AbstractID: 9463 Title: Modeling Head-Scatter Factor for Megavoltage Electrons

To accurately calculate monitor units for electron beams, the incident electron fluence, ϕ_e, must be determined. ϕ_e, defined at isocenter, is influenced by scatter from the accelerator head, the applicator, and the insert. We have proposed to measure ϕ_e by introducing the head-scatter factor, $H_e(r)$, defined as the ratio of in-air diode readings, with and without a circular block of radius r, for the same cone size (c) and source-to-detector distance (SDD). The phantom scatter factor, PSF, defined as the ratio of blocking factor in water at reference depth d_{ref} and H_e, for the same cone size and radius, is only a function of radius and electron energy. In comparison, H_e is a function of electron energy, r, SDD, and the cone size. H_e measured in air agreed with H_e measured in water at surface to within 2% for all electron energies. Its range decreases with increasing electron energies, 46% to 13% for r between 0.5 – 25 cm and energies between 6 and 21 MeV. The SSD dependence of H_e is mostly caused by the scattering in the head. As a result, if H_e is expressed as a function of viewing angle from the detector (or the normalized radius $r_n = r \cdot 5/g$, where the air gap $g = SSD - 95$ cm), it becomes independent of SSD. In conclusion, H_e can be easily measured in air using a diode detector, which accounts for the variation of ϕ_e for beam radius, cone size, electron energy, and SDD.