

AbstractID: 12920 Title: Analytical formalism for the output factors of small MLC-shaped beams

Purpose: The output factor, S_{cp} , of small MLC-shaped beams suffer from two competing effects: The loss of lateral CPE which tends to reduce the dose, and the extra leakage which tends to increase it. S_{cp} measurement is further complicated by the size of the chamber used. We show that for small MLC-beams, CPE is regained. Subsequently, we find measurement-based analytical formula to calculate the output factors of small MLC-shaped beams that is independent of chamber size. **Method and Materials:** A series of S_{cp} measurements, with three photon energies, were taken using various chambers and various MLC-shaped and jaw-shaped fields ranging from 1x1 to 10x10 cm². **Results:** The measured S_{cp} of small MLC-shaped beams was found to closely follow the linear trend of the larger fields. The linear curve joining the S_{cp} of large fields was called the CPE-line and it was extrapolated towards the small fields. For each energy/chamber combination, the CPE linear fitting parameters were calculated and chamber-size effect was found to be minimal. The parameters were averaged over all chambers to present formula that is dependent only on energy and field size. **Conclusion:** Establishing CPE conditions for small MLC-shaped beams allows the use of measurement-based formula to calculate S_{cp} . The formula is a function of field size and energy but not of chamber size. The removal of chamber dependence reduces the potential of underestimating S_{cp} and consequently overdosing the patient. We propose that our formalism can be used in treatment planning systems for modeling of S_{cp} for small MLC-shaped beams for IMRT or SRS treatment or used by physicists to estimate the expected S_{cp} value for the MLC-shaped beams and compare them to their measured data.