AbstractID: 3056 Title: Modifications to the "three-source model" for the calculation of head scatter factors for small field sizes

Purpose: The three-source model proposed by Yang et al.[1] when applied to Siemens PRIMUS 6 MV beam over-estimated head scatter by 10-200% for field sizes less than 2 cm x 2 cm and elongated narrow beams. This necessitated the development of a modified approach

Method and Materials: The complete theoretical background for the three–source model can be found in the published literature[1] in which the total energy fluence at the point of calculation can be divided into three components. The primary component Cp has been chosen around 90% in the model. A modified approach is proposed to the three-source model with the primary source component Cp having growth function that grows exponentially with radius of the beam in the Sp plane. The primary source function was integrated in the Sp plane using the formula, $Cp = Cp3*(exp(-r_s*Cp2)); r_s < r_3$ where Cp2, Cp3 and r_3 are fitting coefficients.

Results: The measured head scatter factors for smaller field sizes including the rectangular fields where the exchanged collimator jaw positions have been compared with both three-source model and modified three-source model for Siemens PRIMUS 6 MV beam. It was observed that the accuracy of the modified model is improved and is within 10% of the measurements for small field sizes.

Conclusion: In routine IMRT treatments, about 10-15% of the segmented fields use small or elongated fields. The modified approach to the three-source model improves the accuracy of the head scatter factors calculation significantly for field sizes below 2 cm x 2cm.

Reference: 1. Y. Yang, L. Xing, A.L. Boyer, Y. Song and Y.Hu, A three-source model for the calculation of head scatter factors. Medical Physics: 29(2002) p2024-2033.