

AbstractID: 8017 Title: A Hybrid of Pencil Beam Model and Clarkson Integration For Accurate Dose Calculation and Monitor Unit Verification Useful for IMRT and SRT

A hybrid of pencil-beam model and Clarkson integration is developed for accurate determination of dose on any point of interest (POI) inside the patient based-on measured circular beam data. A beam (including blocked areas) is divided into many pencil beams having $0.25 \times 0.25 \text{ mm}^2$ cross-sections at the source-axis-distance. The depths and distances from the POI for any pencil beam are determined by an analytical approximation of patient skin. A modified Clarkson integration [Kung, Chen, and Kuchnir, Med Phys 2000] was applied for all pencil beams. The dose from each field configuration in the leaf-sequence for IMRT or static fields for SRT/SRS was given by summation of all pencil beams using multiplications of transmission factor, ratio of the area of pencil beam to the area of the corresponding annular sector, and the difference of the circular beam data. The transmission factors are 100% and 2% for the open and blocked area to the BrainLAB m3-MLC, respectively. Geometric solutions are used for transmission factors at the rounded leaf ends and tongue and groove leaf sides [Boyer and Li, Med Phys 1997]. MUs calculated by the hybrid method agreed within 2% with the planned MUs. Off-axis doses were between the results from pencil beam calculation and Clarkson integration in a commercial planning system. The off-axis doses for individual beams are consist with values of phantom experiments using pinpoint ionization chamber having setup error of 0.5 mm corresponding about 3% dosimetric error.