AbstractID: 9492 Title: Determination of the dose equivalent near proton pencil beams

Purpose: To utilize a silicon-on-insulator (SOI) microdosimetry technique to determine the out-of field dose equivalents and average quality factors in proximity to an actively scanned and an analogous passively scattered and shaped prostate cancer proton field. **Method and Materials:** From measured microdosimetry spectra, we determined the dose equivalent laterally (up to 10 cm from the central axis) and distally (up to 8 cm from the Bragg peak) of a single proton pencil beam. Microdosimetry measurements were also performed for a passively delivered prostate cancer proton field, and out-of field dose equivalents and quality factors were determined. Using GEANT4.8.0, we modeled the microdosimeter response to the single pencil beam and simulated an actively scanned proton treatment field comparable to the passively scanned field with a range of 29 cm in water. **Results:** GEANT4 simulations showed that the dose equivalent lateral to the pencil beam was dominated by contributions from scattered primary protons while neutrons were the major contribution to the dose equivalent downstream of the Bragg peak. This explains that the average quality factor was 2 lateral to the pencil beam and 5 downstream of the Bragg peak. The dose equivalent values in the lateral regions of the actively scanned prostate cancer field were within +10% to -30% at analogous positions in the passively scattered field. Distal to the Bragg peak, the quality factor was 7 for the passively scattered field compared to 5 for the actively scanned field, which demonstrates that the delivery method affects the secondary particle spectra in this region. **Conclusions:** Preliminary results suggest that there are differences in the dose equivalents and quality factors near the treatment field from actively scanned and passively scattered and shaped proton beams. These data highlight interesting directions for further measurements and simulations.