AbstractID: 1151 Title: Another look at the in-air output factors for megavoltage photon beams

The in-air output factor characterizes the incident photon fluence per monitor unit and it varies with collimator settings. Experimental measurements and analytical studies have shown that the change in in-air output factor with the change in collimator opening is attributed to photons scattered inside the accelerator head (commonly known as extra-focal radiation), radiation source obscuring effect, and monitor backscatter effect. The most dominant being the extra-focal radiation. An analysis of measured in-air output factors, with a narrow cylindrical plastic miniphantom (4 cm diameter) that prevents contaminant electrons from reaching the detector, for 4, 6, 8, 10, 15, 18, and 20 MV clinical x-ray beams from different models and manufacturers indicates that they are within a band of 2% for all field sizes. Further analysis shows that most of this difference is primarily due to the monitor backscatter. Therefore, it can be readily concluded that the energy fluence distribution of the extra-focal radiation is independent of the quality of the clinical x-ray beams and the design of the treatment head. The Monte Carlo calculations of megavoltage clinical photon beams of different energy also show that the energy spectra of the extra-focal radiation and its angular spread are independent of the maximum energy of primary photon beam. The energy spectra of the extra-focal radiation peak between 0.3-0.5 MeV. Therefore, it is not surprising that the equivalent square concept works well for the calculation of in-air output factors for irregularly-shaped fields for different energy clinical photon beams.