AbstractID: 2541 Title: Measurement of in-air output ratios for a linear accelerator with and without the flattening filter

Purpose:
In-air output ratios (S_c) for photon beams from linear accelerators describe the change of in-air output as a function of the collimator settings. The physical origin of in-air output ratios is mainly due to the change in scattered radiation that can reach the point of measurement as the geometry of the head changes. The flattening filter and primary collimator are the major sources of scattered radiation. The change of amount of backscattered radiation from the collimator into the monitor ion chamber also contributes to the variation of output. To have a better understanding of the contribution of various components to S_c, we measured S_c and backscatter factor S_b for a linear accelerator with and without flattening filter.

Method and Materials:
In-air output ratio (S_c) measurements were carried out with a Farmer type ion chamber in a mini-phantom at 10 g/cm^2 depth for 6 MV and 18 MV x-ray beams from a Varian 2000EX linear accelerator. Backscatter factor (S_b) were measured with a universal pulse counter and a diode array with build-in counting hardware and software. The scatter component S_h was then derived from the relation, $S_c = S_h \times S_b$, where S_b was the linear fit of measured results.

Results:
Significant differences are observed for S_c with and without the flattening filter. Within experimental uncertainty, the backscatter factors, S_b, are similar with and without the flattening filter. There are significant differences in variations of S_h over the range of field size 3x3 to 40x40 cm^2 with and without the flattening filter; for 6 MV it is 8% versus 3%, and for 18 MV 7% versus 1%.

Conclusion:
By analyzing the backscatter contribution and total in-air output ratios with and without flattening filter, we gained insight on contributions of different components to the total variation of S_c.