

**Purpose:** To evaluate Zebra multi-layer ionization chamber system for patient treatment field and machine QA for spot scanning proton beams (SSPB) and passive scattering proton beams (PSPB).

**Methods:** Zebra dose measurement system (IBA Dosimetry), consisting of 180 parallel plate chambers with 2 mm detector spacing, was used for measuring proton beam depth dose curves (DDC) for spread out Bragg peaks (SOBP) and single spot pristine Bragg peaks (PBP). The measurements were performed for 100 to 250 MeV PSPB and 89.2 to 221.8 MeV SSPB using the Hitachi ProBeat synchrotron based delivery system. An in-house Matlab based analysis software was used to compare the Zebra measured DDC with those measured by the Markus chamber in a PTW water tank (MC-WT). Several verification plans in the water phantom were created for patient treatment fields using the Eclipse treatment planning system (TPS). The DDC for individual verification fields were measured using the Zebra and comparisons were made with the TPS calculations.

**Results:** The dose differences between the Zebra and MC-WT measurements in the plateau regions of the DDC are within 2% for various energies of PSPB, but are larger than 2% at the sharp dose distal gradient regions. The values for distal penumbra widths, range and SOBP widths from Zebra and MC-WT measurements agree within 0.5 mm, 1.5 mm, and 2 mm, respectively. The Zebra measured values of the range of the single spots also agreed within 1 mm with their established values from other measurements. The Zebra measured DDC of verification plan of patient treatment fields showed good agreement with those from the TPS.

**Conclusions:** Our investigation shows that Zebra can be useful for fast and reasonably accurate measurements of the DDC of pristine and spread-out Bragg peaks of both spot scanning and passive scattering proton beams.

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None