth. The protocol recommendations suggesting to place the point of measurement at the inside face of the front window appear to be incorrect for parallel plate chambers and lead to errors in the R_{50} of approximately 0.4 mm at 6 MeV, 1 mm at 12 MeV and 1.2 mm at 18 MeV.

Conclusion: The results indicate that PSDs can be used as perturbation-free detectors in reference dosimetry and that PSDs can be used to experimentally extract ionization chamber perturbation factors.