AbstractID: 1700 Title: Changes in Proton Beam Spot Size due to Spot Scanning Nozzle Components

The physical characteristics of the Bragg peak in proton beam therapy provide an advantage over conventional modalities such as photons and electron beams, due to better conformation of the radiation dose to the target volume. The lateral field size and the range of a proton beam depend upon the characteristics and position of various beam components in the treatment nozzle. The interaction of the beam with these components leads to a degradation of the lateral penumbra and distal dose fall-off, potentially increasing the dose to normal tissues. This work quantifies the influence of nozzle components on the beam spot size (sharpness) in a spot scanning proton therapy system. The degradation of the beam due to each nozzle component was calculated using Monte Carlo methods. A separate simulation was performed for each component in the scanning nozzle (presently under development for a major cancer hospital). The beam degradation was characterized laterally by the full width half maximum at the Bragg maximum and axially by the distal 80-20% fall-off length. The Monte Carlo simulations revealed shape distortions due to laterally inhomogeneous nozzle components, e.g., multiwire ionization chambers, which represents a problem that is intractable with analytical methods.