AbstractID: 13884 Title: A technique to determine the integral depth dose of proton pencil beam spots

Purpose: To develop and validate a technique to determine the integral depth dose (IDD) from the measured profiles and peak doses of proton pencil beam spots (PPBS).
Methods and Materials: The IDDs of 72.5, 146.4 and 221.8 MeV energy PPBS were determined by area integration of their planar dose distributions at different depths. The transverse lateral profiles of the PPBS at selected depths in water were measured by using small volume ion chambers using a beam scanning system. The peak spot dose, $D_{0,}$ was determined by different experimental methods using ion chamber and diode. The extent of anisotropy in spot dose distribution was determined by comparing profiles from film dosimetry along different angles with the principal axes. The IDD was calculated by integrating the measured lateral profiles and the corresponding $D_{0.}$ The IDDs were also measured using PTW Bragg peak chamber (BPC), designed for this purpose, and were compared with the calculated values. **Results:** The spot dose distributions were found to be isotropic. The magnitude of difference in the calculated and BPC measured IDDs was found to be as much as 15.7% for the lower energy spots, and decreased with increase in beam energy. This difference is mainly due to the size limitation of the BPC. The contribution from the tail region of profiles increases with decrease in beam energy, and the BPC chamber size is not large enough to account for the contribution of these long tails. Correction factors for the BPC size effect on the measured IDD were determined from our calculation. **Conclusion:** The technique of area integration of profile is found to be useful for determining the IDD values of PPBS, which are important input parameters for beam modeling in the treatment planning system, with reasonable accuracy.
Conflict of Interest Statement: Research sponsored by Varian Medical Systems.