

AbstractID: 2995 Title: Ionization to Dose for Electron Beams: A Comparison of Three Approaches

Purpose: To compare methods of converting depth-ionization to depth-dose for electron beams. The current TG-25 standard is based on TG-21 calibration protocols and uses stopping power ratios for monoenergetic beams. The current IPEMB code of practice uses stopping power ratios for realistic electron beams, which are also used for the current TG-51 and other electron dose calibration protocols.

Method and Materials: Depth-ionization curves measured with a cylindrical ion chamber were converted to percentage depth dose (pdd) using the current TG-25 approach, the current IPEMB code of practice, and a hybrid method that uses the stopping power ratios of the latter and the replacement correction of the former. For depths greater than the practical range, the stopping power ratio and the replacement correction were set to the values at the end of the practical range.

Results: For energies of 12 MeV or lower, and depths greater than d_{\max} , all methods give results that are almost identical. In the buildup region, the hybrid pdd was up to 0.8% higher than the TG-25 approach and up to 1.0% less than the IPEMB code of practice. For 16 MeV in the buildup region, the hybrid pdd was almost identical to the TG-25 pdd but 0.7% lower than the IPEMB pdd. For 16 MeV at R_{90} , the hybrid method was about 0.6% less than TG-25 and 0.7% greater than IPEMB. For the 20-MeV beam at R_{90} , the hybrid and TG-25 results were about 1% higher than the IPEMB results.

Conclusion: The hybrid method proposed here gives very similar results to the previous TG-25 method and the IPEMB code of practice. The IPEMB method has replacement corrections for only one size of ion chamber, so the hybrid method is more widely applicable, and should be considered as an alternative or replacement for the TG-25 method.