AbstractID: 6401 Title: A Fluence-based Algorithm for MU calculation of Proton Beams

Purpose: We have developed an empirical algorithm to calculate patient specific monitor unit (MU) for megavoltage proton beams.

Method and Materials: The algorithm is based on a well-established formula for proton output calculation.[1] It adds additional data for a broad ranges of SSD, depth, off-axis, snout size, and especially field size defined by the cutout. Pristine percentage depth doses (PDD) of proton beams are used to determine the SOBP PDD using the beam modulation wheel input file. This algorithm adopts the concept of proton head-scatter factor, $H_p(s,r,f)$, to characterize the proton fluence variation with source-to-detector distance (f), snout size (s), and radius of circular cutout (r), which is attributed to the proton scattering in the cyclotron nozzle, snout, and Copper inserts.

Results: A new quantity *PSF(r)* as functions of equivalent beam radius r and depth d, are introduced to account for proton phantom scattering in a water phantom per unit incident fluence. *PSF* is measured as *BF(r)/H(r)*, where *BF* is blocking factor measured as the ratio of dose measured in water at reference depth between a circular field with radius r and an open field, and H_p is the ratio of doses measured in air (without any buildup) using a diode detector for the same conditions. Equivalent radius for an arbitrary field can be calculated using a sector-integration of *PSF(r)*. *PSF* is independent of the snout size.

Conclusion: This algorithm is ideally suitable for calculating patient-specific MU for Monte-Carlo or pencil-beam based treatment planning system for protons.

Ref 1: Phys. Med. Biol. 50 (2005) 5847-5856