AbstractID: 7266 Title: Dosimetric characterization of a 2D diode array detector in passive scattering proton beams

Purpose: To evaluate the dosimetric properties of a two-dimensional (2D) diode array detector in passive-scattered proton beams (PSPBs).

Materials and Methods: The diode array detector, MapCHECK™, was characterized for PSPBs. The relative sensitivity of diodes and absolute dose calibration were determined using a 250 MeV beam. The measured pristine Bragg curves (PBCs) by MapCHECK™ were compared with the results of an ion chamber (IC) using a range shift method. The water-equivalent thickness (WET) of MapCHECK™ buildup was also determined. The inverse square dependence, linearity, and other proton dosimetric quantities measured by MapCHECK™ were also compared with IC. The change of absolute dose response of MapCHECK™ as a function of accumulated dose was used as an indicator of radiation damage. 2D dose distribution with and without compensator were measured and compared with treatment planning system (TPS) results. To facilitate the comparison, in-house software called MU Scaler, was developed.

Results: The measured PBCs by MapCHECK™ are virtually identical to those measured by IC for 160, 180, and 250 MeV proton beams. The WET of MapCHECK™ buildup is determined to be 1.7 cm. The inverse square result of MapCHECK™ is the same as the IC results, within ±0.4%. The linearity of MapCHECK™ is within 1% compared to IC data for MUs larger than 10. All other dosimetric quantities are within 1.3% of IC results. The absolute dose response of MapCHECK™ has been changed by 7.4% after accumulating total dose of 170 Gy. Good results are observed for 2D dose distribution for patient treatment fields with and without compensator when compared with TPS results.

Conclusions: MapCHECK™ is a convenient and useful tool for 2D dose distribution measurements of PSPBs. Variation of dose response of MapCHECK™ with total accumulated dose should be carefully monitored.