

AbstractID: 13883 Title: Adjustment of lateral and longitudinal size of scanned proton-beam spots using a pre-absorber

Purpose: To evaluate the efficacy of adding a pre-absorber in the exit of a scanning proton beam head to reduce the lateral beam spot size, increase the longitudinal spot size and extend the interval of clinically useful beam ranges to shallower depths.

Method and Materials: We investigated a method for adjusting the lateral and longitudinal spot size that utilizes downstream plastic pre-absorbers located near a water phantom. The spot size adjustment was characterized using a validated Monte Carlo model of a modified commercial scanned-beam treatment head.

Results: Our results revealed that the pre-absorbers can be used to reduce the lateral full width at half maximum of dose spots in water by up to 14 mm, and to increase the longitudinal extent from about 1 mm to 5 mm at residual ranges of 4 cm and less. A large factor in manipulating the lateral spot sizes is the drift space between the pre-absorber and the water phantom. Increasing the drift space from 0 cm to 15 cm lead to an increase in lateral FWHM from 2.15 cm to 2.87 cm, at a water equivalent depth of 1 cm.

Conclusion: Our findings suggest that it is possible to improve dose spots delivered from a scanning proton beam treatment head.

By using pre-absorbers we were able to reduce the lateral spot size for shallow target sites (< 17cm). Additionally, we were able to increase the longitudinal spot size and therefore reduce the amount of energy levels necessary to cover the target volume. This method may lead to improved penumbræ for scanned proton treatments of shallow sites, such as head and neck cancer.