

Purpose: to evaluate three different source models for the calculation of head scatter factors.

Method and Materials: The three different source models evaluated in this work are (1) The three-source model (Yang et al) (2) The Gaussian analytic model (Jiang et al) (3) The numerical source model (Chui et al). These source models were developed based on different LINAC models. These source models were implemented and their results reproduced. Each of the source models was then applied to the other's measurement in order to cross-validate accuracy. The effect of the monitor backscattering on the source model was also investigated. Finally, measurement data from a Varian Trilogy machine was used to evaluate each of the source models. The behavior of each model for different SSD data was also evaluated.

Results: Measured output factors exhibit ~1% difference at largest field sizes. The Gaussian analytic model gives 0.2% accuracy when fitting Yang's data, while the three-source model has problem at large fields with error >0.5% when attempted on Jiang's data. So was the numerical model. Inclusion of the monitor backscattering effect into the source models significantly improved the agreement. When applying the models to the Trilogy measurement, the Gaussian analytic model gives the best agreement (<0.3%) while the three-source model has trouble in asymmetric and large symmetric fields again. The numerical source model didn't fit those fields either. While the other two source models gave consistent results for data measured at different SSD, the numerical source model gave large errors (>0.5%).

Conclusion: The Gaussian analytic model gave excellent fit to head scatter factor for a variety of LINAC models. Reasonable accuracy can be achieved if monitor backscatter effect were built into the other two source models.

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