AbstractID: 13156 Title: Scattering factor of energy-stacking layer on outputs of modulated protons using uniform scanning technique

Purpose: To evaluate scattering factor of energy-stacking-layers (ESL) on outputs of modulated protons using uniform scanning technique.

Methods: Using scanning magnet instead of scatterer requires minimal material to spread protons laterally. However, scattering induced by ESL becomes one of factors, such as beam range (R_w), modulation width (M_w) and field-size (FS) that affect outputs of modulated protons. Outputs as functions of R_w and M_w were measured on gantries at Midwest Proton Radiotherapy Institute (MPRI) and Procure Oklahoma City (OKC) center. Using similar beam-line configurations, the energy spread for same R_w and M_w between the two gantries were almost identical at the phantom. In addition, MU chamber and scanning magnet were placed at similar location. However, ELS was placed upstream at OKC versus downstream to the scanning magnet at MPRI. Distances from ESL to MU chamber varied largely between two gantries at different facilities. As a result, scatterings of ELS impacted outputs differently between the two gantries. Observed trends of measured outputs as a function of *r*, defined as $(M_w - R_w)/ M_w$, were further utilized to examine the effect of ELS scattering factor.

Results: After outputs for each individual M_w were normalized to the output of 17cm R_w with same M_w, normalized outputs of 3.5 M_w varied more than 10% to outputs of 12.5 M_w at 13 and 27 cm R_w for OKC outputs while only 5% variations were seen for MPRI outputs. Trend of output as a function of *r* also varied larger for OKC than MPRI.

Conclusion: Larger varied trend as a function of *r* indicates that the scattering factor of ELS placed upstream, farther away from MU chamber, presents a larger effect on outputs in terms of R_w and M_w. The effect of ELS scattering on outputs for field-size dependency need be further studied.