AbstractID: 13677 Title: The Effect of Scanning Pattern and Dose Rate on Output Factor for Uniform Scanning Proton Beam

Introduction: The output factor (OF) is affected by several factors including energy, range, Spread-Out Bragg Peak (SOBP) width, aperture size, and distance. In uniform scanning, it could also be affected by beam scanning pattern and dose rate, which have not been studied. In this study we investigate of the effect of scanning pattern and the dose rate on OF.

Materials and Methods: The OF is measured under reference condition (16 cm energy range, 10 cm SOBP, measured at the center of SOBP) with a calibrated parallel plate chamber at isocenter. To study the effect of dose rate, proton beam current is varied from 0.5 to 7 nA, (50 to 810 MU /min). To study the effect of scanning pattern on OF, the scanning fields are changed from $12x12cm^2$ to $30x30cm^2$ by changing either the horizontal or vertical dimension but keeping the other constant. Statistical analysis is used to explore the relationships between OF and the beam parameters.

Results: For beam current changing from 0.5nA to 7nA, the OF increases (2.4%) in a logarithmic fashion with dose rate (R^2 = 0.883). For squared scanning fields, the output factor increases linearly with the field width (R^2 = 0.993). Keeping the horizontal scanning width constant (25cm), but varying the vertical dimension from 22cm to 30cm has negligible effect on the OF (<0.3%) However, keeping the vertical scanning width constant (25cm), but varying the horizontal dimension from 22cm to 30cm, changes the OF by about 2%.

Conclusion: Output factor changes slowly with dose rate. The 2% change in OF due to the variation in the vertical dimension of the scanning field is due to the stem effect as a larger volume of the ion chamber stem is irradiated. This effect should be taken into consideration for OF calculation for fields without measurements.